KÄLTE KLIMA

AIR COOLED WATER CHILLER REVERSIBLE HEAT PUMP

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

The ACM units are designed and manufactured to operate with liquids R22, R134a, R407C and R404A classified according to the PED 97/23/CE directive as category II- not dangerous fluids.

ENGLISH

CE

SISTEMA DI GESTIONE PER LA QUALITÀ CERTIFICATO UNI EN ISO 9001:2000 SINCERT DNV

AIR COOLED WATER CHILLER AND REVERSIBLE HEAT PUMP			
Issue :	10/05	Supersede :	---

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0. LIST OF ATTACHMENTS

List of documents supplied with the unit and forming an integral part of this manual.

- Refrigeration circuit diagram
- Water connection diagram
- Scale drawing
- Wiring diagram
- Microprocessor manual
- Various electrical instructions
- Various electronic instructions
- Declaration of conformity

1. INTRODUCTION

1.1 GENERAL INFORMATION

This manual contains the installation, use and maintenance instructions for the air-cooled chillers and heat pump manufactured by **ACM Kälte Klima Srl**, and highlights all connected risks and perils. It has been specifically prepared and written so that those authorised can make use of the unit in complete safety and maximum ease. Please read the whole of this manual with care, with particular attention to the sections marked with

as non-compliance may cause harm to people, deteriorate the environment and/or damage the unit.
ACM Kälte Klima S.r.l declines all responsibility for any improper use of the unit, unauthorised modifications or non-compliance with the instructions contained in this manual.
Please keep this manual in a safe place and make it available to chiller operators and maintenance personnel.

1.2 ATTACHMENTS

The documents shown on page 1 form an integral part of this manual.

1.3 WARNINGS

The ACM units have been designed and built to ensure long-term operating reliability and maximum safety; for this reason and thanks also to design and construction policy, **ACM Kälte Klima S.r.l.** is able to guarantee that this product totally complies with EC safety standards.
A further guarantee of this is provided by the factory tests carried out on all the units.
The user, therefore, must only ensure that the unit is used in the appropriate manner and that maintenance operations are carried out according to the indications contained in this manual.

The unit should not be touched until the whole of this manual has been carefully read.

This installation, use and maintenance manual must always be kept within easy reach of authorised staff who are obliged to read it before carrying out any operations on the unit.

For any further information or explanations please contact **ACM Kälte Klima S.r.l.** at the following address:

ACM KÄLTE KLIMA S.r.l.
Customer Service
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35010 Vigonza (PD) ITALY
Tel. 0039-049-8931944
Fax 0039-049-8931271
e-mail: info@acmonline.it

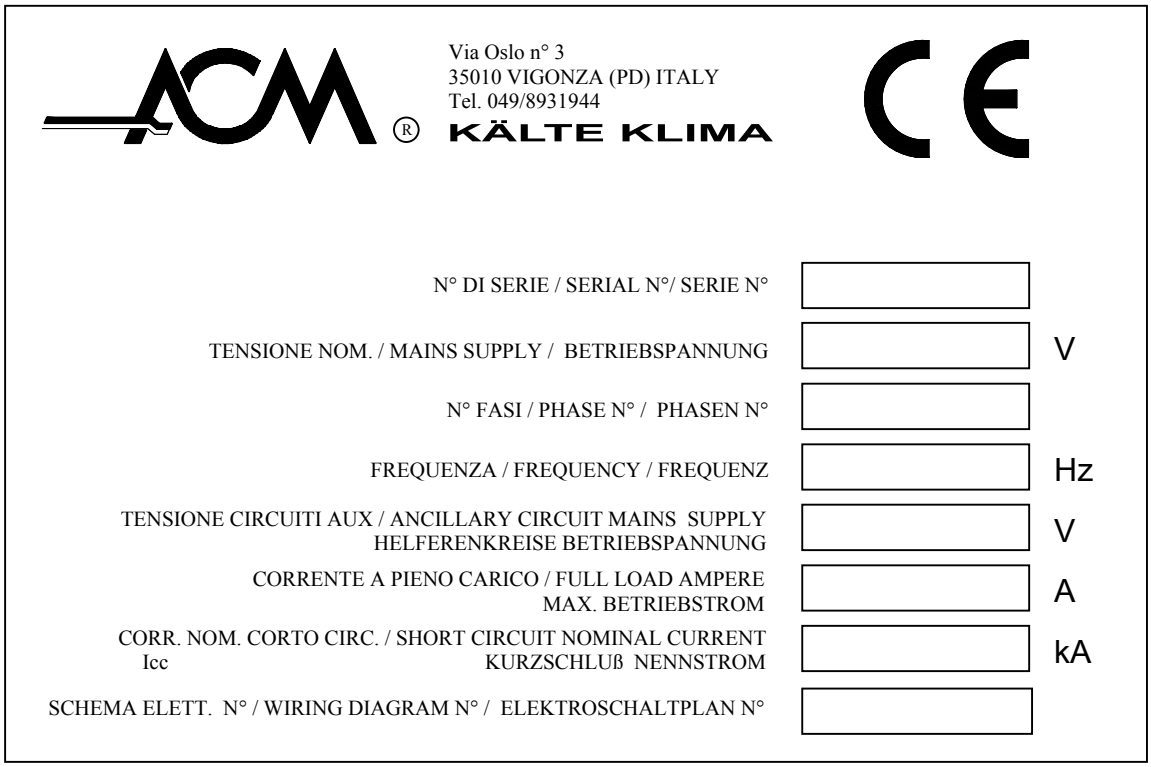
2. UNIT DESCRIPTION

This chapter contains a general description of the main unit characteristics, together with those of its principal standard and optional components.

