

EMICON

USE

AND

MAINTENANCE MANUAL

AIRCOOLED WATER CHILLERS

RAH/PAH



This manual has been drawn up in conformity with UNI EN 292/2 harmonised with the Machine Directive 89/392 and forms an integral part of each EMICON A.C. S.P.A. machine.

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THIS MANUAL REFERS TO THE FOLLOWING MACHINE :

UNIT

SERIAL No.

⚠ CAUTION

EMICON machines are designed for use by professionals.

In the event of installation and maintenance of the machine, refer to the indications given in this manual and on-board the unit.

Any work on the machine must be performed by trained and informed persons.

Machine warranty is subordinated to the dispositions given in this manual.

The manual is intended for reference by the final user only for those operations which can be performed with the panels closed (fixed guards not removed).

The data in this catalogue are provided for information purposes only. EMICON A.C. S.P.A. reserves the right to introduce modifications without prior notice

Before gaining access to any internal part, place the main switch located upline of the machine power line to "off".

Then, after having opened the front panel, also place the main switch of the unit to "off".

Work on the control panel under power and with the panel open is only permitted to our suitably trained personnel, since certain system functions are no longer available in these circumstances.

CAUTION

Fill the Commissioning Report enclosed to the handbook during the first start up and send a copy to Emicon (Service Dept.) for warranty validity.

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SAFETY

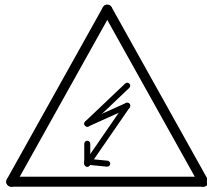
These instructions contain fundamental information for the correct and safe use and maintenance. As well as observing general safety standards, all points specifically highlighted must also be observed.

SYMBOLS USED IN THE INSTRUCTIONS

This manual makes use of information and dispositions indicated with symbols. The non-observance of the safety dispositions marked by the symbol “**generic hazard**”



may cause a hazard affecting personal safety. The non-observance of the safety dispositions marked by the symbol “**electrical warning**”



may cause a hazard affecting personal safety and the integrity of systems. The non-observance of the safety dispositions marked by the word



may cause a hazard affecting the integrity and function of machine systems.

RISKS DERIVING FROM FAILED RESPECT OF THE SAFETY PRESCRIPTIONS

The non-observance of safety dispositions not only causes a hazard for people and damage to the equipment, but also invalidate every warranty right.

The non-observance of safety dispositions may cause:

- non-actuation of certain system safety functions;
- hazard for people as a result of electrical and/or mechanical and/or thermal events.

ACTIVE SAFETY

The machine operating logic is managed by the microprocessor.

It also manages any faults and faulty operation of every machine part to avoid risks involving the machine, people and the environment.

PASSIVE SAFETY

The machine is completely enclosed by panels; inasmuch, the danger areas are not accessible from the outside, including the fans which are fitted with specific protection guards.

REGULATORY REFERENCES

Regulations harmonised with Directive 89/392:

UNI EN 292-1	MACHINERY SAFETY, BASIC METHODS
UNI EN 292-2	MACHINERY SAFETY, TECHNICAL PRINCIPLES
UNI EN 418-2	MACHINERY SAFETY, DESIGN PRINCIPLES
UNI EN 294-2	MACHINERY SAFETY, EMERGENCY HALTS
UNI EN 60204-1	MACHINERY SAFETY, ELECTRICAL EQUIPMENT

Regulations harmonised with Directive 89/336:

EN50081-1:	
EN55022	CONTINUOUS INTERFERENCE - ELECTROMAGNETIC FIELDS
EN55014	INTERMITTENT INTERFERENCE

EN50082-2:	
EN61000-4-4	FAST TRANSITS
EN61000-4-2	ELECTROSTATIC DISCHARGE
ENV50140	ELECTROMAGNETIC FIELDS
ENV50204	ELECTROMAGNETIC FIELDS
ENV50141	RADIO-FREQUENCY INTERFERENCE

Reference standards for directive 72/23 + 93/68:

CEI 17-13	REGULATIONS FOR EQUIPMENT BUILT IN THE FACTORY
CEI 44-5	MACHINERY SAFETY, ELECTRICAL EQUIPMENT
CEI 44-6	DESIGNATION OF COMPONENTS AND EXAMPLES OF OUTLINES, TABLES AND INSTRUCTIONS FOR ELECTRICAL INDUSTRIAL EQUIPMENT

