
Instruction Manual



AQUAFLAIR

ERAC

Air-cooled water chillers with axial fans

ERAH

Air / water cooled heat pumps with axial fans

ERAF

Air-cooled water chillers with axial fans and free-cooling system

0521A - 0621A - 0721A - 0821A - 0921A - 0922A - 1021A - 1022A - 1221A –
1222A

R410A (50-110kW)





Version: 1.5 **Date: July 2010**

The technical data shown in the manual are not binding.

The images shown in this manual are for descriptive purposes only. They may therefore differ from specific models which are selected.

UNIFLAIR SpA policy is one of continuous technological innovation and the Company therefore reserves the right to amend any data herein without prior notice.

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This unit has been subjected to risk analysis under Directive 2006/42/EEC. The technical solutions implemented during the design phase are described in the unit's technical file.

This unit is subject to the European Community Directive 97/23/EEC regarding pressurised equipment. Any intervention on the pressure circuit must be authorized by Uniflair, and carried out by technicians approved by Uniflair. If any of the following components: compressors, liquid receivers, safety valves, refrigerant pressure switches are replaced, Uniflair must be immediately informed of the serial number of these replaced components, otherwise Uniflair shall not guarantee the integrity of the equipment.

Additionally, if any soldered joints need to be repaired on site, Uniflair must be immediately informed of which joint has been repaired and of the name of the engineer.

This equipment has been manufactured for safe operation for the purposes for which it was designed **as long as the installation, operation and maintenance are carried out according to the instructions in this manual and the labels attached to the unit.**

Warnings in this manual which are particularly important for user safety are shown by the danger symbol.

WARRANTY

If these instructions are NOT complied with, the warranty shall be void.

IMPORTANT WARNINGS



This unit contains refrigerant gas circuits, chilled water under pressure, live electrical components, hot surfaces, sharp edges (the fins on the coils) and rotating devices such as the fans.

All service and maintenance operations which require access to the inside of the unit while it is in operation must be performed by qualified and experienced personnel who are aware of the necessary precautions which must be taken.



Before accessing the inside of the unit, disconnect it from the electrical power supply.

In any case, all safety legislation regarding the installation location must be followed.

In the event of fire, water and other conductive substances must not be used to put out the fire near live electrical components. This warning must be displayed on notices in the unit installation location.

If the refrigerants used come into contact with fire they decompose, forming acids and other irritants. The smell of these substances, **even at concentrations below dangerous levels**, gives enough warning to allow evacuation of the area at risk.



Make sure that the mains supply to the unit is the same as that shown on the data plate.

This unit is designed to cool/heat fluids such as water and anti-freeze mixture. If another mixture is used, it can cause corrosion and deterioration.

This unit is not suitable for operation in aggressive environments.

Install a mechanical filter in the section of tubing near the intake of the unit to prevent the heat exchanger being blocked with pieces of welding or flakes of oxidised metal from the water mains.

Emptying of the unit is recommended in the event of prolonged stoppage.

The units are designed to operate both with pure water and with anti-freeze mixtures.

If used with anti-freeze mixtures, the units can only operate with water mixed with ethylene glycol (*) or propylene glycol with a maximum concentration weight of 30%.

With glycol mixtures which are higher than this, it may be necessary to select a different pump group and/or free-cooling circuit (if present).

The use of different fluids may cause corrosion or deterioration to the hydraulic section and unit pump groups.

Basic version units are not suitable for operation in aggressive environments.

(*) the use of ethylene glycol may be subject to specific regulations or legislation. Please pay attention to any eventual limitations regarding its use.

Please contact Uniflair S.p.A. for applications which fall into the limitations described above.

OUTDOOR AIR LOW TEMPERATURE

Units without freecooling: drain all the water from the system before the winter to avoid freezing.

In periods in which the temperature may fall below 0°C, empty the unit in order to prevent serious damage caused by the formation of ice.

This precaution is not necessary if the unit is charged with an appropriate anti-freeze mixture.







Air-cooled water chillers with free-cooling system must be loaded with anti-freeze mixture.

If the unit is fitted with the *optional* heating cable, it must be turned off without cutting the electrical power supply.

“In compliance with Community directive 94/9/CE these units are not to be used in potentially explosive environments”

R410A → GWP = 1900

SYMBOLS USED

SYMBOL	MEANING	SYMBOL	MEANING
	GENERAL DANGER		MOVING COMPONENTS
	IMPORTANT WARNING		HOT SURFACE – DANGER OF BURNING
	HIGH VOLTAGE – ELECTRICAL RISK		SHARP EDGES

SAFETY

The new ERAC chillers, ERAH heat pumps and ERAF units with free-cooling system feature state-of-the-art technology ensuring maximum reliability, safety, quiet operation and respect for the environment.

- 1) **RELIABILITY.** Trouble-free operation of Uniflair precision chillers is ensured by rigorous production process controls carried out under ISO 9001-certified quality procedures:
 - Quality control of components;
 - Pressure testing of refrigerant and water circuits;
 - Testing of current absorption and IEC safety testing;
 - Calibration and testing of instruments and safety devices;
 - Final testing of unit under operating conditions.

- 2) **ACTIVE SAFETY.** UNIFLAIR safety and control systems have a supervision and prevention function with:
 - Automatic blocking of components in dangerous conditions;
 - Indication of unit operating status and reading and continuous display of circulating fluid temperature;
 - Management of compressor start-ups to reduce excessive switching on and off;
 - Alarm signal in the event of a refrigerant leak;
 - Start-up timings of the compressors to reduce inrush currents;
 - Compressor crankcase heater activation when the compressor is switched off;
 - Indication of anomalous conditions and/or alarm states.

- 3) **PASSIVE SAFETY.** The essential functions of these units are protected against anomalous function conditions and potential damage by:
 - High and low pressure switches on the refrigerant circuit (HP with manual re-set);
 - Anti-freeze protection to prevent freezing of the evaporator;
 - Compressor motor electrical protection;
 - Water side differential pressure switch both for the compressor and the evaporator;
 - Crankcase heater (standard for free-cooling and heat pump versions)

- 4) **PERSONAL SAFETY.** The design and wiring of all UNIFLAIR chillers and heat pump is conforms to IEC electro-technical standards. Electrical panels have auxiliary 24V circuits and are equipped with:
 - General door interlock switch;
 - Compressor protection fuses;
 - Thermo-magnetic cut off switches.

DOCUMENTATION INCLUDED WITH THE UNIT



Each chiller and heat pump is delivered complete with the following documentation:

- Instruction manual;
- Control manual;
- Installation drawings;
- Diagram of the refrigerant circuit;
- Electrical diagrams;
- Spare parts list;
- EC declaration with list of European directives and norms to which the unit conforms;
- Warranty Conditions;
- R134a safety data sheet.

DATA PLATE

The chiller data plate is located in the electrical panel and gives the following information:

- Unit model;
- Serial number;
- Voltage, number of phases and power supply frequency for primary and auxiliary circuits;
- Voltage and absorbed power;
- OA (*Operating current*), FLA (*Full load current*) and LRA (*Locked rotor current*);
- Safety device settings;
- Refrigerant type and charge in kg for each circuit.

POWER SUPPLY		SERIAL No.		rev./			
		NO.	VOLT.	OA	FLA	LRA	kW TOT
				(/1)	(/1)	(/1)	(*)
COMPRESSOR 1 COMPRESSOR 2 FANS <input type="checkbox"/> PUMP (OPTION) <input type="checkbox"/> FREE-COOLING PUMP				SAFETY DEVICE SETTINGS <input type="checkbox"/> REFRIGERANT FACTORY CHARGE: kg./CIRC. 1 FACTORY CHARGE: kg./CIRC. 2			
TOTAL (kW)	MOD.	<input type="checkbox"/> MODEL <input type="checkbox"/> MODEL <input type="checkbox"/> MODEL					

GENERAL DESCRIPTION

Aquaflair

The **ACQUAFLAIR** ^{ERAC/H/F} series is composed of ten chillers with hermetic SCROLL compressors, with nominal cooling capacities ranging from **50 to 110 kW**, available in the following series:

- **Cooling only**
- **Heat pump**
- **Chiller with free-cooling**

Our commitment to respect environmental regulations, a commitment typical of UNIFLAIR products, is fully maintained in these series, which have been created and **for standard operation with R410A refrigerant**.

ERAC/H/F units are based on cutting-edge technology and include many innovative features and details.

The various versions can be managed by a UECH control (microprocessor and local user terminal in a single element) or by a UpCO1m system composed of a basic interface board and a local user terminal; both types of control are visible and accessible externally by means of a transparent hatch.

The UECH control allows remote control but does not permit connection to the Uniflair supervision system. The UpCO1m control is suitable for configuration with a LAN card (std), I/O contact, clock card (optional), RS485 serial adapter (optional) for connection to the Uniflair supervision system or a Building Management System.

In both cases please refer to the control manual within the documentation included with the unit.

The design criteria for the **ERAC/H/F** range is based on three key words: **efficiency, reliability and flexibility**.

Hermetic SCROLL compressors, environmentally friendly R410A refrigerant and an electronic thermostatic valve (in versions with UpCO1m control) allow increased energy efficiency in all operating conditions.

The units can be supplied both in **low noise and ultra low noise** versions, reaching sound pressure levels which are among the lowest in their category.

Particular attention has been paid to reliability in the choice of components for adjustment / control: each component is monitored so that it operates within optimum operating parameters.

MAIN SAFETY FEATURES

AQUAFLAIR^{ERAC/H/F} air-cooled water chillers and heat pumps are designed for **outdoor** installation in residential, commercial and technological applications: The chilled water which is produced can be sent to the fan coils or other terminal units for climate control or the air conditioning of technological environments and may also be used for cooling/heating within industrial processes.

If requested with UPC1m microprocessor control, the units can be connected in parallel on a single water circuit in order to increase the units' cooling capacity when needed: it is, in fact, possible to create a local network with the microprocessor control board, creating solutions which are able to satisfy each and every need.

AQUAFLAIR^{ERAC/H/F} water chillers and heat pumps feature state-of-the-art technology allowing maximum reliability, safety, quietness of operation and respect for the environment.

EASE OF INSTALLATION AND MAINTENANCE

The compact dimensions and weight of these chillers make installation even in limited spaces. All of the versions are equipped with a general door interlock switch which allows direct connection to the mains power supply without the need for an external switch; short-circuit protection fuses should, however, be fitted in order to protect the power supply line.

The water chillers and heat pumps are assembled and fully tested in the factory, making installation simply a question of connection to the electrical power supply and water circuits.

Particular attention has been paid to planning the position of the components to allow easy access for ordinary and emergency maintenance.

RESISTENCE TO THE ELEMENTS

Corrosion resistance is an essential feature of UNIFLAIR units. They are built to operate even under extremely severe environmental conditions. The self-standing framework is made of galvanised sheet steel (colour RAL 7037) to ensure corrosion resistance.

USE OF NON CORROSIVE OR AGRESSIVE FLUIDS

The exchangers in these units have been designed to use water or ethylene glycol – ethylene propylene mixes. The use of fluids which are different from this may cause corrosion to the equipment.

RESPECT FOR THE ENVIRONMENT

UNIFLAIR products have always been built with respect for the environment. All synthetic refrigerants damage the ozone and contribute to increasing the temperature of our planet, thus playing a role in increasing the greenhouse effect.

R410A gas, an equi-component mix of R32 and R125, lacks chlorine which guarantees environmentally-friendly, efficient, reliable operation of conditioning systems.



Uniflair continues to offer cutting-edge solutions with its AQUAFLAIR^{ERAC/H/F} range with the aim of reducing its impact on the environment by not only using the environmentally friendly refrigerant R410a, but also eliminating the use of non-recyclable materials and reducing energy consumption, increasing thermo-dynamic efficiency of the components and using compressors with an elevated energetic performance.

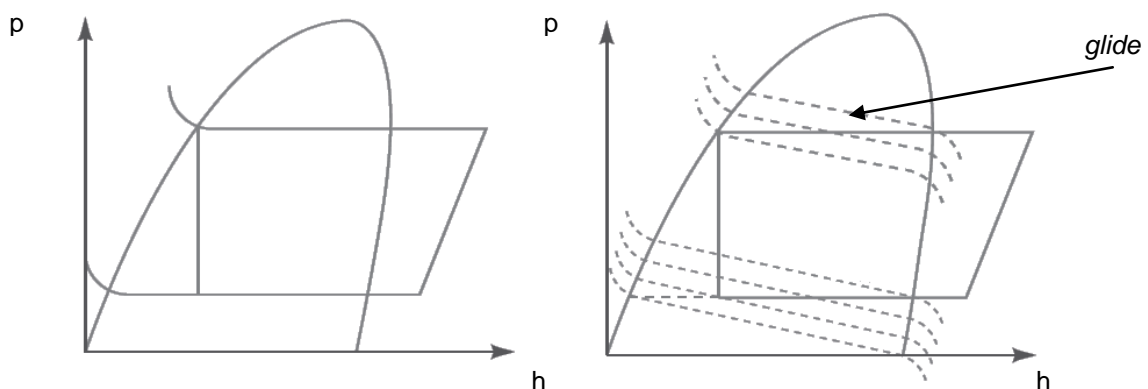
ENVIRONMENTALLY FRIENDLY R410A REFRIGERANT

R410A / Efficiency

R410A gas, whose behaviour is almost azeotropic, is characterised by the absence of glide during state changing phases, which thus occur at a constant pressure without energy loss.

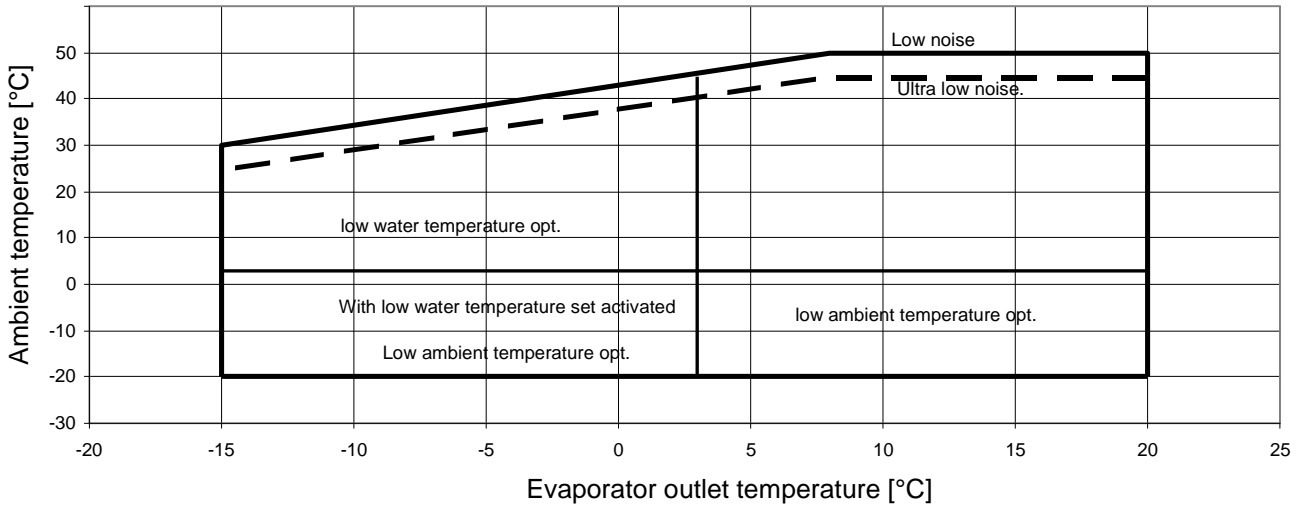
The greater thermal exchange capacity (greater intrinsic efficiency) and a considerable reduction in the load loss (-20% compared with R22 in the condenser and -40% in the evaporator) mean it is possible to install compact components (evaporator, tubing and compressor) with the same power output, thus benefiting from significant reductions in volume and a considerable increase in efficiency.