2.1 IDENTIFICATION

A plate attached to the unit contains the following information:

- Manufacturer's name
- Manufacturer's address
- Description of the series and type of unit
- Serial number
- Year of construction
- Type and quantity of refrigerant liquid
- Operating pressure
- EC certification symbol
- Electrical characteristics
- Wiring diagram identification



Via Oslo n° 3
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KÄLTE KLIMA

TIPO –MODELLO / TYPE – MODEL / TYP - MODELL		
SERIE N°/ SERIAL N° / SERIE N°		
FLUIDO FRIGORIFERO / REFRIGERANT / KÄLTEMITTEL		
PRESS. MAX ESERCIZIO / MAX WORKING PRESSURE MAX BETRIEBSDRUCK		bar
ANNO DI COSTRUZIONE / YEAR / JAHR		
CARICA FLUIDO FRIGORIFERO / REFRIGERANT CHARGE / KÄLTEMITTEL		
CIRCUITO N° / CIRCUIT N° / KREIS N° **1**		kg
CIRCUITO N° / CIRCUIT N° / KREIS N° **2**		kg
CIRCUITO N° / CIRCUIT N° / KREIS N° **3**		kg
CIRCUITO N° / CIRCUIT N° / KREIS N° **4**		kg

2.2 INTENDED USE

The units have been designed to cool water (possibly containing inhibited ethylene glycol) circulating in a closed circuit.
The heat pump units (...H) can cool or heat the water in the closed circuit depending on which operating cycle is chosen.
The heat recovery units (.../DS;.../RCS;.../RCP) can also heat the water circulating in a second closed circuit.
The heat or cold produced can be used for air-conditioning systems or industrial processes.

2.3 CONTRA-INDICATIONS

Do not use inflammable products near the unit.

Do not use substances that can form explosive mixtures near the unit.

Do not use the unit in conditions that could be harmful for the environment (see point 3.5).

2.4 GENERAL DESCRIPTION

All the unit structures are made from galvanised sheet metal and are further protected with polyester powder paints. The structure is free standing and the panels are easy to remove in order to allow access to the inside of the unit for maintenance and repair operations.
The operating diagrams and the components used are attached to this manual.

2.5 OPERATING LIMITS

TEMPERATURE

The units have been designed to operate within a wide temperature range.
However there are some limits both on chilled water and ambient air temperature to respect in order not to damage the unit.

COOLING	Min. Temperature (°C)	Max Temperature (°C)
Air temperature on condenser	+15*	+46
Inlet water temperature	+9	+17
Outlet water temperature	+5**	+10

* to -15°C with condensing temperature control (Optional)
** to -10°C with glycol solution

HEATING	Min. Temperature (°C)	Max Temperature (°C)
Air temperature on condenser	-5	+25
Inlet water temperature	+30	+43
Outlet water temperature	+35	+50

Contact **ACM Kälte Klima Srl** for operation or use of the unit beyond the limits indicated above.

PRESSURE

The pressure during operation will vary depending on the heat load (flow and temperature of the air that is to be treated) and on the temperature of the condenser cooling air.
The pressure switches that are fitted to the unit are already factory set and these settings can for no reason be altered.
The high pressure switch will stop the compressor if the delivery pressure exceeds the set value. **For safety reasons, this switch must be manually reset and can only be done with a differential value that is lower than the setting required to restart the compressors.**
The low pressure switch will stop the compressor when the suction pressure goes below the set value. This switch resets automatically when the pressure has increased and is greater than the differential setting.

3. SAFETY

3.1 DEFINITION

This document uses the following definitions:

- *Dangerous areas*: any area inside and/or near to the unit in which the presence of a person would give rise to a risk for that person's health.
- *Exposed person*: anyone who is wholly or partly inside a dangerous area.
- *Operator/Maintenance person*: person or persons authorised to operate, adjust, service, repair or move the unit.
- *Qualified Operator:* person or persons authorised and capable of installing, of operating, of making adjustments to, of effecting maintenance, of cleaning, of repairing the unit, having sufficient technical understanding or experience to avoid any dangers that derive from these operations, even in the presence of electrical power.
- *Warned Operator:* person adequately informed or supervised by a qualified operator capable of understanding the risks and dangers that can derive from the use of the unit.

3.2 GENERAL SAFETY REGULATIONS

It is forbidden for unauthorised persons to approach the unit.

Scrupulously observe the contents of Chapter 10 before carrying out each maintenance operation on the unit.

It is forbidden to enter the unit. Access is only permitted to qualified staff when the unit is disconnected.

It is forbidden to remove safety guards and by-pass safety and emergency devices.

It is forbidden to stand on the unit.

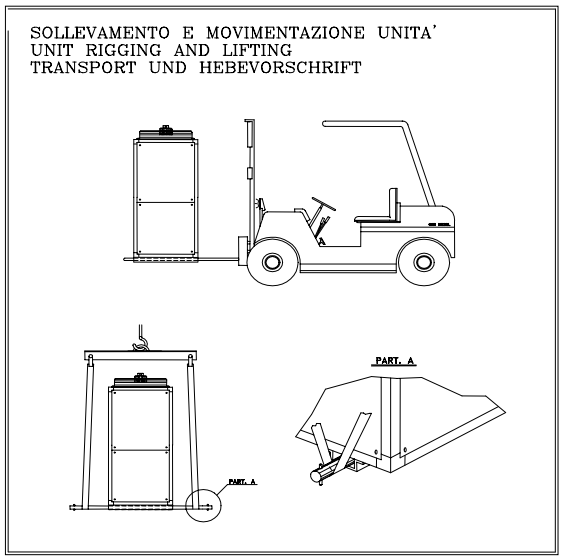
- Only use the unit to do what it was built for.
- The manufacturer declines all responsibility for damage deriving from improper use or technical modifications made to the unit.
- Check that safety devices are in perfect working order on a regular basis.
- Do not dismantle, modify or disconnect unit parts.
- When working on the unit, only use suitable tools and equipment in good condition. Operators must wear normal personal protection equipment (gloves, helmet, goggles, etc.).
- Work on the electrical system of the unit may only be carried out by a qualified electrician.
- Work on the refrigerant circuit may only be carried out by specialised staff.