Other regulations pertinent to safety:

UNI 8011	REFRIGERATION PLANT, SAFETY DISPOSITIONS
UNI 8634	STRUCTURES IN ALUMINIUM ALLOYS, CALCULATION INSTRUCTIONS
CNR 10011	STRUCTURES IN STEEL, CALCULATION INSTRUCTIONS
UNI ISO 8792	MACHINE TRANSPORT
UNI 8199	NOISE-MEASUREMENTS-CRITERIA FOR ACCEPTABILITY
UNI 9219	MECHANICAL PROTECTION DEVICES FOR INDUSTRIAL FANS
UNI 9018	ENBLOC WATER CHILLERS WITH ALTERNATIVE CLASSIFICATION
	COMPRESSORS, REQUIREMENTS AND TEST METHODS

DECLARATION OF CONFORMITY

EMICON A.C. S.P.A. with Head Offices in Via Dragoni n°59 - 47100 Forlì - ITALY

HEREBY DECLARES

under its own responsibility as manufacturer that the machine:

EMICON :

SERIAL Nr. :

conforms:

- to the requirements of the **Machine Directive 89/392/CEE**
- to the requirements of the **Electromagnetic Compatibility Directive 89/336/CEE**
- to the requirements of the **Low Voltage Directive 72/23/CEE + 93/68/CEE**
- to the Standards mentioned in the reference standards in the CE machine Use and Maintenance Manual

Forlì, 31st January 2004

EMICON A.C. S.P.A.
Romano Santucci
EMICON A.C. S.P.A.
UFFICIO TECNICO
Ing. Romano Santucci

GENERAL

The RAH series liquid coolers with screw compressors are suitable for cooling of water to be used in industrial processes and air-conditioning.

The machines have one or more compressors and separate refrigeration circuits.

The design, construction and the components used for these units make it suitable for continuous duty and guarantee reliability over time.

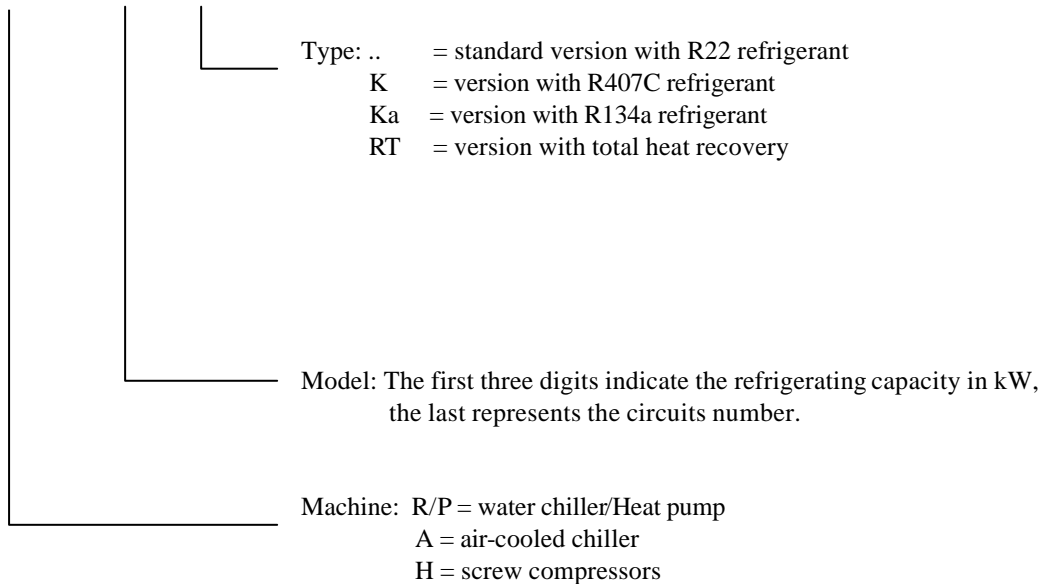
The unit includes:

- one or more refrigeration circuits
- electrical panel
- microprocessor control system with LCD display to view the set parameters, operating status and alarms in progress.

