

CYAN™

Manual for installation, operation and maintenance

20130125



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1. FIELD OF APPLICATION

CYAN is a chiller & heat pump i differens sizes and capacities. i olika storlekar och kapaciteter. The equipment is designed for cooling (chiller only versions) or cooling/heating (heat pump version) water, which is usually utilised for air conditioning or refrigeration applications.

The units must be used exclusively within the operating limits shown in catalogue.

- When installing or servicing the unit, it is necessary to strictly follow the rules described in this manual, to conform to all the items detailed on the unit labels and take any necessary precaution.
- Pressure in refrigerant circuits and danger from electrical shock can be hazardous when installing or servicing the unit.



Any work on the unit must be carried out by trained people only.

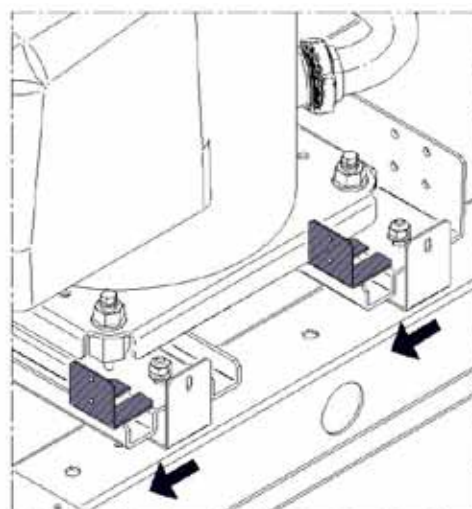
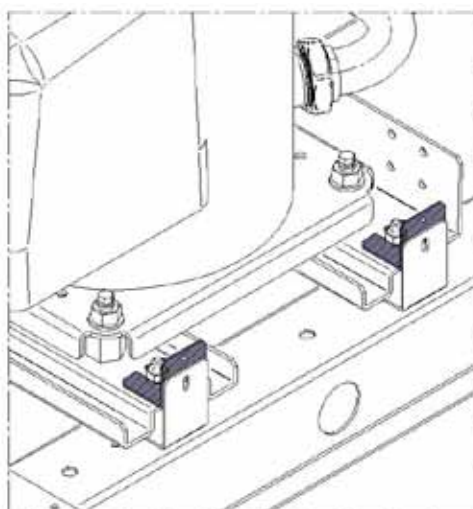


Before repairing or servicing the unit, ensure that the electrical supply is disconnected.

The warranty will be invalid if the rules described in this manual are not observed and if any modifications are made to the unit without prior authorisation of the manufacturer.



**SOME UNITS HAVE YELLOW TRANSPORTATION PROTECTIONS FOR THE COMPRESSORS.
REMOVE THESE BEFORE STARTING!**



IDENTIFICATION

Before installations work, always check that the right product is delivered.

The model, serial number, characteristics, power supply, etc. are shown by means of decals on the unit.

LOGOTYP		CE	
Modello/Model Modell/Modèle			
Tipo refrigerante Refrigerant type Kältemitteltyp Type réfrigérant	IP quadro elettrico IP electrical panel IP Schaltschrank IP tableau électrique	Matricola Serial number Seriennummer Matricule	
Corrente massima assorbita Max. absorbed current Max. Stromaufnahme Courant maxi absorbée	Corrente massima di spunto Max. starting current Max. Anlaufstrom Courant maxi de démarrage		
Tensione-Fasi-Frequenza Voltage-Phases-Frequency Spannung-Phasen-Frequenz Tension-Phases-Fréquence	Tensione circuiti ausiliari Auxiliary circuit voltage Steuerspannung Tension circuits auxiliaires		
Numero circuiti refrigerante Refrigerant circuit number Anzahl der Kältekreise Nombre circuits réfrigérant	Press. max refriger. alta/bassa Max. Refrig. pressure high/low Max. N/n Kältemittelbetriebsdruck Pression maxi refriger. haute/basse		
Press. massima circuito idraulico Max. hydraulic circuit pressure Max. zulässiger Druck im Wassersystem Press. Maxi circuit hydraulique	Data di produzione Date of manufacture Herstellungstatum Date de production		
Carica refrigerante per circuito(kg)/Refrigerant charge per circuit(kg) Kältemittel Füllmenge je Kreislauf(kg)/Charge éfrigérant par circuit(kg)			
C1	C2	C3	C4

LOGOTYP		CE	
MODELLO - MODELE - MODEL - TYP			
MATRICOLA - MATRICULE - SERIAL NO. - SERIENNUMMER			
REFRIGERANTE - REFRIGERANT - KÄLTEMITTEL - REFRIGERANT			

2. INSPECTION, TRANSPORT, SITE HANDLING

2.1 INSPECTION

After receiving the unit, immediately check its integrity. The unit will have left the factory in perfect condition. Therefore on receiving the unit any damage must be verbally described to the carrier and recorded on the Delivery Note before it is signed by both parties. Swegon or their Agent must be informed as soon as possible of the extent of the damage.

The Customer should prepare a written statement and photographic evidence regarding any severe damage.

2.2 UNPACKING

When unpacking the unit pay attention not to damage the unit.

Packaging consists of different materials: wood, paper, nylon etc.

Separate the materials and deliver to the proper gathering centre in order to reduce their environmental impact.

2.3 LIFTING AND SITE HANDLING

Avoid sudden movements and jolts when unloading and positioning the unit. Internal handling procedures must be conducted with care. Do not exert leverage on the components of the machine. The unit must be lifted by inserting steel tubes through the lifting attachments shown by the relative signs (yellow arrow).

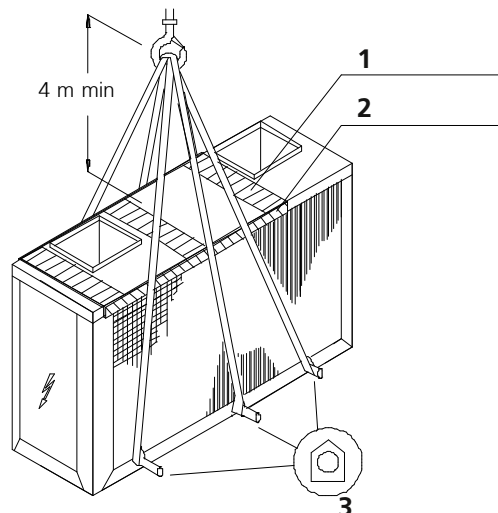
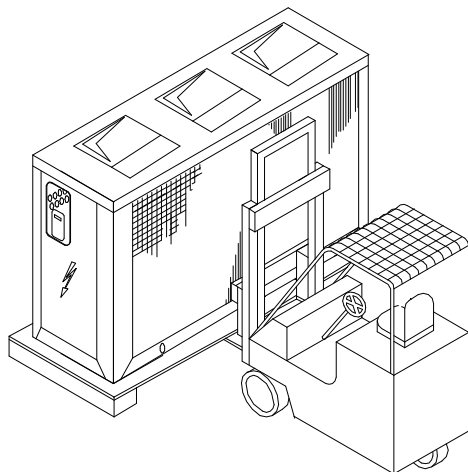
The unit must be lifted by harnessing it as shown in figure 1: use ropes or straps of sufficient length and spacer

bars to avoid damage to the unit's side panels and cover.

Alternatively, the unit can be lifted by a forklift truck, inserting the forks under the pallet (see figure 1).



Ensure that the method of lifting does not allow the unit to slip from chains and slings and does not allow the unit to turn over or slide from lifting devices.



- 1) Space bar
- 2) Side panel protection
- 3) Lifting holes

Fig. 1



All lifting devices, ropes and sling etc, must be selected by someone with the required knowledge and be fully responsible for the use thereof.



The unit must be properly balanced and when using a forklift the forks should be in a low position. If the unit is not balanced apply ballast. Any protruding parts should not be supported by hand.



Do not walk or stand beneath or in the proximity of the load.

Transportation must be by specialised personnel (truck operators, hook-up personal), equipped with the necessary protection equipment (overalls, safety shoes, protective gloves, helmets, goggles). The manufacturer will not accept any responsibility in case of possible accidents due to the non-observance of these warnings.

3. NON APLICABLE APPLICATIONS

The unit should not be applied in the following circumstances:

- In an explosive atmosphere;
- In an inflammable atmosphere;
- In excessively dusty environments;
- By untrained personnel;
- In any manner contrary to the rules in force.
- With incorrect installation;
- With defective power supply;
- Without total or partial observance of instructions;
- With lack of maintenance and/or use of non original spare parts;
- With modifications or other changes unauthorized by the manufacturer;
- Within a location that is not clear of debris or other objects;
- Within a location that is inadequately cleared,
- With anomalous vibrations in the location area

4. SAFETY PRECAUTIONS

The machine conforms to the Directives 2006/42/EC, 2004/108/EC, 2006/95/EC, 97/23/EC, and to the applicable technical standards stated on the Declaration of Conformity which is included with this manual.

4.1 DEFINITION OF DANGER ZONE

The unit is designed and built in accordance with the PED 97/23CE rules, to ensure the maximum level of safety.

To avoid possible situations of risk adhere to the following rules at all times:

- This product contains pressurized containers, electrical components, moving mechanical parts, and surfaces which can reach both high and low temperatures and, in certain circumstances, constitute a potential hazard: all operations must be carried out by specialized personnel who have the necessary qualifications in accordance with the laws in force. Before carrying out any operation, make sure that the appointed personnel has full knowledge of the documentation supplied with the unit
- Always ensure there is a copy of the documentation in the immediate vicinity of the unit.
- The operations indicated in this manual must be integrated with the procedures of instruction manuals of other systems or devices assembled in the unit. The manuals contain all the necessary information to manage, in safety, all devices and the possible operating modes.
- Use the appropriate personal safety equipment (gloves, helmet, safety goggles, safety footwear, etc.) for all maintenance and control operations on the unit.
- Avoid loose garments, dangling accessories such as ties, chains, watches which could be entangled in moving parts of the unit.
- Use only tools and equipment that are in good working order.
- The fans are protected against involuntary intrusion via a protection grille. Adopt the maximum caution not to introduce or let objects fall through the grille.
- The finned coils have sharp surfaces; avoid any accidental contact with them without adequate protection
- The compressor compartment contains various high temperature components. Adopt the maximum caution when working in the vicinity of the compressors and avoid touching any parts of the unit without appropriate protection.
- Do not work within the theoretical discharge trajectory of the relief valves.
- If components are located in positions easily accessed by non qualified people it is mandatory that protection grilles, available as an accessory option, are installed.
- The user must consult the installation and operating section of this manual regarding the systems incorporated.
- All units have safety / warning labels. It is forbidden to remove any safety /warning label.

