GD FLOOR STANDING

R32 3D INVERTER CONTROL

SERVICE MANUAL

R32

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Caution: Risk of fire/flammable material

Safety Precautions

Contents

1. Precautions

To prevent personal injury, or property or unit damage, adhere to all precautionary measures and instructions outlined in this manual. Before servicing a unit, refer to this service manual and its relevant sections.

Failure to adhere to all precautionary measures listed in this section may result in personal injury, damage to the unit or to property, or in extreme cases, death.

WARNING indicates a potentially hazardous situation which if not avoided could result in serious personal injury, or death.

CAUTION indicates a potentially hazardous situation which if not avoided could result in minor or moderate personal injury, or unit damage.

1.1 In case of Accidents or Emergency

WARNING

- If a gas leak is suspected, immediately turn off the gas and ventilate the area if a gas leak is suspected before turning the unit on.
- If strange sounds or smoke is detected from the unit, turn the breaker off and disconnect the power supply cable.
- If the unit comes into contact with liquid, contact an authorized service center.
- If liquid from the batteries makes contact with skin or clothing, immediately rinse or wash the area well with clean water.
- Do not insert hands or other objects into the air inlet or outlet while the unit is plugged in.
- Do not operate the unit with wet hands.
- Do not use a remote controller that has previously been exposed to battery damage or battery leakage.

CAUTION

- Clean and ventilate the unit at regular intervals when operating it near a stove or near similar devices.
- Do not use the unit during severe weather conditions. If possible, remove the product from the window before such occurrences.

1.2 Pre-Installation and Installation

WARNING

- Use this unit only on a dedicated circuit.
- Damage to the installation area could cause the unit to fall, potentially resulting in personal injury, property damage, or product failure.
- Only qualified personnel should disassemble, install, remove, or repair the unit.
- Only a qualified electrician should perform electrical work. For more information, contact your dealer, seller, or an authorized service center.

CAUTION

- While unpacking be careful of sharp edges around the unit as well as the edges of the fins on the condenser and evaporator.

1.3 Operation and Maintenance

WARNING

- Do not use defective or under-rated circuit breakers.
- Ensure the unit is properly grounded and that a dedicated circuit and breaker are installed.
- Do not modify or extend the power cable. Ensure the power cable is secure and not damaged during operation.
- Do not unplug the power supply plug during operation.
- Do not store or use flammable materials near the unit.
- Do not open the inlet grill of the unit during operation.
- Do not touch the electrostatic filter if the unit is equipped with one.
- Do not block the inlet or outlet of air flow to the unit.
- Do not use harsh detergents, solvents, or similar items to clean the unit. Use a soft cloth for cleaning.
- Do not touch the metal parts of the unit when removing the air filter as they are very sharp.
- Do not step on or place anything on the unit or outdoor units.
- Do not drink water drained from the unit
- Avoid direct skin contact with water drained from the unit.
- Use a firm stool or step ladder according to manufacturer procedures when cleaning or maintaining the unit.

CAUTION

- Do not install or operate the unit for an extended period of time in areas of high humidity or in an environment directly exposing it to sea wind or salt spray.
- Do not install the unit on a defective or damaged installation stand, or in an unsecure location.
- Ensure the unit is installed at a level position
- Do not install the unit where noise or air discharge created by the outdoor unit will negatively impact the environment or nearby residences.
- Do not expose skin directly to the air discharged by the unit for prolonged periods of time.
- Ensure the unit operates in areas water or other liquids.
- Ensure the drain hose is installed correctly to ensure proper water drainage.
- When lifting or transporting the unit, it is recommended that two or more people are used for this task.
- When the unit is not to be used for an extended time, disconnect the power supply or turn off the breaker.

2. Information servicing

2.1 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 minimized.
- For repair to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.

2.2 Work procedure

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

2.3 Work procedure

- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out.
- Work in confined spaces 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.

2.4 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.

2.5 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 powder or CO2 fire extinguisher adjacent to the charging area.

2.6 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.

2.7 Ventilated area

- Ensure that the area is in the open or that it is 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.

2.8 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 circuit shall be checked for the presence of refrigerant; marking to the equipment continues to be visible and legible.
  - markings 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.

2.9 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, an 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.

2.10 Repairs to sealed components

- 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.
- 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 to working on them.

2.11 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. 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.

2.12 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.

2.13 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.

2.14 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 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 or 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.

2.15 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:
  - 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 close to any ignition sources and there is ventilation available.

2.16 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.

2.17 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.

- Become familiar with the equipment and its operation.
- Isolate system electrically.
- Before attempting the procedure ensure that:
  - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - all personal protective 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.
- Pump down refrigerant system, if possible.
- If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- Make sure that cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with manufacturer's instructions.
- Do not overfill cylinders. (No more than 80 % volume liquid charge).
- Do not exceed the maximum working pressure of the cylinder, even temporarily.
- 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.
- Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

2.18 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.

2.19 Recovery

- When removing refrigerant from a system, either for 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 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 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 safely.

Specifications

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1. Model Reference

Refer to the following table to determine the specific indoor and outdoor unit model number of your purchased equipment.

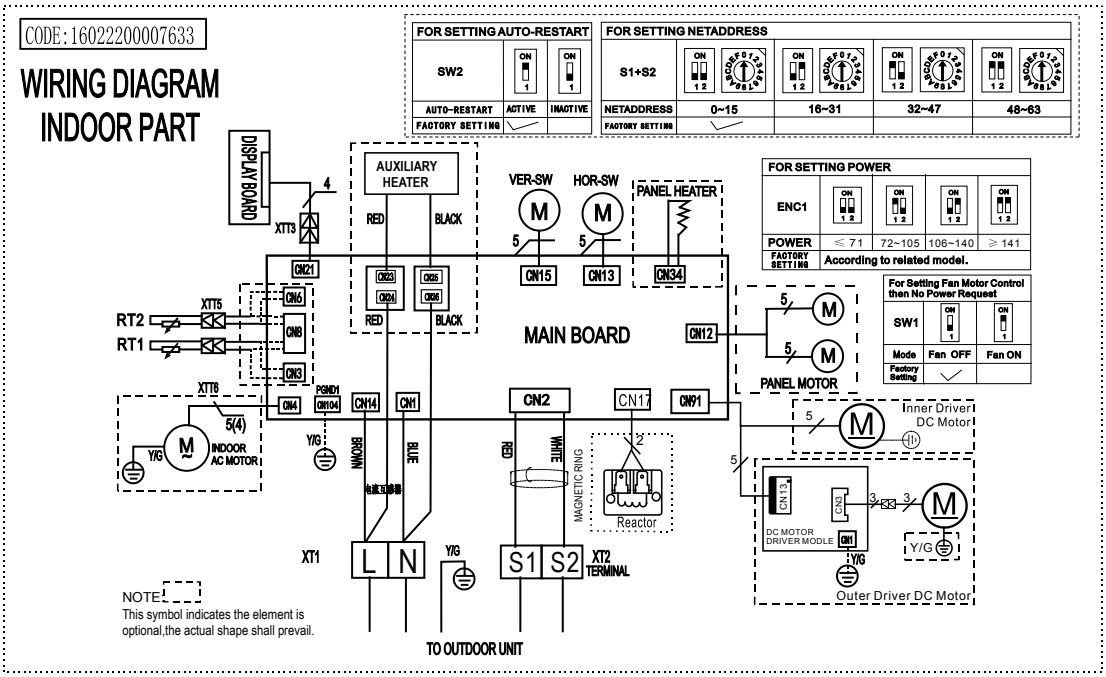
Indoor Unit Model	Outdoor Unit Model	Capacity (Btu/h)	Power Supply
42QFD048R8S	38QUS048R8T	48k	3N~, 380~415V, 50Hz

2. Electrical Wiring Diagrams

2.1 Indoor unit

Abbreviation	Paraphrase
Y/G	Yellow-Green Conductor
HOR-SW	Horizontal Fan
VER-SW	Vertical Fan
L	LIVE
N	NEUTRAL
RT1	Indoor Room Temperature
RT2	Coil Temperature of Indoor Heat Exchanger

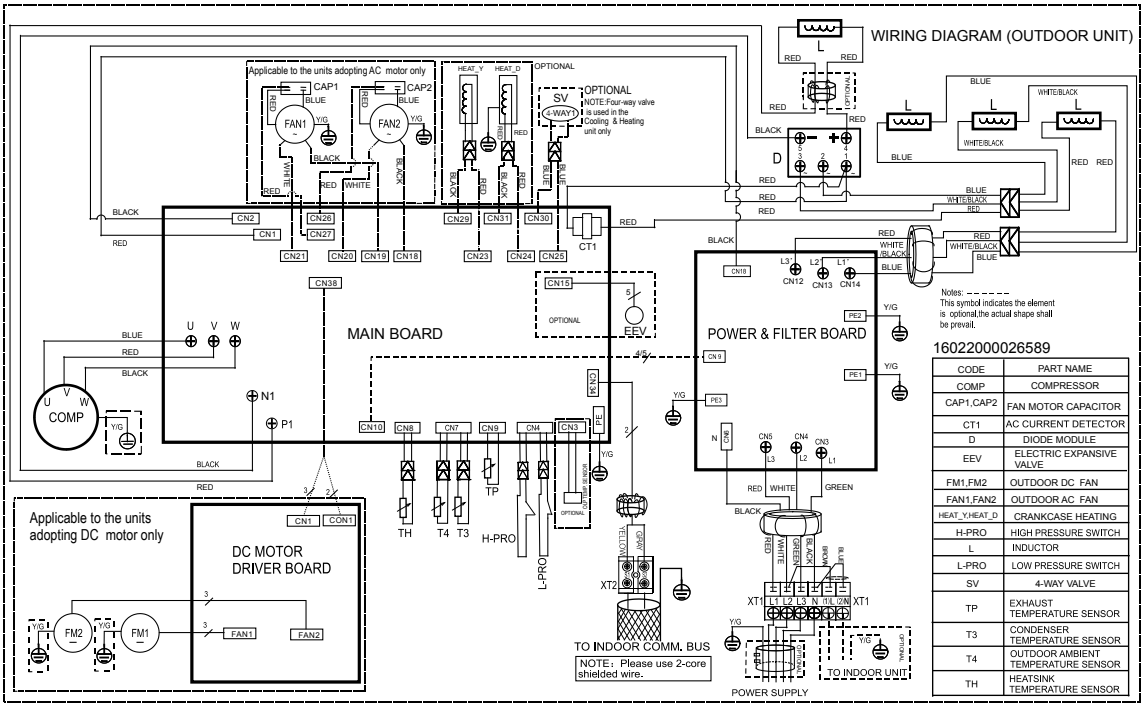
42QFD048R8S



2.2 Outdoor Unit

Abbreviation	Paraphrase
COMP	Compressor
CAP1,CAP2	Fan Motor Capacitor
CT1	AC Current Detector
D	Diode Module
EEV	Electric Expansive Valve
FM1,FM2	Outdoor DC Fan
FAN1,FAN2	Outdoor AC Fan
HEAT_Y,HEAT_D	Crankcase Heating
H-PRO	High Pressure Switch
L	Inductor
L-PRO	Low Pressure Switch
SV	4-Way Valve
TP	Exhaust Temperature Sensor
T3	Condenser Temperature Sensor
T4	Outdoor Ambient Temperature Sensor
TH	Heatsink Temperature Sensor

38QUS048R8T



CODE	PART NAME
COMP	COMPRESSOR
CAP1,CAP2	FAN MOTOR CAPACITOR
CT1	AC CURRENT DETECTOR
D	DIODE MODULE
EEV	ELECTRIC EXPANSIVE VALVE
FM1,FM2	OUTDOOR DC FAN
FAN1,FAN2	OUTDOOR AC FAN
HEAT_Y,HEAT_D	CRANKCASE HEATING
H-PRO	HIGH PRESSURE SWITCH
L	INDUCTOR
L-PRO	LOW PRESSURE SWITCH
SV	4-WAY VALVE
TP	EXHAUST TEMPERATURE SENSOR
T3	CONDENSER TEMPERATURE SENSOR
T4	OUTDOOR AMBIENT TEMPERATURE SENSOR
TH	HEATSINK TEMPERATURE SENSOR

Product Features

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1. Operation Modes and Functions

1.1 Abbreviation

Unit element abbreviations

Abbreviation	Element
T1	Indoor room temperature
T2	Coil temperature of evaporator
T3	Coil temperature of condenser
T4	Outdoor ambient temperature
T5	Compressor discharge temperature

1.2 Safety Features

Compressor three-minute delay at restart

Compressor functions are delayed for up to one minute upon the first startup of the unit, and are delayed for up to three minutes upon subsequent unit restarts.

Low Pressure Check Function

The low pressure switch should be always closed. If it is open, the system will stop until the fault is cleared. During defrosting procedure , 4 minutes after defrosting ends and 5 minutes after compressor is on in heating mode, low pressure switch won't be checked.

Note: The system will not check if the protection could be cleared in 30 seconds after the protection occurs. If this protection occurs 3 times, it won't recover automatically until the main power is cut off.

Over-current protection

When compressor is running, if the current is over twice of the rated for 3 seconds, the compressor will stop and an error code will be displayed on the outdoor PCB. If the current becomes normal, the indoor sends signal to the outdoor, the outdoor will display normally.

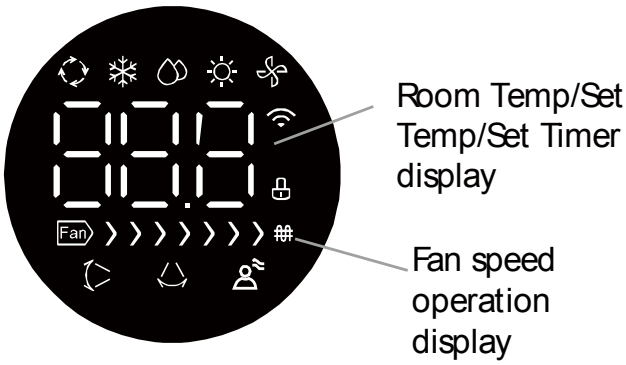
Open Circuit/Disconnection Sensor Protection

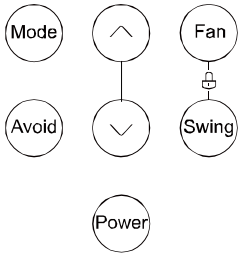
Fan Speed Malfunction

When the indoor fan speed keeps too low (300RPM) for certain time, the unit will stop and the LED will display the failure code.

1.3 Display Function

Unit display functions





- Auto operation
- Cooling operation
- Dry operation
- Heating operation
- Fan operation
- Vertical airflow
- Horizontal airflow
- Avoid direct
- When wireless control feature is activated(some models)
- Electric heating function(some models)
- Lock operation

1.4 Fan Mode

When fan mode is activated:

- The outdoor fan and compressor are stopped.
- Temperature control is disabled and no temperature setting is displayed.
- The indoor fan speed can be set to high, medium, low, or auto.
- The louver operations are identical to those in cooling mode.
- Auto fan: In fan-only mode, AC operates the same as auto fan in cooling mode with the temperature set at 24°C

1.5 Cooling Mode

1.5.1 Indoor Fan Control

- In cooling mode, the indoor fan operates continuously. The fan speed can be set to high, medium, low, or auto.
- The auto fan acts according to the value of T1-Td

1.5.2 Outdoor Fan Control

The outdoor fan is controlled by T3 and T4.

1.5.3 Condenser Temperature Protection

---T2>TP3+5, the compressor stops and restarts only when T2. ≤TP3-3

---TP3≤T2<TP3+5, the compressor frequency is limited and decreases to a lower level.

---TP3-3≤T2<TP3, the compressor maintains its current frequency.

---T2<TP3-3, the compressor frequency is not limited.

1.5.4 Evaporator Temperature Protection

---T2<0°C, the compressor stops and restarts only when T2≥5°C.

---0°C≤T2<4°C, the compressor frequency is limited and decreases to a lower level.

---4°C≤T2<7°C, the compressor maintains its current frequency.

---T2>7°C, the compressor frequency is not limited.

1.6 Heating Mode

1.6.1 Indoor Fan Control

- When the compressor is on, the indoor fan can be set to high/medium/low/auto. And the anti-cold wind function has the priority.
- The indoor fan speed will adjust according to the value of T1-Td.

1.6.2 Outdoor Fan Control

The outdoor fan is controlled by T4.

1.6.3 Defrosting mode

- The unit enters the defrosting mode according to the value of temperature difference T3, and also the compressor running time.
- In defrosting mode, the compressor continues to run, the indoor and outdoor motor will cease operation, defrost lamp of the indoor unit will be lighted "dF" will be displayed
- If any one of the following conditions is satisfied, defrosting ends and the machine switches to normal heating mode:
  - T3 rises above 15°C.
  - T3 maintained above 8°C for 80 seconds.
  - Unit runs for 10 minutes consecutively in defrosting mode

1.6.4 Evaporator Temperature Protection

---T2>60°C, the compressor stops and restarts only when T2≤TEH2.

---56°C<T2≤60°C, the compressor frequency is limited and decreases to a lower level

---TEH2≤T2<56°C, the compressor maintains its current frequency.

---T2<TEH2, the compressor frequency is not limited.

1.7 Auto Mode

- This mode can be selected with the remote controller or display button and the temperature setting can be adjusted between 17℃~30℃
- In auto mode, the machine selects cooling, heating, or fan-only mode on the basis of △T (△T =T1-Ts).

ΔT	Running mode
ΔT>2℃	Cooling
-2℃≤ΔT≤2℃	Fan-only
ΔT<-2℃	Heating*

Heating*: In auto mode, cooling only models run the fan.

- Indoor fans run at the auto fan speed of the relevant mode.
- The louver operates the same as in relevant mode.
- If the machine switches mode between heating and cooling, the compressor pauses for a certain period of

time intermittently and then selects a mode based on T1-TS.

- If the setting temperature is modified, the machine selects a new running function.

1.8 Drying Mode

- Indoor fan speed is fixed at low and cannot be changed. The louver angle is the same as in cooling mode.
- All protections are activated and operate the same as they do in cooling mode.

1.9 Timer Function

- The timing range is 24 hours.
- Timer On. The machine turns on automatically at the preset time.
- Timer Off. The machine turns off automatically at the preset time.
- Timer On/Off. The machine turns on automatically at the preset On Time, and then turns off automatically at the preset Off Time.
- Timer Off/On. The machine turns on automatically at the preset Off Time and then turns off automatically at the preset On Time.
- The timer does not change the unit operation mode. If the unit is off now, it does not start up immediately after the "timer off" function is set. When the setting time is reached, the timer LED switches is off and the unit running mode remains unchanged.
- The timer uses relative time, not clock time

1.10 Sleep Function

- The sleep function is available in cooling, heating, or auto mode.
- The operational process for sleep mode is as follows:
- When cooling, the temperature rises 1℃ (to not higher than 30℃) every hour. After 2 hours, the temperature stops rising and the indoor fan is fixed to auto speed.
- When heating, the temperature decreases 1℃ (to not lower than 17℃) every hour. After 2 hours, the temperature stops decreasing and the indoor fan is fixed at auto speed. Anti-cold wind function takes priority.
- Power off, changing mode by display button or setting fan speed, the unit exits this mode.

1.11 Refrigerant Leakage Detection

- With this new technology, the display area will show "EC" when the outdoor unit detects refrigerant leakage.
- When compressor is active, the value of the Coil temperature of evaporator T2 has no change or very little change.

1.12 Auto-Restart function

- The indoor unit has an auto-restart module that allows the unit to restart automatically. The module automatically stores the current settings and in the case of a sudden power failure, will restore those setting automatically within 3 minutes after power returns.
- If there is a power failure while the unit is running, the compressor starts 3 minutes after the unit restarts. If the unit was already off before the power failure, the compressor starts 1 minute after the unit restarts

Maintenance and Disassembly

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1. Maintenance

1.1 First Time Installation Check

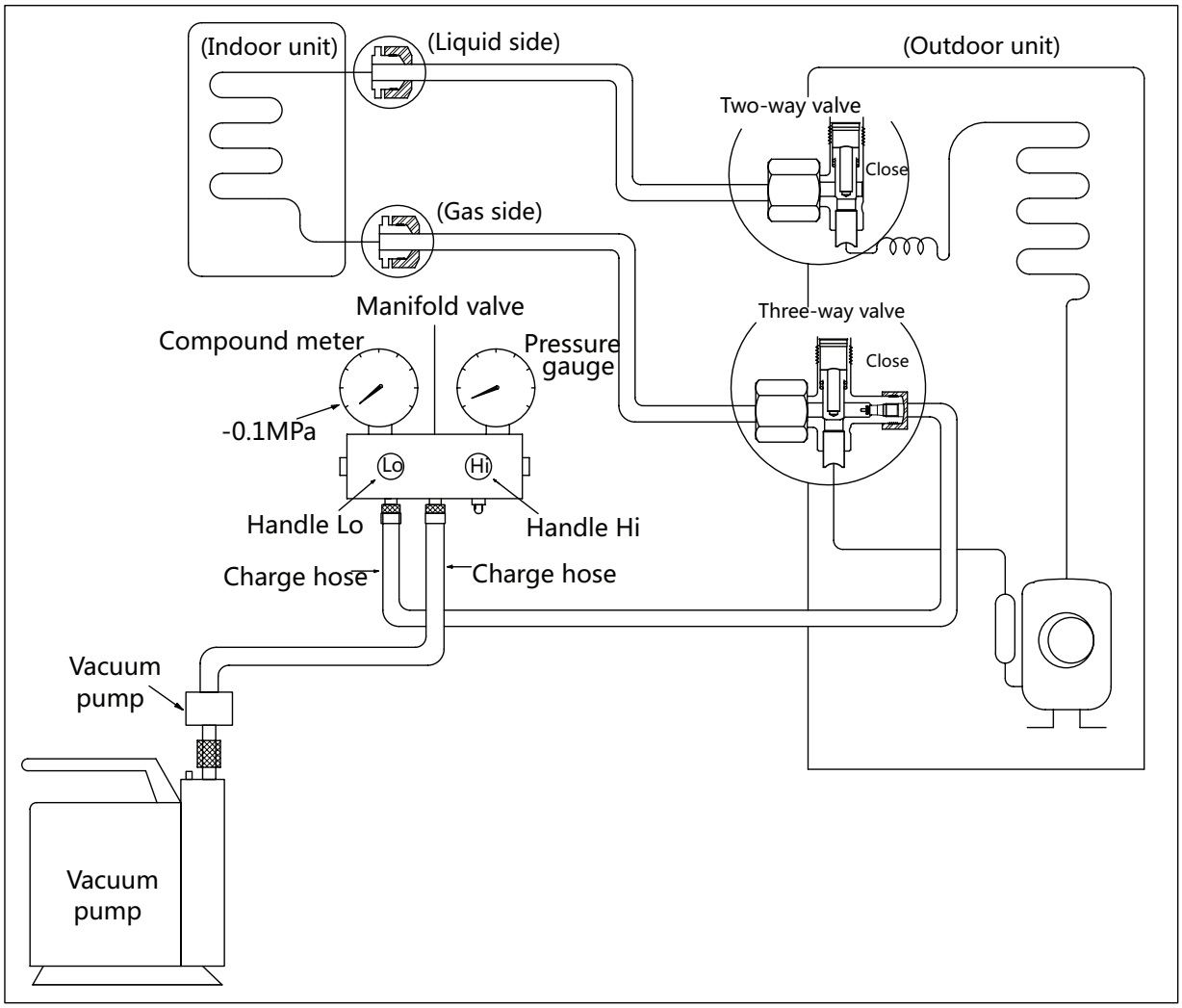
Air and moisture trapped in the refrigerant system affects the performance of the air conditioner by:

- Increasing pressure in the system.
- Increasing the operating current.
- Decreasing the cooling or heating efficiency.
- Congesting the capillary tubing due to ice build-up in the refrigerant circuit.
- Corroding the refrigerant system.

To prevent air and moisture from affecting the air conditioner's performance, the indoor unit, as well as the pipes between the indoor and outdoor unit, must be leak tested and evacuated.

Leak test (soap water method)

Use a soft brush to apply soapy water or a neutral liquid detergent onto the indoor unit connections and outdoor unit connections. If there is gas leakage, bubbles will form on the connection.

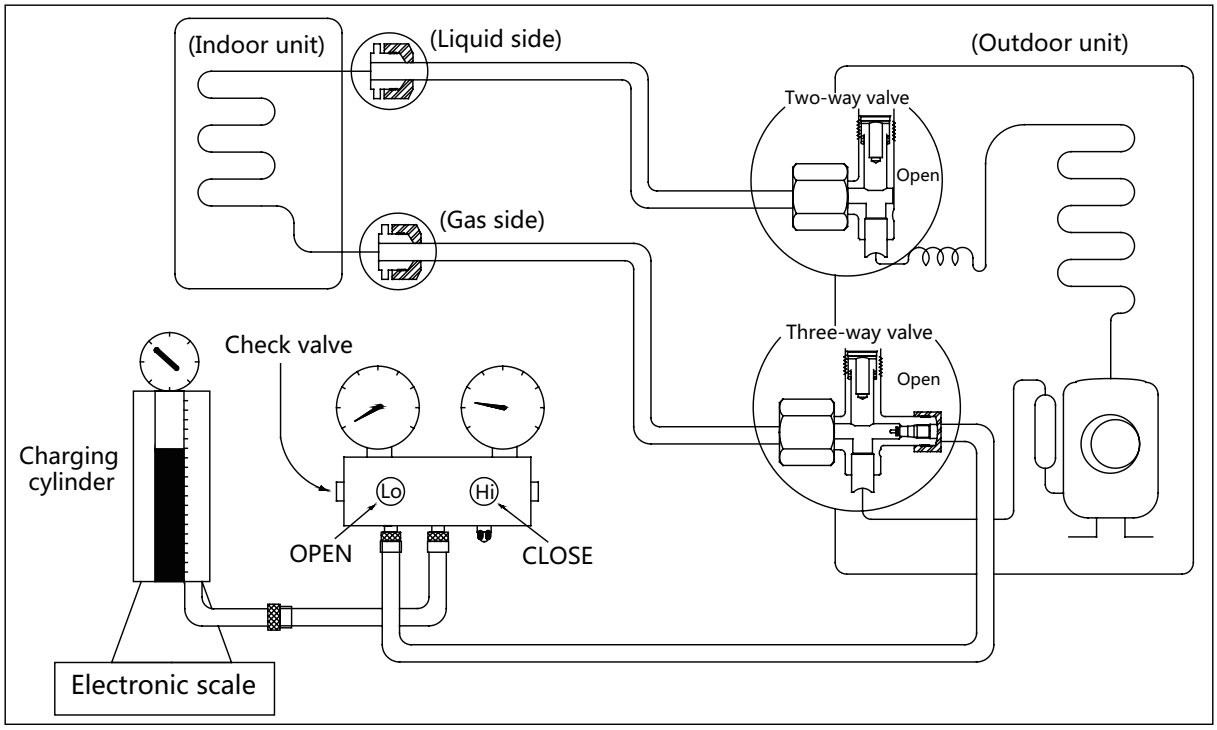


Procedure:

1. Tighten the flare nuts of the indoor and outdoor units, and confirm that both the 2- and 3-way valves are closed.
2. Connect the charge hose with the push pin of Handle Lo to the gas service port of the 3-way valve.
3. Connect another charge hose to the vacuum pump.
4. Fully open the Handle Lo manifold valve.
5. Using the vacuum pump, evacuate the system for 30 minutes.
   a. Check whether the compound meter indicates -0.1 MPa (14.5 Psi).
      - If the meter does not indicate -0.1 MPa (14.5 Psi) after 30 minutes, continue evacuating for an additional 20 minutes.
      - If the pressure does not achieve -0.1 MPa (14.5 Psi) after 50 minutes, check for leakage.
      - If the pressure successfully reaches -0.1 MPa (14.5 Psi), fully close the Handle Lo valve, then cease vacuum pump operations.

   b. Wait for 5 minutes then check whether the gauge needle moves after turning off the vacuum pump. If the gauge needle moves backward, check wether there is gas leakage.
6. Loosen the flare nut of the 3-way valve for 6 or 7 seconds and then tighten the flare nut again.
   a. Confirm the pressure display in the pressure indicator is slightly higher than the atmospheric pressure.
   b. Remove the charge hose from the 3-way valve.
7. Fully open the 2- and 3-way valves and tighten the cap of the 2- and 3-way valves.

