SysTemp

G Series

P Series

R Series

TMC Series

Technical manual for installation,
scheduled and extraordinary maintenance

systemair

SYMBOLS

NOTE!
This symbol is used to indicate useful suggestions to the operator.

WARNING! DANGER!
This symbol is used to indicate situations or operations that are potentially dangerous or that require the care of the operator.

ELECTROCUTION HAZARD!
This symbol is used to indicate situations or operations that potentially expose the operator the risk of electrocution.

DANGEROUS HANDLING!
This symbol is used to indicate situations or operations that potentially expose the operator to the risk of being crushed.

HEAVY LOADS!
This symbol is used to indicate situations or operations entailing handling of heavy loads by the operator.

BURN HAZARD!
This symbol is used to indicate situations or operations that potentially expose the operator the risk of burns.

CUTTING HAZARD!
This symbol is used to indicate situations or operations that potentially expose the operator to the risk of cuts or abrasions.

REVISIONS LIST				
Revision	**Date**	**Author**	**Chapters**	**Description**
A	10/2016		All	First version

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IMPORTANT WARNING

Systemair develops its products on the basis of its ten year experience in the Close Control Air Conditioning sector, on the continuous investment in product technological innovation, on strict quality procedures and processes with functional tests on 100% of its production.

However, Systemair and its branches/affiliates do not guarantee that all aspects of the product, including software, correspond with the final application requirements, despite the product being manufactured in accordance with state-of-the-art techniques. The customer (designer or installer of the final equipment) assumes every responsibility and risk concerning product configuration in order to achieve the estimated results with regard to installation and/or specific final equipment.

In this case, prior to specific agreements, Systemair can intervene as consultant for the good outcome of the application/final machine start-up, but in no case can be considered responsible for the good operation of the final system/equipment.

The Systemair units are an advanced product and their operation is detailed in the technical documentation provided with the product or it can be downloaded, even prior to purchasing. Every Systemair product, in relation to its advanced technological level, requires a qualification/configuration/programming/start-up phase for it to operate at its best, for the specific application. Lack in this study phase, as indicated in the manual, can cause malfunctioning in the final products of which Systemair cannot be considered responsible.

Only qualified personnel can install or carry out technical assistance interventions on the product. The final customer must only use the product as described in the documentation concerning the product itself.

Without this excluding the due compliance with the other warnings present in the manual, please note that it is, in any case, necessary for each Systemair Product:

- Stock and use the product in environments that respect temperature and humidity limits, which are specified in the manual.
- Do not install the device in particularly hot environments. Excessively high temperatures can reduce the duration of the electronic devices, damage them and deform or melt the plastic parts.
- Do not install the device in environments containing petroleum or oil vapour or any sort of aerosol, such as in kitchens (plastic parts could deteriorate) where there are flammable vapours such as petrol-based solvent.
- Do not install the device in environments containing corrosive gases, such as sulphuric gas (this could corrode the pipes and welded points). Do not use corrosive chemical products, aggressive detergents or solvents to clean the device.
- Do not install the device in environments containing equipment that generates electromagnetic waves (the system may be subject to malfunctions), or where the line voltage is subject to considerable fluctuation (such as factories, for example).
- Do not install the device in environments where the air has a high saline content, such as near sea-side cliffs.
- The appliance must not be installed on vehicles or boats.
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may suffer irreparable damage.
- Do not use the product in different applications to those specified in the technical manual.

All the above recommendations are also valid for the microprocessor, the serial boards, the programming keys or, however, for any other accessory of Systemair products portfolio.

Systemair adopts a policy of continuous development, accordingly, the company reserves the right to make changes and improvements to any product described herein, without forewarning.

The technical data and dimensions are not binding.

The responsibility of Systemair in relation to its product is regulated by the Systemair general contract conditions and/or by the specific agreements with customers; in particular, as admitted by the applicable standard, in no case Systemair, its employees or its branches/affiliates will be responsible for any lost profits or sales, data and information loss, costs for substitute services or goods, damages to things or persons, activity interruptions or any direct, indirect, accidental, property, coverage, punitive, special or consequential damages in any way caused, whether contractual, extra contractual or due to negligence or other responsibility deriving from installation, use or impossibility to use the product, even if Systemair or its branches/affiliates have been warned on the possibility of damages.

WARRANTY

All Systemair products, or distinguished by the Systemair trademark, are subject to the following warranty conditions which are deemed to have been fully understood and accepted at the time of placing the order. Systemair undertakes during the period of warranty to repair or to replace with new at its own discretion, in the shortest time possible, any parts found to present recognised defects in materials, construction or workmanship that render them unfit for the intended use.

The warranty on the products sold by Systemair has a duration of TWENTY-FOUR MONTHS (2 years) from the date of shipping the material.

The following are excluded from the warranty:

- All parts typically subject to sliding or rolling friction (bearings, brushes, etc.);
- All parts typically subject to consumption (filters, humidifier cylinders, etc.);
- All parts typically subject to oxidation or corrosion if incorrectly used or maintained (headers, conductors and contacts in copper or metal alloys, internal or external parts of the unit, etc.);
- All parts not supplied by Systemair, even if integrating part of the system to which the product is enslaved.

Furthermore, Systemair reserves the right to cancel the warranty of sold products if:

- The labels or plates showing the Manufacturer mark and serial number have been deleted or removed;
- The product has been subjected to modifications or mechanical work not expressly authorised by Systemair;
- The product has been used not in conformity with the supplied instructions or for purposes different to those for which it was designed.
- The defect is the cause of negligence, inexperience, bad maintenance, carelessness and inability of the final User, damages caused by third party, accidental causes or of force majeure or, however, any other causes not attributable to manufacturing quality defects.

The above mentioned warranty conditions shall be valid provided that the Customer has fulfilled all of his contract obligations and in particular to those regarding the payment terms. The delayed or missed payment, even partial, for supply, suspends every warranty. The warranty does not give the Customer any right to suspend or delay payments that must, in any case, be granted as established at the time of placing the order and specified in our written order confirmation.

The warranty request must be made in writing detailing the found fault, the serial number or unit code where the fault has occurred and indicating the component that caused the fault, should this be easily identifiable. Systemair will not accept any warranty request made by telephone. For operational reasons, the warranty requests will only be accepted during office hours, from Monday to Friday. In the event a request is sent during a holiday, it will be considered received by Systemair during the first hour of the first successive working day to the sending of the same.

Faulty components are replaced ex works Uboldo. Transport costs are borne by the Customer, even in case of acknowledged warranty, unless otherwise specified by Systemair. The replacement costs of the defective components (labour costs, materials, refrigerant, etc.) are met by the Customer, even in case of recognised warranty, unless otherwise specified by Systemair.

Systemair does not have to pay compensation for direct or indirect damages of any nature and for any reason. Furthermore, Systemair does not answer for any delays in the supply of under warranty parts or execution of under warranty interventions.

The materials replaced under warranty remain the property of the Customer, who must dispose of it in accordance with the standard in force. Any disposal costs are met by the Customer. In the event return of the under warranty parts is requested, these must be returned within three (3) months from date of shipment of the substitute piece, under the care and at the expense of the Customer. On the contrary, all spare parts will be charged at the price on the list in force at time of their shipment.

CE DECLARATION OF CONFORMITY

The equipment that this manual is dedicated to is destined to be incorporated in systems for air conditioning and treatment.

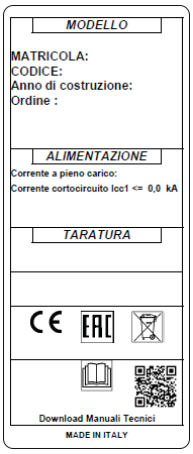
The equipment that this manual is dedicated to is in conformity with what is prescribed in EU Directives 2006/42/EC, 97/23/EC (PED II) and 2004/108/EC and, therefore, in conformity with the following regulations:

EN 953:1997 + A1:2009	Safety of machinery - Guards - General requisites for design and construction of fixed and mobile guards
EN 1037:1995 + A1:2008	Safety of machinery - prevention from unexpected start-up
EN ISO 13849-2:2008	Safety of machinery - Parts of the control system linked to safety - Part 2: Validation
EN ISO 13850:2008	Safety of machinery - Emergency stop - Principles of design
EN ISO 14121-1:2007	Safety of machinery - Risk assessment - Part 1: Principles
EN 60204-1:2006	Safety of machinery - Electrical equipment of the machine - Part 1: General rules
EN 61439-1:2011-10	Assembled protection and handling equipment for low voltage (BT control board) Part 1: General rules
EN 61000-3-2:2006	Electromagnetic compatibility (EMC) - Part 3-2 - Limits for harmonic current emissions (equipment having input current of ≤ 16 A per phase)
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) - Part 6-2: General regulations - Immunity for industrial environments
EN 61000-6-4:2007	Electromagnetic compatibility (EMC) - Part 6-4: General regulations - Emissions for industrial environments
EN 378-2:2008 + A1:2009	Cooling systems and heating pumps - Safety and environmental requirements - Part 2: Design, construction, trial, marking, documentation

The pressure equipment in question contains:
Compressor and/or liquid receiver (with 200<PSxV<1000 bar-litres)
Group 2 cooling refrigerants fluid

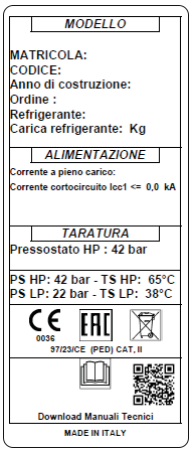
PED category: II
Assessment form: A1
Notified Body: TÜV SÜD Industrie Service GmbH
(ID-No.0036) Ridlerstrasse 65, 80339 München Germany

In any case, always refer to data indicated in the marking on the machine:



Chilled Water Units

Direct Expansion Units (PED Cat. I)



Direct Expansion Units (PED Cat. II)

MAIN UNIT COMPONENTS

MAIN SWITCH
With door lock and emergency stop function

MICROPROCESSOR

TEMPERATURE PROBE

HUMIDITY PROBE

PLUG FAN VENTILATOR

AIR FILTER

CHILLED WATER OR EVAPORATING COIL

ELECTRICAL BATTERY WITH LOW THERMAL INERTIA

WATER VALVE

VALVE ACTUATOR

IMMERSED ELECTRODE HUMIDIFIER

SCROLL COMPRESSOR

ELECTRONIC EXPANSION VALVE

DEHYDRATOR FILTER WITH LIQUID SIGHT GLASS

LIQUID RECEIVER

SOLENOID VALVE

VALVE TO CHECK CONDENSATION PRESSURE

CHECK VALVE

PLATE CONDENSER

PRESSURE VALVE

RECOMMENDED EQUIPMENT

AMERICAN TYPE HEAVY DUTY PIPE WRENCH
Minimum nominal size 2 ½"

ADJUSTABLE WRENCH

REVERSIBLE RATCHET WRENCH

PIPE-BENDING DEVICE FOR COPPER TUBING

PIPE CUTTER FOR COPPER TUBING

OXYGEN/PROPANE SOLDERING KIT

2-WAY MANOMETRIC UNIT WITH FLEXIBLE PIPING (R410A)

ELECTRONIC SCALES

DIGITAL MULTIMETER WITH CURRENT CLAMP

SET FLATHEAD SCREWDRIVERS

SET PHILLIPS SCREWDRIVERS

SET TORX® SCREWDRIVERS

EXPANDER FOR COPPER TUBING

PIPE REAMER FOR COPPER TUBING

NITROGEN PRESSURISATION KIT

HIGH PERFORMANCE VACUUM PUMP

REFRIGERANT THAT IS SUITABLE FOR THE UNIT (R410A)

ELECTRONIC LEAK DETECTOR

1 DESCRIPTION OF UNITS AND OPERATING LIMITS

1.1 P SERIES, G SERIES AND R SERIES UNITS

The machine in question is a Close Control air conditioner with direct expansion or chilled water coil designed for use in technology centres. The machine comprises 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: (A) consisting of a direct expansion coil with expanded copper tubes inside aluminium fins, scroll compressor fastened to the machine's structure with rubber vibration damping supports, electronic adjustment expansion valves (EEV), receiver-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.
- Hydraulic circuit (U): with chilled water expansion coil featuring copper pipes in aluminium fins, 2 or 3-way motorised valve with manual emergency opening control, water circuit with anti-condensation thermal insulation.
- Electric post-heating low thermal inertia coil in stages or with Triac modulation.
- Immersed electrode humidifier.

1.1.1 P SERIES, G SERIES AND R SERIES UNIT ENCODING

1	**ST**		SysTemp
2	**O**	Air supply type:	**H** Horizontal supply **O** Upflow air supply **U** Downflow air supply
3	**P**	Series name	**P** Close Control Air Conditioners: Perimeter installation **G** Air Conditioners for large Data Centres: Perimeter Installation **R** Air Conditioners for large Data Centres: In Row installation
4	**A**	Cooling type:	**A** Direct expansion coil **U** Chilled water coil
5	**07**	Nominal size (nominal cooling capacity in kW)	
6	**1**	Number of cooling circuits (Only direct expansion units)	
7	**a**	Series modification index	
8	**TS**	Accessories:	**TS** Two Sources **FC** Free Cooling

1.2 UNIT SERIES TMC

The machine in question is an air-cooled condenser with axial blowers. The machine comprises 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 aluminum fins.

1.2.1 UNIT SERIES TMC CODING

1	**TMC**	Air-cooled condensers with axial fans:
2	**11**	Nominal size (nominal cooling capacity in kW)

1.3 OPERATIONAL LIMITS

WARNING!

Systemair tests water components with dried compressed air at 24 bar. This ensures that no water is present in the water circuits, thereby preventing the possibility of freezing during storage prior to installation.

However, during the 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 have been implemented (e.g. insulation, addition of glycol, etc.).

AIR CONDITIONERS

	Direct Expansion	Chilled Water
Maximum Temperature (Air infeed)	40°C	40°C
Minimum Temperature (Air infeed)	20°C	18°C
Maximum Humidity (Air infeed)	60%	60%
Minimum Humidity (Air infeed)	25%	25%
Storage Conditions	Temperature from -20°C to + 50°C - Humidity 10%Ur to 90 %Ur non condensing – Store in a room that is closed and protected from external atmospheric agents.	

TMC AIR-COOLED CONDENSERS

	Air infeed temperature
Maximum Temperature	55 °C
Minimum Temperature	- 40 °C

WATER CIRCUITS

Type	Chilled Water	Hot Water	Internal Humidifier	Plate Condenser
Maximum Pressure	16 bar (1.6 MPa)	16 bar (1.6 MPa)	8 bar (0.8 MPa)	16 bar (1.6 MPa)
Minimum Pressure	-	-	1 bar (0.1 MPa)	1 bar (0.1 MPa)
Maximum adjustment valve ΔP	2.5 bar (250 kPa)	2.5 bar (250 kPa)	-	2.5 bar (250 kPa)
Maximum Temperature	-	85 °C	40 °C	45 °C
Minimum Temperature	5°C	-	5°C	-10 °C

For different work conditions contact Systemair offices

1.4 CONFIGURATION EXAMPLES

1.4.1 ST OPA/ST OPU - OVER SERIES (UPFLOW SUPPLY)

Standard version

Version with supply plenum

Version with suction from the bottom and closed front panel

1.4.2 ST UPA/ ST UPU - UNDER SERIES (DOWNFLOW SUPPLY)

Standard version

Version with supply plenum

Version with front supply

1.4.3 ST UGA/ST UGU - UNDER SERIES (DOWNFLOW SUPPLY)

Standard version

Version with closed supply plenum for installations above the raised floor

Version with rear supply and rear suction plenum

1.4.4 ST HRA/ST HRU - HORIZONTAL SERIES (HORIZONTAL/FRONT SUPPLY)

Standard version with rear suction and front and side

1.4.5 TMC H/V - HORIZONTAL (HORIZONTAL INSTALLATION) AND VERTICAL (VERTICAL INSTALLATION) SERIES

Horizontal installation

Vertical installation

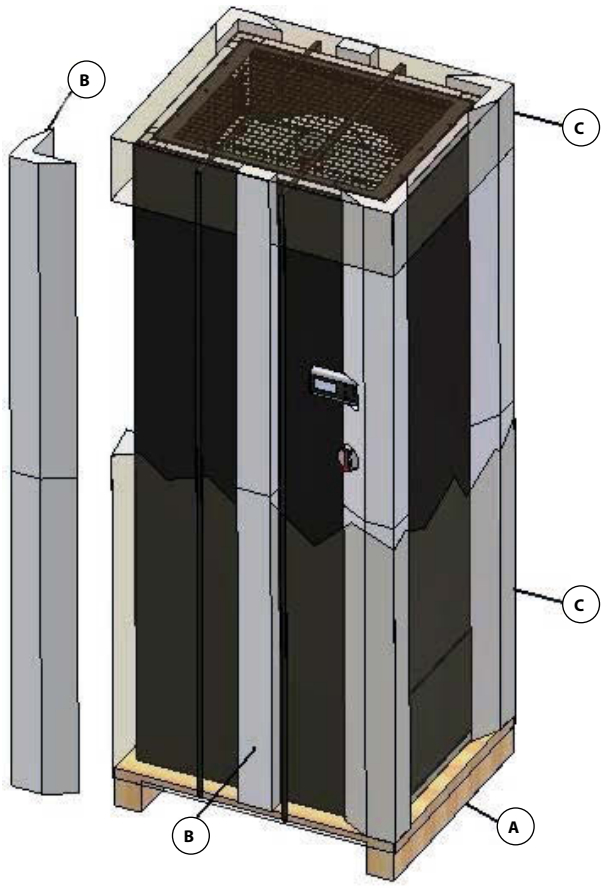
2 TRANSPORT, POSITIONING AND INSTALLATION PROCEDURES

WARNING!
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 otherwise agreed with the Customer, Systemair shall supply their machines ex works (EXW) with standard packaging consisting of: Wooden pallet, Protective polystyrene packing and polythene sheet.



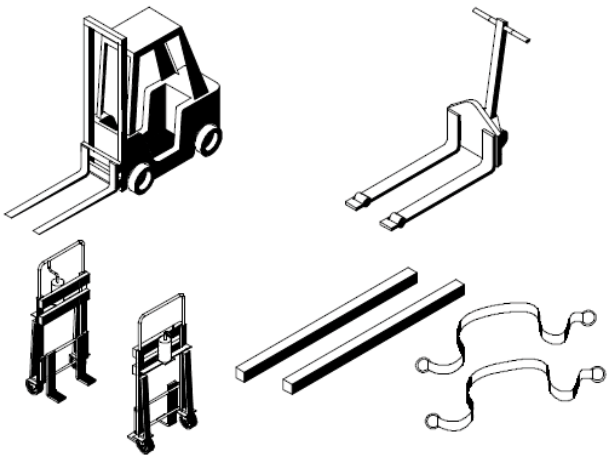
A Wooden pallet
B Polystyrene shockproof coatings
C Polyethylene protective film

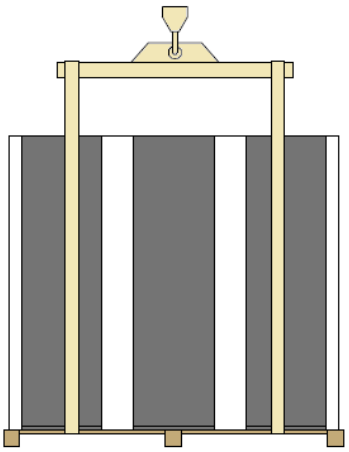
As the Carrier is always responsible for damage sustained by the goods during transport, before signing the delivery note to accept the supply, make sure the packaging is intact and that there are no visible signs of damage to the machine or traces of oil/refrigerant liquid leakage. In the event of evident damage to the unit, or if there is the slightest doubt as to whether the conditioner has been damaged during transport, it is necessary to express your reservations in writing to the Carrier, whilst also informing the Systemair Sales Department.

2.1.1 UNIT HANDLING

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.



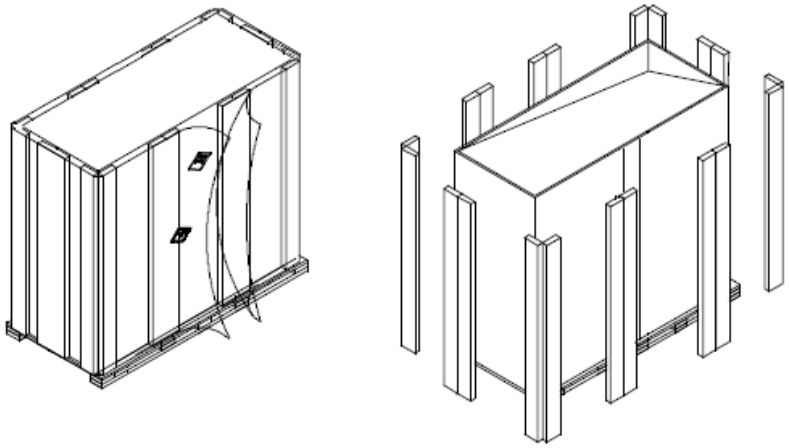


If the unit is not to be installed immediately after its arrival on site, it should be stored in its original packaging, in a dry, enclosed area, preferably heated during the winter months.

2.1.2 PACKAGING REMOVAL

For final placement of the units the shipping packaging must be removed. To remove the packaging proceed 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 shock-proof polystyrene pads.



2.2 WEIGHT IN OPERATING SET-UP AND CLEARANCE SPACES FOR ROUTINE MAINTENANCE

2.2.1 WEIGHT IN OPERATING SET-UP

For a units correct installation, and to ensure the security of the operators, it is essential to make sure that the surface (the actual floor or raised floor) where the conditioners are installed is able to support the weight during operation.

The latter information can be taken from the order confirmation or in the following table (standard models).

Standard models	Weight kg	Standard models	Weight kg	Standard models	Weight kg
P Series					
071	180	**302**	340	**10**	155
111	200	**372**	350	**20**	160
141	210	**422**	450	**30**	220
211	270	**512**	500	**50**	240
251	270	**612**	640	**80**	340
301	320	**662**	640	**110**	360
361	440	**852**	660	**160**	540
461	450	**932**	860	**220**	700
491	540				
G Series					
461	630	**70**	610	**300**	1250
612	680	**150**	750		
932	870	**230**	930		
R series					
231	215	**361**	215	**40**	190

If the units are installed on a normal floor, it is necessary to place a layer of vibration damping material (rubber or similar material) between the machine and the floor to avoid transmitting vibrations to the structure of the building.

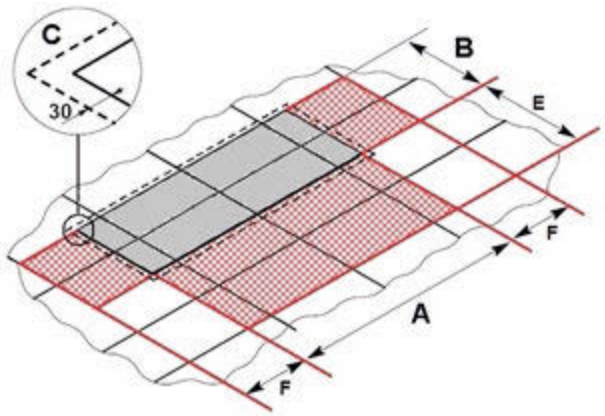
This layer of vibration damping material also makes up for floors that are not perfectly flat, guaranteeing the air seal between the elements and containing the noise level of the installation.

