2. SAFETY INSTRUCTIONS

Read Safety Precautions Before Operation and Installation

Incorrect installation due to ignoring instructions can cause serious damage or injury.
The seriousness of potential damage or injuries is classified as either a **WARNING** or **CAUTION**.

⚠ WARNING
This symbol indicates the possibility of personnel injury or loss of life.

⚠ CAUTION
This symbol indicates the possibility of property damage or serious consequences.

⚠ WARNING

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(EN Standard requirements).

This appliance is not intended for use by persons(including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance(IEC Standard requirements).

⚠ WARNINGS FOR PRODUCT USE

- If an abnormal situation arises (like a burning smell), immediately turn off the unit and disconnect the power. Call your dealer for instructions to avoid electric shock, fire or injury.
- **Do not** insert fingers, rods or other objects into the air inlet or outlet. This may cause injury, since the fan may be rotating at high speeds.
- **Do not** use flammable sprays such as hair spray, lacquer or paint near the unit. This may cause fire or combustion.
- **Do not** operate the air conditioner in places near or around combustible gases. Emitted gas may collect around the unit and cause explosion.
- **Do not** operate your air conditioner in a wet room such as a bathroom or laundry room. Too much exposure to water can cause electrical components to short circuit.
- **Do not** expose your body directly to cool air for a prolonged period of time.
- **Do not** allow children to play with the air conditioner. Children must be supervised around the unit at all times.
- If the air conditioner is used together with burners or other heating devices, thoroughly ventilate the room to avoid oxygen deficiency.
- In certain functional environments, such as kitchens, server rooms, etc., the use of specially designed air-conditioning units is highly recommended.

CLEANING AND MAINTENANCE WARNINGS

- Turn off the device and disconnect the power before cleaning. Failure to do so can cause electrical shock.
- **Do not** clean the air conditioner with excessive amounts of water.
- **Do not** clean the air conditioner with combustible cleaning agents. Combustible cleaning agents can cause fire or deformation.

⚠ CAUTION

- Turn off the air conditioner and disconnect the power if you are not going to use it for a long time.
- Turn off and unplug the unit during storms.
- Make sure that water condensation can drain unhindered from the unit.
- **Do not** operate the air conditioner with wet hands. This may cause electric shock.
- **Do not** use device for any other purpose than its intended use.
- **Do not** climb onto or place objects on top of the outdoor unit.
- **Do not** allow the air conditioner to operate for long periods of time with doors or windows open, or if the humidity is very high.

⚠ ELECTRICAL WARNINGS

- Only use the specified power cord. If the power cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.
- Keep power plug clean. Remove any dust or grime that accumulates on or around the plug. Dirty plugs can cause fire or electric shock.
- **Do not** pull power cord to unplug unit. Hold the plug firmly and pull it from the outlet. Pulling directly on the cord can damage it, which can lead to fire or electric shock.
- **Do not** modify the length of the power supply cord or use an extension cord to power the unit.
- **Do not** share the electrical outlet with other appliances. Improper or insufficient power supply can cause fire or electrical shock.
- The product must be properly grounded at the time of installation, or electrical shock may occur.
- For all electrical work, follow all local and national wiring standards, regulations, and the Installation Manual. Connect cables tightly, and clamp them securely to prevent external forces from damaging the terminal. Improper electrical connections can overheat and cause fire, and may also cause shock. All electrical connections must be made according to the Electrical Connection Diagram located on the panels of the indoor and outdoor units.
- All wiring must be properly arranged to ensure that the control board cover can close properly. If the control board cover is not closed properly, it can lead to corrosion and cause the connection points on the terminal to heat up, catch fire, or cause electrical shock.
- If connecting power to fixed wiring, an all-pole disconnection device which has at least 3mm clearances in all poles, and have a leakage current that may exceed 10mA, the residual current device(RCD) having a rated residual operating current not exceeding 30mA, and disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.

TAKE NOTE OF FUSE SPECIFICATIONS

The air conditioner's circuit board (PCB) is designed with a fuse to provide overcurrent protection. The specifications of the fuse are printed on the circuit board.

NOTE: For the units with R32 or R290 refrigerant , only the blast-proof ceramic fuse can be used.

