This product utilizes **R-454B** *refrigerant*

Olympus Series E-Star® Mini-Split System

Service Manual

MODELS:

O-*-HP-WMAH-230C-O
O-ES-*-HP-C-230C-O1

Read this manual carefully before installation and keep it where the operator can easily find it for future reference.

Due to updates and constantly improving performance, the information and instructions within this manual are subject to change without notice.

Version Date: May 12, 2025
Please visit www.mrcool.com/documentation to ensure you have the latest version of this manual.

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COMFORT MADE SIMPLE

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Safety Precautions

Read Before Using

Incorrect usage may cause serious damage or injury.

The symbols below are used throughout this manual to indicate instructions that should be followed closely or actions that should be avoided to prevent death, injury, and/or property damage.

WARNING	Indicates the possibility of personal injury or loss of life.
CAUTION	Indicates the possibility of property damage or serious consequences.

WARNING FOR PRODUCT INSTALLATION

INSTALLATION MUST BE PERFORMED BY AN AUTHORIZED DEALER OR SPECIALIST. DEFECTIVE INSTALLATION CAN CAUSE WATER LEAKAGE, ELECTRICAL SHOCK, OR FIRE.

******ELECTRICAL WORK MUST BE COMPLETED BY A QUALIFIED ELECTRICAL TECHNICIAN******

- ⊘ ***DO NOT*** **install the unit in a location that may be exposed to combustible gas leaks. If combustible gas accumulates around the unit, it could cause fire.**
- ⊘ ***DO NOT*** **turn on the power until the installation and all work has been completed.**

1. Installation must be performed according to the installation instructions. Improper installation could cause water leakage, electrical shock, or fire.
2. Contact an authorized service technician for repair or maintenance of this unit.
3. This appliance must be installed in accordance with national wiring regulations.
4. Only use the included accessories, parts, and specified parts for installation. Using non-standard parts can cause water leakage, electrical shock, fire, and/or failure of the unit.
5. Install the unit in a firm location that can support the unit's weight. If the location cannot support the unit's weight, or the installation is not done properly, the unit may drop and cause serious injury and damage.
6. Install the drainage piping according to the instructions in this manual. Improper drainage could cause water damage to your home and/or property.
7. When moving or relocating the air conditioner, consult experienced service technicians for disconnection and re-installation of the unit.
8. For detailed information of how to install the indoor and outdoor units to their respective supports, please refer to the indoor unit installation and outdoor unit installation sections of this manual.
9. USB device access, replacement, and maintenance operations must be carried out by professional staff.

WARNING FOR CLEANING & MAINTENANCE

1. **DO NOT** clean the unit with excessive amounts of water.
2. **DO NOT** clean the unit with combustible cleaning agents, as these could cause deformation and/or fire.
3. Turn off the device and disconnect the power before cleaning. Failure to do this could result in electrical shock.

TAKE NOTE OF FUSE SPECIFICATIONS

- The unit's circuit board (PCB) is designed with a fuse to provide over-current protection.
- The specifications of the fuse are printed on the circuit board, examples of such are T5A/250VAC and T10A/250VAC.

Note: Only a blast-proof ceramic fuse can be used.

1 SAFETY

WARNING FOR PRODUCT USE

- ⊘ ***DO NOT*** **insert fingers, rods, or other objects into the air inlet or outlet. This could cause injury, since the fan may be rotating at high speeds.**
- ⊘ ***DO NOT*** **use flammable sprays such as hair spray, lacquer or paint near the unit, as this could cause fire and/or an explosion.**
- ⊘ ***DO NOT*** **operate the unit in places near or around combustible gases. Emitted gas may collect around the unit and cause an explosion.**
- ⊘ ***DO NOT*** **allow children to play with the appliance. Children must be supervised around the unit at all times.**
- ⊘ ***DO NOT*** **operate the unit in a room where it could be exposed to excessive amounts of water, such as a bathroom or laundry room. Exposure to excessive water amounts can cause the electrical components to short circuit.**
- ⊘ ***DO NOT*** **expose your body directly to direct cool airflow from the unit for a prolonged period of time.**

1. If the unit operates abnormally (emits strange noises or a burning smell), immediately turn off the unit and disconnect the power in order to avoid electric shock, fire, and/or injury. Call your local dealer, or MRCOOL® tech support at (270) 366-0457, for further assistance.
2. If the air conditioner is used together with burners or other heating devices, thoroughly ventilate the room in order to avoid an oxygen deficiency.
3. In certain functional environments (such as kitchens and server rooms etc.), the use of specially designed air-conditioning units is highly recommended.
4. This appliance is not intended for use by persons(including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.
5. Turn off the unit and disconnect the power before performing any cleaning, installation, or repairing. Failure to do so can cause electric shock.

CAUTION

- ⊘ ***DO NOT*** **allow the air conditioner to operate for extended periods of time with the doors or windows open, or in very high humidity.**
- ⊘ ***DO NOT*** **operate the air conditioner with wet hands, as this could cause electric shock.**
- ⊘ ***DO NOT*** **use device for any other purpose than its intended use.**
- ⊘ ***DO NOT*** **climb onto or place objects on top of the outdoor unit.**

1. Make sure that water condensation can drain smoothly and unhindered from the unit.
2. Turn off the unit and disconnect the power if the unit will not be used for an extended period of time.
3. Turn off and unplug the unit during storms.

ELECTRICAL WARNINGS

******ELECTRICAL WORK MUST BE COMPLETED BY A QUALIFIED ELECTRICAL TECHNICIAN******

- ⊘ ***DO NOT*** **share the power supply with other appliances. An improper or insufficient power supply could cause fire and/or electrical shock.**

1. Only use the specified wire. If the wire is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.
2. The product must be properly grounded during installation or electrical shock could occur.
3. Appropriate wiring standards, regulations, and the installation manual must be followed for all electrical work.
4. If connecting power to fixed wiring, an all-pole disconnection device must be incorporated in the fixed wiring in accordance with the wiring rules and must meet the following requirements: at least 3 mm of clearances in all poles, a leakage current that may exceed 10 mA, and a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.
5. Connect cables tightly and clamp them securely to prevent external forces from damaging the terminal.

ELECTRICAL WARNINGS

Improper electrical connections could overheat, causing fire and/or electrical shock.

5. All electrical connections must be made according to the Electrical Connection Diagram located on the panels of the indoor and outdoor units.
6. All wiring must be properly arranged to ensure that the control board cover can close properly. If the control board cover is not properly closed, it can lead to corrosion and cause the connection points on the terminal to heat up, catch fire, or cause electrical shock.
7. Disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.

FLAMMABLE REFRIGERANT WARNINGS

1. The installation of pipe-work should be kept to a minimum and should be protected from physical damage.
2. Refrigerant pipes should comply with national gas regulations.
3. All mechanical connections and ventilation openings should be kept clear of obstruction.
4. Utilize proper disposal processes based on national regulations.
5. Any person involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorizes their competence to handle refrigerants safely in accordance with an industry recognized assessment specification.
6. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.
7. Do not use any means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
8. The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater).
9. Do not allow foreign matter (oil, water, etc.) to enter the piping, and securely seal the opening by pinching, taping, etc.
10. Do not pierce or burn.
11. Refrigerants may not contain an odor.
12. Working procedures that affect safety should only be carried out by competent persons.
13. The unit should be stored in a well-ventilated area where the room size corresponds to the room area as specific for operation, and should be stored so as to prevent potential mechanical damage from occurring.
14. Joints should be tested with detection equipment with a capability of 5 g/year of refrigerant or better, with the equipment in standstill and under operation or under a pressure of at least these standstill or operation conditions after installation. Detachable joints should NOT be used in the indoor side of the unit (brazed, welded joint could be used).
15. A leak detection system is installed. The unit must be powered except for service. For units with a refrigerant sensor, the indoor unit will display an error code and emit a buzzing sound, the compressor of the outdoor unit will immediately stop, and the indoor fan will start running. The service life of the refrigerant sensor is 15 years. When the refrigerant sensor malfunctions, the indoor unit will display the error code "FHCC". The refrigerant sensor cannot be repaired and can only be replaced by the manufacturer. It should only be replaced with the sensor specified by the manufacturer.
16. When a flammable refrigerant is used, the requirements for installation space of the appliance and/or ventilation requirements are determined according to:
    - The mass charge amount (M) used in the unit.
    - The installation location.
    - The type of ventilation of the location of the unit.
    - Piping material, pipe routing, and installation must include protection from physical damage in operation and service. This must be in compliance with local codes and standards, such as ASHRAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints must be accessible for inspection prior to being covered or enclosed.
    - Protection devices, piping and fittings must be protected as much as possible against adverse environmental effects. For example, against the danger of water collecting and freezing in relief pipes or against accumulation of dirt or debris.

FLAMMABLE REFRIGERANT WARNINGS

- Piping in refrigeration systems must be designed and installed to minimize the likelihood of hydraulic shock, resulting in damage from the system.
- Steel pipes and components must be protected against corrosion with a rust-proof coating before applying insulation.
- Precautions must be taken against excessive vibration or movement of the unit.
- The minimum floor area of the room must be mentioned in the form of a table or a single figure without reference to a formula.

17. After completion of field piping for split systems, the field pipework should be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:
    - The minimum test pressure for the low side of the system should be the low side design pressure and the minimum test pressure for the high side of the system should be the high side design pressure, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system should not be pressure tested to the low side design pressure.
    - The test pressure after removal of pressure source shall be maintained for at least 1 hour with no decrease of pressure indicated by the test gauge, with test gauge resolution not exceeding 5% of the test pressure.
18. Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repairs to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.
19. Work should be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
20. All maintenance staff and others working in the local area should be instructed on the nature of work being carried out. Avoid work in confined spaces.
21. The area should 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.
22. If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment should be on site and readily available. Have a dry power or CO2 fire extinguisher adjacent to the charging area.
23. No person carrying out work in relation to a refrigerating system which involves exposing any pipe work should 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 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 should be displayed.
24. 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.
23. 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 ad service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance. The following checks should be applied to installations using flammable refrigerants:
    - the actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed;
    - the ventilation machinery and outlets are operating adequately and are not obstructed;
    - if an indirect refrigerating circuit is being used, the secondary circuits should be checked for the presence of refrigerant;
    - marking to the equipment continues to be visible and legible, marking and signs that are illegible should be corrected;
    - refrigerant 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 or protected against corrosion.

FLAMMABLE REFRIGERANT WARNINGS

24. 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 should be used.
25. Initial safety checks should include:
    - that capacitors are discharged: this should be done in a safe manner to avoid the possibility of sparking;
    - that there are no live electrical components and wiring are exposed while charging, recovering, or purging the system;
    - that there is continuity of earth bonding.
26. Sealed electrical components should be replaced if damaged.
27. Intrinsically safe components should be replaced if damaged.
28. Check that wiring 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.
29. Under no circumstances should potential sources of ignition be used in the search for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) should not be used. The following leak detection methods are deemed acceptable for refrigerant systems. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, 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 should be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% minimum) is confirmed. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine may react with the refrigerant and corrode the copper work. Examples of leak detection fluids are the bubble method, fluorescent method agents, etc. If a leak is suspected, all naked flames should be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant should be recovered from the system, or isolated (by means of shut-off valves) in a part of the system remote from the leak. See the following instructions of removal of refrigerant.
30. When breaking into the refrigerant circuit to make repairs, or for any other purpose, conventional procedures should be used. However, for flammable refrigerants, it is even more vital to follow best practice. The following procedure should be adhered to:
    - safely remove refrigerant following local and national regulations;
    - evacuate;
    - purge the circuit with inert gas;
    - evacuate;
    - continuously flush or purge with inert gas when using flame to open circuit;
    - open the circuit
31. The refrigerant charge should be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For units containing flammable refrigerants, the system should be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. For appliances containing flammable refrigerants, refrigerant purging should be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process should be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system should be vented down to atmospheric pressure to enable work to take place. The outlet for the vacuum pump should not be close to any potential ignition sources, and ventilation should be available.
32. In addition to conventional charging procedures, the following requirements should be followed:
    - Work should be undertaken with appropriate tools only (in case of uncertainty, please consult the manufacturer of the tools for use with flammable refrigerants)
    - 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.

FLAMMABLE REFRIGERANT WARNINGS

- Ensure that the refrigeration system is grounded prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care should be taken not to overfill the refrigeration system.
- Prior to recharging the system, it should be pressure tested with oxygen-free nitrogen (OFN). The system should 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.

33. Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is good recommended practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample should be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.
    a. Become familiar with the equipment and its operation.
    b. Isolate the system electrically.
    c. 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.
    e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
    f. Make sure that the cylinder is situated on the scales before recovery takes place.
    g. Start the recovery machine and operate in accordance with instructions.
    h. Do not overfill cylinders (no more than 80% volume liquid charge).
    i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
    j. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and equipment are removed from the site promptly and all isolation valves on the equipment are closed off.
    k. Recovered refrigerant should not be charged into another refrigeration system unless it has been cleaned and checked.
34. Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label should be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.
35. When removing refrigerant from a system, either for servicing or decommissioning, it is good recommended practice that all refrigerants are removed safely. When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used should be designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs. The recovery equipment should be in good working order with a set of instructions concerning the equipment that is at hand and should be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales should be available and in good working order. Hoses should be complete with leak-free disconnect couplings and in good condition. The recovered refrigerant should be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
36. 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 compressor body should not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it should be carried out safely.
37. An unventilated area where the appliance using flammable refrigerants is installed should be constructed so that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard. If appliances connected via an air duct system to one or more rooms below the ventilation requirements,

FLAMMABLE REFRIGERANT WARNINGS

that room should never contain potential ignition sources. A flame-producing device may be installed in the space if the device is provided with an effective flame arrest. Auxiliary devices which may be a potential ignition source should not be installed in the duct work. Examples of such are hot surfaces with a temperature exceeding 1292°F (700°C) and electric switching devices. Only auxiliary devices (such as a certified heater kit) approved by the manufacturer or declared suitable with the refrigerant should be installed in connecting ductwork. False or drop ceilings may be used as a return air plenum if a refrigerant detection system is provided in the appliance and any external connections are also provided with a sensor immediately below the return air plenum duct joint. Refrigerant sensors for refrigerant detection systems should only be replaced with sensors specified by the manufacturer. A leak detection system is installed. The unit must be powered except for service.

38. Transport of equipment containing flammable refrigerants should comply with transportation regulations.
39. Marking of equipment using signs should comply with local regulations.
40. Disposal of equipment using flammable refrigerants should comply with national regulations.
41. Storage of equipment/appliances should be in accordance with the manufacturer's instructions.
42. Storage of packed (unsold) equipment should be constructed so that mechanical damage to the equipment inside the package will not cause a leak of the refrigerant charge. The maximum number of pieces of equipment permitted to be stored together will be determined by local regulations.
43. During the evacuation test, after achieving a vacuum level specified in the manual or less, the refrigeration system shall be isolated from the vacuum pump and the pressure shall not rise above 1500 microns within 10 minutes. The vacuum pressure level should be specified in the manual, and should be the lessor of 500 microns of the value required for compliance with national and local codes and standards, which may vary between residential, commercial, and industrial buildings.
    - Field-made refrigerant joints indoors should be tightness-tested according to the following requirements: the test method should have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak should be detected.
    - Any servicing should be performed only as recommended by MRCOOL®.
43. Any maintenance, service, or repair operations must be performed by qualified personnel. Every working procedure that affects safety should only be carried out by competent persons that are both trained and certified. The training of these procedures should be carried out by national training organizations or manufacturers that are accredited to teach the relevant national competency standards that may be set in legislation. All training should follow the ANNEX HH requirements of UL 60334-2-40 4th Edition.

    Examples of such working procedures are:
    - breaking into a refrigerant circuit
    - opening of sealed components
    - opening of ventilated enclosures

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

2 SPECIFICATIONS

2.1 Model Reference

Outdoor Unit Model	Capacity (Btu/h)	Power Supply
O-ES-09-HP-C-230C-O1	9K	1Ph, 208/230V~, 60Hz
O-ES-12-HP-C-230C-O1	12K	
O-ES-18-HP-C-230C-O1	18K	
O-ES-24-HP-C-230C-O1	24K	