1.2 Refrigerant Recharge



Prior to recharging the refrigerant, confirm the additional amount of refrigerant required using the following table:

Models	Standard length	Max. elevation	Max. length	Additional refrigerant
48k	5m (16.4ft)	30m (98.4ft)	65m (213.3ft)	24g/m (0.26oz/ft)

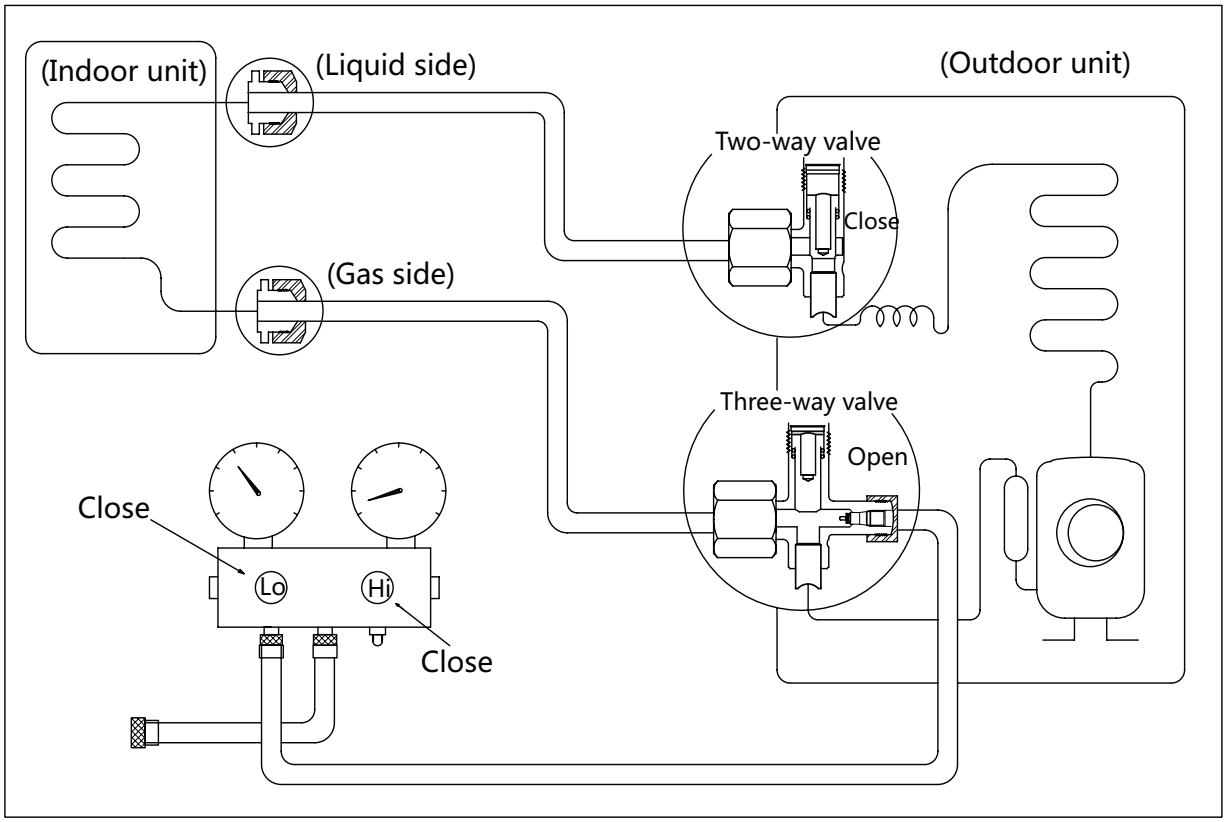
Procedure:

1. Close both 2- and 3-way valves.
2. Slightly connect the Handle Lo charge hose to the 3-way service port.
3. Connect the charge hose to the valve at the bottom of the cylinder.
4. If the refrigerant is R410A, invert the cylinder to ensure a complete liquid charge.
5. Open the valve at the bottom of the cylinder for 5 seconds to purge the air in the charge hose, then fully tighten the charge hose with push pin Handle Lo to the service port of 3-way valve..
6. Place the charging cylinder onto an electronic scale and record the starting weight.
7. Fully open the Handle Lo manifold valve, 2- and x3-way valves.
8. Operate the air conditioner in cooling mode to charge the system with liquid refrigerant.
9. When the electronic scale displays the correct weight (refer to the gauge and the pressure of the low side to confirm), turn off the air conditioner, then disconnect the charge hose from the 3-way service port immediately..
10. Mount the caps of service port and 2- and 3-way valves.
11. Use a torque wrench to tighten the caps to a torque of 18 N.m.
12. Check for gas leakage.

1.3 Re-Installation

1.3.1 Indoor Unit

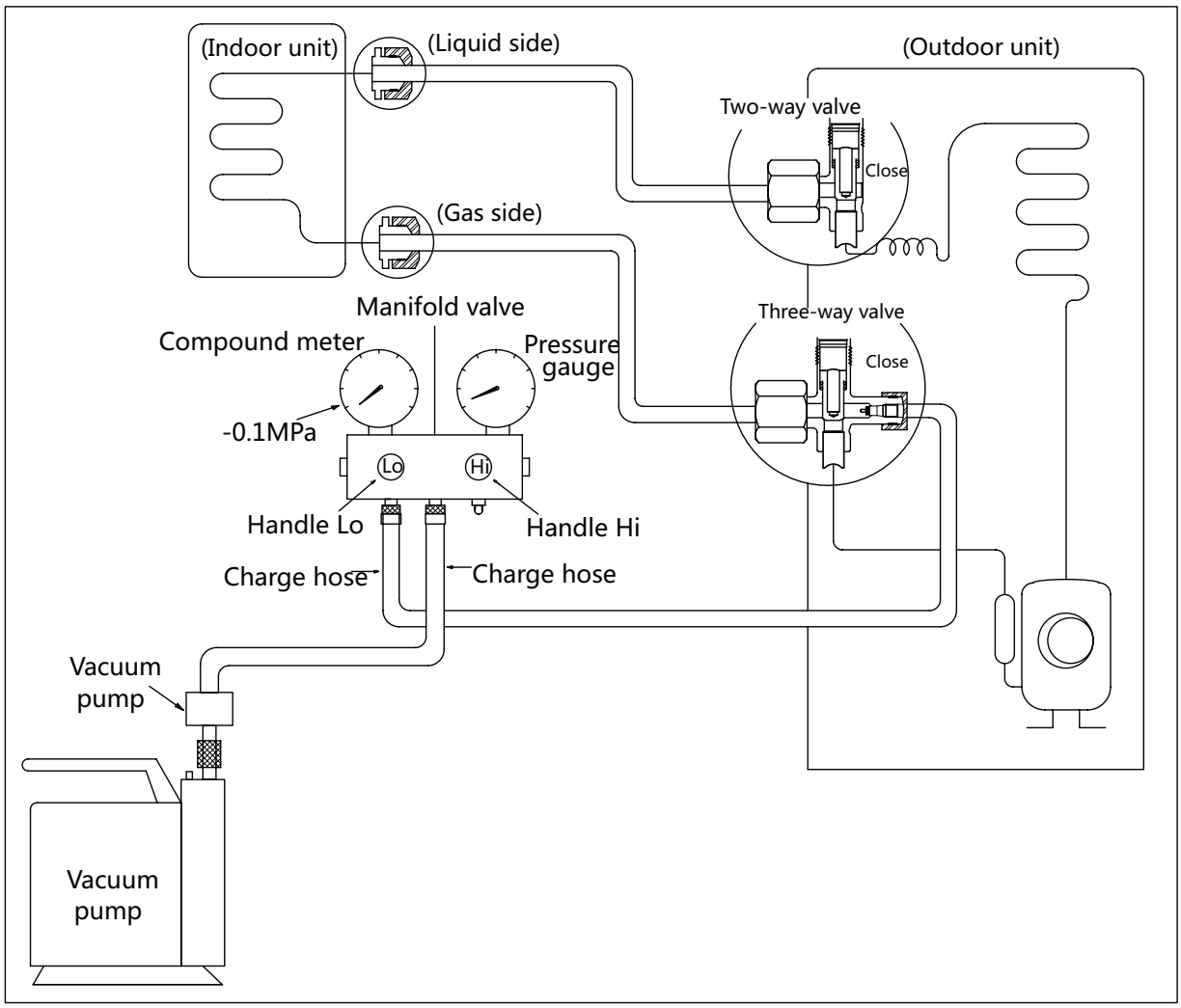
Collecting the refrigerant into the outdoor unit



Procedure:

1. Confirm that the 2- and 3-way valves are opened.
2. Connect the charge hose with the push pin of Handle Lo to the 3-way valve's gas service port.
3. Open the Handle Lo manifold valve to purge air from the charge hose for 5 seconds and then close it quickly.
4. Close the 2-way valve.
5. Operate the air conditioner in cooling mode. Cease operations when the gauge reaches 0.1 MPa (14.5 Psi).
6. Close the 3-way valve so that the gauge rests between 0.3 MPa (43.5 Psi) and 0.5 MPa (72.5 Psi).
7. Disconnect the charge set and mount the caps of service port and 2- and 3-way valves.
8. Use a torque wrench to tighten the caps to a torque of 18 N.m.
9. Check for gas leakage.

Air purging with vacuum pump



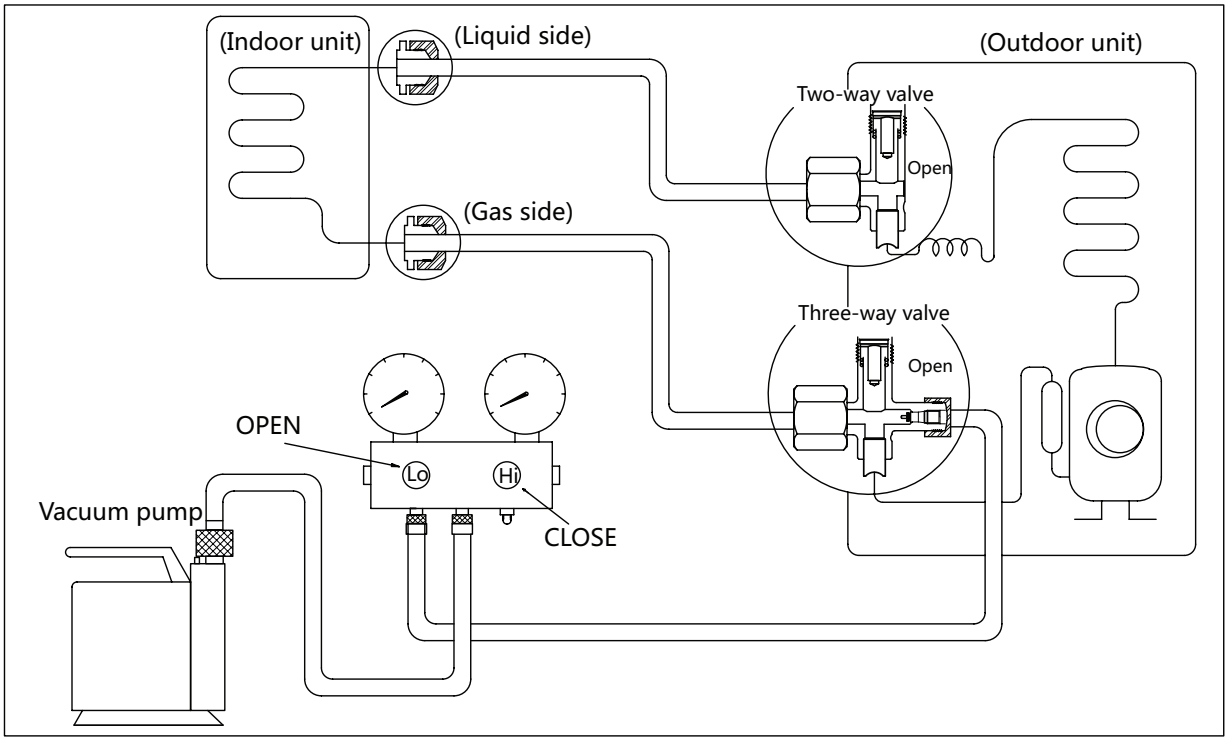
Procedure:

1. Tighten the flare nuts of the indoor and outdoor units, and confirm that both the 2- and 3-way valves are closed.
2. Connect the charge hose with the push pin of Handle Lo to the gas service port of the 3-way valve.
3. Connect another charge hose to the vacuum pump.
4. Fully open the Handle Lo manifold valve.
5. Using the vacuum pump, evacuate the system for 30 minutes.
   a. Check whether the compound meter indicates -0.1 MPa (14.5 Psi).
      - If the meter does not indicate -0.1 MPa (14.5 Psi) after 30 minutes, continue evacuating for an additional 20 minutes.
      - If the pressure does not achieve -0.1 MPa (14.5 Psi) after 50 minutes, check for leakage.
      - If the pressure successfully reaches -0.1 MPa (14.5 Psi), fully close the Handle Lo valve, then cease vacuum pump operations.

   b. Wait for 5 minutes then check whether the gauge needle moves after turning off the vacuum pump. If the gauge needle moves backward, check wether there is gas leakage.
6. Loosen the flare nut of the 3-way valve for 6 or 7 seconds and then tighten the flare nut again.
   a. Confirm the pressure display in the pressure indicator is slightly higher than the atmospheric pressure.
   b. Remove the charge hose from the 3-way valve.
7. Fully open the 2- and 3-way valves and tighten the cap of the 2- and 3-way valves.

1.3.2 Outdoor Unit

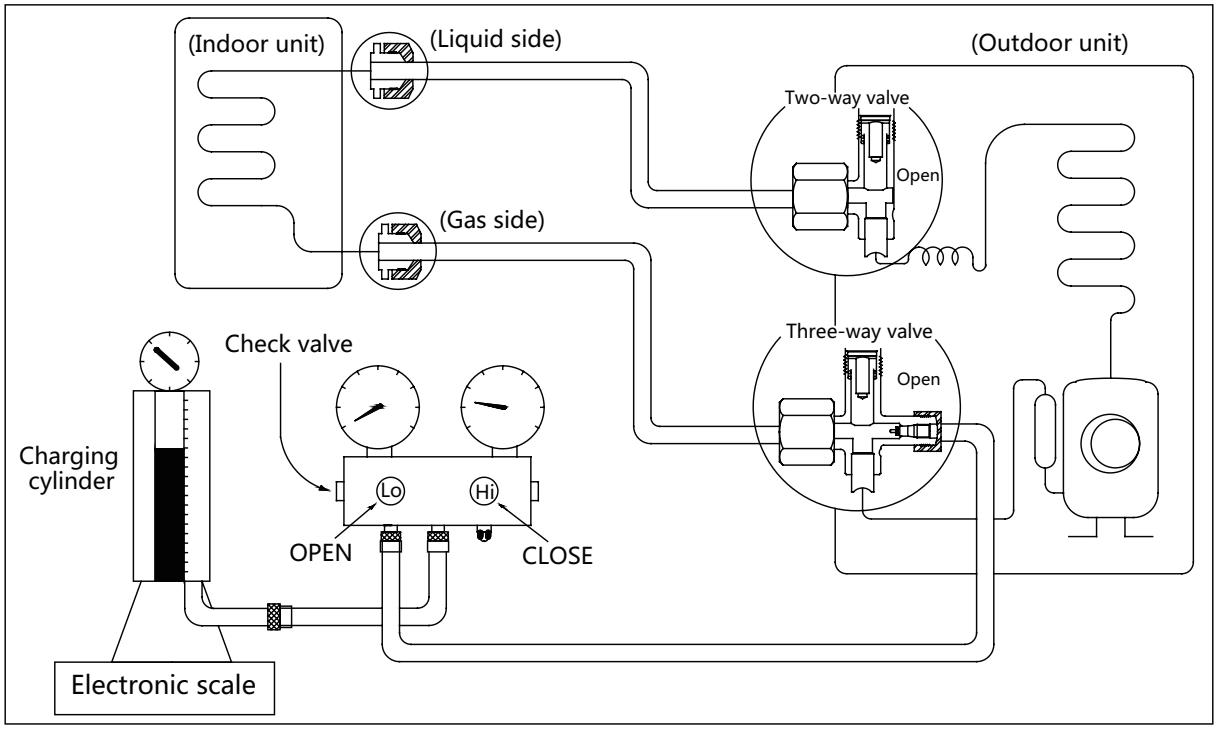
Evacuation for the whole system



Procedure:

1. Confirm that the 2- and 3-way valves are opened.
2. Connect the vacuum pump to the 3-way valve's service port.
3. Evacuate the system for approximately one hour. Confirm that the compound meter indicates -0.1 MPa (14.5Psi).
4. Close the valve (Low side) on the charge set and turn off the vacuum pump.
5. Wait for 5 minutes then check whether the gauge needle moves after turning off the vacuum pump. If the gauge needle moves backward, check whether there is gas leakage.
6. Disconnect the charge hose from the vacuum pump.
7. Mount the caps of service port and 2- and 3-way valves.
8. Use a torque wrench to tighten the caps to a torque of 18 N.m.

Refrigerant charging



Procedure:

1. Close both 2- and 3-way valves.
2. Slightly connect the Handle Lo charge hose to the 3-way service port.
3. Connect the charge hose to the valve at the bottom of the cylinder.
4. If the refrigerant is R410A, invert the cylinder to ensure a complete liquid charge.
5. Open the valve at the bottom of the cylinder for 5 seconds to purge the air in the charge hose, then fully tighten the charge hose with push pin Handle Lo to the service port of 3-way valve..
6. Place the charging cylinder onto an electronic scale and record the starting weight.
7. Fully open the Handle Lo manifold valve, 2- and 3-way valves.
8. Operate the air conditioner in cooling mode to charge the system with liquid refrigerant.
9. When the electronic scale displays the correct weight (refer to the gauge and the pressure of the low side to confirm), turn off the air conditioner, then disconnect the charge hose from the 3-way service port immediately..
10. Mount the caps of service port and 2- and 3-way valves.
11. Use a torque wrench to tighten the caps to a torque of 18 N.m.
12. Check for gas leakage.

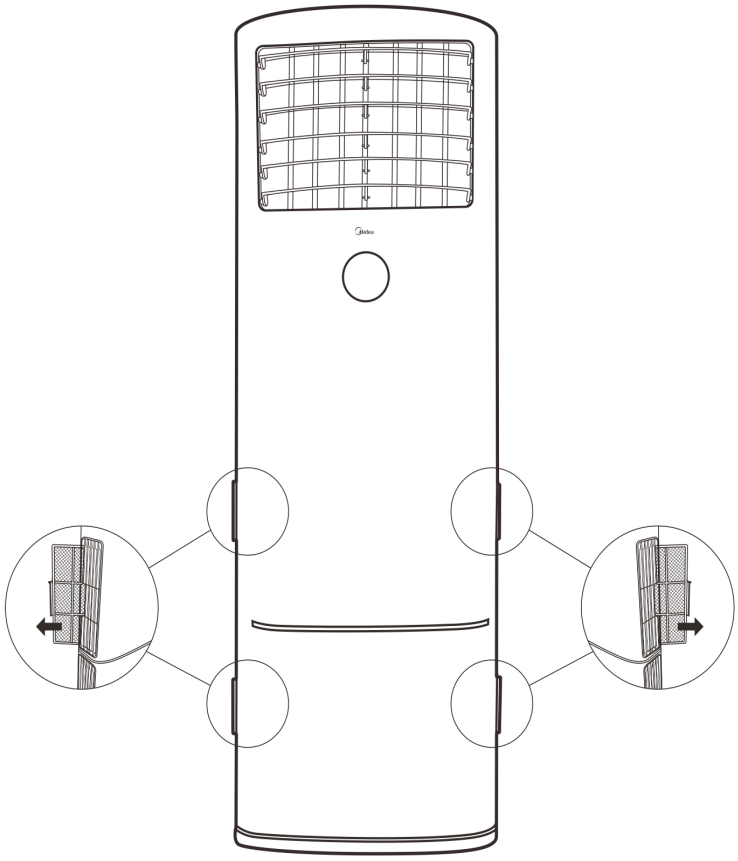
Note: 1. Mechanical connectors used indoors shall comply with local regulations.

2. When mechanical connectors are reused indoors, sealing parts shall be renewed. When flared joints are reused indoors, the flare part shall be re-fabricated.

2. Disassembly

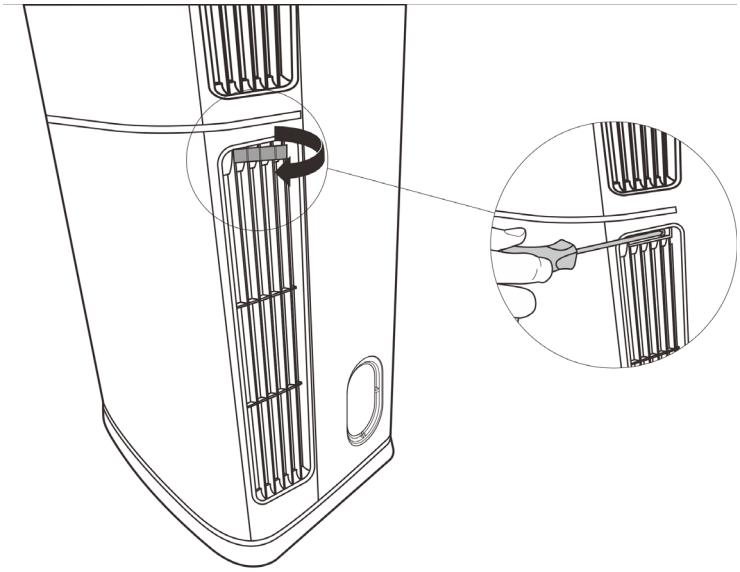
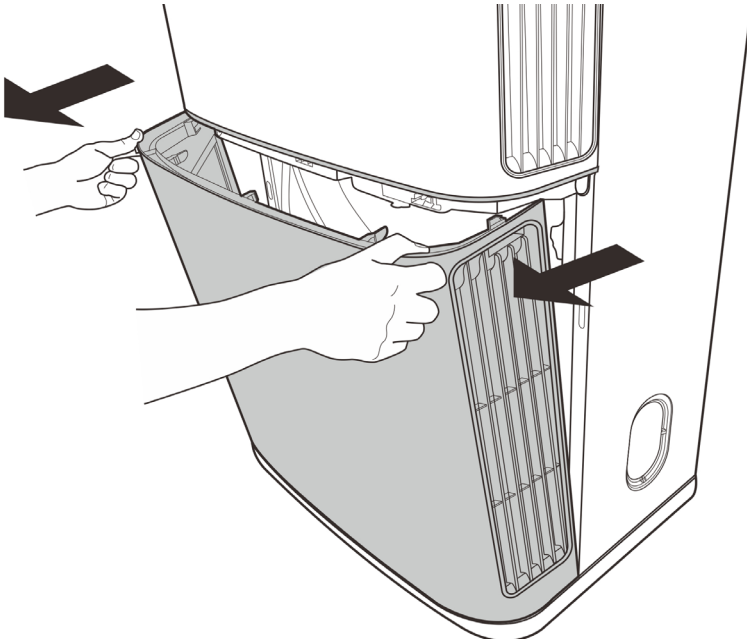
2.1 Indoor unit

1. Filter

Procedure	Illustration
1) Pull out the filters from each side of air inlet grille subassembly and air outlet subassembly (see CJ_GD_001)	 CJ_GD_001

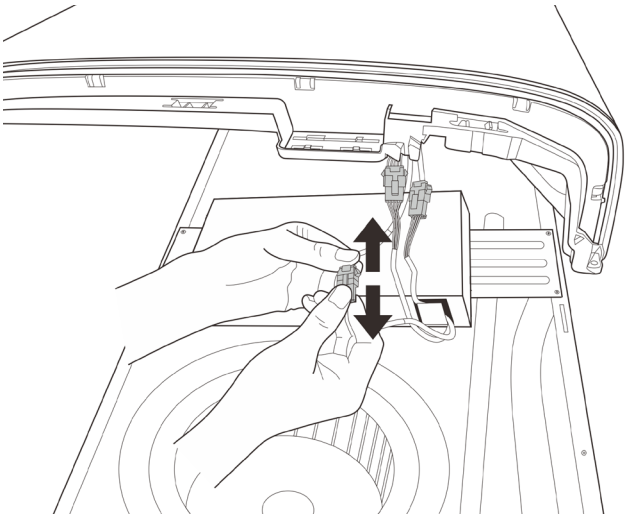
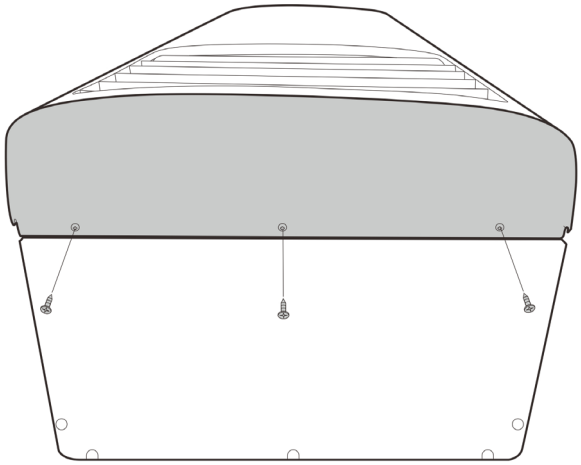
Note: This section is for reference only. Actual unit appearance may vary.

