# Installation, operating and maintenance manual

# core & core max

High efficiency water/water and geothermal heat pumps





## 1 CORE and CORE MAX

For construction and technical specifications, and for the list of available models, refer to the TECHNICAL BOOK. The model, serial number, characteristics, power supply, etc., are shown on the stickers applied to the machine. The example images below are for illustrative purposes only.

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### 2 INTENDED PURPOSE

T hese machines are intended for cooling / heating (if fitted with heat pump) of water and for the production of domestic hot water (HWS version).

Their use is only recommended within the functional limits stated in the TECHNICAL BOOK.

These units must only be installed indoors. The unit must be sheltered from atmospheric agents, humidity, water ingress, etc.

#### 2.1 GENERAL

- During installation, or whenever working on the unit, it is necessary to adhere carefully to the instructions in this manual, to observe notices and warnings on the unit itself, and generally taking all precautions necessary.

- The pressures present in the refrigeration system, and the electrical components, may cause dangerous situations during installation and during any other work on the unit.



Failure to respect the instructions contained herein, and any modification or work performed on the unit not previously authorised in writing, will immediately void the guarantee.

## 3 ECODESIGN CONFORMITY

#### 3.1 Documentation supplied with the product

Listed below are the documents supplied with the machine according to its type, with particular reference to conformity with Directive 2009/125/EC of the European Parliament and of the Council, of 21 October 2009, regarding the establishment of a framework for drafting specifications for the eco-friendly design of energy-related products, and relevant Regulations (hereinafter "Ecodesign").

These documents may or may not be binding depending on the country of installation.

Conformity of the units with the directives and standards in force in the European Union is broken down into the following cases, with regard to applicability of Ecodesign:

- 1. Units conforming to all EC requirements including the Ecodesign Directive;
- 2. Units exempt from the Ecodesign Directive and in general conforming to all EC requirements;
- 3. Partly completed machine;
- 4. Units conforming to all EC requirements except for the Ecodesign Directive.

#### 3.1.1 Units conforming to all EC requirements including the Ecodesign Directive

#### Application of the Ecodesign Directive depends on the type of unit.

#### The CE marking is present.

The units can be put on the market in any country.

More specifically, they are allowed to be put on the market in member countries of the European Union (hereinafter "EU").

Putting the units on the market in the EU entails installation and running of the unit within this scope. Putting the units on the market in the EU is bound by the effective dates required by each Regulation.

The EC Declaration of Conformity (hereinafter "EC Declaration") is supplied with the unit:

- irrespective of the destination country;
- according to the relevant Regulation, the EC Declaration is supplemented by one or more attached documents, also called product fiches (hereinafter "Attached Document");
- where envisaged, the Attached Document is always supplied irrespective of the destination country.

Units involved:

- chillers (with or without free-cooling mode);
- reversible heat pumps (cooling / heating), including multifunction units;
- non-reversible heat pumps (heating only) where applicable.

#### 3.1.2 Units exempt from the Ecodesign Directive and in general conforming to all EC requirements

#### Units for which conformity with the Ecodesign Directive is not necessary.

All the points described in the first paragraph apply, with the exceptions stated below. The EC Declaration is not accompanied by Attached Documents.

Units involved:

- non-reversible heat pumps (heating only) where applicable with Pdesign>400kW.
- chillers in general used for "Process" applications with water delivery temperature > 12°C or between -8°C and +2°C (extremes excluded).

#### 3.1.3 Partly completed machine

## Units for which conformity with the Ecodesign Directive must be related to a 'partly completed machine plus remote heat exchanger' system. Otherwise, the unit conforms to all EC requirements.

All the points described in the first paragraph apply, with the exceptions stated below.

The EC Declaration is not accompanied by Attached Documents

Conformity with the Ecodesign Directive depends on the combination of partly completed machine plus remote heat exchanger and is therefore the responsibility of the person who makes the selection and combination at the installation stage.

Units involved:

- chillers or reversible units with remote source heat exchanger;
- chillers or reversible units with remote user heat exchanger.

#### 3.1.4 Attached Documents envisaged with regard to the type of unit

Type of unit	Regulation	Supplied Attached Documents, reference param		
CE unit	2016/2281	SEER/ŋsc LT		
CE unit	2016/2281	SEER/r	sc MT	
CE unit	2016/2281	SEER/ηsc LT	SEPR HT	
CE unit	2016/2281	SEER/ηsc MT	SEPR HT	
CE unit	2013/813	SCOP/ŋsh (1)	Eco-label (2)	
CE unit/exempt from Ecodesign	not applicable	no	ne	
CE partly completed machine	2016/2281 or 2013/813	no	ne	

A table summarising the attached documents with regard to the type of unit is shown below. **Table (a)** 

(1) SCOP/ŋsh LT or MT as required by Regulation 2013/813.

(2) Where provided for by Regulation 2013/811, applies to heat pumps with Pdesign <70kW.

3.1.5 Efficiency parameters required for conformity

To avoid ambiguity, this chapter identifies efficiency parameters with the acronyms indicated below. Regulation 2016/2281 envisages conformity according to the following efficiency parameters:

- nsc low temperature: user-side inlet/outlet temperatures 12/7°C; identified in this document as SEER/nsc LT;
- ηsc medium temperature: user-side inlet/outlet temperatures 23/18°C; identified in this document as SEER/ηsc MT;
- SEPR HT.

Regulation 2013/813 envisages conformity according to the following efficiency parameters:

- ηsh low temperature: user-side inlet/outlet temperatures 30/35°C, average climate design conditions; identified in this document as SCOP/ηsh LT;
- ηsh medium temperature: user-side inlet/outlet temperatures 47/55°C, Average climate design conditions; identified in this document as SCOP/ηsh MT; this applies as regards models that can operate with delivery temperature ≥ 52°C at a source temperature of -7°C db/-8°C wb (air-water unit) (10°C inlet for water unit) in the aforesaid climate profile.