It is forbidden to:

Remove or by-pass any safety measure for people protection.-

- Tamper and/or modify, even partially, the safety devices of the unit.
- In case of alarm signals, and the consequent intervention of safety devices, the operator must contact qualified maintenance technicians. A possible accident could cause serious injuries or death.
- All safety devices must be verified according to the instruction manual. Verification and repair/adjustment must be performed by qualified personnel authorised with a written instruction by the customer. A copy of the results of the repair/adjustment made must be left on the unit. A possible accident could cause serious injuries or death.

The Manufacturer is not responsible for any damage to people, pets or objects due to the re use of any part of the unit for functions or assemblies different to its original purpose.

It is forbidden to tamper/change without authorisation any component of the unit.

The use of accessories, tools or components different from those recommended by the Manufacturer exonerates the Manufacturer from any civil or penal responsibility.

The operations of removal and demolition of the unit must be carried out only by personnel adequately trained and equipped.

4.3 INSTALLATION IN AREAS WITH EXPLOSIVE ATMOSPHERES

The units are not subjected to the rule ATEX 94/9/CE - DPR 23/3/98 n.126

4.4 PROTECTION

The unit uses technical means to protect people from dangers that cannot be reasonably eliminated or limited when the unit is designed.

It is forbidden:

- To remove or to make ineffective the protections designed for the safety of people;
- To tamper and/or modify, even partially, the safety devices installed on the unit

4.5 LIGHTING

Must allow working conditions without risks due to zones in shadow (as for instance during maintenance operations).

4.6 QUALIFICATION OF PERSONNEL – OBLIGATIONS

The user must know and apply the prescriptions related to safety in the working places of directives 89/391/CE and 1999/92/CE.

The knowledge and the understanding of the manual are a necessary tool for the reduction of risks, safety and health of operators.

The operator must have an adequate degree of knowledge to carry out the various activities during the phases of the technical life of the unit.

4.7 VARIOUS INSTRUCTIONS

In the use of the unit use the protection devices decreed by law, whether integrated in the unit or by human activity.

The technical manual is kept by the manufacturer.

The manufacturer takes no responsibility for possible injuries to persons, domestic animals or damage to items due to non respect of safety rules and recommendations contained in the supplied documentation.

This manual has to be integrated with information contained in other documents. Consult these documents whenever necessary.



The operator must have knowledge against possible anomalies, disfunctions dangerous conditions for him or for others, and must comply with the following prescriptions:

- **Immediately stop the unit via the emergency pushbutton(s);**
- **Not perform interventions outside his assignments and technical knowledge;**
- **Immediately inform the responsible superior and avoid any unauthorised actions.**

5. POSITIONING

Read the following points carefully when choosing the most suitable site for the unit and its connections:

- dimensions and connection point of hydraulic pipelines;
- location of the electrical power connection point;
- accessibility for maintenance and repair work;
- loading capacity and compactness of the supporting surface;
- ventilation of air-cooled condenser;
- orientation and exposure to sunlight; as far as possible the condenser coil should not be exposed to direct sunlight;
- direction of prevailing winds: do not position the unit in such a way that prevailing winds can give rise to air recirculation at the condenser coil;
- type of support surface: to limit the risk of overheating, do not install the unit on a dark coloured surface (e.g. bitumen roofing membranes and compounds);
- possible sound reverberation.

All models in the CYAN series are designed for exterior installation (patios, gardens, etc.). To avoid the risks of undesirable air recirculation, these units must not be covered by a shelter roof or located under trees (even if the unit is only partially covered).

It is advisable to make a supporting plinth of dimensions commensurate with the footprint of the unit. This precaution is indispensable if the unit is to be located on unstable ground (various types of terrain, gardens, etc.).

The unit transmits a low level of vibration to the supporting structure: we recommend interposing a layer of rigid rubber sheeting between the base of the unit and the supporting surface.

If a higher level of vibration damping is required, use anti-vibration mounts (contact our company for details).

The units should not be installed next to offices, bedrooms, or other areas where low noise levels are a necessity.

To avoid excess sound reverberation do not install the units in narrow or confined spaces.

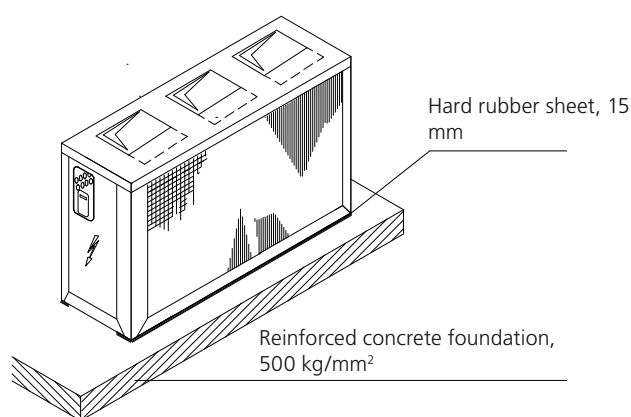


Fig. 2

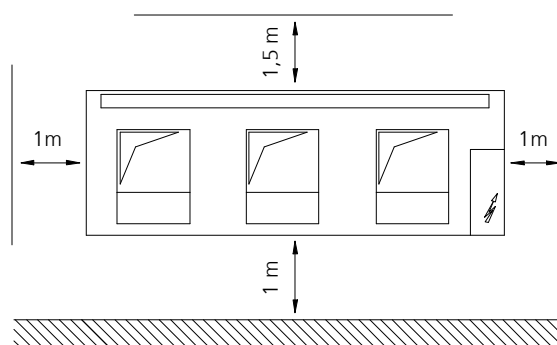
6. INSTALLATION

6.1 INSTALLATION CLEARANCES

It is highly important that there is an adequate volume of air at the intake and exhaust sides of the condenser coil.

It is essential to avoid air recirculation between the intake and exhaust sides to prevent a reduction of rated performance levels or interruption of normal operation. For this reason ensure that the minimum clearances, indicated in figure 3, are adhered:

- condenser coil side: min. 3 metres for horizontal discharge;
min. 1.5 metres for vertical discharge.
- side opposite condenser coil: 1 metre
- electrical panel side: min. 1 metre
- side opposite electrical panel: min. 1 metre.
- top: no obstructions to the free discharge of air are permitted (for vertical discharge).
- units installed side by side: min.4 metres (non-ducted units).



SIDE BY SIDE

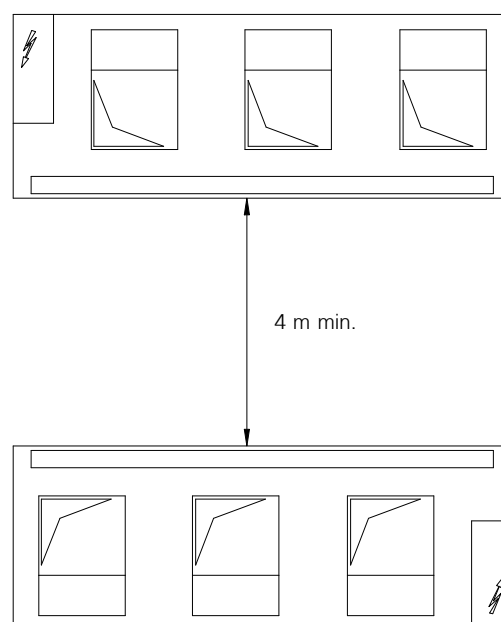


Fig. 3

6.2 INTERIOR INSTALLATION

For this type of installation it is possible to duct both the intake and outlet sides of the condenser coil (fig. 4).

The ducts must be connected to the exterior by means of suitable openings in the building walls.

In the event of ducted suction, the duct dimensions must be equal to the dimensions of the condenser coil.

The ducts must be suitably sized in relation to their length and dimensions. In this regard, the units are manufactured in standard versions with available pressure of 50 Pa. If higher pressure drops are predicted, consult Swegon.

If the unit must be installed in enclosed spaces or internal courtyards, ducting must be fitted to reduce air velocity in order to limit pressure drops and noise levels. The unobstructed air flow cross section must be at least twice the cross section of the machine air intake. You must maintain between the discharge outlet and the suction zone a minimum distance H of 2 metres, ensuring that $H \gg 2A$ (fig. 5).

The following service clearances must be observed:

- air discharge side: min. 3 metres.
- side opposite condenser coil: min. 1 metre to allow access for hydraulic connections.
- condenser coil side, where possible: min. 1 metre for intake and removal / cleaning of metal coil guards.