2. Air Inlet Grille Subassembly

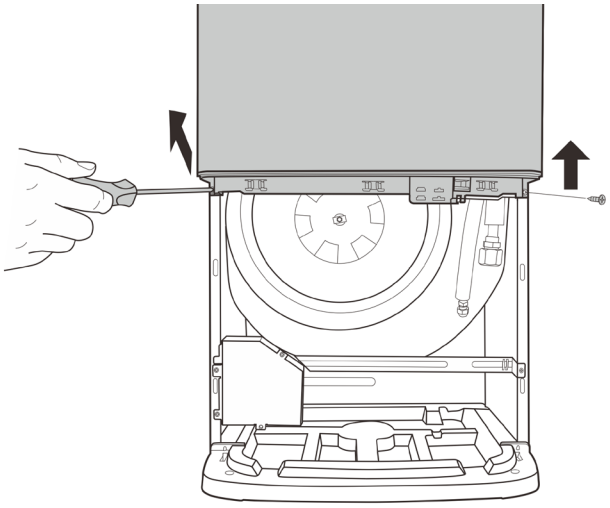
Procedure	Illustration
1) Open the screw cap on each side of air inlet grille subassembly.(see CJ_GD_002) 2) Remove 2 screws. (see CJ_GD_002)	 CJ_GD_002
3) Then pull the air inlet grille subassembly and lift up to remove it (see CJ_GD_003) (Note: To prevent injury, pay attention to the hooks located at the bottom.)	 CJ_GD_003

Note: This section is for reference only. Actual unit appearance may vary.

3. Air Outlet Frame Subassembly

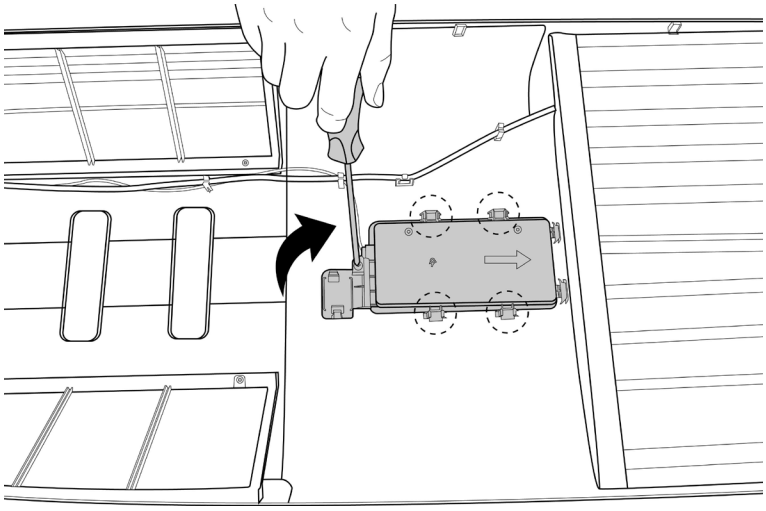
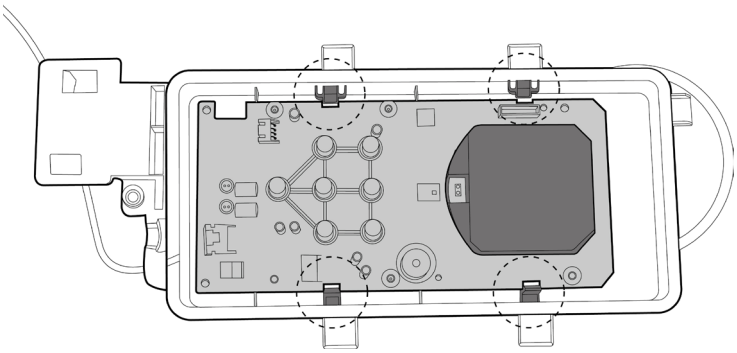
Procedure	Illustration
1) Unplug the 3 connections.(see CJ_GD_004)	 CJ_GD_004
2) Remove 3 screws located on the top of air outlet frame subassembly. (see CJ_GD_005)	 CJ_GD_005

Note: This section is for reference only. Actual unit appearance may vary.

Procedure	Illustration
3) Remove 2 screws located on the bottom left and right of air outlet frame subassembly. (see CJ_GD_006) 4) Lift the air outlet frame subassembly up and pull it up to turn it over. (see CJ_GD_006)	 **CJ_GD_006**

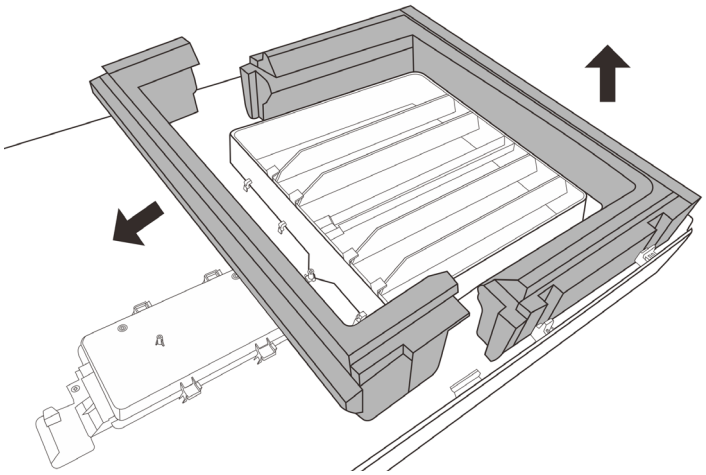
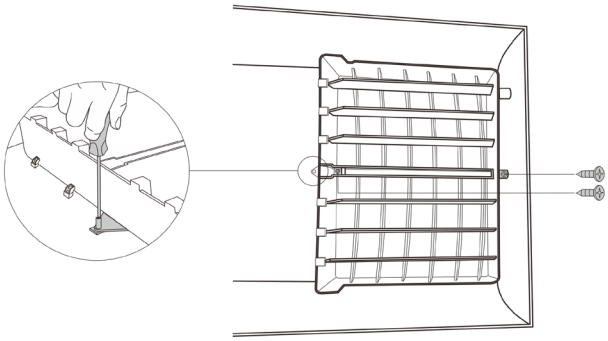
Note: This section is for reference only. Actual unit appearance may vary.

4. Display Board

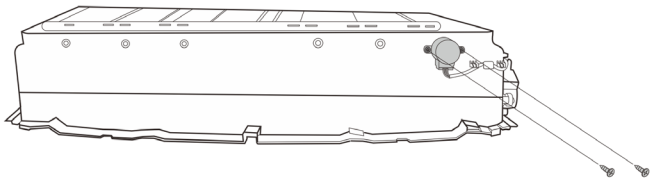
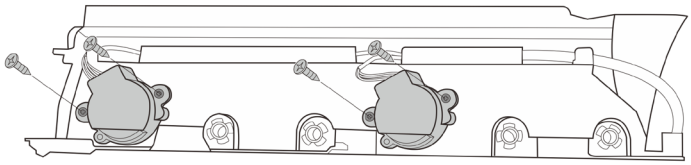
Procedure	Illustration
1) Remove 1 screw. (see CJ_GD_007) 2) Release 4 hooks. (see CJ_GD_007) 3) Take out display control box subassembly and turn it over.(see CJ_GD_007)	 **CJ_GD_007**
4) Release 4 hooks and take out the display board. (see CJ_GD_008)	 **CJ_GD_008**

Note: This section is for reference only. Actual unit appearance may vary.

5. Swing Motor

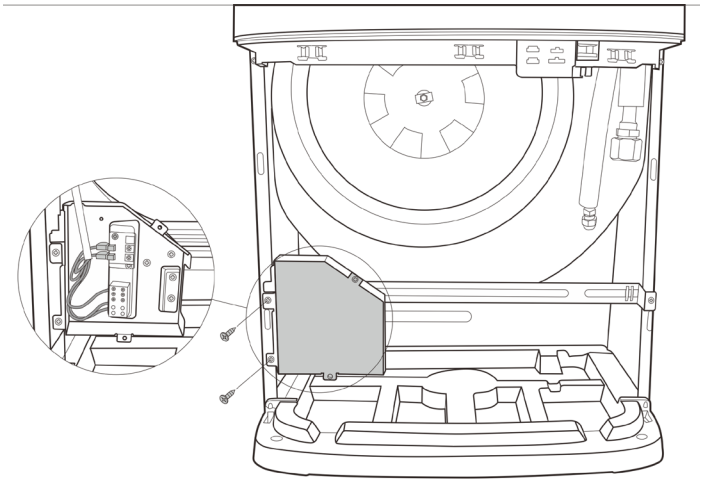
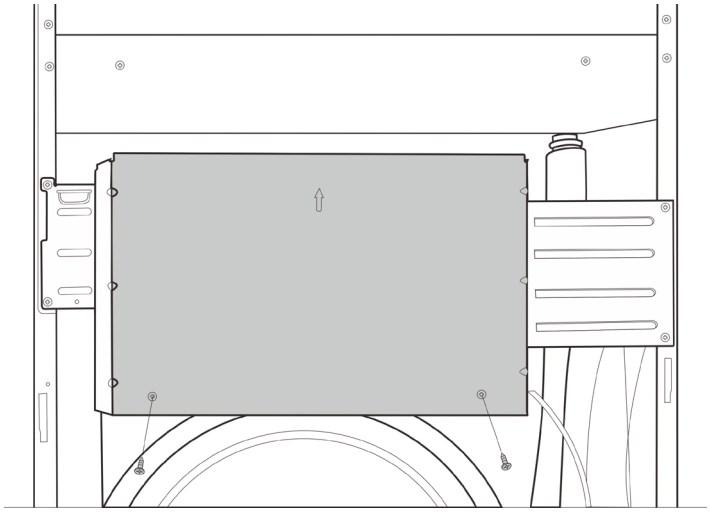
Procedure	Illustration
1) Remove top air outlet foam and bottom air outlet foam . (see CJ_GD_009)	 CJ_GD_009
2) Remove 2 screws. (see CJ_GD_010)	 CJ_GD_010

Note: This section is for reference only. Actual unit appearance may vary.

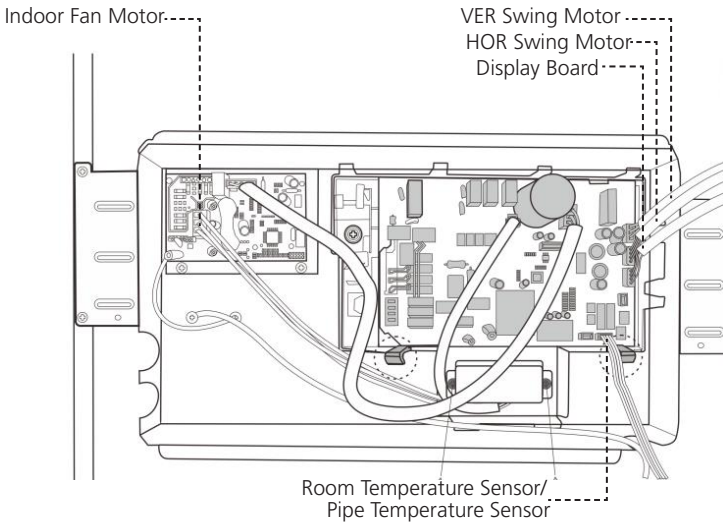
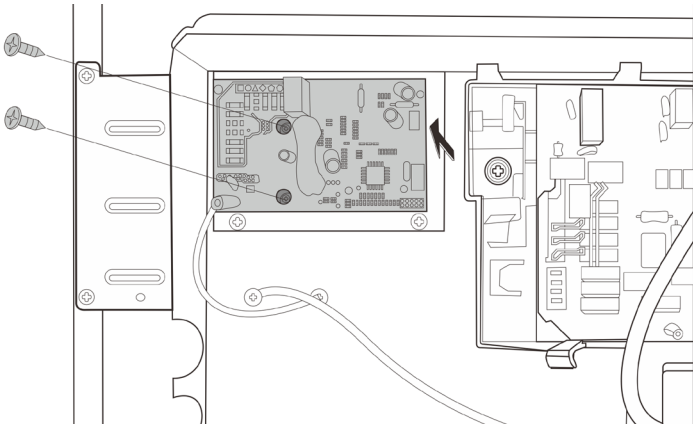
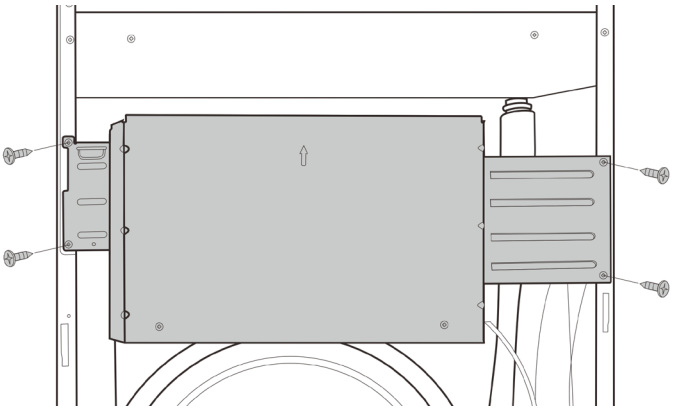
Procedure	Illustration
3) Take out inner frame subassembly with 3 swing motors(one is vertical swing motor, two are horizontal swing motors). 4) Remove 2 screws to remove the swing motor. (see CJ_GD_011&012)	 **CJ_GD_011**  **CJ_GD_012**

Note: This section is for reference only. Actual unit appearance may vary.

6. Electrical parts (Antistatic gloves must be worn.)

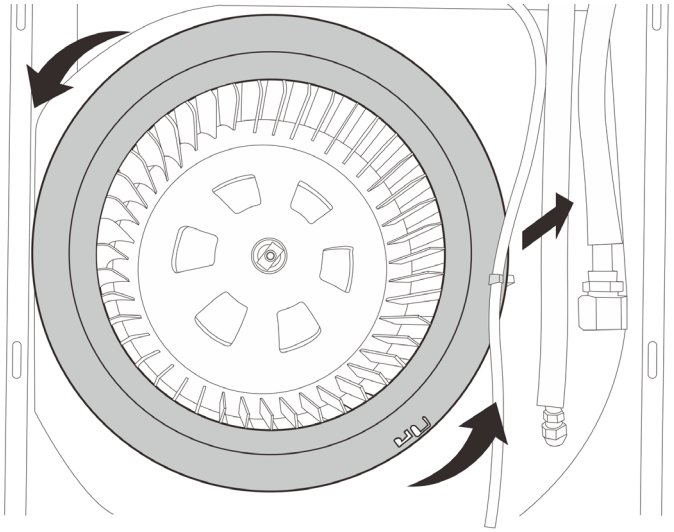
Procedure	Illustration
1) Remove 2 screws of the cover of electrical connector.(see CJ_GD_013)	 CJ_GD_013
2) Remove 2 screws of the cover of the electronic control box (see CJ_GD_014) 3) Then remove the cover.	 CJ_GD_014

Note: This section is for reference only. Actual unit appearance may vary.

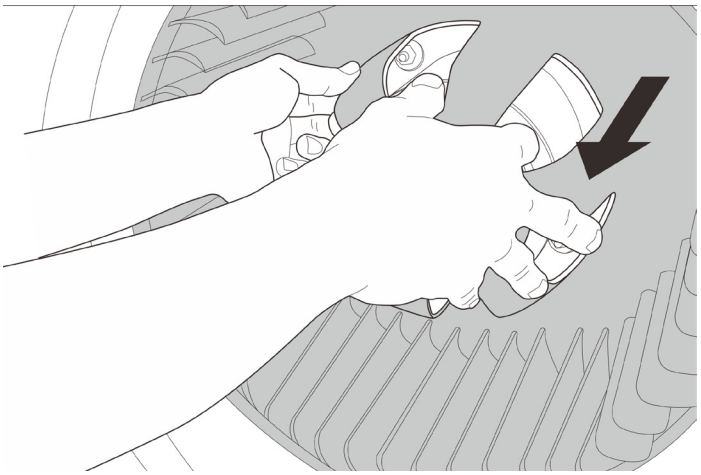
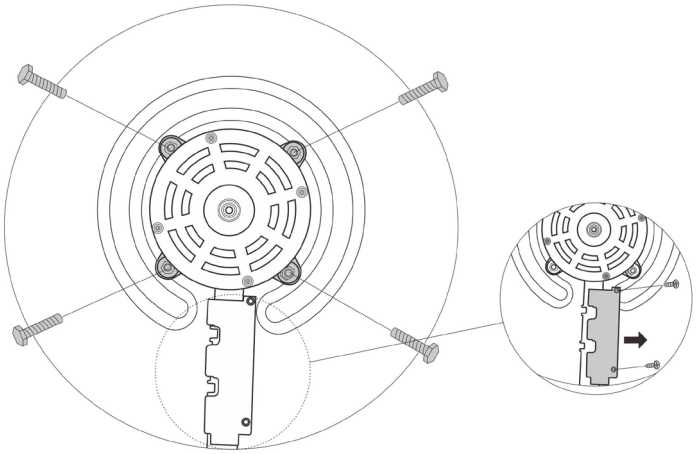
Procedure	Illustration
4) Unplug all the connections on the main PCB. (see CJ_GD_015) 5) Release 2 hooks and take out the main PCB (see CJ_GD_015) 6) Release 2 screws then take out the reactor. (see CJ_GD_015)	 **CJ_GD_015**
7) Release 2 screws then take out the inverter control board subassembly. (see CJ_GD_016)	 **CJ_GD_016**
8) Release 4 screws affixing the electrical control box and remove it.(see CJ_GD_017)	 **CJ_GD_017**

Note: This section is for reference only. Actual unit appearance may vary.

7. Fan Motor

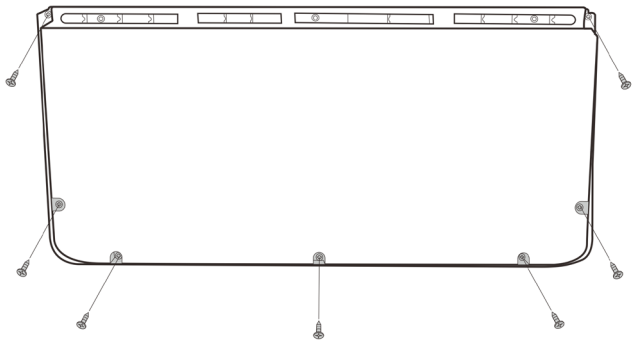
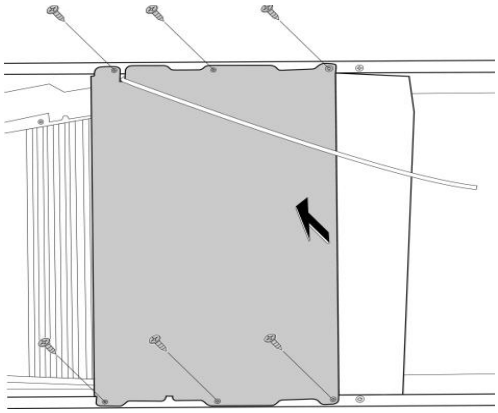
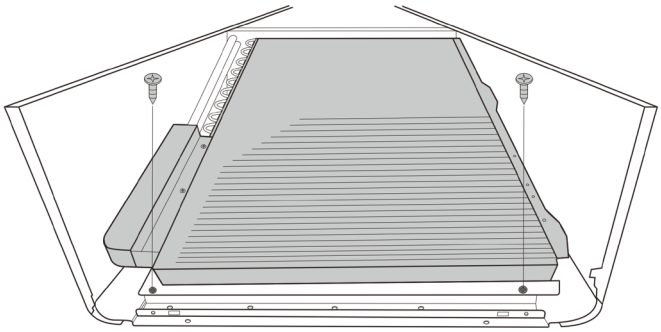
Procedure	Illustration
1) Rotate the ventilation ring counter-clockwise and until the 4 clips pop out of their holes. (see CJ_GD_018) 2) Pull out the ventilation ring. (see CJ_GD_018)	
	CJ_GD_018
3) Remove the affixing nut on the axis of the fan wheel. (see CJ_GD_019)	
	CJ_GD_019

Note: This section is for reference only. Actual unit appearance may vary.

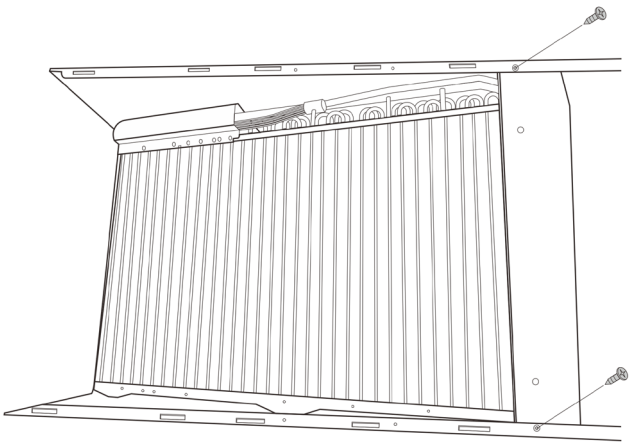
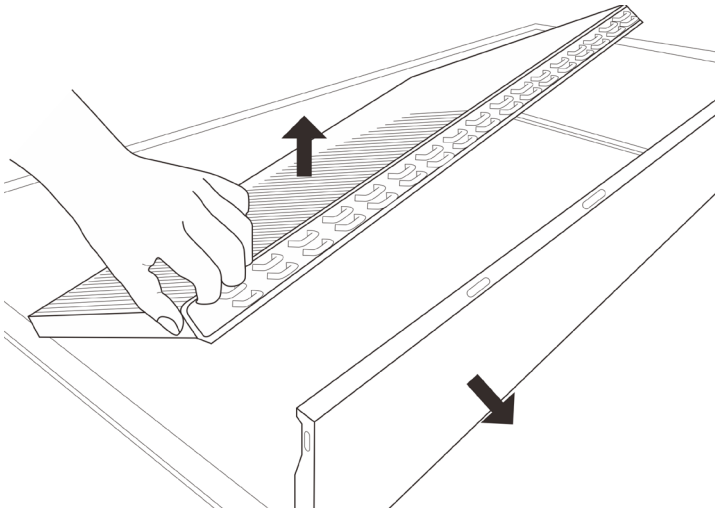
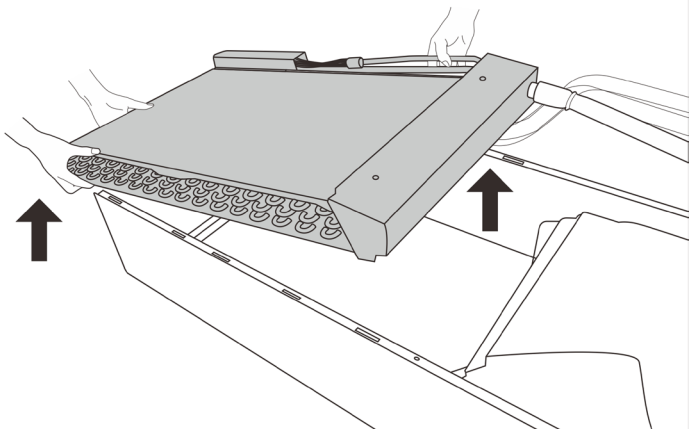
Procedure	Illustration
4) Take the fan wheel out(see CJ_ GD_020)	 CJ_GD_020
5) Remove 4 nuts around of the motor and 2 screws affixing the cover for the wires. (see CJ_GD_021) 6) Remove the fan motor.	 CJ_GD_021

Note: This section is for reference only. Actual unit appearance may vary.

8. Evaporator

Procedure	Illustration
1) Remove 7 screws affixing the top cover.(see CJ_GD_022) 2) Remove the top cover.	 **CJ_GD_022**
3) Remove 3 screws on each side of the cover assembly.(see CJ_GD_023) 4) Take the cover off.	 **CJ_GD_023**
5) Remove 2 screws affixing the inlet/ outlet pipes of the evaporator.(see CJ_GD_024)	 **CJ_GD_024**

Note: This section is for reference only. Actual unit appearance may vary.

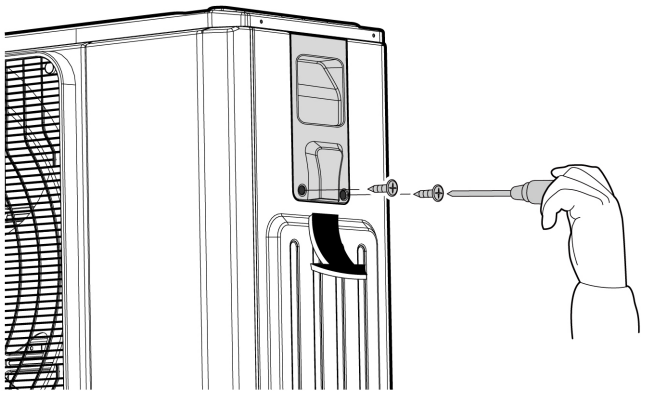
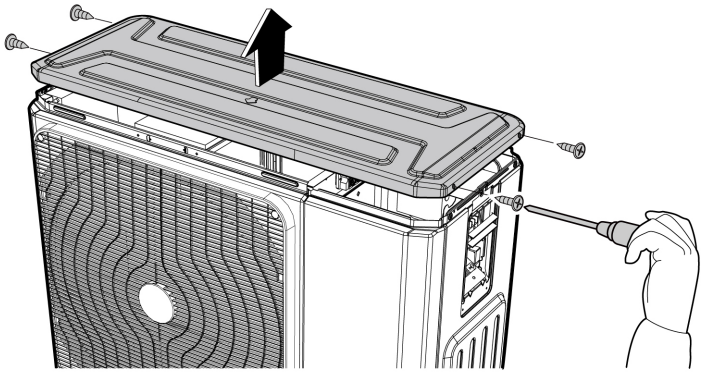
Procedure	Illustration
6) Remove 2 screws affixing the water collector subassembly.(see CJ_GD_025)	 CJ_GD_025
7) Push the side panel slightly so that you can lift the evaporator.(see CJ_GD_026)	 CJ_GD_026
8) Remove the evaporator.(see CJ_GD_027)	 CJ_GD_027

Note: This section is for reference only. Actual unit appearance may vary.