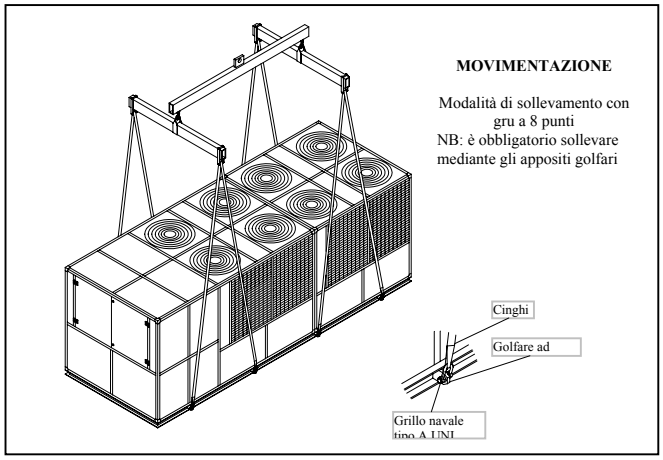
3.3 WARNING LABELS

Check the state of the plates on a regular basis and replace or renew if necessary.

3.3.1 Safety signs

Care should be taken to follow the indications on the labels placed on the unit, in particular regarding safety and instructions on how to move the unit.





3.4 EMERGENCY AND SAFETY DEVICES

An external emergency circuit breaker must be fitted by the installer to disconnect the unit from the electrical power supply.

If the refrigeration circuit is fitted with a safety (purge) valve, the discharge of the gas must be directed to the outside of the unit using a tube with a diameter not inferior to that of the discharge of the valve itself.

Warning!
The direction of the gas discharge from the safety valve should be positioned so as not to create a danger to persons.

3.5 DESCRIPTION OF INHERENT DANGERS

The description of inherent dangers includes the following elements:

- the kind of danger the people working on the unit are subjected to;
- description of the main dangers;
- who is exposed to such dangers;
- the main safety methods used to reduce the risk of injury.

The following accident prevention instructions, with reference to the relative areas concerned by inherent risks, must be integrated with all the general indications contained in the present chapter and with the accident prevention regulations in force in the country of installation.

3.5.1 The description of inherent dangers includes the following elements:

- Electrocution if the unit is not properly connected to the mains power supply and earth circuit.
- Cuts or abrasions caused by sharp surfaces.
- Burns caused by hot surfaces.
- Removal and subsequent dispersion in the environment of substances present on the installation site.
- Ejection of objects falling on the fan blades.
- Leaking water (in case of malfunction).
- Formation of condensation and ice in front of the unit while the heat pumps are working.
- Alteration of the micro climate (during operation).
- Noise (during operation).
- Leaking oil (in case of malfunction).
- Leaking refrigerant liquid (in case of malfunction).

N.B. Refrigerant gases are substances that contribute to the greenhouse effect, and, in the case of R22, can also damage the ozone layer. Its vapours are heavier than air and can cause suffocation by reducing the amount of oxygen available for breathing. Rapid evaporation of the liquid can cause freezing.

3.5.2 Measures to take in case of leaking refrigerant gas

- *Product type:* R22 - R407C - R134a - R404A.
- *First aid measures:*
  General information:
  do not give anything to people who have fainted.
  Inhalation:
  take the person out into the open air. Use oxygen or artificial respiration if necessary. Do not give adrenaline or similar substances.
  Contact with eyes:
  carefully rinse with abundant water for at least 15 minutes and see a doctor.
  Contact with the skin:
  wash with abundant water and remove all contaminated clothing immediately.
- *Measures to take in case of accidental leaking:*
  Personal precautions:
  evacuate all staff to safety areas. Make sure the area is suitably ventilated. Use personal protection equipment such as: eye protection, gloves, face masks with filters specifically for organic vapours.
  Environmental precautions: whenever possible, stop the emission of the substance into the environment.
  Cleaning methods: use specific absorbent products.

3.5.3 Operations with the panels removed

Some of the following operations and/or controls require the panels of the unit to be removed in order to access the inside of the unit.

Before removing an outer panel, the unit must be disconnected from the mains power supply

Please note that some surfaces inside the unit may be hot (piping, compressor, etc.), cold (compressor, suction line separator, etc.), sharp (coil fins) or moving (fans).

These operations may only be carried out by qualified staff wearing appropriate safety clothing.

Operating checks may require the unit to work (totally or partially) with the panels open. In this case, the panel should be totally removed when the machine is not yet in operation.

These checks are particularly dangerous and may only be carried out by highly qualified staff.

Proceed as follows:

- Ensure that all unauthorised persons are kept at a safe distance;
- Limit access to the area where the work is to be effected;
- Turn off mains power with the main power switch;
- Open the electrical panel and remove the relative fuses to disconnect the components that do not need to be operating in order to carry out the relative check.
- Close the electrical panel.
- Remove the panel in question.
- Start the unit.
- Carry out the relative check with the greatest of care and using personal protection equipment.
- After completing the check, stop the unit and put the panel back in place.
- Turn off mains power and put back any fuses that were previously removed.
- Close the electrical panel.

It is advisable to limit access to the area where work is proceeding using coloured tapes as well as place appropriate danger signs in these areas where any adjustments, maintenance or troubleshooting is being done. Once the maintenance work has finished, the unit can be turned on and checked in operation. The above precautions can only disregarded after the maintenance has been terminated.

4. INSPECTION AND TRANSPORT

4.1 INSPECTION

Check the condition of the unit on receipt. Remove all the packing material that was used during shipping taking care not to damage the unit in any way.
Since the unit was carefully checked before leaving the factory, any claims for damages should be addressed to the forwarder. Any damage should therefore be indicated on the Delivery Note before signing it.
Please also immediately inform ACM Kälte Klima of the nature of the damage to the unit.
The Customer must always provide a written a report describing any damage caused to the unit.
Avoid installing a unit that has evident damage on the outside panelling, loosely fitted components or any liquid leaks.