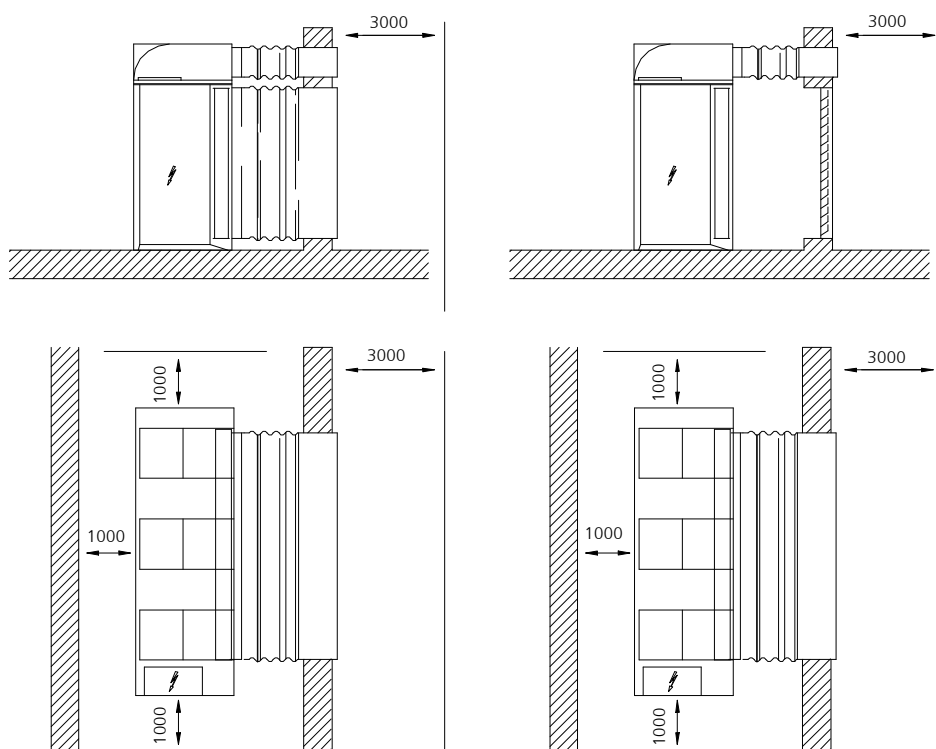


Fig. 4

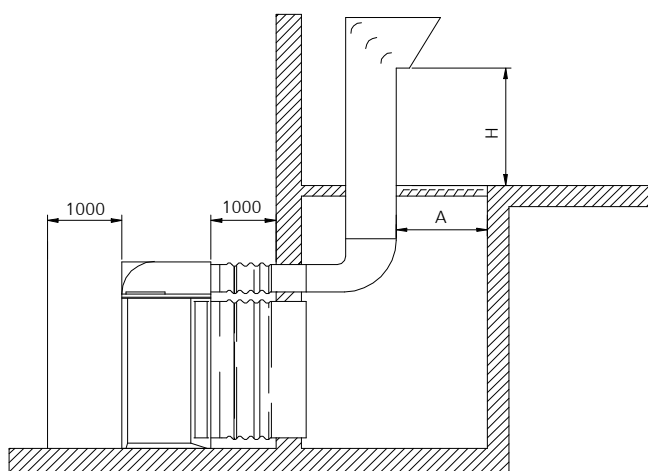


Fig. 5

6.3 DYNAMIC PRESSURE

To optimise the air flow rate required for proper operation of the condensing coil it is important that the delivery port of the fan be equipped with a duct of the same dimensions as the fan port and of a length that is twice the diameter of the fan wheel.

With this solution, part of the dynamic pressure generated by the fan is transformed into static pressure and hence available to overcome pressure drops, otherwise this portion of the pressure would be dispersed with a consequent reduction in fan available pressure.

(See fig. 6).

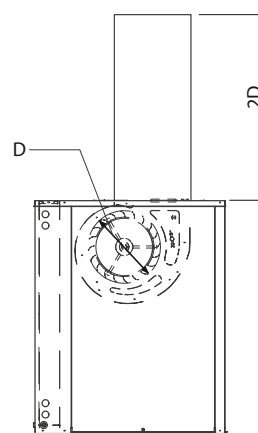


Fig. 6

6.4 ANTI-VIBRATION ISOLATORS (option)

It is recommended that the unit is installed on rubber or spring anti-vibration mountings, supplied as an option, to reduce vibrations transmitted to the building structure. It is advisable to use rubber isolators for units installed in the basement, or ground floors in contact with the earth, and spring isolators for units installed on intermediate floors.

The anti-vibration isolators must be installed before the unit is positioned.

Ensure that during lifting the unit is firmly secured with straps.

6.4.1. Rubber Anti-Vibration Isolators

Rubber isolators are made of an upper metallic bell with a fixing screw to the base-frame of the unit. The isolator is fixed at the foundation via 2 holes on the flange. On the flange there is a number (45, 60, 70 ShA) which identifies the hardness of the rubber isolator. The dimensional drawing, enclosed in the machine, shows the unit footprint with the position and weight of each isolator.

(Fig. 7)

6.4.2 Spring Anti-Vibration Isolators

Anti-Vibration Isolators with cylindrical springs are recommended to reduce any mechanical and sound vibration.

Each isolator has a code which identifies the maximum permitted load.

When installing spring Anti-Vibration Isolators, it is compulsory to carefully follow all recommendations and assembly instructions. The dimensional drawing, enclosed in the machine, shows the footprint with the position and weight of each isolator.

Standard spring antivibration isolators

The isolator is fixed to the unit's baseframe with a nut and two bolts and washers.

Spring antivibration isolators for heavy loads

The load of the unit is supported by the full surface of the isolators. The load is not exerted on the bolt.

(Fig. 8)

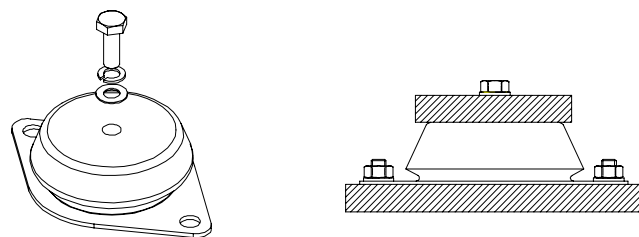


Fig. 7

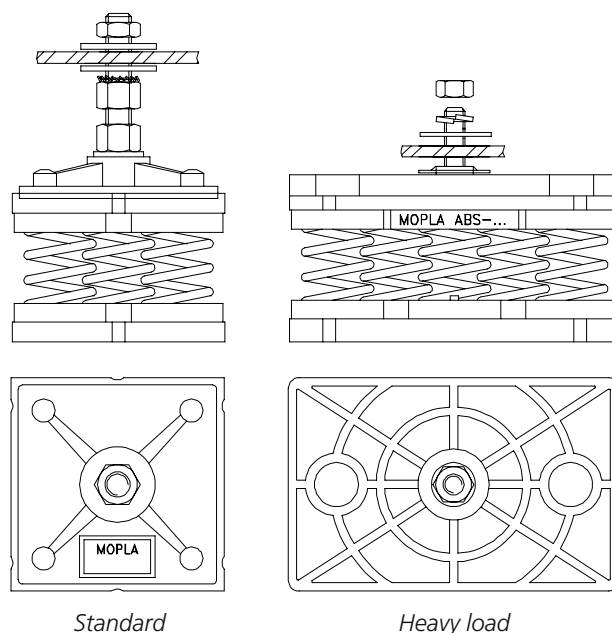


Fig. 8

6.5 WATER PIPING CONNECTIONS

Unit water pipework must be installed in accordance with national and local regulation and codes.

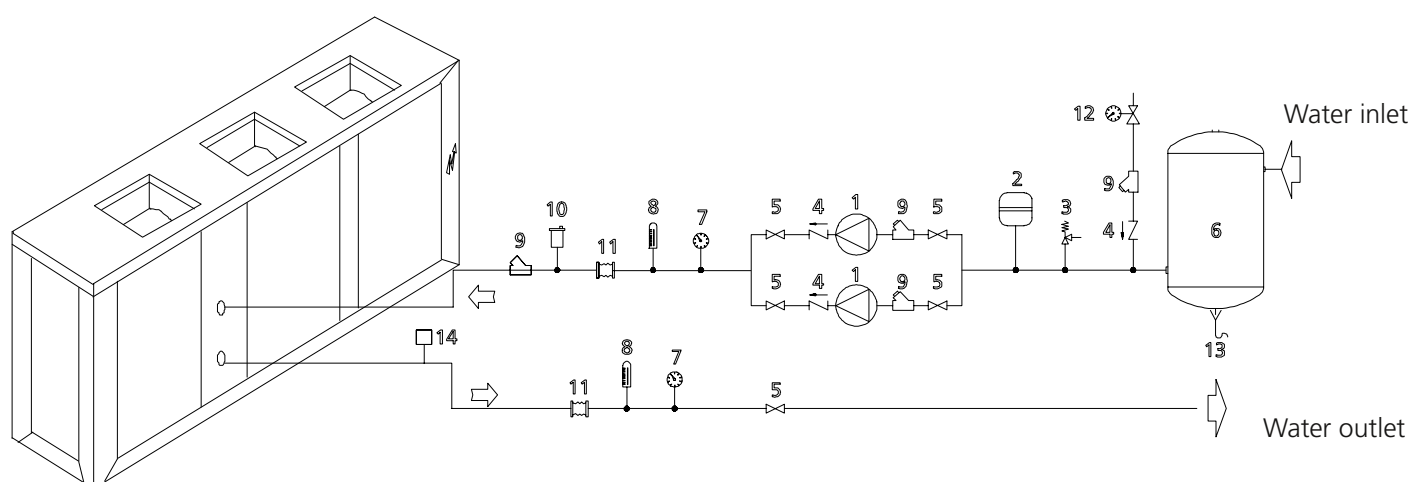
Follow the recommendations below when designing the water piping circuit (refer to the diagrams included in this manual).

Piping should be connected to the unit with flexible joints, to avoid vibration transmission and allow for thermal expansion (the same procedure should be adopted for the circulating pumps).

The following devices should be located on the piping system:

- isolating/regulating valves, temperature gauges or thermometer pockets, pressure gauges or binder points required for servicing operations.
- Serviceable mesh strainer, with a filtration level no larger than 1mm, located on the unit inlet to prevent
- debris from entering the heat exchangers.
- vent valves, to be installed in the upper parts of the circuit, for air bleeding.
- expansion device with accessories for circuit pressurisation, water thermal expansion compensation and system filling.
- unload valve and if necessary drainage tank for circuit emptying during maintenance and seasonal stop.

RECOMMENDED HYDRAULIC CIRCUIT DIAGRAM FOR CYAN UNITS



Pos.	Description
1	Pump
2	Expansion tank
3	Relief valve
4	Check valve
5	Ball valve
6	Tank
7	Water pressure gauge

8	Thermometer
9	Water filter
10	Bleed valve
11	Flexible connection
12	Circuit filling unit
13	Water drain
14	Flow switch

6.6 EVAPORATOR WATER PIPE CONNECTIONS



The water inlet and outlet must be connected in the positions indicated as labelled on the unit.



USER WATER

If incorrectly connected the antifreeze thermostat will not operate and the evaporator may freeze.

The hydraulic connections are threaded. The type and size are indicated on the dimensional drawings at the end of this manual.



A constant water flow to the evaporator must be guaranteed at all operating conditions to prevent liquid refrigerant from entering the compressor and causing irreparable damage.