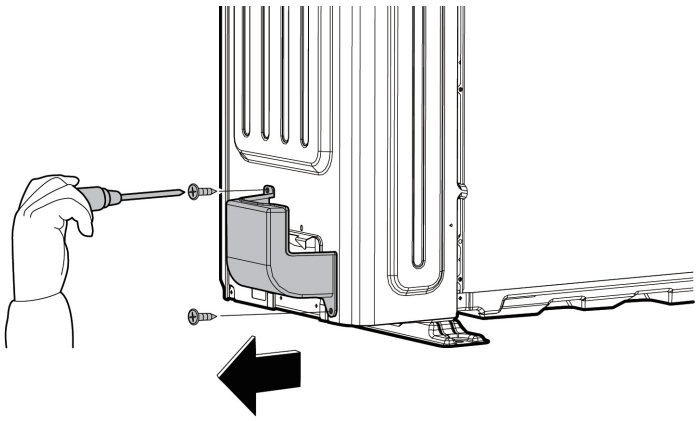
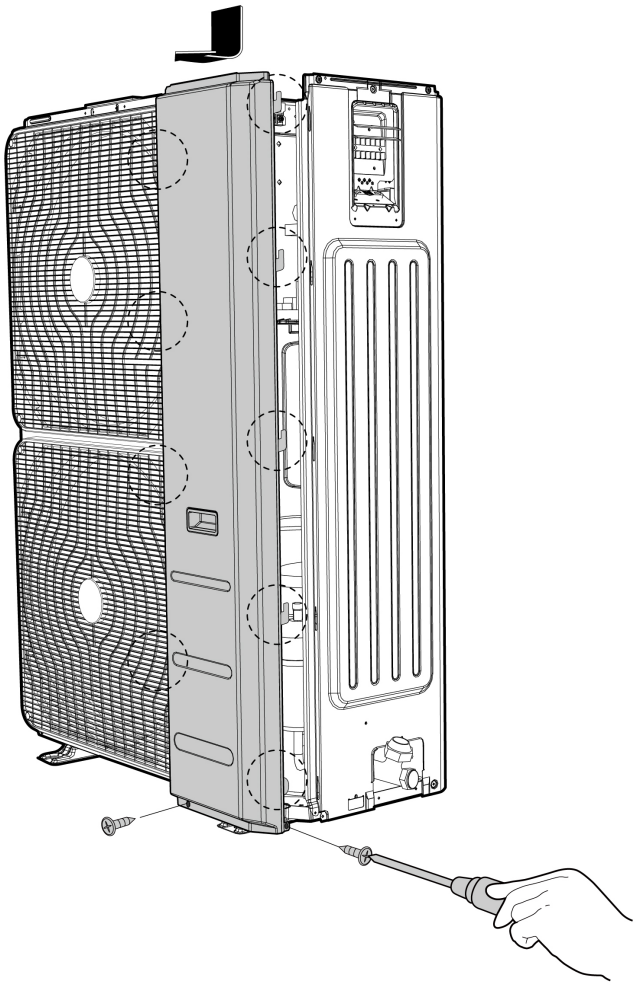
2.2 Outdoor unit

1. Panel Plate

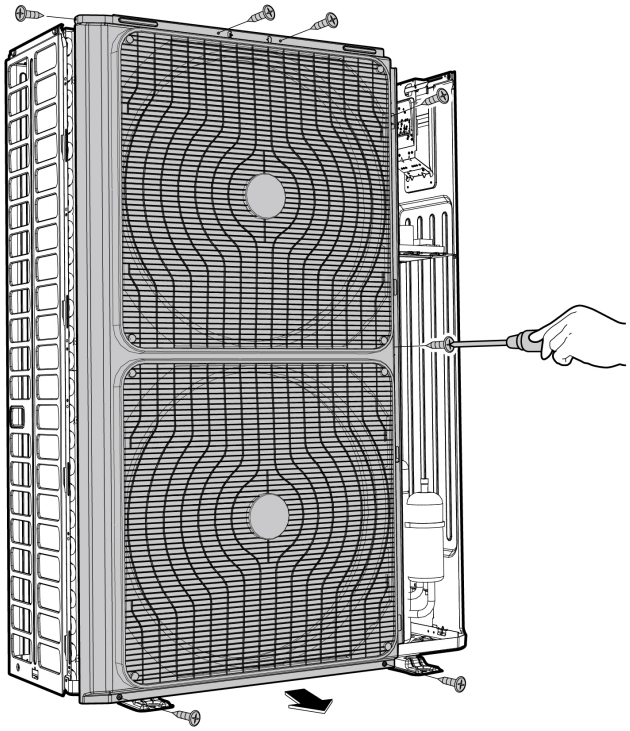
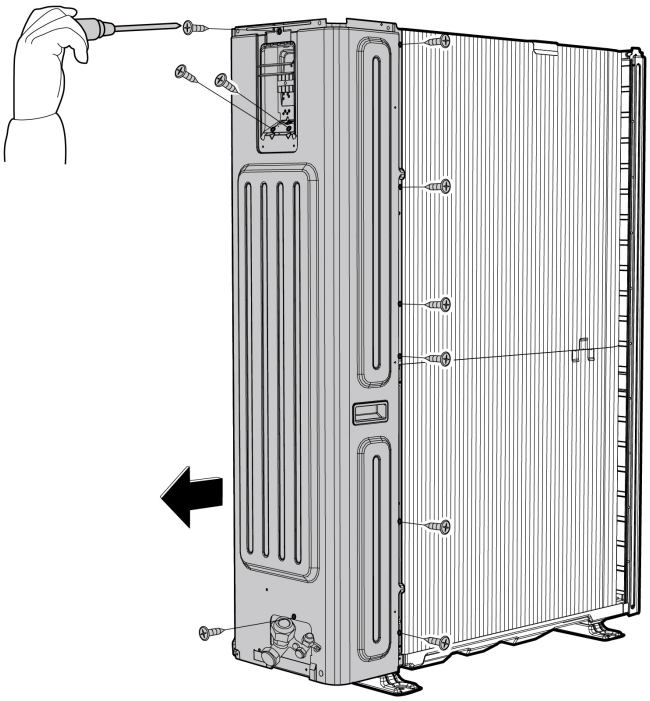
38QUS048R8T

Procedure	Illustration
1) Turn off the air conditioner and the power breaker. 2) Remove the screws of the big handle and then remove the big handle (2 screws) (see CJ_E30_001).	 **CJ_E30_001**
3) Remove the screws of the top cover and then remove the top cover (4 screws). Two of the screws is located underneath the big handle (see CJ_E30_002).	 **CJ_E30_002**

Note: This section is for reference only. Actual unit appearance may vary.

Procedure	Illustration
4) Remove the screws of water collecting cover and then remove the water collecting cover (2 screw) (see CJ_ E30_003). 5) Remove the screws of the front right panel and then remove the front right panel (2 screws) (see CJ_E30_004).	 CJ_E30_003  CJ_E30_004

Note: This section is for reference only. Actual unit appearance may vary.

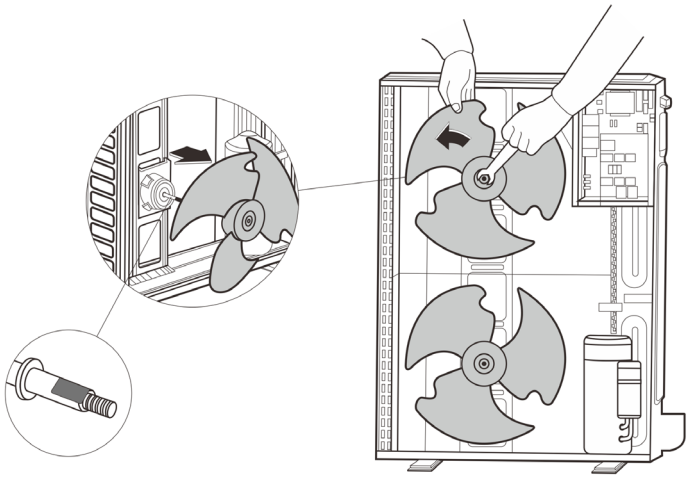
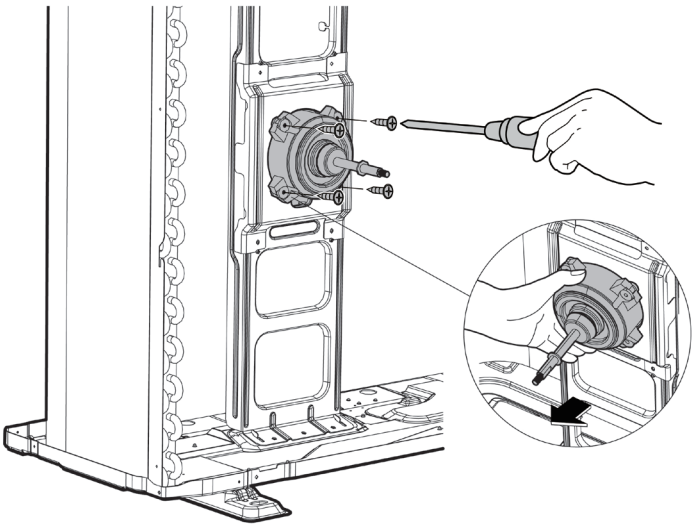
Procedure	Illustration
6) Remove the screws of the front panel and then remove the front panel (7 screws) (see CJ_E30_005).	 CJ_E30_005
7) Remove the screws of the right panel and then remove the right panel (10 screws) (see CJ_E30_006).	 CJ_E30_006

Note: This section is for reference only. Actual unit appearance may vary.

2. Fan disassembly

Note: Remove the panel plate and (refer to 1. Panel plate) before disassembling fan.

38QUS048R8T

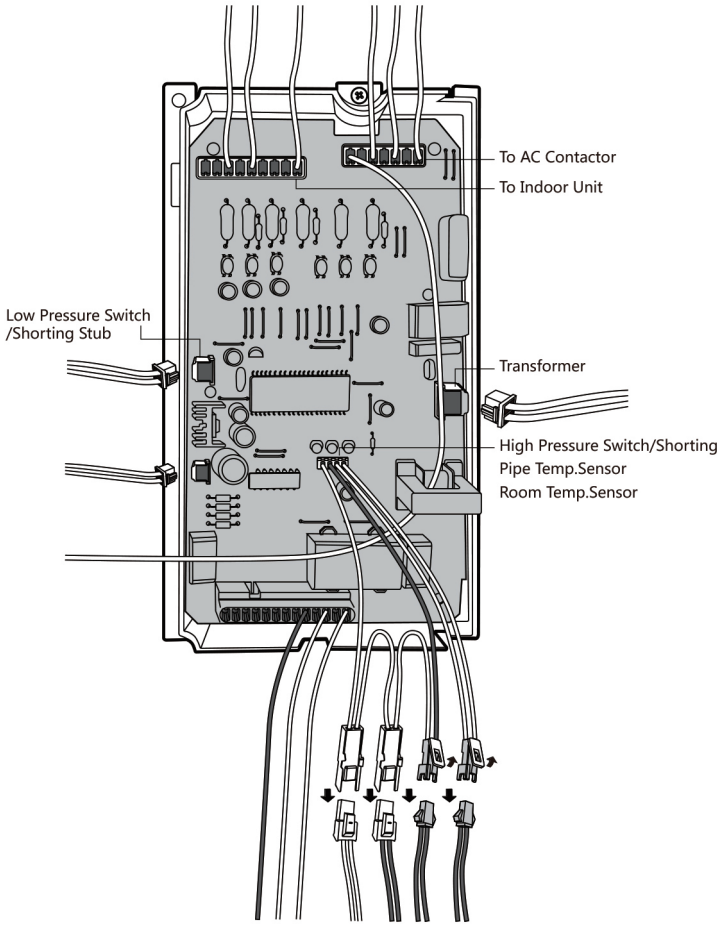
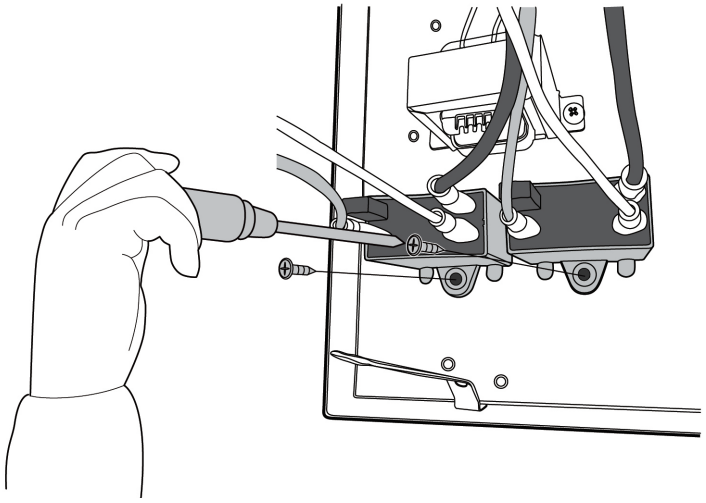
Procedure	Illustration
1) Remove the nut securing the fan with a spanner (see CJ_ODU_007). 2) Remove the fan. 3) Disconnect the connectors for fan motor from the terminal. (see CJ_ ODU_007)	 **CJ_ODU_007**
4) Remove the fixing screws of the fan motor (4 screws) (see CJ_ODU_008). 5) Remove the fan motor.	 **CJ_ODU_008**

Note: This section is for reference only. Actual unit appearance may vary.

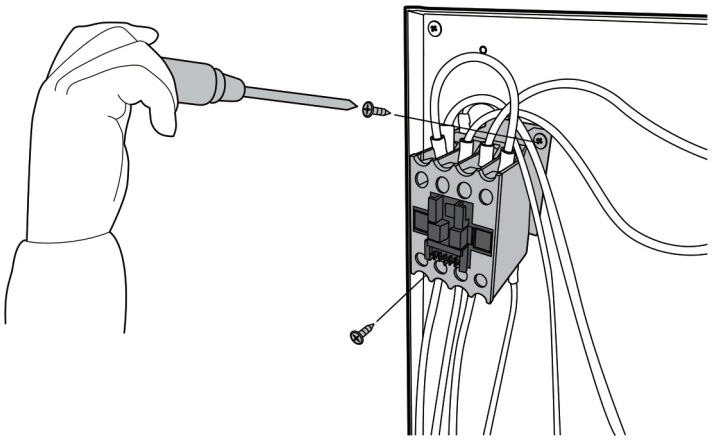
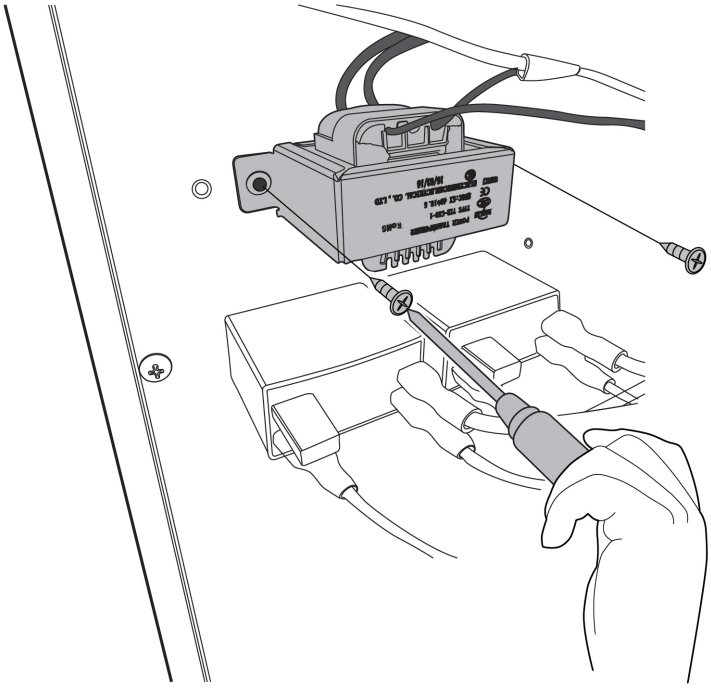
3. Electrical parts

Note: Remove the panel plate and fan assembly (refer to 1. Panel plate and 2. Fan assembly) before disassembling electrical parts.

38QUS048R8T

Procedure	Illustration
1) Disconnect the wires connected to the transformer. (see CJ_ODU_011) 2) Disconnect the wires connected to high/low pressure switch. (see CJ_ODU_011) 3) Disconnect the wires connected to indoor unit. (see CJ_ODU_011) 4) Disconnect the wires connected to AC contactor. (see CJ_ODU_011)	 CJ_ODU_011
5) Remove the screws of the capacitor and then remove it (1screw for each capacitor). (see CJ_ODU_012)	 CJ_ODU_012

Note: This section is for reference only. Actual unit appearance may vary.

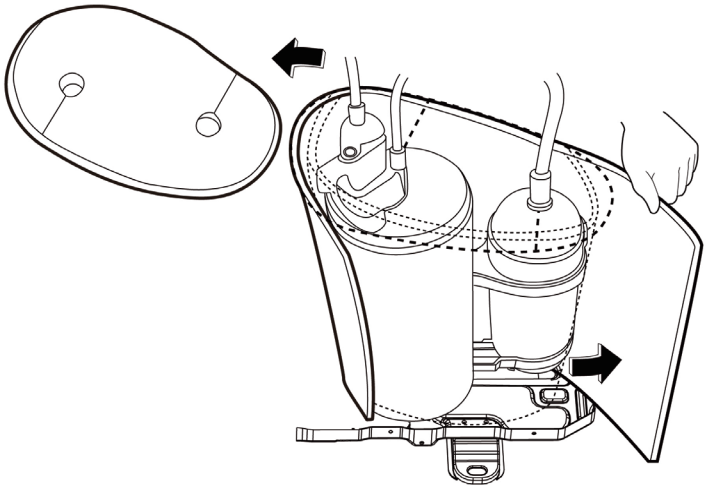
Procedure	Illustration
6) Remove the 1 screw of the AC contactor and then remove it. (see CJ_ODU_013)	 CJ_ODU_013
7) Remove 2 screws of the transformer and then remove it. (see CJ_ ODU_014)	 CJ_ODU_014

Note: This section is for reference only. Actual unit appearance may vary.

4. Sound blanket

WARNING: Recover refrigerant from the refrigerant circuit before remove the compressor.

Note: Remove the panel plate, electrical parts, and fan assembly (refer to 1. Panel plate, 2. Electrical parts, and 3. Fan assembly) before disassembling sound blanket.

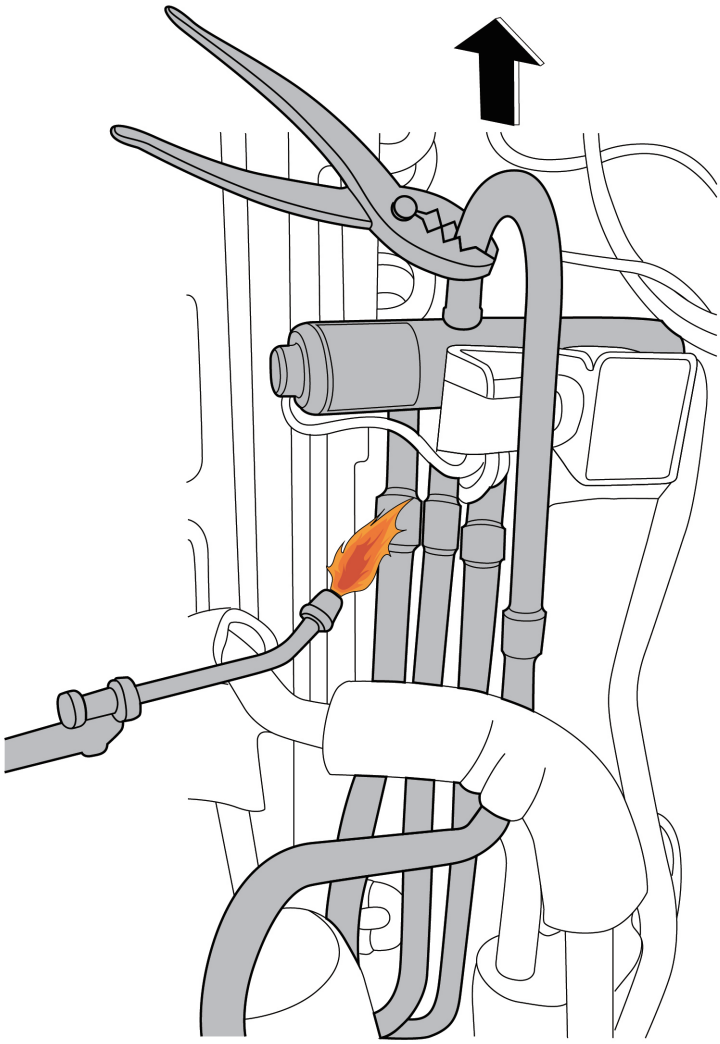
Procedure	Illustration
1) Remove the sound blanket (side and top) (see CJ_ODU_015).	 CJ_ODU_015

Note: This section is for reference only. Actual unit appearance may vary.

5. Four-way valve (For heat pump models)

WARNING: Recover refrigerant from the refrigerant circuit before remove the four-way valve.

Note: Remove the panel plate, electrical parts, and fan assembly (refer to 1. Panel plate, 2. Electrical parts, and 3. Fan assembly) before disassembling four-way valve.

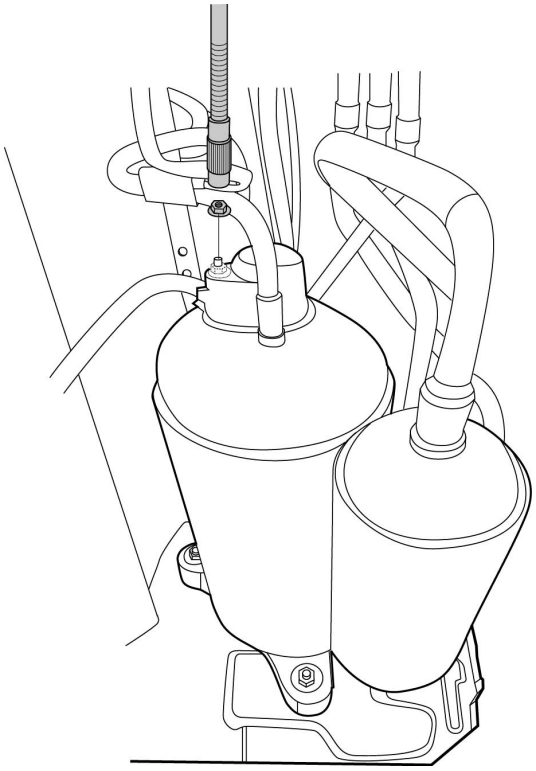
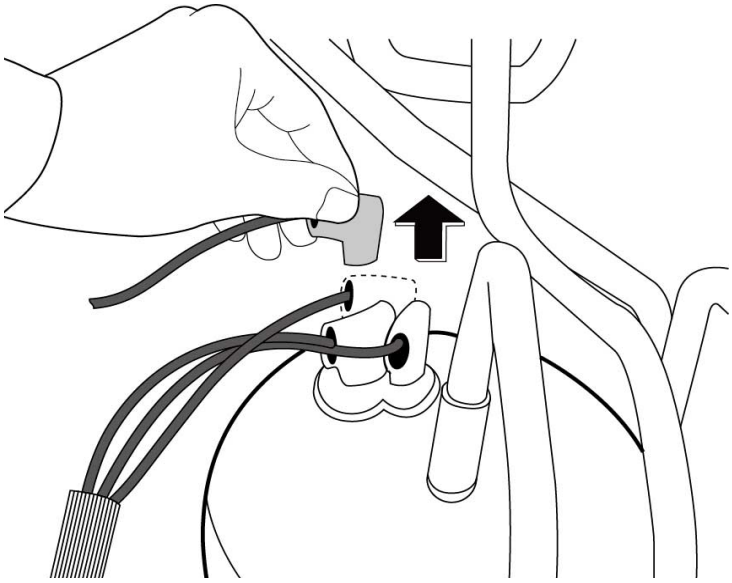
Procedure	Illustration
1) Heat up the brazed parts and then detach the the four-way valve and the pipe (see CJ_ODU_016). 2) Remove the four-way valve assembly with pliers.	 CJ_ODU_016

Note: This section is for reference only. Actual unit appearance may vary.

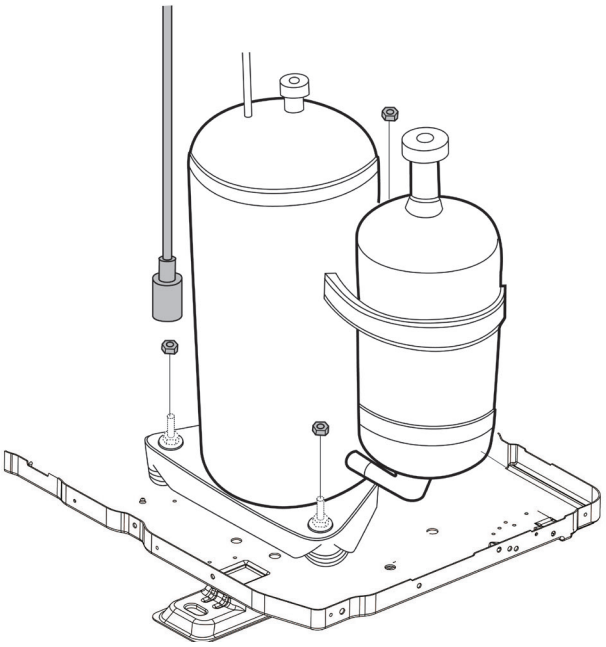
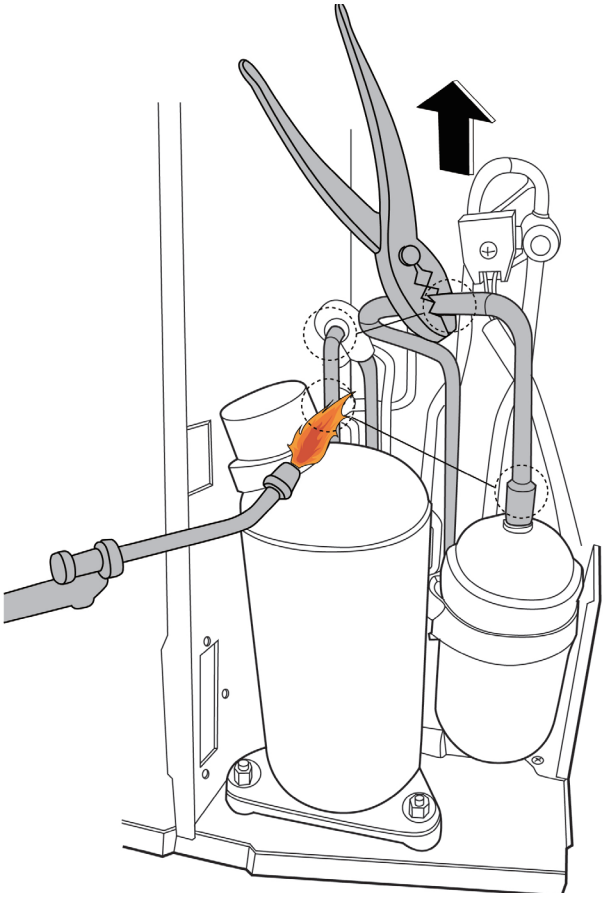
6. Compressor

WARNING: Recover refrigerant from the refrigerant circuit before remove the compressor.