For each unit, the composition of the Attached Document(s) is predefined and comes under one of the cases in table (a); therefore, more specifically:

- if the type of unit and/or the expected operating condition are exempt from conformity, the EC Declaration will in any case be accompanied by Attached Document(s) according to table (a);
- in any case, the operating temperatures specified when ordering do NOT determine the type of Attached Document supplied.

#### 3.2 Conformity of the application

The applications allowed as regards the documentation supplied with the unit are indicated below. This applies only in the case of units intended for installation and operation in the European Union.



The customer is required to select the unit with regard to the expected operating condition and the Ecodesign conformity required for that condition.

The documentation available during pre-sale enables the unit to be selected, ordered and purchased correctly for this purpose.

Table (b) indicates the type of conformity required according to the operating condition.

Conformity is to be verified during selection/pre-sale and will be certified by the Attached Document supplied with the unit.

The applications are defined by the Regulations as follows:

- 1. "Comfort" = application intended for the thermal comfort of people;
- 2. "Process" = application intended for cooling an appliance or a refrigeration system, whose aim is not to ensure cooling of a room for the thermal comfort of people.

A table summarising the Ecodesign Conformity required with regard to operating condition is shown below.

#### Tab<u>le (b)</u>

Operation / Water delivery temp °C	Conformity	Notes	
1) Comfort, cooling-only	< 18	SEER/ηsc LT	
2) Comfort, cooling-only	≥18	SEER/ηsc MT	(1)
3) Process, cooling-only	$+2 \le LWT \le 12$	SEPR HT	
4) Process, cooling-only	> 12	none	
5) Process, cooling-only	-8 < LWT < 2	none	

(1) - All the more so, SEER/ $\eta sc$  LT conformity is also valid.



In the "Process, cooling only" case with delivery temperature between  $-8^{\circ}C$  and  $+2^{\circ}C$  (point 5 of table (b)), no type of conformity is required if the unit can operate only at delivery temperatures strictly higher than  $-8^{\circ}C$ .

Operation / Unit: type and Pdesi	Conformity	
6) Comfort, heating + cooling	$\leq$ 400kW	SCOP/ŋsh
7) Comfort, heating + cooling	> 400kW	see point 1 or 2
8) Heating	heating-only unit $\leq$ 400kW	SCOP/ŋsh
9) Heating	heating-only unit > 400kW	none



Operating conditions other than those indicated are not allowed because they may be in conflict with the issued Ecodesign conformity.

As regards the pre-sale stage, the Manufacturer reserves the right to consider and, if necessary, implement devices for specific operating conditions.



The customer (or the installer or the system operator) is responsible for the adopted operating condition and its consistency with the Ecodesign conformity issued by the Manufacturer.



The Manufacturer refuses all liability arising from improper use of the machine and more specifically from operation in temperature conditions not allowed by the technical documentation.

See also the "Intended use" and "Unintended use" paragraphs of the "Product description" chapter.

## 4 INSPECTION, UNPACKING, TRANSPORT

#### 4.1 INSPECTION

Upon receiving delivery of the unit, verify its integrity: the machine left the factory in perfect condition; any damage must be immediatedly contested with the delivery service and noted on the Delivery Note before countersigning. The Manufacturer, or its Agent, must be informed immediately of the nature of any damage. The Client must compile a written and photographic report concerning each area of damage found.

#### 4.2 UNPACKING

Disposal of packaging material is the responsibility of the consignee and must be done in compliance with any and all applicable laws of the country where the delivery has taken place.

#### 4.3 LIFTING AND TRANSPORT

While unloading and positioning the unit, take extreme care to avoid sudden, violent movements. Avoid applying force to components of the machine. The unit may be lifted using assistance from a forklift, inserting the lifting forks in the lifting pallet (see fig. 1).



WARNING: During any lifting operation, ensure the unit is stable and secure to prevent it tipping over or falling.



Figure 1



The machine is balanced. In every case, keep the forks low. Use ballast to balance the machine if unbalanced. It is prohibited to lift protruding parts of the machine by hand.



Lifting machines, ropes, slings, etc., must be chosen by personnel with suitable skills able to assume responsibility for their use.



Never move beneath the load, or in close proximity to same. The movement must be performed by qualified personnel (dollymen, slingers) with suitable protective equipment and clothing (protective overalls, steel-toed boots, hard hats, gloves, goggles). The manufacturer does not accept any responsibility for any incidents caused by failure to observe these warnings and notices.

#### 4.4 REMOVING TRANSPORTATION BRACES

During transport, the unit may be subjected to strong vibrations. To ensure no damage occurs as a result, transport braces were fitted prior to transport. When the unit arrives, it is necessary to remove these from the unit and the pallet.





When the unit has been positioned, and prior to its activation, it is necessary to remove the transportation screws between the wooden pallet and the damping platform. The screws are indicated within the unit with appropriate labels. The number of braces depends on the size of the unit.

Example of screws to remove

Example of screws to remove



## 5 PROHIBITED USES

It is prohibited to use the machine:

- in an explosive atmosphere;
- in a flammable atmosphere;
- in excessively dusty environments;
- in environments subject to atmospheric effects;
- using untrained personnel;
- in violation of any applicable laws;
- when incorrectly installed;
- with a defective supply;
- with partial or complete ignorance of the instructions;
- with poor maintenance and / or use of unauthorised parts;
- with modifications or other work not authorised by the manufacturer;
- when the working area is not kept clear of tools and other objects;
- when the working area is not kept adequately clean;
- when the working area is subjected to anomalous vibrations;
- in the open, or subject to atmospheric effects;
- for treatment of alimentary products.