Performance levels are maintained over the years, and do not decrease due to separation of the gas components. In fact, eventual refrigerant losses, with the necessary integrations, can be managed quickly and efficiently without having to completely replace the refrigerant, thus the initial composition remains unvaried.

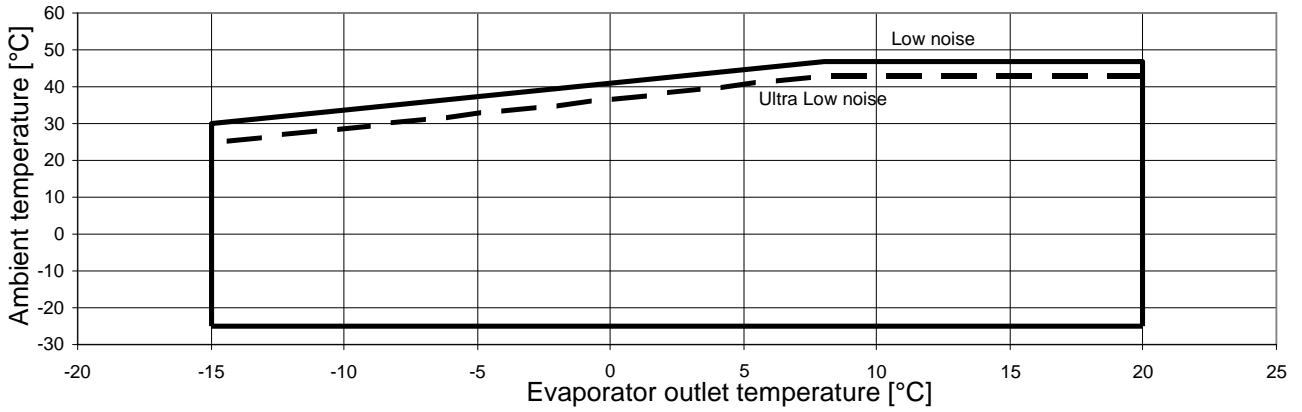


OPERATING LIMITS

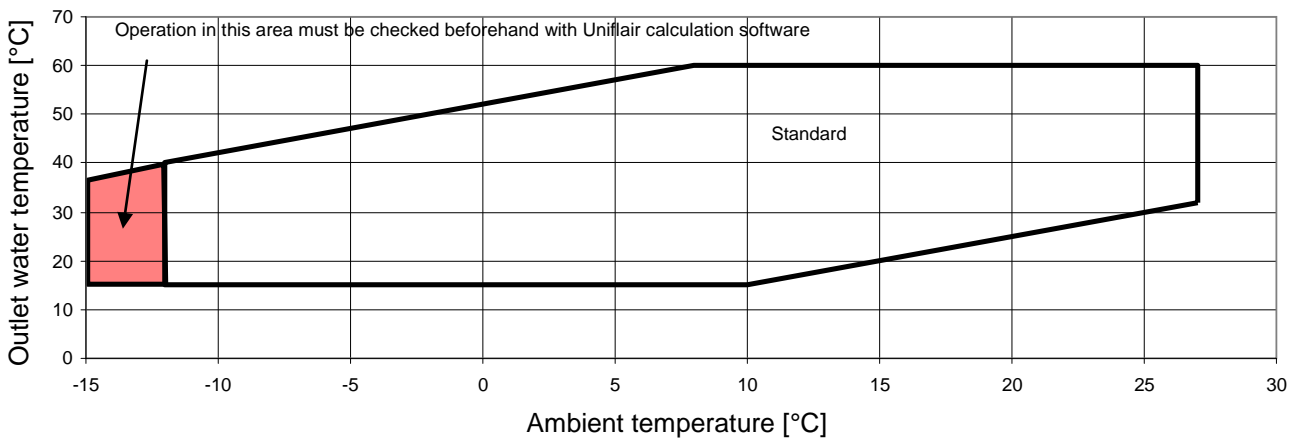
ERAC



ERAF



ERAH – heating mode



In cooling mode the standard units are suitable for an outlet temperature of 5°C

It is possible to obtain outlet water temperatures of down to -15°C provided that the water contains enough anti-freeze to prevent the water freezing inside the evaporator.

Minimum fluid temperature with unit running	5.0 °C	3.0 °C	-5.0 °C	-10.0 °C	-18.0 °C	-28.0°C
Freezing temperature	0 °C	-4.4 °C	-9.6 °C	-16.1 °C	-24.5 °C	-35.5 °C
Percentage in weight of glycol	0%	10%	20%	30%	40%	50%

WATER TEMPERATURE: PRECISION ON THE SET POINT

In the AQUAFLAIR^{ERA} range, control of the chilled water (or hot water for ERAH units) is carried out by checking the outlet temperature.

The unit can therefore regulate the effective temperature required by the system ensuring that the set point is maintained with an elevated level of precision.

In the table below the values of this precision are shown, referring to units equipped with an inertial water tank or with a system capacity as shown in the table.

Model		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
ΔT on the outlet water set point											
load < 50% of the nominal	°C	max $\pm 1,6^\circ\text{C}$									
load > 50% of the nominal	°C	max $\pm 1^\circ\text{C}$									
Minimum system capacity ¹	Lt	135	135	240	240	240	240	300	300	300	300

¹ Only with units without water tank

MAIN COMPONENTS

Electrical panel

The panel conforms to EC directives (2006/95/EEC and EMC 2004/108/EEC) and features:

- IP54 protection grade
- 12 / 24 V and 230V auxiliary transformer
- General door interlock switch
- Thermo-magnetic protection for the compressors, fans and auxiliaries
- Remote control switches for the compressors
- Anti-condensation heaters (with low ambient temperature option)
- Motor protection for the pump/s and the free-cooling pump (ERAF)



Microprocessor control

For the ERAC/H/F chillers and heat pumps the following types of control are available:

- UECH
- UpCO1m

UECH control



The **UECH** microprocessor control is integrated with the local user terminal where the regulation software is housed. This control includes the following components:

- User terminal with LCD display and signal lights
- Outlet chilled water temperature regulation
- Anti-freeze protection
- Free-cooling management (ERAF)
- Protection and timing of compressors and pumps
- Modulating condensing pressure control
- Total / partial heat recovery management
- High pressure transducers
- Alarm code signalling and centralisation for general alarm reports as a clean contact
- Remote cycle inversion control (ERAH)
- ON-OFF remote control

UpCO1m control



The **UpCO1m** control system consists of two sections:

- a control board which consists of one (UPC1m) I/O board containing the regulation software and which is fitted in the unit.
- a User Terminal which consists of a user interface and which can be installed locally or remotely.

Features:

- 16 bit microprocessor, 14 MHz, internal registers and operations at 16 bit, 512 byte of internal RAM;
- FLASH MEMORY: up to 2 Mbyte per programme;
- 128 kByte RAM static;
- RS485 serial output for LAN (LAN card);
- 24 Vac/Vdc power supply;
- Telephonic connection for the user terminal;
- LED indication of power supply

Compressors

All of the units are equipped with two highly efficient hermetic SCROLL compressors with a low sound power level and integrated thermal protection.

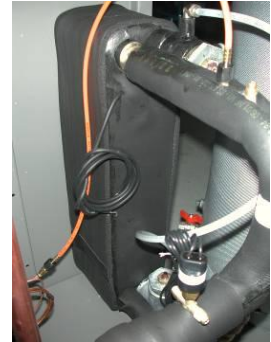


ERAC/F units with the suffix **21 are provided with two compressors connected in parallel on the same refrigerant circuit: The unit therefore features two partialization steps, ensuring modulation of the cooling capacity.



Water side exchanger

The direct expansion brazed plate evaporator / condenser is entirely made of stainless steel and features counter flow. The exchange surface is configured in such a way as to maximise the exchange coefficient with reduced pressure drops. The inlet and outlet connections are equipped with air bleeding and draining. The closed-cell expanded neoprene insulation prevents the formation of condensation and reduces heat dispersion.



Air side exchanger

The condenser (evaporator) is sized in order to operate at high ambient temperatures, it is composed of a finned pack exchange coil with aluminium fins and mechanically expanded copper piping to obtain improved metallic contact for maximum exchange capacity.



Fans

ERAC/H/F units are equipped with new generation axial fans made from a composite material: aluminium and reinforced plastic. This solution creates significant advantages in terms of efficiency, reliability and noise levels.



Refrigerant components / main hydraulic components

- Dryer filter
- Liquid sight glass
- Dual flow thermostatic expansion valve with external equalisation in stainless steel
- High and low pressure switches
- Cycle inversion valve (ERAH)
- Liquid receiver (ERAH)
- Differential water flow pressure switch: blocks the unit in the event of a lack of water flow, protecting the chiller from damage
- Direct onboard connections for:
 - Checking the liquid sight glass
 - Setting the expansion valve
 - Refrigerant load

HYDRAULIC CIRCUIT

ERAC/H/F units are available with the following hydraulic configurations:

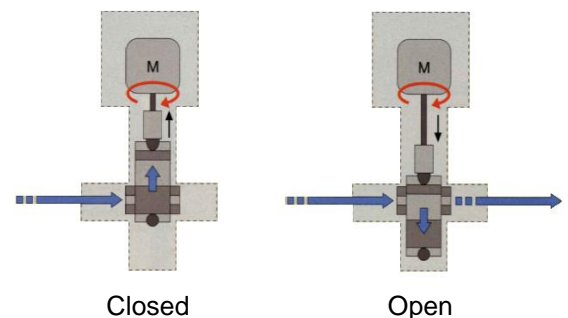
- Without pump
- Unit equipped with 1 pump
- Unit equipped with 2 pumps
- Unit equipped with 1 pump and a water tank
- Unit equipped with 2 pumps and a water tank
- Unit equipped with 1 pump and a water tank in primary/secondary configuration
- Unit equipped only with a water tank



ELECTRONIC EXPANSION VALVE

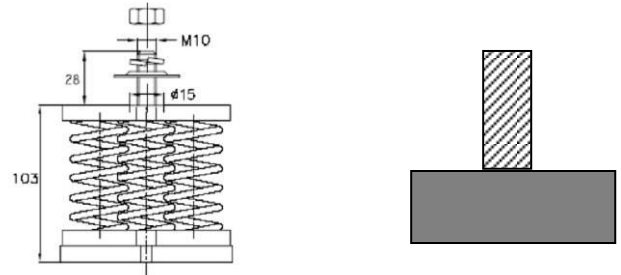
Units equipped with UpCO1m control use an electronic expansion valve driven by a diver which sends signals to open and close the valve depending on the level of super-heating required.

When the compressor is idle, refrigerant doesn't flow through the valve. When there is a request for cooling, and the compressor is activated, the drivers are informed of the action which is taking place and it starts to control the mass flow of refrigerant, positioning the electronic expansion valve in the operating conditions required according to the operation of the system.



ANTIVIBRATION SUPPORTS

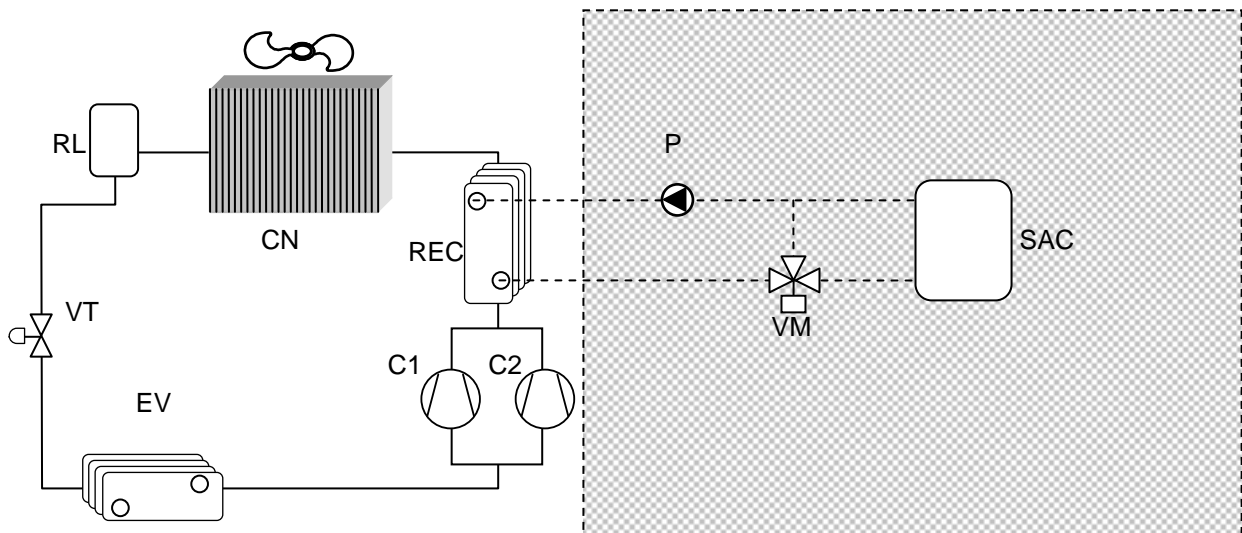
Both rubber and spring anti-vibration supports are available as optional to insulate the unit from the support slab.



TOTAL AND PARTIAL HEAT RECOVERY

In the AQUAFLAIR^{ERA} range, both partial and total heat recovery are carried out by plate heat exchangers placed between the discharge section of the compressor and the air condenser; the following diagram shows the recovery circuit within the unit and the circuit used.

For correct operation of the chiller it is necessary to avoid supplying the recovery exchanger (R) with water which is too cold (temperatures lower than 30°C). For this reason, it is advisable to install a 3-way valve (VM) as shown in the diagram.