Note: Remove the panel plate, electrical parts, and fan assembly (refer to 1. Panel plate, 2. Electrical parts, and 3. Fan assembly) before disassembling compressor.

Procedure	Illustration
1) Remove the flange nut of terminal cover and remove the termianal cover (see CJ_ ODU_017).	 CJ_ODU_017
2) Disconnect the connectors (see CJ_ ODU_018).	 CJ_ODU_018

Note: This section is for reference only. Actual unit appearance may vary.

Procedure	Illustration
3) Remove the hex nuts and washers securing the compressor, located on the bottom plate (see CJ_ODU_019).	 CJ_ODU_019
4) Heat up the brazed parts and then remove the the discharge pipe and the suction pipe (see CJ_ODU_020). 5) Lift the compressor from the base pan assembly with pliers.	 CJ_ODU_020

Note: This section is for reference only. Actual unit appearance may vary.

Troubleshooting

Contents

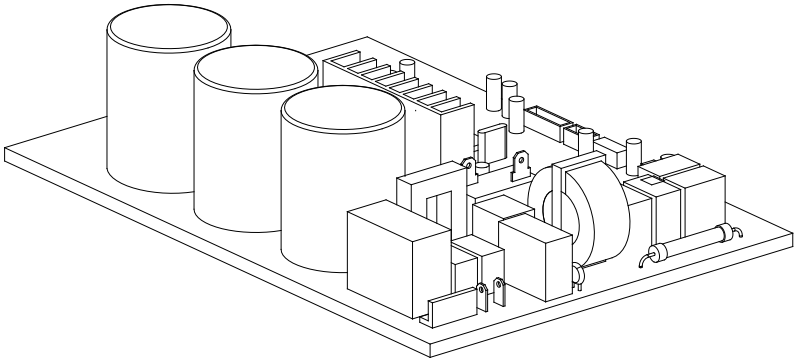
Troubleshooting

Contents

1. Safety Caution

WARNING

Electricity remains in capacitors even when the power supply is off.
Ensure the capacitors are fully discharged before troubleshooting.



2. General Troubleshooting

2.1 Error Display (Indoor Unit)

When the indoor unit encounters a recognized error, the indicator light will flash in a corresponding series, the timer display may turn on or begin flashing, and an error code will be displayed. These error codes are described in the following table:

Display	Error Information	Solution
E0	Indoor unit EEPROM parameter error	Page 61
E1	Indoor / outdoor unit communication error	Page 62
E3	The indoor fan speed is operating outside of the normal range	Page 64
E4	Indoor room temperature sensor T1 is in open circuit or has short circuited	Page 67
E5	Evaporator coil temperature sensor T2 is in open circuit or has short circuited	Page 67
Eb	Indoor PCB /Display board communication error	Page 68
EC	Refrigerant leak detected	Page 69
F0	Current overload protection	Page 70
F1	Outdoor ambient temperature sensor T4 is in open circuit or has short circuited	Page 67
F2	Condenser coil temperature sensor T3 is in open circuit or has short circuited	Page 67
F3	Compressor discharge temperature sensor TP is in open circuit or has short circuited	Page 67
F4	Outdoor unit EEPROM parameter error	Page 61
F5	The outdoor fan speed is operating outside of the normal range	Page 64
P0	IPM module malfunction	Page 71
P1	Over voltage or over low voltage protection	Page 72
P2	Top of compressor high temperature protection	Page 73
P3*	Outdoor ambient temperature is too low	Page 50
P4	Inverter compressor drive protection	Page 74
P6	Protection of low compressor pressure	Page 75
P7	Outdoor IGBT sensor is faulty	Page 63

P3*:

1) In heating mode, when the outdoor temperature is lower than LowHeatPreTemp°C for 1 hour, the indoor unit display error code P3.

2) If the outdoor temperature is higher than LowHeatPreTemp+3°C for 10 minutes and compressor stop for 1 hour or outdoor temperature is higher than LowHeatPreTemp+20°C for 10 minutes, then the unit will return to work.

2.2 Error Display (Outdoor Unit)

Display	Malfunction or Protection	Solution
E1	Communication malfunction between indoor and outdoor units	Page 62
F0	Over current protection (for some units)	Page 70
F1	Outdoor ambient temperature sensor T4 is in open circuit or has short circuited	Page 67
F2	Condenser coil temperature sensor T3 is in open circuit or has short circuited	Page 67
F3	Exhaust temperature sensor T5 is in open circuit or has short circuited	Page 67
F4	Outdoor unit EEPROM parameter error (for some units)	Page 61
F5	The outdoor fan speed is operating outside of the normal range	Page 64
P0	IPM module malfunction	Page 71
P1	DC voltage too high/too low protection	Page 72
P2	Top of compressor high temperature protection	Page 73
P4	Inverter compressor drive protection	Page 74
P7	Outdoor IGBT sensor is faulty	Page 63
U0	Evaporator high temperature protection	Page 76
U1	Condenser high temperature protection	Page 77
U2	High discharge temperature protection	Page 78
U3	PFC module protection	Page 79
U4	Communication error between outdoor main chip and compressor driven chip	Page 80
U5	High pressure protection	Page 81
U6	Low pressure protection	Page 75
U8	AC power input voltage protection	Page 82

For other errors:

The display board may show a garbled code or a code undefined by the service manual. Ensure that this code is not a temperature reading.

Troubleshooting:

Test the unit using the remote control. If the unit does not respond to the remote, the indoor PCB requires replacement. If the unit responds, the display board requires replacement.

3. Error Diagnosis and Troubleshooting Without Error Code

WARNING

Be sure to turn off unit before any maintenance to prevent damage or injury.

3.1 Remote maintenance

SUGGESTION: When troubles occur, please check the following points with customers before field maintenance.

	Problem	Solution
1	Unit will not start	Page 54-55
2	The power switch is on but fans will not start	Page 54-55
3	The temperature on the display board cannot be set	Page 54-55
4	Unit is on but the wind is not cold(hot)	Page 54-55
5	Unit runs, but shortly stops	Page 54-55
6	The unit starts up and stops frequently	Page 54-55
7	Unit runs continuously but insufficient cooling(heating)	Page 54-55
8	Cool can not change to heat	Page 54-55
9	Unit is noisy	Page 54-55

3.2 Field maintenance

	Problem	Solution
1	Unit will not start	Page 56-57
2	Compressor will not start but fans run	Page 56-57
3	Compressor and condenser (outdoor) fan will not start	Page 56-57
4	Evaporator (indoor) fan will not start	Page 56-57
5	Condenser (Outdoor) fan will not start	Page 56-57
6	Unit runs, but shortly stops	Page 56-57
7	Compressor short-cycles due to overload	Page 56-57
8	High discharge pressure	Page 56-57
9	Low discharge pressure	Page 56-57
10	High suction pressure	Page 56-57
11	Low suction pressure	Page 56-57
12	Unit runs continuously but insufficient cooling	Page 56-57
13	Too cool	Page 56-57
14	Compressor is noisy	Page 56-57
15	Horizontal louver can not revolve	Page 56-57

1.Remote Maintenance	Electrical Circuit							Refrigerant Circuit						
Possible causes of trouble	Power failure	The main power tripped	Loose connections	Faulty transformer	The voltage is too high or too low	The remote control is powered off	Broken remote control	Dirty air filter	Dirty condenser fins	The setting temperature is higher/lower than the room's(cooling/heating)	The ambient temperature is too high/low when the mode is cooling/heating	Fan mode	SILENCE function is activated(optional function)	Frosting and defrosting frequently
Unit will not start	☆	☆	☆	☆										
The power switch is on but fans will not start			☆	☆	☆									
The temperature on the display board cannot be set						☆	☆							
Unit is on but the wind is not cold(hot)										☆	☆	☆		
Unit runs, but shortly stops					☆					☆	☆			
The unit starts up and stops frequently					☆						☆			☆
Unit runs continuously but insufficient cooling(heating)								☆	☆	☆	☆		☆	
Cool can not change to heat														
Unit is noisy														
Test method / remedy	Test voltage	Close the power switch	Inspect connections - tighten	Change the transformer	Test voltage	Replace the battery of the remote control	Replace the remote control	Clean or replace	Clean	Adjust the setting temperature	Turn the AC later	Adjust to cool mode	Turn off SILENCE function.	Turn the AC later

Check heat load			☆							Heavy load condition	Others
Tighten bolts or screws	☆									Loosen hold down bolts and / or screws	
Close all the windows and doors			☆							Bad airproof	
Remove the obstacles			☆	☆						The air inlet or outlet of either unit is blocked	
Reconnect the power or press **ON/OFF** button on remote control to restart								☆		Interference from cell phone towers and remote boosters	
Remove them	☆									Shipping plates remain attached	

2.Field Maintenance	Electrical Circuit														
Possible causes of trouble	Power failure	Blown fuse or varistor	Loose connections	Shorted or broken wires	Safety device opens	Faulty thermostat / room temperature sensor	Wrong setting place of temperature sensor	Faulty transformer	Shorted or open capacitor	Faulty magnetic contactor for compressor	Faulty magnetic contactor for fan	Low voltage	Faulty stepping motor	Shorted or grounded compressor	Shorted or grounded fan motor
Unit will not start	☆	☆	☆	☆	☆			☆							
Compressor will not start but fans run				☆		☆			☆	☆				☆	
Compressor and condenser (outdoor) fan will not start				☆		☆				☆					
Evaporator (indoor) fan will not start				☆					☆		☆				☆
Condenser (Outdoor) fan will not start				☆		☆			☆		☆				☆
Unit runs, but shortly stops										☆		☆			
Compressor short-cycles due to overload										☆		☆			
High discharge pressure															
Low discharge pressure															
High suction pressure															
Low suction pressure															
Unit runs continuously but insufficient cooling															
Too cool						☆	☆								
Compressor is noisy															
Horizontal louver can not revolve			☆	☆									☆		
Test method / remedy	Test voltage	Inspect fuse type & size	Inspect connections - tighten	Test circuits with tester	Test continuity of safety device	Test continuity of thermostat / sensor & wiring	Place the temperature sensor at the central of the air inlet grille	Check control circuit with tester	Check capacitor with tester	Test continuity of coil & contacts	Test continuity of coil & contacts	Test voltage	Replace the stepping motor	Check resistance with multimeter	Check resistance with multimeter

Replace the compressor														☆		Compressor stuck
Leak test				☆	☆		☆		☆	☆						Shortage of refrigerant
Replace restricted part				☆	☆					☆						Restricted liquid line
Clean or replace				☆	☆											Dirty air filter
Clean coil				☆	☆											Dirty evaporator coil
Check fan				☆	☆											Insufficient air through evaporator coil
Change charged refrigerant volume		☆				☆		☆	☆	☆						Overcharge of refrigerant
Clean condenser or remove obstacle				☆				☆	☆	☆						Dirty or partially blocked condenser
Purge, evacuate and recharge				☆				☆								Air or incompressible gas in refrigerant cycle
Remove obstruction to air flow				☆				☆								Short cycling of condensing air
Remove obstruction in air or water flow								☆								High temperature condensing medium
Remove obstruction in air or water flow								☆								Insufficient condensing medium
Replace compressor		☆														Broken compressor internal parts
Test compressor efficiency				☆		☆	☆									Inefficient compressor
Replace valve					☆											Expansion valve obstructed
Replace valve					☆					☆						Expansion valve or capillary tube closed completely
Replace valve					☆					☆						Leaking power element on expansion valve
Fix feeler bulb						☆										Poor installation of feeler bulb
Check heat load				☆		☆										Heavy load condition
Tighten bolts or screws		☆														Loosen hold down bolts and / or screws
Remove them		☆														Shipping plates remain attached
Choose AC of lager capacity or add the number of AC				☆												Poor choices of capacity
Rectify piping so as not to contact each other or with external plate		☆														Contact of piping with other piping or external plate

Refrigerant Circuit

Others

4. Quick Maintenance by Error Code

If you do not have the time to test whether specific parts are faulty, you can directly change the required parts according the error code.

You can find the parts to replace by error code in the following table.

Part requiring replacement	Error Code									
	E0	E1	E3	E4	E5	EC	EE	Ed	F0	F1
Indoor PCB	✓	✓	✓	✓	✓	✓	x	x	x	x
Outdoor PCB	x	✓	x	x	x	x	x	✓	✓	✓
Indoor fan motor	x	x	✓	x	x	x	x	x	x	x
Outdoor fan motor	x	x	x	x	x	x	x	✓	✓	x
T1 sensor	x	x	x	✓	x	x	x	x	x	x
T2 Sensor	x	x	x	x	✓	✓	x	x	x	x
T3 Sensor	x	x	x	x	x	x	x	x	x	x
T4 Sensor	x	x	x	x	x	x	x	x	x	✓
TP Sensor	x	x	x	x	x	x	x	x	x	x
IGBT Sensor	x	x	x	x	x	x	x	x	x	x
Additional refrigerant	x	x	x	x	x	✓	✓	x	✓	x
Water-level switch	x	x	x	x	x	x	✓	x	x	x
Water pump	x	x	x	x	x	x	x	x	x	x
Capacitor of compressor	x	x	x	x	x	✓	x	x	x	x
Compressor	x	x	x	x	x	✓	x	✓	✓	x
IPM board	x	x	x	x	x	x	x	x	x	x
Capacitor of fan motor	x	x	x	x	x	✓	x	x	x	x
Outdoor fan	x	x	x	x	x	✓	x	x	x	x
Display board	x	x	x	x	x	x	x	x	x	x

Part requiring replacement	Error Code									
	F2	F3	F4	F5	P0	P1	P2	P3	P4	P7
Indoor PCB	x	x	x	x	x	x	x	x	x	x
Outdoor PCB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Indoor fan motor	x	x	x	x	x	x	x	x	x	x
Outdoor fan motor	x	x	x	✓	x	x	x	x	x	x
T1 sensor	x	x	x	x	x	x	x	x	x	x
T2 Sensor	x	x	x	x	x	x	x	x	x	x
T3 Sensor	✓	x	x	x	x	x	x	x	x	x
T4 Sensor	x	x	x	x	x	x	x	x	x	x
TP Sensor	x	✓	x	x	x	x	x	x	x	x
IGBT Sensor	x	x	x	x	x	x	x	x	x	x
Additional refrigerant	x	x	x	x	x	x	✓	x	x	✓
Water-level switch	x	x	x	x	x	x	x	x	x	x
Water pump	x	x	x	x	x	x	x	x	x	x
Capacitor of compressor	x	x	x	x	x	x	x	x	x	x
Compressor	x	x	x	x	✓	✓	✓	x	✓	x
IPM board	x	x	x	x	✓	✓	x	x	✓	x
Capacitor of fan motor	x	x	x	x	x	x	x	x	x	x
Outdoor fan	x	x	x	x	x	x	x	x	x	x
Display board	x	x	x	x	x	x	x	x	x	x

5. Troubleshooting by Error Code

5.1 Common Check Procedures

5.1.1 Temperature Sensor Check

Disconnect the temperature sensor from PCB, measure the resistance value with a tester.

Temperature Sensors.

Room temp.(T1) sensor,

Indoor coil temp.(T2) sensor,

Outdoor coil temp.(T3) sensor,

Outdoor ambient temp.(T4) sensor,

Compressor discharge temp.(Tp) sensor.

Measure the resistance value of each winding by using the multi-meter.

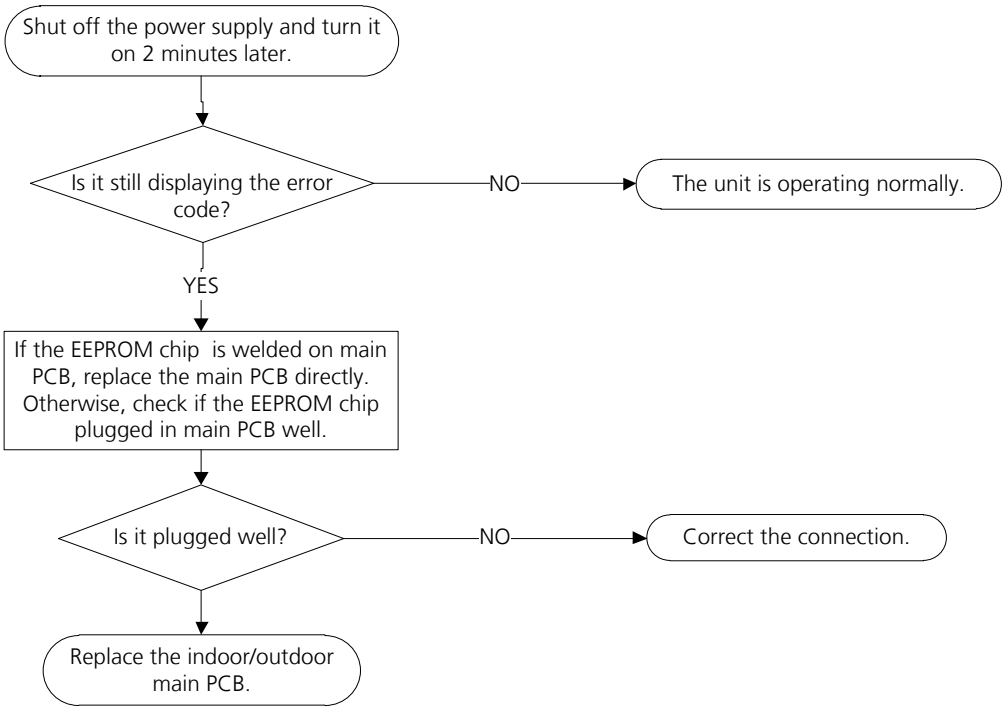
5.2 E0/F4 (EEPROM parameter error)

Description: Indoor or outdoor PCB main chip does not receive feedback from EEPROM chip.

Recommended parts to prepare:

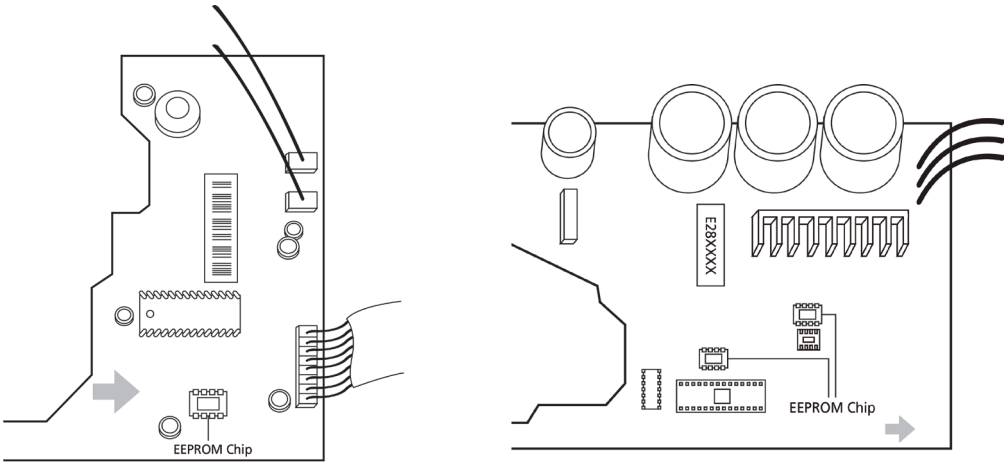
- Indoor PCB
- Outdoor PCB

Troubleshooting and repair:



Remarks:

The location of the EEPROM chip on the indoor and outdoor PCB is shown in the following two images:



Note: These images are for reference only.

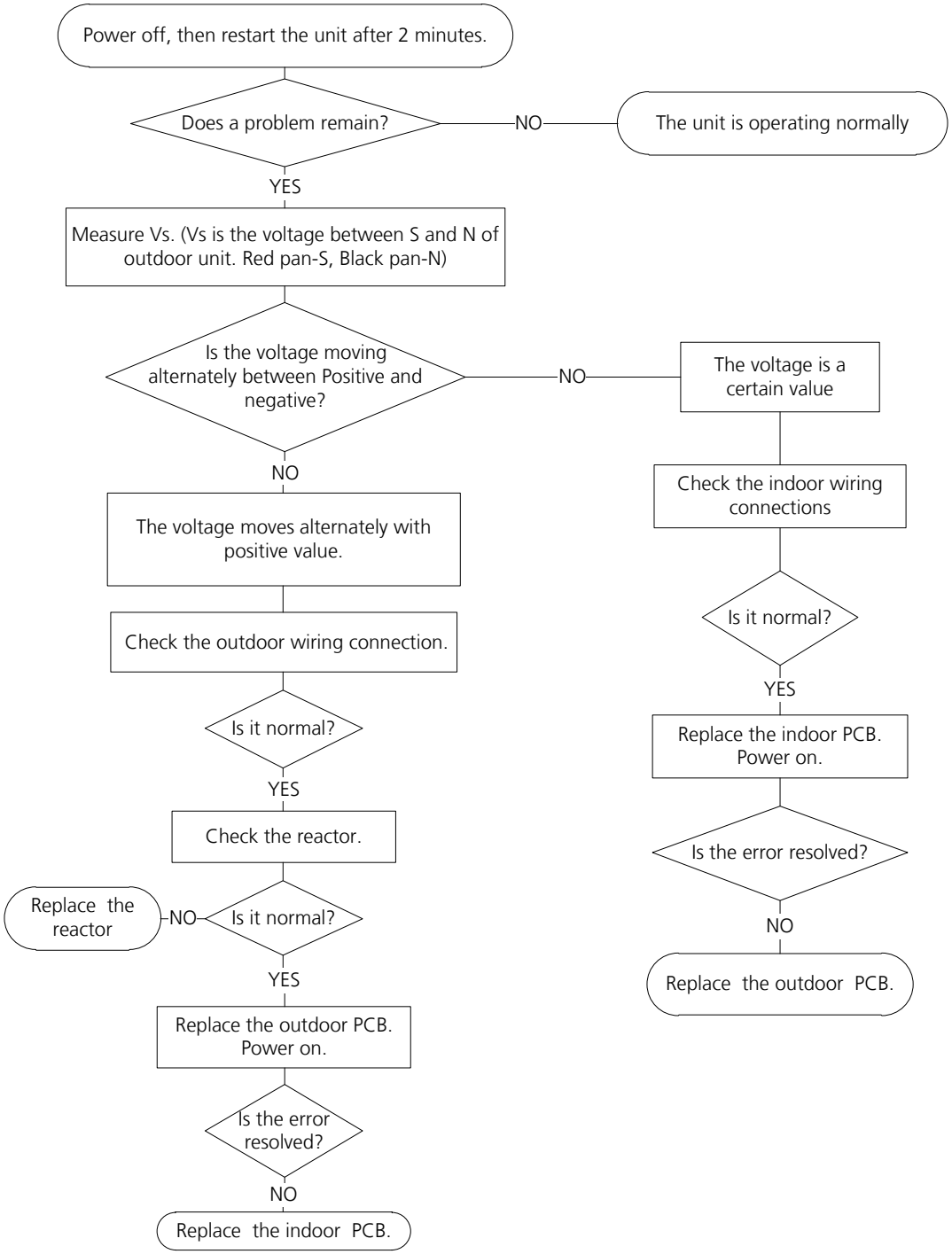
5.3 E1 (Indoor and outdoor unit communication error)

Description: The indoor unit has not received feedback from the outdoor unit for 1 minute.

Recommended parts to prepare:

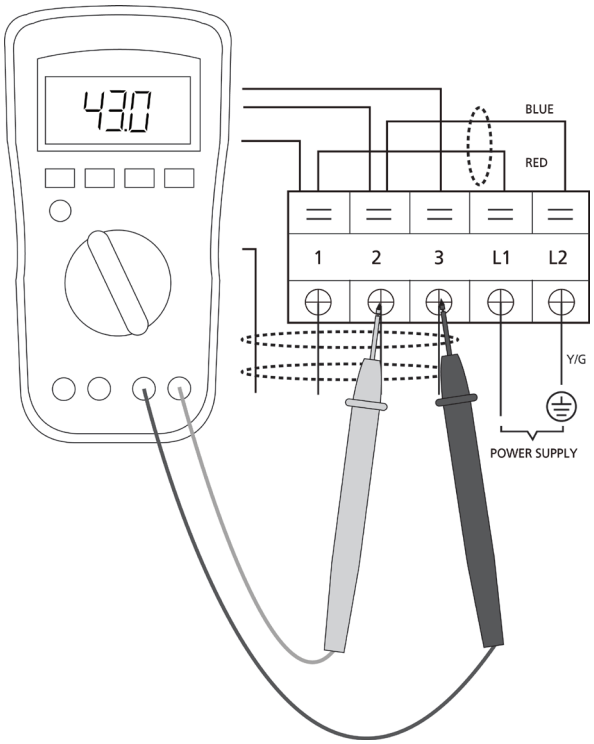
- Indoor PCB
- Outdoor PCB
- Reactor

Troubleshooting and repair:

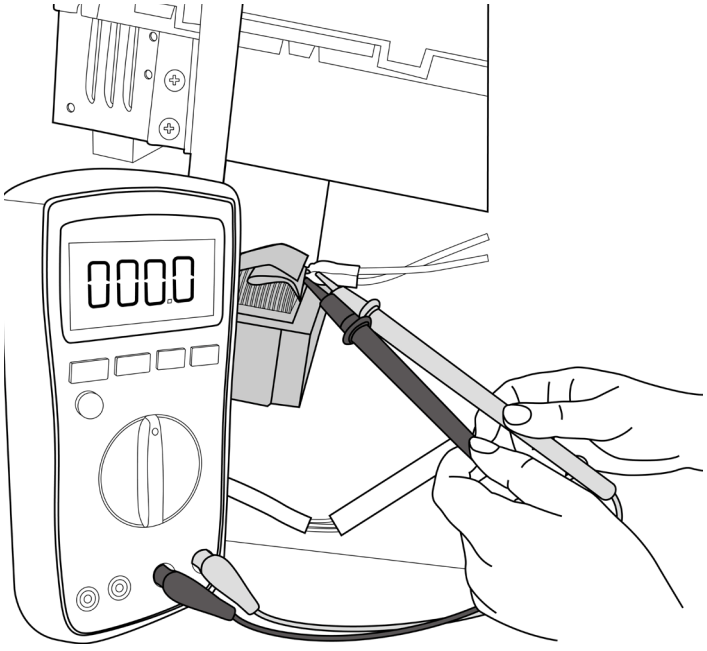


Remarks:

- Use a multimeter to test the DC voltage between 2 port and 3 port of outdoor unit. The red pin of multimeter connects with 2 port while the black pin is for 3 port.
- When AC is normal running, the voltage will move alternately between -25V to 25V.
- If the outdoor unit has malfunction, the voltage will move alternately with positive value.
- While if the indoor unit has malfunction, the voltage will be a certain value.



