Swimming pool heat pump

DC INVERTER

Directions for installation and maintenance

Contents

1- Introduction

We thank you for having chosen our Heat pump.

This installation and maintenance notice contains the necessary information to its installation (delivery control, the installation, the connections) and to its repair. It is a complementary document to the user's manual which describes its instructions for use. We invite you to read it first.

2- Caution

This document is an integral part of the product and it must stays in the technical room.

This Heat pump is exclusively for heating swimming pools.

Any other use not in conformity and random will be considered as dangerous and unsuitable.

This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved.

Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

The assembly, the electric connection and the start up must be carried out by specialized and professional person.

If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

The appliance shall be installed in accordance with national wiring regulations.

When connect to socket (power supply), please make sure that live wire, neutral wire, earth wire is right.

It is essential to maintain the temperature in the swimming pool lower than the recommended value by the swimming pool's manufacturer.

Please make sure that minimum water flow speed is 4~9 m^3/h.

In a concern to a constant improvement, our products can be modified without notice; the present pictures in this note or the characteristics which are described are not contractual.

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.)

Do not pierce or burn.

Be aware that refrigerants may not contain an odour.

3- Delivery's control

At the delivery time, check the condition of packing; in case of damages, have reservation about them to the carrier, before 48 hours and by registered letter with acknowledged receipt.

Before any manipulation, check the complete state of the machine.

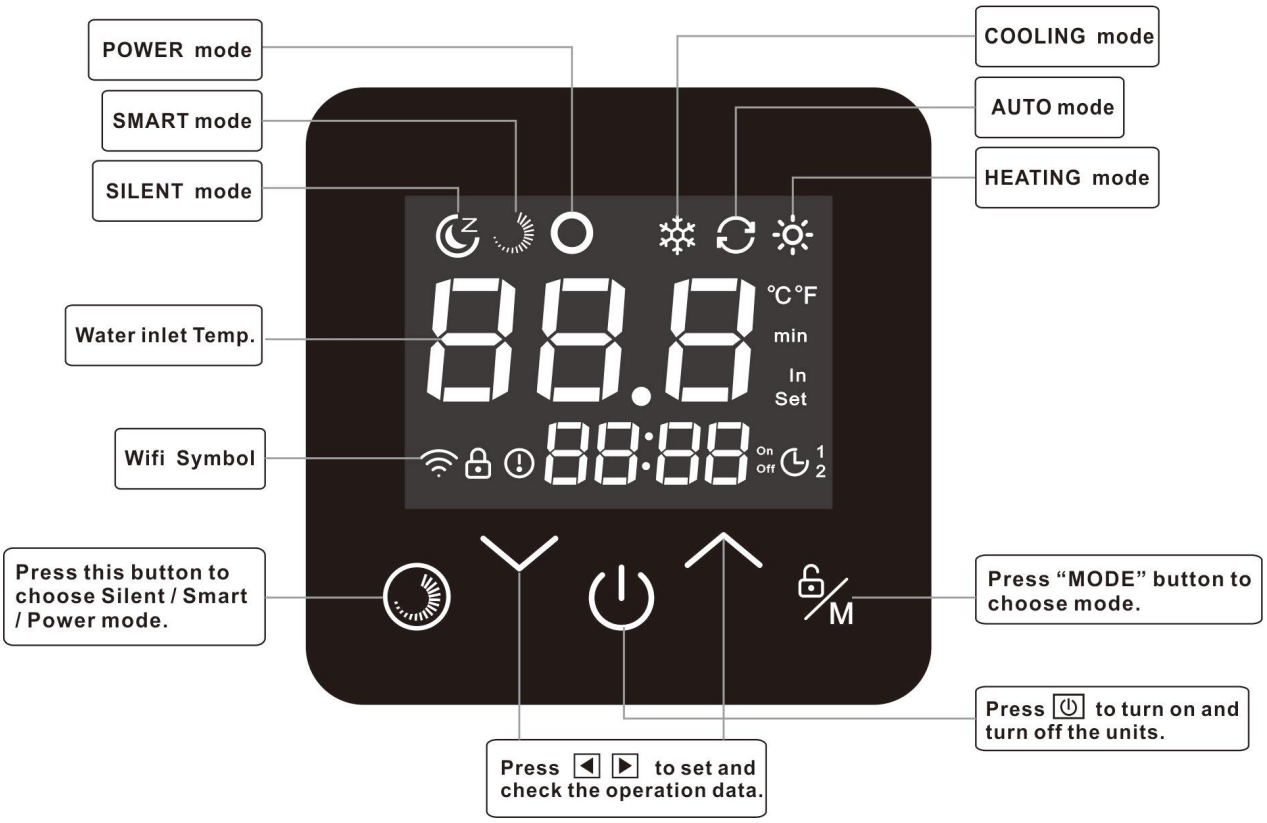
4- Technical description

Characteristics:

Unit Model	Unit	CP90LS	CP150LS	CP170LS	CP210LS
Heating Capacity A26/W26/Humid.80%	kW	9~2.1	15~3.7	17.5~4.4	21.2~5.6
COP A26/W26/Humid.80%(Smart)	W/W	7.0~16.1	7.2~16.2	7.1~16.0	6.8~15.7
Heating Capacity A15/W26 /Humid.70%	kW	6.4~1.7	10.2~3	11.7~3.4	14.7~4.1
COP A15/W26/Humid.70%(Smart)	W/W	5.0~7.9	5.2~8.0	5.1~7.9	4.9~7.7
Power Input	kW	1.6~0.18	2.4~0.25	2.8~0.3	3.8~0.39
Current	A	7.5~0.9	10.7~1.2	12.8~1.5	17.2~1.8
Power Supply	V/P/Hz	230/1/50			
Advised pool volume (with pool cover)	m3	20~40	45~65	50~70	65~75
Operating air temperature	℃	-7~43			
Water flow volume	m3/h	4	7	8	9
Water Connection	mm	50	50	50	50
Noise 10m	dB(A)	17~27	20~30	21~31	22~32
Noise 1m	dB(A)	36~47	40~50	41~51	42~52
Compressor style		ROTARY DC-INVERTER			
Heating Exchanger		Titanium in PVC			
Casing		Aluminum alloy casing			
Refrigerant		R32			
Co_2 weight of the fluorinated greenhouse gases	T	0.54	0.68	0.81	0.91
Net Unit Size (L/W/H)	mm	980x400x655	1080x430x755	1080x430x755	1080x460x755
Carton Size (L/W/H)	mm	1020x490x690	1120x520x790	1120x520x790	1120x550x790
Net/Gross Weight	kg	54/64	73/84	75/86	80.5/91.5

**** possible variations of value according to climatic conditions***

Wire control operation



Symbol explanation

Symbol	Explanation	Symbol	Explanation
+	Smart heating mode	In	Inlet water temperature
+	Silent heating mode	Set	Setting temperature
+	Power heating mode	On Off	Timer on or off
+	Smart cooling mode	88:88	Clock or timer
+	Silent cooling mode		Error
+	Power cooling mode		Key lock
+	Smart auto mode		Wifi
+	Silent auto mode		
+	Power auto mode		

Wire controller operation

- **Mode change:** Press button to change the mode, heating/cooling/auto.
- **Running speed change:** Press button to change the running speed.
- **Target temperature setting:**

  When machine power on, press page up button or page down button to enter temperature setting. Page up button or page down button can also adjust the temperature. Without action for 3s, the display will back to inlet water temperature.

- **Review and setting user parameters(ON/OFF both can operation):**
  - ✓ Press button 3 seconds to enter user parameters review interface while under default interface. Press page up button or page down button to change parameter.
  - ✓ Press button to set user parameters while under user parameters review interface. "SET" will flash. Press page up button or page down button to change value. Press function button again to return to user parameters review interface. ("SET" will not flash in parameters review interface)
  - ✓ No action in 30s under user parameters review or setting interface, it will save setting and return to default interface. Press button also can return to default interface.

Code	Description	Range	Default
L0	Water pump mode	0: Water pump not stop 1: Water pump stop 60s after compressor stop. Water pump will run 5 min every (L1) min.	0
L1	Water pump running interval	Water pump will run 5 min every (L1) min ,L1=3～180min	30
L2	Timer ON/OFF	0=OFF,1=ON	1
L3	Power-off Memory	0=OFF,1=ON	1
L4	--	--	--
L5	Running mode	0= Heating only； 1= Cooling only； 2= Heating & Cooling； 3= Inverter	3

- **Real-time clock setting:**
  - ✓ Press page down button 5 seconds to enter real-time clock setting while under default interface. The hour and minute will flash.
  - ✓ Press button to set hour while under clock setting interface. The hour will flash. Press page up and page down to change value.
  - ✓ Press button again to set minute after hour setting. The minute will flash. Press page up and page down to change value.
  - ✓ Press button again to return to default interface after minute setting.
  - ✓ Press button under clock setting interface, it will save the current setting and return to default interface.
  - ✓ No action for 30s in clock setting interface, it will save the current setting and return to default interface.

- **Timer setting:**
  Pararmeter L2: Timer ON/OFF
  0: Timer OFF, Timer symbol not light
  1: Timer ON, Timer symbol light
  - ✓ Press button 3s to enter timer setting interface.
  - ✓ Timer 1 flash first. Totally two timers.
  - ✓ Press button to set hour for turn on while timer 1 flash. Press page up and page down to change value while the hour flash.
  - ✓ Press button again to set minute for turn on after hour setting. Press page up and page down to change value while the minute flash.
  - ✓ Press button again to set timer 1 for turn off. It is same as above.
  - ✓ Press button again to save the timer setting. You can use page up and page down"▼"to choose timer 2 for setting. It is the same as timer 1
  - ✓ If the timer ON, the number will light on the display.
  - ✓ If the turn off time is the same as turn on time, the timer will be not available.
  - ✓ No action in 30s under timer setting interface, it will save the current setting and return to default interface.
  - ✓ Press button under timer setting interface, it will save the current setting and return to default interface.
  - ✓ **Under timer setting interface, press button 3s will activate the chosen timer.**
  - ✓ **Under timer setting interface, press button 3s will also can de-activate the chosen timer.**

- **Key lock:**
  - ✓ No action for 60s, the controller will be key-lock.And the key lock symbol will light.
  - ✓ Press button 5 seconds to unlock controller while under locked mode.

- **Resume factory setting (Must operate under Power OFF) :**
  - ✓ Press and button 5s to resume factory setting.

✓ Press  and  button 3s to reset error log.

- **Machine status:**

✓ Press  button 3 seconds to enter current state review interface. Press page up button  or page down  button to check parameter.