VERSIONS

The refrigeration unit can be identified by the symbol which makes up its name:

R/PAH 1203 ...



AVAILABLE ACCESSORIES

- TE** : Electronic thermostat expansion valve
- PF** : Safety water flow pressure switch.
- BT** : Operating system for low outside air temperatures up to a limit of -20°C. Controls condensation with modulating operation of the fan rotation speed using a phase-cutting control unit.
- LI** : Liquid injection, standard on this unit
- M8, M12, M25** : Modulating cooling capacity control
- RA** : Antifreeze heating coil incorporated in the evaporator.
- PM** : Spring vibration dampers on the base

RR	:	Condensing coil with copper fins
RS	:	Condensing coil with tinned copper fins
RM	:	Condensing coil with fins in seaworthy alloy
GP	:	Metal protection screen on condensation unit against accidental knocks
FA	:	Re-usable metal filters with low pressure drop to protect condensing coils from dirt
RT	:	100% condensation heat recovery by means of a gas/water exchanger and 3-way valve
PD	:	Remote control panel. Controls: Machine ON/OFF
		Signals: the machine state
		compressor 1 on
		compressor 2 on
		Machine in alarm
DS	:	Star-delta start-up
RF	:	Power factor correction system by means of special condensers. A value of $\cos \phi \geq 0.9$ is guaranteed
VS	:	Solenoid valve
PQ	:	Remote control microprocessor
IB	:	RS 422 serial interface for connection to a supervision system and/or centralised teleservice on computer
IH	:	RS 485 serial interface
CS	:	Pick-up counter
IG	:	Clock card
RL	:	Compressor overload relays
A	:	Amperemeter
V	:	Voltmeter
VB	:	Brine version for water temperature under 0°C

FIELD OF USE

Air: The refrigeration units operate with a condensing air temperature between + 15°C and + 42°C.
With the option BT or BF (low-temperature operation) the minimum limit becomes -20°C.

Water: The machines operate with cooled water temperature between + 7°C outgoing (minimum value) and + 12°C incoming (maximum value). (Outside air 32°C)

TECHNICAL DATA

MAIN COMPONENTS

Frame and structure

Base and load-bearing structure with frame in galvanised painted profiles.

Compressors

Semi-hermetic type compressors with double screw realised by machining with very low tolerance and high-quality materials, allowing high efficiency, reduced vibration and a low noise level.

These compressors have been specifically designed for operation at standard conditions of air conditioning, assuring optimal performances.

The lubrication system is the forced type without pump and, to prevent excessive flow of oil to the refrigerating circuit, the compressor is equipped with an oil separator incorporated in the delivery line.

The casing heating element automatically maintains the oil at the suitable temperature.

The provision has been made for starting with reduced pickup current.

The compressor is fitted with a step capacity control through a system with slide valve, hydraulically controlled by the oil used for lubrication. This system allows delivering variable output from 25% to 100% from each compressor.

Filled with the appropriate oil, the compressor is suitable for operation with refrigerant R22 and R407C for K-series and R134a, for Ka-series.

Evaporator

Tube-bundle type with dry-expansion with one or more gas circuits and scored copper tubes for highly efficient heat exchange.

Tube plate and shell in carbon steel, copper tubes. Supplied complete with anti-condensate insulation made of closed-cell polyurethane foam, and with safety valve where ISPESEL testing for the Italian market is required.

If required, the evaporator and the valves can be supplied with test certificate in accordance with current regulations on the foreign markets.

Condenser coil

Frame made of galvanised steel and peralluman, copper tubes and aluminium fins.

Axial fans

Helical type with low rpm, directly coupled to the electric motor with heat shield, electronic balancing, low-noise blade profiles, complete with special air conveyor and protection grill.

Degree of protection of the motor/fan assembly suitable for operation outdoors.

IMPORTANT: The fan protection grill is a fixed guard which delimits a danger zone of the machine. Do not remove it. Replace it in case of damage.



Gas circuit

Each circuit is equipped with a thermostat, dehydrating filter, fluid passage indicator, safety valve, low and high pressure switches, low and high pressure gauges, antifreeze safety switch for the water circuit, non-return valve and cock on the liquid line.