- Use a multimeter to test the resistance of the reactor which does not connect with capacitor.
- The normal value should be around zero ohm. Otherwise, the reactor must have malfunction.



5.4 E3/F5(Fan speed is operating outside of the normal range)

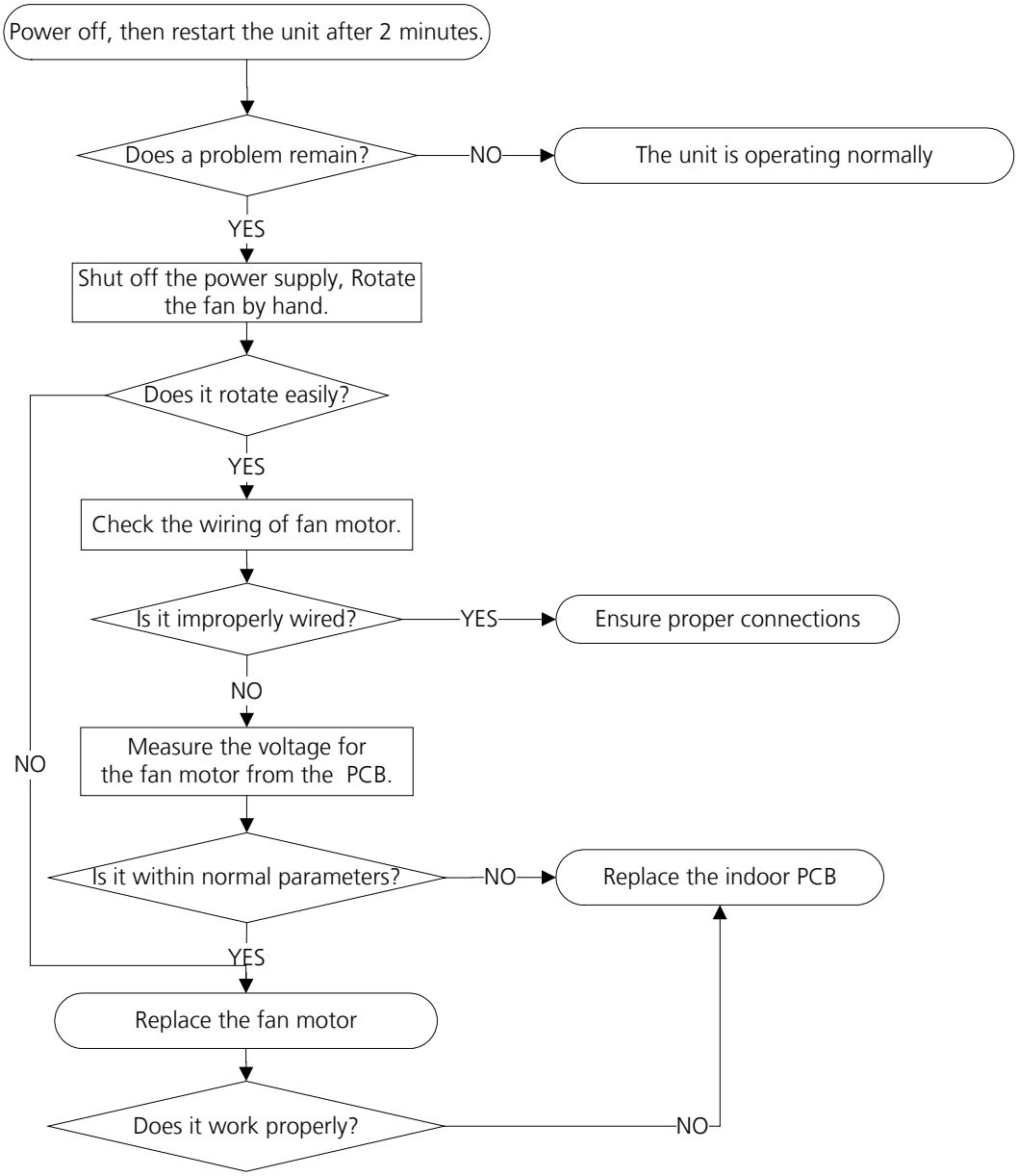
Description: When the indoor fan speed keeps too low (300RPM) for certain time, the unit will stop and the LED will display the failure(E3).

When the outdoor fan speed registers below 300RPM or over 1500RPM for an extended period of time, the unit will stop and the LED will display the failure(F5).

Recommended parts to prepare:

- Wiring mistake
- Faulty fan assembly
- Faulty fan motor
- Faulty PCB

Troubleshooting and repair:



Index:

1. Indoor or Outdoor DC Fan Motor(control chip is in fan motor)

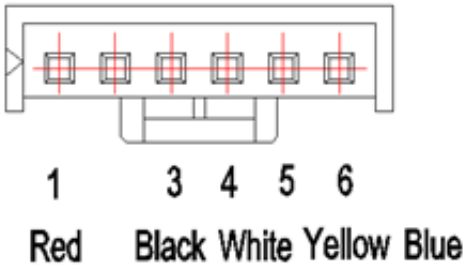
Power on and when the unit is in standby, measure the voltage of pin1-pin3, pin4-pin3 in fan motor connector. If the value of the voltage is not in the range showing in below table, the PCB must has problems and need to be replaced.

- DC motor voltage input and output (voltage: 220-240V~):

No.	Color	Signal	Voltage
1	Red	Vs/Vm	280V~380V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	14-17.5V
5	Yellow	Vsp	0~5.6V
6	Blue	FG	14-17.5V

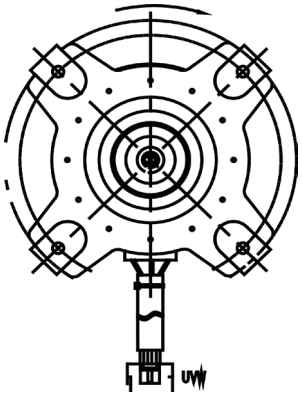
- DC motor voltage input and output (voltage: 115V~):

No.	Color	Signal	Voltage
1	Red	Vs/Vm	140V~190V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	14-17.5V
5	Yellow	Vsp	0~5.6V
6	Blue	FG	14-17.5V



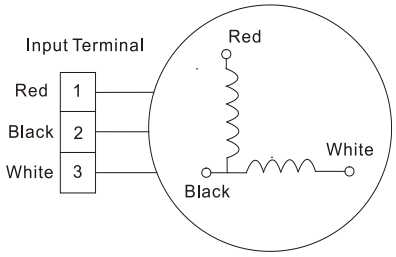
2. Outdoor DC Fan Motor (control chip is in outdoor PCB)

Release the UVW connector. Measure the resistance of U-V, U-W, V-W. If the resistance is not equal to each other, the fan motor must has problems and need to be replaced. otherwise the PCB must has problems and need to be replaced.



3. Indoor AC Fan Motor

Power on and set the unit running in fan mode at high fan speed. After running for 15 seconds, measure the voltage of pin1 and pin2. If the value of the voltage is less than 100V(208~240V power supply) or 50V (115V power supply), the PCB must has problems and need to be replaced.



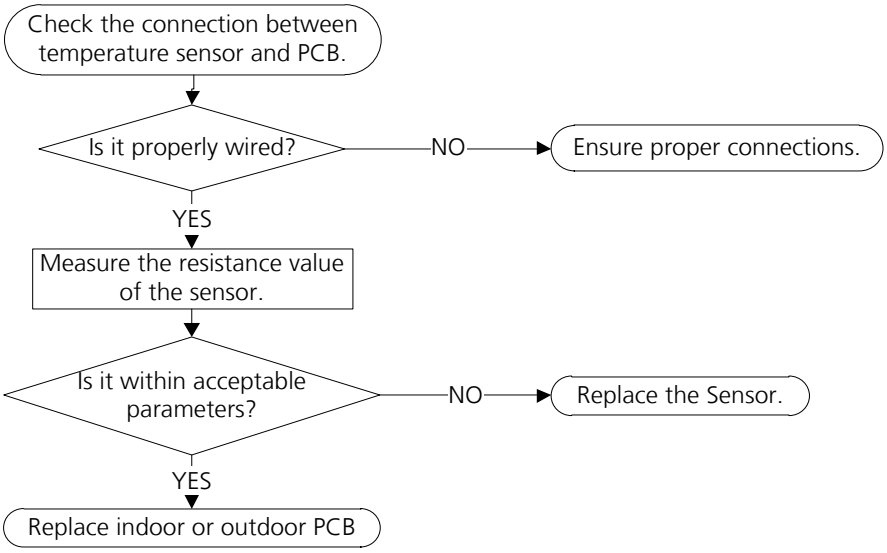
5.5 E4/E5/F1/F2/F3/P7 (Open circuit or short circuit of temperature sensor diagnosis and solution)

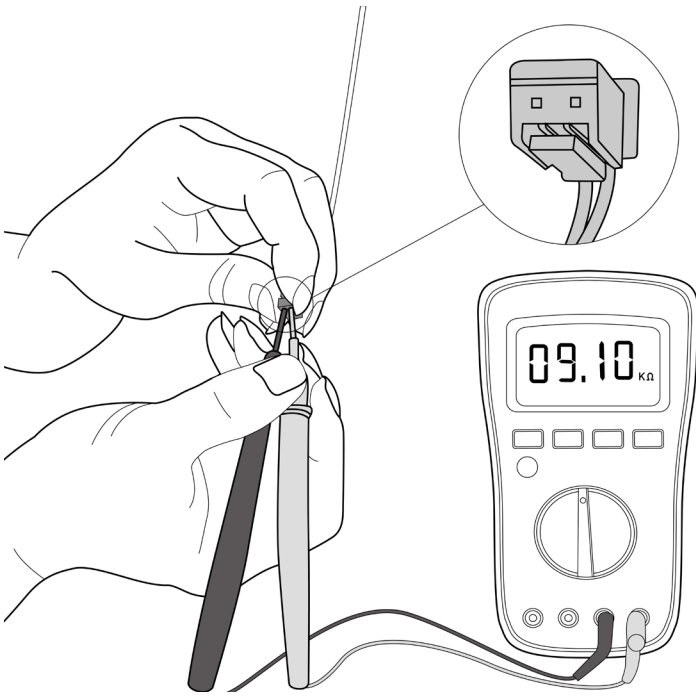
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED will display the failure.

Recommended parts to prepare:

- Connection wires
- Sensors
- PCB

Troubleshooting and repair:





Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole. This picture and the value are only for reference, actual appearance and value may vary

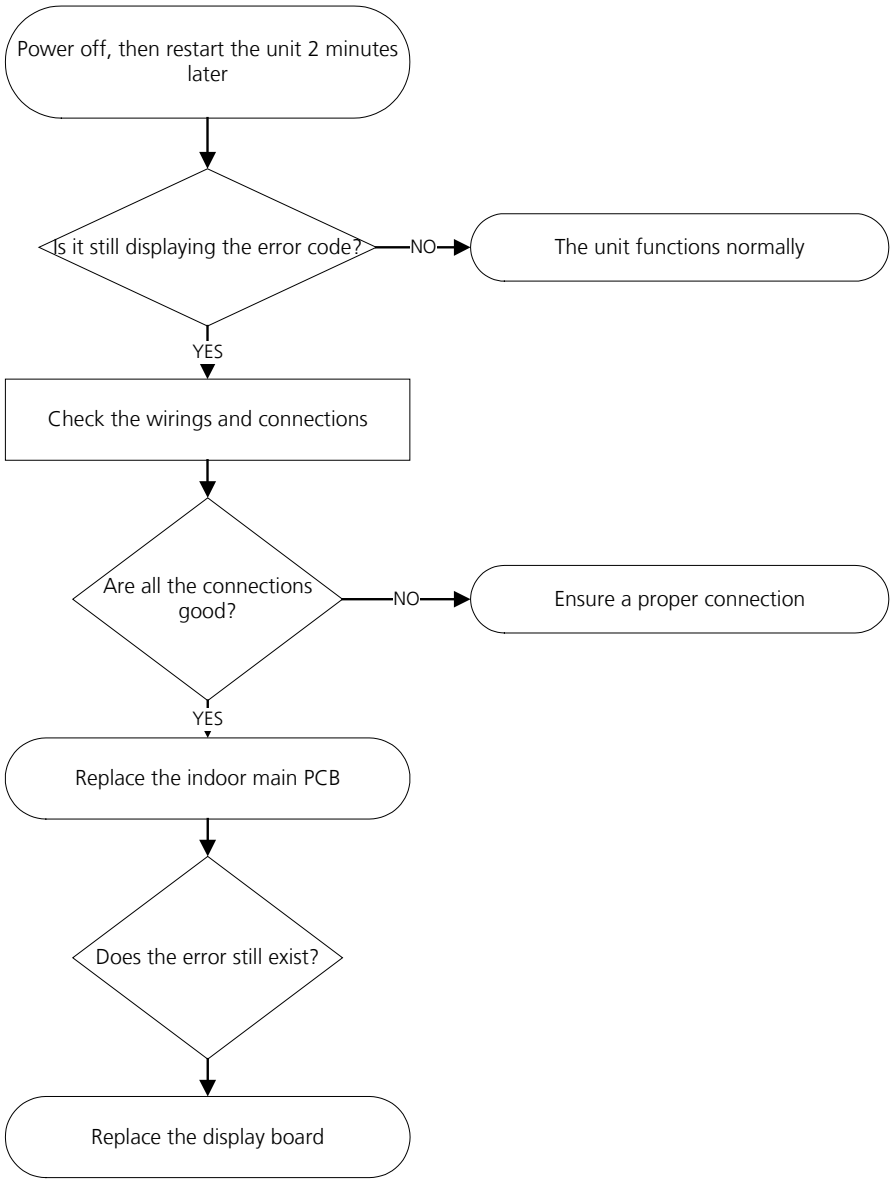
5.6 Eb (Indoor PCB / Display board communication error diagnosis and solution)

Description: Indoor PCB does not receive feedback from the display board.

Recommended parts to prepare:

- Communication wire
- Indoor PCB
- Display board

Troubleshooting and repair:



5.7 EC (Refrigerant Leakage Detection diagnosis and solution)

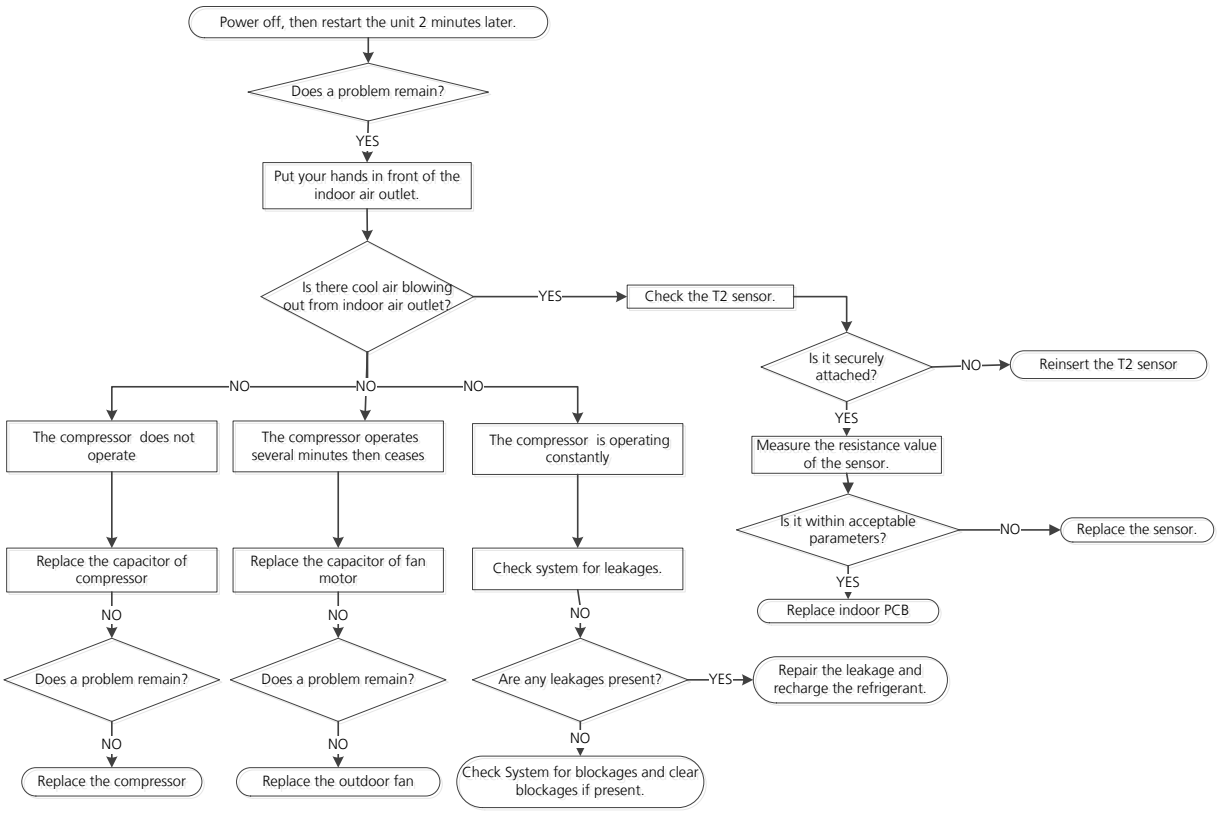
Description: Define the evaporator coil temperature T2 of the compressor just starts running as Tcool.

In the beginning 8 minutes after the compressor starts up, if T2<Tcool-1°C does not keep continuous 4 seconds and compressor running frequency higher than 50Hz does not keep continuous 3 minutes, and this situation happens 3 times, the display area will show "EC" and AC will turn off.

Recommended parts to prepare:

- T2 sensor
- Compressor
- Capacitor of compressor
- Indoor PCB
- System problems, such as leakage or blockages
- Capacitor of fan motor
- Outdoor fan

Troubleshooting and repair:



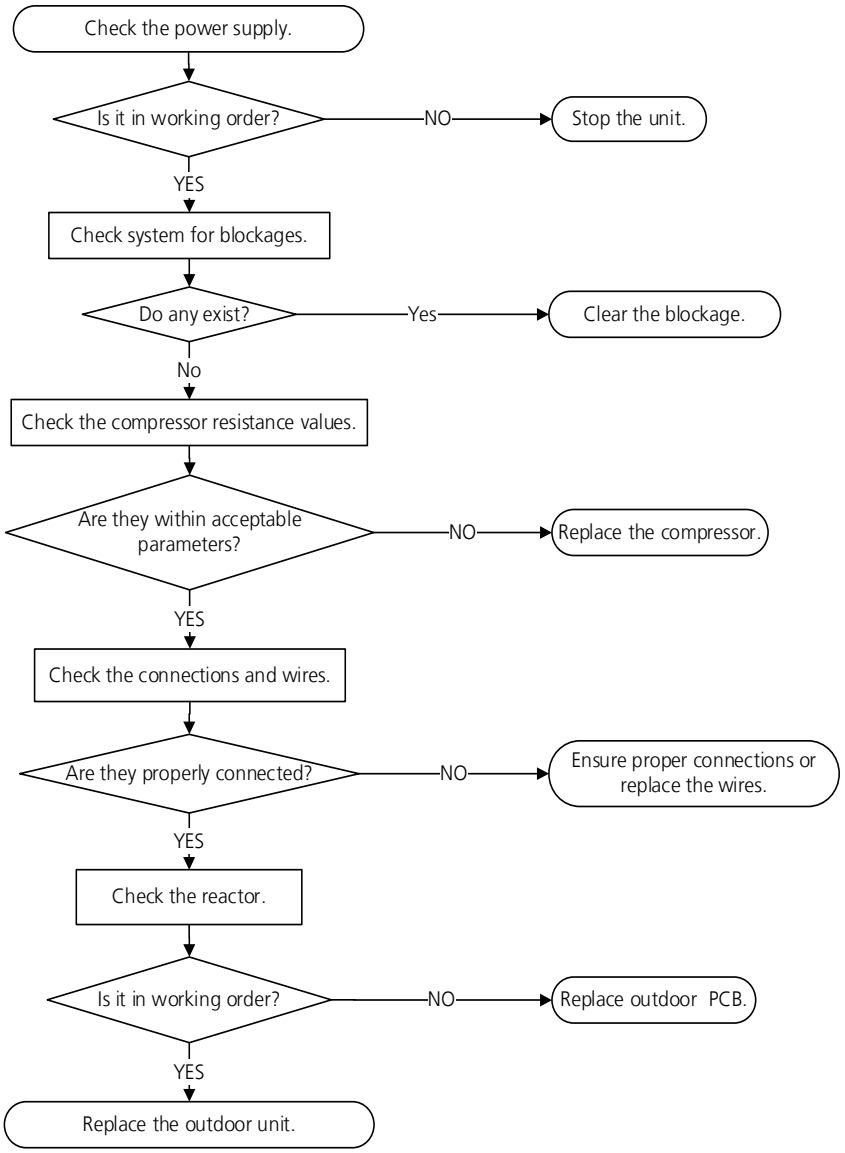
5.8 F0 (Overload current protection diagnosis and solution)

Description: An abnormal current rise is detected by checking the specified current detection circuit.

Recommended parts to prepare:

- PCB
- Connection wires
- Compressor

Troubleshooting and repair:



Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

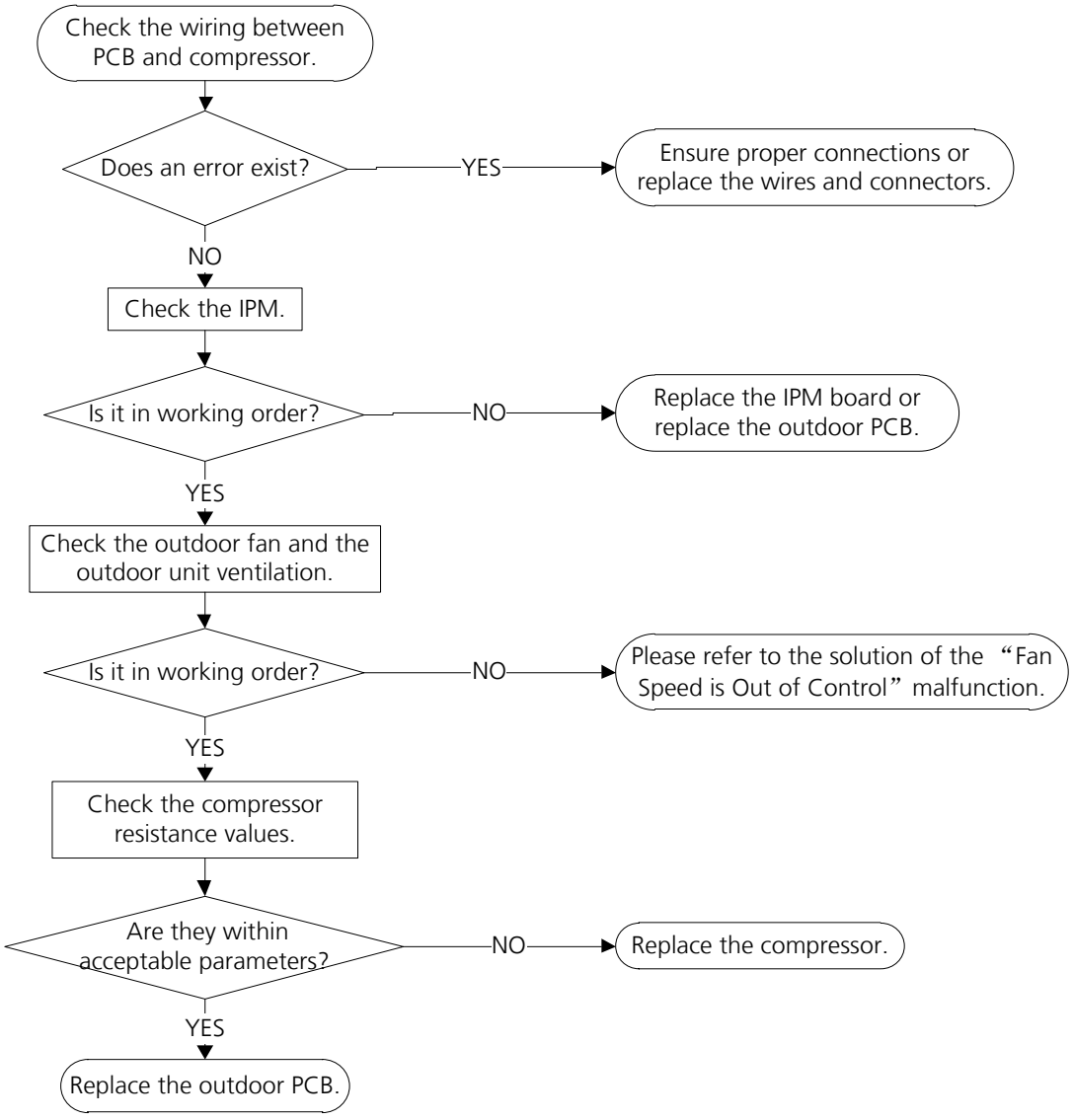
5.9 P0 (IPM malfunction or IGBT over-strong current protection diagnosis and solution)

Description: When the voltage signal the IPM sends to the compressor drive chip is abnormal, the display LED shows "P0" and the AC turn off.