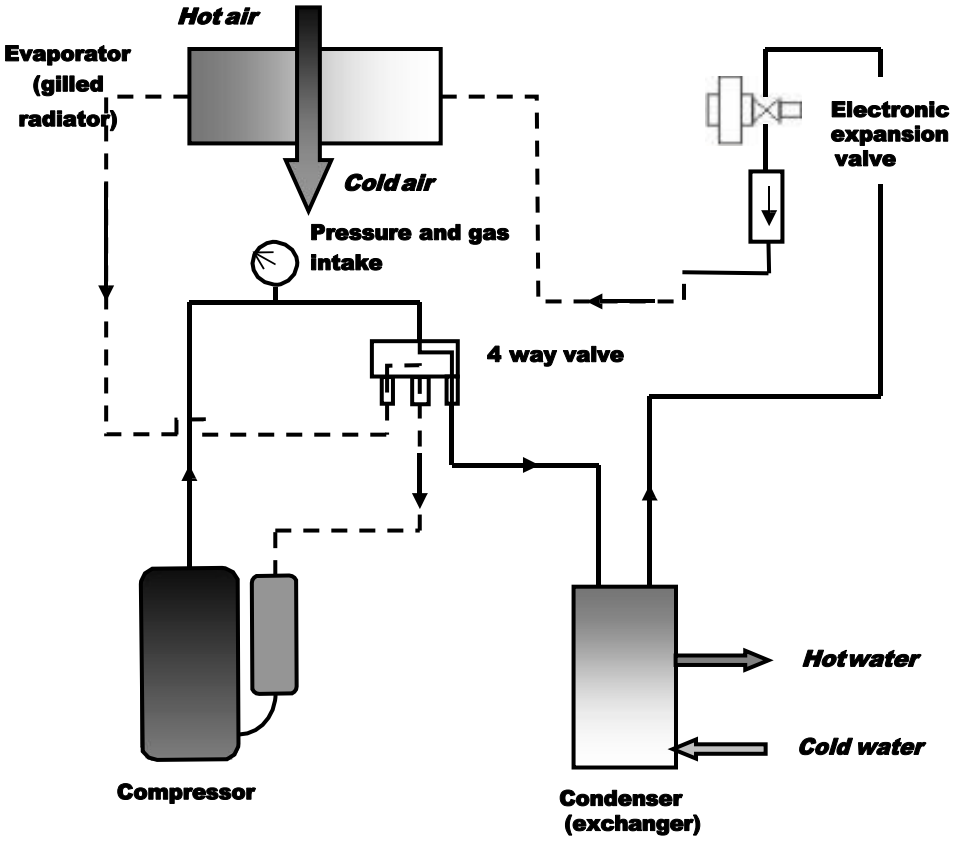
Code	Description
T1	Exhaust gas temperature
T2	Return gas temperature
T3	Inlet water temperature
T4	Outlet water temperature
T5	Outdoor Coil temperature
T6	Ambient temperature
T7	IPM temperature
T8	Indoor Coil temperature
T9	N/A
T10	N/A
T11	N/A
Ft	Target frequency
Fr	Actual frequency
1F	Main Expansion valve aperture
2F	Sub Expansion valve aperture
od	1:Cooling 4: Heating
Pr	AC Motor：1:H, 2:M, 3:L DC Motor：current revolution（Digital *10）
dF	Defrosting
OIL	
r1	N/A
r2	electrical heater ON/OFF
r3	N/A
STF	4-way valve ON/OFF
HF	N/A
PF	N/A
PTF	N/A
Pu	Water pump ON/OFF
AH	AC motor high speed ON/OFF
Ad	AC motor middle speed ON/OFF
AL	AC motor low speed ON/OFF
dcU	DC bus voltage
dcC	Inverter compressor current
AcU	Input voltage
AcC	Input current
HE1	Error codes log
HE2	Error codes log
HE3	Error codes log
HE4	Error codes log
Pr	protocol version
Sr	software version

General diagram of the refrigerating circuit

The heat pump is reversible allowing the swimming-pool's heating or cooling:

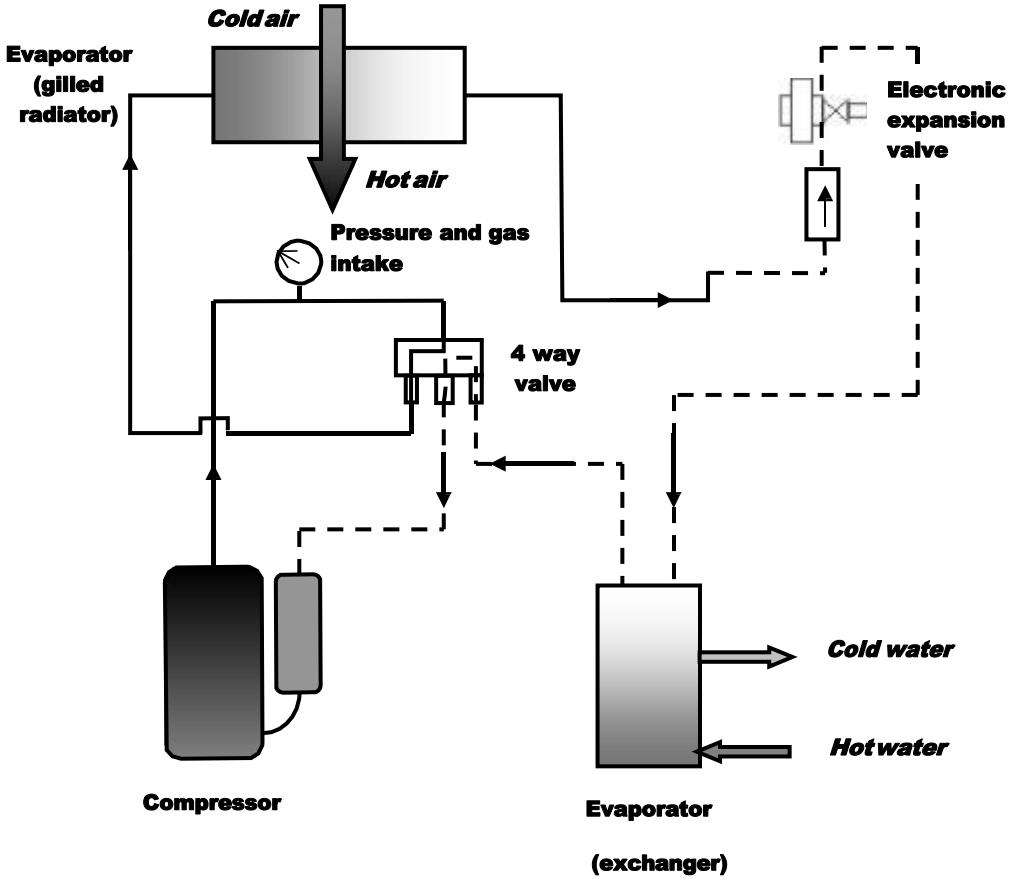
Swimming-pool water's heating mode:

The cold and liquid refrigerant fluid absorbs the heat contained in the air through the evaporator (gilled radiator), in which it is vaporizing; it is then put up in pressure and in temperature by the compressor which sends it in the condenser (exchanger) where it loses its heat (in giving it to the water of swimming pool) and comes back in liquid state; it loses its pressure and still cools in the expansion valve before turning back to the evaporator for a new cycle.



Swimming-pool water's cooling mode:

The 4 way valve reverses the circulation of the refrigerant fluid; the fluid vaporizes in the exchanger (evaporator) in getting the heat of the water, goes through in the compressor which reheats it and through in the gilled radiator (which becomes condenser) where it comes back to liquid state.



Safety and control systems

Heat pumps are equipped with the following standard protection systems:

1. Water flow switch

Thanks to this flow switch, the heat pump will not work when the filter pump is not working (and the water is not circulating). This system prevents the heat pump from heating only the water flow in the heat pump itself. The protection also stops the heat pump if water circulation is cut off or stopped.

2. Refrigerant gas high and low pressure protection

The high pressure protection makes sure the heat pump is not damaged in case of overpressurisation of the gas. The low pressure protection emits a signal when refrigerant is escaping from the conduits and the unit cannot be kept running.

3. Overheating protection on the compressor

This protection protects the compressor from overheating.

4. Automatic defrost control

When the air is very humid and cold, ice can form on the evaporator. In that event, a thin layer of ice appears that will grow increasingly bigger as long as the heat pump is running. When the temperature of the evaporator has become too low, automatic defrost control will be activated, which will reverse the heat pump cycle so that hot refrigerant gas is sent through the evaporator during a brief period of time to defrost it.

5. Anti-frost protection during winter

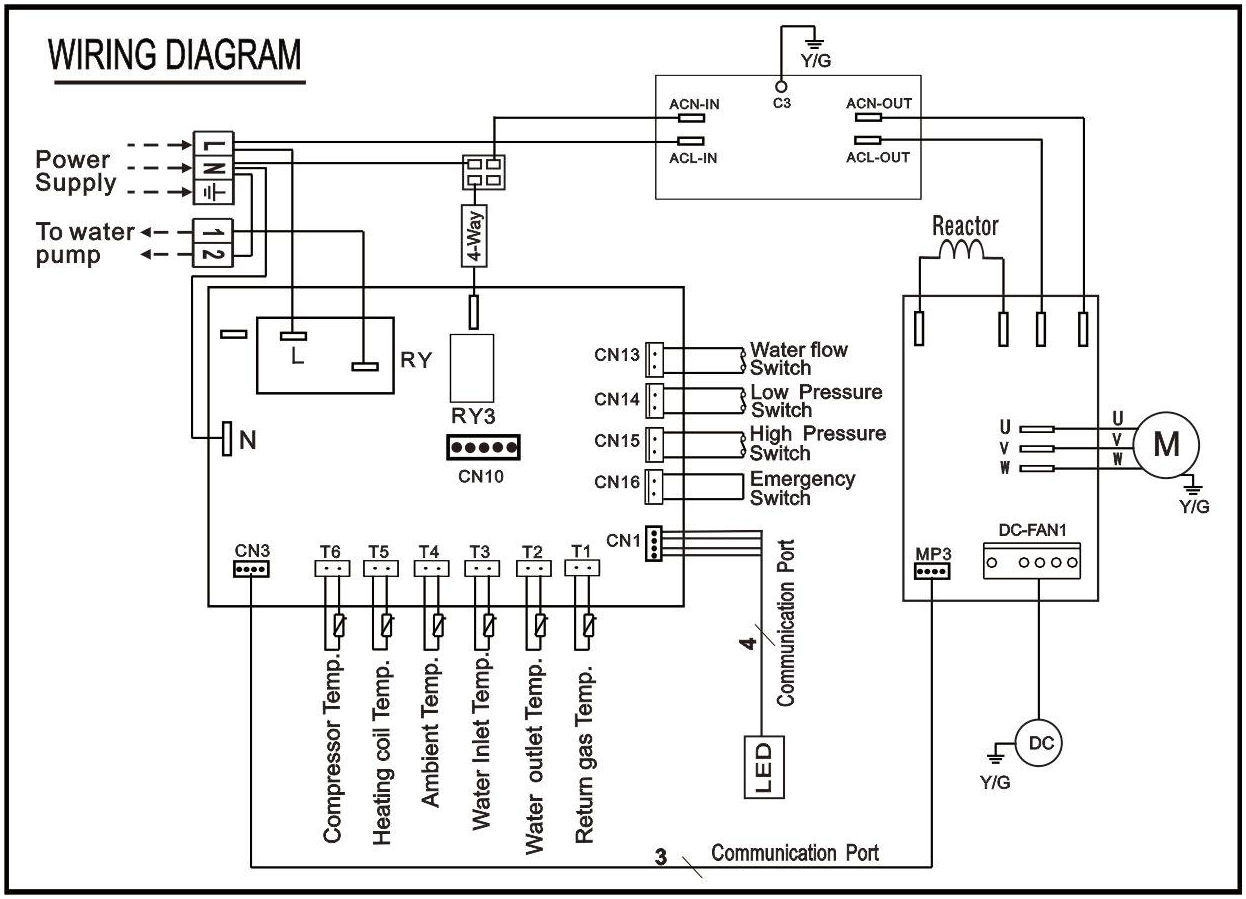
This protection can only be activated if the heat pump in STAND-BY situation.