2.2 External Appearance

9/12K

18K

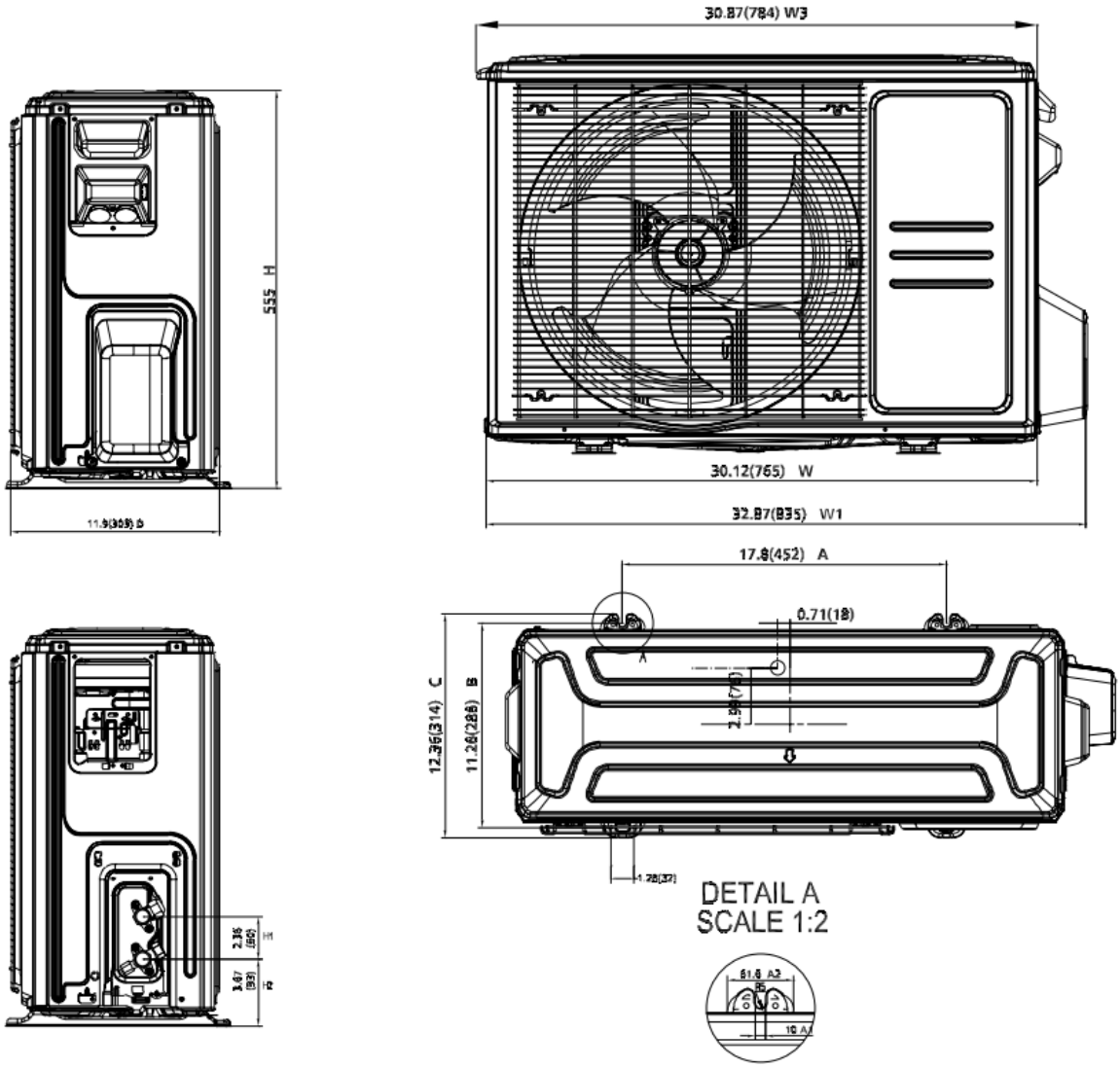
24K

2.3 Dimensional Drawing

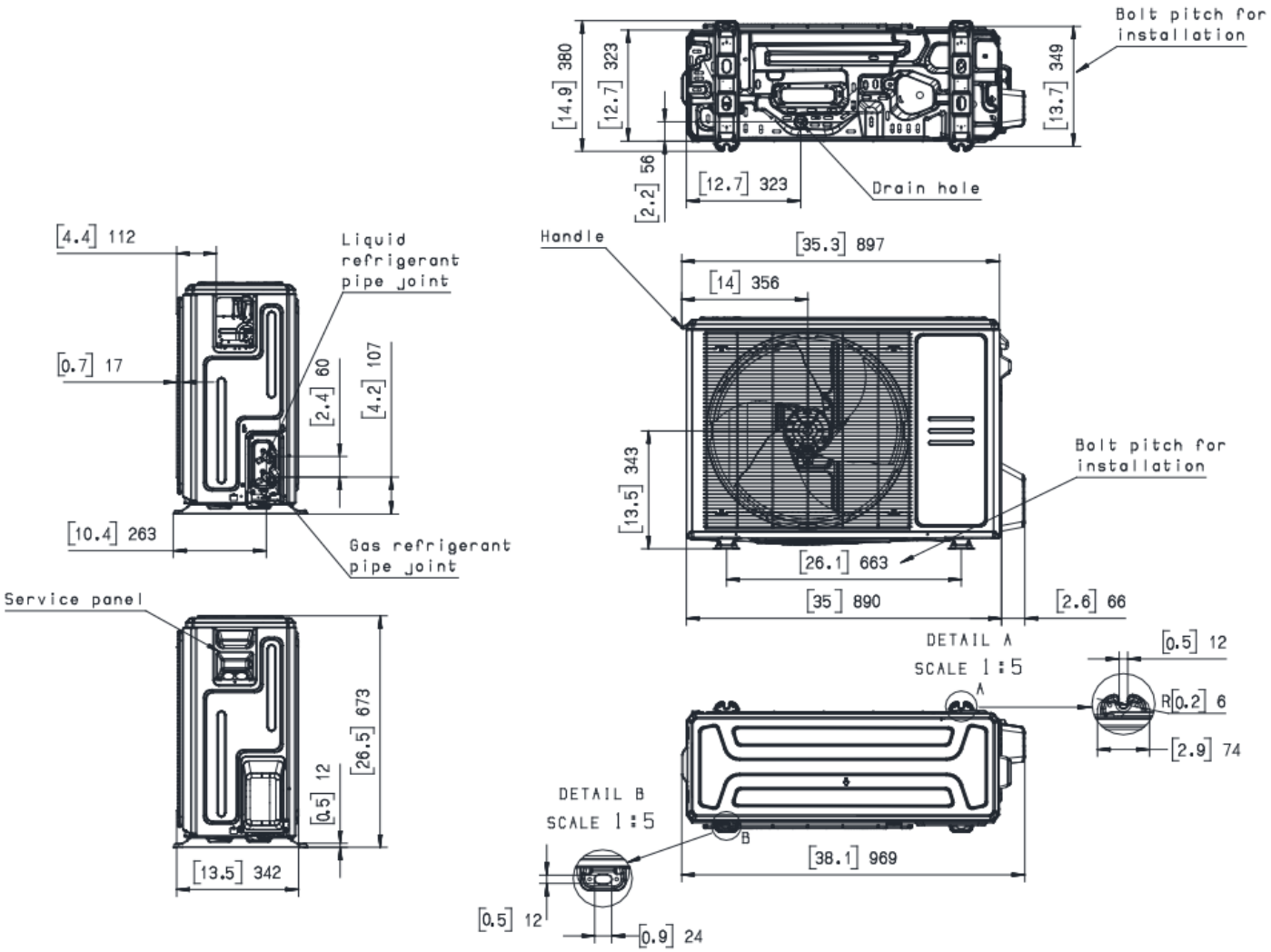
Please check the corresponding dimensional drawing according to the panel plate.

Outdoor Unit Model	Panel Plate
O-ES-09-HP-C-230C-O1	X230
O-ES-12-HP-C-230C-O1	X230
O-ES-18-HP-C-230C-O1	X430
O-ES-24-HP-C-230C-O1	D30

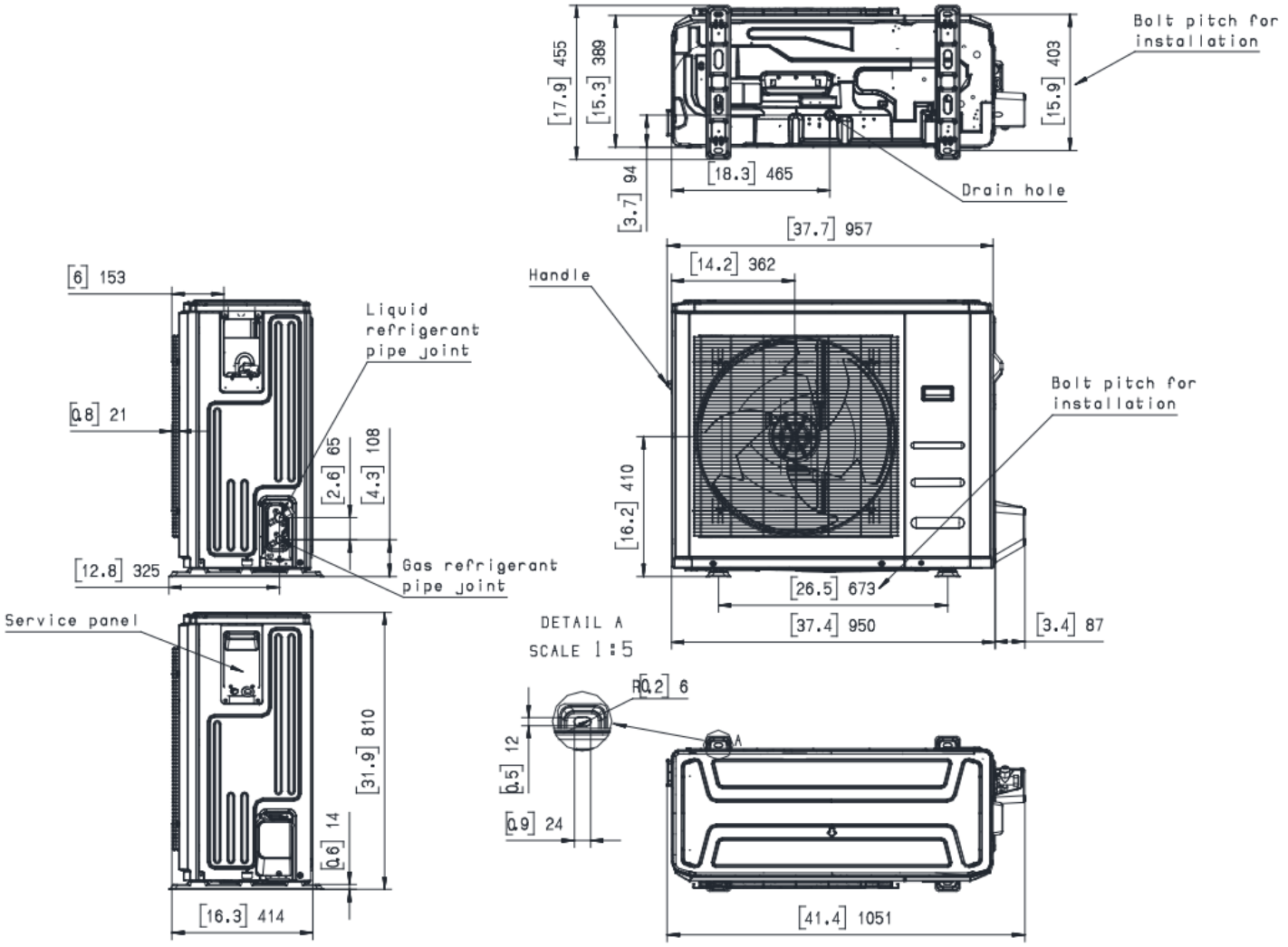
X230 Platform



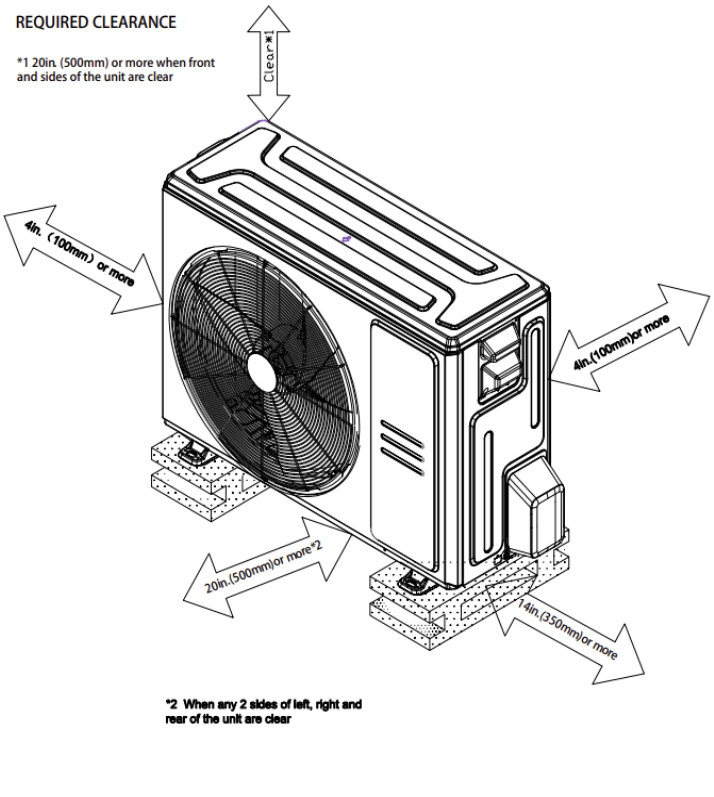
X430 Platform

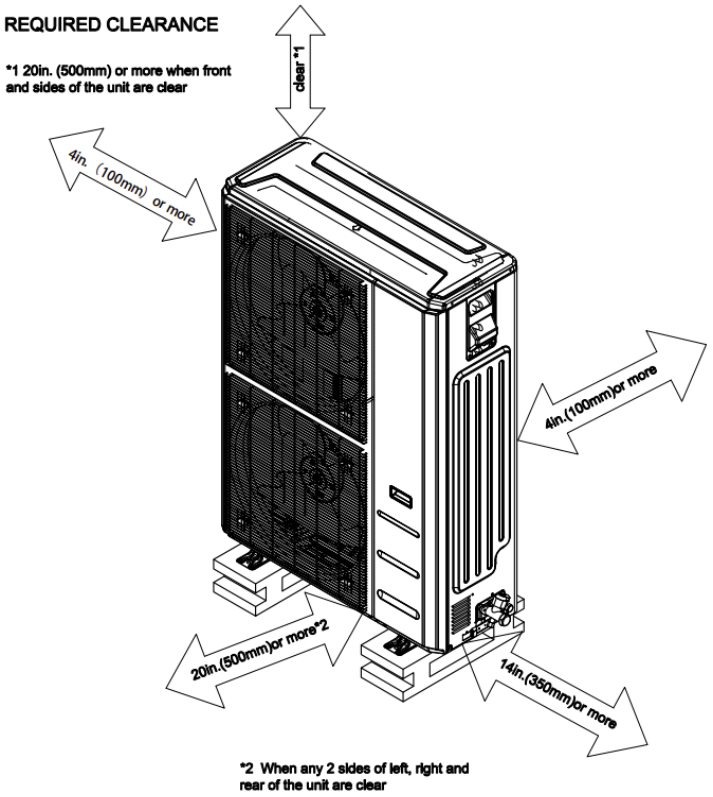


D30 Platform



2.4 Install Location





2.5 Line Set Height Difference

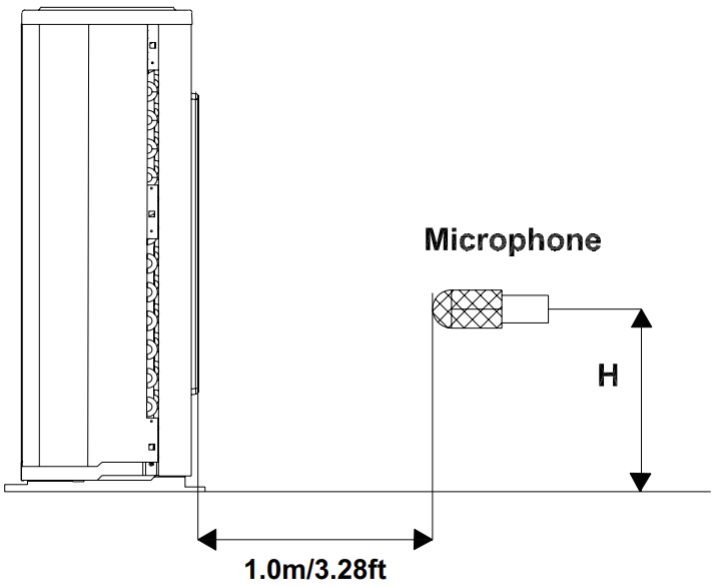
Capacity (Btu/h)	9K		Pipe Length (ft/m)			
Cooling			24.6/7.5	32.8/10	65.6/20	82/25
Height Difference H (ft/m)	Indoor Higher Than Outdoor	15/49.2			0.975	0.911
		32.8/10		0.985	0.985	0.920
		16.4/5	0.995	0.995	0.995	0.929
		0	1.000	1.000	1.000	0.934
	Outdoor Higher Than Indoor	-16.4/-5	1.000	1.000	1.000	0.934
		-32.8/-10		1.000	1.000	0.934
		-15/-49.2			1.000	0.934
Heating			24.6/7.5	32.8/10	65.6/20	82/25
Height Difference H (ft/m)	Indoor Higher Than Outdoor	15/49.2			1.000	0.956
		32.8/10		1.000	1.000	0.956
		16.4/5	1.000	1.000	1.000	0.956
		0	1.000	1.000	1.000	0.956
	Outdoor Higher Than Indoor	-16.4/-5	0.992	0.992	0.992	0.948
		-32.8/-10		0.984	0.984	0.941
		-15/-49.2			0.976	0.933

Capacity (Btu/h)	12K		Pipe Length (ft/m)			
Cooling			24.6/7.5	32.8/10	65.6/20	82/25
Height Difference H (ft/m)	Indoor Higher Than Outdoor	15/49.2			0.975	0.932
		32.8/10		0.985	0.985	0.942
		16.4/5	0.995	0.995	0.995	0.951
		0	1.000	1.000	1.000	0.956
	Outdoor Higher Than Indoor	-16.4/-5	1.000	1.000	1.000	0.956
		-32.8/-10		1.000	1.000	0.956
		-15/-49.2			1.000	0.956
Heating			24.6/7.5	32.8/10	65.6/20	82/25
Height Difference H (ft/m)	Indoor Higher Than Outdoor	15/49.2			0.981	0.974
		32.8/10		0.994	0.981	0.974
		16.4/5	1.000	0.994	0.981	0.974
		0	1.000	0.994	0.981	0.974
	Outdoor Higher Than Indoor	-16.4/-5	0.992	0.986	0.973	0.966
		-32.8/-10		0.978	0.965	0.958
		-15/-49.2			0.957	0.951

Capacity (Btu/h)	18K		Pipe Length (ft/m)			
Cooling			24.6/7.5	32.8/10	65.6/20	98.4/30
Height Difference H (ft/m)	Indoor Higher Than Outdoor	65.6/20			0.941	0.919
		32.8/10		0.974	0.951	0.928
		16.4/5	0.995	0.983	0.960	0.937
		0	1.000	0.988	0.965	0.942
	Outdoor Higher Than Indoor	-16.4/-5	1.000	0.988	0.965	0.942
		-32.8/-10		0.988	0.965	0.942
		-65.6/-20			0.965	0.942
Heating			24.6/7.5	32.8/10	65.6/20	98.4/30
Height Difference H (ft/m)	Indoor Higher Than Outdoor	65.6/20			0.987	0.978
		32.8/10		0.996	0.987	0.978
		16.4/5	1.000	0.996	0.987	0.987
		0	1.000	0.996	0.987	0.978
	Outdoor Higher Than Indoor	-16.4/-5	0.992	0.988	0.979	0.970
		-32.8/-10		0.980	0.971	0.962
		-65.6/-20			0.963	0.955

Capacity (Btu/h)	24K		Pipe Length (ft/m)					
Cooling			24.6/7.5	32.8/10	65.6/20	98.4/30	131.20/40	164/50
Height Difference H (ft/m)	Indoor Higher Than Outdoor	82/25				0.917	0.898	0.879
		65.6/20			0.946	0.926	0.907	0.887
		32.8/10		0.975	0.955	0.936	0.916	0.896
		16.4/5	0.995	0.985	0.965	0.945	0.925	0.905
		0	1.000	0.990	0.970	0.950	0.930	0.910
	Outdoor Higher Than Indoor	-16.4/-5	1.000	0.990	0.970	0.950	0.930	0.910
		-32.8/-10		0.990	0.970	0.950	0.930	0.910
		-65.6/-20			0.970	0.950	0.930	0.910
		-82/-25				0.950	0.930	0.910
Heating			24.6/7.5	32.8/10	65.6/20	98.4/30	131.2/40	164/50
Height Difference H (ft/m)	Indoor Higher Than Outdoor	82/25				0.984	0.978	0.972
		65.6/20			0.991	0.984	0.978	0.972
		32.8/10		0.997	0.991	0.984	0.978	0.972
		16.4/5	1.000	0.997	0.991	0.984	0.978	0.972
		0	1.000	0.997	0.991	0.984	0.978	0.972
	Outdoor Higher Than Indoor	-16.4/-5	0.992	0.989	0.983	0.977	0.970	0.964
		-32.8/-10		0.981	0.975	0.969	0.963	0.957
		-65.6/-20			0.967	0.961	0.955	0.949
		-82/-25				0.953	0.947	0.941

2.6 Noise Curves



Note: H= 0.5 × height of outdoor unit

Notes:

-Sound is measured at 3.25ft/1.0m away from the center of the unit.

-Data is valid at free field condition.

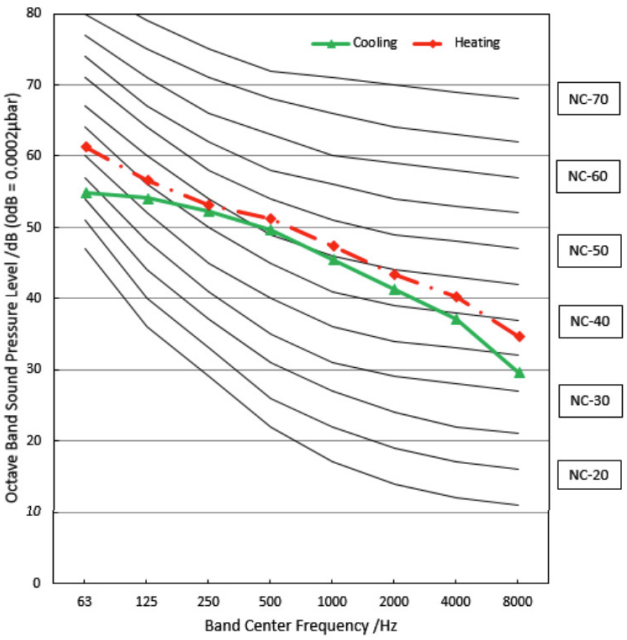
-Data is valid at nominal operation condition.

-Reference acoustic pressure 0db=20μPa.

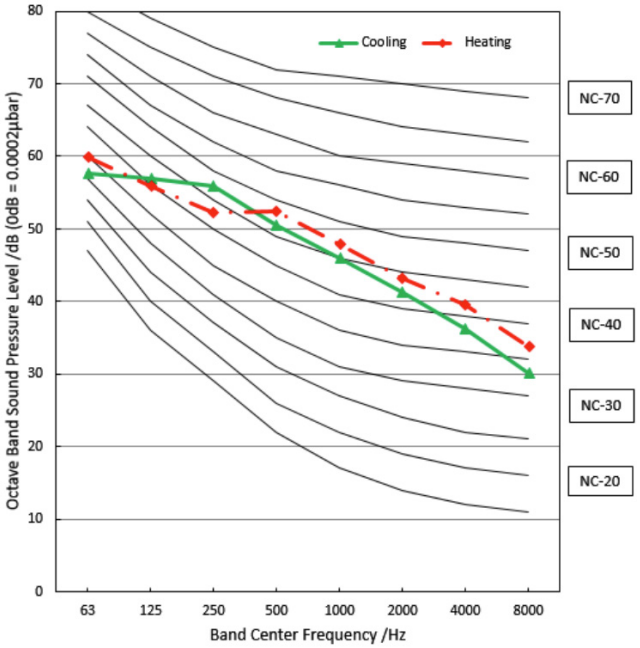
-The sound level will vary depending on arrange off factors as the construction (acoustic absorption coefficient) of the room in which the equipment is installed.