4.2 STORAGE

The units must always be stored in a closed storeroom that is not dusty, where the relative humidity is not higher than 80% and the temperature ranges at the most between -20 and +50°C.
If the unit does not have any packing and the air inlets are not protected, it is advisable to cover the unit with a plastic sheet to avoid dirt entering.

4.3 LIFTING AND TRANSPORT

The machine should moved only by a qualified operator that is acquainted with current safety and sanitary norms.
When unloading and positioning the unit, take great care not to make sudden and/or violent manoeuvres. Do not lift the unit by its piping or any other components. Never apply any weight to nor push against the outer chassis.
The unit should only be moved as shown in the plate attached to it. The lifting points are clearly indicated with the label.

Before moving the unit make sure that the transport vehicle to be used is adequate in terms of strength. Use only transport vehicles that conform to the safety requirements as indicated by the Machine Directive 89/392/UE and subsequent modifications and integrations. The vehicles must also have the appropriate documentation that certifies its conformity to the above-mentioned requirements and must be able to whitstand the full weight of the unit and its packing. Carefully note any indications that may be printed on the packing of the unit (the weight is indicated n the external part of the packing). Do not use ropes or chains around the packing to lift it.

Warning!
Make sure the unit is securely anchored before lifting it in order to prevent it from accidentally overturning or falling.

Never leave the unit hanging in the air.

The lifting points are indicated on the base of the of the unit.
Use a crane and ropes or a forklift and insert the support bars in the appropriate positions.

4.4 UNPACKING

Only unpack the unit when it has reached the installation site and no longer needs to be moved.
Remove the packing material with care, making sure not to damage the unit.
Given that various kinds of packing materials are used (wood, nylon, polystyrene, cardboard, etc.), they should be separated and delivered to specialised disposal and recycling companies for environmental reasons.

5. INSTALLATION

5.1 CHOOSING THE INSTALLATION SITE

When selecting a location for the unit the following must be considered:

- *Unit weight*:

The supporting surface under the unit must be perfectly horizontal and able to withstand its full operating weight.

A supporting surface with an appropriate area should be built. This is particularly important if the unit is installed on unstable gound (gardens, embankments, …).
The supporting surface must:

- lie on suitable foundations and be about 10-15 cm higher than its surroundings;
- be horizontal and able to withstand about 200% of the weight of the unit in operation.

- *Clearances* :

Make sure that sufficient free space, as indicated on the scale drawing, is maintained around the unit.

Less space will make it difficult or impossibile to carry out maintenance operations and/or lead to faults in the unit due to the reduction in the air flow to the condenser coil or its recirculation.

Please note that, except for units with radial fans, obstacles such as canopies, shelters or coverings in general are not permitted.

Please note that heat pump units cause ice and condensation to form and deposit on the floor in front of the unit. This water must therefore be collected and drained to prevent the floor from becoming slippery.

People may not enter the area surrounding the unit unless they are authorized operators and maintenance personnel.

- *Noise:*

The unit generates noise while it's working; do not install it in an area where any reverberation is possible. The unit must be positioned with the coil side facing the direction where noise is less critical.

- *Prevailing winds*:

Wind may alter operating conditions; to minimise its effects the unit should be positioned with its length parallel to the direction of prevailing winds.

- *Vibrations*

Although the units transmit a low level of vibrations to the ground, a sheet of rigid rubber should always be placed between the unit base and the supporting surface. If greater insulation is required, vibration dampening supports should be used (in rubber or with springs).

5.2 WATER CONNECTIONS

5.2.1 General

When preparing the chilled water and refrigerant circuits, the points below, as well as current norms that apply, should be carefully followed.

Warning!
The water pipes must be suitably supported with brackets in order not to weigh on the chiller.

- Flexible connections should be made between the pipework and the chiller to avoid transmission of vibrations and to compensate for heat transfer.
- Fit the following components to the piping:

- Shut-off valves to disconnect the unit from the rest of the circuit;
- Temperature and pressure gauges for routine maintenance and inspection purposes.

- If temperature gauges are not fitted, then check points should be inserted into inlet and outlet pipes to take temperature readings;
- Metallic filter (on inlet pipe) with maximum 1mm wire mesh to protect the heat exchanger from deposits or impurities that may be present in the piping.
- Relief valves fitted at the highest part of the water circuit to allow air to be purged from the system;

- **expansion vessel of a suitable size for the quantity of water contained in the system and the expected temperature range, and the automatic inlet valve for maintaining the pressure of the system and compensating the thermal expansion of the fluid.**
- Drain valve and, where necessary, drainage tank to empty the system during maintenance operations and during seasonal shut-down.

Warning!
A safety flowswitch must be installed on a straight piece of piping at a distance from the outlet that is equal to and not less than 8-10 times the diameter of the piping itself. If this is not done, the warranty will immediately be invalidated.

5.2.2 Evaporator

It is vitally important that the water enters the unit from the connection point marked with the "WATER INLET" label.

Threaded unions, flanged unions, or flexible connections, depending on the models, are used to make water connections (please refer to the scale drawing which also show the position of the unions).

It is vitally important to connect the water circuit so that the flow of water to the exchanger is always constant under all operating conditions. A variable water flow is only accepted for the desuperheaters mounted in the units (/DS).

As the demand for cooling by utilities does not generally coincide with what is delivered by the compressors, they often work intermittently. In units with a low water content, where the effect of thermal inertia is not felt so much, the system should be checked to make sure following relation is satisfied:

$$V > P/45\ n$$

where:

V= volume of water (litres); P= capacity of the unit; n= capacity steps.

If the above volumes are not obtained, a storage tank should be installed so as to satisfy the above relation when added to the capacity of the system. This tank requires no special features; it just needs to be insulated, just like the chilled water pipes, so as not to affect the performance of the system and to prevent the formation of condensation.

A safety valve should be installed on the water circuit. In case of serious systems faults (e.g. fire) this will allow the system to be drained in order to prevent the risk of explosions. Always connect the drain to a pipe with a diameter not less than that of the valve opening and install the outlet in an area where the jet cannot cause harm to people.