5.1 First anti-frost protection
- When the Ambient temperature ≤4℃ and 2℃＜inlet water temperature≤4℃, the first anti-frost protectionin start. every 10min the pump will work for 30s, this program will keep running till the Ambient temperature＞5℃ or inlet water temperature＞5℃.

5.2 Second anti-frost protection
- When the Ambient temperature ≤4℃ and inlet water temperature≤2℃, the second anti-frost protectionin will start and heat pump turn to heating mode automatically. The Second anti-frost protection will stop when the Ambient temperature＞5℃ or inlet water temperature≥3℃.

*If the inlet water temperature sensor is out of work, When the Ambient temperature ≤4℃,the second anti-frost protectionin will also start.And it will stop when Ambient temperature＞5℃.
If the Ambient temperature sensor is out of work, When the 2℃＜inlet water temperature≤4℃,the first anti-frost protectionin will also start. When the inlet water temperature≤2℃,the second anti-frost protectionin will also start.And it will stop when inlet water temperature＞5℃.
If the Ambient temperature sensor and Inlet water temperature sensor are all out of work, the anti-frost protection will not work.

Electric diagram



5- Installation

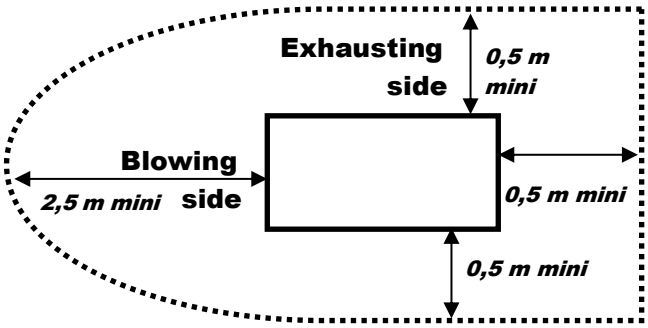
Rules of installation:

Electric and hydraulic connections must be carried out according to standards in effect (NF C 15 100, CE I 364).

The machine must be installed outside.

The machine must be posed on its ant vibratory studs, set and lying flat and on a massive base (concrete slab); this base must have a sufficient height to prevent any entry of water by the bottom of the machine. Height must be adjusted to fit the connector collecting the condensates.

The obstacles such as wall and vegetation must be separated from the machine as indicated on the diagram below.



Do not to install the Heat pump in a confined place (the fan would recycle its air and the Heat pump would be down performance).

The fan should not blow towards the windows or crossing point.

Safety distance between the swimming pool and the foot bath: the fitter must imperatively refer to the standard C15-100 section 702; the machine should not be installed in volume 1 surrounding the swimming pool but at least in volume 2 so at a distance of 3 m minimum of the swimming pool and foot bath.