-The operating conditions are assumed to be standard.

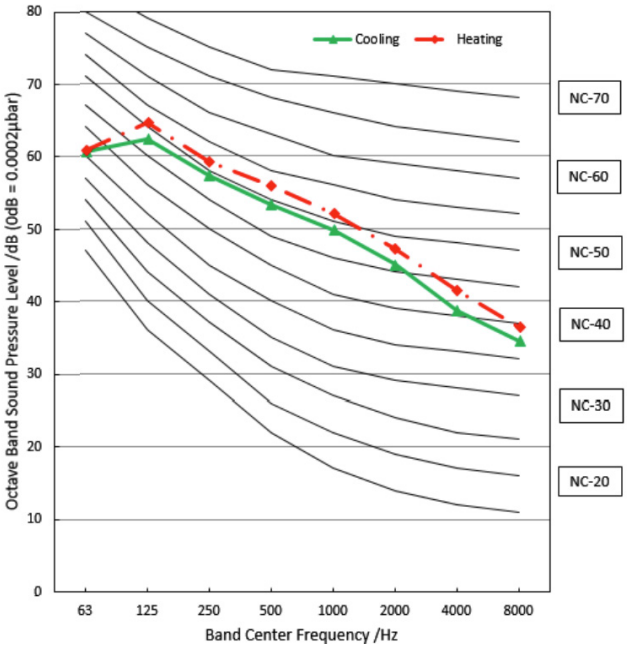
O-ES-09-HP-C-230C-O1



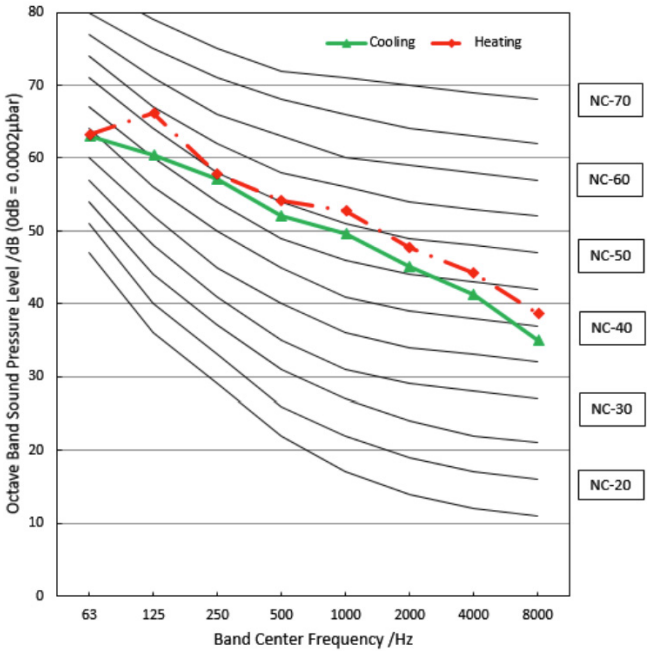
O-ES-12-HP-C-230C-O1



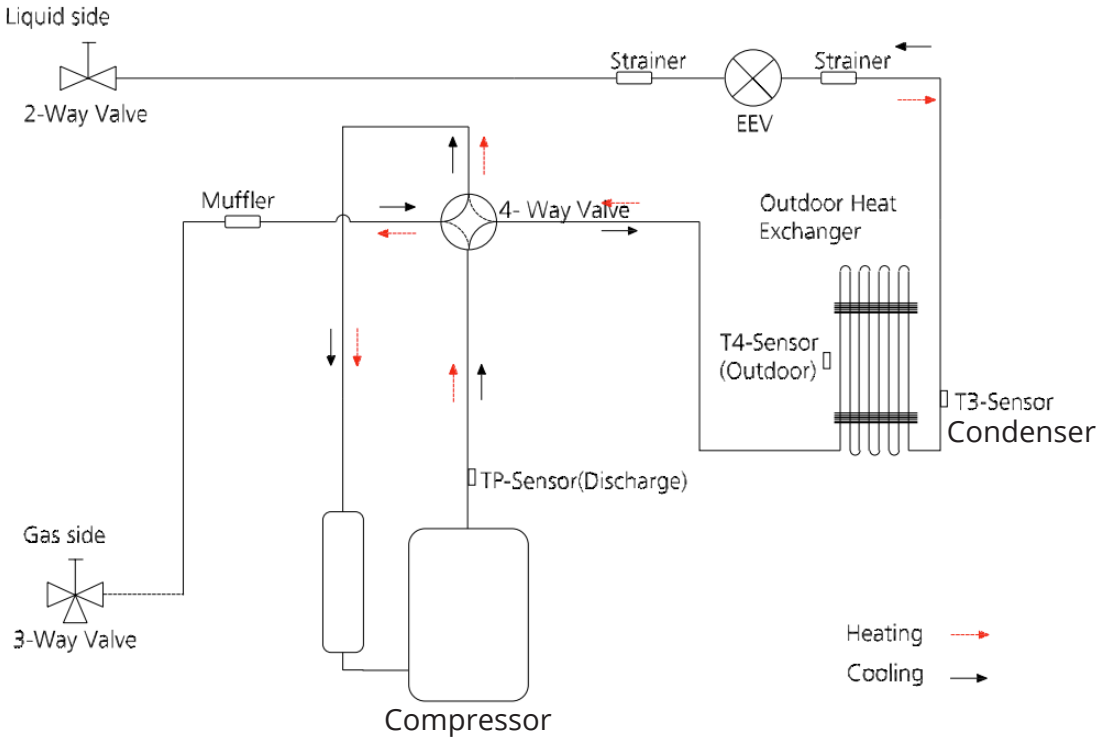
O-ES-18-HP-C-230C-O1



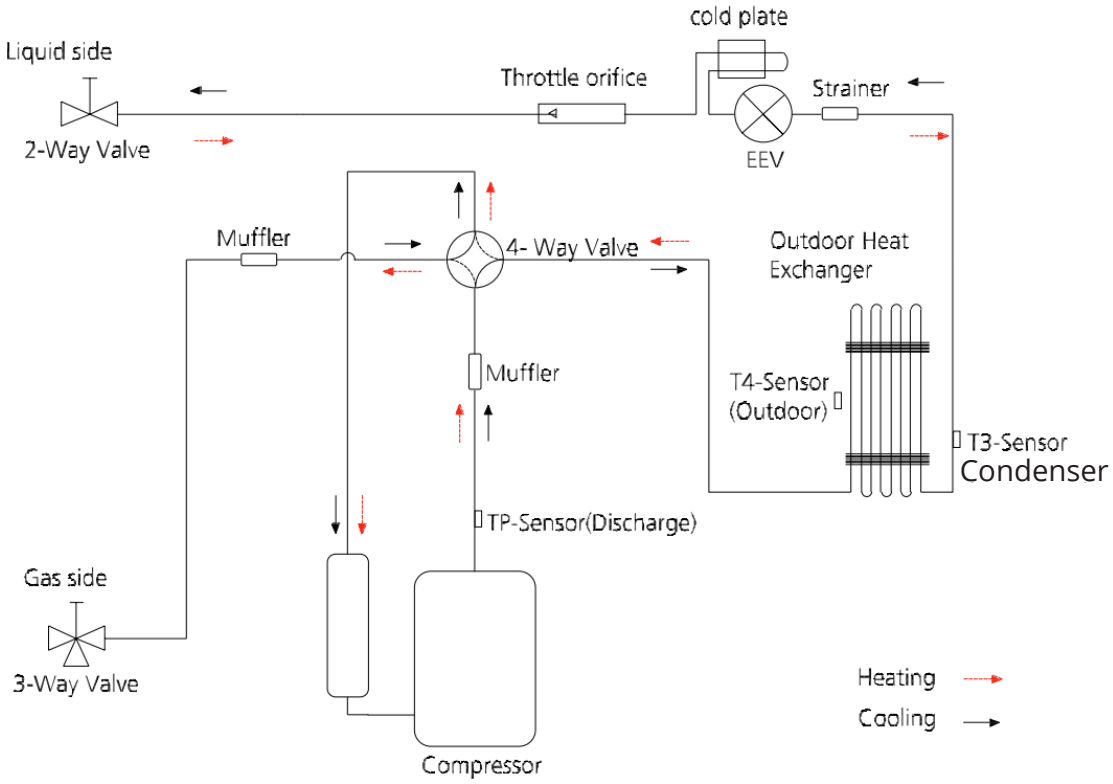
O-ES-24-HP-C-230C-O1



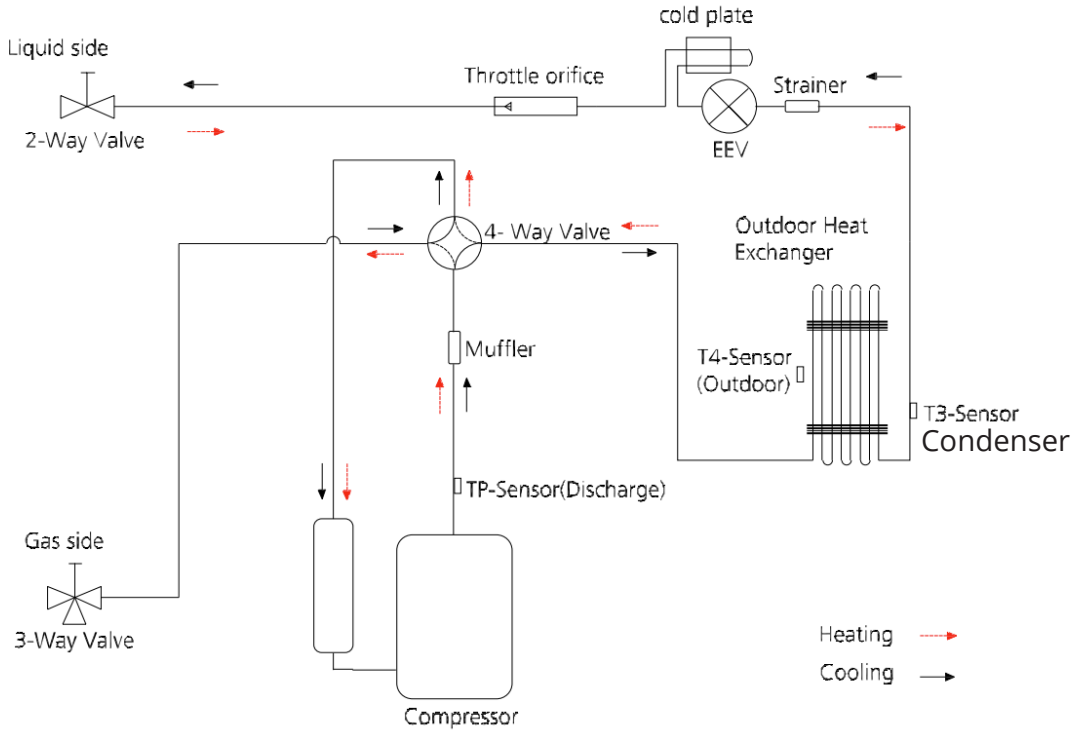
2.7 Refrigerant Cycle Diagrams



Model No.	Pipe Size (Diameter:Ø) inch(mm)		Piping Length (ft/m)		Elevation (ft/m)		Additional Refrigerant
	Gas	Liquid	Rated	Max.	Rated	Max	
O-ES-09-HP-C-230C-O1	3/8(9.52)	1/4(6.35)	24.6/7.5	82/25	0	49.2/15	0.16oz/ft (15g/m)
O-ES-12-HP-C-230C-O1							



Model No.	Pipe Size (Diameter:Ø) inch(mm)		Piping Length (ft/m)		Elevation (ft/m)		Additional Refrigerant
	Gas	Liquid	Rated	Max.	Rated	Max	
O-ES-18-HP-C-230C-O1	1/2(12.7)	1/4(6.35)	24.6/7.5	98.4/30	0	65.6/20	0.16oz/ft (15g/m)

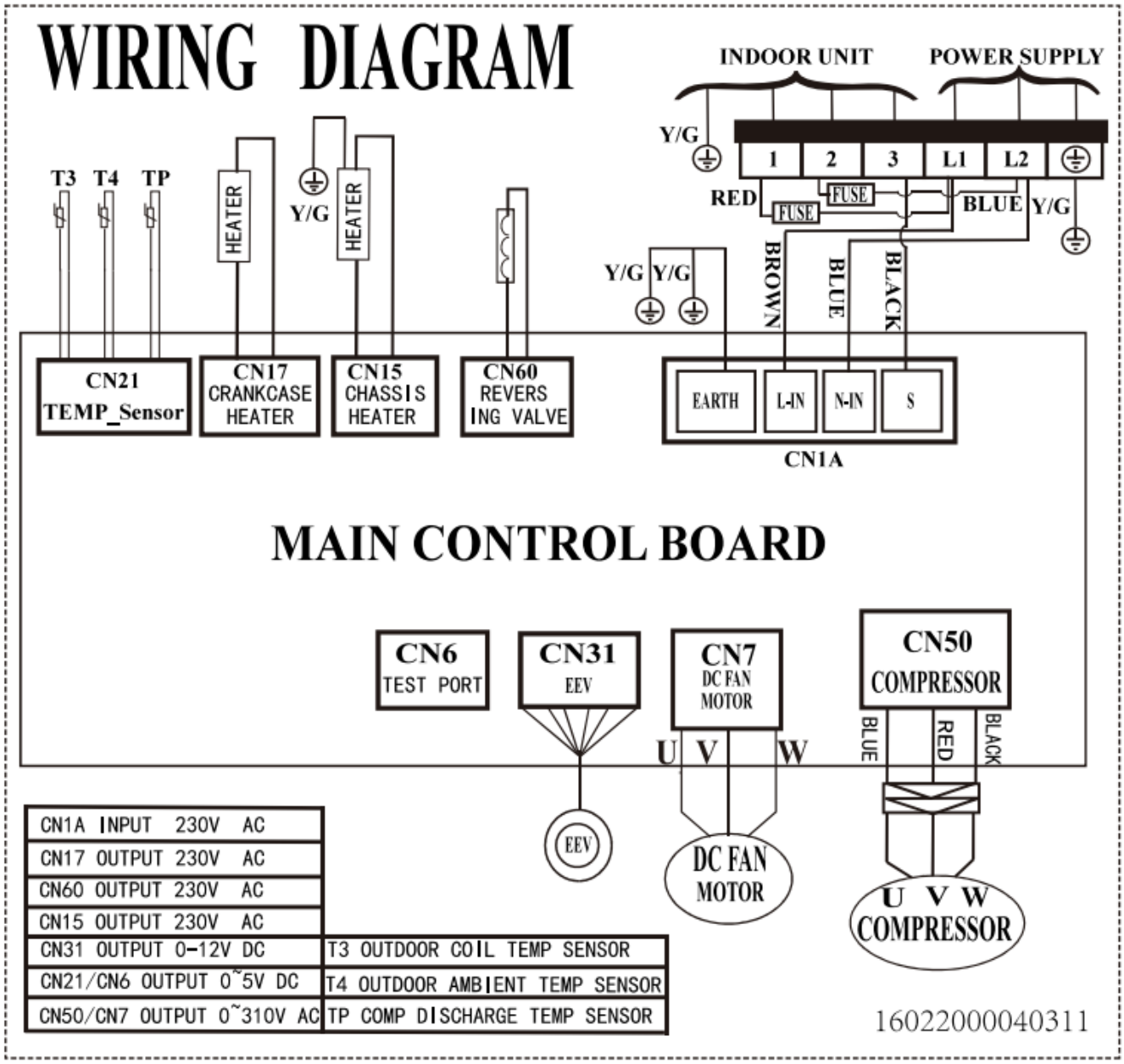


Model No.	Pipe Size (Diameter:Ø) inch(mm)		Piping Length (ft/m)		Elevation (ft/m)		Additional Refrigerant
	Gas	Liquid	Rated	Max.	Rated	Max	
O-ES-24-HP-C-230C-O1	5/8(16)	3/8(9.52)	24.6/7.5	164/50	0	82/25	0.32oz/ft (30g/m)

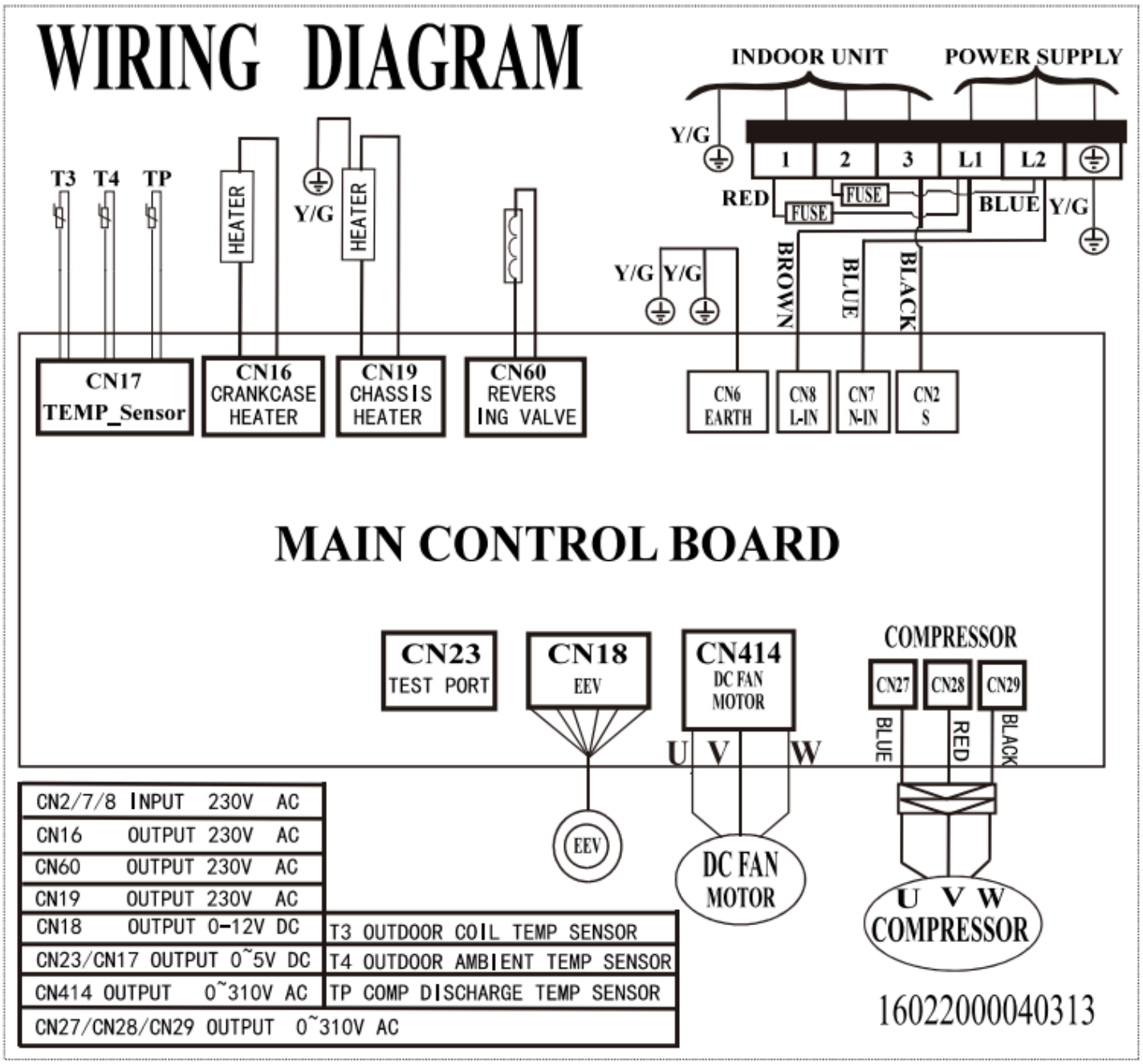
2.8 Electrical Wiring Diagrams

ODU Model	ODU Wiring Diagram	ODU Main Printed Circuit Board
O-ES-09-HP-C-230C-O1	16022000040311	17122000057661
O-ES-12-HP-C-230C-O1		
O-ES-18-HP-C-230C-O1	16022000040313	17122000048066
O-ES-24-HP-C-230C-O1		17122000048064