⚠ WARNINGS FOR PRODUCT INSTALLATION

1. Installation must be performed by an authorized dealer or specialist. Defective installation can cause water leakage, electrical shock, or fire.
2. Installation must be performed according to the installation instructions. Improper installation can cause water leakage, electrical shock, or fire.
   (In North America,installation must be performed in accordance with the requirement of NEC and CEC by authorized personnel only.)
3. Contact an authorized service technician for repair or maintenance of this unit. This appliance shall be installed in accordance with national wiring regulations.
4. Only use the included accessories, parts, and specified parts for installation. Using non-standard parts can cause water leakage, electrical shock, fire, and can cause the unit to fail.
5. Install the unit in a firm location that can support the unit's weight. If the chosen location cannot support the unit's weight, or the installation is not done properly, the unit may drop and cause serious injury and damage.
6. Install drainage piping according to the instructions in this manual. Improper drainage may cause water damage to your home and property.
7. For units that have an auxiliary electric heater, **do not** install the unit within 1 meter (3 feet) of any combustible materials.
8. **Do not** install the unit in a location that may be exposed to combustible gas leaks. If combustible gas accumulates around the unit, it may cause fire.
9. Do not turn on the power until all work has been completed.
10. When moving or relocating the air conditioner, consult experienced service technicians for disconnection and reinstallation of the unit.
11. How to install the appliance to its support, please read the information for details in "indoor unit installation" and "outdoor unit installation" sections .

Note about Fluorinated Gasses

1. This air-conditioning unit contains fluorinated greenhouse gasses. For specific information on the type of gas and the amount, please refer to the relevant label on the unit itself or the "Owner's Manual - Product Fiche " in the packaging of the outdoor unit. (European Union products only).
2. Installation, service, maintenance and repair of this unit must be performed by a certified technician.
3. Product uninstallation and recycling must be performed by a certified technician.
4. For equipment that contains fluorinated greenhouse gases in quantities of 5 tonnes of CO_2 equivalent or more, but of less than 50 tonnes of CO_2 equivalent, If the system has a leak-detection system installed, it must be checked for leaks at least every 24 months.
5. When the unit is checked for leaks, proper record-keeping of all checks is strongly recommended.

⚠ WARNING for Using R32 Refrigerant

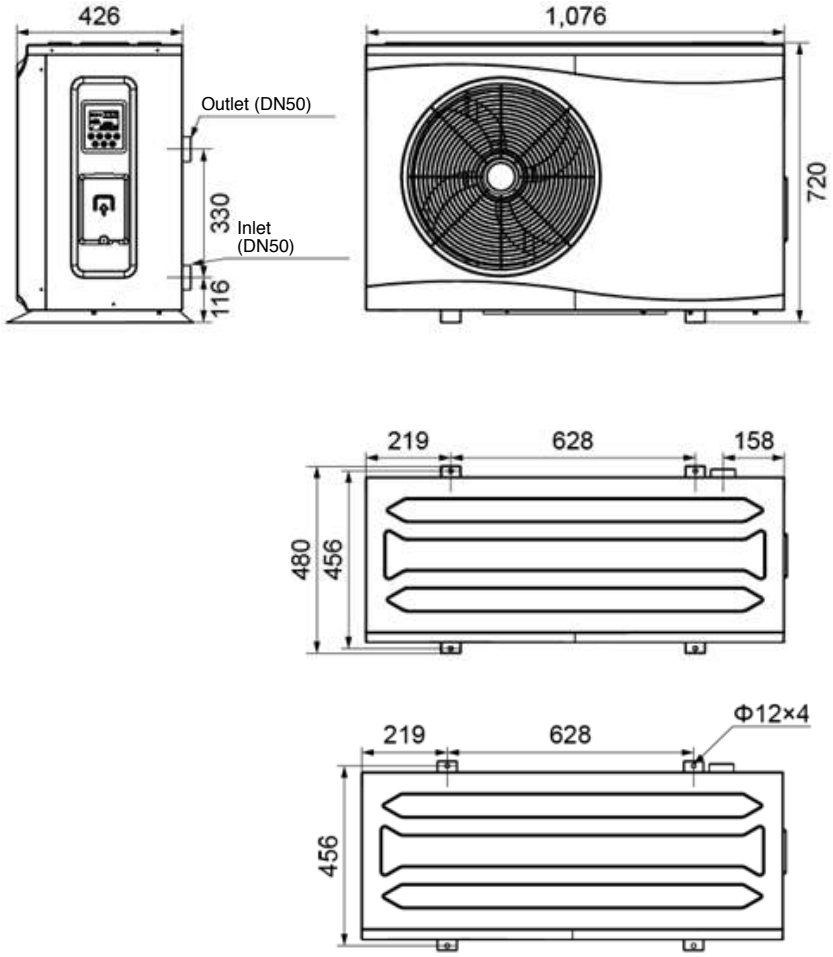
- When flammable refrigerant are employed, appliance shall be stored in a well -ventilated area where the room size corresponds to the room area as specifiec for operation.
  For R32 frigerant models:
  Appliance shall be installed, operated and stored in a room with a floor area larger than $4m^2$.
  Appliance shall not be installed in an unvertilated space, if that space is smaller than $4m^2$.