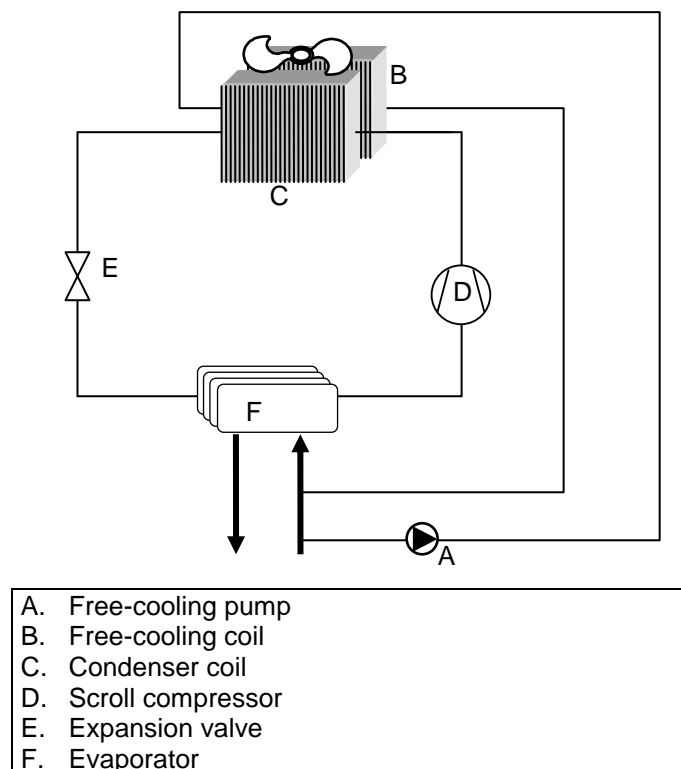
- CN Condensing coil
- RL Liquid receiver (only for ERAH)
- VT Expansion valve
- EV Evaporator
- C1/2 Scroll Compressors
- VM 3-way valve
- SAC Water tank
- P Circulation pump
- REC Recuperator



If the system involves technological systems or industrial processes which operate continuously throughout the year, and therefore also with low external temperatures, it is energetically convenient to use systems which have been designed to exploit these conditions; cooling systems with a free-cooling device are a typical solution.

The idea behind the free-cooling mode is producing chilled water using external air instead of direct expansion operation.

ERAF are free-cooling chillers and in these units, if the external temperature is low enough, it is possible to reduce or even eliminate, depending on the external temperature, the use of the “refrigerant” part of the chiller, i.e. the compressors, which are the components principally responsible for energy consumption. Water is circulated by the free-cooling pump inside special heat exchange coils and cooled by external air forced in by the fans, which, together with the pump, are the only components which absorb energy. The water is then conveyed back into the circuit and supplied to the equipment. Chilled water can therefore be available at absolutely no cost.



It is important to bear in mind that an installation’s heat load - i.e. the amount of “cold” energy required - depends on both the heat generated inside it (hence machinery, people, lights...) and the external temperature. Generally, therefore, the heat load in summer will be greater than in the winter months. Based on this premise, we can reasonably assume that if the chilled water produced needs to have a temperature of approx. 7°C during the warmer months, during the colder months $T_{\text{outlet water}} = 10^{\circ}\text{C}$ may be sufficient.

Based on these assumptions, the unit can work in full free-cooling mode with a T_{external} as high as 5°C.

In general operating ranges for ERAF units can be split into:

- Free-cooling, with $T_{\text{ext}} < 5^{\circ}\text{C}$
- Mixed, with $5^{\circ}\text{C} < T_{\text{ext}} < 12$ to 15°C
- Mechanical cooling (direct expansion) with $T_{\text{ext}} > 12$ to 15°C

FREE-COOLING SERIES

Redundancy: “N+1”

When designing systems for which uninterrupted service must be guaranteed, reliability is fundamental.

Technological environments, i.e. rooms which contain technological equipment and/or particular processes which require guaranteed uninterrupted optimum operating conditions, as well as many industrial processes, very often have higher breakdown costs than the cost of the equipment itself.

Designing a reliable system means choosing both a unit which is intrinsically reliable, and therefore designed and built in such way as to guarantee an extremely low breakdown and inefficiency percentage, as well as creating suitable reserves: the system is equipped with one or more additional units, and for this reason we speak of the “n+1” logic, which ensures that there is always a unit in “stand-by” which guarantees emergency intervention when, for any reason, a system component shows signs of having problems.

Intelligent free-cooling

By combining the above concepts in applications where uninterrupted operation is required, units equipped with a free-cooling device featuring a redundancy logic can be installed and therefore part of the available cooling capacity is in stand-by.

The same consideration can be made regarding the available free-cooling capacity.

The principle which forms the basis of intelligent free-cooling is that of also exploiting, when external temperatures allow, the air / water exchangers of the unit/s in stand-by.

By linking all of the air / water exchangers together, it is possible for the water which is to be cooled to flow through all of the free-cooling coils which are available.

Thanks to the fact that in Uniflair free-cooling units the water is sent to the free-cooling coils by a pump and not by a simple three-way valve, it is in fact possible, to also use the exchangers of the units in stand-by and therefore increase the free-cooling capacity which is available and therefore its application, with evident advantages in terms of energy saving.

DIMENSIONS and WEIGHTS







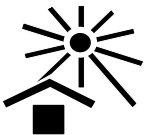
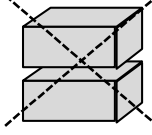
ERAC-H-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Height	mm	1560	1560	1560	1560	1560	1560	1874	1874	1874	1874
Depth	mm	1190	1190	1190	1190	1190	1197	1192	1197	1192	1197
Width	mm	2008	2008	2798	2798	2798	2804	3075	3076	3075	3076
Weight ERAC											
Weight (basic version without hydraulic kit)	Kg	607	612	730	760	766	781	975	990	1003	1018
Weight (version with pump) (*)	Kg	632	637	760	790	796	811	1007	1022	1035	1050
Weight (version with water tank and pump) (*)	Kg	692	697	850	880	886	901	1117	1132	1145	1160
Weight with total heat recovery – basic version without hydraulic kit (*)	Kg	641	646	775	804	810	n.a.	1028	n.a.	1056	n.a.
Weight ERAH											
Weight (basic version without hydraulic kit)	Kg	632	637	760	790	797	n.a.	1019	n.a.	1047	n.a.
Weight (version with pump) (*)	Kg	662	667	790	822	829	n.a.	1051	n.a.	1079	n.a.
Weight (version with water tank and pump) (*)	Kg	752	757	880	932	939	n.a.	1161	n.a.	1189	n.a.
Weight with total heat recovery – basic version without hydraulic kit (*)	Kg	666	671	805	834	841	n.a.	1072	n.a.	1100	n.a.
Weight ERAF											
Weight (basic version without hydraulic kit)	Kg	700	705	855	884	890	905	1128	1143	1157	1172
Weight (version with pump) (*)	Kg	730	879	914	920	911	926	1139	1154	1169	1184
Weight (version with water tank and pump) (*)	Kg	790	939	1004	1010	1001	1016	1249	1264	1279	1294
Weight with total heat recovery – basic version without hydraulic kit (*)	Kg	704	709	861	890	896	n.a.	1136	n.a.	1164	n.a.

(*) with empty hydraulic circuit.
n.a. not available

INSTALLATION GUIDE

TRANSPORT AND HANDLING

The symbols on the packaging conform to the ISO7000 standard and are explained below.

SEGNO GRAFICO	SIGNIFICATO	SEGNO GRAFICO	SIGNIFICATO
	FRAGILE: handle with care.		THIS SIDE UP shows the orientation of the unit.
	PROTECT AGAINST MOISTURE: the packaged unit must be stored in a dry place.		TEMPERATURE LIMITS: the unit must not be stored outside these limits.
	CENTRE OF GRAVITY: shows the centre of gravity of the packaged unit.		NO HOOKS: do not use hooks to lift the packed unit.
	KEEP AWAY FROM HEAT: the unit must be kept away from heat sources.		DO NOT STACK.

Move the unit as near to the installation site as possible before removing packaging.

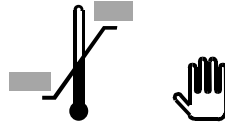
The unit must be lifted using equipment and procedures illustrated in the drawings in the last section of this manual.

WARNING: check the drawing attached to the unit or the installation drawings printed on the last few pages of this manual.

Unit dimensions are given in the technical data tables and installation drawings included with the unit.

RECEIVING AND STORING THE UNIT

Each unit leaves the factory in perfect condition. Therefore please check the unit very carefully on delivery and notify the transport company immediately and in writing of any damage which may have been caused during transportation.



RESPECT THE STORAGE TEMPERATURE: FROM -15°C....+50°C

POSITIONING THE UNIT – OPERATING SPACE

This unit has been built for outdoor installation and therefore with a free flow of air to the condensing coil. The air flow aspirated by the fans through the condensing coil must not be blocked in order to not affect the unit's efficiency and to avoid the safety devices intervening.

In any case the safety standards in force in the installation site must be respected as well as the minimum distances indicated (see operating space paragraph), they must also be respected when any maintenance is carried out.

Avoid installation in particularly harsh environments (in this case please contact Uniflair S.p.A. for possible technical solutions.)

The rubber or spring anti-vibration supports (both optional) reduce the transmission of vibrations to the support slab.

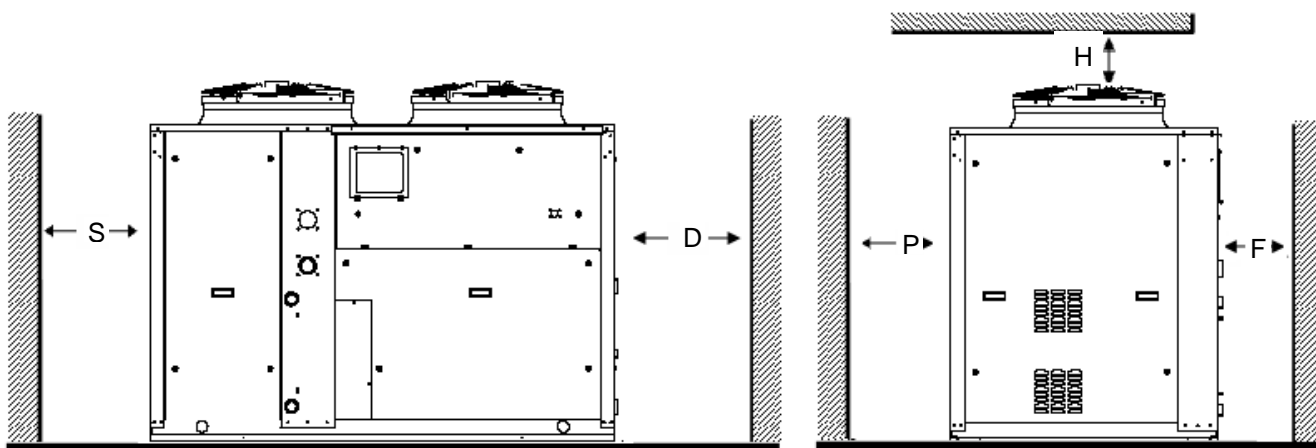


Check that the load capacity of the floor is sufficient to support the weight of the unit.

The unit must be set on a solid, level surface. Once positioned, level the unit with the aid of a suitable spirit level using the adjustable feet and, where necessary, shims: the gradient **should not exceed 0.5 degrees under any circumstances.**

Warning: the unit must not be turned on its side or upside down.

OPERATING SPACE



In the figures shown above, the minimum advised distances are indicated for correct operation, accessibility to the components and for maintenance.

WARNING:

Avoid air recirculation between the air expelled from the condenser and the air which is to be aspirated.

ERAC-H-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
H	mm	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
D	mm	500	500	500	500	500	500	500	500	500	500
S	mm	500	500	500	500	500	500	500	500	500	500
P	mm	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
F	mm	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

NOTE

If two of the dimensions out of P, F and H are near their limits, it is advisable to install the unit ensuring that the third dimension is at least three times that shown in the table.

ACCESSIBILITY TO THE MAIN COMPONENTS

WARNING: When carrying out maintenance ALWAYS set the general cut off switch to 'O'.

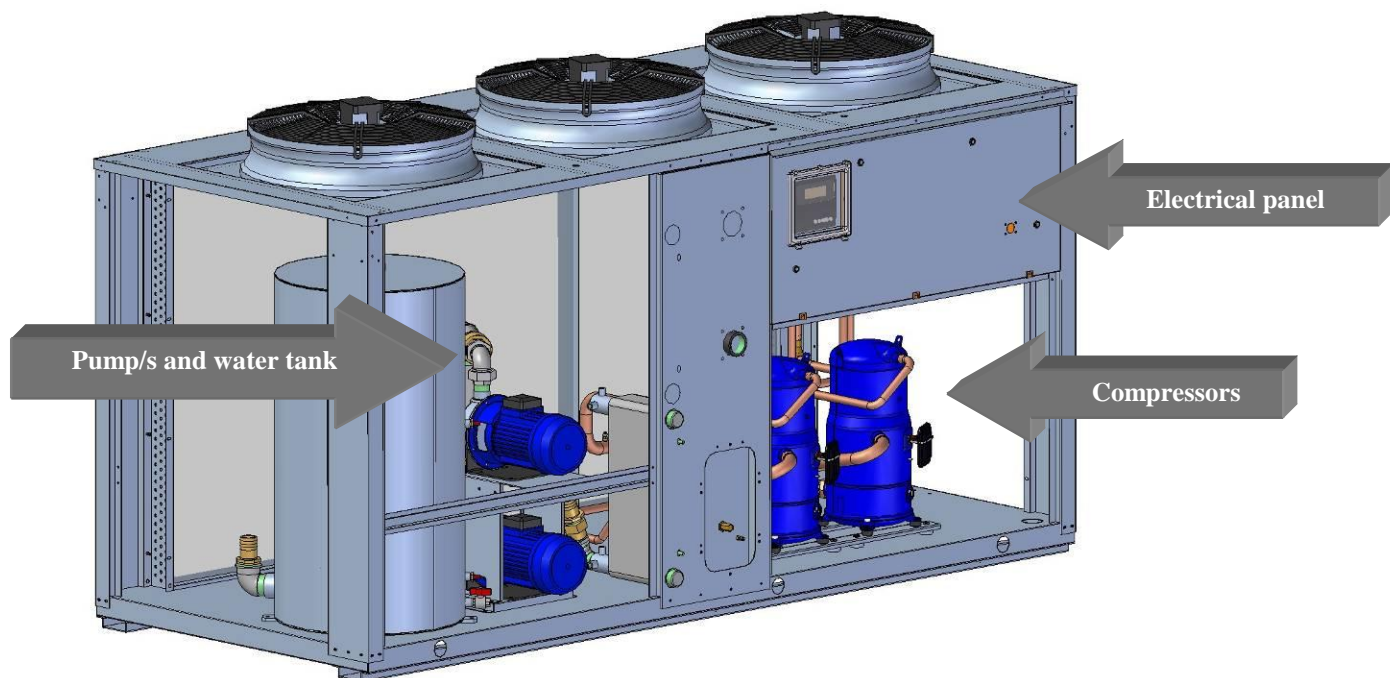


ELECTRICAL PANEL

To access the electrical panel, set the lever of the general cut off switch to 'O' and turn latches a ¼ turn and lift using a suitable flat-head screwdriver.

This operation allows the panel to be opened, which is hinged to the base of the electrical panel.

ALL OF THE PANELS ARE FIXED USING A SCREWDRIVER AND ROTATING FASTENERS



COMPRESSORS

To access the compressor compartment turn the latches which hold the front panels of the unit a ¼ turn (using a suitable flat head screwdriver).