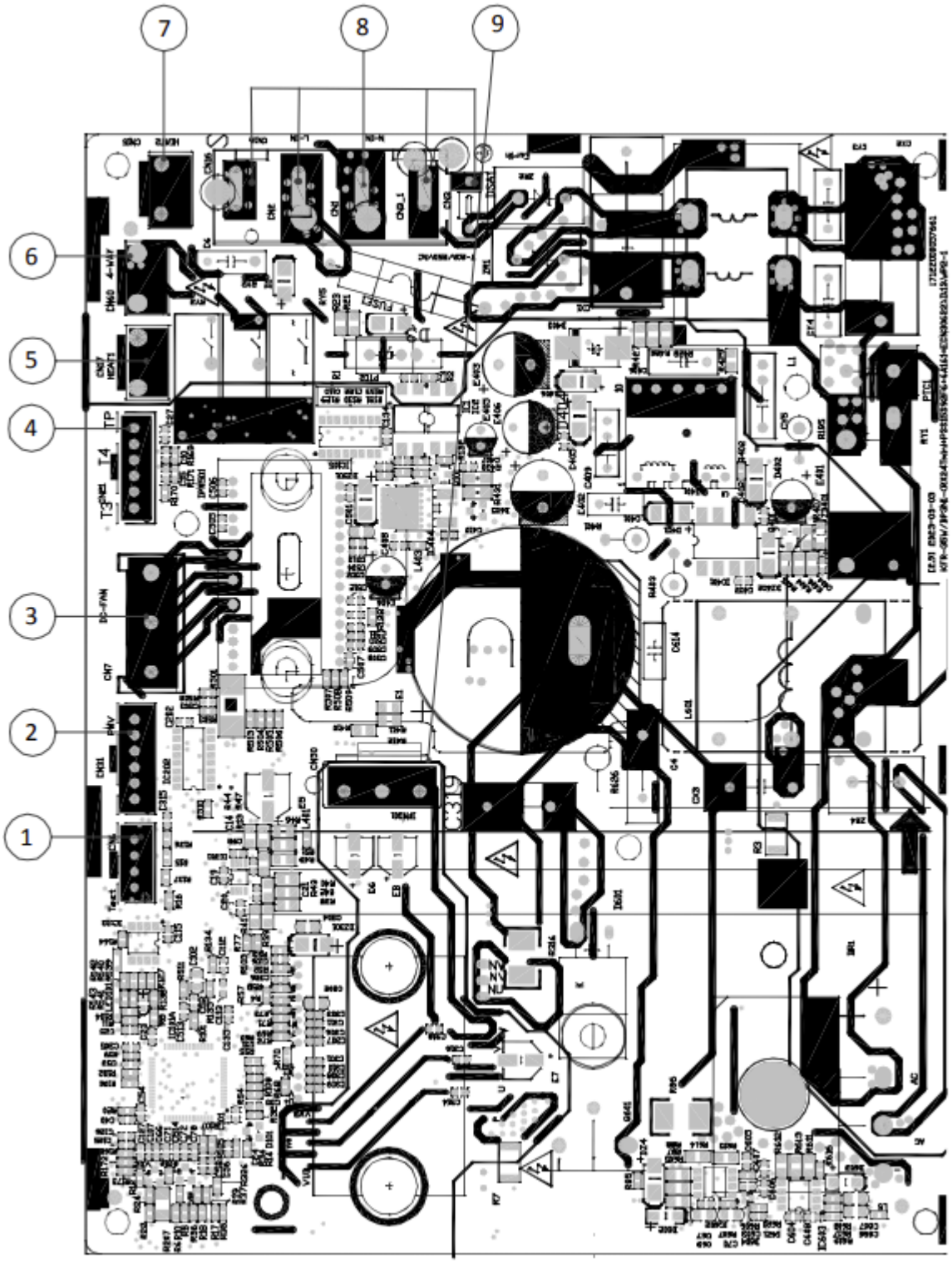
Outdoor Unit Wiring Diagram: 16022000040311



Outdoor Unit Wiring Diagram: 16022000040313



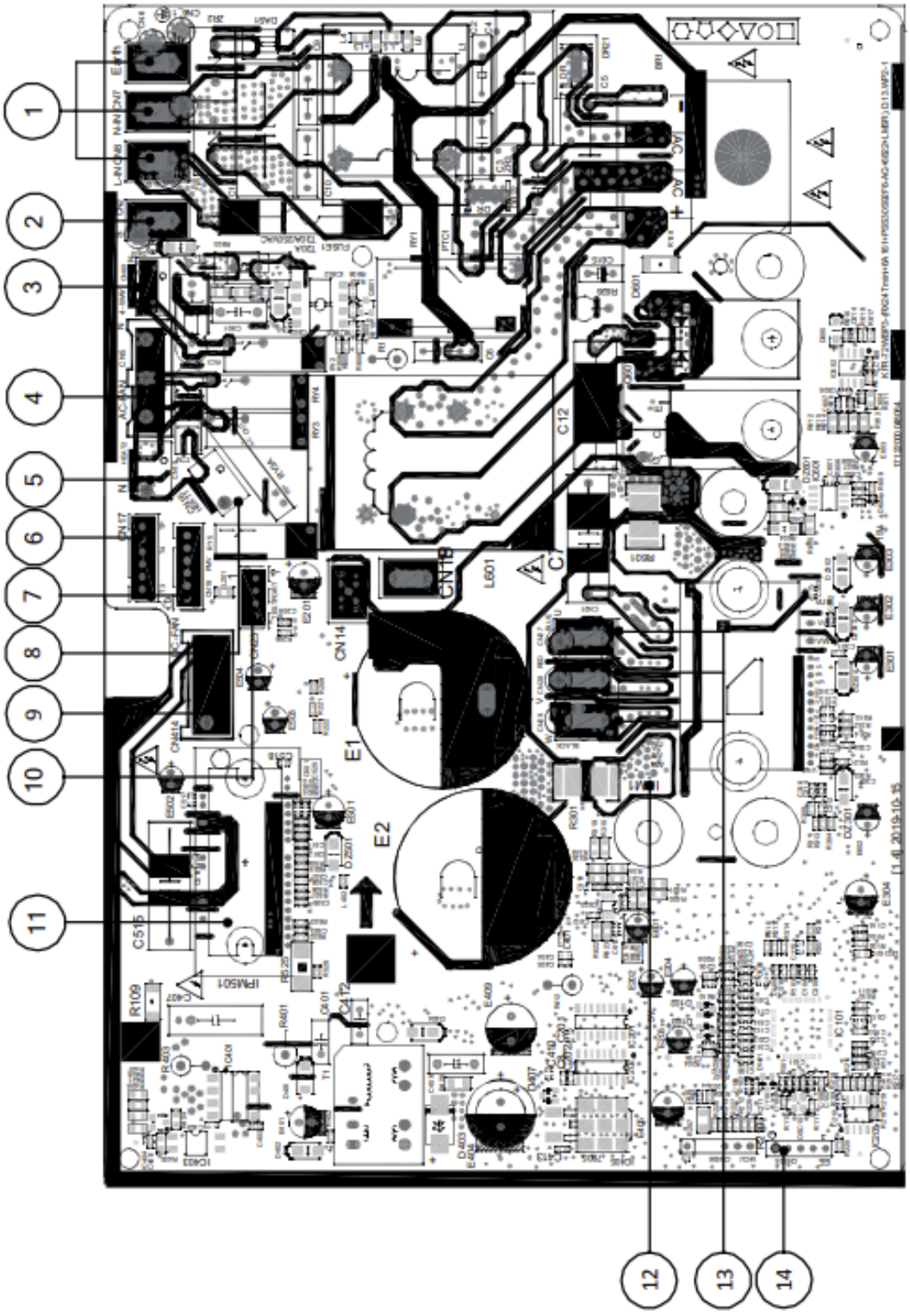
Outdoor Unit Wiring Diagram: 17122000057661



No.	Name	NC#	Meaning
1	TESTPORT	NC6	Used for testing
2	PMV	CN31	Connects to electric expansion valve (Output: 0~20VDC)
3	DC-FAN	CN7	Connects to DC fan (Output: 0~310VAC)
4	TP T4 T3	CN31	Connects to pipe temp. sensor T3, Ambient Temp. sensor T4, exhaust temp. sensor TP (Output: 0~5VDC)
5	HEAT1	CN17	Connects to compressor heater (Output: 230VAC)
6	4-WAY	CN60	Connects to 4 way valve (Output: 230VAC)
7	HEAT2	CN15	Connects to chassis heater (Output: 230VAC)
8	CN1A	CN16	S: Connects to indoor unit communication
		CN2	L_in: Connects to L-line (230VAC input)
		CN1	N_in: Connects to N-line (230VAC input)
		CN3	Earth
9	CN50	W	Connects to compressor (Output: 0~310VAC)
		V	
		U	

Note: This section is for reference only. Please take practicality as standard.

Outdoor Unit Wiring Diagram: 17122000048064 & 17122000048066



No.	Name	NC#	Meaning
1	Power Supply	CN6	Earth: Connects to ground
		CN7	N_in: Connects to N-line (230VAC input)
		CN8	L_in: Connects to L-line (230VAC input)
2	S	CN2	S; Connects to indoor unit communication (230VAC input)
3	4-WAY	CN60	Connects to 4 way valve (Output: 230VAC)
4	AC-FAN	CN5	Connects to AC fan
5	HEAT2	CN18	Connects to chassis heater (Output: 230VAC)
6	TP T4 T3	CN17	Connects to pipe temp. sensor T3, ambient temp. sensor T4, exhaust temp. sensor TP (Output: 0~5VDC)
7	PMV	CN18	Connects to electric expansion valve
8	HEAT1	CN16	Connects to compressor heater (Output: 230VAC)
9	DC-FAN	CN414	Connects to DC fan (Output: 230VAC)
10	TESTPORT	CN23	Used for testing
11	FAN_IPM	IPM501	IPM for DC fan
12	COMP_IPM	IPM1	IPM for compressor
13	U	CN27	Connects to compressor (Output: 0~310VAC)
	V	CN28	
	W	CN29	
14	EE_PORT	CN505	EEPROM programmer port

Note: This section is for reference only. Please take practicality as standard.

3.1 Accessories

Name	Shape	Quantity
Drain Joint		1
Seal		1

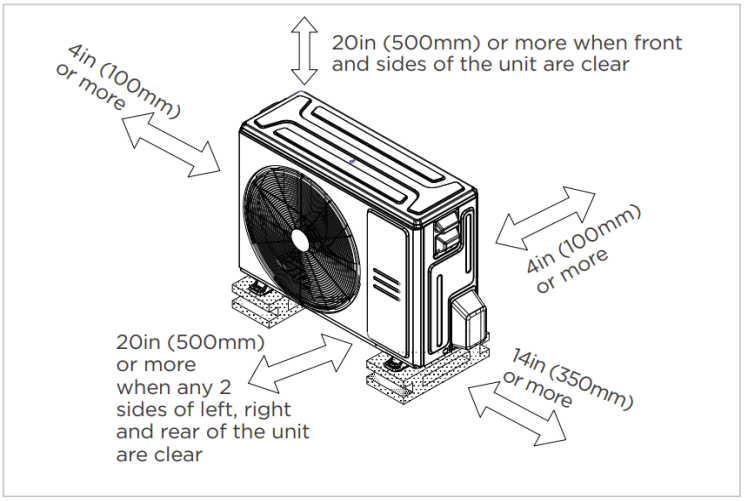
3.2 Location Selection

-For unit location selection refer to the installation manual.

DO NOT install the unit in the following locations:

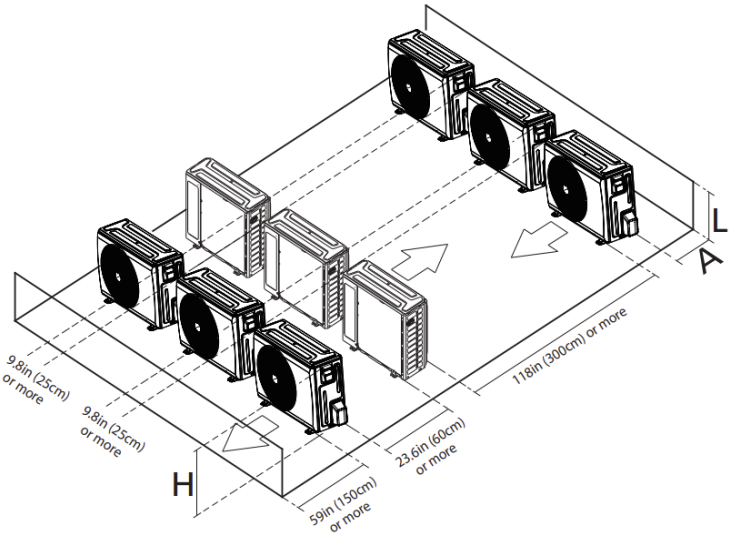
- Near an obstacle that will block air inlets and outlets.
- Near a public street, crowded areas, or where noise from the unit will disturb others.
- Near animals or plants that will be harmed by hot air discharge.
- Near any source of combustible gas.
- In a location that is exposed to large amounts of dust.
- In a location exposed to excessive amounts of salty air.

Meet all requirements shown in the Installation Clearance Requirements below.



Rows of Series Installation:

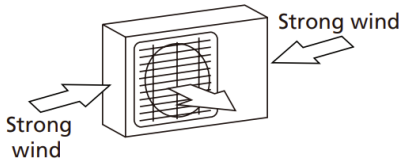
	L	A
L≤H	L≤1/2H	9.8in (25cm) or more
	1/2H<L≤H	11.8in (30cm) or more
L>H	Cannot be installed	

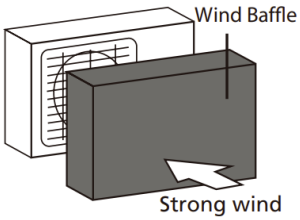


Note:
H: Unit Height
L: Height of the wall behind the unit
A: Distance between the unit and the wall

If the unit is exposed to heavy wind:

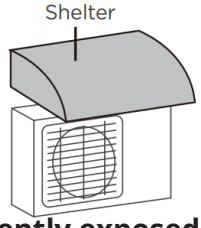
- Install the unit so that the air outlet fan is at a 90° angle to the direction of the wind. If needed, build a barrier in front of the unit to protect it from extremely heavy winds.





If the unit is frequently exposed to heavy rain or snow:

- Build a shelter above the unit to protect it from the rain or snow. Be careful not to obstruct air flow around the unit.



If the unit is frequently exposed to salty air (seaside):

- Use an outdoor unit that is specially designed to resist corrosion.

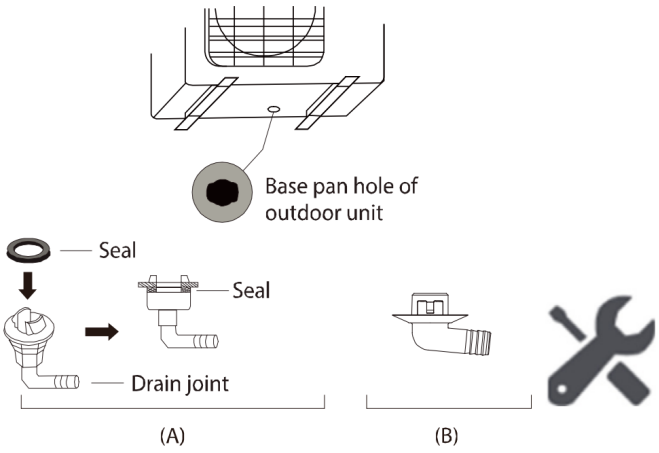
3.3 Outdoor Unit Installation

Installation of Drain Joint:
Before bolting the outdoor unit in place, you must install the drain joint at the bottom of the unit.
Note that there are two different types of drain joints depending on the type of outdoor unit.
If the drain joint comes with a rubber seal (see Fig. A), do the following:

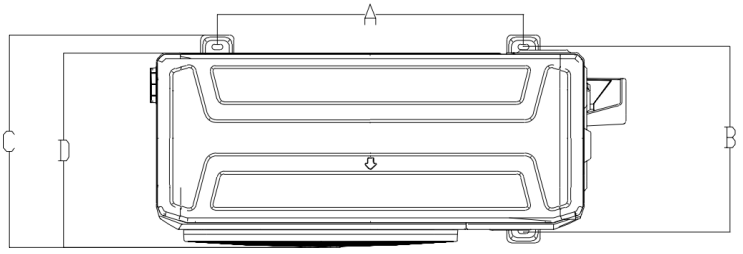
1. Fit the rubber seal on the end of the drain joint that will connect to the outdoor unit.
2. Insert the drain joint into the hole in the base pan of the unit.
3. Rotate the drain joint 90° until it clicks in place facing the front of the unit. *For some panel plates, you need to use a tool.*
4. Connect a drain hose extension (not included) to the drain joint to redirect water from the unit during heating mode.

If the drain joint doesn't come with a rubber seal (see Fig. B), do the following:

1. Insert the drain joint into the hole in the base pan of the unit. The drain joint will click into place.
2. Connect a drain hose extension (not included) to the drain joint to redirect water from the unit during heating mode.



Anchor Outdoor Unit:
The outdoor unit can be anchored to the ground or to a wall-mounted bracket with bolt (M10). Prepare the installation base of the unit according to the dimensions in the next column.
The following is a list of different outdoor unit sizes and the distance between their mounting feet.



Panel Plate	Unit	D	A	B	C
X2	inch	11.93	17.80	11.26	12.36
	mm	303	452	286	314
X4	inch	13.46	26.1	13.94	15.5
	mm	642	663	354	394
D30	inch	16.14	26.50	15.87	17.9
	mm	410	673	403	455

3.4 Refrigerant Pipe Installation

Maximum Length and Drop Height:
Ensure that the length of the refrigerant pipe, the number of bends, and the drop height between the indoor and the outdoor units meet the requirements shown in the following table.

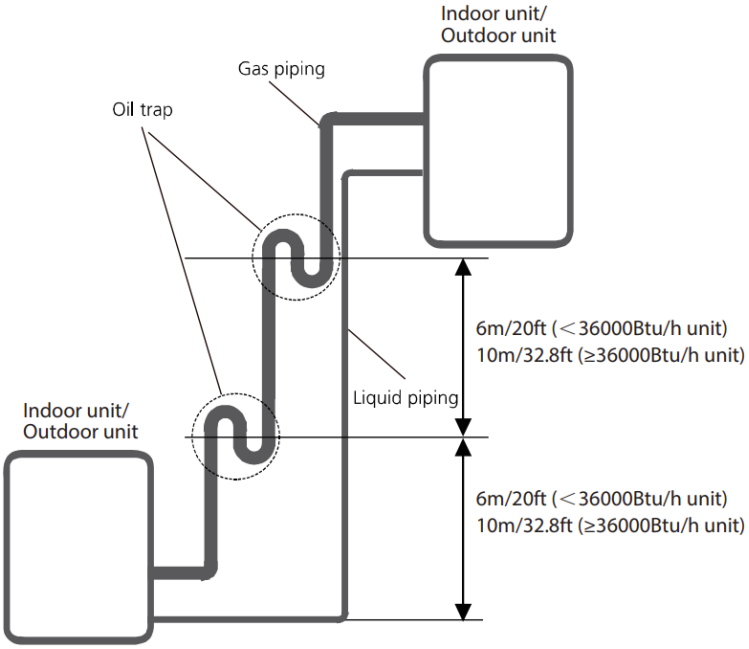
Current Loop

Capacity (kBtu/h)	Max. Length (ft/m)	Max. Elevation (ft/m)
9/12K	82/25	49.2/15
18K	98.4/30	65.6/20
24	164/50	82/25

! CAUTION

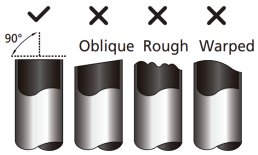
1. The capacity test is based on the standard length and the maximum permissive length is based on the system reliability.
2. Oil traps

- If oil flows back into the outdoor unit's compressor, this might cause liquid compression or deterioration of oil return. Oil traps in the rising gas piping can prevent this.
- An oil trap should be installed every 20ft(6m) of vertical suction line riser (<36KBtu/h unit).
- An oil trap should be installed every 32.8ft(10m) of vertical suction line riser (≥36KBtu/h unit).