Compressors start and stop often due to changes in cooling demand. In hydraulic circuits with low water volume, where the thermal inertia action is low, it is advisable to verify that the water volume equals or exceeds the following ratio:

$$M \geq \frac{24 \cdot Q_{\text{Comptot}}}{N}$$

where:

M = system water content(kg)

Q_{Comptot} = unit cooling capacity (kW)

N = number of capacity steps

If the water volume does not reach the value given by the formula, it is advisable to provide the circuit with a storage vessel to increase the volume (tank + circuit) to match the result of the formula.

The chilled water piping and storage vessel must be insulated to prevent condensation on the pipe surfaces and to avoid circuit performance losses.



It is compulsory to install a metallic filter, on the water inlet piping. If a filter is not installed the warranty will be terminated immediately.



We strongly recommend installing a pressure relief valve on the hydraulic circuit. In the event of serious system breakdown or emergency (e.g. fire), the relief valve will make it possible to depressurise the system thus forestalling possible pipe bursts. Always connect the relief valve outlet to a pipe of diameter no smaller than the valve opening, and route it to a location in which persons are protected from the jet of expelled water.



When making hydraulic connections never use naked flames close to or inside the unit.

6.7 WATER FLOW SWITCH INSTALLATION INSTRUCTIONS

Valid for sizes 3.2 to 13.2. For models from 14.4 to 33.4 the flow switch is already installed as part of the standard equipment.

Clean the pipeline system into which the flow switch is to be fitted and take away any magnetic particle, such as welding residues. To prevent turbulent flow there must be straight pipework, equal to 5 times the diameter of the pipe, either side of the flow switch.

To avoid leakage, seal the connection by using teflon. The flow switch should be installed on the heat exchanger that is closer to the electrical board.

Connect the "T" shaped metallic manifold (on which the flow switch is mounted) into the evaporator male threaded water outlet labelled with:



- To avoid leakage, seal the connection by using teflon. The flow switch should be installed on the heat exchanger that is closer to the electrical board.
- The flow switch must be tightened on the "T" shaped metallic manifold by the plastic knurled union nut. Check that the arrow located on the upper side is pointing in the direction of flow. Be sure to fit the O-ring seal, through the brass manifold and the plastic ring nut. The O-ring seal is supplied in a plastic cover to protect the flow switch shaft.
- Connect the flow switch to the other end of the "T" manifold.
- Route the flow switch electrical cable through the hole in the unit structure and run it to the electrical panel by ascending the upright in the machine interior. Connect the flow switch to terminals 1-14 as indicated on the electrical drawing.
- The flow switch can be removed by screwing out the plastic knurled union nut. In order to reassemble it, ensure that the O-ring seal is positioned in the proper location. (See figure 8).



Flow switch is named SPW1 in electrical scheme.

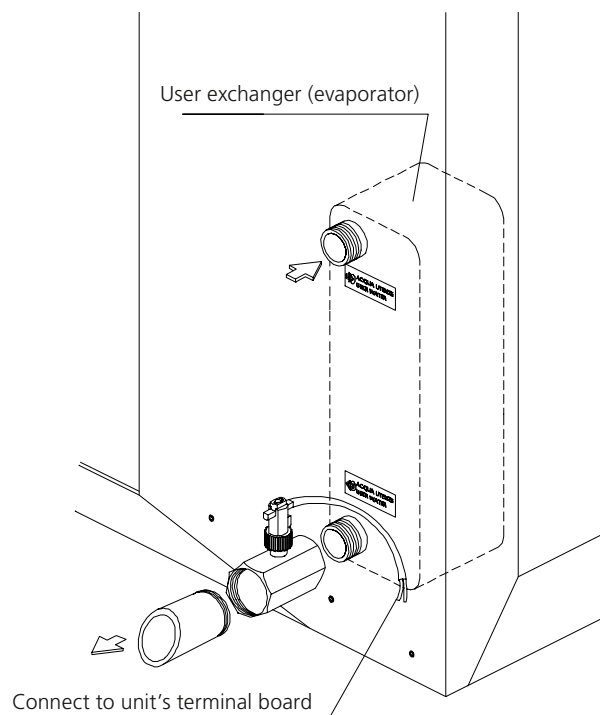


Fig. 9

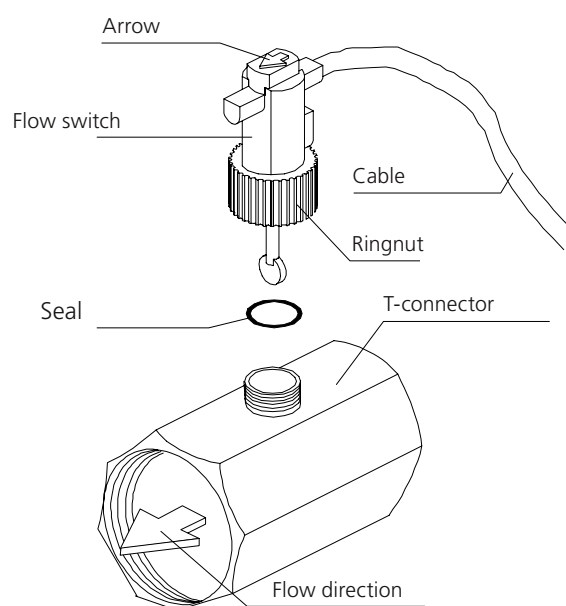


Fig. 10

6.8 DESUPERHEATER HYDRONIC CONNECTION (optional)

For all units equipped with desuperheaters, the hydraulic connections are steel tubes with male thread. The connections are identified by the following decals:

Recovery water inlet	IN ↓	DESUPERHEATER WATER
Recovery water outlet	OUT ↑	DESUPERHEATER WATER



On HP version units the hydronic connection to the desuperheater must be isolated during heat pump operation.

6.9 HEAT RECOVERY EXCHANGER HYDRONIC CONNECTIONS

For all units equipped with a recovery condenser, the relative hydronic circuit connections are male threaded steel pipes (the diameter depends on the unit's size)

The units are equipped with a probe that monitors the temperature of the water returning from the system. The microprocessor controller enables recovery when necessary, disconnecting the fans, and restarting regular operation once the water has reached the desired temperature.

If faults occur on the recovery condenser the microprocessor controller restarts the fans.

The calibration values of the thermostat and pressure switches are given in the relevant controller instruction manual.



The water inlet and outlet must be connected in the positions indicated as labelled on the unit.



RECOVERY WATER



It is mandatory to install a three-way modulating, valve with water temperature probe, on the inlet to the unit to ensure that, at steady state conditions, the inlet water temperature is not less than 20 °C.

Alternatively: a condensing pressure control valve for each refrigerant circuit that ensures an average condensing temperature of at least 33 °C.

DIAGRAM WITH 3-WAY VALVE

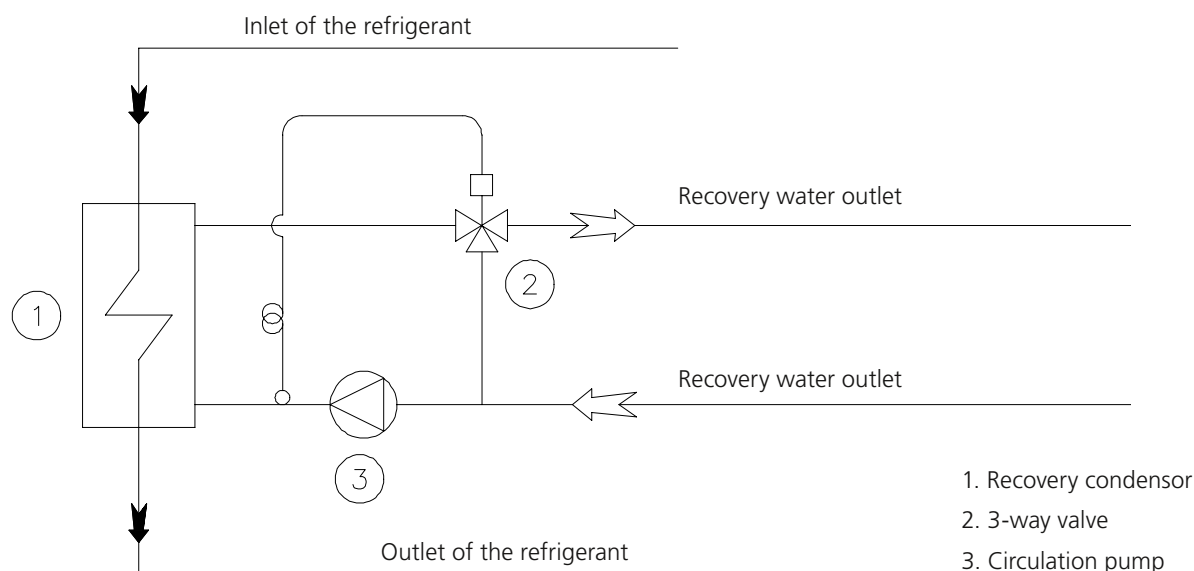


Fig. 11

DIAGRAM WITH CONDENSING PRESSURE CONTROL VALVE

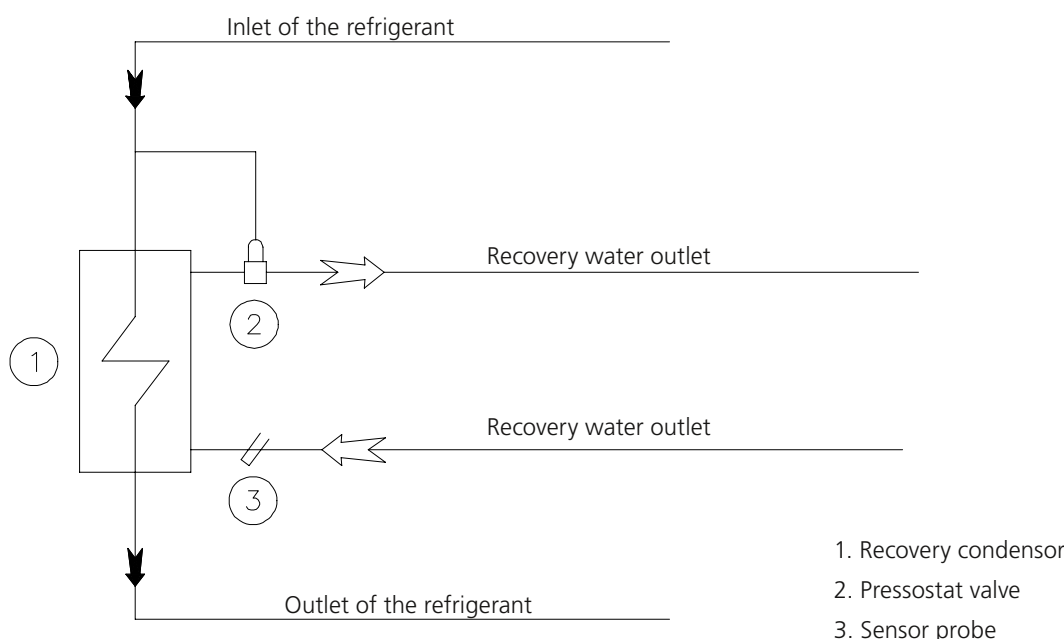


Fig. 12

6.10 PRESSURE RELIEF VALVES

Pressure relief valves are fitted on the high pressure side and low pressure side of the refrigerant circuit. The valves must be vented, to outdoors, through a vent pipe.