Electrical panel

Housed in a special compartment protected by the internal safety panel fitted with a knife switch with interlock (guard interlocked) and the external panel is openable on hinges.

Complete with remote control switches, magnetothermal switches or fuses for each utility, transformer for auxiliaries and microprocessor, terminal board.

Conditions of supply

The machines are tested at the factory and supplied with refrigerant charge and filled with suitable oil.

TECHNICAL DATA

TRANSPORT AND INSTALLATION

INSPECTION

Since the machine leaves the factory in perfect condition complete with coolant and low-temperature resistant oil, the client must check its integrity on delivery.

Any damage must be notified immediately to the haulier and entered on the Delivery Sheet.

The client shall then prepare a report detailing the damage suffered by the machine and then contact EMICON A.C. S.P.A.

TRANSPORT AND POSITIONING

For machine handling, refer to the figure (see Enclosure B).

Unpack the unit as close as possible to the place of installation.

Before defining the most appropriate place for positioning the machine, carefully verify the following points:

- dimensions and origin of hydraulic pipes;
- possibility of correct ventilation of the condenser;
- voltage setting and location of electrical cables;
- good access to the machine for repair and/or maintenance operations;



CAUTION!



CAUTION!

- solidity of the base floor compared with the weight of the machine;
- precautions concerning possible resonance or excessive reverberation of sound waves;
- precautions concerning the vibrations that the machine transmits to the ground (EMICON A.C. S.P.A. can supply suitable anti-vibration systems).

INSTALLATION

The machine must be placed on a perfect horizontal floor.

CAUTION!

The machine may be installed inside or outside provided that the following conditions are ensured:

- make sure that there is no air recirculating between intake and delivery; in this regard, maintain the distances indicated in the figure (see Enclosure C);
- make sure that there is sufficient access space around the machine; in this regard, maintain the distances indicated in the figure (see Enclosure C);
- if the machine is fitted with axial fans and it is installed inside, make sure that there is a free space above of at least 2 metres

CAUTION!

HYDRAULIC CONNECTIONS

The hydraulic connections must be made with particular care, observing the direction of the circuit indicated by specific notes.

It is advisable to adhere to the following indications:

- insulate all piping to avoid the formation of condensation;
- use anti-vibration couplings to avoid the transmission of vibrations and allow for heat expansion;
- insert in the hydraulic circuit the cut-out cocks and a filter for the incoming water to the machine;
- carefully bleed the water plant (important);
- use water with maximum hardness equal to 30° French;
- for low application temperatures (less than 4°C at the outlet), use mixtures with antifreeze;
- if the machine is installed outside, EMICON prescribes a minimum percentage of glycol of 15% in the water circuit.

CAUTION!

CAUTION!

ELECTRICAL CONNECTIONS

Having positioned the unit in the installation site, verify that the components of the control panel are all integral and cabled, that is to say that all terminals have not become slack during transport.

CAUTION!

Verify that supply voltage matches the rated data of the unit shown on the data plate located on-board the machine (voltage, frequency and number of phases).

Use a power lead of cross-section no less than that indicated in the wiring diagram, which should be as short as possible to avoid excessive drops in voltage.

The power lead must be protected upline by an automatic switch or a set of three fuses whose nominal current must be equal to that of the main knife-switch located inside the control panel of the machine. Moreover, the cut-out power for these parts must not be less than the maximum short-circuit current which may occur, in the event of failure, where the machine is installed.

CAUTION!

The "user terminal board" (see wiring diagram) indicates all necessary information for external enables and signals (REMOTE ON- OFF, cumulative alarms, etc.).

For machines fitted with the "Remote Control Panel" option, the relative cabling must be installed as indicated in the wiring diagram.

The machine is designed to withstand voltage variations within 5% and unbalance within 2%. The protection lead must always be connected to the equipotential node of the machine .



FIRST STARTING

The machine is equipped with gearcase resistances to maintain the right compressor oil temperature and viscosity even when OFF; inasmuch, the machine should be powered up for 12 hours before pressing the ON button.

CAUTION!

Press the ON button: in this situation, the machine will start whenever the service thermostat and differential water pressure switch provide enables. Make sure that the rotation direction of the compressors, fans and any pumps is correct; if not, invert two of the three phases on the main knife-switch.

