

**USE AND
MAINTENANCE
HANDBOOK**

PAE-RAE



This manual has been prepared in compliance with the harmonised standard UNI EN 292/2 to the Machinery Directive 89/392, and it is an essential part to every Emicon unit

Rev. n° 4	Date of rev.: 06/11/07	File: RAE_MAN_EN_NO_MICRO.doc	Code: 101500007
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THIS MANUAL REFERS TO THE FOLLOWING UNIT:

UNIT	<input type="text"/>
OPTIONAL	<input type="text"/>
SERIAL No	<input type="text"/>
WIRING DIAGRAM No.	<input type="text"/>

 **ATTENTION**

EMICON units are only intended for professional uses.
The instructions contained herein and attached to the unit are to be strictly complied with whenever the unit is installed or serviced.
Any operation on this unit must be carried out by skilled personnel having themselves made fully conversant with these instructions.
The guarantee for this unit shall only be valid as long as the instructions contained herein are duly complied with.
This manual is intended for end users only in case of operations which can be carried out having the panels closed (fixed guards are not removed).
Data on this catalogue are only guideline data. EMICON A.C. S.P.A. reserves the right to make changes without prior notice
Before any operation inside the unit, turn OFF the main switch upstream the line feeding the unit; then open the front panel and turn OFF the unit main switch too.
Operations when power is still supplied to the electrical board and the panel is open are allowed to our skilled technicians only, who have been duly trained. In such conditions some of the system functions are not present.

ATTENTION

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

SAFETY

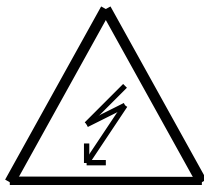
These instructions contain basic references to correctly and safely use and service our units.
Besides general safety norms, all specially marked points must be duly observed.

SAFETY MARKS CONTAINED IN THESE INSTRUCTIONS

This manual contains some information and references which are marked by symbols.
If the safety precautions marked by the symbol “**danger from general cause**” are not complied with



injuries to persons may be caused.
If the safety precautions marked by the symbol “**danger from electrical causes**” are not complied with



injuries to persons or damages to things may be caused.
If the safety precautions highlighted by the word



are not complied with, damages to the unit or to its functions may be caused.

DANGERS FROM NON OBSERVANCE OF SAFETY REFERENCES

Non-observance of safety references may cause bodily harm to persons or damage to the equipment. Failure to comply with safety references shall invalidate warranty and/or damage claims.

Non-compliance could have the following dangerous consequences:

- failure of important system functions;
- risk for the operators' safety due to electrical and/or mechanical causes.

ACTIVE SAFETY

The operating logic of our units is controlled by a microprocessor.
This microprocessor also manages faults and malfunctions (if any) of every part of the unit, thus ensuring no risks are run by machinery, persons and the environment.

PASSIVE SAFETY

Our units are completely enclosed by panels, which prevent access to dangerous areas from outside, including fans which are equipped with suitable protection grilles.

DECLARATION EC OF CONFORMITY

The Manufacturer

EMICON A.C. S.P.A.

Via Dragoni, 59

47100 Forlì (FC)

tel. (0039) 0543/411711

fax. (0039) 0543/411725

DECLARES

that the equipment

Model

Serial Number

suits the followings directives

- 73/23/CEE
- 89/336/CEE
- 98/37/CE

because it has been designed, manufactured and tested according to the following Standards

EN 12055	EN 61000-6-1	EN 292-1
EN 60204-1	EN 61000-6-2	EN 292-2
EN 60335-1	EN 61000-6-3	EN 294
EN 60335-2-40	EN 61000-6-4	EN 418
EN 60439-1		EN 563
		EN 954-1
		ISO 3744
		UNI 10615

Forlì, 31.10.07

Romano Santucci



Technical Manager

GENERAL INFORMATION

RAE chillers and PAE heat pumps are available in different sizes and different cooling capacities ranging from 20 to 110 kW. The following versions are offered:

VERSIONS

RAE ... - STANDARD CHILLER WITH AXIAL FANS

RAE ...C - STANDARD CHILLER WITH CENTRIFUGAL FANS

This version is supplied complete with:

- Control microprocessor
- Control panel for the unit (remote control up to 30 m)
- Water flow safety pressure-switch
- Modulating control of condensing pressure active on the fans' r.p.m.
- Electric heater on the water/gas exchanger to prevent frost-caused breakdowns

RAE ... U - ULTRASILENCED CHILLER WITH AXIAL FANS

RAE ...CU - ULTRASILENCED CHILLER WITH CENTRIFUGAL FANS

This version is supplied complete with:

- Control microprocessor
- Unit control panel (remote control up to 30 m)
- Water flow safety pressure-switch
- Modulating control of condensing pressure active on the fans' r.p.m.
- Low r.p.m.-fans ensuring low noise levels
- Electric heater on the water/gas exchanger to prevent frost-caused breakdowns

PAE ... - STANDARD HEAT PUMP WITH AXIAL FANS

PAE ... C - STANDARD HEAT PUMP WITH CENTRIFUGAL FANS

It is supplied complete with:

- Control microprocessor
- Unit control panel (remote control up to 30 m)
- Water flow safety pressure-switch
- Cycle- reversing valve
- Modulating control of condensing pressure active on the fans' r.p.m.
- Electric heater on the water/gas exchanger to prevent frost-caused breakdowns

PAE ... U - ULTRASILENCED HEAT PUMP WITH AXIAL FANS

PAE ... CU - ULTRASILENCED HEAT PUMP WITH CENTRIFUGAL FANS

It is supplied complete with:

- Control microprocessor
- Unit control panel (remote control up to 30 m)
- Water flow safety pressure-switch
- Cycle-reversing valve
- Modulating control of condensing pressure active on the fans' r.p.m.
- Low r.p.m. fans ensuring low noise levels
- Electric heater on the water/gas exchanger to prevent frost-caused breakdowns

TRANSPORT AND INSTALLATION

INSPECTION

Our factory supplies units in perfect working conditions, filled with refrigerant charge and anti-freezing oil. Customers are therefore required to check it out upon delivery.

Detected damages shall be immediately notified to carrier and noted down in the Delivery Note.

Customers shall draw up a report on detected damages and contact EMICON A.C. S.P.A..

TRANSPORT AND POSITIONING

IMPORTANT Do not stack the units even if they are packaged.

To handle the unit please refer to the relevant picture (see appendices “B”).

The following considerations should be taken into due account, before you choose the most suitable place to position your unit :

- length and origin of hydraulic lines;
- correct ventilation of condensing coil;
- origin of electric supply cables;
- make sure the unit is accessible for maintenance and/or repairs;
- make sure the support your unit stands on is strong enough;
- possible sound resonance problems;
- vibrations the unit transmits to the ground (if necessary mount suitable vibration-dampers) .

ATTENTION !



ATTENTION !



INSTALLATION

Lay the unit on a perfectly even surface.

The unit can be installed both indoors and outdoors, provided that the following conditions are met:

- make sure air cannot blow back between suction and delivery; to this purpose distances shall be observed as are indicated in the relevant picture;
- if the machine is fitted with centrifugal fans and is installed outdoors lay some of the air distribution lines into ducts to prevent water and leaves from getting into the fan compartment.

ATTENTION !

ATTENTION !

HYDRAULIC CONNECTIONS

Comply with the local regulations and with the following instructions:

- join pipes as shown in the picture (see appendices “B”);
- use vibration-damping joints to prevent vibration transmission and allow thermal expansion;
- Fit the hydraulic circuit with cut-off cocks and water filter at water inlet opening;
- IMPORTANT: thoroughly drain the hydraulic system;
- in case of low temperature operations (outlet water temperature lower than 4°C) use anti-freezing mixtures; please refer to the “working limits” paragraph.