The vent pipe must be sized no smaller than the relief valve and it must not be supported from the valve.



The relief valve must be directed into a safe zone where no injuries can be caused to people.

6.11 CONNECTIONS FOR VERSION /LE (MOTO-CONDENSING UNIT)



The operations described below involve the use of pressurized pipes and braze welded connections. These must be handled by specialized personnel who have the necessary qualifications in accordance with the laws in force.

6.11.1 General

The /LE (condensing unit) versions must be connected to a remote evaporator by means of refrigerant lines. For separate section type /LE versions, the route followed by refrigerant lines depends on the location of the sections and the characteristics of the surrounding building structure.

Pipe runs should be as short as possible to limit the pressure drop and the refrigerant charge volume. The maximum permissible pipeline length is 30 metres. If this limits cannot be adhered to contact Swegon for further information.

6.11.2 Evaporating section at lower level than condensing section (Fig. 13)

- The vertical riser must be equipped with siphons at least every 6 metres to facilitate the return of oil to the compressor;
- Make a collection pit on the suction line downstream of the thermostatic valve bulb;
- Horizontal sections of the suction line should follow a grade of at least 1% to facilitate oil return to the compressor (see above).

6.11.3 Evaporating section positioned higher than the condensing unit section (Fig. 14)

- Form a siphon on the suction line, at the same height as the evaporator, to avoid drainage of liquid towards the compressor when the unit is stopped.
- Make a collection pit on the suction line, downstream from the thermostatic valve bulb, for the collection of liquid refrigerant that can accumulate during unit shutdown. When the compressor restarts the refrigerant will evaporate rapidly.
- It is advisable to create the accumulation pit well away from the bulb to avoid the risk of affecting the operation of the thermostatic valve.
- Horizontal sections of the suction line should follow a grade of at least 1% to facilitate oil return to the compressor.

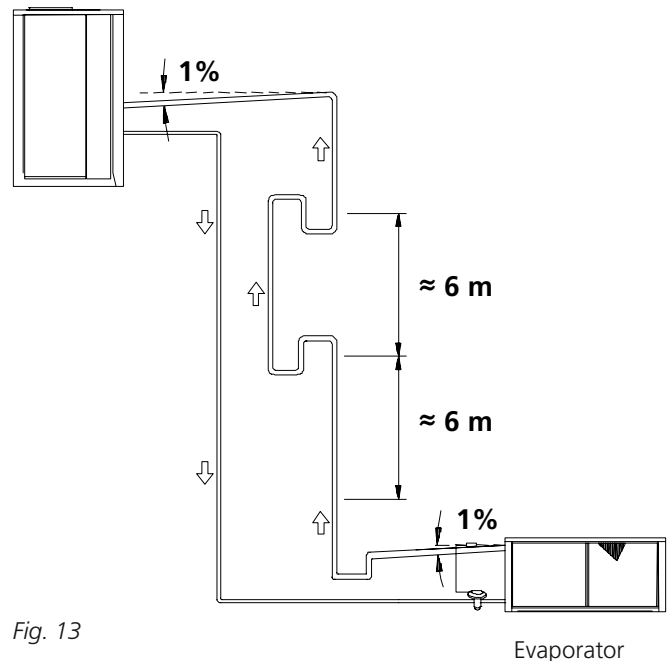


Fig. 13

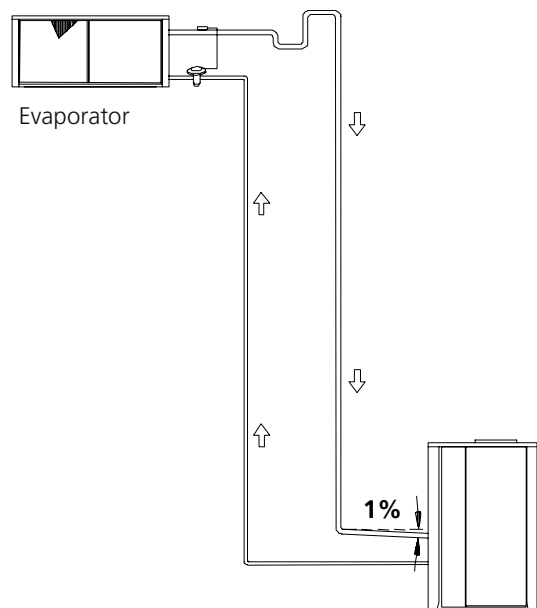


Fig. 14

6.12 WATER FLOW RATE TO EVAPORATOR

The nominal water flow rate is based on a 5 °C temperature difference between inlet and outlet in relation to the supplied cooling capacity.

The maximum permissible flow rate is that which results in a temperature difference of 4 °C: higher flow rates will lead to excessive pressure drops and could damage the evaporator.

The minimum permissible flow rate is that which results in a temperature difference of 7 °C or a pressure drop of no less than 10 kPa: lower flow rates will lead to excessively low evaporation temperatures with consequent tripping of safety devices and shutdown of the unit.

6.13 CHILLER WATER TEMPERATURE (summer cycle)

For the minimum water temperature at the evaporator outlet refer to section 6.17.

The maximum water temperature at the evaporator inlet is 20 °C. In the case of higher temperatures specific solutions are necessary (dual circuits, three-way valves, by-pass, storage tanks): consult the Bluebox Engineering Department to discuss the most suitable solution for your application.

6.14 HOT WATER TEMPERATURE (winter cycle)

The minimum water temperature at the condenser inlet, once the system is operating in steady state conditions, must be no lower than 25 °C: lower values could result in operating anomalies of the compressor with the consequent risk of compressor breakdown.

The maximum water temperature at the condenser outlet must be no higher than 48 °C. In the event of higher temperatures the safety devices will trip causing the unit to shut down.

6.15 AMBIENT AIR TEMPERATURE

The units are designed and built to operate with ambient air temperatures within the limits shown on the operating limits diagrams (see catalogue). Contact Swegon if the unit is required to operate at different ambient temperatures.

It should be noted that the performance of heat pump units decreases significantly at lower ambient temperatures.

The units can be optionally equipped with an electric element for heating the evaporator. The heater cuts in, when the machine is switched off, if the water temperature in the evaporator falls below the freeze protection calibration temperature.

6.16 OPERATION IN LOW AMBIENT AIR TEMPERATURE CONDITIONS (option)

As ambient air temperature decreases it is possible to maintain the necessary condensation pressure for correct operation of the cooling cycle within the machine operating range by adjusting the cooling air flow through the condenser.

Condensation pressure control is only active when the machine is operating in cooling mode.

Condensation control is disregarded during heat pump mode operation.

Condensation pressure regulation by de-energising fans (option available for models from 8.2 to 33.4)

A thermostat checks the ambient air temperature and generates a signal to de-energise one fan on three fan units and two fans on four fan units.

Condensation pressure regulation using modulating dampers (optional available on all models)

Condensation pressure regulation is achieved by a modulating damper that varies the air volume over the condenser coil in accordance with the condensing pressure read by the pressure transducers.

6.17 OPERATION WITH LOW TEMPERATURE CHILLED WATER AT EVAPORATOR



Units from the normal production range are not designed to operate with lower chilled water temperatures, at the evaporator outlet, than those indicated in the operating limit diagrams. To operate outside this limit the unit may require structural modifications. If this should become necessary, contact Swegon.

Units from the normal production range are not designed to operate with lower chilled water temperatures, at the evaporator outlet, than those indicated in the operating limit diagrams. To operate outside this limit the unit may require structural modifications. If this should become necessary, contact Swegon.

With temperatures lower than those shown in the operating limit diagrams, the hydraulic circuit should be filled with a suitable water and antifreeze solution. In such cases the service thermostat and the freeze protection thermostat must be reset.

These calibrations are normally set in the factory.

The ethylene glycol percentage must be selected in relation to the required chilled water temperature.

See Table 1.

TABELL 1 - FREEZING POINT FOR WATER-ANTIFREEZE MIXTURES

LIQUID OUTLET TEMPERATURE OR MINIMUM AMBIENT TEMPERATURE (°C)	+0°	-5°	-10°	-15°	-20°	-25°	-30°	-35°	-40°
FREEZING POINT (°C)	-5°	-10°	-15°	-20°	-25°	-30°	-35°	-40°	-45°
ANTIFREEZE	% BY WEIGHT								
ETHYLENE GLYCOL	6	22	30	36	41	46	50	53	56
PROPYLENE GLYCOL	15	25	33	39	44	48	51	54	57
METHANOL	8	14	20	26	30	34	38	41	45
CALCIUM CHLORIDE	9	14	18	21	24	26	27	28	30
TEMPER -20	T -20°C					---			
TEMPER -40	T -40°C								---
TEMPER -60	T -60°C								
TIFOXITE	40			50	60	63	69	73	---
FREEZIUM	10	20	25	30	34	37	40	43	45
PEKASOL 50	50		59	68	75	81	86	90	---



In the case of ST versions with a glycol content greater than 30% pumps with special seals must be specified at the time of the order.