Explanation of symbols displayed on the indoor unit or outdoor unit:

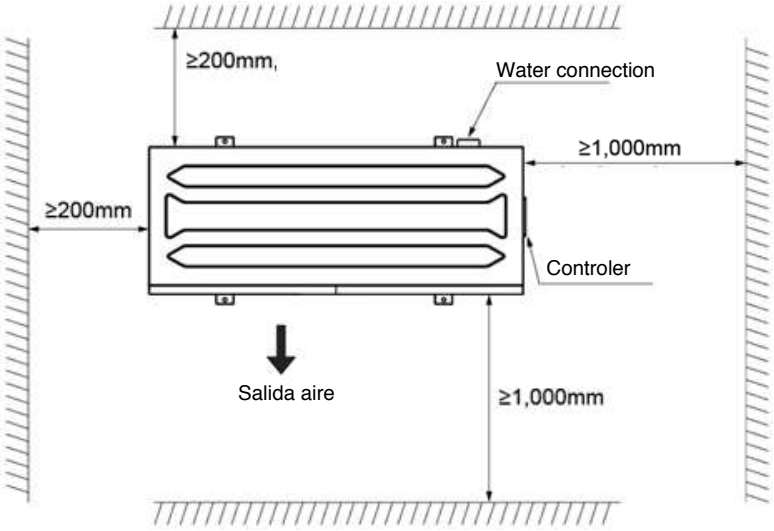
	**WARNING**	This symbol shows that this appliance uses a flammable refrigerant. If the refrigerant is leaked and exposed to an external ignition source, there is a risk of fire.
	**CAUTION**	This symbol shows that the operation manual should be read carefully.
	**CAUTION**	This symbol shows that a service personnel should be handling this equipment with reference to the installation manual.
	**CAUTION**	
	**CAUTION**	This symbol shows that information is available such as the operating manual or installation manual.

4. OVERVIEW OF THE UNIT

4.1 Unit Dimension (mm)



4.2 Necessary space around the heat pump



5.7 Trial running

After connecting water to the pool system, complete with a suitable by-pass and electrical connections by a qualified engineer.
Be sure that:
Appliance is horizontal and on a firm base.
Water circuit is well connected (no leaks and no chance of injury due to badly fitted hydraulic couplings).
Electrical circuit is well connected (all cables tightened correctly at terminals and intermediate circuit breaker), insulated and earthed correctly.
The installation requirements described previously are strictly adhered to.

⚠ ATTENTION: THE HEAT PUMP ONLY FUNCTIONS WHEN WATER FLOW IS PRESENT.

Then you can start up the heat pump following every point in the below order:
1. Open by-pass valves
2. Start pool system pump
3. Turn on pool heat pump
4. Set the temperature regulation

6. OPERATING THE UNIT

⚠ Operating the unit comes down to operating the digital controller.

NEVER LET THE DIGITAL CONTROLLER GET WET. THIS MAY CAUSE AN ELECTRIC SHOCK OR ⚠ FIRE.