## 6 SAFETY MEASURES

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

#### 6.1 DEFINITION OF A DANGEROUS AREA

Only authorised personnel should have access to the machine.

- The external danger area is defined by a space of around 2 metres around the machine. Access to this zone must be interdicted by an appropriate guard in case the unit is positioned in unprotected areas that can be easily reached by unqualified personnel.
- The internal danger area is accessed by entering the machine. Unauthorised personnel must never be permitted access to the internals of the machine, nor should access be permitted when the machine is still active.

#### 6.2 SAFETY DEVICES

Every unit is designed and built in accordance with applicable laws and regulations in order to guarantee maximum safety. Adhere to the instructions below to avoid possible risks or danger:

- This product contains pressurized containers, electrical components, moving mechanical parts, and surfaces which can reach both high and low temperatures and, in certain circumstances, constitute a potential hazard: all operations must be carried out by specialized personnel who have the necessary qualifications in accordance with the laws in force. Before carrying out any operation, make sure that the appointed personnel has full knowledge of the documentation supplied with the unit
- Always keep a copy of the documentation near the unit.
- The operations described in this manual must be integrated with the procedures described the instruction manuals for any other systems and components incorporated in the machine. These manuals contain all the information necessary to safely operate all the devices and available functions.
- Use adequate protection (gloves, hard hat, protective eyewear, safety boots, etc.) for any operation performed on the unit, be it for maintenance or control.
- Do not wear large, loose clothing, such as ties, chains, or watches thac could get caught in the moving parts of the machine.
- Ensure safety instruments and equipment are maintained in good order.
- The compressor section contains components operating at high temperatures. Take extreme care when working in this area to avoid touching these components without adequate protection.
- Do not work in the discharge path of the safety valves.
- If the system is located in an area not protected from, and easily reached by, unqualified personnel, it is obligatory to install adequate protection.
- The operator is obliged to consult the installation and operations manual of the incorporated systems and annexed to this manual.
- There may be potential, non-obvious, risks. For this reason, the machine includes warnings and notices.
- It is forbidden to remove the warnings and notices.

#### It is forbidden to:

- Remove or render unusuable any shields, covers, etc., fitted for safety purposes;
- Tamper and / or modify, even partially, the safety devices installed on the machine.
- In case of alarm warnings and after consequent operation of safety devices, the operator must request immediate assistance from qualified maintenance technicians. An accident may cause serious injury or death.
- The safety devices must be tested as described within the attached instruction manuals. Testing of controls must be performed by persons authorised by the employer via a written job assignment document. A copy of the test results must be left on, or near, the machine. An accident may cause serious injury or death.

The manufacturer accepts no responsibility for damage to persons, domestic animals, or property caused by the reuse of individual components of the machine for functions or purposes other than those for which they were designed. It is forbidden to tamper with, or substitute unauthorised parts of the machine.

The use of accessories, tools, or consumable materials not recommended by the manufacturer automatically exonerates said manufacturer from any civil or criminal responsibility.

Decommissioning, dismantling or destruction of the machine must be performed only by suitably trained and equipped personnel.

#### 6.3 INSTALLATION IN AREAS WITH EXPLOSIVE ATMOSPHERES

These machines are not suitable for applications in the fields covered by Directive ATEX 94/9/EC – Presidential Decree 23/3/98, No. 126.

#### 6.4 PROTECTION SYSTEMS

The machine uses technical devices designed to protect people from dangers that cannot be reasonably eliminated or sufficiently limited by design.

It is forbidden:

- Remove or render unusuable any shields, covers, etc., fitted for safety purposes;
- Tamper and / or modify, even partially, the safety devices installed on the machine.

#### 6.5 ILLUMINATION

The illumination must permit working on the machine without creating risks due to shadows.

#### 6.6 PERSONNEL QUALIFICATIONS – OBBLIGATIONS

The User must understand and apply the requirements regarding workplace safety in the Directives 89/391/EC and 1999/92/EC.

The knowledge and understanding of the manual are prerequisites for the reduction of risks to worker health and safety. The operator must have a level of knowledge adequate to perform his activities during the working life of the machine.

The operator must be instructed in the possible faults, malfunctions, or conditions dangerous to himelf/ herself or to others, and in every case, must comply with the following requirements:



stop the machine immediately using the emergency stop button; never perform operations or repairs outside his/her area of competence and

never perform operations or repairs outside his/her area of competence an expertise;

avoid personal initiative and immediately inform his/her superior.

#### 6.7 VARIOUS REMARKS

During use, make use of protection and safety devices as required by law, whether integrated into the machine or separate. The technical sheet of the machine should be filed with the manufacturer.

The manufacturer assumes no responsibility for any harm caused to persons, domestic animals, or property arising from failure to respect the safety rules and recommendations contained in the supplied documentation.

This manual is an integral part of the total information provided in other documents. These other documents should be consulted when necessary.

### 7 LOCATION

The following should be considered when determining the best site for the unit and its related connections:

- dimensions and origin of hydraulic lines;
- location of electrical supply;
- accessibility for maintenance and repair operations;
- suitability of the surface on which the machine is to be placed;
- any problems arising from noise and / or vibration

The units impart a low level of vibration to the surface: it is necessary to carefully evaluate the siting within the structure to minimise the effects of vibration transmission through solid materials.

The units transmit a low level of vibration through hydraulic lines: it is necessary to carefully evaluate the clamping and connection of the hydraulic lines with the goal of minimising the effects of noise transmission through solid materials.

## 8 INSTALLATION

#### 8.1 CLEARANCE AREAS

The clearance areas are shown on the dimensional drawings and must be strictly observed.