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 every case, to the drawings supplied with the order confirmation.

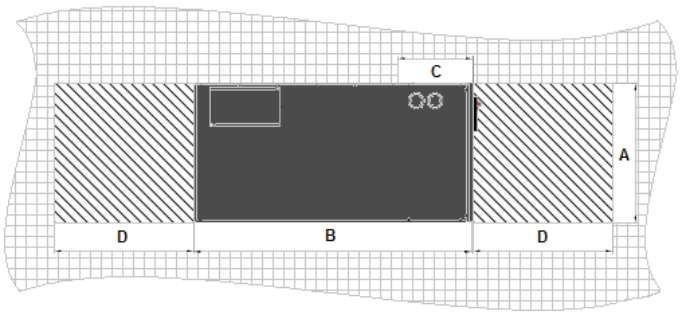
The units must be positioned differently based on the type of unit, and always following the design and manufacturing requirements of the unit.

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



Series P and Series G clearance spaces

Standard models	Plan dimensions					
	Dimensions (mm)			Clearances (mm)	Maintenance (mm)	
	Length	Depth	Height	Edging	Scheduled	Unscheduled
	A	B	H	C	E	F
P Series Units						
071 – 111- 141	750	600	1990	30	860	600
10 – 20						
211 – 251	860	880				
30 – 50						
301 – 302 – 372	1410					
361 – 461 – 422 – 512	1750					
80 – 110						
491 – 612 – 662 – 852	2300					
932	2640					
160						
220	3495					
G Series Units						
70	1320	921	1990	30	860	-
461 - 612	1490					
150	2220					
932	2390					
230	3120					
300	4020					



Series R clearance spaces

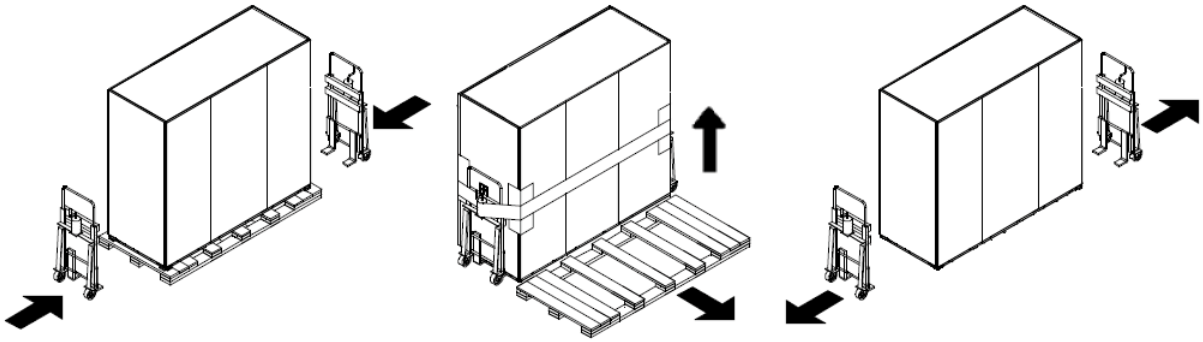
Standard models	Plan dimensions						
	Dimensions (mm)			Clearances (mm)		Maintenance (mm)	
	Length	Depth	Height	Front and side supply	Front supply	Sched-uled	Unscheduled
	A	B	H	C		D	
R series unit							
231 - 361	600	1222	2020 + 35*	315	45	800	1300
40							
* Height of the "Wheel Kit" accessory							

2.3 UNIT POSITIONING

2.3.1 UNIT PLACEMENT BY USING THE 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.



2.3.2 WHEELS TO SET SERIES R IN POSITION (ACCESSORY)

The 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.

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.

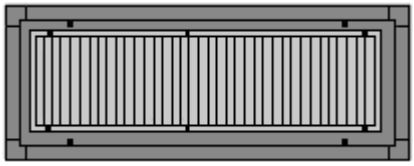
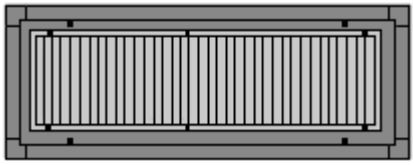
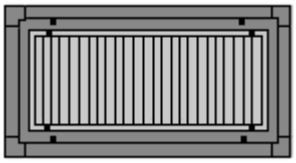
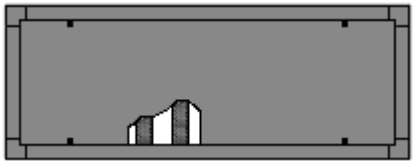
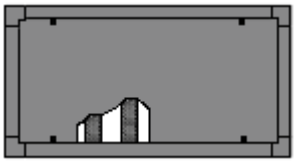
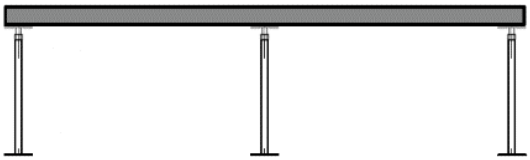
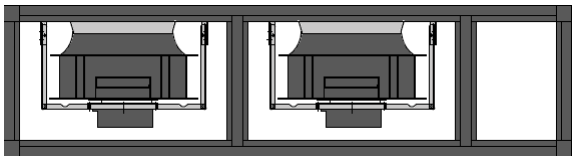
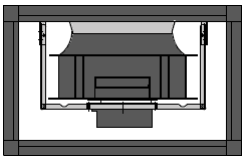
The type of keys used in series P and G is numbered, whereas for series R is is standard size, it is therefore always possible to purchase a duplicate in a hardware shop, by providing the number stamped on the lock (5333) or the type of engagement.

2.4 PLENUMS AND PLINTHS (ACCESSORY)

Various types of air distribution plenum and plinth are available as accessories for both the Under (U) and Over (O) versions of the unit.

When installing plenums and plinths, it is advisable to place a gasket (rubber or similar material), of an adequate thickness and length, between them and the machine to avoid transmitting vibrations to the structure. Placing this gasket in between also ensures the air seal between the two elements and contains the noise level of the installation.

Below are the various types of available plenums and plinths:

Type	Front view	Right – Left Side View
Plenum with opaque panels (Drilling must be carried out by the customer)		
Plenum with front grille		
Plenum with front and side grilles		
Soundproofed duct section		
Series P Adjustable Bases		
G series unit ventilated plinths		

2.4.1 PLENUM AND PLINTH DIMENSIONS

The dimensions of the plenum and the plinths are found in the order confirmation or in the following tables (standard models).

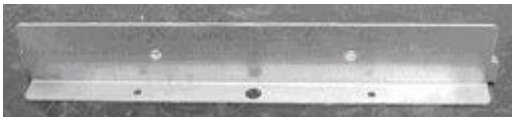
Standard models	Plenum and Soundproofed duct section		
	Plan dimensions - standard model Dimensions (mm)		
	Length	Depth	Height
071 – 111- 141 – 10 – 20	750	580	450
211 – 251 – 30 – 50	860	850	550
301 – 302 – 372	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
491 – 612 – 662 – 852	2300		
932 – 160	2640		
220	3495		

Standard models	Adjustable plinths		
	Plan dimensions - standard model Dimensions (mm)		
	Length	Depth	Height
071 – 111- 141 – 10 – 20	750	580	220 / 600
211 – 251 – 30 – 50	860	850	
301 – 302 – 372	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
491 – 612 – 662 – 852	2300		
932 – 160	2640		
220	3495		

Standard models	ST UGA/ ST UGU unit ventilated plinths		
	Plan dimensions - standard model Dimensions (mm)		
	Length	Depth	MINIMUM height
70	1320	900	550
461 - 612	1490		
150	2220		
932	2390		
230	3120		
300	4020		

2.4.2 INSTALLATION OF PLENUMS AND DUCT SECTIONS ABOVE THE UNIT

The plenums and duct sections at the top of the unit are installed using the four brackets supplied, which are to be fitted to the upper frame members of the unit.

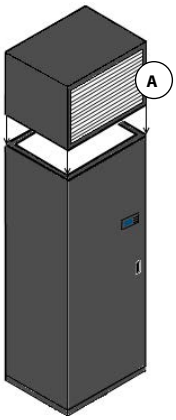


Fixing bracket

Do the following to install plenums and duct sections:

1) Fix the brackets to the aluminium frame of the unit using self-tapping screws. The brackets should be attached, in a central position, to each side of the unit.

2) Place the relative gasket on the profiles of the plenum and position it on the unit being careful to line up the profiles. The plenum must not be attached.



A Plenum

Example of installation with upper plenum

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

Do the following to install a plenum under the unit:

1) Position the plenum on the floor and place the relative gasket on its profiles.
2) Position the unit on the plenum, making sure that the sections are properly aligned with each other.

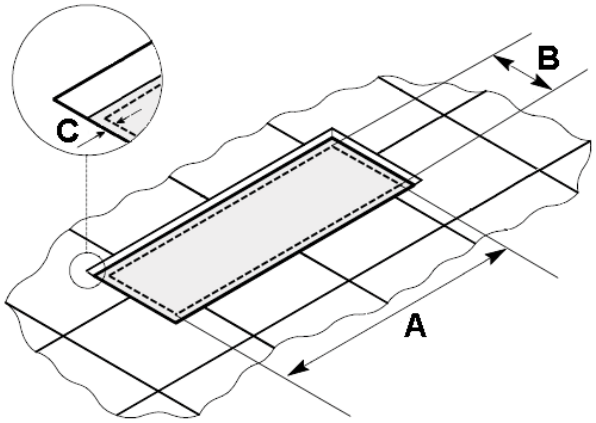
A Plenum

3) Fix the unit to the plenum using adequately sized self-tapping screws.

Example of installation with lower plenum

2.4.4 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 (standard models).



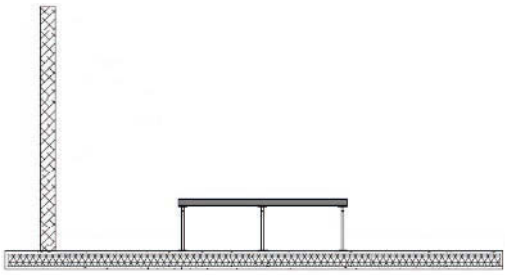
Standard models	Plinth plan dimensions - Dimensions (mm)		
	Length	Depth	Tolerance
	A	B	C
071 – 111- 141 – 10 – 20	750	580	10
211 – 251 – 30 – 50	860	850	
301 – 302 – 372	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
491 – 612 – 662 – 852	2300		
932 – 160	2640		
220	3495		

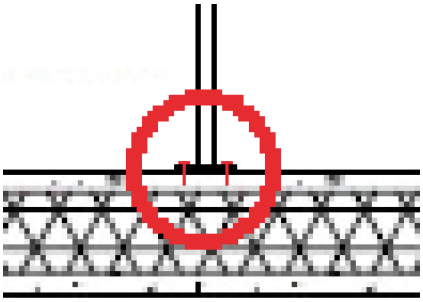
Standard models	Series G Ventilated Plinths Plan Dimensions - Dimensions (mm)		
	Length	Depth	Tolerance
	A	B	C
70	1320	900	10
461 - 612	1490		
150	2220		
932 – 1232	2390		
230	3120		
1342 – 1732	3290		
300	4020		

2.4.5 INSTALLATION OF ADJUSTABLE AND VENTILATED PLINTHS ON FINISHED FLOOR SURFACE

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

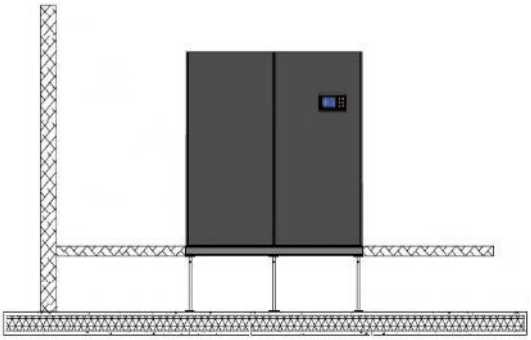
1) Position the plinth on the slab and attach the feet to the slab using anchor plugs (not supplied by Systemair).





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

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



Example of installation with plinth

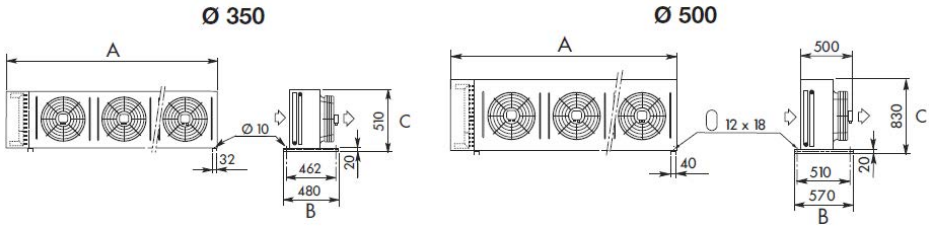
2.5 TMC AIR CONDENSER PLACEMENT AND INSTALLATION

2.5.1 DIMENSIONS FOR INSTALLATION AND CLEARANCES

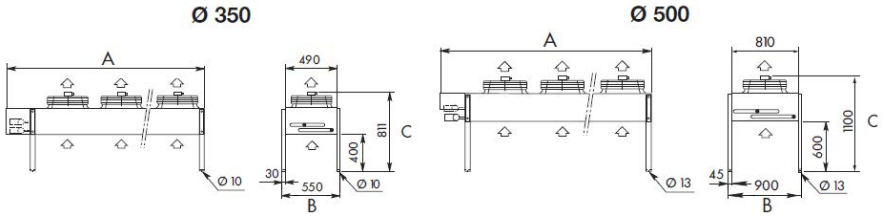
The figure below shows the dimensions to be taken into account during installation of the TMC air-cooled condensers. For the exact values referring to the dimensions indicated in the figure, refer to the following table and, in every case, to the drawings supplied with the order confirmation. The units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

TMC condenser dimensions

Vertical Installation (V)

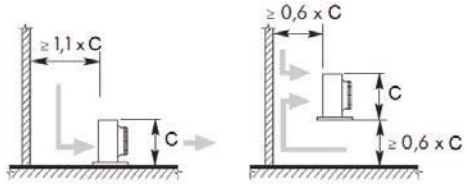
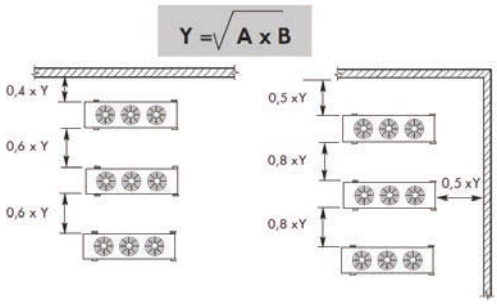


Horizontal Installation (H)



Standard models	Length (A) mm	Depth (B) mm		Height (C) mm		Weight Kg
		V	H	V	H	
TMC 11	882	480	550	510	811	27
TMC 19	1582					44
TMC 21						47
TMC 28	2282					62
TMC 33						68
TMC 37	2982					81
TMC 42						88
TMC 55	2206	570	900	830	1100	112
TMC 63						120
TMC 84	3206					157
TMC 92						170

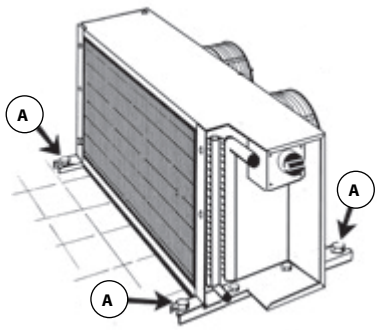
Clearance spaces calculation

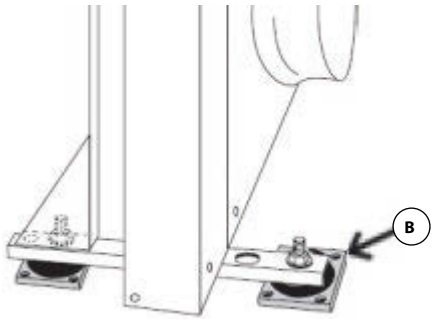
Vertical Installation (V)	Horizontal Installation (H)
	

2.5.2 TMC AIR-COOLED CONDENSER INSTALLATION

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

Vertical Installation (V)

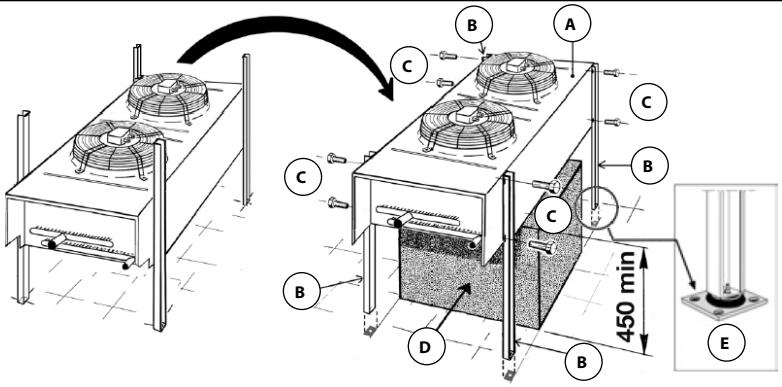




A **Brackets**
B **Vibration damping supports (accessory)**

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).

Horizontal Installation (H)

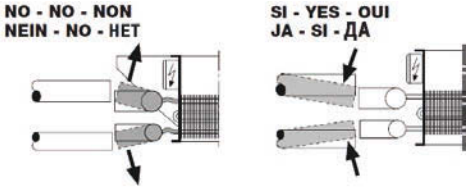


A **TMC Condenser**
B **Feet for horizontal installation (H)**
C **Screws for fastening the feet**
D **Support**
E **Vibration dampers (accessory)**

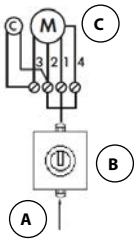
1) Remove the TMC condenser from the packaging.
2) Position the condenser on a support.
3) Remove the feet from the transport position.
4) Fasten the feet in the final position with the screws previously removed.
5) Install the supplied vibration damping (accessory).

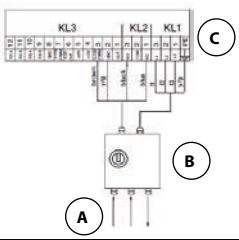
Cooling and Electrical Connections

Cooling Connections



AC and EC motors Electrical Connections





A **Power supply and signal line**
B **Electrical panel with disconnect switch**
C **Motor**

3 CONNECTION OF CONDENSATE DRAIN AND HUMIDIFIER

3.1 CONNECTION OF CONDENSATE DRAIN AND HUMIDIFIER

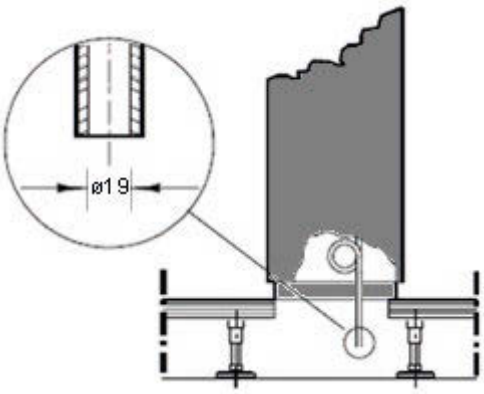
WARNING!

THE DRAINAGE WATER OF THE HUMIDIFIER MAY REACH TEMPERATURES OF 100 °C!

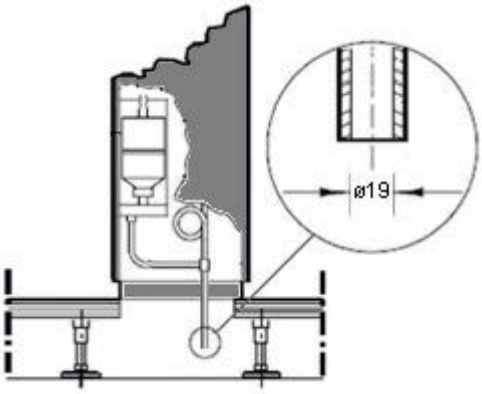
All air conditioners, whether direct expansion or water chilled coils, require a condensate drain connection, and the humidifier drain of the building waste drainage system.

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 drain pipe is a Retiflex pipe with ø 19x25 mm.

The humidifier drain, which does not require a trap, is supplied ready connected to the termination of the condensate drain. **The drainage water of the humidifier may reach temperatures of 100°C.**



Connection of the condensation drain



Connection of the condensation drain with humidifier

WARNING!

The condensate drain is supplied with a trap!

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

3.2 CONDENSATE DRAIN PUMP CONNECTION (ACCESSORY)

WARNING!

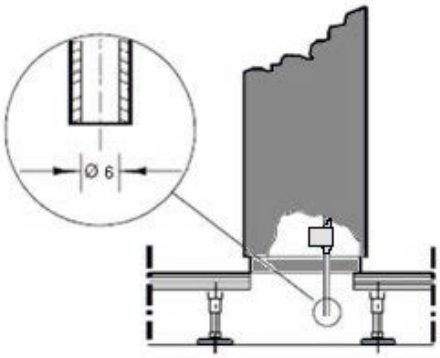
THE DRAINAGE WATER OF THE HUMIDIFIER MAY REACH TEMPERATURES OF 100 °C!

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

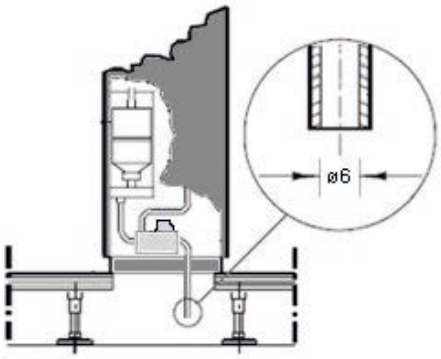
The condensate booster pump is standard supplied or mounted and installed, depending on the unit models. When the unit is installed the drain pipe must be connected to the building's sewage network by the installer. The drainage pipe is flexible and transparent, with a ø 6x9 mm diameter.

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

Condensation pumping trap



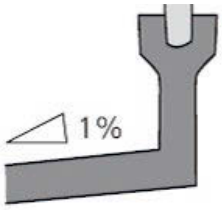
Connection of the condensation drain pump



Connection of the condensation drain with integrated humidifier

WARNING!

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



4 WATER CIRCUIT CONNECTIONS

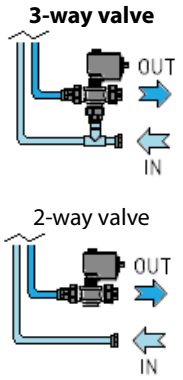
4.1 COOLED WATER COIL CONNECTION

It will be necessary to install water inlet and outlet pipes for machines with chilled water coils. The inlet and the outlet connections are indicated in the order confirmation or in the following tables (standard models).