Warning!
While connecting the water circuit, never work with naked flames near to or inside the unit.

5.3 DUCTWORK CONNECTION FOR UNITS THAT HAVE THIS FEATURE

When creating ductwork, in those installations that require it, it is highly reccomended to follow the indications below very carefully as well as any norms or regulations that exist in the country where the unit is being installed.

Warning!
The ductwork should be adequately bracketed so that it does not weigh solely on the machine structure.

- Connect the ducts to the chiller using flexible connectors to avoid vibrations being transmitted and to compensate for any thermal expansion.
- Ducts shold also have the following installed:

- Grills to avoid birds accidentally entering the unit;
- Grills to avoid rainwater entering the unit.

Warning!
The ducts should be positioned to avoid recicrculation of the air between the supply air and return air.

- When ductwork is required on the return air of the unit, it is advisable to have an access to the interior of the duct in order to reach the condenser coil.
- The pressure drop of the ducts (including grills and sound attenuators) at the nominal airflow should never exceed the available static pressure of the unit itself.

5.4 ELECTRICAL CONNECTIONS

5.4.1 General

These operations may only be carried out by specialised staff.

Before carrying out any operations on electrical components, make sure the unit is disconnected from the mains power supply.

Make sure that the mains power supply corresponds to the rated values of the unit shown on the plate (voltage, number of phase, frequencies)
Wiring is with a three strand wire plus earth wire.

When making electrical connections carefully follow the instructions shown on the wiring diagram attached to the unit.
The earth connection is always obligatory. The earth cable must be connected to the earth bar located in the electrical panel and marked PE.
Auxiliary circuit power is supplied by the power line by means of a transformer located in the electrical panel.

The cross-section of the cable and the line protections must comply with the indications shown on the wiring diagram and in the relative sheet attached to the unit.

Observe the phase sequence, otherwise the unit will not work.
Input voltage must not exceed variations of over ±5% and phase unbalance must always be less than 2%.

Operation of the unit must be at the above mentioned conditions otherwise the warranty of the unit will be void.

5.4.2 Electrical connections to the flowswitch.

The chiller must only work while water is flowing.
The flowswitch must therefore be connected as shown on the wiring diagram supplied with the unit.

5.4.3 Electrical connections to the circulation pump.

The circulation pump must always be connected to the unit control system as shown on the wiring diagram.

The pump must be started up before starting up the chiller and it must be stopped after the chiller has been stopped (minimum recommended delay : 40 seconds).

5.4.4 External signals

If a remote ON-OFF command is required, connect the external enable to the contacts shown on the wiring diagram. Never install control cables inside the cableducts used for power supply cables; if this is not possible, then it is necessary to use screened cables.

When making the connections described in paragraphs 5.4.2 – 5.4.3 – 5.4.4 carefully follow the indications shown in the wiring diagram. The connecting cables must have a minimum cross-section of 1.5 mm².

6. START-UP

6.1 PRELIMINARY CHECKS.

- Make sure that the electrical connections have been made correctly and that all the terminals have been adequately tighened.
- Make sure that the voltage on terminals L_1, L_2, L_3 is equal to that shown on the rating plate (allowed tolerance ±5%) and should be checked with a tester. If voltage is subject to frequent variations, please contact our technical department in order to decide on suitable protection devices.
- Make sure that the pressure gauges (when fitted) show the correct pressure. The pressure gauges are fitted with shut-off valves. These must only be opened when necessary and closed again after inspection.
- Use a leak tester, if necessary to make sure there are no leaks of refrigerant liquid.
- Check that the oil heater, if fitted is correctly powered.

The heating elements must be turned on at least 12 hours before start up; this takes place automatically when the main power switch is closed (position I).

To check if the heating elements work correctly, make sure that the lower part of the compressor is 10÷15 °C higher than the room temperature.

- Check that the water circuit is correctly connected according to the enclosed layout drawing.
- Make sure that the water circuit has been cleaned beforehand: the water circuit should be washed, bypassing the unit, and then the system filter checked for dirt.
- The unit is shipped with the relief valves and drains open. Special plates show where they are located. They must be closed during installation before the water circuit is filled.
- Make sure the water circuit has been well vented to eliminate any air residues. This operation is carried out by gradually loading and opening the relief valves fitted to the uppermost part of the unit by the installer (please consult section 5.2).
- Before starting the pump, make sure that the moving parts turn freely.
- Power the unit and check, with three-phase versions, that the pump motor rotates clockwise, looking at it from the fan side. If this is not the case, invert any two of the phase wires.
- After starting the pump, make sure that the correct quantity of water is circulating. The pressure gauges installed upline and downline from the pump may be used to carry out this check; the difference between the two pressures must be equal to the pressure drop of the system, including the evaporator. To adjust the waterflow, turn the valve located downline from the pump. Mark the position of each valve so that if they are closed for mintenance operations, they can be moved to the same place before starting up the unit again.

Warning!
Before starting up the unit, make sure that all the external panels are in place and fixed with screws.

6.1.1 Preliminary checks when starting up ducted units.

- Check that the ductwork has been correctly installed and guarantee that there is no recirculation between supply and return air.

- Check that there is a correct airflow in the ducts and act on the variable pulley of the motor if an adjustment is necessary.
- Check that the engaged current and power of the fan motors does not exceed the values indicated on the labels.

To effect these checks you can remove the compressor fuses and then start the unit (see paragraph 6.2). In the units with semi-hermetic compressors it is also necessary to short-circuit the differential pressure switch of the oil.
Once the checks have been effected, the electrics should be returned to their original state.

6.2 START UP

Select the operating cycle (heating or cooling).
For units with a microprocessor control, select "summer" (cooling mode) or "winter" (heating mode) by acting on the appropriate selector switch or remote control (always verify first that this operation is possible using the keypad).
N.B.: this operation is only required for the heat pump versions.