#### 8.2 GENERAL RECOMMENDATIONS FOR HYDRAULIC CONNECTIONS

When installing the hydraulic systems, it is good practice to adhere to the following and also to the national and local codes and regulations (see schematics included in the manual).

- Connect the pipes to the unit via flexible hoses to avoid transmission of vibrations and to compensate for thermal expansion and contraction.

Install the following components to the pipes:

- Stopcocks, temperature and pressure indicators, for normal maintenance and control of the system.
- Wells at the entrances and exits of the pipes for checking temperature should temperature indicators not be present.
- Shut-off valves to isolate the system from the hydraulic system.
- Metallic filter (entry pipe) with mesh grid no larger than 0.88 mm. to protect the exchanger from debris and impurities in the pipes. Each water system inlet connected to the unit must be fitted with such a filter.
- Hydraulic connections between the unit and the system/sanitary/probe pipes, must be provided using flexible hoses so as to prevent the transmission of vibration. If fixed pipes are used, these could cause vibration-related problems, or damage.
- Venting valves, fitted at the highest points of the hydraulic system, to permit venting of excess gases.
- Expansion tank and automatic charging valves for maintenance of pressure in the system and to compensate for thermal expansion. The expansion tank, if present within the unit, should not be considered sufficient for the protection of the system. It is necessary for either the unit installer, or the end user, to install an additional expansion tank.
- Drain tap and, where necessary, a drainage tank to permit the draining of the system for maintenance operations, or for seasonal shutdowns.

#### HYDRAULIC DIAGRAM

USER HEAT EXCHANGER

## EVAPORATORE IN FUNZ IONAMEN TO ESTIVO - CONDENSATORE IN FUNZIONAMENTO INVERNALE EVAPORATOR IN THE SUMMER MODE CONDENSAR IN THE WINTER MODE



SOURCE HEAT EXCHANGER

#### CONDENSATORE IN FUNZIONAMENTO ESTIVO - EVAPORATORE IN FUNZIONAMENTO INVERNALE CONDENSER IN THE SUMMER MODE - EVAPORATORE IN THE WINTER MODE



#### ▲ TOTAL RECOVERY EXCHANGER



- EL ELECTRIC PUMP
- FL FLOWSWITCH

- SF EXHAUST VALVE
- VE EXPANSION TANK

#### 8.3 HYDRAULIC EVAPORATOR CONNECTION

IN



It is of crucial importance that the water supply is provided via the connection labelled as shown below:

WATER UTILITIES

#### 8.4 Minimum water content of the system

For the machine to work correctly, it is necessary to ensure sufficient inertia on the system to respect the minimum operating time, taking into consideration the greater value of the minimum OFF time and the minimum ON time. Ultimately, these contribute to limit the number of hourly startings of the compressors and to avoid undesired out of setting parameters of the water temperature delivered.

Larger quantities of water are always preferable since they involve a smaller number of ON/OFF operations by the compressors, resulting in less wear of them, and a slight increase in system efficiency due to the decrease in the number of transients. It should also be pointed out that with air-water units that operate with a heat pump, the minimum amount of water will require the unit to execute defrosting: having an adequate volume of inertia will enable the prevention of high drifts in water temperature delivered at the end of the defrosting cycle. The experimental formula below is to calculate the system's minimum water content, both the cold and hot sides:

 $v = \frac{Ptot}{N} * 1000 * \frac{\Delta \tau}{(\Delta T * \rho * Cp)} * Fm + Ptot * K_1$ 

Where

ν	= Minimum water content of the system [ ]	1	]
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*Ptot* = Total cooling power [kW]

 $N = N^{\circ}$  of capacity control steps

 $\Delta \tau$  = Time interval - greater time between minimum OFF and ON [s]

 $\Delta T$  = Permitted differential of water temperature [°C] (unless specified, equivalent to 2.5°C)

 $\rho$  = Water density 1000 [kg / m<sup>3</sup>]

Cp = Specific water heat 4.186 [kJ / (kg°C)]

Fm = Quality factor: experimental factor, varies by 1 with some types of units

 $K_1$  = Multiplicative constant experimental dependent on the type of compressor

If some terms are grouped together, the formula may be written as follows:

$$v = \frac{Ptot}{N} * K * Fm + Ptot * K_1$$

In all the cases that will be considered below, where the carrier fluid is composed of water-glycol (ethylene, propylene or other) mixtures, the density and specific heat values must be adjusted accordingly

	Units with 1 scroll
	compressor
<i>k</i> [l/kW]	17.20
N	1
Fm	0.50
K_1	0.25

The constant K considers that the maximum between the minimum time ON and OFF is equivalent to 180s.



Installation of the flowmeter, if not supplied with the system, is required, fitted to the water return connection of the evaporator labelled as shown below:



WATER UTILITIES



Installation of the metallic filter mesh on each pipe connected to the unit's water inlet connector is obligatory: if omitted, the guarantee is rendered null and void.



It is obligatory to use flexible hoses between the unit and the water system: if not fitted, the guarantee is rendered null and void



It is highly advisable to install a safety valve on the hydraulic system. In case of grave anomalies in the system (e.g. a fire), this will permit draining of the system to avoid burst pipes or explosions. Always connect the outlet to a drainage pipe with a diameter no smaller than that of the opening, and position the end of the drainage pipe such that its flow will not cause harm to people.

WARNING: When connecting the hydraulic system, do not use naked flames in proximity, or inside, the unit.

#### 8.5 HYDRAULIC CONNECTION TO THE CONDENSATOR / RECOVERY

It is important to ensure the incoming water supply is connected to the inlet labelled as shown below:



CONDENSATION WATER

#### 8.5.1 Types of condensation control

The units in this series are not designed to function with condesator cooling water temperatures below 20 °C. To function below this limit, the unit may require structural modifications.