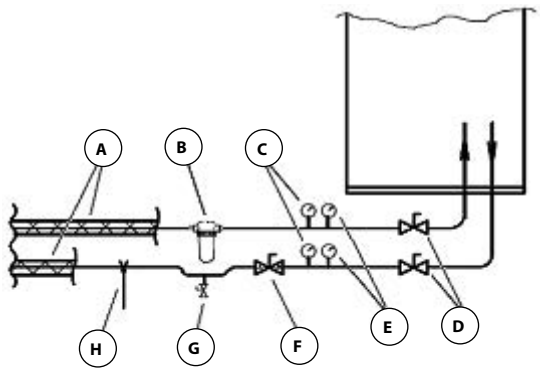
Standard models		Dimensions Ø (Inches)	
		Inlet	Outlet
ST OPU ST UPU	10	1/2" Female	1/2" Female
	20 – 30	1" Female	1" Female
	50 - 80	1 1/4" Female	1 1/4" Female
	110	1 1/2" Female	1 1/2" Female
	160	2" Female	2" Female
	220	2 1/2" Female	2 1/2" Female
ST UGU	70	1 1/2" Female	1 1/2" Female
	150	2" Female	2" Female
	230 - 300	2 1/2" Female	2 1/2" Female
ST HRU	40	1 1/4" Female	1 1/4" Female

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 coils is 16 bar (1.6 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 a pressure reducing valve upstream of the valve.



Water connections



Water supply line

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

To ensure that circuit pipes are installed correctly, we recommend that the following indications are observed:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Support 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 drain 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 a water/glycol solution where necessary.

4.1.1 INDEPENDENT PRESSURE WATER FLOW ADJUSTMENT SYSTEM (ACCESSORY)

The systems controlled by variable speed pumps feature some issues connected to the water circuit pressure.

These systems - in the event of sudden drop in cooling capacity by some users - may lead to pressure peaks in the circuit, owing to the pumps' modulation time, hence to an increase in the water flow rate inside the units. During these times the units' water circuit is over-supplied, hence it may cause adjustment imbalances and difficulty in valve movement.

This problem may be avoided with the installation of balancing valves on each unit's water circuit. This type of installation, however, features a number of issues, the most significant of which is the issue of calibration, to be effected with completed circuit during commissioning with suitable instruments.

To address the issues connected to balancing valves, Systemair has developed an independent pressure water flow adjustment system that makes it possible to limit the system's maximum flow rate even when faced with high water pressure in the circuit.

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 SySmart. Should this threshold be exceeded, SySmart 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.

The obtainable advantages are the following:

- High energy savings, preventing the circuit from being over-supplied.
- Precise and reliable adjustment of environmental energy loads, preventing annoying over-adjustments due to the sudden increase in water flow rate.
- Simplification in making the water system, thanks to elimination of the balancing valves.
- Savings in the system's commissioning time, thanks to the extreme ease of setting the water flow value, resulting in system start-up and management cost savings.
- Thorough monitoring of the system's thermal loads, which will allow the user to plan corrective actions or targeted system expansion, with further management cost savings.

Water flow measuring device

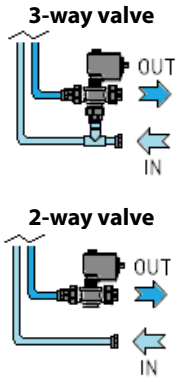
4.2 CHILLED WATER COIL CONNECTION - TWO SOURCES DESIGN (ACCESSORY)

It will be necessary to install water inlet and outlet pipes for TS units as it was for machines with chilled water coils. The inlet and the outlet connections are indicated in the order confirmation or in the following tables (standard models).

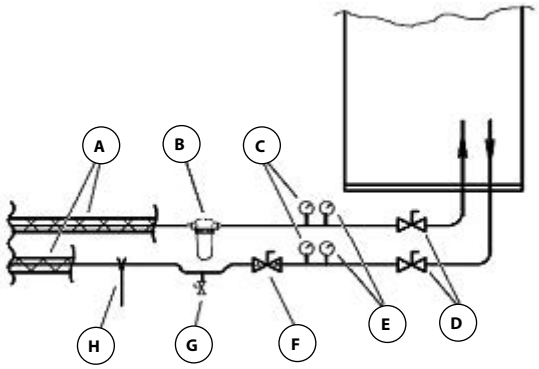
Standard models		Dimensions Ø (Inches)	
		Inlet	Outlet
ST OPA ST UPA	301 – 302 – 372	1 1/4" Female	1 1/4" Female
	491 – 612 – 662 – 852 – 932	1 1/2" Female	1 1/2" Female
ST HRU	40	1" Female	1" Female
ST HRA	231 - 361	1" Female	1" Female

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 coils is 16 bar (1.6 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 a pressure reducing valve upstream of the 3-way valve.



Water connections



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

Water supply line

To ensure that circuit pipes are installed correctly, we recommend that the following indications are observed:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Support 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 drain 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 a water/glycol solution where necessary.

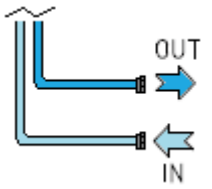
4.3 FREE COOLING UNIT WATER CIRCUITS CONNECTION (ACCESSORY)

Machines in Free Cooling execution are supplied with water circuits connected to the pre-set valve and water condenser. It will therefore be necessary to install circuit water inlet and outlet pipes. The diameters of the pipes and the inlet and the outlet fittings are indicated in the order confirmation or in the following tables (standard models).

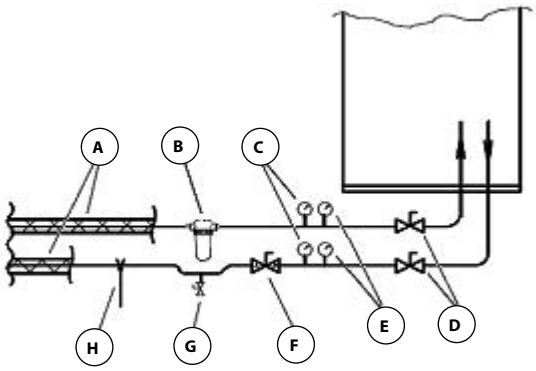
Standard models		Dimensions Ø (Inches)	
		Inlet	Outlet
ST OPA ST UPA	301 – 302 – 372	1 1/4" Female	1 1/4" Female
	491 – 612 – 662 – 852 – 932	1 1/2" Female	1 1/2" Female
ST HRA	231	1" Female	1" Female

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 coils is 16 bar (1.6 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 a pressure reducing valve upstream of the 3-way valve.



Water connections



Water supply line

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

To ensure that circuit pipes are installed correctly, we recommend that the following indications are observed:

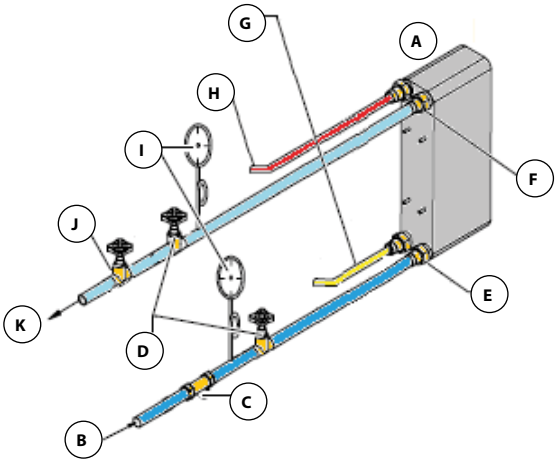
- Use piping suited to the circuit pressure (copper, steel or plastic).
- Support pipes with suitable brackets.
- Insulate both pipes with Armaflex type insulation.
- Install shut-off valves to facilitate maintenance.
- Install a Thermometer and Pressure gauge on the inlet and outlet.
- Install a drain 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 a water/glycol solution where necessary.

4.4 WATER CONDENSER CONNECTION (ACCESSORY)

For machines with integral water-cooled condenser, it will be necessary to install the feed and discharge lines to the condenser. The diameters of the pipes and the inlet and the outlet fittings are indicated in the order confirmation or in the following tables (standard models).

Standard models		Dimensions Ø (Inches)		
		Standard	With pressure adjustment valve	
		Inlet/Outlet	Inlet	Outlet
ST OPA ST UPA	071	3/4" Male	3/4" Female	3/4" Female
	111 – 141	1" Male	1" Female	1" Female
	211 – 251 – 301	1 1/4" Male	1 1/4" Female	1 1/4" Female
	361 – 461 – 491	1 1/4" Male	1 1/4" Female	1 1/4" Female
	302	2 x 1" Male	2 x 1" Female	2 x 1" Female
	372 – 422 – 512 – 612	2 x 1 1/4" Male	2 x 1 1/4" Female	2 x 1 1/4" Female
	662 – 852 – 932	2 x 1 1/4" Male	2 x 1 1/4" Female	2 x 1 1/4" Female
ST UGA	461	1 1/4" Male	1 1/4" Female	1 1/4" Female
	612 – 932	2 x 1 1/4" Male	2 x 1 1/4" Female	2 x 1 1/4" Female
ST HRA	231	1 1/4" Male	1 1/4" Female	1 1/4" Female
	361	1 1/4" Male	1 1/4" Female	1 1/4" Female

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).



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

Water connections

To ensure that circuit pipes are installed correctly, we recommend that the following indications are observed:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Support 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 drain 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 a water/glycol solution where necessary.

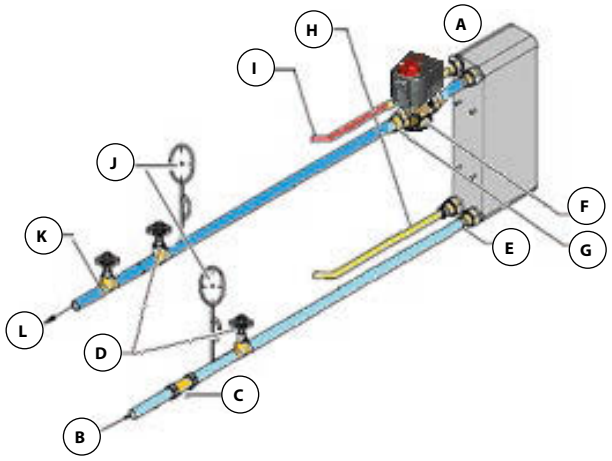
4.4.1 CONDENSATION PRESSURE ADJUSTMENT MODULATING VALVE (ACCESSORY)

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 (e.g. below fifteen degrees) that the machine's condensation temperature is excessively lowered. The valve is factory-installed on the condenser water outlet.

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 clogged by impurities in the water.

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 a pressure reducing valve upstream of the valve.



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

Water connections

To ensure that circuit pipes are installed correctly, we recommend that the following indications are observed:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Support 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 drain 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 a water/glycol solution where necessary.

4.5 CONNECTION OF THE INTERNAL SUBMERGED ELECTRODE HUMIDIFIER (ACCESSORY)

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

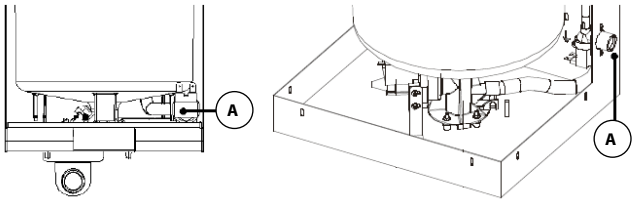
This type of humidifier exploits the conductivity of the water in the cylinder to produce steam. Applying voltage to the electrodes in the cylinder, current will flow between the electrodes that will heat the water until it reaches boiling point.

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.

Immersed electrode humidifier

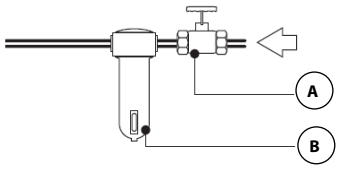
4.5.1 WATER CONNECTIONS OF THE SUBMERGED ELECTRODE HUMIDIFIER

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.



Ø Diameter hydraulic connection (A)	
Hose (mm)	**Threaded Fitting (Inches)**
6 (mm)	¾" Male

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



A Shut-off cock
B Mechanical filter

Hydraulic line characteristics
A shut-off cock must be installed on the water supply pipe (B)
A 50 µ mechanical filter must be installed on the supply line (C)
Pressure between 1-8 bar (100 and 800 kPa)
Temperature between 1 and 40 °C
Instantaneous flow rate no lower than the nominal flow rate of the supply solenoid valve (0.6 - 1.2 l/m)
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

4.5.2 CHEMICAL/PHYSICAL CHARACTERISTICS OF THE WATER SUPPLY

IMPORTANT WARNING!

There is no need to use water softeners!

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		**LIMITS**	
		Min.	**Max.**
Hydrogen ion activity	pH	7	8.5
Specific conductivity at 20 °C	µS/cm	350	750
Total dissolved solids	mg/l	320	700
Fixed residue at 180 °C	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 chlorine	mg/l C1	0	0.2
Calcium sulphate	mg/l CaSO4	0	100
Metallic impurities, solvents, thinners, soap, lubricants	mg/l	0	0

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: Suited to water with specific conductivity at 20 °C between **125 and 350 µS/cm.**
2) Cylinders for **HIGH** conductivity: Suited to water with 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.

5 COOLING CIRCUIT CONNECTIONS

5.1 PRECAUTIONS

- **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}) = 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.**

5.2 COOLING CIRCUIT ACCESSORIES

5.2.1 LARGER LIQUID RECEIVER (ACCESSORY)

Installation of a larger liquid receiver is required in the event of very wide thermal excursions and particularly long cooling lines. In these cases in fact, the refrigerant charge effected in the winter time may be very significant and, during the summer time, it tends to flood the liquid receiver thus voiding its function.

For very low external temperatures, it is recommended to evaluate installation of the operational kit for very low external temperatures (see next chapter).

5.2.2 CHECK VALVE ON SUPPLY PIPES (ACCESSORY)

The installation of check valves on supply pipe will prevent the refrigerant, in the event of compressor shutdown, from flowing back down the supply pipe to the compressor and damaging it at the next start-up and/or preventing normal operation by causing a high-pressure blockage. Naturally the valve must be installed such that it respects the refrigerant flow.

For very low external temperatures, it is recommended to evaluate installation of the operational kit for very low external temperatures (see next chapter).

5.2.3 CHECK VALVE ON LIQUID PIPES (ACCESSORY)

Installation of check valves on the liquid piping has the purpose of preventing the liquid refrigerant from migrating towards the condenser. In fact, mainly during winter months, the refrigerant liquid may accumulate in the condenser, which may create a problem of low pressure on starting the compressor. Naturally the valve must be installed such that it respects the refrigerant flow.

For very low external temperatures, it is recommended to evaluate installation of the operational kit for very low external temperatures (see next chapter).

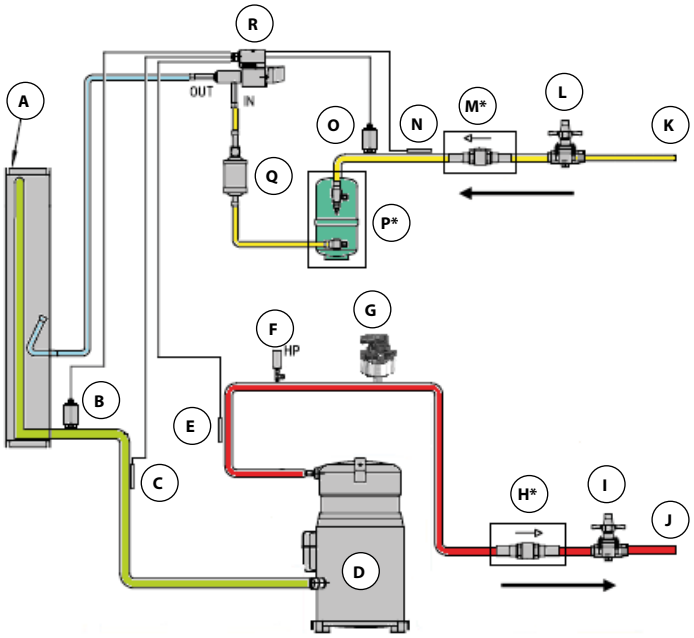
5.2.4 OPERATING KIT WITH VERY LOW OUTDOOR TEMPERATURE - "KIT LT" (ACCESSORY)

During winter months, with very low temperature, the refrigerant liquid may accumulate in the condenser, which may create a problem of low pressure on starting the compressor.

The kit for operation with very low outdoor temperature consists of a larger liquid receiver, able to contain a larger amount of refrigerant, a check valve on the liquid line to prevent migration of the refrigerant liquid in the condenser and a check valve on the supply pipe to prevent migration of the liquid refrigerant in the compressor.

During the winter time, with very low temperatures, the installed components prevent the liquid refrigerant from migrating towards the condenser. The refrigerant however will remain inside the liquid receiver to the extent of preventing low pressure problems during start up.

The check valve on the supply instead, prevents liquid return to the compressor during the summer period which, by condensing after a compressor stop, could cause damage on start up and/or prevent smooth operation causing a high pressure block.



A Direct expansion coil
B Evaporation pressure probe
C Intake temperature probe
D Compressor
E Drain temperature probe
F High pressure switch
G Air condenser pressure regulator (Accessory)
H Hot gas line check valve*
I Hot gas line cock
J Hot gas line connection
K Liquid line connection
L Liquid line cock
M Liquid line check valve*
N Liquid temperature probe
O Condensation pressure probe
P Oversize liquid receiver*
Q Receiver-drier and liquid inspection
R Electronic expansion valve

* LT Kit

5.3 ROUTING OF THE COOLING CIRCUIT PIPES

IMPORTANT WARNING!

Correct routing of the cooling circuit pipes is essential to the successful operation of the air conditioner. It is necessary to take special care in the selection and positioning of the supply pipes and liquid pipes, above all when these lines are relatively long.

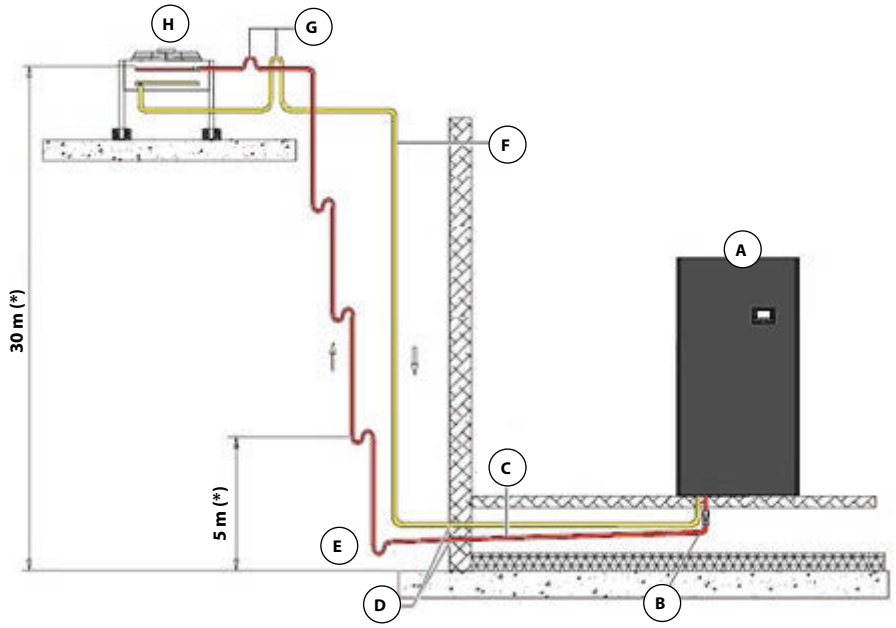
It is important to remember that the pipes should be **SHORT AND WITH THE LEAST BENDS POSSIBLE**, since the cooling capacity of the circuit can be reduced exponentially by its length.

In installations with cooling circuit pipes featuring vertical pipe runs and the condenser located higher than the machine, it will be necessary to install a check valve on the refrigerant supply pipe (accessory) as near as possible to the machine outlet

In installations with cooling circuit pipes featuring vertical pipe runs and the condenser located higher than the machine, it will be necessary to install a check valve on the refrigerant supply pipe (accessory) as near as possible to the machine inlet.

5.3.1 COMMON EXAMPLES OF COOLING CIRCUITS

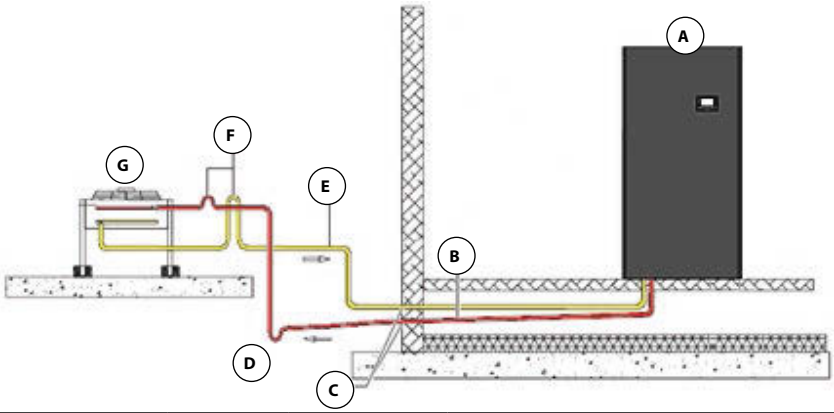
Installation with condenser at top

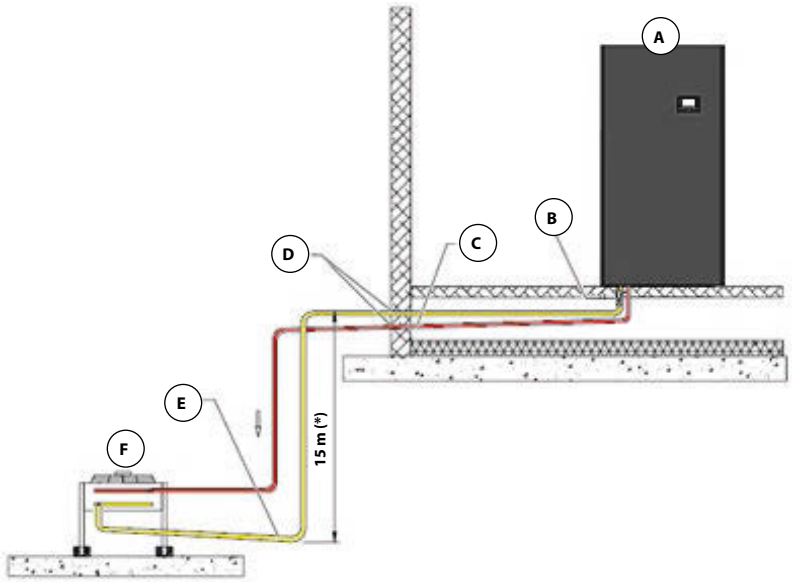


A Unit
B Check valve on supply line (accessory)
C Supply line
D Outlet Point
E Oil traps
F Liquid line
G Inverted curves (higher than the condenser coil)
H Air-cooled condenser

(*) Maximum height differences

Vertical height difference maximum	30 m	**Precautions**	Plan for oil traps on the supply piping for every 5 m in level difference
			Plan for a minimum supply piping gradient of 1%
			Plan for a check valve on the supply pipe when exiting the machine
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

Installation with condenser on a level			
			**A Unit** **B Supply line** **C Outlet Point** **D Oil trap** **E Liquid line** **F Inverted curves (higher than the condenser coil)** **G Air-cooled condenser**
Precautions			Plan for a minimum supply piping gradient of 1%
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

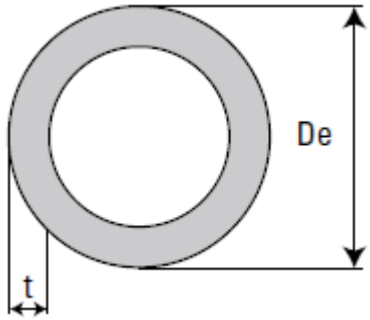
Installation with condenser at bottom			
			**A Unit** **B Check valve on liquid line (accessory)** **C Supply line** **D Outlet Point** **E Liquid line** **F Air-cooled condenser** **(*) Maximum height differences**
Vertical height difference maximum	15 m	**Precautions**	Plan for a minimum supply piping gradient of 1%
			Set up a 1% inclination for the liquid pipe
			Plan for a check valve on the liquid pipe at the condenser inlet
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

5.4 COOLING CIRCUIT SIZING

5.4.1 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.