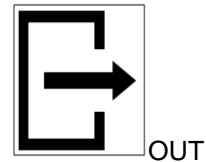
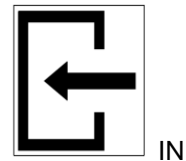
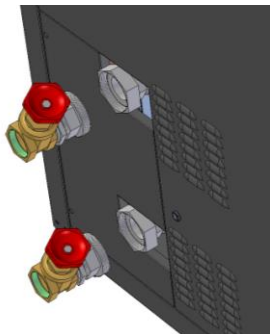
WARNING: HOT SURFACE – BURN HAZARD. After having removed the panel the compressors and the discharge piping of the refrigerant circuit can be accessed, which during normal operation reach high temperatures and may therefore be potentially dangerous.

HYDRAULIC CONNECTIONS

1) **CHECK** that the section of the chilled water pipes and the circulation pump fitted are adequate. An inadequate water flow significantly reduces the cooling capacity of the unit.

2) **CHECK** the water intake/output directions. There are labels next to the intake and output connections as shown in the diagram below.

(The valves of the intelligent free-cooling attachments are supplied disassembled and packaged separately and can be found inside the unit near the pump and the expansion tank. The client is responsible for installing the valves).



3) **CONNECT** the chiller using flexible tubes to stop the transmission of vibrations. Fit shut-off valves so that the unit can be isolated from the water circuit;

4) **INSULATE** the chilled water pipes to stop the formation of condensation on the external surface;

5) **FIT** temperature measuring points on the pipes near the intake and output connections;

6) **INSTALL** a metal filter in the section of pipe next to the unit **intake** to prevent pieces of welding or flakes of rust entering the heat exchanger.

7) **PROVIDE** a discharge well near the output connection in case the unit needs to be emptied.



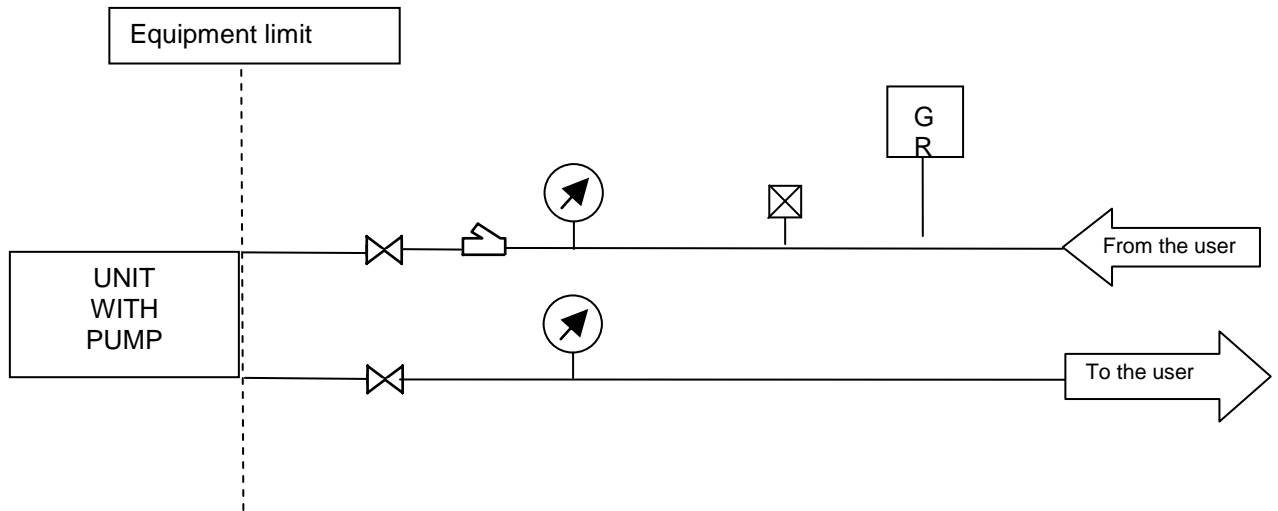
WATER TANK

In units with the heat pump option, the water tank can be found packaged separately inside the unit and needs to be installed by the client.

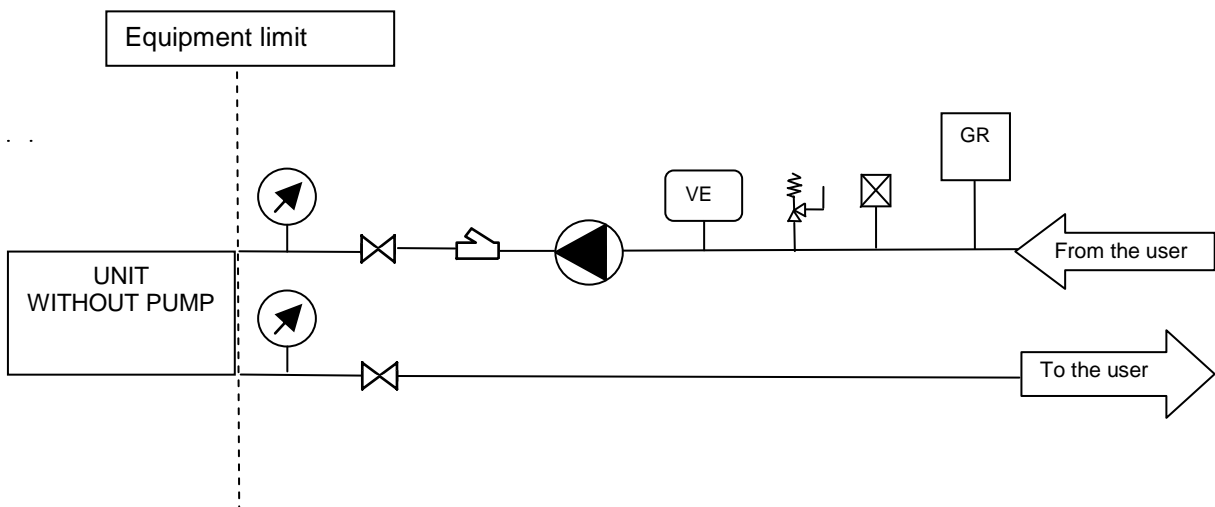


If during winter shutdown the external temperature falls below zero, it is necessary to empty the unit if it doesn't contain glycol and make sure that there is the option of using heaters.

EXAMPLE OF UNIT INSTALLATION WITH OR WITHOUT PUMP



- | | | | |
|----|---------------------|--|-------------------|
| VE | EXPANSION VESSEL | | SAFETY VALVE |
| GR | FILL IN | | VALVE |
| | PUMP | | MECHANICAL FILTER |
| | AUTOMATIC AIR VALVE | | MANOMETER |



FREE-COOLING HYDRAULIC CONNECTIONS

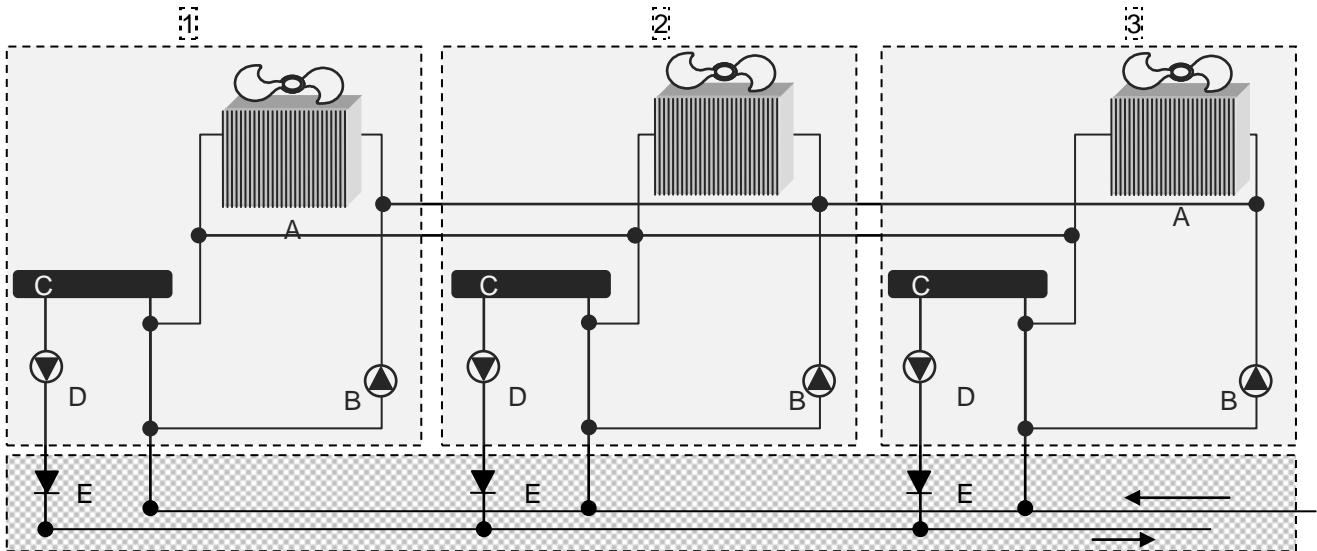
When carrying out the hydraulic connections between the air / water exchangers two separate cases need to be identified:

- Units equipped with an on-board pump on the primary circuit
- Installations supplied with a primary pump outside the unit (placed on the suction or discharge side)

The system design can vary depending on each particular situation.

Units equipped with an onboard pump

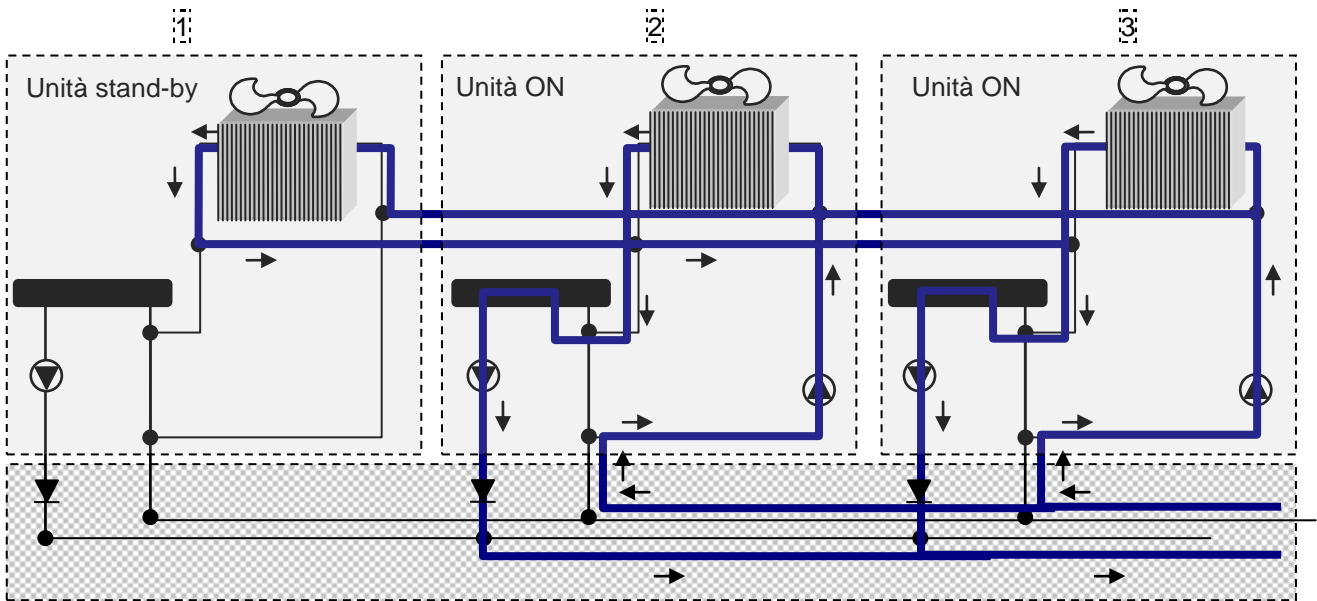
When there is an onboard pump for the primary circuit, the solution is as shown in the following diagram.



A	Free-cooling coil	E	Check valve
B	Free-cooling pump		Supplied by Uniflair
C	Evaporator		Not supplied by Uniflair
D	Main pump (onboard the unit)		

By analyzing a situation such as the following, where unit 1 is in stand-by, units 2 and 3 are operating and the three units are connected together with an intelligent free-cooling solution and when the external temperature is low enough for free-cooling to be activated, the control of the two units which are operating activates the fans in the stand-by unit (1) and the free-cooling pump (B) of the units themselves (2 and 3); this happens in such a way that the water arriving from the system is sent to all of the available the free-cooling coils.

In fact, since the stand-by unit is also linked, the water also flows through its air / water exchangers (see the diagram below).

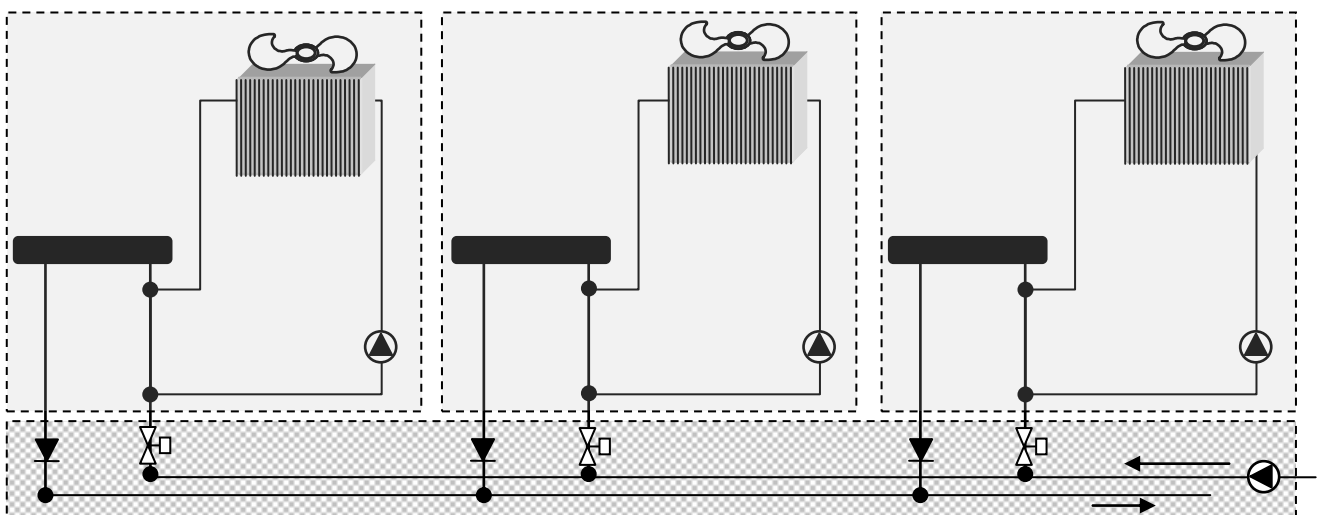


Finally, the difference in pressure, which is due to the fact that the pump which is installed onboard the stand-by unit (1) is at a standstill, prevents a by-pass through the evaporator of this unit.