Warning!
The operating cycle should be changed on a seasonal basis. Frequent changes between summer and winter modes should be avoided as they can cause the compressors to work badly and consequently damage them.

Start the unit by pressing the „ON" button located on the microprocessor cover and make sure the following occurs (indications in brackets refer to unit with heat pumps working in the heating cycle mode):
First the pump starts and, if the temperature of the water returning from the unit is high (low) enough, the compressors and the fans will start up automatically after about one minute.
When the temperature of the water returning from the unit decreases (increases), the compressors will step down the capacity or stop in sequence.
The fan will stop together with the last compressor whereas the water circulation pump will remain operating.
When the temperature of the water returning from the unit increases (decreases) the compressors will start up in sequence as well as the fans.

N.B. not all the fans may start up in units fitted with condenser control devices (low ambient or winter start) when the external air temperature is lower than 15 °C.
If the unit does not start, please consult chapter 8.

The power supply must not be switched off while the unit is stopped. Power should only be switched off for prolonged pauses (e.g. seasonal shut downs). To shut down the unit for short periods, please carefully follow the instructions shown in paragraph 6.4.

6.3 CHECKS DURING UNIT OPERATION

6.3.1 General

- Check the unit for strange sounds or excessive vibrations.
- Check that the above sequence is repeated regularly, leaving each compressor working for at least 10 minutes (if this is not the case, unit inertia must be increased).
- After a few operating hours, check that the crown of the liquid and moisture indicator indicates a dry circuit.
- Make sure there are no bubbles inside the liquid indicator. Bubbles generally indicate there is not enough refrigerant liquid in the circuit (though a few bubble are often acceptable).

- A few minutes after the compressors start during the summer operating cycle, make sure the condensing temperature is 18 ± 4K higher than the temperature of the air entering the condenser and that the evaporating temperature is about 5K lower than the temperature of the water leaving the evaporator (depending on the size of the chiller, the kind of refrigerant gas used and the room temperature).

- Make sure that the overheating temperature of the refrigerant lies between 5 and 7K. Do this by measuring the temperature with a contact thermometer placed on the suction pipe of the compressor and that indicated on a pressure gauge (dew point) connected to the suction line as well: the difference between the two gives the values of overheating.

- Make sure that the subcooling temperature of the refrigerant fluid lies between 4 and 8K. Do this by measuring the temperature with a contact thermometer placed on the outlet line from the condenser and that indicated on a pressure gauge (bubble point) connected to the suction line as well: the difference between the two gives the values of subcooling.

- Check the electrical consumption of the pump (when fitted) during operation: the values should correspond to those indicated on the electrical schematics. If this is not the case then the pump is not working correctly: act on the valve downline to return to an acceptable value.

The above checks can be made by using the supplied pressure gauges (if fitted). In this case, remember to close the shut-off valves after taking the readings.

6.3.2 Defrosting (Only heat pump units)

During operation in the winter cycle (heat pump), the coil works as an evaporator, cooling and dehumidifying the external air. Depending on the temperature and moisture of the external air, condensation or frost will form.
The frost accumulated on the coil obstructs the air inlet thereby reducing air flow and the heat transer rate. The heat pump units are fitted with control devices that automatically defrost the coil whenever necessary. This control device features a temperature probe places on the coil or pressure probe on the refrigerant circuit which, when the temperture is equal to or lower than the set-point, activates the defrost cycle function which will take place only if a certain time (default setting: 30 minutes) has elapsed since the last defrosting process.

Defrost takes place as follows:

- The fans stop;
- The operating cycle is inverted with the 4-way valve, thereby making the finned coil work like a condenser. The condensation heat causes the frost to melt and drain to the ground.

When the end of cycle temperature is reached, the 4-way valve is inverted once more and the winter operating cycle continues. Defrosting lasts from about 1 to a maximum of 5 minutes when it is interrupted even if the end of cycle temperature set-point has not been reached.

6.4 STOPPING THE UNIT

Stop the unit by pressing the “OFF” key on the front panel.

Warning!
Do not stop the unit by turning off the main power switch as this would also disconnect the heating elements of the sump which would affect compressor operation after start up.

7. OPERATION

7.1 GENERAL

The unit must be started and stopped by pressing the ON/OFF botton on the front panel of the microprocessor.
Compressors and condensing fans will be automatically started and stopped depending on the temperature of the water returning while the circulation pump will remain working continuosly.
If something doesn't work as it should, the unit will stop – totally or partially – giving an alarmcode on the disply of the microprocessor indicating which device has caused the stopping. Before restarting the unit, the reason for stop must be cleared and eliminated. To restart some safety devices it is necessary, to intervene on the safety organ by resetting it, together with the normal restarting procedure through the keyboard.

All the above mentioned must be effected by qualified personel only.
DO NOT TAMPER WITH THE SAFETY DEVICES.

7.2 SEASONAL SHUT DOWN

If the unit is planned to be shut down for a long time and the unit is required to be disconnected from the mains supply, the minimum temperature to which the unit may be subjected must be identified. If this is lower than the freezing point of the fluid contained in the exchangers, these must be drained.