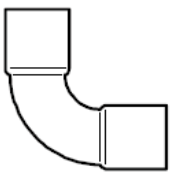
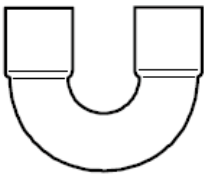
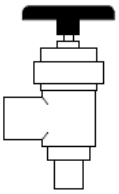
Ø External diameter		Minimum pipe thickness
Inches	**mm**	**t (mm)**
3/8"	**9.52**	0.8
1/2"	**12.70**	0.8
5/8"	**15.88**	1
3/4"	**19.05**	1
7/8"	**22.22**	1
1 1/8"	**28.57**	1

5.4.2 CALCULATION OF THE EQUIVALENT PIPE LENGTH

For correctly sizing the unit cooling lines it is necessary to calculate the equivalent length of coolant 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:

		 90°	 45°	 180°	 90°	
Ø External diameter		**Equivalent Metres**				
Inches	**mm**	**m**				
3/8"	**9.52**	0.49	0.24	0.75	2.00	1.90
1/2"	**12.70**	0.53	0.26	0.80	2.20	2.00
5/8"	**15.88**	0.55	0.27	0.85	2.40	2.10
3/4"	**19.05**	0.60	0.30	0.95	2.70	2.40
7/8"	**22.22**	0.70	0.35	1.10	3.20	2.80
1 1/8"	**28.57**	0.80	0.45	1.30	4.00	3.30

5.4.3 DIAMETERS OF COOLING CIRCUIT CONNECTION PIPES

IMPORTANT WARNING!

For lines with Equivalent Length per section exceeding 60 m a 20% larger air condenser must be provided!

For lines with descending vertical height difference exceeding 8 m a 30% larger air condenser must be provided!

The recommended diameters for the supply, liquid and intake lines according to standard model size (expressed by the number sequence of coding) are set out in the order confirmation or in the following table

Recommended external diameters for cooling lines with:

- **MAXIMUM section Equivalent Length: 100 m**
- **MAXIMUM Total Equivalent Length of the circuit: 200 m**
- **MAXIMUM ascending vertical height difference: 20 m**
- **MAXIMUM descending vertical height difference: 15 m**
- **MAXIMUM condensing temperature: 60 °C**

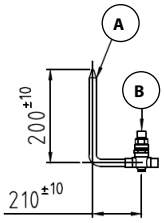
Standard models	Ø Supply piping		Ø Liquid piping		Ø Suction piping	
	Inches	mm	Inches	mm	Inches	mm
P Series						
071	1/2 "	12.70	3/8"	9.52	5/8 "	15.88
111	5/8 "	15.88	1/2 "	12.70	7/8 "	22.22
141	5/8 "	15.88	1/2 "	12.70	7/8 "	22.22
211	3/4 "	19.05	5/8 "	15.88	7/8 "	22.22
251	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
301	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
361	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
461	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
491	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
302	5/8 "	15.88	1/2 "	12.70	7/8 "	22.22
372	3/4 "	19.05	5/8 "	15.88	7/8 "	22.22
422	3/4 "	19.05	5/8 "	15.88	7/8 "	22.22
512	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
612	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
662	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
852	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
932	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
G Series						
461	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
612	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
932	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57
R series						
231	3/4 "	19.05	5/8 "	15.88	7/8 "	22.22
361	7/8 "	22.22	3/4 "	19.05	1 1/8''	28.57

For models with several circuits the figures are intended per circuit

5.5 COOLING CIRCUIT INSTALLATION

5.5.1 HOT OR PRESSURISED GAS SUPPLY PIPE CONNECTION

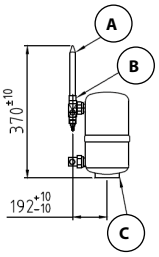
To facilitate connection inside the air conditioner, there is a section of pipe approximately 200 mm long, of which one end is connected to the compressor outlet with its cock, while the other end is crimped and soldered shut.

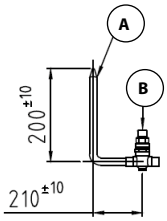


A Supply connection
B Supply cock

5.5.2 LIQUID OR RETURN LINE CONNECTION

To facilitate connection inside the air conditioner, there is a section of pipe approximately 200 mm long, of which one end is connected to the liquid receiver inlet with its cock, while the other end is crimped and soldered shut. Where a check valve is fitted to the line, the cock will be separate from the liquid receiver and located on the line.

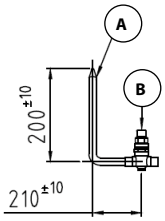




A Liquid connection
B Liquid cock
C Liquid receiver

5.5.3 INTAKE LINE CONNECTION

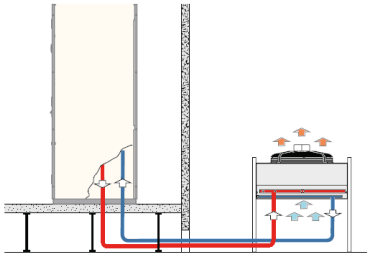
To facilitate connection inside the air conditioner, there is a section of pipe approximately 200 mm long, of which one end is connected to the compressor outlet with its cock, while the other end is crimped and soldered shut.



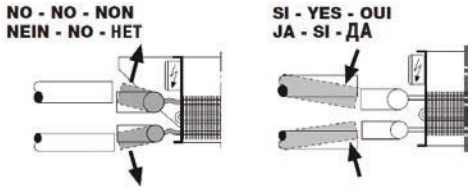
A Suction connection
B Suction cock

5.5.4 AIR CONDENSERS CONNECTION

The refrigerant inlet and outlet connections on the air-cooled condenser can be identified by their adhesive labels. In any case, note that the exchange of heat between the air and the refrigerant should occur in the opposite direction to flow. This means that the condenser inlet union for the supply piping is the union furthest from the air inlet into the coil, i.e. the union nearest the fans. Conversely, the condenser outlet union for the liquid piping is the union furthest away from the fans.



Refrigerant connections opposite to flow direction



Connections to condenser manifolds

5.5.5 COOLING CIRCUIT FITTING SIZES

The diameters of the units' cooling connections for supply, liquid and suction pipes (depending on the size of standard models expressed by the encoding numerical sequence) are indicated in the order confirmation or in the following table:

Standard models	Ø Supply piping connections	Ø Liquid piping connections	Ø Intake piping connections
	mm	mm	mm
P Series			
071 - 111	12	12	16
141 - 302	16	12	22
211 - 372 - 422	16	16	22
251 - 301 - 361 - 461 - 491 - 512 - 612 - 662 - 852 - 932	22	16	28
G Series			
461 - 612 - 932	22	16	28
R series			
231	16	16	22
361	22	16	28
Series TMC			
11 - 19	16	16	
21 - 28 - 33 - 37	22	22	
42 - 63	28	28	
55 - 84	35	28	
92	42	35	
For models with several circuits the figures are intended per circuit			

5.5.6 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.**
- **Welds may be effected by capillary brazing with an oxyacetylene welding torch. The solder alloy must be copper or a copper silver alloy.**
- **Protect the components with a damp cloth to prevent overheating.**

5.5.7 PRECAUTIONS FOR BRAZING

WARNING!

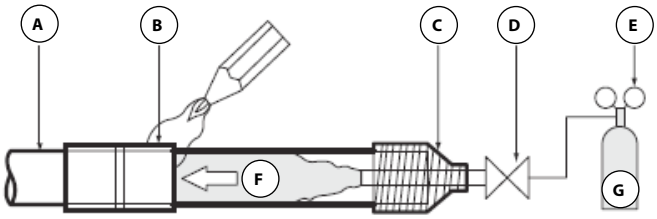
BURN HAZARD DURING COOLING CIRCUIT BRAZING PROCEDURES!

- **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 Point requiring brazing
C Insulating tape
D Manual valve
E Pressure reduction valve
F Nitrogen
G Nitrogen cylinder

5.5.8 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 may 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 from 40 to 42 Bar (4 - 4.2 MPa):
   a) If the pressure is unable to achieve this reading, it means there is a leak in the circuit.
   b) If the recommended pressure is achieved, 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.
6) 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

5.6 COOLING CIRCUIT VACUUM DRYING OPERATIONS

WARNING!

Remote condenser air conditioners are shipped pressurised with nitrogen at 2.5 Bar (250 kPa).

Air-cooled condensers are shipped pressurised with nitrogen at 2.5 Bar (250 kPa).

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

WARNING!

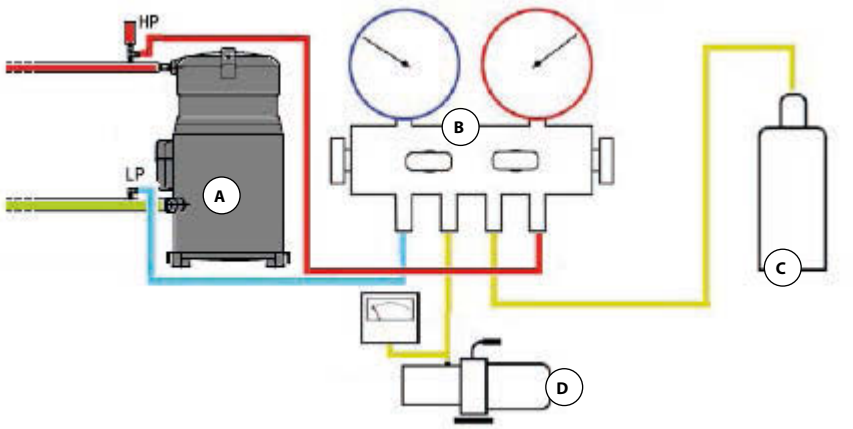
It is necessary to power the solenoid valve (if present) during the vacuum phase!

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 operatios suited to the cooling circuits.

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 reading that must be obtained on the installation site is equivalent to - 1 Bar (-100 kPa).**
8) Leave the pump in operation for a few hours (min. 2 hours):
   a) If, within two hours, the pump is unable to reach - **1 Bar (-100 kPa)**, this means that there are still traces of humidity or there is a leak.
   b) If a vacuum of - **1 Bar (-100 kPa)** has been reached, leave it for at least an 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

5.7 CHARGING THE CIRCUIT WITH REFRIGERANT

5.7.1 CALCULATION FOR THE QUANTITY OF REFRIGERANT IN THE CIRCUIT

WARNING!

The weights listed in the table are guidelines and may vary if accessories are used or special applications implemented! Refrigerant loading 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 formula:

Total load (kg) = Unit load (kg) + Supply pipe load (kg) + Liquid pipe load (kg) + External condenser load (kg)

The refrigerant content of the individual circuit elements are given in the following table.

Unit refrigerant content							
Models standard	Unit	LT Kit	Water-cooled condenser	Models standard	Unit	LT Kit	Water-cooled condenser
	kg	kg	kg		kg	kg	kg
P Series							
071	2.30	0.30	0.20	**302**	2.65	0.30	0.35
111	2.75	0.30	0.25	**372**	3.00	0.30	0.50
141	2.85	0.30	0.35	**422**	3.50	0.30	0.50
211	3.00	0.30	0.50	**512**	4.65	1.45	0.55
251	3.45	1.45	0.55	**612**	5.35	1.45	0.65
301	3.85	1.45	0.65	**662**	5.75	1.45	0.75
361	5.25	1.45	0.75	**852**	6.00	1.45	1.00
461	5.00	1.45	1.00	**932**	7.00	1.45	1.00
491	6.50	1.45	1.00				
G Series							
461	6.00	1.45	1.00	**612**	6.50	1.45	0.65
				932	8.00	1.45	1.00
R series							
231	3.50	1.45	0.55	**361**	5.00	1.45	0.75
For models with several circuits the figures are intended per circuit							

Refrigerant content per metre of pipe			
Ø External diameter		Weight of refrigerant per metre of pipe	
Inches	mm	Liquid	Supply
		kg/m	kg/m
3/8"	**9.52**	0.05	0.005
1/2"	**12.70**	0.10	0.010
5/8"	**15.88**	0.20	0.015
3/4"	**19.05**	0.25	0.025
7/8"	**22.22**	0.35	0.030
1 1/8"	**28.57**	0.60	0.055

Refrigerant content for TMC condensers			
Standard models	Circuit refrigerant content kg	Standard models	Circuit refrigerant content kg
TMC 11 H/V	0.30	**TMC 42 H/V**	1.15
TMC 19 H/V	0.40	**TMC 55 H/V**	1.40
TMC 21 H/V	0.60	**TMC 63 H/V**	1.80
TMC 28 H/V	0.60	**TMC 84 H/V**	2.00
TMC 33 H/V	0.80	**TMC 92 H/V**	2.75
TMC 37 H/V	0.75		

For non TMC condensers, the refrigerant content, expressed in kg, is provided by the following expression:

$$\frac{\text{Coil volume (dm}^3\text{)}}{K_{REF}\ (4)} = \text{Unit refrigerant content (kg)}$$

5.7.2 CHARGING THE CIRCUIT WITH REFRIGERANT

WARNING!

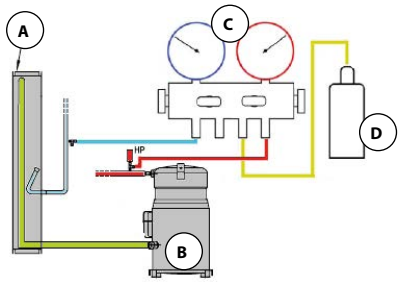
Cooling circuit charging operations must be carried out with the unit in operation. Make sure that electrical connections are correct.

Refrigerant must always be charged in its liquid phase. Make sure that piping connections to the tank are completed correctly.

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 coolant 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.
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 "Load" position.
8) Open the HIGH PRESSURE SIDE filling valve to insert refrigerant until it approximately reaches 2/3 of the calculated quantity.
9) Load any amount of top up oil through the provided valve placed on the compressor.
10) Turn on the unit fans and compressors.
11) Verify overheating and operational parameters in order to evaluate the charge (see chap.5.10).
12) Connect the pressure gauges to the charge outlet placed downstream of the expansion valve, to add small amounts of refrigerant until achieving the correct operating values (see ch. 5.7.2).
13) Calibrate the remote condenser speed variator to the temperature of required condensation (see chap.5.9).



A Coil
B Compressor
C Pressure gauges
D Refrigerant

5.8 TYPE AND QUANTITY OF COMPRESSOR LUBRICANT OIL

5.8.1 VERIFYING THAT THE LUBRICATING OIL CHARGE IN THE CIRCUIT IS CORRECT

Correct loading of lubricating oil is an indispensable requisite for perfect operation of the direct expansion circuit. It is also true that lack of lubricating oil, as well as an excess, may cause problems to the circuit such as a mechanical breakage of the circuit or a drop in performance of the unit. The following tables indicate the amount of lubricant oil contained in the compressors.

Use the following mathematical formula to assess the need for a refill of lubricant oil in the cooling circuit:

$$\frac{\text{Total refrigerant charge (kg)}}{6} \leq \text{Compressor oil content (l)}$$

Data on the type of oil to use are shown in the following table:

Typical characteristics					
Type	Polyester oil		**Viscosity Index**	-	100
Viscosity @ 40°C	cSt	68	**Ignition Point**	°C	260
Viscosity @ 100°C	cSt	8.7	**Freezing Point**	°C	-39

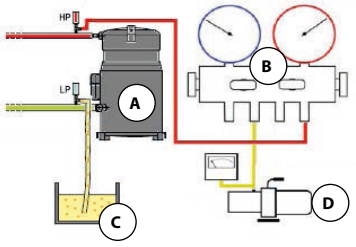
Standard models	Initial content Litres	Standard models	Initial content Litres
P Series			
071	0.6	**251 - 301 - 361 - 512 - 612 - 662**	2.8
111 - 141 - 211 - 302 - 372 - 422	1.7	**461 - 491 - 852 - 932**	3.5
G Series			
612	2.8	**461 - 932**	3.5
R series			
231	1.7	**361**	1.7
For models with several circuits the figures are intended per circuit			

5.8.2 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:**

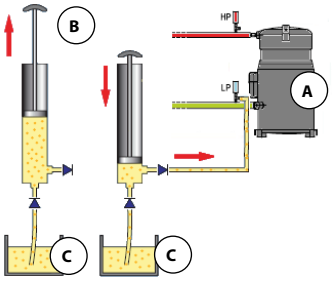
1) Connect a capillary to the low pressure side.
2) Immerse the capillary into a container.
3) Fill the container with the amount of oil needed.
4) Connect the pressure gauge unit from the high pressure side.
5) Proceed with the vacuum operations from the high pressure side.
6) The oil will be drawn into the circuit.
7) Once charging is complete, proceed with the vacuum as described in chapter 5.6.



A Compressor
B Pressure gauges
C Oil
D Vacuum pump

- **OIL TOP-UP WITH COOLANT LOADING CIRCUIT:**

1) Top-up with a specific pump.
2) Connect the pump to the circuit using the specific safety valve.
3) Connect the specific capillary to the intake valve.
4) Immerse the capillary into a container.
5) Fill the container with the amount of oil needed.
6) Activate the pump for the oil to enter the circuit.



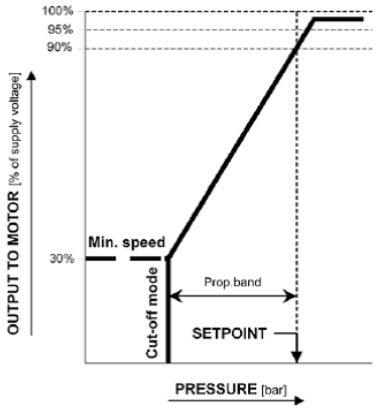
A Compressor
B Oil pump
C Oil

5.9 TMC CONDENSER PRESSURE REGULATOR (ACCESSORY)

Systemair installs speed regulators for TMC remote condenser fans inside the actual unit. Therefore, after installation of the cooling circuit for the units, the unit and the external condenser need to be connected electrically.

Adjust the condensation pressure using the relevant screw so that the condensation temperature, as read on the gauges, stabilises around the desired pressure value.

Speed adjustment of the fans (and consequently the condensation pressure) takes place in accordance with the model installed, as listed in the table:

<table>
<tr><th colspan="3">Regulator 4 A</th></tr>
<tr>
<td>  </td>
<td> 
REGULATION SCREW
DEFAULT 26 Bar</td>
<td> 
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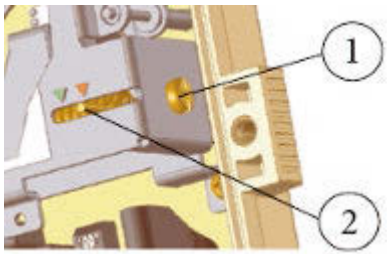
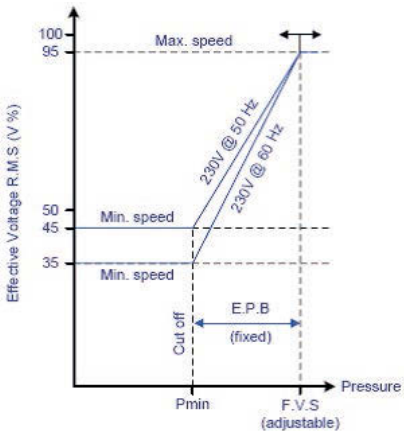
</tr>
<tr><th colspan="3">Regulator 8 A</th></tr>
<tr>
<td>  </td>
<td> 

1 = REGULATION SCREW
2 = SET POINT INDICATOR
DEFAULT 32 Bar</td>
<td> 
</td>
</tr>
<tr><th colspan="3">Regulator 12 A</th></tr>
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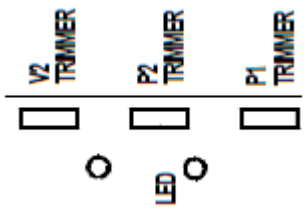
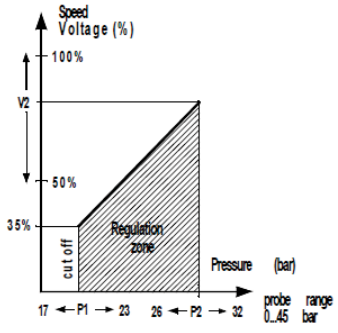
<td> 

DEFAULT 29 Bar</td>
<td> 
</td>
</tr>
</table>

5.10 VERIFICATION OF REFRIGERANT CHARGE

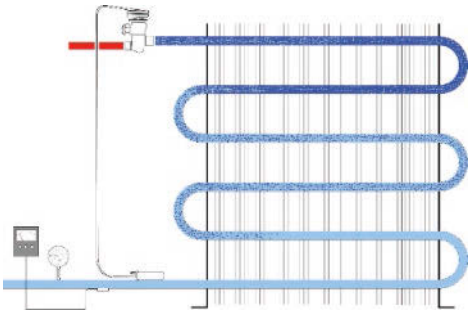
WARNING!

SOME PARTS OF THE COOLING CIRCUIT MAY BE HOT!

Correct system equilibrium, which depends on the choice of fundamental components and measuring the refrigerant charge, can be demonstrated by measuring overheating of refrigerant exiting the evaporator and the under-cooling upon exiting the condenser.

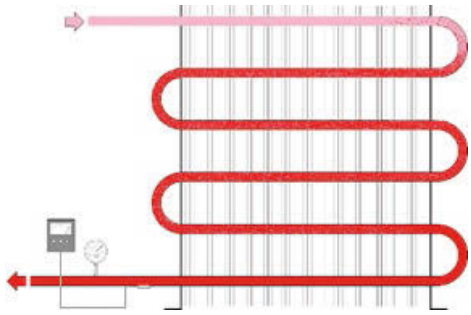
Excessive overheating content indicates incomplete evaporation of refrigerant liquid in the evaporator, with the consequent return of liquid to the compressor. A correct overheating value, between **6 and 10 K**, demonstrates that the coolant supplied to the evaporator is completely evaporated and there is no liquid in the suction line. Moreover, a correct value of overheating shows that the system is charged with the right amount of refrigerant.