If such works are necessary, contact our agent.

With the aim of guaranteeing correct use of the unit, within the correct functional limits, when using well-water or water with an elevated temperature in the condensator section, it is obligatory to use a condensation controller system that guarantees the condensation pressure always remains above 20 bar. Some suggested solutions are:

- Use a pressure valve
- Use a three-way valve
- Use a two-way modulating valve
- Use a variable power pump

Contact our agent for the optimal choice for the type of application required. Using a pressure valve

Use of a pressure valve (or one of the other technical sulutions) is required even in closed systems. In fact, this tends to stabilise the function of the unit when the condenser water temperature varies (e.g. when restarting after weekly shutdowns).

The installation of the pressure valve is absolutely required if the mains water at the entrance to the condenser may drop below 25 °C (see fig. 3). The pressure valve must guarantee a condensation pressure above 20 bar (relative). Contact our agent for further details.



Using a three-way valve:

Instead of a pressure valve, a three-way modulation valve can be fitted, with a temperature sensor on the water entering the exchanger, that guarantees the water entering the condenser / recovery system is above 25 °C. See figure 4.



- Condenser/recovery
- 1 2 3 Three-way valve
- Circulation pump

Figure 4

#### 8.6 HYDRAULIC CONNECTION TO RECOVERY CONDENSER (HWS MODEL ONLY)



It is important that the water entering the recovery circuit does so via the inlet labelled as shown:



**RECOVERY WATER** 

In order that the unit operates correctly with the heat recovery function, the temperature of the condensation must be maintained at approximately 50 °C. To ensure the function of the unit, the recovery condenser outlet temperature must remain within the limits defined by the functional limits diagram (see Technical Book).

The flow of the water at the main condenser, and at the recovery condenser, must be controlled so as to att ain the required temperature set on the recovery system, and to maintain the condensation pressure always above 20 bar.

#### 8.7 SAFETY VALVE OUTFLOWS

The refrigerant circuit includes safety valve: some regulations require the outflows from these is taken outside via an appropriate tube or pipe, which must be of a diameter at least equal to that of the valve's outlet, and which is not so heavy as to damage the valve itself.



WARNING: Ensure the safety valve outflow cannot cause harm to people.

#### 8.8 WATER QUALITY

Working with either well or river water raises the possibility of corrosion and encrustation problems due to the water quality. In such cases, we advise analysing the water to check its pH, electrical conductivity, presence of ammonia ions, of sulpher, chloride, hardness, etc., and to provide any required chemical treatments.

#### 8.9 WATER FLOW TO EVAPORATOR AND CONDENSER

The nominal water flow refers to a thermal differential between inlet and outlet of 5 °C for mains water, or 15 °C for well water in relation to the refrigeration power or supplied heat.

The maximum permitted flow is that which presents a thermal differential of 3 °C: higher values would cause large drops in load, causing elevated vibration and a risk of damage to the exchangers.

Minimum permitted flow is that presenting a thermal differential of 5 °C: lower values could cause evaporation temperatures that are too low, triggering safety systems and shutdown of the unit, with condenser temperatures high enough to carry a risk of triggering over-pressure safety systems.

The manufacturer reserves the right to fix the temperature differences relating to the set point requested, with the scope of enabling correct function of the unit. This value must never be modified without written authorisation from the manufacturer.

#### 8.10 REFRIGERATED WATER TEMPERATURE (SUMMER CYCLE)

When minimum temperature of the water at the evaporator outlet is 5 °C.

The maximum temperature at the evaporator inlet is 20 °C. For higher temperatures, additional components must be installed in the hydraulic supply (split circuits, three-way valves, bypasses, storage tanks): contact our agent for the most suitable solution.

#### 8.11 OPERATION WITH LOW TEMPERATURE EVAPORATOR WATER



The units in this series are not designed to function with refrigerated water temperatures below those indicated in the operational limits diagram for the evaporator outlet. To operate beyond this limit, the unit may require structural modifications. If such prove necessary, contact our agent.

With temperatures below those indicated in the operational limits diagrams, it is necessary to operate the machine with water and antifreeze mixtures. In this case, it is necessary to vary the service and antifreeze thermostat settings. The percentage of glycols by weight is determined as a function of the desired temperature of the refrigerated water (see Table 5).

Fluid outlet temperature, or minimum ambient temperature (°C)	$+0^{\circ}$	-5°	-10°	-15°	-20°	-25°	-30°	-35°	-40°
Freezing point (°C)	-5°	-10°	-15°	-20°	-25°	-30°	-35°	-40°	-45°
Antifreeze				Q	% by wei	ght			
Ethylene Glycol	6	22	30	36	41	46	50	53	56
Polypropylene Glycol		25	33	39	44	48	51	54	57
Methanol		14	20	26	30	34	38	41	45
Calcium Chloride		14	18	21	24	26	27	28	30
Temper -20		t -20°C —							
Temper -40		t -40°C							
Temper -60					t -60°C	2			
Tifoxite	40			50	60	63	69	73	
Freezium	10	20	25	30	34	37	40	43	45
Pekasol 50	5	0	59	68	75	81	86	90	

#### TABLE 5 – FREEZING POINT FOR WATER-ANTIFREEZE MIXTURES

To correctly determine the freezing point, it is necessary to analyse the water / glycol mixture.



Whenever an ambient temperature below the freezing point of water is expected, it is necessary to use antifreeze mixtures in the proportions indicated above.



When using water / glycol mixtures in proportions greater than 30% with pumps present, it is necessary to request special pumps when ordering.