8. TROUBLE SHOOTING

FAULT	PROBABLE CAUSE	POSSIBLE SOLUTIONS
I. THE UNIT DOESN'T START	1. There is no electrical power supply 2. The electrical connections are faulty or the on-off contacts are open. 3. Compressor thermal overload has cut-out 4. Remote consent missing (remote start signal). 5. No consent signal from the operating sensor. 6. No consent signal from the anti-freeze. 7. No consent signal from one of the safety devices. 8. The fan thermal cut-out.	1. Check that the unit is correctly wired to a power supply. 2. Check the phase sequence, check the voltage and close the contacts. 3. See point VII. 4. Check the water circulation pump, flowswitch and vent the circuit. Check any other external consent signals. 5. System on temperature, no cooling demand. Check set point and operation. 6. Check calibration and operation of the devices. 7. See point IV – V – VI. 8. See point VIII
II. ONE OR BOTH COMPRESSORS DON'T START	1. The compressor has burnt out. 2. The power circuit is open. 3. The compressor contactor is faulty 4. The compressor contactor is disabled.	1. Replace compressor. 2. Close the compressor circuit breaker after identifying the reason why they cut in. 3. Compressor was working in critical conditions or there isn't enough refrigerant charge. Check the working conditions and see point VII. 4. Check the voltage at the ends of the contactor coil and the continuity of the coil. Replace if faulty.
III. A COMPRESSOR STARTS AND STOPS CONTINUOUSLY	1. The compressor is faulty. 2. The low pressure switch has cut in. 3. The compressor contactor is faulty. 4. The set-point values are incorrectly set. 5. There is not enough refrigerant charge.	1. Check and replace if necessary. 2. See point V. 3. Check and replace if necessary. 4. Modify them by referring to the informing shown on the microprocessor programme. 5. See point IX
IV. A COMPRESSOR DOESN'T START BECAUSE THE HIGH PRESSURE SWITCH CUTS IN	1. The pressure switch doesn't work. 2. The end of the defrost cycle pressure switch doesn't work. ** 3. The unit is overcharged. 4. There is non-condensable gas in the refrigerant circuit. 5. The refrigerant dryer is clogged. 6. The metal condenser filter (grill) is clogged. The air flow is too low.* 7. The fans do not work. * 8. There is air in the water circuit. 9. The circulation pump is faulty. ** 10. Centrifugal fan drive belts are broken or belt tension is incorrect*	1. Check and replace. 2. Check and replace. 3. Remove the excess refrigerant liquid from the system. (as indicated in chapter 10) 4. Drain the circuit, pressurise and recharge the unit. 5. Check and replace. 6. Clean the filters (grills) with compressed air or water. 7. See point VIII. 8. Vent the water circuit. 9. Check the pump and replace if necessary. 10. Check and replace if necessary.
V. A COMPRESSOR DOESN'T START BECAUSE THE LOW PRESSURE SWITCH CUTS IN	1. The pressure switch doesn't work. 2. The unit is completely empty. 3. The liquid shut-off valve is not completely open. 4. The solenoid valve on the liquid line doesn't work properly. 5. The thermostatic expansion valve doesn't work properly. 6. The dryer is clogged. 7. The metal filters of the evaporator are clogged. The air flow is too low**. 8. The evaporator fans do not work**. 9. The evaporating coil is covered with frost. 10. The water pump is faulty. 11. Centrifugal fan drive belts are broken or belt tension is incorrect*	1. Check and replace. 2. See point IX. 3. Check and open it completely if necessary. 4. Check power supply to the solenoid and replace if necessary. 5. Check, clean and replace if necessary. 6. Check and replace. 7. Clean the filters with compressed air or water. 8. See point VII. 9. See point XIV. 10. Check the pump and replace if necessary. 11. Check and replace if necessary.

VI. A COMPRESSOR DOESN'T START BECAUSE THE OIL PRESSURE SWITCH CUTS IN	1. Excess of refrigerant in the compressor sump. 2. Insufficient quantity of oil in the compressor sump. 3. The oil filter is clogged. 4. The pump oil is faulty.	1. Check that the sump heater is working correctly. Check the heating by acting on the thermostatic expansion valve. 2. See point X. 3. Clean the filter. 4. Replace pump.
VII. A COMPRESSOR DOESN'T START BECAUSE THE THERMAL OVERLOAD CUTS IN.	1. The compressor is faulty. 2. Compressor motor is overcharged. 3. Insufficeint charge / the overheating in the suction line is too high. 4. The thermal overload is faulty. 5. Incorrect operation of the Y-Δ commutation.	1. Check, replace if necessary. 2. Check the power into the compressor and the supply pressure. 3. Check the overheating adjusting the thermostatic valve. 4. Replace. 5. Check components and wires. Check the time setting for the commutation.
VIII. THE FANS DON'T START	1. The fan contactor is not energised. 2. The fan thermal cut-outs trip. 3. The connections are faulty. 4. The fan motor is faulty.	1. Check the voltage at the ends of the contactor coil and the continuity of the coil. Replace if faulty. 2. Inspect the insulation between the idividual windings and between the winding and earth. 3. Check and tighten. 4. Check and replace if necessary.
IX. LACK OF REFRIGERANT LIQUID	1. There is a leak in the refrigerant circuit.	1. After pressurising the circuit at about 10 bar, check with a leak tester. Repair, create a vacuum and fill with refrigerant liquid.
X. LACK OF OIL	1. Possible compression of liquid or of liquid return in the circuit. 2. Differential pressure is too low.	1. Check the sump heater. Check for overheating by adjusting the thermostatic expansion valve. Check the oil filter. Fill with oil if necessary. 2. Check the relevant setting. On units that are fitted with a pressure adjusting valve, check also the calibration of this valve.
XI. THE LIQUID PIPE IS HOT	1. Not sufficient refrigerant charge.	1. See point IX.
XII. THE LIQUID PIPE IS COVERED WITH FROST	1. The liquid line shut-off valve is closed. 2. The liquid line filter is clogged.	1. Open it. 2. Check and replace if necessary.
XIII. THE SUCTION PIPE IS COVERED WITH FROST	1. The thermostatic expansion valve doesn't work properly. 2. Too low refrigerant charge. 3. The liquid line shut-off valve is not completely open. 4. The filter is clogged. 5. The water circulation pump is faulty*	1. Check, clean and replace if necessary. 2. See point IX. 3. Check and open it completely if necessary. 4. Check, clean and replace if necessary. 5. Check and replace if necessary.
XIV. THE DEFROST CYCLE IS NEVER ACTIVATED	1. The 4-way valve is not energised.** 2. The setting of the defrost thermostat is incorrect or the sensor is faulty. **	1. Check the voltage and the contactor of the valve. Replace the valve if necessary. 2. Modify the setting or replace the sensor probe if necessary.
XV THE UNIT OPERATES CONTINUOSLY	1. Lack of refrigerant. 2. Compressor not performing. 3. Excessive thermal load. 4. Control thermostat doesn't work or has a long setpoint. 5. The liquid line filter is clogged. 6. The compressor works only on a partial load.	1. See pont IX. 2. Check, grind or replace. 3. Reduce thermal load. 4. Check the thermostat working setpoint and replace if necessary. 5. Clean and replace if necessary. 6. Check the power supply to the partialising solenoids and replace if necessary.
XVI THE UNIT WORKS CONTINUOUSLY BUT HAS TOO LOW CAPACITY	1. Too low refrigerant charge. 2. Moisture presence in the refrigerant circuit. 3. The compressor works only on a partial load. 4. The liquid injection line is active.	1. See point X. 1. Replace the filter. If necessary circuit should be dried and recharged. 1. Check the power supply to the partialising solenoids and replace if necessary. 1. Check the discharge pressure. Check the solenoid valve and replace the solenoid if necessary.