It is also important to verify the under-cooling value. An under-cooling value that is excessively limited means that condensation of refrigerant liquid in the condenser is incomplete, this results in a shortness of liquid refrigerant to the thermostatic valve. A correct under-cooling value between **2 and 10 K**, demonstrates that the refrigerant supplied to the thermostatic valve is completely condensed and there is no vapour in the liquid line.



Overheating = Suction temperature – Evaporation temperature

OVERHEATING MEASUREMENT



Under-cooling = Condensation temperature – Temperature of the liquid

UNDERCOOLING MEASUREMENT

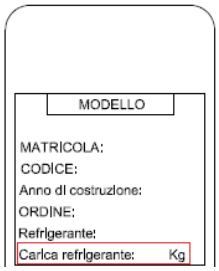
5.10.1 VERIFY THE COOLANT CHARGE WITH THE DC INVERTER COMPRESSOR

During the cooling capacity control stages, the superheating and sub-cooling values can reach satisfactory values, however, they may no longer be consistent at higher 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 coolant introduced in the circuit on the CE marking found in the unit.



5.11 PRECAUTIONS AGAINST REFRIGERANT LEAKAGE

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 controls in search of leaks, at 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.**

5.12 CHECK THE MAXIMUM CONCENTRATION OF THE 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 measure 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.

It is possible to calculate the concentration of refrigerant in the following way:

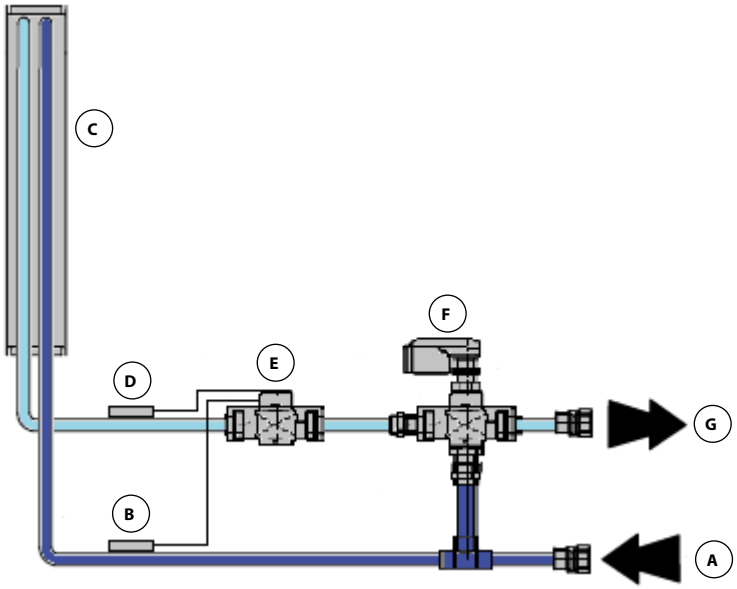
$$\frac{\text{TOTAL QUANTITY OF REFRIGERANT (kg)}}{\text{MINIMUM INTERNAL VOLUME WHERE THE CONDITIONER WILL BE INSTALLED (m}^3\text{)}} \leq 0.44 \text{ kg/m}^3$$

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 a forced extraction system controlled by a leak detector.

6 EXAMPLES OF WATER AND COOLING CIRCUITS

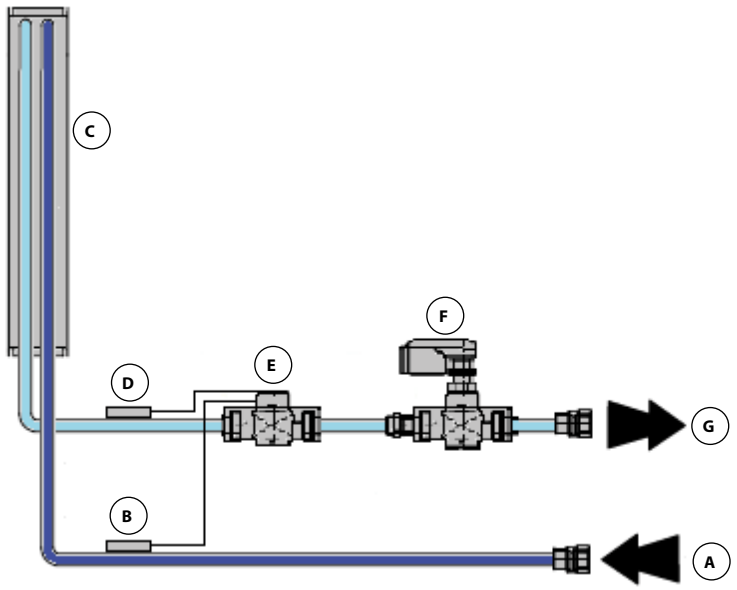
6.1 EXAMPLE OF CHILLED WATER HYDRAULIC CIRCUIT

The following image represents the hydraulic circuit of chilled water units with three-way valves.



A WATER INLET
B WATER INLET TEMPERATURE (ACCESSORY)
C CW COIL
D WATER OUTLET TEMPERATURE (ACCESSORY)
E WATER FLOW MEASURING DEVICE (ACCESSORY)
F 3-WAY VALVE
G WATER OUTLET

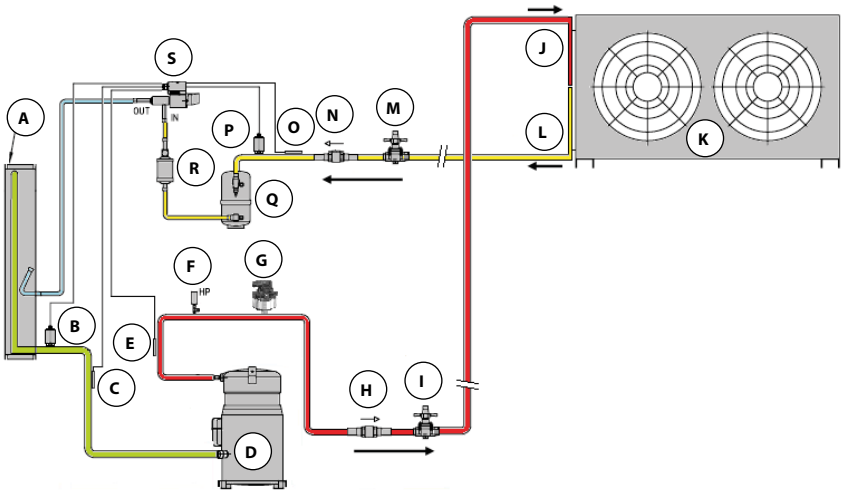
The following image represents the hydraulic circuit of chilled water units with two-way valves.



A WATER INLET
B WATER INLET TEMPERATURE (ACCESSORY)
C CW COIL
D WATER OUTLET TEMPERATURE (ACCESSORY)
E WATER FLOW MEASURING DEVICE (ACCESSORY)
F 3-WAY VALVE
G WATER OUTLET

6.2 EXAMPLE OF AIR CONDENSER COOLING CIRCUIT

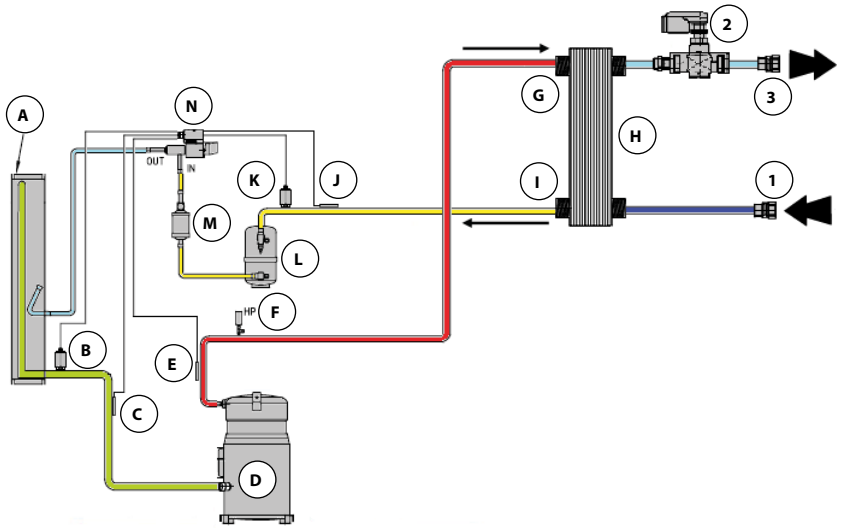
The following image represents the cooling circuit in units with external air condenser.



A Direct expansion coil
B Evaporation pressure probe
C Intake temperature probe
D Compressor
E Drain temperature probe
F High pressure switch
G Air condenser pressure regulator (Accessory)
H Hot gas line check valve (Accessory)
I Hot gas line cock
J Air-cooled condenser input
K Air-cooled condenser
L Air-cooled condenser output
M Liquid line cock
N Liquid line check valve (accessory)
O Liquid temperature probe
P Condensation pressure probe
Q Liquid receiver
R Receiver-drier and liquid inspection
S Electronic expansion valve

6.3 EXAMPLE OF WATER CONDENSER COOLING CIRCUIT

The following image represents the cooling circuit in units with water condenser.

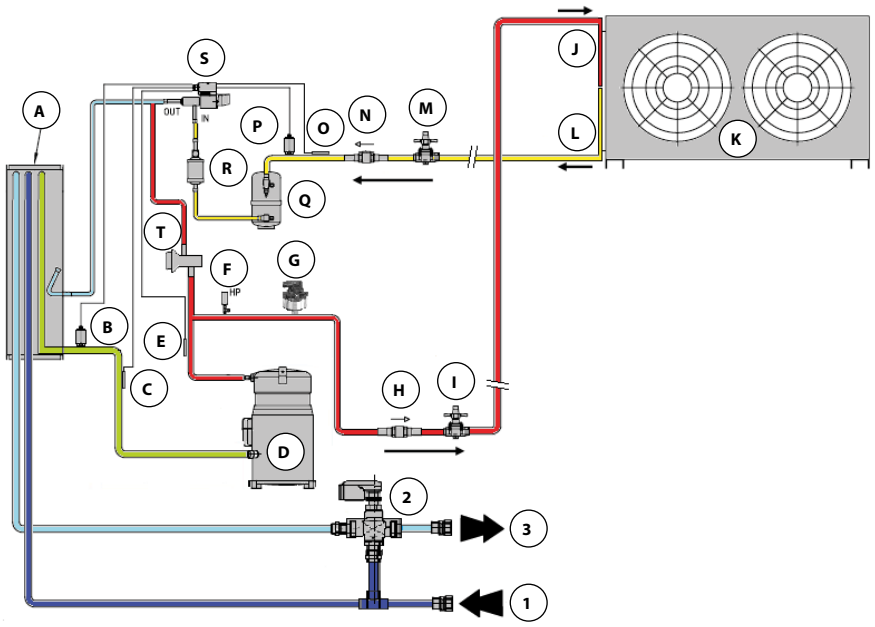


A Direct expansion coil
B Evaporation pressure probe
C Intake temperature probe
D Compressor
E Drain temperature probe
F High pressure switch
G Water-cooled condenser input
H Water-cooled condenser
I Water-cooled condenser output
J Liquid temperature probe
K Condensation pressure probe
L Liquid receiver
M Receiver-drier and liquid inspection
N Electronic expansion valve

1 Condenser water inlet
2 Condensation pressure adjustment valve
3 Condenser water outlet

6.4 EXAMPLE OF CW/DX TWO SOURCES COOLING CIRCUIT UNIT

The following image illustrates the cooling circuit of the Two Sources units, with a chilled water (CW) and direct expansion (DX) circuit.



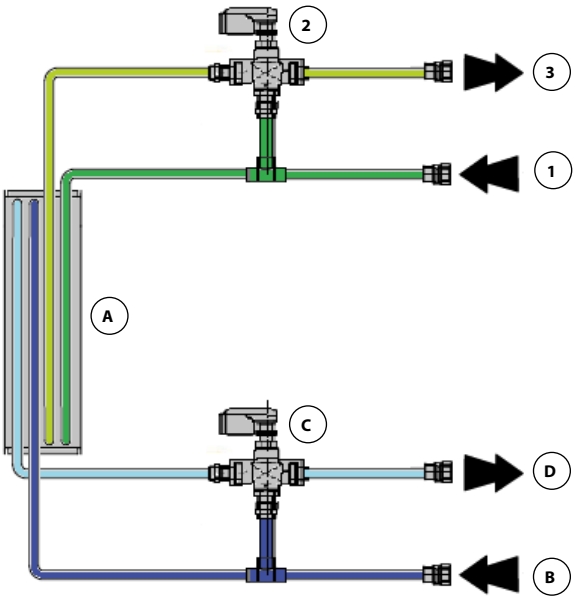
A Coil Two Sources
B Evaporation pressure probe
C Intake temperature probe
D Compressor
E Drain temperature probe
F High pressure switch
G Air condenser pressure regulator (Accessory)
H Hot gas line check valve (Accessory)
I Hot gas line cock
J Air-cooled condenser input
K Air-cooled condenser
L Air-cooled condenser output
M Liquid line cock
N Liquid line check valve (accessory)
O Liquid temperature probe
P Condensation pressure probe
Q Liquid receiver
R Receiver-drier and liquid inspection
S Electronic expansion valve
T Heating gas by-pass valve

1 CW circuit water inlet
2 CW Circuit 3-way valve
3 CW circuit water outlet

CW/DX Two Sources cooling circuit unit

6.5 EXAMPLE OF TWO SOURCES COOLING CIRCUIT UNIT

The following image illustrates the cooling circuit of the Two Sources units, with a double chilled water (CW) circuit.



A Coil Two Sources

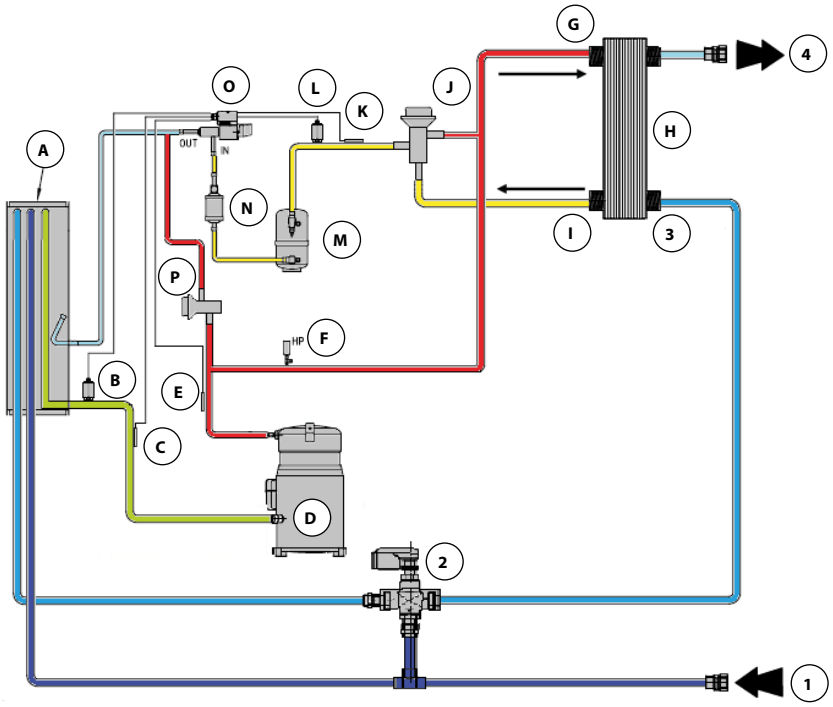
B Circuit 1 water inlet
C Circuit 1 3-way valve
D Circuit 1 water outlet

1 Circuit 2 water inlet
2 Circuit 2 3-way valve
C Circuit 2 water outlet

CW/CW Two Sources cooling circuit unit

6.6 EXAMPLE OF FREE COOLING UNIT COOLING CIRCUIT

The following image represents the cooling circuit of the Free Cooling units.



A Free Cooling Coil
B Evaporation pressure probe
C Intake temperature probe
D Compressor
E Drain temperature probe
F High pressure switch
G Water-cooled condenser input
H Water-cooled condenser
I Water-cooled condenser output
J Condensation pressure adjustment valve
K Liquid temperature probe
L Condensation pressure probe
M Liquid receiver
N Receiver-drier and liquid inspection
O Electronic expansion valve
P Heating gas by-pass valve

1 FC Circuit water inlet
2 FC Circuit 3-way valve
3 Condenser water inlet
4 Condenser water outlet

Free Cooling unit cooling circuit

7 ELECTRICAL CONNECTIONS

WARNING!

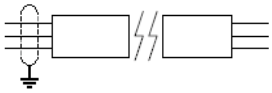
It is however necessary to always refer to the electrical diagram supplied with the unit.

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

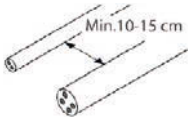
WARNING FOR SIGNAL CABLES!

Avoid creating branches

Connect one end only of shielding to earth



Avoid creating branches



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

- They must be suitably dimensioned to withstand the maximum load in Amperes indicated on the electrical wiring diagram and on the data plate located inside the electrical compartment of the unit itself. The earth connection must be made with a conductor with a minimum cross-section as indicated in the electrical wiring diagram.

- The power supply must be within the following limits in order to avoid possible malfunction of the installed components, according to EN 60654-2 & EN 61000-4-11 standards:

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

- The thermal-magnetic circuit breaker, the installation of which is responsibility of the Customer is essential in order to provide overcurrent protection on the power supply line (Art. 7.2.1 and 7.2.6 of CEI EN 60204-1 Standard), and must be located as near as possible to the machine. The thermal-magnetic circuit breaker must be equipped with a residual current device (RCD) with a variable trip setting of 30 - 300 mA to provide personal protection both indirect and direct contact, in addition to thermal and magnetic overload protection. The RCD serves also to protect the air conditioner against insulation failure.

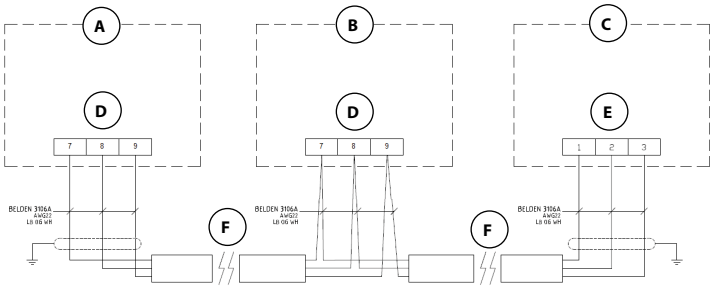
- To prevent operating problems with the microprocessor controls, it is necessary that no other loads (pumps, condensers, etc.), even those that are part of the same system, are connected downstream of the main switch for the air conditioner, unless explicit permission is granted by Systemair. If this condition cannot be met, it will be necessary to connect suppressors (R + C) in parallel with the coils of the relays of any such loads.

- To avoid potential damage to electrical and electronic equipment caused by voltage surges in the electricity supply line, Systemair 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.

7.1 MODBUS RTU RS485 SERIAL COMMUNICATION BOARD

SySmart microprocessors may be connected to a supervisory system and/or BMS (Building Management System) that adopts the standard Modbus® RS485 through a RS485 serial circuit board. Via this board it is also possible to connect gateways required for the SySmart to interface with the networks that use different protocols

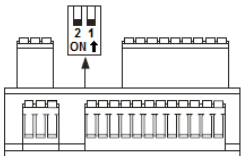
To create a connection to the Modbus system, simply connect the units from the terminals on it (see wiring diagram for further information):



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.

SySmart 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.

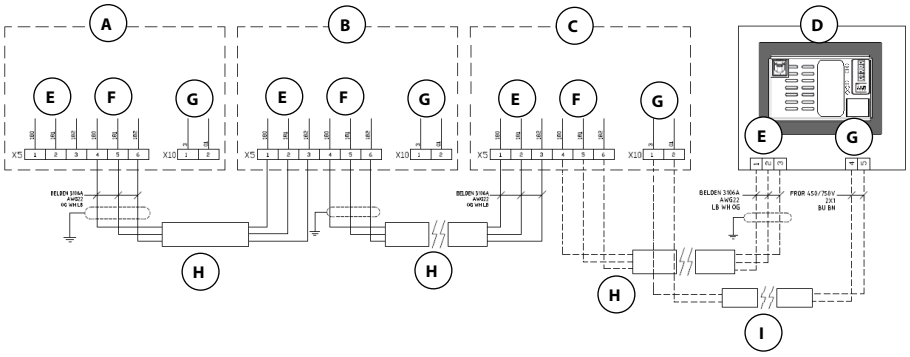
The type of cable to be used for the connection must have the following features:

MAIN FEATURES OF SERIAL COMMUNICATION CABLE		
Type	Data transmission cable for RS485, Modbus or CANbus interfaces	
Shielding	Tinned copper braid - Cover at least 65%	
Conductor section	0.34 mm - 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		

7.2 CANBUS LAN CONNECTION (ACCESSORY)

SySmart microprocessors can be interconnected in a CANbus local network (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%	
Conductor section	0.34 mm - 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		

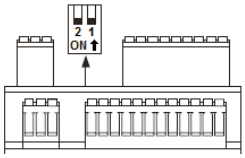
7.2.1 CANBUS LOCAL NETWORK TERMINATING RESISTORS

WARNING!

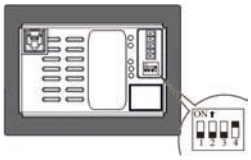
Set micro-switches to ON to activate 120 Ω terminating resistor IN THE FIRST (Unit 1) and LAST UNIT OF THE LOCAL NETWORK.

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

SySmart 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.



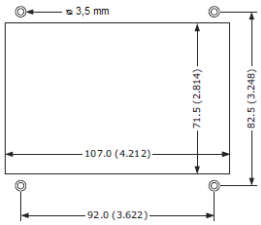
Set micro-switch 4 to ON to activate the 120 Ω terminating resistor.