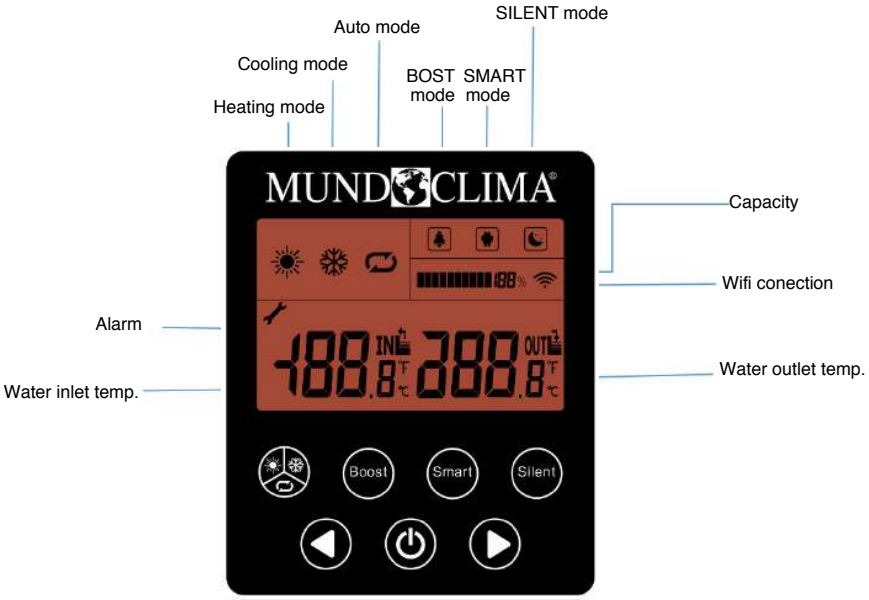
NEVER PRESS THE BUTTONS OF THE DIGITAL CONTROLLER WITH A HARD, POINTED ⚠ OBJECT.
THIS MAY DAMAGE THE DIGITAL CONTROLLER.
NEVER INSPECT OR SERVICE THE DIGITAL CONTROLLER YOURSELF, ASKS A QUALIFIED SERVICE PERSON TO DO THIS.

6.1 Controller Instruction

6.1.1 General

Input Voltage: DC12V
RS485 Communication
Short-Press for 1~5 seconds
Long-Press for 5 seconds
No Button press for more than 30s, controller surface will exit to original normal.
User can operate the controller only when the screen is light on.
Back light of Screen is Purple, characters and symbols are black.
Operation temperature range is 15ºC to 40ºC for heating, and 8ºC to 25ºC for cooling.

6.1.2 Display and Operation Surface



Notes:
1. If the unit is OFF the operating mode is displayed without temperature displaying, and the unit output rate will be display 0%.
2. When the unit has some problem, the icon will flash, and the icon in the left of the icon will display P (Protection) or E (Error), and the icon in the left of the icon.

6.2 Display Instruction

6.2.1 Instruction for Buttons

ON/OFF: Short-press to turn. Also user can press this button to exit when they finish setting or checking.

Running Modes: Short-Press to turn. Long-Press to into menu.

Increase: Temperature set + or previous one.

Decrease: Temperature set+ or next one.

Boost Running mode: Short-press to enter into Boost mode.

Smart Running mode: Short-press to enter into Smart mode.

Silent Running mode: Short-press to enter into Silent mode.

6.2.2 Instructions for Display Symbols

: Heating Pool mode

: Cooling Pool mode

: Auto run mode

: Boost run mode

: Smart run mode

: Silent run mode

: Heat Pump output capacity in actual time

: Current water inlet temperature

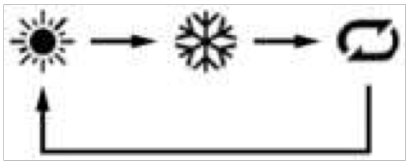
: Current water outlet temperature

: Error Warning

6.3 Instruction for Function

6.3.1 Switch Modes

When heat pump is on, short-press to switch Heat/Cool/Auto, each mode is available for selecting Boost/Smart/Silent modes.

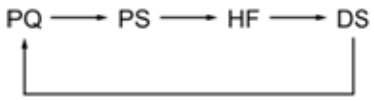


6.3.2 Set Temperature

When heat pump is on, short-press or into water temperature setting surface, symbol displays normally, Setting area's temperature value twinkles, press or to select value, press to confirm and exit current setting. No any set up after 30 seconds, the controller will save the last setting and go back to original surface.

6.3.3 Parameters query and Parameters configuration functions

When unit is running or standby, press Mode button for 3 to 5 seconds, the unit will be in query or configuration status. At this time, the percent section of output rate icon will flash with PQ letter. Press Up or Down button, and the displayed letter will in turns as following figure:

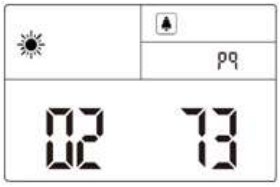


Notes:

PQ: Parameter Query interface;
PS: Parameter Setting interface; (Only available for factory)
HF: History Fault interface;
DS: Debug Status interface. (Only available for factory)

After select one interface from above 4 interfaces, press Mode button to confirm and enter the selected interface.

6.3.3.1 Parameter Query interface "PQ"



The digital tubes near inlet water icon will display the item code. The digital tubes near outlet water icon will display the item value.