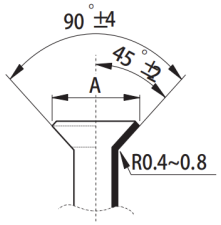


Procedure of Connecting Pipes:

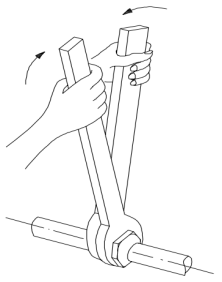
1. Choose the pipe size according to the specification table.
2. Confirm the cross way of the pipes.
3. Measure the necessary pipe length.
4. Cut the selected pipe with a pipe cutter.
   - Make the section flat and smooth.



5. Insulate the copper pipe.
   - Before test operation, the joint parts should not be heat insulated.
6. Flare the pipe.
   - Insert a flare nut into the pipe before flaring the pipe according to the following table.

Pipe Diameter (inch(mm))	Flare Dimension A		Flare Shape
	Min.	Max.	
Ø1/4 (Ø6.35)	0.33/8.4	0.34/8.7	
Ø3/8(Ø9.52)	0.52/13.2	0.53/13.5	
Ø1/2(Ø12.7)	0.64/16.2	0.65/16.5	
Ø5/8(Ø15.9)	0.76/19.2	0.78/19.7	
Ø3/4(Ø19)	0.91/23.2	0.93/23.7	
Ø7/8(Ø22)	1.04/26.4	1.06/26.9	

   - After flaring the pipe, the opening end must be sealed to avoid dust or impurities from coming into the piping.
7. Drill holes if the pipes need to pass through the wall.
8. If needed bend the pipes slowly to pass through the wall.
9. Bind and wrap the wire together with the insulated pipes if necessary.
10. Set the wall conduit.
11. Set the supporter for the pipe.
12. Locate the pipe and fix it by the supporter.
    - For horizontal refrigerant pipe, the distance between supporters should not exceed 3.2ft (1m).
    - For vertical refrigerant pipe, the distance between supports should not exceed 4.9ft (1.5m).
13. Connect the pipe to the indoor and outdoor unit by using two crescent wrenches.
    - Be sure to use two crescent wrenches and proper torque to fasten the nut, too much torque will damage the bell housing, and too little of torque can cause leakage. **Refer to the following table for different pipe connections.**

Pipe Diameter (inch(mm))	Torque N.m (lb.ft)	Flare Shape
Ø1/4 (Ø6.35)	18~20 (13.3~14.8)	
Ø3/8(Ø9.52)	32~39 (23.6~28.8)	
Ø1/2(Ø12.7)	49~59 (36.1~43.5)	
Ø5/8(Ø15.9)	57~71 (42~52.4)	
Ø3/4(Ø19)	67~101 (49.4~74.5)	
Ø7/8(Ø22)	85~110 (62.7~81.1)	

3.4 Vacuum Drying & Leak Checks

The Purpose of Vacuum Drying:

- Eliminating moisture in the system to prevent the formation of ice-blockage and copper oxidation which can damage the compressor.
- Eliminating non-condensible gas (air) in the system prevents the components from oxidizing, pressure fluctuation, and poor heat exchange during the operation of the system.

Selection of a Vacuum Pump:

- The maximum vacuum degree of a pump shall be -756mmHg or above.
- Precision of a vacuum pump shall reach 0.02mmHg or above.

Operation Procedure for Evacuation:

- Due to different construction environments two ways of evacuation can be done, ordinary evacuation and special evacuation.

Ordinary Evacuation:

- When conducting the first evacuation, connect your gauges to the gas and liquid pipe and run the vacuum pump for 1 hour (the degree of the vacuum pump shall be reached -755mmHg).
- If the vacuum degree could not reach -755mmHg after 1 hour of running, it indicates that there is moisture or leakage in the pipeline of the system and needs to run for an additional half hour.
- If the vacuum degree still could not reach -755mmHg after and hour and a half of running, check to see if there is a leak in the system.
- Leakage test: After the vacuum degree reaches -755mmHg, stop the pump and let it set for an hour. If the indicator of the vacuum gauge does not go up it is sealed. If the gauge goes up it indicates there is moisture in the system or a leak source.

Special Evacuation:

Special evacuation should be used when:

1. Finding moisture when flushing the refrigerant pipe.
2. Installation on a rainy day (as rain may have entered the pipeline).
3. Installation period is long and rain water may have entered the pipeline.

Procedures of special evacuation are as follows:

1. Vacuuming for one hour.
2. Stop the pump and fill with nitrogen to reach 0.5Kgf/cm^2.
3. Vacuum again for half an hour.

If the pressure reached -775mmHg, start to pressure leak test. If it cannot reach the value vacuum again for 1 hour.

4. Leakage test: After the vacuum degree reaches -755mmHg, stop the pump and let it set for an hour. If the indicator of the vacuum gauge does not go up it is sealed. If the gauge goes up it indicates there is moisture in the system or a leak source.

3.5 Additional Refrigerant Charge

After the vacuuming process is carried out, the additional refrigerant charge process needs to be performed.

The outdoor unit is factory charged with refrigerant. The additional refrigerant charge volume is decided by the diameter and length of the liquid pipe between the indoor and outdoor unit. Refer to the next column for the formula to calculate the charge volume.

	Diameter of Liquid Pipe (inch(mm))	Formula
R454B	Ø1/4(Ø6.35)	V=0.16(15)oz/ft(g/m)x(L-standard pipe length)
	Ø3/8(Ø9.52)	V=0.32(30)oz/ft(g/m)x(L-Standard pipe length)

V: Additional refrigerant charge volume
L: The length of the liquid pipe

NOTE

- Refrigerant may only be added after vacuuming.
- Always use gloves and safety glasses to protect your hands and eyes during charging.
- Use an electronic scale or fluid infusion apparatus to weigh in refrigerant. Be sure to avoid overcharging as it can cause liquid hammering of the compressor.
- Charge the system in a liquid state.
- Before recharging the air in your gauges and lines should be purged.
- After charging check for leaks at joints using an leak detector or soapy water.

3.6 Insulation

Insulation of Refrigerant Pipe:

Cut the pipe—insulation (except joint section)—flare the pipe—piping layout and connection—vacuum—insulate the joining parts

Purpose of Refrigerant Pipe Insulation:

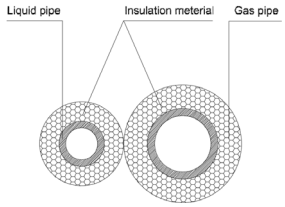
- During operation the temperature of the gas pipe and liquid pipe will be hot/cold. Therefore, it is necessary to install insulation; otherwise it will lower performance or burn up the compressor.
- The gas pipe temperature is low during cooling. If there is insufficient insulation it will condensate and drip.
- The temperature of the gas pipe is high (122°F~212°F(50°C~100°C) during heating. Insulation must be installed to prevent burns.

Insulation Material Selection for Refrigerant Pipe:

- The insulation rating should be over 248°F (120°C).
- Choose insulation according to local codes and ordnances.
- The thickness of the insulation should be above 0.39in(10mm). If in a hot or wet environment use thicker insulation.

Installation Highlights:

- The gas and liquid pipe should be insulated separately, if the gas pipe and liquid pipe were insulated together it will decrease the performance of the system.



- The insulation material at the joint pipe should be 1.96in~3.93in(5cm~10cm) longer than the gap of insulation material.
- The insulation material at the joint pipe should be inserted into the gap of the insulation material.
- The insulation material at the joint pipe should be banded to the gap pipe and liquid pipe tightly.
- The a joining part should be glued together.
- Be sure not to bind the insulating material over-tight, it may extrude out the air in the material and cause it to rot.

3.7 Electrical Wiring

Highlights of Electrical Wiring Installation:

- All wiring must comply with local and national electrical codes, regulations, and must be installed by a licensed electrician.
- All electrical connections must be made according to the Electrical Connection Diagram located on the panels of the indoor and outdoor unit.
- If there is a serious safety issue with the power supply, stop work immediately. Explain your reasoning to the client, and refuse to install the unit until the safety issue is properly resolved.
- Power voltage should be within 90~110% of the rated voltage. Insufficient power supply can cause malfunction, electrical shock, or fire.
- Installation of an external surge suppressor at the outdoor disconnect is recommended.
- If connecting power to fixed wiring, a switch or circuit breaker that disconnects all poles and has a contact separation of at least 1/8in(3mm) must be incorporated in the fixed wiring. The qualified technician must use an approved circuit breaker or switch.
- Only connect the unit to an individual branch circuit. Do not connect another appliance to that outlet.
- Make sure to properly ground the air conditioner.
- Every wire must be firmly connected. Loose wiring can cause the terminal to overheat, resulting in product malfunction and possible fire.
- Do not let wires touch or rest against refrigerant tubing, the compressor, or any moving parts within the unit.
- If the unit has an auxiliary electric heater, it must be installed at least 40in(1m) away from any combustible material.
- To avoid electrical shock, never touch the electrical components after the power supply has been turned off. After turning off the power, always wait 10 minutes or more before you touch the electrical components.
- Make sure that you do not cross your electrical wiring with your signal wiring as this may cause distortion, interference, or possibly damage to the circuit boards.
- No other equipment should be connected to the same power circuit.
- Connect the outdoor wires before connecting the indoor wires.

Table: Minimum Cross-Sectional Area of Power and Signal Cables:

Rated Current of Appliance (A)	AWG
≤6	18
6~10	16
10~16	14
16~25	12
25~32	10

Outdoor Unit Wiring:

Before performing any electrical work, turn off the main power to the system.

1. Prepare the cable for connection.
   a. You must first choose the right cable size. Choose the cable type according to the electrical codes and regulations.
   b. The size of the power supply cable, signal cable, fuse, and switch needed is determined by the Minimum Circuit Ampacity of the unit. The Minimum Circuit Ampacity is indicated on the nameplate located on the side panel of the unit. Refer to this nameplate to choose the right cable, fuse, or switch.
   c. Using wire strippers, strip the rubber jacket from both ends of the signal cable to reveal approximately 5.9in(150mm) of wire.
   d. Strip the insulation from the ends.
   e. Using a wire crimper, crimp u-lugs on the ends.

Note: When connecting the wires, strictly follow the wiring diagram found inside the electrical box cover.

2. Remove the 2 screws fixed on the front right panel, then take it down to perform wire connections (for double fan units). Unscrew the big handle and remove it (for single fan outdoor units).
3. Connect the u-lugs to the terminals and match the wire colors/labels with the labels on the terminal block. Firmly screw the u-lug of each wire to its corresponding terminal.
4. Clamp down the cable with the cable clamp.

5. Insulate unused wires with electrical tape. Keep them away from any electrical or metal parts.
6. Reinstall the cover of the electric control box.

3.8 Test Operation

Confirm the following points before the test operation:

- The indoor and outdoor unit are installed properly.
- Piping and wiring are properly connected.
- Be sure that there are no obstacles near the inlet and outlet of the unit that might cause poor performance or product malfunction.
- The refrigeration system does not leak.
- The drainage system is unimpeded and draining to a safe location.
- The heating insulation is properly installed.
- The grounding wires are properly connected.
- The length of the piping and the added refrigerant stow capacity have been recorded.
- Power voltage is the correct voltage for the air conditioner.

! CAUTION

Failure to perform the test run may result in unit damage, property damage, or personal injury.

Test Run Instructions:

1. Open both the liquid and gas stop valves.
2. Turn on the main power switch and allow the unit to warm up.
3. Set the air conditioner to COOL mode and check the following points:

Indoor Unit

- Double check to see if the room temperature is being registered correctly.
- Be sure the manual buttons on the indoor unit work properly.
- Check to see that the drainage system is unimpeded and draining smoothly.
- Be sure there is no vibration or abnormal noise during operation.

Outdoor Unit

- Check to see if the refrigeration system is leaking.
- Make sure there is no vibration or abnormal noise during operation.
- Be sure the wind, noise, and water generated by the unit do not disturb your neighbors or pose a safety hazard.

Drainage Test:

1. Be sure the drainpipe flows smoothly. New buildings should perform this test before finishing the ceiling.
2. Turn on the main power switch and run the air conditioner in COOL mode.
3. Check to see that the water is discharged. It may take up to one minute before the unit begins to drain depending on the drainpipe.
4. Make sure that there are no leaks in any of the piping.
5. Stop the air conditioner. Turn off the main power switch and reinstall the test cover.

4.1 Abbreviation

Unit Element Abbreviations:

Abbreviation	Element
T1	Indoor room temperature
T2	Coil temperature of evaporator
T3	Coil temperature of condenser
T4	Outdoor ambient temperature
TP	Compressor discharge temperature
Tsc	Adjusted setting temperature
CDIFTEMP	Cooling shutdown temperature
HDIFTEMP2	Heating shutdown temperature
TCDE1	Exit defrost temperature 1
TCDE2	Exit defrost temperature 2 (maintain for a period of time)
TIMING_ DEFROST_ TIME	Enter defrost time

In this manual, such as CDIFTEMP, HDIFTEMP2, TCDE1, TCDE2, TIMING_DEFROST_TIME...etc., they are well-setting parameter of EEPROM.

Fan Mode:

When fan mode is activated:

- The outdoor fan and compressor are stopped.

Cooling Mode:

Reach the configured temperature:

1. When the compressor runs continuously for less than 120 minutes.
   - If the following conditions are satisfied, the compressor ceases operation.
     - Calculated frequency(fb) is less than minimum limit frequency(FminC).
     - Compressor runs at FminC more than ten minutes.

- Indoor room temperature(T1) is lower than or equal to (Tsc-CDIFTEMP-0.9°F(0.5°C).

2. When the compressor runs continuously for more than 120 minutes.
   - If the following conditions are satisfied, the compressor ceases operation.
   - Calculated frequency(fb) is less than minimum limit frequency(FminC).
   - Compressor runs at FminC more than 10 minutes.
   - When the indoor room temperature(T1) is lower than or equal to (Tsc-CDIFTEMP).

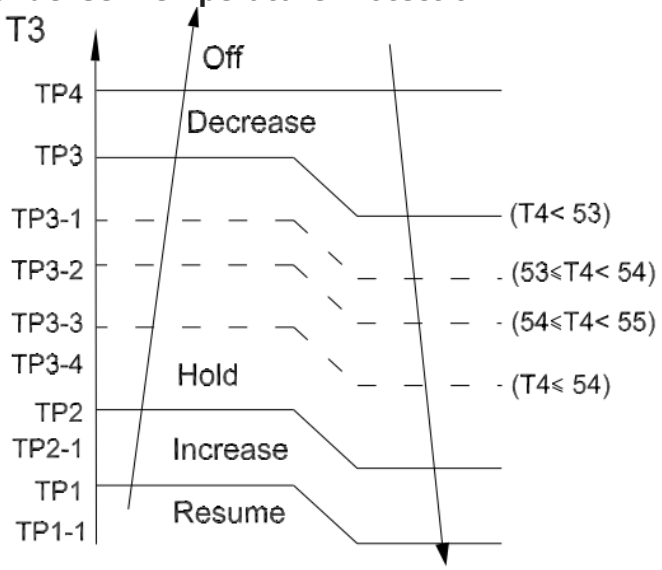
Note: CDIFTEMP is EEPROM setting parameter. It is 35.6°F(2°C) normally.

3. If one of the following conditions is satisfied, do not judge protective time.
   - Compressor running frequency is more than test frequency.
   - When the compressor running frequency is equal to the test frequency, the outdoor ambient temperature(T4) is more than 59°F(15°C) or outdoor ambient sensor(T4) fault.
   - Change the setting temperature.
   - Turning on/off turbo or sleep function.
   - Various frequency limit shutdown occurs.

Outdoor Fan Control:

- The outdoor unit will be ran at different fan speeds according to the outdoor ambient temperature(T4) and compressor frequency.
- For different outdoor units, the fan speeds are different.

Condenser Temperature Protection



When the condenser temperature exceeds a configured value, the compressor ceases operation.

Heating Mode:

Compressor Control:

1. Reach the configured temperature
   - If the following conditions are satisfied, the compressor ceases operation.
   - Calculated frequency(fb) is less than minimum limit frequency(FminH).
   - Compressor runs at FminH more than 10 minutes.
   - T1 is higher than or equal to Tsc+HDIFTEMP2.

Note: HDIFTEMP2 is EEPROM setting parameter. It is 35.6°F(2°) normally.

   - If one of the following conditions is satisfied, do not judge protective time.
   - Compressor running frequency is more than test frequency.
   - Compressor running frequency is equal to test frequency, outdoor ambient temperature(T4) is more than 59°F(15°C), or outdoor ambient sensor(T4) fault.
   - Change setting temperature.
   - Turning on/off turbo or sleep function

2. When the current is higher than the predefined safe value, sure protection is activated, causing the compressor to cease operations.

Outdoor Fan Control:

- The outdoor unit will run at different fan speeds according to the outdoor ambient temperature(T4) and compressor frequency.
- For different outdoor units, the fan speeds are different.

Defrosting Mode:

- The unit enters defrosting mode according to the temperature value of the condenser temperature(T3) and outdoor ambient temperature(T4) as well as the compressor running time.
- In defrosting mode, the compressor continues to run, the indoor and outdoor motor will cease operation, the defrost light of the indoor unit will turn on, and the "DF" symbol is displayed.
- If any one of the following conditions are satisfied, defrosting ends and the machine switches to normal heating mode:
  - Condenser temperature(T3) rises above TCDE1.
  - Condenser temperature(T3) maintained above TCDE2 for 80 seconds.
  - Unit runs for 15 minutes consecutively in defrosting mode.
- If the outdoor ambient temperature(T4) is lower than or equal to -7.6°(-22°C) and the compressor running time is more than TIMING_DEFROST_TIME, if any one of the following conditions are satisfied, defrosting ends and the machine switches to normal heating mode:
  - Unit runs for 10 minutes consecutively in defrosting mode.
  - Condenser temperature(T3) rises above 50°F(10°C).
- If any one of the following conditions are satisfied, the unit enters defrosting mode.

- If condenser temperature(T3) or outdoor ambient temperature(T4) is lower than 26.6°F(-3°C) for 30 seconds, Ts-T1 is lower than 41°F(5°C) and the compressor running time is more than EE_TIME_DEFROST7.
- If condenser temperature(T3) or outdoor ambient temperature(T4) is lower than 26.6°F(-3°C) for 30 seconds and the compressor running time is more than EE_TIME_DEFROST7+30 minutes.

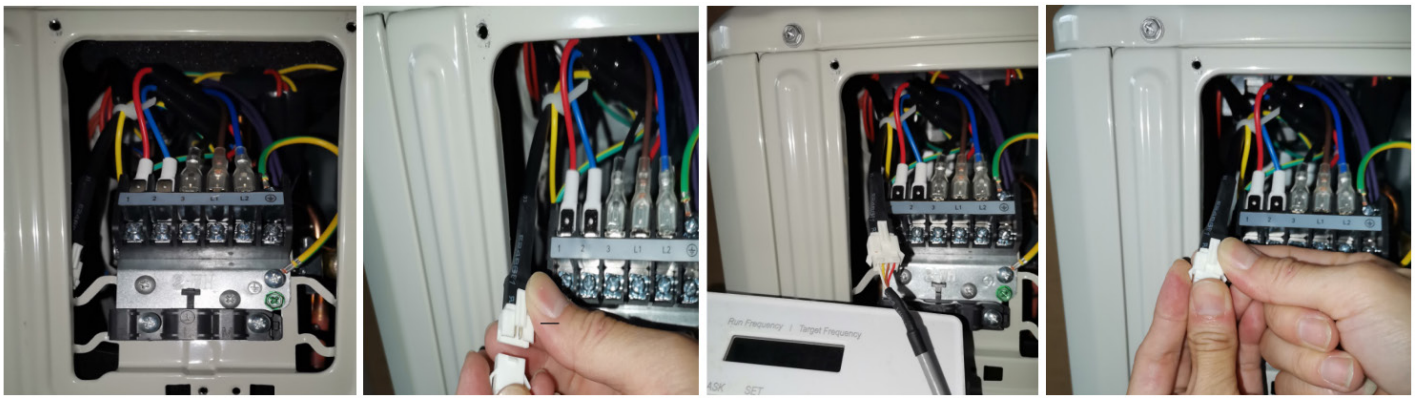
- If any one of the following conditions are satisfied, defrosting ends an the machine switches to normal heating mode:
  - Condenser temperature(T3) rises above TCDE1+7.2°(4°C).
  - Condenser temperature(T3) maintained above TCDE2+7.2°F(4°C) for 80 seconds.
  - Unit runs for 15 minutes consecutively in defrosting mode.