6.18 ELECTRICAL CONNECTIONS

6.18.1 General

- Electrical connections must be made in accordance with the information given on the electrical drawing attached to the unit and in compliance with the applicable local regulations.
- An Earth (ground) connection is compulsory. The installer must connect the earth cable with a dedicated terminal on the earth bar in the electrical board (refer to the illustration on the following page) labelled PE.
- It must be verified that the electrical supply corresponds to the unit electrical nominal data (tension, phases, frequency) indicated on the label on the front panel of the unit.
- Line voltage fluctuations must not be more than $\pm 5\%$ of the nominal value, while the voltage unbalance between one phase and another must not exceed 2%. If these tolerances are not possible contact Swegon to provide the necessary devices.
- Check that the line is connected with the correct phase sequence.
- The cable inlet point is created by drilling a hole in the side or base of the electrical enclosure, depending on the model.
- The control circuit is derived from the power supply through a transformer located inside the electrical panel.
- The control circuit is protected by fuses.

6.18.2 Power supply to crankcase heaters

- 1) Close the main disconnect switch by turning it from position "0" to position "1"
- 2) Check that the word "OFF" is shown on the display
- 3) Ensure that the unit is in "OFF" status and that the external enabling contact is open
- 4) After a few moments, if the phase sequence is incorrect the alarm "INCORRECT PHASE SEQUENCE" will be displayed (4-compressor models from 14.4 to 33.4 only, with pCO₂ controller). In this case invert the connections of two of the power line phase wires.
- 5) Leave the unit in this condition for at least 12 hours to allow the crankcase heaters to perform their function.

6.18.3 Potential free contacts

The following potential free contacts are available:

- 1 potential free contact for general alarm (terminals 100 - 101 - 102)
- 1 potential free contact for each compressor (option)
- 1 contact for each pair of fans (option)
- 1 contact for each pump (option - ST models)

6.18.4 Flow switch electrical connections

Flow switch electrical connections (see paragraph 6.5) must be connected to terminal 1-14 for chiller units.

6.18.5 Circulating pump electrical connections

The external interlocks of unit must close for the unit to operate. The normally open external water circulating pump contactor terminals must be wired in series with terminals 1 and 2, on the unit control panel, to ensure that the chiller can only start after the pump is in operation.

In ST units external enabling contacts 1-2 must be jumpered (unless they are required for system functions).



Turn on the pump before the unit starts and stop it after the unit has stopped (recommended time delay: 60 sec.).

6.19 MIKROPROCESSORSTYRNING

The units are equipped with microprocessor controllers. See the control equipment manual.

6.20 COMMUNICATION

All units can be equipped with a serial interface board for supervision or remote diagnostics functions by means of a computer.

The serial interface board plugs into a dedicated slot on the connection board.

Connection to the supervision or remote diagnostics serial line is executed in compliance with standard RS485 and is achieved by means of the serial interface boards.



Electrical cable anchorage: anchor the electrical power cables with fixing systems able to withstand pulling and torsional stress.



Before any operation on the electrical section, be sure that the electric supply is disconnected.



Power cable and line protection must be sized according to the specification indicated on the wiring diagram and the documents supplied with the unit.



The crankcase heaters must be connected at least 12 hours before starting the unit; the heaters are automatically connected when the main disconnect switch is set to the ON position.



The electrical supply must be within the limits shown. If this is not the case the warranty will be terminated immediately.

7. OPERATING DESCRIPTION

7.1 Introduction

The microprocessor control regulates the water temperature of the evaporator maintaining it at the set-point value acting on the compressors management.

As well as the compressors the controller manages the operation of other components of the chiller such as the pumps (ST version) and fans, with relative operating times and alarms, and "ancillary" functions such as condensation control, etc., as described below.

Almost all the parameters referred to below (set-points, differentials, calibration, delays...) can be programmed by means of the various menus. Refer to the specific manual for the pCO₂ controller.

7.2 Unit in stand-by mode

The unit is in stand-by mode when it is correctly supplied with power but not actually enabled to operate.

In this condition the display shows the values of the various machine parameters, but the operation of the compressor is not inhibited.

Power-on is obtained by pressing the "ON-OFF" button of the microprocessor control or via an external interlock.

7.3 Enabling the unit

Start-up of the unit from stand-by mode can be achieved after closing the external enabling contact, by pressing the "ON/OFF" button, or by means of a signal on the serial line.

Activation of the controller outputs that manage the various sections of the chiller is executed in strict compliance with the operating times. If the "ON" button is pressed before the external interlocks are closed, the display indicates which of the external interlocks is not yet enabled.

Operation of the pump has priority to the compressors, which can start only after the evaporator pump is running.

7.4 Pump management (ST units only)

If system pump control is included switching on the unit will automatically enable the pump.

If there are two pumps (run and stand-by) they will be activated alternately when the programmed operating time limit for each pump has elapsed.

When the pumps are switched over both pumps will run in tandem, for a few seconds, to ensure a constant flow of water in the system circuit.

When the unit is switched from active status to stand-by, if performed by opening an external permissive, the currently active pump of the ST unit will be stopped with a delay interval, after the disconnection of the last compressor in operation, making it possible to exploit the thermal inertia of the system.

7.5 Compressor start-up

The controller allows the compressors to be started if the flow switch input is closed within the compressor start-up delay time interval. If the flow switch input opens, after the compressor has started, the trip is retarded if it occurs within the time programmed for the compressor stop.

If the unit trips due to the opening of the flow switch input, the relative alarm is displayed.

Starting and stopping of the compressors and capacity step control is managed by the controller in accordance with the building cooling demands.

7.6 Chiller mode operation

In chiller operation, the controller lowers the water temperature value, maintaining it as close as possible to the programmed set-point. In the standard version, in which the control acts on the evaporator entering water, the management of compressor operation and capacity steps is linked to the difference between the entering water temperature and the programmed set-point.

7.7 Heat pump mode operation

In heat pump operation, the controller increases the water temperature value, maintaining it as close as possible to the programmed set-point.

Management of compressor operation is performed in the same way as already illustrated for chiller mode operation.

7.8 Evaporator low temperature chilled water protection

If the evaporator leaving water temperature is lower than the limit value programmed in the low temperature chilled water protection set-point, the controller will stop all the compressors and activate the low temperature water alarm.

This alarm must be reset manually and the compressor restarted only when the evaporator leaving water temperature is equal to or higher than the alarm trip value, increased by the low temperature water differential.

The low temperature water alarm can only appear when the unit is switched on (in stand-by conditions the freeze alarm is not operational).

7.9 Evaporator anti-freeze protection electric heater (optional)

In conditions that lead to tripping the freeze alarm, the controller energises the heater.

The heater remains powered for the entire time that the conditions for the freeze alarm continue.

Unlike the low water temperature alarm, which is enabled only when the unit is powered on, the anti-freeze heater can be energised when the machine is on stand-by.

7.10 Compressor operation

When the unit is running correctly and no general alarms are present, the microprocessor controller starts the compressors in accordance with the water temperature reading.

Compressor starts are staggered in accordance with preset delay intervals, thus avoiding excess input current surges.

Before starting a compressor, the microprocessor checks the value of the delivery pressure by means of the relevant transducer, the status of the high pressure switch and the compressor motor windings temperature by checking the thermal protection.

When the compressor has been started, tripping of any of the safety devices will cause the compressor to stop immediately and an alarm will be displayed.

While the compressor is running, discharge pressure and suction pressure are monitored constantly by means of the relevant sensors.

On unit start-up the first compressor is started with a delay, set on the microprocessor controller, after the start of the hydraulic system circulating pump.

Once started, each compressor must run for a minimum operating period, unless a critical alarm should trip in the meantime.

The critical alarms which can stop the compressor during the minimum operating time are the high pressure alarm and the compressor thermal cut-out alarm. Once stopped each compressor can be restarted only after a minimum idle time or after a minimum time interval between two consecutive starts has elapsed.

The consecutive starting of two compressors or the consecutive starting of one compressor, is executed with minimum delay intervals equal to the capacity step activation time.

Stopping compressors is also performed with a minimum programmed delay interval.

7.11 Compressor management

Start-up of the compressors is automatic when the reference water temperature changes with respect to the programmed set-point.

Normally the reference water temperature is the value detected at the inlet to the chiller unit.

Balancing of duty hours over all the compressors in the unit is performed by selecting the rotation of starts.

With the rotation function of starts active, the first compressor to start is the first one that previously stopped. The first compressor to start will be the one with the least operating hours.

7.12 High and low pressure alarms

Discharge pressure (high pressure) and suction pressure (low pressure) are managed by the microprocessor controller through the relevant sensors.

When a compressor is running, the controller checks that:

Discharge pressure is always lower than the safety value set for cooling or heating mode operation. If the values are exceeded, the controller immediately stops the compressor and displays a high pressure alarm. The high pressure alarm can be reset manually on the controller only when the pressure detected by the discharge pressure sensor is lower than the value that caused the alarm to trip, less the differential value.

The suction pressure is always higher than the safety value set for operation in cooling or heating mode. If the value read by the suction pressure sensor is lower than the limits set for the relative operating conditions, the controller will stop the compressor and generate a low pressure alarm. The low pressure alarm is not instantaneous, but operates after a preset delay interval, both in the starting phase and during the normal running of the machine. The low pressure alarm can be reset automatically or manually, depending on the relative parameter setting. In all cases the low pressure alarm can only be reset when the pressure detected by the suction sensor is higher than the value that caused the alarm to trip, plus the differential value. It is possible to program the number of permissible consecutive compressor starts before the unit shuts down in safety status.

7.13 Changeover from chiller to heat pump and vice versa

The changeover from chiller to heat pump and back can be performed at any time, either by means of an external signal on a digital input, from the keypad, or via the serial line. The operating mode changeover must be only seasonal and only with the unit off.

After a mode changeover, the controller re-starts the unit in the new mode with a factory set minimum delay time.

The unit operates with temperature control on the inlet to which has been inactive for the longest time. the unit (or return from the system).

7.14 Defrosting (heat pump units only)

During winter heat pump mode operation the finned coil of the air cooled condenser functions as an evaporator, cooling and dehumidifying ambient air.

During heat pump operation, the evaporation pressure is monitored to prevent it from falling below a preset value. The evaporation control is active only during heating mode operation.

Depending on the ambient air temperature and humidity conditions, condensate or frost will tend to form, consequently obstructing the free passage of air and causing thermal insulation. The frost that builds up on the coil obstructs the passage of air and reduces the available heat exchange surface area (and thus the thermal efficiency) and can damage the heat exchanger.