Item code	Item value
1	Running frequency of compressor (Hz)
2	EEV Open degree (Displayed value/5)
3	Ambient air temperature (ºC)
4	Outlet water temperature (ºC)
5	Discharge temperature of refrigerant (ºC)
6	Suction temperature of refrigerant (ºC)
7	Air side heat-exchanger pipe temperature (ºC)
8	Outlet refrigerant temperature of EXV (ºC)
9	Water pump status (0=Off, 1=On)
10	4-way valve status (0=Off, 1=On)
11 - 15	Reserved
16	Current of compressor (Displayed value /10)
17	Voltage (Displayed value ×10)
18 - 20	Reserved
21	Fan speed (Displayed value ×15)
22	DC link voltage (Displayed value ×5)
23	DC link current (Displayed rounded the current)
24	PFC temperature (ºC)
25	IPM temperature (ºC)
26	Frequency target of compressor

6.3.3.2 History Fault interface "HF"

The digital tubes near inlet water icon will display latest 5 series number of error and protection codes. The digital tubes near outlet water icon will display the error or protection code according to each series number of the codes. E or P will be displayed after the point in the screen right side.

7. MALFUNCTIONING

When an error occurs or the protection mode is set automatically, the circuit board and the wired controller will both display the error message.

Error	Meaning	Analysis	Diagnosis	Solution
P01	Water Flow failure	2. No water flow 2. Flow switch failure 3. Water system block	1. Check if water in valve is closed or no water in 2.Check if flow switch is blocked or damaged 3. Check if"Y"Shape filter blocked	1. Open the valve 2. Change a new flow switch 3.Clean or change a new filter
P02	High pressure protection	1.Water flow is too small 2. High-pressure switch is damaged ; 3.Refrigerant system block ; 4. EEV dead lock.	1. Check if water flow is not enough or water pump flow is not enough; 2. Check if high-pressure switch is off ; 3.Check if refrigerant system is blocked 4. When heat pump is off and turn the heat pump on and off to check if EEV can be listened by sound of reset.	1. Reinject water or change to a new pump of larger water flow; 2. Change a new high-pressure switch 3. change a new filter 4.Change a new EEV
P03	Low pressure protection	1. Lack of gas 2.Refrigerant system block ; 3.Exceed heat pump operation range	1.Check if gas system is leaking 2. Check if filter is blocked 3. Check ambient Temp. and water temp. is over limitation	1.Amend the leakage and reinject the gas 2.change a new filter
P04	T3 Coil overheat protection	1. Heat Pump fan blowing area is blocked 2. Evaporator is blocked 3. T3 coil sensor position was changed	1. Check if the blowing area is open 2. check if the evaporator is blocked 3.check if the coil sensor resistance value is correct	1. Put away the blow area 2. Clean the evaporator 3. Change a new sensor
P05	Exhausting gas temperature protection	1. Lack of gas 2. sensor position was changed	1.Ceheck if refrigerant system is leaking 2.check if the sensor resistance value is correct	1.Amend the leakage and reinject the gas 2.Change a new sensor

P06	Outlet water temperature anti-freezing protection	1. Lower water flow ; 2. Heat exchanger blocked ; 3. Y-shaped filter blocked ; 4. Overlow load.	1. Check if air exists in water system ; 2.Clean the heat exchanger if blocked ; 3. Check if Y-shaped filter has block ; 4. Check design of indoor water system if reasonable, if have water bypass.	1. If drain valve has problem, change a new one ; 2. Blow plate heat exchanger with water or high-pressure gas through reverse direction ; 3. Clean Y-shaped filter; 4. Water system must have bypass.
P07	Pipe temperature anti-freezing protection	1. System lack of gas ; 2. Water system has block ; 3. Cooling system has block。	1. Check system if any leakage ; 2. Check Y-shaped filter has block ; 3. Check if cooling system filter has block。	1. Fix leakage and re-charge gas ; 2. Clean Y-shaped filter ; 3. Change filter。
P11	DC motor fault protection	The fan motor is not detected	Check the fan motor	Change the fan motor and/or the main PCB
E01	Controller communication failure	Communication cable cuts	Check communication cable if cut	Change connection cable or re-connect
E02	TP1 exhaust gas temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E03	T3 coil temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E04	T4 ambient temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E05	T5 liquid gas temperature sensor	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E06	TH return gas temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E07	reserved			