5.1 Safety Caution

⚠ WARNING

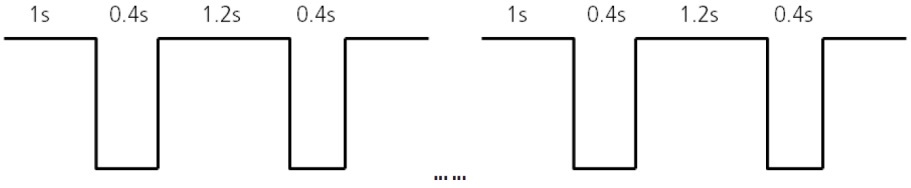
Be sure to turn off all power supplies or disconnect all wires to avoid electric shock. While checking the indoor/outdoor PCB, please equip yourself with anti-static gloves or a wrist strap to avoid damaging the board.
Electricity will remain in capacitors even when the power supply is off. Ensure the capacitors are fully discharged before troubleshooting

Note: If using the inverter test tool for maintenance, remove the big handle from the unit, take out the detection cable, take out the female end of the cable, and connect the inverter testing tool. After maintenance is completed, insert the female end back into the port.



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

LED Flash Frequency:



5.2 Error Display

Display	Error Information	Solution
DF	Defrost	Normal display, not error code
FC	Forced cooling	
EC 07	ODU fan speed out of control	TS14
EC 71	Over current failure of outdoor DC fan motor	TS14
EC 72	Lack phase failure of outdoor DC fan motor	TS34
EC 50	ODU temp. sensor error (T3,T4, TP)	TS16
EC 51	ODU EEPROM parameter error	TS10
EC 52	ODU coil temp. sensor (T3) error	TS16
EC 53	ODU ambient temp. sensor (T4) error	TS16
EC 54	COMP. discharge temp. sensor (TP)	TS16
EC 55	ODU IPM module temperature sensor malfunction	TS36
EC 56	IDU coil outlet temp. sensor (T2B) error	TS16
EC 57	Refrigerant pipe temperature sensor error	TS16
EL 01	IDU & ODU communication error	TS11
PC 00	IPM module protection	TS19
PC 02	Compressor top (or IPM) temp. protection	TS27
PC 06	Discharge temperature protection of compressor	TS25
PC 08	Outdoor overcurrent protection	TS18
PC 0A	High temperature protection of condenser	TS26
PC 0F	PFC module protection	TS24
PC 0L	Low ambient temperature protection	--
PC 10	ODU low AC voltage protection	TS21
PC 11	ODU main control board DC bus high voltage protection	TS21
PC 12	ODU main control board DC bus low voltage protection / 341 MCE error	TS21
PC 13	The AC power is cut off or the AC voltage detection circuit fails	TS29
PC 30	System high pressure protection	TS31
PC 31	System low pressure protection	TS23
PC 40	Communication error between ODU main chip and compressor driven chip	TS17
PC 42	Compressor start failure of outdoor unit	TS34
PC 43	ODU compressor lack phase protection	TS17
PC 45	ODU IR chip drive failure	TS35
PC 46	Compressor speed has been out of control	TS17
PC 49	Compressor overcurrent failure	TS17
LC 06	High temperature protection of Inverter module (IPM)	TS28
PH 90	High temperature protection of evaporator	TS37
PH 91	Low temperature protection of evaporator	TS38

5.3 Outdoor Unit Point Check Function

- A check switch is included on the auxiliary board.
- Press SW1 to check the unit's status while running. The digital display shows the following codes each time the SW1 button is pushed.

Number of Presses	Display	Remark
00	Normal display	Display running frequency, running state or malfunction code
01	Indoor unit capacity demand code	Actual data*HP*10 If capacity demand code is higher than 99, the digital display tube will show single digit and tens digit. (For example, the digital display tube show “5.0”,it means the capacity demand is 15. the digital display tube show “60”,it means the capacity demand is 6.0) S communication, the digital display tube will show: “--”
02	Amendatory capacity demand code	
03	The frequency after the capacity requirement transfer	
04	The frequency after the frequency limit	
05	The frequency of sending to 341 chip	
06	Indoor unit evaporator temperature (T2)	If the temp. is lower than -9°C, the digital display tube will show “-9”. If the temp. is higher than 70°C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show: “--”
07	Condenser pipe temp. (T3)	
08	Outdoor ambient temp. (T4)	
09	Compressor discharge temp. (tp)	The display value is between 0~199°C. If the temp. is lower than 0°C, the digital display tube will show “0”.If the temp. is higher than 99°C, the digital display tube will show single digit and tens digit. (For example, If the display shows 0.5, so 0.5 multiplied by 10 to become 5, then added to 100 to become 105°C.)
10	AD value of current	The display value is a hex number. For example, the digital display tube shows “Cd”, so C*161+d*160=12*16+13=205, it means AD value is 205. AD value is detected by the chip.
11	AD value of voltage	
12	Indoor unit running mode code	S communication: Standby:0, Cooling:1, Heating:2, Fan only 3,Drying:4, Forced cooling:6, Defrosting: 7,485 communication: Standby:0, Fan only 1,Cooling:2, Heating:3,Forced cooling:4, Drying:6, Self clean:8
13	Outdoor unit running mode code	
14	EXV open angle	Actual data/4. If the value is higher than 99, the digital display shows single and double digits. For example, if the digital display shows “2.0”, so 2.0 multiplied by 10 to become 20, then added to 100 to become 120, the EXV open angle is 120×4=480p.

Number of Presses	Display	Remark		
15	Frequency limit symbol	Bit7	Frequency limit caused by IGBT radiator	The display value is a hexadecimal number. For example, the digital display show 2A, then Bit5=1, Bit3=1, and Bit1=1. This means that a frequency limit may be caused by T2, T3, or the current.
		Bit6	Frequency limit caused by PFC	
		Bit5	Frequency limit caused by high temperature of T2	
		Bit4	Frequency limit caused by low temperature of T2	
		Bit3	Frequency limit caused by T3	
		Bit2	Frequency limit caused by TP	
		Bit1	Frequency limit caused by current	
		Bit0	Frequency limit caused by voltage	
16	Outdoor unit fan motor state	Off: 0, Turbo:1 High speed:2, Med speed: 3, Low speed: 4, Breeze:5, Super breeze: 6 other speed:7		
17	IGBT radiator temp.	The display value is between 0~130°C. If the temp. is higher than 99°C, the digital display tube will show single digit and tens digit. (For example, the digital display tube show “0.5”,it means the IGBT radiator temp. is 105°C. the digital display tube show “1.6”,it means the IGBT radiator temp. is 116°C)		
18	Indoor unit number	The indoor unit can communicate with outdoor unit well. General:1, Twins:2		
19	Evaporator pipe temp. T2 of 1# indoor unit	If the temp. is lower than 0°C, the digital display tube will show “0”.If the temp. is higher than 70°C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show: “--”(heating T2, cooling T2B) S communication, the digital display tube will show: “--”		
20	Evaporator pipe temp. T2 of 2# indoor unit			
21	Reserved			
22	1# Indoor unit capacity demand code	Actual data*HP*10 If capacity demand code is higher than 99, the digital display tube will show single digit and tens digit. (For example, the digital display tube show “5.0”,it means the capacity demand is 15. the digital display tube show “60”,it means the capacity demand is 6.0). If the indoor unit is not connected, the digital display tube will show: “--” S communication, the digital display tube will show: “--”		
23	2# Indoor unit capacity demand code			
24	Reserved			
25	Room temp. T1 of 1# indoor unit	If the temp. is lower than -9°C, the digital display tube will show “-9”. If the temp. is higher than 70°C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show: “--” S communication, the digital display tube will show: “--”		
26	Room temp. T1 of 2# indoor unit	If the temp. is lower than 0°C, the digital display tube will show “0”.If the temp. is higher than 70°C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show:“--” S communication, the digital display tube will show: “--		
27	Average room temp. T1	If the temp. is lower than 0°C, the digital display tube will show “0”.If the temp. is higher than 70° C, the digital display tube will show “70”		
28	Reason of stop			
29	Evaporator pipe temp. T2b of 1# indoor unit	If the temp. is lower than -9°C, the digital display tube will show “-9”.If the temp. is higher than 70°C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show: “--” S communication, the digital display tube will show: “--”		
30	Evaporator pipe temp. T2b of 2# indoor unit	If the temp. is lower than 0°C, the digital display tube will show “0”. If the temp. is higher than 70° C, the digital display tube will show “70”. If the indoor unit is not connected, the digital display tube will show: “--” S communication, the digital display tube will show: “--”		

5.4 Quick Maintenance by Error Code

If you do not have the time to test which specific parts are faulty, you can change the required parts according to the error code. You can find the parts to replace by error code in the following table.

Part Requiring Replacement	Error code								
	EL 01	EH 50	EC 51	EC 52	EC 53	EC 54	EC 55	EC 56	EC 57
Indoor PCB	√	X	X	X	X	X	X	X	X
Outdoor PCB	√	√	√	√	√	√	√	√	√
ODU coil temp. sensor	X	√	X	√	X	X	X	X	X
ODU ambient temp. sensor	X	√	X	√	X	X	X	X	X
COMP. discharge temp. sensor	X	√	X	X	√	X	X	X	X
IPM module temperature sensor	X	X	X	X	X	√	X	X	X
IDU coil outlet temp. sensor	X	X	X	X	X	X	√	X	X
Refrigerant pipe temperature sensor	X	X	X	X	X	X	X	√	X
Condenser temperature sensor	X	X	X	X	X	X	X	X	√
Reactor	√	X	X	X	X	X	X	X	X
IPM module board	√	X	X	X	X	X	X	X	X

Part Requiring Replacement	Error code							
	EC07 / EC 71	PC 00	PC01 / PC 10 / PC 11 / PC 12	PC 02	PC 08 / PC 42 / PC 44 / PC 46 / PC 49	PC 0F	PH 90	PH 91
Outdoor PCB	√	√	√	√	√	√	X	X
Outdoor fan motor	√	√	X	X	√	X	X	X
Reactor or inductance	X	√	√	X	√	√	X	X
Compressor	X	√	X	X	X	X	X	X
IPM module board	X	√	√	X	√	X	X	X
Bridge rectifier	X	√	√	X	√	X	X	X
Evaporator coil temperature sensor	X	X	X	X	X	X	√	√
PFC module	X	X	X	X	X	√	X	X
Additional refrigerant	X	X	X	X	X	X	X	X
Overload protector	X	X	X	√	X	X	X	X
ODU ambient temp. sensor	X	X	X	X	X	X	X	X
Refrigerant pipe temperature sensor	X	X	X	X	X	X	X	X
Indoor fan	X	X	X	X	X	X	√	X
Indoor PCB	X	X	X	X	X	X	√	√

Part Requiring Replacement	Error code							
	PC 40	EC 72	PC 43	PC 45	PC 06	PC 0A	PC 30	PC 31
Outdoor PCB	√	√	√	X	√	√	√	√
Outdoor fan motor	X	√	X	X	X	√	√	√
ODU coil temp. sensor	X	X	X	X	X	√	X	X
COMP. discharge temp. sensor	X	X	X	X	√	X	X	X
Compressor	X	X	√	X	X	X	X	X
IPM module board	X	X	X	√	X	X	X	X
Additional refrigerant	X	X	X	X	√	√	X	√
Electric control box	√	X	X	X	X	X	X	X
High pressure switch	X	X	X	X	X	X	√	X
Low pressure switch	X	X	X	X	X	X	X	√

5.5 Troubleshooting by Error Code

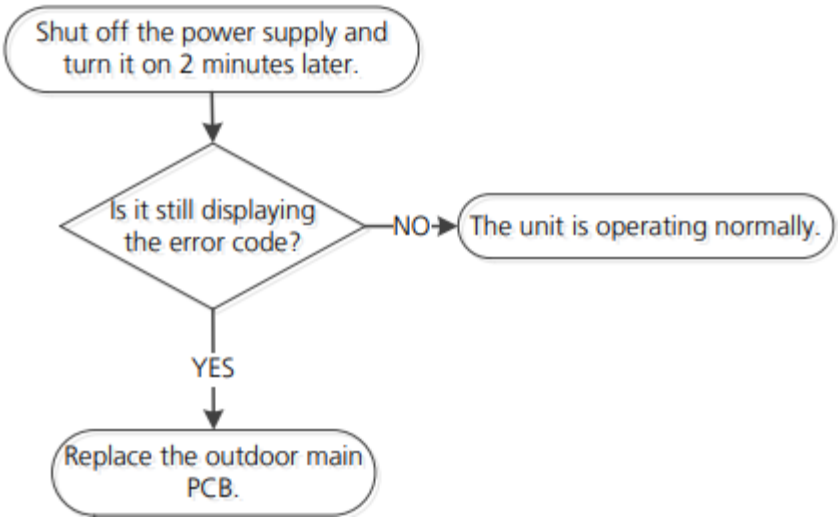
EC 51: EEPROM malfunction error diagnosis and solution.

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

Recommended parts to prepare:

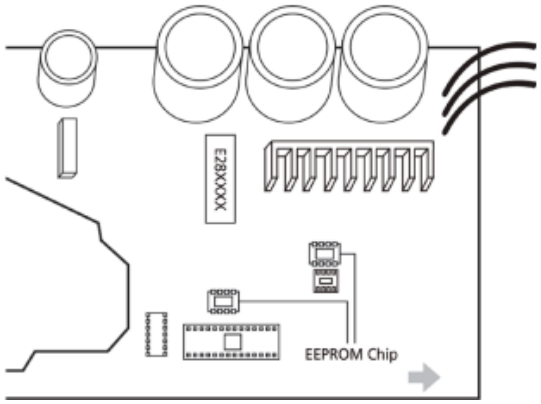
- Indoor PCB
- Outdoor PCB

Troubleshooting and repair:



Remarks:

EEPROM: A read-only memory whose contents can be erased and reprogrammed using a puled voltage. The location of the EEPROM chip on the indoor and outdoor PCB is shown in the following image:



Note: This picture is only for reference, actual appearance may vary.

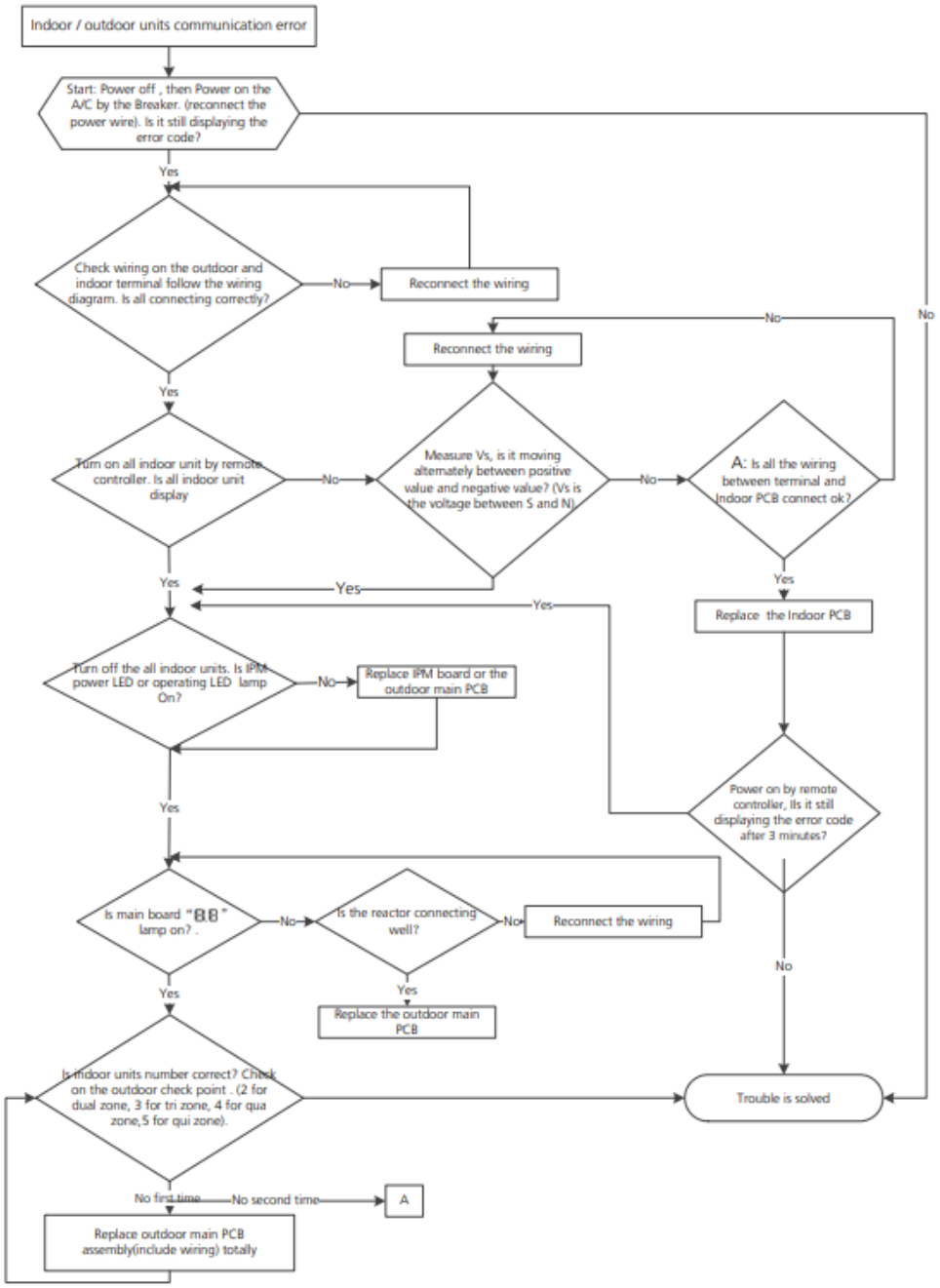
EL 01: IDU & ODU communication error diagnosis and solution.

Description: The indoor unit does not receive the feedback from the outdoor unit during 110 seconds and this condition happens 4 times continuously.

Recommended parts to prepare:

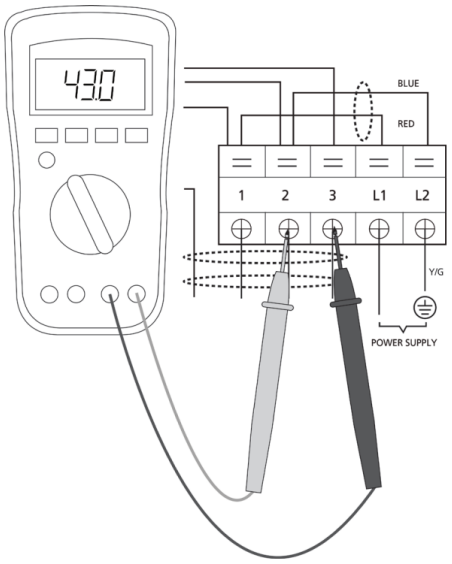
- Indoor PCB
- Outdoor PCB
- IPM module board
- Reactor

Troubleshooting and repair:



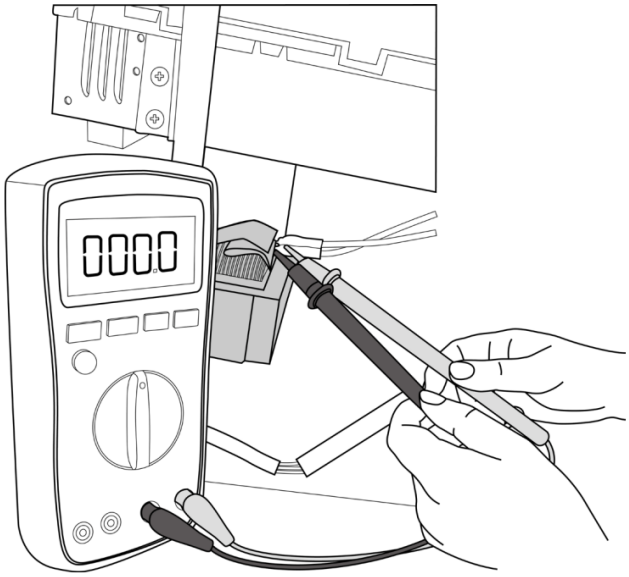
Remarks:

- Use a multimeter to test the DC voltage between 2 port (or S or L2 port) and 3 port (or N or S port) of the outdoor unit. The red pin of the multimeter connects with 2 port (or S or L2 port) while the black pin is for 3 port (or N or S port).
- When the AC is operating normally, the voltage is moving alternately as positive values and negative values.
- If the outdoor unit has a malfunction, the voltage will have a positive value.
- While if the indoor unit has a malfunction, the voltage will have a certain value.