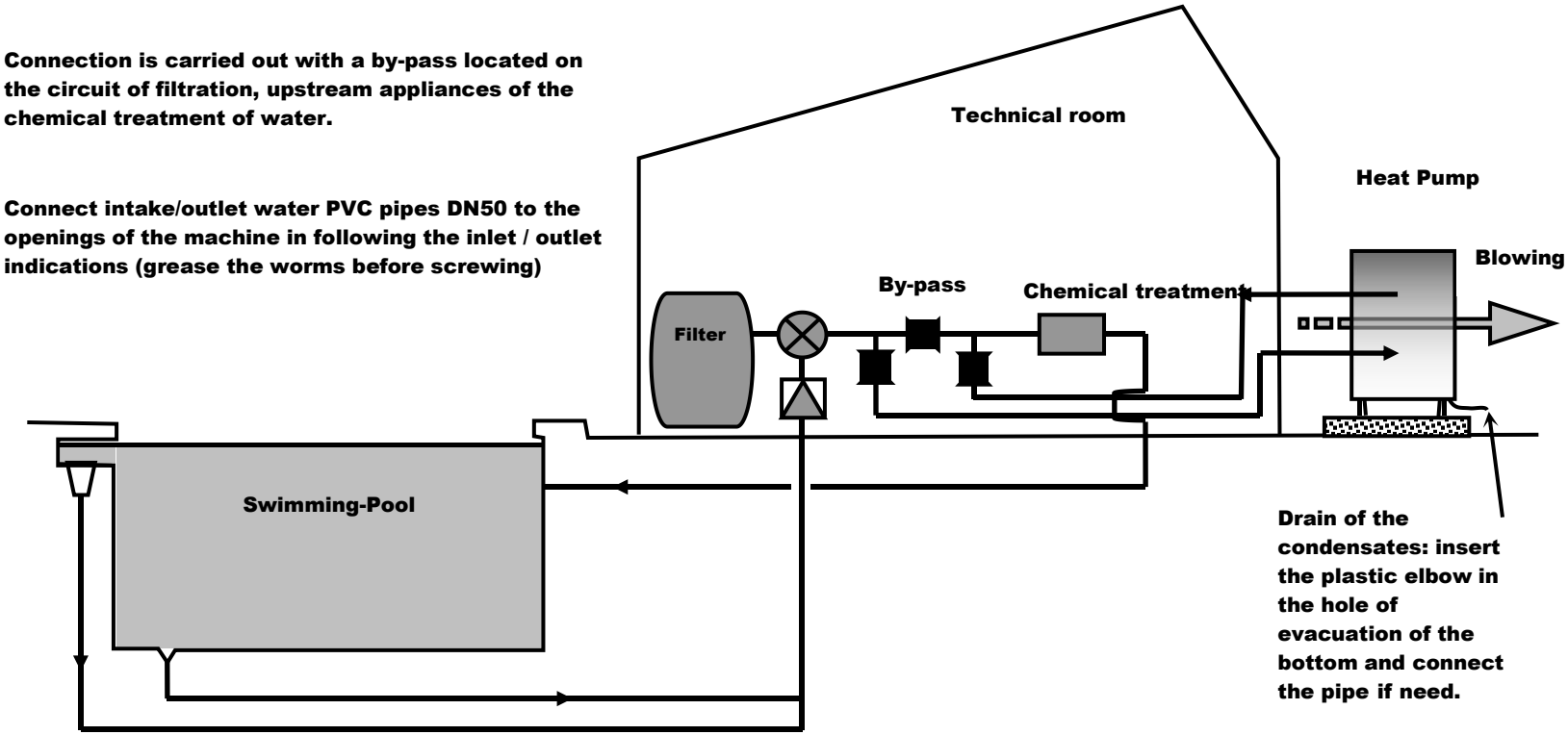
Other precautions of installation:

- Do not to install the machine near a way with circulation of car in order to avoid mud projections.
- Avoid directing blowing against dominant winds.
- If the machine is intended to be used in winter, put it in a place protected from the falls of snow.
- The machine must be able to be supervised in order that children do not play around

Hydraulic connections: To respect imperatively

Connection is carried out with a by-pass located on the circuit of filtration, upstream appliances of the chemical treatment of water.

Connect intake/outlet water PVC pipes DN50 to the openings of the machine in following the inlet / outlet indications (grease the worms before screwing)



Electric connections:

CAUTION: before connecting the machine, make sure that the feeder is disconnected to the electrical network.

The electric installation must be carried out by an experienced electrician and the supply must come from a severing equipment and differential protection; the whole must be carried out according to standards' in force in the country where the material is installed.

Characteristics of the electric supply:
- 230 V +/- 10%, single-phase current, 50 Hz
- Mode of neutral TT and TN.S; the circuit of heat pump must be connected to an earth circuit.

Characteristic minimum of the protection:
- Protection must be of 16 A, by circuit breaker or fuse; it must protect the Heat pump exclusively; the circuit breaker must be specified with curve D, the fuse must be specified Am.
- Differential protection : 30 mA (the length of cable between the connector block of the heat pump and the protection of should not exceed 12 m).

Control :

The heat pump is fitted out with a water flow detector which function is to apply the signal to the electronic card when the water flow is sufficient.

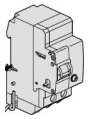
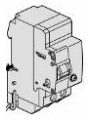
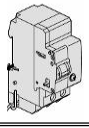
We recommend when it is possible to control the heat pump to the filtration pump (by contacting relay non supplied to insert in the feeding circuit of the heat pump).

The remmonded water flow speed is 4~9 m^3/h.

Removed control panel:

An extension cord allows the removal of the panel in inserting it in a standard electric box into the technical local; the option is supplied with a cover allowing to seal the aperture let by the removal of the control panel.

Procedure of use

Action	External Appliance or Button of heat pump	Display	Heat pump response
Put the heat pump under tension	Engage the circuit breaker of the heat pump 		Display Water inlet temperature
Put in circulation the swimming pool water into the pipes	Engage the circuit breaker of pump of filtration 		
Start	Press the button  3S start heat pump		Start between 1-4 minutes in the previous operation mode (heating/auto /cooling)
Chose the operation mode	Press the button 3S 		Stop for 3-4 minutes, reverse of cycle and restart in a new mode
Set the water temperature into the swimming pool	 , adjustable from 10°C to 45°C		The heat pump heats or cools until the required temperature
Chose the control mode	Press the button 		The heat pump operates in power or smart or silent mode
Stop	Press the button 		Immediate stop and wait
Switch off	Use the circuit breaker of pump of filtration, and heat pump 		Complete stop

6- Water Flow and refrigerating circuit pressure

After putting into service, do the settings of pressure of the refrigerant circuit for having an optimal operating of the heat pump, following:

Stage 1:
Before starting the Heat Pump, ambient temperature around 20°C, refrigerant meter shows pressure from 14 to 16kg/cm².

Stage 2:
Close completely the by pass valve and open large inlet and outlet valves of the Heat Pump; in these conditions the totality of the water flow goes by the Heat Pump.
Put into service the Heat Pump in heating mode, wait for the indicated pressure being stabilized; the correct setting of the pressure is from 21 to 35 kg/cm²;
In most of cases (pump of filtration given a flow until 20m³/h) you do not have to open the by pass valve.
If the stabilized pressure is under 21kg/cm², the progressive opening of the by pass valve will allow rising this pressure.