IMPORTANT : NEVER MODIFY THE INTERNAL ELECTRICAL CONNECTIONS.

Never isolate machine voltage during halt periods except for prolonged pauses for maintenance purposes.

To shut-down the machine, use the OFF command.



MAINTENANCE

NATURE AND FREQUENCY OF PERIODIC MAINTENANCE

IMPORTANT

BEFORE ACCESS TO ANY INTERNAL PART, PLACE THE MAIN SWITCH LOCATED UPLINE OF THE MACHINE POWER LINE TO "OFF". THEN, AFTER HAVING OPENED THE FRONT PANEL, ALSO PLACE THE MAIN SWITCH OF THE UNIT TO "OFF".

IMPORTANT

WORK ON THE CONTROL PANEL UNDER POWER AND WITH THE PANEL OPEN IS ONLY PERMITTED TO OUR SUITABLY TRAINED PERSONNEL, SINCE CERTAIN SYSTEM FUNCTIONS ARE NO LONGER AVAILABLE IN THESE CIRCUMSTANCES.

It is a good practice to perform periodic controls to verify the correct operation of the machine.

It must be pointed out that these operations, including any maintenance work, should only be performed by qualified personnel (trained and authorized people).

Monthly checks:

- check the tightening of the electrical terminals on both the control panel and the terminal strips of the various electrical parts after having isolated the machine from the power supply using the protection device located upline of the system;

- make sure that the remote-switch contacts are clean and in good conditions (replaced as required);

- make sure that the water circuit is free of air bubbles;

- check the correct operation of the differential water pressure switch;

- clean the fins of the condensation unit with compressed air or, if necessary, with water (operate in the opposite direction compared with the air passage direction);

If the machine becomes unusually noisy in operation over time, perform a special control to identify and eliminate the causes.

CAUTION!

CAUTION!

TROUBLESHOOTING

The following tables indicate the most common causes which may cause lock-out or malfunction of the machine.

SYMPTOM	PROBABLE CAUSE	POSSIBLE REMEDY
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A) The system does not start	Faulty connection or open contacts	Verify the voltage and close the contacts
	No external enables	Check the operation and the flow-switch; bleed the system; check various other external enables
	Timer	Wait for 3 minutes
A) The system does not start	No service thermostat enable	Plant at operating temperature, no request; verify calibration and function
	No antifreeze service thermostat enable	Verify calibration and function
	Fan thermics tripped	Refer to item F
	No safety device enable	See points D - E



CAUTION!

CAUTION!

CAUTION!

B) The compressor does not start	Compressor burnt or gripped	Replace the compressor
	Compressor remote control switch not activated	Check the voltage at the terminals of the compressor spool and the continuity of the spool itself
	Power circuit open	Find out why the protection has tripped; close compressor automatic

CAUTION!



C) The compressor starts and stops repeatedly	Minimum pressure switch tripped	Refer to item E
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D) The compressor does not start because the maximum pressure switch has tripped	Pressure switch faulty	Verify and replace
	There is too much refrigerant in the unit	Discharge excess gas
	Condensation unit clogged Air delivery too low	Clean with compressed air
	Condensation unit fans do not work	Refer to item F
	There is uncondensable gas in the refrigeration circuit	Recharge the circuit after having discharged it and placed it under a vacuum.

CAUTION!



E) The compressor does not start because the minimum pressure switch has tripped	Pressure switch faulty	Verify and replace
	Machine completely discharged	Refer to item G
	Filter clogged	Verify and replace
	Cock on the liquid line not completely open	Verify and eventually open completely
	E1) The compressor starts and stops repeatedly	Thermostat expansion valve does not function correctly

F1) The fans do not start	Fan motor remote control switch not activated	Check the voltage at the terminals of the remote control switch spool and the continuity of the spool itself
	Fan motor thermics tripped	Check the insulation between the windings and between these and ground/earth. Reduce belt tension
	Speed regulator not calibrated or faulty	Check the calibration of theregulator or replace it

CAUTION!



G) No gas	Leaks from the refrigeration circuit	Check the cooling circuit with a leak detector after having placed the circuit under pressure at about 4 bar. Repair, generate a vacuum and perform recharging
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CAUTION!