Recommended parts to prepare:

- Connection wires
- IPM module
- Outdoor fan assembly
- Compressor
- Outdoor PCB

Troubleshooting and repair:



Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

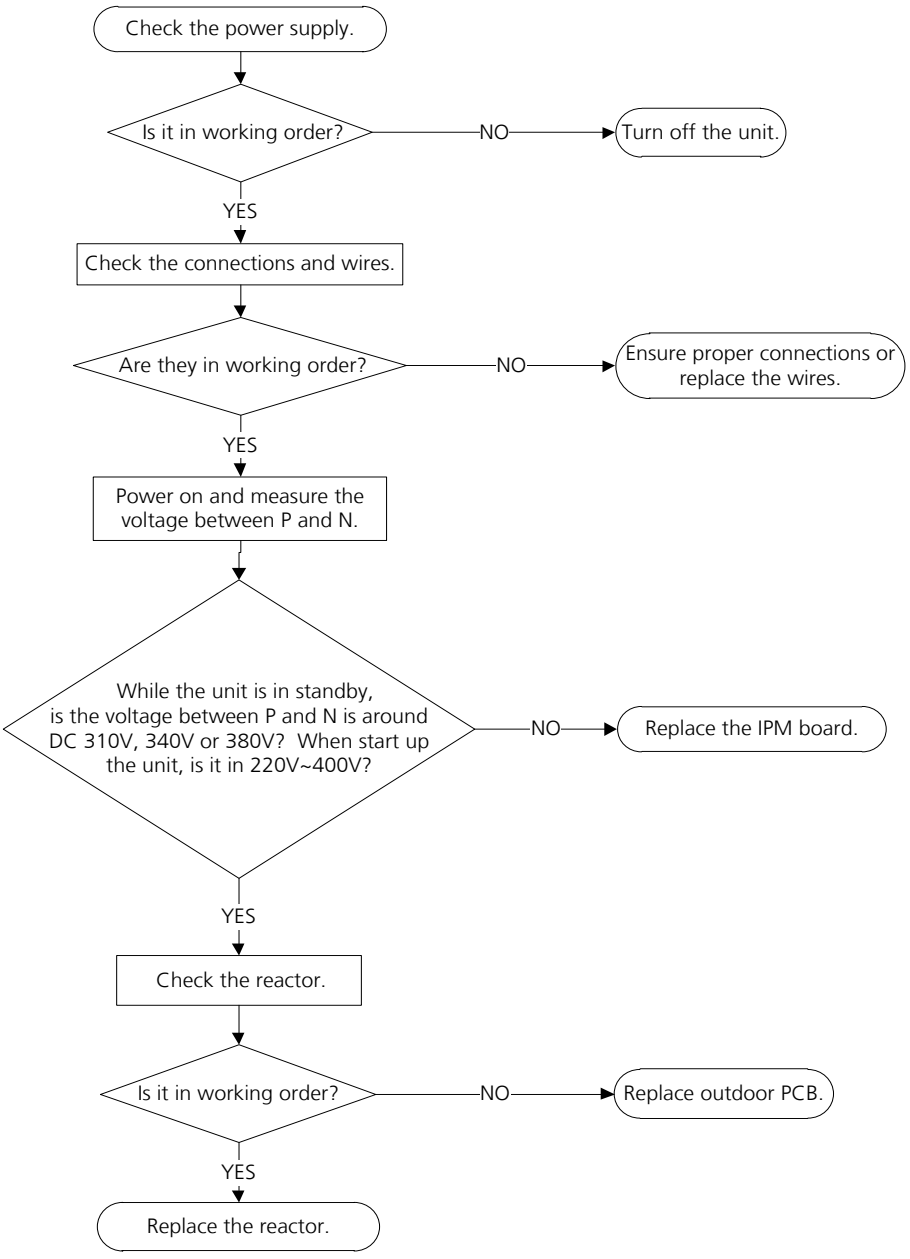
5.10 P1(Over voltage or too low voltage protection diagnosis and solution)

Description: Abnormal increases or decreases in voltage are detected by checking the specified voltage detection circuit.

Recommended parts to prepare:

- Power supply wires
- IPM module
- PCB
- Reactor

Troubleshooting and repair:



Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

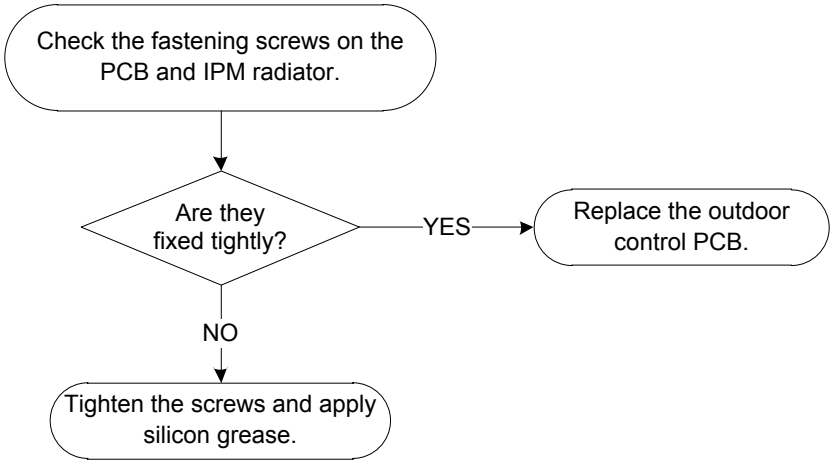
5.11 P2(High temperature protection of IPM module diagnosis and solution)

Description: If the temperature of IPM module is higher than a certain value, the LED will display the failure.

Recommended parts to prepare:

- Outdoor PCB
- IPM module

Troubleshooting and repair:



Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

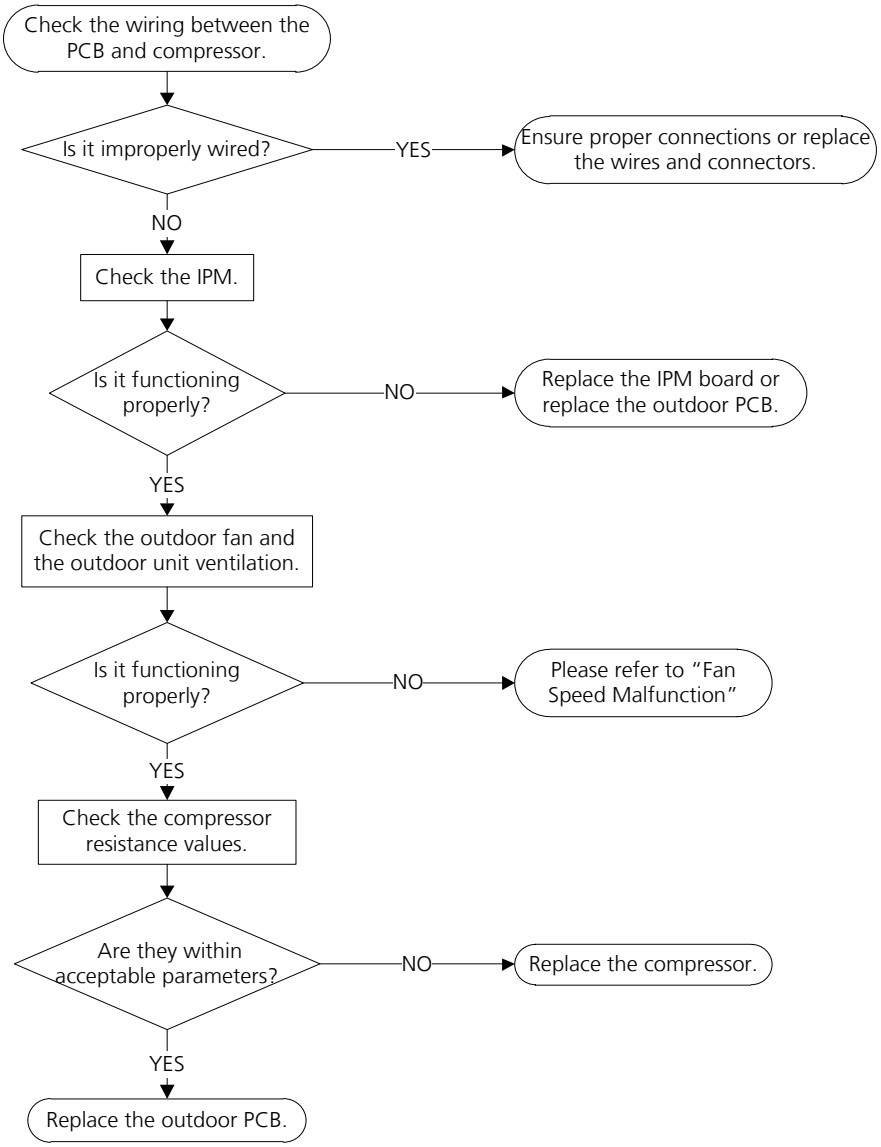
5.12 P4(Inverter compressor drive error diagnosis and solution)

Description: An abnormal inverter compressor drive is detected by a special detection circuit, including communication signal detection, voltage detection, compressor rotation speed signal detection and so on.

Recommended parts to prepare:

- Connection wires
- IPM Board
- Outdoor fan assembly
- Compressor
- Outdoor PCB

Troubleshooting and repair:



Note: For certain models, outdoor PCB could not be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

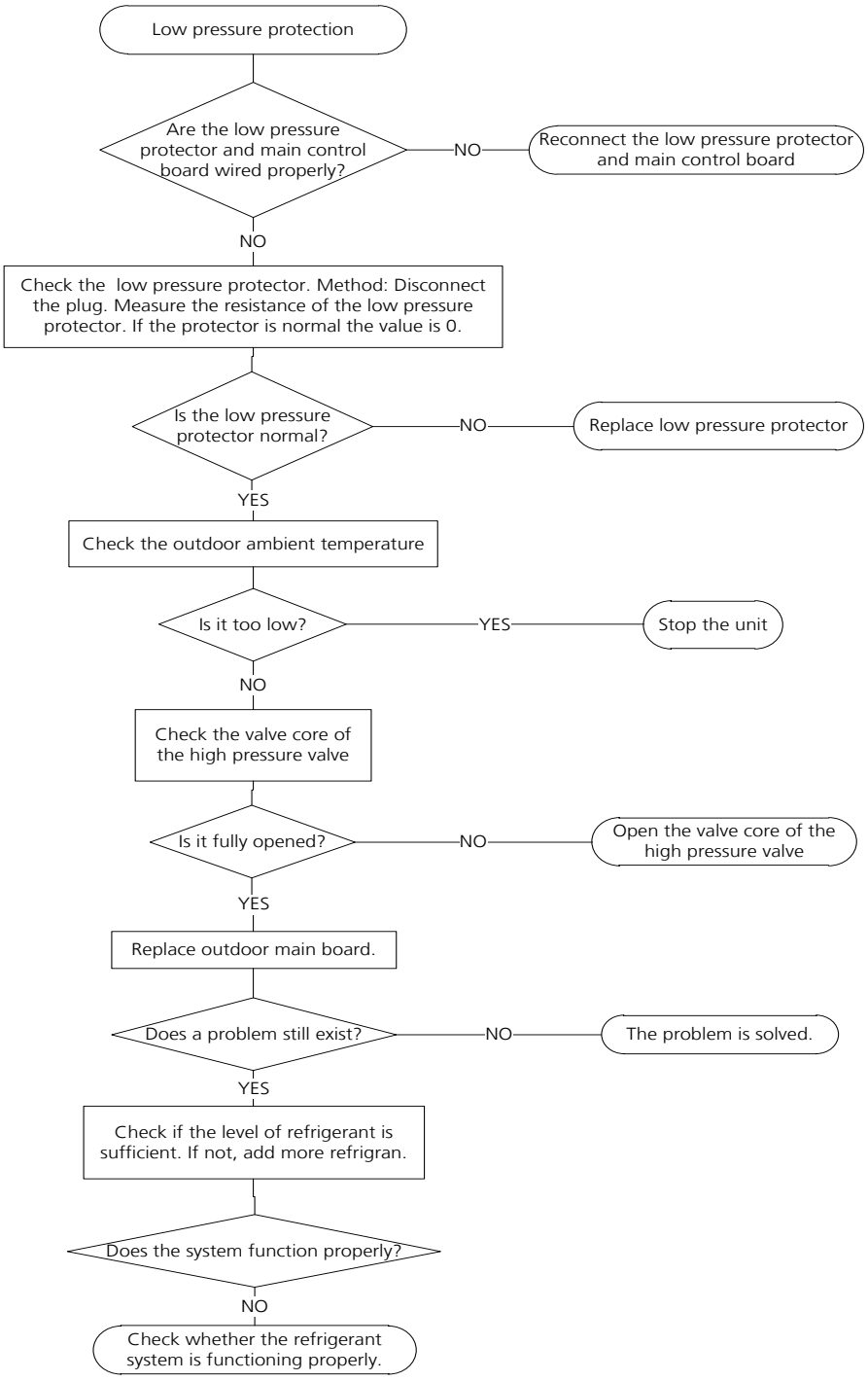
5.13 P6/J6(Low pressure protection)

Description: If the sampling voltage is not 5V, the LED displays a failure code.

Recommended parts to prepare:

- Wiring mistake
- Faulty over load protector
- System blockages
- Faulty outdoor PCB

Troubleshooting and repair:



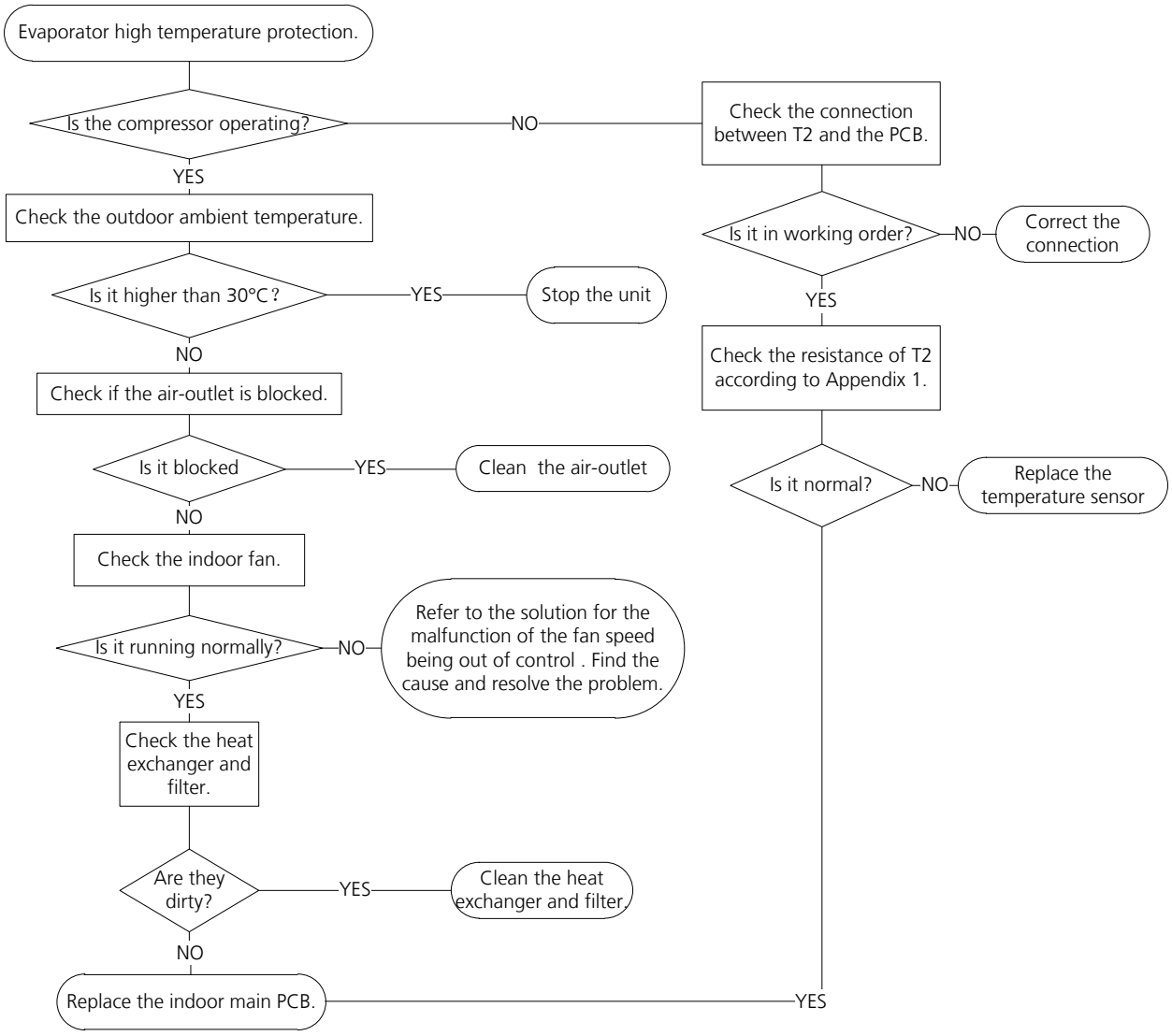
5.14 J0(Evaporator high temperature protection)

Description: When evaporator coil temperature is more than 60°C, the unit stops. It starts again only when the evaporator coil temperature is less than a certain value.

Recommended parts to prepare:

- Faulty evaporator coil temperature sensor
- Dirty heat exchanger
- Faulty fan
- Faulty PCB

Troubleshooting and repair:



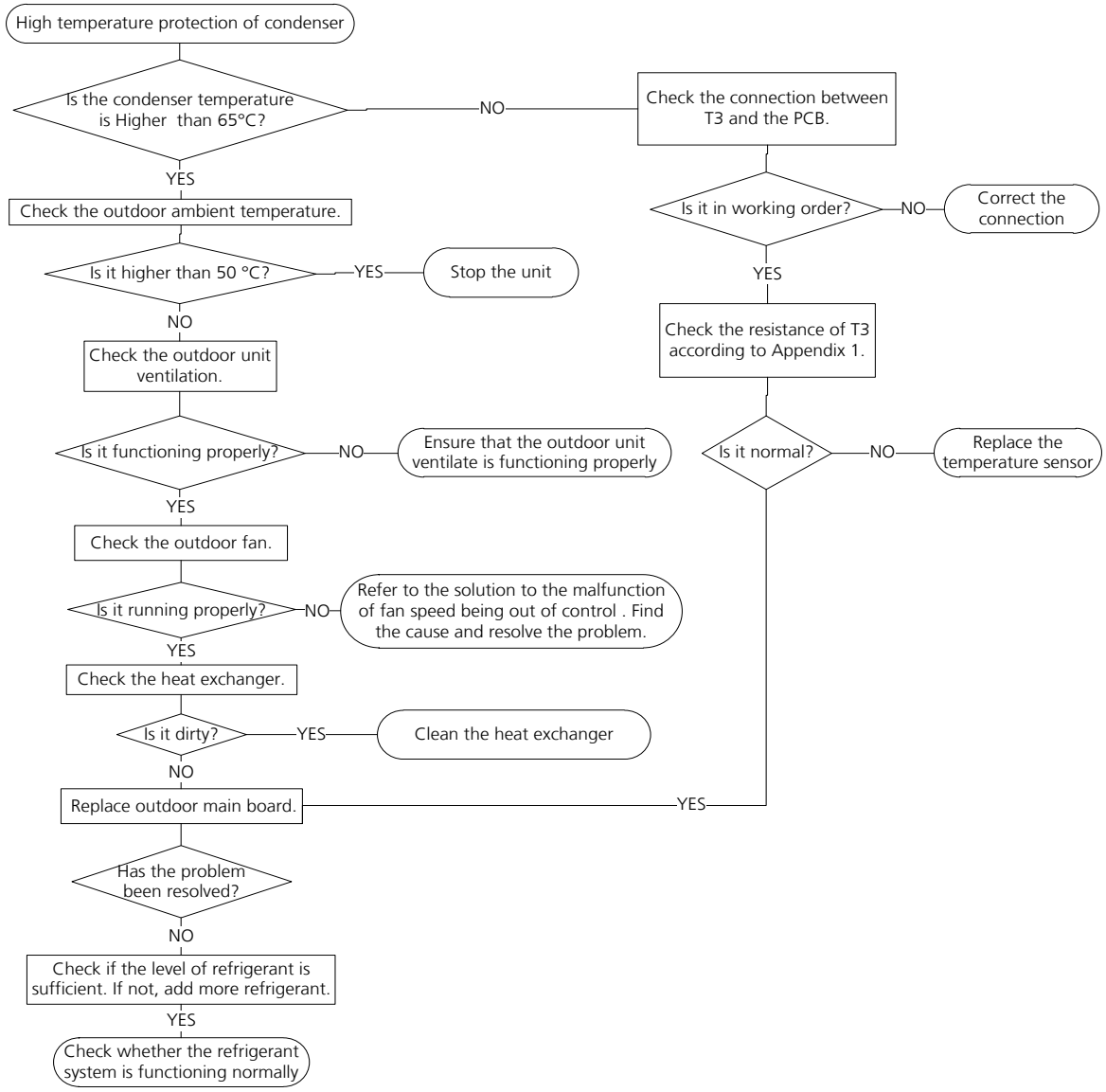
5.15 J1 (Condenser high temperature protection)

Description: When the outdoor pipe temperature is more than TP3+5°C, the unit stops. It starts again only when the outdoor pipe temperature is less than TP3-3°C.

Recommended parts to prepare:

- Faulty condenser temperature sensor
- Dirty heat exchanger
- System leakage or blockages

Troubleshooting and repair:



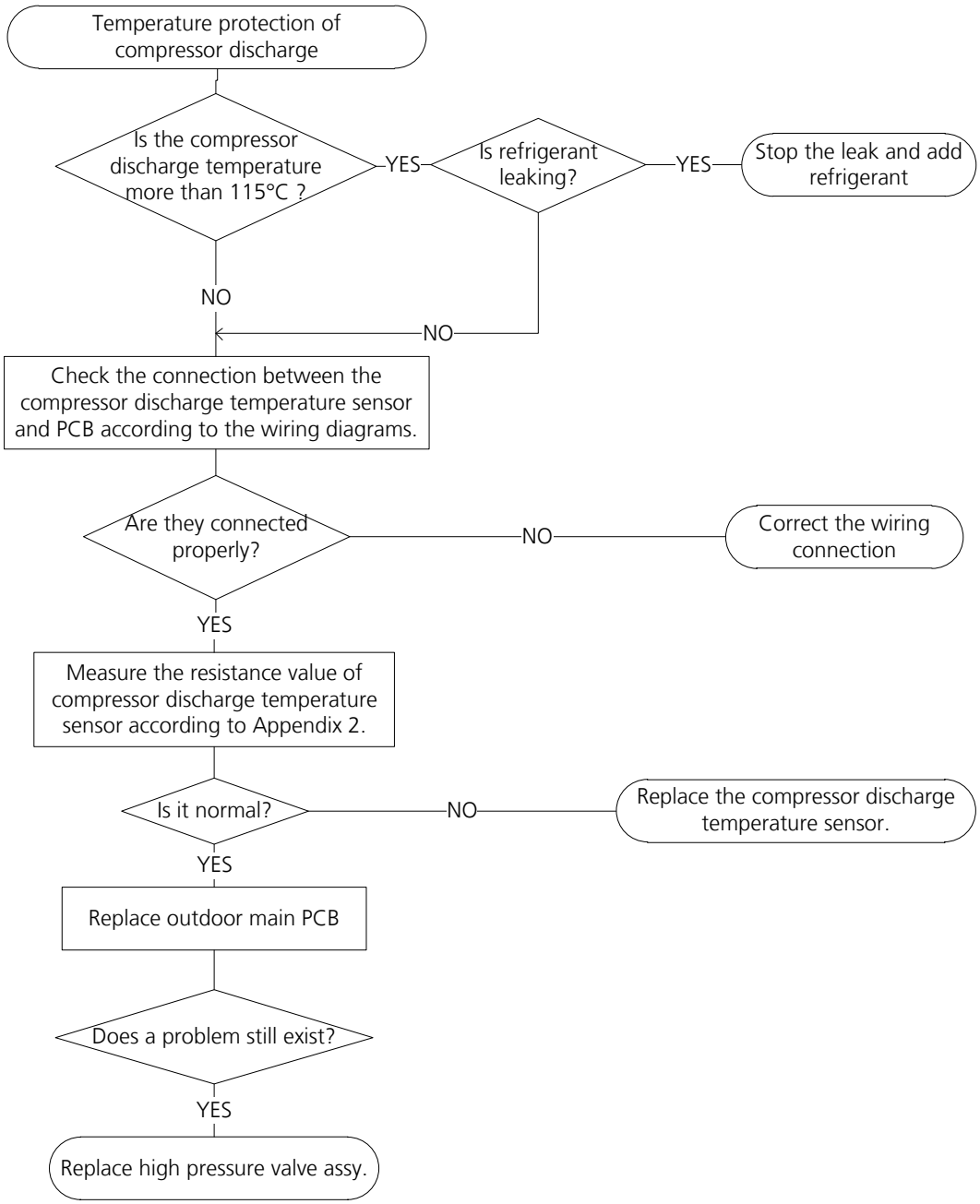
5.16 J2 (High discharge temperature protection)

Description: When the compressor discharge temperature (T5) is more than 115°C for 10 seconds, the compressor will stop and not restart until T5 is less than 90°C.