The adjustment of the by pass valve done, you have in principle no reason to modify it during the season. See the paragraph "Environment problem" too.

7 – Environment problem

Under certain external conditions the heat exchanges between the refrigerant and the water on one hand and between the fluid and the air on the other hand are insufficient; the consequence is that the refrigerating circuit runs up in pressure and the compressor consumes more electricity.

The temperature sensors compressor outlet and the magnetic circuit breaker on the compressor power supply protect the compressor from these extreme conditions; the error messages P 11 occur.

The condition causing this situation is as follows:
In heating mode:
- insufficient water flow:
close the by-pass valve for increasing the refrigerant exchange → water
In cooling mode:
- too important water flow: open the by pass valve for decreasing the water flow and so the exchange water → refrigerant
- insufficient air flow: be sure that the real net of condenser are not blocked.

Note: these error codes are likely to occur if temperature of swimming pool water is high and the ambient air is hot.

8 – Error codes:

This table explains the error codes caused by a defective regulating component or by a security operation. When multiple error occur at the same time, each error code will be displayed for 5 seconds in turn, and also inlet water temperature.

Error codes	Problem	Cause	Solution
E 01	Compressor exhaust sensor fault	Connection fault	Check the connection
		Compressor exhaust sensor fault	Replace the compressor exhaust sensor
E 05	Evaporator sensor fault	Evaporator fault	Check the connection
		Evaporator temperature sensor fault	Replace the Evaporator temperature sensor
E 09	Return gas temperature sensor fault	Connection fault	Check the connection
		Return gas temperature sensor fault	Replace the return gas temperature sensor
E 17	Water Inlet temperature sensor fault	Connection fault	Check the connection
		Inlet temperature sensor fault	Replace the inlet temperature sensor
E 18	Water Outlet temperature sensor fault	Connection fault	Check the connection
		Outlet temperature sensor fault	Replace the outlet temperature sensor
E 21	Communication fault between wire controller and PCB	Communication wire fault	Check or replace the wire
		wire controller fault	replace the wire controller

E 22	Ambient sensor fault	Connection fault	Check the connection
		Ambient temperature sensor fault	Replace the ambient temperature sensor
E 25	Water flow switch protection	Insufficient water flow	Check the water flow
		Water flow switch out of order	Replace the Water flow switch
E 27	Communication failure of variable frequency drive module	PCB failure	Please replace the PCB
P 02	High pressure protection	Insufficient water flow	Check the water flow
		Pressure switch out of order	Replace the pressure switch Have
		Too much refrigerant gas present	the heat pump checked by a refrigeration technician
P 06	Low pressure protection	Not enough refrigerant gas	Have the heat pump checked by a refrigeration technician
		Leak in the cooling conduits	Have the heat pump checked by a refrigeration technician
P 11	Compressor exhaust temperature is too high	Water temperature and environmental temperature is too high	Set to the safety of water temperature.
		Refrigerant leakage	Check and repair.
		Insufficient water flow	Check the water flow
P 15	Over water temperature difference protection	Water flow not enough	Water flow switch fault
			Check the water pump
			Pipe block
P 16	Cooling out water temperature over low protection	Connection fault	Check the connection
		Outlet temperature sensor fault	Replace the outlet temperature sensor
		The water flow is too low	Check pump and water flow
P 17	Anti-freezing protection	Normal protection of machine	No need to do anything
P 19	Current protection of compressor	Normal protection of machine	No need to do anything
P 24	DC Fan motor fault	DC Motor fault	Check and change motor
		The PCB fault	Check and change PCB
P 25	Low ambient temperature protection	Ambient temperature is too low or protection temperature setting set too high	Check and repair.
r02	Drive fault of compressor	Data reading fault	reset
		PCB fault	replace the PCB
r05	IPM module over heating protection	IPM module over heating	Set the mode to SMART
			Check and change module

r06	Over current protection	The current is too high	Check the power supplier
			Water temperature is too high
r10	DC over voltage protection	DC short voltage too high	Check and change module
r11	DC short voltage protection	DC short voltage too low	Check and change module
r12	AC voltage protection	The power supplier is too high or too low	Check the power supplier
r24	Abnormal power supply	Abnormal power supply	Check the power supply
r21	IPM module over current protection	IPM module over current too high	Set the mode to SMART

9 - Service operations:

This heat pump contains a flammable refrigerant R32.

Any intervention on the refrigerant circuit is prohibited without a valid authorization. Before working on the refrigerant circuit, the following precautions are necessary for safe work.

Only persons authorized by an accredited agency certifying their competence to handle refrigerants in compliance with sector legislation should work on refrigerant circuits.

Servicing shall be performed only as recommended by the manufacturer.

Any person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerants safely in accordance with an industry recognised assessment specification.

Servicing shall only be performed as recommended by the equipment manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants

1. Checks to the area

Prior to beginning work on systems containing flammable refrigerants, safely checks are necessary to ensure that the risk of ignition is minimised. For repair to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.

2. Work procedure

The work must be carried out according to a controlled procedure, in order to minimize the risk of presence of flammable gases or vapors during the execution of the works.

3. General work area

All persons in the area must be informed of the nature of the work in progress. Avoid working in a confined area. The area around the work area should be divided, secured and special attention should be paid to nearby sources of flame or heat.

4. Verification of the presence of refrigerant

The area should be checked with a suitable refrigerant detector before and during work to ensure that there is no potentially flammable gas. Make sure that the leak detection equipment used is suitable for flammable refrigerants, i.e. it does not produce sparks, is properly sealed or has internal safety.