7.3 REMOTE CONTROL TERMINAL (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 templates are as follows:

Dimensions



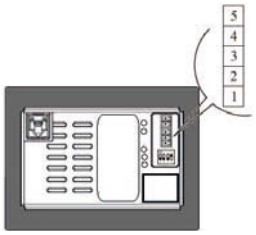
Bore template

7.3.1 CONNECTION OF REMOTE TERMINAL (ACCESSORY)

To set up the connection between the remote terminal and the unit simply connect the terminals in the electric panel and the removable terminal connectors on the remote terminal with cables having 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%	
Conductor section	0.34 mm - 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	Cable Fror 450/750 2 x 1	
Shielding	Not necessary	
Conductor section	1 mm^2	
Maximum length	m	100
Example		



Rear view

PIN	FUNCTION
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)

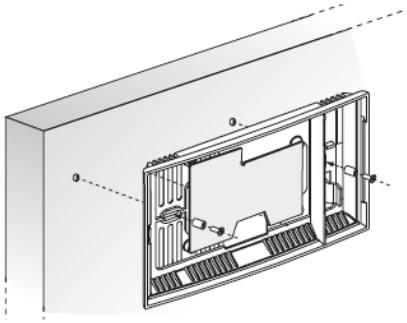
Connection of the remote terminal

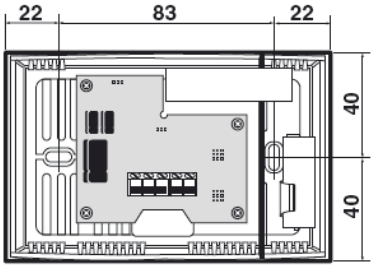
7.4 INSTALLATION OF THE SUPPLIED TEMPERATURE AND HUMIDITY SENSOR (ACCESSORY)

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.

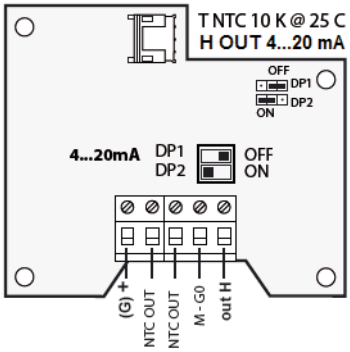
The supplied probe is of wall installation type. It is advised to install the probe at a minimum height of 1600 mm from the floor.

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





Bore template



Probe connection and jumpers positioning

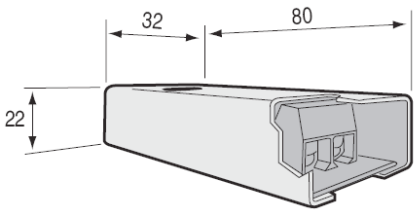
7.5 INSTALLATION OF THE WATER DETECTION PROBE (ACCESSORY)

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

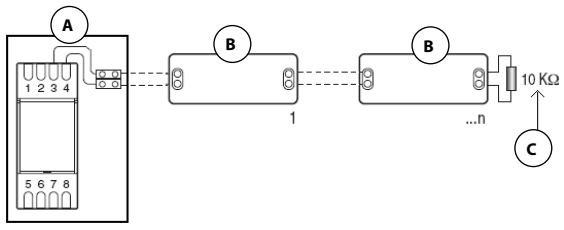
The probe is made of an anti-corrosive metal container, through which it is possible to access the two terminals for connecting the line and the closing resistance (supplied along with the probe). It is possible to connect multiple probes in series to control a wider area.

The probe must be positioned in the area being checked and connected as shown in the electrical wiring diagram supplied with the unit, paying attention that the detection portion is positioned correctly. The following figure shows and example of connection.

Flood detector



Probe dimensions



A Unit electrical panel
B Probe
C Terminating resistance (supplied with the probe)

Probe connection

8 SCHEDULED AND UNSCHEDULED MAINTENANCE

WARNING!

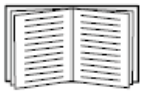
BEFORE CARRYING OUT ANY PROCEDURES ON THE UNIT, SET THE MAIN SWITCH TO POSITION "O"

COMPONENTS		CHECK EVERY			
		2 WEEKS	1 MONTH	3 MONTHS	6 MONTHS
CONTROL MICROPROCESSOR	Make sure the system is operating correctly	X			
	Check for the presence of 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 the condition of the filters: Mountings, signs of damage			X	
	Check operation and calibration of differential pressure switches				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 drain valves			X	
	Inspect the gaskets/seals			X	
	Replace the cylinder if necessary			X	
FANS	Check the general sate of corrosion, of how securely it is attached, of how clean it is			X	
	Check motor noise.			X	
	Check the blade: vibrations, unbalanced			X	
	Check power consumption.				X
	Clean the rotor and the motor.				X
ELECTRICAL CONTROL 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 valve.			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
	Check that the water circulates correctly.				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 glycol 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

	SCHEDULED MAINTENANCE	User responsibility
	UNSCHEDULED MAINTENANCE	Under the responsibility of the maintenance service or service centre

8.1 SCHEDULED MAINTENANCE

8.1.1 CONTROL MICROPROCESSOR MAINTENANCE



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

The microprocessor requires periodical controls 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.

8.1.2 MAINTENANCE OF THE AIR FILTERS

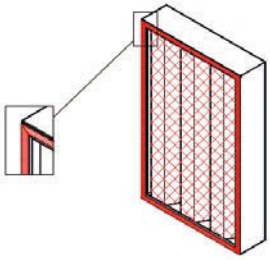
WARNING!

The filters cannot be regenerated.

It is recommended to replace with original spare parts only. Filters which do not comply with the original ones could be incompatible with the performance of the unit and cause problems to its standard operation.

In Systemair air conditioners, all air filters are equipped with differential pressure probes in order to monitor pressure loss caused by clogging. The microprocessor signals when the measured pressure difference exceeds the set value. To change the trip setting of a differential pressure probe, simply unscrew the cover and turn the setting dial to the desired pressure differential value.

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



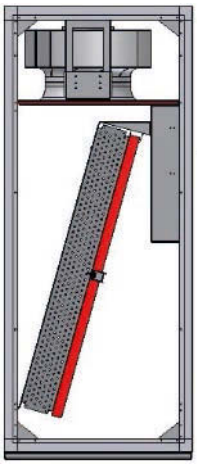
WARNING!

To guarantee the efficiency of the filters, it is necessary to install a 15x3 mm seal.

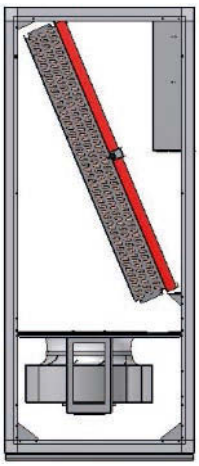
8.1.3 AIR FILTER REPLACEMENT

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

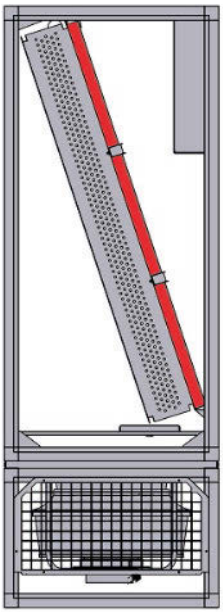
1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Remove the filter support by adjusting the fixing screws.
4) Replace clogged filters with clean ones.
5) Position the support and secure using the fixing screws.
6) Close the panels and return the main switch to "I".



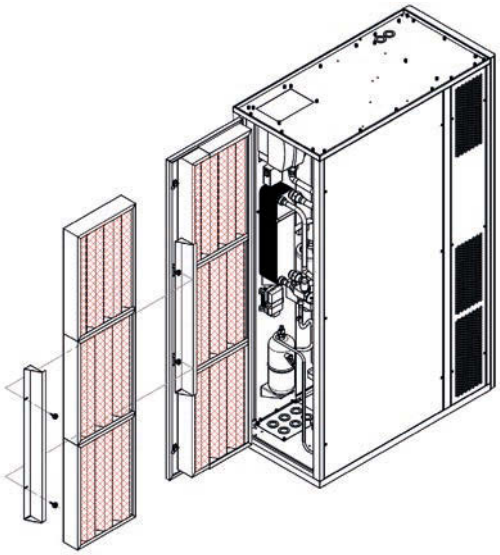
Position of air filters in OP units



Position of air filters in UP units



Position of air filters in UG units



Position of air filters in HR units

8.1.4 MAINTENANCE OF INTERNAL HUMIDIFIER

WARNING!

THE CYLINDER MAY BE HOT!

LEAVE TO COOL BEFORE HANDLING OR USE PROTECTIVE GLOVES

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:

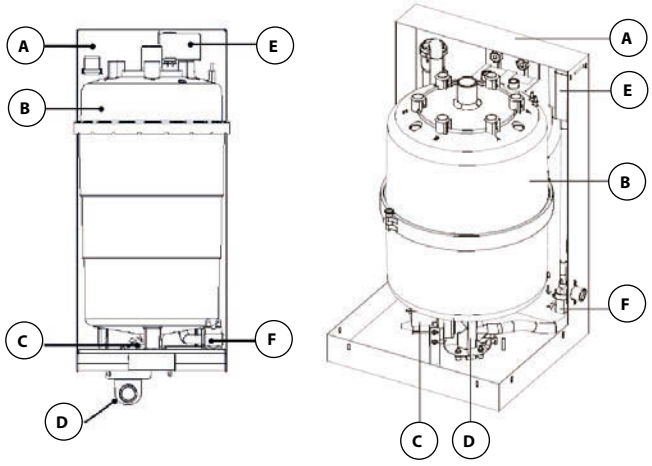
- **Not exceeding the first 300 hours of operation**: Check operation, make sure there are no significant leaks of water, and check the general condition of the housing. Make sure that no sparks or arcs between electrodes are formed during operation.
- **Quarterly and not exceeding 1000 hours of operation**: Check operation, make sure there are no significant leaks of water, and replace the cylinder if necessary.
- **Yearly and not exceeding 2500 hours of operation**: Proceed with cylinder replacement

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.

8.1.5 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 structure
B Cylinder
C Solenoid valve/drainage pump
D Drainage fitting
E Filling tank + conductivity meter
F Supply solenoid valve

Internal humidifier components

8.2 UNSCHEDULED MAINTENANCE

WARNING!

BEFORE CARRYING OUT ANY PROCEDURES ON THE UNIT, SET THE MAIN SWITCH TO POSITION "O"

8.2.1 CONTROL MICROPROCESSOR MAINTENANCE

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 SySmart microprocessor technical manual.

8.2.2 MAINTENANCE OF THE FANS

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

1) Check the general sate of corrosion, of how securely it is attached, of how clean it is.
2) Check motor noise.
3) Check the blade: vibrations, unbalanced.
4) Check power consumption.
5) Clean the rotor and the motor.

8.2.3 REPLACEMENT OF 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 all electrical connections from the terminal board of the fan.
4) Remove the fan from its seat.
5) Replace with original spare parts.
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".

8.2.4 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 correct tightening of the clamps.
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.

8.2.5 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 valve.
5) Check the amount of glycol in the circuit.
6) Check that the water circulates correctly.

8.2.6 WATER WALVE OPENING AND CLOSING WITH RING NUT ACTUATOR

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 anti-clockwise to close (Open or Closed).
5) Completely unscrew the cap to close the valve
6) Close the front panels.

8.2.7 REPLACEMENT OF WATER WALVE ACTUATORS WITH RING NUT ACTUATOR

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

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

8.2.8 MANUAL WATER WALVE OPENING AND CLOSING WITH CONNECTION ACTUATOR

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 again the position indicator to go back to automatic operation.
5) Close the front panels.

8.2.9 REPLACEMENT OF WATER WALVE ACTUATORS WITH CONNECTION ACTUATOR

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 original spare parts.
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".

8.2.10 REPLACEMENT OF MAIN COMPONENTS OF THE COOLING CIRCUIT

To replace the components of the circuit (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 chapter.
5) Open the vents placed next to the coil and and the cock on the circuit and drain the water.
6) Remove the component from its seat.
7) Replace with original spare parts.
8) Open the water circuit paying close attention to vent the air.
9) Check for any leaks.
10) Replace the regulation valve.
11) Close the panels and return the main switch to "I".

8.2.11 COOLING CIRCUIT MAINTENANCE

WARNING!

SOME PARTS OF THE COOLING CIRCUIT MAY BE HOT!

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 operating temperatures and pressures (Chapter 5.10).
2) Check for overheating and under-cooling (Chapter 5.10).
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 valves (Chapter 5.9).
6) Check the refrigerant charge level and for circuit leaks (Chapter 5.10).
7) Check the condition of the cooling coil. Any cleaning must be carried out with hot water and soap using a brush with long soft bristles. Compressed air may also be used, provided that it is free of oil.

8.2.12 REPLACEMENT OF MAIN COMPONENTS OF THE COOLING CIRCUIT

WARNING!

NEITHER THE CIRCUIT NOR THE COMPRESSOR MUST BE LEFT IN OPEN AIR FOR MORE THAN 15 MINUTES TO AVOID HUMIDITY CONTAMINATING THE OIL.

POLYESTER OIL IN CONTACT WITH WATER FORMS EXTREMELY AGGRESSIVE AND DANGEROUS HYDROFLUORIC ACID; IN THE EVENT OF DOUBT THAT HUMIDITY HAS ENTERED THE CIRCUIT, YOU ARE REQUIRED TO PAY PARTICULAR ATTENTION FOR YOUR OWN SAFETY (EYES, HANDS, ETC.) IF YOU COME INTO CONTACT WITH POLLUTED OIL.

WARNING!

BURN HAZARD DURING COOLING CIRCUIT BRAZING PROCEDURES!

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 (Chapter 2.3.3).
3) Collect all refrigerant (with the special recovery pump, pressure gauge and rechargeable tank) until reaching pressure of -0,5 Bar (-50 kPa). **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 connection of the components in question.
6) Remove the component by cutting the pipes next to it and install a new component (Chapter 5.5).
7) Braze everything as indicated in the previous chapter (Chapter 5.5.7).
8) Close the cooling circuit by re-applying the service needle valves with the provided key.
9) Perform a test using pressurised Nitrogen to verify that the system is airtight, as specified in the previous chapter (Chapter 5.5.8).
10) With soap lather, check all new soldering has been carried out and leave under pressure for at least 24 hours (Chapter 5.5.8).
11) After the required time, perform a pressure check with the provided pressure gauges (Chapter 5.5.8).
12) On completion of the test, empty out all the nitrogen and proceed to the vacuum phase (Chapter 5.6).
13) Vacuum the cooling circuit, as specified in the previous chapters (Chapter 5.6).
14) Close the panels and return the main switch to "I".
15) Charge with new Freon, as specified in the previous chapters (Chapter 5.7.2).
16) Check the condition of operation of the cooling circuit, as specified in the previous chapters (Chapter 5.10).

8.2.13 COMPRESSOR REPLACEMENT

WARNING!

NEITHER THE CIRCUIT NOR THE COMPRESSOR MUST BE LEFT IN OPEN AIR FOR MORE THAN 15 MINUTES TO AVOID HUMIDITY CONTAMINATING THE OIL.

POLYESTER OIL IN CONTACT WITH WATER FORMS EXTREMELY AGGRESSIVE AND DANGEROUS HYDROFLUORIC ACID; IN THE EVENT OF DOUBT THAT HUMIDITY HAS ENTERED THE CIRCUIT, YOU ARE REQUIRED TO PAY PARTICULAR ATTENTION FOR YOUR OWN SAFETY (EYES, HANDS, ETC.) IF YOU COME INTO CONTACT WITH POLLUTED OIL.

WARNING!

BURN HAZARD DURING COOLING CIRCUIT BRAZING PROCEDURES!

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 gauge and rechargeable tank) until reaching pressure of -0,5 Bar (-50 kPa). **This gas cannot be used again 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 (Chapter 5.5).
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 scavenging all cooling components (pipes, evaporation coils, condenser, liquid receiver) with special scavenging fluid that is easily evaporated (Parker ParFlush Kit or similar).
10) Blow NITROGEN into the whole cooling circuit to eliminate all scavenging fluid (Chapter 5.5.7).
11) Install a receiver-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 receiver-drier and de-acidifier Sporlan Parker WSG Series or similar).
13) Install a new compressor, always keeping it vertical.
14) Solder everything as indicated in the previous chapter (Chapter 5.5.7).
15) Close the cooling circuit by re-applying the service needle valves with the provided key.
16) Perform a test using pressurised Nitrogen to verify that the system is airtight, as specified in the previous chapter (Chapter 5.5.8).
17) With soap lather, check all new soldering has been carried out and leave under pressure for at least 24 hours (Chapter 5.5.8).
18) After the required time, perform a pressure check with the provided pressure gauges (Chapter 5.5.8).
19) On completion of the test, empty out all the nitrogen and proceed to the vacuum phase (Chapter 5.6).
20) Vacuum the cooling circuit, as specified in the previous chapters (Chapter 5.6).
21) Close the panels and return the main switch to "I".
22) Charge with new Freon, as specified in the previous chapters (Chapter 5.7.2).
23) Check the condition of operation of the cooling circuit, as specified in the previous chapters (Chapter 5.10).

8.3 MAINTENANCE OF TMC AIR-COOLED CONDENSERS

8.3.1 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) Check the general sate of corrosion, of how securely it is attached, of how clean it is.
2) Check motor noise.
3) Check the blade: vibrations, unbalanced.
4) Check power consumption.
5) Clean the rotor and the motor.

8.3.2 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:

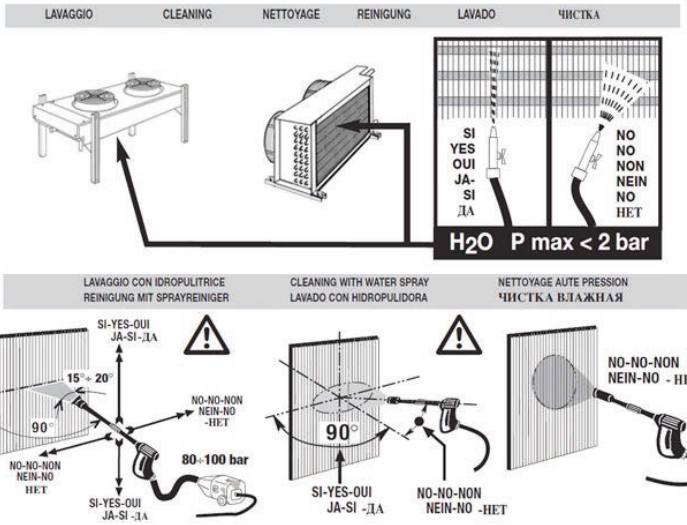
1) Set the main switch to “0”.
2) Disconnect all electrical connections from the terminal board of the fan.
3) Remove the fan from its seat.
4) Replace with original spare parts.
5) Implement the electrical connections from the terminal board of the fan.
6) Bring the main switch back to the "I" position.

8.3.3 CLEANING THE COILS OF THE TMC AIR-COOLED CONDENSERS

WARNING!

BURN HAZARD, HOT HEADERS!

SHARP PARTS!



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 hydro-cleanser.
3) Keep the water spray at right angles to the fin edge both vertically and horizontally.

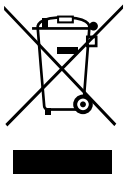
9 DEACTIVATION, DISASSEMBLY AND SCRAPPING

WARNING!

BEFORE CARRYING OUT ANY PROCEDURES ON THE UNIT, SET THE MAIN SWITCH TO POSITION "O"

Systemair air conditioners must only be dismantled by specialised technical personnel. With reference to Directive 2002/96/EC of the European Parliament and of the Council dated 27 January 2003 and relative national implementing standards, we inform you that:

- There is the obligation not to dispose the WEEE as urban waste and to separately collect all said waste;
- The public or private waste collection systems defined by local legislation must be used for disposal. It is also possible to return the obsolete equipment to the distributor, when purchasing new one;
- This appliance can contain hazardous substances: improper use or an incorrect disposal may have negative effects on human health and on the environment;
- The symbol (crossed-out wheeled bin) reported on the product or on the packaging and on the instruction sheet, indicates that the equipment was placed on the market after the 13 August 2005 and that must be separately collected;
- In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste-disposal legislation.



9.1 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 no. 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	Various	0.8%	-

TMC series unit			
Material	**Composition**	**Weight**	**CAS no. 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%	-

10 APPENDIX 1: PRELIMINARY CHECKS AND FIRST START-UP

WARNING!

BEFORE CARRYING OUT ANY PROCEDURES ON THE UNIT, SET THE MAIN SWITCH TO POSITION "O"

10.1 PRELIMINARY CHECKS

10.1.1 VERIFICATION OF POSITION AND INSTALLATION

	DESCRIPTION	CHAPTER	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.	2.1.2		
4	Check that the unit is placed flat and sufficiently insulated from the floor and walls (if necessary).	2.2		
5	Verification of compliance with the space for routine maintenance.	2.2.2		
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.	-		

10.1.2 VERIFYING THE DRAIN CONNECTIONS

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Verify that the condensate and humidifier drains are connected properly to the drain line.	3.1		
2	Verify that the trap in the unit has not been removed.	3.1		
3	Make sure the drain line has no counter slopes or traps that may prevent the regular flow of water.	3.1		

10.1.3 WATER CIRCUIT CHECKS

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check that the inlet and outlet of the hot and cold water supplies conform with the arrows marked on the fittings.	4		
2	Check that all liquid supply pipes have manual shut-off taps just outside the machine, and that these taps are open.	4		
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.	4.5		
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.	1.3		
7	Verify that the water temperature entering the circuit is consistent with that indicated in the project and is within the operating limits.	1.3		
8	Verify any presence and concentration of glycol in the circuit and that it is consistent with that indicated in the project.	-		

10.1.4 CHECKS ON THE WATER CONDENSED DIRECT EXPANSION CIRCUIT

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check that the cooling circuit valves are open.	4.4		
2	Check the connections of the water circuit.	4.4		
3	Check that all liquid supply pipes have manual shut-off taps just outside the machine, and that these taps are open.	4.4		
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.	1.3		
7	Verify that the water temperature entering the circuit is consistent with that indicated in the project and is within the operating limits.	1.3		
8	Verify any presence and concentration of glycol in the circuit and that it is consistent with that indicated in the project.	-		

10.1.5 CHECKS ON THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check the supply and liquid pipe diameter conforms with the indications in the installation manual.	5.4		
2	Check "horizontal" sections of the supply and liquid pipes have a gradient of at least 1% in the direction of refrigerant flow.	5.3		
3	Make sure there are oil traps at the base of each rising pipe and every 5 m (max.) rising pipe section (raised condenser).	5.3		
4	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).	5.3		
5	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).	5.3		
6	Check that the supply pipe is insulated in the sections where accidental operator contact is possible (pipe temperature in operation approx. 70/80 °C).	5.3		
7	Check that support brackets are installed on the supply and liquid pipe are not too tight, so as to allow expansion of the pipe.	5.3		
8	Check that cooling circuit pipe connections of the condenser with the evaporator are opposite the flow direction of the air flow.	5.3		
9	Check that the condenser is positioned correctly, to prevent air recirculation that would otherwise impair performance.	2.5		

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

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check that 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.	5.5.8		
4	Check the high and low side pressure gauges connection in VACUUM position.	5.6		
5	Check the vacuum level of the cooling circuit.	5.6		

10.1.7 REFRIGERANT CHARGE OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check the high and low side pressure gauges connection in CHARGING position.	5.7.2		
2	Check the correspondence of refrigerant with that used by the unit (R410A).	5.7.2		
3	Check HIGH PRESSURE side introduction of an amount of refrigerant equal to 2/3 of the total calculated content.	5.7.2		
4	Check final refrigerant charge by filling in through the suitable fitting downstream of the thermostatic valve.	5.7.2		

10.1.8 ELECTRICAL POWER SUPPLY CHECK

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check the connection of the three phases, neutral and earth.	7		
2	Verify that the characteristics of the electrical supply line fall within the operating limits and comply with that indicated in the wiring diagram.	7		
3	Verify that the electrical connections with the condenser isolator fall within the operating limits and comply with that indicated in the wiring diagram.	7		

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

	DESCRIPTION	CHAPTER	POSITIVE	NEGATIVE
1	Check positioning of the remote terminal as described in the installation manual.	7.3		
2	Check that the electrical connection between the remote terminal and the electrical panel is as indicated in the wiring diagram and the installation manual.	7.3		
3	Check positioning of the room probes as described in the installation manual.	7.4		
4	Check that electrical connection between the sensors and the electrical panel is as indicated in the electrical wiring diagram and the installation manual.	7.4		
5	Check positioning of the water detection probes as described in the installation manual.	7.5		
6	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.	7.5		
7	Check wiring of the closing resistance of the water detection sensors.	7.5		
8	Check connection of LAN cable as indicated in the electrical wiring diagram and the installation manual.	7.2		
9	Check the activation of the opening and terminating resistance of the LAN.	7.2		
10	Check that wiring of the RS485 board follows the electrical diagram and the installation manual.	7.1		
11	Check the activation of the terminating resistance of the RS485 network.	7.1		

10.2 COMMISSIONING

WARNING!