E08	T6 inlet water temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E09	T7 outlet water temperature sensor failure	Sensor temperature deviation or cuts	Check sensor resistance value or if sensor cuts	Change sensor or re-connect cable
E10	Controller and Drive PCB Communicate failure	Communication cable cuts	Check communication cable if cut	Change connection cable or re-connect
E11	reserved	Wiring error or IPM module invalid Check if wiring error Re-connect cable or change IPM module		
E12	reserved			
E13	reserved			
E14	reserved			
E15	DC main cable voltage extra low			
E16	DC main cable voltage extra high			
E17	AC current protection (input side)			
E18	IPM module abnormity			
E19	PFC abnormity			
E20	Compressor start failure			
E21	Compressor lack-phase			
E22	IPM module reset			
E23	Compressor over-current			

E24	PFC module extra high temperature	Wiring error or IPM module invalid Check if wiring error Re-connect cable or change IPM module
E25	Current detection Circuit failure	
E26	out of step	
E27	PFC module temperature sensor abnormity	
E28	communication failure	
E29	IPM module extra high temperature	
E30	IPM module temperature sensor failure	
E31	reserved	
E32	IPM adjustment data	
E33	IPM adjustment data	
E34	AC input voltage abnormality	
E35	IPM adjustment data	
E36	Reserved	
E37	IPM module current frequency limits	
E38	IPM module voltage frequency limits	
E51	Failure of Fan motor drive	

8. MAINTENANCE

To protect the paintwork, avoid leaning or putting objects on the device. External heat pump parts can be wiped with a damp cloth and domestic cleaner. (Attention: Never use cleaning agents containing sand, soda, acid or chloride as these can damage the surfaces.)
To prevent faults due to sediments in the titanium heat exchanger of the heat pump, ensure that the heat exchanger cannot be contaminated (water treatment and filter system necessary). In the even that operating malfunctions due to contamination still occur, the system should be cleaned as described below. (Warning: the fins on the finned tube heat exchanger are sharp-edged -- danger of being cut!)

8.1 Cleaning the pipe system in the heat exchanger

Contamination in the pipes and heat exchanger can reduce the performance of the heat pump's titanium heat exchanger. If this is the case, the pipe system and heat exchanger must be cleaned by a technician.
Use only pressurized drinking water for cleaning.

8.2 Cleaning the air system

The finned heat exchanger, ventilator and condensate outflow should be cleaned of contaminants (leaves, twigs, etc.) before each new heating period. These types of contaminants can be manually removed using compressed air or by flushing with clean water.
It may be necessary to remove the device cover and air inlet grid first.
Attention: Before opening the device, ensure that all circuits are isolated from the power supply.
To prevent the evaporator and the condensate tray from being damaged, do not use hard or sharp objects for cleaning.
Under extreme weather conditions (e.g. snow drifts), ice may form on the air intake and exhaust air outlet grids. If this happens, the ice must be removed in the vicinity of the air intake and exhaust air outlet grids to ensure that the minimum air flow rate is maintained.

8.3 Winter Shutdown/Lay-up

If there is a chance of frost after the bathing-season has ended when the swimming pool heating is switched off and the external temperature is expected to drop below the operating limit, the water circuit of the heat pump should be completely drained. Otherwise, suitable constructional measures should be taken by the customer to protect the heat pump against damage from frost.
Attention: The warranty does not cover damage caused by inadequate lay-up measures during the winter.

9. TROUBLESHOOTING

This section provides useful information for diagnosing and correcting certain troubles which may occur. Before starting the troubleshooting procedure, carry out a thorough visual inspection of the unit and look for obvious defects such as loose connections or defective wiring.

Before contacting your local dealer, read this chapter carefully, it will save you time and money.

⚠ WHEN CARRYING OUT AN INSPECTION ON THE SWITCH BOX OF THE UNIT, ALWAYS MAKE SURE THAT THE MAIN SWITCH OF THE UNIT IS SWITCHED 'OFF'.

The guidelines below might help to solve your problem. If you cannot solve the problem, consult your installer/local dealer.

The heat pump does not run.

Please check whether:

1. There is supply voltage (tripped fuse, power failure).
2. The operating switch on the wired controller is switched on, and whether the correct set point temperature has been set.

The set temperature level cannot be reached.

Please check whether:

3. The permissible operating conditions for the heat pump have been adhered to (air temperatures too high or too low).
4. The air inlet or outlet area is blocked, restricted or very dirty.
5. There are closed valves or stop-cocks in the water pipes.