ATTENTION !

ATTENTION !

ELECTRIC CONNECTIONS

Check power supply against name plate data on unit (voltage, frequency, phase number). Relevant regulations must be strictly adhered to .

Use a power supply cable whose section shall not be smaller than the value shown in the wiring diagram and whose length shall be moderate to ensure there won't be excessive voltage drops.

Upstream the cable shall be protected by means of an automatic circuit breaker or of three fuses whose nominal current is equal to that of the unit's main disconnecting switch inside the unit's electric panel. The breaking power of these elements must be at least equal to the max. short-circuit current which is generated if a failure occurs in the place where the unit is installed.

On the "user's terminal box" (see wiring diagram) necessary information on enabling responses and external signalling (REMOTE ON-OFF, total alarms) is reported.

A remote control panel is also available. Carefully follow the instructions listed in paragraph "Preliminary start-up".

ATTENTION !

ATTENTION!

MAIN COMPONENTS

Panels and frame

IMPORTANT: panels (fixed guards) enclose potentially dangerous areas in case of failure or damage; before they are removed disconnect the unit power supply from the main switch and close the water cocks.

The panels enclosing the various parts of the unit are made up of painted galvanised steel plate.

The technical compartment is completely closed, with acoustic insulation and separated from the air flow. It contains the compressors and the main components of the unit.



Compressor

SCROLL compressors with high-efficiency, low sound-level orbiting spirals fitted with electric protection and basic vibration dampers.

Air/Gas Exchange coil

It includes a sub-cooling circuit to optimise efficiency and facilitate defrosting when the heat pump is running.

The frame is made up of galvanised steel, copper pipes, special corrugated aluminium fins to allow for a better exchange power.

Water /Gas Exchanger

Properly insulated exchanger consisting of braze-welded plates. All versions are equipped with anti-frost electric protection.

Axial fans

Axial fans are directly coupled to an electric 8-6 pole motor with overload protection, electronic balancing, blades with low-sound-level wing contour and complete with a special air conveyor and protection grilles.

Standard units are supplied with modulating control for speed.



IMPORTANT The protection grille for fans is a fixed guard enclosing a risk zone of the unit. Do not remove it, replace it if damaged.

Centrifugal fans

Double suction centrifugal fans, high-efficiency motor coupled to the impeller with belt. Low operating sound level and high static pressure.

The protection degree of the motor-fan unit makes it suitable for outdoors operation.

IMPORTANT The protection grille for fans is a fixed guard enclosing a risk zone of the unit. Do not remove it, replace it if damaged.



Gas circuit

Each circuit is equipped with: thermostatic valve, dehydrating filter, fuse plug, high and low pressure switches,

The heat pump version is further fitted with a four-way valve for cycle reversion and an orifice tube on the external exchanger.

Electric board

The electric board is located inside a proper compartment which is fitted with a main disconnecting switch and an external panel with door.

It includes: remote control switches, thermal switches for any requirement, auxiliary transformer, microprocessor, additional terminal box.

Control system

It consists of a display microprocessor which is installed on the internal safety panel of the electric board.

WORKING LIMITS

The water flow rate supplied by the unit is related to a 5 °C temperature jump between input and output which depends on the supplied cooling power. The max. allowable flow rate entails a 3 °C jump (higher flow rates may cause too high evaporating temperatures and damage to the evaporator).

The min. allowable flow rate entails a 7 °C jump (lower flow rates may cause too low evaporating temperatures, as a consequence the safety devices would be enabled and the unit would stop)

Cool water temperature:

The min. outlet temperature of evaporator is 5 °C not included “brine” versions (*); the max. inlet temperature to the evaporator is 20°C.

Heated water temperature:

The min. inlet temperature to the condenser (steady conditions) should not be lower than 25 °C (lower temperatures may cause compressor’s failure and possible breakdown).