Defrosting is the procedure that eliminates the ice that has formed on the evaporator coil during heat pump mode operation of an air/water unit.

Defrosting is performed simultaneously for the entire unit.

All heat pump versions are equipped with a control that activates an automatic coil defrost cycle when necessary. After starting however, the first defrost cycle will be started after a preset minimum operating time to allow the formation of sufficient thermal inertia to allow the cycle to be completed successfully.

Defrost cycle activation is based on the detection of a low suction pressure value due to insufficient heat exchange between the evaporator and the air due to the formation of a layer of ice, which exerts a thermal insulation effect. For a defrost cycle to be able to start a suction pressure of at least one of the currently operating compressors must remain below the pressure set for the defrost cycle trip signal for a preset time interval.

Before starting to defrost the coils, all the compressors are started, after which the unit reverses its operation from heat pump to chiller mode.

When the cycle is reversed the fans stop and the compressors force hot gas into the coil.

A pressure switch on the high pressure circuit maintains the discharge gas pressure below the defrost end value.

To maintain the pressure lower than the defrost end pressure the pressure switch activates the fans.

To reduce the air flow and obtain more efficient heating of the outer part of the coil, the pressure switch signal causes the fans to stop.

When the defrost end temperature is reached, as measured by a thermostat with a probe located in the lower part of the coil, the pressure switch allows the discharge pressure to reach the defrost end pressure.

When the defrost end pressure has been reached, the controller reverses the unit from chiller mode to heat pump mode, thereby terminating the defrost procedure.

Even though in certain conditions the surface temperature of the coil and the condensation pressure fail to reach the defrost values within the preset time limit, the defrost cycle

is forcibly terminated as though the defrost end signal were present. The controller restarts the fans, and when the pressure lowers again to the preset value, it reverses the unit's operating mode again.

If the defrost cycle is forcibly interrupted, with the timeout signal, a message is displayed on the controller, although no controller functions are activated.

The defrost timeout alarm is automatically cleared from the active alarms menus when a defrost cycle terminates normally because the defrost end pressure has been reached. In any event, the alarms historical file will contain a record of all defrost cycles that were terminated forcibly due to a timeout intervention.

Consecutive defrost cycles must be at least 30 minutes apart. If the forced defrost signal persists, inform the Service organisation.

7.15 Total heat recovery (option)

Heat recovery is the function where all the energy that would normally be rejected to the air cooled condenser is recovered at a refrigerant to water condenser installed in series with the air-cooled condenser.

The heat recovery process is managed by the microprocessor controller.

During energy recovery the fans are stopped and the condensing coil is by-passed via solenoid valves connected downstream of the thermostat valve. The machine is equipped with a liquid receiver.

Heat recovery can only occur when the water temperature at the recovery exchanger inlet is lower than the recovery set-point. Heat recovery is terminated when the temperature increases by the recovery differential value.

It is mandatory to use a condensing pressure control valve (one for each hydraulic circuit) or three-way valve, fitted by the installer, to avoid condensation values that are incompatible with operation of the machine.

7.16 Dual set-point (option)

operation with a dual set-point is possible only in chiller mode.

With double thermostatic valves and solenoid valves that are automatically switched according to the required expansion temperature. Two set-point values can be programmed on the microprocessor controller via the keypad or a digital input. Switching of the thermostatic valves is always automatic, in accordance with the water temperature.

The valves are sized on the basis of the temperature values specified at the time of the order. The machine

operating limits shown in the catalogue are not affected. If the hydraulic circuit contains glycol in sufficient quantities to eliminate the risk of freezing, the lower limit is extended to a minimum of -5 °C leaving water temperature.

7.17 Operation leaving water temperature control (option)

With leaving chilled water temperature control the reference sensor must be installed on the evaporator outlet or, if there is more than one evaporator, on the common outlet pipeline downstream from the relative manifold. The unit's capacity steps are activated / deactivated with delay intervals in relation to a dead zone. When the leaving water temperature is higher than the programmed set-point compressors start is enabled.

8. START-UP

8.1 FIXED PROTECTIONS

- The protections are positioned and fixed in a solid manner.
- Their opening requires the use of specific tools. They do not stay in place without the fixing devices.



It is absolutely forbidden to switch on and start the unit without the fixed protection devices.



Before starting up the unit check that all the closing panels are in position and secured with the relative screws.



If the unit fails to start: do not change internal electrical connections on penalty of immediate invalidation of the warranty.

8.2 START

- For the start-up procedure refer also to the microprocessor controller manual.
- Close the external enabling contacts
- Press the "ON" button on the microprocessor controller
- If all the controls are enabled the display will show the message "UNIT ON"
- After having performed the above procedures the unit will start automatically after a delay of approximately 5 minutes, assuming that the enabling signals of the microprocessor, the flow switches, and the water pumps continue to be present.



On heat pump versions the operating cycle must be reversed at the start and end of the season. Frequent switching from summer to winter mode, and vice versa, should be avoided at all costs because it can lead to malfunctions and subsequent breakdown of the compressors.



During idle periods do not disconnect the unit from the power supply (the compressor crankcase heaters must remain switched on in these intervals). Disconnect the unit from the power supply only in the event of prolonged disuse (e.g. seasonal shutdowns).

8.3 PRELIMINARY CHECKS

- Check that the electrical connections have been made correctly, and that all terminals are well tightened.
- Check that the voltage on the RST terminals is $400\text{ V} \pm 5\%$ (or the unit's rated value, in the event of units supplied to run on non-standard power supplies). If the mains voltage is subject to frequent fluctuations, consult our Engineering Department to discuss the necessary protection systems.
- Check that the display shows the gas pressure in the refrigerant circuit (4-compressor models only).
- Inspect the unit for refrigerant leaks using a leak detector if necessary.
- Check that the crankcase heaters are correctly supplied with power.



The heaters must be connected at least 12 hours before starting the unit; the heaters are automatically connected when the main disconnect switch is set to the ON position.

- Verify that heaters are working correctly: after the warm up period the crankcase must be warm to the touch and must have at least a temperature $10 - 15\text{ }^{\circ}\text{C}$ higher than ambient temperature.
- Check that all hydronic connections are correctly installed and all indications on unit labels are observed.
- Check that the hydronic system has been vented to eliminate any air remaining; charge it gradually and open the vent devices on the upper part, provided at the care of the installer together with an expansion tank of a proper size.

9. STOPPING THE UNIT

9.1 TEMPORARY STOP

- To stop the unit press the "OFF" button on the front panel.

9.2 SEASONAL STOP

- Disconnect the power supply
- Drain the system circuit (unless it contains a water/glycol solution)
- When the unit is to be restarted repeat the initial start-up procedure



Do not use the machine main power switch to stop the unit: This switch must be used to disconnect the electrical supply when no current is flowing on the circuit, i.e. only when the unit is in OFF status. Note also that if power is disconnected from the unit, the crankcase heaters will be switched off with the resulting risk of compressor damage at the time of restarting.

9.3 EMERGENCY STOP

- Emergency stops are obtained by turning the red colour main disconnect switch on the electrical panel to position 0.

10. CHECKS DURING OPERATION

10.1 INTRODUCTION

- Check that the water temperature at the evaporator inlet is close to the set-point value of the service thermostat.
- For units equipped with pump units, if the pump runs noisily, close the relative delivery cock until the pump starts running smoothly again. This situation can occur when system pressure drops deviate significantly from the pump available pressure.

10.2 Checking the refrigerant charge

- After a few hours of unit operation check that the sight glass moisture indicator has a green coloured core. If the core is yellow, moisture is present in the circuit. In such a situation the circuit must be dehydrated by a qualified technician.
- Check the sight glass for bubbles. A constant passage of bubbles through the sight glass could indicate that the refrigerant must be replenished. Occasional bubbles are considered normal.
- A few minutes after the start of the compressors, check that the condensing temperature, equivalent to the pressure read on the pressure gauge, is approximately 18 °C higher than condenser inlet air temperature. Also check that the evaporating temperature, equivalent to the pressure read on the pressure gauge, is 5 °C lower than the evaporator outlet temperature.
- Check that refrigerant liquid superheating is between 5 and 7 °C; to do this:
 - 1) measure the temperature using a contact thermometer placed on the compressor suction pipeline;
 - 2) read the temperature, equivalent to the pressure read on the pressure gauge connected to the compressor suction side (saturation temperature corresponding to suction pressure).

The difference between the temperatures measured in this manner is equivalent to the superheating value.

- Check that refrigerant subcooling is between 5 and 7 °C; to do this:
 - 1) measure the temperature using a contact thermometer placed on the compressor discharge pipeline;
 - 2) read the temperature, equivalent to the pressure read on the pressure gauge connected to the liquid connection at the condenser outlet (saturation temperature corresponding to condenser delivery pressure).

The difference between the temperature values measured in this manner is equivalent to the subcooling value.

11. CALIBRATION OF CONTROL EQUIPMENT

11.1 INTRODUCTION

All the control equipment is factory calibrated before the machine is shipped. Control equipment and safety devices should nonetheless be checked after a reasonable period of operation. Calibration values are given in Tables 2 and 3.



All service operations on the control equipment must be carried out by QUALIFIED PERSONNEL ONLY; incorrect calibration values can cause serious damage to the unit and personal injury.

TABELL 2 - CALIBRATION OF CONTROL EQUIPMENT

		CAPACITY STEPS			
		2		4	
		SET POINT	DIFFERENTIAL	SET POINT	DIFFERENTIAL
Service calibration summer	°C	10	2	9	3
Service calibration winter	°C	42	2	43	3

TABELL 3 - CALIBRATION OF SAFETY DEVICES

CONTROL ELEMENT		ACTIVATION SET-POINT	DIFFERENTIAL	RESET
No-frost setting	°C	3	6	manual
Maximum pressure switch setting	bar	37,8	7	manual
Minimum pressure switch setting	bar	4/1*	1	Manual (from controller)
Evaporator heater setting	°C	3	6	automatic
Defrost start setting	bar	4	—	automatic
Defrost end setting	bar	28	—	automatic
Defrost end thermostat setting	°C	5	—	automatic
Defrost pressure switch setting	bar	25	2	—

* Chiller / heat pump

12. MAINTENANCE AND PERIODIC CHECKS

12.1 GENERAL

- All operations described in this chapter MUST BE PERFORMED EXCLUSIVELY BY QUALIFIED PERSONNEL.
- Make sure that the unit has been disconnected from the power supply before carrying out any work or accessing internal parts.
- The compressor head and discharge pipeline can reach high temperatures.
- Always exert caution when working in the vicinity of the compressor.
- Adopt the maximum caution when working in the vicinity of the finned coils because of the sharp edges of the aluminium fins.
- After performing maintenance work always refit the outer panels and secure them with the screws.