START-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 THE COMPRESSOR, SO AS TO ENSURE THAT THE COMPRESSORS FUNCTION CORRECTLY.

THE CRANKCASE HEATERS SWITCH ON AUTOMATICALLY WHEN THE MACHINE IS POWERED ON.

10.2.1 UNIT SUPPLY

	DESCRIPTION	POSITIVE	NEGATIVE
1	Check that the disconnect switch is in the ON position (unit powered).		
2	Check that the disconnect switch of the condenser is in the ON position (condenser powered on).		
3	Check that the Phase sequencer is working properly (direct expansion unit).		
4	Check that all electrical utilities of the unit are correctly powered.		

10.2.2 UNIT SWITCH-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 by means of the ON-OFF key.		

10.2.3 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.		

10.2.4 QUANTITY OF REFRIGERANT IN THE CIRCUIT

	DESCRIPTION	TYPE	KG
1	Charging refrigerant during the start-up phase.		
2	Possible field integration.		

10.2.5 MAKE SURE THE COMPONENTS ARE OPERATING CORRECTLY

	DESCRIPTION	POSITIVE	NEGATIVE
	FANS		
1	Check power consumption of the fan.		
2	Check operation of the flow sensor.		
3	Check reading of the differential pressure probe (if present).		
	COMPRESSORS		
1	Check the power consumption of 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 thermostatic valve (if present).		
5	Check correct operation of the hot gas valve (if present).		
6	Check the condensation regulation of the water condensers.		
	WATER CIRCUIT		
1	Check the opening of the valves.		
2	Check the positioning of the valves.		
3	Check the flows and temperature at unit inlet.		
	ELECTRIC COILS		
1	Check the power consumption of the electric coil.		
2	Check correct operation of the electric coil.		
	HUMIDIFICATION		
1	Check the power consumption of the humidifier.		
2	Check correct operation of the humidifier.		
3	Check correct water charge.		
4	Check correct water discharge.		

	LAN SET UP		
1	Check correct operation of the LAN.		
2	Check rotation of the unit in LAN.		
	VARIOUS		
1	Check correct operation of the dirty filter alarm.		
2	Check correct operation of the water alarm.		
3	Check operation of the remote OFF.		
4	General check of the unit electrical components.		

10.2.6 MAKE SURE THE UNIT IS OPERATING CORRECTLY

	DESCRIPTION	POSITIVE	NEGATIVE
1	Check the reaching of the set temperature.		
2	Check the reaching of the set humidity.		
3	Check general correct operation of the unit.		

10.2.7 NOTES ON ANOMALIES ENCOUNTERED DURING CHECKS

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11 APPENDIX 2: FAULT DIAGNOSIS

WARNING!

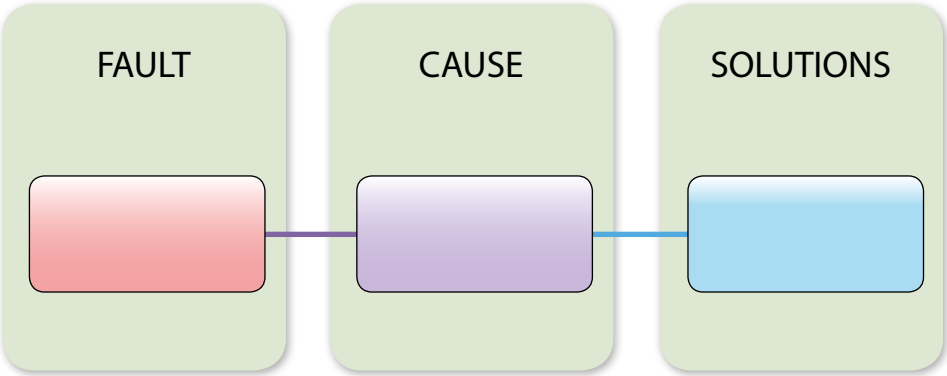
BEFORE CARRYING OUT ANY PROCEDURES ON THE UNIT, SET THE MAIN SWITCH TO POSITION "O"

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.

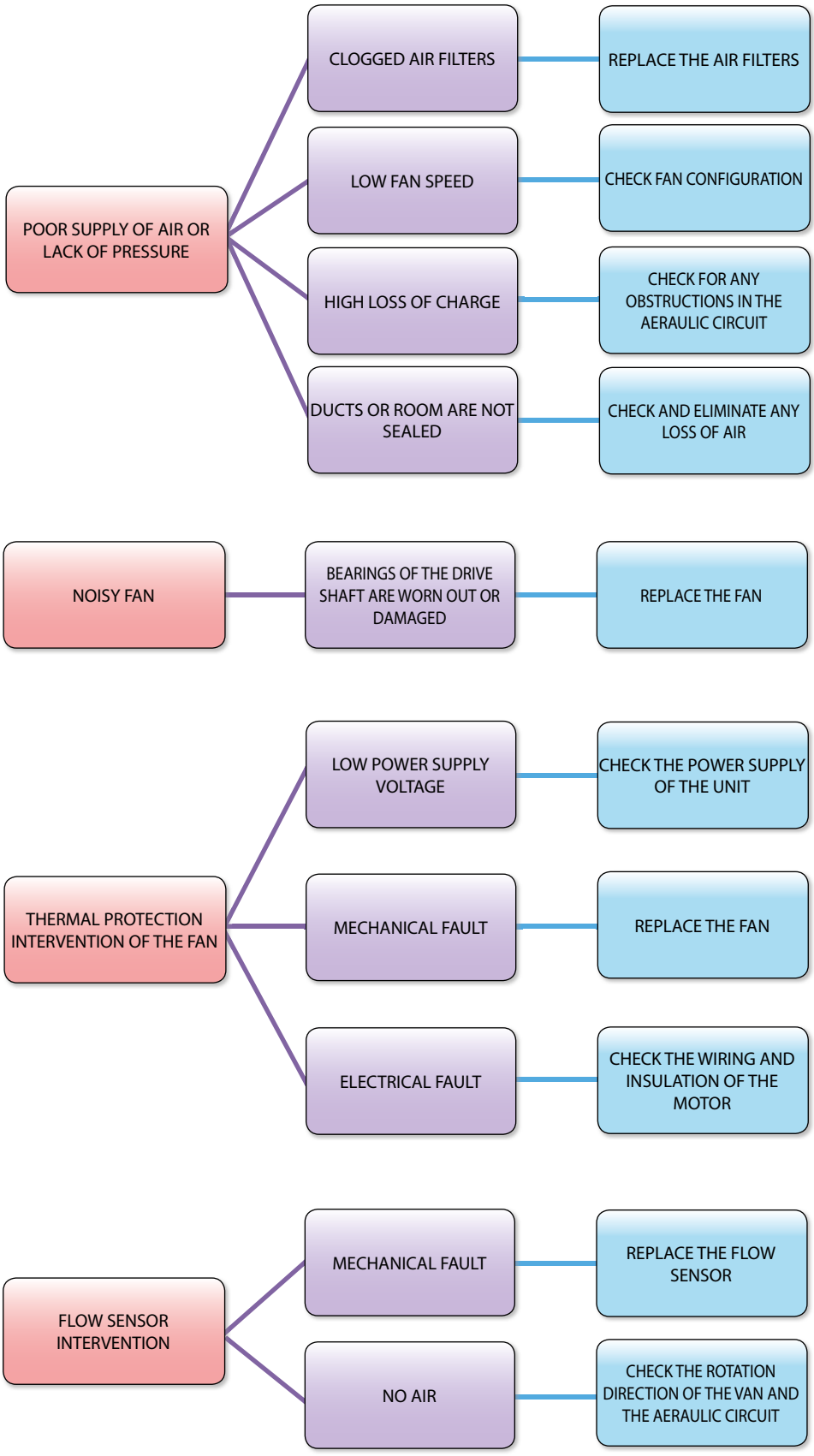
All servicing and repair of the machine must be carried out by qualified personnel only.

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

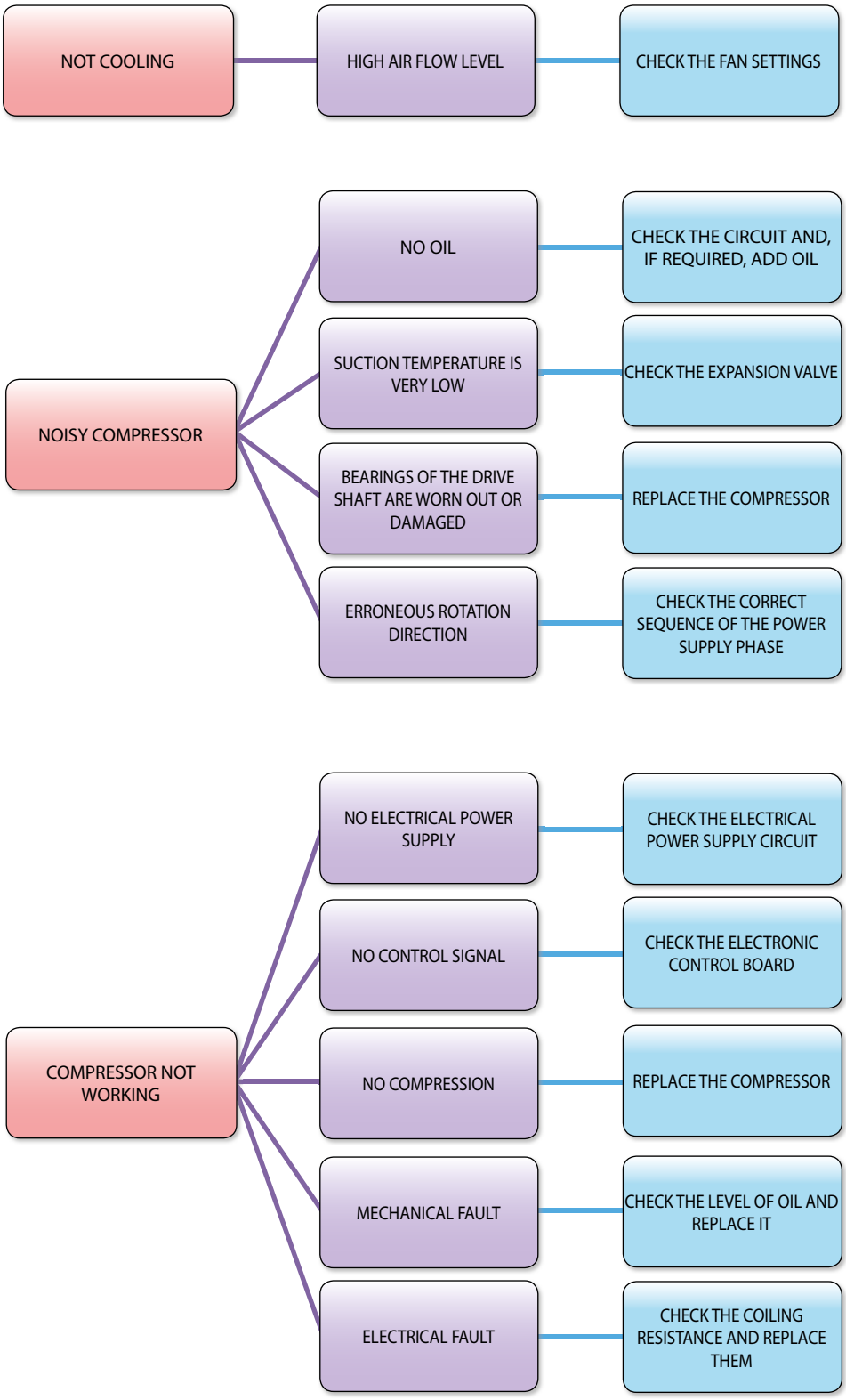
Key:

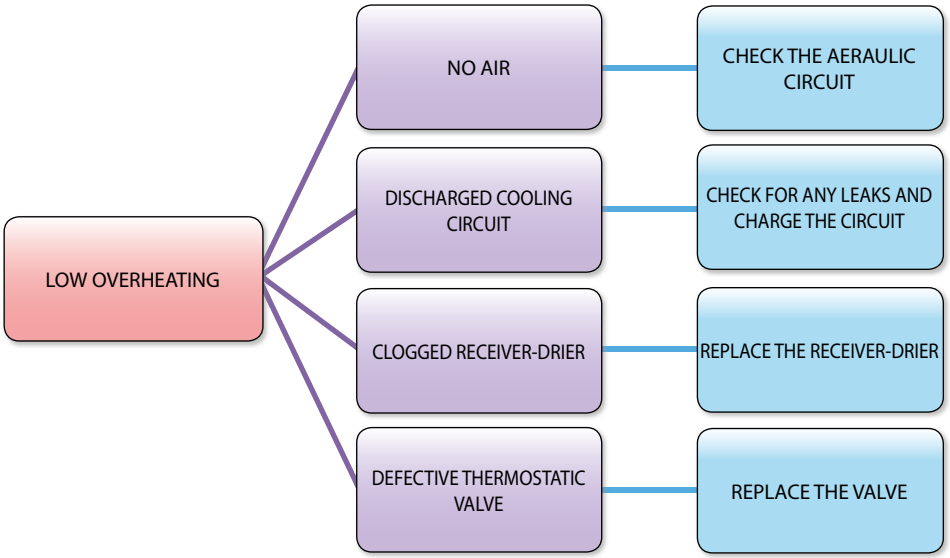


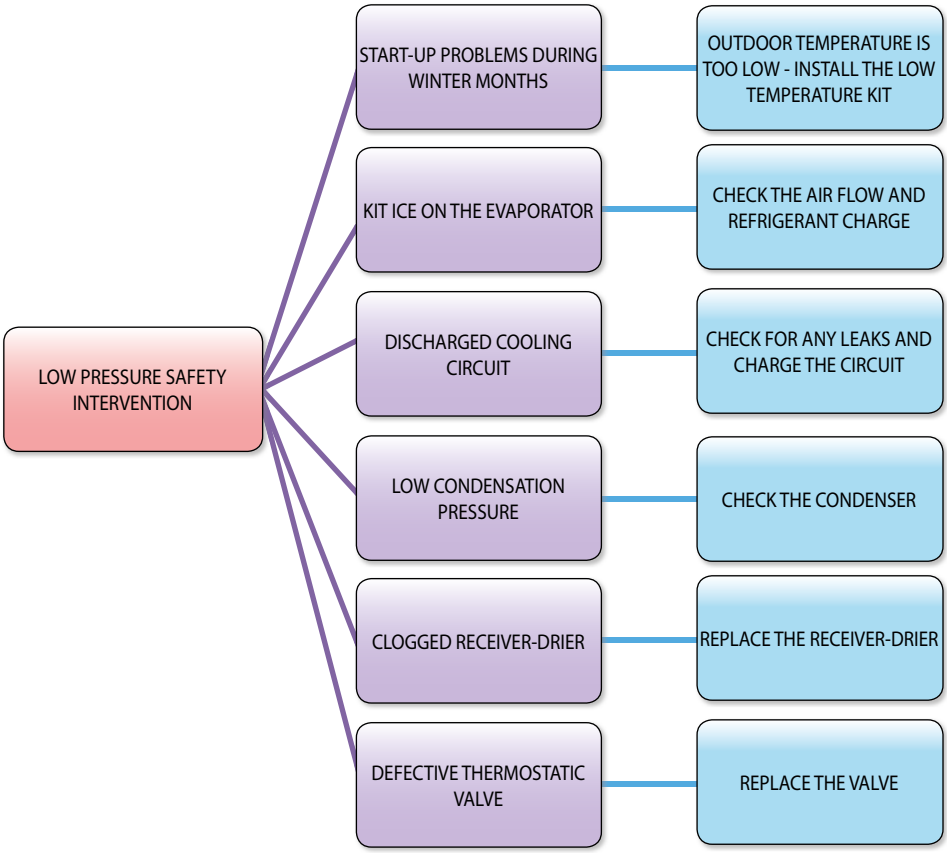
11.1 VENTILATION PROBLEMS

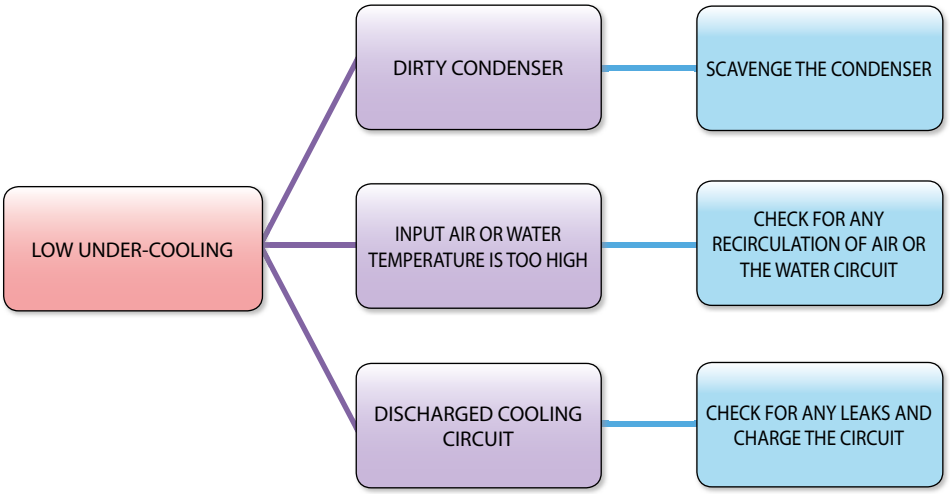


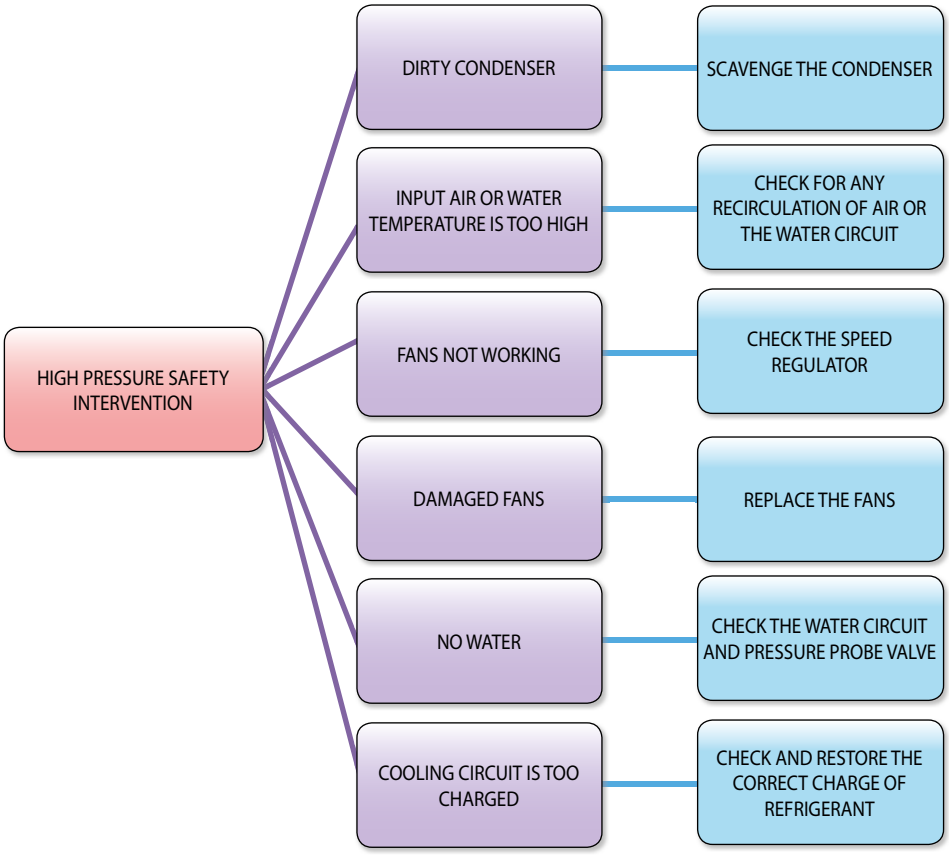
11.2 PROBLEMS WITH THE DIRECT EXPANSION COOLING CIRCUIT



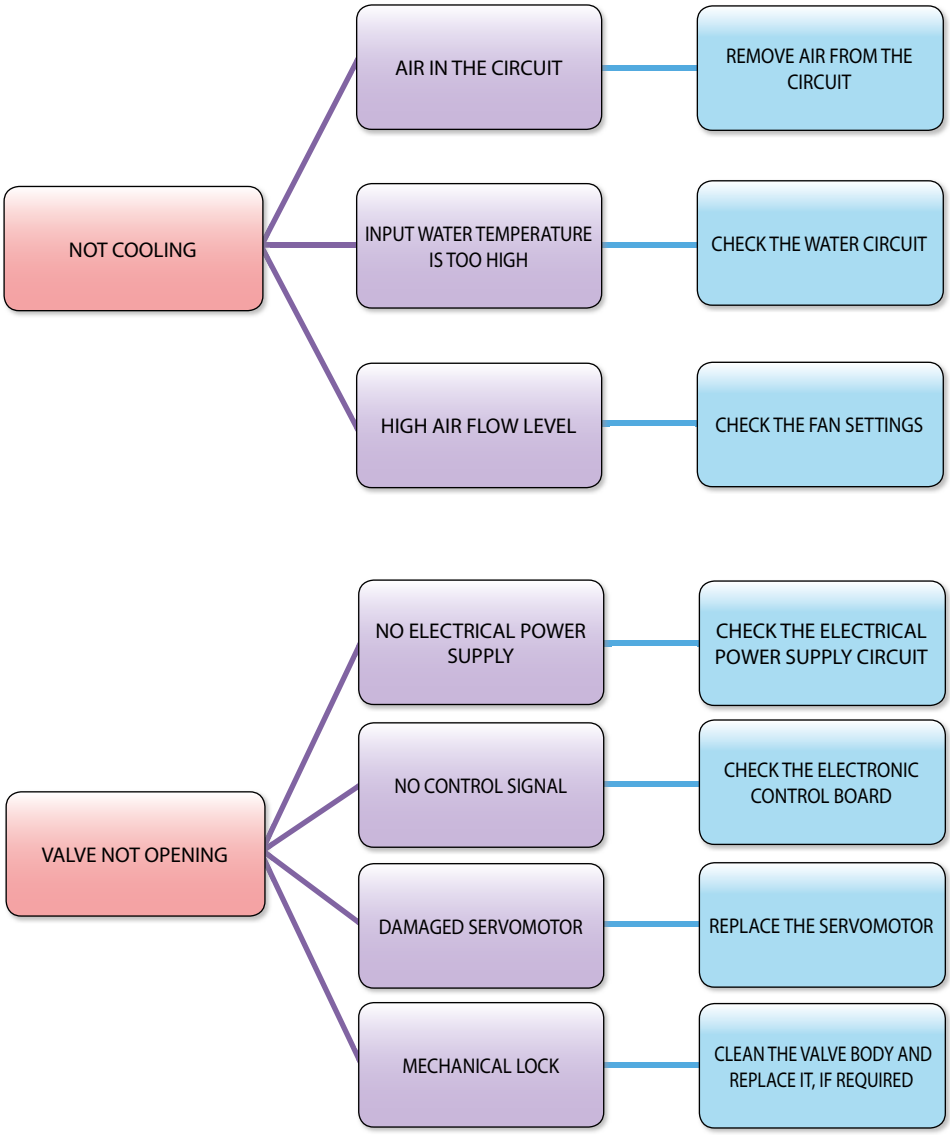

LOW OVERHEATING
NO AIR
CHECK THE AERAULIC CIRCUIT
DISCHARGED COOLING CIRCUIT
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT
CLOGGED RECEIVER-DRIER
REPLACE THE RECEIVER-DRIER
DEFECTIVE THERMOSTATIC VALVE
REPLACE THE VALVE