XVII ABNORMAL NOISE AND VIBRATIONS IN THE SYSTEM.	1. The compressor is faulty. 2. The thermostatic expansion valve is noisy. 3. Piping vibrations. 4. Panel vibrations.	1.Check and replace if necessary. 2.Check and recharge the system. 3.Clamp the pipes. 4.Install and fix correclty.

* Cooling operation (summer mode).
** Heating operation (winter mode) – for heat pump only (…H).

If the operator has not been able to rectify the fault, turn off the unit and contact ACM Kälte Klima Srl or an authorised service centre.

9. MAINTENANCE AND PERIODICAL CONTROLS.

WARNING

Make sure that the power supply is OFF before effecting any maintenance or access the internal part of the unit.

The discharge pipe on the compressor can reach very high temperatures; care should be taken when work is done closed to these pipes and in any case the pipes should be allowed to cool down.

Care should be taken when operating near the finned coils; the aluminium fins can be particularly sharp and can be the cause of injury. It is highly advisable to cover them with a sheet or a panel.

When maintenance operations have been terminated it is important to close the unit by securely screwing all the panels into their positions.

It is essential that all the operations described in this chapter MUST BE EFFECTED ONLY BY QUALIFIED PERSONNEL USING ADEQUATE PERSONAL PROTECTION.

9.1 GENERAL

Periodical checks are advisable in order to ensure that everything is operating correctly. Below are the periodical checks that should be effected. Furthermore, if there are to be long periods during which the unit is not operational, the water should be drained out of the piping and out of the heat exchangers, expecially if the temperature during these periods falls below the freezing point of the fluid used.

9.1.1 Periodical checks

All the functions of the unit and the control equipment are tested and adusted in the factory before the unit is shipped.

Check, at regular intervals, that all operating and safety devices are working correctly.

Always run regular checks on the correct operation of the unit itself.

Check the state of the outer housing of the unit: any scratches should be touched-up to avoid the formation of corrosion..

Check regularly that the fan blades are well fixed, correctly balanced and that they are in a good general condition.

9.1.2 Maintenance programme

Operation	Check
Check internally for water leaks and condensation	Monthly
Check the refrigerant charge using the sight-glass on the liquid line	Monthly
Check that the compressor does not have any oil leaks	Monthly
Check that moisture indicator on the liquid sight-glass is green If it is yellow then this indicates a presence of moisture and the filter should then be replaced	Monthly
Check the compressor heaters	Monthly
Check that all electrical contacts are in perfect condition and all terminals screwed tightly Clean the mobile and fixed contacts of the contactors. Replace any worn or deterioriated components	Monthly
Use compressed air or water or steam to clean the fins of the external heat exchangers	Monthly
Test the defrost cycle (only for heat-pump units)	Monthly
Check that the sound coming from the unit is normal	Monthly
Check the operating power consumptions, temperature and pressure	Annually
Check the operation of all the control and safety devices on the unit	Annually
Mechanical check: clean the inside of the unit and check that all fixing screws / nuts / bolts of the various components are tight	Annually

9.2 REPAIRWORK TO THE REFRIGERANT CIRCUIT

These repairs may only be effected by specialised staff using the normal techniques for chillers that make use of halogen fluids as refrigerants.

9.3 TOPPING UP THE REFRIGERANT

This operation should only be carried out after identifying and repairing a leak.

For units using R407C or R404A no more than two top-ups are allowed. If another top-up is required the refrigerant circuit must be completely emptied and then refilled with new refrigerant.

It is illegal to free refrigerant gases in the environment. It is obligatory to recuperate any gases that are no longer usable and to return them to the supplier or dispose of them in an authorised centre.
When it is necessary to empty a refrigerant circuit, always recuperate all the refrigerant present in the circuit.
Never discharge or free the gas directly into the air!

10. DE-COMMISSIONING AND DISMANTLING

When the unit is removed or replaced because it has reached the end of its life, it must be disposed of in a specialised collection centre.

If no specialised centres are available, proceed as follows:

- Disconnect the unit from the electrical supply and from the external water system and remove it from its installation site.

- Specialised personnel should recuperate all the refrigerant gas it contains, taking care not to disperse any into the enviroment and then send it to an authorized collection centre.

- The lubricating oil must also be collected and sent to authorized collection centres for disposal.

- Dismantle the various components and the bodywork and sort the various materials into separate groups for disposal (please bear in mind that considerable quantities of copper and aluminium are contained in the unit)

The above allows the various materials to be recovered and disposed of in order to reduce to a minimum any enviromental damage.

If the unit has to be stored, make sure that storage location is well protected against atmospheric conditions. Ensure also that the unit can not be kbnocked around also that nobody can tamper with any of its parts until it can be eliminated entirely – this will have to be done in total accordance with the laws in force in the country where the unit has been installed.

IMPORTANT!
After having removed the unit from its working position, fix a sign on the unit that indicates:
"MACHINE TO BE DISMANTLED, DO NOT USE".

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