#### 8.12 WATER COMPOSITION

The presence of substances dissolved in the water may cause corrosion in the exchangers. It is obligatory to check the composition of the water is within the parameters below:

pН	between 7.5-9.0
SO4	< 100 ppm
HCO3-/SO4	> 1 ppm
Durezza	between 4.0- 8.5 dH
Cl-	< 50 ppm
Cl2	< 0.5 ppm
PO43-	< 2.0 ppm
NH3	< 0.5 ppm
Free Chlorine	< 0.5 ppm
Fe+++	<0.5 ppm
Mn+++	< 0.05 ppm
CO2	< 10 ppm
H2S	< 50 ppb
Temperature <	65 °
Oxygen content	< 0.1 ppm

If the water composition is outside these parameters, the unit will break. The use of the unit with water outside the parameters shown above will automatically make the guarantee null and void.

It is required to install systems that will remove any organic substances from the water that could pass through the unit's filters and enter the exchanges and, over time, provoke malfunctions and / or breakage.

Use of the unit with the presence of organic substances in the water will automatically void the guarantee.

#### 8.13 ELECTRICAL CONNECTIONS

#### 8.13.1 General

- Electrical connections must be made in accordance with the information reported on the electrical wiring diagram supplied with the unit, and with any and all applicable rules and codes.
- The earth connection is obligatory by law. The installer must connect the earth cable with the appropriate PE terminal on the earthing bar situated on the electrical panel.
- Ensure the power supply corresponds with the nominal specifications for the unit (power, phases, frequency) as shown on the plate affixed to the outer casing.
- The power supply must not have any variation greater than ± 5%, and the balancing of the phases must always be below 2%. If this is not the case, contact our technical support office to choose the correct protection systems. A power supply that violates the limits cited may be dangerous, and cause permanent damage to the unit. The use of the unit with such a supply, even for brief periods, will automatically void the guarantee.
- Ensure the line is connected with the phases in the correct sequence.
- Refer to the dimensional diagram for the cable entry.
- Control circuit power supply is derived from the main supply via a transformer located on the electrical panel. The control circuit is protected by appropriate fuses.
- The compressors may rotate in only one direction. If the phases (in a 3-phase supply) are incorrectly connected, the compressor will make a loud noise during operation and, if not disconnected, will stop after a few minutes after triggering the internal protection systems. It is therefore crucial to disconnect the power supply and invert the two phases on the unit's supply. To ensure the compressors are functioning correctly, it is necessary to switch on the unit while controlling (using a pressure gauge connected to the part of the system subject to high pressure, and a pressure gauge connected to the part of the circuit subject to low pressure) that the condensation and evaporation pressures increase and decrease respectively.



Attaching the power supply cable: use connectors that are resistant to tractive and torsional forces.



Before performing any work of an electrical nature, ensure the power is switched off.



The cable section, and the line protection, must conform to the specifications shown in the electrical diagram and in the appropriate table affixed to the unit.



Activation of heaters must be performed at least 12 hours prior to starting the unit, and will occur automatically upon shutdown of the general isolator.

The system must operate only within the parameters cited above: if this is not the case, the guarantee will immediately become null and void.

#### 8.13.2 Power supply for compressor crankcase heater

To power the crankcase heater:

- 1) Confirm the phase sequence is correct (if the "PHASE MONITOR" accessory is not present.)
- 2) Shut off the isolator switch by moving it from the position marked "0" to the position marked "1".
- 3) Ensure the display shows "OFF".
- 4) Ensure the unit is switched off and that the indicator is on.
- 5) If the "PHASE MONITOR" accessory is present: after a few moments, if the phase sequence is incorrect, the
- "PHASE SEQUENCE INCORRECT" alarm will appear. In this case, invert the two phases of the power supply.
- 6) Leave the machine for at least 12 hours to power the crankcase heaters.

#### 8.13.3 Dry Contacts

- The following dry contacts are available:
- 1 replacement contact for cumulative alarm
- 1 contact for each compressor (optional)

#### 8.13.4 Circulation pump electrical connections

The unit may be started only after the unit's water or recovery system circulation pump(s) are functioning. In HWS units, all the pumps must be controlled by the unit's control system. In the QE models, controls for their operation are present.



The pump must be started before starting the unit, and stopped after the unit is stopped. The minimum recommended delay between the two is 60 seconds.

8.14 MICROPROCESSOR CONTROL Refer to the supplied manual.

## 9 STARTING

#### 9.1 PRELIMINARY CHECKS

- Ensure the electrical connections have been made correctly and all clips and terminals are tight.

– Ensure the power supply on the RST terminals is  $400 \text{ V} \pm 5\%$  (or as shown on the plate affixed to the unit if an unusual power supply voltage is being used).

If the supply voltage is subject to frequent variation, contact our technical support office for details about appropriate protection systems. If the supply violates the required limits, it can cause danger and permanent damage to the unit. Use of the unit with such a power supply, even for brief periods, will automatically void the guarantee.

- Ensure the display shows the refrigerant gas circuit pressure.
- Ensure there is no leakage of the refrigerant fluid; use a leak-finder if necessary.
- Ensure the correct supply of power to the crankcase heaters.



Activation of the heaters must be performed at least 12 hours prior to starting the unit, and will occur automatically when the isolation switch is activated.

To check for correct function of the heaters, verify the lower part of each compressor is warm and, that each is at a temperature between 10 - 15 °C above ambient temperature.

- Verify the hydraulic connections have been made correctly, respecting the information on the stickers alongside the inlet and outlet connectors on the machine's outer casing.

- Ensure the hydraulic system has been bled of any and all residual gases, charging the system slowly and opening the bleed valves fitted by the installer along with an expansion tank of adequate capacity.

- Verify the presence of the metallic filter mesh at the unit's water inlets. Each water inlet connection must be fitted with such a filter.

- Verify the presence of flexible connections between the unit and the water pipes of the hydraulic system. Each pipe connection must be made using a flexible pipe.