S and N or L2 and S or 2 and 3

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



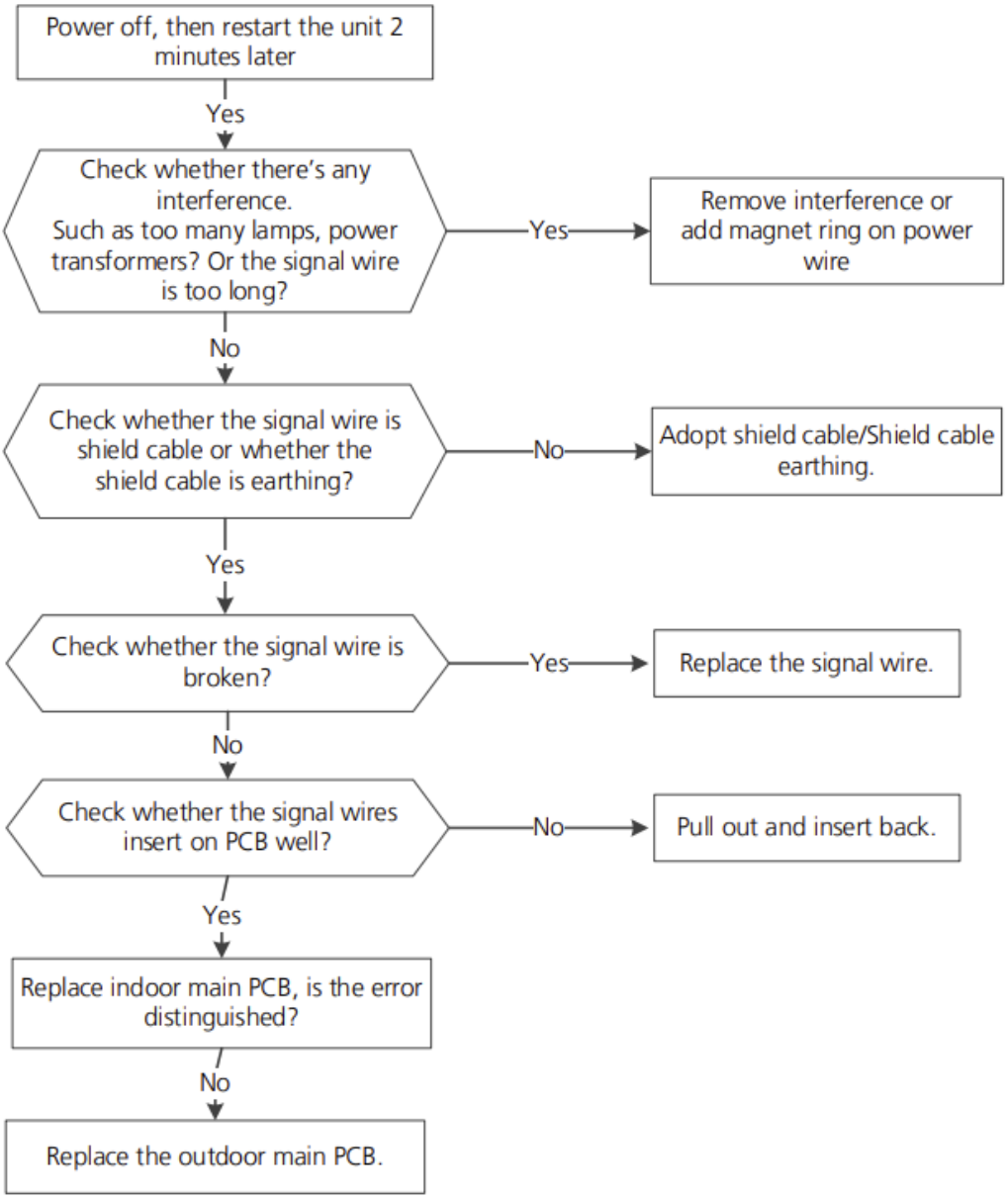
Note: This picture and the value are only for reference, actual condition and specific value may vary.

485 Communication (S1,S2 Communication):

Recommended parts to prepare:

- Signal wires
- Magnet ring
- Indoor PCB
- Outdoor PCB

Troubleshooting and repair:



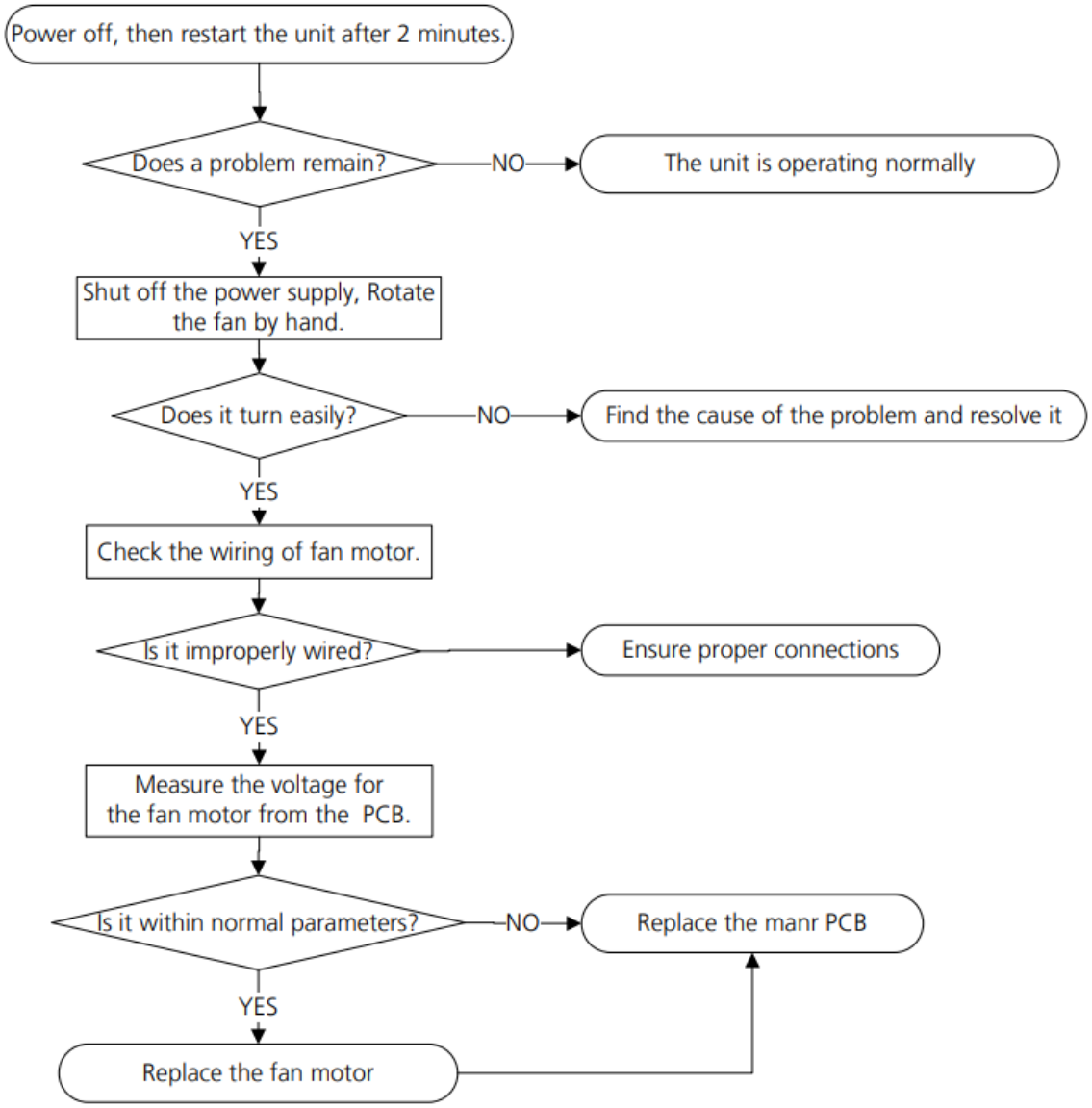
EC 07: Fan speed is operating outside of normal range. EC 71: Overcurrent failure of outdoor DC fan motor diagnosis and solution.

Description: When the indoor/outdoor fan speed keeps too low or too high for a certain time, the LED displays the failure code and the system turns off.

Recommended parts to prepare:

- Connection wires
- Fan assembly
- Fan motor
- PCB

Troubleshooting and repair:

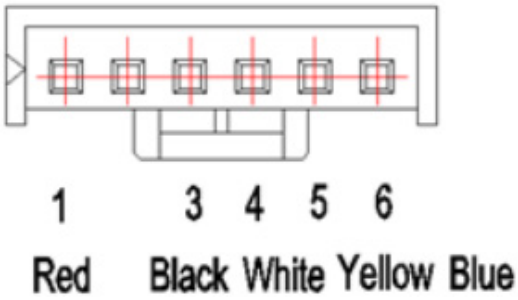


Index:

1. Outdoor DC fan motor (control chip is in fan motor)

Power on and make sure the unit is in standby, measure the voltage of pin1-pin3, pin4-pin3 in the fan motor connector. If the value of the voltage is not in the range showing in the tables below the PCB will have problems and will need to be replaced.

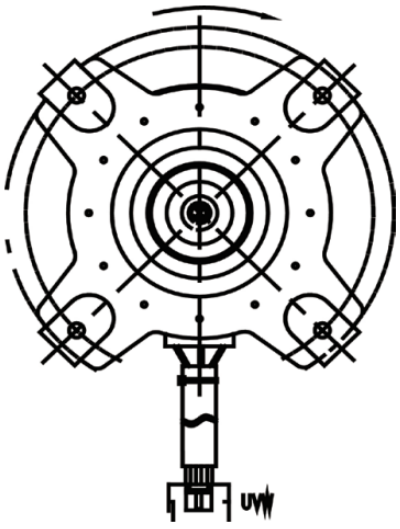
NO.	Color	Signal	Voltage
1	Red	Vs/Vm	192V~380V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	13.5-16.5V
5	Yellow	Vsp	0~6.5V
6	Blue	FG	13.5-16.5V



Index:

1. Outdoor DC fan motor (control chip is in outdoor PCB)

Release the UVW connector and measure the resistance of U-V, U-W, V-W. If the resistance is not equal to each other the fan motor has a problem and needs to be replaced. Otherwise the PCB has a problem and needs to be replaced.



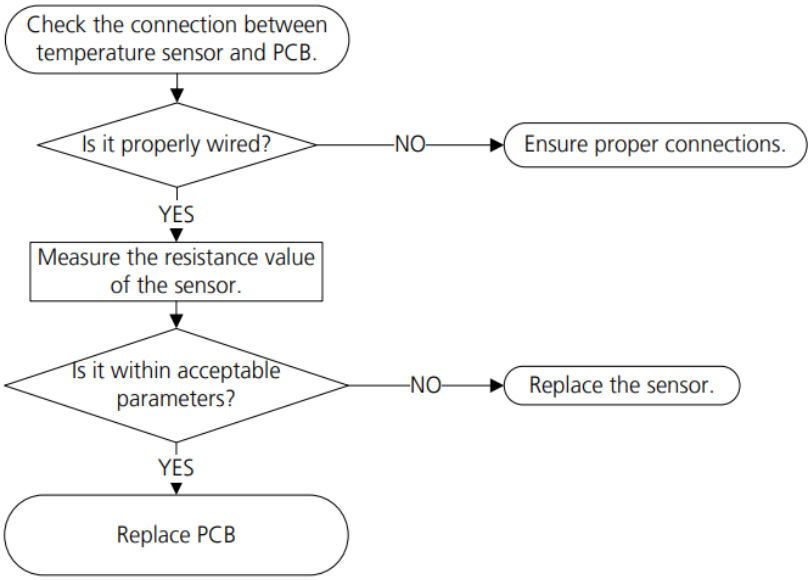
EC 52/ EC 53/ EC 54/ EC 56/ EC 57/ EC 50: Open circuit or short circuit of temperature sensor diagnosis and solution.

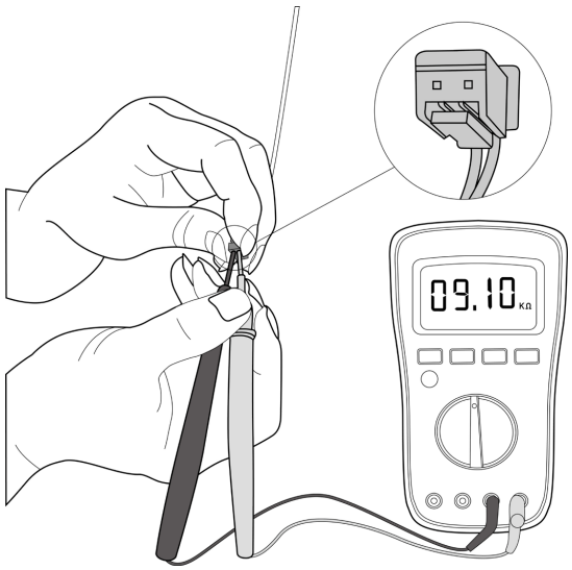
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED displays a fault code.

Recommended parts to prepare:

- Connection wires
- Sensors
- PCB

Troubleshooting and repair:





Note: This picture and the value are only for reference, actual condition and specific value may vary.

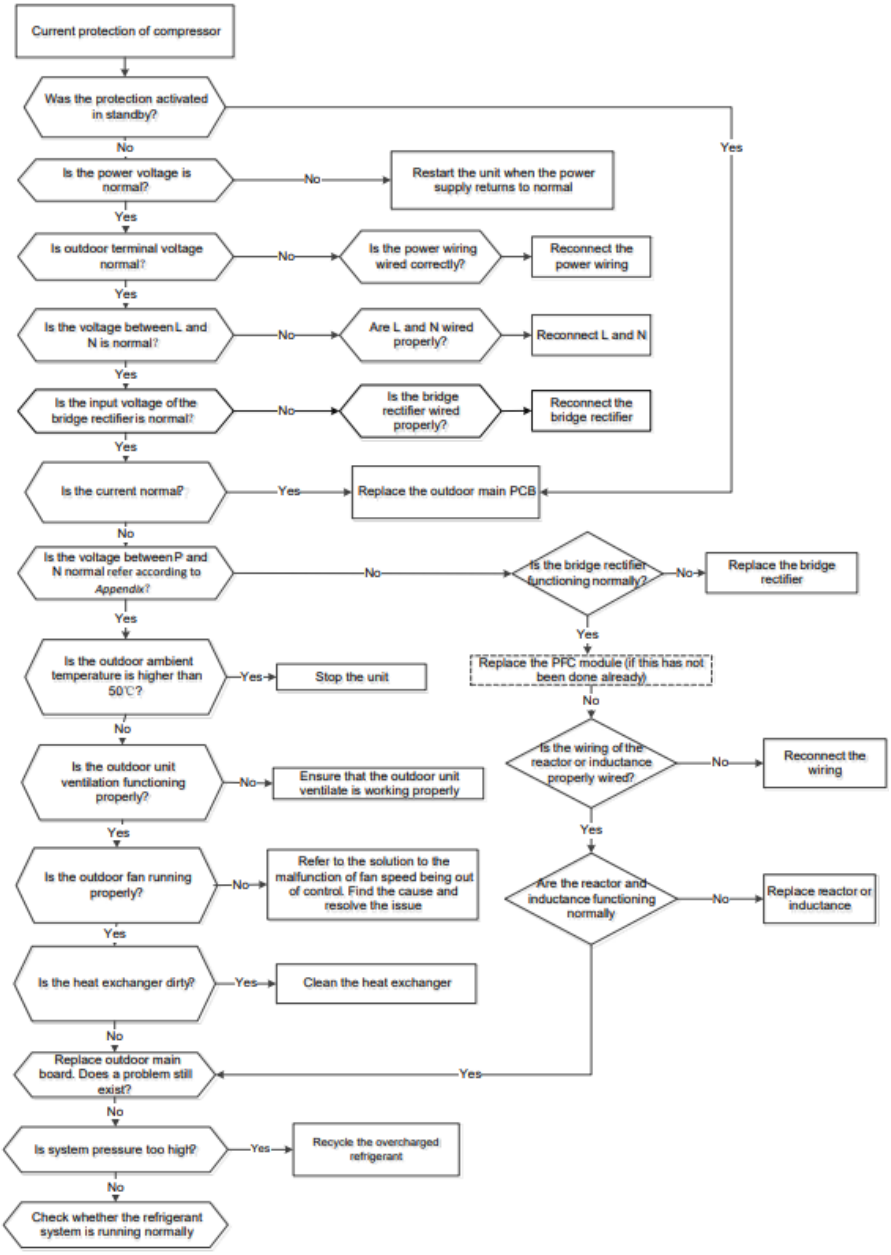
PC 08: Current overload protection. PC 42: Compressor start failure of outdoor unit. PC 44: ODU zero speed protection. PC 46: Compressor speed has been out of control. PC 49: Compressor overcurrent failure.

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

Recommended parts to prepare:

- Outdoor PCB
- Connection wires
- Bridge rectifier
- PFC circuit or reactor
- Refrigeration piping system
- Pressure switch
- Outdoor fan
- IPM module board

Troubleshooting and repair:



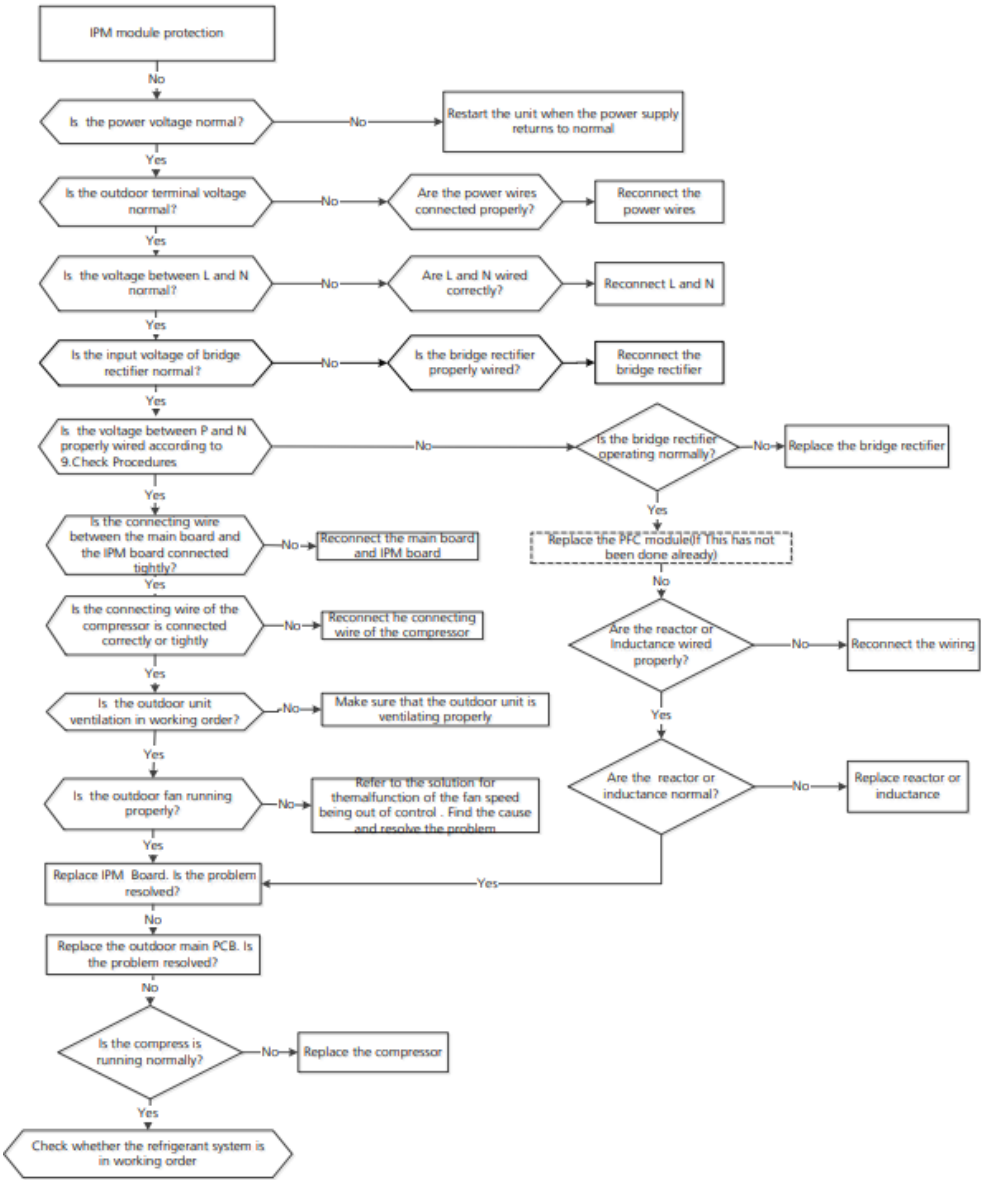
PC 00: IPM malfunction diagnosis and solution.