(*): Operation with low-temperature water:

if the cool water temperature is lower than 4 °C (out of the evaporator) a water-ethyl glycol mixture should be used (see table below). The antifreeze thermostat (always 3-5 °C above the mixture freezing point), the operating thermostat and the set point (4°C above the desired water temperature out of the evaporator) must also be set to new values.

OPERATION WITH WATER-ETHYL GLYCOL MIXTURE								
DESCRIPTION	PERCENTAGE OF ETHYL-GLYCOL OUT OF MIXTURE WEIGHT							
	5	10	15	20	25	30	35	40
FREEZING TEMPERATURE	-2.1	-4.5	-7	-10	-13	-17	-21	-25

External air temperature:

to ensure the unit can properly perform cooling, the external air temperature must be between -15 and 40°C. For different requirements please contact our Engineering division.

When the unit works as a heat pump there are no special limits as to the external air temperature; please note however that the unit efficiency is impaired when the temperature is very low (below 0°C).

NOTE: using the unit improperly forthwith voids the guarantee; moreover it may cause unit failures and the tripping of safety devices.

NOTE: if the unit is installed outdoors EMICON recommends that a min. 15% of glycol is added into the water circuit..

PRELIMINARY START UP

The machine is fitted with an anti-frost heater on the evaporator; such heater is always ON when the unit is powered and the compressor is OFF. In winter times when the unit is not used we recommend that you do not disconnect the unit or empty the hydraulic circuit to prevent ice formation and damages to the evaporator.

ATTENTION !

If the unit is a heat pump select the type of operation (heating or cooling).

Press ON: if everything is OK, the machine start-up is enabled by the operating thermostat and the water differential pressure switch.

If you wish a remote-control panel, please follow these instructions carefully:

- turn the main disconnecting switch to OFF
- fit a screwdriver into the slots available and lever to separate the (white) control console from its (black) base on the panel which closes the electric board
- disconnect the electric cable from the console terminal box
- remove the panel which closes the electrical board and disconnect from the user terminal box of the unit the cable which was previously connected with the console
- remove the (black) console base from the panel and attach it to the desired wall
- to electrically connect unit and console, use a 4x0.5 mm² twisted shielded cable. At this stage be careful that:
 - 1) the cable passes through the suitable holes (unit side - see appendices)
 - 2) the cable passes through the round hole of the console base (console side)
 - 3) connect shielding from the unit side to the main ground node
- be careful to polarities are shown as in the wiring diagram
- assemble the panels which close the unit again
- turn the main disconnecting switch ON again



ATTENTION !

IMPORTANT: when the unit is equipped with a Scroll three-phase compressor, check its direction of rotation as soon as you start up the unit. If it rotates in the wrong direction it is noisier, pressure does not



SINCERT



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UNI EN ISO 9001:2000
UNI EN ISO 14001:2004

increase and electric input values are lower. The internal electric guard can be opened after a few minutes of rotation in the wrong direction.

Reset correct direction of rotation by reversing two out of the three power supply phases.

To turn off the unit use the OFF control.



TROUBLESHOOTING

The following tables show some of the most frequent causes of machine stops and malfunctions.

TROUBLE	PROBABLE CAUSE	POSSIBLE CURE
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A) The unit doesn't start up	Defective connection or open contacts	Check voltage and close contacts
	External response is missing	Check water pump and flow detector operation Drain system and check other external enabling responses (if any)
	Compress. delay timer	Wait for set delay time
	Running thermostat response is missing	System temperature OK, no request; check setting and working
	Anti-freezing thermostat response is missing	Check setting and working
	Safety device response is missing	See points D - E



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B) Compressor doesn't start	Burned or seized compressor	Replace compressor
	compressor remote control switch is de-energised	Check voltage at compressor coil's ends and check out for coil continuity
	Power circuit open	Try to find out the reason why protection is activated; close compressor's circuit

ATTENTION !