LOW PRESSURE SAFETY INTERVENTION
START-UP PROBLEMS DURING WINTER MONTHS
OUTDOOR TEMPERATURE IS TOO LOW - INSTALL THE LOW TEMPERATURE KIT
KIT ICE ON THE EVAPORATOR
CHECK THE AIR FLOW AND REFRIGERANT CHARGE
DISCHARGED COOLING CIRCUIT
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT
LOW CONDENSATION PRESSURE
CHECK THE CONDENSER
CLOGGED RECEIVER-DRIER
REPLACE THE RECEIVER-DRIER
DEFECTIVE THERMOSTATIC VALVE
REPLACE THE VALVE

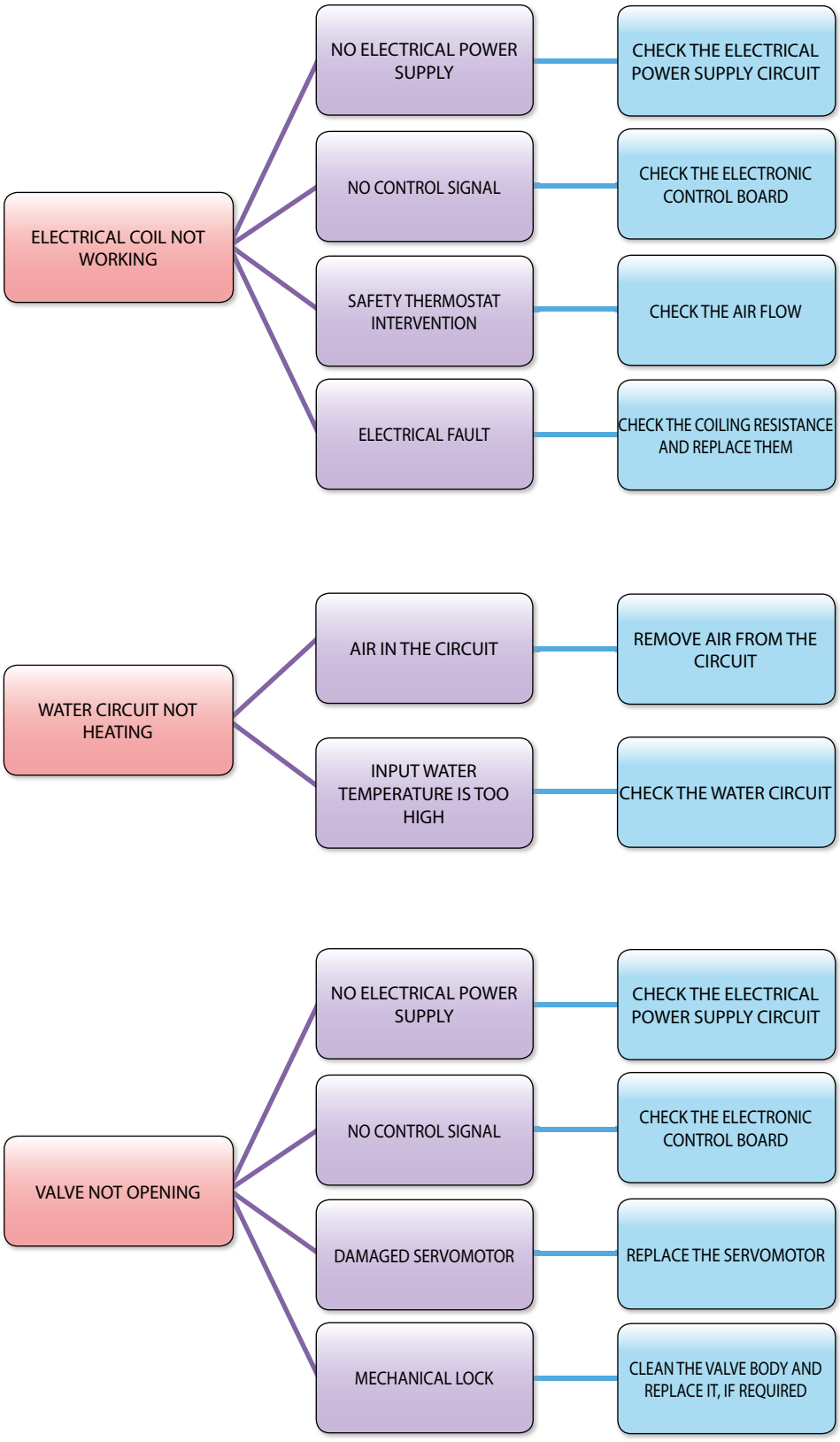

LOW UNDER-COOLING
DIRTY CONDENSER
SCAVENGE THE CONDENSER
INPUT AIR OR WATER TEMPERATURE IS TOO HIGH
CHECK FOR ANY RECIRCULATION OF AIR OR THE WATER CIRCUIT
DISCHARGED COOLING CIRCUIT
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT


HIGH PRESSURE SAFETY INTERVENTION
DIRTY CONDENSER
SCAVENGE THE CONDENSER
INPUT AIR OR WATER TEMPERATURE IS TOO HIGH
CHECK FOR ANY RECIRCULATION OF AIR OR THE WATER CIRCUIT
FANS NOT WORKING
CHECK THE SPEED REGULATOR
DAMAGED FANS
REPLACE THE FANS
NO WATER
CHECK THE WATER CIRCUIT AND PRESSURE PROBE VALVE
COOLING CIRCUIT IS TOO CHARGED
CHECK AND RESTORE THE CORRECT CHARGE OF REFRIGERANT

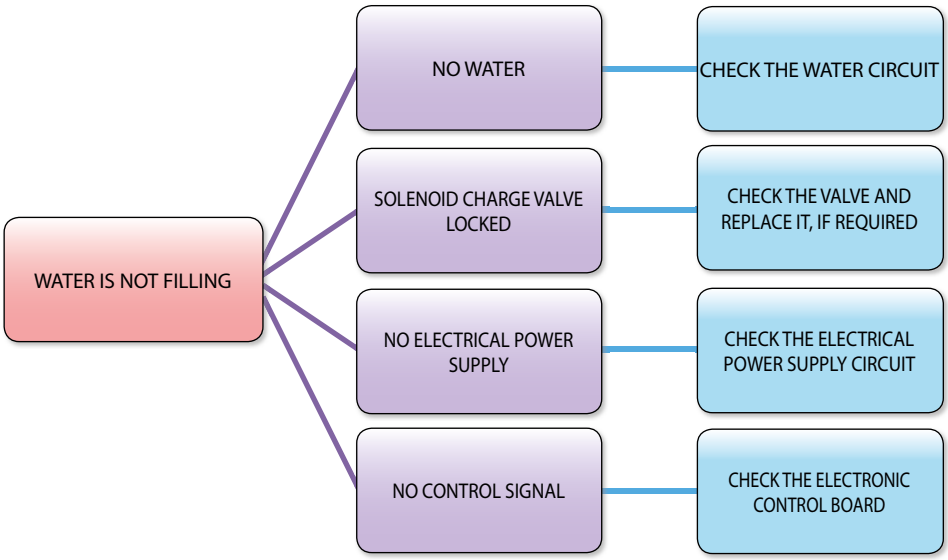
11.3 PROBLEMS WITH THE CHILLED WATER HYDRAULIC CIRCUIT

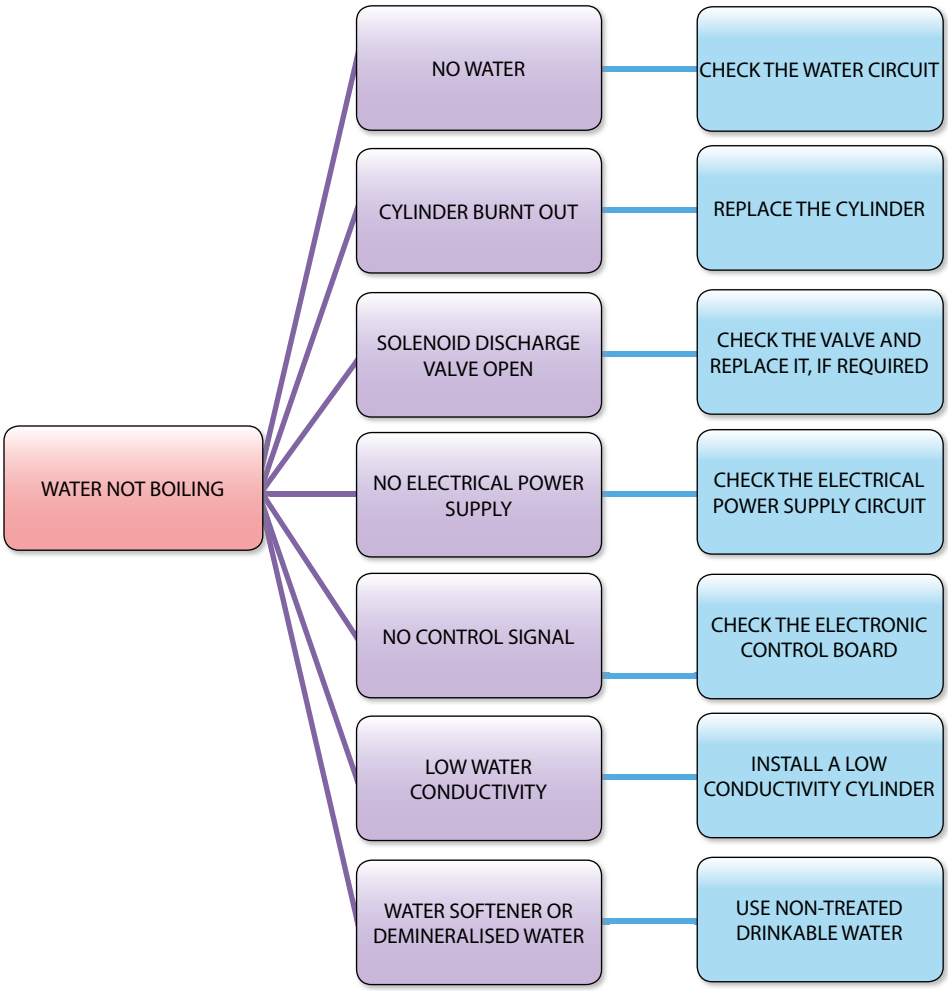


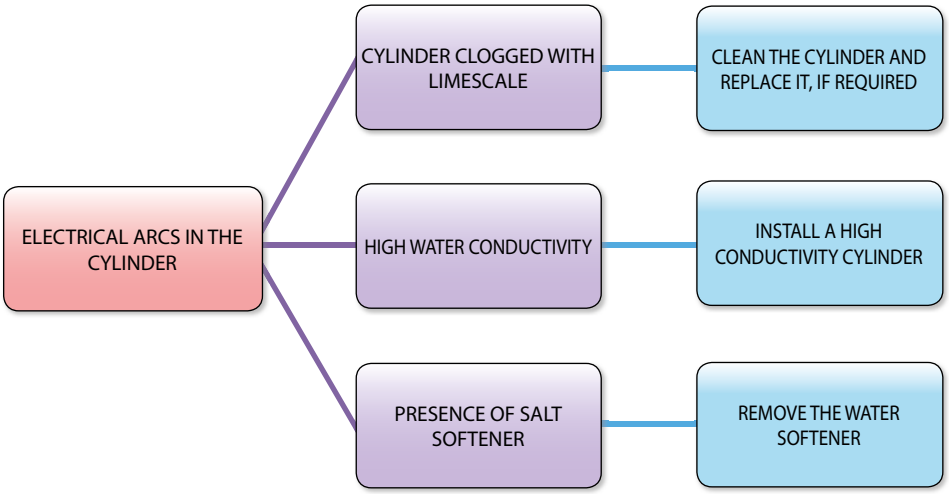
11.4 HEATING SECTION PROBLEMS

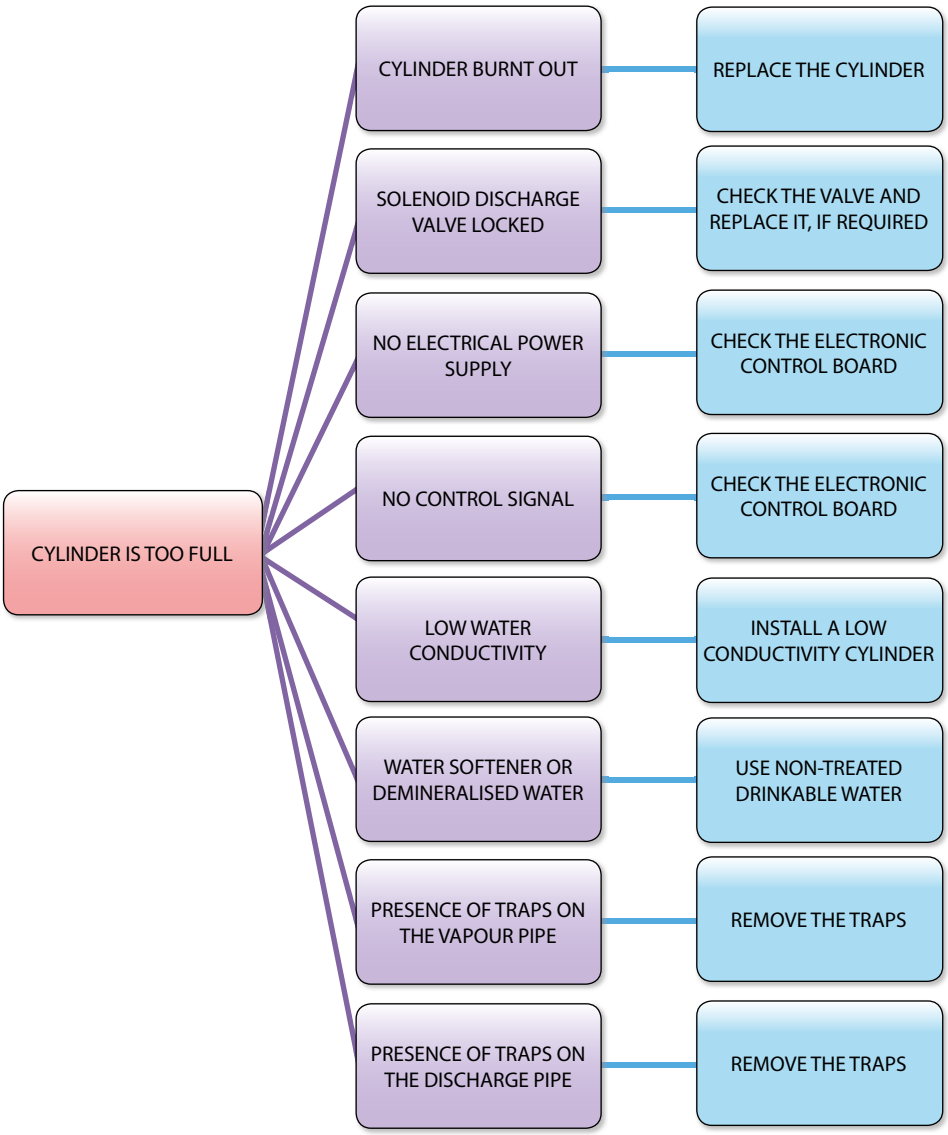


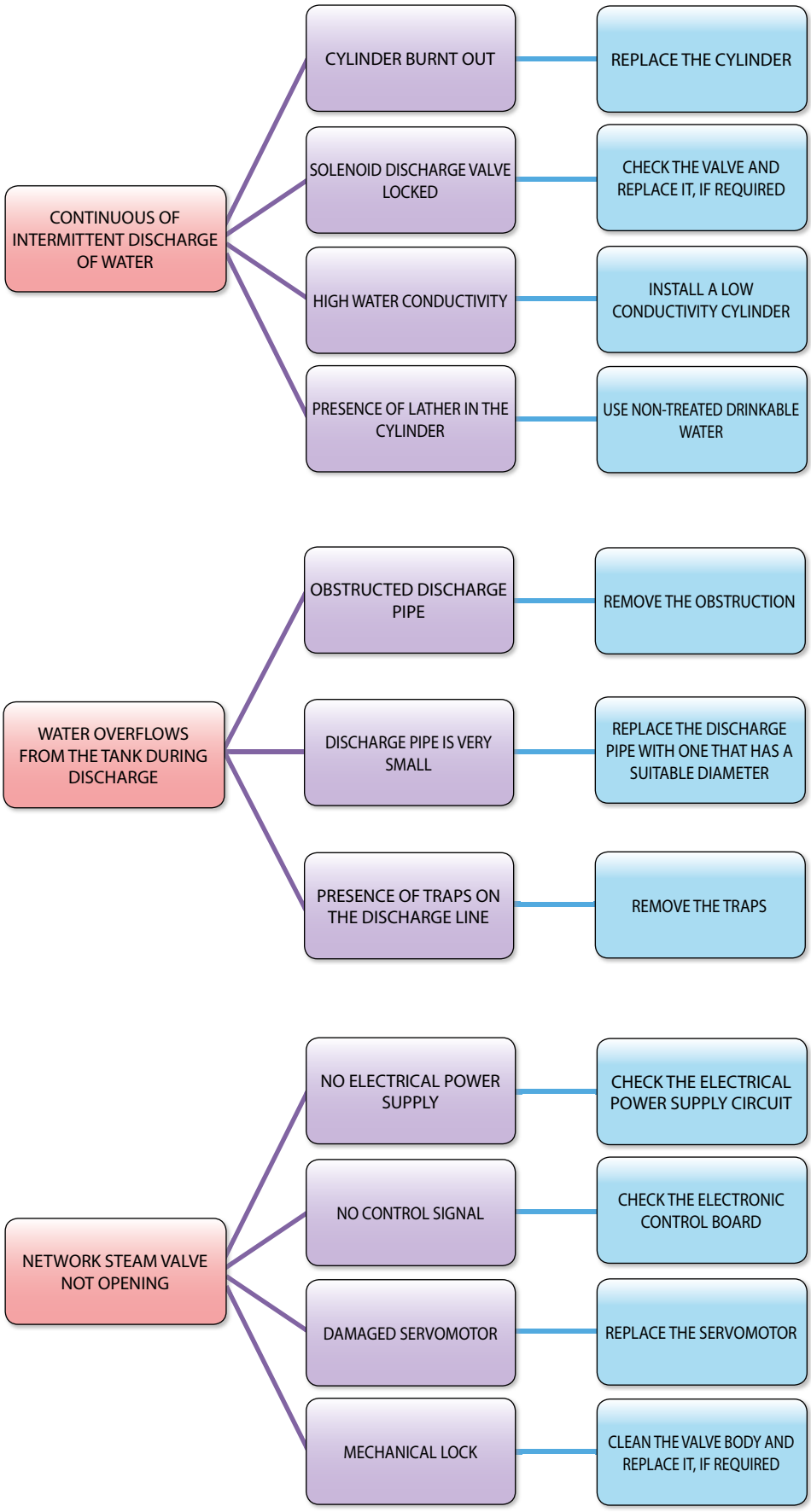
11.5 HUMIDIFICATION PROBLEMS






ELECTRICAL ARCS IN THE CYLINDER
CYLINDER CLOGGED WITH LIMESCALE
CLEAN THE CYLINDER AND REPLACE IT, IF REQUIRED
HIGH WATER CONDUCTIVITY
INSTALL A HIGH CONDUCTIVITY CYLINDER
PRESENCE OF SALT SOFTENER
REMOVE THE WATER SOFTENER


CYLINDER IS TOO FULL
CYLINDER BURNT OUT
REPLACE THE CYLINDER
SOLENOID DISCHARGE VALVE LOCKED
CHECK THE VALVE AND REPLACE IT, IF REQUIRED
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
WATER SOFTENER OR DEMINERALISED WATER
USE NON-TREATED DRINKABLE WATER
PRESENCE OF TRAPS ON THE VAPOUR PIPE
REMOVE THE TRAPS
PRESENCE OF TRAPS ON THE DISCHARGE PIPE
REMOVE THE TRAPS


CONTINUOUS OF INTERMITTENT DISCHARGE OF WATER
CYLINDER BURNT OUT
REPLACE THE CYLINDER
SOLENOID DISCHARGE VALVE LOCKED
CHECK THE VALVE AND REPLACE IT, IF REQUIRED
HIGH WATER CONDUCTIVITY
INSTALL A LOW CONDUCTIVITY CYLINDER
PRESENCE OF LATHER IN THE CYLINDER
USE NON-TREATED DRINKABLE WATER
WATER OVERFLOWS FROM THE TANK DURING DISCHARGE
OBSTRUCTED DISCHARGE PIPE
REMOVE THE OBSTRUCTION
DISCHARGE PIPE IS VERY SMALL
REPLACE THE DISCHARGE PIPE WITH ONE THAT HAS A SUITABLE DIAMETER
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 LOCK
CLEAN THE VALVE BODY AND REPLACE IT, IF REQUIRED

12 NOTES

Manual code E34021
"TRANSLATIONS OF ORIGINAL INSTRUCTIONS"

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