## 10 STARTUP



WARNING: Before proceeding with the startup process, verify all panels are in place and secured with the appropriate screws.

#### 10.1 SEASONAL SHUTDOWN

- Shut off the power supply using the machine's main isolator switch.
- Discharge the system (if it does not contain a water / glycol mix).
- On the next restart, repeat the startup procedure.

#### 10.2 EMERGENCY STOP



If the unit fails to start, do not modify the internal electrical connections. If you do so, the guarantee will be automatically null and void.



It is not recommended to cut power to the unit during temporary shutdowns in order to ensure the crankcase heaters remain on. Cut power to the unit only if it will be kept switched off for a prolonged period (e.g. during a seasonal shutdown).



WARNING: to stop the unit, do not cut power using the machine's general isolator switch: this must only be used to cut power when the unit is already switched OFF. Furthermore, cutting all power to the unit will switch off the crankcase heaters, affecting the integrity of the compressor when restarting.

## 11 CHECKS TO BE PERFORMED DURING OPERATION OF THE UNIT

- Ensure the temperature of the water at the evaporator inlet is approximately that set on the service thermostat.
- For units fitted with pumps: if the pump is making excessive noise, turn its tap off until the pump is restored to correct operation. This may occur when the pressure load in the system differs significantly from the pump head.

#### 11.1 CHECKING THE REFRIGERANT LOAD

- Verify, after a few hours of operation, that the fluid inspection window has a green corona: a yellow corona indicates the presence of humidity in the circuit, in which case, the circuit must be dehydrated by a qualified technician.

- Ensure no bubbles appear in the fluid inspection window. If a continuous passage of bubbles is seen, this may indicate that the level of refrigerant fluid in the system is too low and must be topped-up. The occasional bubble is acceptable.

## 12 MAINTENANCE AND PERIODIC CHECKS

#### 12.1 WARNINGS



All the operations described in this chapter MUST BE PERFORMED BY QUALIFIED PERSONNEL ONLY.



Before starting any work on the unit, or accessing any internal components, ensure the power supply to the unit has been shut off.



The heads and feed pipes of the compressor will be at a high temperature. Take suitable precautions when working in their vicinity.



After any maintenance operations, always close the unit's panels, securing them with the appropriate screws.

#### 12.2 GENERAL INFORMATION

It is best practice to perform periodic checks to ensure correct functioning of the unit:

OPERATION	RECOMMENDED INTERVAL
Verify the correct function of all the control and safety apparatus as described previously	Monthly
Check the electrical connections both inside and outside the machine, including the terminals on the electrical panel and those on the compressors. Removable and fixed contacts and contactors must be periodically cleaned, and replaced when signs of deterioration are found	Monthly
Check the refrigerant fluid levels via the fluid inspection window	Monthly
Ensure there is no oil leakage from the compressor	Monthly
Ensure there is no water (or water + antifreeze) leakage from the hydraulic system	Monthly
If the unit must be kept out of service for a prolonged period, drain the water from the system and from the heat exchanger. This operation is crucial in cases when the unit is likely to remain shut down in ambient temperatures below the freezing point of the fluid used	Seasonal
Check the recharging of the water into the hydraulic circuit and that no air remains	Monthly
Verify correct function of the flowmeter	Monthly
Check the compressor crankcase heaters	Monthly
Clean the metallic filters in the water pipes. (During the first four months after starting the unit, the filters should be cleaned weekly.)	Monthly
Check the fluid inspection window for signs of humidity (green = dry, yellow = humid); if the window is not green, as indicated on the label beside the inspection window, replace the filter	4 months
Check the unit is not making excessive noise	4 months
If using well water, check the water pressure	Monthly

#### 12.3 ENVIRONMENTAL PROTECTION

The laws regarding the use of substances deleterious to the stratospheric ozone layer bans the emission of refrigerant gases into the atmosphere and obliges owners of devices using such materials to retain said gases and return them, after their operational use, to the vendor, or to appropriate recycling centres.



It is therefore recommended to pay particular attention during maintenance procedures to reduce leakage or release of refrigerant gases as far as possible.

#### 13 Decommissioning

With reference to the European waste management directive, we inform you of the following:

The owner of electrical and electronic equipment (EEE) is obliged not to dispose of it as non-separated municipal waste, and must dispose of it via separate collection through public or private waste collection systems as required by local regulations. The owner can return EEE to the dealer at the end of its life when purchasing equivalent new equipment.

This EEE may contain hazardous substances such as refrigerant gases, lubricating oils and accumulators or other materials, and improper or incorrect disposal of them may have adverse effects on human health and the environment.

Incorrect disposal of them also entails penalties as provided for by local regulations.

The symbol shown on the equipment, which indicates separate collection of EEE, is a crossed out wheelie bin accompanied by a solid horizontal bar and identifies that it was put on the market after 13 August 2005.



## 14 CONFIGURING THE CONTROL SYSTEMS

#### 14.1 GENERAL INFORMATION

All the control apparatus are calibrated and tested at the factory prior to delivery of the unit. After the unit has been in operation for a reasonable period of time, it is possible to make an inspection of the safety systems. The settings are reported in Table 3.



All the servicing operations on the control apparatus must be performed ONLY BY QUALIFIED PERSONNEL: incorrect settings may cause serious damage to both the machine and to people.