The scheduled timer does work but the programmed actions are executed at the wrong time (e.g. 1 hour too late or too early).

Please check whether:

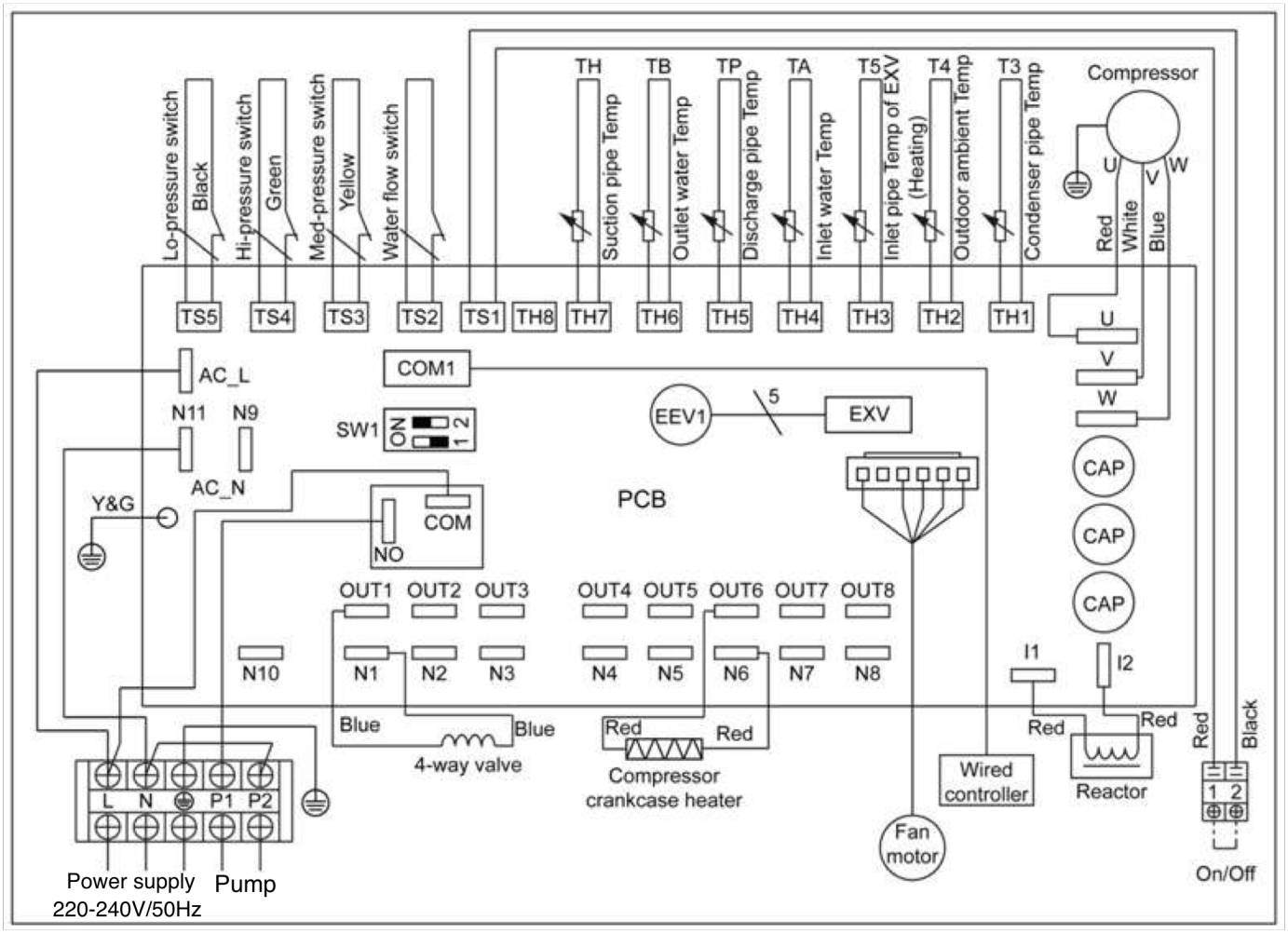
6. The clock and the day of the week are set correctly, adjust if necessary.

If you cannot correct the fault yourself, please contact your after-sales service technician.

Work on the heat pump may only be carried out by authorized and qualified after-sales service technicians.

10.WIRING DIAGRAM

Please refer to the wiring diagram on the electric box.