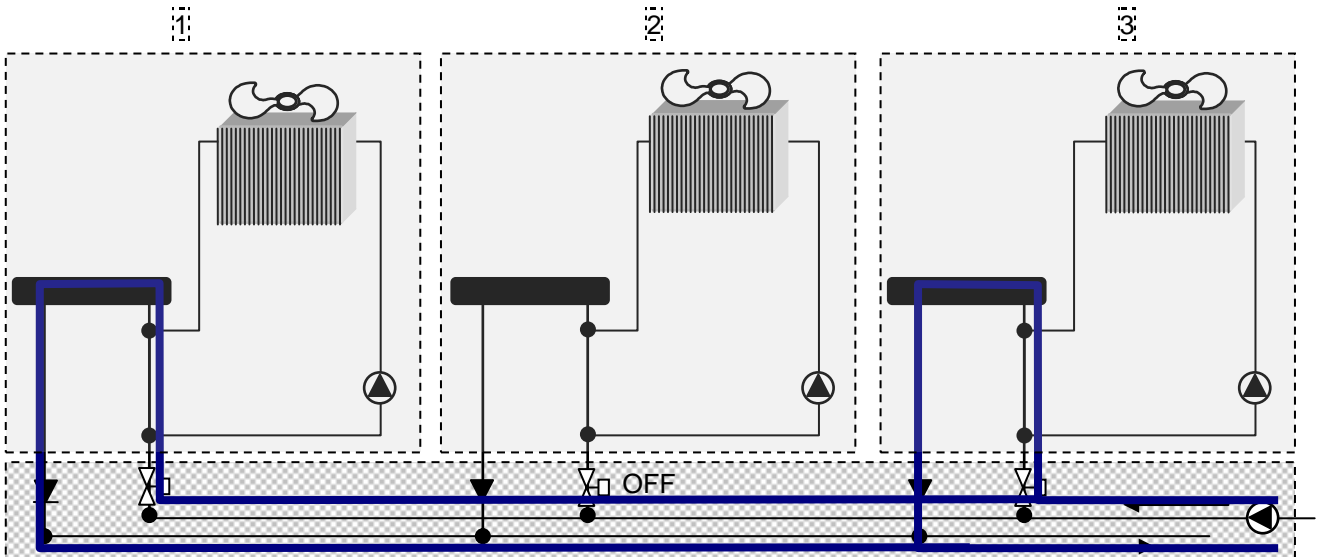
System equipped with a pump for the primary circuit outside the unit

If there isn't an onboard pump, but one has been mounted up or down stream from the chillers, it is necessary to equip the unit with devices which isolate the stand-by unit.

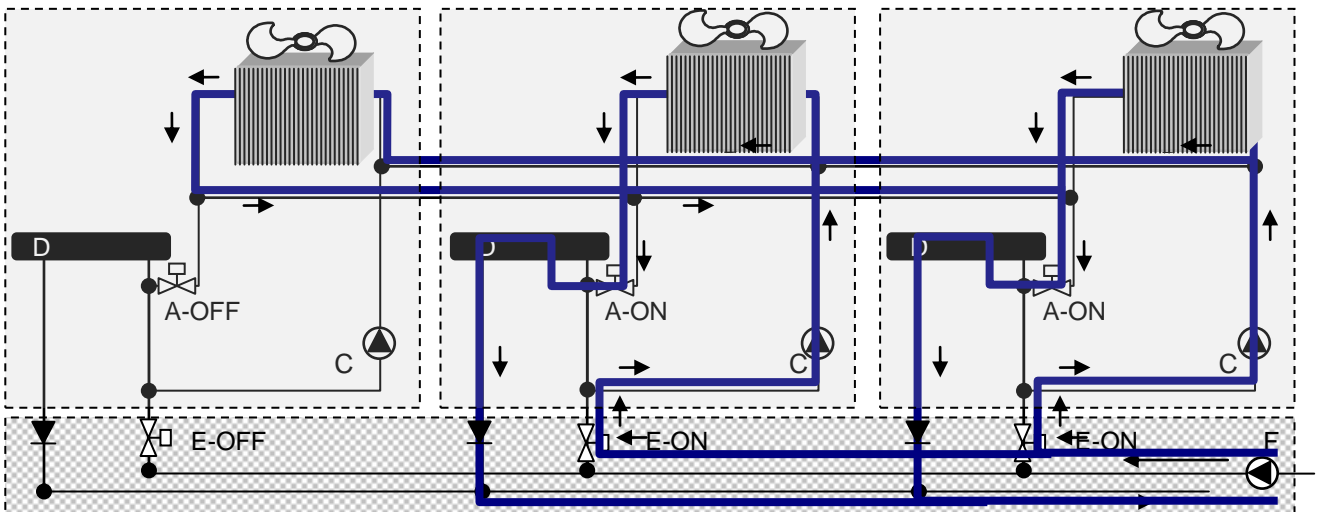
For this reason a motorized valve is usually placed on the inlet line and a check valve on the outlet line (see the diagram below).



During operation, the stand-by unit is isolated by the motorized valve which is placed on the aspiration line and the non return valve which is placed on the discharge line. In the following diagram, operation with units 1 and 3 operating and unit 2 in stand-by is shown.



When considering an intelligent free-cooling solution for installations of this type, it is necessary for the units to be equipped with an additional internal motorized valve in order to prevent an eventual by-pass through the evaporator of the stand-by unit.



A	Free-cooling coil	E	Check valve
B	Free-cooling pump		Supplied by Uniflair
C	Evaporator		Not supplied by Uniflair
D	Main pump (onboard the unit)		

WIRING

(consult wiring diagram)

In order for accidents to be prevented and for the chiller to provide good, lasting, unaltered service, it is that essential wiring is carried out correctly, in a professional manner and in accordance with the regulations in force.

GENERAL INSTRUCTIONS

CONNECTION TO THE POWER SUPPLY



It is extremely important that the phases are connected correctly in the positions indicated in the electrical diagrams supplied with the unit, **since incorrect connection will prevent correct operation.**

The electrical wiring must be carried out by qualified technicians.

The power cables must be protected against short circuit and current overload by a suitable device which conforms to the current legislation in force.

The section of cable must be calibrated by a protection system placed upstream and which must take into account the temperature, the type of installation, the number of cables placed in parallel and the type of insulation used. Please refer to the relative tables supplied concerning current legislation in force.

It is extremely important that the earth connection is carried carefully, using a cable which is suitable both in size and quality (conforming to current legislation).

It is important that the protection cable runs parallel and near to the power supply cable.

When sizing the supply line of the unit, the total FLA, FLI and LRA values which are shown the electrical data table must be taken into consideration.

OPERATION DESCRIPTION

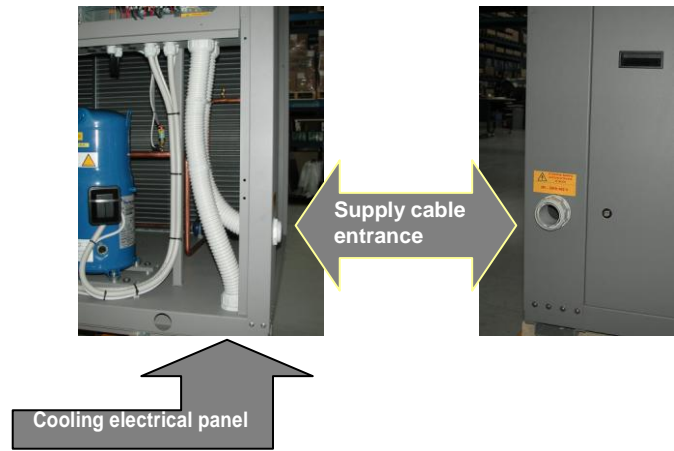
OPEN the door of the general electrical panel, which is located on the front of the unit;

CHECK that the network voltage corresponds to the voltage shown on the data plate of the unit (voltage, number and frequency of phases).

INSERT the power supply cable using the cable gland which can be found on the external side next to the compressor housing (see the drawings at the end of this manual).



The pipework used for cooling the electrical panel draws in air from the base of the unit and **must not be used for passing through the supply cable**, the electrical panel could superheat and cause consequent damage to the relative electrical and electronic components.



The supply cable is not supplied by UNIFLAIR S.p.A. and must be sized correctly by the installer. The section of supply cable **must be chosen according to its length** and the type of installation, according to the maximum absorbed current of the chiller and in such a way as to not cause an excessive fall in voltage (The supply voltage must be between $\pm 10\%$ the nominal value).

CONNECT the cables to the terminals of the general cut off switch after having checked that none of the electrical parts are connected to the power supply.

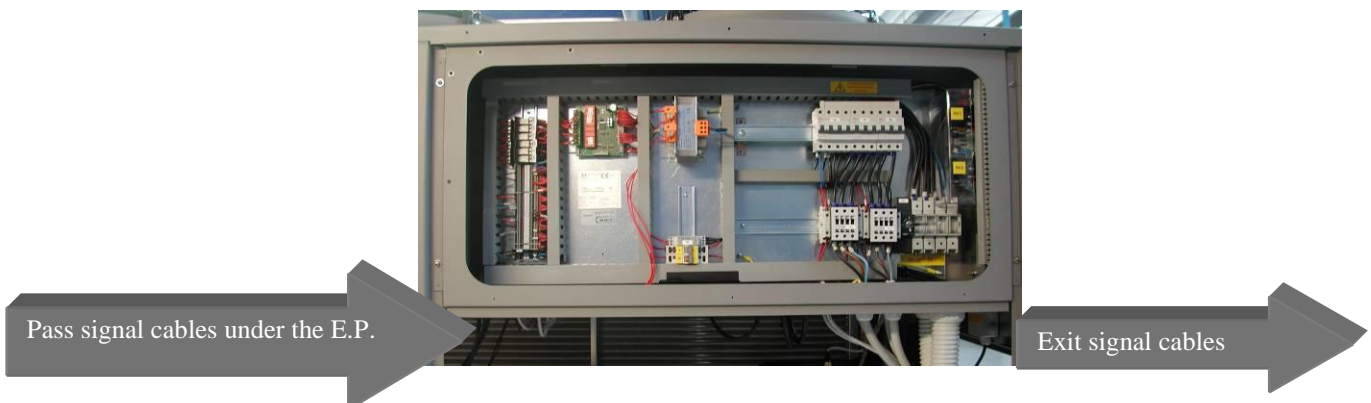
For connection to a remote on-off, E/I switch, alarm signal and supervision system:

CONNECT the remote ON/OFF cut off switch to the terminals indicated in the electrical diagram.
Pass the cables outside the electrical panel as shown in the figure below.

CONNECT the remote SUMMER/WINTER selector to the terminals indicated in the electrical diagram.
Pass the cables outside the electrical panel as shown in the figure below.

If a remote alarm signal is required (when there isn't a remote user terminal) carry out the following procedure:

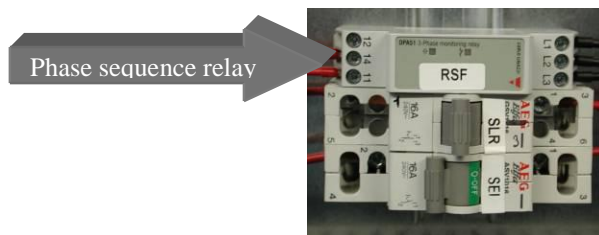
USE the exchange contact indicated in the electrical diagram enclosed with the unit documentation for GENERAL ALARM signal or for the intervention of one of the protection devices.
Pass the cables outside the electrical panel as shown in the figure below.



CHECK LIST FOR START-UP AND FINAL TESTING

Once installation has been completed, carry out the following operations in the sequence shown below; for any problems which may arise, consult the section of the manual titled “Problem Solving” or contact a Uniflair S.p.A. technical assistance centre.

Close the general cut off switch and all of the thermo-magnetic switches in the Electrical Panel, check that the two leds of the phase sequence relay are lit up (green and red), if only the green led is lit it means that the power supply is connected but it is necessary to invert two phases in order to allow the compressors to rotate in the right direction (with UECH control, the E41 alarm appears, while with mP20 control the alarm phases are inverted).



Units with crankcase heaters (standard in heat pump and free-cooling models) must be connected to the power supply at least 12 hours before unit start-up (closing the thermo-magnetic cut off switch in the electrical panel), this enables the oil contained in the compressor crankcase to be heated and migration of the refrigerant contained within the crankcase itself.

Open all of the valves and water shut off valves.

Start up the unit following the instructions included in the control manual enclosed with the unit documentation.

PROBLEM SOLVING

GUIDE TO TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE	CHECKS/CORRECTIVE ACTION
THE CHILLER DOESN'T WORK	The onboard electrical panel isn't connected to the power supply	Check that the unit is connected to the power supply Check that the general cut off switch is closed
	The control base card is not connected to the power supply	Check that the IM8 automatic cut off switch of the auxiliaries is armed Check that the fuse protection of the board hasn't intervened
	The board is connected to the power supply but unit operation is not activated	Check that there are no alarms present
HIGH DISCHARGE PRESSURE OR INTERVENTION OF THE HIGH PRESSURE SWITCH	The air flow to the condenser is insufficient or the inlet temperature is too high	Check to see if there is any recirculation of the condensing air and that the instructions container in the paragraph "Positioning the chiller" have been followed correctly
		Check that the air temperature is within the unit's operating limits
		Check that the finned pack coils and metal filters are not dirty
		Check the fan rotation direction
	Control of the condensing pressure is not efficient	Control the setting and operation of the fan regulator
	One or more of the fans are out of service	Check to see if the fan protection has intervened Repair or replace the fan which is broken
		Incondensable air in the circuit which can be detected by the presence of bubbles, even if there is a high level of subcooling
The circuit is overfilled with refrigerant; the condenser is partially flooded	The subcooling of the liquid on the condenser discharge is excessive, remove some refrigerant from the circuit	
Dirty condenser or metal filters	Remove the material which is blocking the condenser (leaves, paper etc...)	