12.2 INTRODUCTION

Carry out the following periodic checks to ensure the unit is operating correctly:

CHECK	PERIOD
Check that safety and control devices work correctly as previously described	monthly
Check that all the terminals within the electric panel and compressor are tight The sliding terminals of the contactors should be periodically cleaned: if any damage is found, replace the contactors	monthly
Check the sight glass to verify the refrigerant charge.	monthly
Check that there is no oil leakage from the compressor	monthly
Check that there is no water leakage in the hydraulic system	monthly
If the unit is to be stopped for a long period the hydraulic circuit, including all pipes and heat exchangers, should be drained. This is compulsory if the ambient temperature is expected to fall below the freezing point of the liquid employed.	seasonal operation
Check process water levels	monthly
Check that the flow switch is operating correctly.	monthly
Check that the crankcase heater is operating correctly and there is a power supply.	monthly
Clean metallic filters on water piping	monthly
Clean the finned coil or the filter coils, if present, by means of compressed air, which should be directed in the opposite direction to the normal direction of air flow. If the coil is completely clogged clean with a jet of water.	monthly
Execute a defrost test (heat pump units only)	monthly
Check drive belt tension and wear. To check belt tension apply a force of approximately 5 kg in a direction perpendicular to the belt in a central position. The deflection of the belt with respect to its initial position must be approximately 10 - 12 mm.	every 4 months
Check the colour of the sight glass core (green = no moisture, yellow = moisture present): if it is yellow change the refrigerant filter.	every 4 months
Check that the noise level has not increased.	every 4 months
Kontrollera att ljudnivån inte har ökat	Var fjärde månad
Kontrollera att det ljud som maskinen avger är normalt.	Var fjärde månad

12.3 REPAIRING THE REFRIGERANT CIRCUIT

If repairs have been made to the refrigerant circuit, perform the following steps:

- leak test;
- vacuum and dehydration of refrigerant circuit;
- refrigerant charge.



If the circuit is to be emptied, use the appropriate equipment to collect the refrigerant.

12.3.1 Leak test

Charge the refrigerant circuit to a pressure of 15 bar with dry nitrogen gas by means of a cylinder fitted with a pressure reducer. Check the circuit for leaks with a leak detector. The formation of bubbles or foam indicates the presence of leaks.

If leaks are found during the test, empty the refrigerant circuit and then repair the point of leakage by welding with appropriate alloys.



Do not use oxygen instead of nitrogen: explosion hazard.

12.3.2 High vacuum and dehydration of the refrigerant circuit

To generate a high vacuum in the refrigerant circuit use a high vacuum pump able to reach 0.1 mbar of absolute pressure with a flow rate of 10 m³/h. With this type of pump, a single vacuum cycle is normally sufficient to reach an absolute pressure of 0.1 mbar.

If this type of pump is not available, or in the event that the circuit has been left open for a long period of time, you are strongly advised to use the triple evacuation method. This procedure is also prescribed in the event of moisture in the refrigerant circuit.

Connect the vacuum pump to the charge connector.

Proceed as follows:

- Evacuate the circuit to a pressure of at least 35 mbar absolute. Charge the circuit with nitrogen to a relative pressure of approx. 1 bar.
- Repeat the operation described above.
- Repeat the operation described above for the third time in order to reach the highest degree of vacuum possible.

This procedure should guarantee the elimination of up to 99% of contaminants.

12.3.3 Refrigerant charge

- Connect the refrigerant gas cylinder R410A to the male 1/4 SAE charge connector, on the liquid line, and allow a small amount of gas to escape so that air in the connection hose is purged.
- The circuit must be charged exclusively with liquid; therefore, if the cylinder is not equipped with a dip pipe it must be turned upside-down.

12.4 ENVIRONMENTAL CONSIDERATIONS

Laws governing the use of substances detrimental to the ozone layer prohibit the dispersal of refrigerant gases in the environment, obliging users to recover refrigerants at the end of their useful life and consign them to the dealer or to specific collection centres.

Refrigerants R410A is mentioned among substances subject to special monitoring regimes established by law, and as such is subject to the prescriptions indicated above.



Use special care during maintenance work in order to limit the risk of refrigerant leakage as far as possible.

13. DECOMMISSIONING THE UNIT

When the unit has reached the end of its useful life and must therefore be removed and replaced, adhere to the following rules:

- the refrigerant must be recovered by a qualified technician and sent to an authorised collection centre;
- also the compressor lubrication oil must be recovered and sent to a collection centre;
- the structure and components, if unusable, must be stripped down and separated according to the material type; this is particularly important for copper and aluminium, which are fairly abundant on the machine.

This procedure is designed to assist the work of collection, disposal, and recovery specialists and to reduce the associated environmental impact.

R410A REFRIGERANT SAFETY SHEETS

1. ELEMENTS IDENTIFYING THE SUBSTANCE OR THE PREPARATION	1.1	Identification of the preparation	SUVA* 410A Refrigerant
		ASHRAE Refrigerant number designation	R410A
2. COMPOSITION/INFORMATION ON THE INGREDIENTS	Chemical nature of the preparation		% in weight – N. Cas – CE N.
	Difluoromethane (R32)		50 – 75-10-5 200-839-4
	Pentafluoroethane (R125)		50 354-33-6 206-557-8
3. INDICATION OF THE DANGERS	3.1	Severe dangers	The steams are heavier than air and can cause suffocation by reducing the oxygen available for breathing.
	3.2	Specific dangers	A rapid evaporation of the liquid can cause freezing. It can cause heart trouble.
4. FIRST AID MEASURES	4.1	Eyes	Accurately rinse with running water for at least 15 minutes and contact a doctor.
		Skin	Immediately wash with running water. Remove all contaminated clothing immediately.
		Inhalation	Move into the open air. Use oxygen or artificial respiration if necessary. Do not administer adrenalin or similar substances.
		General information	Do not administer anything to fainted persons.
5. FIRE-PREVENTION MEASURES	5.1	Appropriate extinguishing means	Any.
	5.2	Specific dangers	Pressure increase.
	5.3	Specific methods	Cool the containers/tanks using water jets.
6. MEASURES IN CASE OF ACCIDENTAL LEAKING	6.1	Individual precautions	Evacuate staff to the safety areas. Envision adequate ventilation. Wear protective clothing.
	6.2	Environmental precautions	Evaporates.
	6.3	Cleaning methods	Evaporates.
7. HANDLING AND STORAGE	7.1	Handling	Technical Measures/Precautions: assure sufficient air exchange and/or intake in the work environments. Recommendations for the safe use: Use only well ventilated premises. Do not inhale steams or aerosol.
	7.2	Storage	Technical measures/Storage methods: accurately close and keep in a fresh, dry and well ventilated place. Incompatible products: explosives, inflammable materials, Organic peroxide. Packaging material: Keep in the original containers.

R410A REFRIGERANT SAFETY SHEETS

8. CONTROL OF THE EXPOSURE /INDIVIDUAL PROTECTION	8.1	Control parameters	Difluoromethane: Limits of exposure recommended by DuPont: AEL(8-h and 12-h TWA) = 1000 ml/m ³ ; DuPont (1999).
	8.2	Respiratory protection	For saving and maintenance work in tanks, use an autonomous breathing apparatus. The steams are heavier than air and can cause suffocation by reducing the oxygen available for breathing.
		Hands protection	Rubber gloves.
		Eye protection	Safety goggles.
		Hygienic measures	Do not smoke.
9. STABILITY AND REACTIVITY	9.1	Stability	No decomposition if used according to appropriate instructions.
	9.2	Conditions to be avoided	The product is not flammable in contact with the air in the normal temperature and pressure conditions. The mixture can become inflammable under pressure with air or oxygen. Certain mixes of HCFC or HFC and chloride can become inflammable or reactive in certain conditions.
	9.3	Materials to be avoided	Alkaline metals, alkaline earth metal, granular metal salts, Al, Zn, Be, etc in powder.
	9.4	Dangerous decomposition productions	Halogen acids, traces of carbonyl halide,
10. TECHNOLOGICAL INFORMATION	10.1	Acute toxicity	Difluoromethane: CL50/inhalation/4 hours/on tract = >760 ml/l Pentafluoroethane (R125): CL50/inhalation/1 hour/on tract = >3480 mg/l
	10.2	Local effects	Concentrations substantially above the TLV value can cause narcotic effects. Inhalation of products in decomposition with high concentration can cause respiratory insufficiency (pulmonary edema)
	10.3	Long-term toxicity	Has not shown carcinogen, teratogenic or mutagens effects in experiments on animals.
	10.4	Specific effects	A rapid evaporation of the liquid can cause freezing. It can cause heart trouble.
11. ECOLOGICAL INFORMATION	11.1	Effects linked to ecotoxicity	Pentafluoroethane (R125): Global heating potential of the halocarbons;HGWP; (R-11 = 1) = 0.84 Impoverishment power of the ozone; ODP; (R-11 = 1) = 0
12. DISPOSAL	12.1	Waste from rejects/ unused products	Usable with reconditioning.
	12.2	Contaminated containers	The depressurised containers must be returned to the supplier.
13. TRANSPORT INFORMATION	N. O.N.U.		3163
	ADR/RID		3163 Gas, compressed, n.a.s. (Difluoromethane, Pentafluoroethane), 2, ADR.

IMPORTANT INFORMATION REGARDING THE REFRIGERANT USED

This product contains fluorinated greenhouse gases included in the Kyoto protocol. Do not dispose of such gases in the environment

Type of refrigerant: R 410A

GWP Value (1): 1975

GWP = global warming potential

The amount of refrigerant is shown on the plate with the name of the unit. regular inspections may be required to check for any refrigerant leaks according to the local and/or European regulations. Contact your local dealer for additional information.