11. ENVIRONMENTAL INFORMATION

This equipment contains fluorinated greenhouse gases covered by the Kyoto Protocol. It should only be serviced or dismantled by professional trained personnel.
This equipment contains R32 refrigerant in the amount as stated in the specification.
Do not vent R32 into the atmosphere: R32 is a fluorinated greenhouse gas with a Global Warming Potential (GWP) = 675.

12. DISPOSAL REQUIREMENTS

Dismantling of the unit, treatment of the refrigerant, of oil and of other parts must be done in accordance with relevant local and national legislation.

Your product is marked with this symbol. This means that electrical and electronic products shall not be mixed with unsorted household waste.

Do not try to dismantle the system yourself: the dismantling of the system, treatment of the refrigerant, of oil and other parts must be done by a qualified installer in accordance with relevant local and national legislation.

Units must be treated at a specialized treatment facility for re-use, recycling and recovery. By ensuring that this product is disposed off correctly, you will help to prevent potential negative consequences for the environment and human health. Please contact the installer or local authority for more information.

13.INFORMATION SERVICING

Please note all service information before performing any installation, maintenance or handling of this R-32 gas air conditioner.

1. Checks to the area

Prior to beginning work on systems containing flammable refrigerants, safety 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

Works shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed.

3. General work area

All mintenance staff and others working in the local area shall be instructed on the nature of work being carried out. work in confined sapces shall be avoided. The area around the work space shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.

4. Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with flammable refrigerants, i.e. no sparking, adequately sealed or intrinsically safe.

5. Presence of fire extinguisher

If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry power or CO2 fire extinguisher adjacent to the charging area.

6. No ignition sources

No person carrying out work in relation to a refrigeration system which involves exposing any pipe work that contains or has contained flammable refrigerant shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which flammable refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. ''NO SMOKING'' signs shall be displayed.

7. Ventilated area

Ensure that the area is in the open or that it it adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

8. Checks to the refrigeration equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt consult the manufacturer's technical department for assistance. The following checks shall be applied to installations using flammable refrigerants:

- the charge size is in accordance with the room size within which the refrigerant containing parts are installed;
- the ventilation machinery and outlets are operating adequately and are not obstructed;
- if an indirect refrigerating circuit is being used, the secondary circuits shall be checked for the presence of refrigerant; marking to the equipment continues to be visible and legible.
- marking and signs that are illegible shall be corrected;
- refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless
- the components are constructed of materials which are inherently resistant to being
- corroded or are suitably protected against being so corroded.

9. Checks to electrical devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, and adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

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

10. Repairs to sealed components

10.1 During repairs to sealed components, 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.

10.2 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. Instrinsically safe components do not have to be isolated prior to working on them.

11. 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. Intrinscially 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.

12. 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 aging or continual vibration from sources such as compressors or fans.

13. 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.

14. 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. 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 or extinguished. If a leakage of refrigernat 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.

15. Removal and evacuation

When breaking into the refrigerant circuit to make repairs of 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:

- remove refrigerant;
- purge the circuit with inert gas;
- evacuate;
- purge again with inert gas;
- 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 closed to any ignition sources and there is ventilation available.

16. Charging procedures

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

- Ensure that contamination of different refrigerants 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 leak tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

17. 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:
- mechanical handling equipment is available, if required, for handling refrigerant cylinders;
- all personal protetive equipment is available and being used correctly;
- the recovery process is supervised at all times by a competent person;
- 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 manufacturer's 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.

18. Labelling

Equipment shall be labelled 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.

19. Recovery

- When removing refrigerant from a system, either for service or decommissioning, it is recommended good practice that all refrigerants are removed safely.
- When tranferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct numbers of cylinders for holding the total system charge are available. All cylinders to be used are designated for the recovered refrigerant and labelled 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 units 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 retruning 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 safely.

20. Transportation, marking and storage for units

1. Transport of equipment containing flammable refrigerants
   Compliance with the transport regulations
2. Marking of equipment using signs
   Compliance with local regulations
3. Disposal of equipment using flammable refrigerants
   Compliance with national regulations
4. Storage of equipment/appliances
   The storage of equipment should be in accordance with the manufacturer's instructions.
5. Storage of packed (unsold) equipment
   Storage package protection should be constructed such that mechanical damage to the equipment inside the package will not cause a leak of the refrigerant charge.
   The maximum number of pieces of equipment permitted to be stored together will be determined by local regulations.