#### TABLE 6 – CONTROL & SAFETY DEVICE SETTINGS

Control & Safety Devices	Activation Set Point	Differential	Reinsertion	
Antifreeze setting	°C	4	6	manual
Pressure meter max. pressure	bar	40,5	7	manual
Pressure meter min. pressure in chiller operation mode	bar	4,5	1	manual (from control)
Pressure meter min. pressure, winter operation mode	bar	4,5	1	manual (from control)

## 15 REFRIGERANT R410A SAFETY DATA SHEET



1.IDENTIFICATION OF	1.1	Preparation ID		SUVA* 410a refrigerant				
THE SUBSTANCE OR PREPARATION		ASHRAE refrigerant number designation		R410A				
	Cho	migal nature of propagation	by maga	Cas No	EC No			
INFORMATION ON	Dif	$\frac{1}{1}$	<sup>%0</sup>	by mass –	$\frac{1}{75,10,5}$	200 830 <i>4</i>		
INGREDIENTS	Pen	tafluoroethane (r125)	50-	-	354-33-6	206-557-8		
3 HAZARDS	2.1	Major hazards		Vanours ar	e heavier than air	and can cause suffocation		
IDENTIFICATION	5.1	Widjor Huzurds		by reducing	g oxygen available	e for breathing.		
	3.2	Specific hazards		Rapid evap May cause	oration of the liqu cardiac arrhythmi	id may cause frostbite. a.		
	4 1			TT 11 1	1			
4. FIRST AID MEASURES	4.1	Eye contact		for at least	15 minutes. Get n	eyes with plenty of water nedical attention.		
		Skin contact		Take off all contaminated clothing immediately. Flush area with lukewarm water. Do not use hot water. If frostbite has occurred, call a physician.				
		Inhalation		Remove from exposure, lie down. Move to fresh a Keep patient warm and at rest. Artificial respiration and/or oxygen may be necessary. Consult a physician				
		General information		Never give When sym medical ad	anything by mout ptoms persist or vice.	h to an unconscious person. in all cases of doubt seek		
5. FIRE-FIGHTING MEASURES	5.1	Extinguishing media		Water spra (CO2)	y, Foam, Dry chei	nical, Carbon dioxide		
	5.2	Specific dangers		Increase in	pressure.			
	5.3	Specific methods		Chill conta	iners / cisterns wi	th water sprays.		
		-						
6. ACCIDENTAL RELEASE MEASURES	6.1	Personal precautions		Evacuate especially might colle	personnel to sa low or enclosed p ect.	fe areas. Ventilate area, laces where heavy vapours		
	6.2	Environmental precautions		Evaporates	i.			
	6.3	Cleaning methods		Evaporates				
7. HANDLING AND STORAGE	7.1	Handling		Technical air exchang Advice for cool and w or mist.	Measures / Precau ge and/or exhaust safe handling: Ke vell-ventilated plac	tions: Provide sufficient in work rooms. eep containers in a dry, ee. Do not breathe vapours		
	7.2	Storage		Technical containers ventilated Incompatil materials, o Packaging	Measures / Sto tightly closed i place ble products: organic peroxide. material: Store in	orage requirements: Keep n a dry, cool and well- explosives, flammable original container.		

8. EXPOSURE CONTROLS / PERSONAL PROTECTION	8.1	Control Parameters	Difluoromethane: limiti di esposizione raccomandati da DuPont: ael (8-h e 12-h tWa) = 1000 ml/m3; DuPont (1999).
	8.2	Respiratory Protection	For rescue and maintenance work in storage tanks use self-contained breathing apparatus. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
		Hand Protection	Heat insulating gloves
		Eye Protection	Safety glasses with side-shields and face shields.
		Hygiene Measures	No smoking. Handle in accordance with best practice.

9. STABILITY AND REACTIVITY	9.1	Stability	The product is chemically stable.
	9.2	Conditions to avoid.	The product is not flammable in air under ambient conditions of temperature and pressure. When pressurised with air or oxygen, the mixture may become flammable. Certain mixtures of HCFCs or HFCs with chlorine may become flammable or reactive under certain conditions.
	9.3	Incompatible Materials	Alkali metals Alkaline earth metals Powdered metals Powdered metal salts
	9.4	Hazardous decomposition products	Carbon oxides Hydrogen fluoride Carbonyl fluoride Fluorocarbons

10. TECHNOLOGICAL INFORMATION	10.1	Acute Toxicity	Difluoromethane: Cl50/inhalation/4 hour/(on rats)= >760 ml/l Pentafluoroethane (r125): Cl50/inhalation/1 hour/(on rats) = >3480 mg/l
	10.2	Local Effects	Concentrations substantially above the tIV value may cause narcotic effects. Inhalation of products in decomposition at high concentrations may cause respiratory deficiency (pulmonary oedema).
	10.3	Long-term Toxicity	No carcinogenic, teratogenic, or mutagenic effects demonstrated in animal testing.
	10.4	Specific Effects	Rapid evaporation of liquid may cause frostbite. May cause cardiac arrhythmia.

11. ECOLOGICAL	11.1	Ecotoxic Effects	Pentafluoroethane (r125): Potential global warming
INFORMATION			effect due to halocarbons. Global Warming Potential
			(GWP): 2088.
			Ozone Depletion Potential $(ODP) = 0$ .

12. DISPOSAL CONSIDERATIONS	12.1	Waste treatment methods: product	Can be used after re-conditioning. In accordance with local and national regulations.
	12.2	Contaminated packaging	Empty pressure vessels should be returned to the supplier.

13. TRANSPORT INFORMATION	UN No.	3163
	ADR	3163 Gas, compressed, n.o.s. (Pentafluoroethane, Difluoromethane), 2, ADR.

#### 15.1 IMPORTANT INFORMATION REGARDING THE REFRIGERANT

This product contains fluorated greenhouse gases covered by the Kyoto Protocol. Do not release these gases into the atmosphere.

Refrigerant Type: R410A GWP Value (1): 1975 GWP = Global Warming Potential

The quantity of refrigerant is indicated on the plate with the name of the unit.

It is possible that periodic inspections are required to check for any refrigerant leakage according to local and / or European laws and regulations. For further details, contact the local reseller.