C) Compressor starts and stops repeatedly	Min. pressure switch is actuated	See point E
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D) Compressor doesn't start Because the max. pressure switch has been actuated	Pressure switch out of order	Check and replace
	Excessive refrigerant charge	Recover excessive gas
	Clogged air condenser Too limited air capacity	Clean with compressed air or water jet
	Condenser fans are not working	See point F
	Condenser fans rotate in wrong direction	See Electric Connections paragraph
	Pressure switch to stop defrost is out of order	Check and replace
	Non-condensing gas	Refill circuit after it has



ATTENTION !



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	in cooling circuit	been emptied and air has been exhausted (vacuum).
E) Compressor does not start because the min. pressure switch has been actuated	Press. switch out of order	Check and replace
	Empty unit	See point G
E1) Compressor starts and stops repeatedly	Clogged evaporator too limited air capacity	Clean with compressed air
	Ice formation on the evaporating coil	See point L
	Evaporator's fans are not working	See point F
	Clogged freon filter	Check and replace
	Thermostatic expansion valve is not working correctly	Check, clean or, if necessary, replace
E2) Three-phase units: compressor starts but does not heat and is noisy	Compressor rotates in the wrong direction	Exchange two phases out of three



F1) Fans do not start	Speed variator is wrongly set or defective	Check control system or replace it
	Faulty condensing temperature probe	Check or replace



G) No gas to the system	Leak in the cooling circuit	Check cooling circuit with leak finder after the circuit is supplied with about 4 bar pressure. Then repair, exhaust air (vacuum) and charge. See para. 6.2
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ATTENTION !

H) The unit works and never stops	Cooling gas is missing	See point G
	Operating thermostat wrongly set	Check set values and possibly replace microproc.
	Excessive thermal load	Reduce thermal load
	Compressor cooling capacity isn't as high as expected	Check, replace or reset
	Clogged liquid filter	Clean or replace

I) The unit works properly, but its capacity is not sufficient	Insufficient refrigerant charge	See point G
	Moisture inside the cooling circuit	Replace filter and, if necessary, dry and re-charge circuit

ATTENTION !

	4-way reversing valve is de-energised	check power supply and valve coils. If necessary replace valve
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L) De-frost cycle is never started	4-way reversing valve is de-energised	Check power supply and valve coil and, if necessary, replace valve
	De-frost thermostat is out of order or it has a wrongly set value	Check, if defective replace otherwise adjust setting value



M) Pump doesn't start	Pump is blocked after a long storage period	Unlock impeller
	Burned pump	Check or replace
	Water differential press. switch is actuated	Check or replace
	No water inside the circuit	Check out hydraulic system to find leaks, if any, and refill



ATTENTION !

N) Signal of water differential pressure switch is not present	Pump set for low speed	Increase speed through variator on the pump
	Limited water capacity of the system	Check pressure drops in the system
	Shut-off valve of water circuit is closed	Open closed valves
	Insufficient hydraulic circuit pressure	Supply 1.5-2 bar pressure to circuit

TYPE AND FREQUENCY OF ROUTINE MAINTENANCE

IMPORTANT

BEFORE ANY OPERATION INSIDE THE UNIT TURN OFF THE MAIN SWITCH UPSTREAM THE UNIT POWER LINE. THEN OPEN THE FRONT PANEL AND TURN OFF THE UNIT MAIN SWITCH TOO.

IMPORTANT

ONLY OUR TRAINED TECHNICIANS ARE DULY QUALIFIED TO SERVICE THE UNIT WHEN POWER IS SUPPLIED TO THE ELECTRICAL BOARD AND THE PANEL IS OPEN . IN THESE CONDITIONS SOME OF THE SYSTEM FUNCTIONS ARE NOT PRESENT

Periodical maintenance is a good practice to check if the unit works properly.

Please note that these services, including possible maintenance operations, should be carried out by qualified personnel only.