5. Presence of fire extinguisher

If hot work is to be performed on the refrigeration equipment or any associated part, appropriate fire extinguishing equipment must be available. Install a dry powder or CO2 fire extinguisher near the work area.

6. No source of flame, heat or spark

It is totally forbidden to use a source of heat, flame or spark in the direct vicinity of one or more parts or pipes containing or having contained a flammable refrigerant. All sources of ignition, including smoking, must be sufficiently far from the place of installation, repair, removal and disposal, during which time a flammable refrigerant may be released into the surrounding area. Before starting work, the environment of the equipment should be checked to ensure that there is no risk of flammability. «No smoking» signs must be posted.

7. Ventilated area

Make sure the area is in the open air or is properly ventilated before working on the system or performing hot work. Some ventilation must be maintained during the duration of the work.

8. Controls of refrigeration equipment

When electrical components are replaced, they must be suitable for the intended purpose and the appropriate specifications. Only the parts of the manufacturer can be used. If in doubt, consult the technical service of the manufacturer.

The following controls should be applied to installations using flammable refrigerants:

- The size of the load is in accordance with the size of the room in which the rooms containing the refrigerant are installed;

- Ventilation and air vents work properly and are not obstructed;

- If an indirect refrigeration circuit is used, the secondary circuit must also be checked.

- The marking on the equipment remains visible and legible. Illegible marks and signs must be corrected;

- Refrigeration pipes or components are installed in a position where they are unlikely to be exposed to a substance that could corrode components containing refrigerant

9. Verification of electrical appliances

Repair and maintenance of electrical components must include initial safety checks and component inspection procedures. If there is a defect that could compromise safety, no power supply should be connected to the circuit until the problem is resolved.

Initial security checks must include:

• That the capacitors are discharged: this must be done in a safe way to avoid the possibility of sparks;

• No electrical components or wiring are exposed during loading, recovery or purging of the refrigerant gas system;

• There is continuity of grounding.

10.Initial safety checks shall include

- that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- that no live electrical components and wiring are exposed while charging, recovering or purging the system;
- that there is continuity of earth bonding.

11.Repairs to sealed components

During repairs to sealed component, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.

Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.

Ensure that apparatus is mounted securely.

Ensure that seals or sealing materials have not degraded such that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

NOTE The use of silicon sealant may inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior ta working on them.

12.Repair to intrinsically safe components

Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.

Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.

Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

13.Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects .The check shall also take into account the effects of ageing or continual vibration from sources such as compressors or fans.

14. Detection of flammable refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

15.Leak detection methods

The following leak detection methods are deemed acceptable for systems containing flammable refrigerants.

Electronic leak detectors shall be used to detect flammable refrigerants, but the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area. Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed and the appropriate percentage of gas (25% maximum) is confirmed.

Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

16.Removal and evacuation

When breaking into the refrigerant circuit to make repairs - or for any other purpose - conventional procedures shall be used. However, it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:

1. remove refrigerant;
2. purge the circuit with inert gas;
3. evacuate;
4. purge again with inert gas;
5. open the circuit by cutting or brazing.

The refrigerant charge shall be recovered into the correct recovery cylinders. The system shall be "flushed" with OFN to render the unit safe. This process may need to be repeated several times. Compressed air or oxygen shall not be used for this task.

Flushing shall be achieved by breaking the vacuum in the system with OFN and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final OFN charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe - work are to take place.

Ensure that the outlet for the vacuum pump is not close to any ignition sources and there is ventilation available.

17.Charging procedures

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerant does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept upright.
- Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigeration system.

Prior to recharging the system it shall be pressure tested with OFN. The system shall be tested on completion of charging but prior to commissioning. A follow up leak test shall carried out prior to leaving the site.

18.Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of reclaimed refrigerant. It is essential that electrical power is available before the task is commenced.

a) Become familiar with the equipment and its operation.
b) Isolate system electrically.
c) Before attempting the procedure ensure that.

1. mechanical handling equipment is available, if required, for handling refrigerant cylinders:
2. all personal protective equipment is available and being used correctly
3. the recovery process is supervised at all times by a competent person;
4. recovery equipment and cylinders conform to the appropriate standards.
d) Pump down refrigerant system. if possible.
e) If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
f) Make sure that cylinder is situated on the scales before recovery takes place.
g) Start the recovery machine and operate in accordance with manufacturers instructions.
h) Do not overfill cylinders. (No more than 80 volume liquid charge).
i) Do not exceed the maximum working pressure of the cylinder, even temporarily.
j) When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
k) Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

19.Labeling

Equipment shall be labeled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

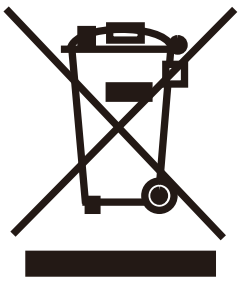
20Recovery
When removing refrigerant from a system, either for the servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge are available. All cylinders to be used are designate for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of Refrigerant). Cylinders shall be complete with pressure relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of flammable refrigerants In addition, a set of calibrated weighing scales shall be available and in good working order Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant Waste Transfer Note arranged. Do not mix refrigerants in recovery nits and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safety.

	Correct disposal of this product
	**This symbol on the product, or in its packaging, indicates that this product may not be treated as household waste. Instead, it should be taken to the appropriate waste collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by the inappropriate waste handling of this product. For more detailed information about the recycling of this product, please contact your local council, your household waste disposal service, or the shop where you purchased the product.**