PROBLEM	POSSIBLE CAUSE	CHECKS/CORRECTIVE ACTION
⇒ HIGH DISCHARGE PRESSURE OR INTERVENTION OF THE HIGH PRESSURE SWITCH	High suction pressure	Check the return water temperature of the chilled water and the values set in the control
LOW DISCHARGE PRESSURE OR INTERVENTION OF THE LOW PRESSURE SWITCH	Thermostatic valve decalibrated or defective	Check that the superheating of the thermostatic valve is correct (about 5°C) Check that the bulb hasn't lost its charge
	Dirty filter dryer cartridge	Check that the filter dryer cartridge doesn't need to be replaced; the difference in temperature measured up and down stream from the filter must be less than 2°C
	With a cold external climate the low pressure switch intervenes before the refrigerant circuit stabilizes	Increase the inhibit time of the low pressure switch start up to 120 seconds
	Insufficient refrigerant load	Check to see if there are any leaks and top up the load until the subcooling of the discharge liquid reaches 3 ±5°C.
	Insufficient water flow (significant difference between the inlet and outlet chilled water temperatures)	Check the pump and the pressure drop in the piping
INTERVENTION OF THE ANTI-FREEZE SAFETY DEVICE	The outlet temperature of the chilled water is too low	Check that the water flow is sufficient and that the difference between the inlet and outlet water temperatures is not too high
	The anti-freeze alarm setting is wrong or the probe is defective	Check the setting of the alarm on the control

PROBLEM	POSSIBLE CAUSE	CHECKS/CORRECTIVE ACTION
THE COMPRESSOR DOESN'T WORK DESPITE IT BEING REQUESTED BY THE THERMOSTAT	One of the unit's safety devices has intervened	Check to see if there are any alarms present on the display of the user terminal
	The short circuit protection has intervened	Check the cause of the short circuit and reset the thermo-magnetic cut off switch
	One of the unit's safety devices has intervened (high or low pressure switches, anti-freeze safety)	See paragraphs: 'Low discharge pressure or intervention of the low pressure switch', 'High discharge pressure or intervention of the high pressure switch', 'Intervention of the anti-freeze safety device'
	The control is not giving the correct signal	Check the control
	The water flow meter is not giving the go-ahead for the compressors to start up	Check the water flow as well as the water flow meter and pump function
INTERVENTION OF THE COMPRESSOR INTERNAL PROTECTION <i>N.B. Before starting up the compressors check the compressor heaters and windings</i>	There is no phase	Check the electrical connections of the compressor
	The motor is overloaded	Check that the power supply voltage is not too high or too low
	Blocked rotor	Replace the compressor
THE COMPRESSOR IS NOISY	Liquid return to the compressor	Check the function and superheating of the expansion valve
	The compressor is damaged	Call the nearest Technical Assistance Centre in order to replace the compressor
LOW DISCHARGE PRESSURE	The control system of the condensing pressure is not efficient	Check the regulatory function of the fan speed Check the function of the air temperature probe
	The chiller is operating with an external temperature which is too low	Check that the unit is operating within its temperature limits
HIGH SUCTION PRESSURE	The return temperature of the chilled water is higher than the nominal value	Check that the unit is operating within its temperature limits
	Return of liquid refrigerant to the compressor	Check the function of the expansion valve and that the bulb is positioned correctly
		Check that the superheating of the thermostatic valve is correct (about 5°C)

IMPORTANT WARNING



Before accessing the internal components of the unit, disconnect the unit from the power supply.

All service or maintenance operations which require access to inside the unit while the unit is running must be carried out by qualified and experienced technicians who are aware of the necessary precautions which must be taken.

CHARGING THE REFRIGERANT OR OIL LOAD

The units are pre-charged in the factory and it is not necessary to charge them again unless problems occur during transportation or installation or if the safety valve intervenes. If it is necessary to top up the refrigerant load, follow the instructions shown below.

If the circuit has been emptied in order to replace a component or if the safety valve has intervened, it is necessary to carry out a preliminary evacuation of the circuit.

EVACUATION OF THE CIRCUIT

Connect the unloaded pump to the suction and discharge taps and fill up the unit to a vacuum level of 0.3 mbar; please note that it is important not to reach the vacuum level too quickly (it should take at least 120 minutes).

Once the vacuum level has been reached, maintain it for at least 60 minutes.

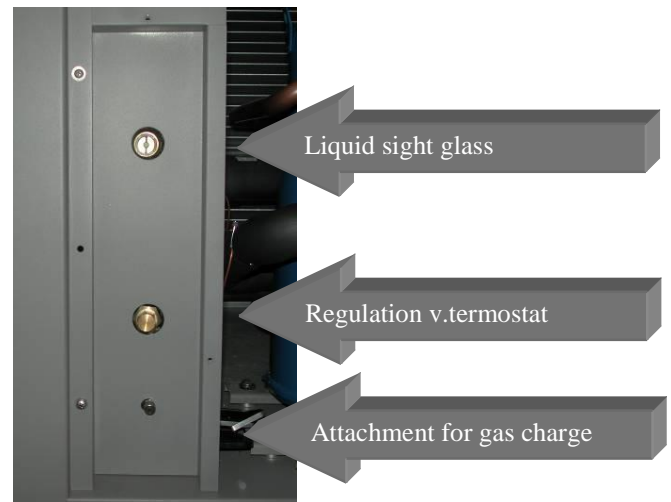
REFRIGERANT CHARGE

The system must be loaded with refrigerant fluid through a needle valve placed between the thermostatic expansion valve and the evaporator (accessible from outside the unit after having removed the front panel).

The charge must be checked at nominal conditions.

As well as checking the data plate for the refrigerant quantity needed, it is advisable to also check that the subcooling of the liquid at the thermostatic inlet is between 3 and 5°C less than the condensation temperature read on the gauge and that the superheating is between 4 and 7°C.

NOTE: when charging refrigerant R410A it is important to check that there are non bubbles in the liquid sight glass.



IMPORTANT WARNING



Adding oil to the compressor

Top up the oil using only the type of oil indicated:

Refrigerant	Type of oil to be used
R410A	Danfoss 160SZ : Polyester oil

Do not use the compressor to create a vacuum in the circuit.

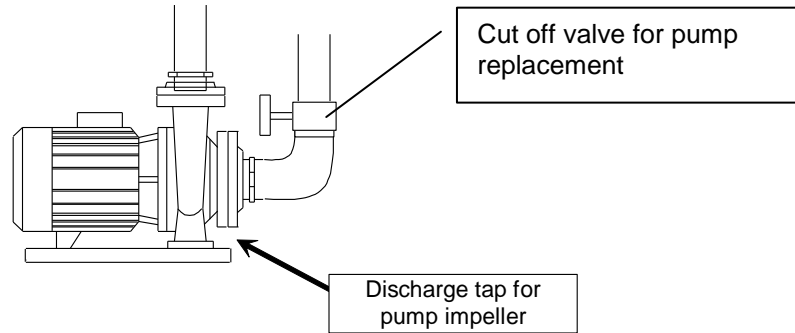
When charging, introduce the refrigerant in liquid form.

BLEEDING AND UNLOADING THE HYDRAULIC CIRCUIT

If there is air inside the hydraulic circuit it is possible to bleed the circuit using the valves present on the water tank.

During winter shutdown (*in cooling only units*) or when supplementary maintenance is carried out on the hydraulic circuit, it may be necessary to remove the water container within the system.

In order to do this, a tap is placed on the lower part of the water tank as well as a tap for the discharge of water present inside the pump impeller (see figure below).



MAINTENANCE AND CLEANING OF THE UNIT

All maintenance and cleaning of the unit must be carried out safely, respecting the instructions shown in this manual.

For correct unit operation it is necessary to periodically clean the coils of the exchanger and the metal protection filters.

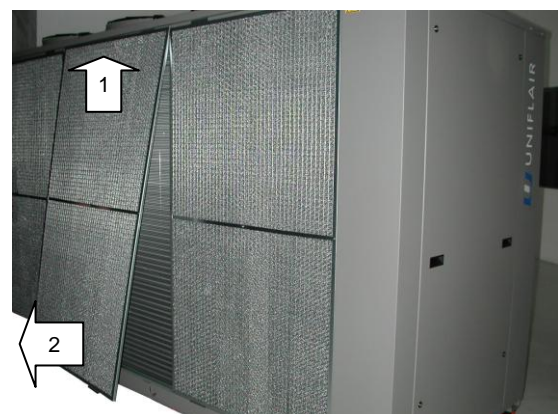
REPLACING THE AIR FILTERS

The condensing coils are protected by metal filters placed on the suction side compared to the air flow.

The filters can be moved from their supports for cleaning and replacing the filters.



WARNING: when removing the metal filters it is necessary to pay attention to the **sharp edges** of the finned condensing or free-cooling coils.



MAINTENANCE PROGRAMME

3 MONTHS
Check the power supply
Check the alarm status
Check the working pressures and temperatures
Check the correct operation of the local/remote controls
Check and clean the condensing and free-cooling coil/s and any metal pre-filters

6 MONTHS (repeat these checks on a three-monthly basis)
Check the fittings and the operation of the condensing fans
Check the correct water flow by measuring the thermal gradient of the fluid
Check the fittings, the operation and the absorption of the circulation pump(s) onboard the unit
Check for fouling of the water filters and carry out any cleaning needed

12 MONTHS (repeat these checks on a six-monthly basis)
Check the varnish and the nuts and bolts
Check the hinges, rabbets and gaskets
Check the cables and wiring
Tighten the terminal blocks
Check and reset if necessary the safety device settings (pressure switches, thermostats, water flow switches and protection devices)
Check the fittings, operation and absorption of the compressor/s
Check the gas leak detector and if necessary replace the seal of the refrigerant circuit/s and tighten the joints and connections of the unit
Check and if necessary top up the refrigerant gas and/or oil
Check and if necessary reset the regulation devices setting
Check the tightness of the water joints and internal connections and if necessary replace the seals
Check the seals of the regulation valves and/or water shut off valve which are onboard the unit
Check the glycol concentration and if necessary adjust it

60 MONTHS
Check and if necessary replace the gas filters
Check and if necessary replace the compressor oil



Important: if a winter shut down period is planned, it is necessary to empty the hydraulic circuit.

TECHNICAL DATA

GENERAL TECHNICAL DATA

ERAC-H-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Power supply	V/ph/Hz	400 / 3 + N / 50									
Refrigerant		R410A									
Fans	N°	2	2	2	3	3	3	3	3	4	4
Poles	N°	6	6	6	6	6	6	6	6	6	6
Fans	Type	Axial									
Refrigerant circuit	Nr	1	1	1	1	1	2	1	2	1	2
Compressors	Nr	2	2	2	2	2	2	2	2	2	2
Compressors	Type	Scroll									
Evaporator	Type	Plate									
Exchanger for partial heat recovery	Type	Plate									
Exchanger for total heat recovery	Type	Plate									

TECHNICAL DATA: NOMINAL CONDITIONS AND CORRECTIVE FACTORS

The technical data shown in the following pages refer to nominal conditions and the tolerances are as follows:

Nominal conditions		ERAC	ERAH		ERAF	
Operation		Cooling	Cooling	Heating	Cooling	Free-cooling
Water inlet/outlet temperature	°C	12 / 7	12 / 7	40 / 45	15 / 10	15
External temperature	°C	35	35	7 bs / 6 bu	35	5
Glicol content	%	0	0	0	20	20
Nominal power supply tolerance	R ₀	400V +/- 10%				
Storage conditions	C ₀	between - 20°C e + 45°C for all models				

When using anti-freeze mixes, some of the technical data shown in the table (capacity, water flow, pressure drop) will be subject to change.

The correction factors necessary to calculate the data at different glycol percentages are shown below.

Minimum fluid temperature with the unit running	5.0 °C	3.0 °C	-5.0 °C	-10.0 °C	-18.0 °C	-28.0 °C
Freezing temperature	0 °C	-4.4 °C	-9.6 °C	-16.1 °C	-24.5 °C	-35.5 °C
Percentage of glycol weight	0%	10%	20%	30%	40%	50%

Corrective factors	%	0%	10%	20%	30%	40%	50%
Cooling capacity	R_0	1	0.985	0.98	0.97	0.96	0.95
Absorbed power of the compressors	P_0	1	0.995	0.99	0.98	0.98	0.97
Volumetric flow	L_0	1	1.02	1.05	1.08	1.10	1.14
Water side pressure drop	C_0	1	1.10	1.25	1.40	1.60	1.7

Corrected cooling capacity (**)= Nominal cooling capacity x R_0 .

Corrected absorbed power of the compressors (**): Absorbed nominal power x P_0 .

Corrected volumetric flow (**)= Nominal volumetric flow x L_0

Corrected water side evaporator pressure drop (**): Evaporator pressure drop x C_0 .

(**) with the same evaporator inlet and outlet temperatures 12/7

NOMINAL TECHNICAL DATA (LN)

ERAC Cooling only		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽¹⁾	kW	47	56	65	75	83	83	96	95	111	111
Absorbed power ⁽¹⁾	kW	13.8	17.6	19.7	21.9	25.9	25.9	30.2	30.2	35.1	35.2
E.E.R. ⁽²⁾		3.41	3.16	3.30	3.43	3.20	3.21	3.17	3.16	3.16	3.16
E.S.E.E.R. ⁽⁷⁾		5.23	5.16	5.40	5.44	5.26	5.10	5.49	5.28	5.38	5.37
I.P.L.V. ⁽⁸⁾		5.54	5.49	5.72	5.76	5.61	5.38	5.74	5.48	5.77	5.76
Water flow ⁽¹⁾	l/h	8082	9561	11185	12940	14250	14310	16453	16418	19065	19137
Evaporator pressure drop ⁽¹⁾	kPa	56	53	50	52	55	54	63	70	63	71
Air flow ⁽¹⁾	m ³ /h	19205	19205	20486	28807	28807	28807	30244	30244	38347	38347

ERAH Heat pump		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Heating capacity ⁽⁴⁾	kW	54	64	74	85	95	n.a.	111	n.a.	128	n.a.
Absorbed power ⁽⁴⁾	kW	14,6	17,6	19,8	22,8	26,0	n.a.	30,7	n.a.	35,8	n.a.
C.O.P. ⁽²⁾		3,71	3,64	3,74	3,73	3,64	n.a.	3,61	n.a.	3,58	n.a.
Water flow ⁽²⁾	l/h	9300	10994	12743	14524	16167	n.a.	18941	n.a.	21957	n.a.
Evaporator pressure drop ⁽²⁾	kPa	70	60	79	69	62	n.a.	62	n.a.	70	n.a.

ERAF Free-cooling		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽⁵⁾	kW	50	59	69	80	88	88	102	102	117	118
Absorbed power ⁽²⁾⁽⁵⁾	kW	14.7	18.8	20.7	23.3	27.7	27.7	31.8	31.8	37.4	37.5
E.E.R. ⁽²⁾		3.40	3.13	3.35	3.43	3.17	3.17	3.20	3.20	3.14	3.14
Capacity in free-cooling ⁽⁶⁾	kW	35	37	43	52	53	53	62	62	71	71
Absorbed power ⁽³⁾⁽⁶⁾		1.6	1.6	2.0	2.7	2.7	2.7	2.4	2.4	3.1	3.1
E.E.R. ⁽³⁾⁽⁶⁾		22.40	23.50	21.30	18.98	19.53	19.53	25.58	25.58	22.80	22.84
Water flow ⁽⁵⁾	l/h	9178	10825	12756	14700	16119	16151	18681	18681	21596	21672
Evaporator pressure drop ⁽⁵⁾	kPa	64	61	58	59	62	61	70	80	69	80

(1) Data refer to nominal conditions: water temperature 12 / 7 °C; ambient temperature 35 °C; glycol 0%

(2) Data refer to total absorbed power (compressors and fans)

(3) Data refer to absorbed power of the fans and free-cooling pump

(4) Data refer to nominal conditions: water temperature 40 / 45°C, external temperature 7°C dry bulb, 6°C wet bulb

(5) Data refer to nominal conditions: water temperature 15 / 10 °C; ambient temperature 35 °C; glycol 20%

(6) Data refer to nominal conditions: water inlet temperature 15 °C; ambient temperature 5 °C; glycol 20%

(7) European Seasonal Energy Efficiency Ratio

(8) Integrated Partial Load Value

NOMINAL TECHNICAL DATA (SLN)

ERAC Cooling only		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽¹⁾	kW	46	53	62	73	80	80	91	92	106	107
Absorbed power ⁽¹⁾	kW	14.2	18.4	20.7	22.8	27.2	27.2	31.9	31.9	36.9	37.0
E.E.R. ⁽²⁾		3.20	2.90	3.01	3.19	2.93	2.93	2.87	2.87	2.89	2.90
E.S.E.E.R. ⁽⁷⁾		5.21	5.07	5.25	5.38	5.16	4.99	5.39	5.12	5.29	5.22
I.P.L.V. ⁽⁸⁾		5.42	5.42	5.63	5.70	5.47	5.31	5.66	5.40	5.69	5.60
Water flow ⁽¹⁾	l/h	7845	9182	10742	12508	13708	13733	15722	15751	18303	18445
Evaporator pressure drop ⁽¹⁾	kPa	56	53	50	52	55	54	63	70	63	71
Air flow ⁽¹⁾	m ³ /h	14943	14943	16037	22415	22415	22415	23665	23665	29886	29886

ERAH Heat pump		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Heating capacity ⁽⁴⁾	kW	52	62	71	82	91	n.a.	107	n.a.	124	n.a.
Absorbed power ⁽⁴⁾	kW	14,8	17,9	20,7	23,3	26,4	n.a.	31,1	n.a.	35,7	n.a.
C.O.P. ⁽²⁾		3,53	3,45	3,43	3,53	3,46	n.a.	3,43	n.a.	3,47	n.a.
Water flow ⁽⁴⁾	l/h	8989	10581	12213	14135	15697	n.a.	18329	n.a.	21281	n.a.
Evaporator pressure drop ⁽⁴⁾	kPa	70	59	77	68	61	n.a.	60	n.a.	59	n.a.