Every month:



- check if the electrical terminals on the electric board and on the terminal boxes of the various electric parts are correctly clamped ;
- check if the contacts of the remote control switches are clean and in sound conditions (if necessary, replace them);
- check if the water circuit is uniformly filled (no air inside of it);
- check if the water differential pressure switch operates correctly;
- clean condensing receiver (heat pumps);
- clean fins of condensing coil by blowing compressed air or, if necessary, flushing them with water (operate in the opposite direction with respect to airflow);
- check if the defrost procedure is correctly performed.

ATTENTION !

If, after a few working hours, the unit makes anomalous noises an extraordinary check shall be carried out to detect and eliminate their causes.

MAINTENANCE OF THE COOLING CIRCUIT

IMPORTANT During any operation requiring the cooling circuit to be exhausted, it is necessary, to ensure environmental safety, that the gas is collected into a proper receiver.

After the cooling circuit is repaired, carry out the following operations:

- tightness test;
- cooling system draining and drying;
- refrigerant charge.

TIGHTNESS TEST

Fill the cooling circuit with gaseous R22 and reach a 1 bar pressure. Then add nitrogen through bombs equipped with a reducing valve and reach a 15 bar pressure.

Check leaks with the leak finder. If leaks are detected exhaust the cooling circuit before welding (with copper-phosphor alloy and 2% silver).

It is important that the cooling system is completely exhausted before welding, to prevent explosions. Never use oxygen as a substitute of nitrogen, otherwise explosions might occur..

ATTENTION !



COOLING CIRCUIT DRAINING AND DRYING

For a good vacuum condition use a suitable pump (1.4 mbar absolute pressure, 30 l/min. capacity). When the circuit is opened for a very short time, with this pump you normally need only one vacuum operation to reach the absolute pressure of 1.4 mbar.

If such a vacuum pump is not available, or if the circuit remains open for a long time, we strongly recommend that you follow the three-fold pumping method.

Such method is also advisable if moisture is present in the circuit.

The vacuum pump must be connected to the intake openings.

Comply with the following procedure:

- evacuate the circuit up to a 35 mbar absolute pressure at least, then fill the cooling circuit with R22 and reach an about 1 bar pressure;
- repeat the above described operation and reach an absolute pressure of 35 mbar;
- repeat the above described procedure a third time and reach an absolute pressure which should be as low as possible.

ATTENTION !



With this procedure up to 99% of pollutants can be removed..

REFRIGERANT CHARGE

Always follow this procedure:

-Connect the refrigerant bomb to the 1/4" SAE male intake on the liquid line, blow out some gas to exhaust air from the interconnection tube;

-capsize the bomb and fill the circuit with liquid refrigerant: fill 75% of total charge ;

-now connect it to the intake on the suction line and, holding the bomb upright, fill the line completely until in the chiller the temperature of the liquid tube, before the filter, is 7-8°C lower (or 4°C lower in case of heat pumps) than the °C temperature read on the R22 pressure gauge on the distribution tube.

ATTENTION !

DISMANTLING

When the unit is to be dismantled drain the cooling circuit and collect gas through a suitable receiver. This operation ensures safety to persons and environment.

IMPORTANT DO NOT DISPOSE OF GAS CONTAINED IN THE COOLING CIRCUIT IMPROPERLY FOR NO REASON.

ATTENTION !

When the unit is dismantled or the compressor is replaced carefully pour compressor's oil into a suitable receiver and send it to a specialised centre for oil disposal.

IMPORTANT DO NOT DISPOSE OF COMPRESSOR OIL IMPROPERLY FOR NO REASON WHATSOEVER



EMERGENCIES

By:

Floods; immediately cut out the automatic circuit breaker that is located upstream the power supply line to the unit and turn off the water pump - if it is part of the hydraulic system. Then repair the defective part of the water circuit..



Fire: immediately cut out the automatic circuit breaker which is located upstream the power supply line to the unit and use a powder-based or CO₂ - based fire extinguishing product.

ATTENTION !