Recommended parts to prepare:

- Refrigerant leakage
- Wiring mistake
- Faulty discharge temperature sensor
- Faulty outdoor PCB

Troubleshooting and repair:



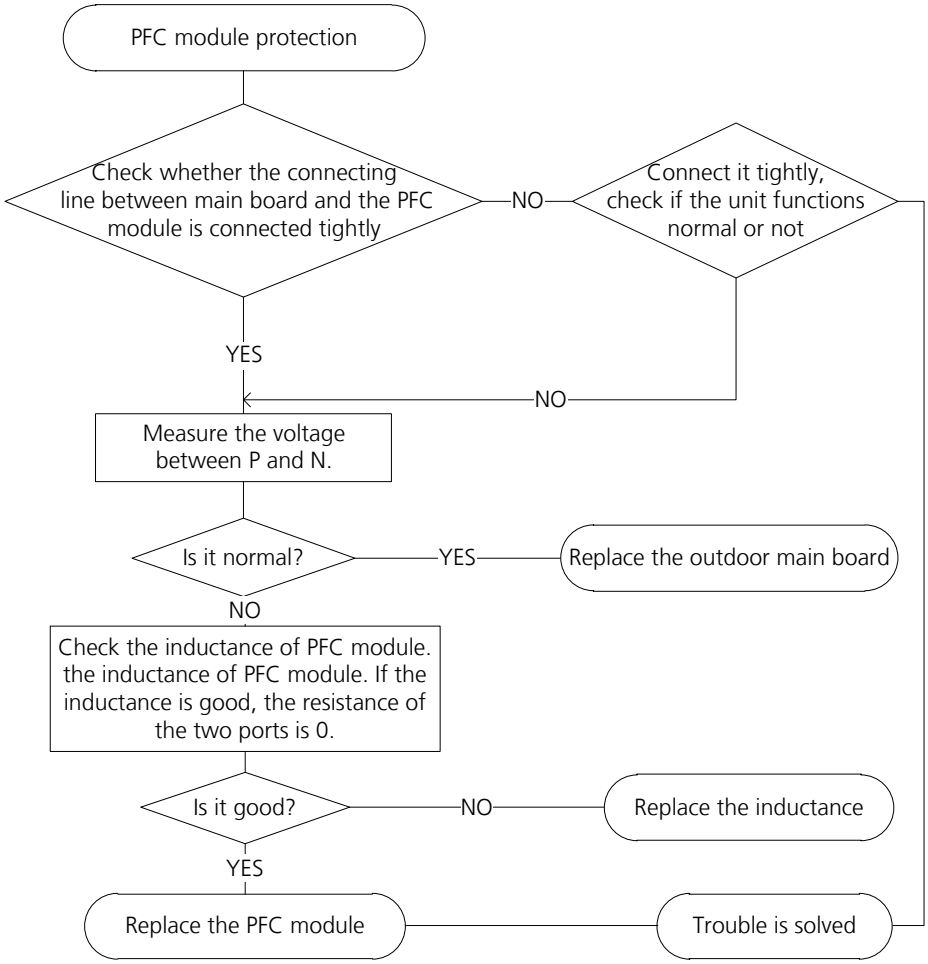
5.17 J3 (PFC module protection)

Description: When the voltage signal that IPM send to compressor drive chip is abnormal, the display LED will show "J3" and AC will turn off.

Recommended parts to prepare:

- Wiring mistake
- Faulty IPM board
- Faulty outdoor fan assembly
- Compressor malfunction
- Faulty outdoor PCB

Troubleshooting and repair:



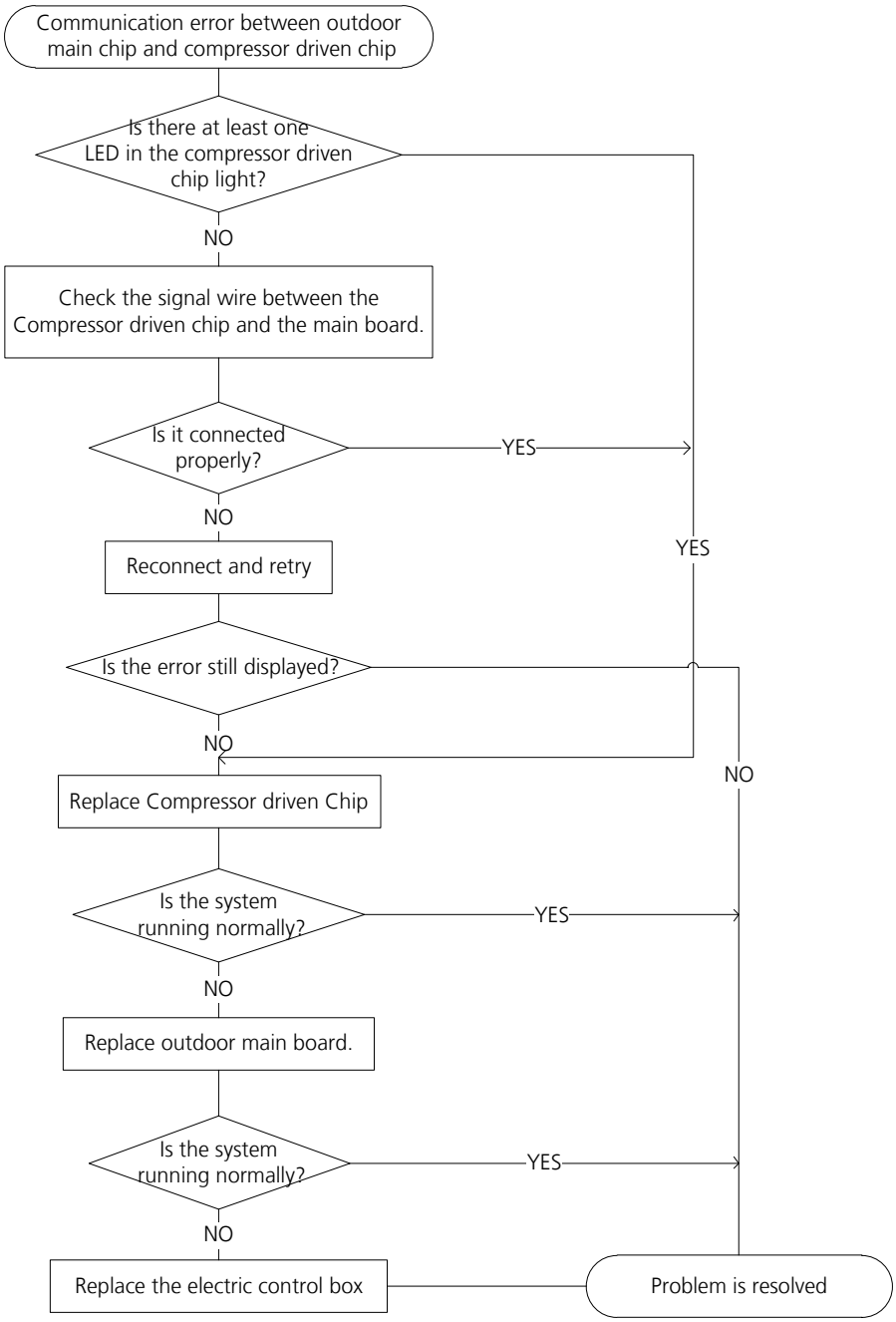
5.18 J4 (Communication error between outdoor main chip and compressor driven chip)

Description: The main PCB has not received feedback from the driven chip for 1 minute or the feedback data is wrong; The driven chip has not received feedback from the main PCB for 1 minute or the feedback data is wrong. The failure code disappears after the compressor stops or the communication runs well.

Recommended parts to prepare:

- Outdoor PCB
- Compressor driven chip
- The signal wire

Troubleshooting and repair:



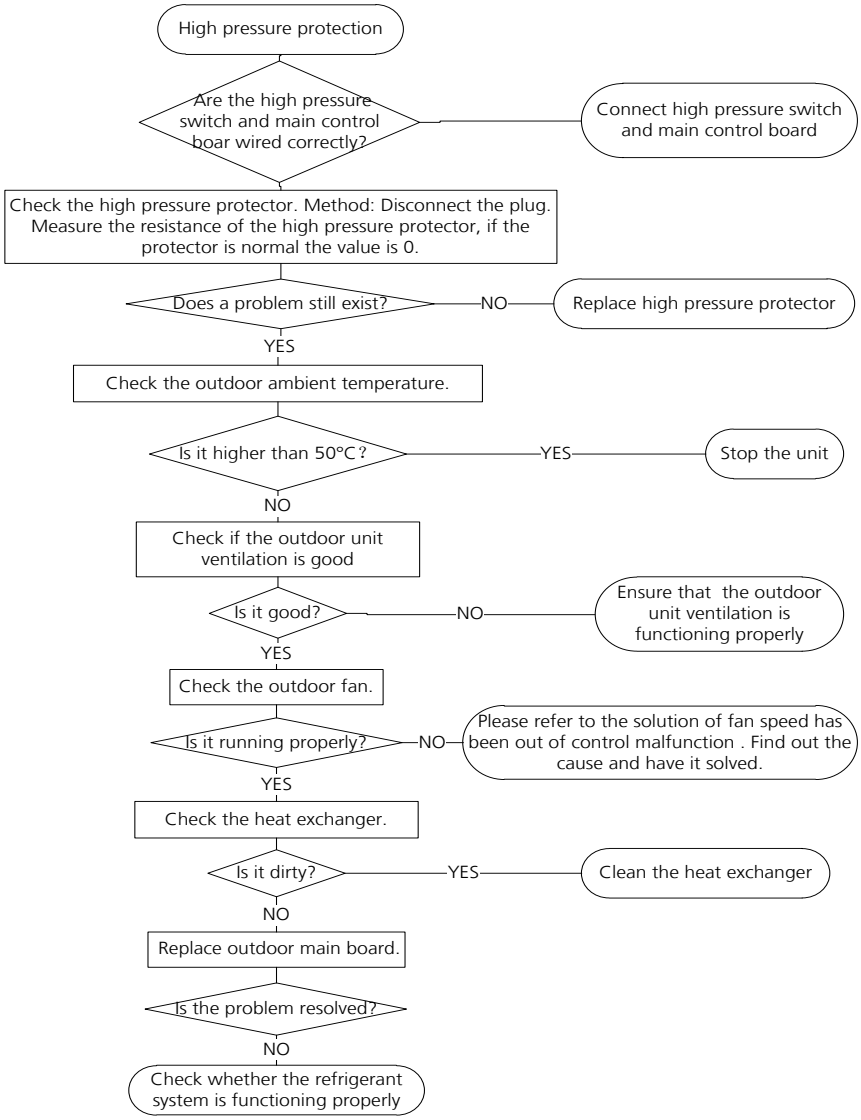
5.19 J5 (High pressure protection)

Description: If the sampling voltage is not 5V, the LED displays a failure code.

Recommended parts to prepare:

- Wiring mistakes
- Faulty overload protector
- System blockages
- Faulty outdoor PCB

Troubleshooting and repair:



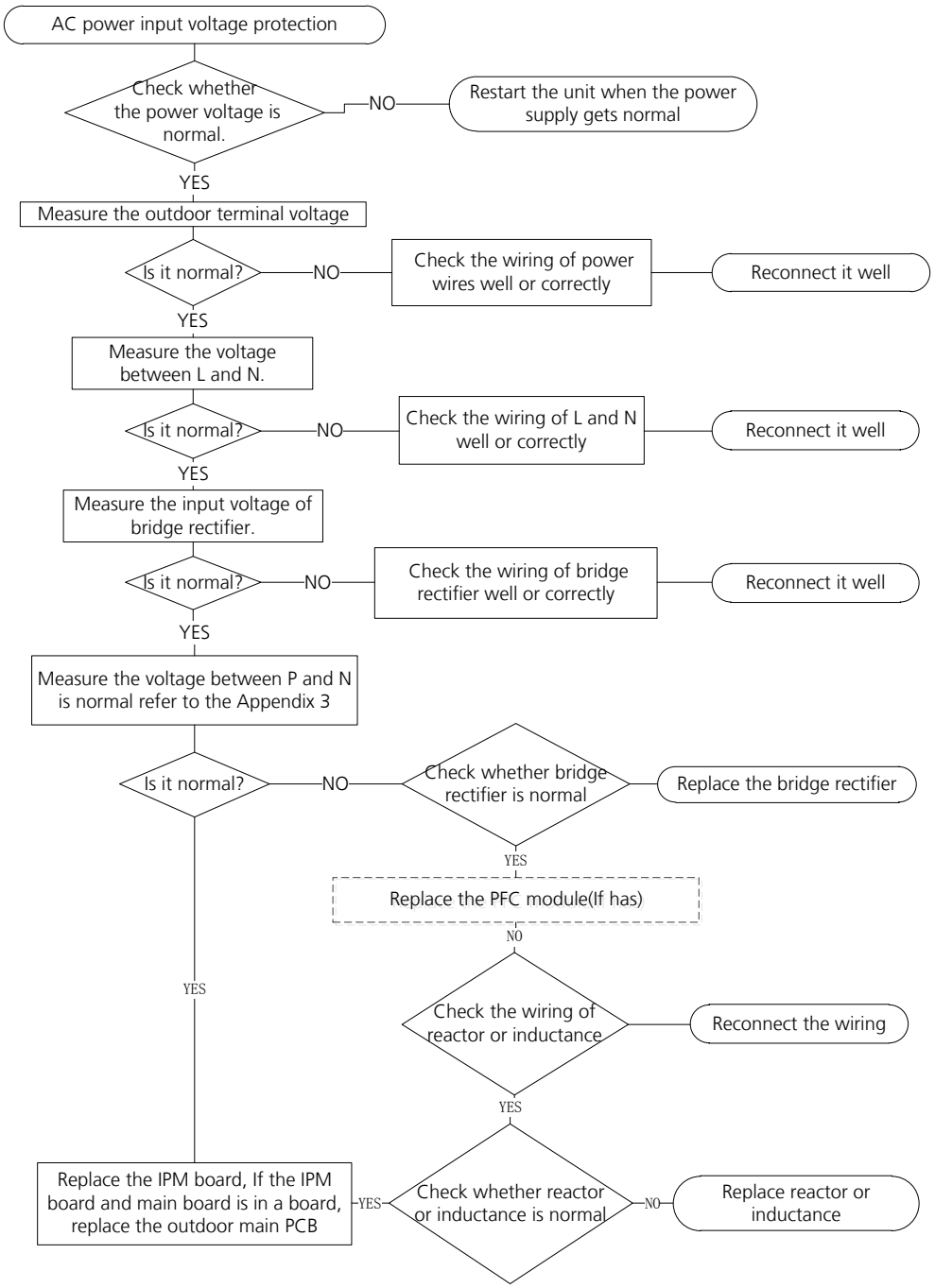
5.20 J8 (AC power input voltage protection)

Description: An abnormal voltage rise or drop is detected by checking the specified voltage detection circuit.

Recommended parts to prepare:

- Abnormal power supply
- Wiring mistake
- Faulty bridge rectifier
- Faulty IPM board

Troubleshooting and repair:



Appendix

Contents

i) Temperature Sensor Resistance Value Table for T1,T2,T3 and T4 (°C – K)

°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
-20	-4	115.266	20	68	12.6431	60	140	2.35774	100	212	0.62973
-19	-2	108.146	21	70	12.0561	61	142	2.27249	101	214	0.61148
-18	0	101.517	22	72	11.5	62	144	2.19073	102	216	0.59386
-17	1	96.3423	23	73	10.9731	63	145	2.11241	103	217	0.57683
-16	3	89.5865	24	75	10.4736	64	147	2.03732	104	219	0.56038
-15	5	84.219	25	77	10	65	149	1.96532	105	221	0.54448
-14	7	79.311	26	79	9.55074	66	151	1.89627	106	223	0.52912
-13	9	74.536	27	81	9.12445	67	153	1.83003	107	225	0.51426
-12	10	70.1698	28	82	8.71983	68	154	1.76647	108	226	0.49989
-11	12	66.0898	29	84	8.33566	69	156	1.70547	109	228	0.486
-10	14	62.2756	30	86	7.97078	70	158	1.64691	110	230	0.47256
-9	16	58.7079	31	88	7.62411	71	160	1.59068	111	232	0.45957
-8	18	56.3694	32	90	7.29464	72	162	1.53668	112	234	0.44699
-7	19	52.2438	33	91	6.98142	73	163	1.48481	113	235	0.43482
-6	21	49.3161	34	93	6.68355	74	165	1.43498	114	237	0.42304
-5	23	46.5725	35	95	6.40021	75	167	1.38703	115	239	0.41164
-4	25	44	36	97	6.13059	76	169	1.34105	116	241	0.4006
-3	27	41.5878	37	99	5.87359	77	171	1.29078	117	243	0.38991
-2	28	39.8239	38	100	5.62961	78	172	1.25423	118	244	0.37956
-1	30	37.1988	39	102	5.39689	79	174	1.2133	119	246	0.36954
0	32	35.2024	40	104	5.17519	80	176	1.17393	120	248	0.35982
1	34	33.3269	41	106	4.96392	81	178	1.13604	121	250	0.35042
2	36	31.5635	42	108	4.76253	82	180	1.09958	122	252	0.3413
3	37	29.9058	43	109	4.5705	83	181	1.06448	123	253	0.33246
4	39	28.3459	44	111	4.38736	84	183	1.03069	124	255	0.3239
5	41	26.8778	45	113	4.21263	85	185	0.99815	125	257	0.31559
6	43	25.4954	46	115	4.04589	86	187	0.96681	126	259	0.30754
7	45	24.1932	47	117	3.88673	87	189	0.93662	127	261	0.29974
8	46	22.5662	48	118	3.73476	88	190	0.90753	128	262	0.29216
9	48	21.8094	49	120	3.58962	89	192	0.8795	129	264	0.28482
10	50	20.7184	50	122	3.45097	90	194	0.85248	130	266	0.2777
11	52	19.6891	51	124	3.31847	91	196	0.82643	131	268	0.27078
12	54	18.7177	52	126	3.19183	92	198	0.80132	132	270	0.26408
13	55	17.8005	53	127	3.07075	93	199	0.77709	133	271	0.25757
14	57	16.9341	54	129	2.95896	94	201	0.75373	134	273	0.25125
15	59	16.1156	55	131	2.84421	95	203	0.73119	135	275	0.24512
16	61	15.3418	56	133	2.73823	96	205	0.70944	136	277	0.23916
17	63	14.6181	57	135	2.63682	97	207	0.68844	137	279	0.23338
18	64	13.918	58	136	2.53973	98	208	0.66818	138	280	0.22776
19	66	13.2631	59	138	2.44677	99	210	0.64862	139	282	0.22231

ii) Temperature Sensor Resistance Value Table for TP (°C – K)

°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
-20	-4	542.7	20	68	68.66	60	140	13.59	100	212	3.702
-19	-2	511.9	21	70	65.62	61	142	13.11	101	214	3.595
-18	0	483	22	72	62.73	62	144	12.65	102	216	3.492
-17	1	455.9	23	73	59.98	63	145	12.21	103	217	3.392
-16	3	430.5	24	75	57.37	64	147	11.79	104	219	3.296
-15	5	406.7	25	77	54.89	65	149	11.38	105	221	3.203
-14	7	384.3	26	79	52.53	66	151	10.99	106	223	3.113
-13	9	363.3	27	81	50.28	67	153	10.61	107	225	3.025
-12	10	343.6	28	82	48.14	68	154	10.25	108	226	2.941
-11	12	325.1	29	84	46.11	69	156	9.902	109	228	2.86
-10	14	307.7	30	86	44.17	70	158	9.569	110	230	2.781
-9	16	291.3	31	88	42.33	71	160	9.248	111	232	2.704
-8	18	275.9	32	90	40.57	72	162	8.94	112	234	2.63
-7	19	261.4	33	91	38.89	73	163	8.643	113	235	2.559
-6	21	247.8	34	93	37.3	74	165	8.358	114	237	2.489
-5	23	234.9	35	95	35.78	75	167	8.084	115	239	2.422
-4	25	222.8	36	97	34.32	76	169	7.82	116	241	2.357
-3	27	211.4	37	99	32.94	77	171	7.566	117	243	2.294
-2	28	200.7	38	100	31.62	78	172	7.321	118	244	2.233
-1	30	190.5	39	102	30.36	79	174	7.086	119	246	2.174
0	32	180.9	40	104	29.15	80	176	6.859	120	248	2.117
1	34	171.9	41	106	28	81	178	6.641	121	250	2.061
2	36	163.3	42	108	26.9	82	180	6.43	122	252	2.007
3	37	155.2	43	109	25.86	83	181	6.228	123	253	1.955
4	39	147.6	44	111	24.85	84	183	6.033	124	255	1.905
5	41	140.4	45	113	23.89	85	185	5.844	125	257	1.856
6	43	133.5	46	115	22.89	86	187	5.663	126	259	1.808
7	45	127.1	47	117	22.1	87	189	5.488	127	261	1.762
8	46	121	48	118	21.26	88	190	5.32	128	262	1.717
9	48	115.2	49	120	20.46	89	192	5.157	129	264	1.674
10	50	109.8	50	122	19.69	90	194	5	130	266	1.632
11	52	104.6	51	124	18.96	91	196	4.849			
12	54	99.69	52	126	18.26	92	198	4.703			
13	55	95.05	53	127	17.58	93	199	4.562			
14	57	90.66	54	129	16.94	94	201	4.426			
15	59	86.49	55	131	16.32	95	203	4.294			
16	61	82.54	56	133	15.73	96	205	4.167			
17	63	78.79	57	135	15.16	97	207	4.045			
18	64	75.24	58	136	14.62	98	208	3.927			
19	66	71.86	59	138	14.09	99	210	3.812			

iii) Normal voltage of P and N

Normal voltage of P and N			
208-240V(1-phase,3-phase)			380-415V(3-phase)
In standby			
around 310VDC			around 530VDC
In operation			
With passive PFC module	With partial active PFC module	With fully active PFC module	/
>200VDC	>310VDC	>370VDC	>450VDC

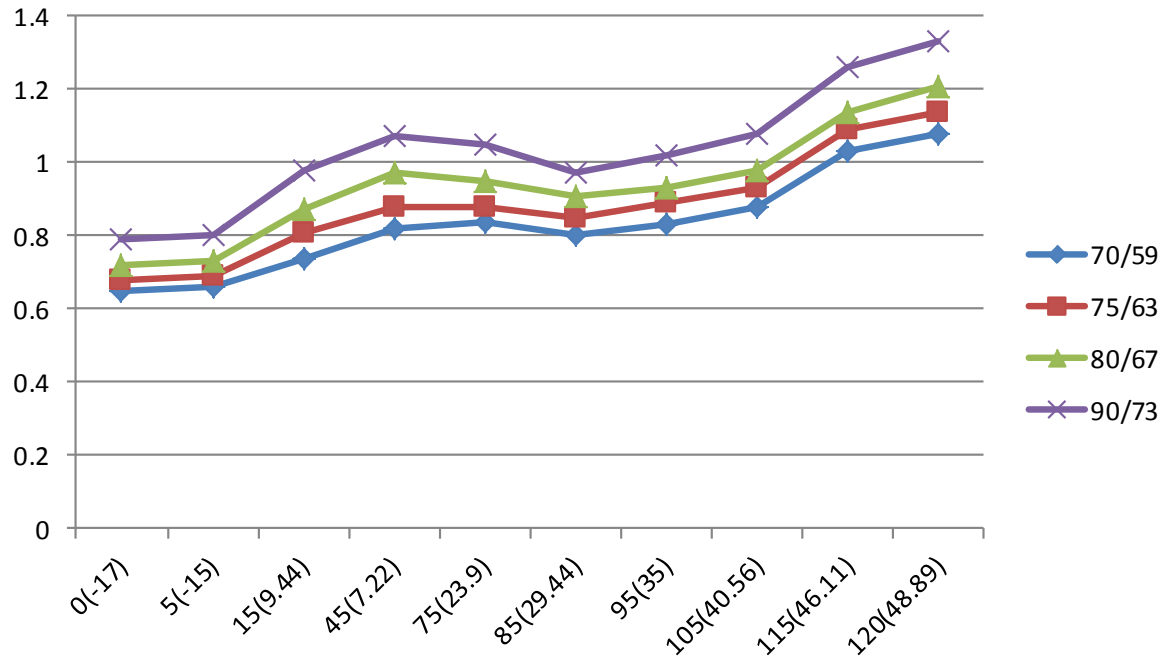
iv) Pressure On Service Port(R32)

Cooling chart:

°F(°C)	ODT / IDT	0(-17)	5(-15)	15 (9.44)	45 (7.22)	75 (23.89)	85 (29.44)	95 (35)	105 (40.56)	115 (46.11)	120 (48.89)
BAR	70/59	6.5	6.6	7.4	8.2	8.4	8.0	8.3	8.8	10.3	10.8
BAR	75/63	6.8	6.9	8.1	8.8	8.8	8.5	8.9	9.3	10.9	11.4
BAR	80/67	7.2	7.3	8.7	9.7	9.5	9.1	9.3	9.8	11.4	12.1
BAR	90/73	7.9	8.0	9.8	10.7	10.5	9.7	10.2	10.8	12.6	13.3

°F(°C)	ODT / IDT	0(-17)	5(-15)	15 (9.44)	45 (7.22)	75 (23.89)	85 (29.44)	95 (35)	105 (40.56)	115 (46.11)	120 (48.89)
PSI	70/59	95	96	108	118	121	115	119	128	150	157
PSI	75/63	99	101	117	128	126	122	129	135	158	165
PSI	80/67	105	106	125	141	138	132	135	143	165	176
PSI	90/73	114	115	142	155	152	141	148	157	184	193

°F(°C)	ODT / IDT	0(-17)	5(-15)	15 (9.44)	45 (7.22)	75 (23.89)	85 (29.44)	95 (35)	105 (40.56)	115 (46.11)	120 (48.89)
MPA	70/59	0.65	0.66	0.74	0.82	0.84	0.80	0.83	0.88	1.03	1.08
MPA	75/63	0.68	0.69	0.81	0.88	0.88	0.85	0.89	0.93	1.09	1.14
MPA	80/67	0.72	0.73	0.87	0.97	0.95	0.91	0.93	0.98	1.14	1.21
MPA	90/73	0.79	0.80	0.98	1.07	1.05	0.97	1.02	1.08	1.26	1.33



Heating chart:

°F(°C)	ODT / IDT	57/53 (13.89/11.67)	47/43 (8.33/6.11)	37/33 (2.78/0.56)	27/23 (-2.78/-5)	17/13 (-8.33/-10.56)	0/-2 (-17/-19)	-17/-18 (-27/-28)
BAR	55	30.9	29.1	25.8	23.3	21.2	18.9	16.8
BAR	65	33.2	30.6	27.1	25.9	23.8	20.9	19.4
BAR	75	34.5	32.1	28.4	26.8	25.4	21.9	20.4

°F(°C)	ODT / IDT	57/53 (13.89/11.67)	47/43 (8.33/6.11)	37/33 (2.78/0.56)	27/23 (-2.78/-5)	17/13 (-8.33/-10.56)	0/-2 (-17/-19)	-17/-18 (-27/-28)
PSI	55	448	421	374	337	308	273	244
PSI	65	480	444	394	375	346	303	282
PSI	75	499	466	411	389	369	318	296

°F(°C)	ODT / IDT	57/53 (13.89/11.67)	47/43 (8.33/6.11)	37/33 (2.78/0.56)	27/23 (-2.78/-5)	17/13 (-8.33/-10.56)	0/-2 (-17/-19)	-17/-18 (-27/-28)
MPA	55	3.09	2.91	2.58	2.33	2.12	1.89	1.68
MPA	65	3.32	3.06	2.71	2.59	2.38	2.09	1.94
MPA	75	3.45	3.21	2.84	2.68	2.54	2.19	2.04