ERAF Free-cooling		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽⁵⁾	kW	48	56	67	77	84	84	97	97	112	113
Absorbed power ⁽²⁾⁽⁵⁾	kW	15.2	19.8	22.0	24.4	29.3	29.3	33.8	33.9	39.6	39.7
E.E.R. ⁽²⁾		3.18	2.85	3.04	3.16	2.87	2.87	2.87	2.88	2.83	2.85
Capacity in free-cooling ⁽⁶⁾	kW	31	32	38	46	47	47	54	54	63	63
Absorbed power ⁽³⁾⁽⁶⁾		1.3	1.3	1.8	2.3	2.3	2.3	2.1	2.1	2.5	2.5
E.E.R. ⁽³⁾⁽⁶⁾		24.29	25.29	20.51	20.02	20.51	20.51	25.91	25.91	24.63	24.29
Water flow ⁽⁵⁾	l/h	8900	10366	12260	14174	15447	15473	17873	17926	20618	20803
Evaporator pressure drop ⁽⁵⁾	kPa	64	61	58	59	62	61	70	80	69	80

(1) Data refer to nominal conditions: water temperature 12 / 7 °C; ambient temperature 35 °C; glycol 0%

(2) Data refer to total absorbed power (compressors and fans)

(3) Data refer to absorbed power of the fans and free-cooling pump

(4) Data refer to nominal conditions: water temperature 40 / 45°C, external temperature 7°C dry bulb, 6°C wet bulb

(5) Data refer to nominal conditions: water temperature 15 / 10 °C; ambient temperature 35 °C; glycol 20%

(6) Data refer to nominal conditions: inlet water temperature 15 °C; ambient temperature 5 °C; glycol 20%

(7) European Seasonal Energy Efficiency Ratio

(8) Integrated Partial Load Value

REFRIGERANT CONTENT

The tables below show the refrigerant quantities present within the basic unit. These values are indicative only and the quantities may vary according to adjustments carried out during the final testing of the unit. The data shown below refer to the basic version unit and therefore may vary depending on the configuration of the unit.

ERAC-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Circuit 1	Kg	7,2	7,5	9,5	10,0	10,0	5	15,0	7,5	15,0	7,5
Circuit 2	Kg	-	-	-	-	-	5	-	7,5	-	7,5

ERAH		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Circuit 1	Kg	8,5	8,5	12	12,5	12,5	n.a.	18,5	n.a.	18,5	n.a.

HYDRAULIC CONNECTIONS

ERAC-H-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Main hydraulic connections	bsp	2"	2"	2"	2"	2"	2"	2 ½"	2 ½"	2 ½"	2 ½"
Partial heat recovery hydraulic connections	bsp	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
Total heat recovery hydraulic connections	bsp	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"

CAPACITY OF THE HYDRAULIC CIRCUIT

This table shows the capacity of the hydraulic circuit in litres for cooling only and heat pump units. The data refer to standard units without pump group and water tank.

ERAC-H		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Evaporator	litres	2.5	3.1	3.8	4.5	4.8	5.0	6.2	5.0	7.4	6.2
Expansion tank	litres	5	5	5	5	5	5	8	8	8	8
Water tank (opt.)	litres	135	135	240	240	240	240	300	300	300	300

This table shows the capacity of the hydraulic circuit in litres for free-cooling units.
The data refer to standard units without pump group and water tank.

ERAF		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Evaporator	litres	2,5	3,1	3,8	4,5	4,8	5,0	6,2	5,0	7,4	6,2
Expansion tank	litres	5	5	5	5	5	5	8	8	8	8
Free-cooling coil	litres	12	12	16	16	16	16	26	26	26	26
Water tank (opt.)	litres	135	135	240	240	240	240	300	300	300	300

RECOMMENDED MINIMUM PLANT CAPACITY

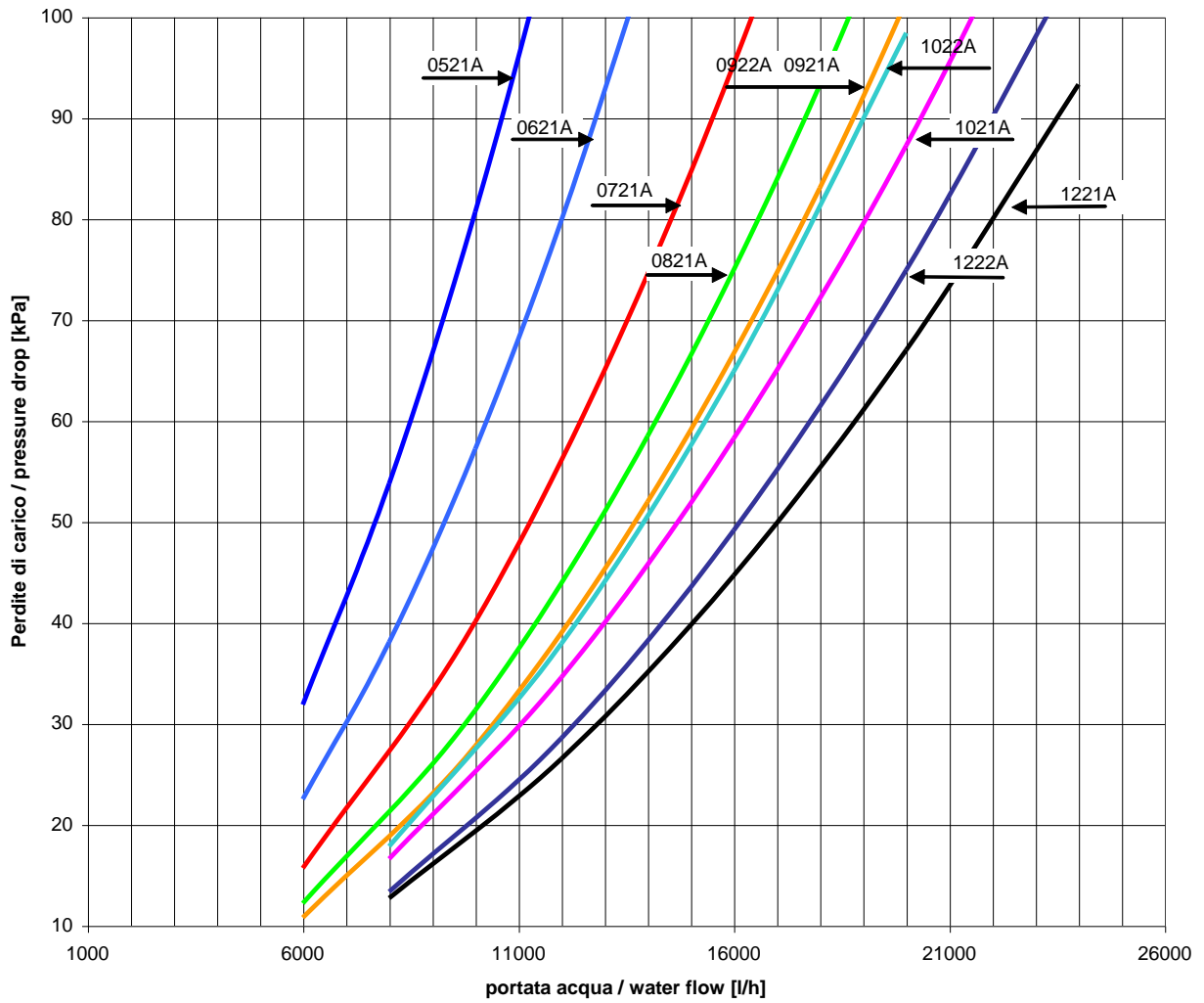
The table below shows the recommended minimum plant capacity if there isn't a water tank inside the unit and an optional water tank capacity.

ERAC-H-F		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Recommended minimum plant capacity	litres	135	135	240	240	240	240	300	300	300	300
Water tank capacity (optional)	litres	135	135	240	240	240	240	300	300	300	300

MAXIMUM WORKING PRESSURE OF THE HYDRAULIC CIRCUIT

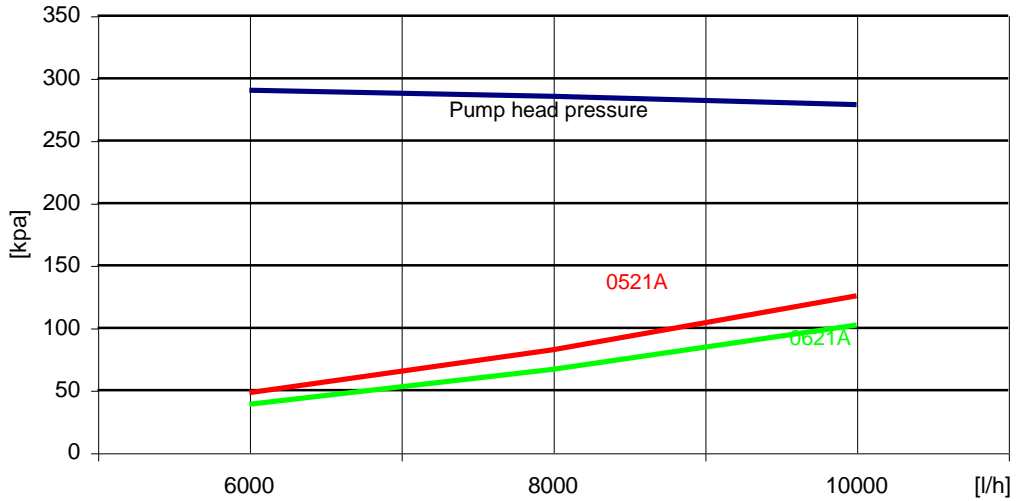
Maximum working pressure of hydraulic circuit	P_0	6
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EVAPORATOR PRESSURE DROP

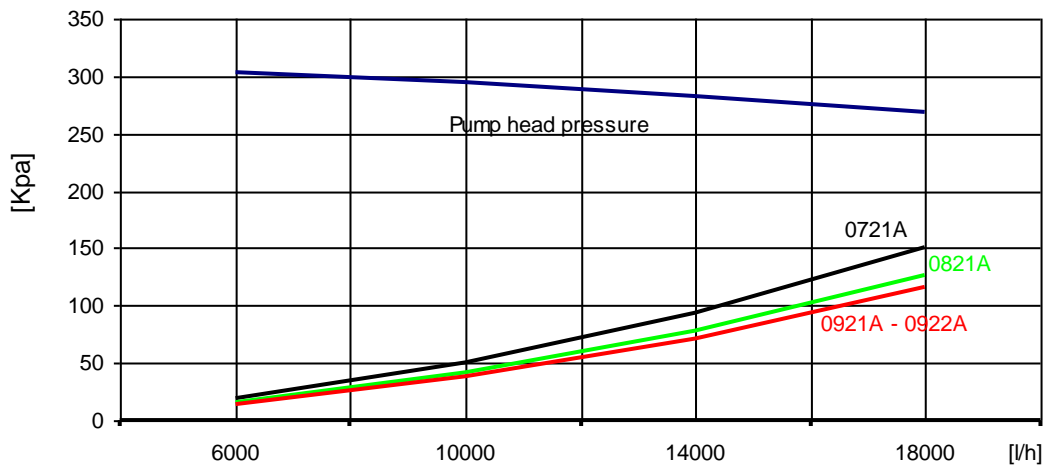


PUMP HEAD PRESSURE AND UNIT PRESSURE DROPS

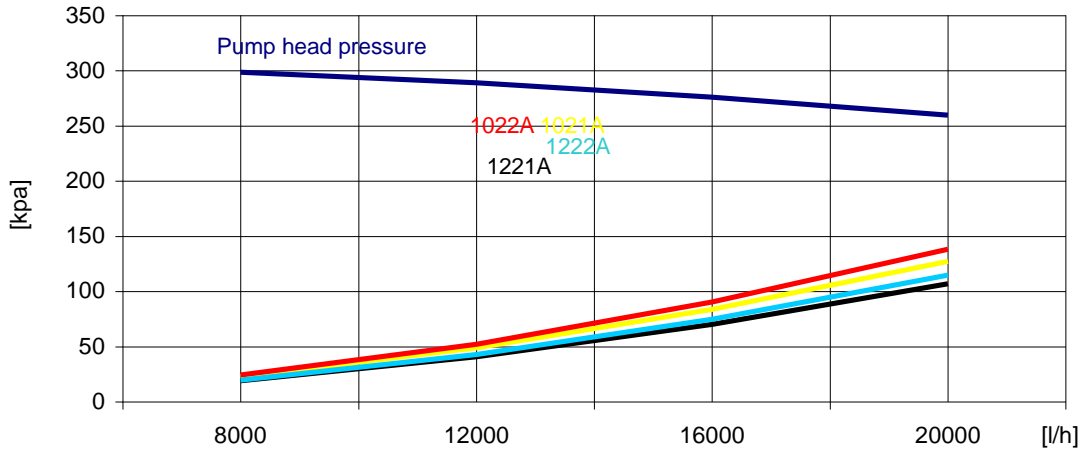
ERAC/H/F 0521A - 0621A



ERAC/H/F 0721A - 0821A - 0921A - 0922A



ERAC/H/F 1021A - 1022A - 1221A - 1222A



PARTIAL HEAT RECOVERY

Partial condensation heat recovery		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽¹⁾	kW	47	56	66	76	84	84	97	97	113	113
Absorbed power ⁽¹⁾	kW	13,6	17,3	19,3	21,6	25,4	25,4	29,5	29,5	34,4	34,4
Heat recovery heating capacity ⁽¹⁾	kW	12,3	16,6	19,3	19,9	24,2	25,6	29,1	29,5	32,9	33,3
Heat recovery water flow ⁽¹⁾	l/h	2344	2970	3328	3714	4370	4365	5082	5079	5916	5923
Heat recovery pressure drop ⁽¹⁾	kPa	8	13	9	11	14	7	12	10	16	13

TOTAL HEAT RECOVERY (*)

Total condensation heat recovery		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
Cooling capacity ⁽¹⁾	kW	47	58	67	76	86	n.a.	99	n.a.	115	n.a.
Absorbed power ⁽¹⁾	kW	13,3	16,3	18,6	20,8	23,8	n.a.	27,9	n.a.	32,4	n.a.
Heat recovery heating capacity ⁽¹⁾	kW	49,9	59,7	74,1	81,3	88,5	n.a.	104,6	n.a.	119,0	n.a.
Heat recovery water flow ⁽¹⁾	l/h	10362	12687	14706	16656	18838	n.a.	21904	n.a.	25330	n.a.
Heat recovery pressure drop ⁽¹⁾	kPa	60	84	53	67	83	n.a.	73	n.a.	96	n.a.