H) The system functions without ever stopping	No cooling gas	Refer to item G
	Faulty calibration of the function thermostat	Verify the calibration and eventually replace the master card
	Excessive thermal load	Reduce the thermal load
	The compressor does not supply the cooling yield expected	Check, replace or overhaul
	Fluid filter clogged	Clean or replace

I) The system works regularly but with insufficient capacity	There is too little refrigerant in the unit	Refer to item G
	There is moisture in the refrigeration circuit	Replace the filter and eventually dry or recharge the circuit



M) The pump does not start	Pump blocked after a long period of inactivity	Release the impeller
	Pump burnt	Verify or replace
	Differential water pressure switch tripped	Verify or replace
	No water in the circuit	Check for any leaks from the hydraulic system and top-up

CAUTION!



OPERATIONS ON THE REFRIGERATION CIRCUIT

IMPORTANT All work which involves discharging of the cooling circuit must include, for environmental safety purposes, the collection of the gas using the specific recovery system.

After having performed the repairs to the cooling circuit, make the following operations:

- seal check;**
- bleed and dry the cooling circuit;**
- fill with refrigerant.**

Seal check

Fill the cooling circuit with refrigerant R407C up to a pressure of 1 bar. Subsequently add nitric nitrogen using cylinders with reducers up to a pressure of 15 bar .

Check for leaks with the leak detector and, if found, discharge the cooling circuit before performing welds (with copper phosphorus alloy with 2% silver).

It is very important to discharge the cooling circuit completely before welding to avoid explosions.

It is very important NOT to use oxygen in place of nitrogen, to avoid explosions.

CAUTION!



Bleed and dry the cooling circuit

To achieve a good vacuum, use a suitable pump (1.4 mbar absolute pressure, 30 l/min. capacity). When the circuit is opened very briefly and this pump is used, it is normally sufficient to perform just one vacuum operation to an absolute pressure of 1.4 mbar.

When such a vacuum pump is not available, or when the circuit has remained open for long periods of time, it is strongly advised to use the triple evacuation method.

This method is also indicated when there is humidity in the circuit.

The vacuum pump should be connected to the charging sockets.

Implement the following procedure:

-evacuate the circuit to a pressure of at least 35mbar absolute, then fill the cooling circuit with R407C up to a pressure of about 1 bar;

-repeat the operation described always up to an absolute pressure of 35 mbar;

-repeat the operation described for the third time to the lowest absolute pressure attainable.

This procedure makes it possible to eliminate up to 99% of pollutants.

CAUTION!



Filling with refrigerant

Implement the following procedure:

-connect cylinders of refrigerant gas to the 1/4" SAE male filling socket on the liquid line, allowing a little gas to escape to eliminate the air in the connection pipe;

-turn the cylinder over and perform filling in liquid form until 75% of the total charge is reached;

-now connect to the filling socket on the intake line and, holding the cylinder in a vertical position, complete the charge until the temperature of the liquid pipe upline of the filter is less than 4°C for the chiller at the temperature read on the pressure gauge-thermometer which should be mounted on the delivery pipe. (Correct degree of liquid subcooling).

CAUTION!



DEMOLITION

Demolition requires that the cooling circuit should be discharged, collecting the gas using the specific recovery system to protect the health of people and the environment.

IMPORTANT : NEVER RELEASE THE GAS INSIDE THE COOLING CIRCUIT FOR ANY REASON WHATSOEVER INTO THE ENVIRONMENT.

CAUTION!

On demolition of the machine or the replacement of the compressor, carefully collect the oil from the latter unit and send it to a specialist centre for processing waste oils.

IMPORTANT : NEVER RELEASE THE OIL INSIDE THE COMPRESSOR FOR ANY REASON WHATSOEVER INTO THE ENVIRONMENT .



EMERGENCIES

In the event of:

Flooding: immediately open the automatic switch located upline of the machine power supply line and shut down the water pump if this is part of the hydraulic system. Intervene on the faulty part of the water circuit.



Fire: immediately open the automatic switch located upline of the machine power supply line and use a powder or CO₂ extinguisher.

CAUTION!