(1) Data refer to nominal conditions: water temperature 12 / 7 °C; ambient temperature 35 °C; recovery water temperature: 40/45°C; glycol 0%

SETTING THE SAFETY DEVICES

The setting values of the operating parameters set on the microprocessor are shown in the specific instruction manual.

In this following table the settings for the safety devices are shown; these values are also shown on the data plate which can be found inside the unit.

Component	Settings	Differential	Reset
Refrigerant circuit (R410A)			
High pressure switch (AP1-AP2)	45 bar	--	Manual reset
Low pressure switch (BP1-BP2) ¹	1.5 bar	1 bar	2.5 bar
Anti-freeze safety ¹	2 °C	-	-
Water circuit			
Water side safety valve	6.0 bar	-	-

¹ Data refer to standard versions with pure water

ELECTRICAL ABSORPTION

The power supply for all units is **400V / 3ph + N / 50Hz**,
Versions with a different power supply can be made on request.

The electrical data are as follows:

Data for the compressors:

- **OP:** Operating Power, the absorbed power at nominal conditions [kW]
- **OA:** Operating Amperage, the electrical absorption at nominal conditions [A]
- **FLI:** Full Load Input Power, the maximum absorbed power of the unit [kW]
- **FLA:** Full Load Amperage, the maximum absorbed current [A]
- **LRA:** Locked Rotor Amperage, the current of the locked rotor
- **SC:** Starting current, is the current absorbed by the compressor and by the eventual pump(s) at the start-up of the unit [A].

Unit LN	For each Compressor						For each Fan					For each circulation pump	
	n.	OP	OA	FLI	FLA	LRA	n.	OP	OA	FLI	FLA	FLI	FLA
0521A	1	7,14	13,94	10,55	18,6	156	2	0,26	1,16	0,56	2,5	2,3	4,8
	1	6,12	11,95	9	15,3	99							
0621A	2	8,54	16,34	11,89	20,7	130	2	0,26	1,16	0,56	2,5	2,3	4,8
0721A	2	9,70	18,62	13,64	23	163	2	0,16	0,71	0,56	2,5	3,3	5,7
0821A	2	10,56	19,30	15,38	25	158	3	0,26	1,16	0,56	2,5	3,3	5,7
0921A	2	12,56	22,73	17,58	30	167	3	0,26	1,16	0,56	2,5	3,3	5,7
0922A	2	12,57	22,75	17,58	30	167	3	0,26	1,16	0,56	2,5	3,3	5,7
1021A	1	16,9	32,8	23,84	40	215	3	0,19	0,84	0,56	2,5	3,3	5,7
	1	12,6	24,6	17,3	30,5	160							
1022A	1	16,9	32,8	23,84	40	215	3	0,19	0,84	0,56	2,5	3,3	5,7
	1	12,6	24,6	17,3	30,5	160							
1221A	2	17,02	31,93	23,84	41,5	215	4	0,26	1,16	0,56	2,5	3,3	5,7
1222A	2	17,04	31,96	23,84	41,5	215	4	0,26	1,16	0,56	2,5	3,3	5,7

Unit LN	Complete unit without circulation pump							
	OP	OA	SC	FLI	FLA	LRA	Cosphi	Cosphi-rif
0521A	13,8	28,21	156,0	20,7	38,9	176,3	0,76	0,92
0621A	17,6	35,00	130,0	24,9	46,4	155,7	0,76	0,93
0721A	19,7	38,66	163,0	28,4	51,0	191,0	0,79	0,93
0821A	21,9	42,08	158,0	32,4	57,5	190,5	0,83	0,92
0921A	25,9	48,94	167,0	36,8	67,5	204,5	0,83	0,91
0922A	25,9	48,98	167,0	36,8	67,5	204,5	0,83	0,91
1021A	30,2	59,92	215,0	42,9	78	253,0	0,77	0,91
1022A	30,2	59,92	215,0	42,9	78	253,0	0,77	0,91
1221A	35,1	68,50	215,0	49,9	93	266,5	0,80	0,92
1222A	35,2	68,50	215,0	49,9	93	266,5	0,80	0,92

Unit LN	Complete unit with circulation pump							
	OP	OA	SC	FLI	FLA	LRA	Cosphi	Cosphi-rif
0521A	16,1	33,01	160,8	23,0	43,7	181,1	0,75	0,91
0621A	19,9	39,80	134,8	27,2	51,2	160,5	0,78	0,92
0721A	23	44,36	168,7	31,7	56,7	196,7	0,79	0,93
0821A	25,2	47,78	163,7	35,8	63,2	196,2	0,83	0,92
0921A	29,2	54,64	172,7	40,2	73,2	210,2	0,83	0,91
0922A	29,2	54,68	172,7	40,2	73,2	210,2	0,83	0,91
1021A	33,5	63,10	220,7	46,2	83,7	258,7	0,78	0,91
1022A	33,5	63,10	220,7	46,2	83,7	258,7	0,78	0,91
1221A	38,4	73,50	220,7	53,3	98,7	272,2	0,80	0,92
1222A	38,5	73,50	220,7	53,3	98,7	272,2	0,80	0,92

Free-cooling pump		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A
FLI	kW	1,12	1,12	1,99	1,99	1,99	1,99	1,99	1,99	1,99	1,99

FLA	A	2,17	2,17	3,65	3,65	3,65	3,65	3,65	3,65	3,65	3,65		
ULN Unit	For each Compressor						For each Fan					For each circulation pump	
	n.	OP	OA	FLI	FLA	LRA	n.	OP	OA	FLI	FLA	FLI	FLA
0521A	1	7,14	13,94	10,55	18,6	156	2	0,17	0,76	0,56	2,5	2,3	4,8
	1	6,12	11,95	9	15,3	99							
0621A	2	8,54	16,34	11,89	20,7	130	2	0,17	0,76	0,56	2,5	2,3	4,8
0721A	2	9,70	18,62	13,64	23	163	2	0,10	0,44	0,56	2,5	3,3	5,7
0821A	2	10,56	19,30	15,38	25	158	3	0,17	0,76	0,56	2,5	3,3	5,7
0921A	2	12,56	22,73	17,58	30	167	3	0,17	0,76	0,56	2,5	3,3	5,7
0922A	2	12,57	22,75	17,58	30	167	3	0,17	0,76	0,56	2,5	3,3	5,7
1021A	1	16,9	32,8	23,84	40	215	3	0,12	0,54	0,56	2,5	3,3	5,7
	1	12,6	24,6	17,3	30,5	160							
1022A	1	16,9	32,8	23,84	40	215	3	0,12	0,54	0,56	2,5	3,3	5,7
	1	12,6	24,6	17,3	30,5	160							
1221A	2	17,02	31,93	23,84	41,5	215	4	0,17	0,76	0,56	2,5	3,3	5,7
1222A	2	17,04	31,96	23,84	41,5	215	4	0,17	0,76	0,56	2,5	3,3	5,7
ULN Unit	Complete unit without circulation pump									Cosphi	Cosphi-rif		
	OP	OA	SC	FLI	FLA	LRA							
0521A	13,6	27,4	156,0	20,7	38,9	176,3			0,76	0,92			
0621A	17,42	34,2	130,0	24,9	46,4	155,7			0,76	0,93			
0721A	19,6	38,12	163,0	28,4	51,0	191,0			0,79	0,93			
0821A	21,63	40,88	158,0	32,4	57,5	190,5			0,83	0,92			
0921A	25,63	47,74	167,0	36,8	67,5	204,5			0,83	0,91			
0922A	25,65	47,78	167,0	36,8	67,5	204,5			0,83	0,91			
1021A	29,76	59,02	215,0	42,9	78	253,0			0,77	0,91			
1022A	29,76	59,02	215,0	42,9	78	253,0			0,77	0,91			
1221A	34,72	66,9	215,0	49,9	93	266,5			0,80	0,92			
1222A	34,76	66,96	215,0	49,9	93	266,5			0,80	0,92			
ULN Unit	Complete unit with circulation pump									Cosphi	Cosphi-rif		
	OP	OA	SC	FLI	FLA	LRA							
0521A	15,9	32,2	160,8	23,0	43,7	181,1			0,75	0,91			
0621A	19,72	39	134,8	27,2	51,2	160,5			0,78	0,92			
0721A	22,9	43,82	168,7	31,7	56,7	196,7			0,79	0,93			
0821A	24,93	46,58	163,7	35,8	63,2	196,2			0,83	0,92			
0921A	28,93	53,44	172,7	40,2	73,2	210,2			0,83	0,91			
0922A	28,95	53,48	172,7	40,2	73,2	210,2			0,83	0,91			
1021A	33,06	64,72	220,7	46,2	83,7	258,7			0,78	0,91			
1022A	33,06	64,72	220,7	46,2	83,7	258,7			0,78	0,91			
1221A	38,02	72,66	220,7	53,3	98,70	272,2			0,80	0,92			
1222A	38,06	72,66	220,7	53,3	98,70	272,2			0,80	0,92			
Free-cooling pump		0521A	0621A	0721A	0821A	0921A	0922A	1021A	1022A	1221A	1222A		
FLI	A	1,12	1,12	1,99	1,99	1,99	1,99	1,99	1,99	1,99	1,99		
FLA	A	2,17	2,17	3,65	3,65	3,65	3,65	3,65	3,65	3,65	3,65		

HOW TO DISPOSE OF THE EQUIPMENT

The following instructions deal with the disposal of UNIFLAIR machines. The procedures described below are guidelines only, provided to make the machine disassembling easier. The purpose of these operations is to achieve homogeneous material quantities for disposal or recycling.

These instructions are followed by a list of the possible typical EWC 2002 codes to allow an easier disposal of the machine parts.

IMPORTANT WARNINGS



Observe the safety precautions at work wearing the suitable individual protection devices (IPD) and using the appropriate equipments. Maintenance and service operations (disassembling included) must be performed by qualified and expert personnel, aware of the essential precautions.

1. PRELIMINARY OPERATIONS

Power supply and data processing system:

Turn the machine off and unplug it from the power supply and from the communication system.

Hydraulic circuit:

Drain the hydraulic circuit and disconnect the hydraulic line.

Refrigerating circuit:

Purge the refrigeration system with suitable recovery equipments to avoid gas leakage in the environment.

IMPORTANT WARNINGS



The circuits can be pressurised; any maintenance and service operation must only be carried out by expert and qualified personnel, aware of the essential safety precautions.

The machine can contain hot water: adopt all of the essential safety cautions.

1. DISASSEMBLING THE MACHINE

The following paragraphs describe the main macrocomponents to facilitate the disassembling, disposal and recycling of materials with appropriate features.
To disassemble the machine properly, follow the guidelines provided below.

1.1. ELECTRICAL PANEL

Remove the electrical panel and dispose its parts following the procedures provided by the relevant standards. The models equipped with a “clock board” in the electrical panel have a service battery which must be disposed separately.

Materials: electronic parts, electrical cables, metal and plastic supports, batteries.

1.2. COVER PANELS

Remove the metal cover and protection panels of the machine.
The panels can be made of polypaired materials, that is insulating material together with metal. In this case, separate the different elements.

Materials: galvanized sheet, aluminium, soundproof panels: expanded polyurethane, thermoinsulating panels: mineral wool.

1.3. AIR FILTERS

Remove the air filters.

Materials: metallic net, synthetic fibre.

1.4. FINNED COIL

Remove the finned coils from the machine.

Materials: copper, aluminium, steel.

1.5. HUMIDIFIER

If a humidifier is installed, remove it.

Materials: polypropylene, iron materials.

1.6. ELECTRO-MECHANICAL PARTS

Find and remove valves, electro-mechanical and electronic parts (three-way valves, sensors, etc.) from the machine.

1.1. RESISTANCES

Remove the resistances if they are installed.

Materials: aluminium, inseparable copper + magnesium oxide.

1.2. PIPES AND PARTS OF THE REFRIGERATING CIRCUIT

Find the connection pipes installed in the machine and separate them from the other elements.
Pipes can be caulked: in this case, before recovery, separate the insulating material from the metal pipe.
Even the elements of the refrigerating circuit are considered as pipes: joints or valves.

Materials: copper, brass, cast iron, steel and plastic.

1.3. PUMP

Remove the pump from the machine.

Materials: pump.

1.4. CONDENSER

Remove the condenser, if installed.
The condenser contains the elements of a machine, equipped with a small electrical panel, fans and a thermal exchange battery, usually characterized by aluminium structure and feet made of varnished steel.

Materials: electrical elements, aluminium, steel (varnished).

1.5. BRAZED PLATE EXCHANGER

If installed, remove the brazed plate exchanger.

Materials: INOX AISI braze welding, with an alloy containing a large amount of silver.

1.6. FANS

Remove the fans. Disassemble the metal frame and proceed with the recycling of the metal alloy.

Materials: electro-mechanical elements, iron wrecks.

IMPORTANT WARNINGS



The fans of some machine models are integral part of the carrying structure. Removing the fans can compromise the stability of the frame. We recommend to pay attention during disassembling operations.

1.1. COMPRESSORS AND LIQUID SEPARATORS

Finally remove the liquid separators and the compressors from the machine base.

Materials: liquid separators and compressors.

IMPORTANT WARNINGS



Pay attention to oil contained in the compressors. Avoid any loss of oil during operations. If possible, dispose oil and compressors separately.

1.2. METAL BASE

Proceed with the recycling of the metal base.

Materials: galvanised sheet.

IMPORTANT WARNINGS



Waste deriving from machine disassembly must be disposed of and classified according to EWC codes only consulting authorised and specialist companies.

The following chart contains a partial list of the typical EWC codes applied to waste deriving from disassembling, so it must be considered just as an indication.

Element	EWC 2002 Code
Electrical cables	17 04 11
Plastic materials	16 01 19
Metal supports	16 01 17
Galvanised sheet	17 04 07
Aluminium	17 04 02
Metallic net	17 04 05
Synthetic fibre	15 02 03
Copper	17 04 01
Brass	17 04 01
Cast iron	17 04 05
Steel	17 04 07
Refrigerating gas	14 06 01
Battery	16 06 04
Pumps, electro-mechanical elements, compressors	16 02 13 16 02 14



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