Description: When the voltage signal the IPM sends to the compressor drive chip is abnormal, the LED displays a fault code and the system turns off.

Recommended parts to prepare:

- Connection wires
- IPM module board
- Outdoor fan assembly
- Compressor
- Outdoor PCB
- Reactor or inductance
- Bridge rectifier

Troubleshooting and repair: At first test the resistance between every two ports of U, V, W of the IPM and P, N. If any result of them is 0 or close to 0, the IPM is defective. Otherwise, please follow the procedure below:



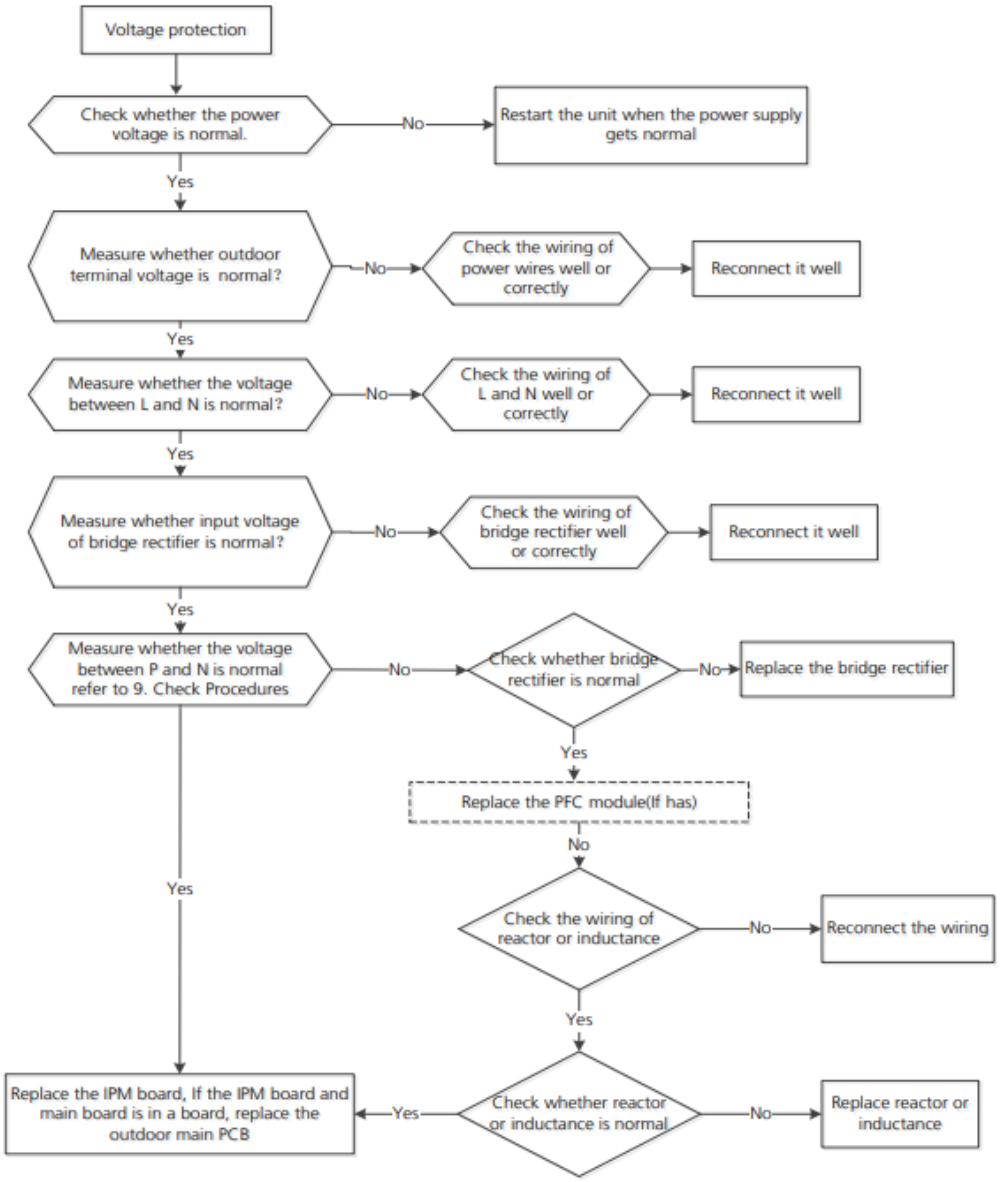
PC01: over voltage or too low voltage protection. PC 10: ODU low AC voltage protection. PC 11: ODU main control board DC bus high voltage protection. PC 12: ODU main control board DC bus low voltage protection/ 341 MCE error diagnosis and solution.

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 board
- Outdoor PCB
- Bridge rectifier
- PFC circuit or reactor

Troubleshooting and repair:



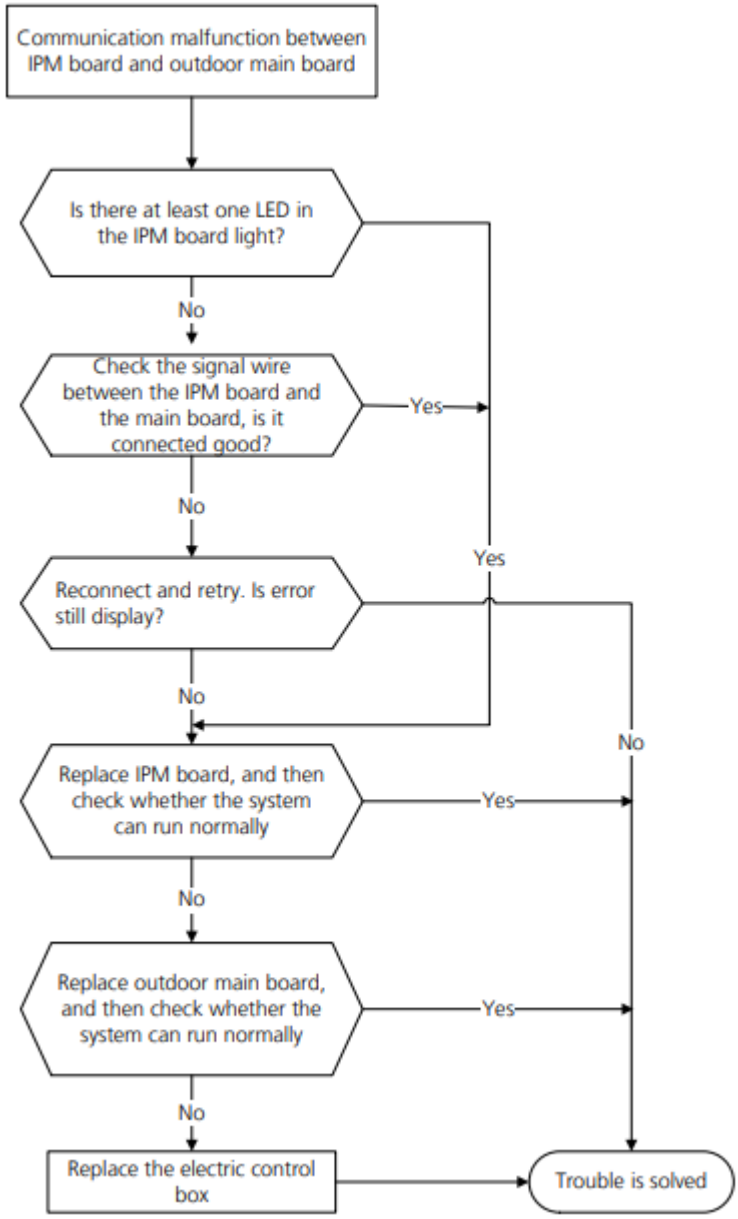
PC 40: Communication error between ODU main chip and compressor driven chip diagnosis and solution.

Description: The main PCB cannot detect the IPM board.

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- IPM module board
- Electric control box

Troubleshooting and repair:



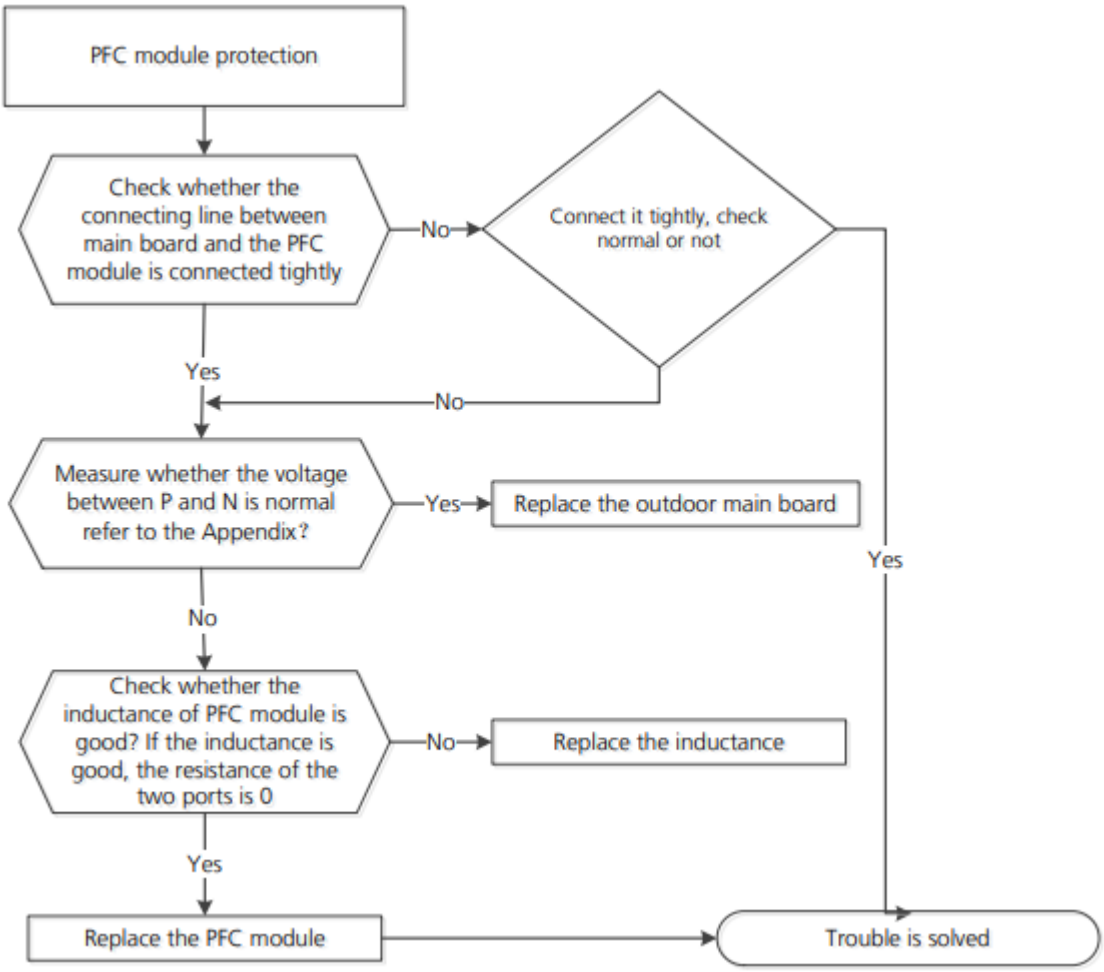
PC 0F: PFC module protection diagnosis and solution.

Description: Outdoor PCB detects PFC signal is low voltage or DC voltage is lower than 340V for 6s when quick check.

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- Inductance
- PFC circuit or IPM module board

Troubleshooting and repair:



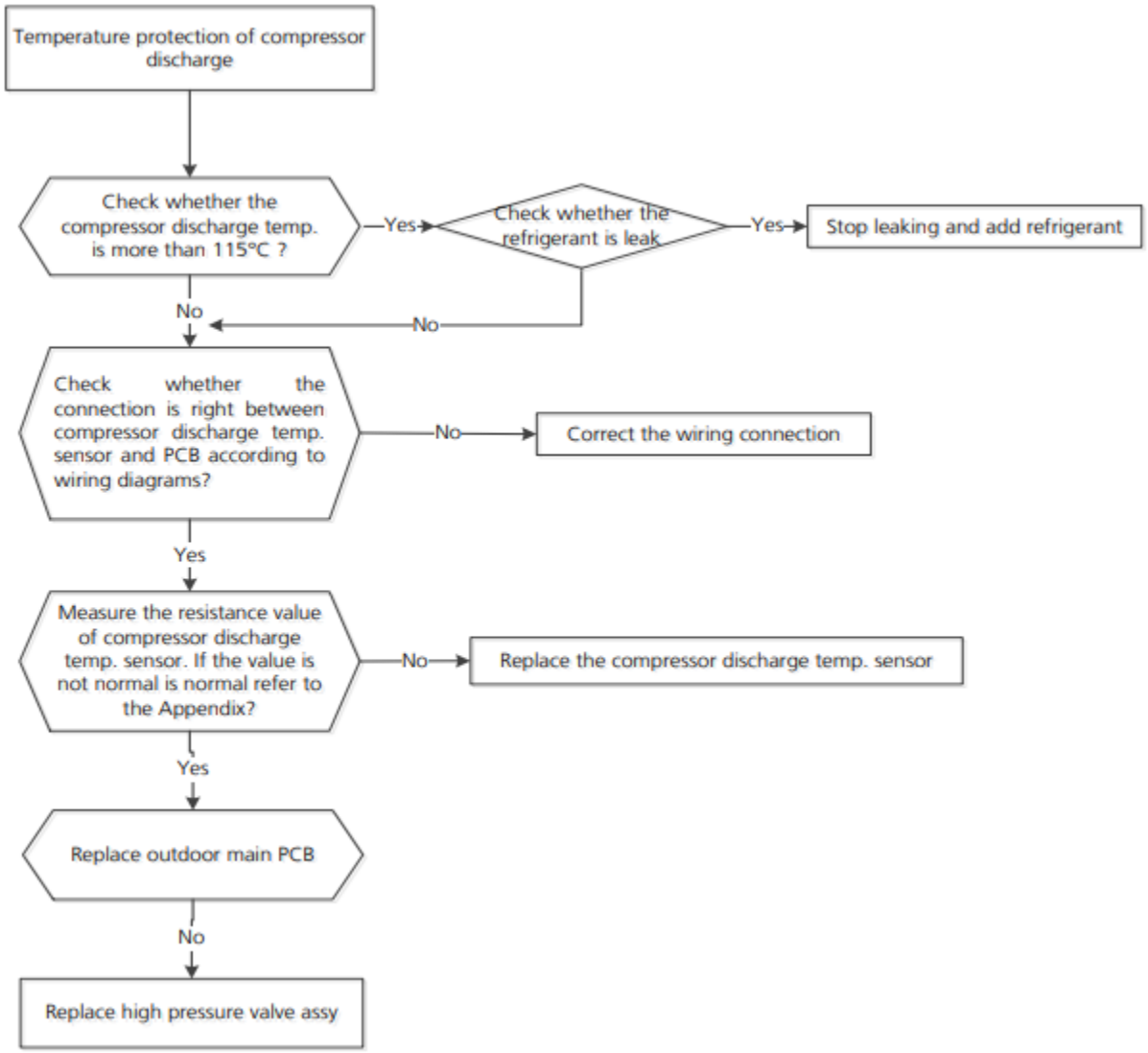
PC 06: Discharge temperature protection of compressor diagnosis and solution.

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

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- Discharge temperature sensor
- Refrigerant

Troubleshooting and repair:



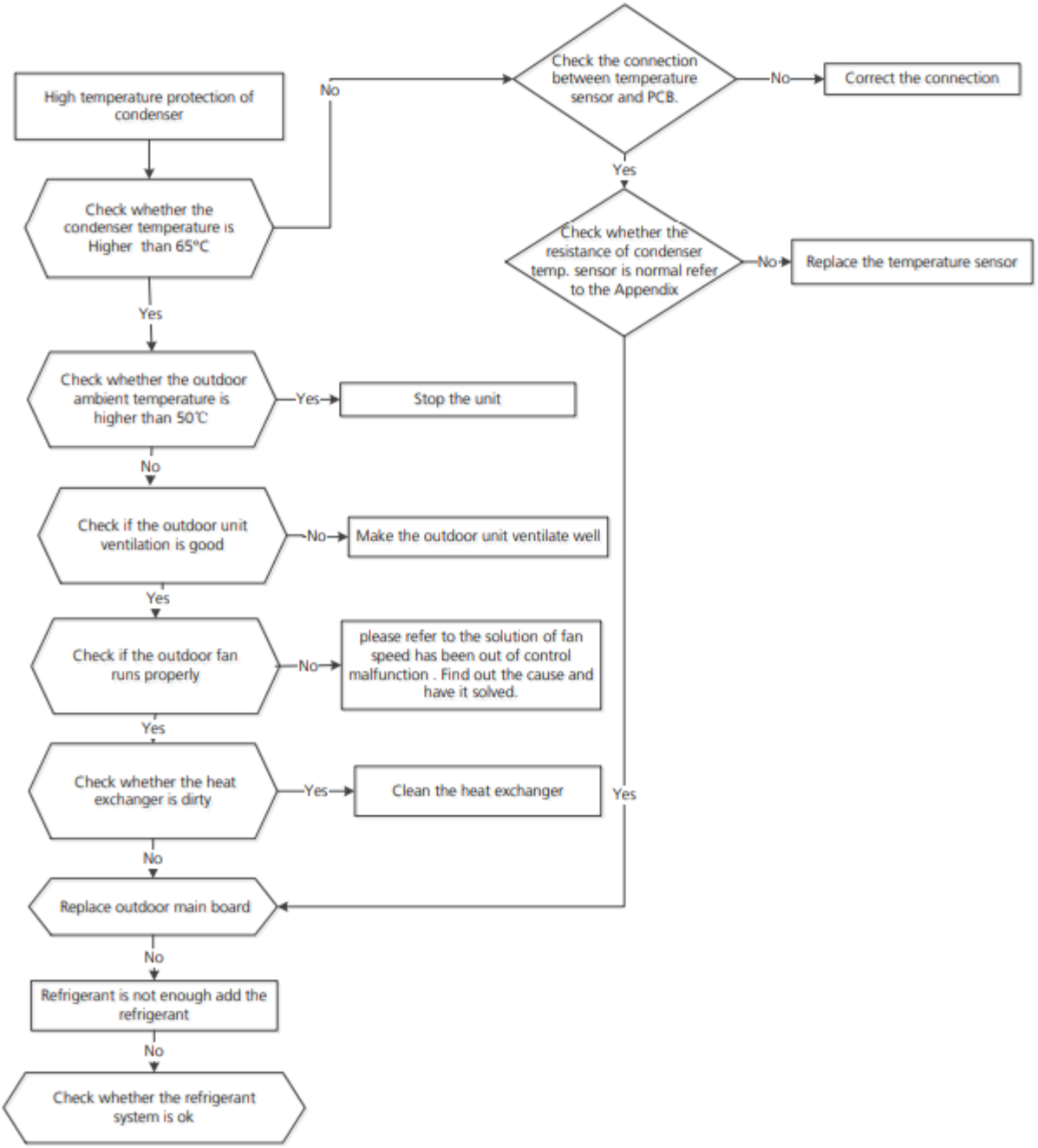
PC 0A: High temperature protection of condenser diagnosis and solution.

Description: The unit will stop when the condenser temperature is higher than 65°C, and runs again when it is less than 52°C.

Recommended parts to prepare:

- Connection wires
- Condenser temperature sensor
- Outdoor fan
- Outdoor main PCB
- Refrigerant

Troubleshooting and repair:



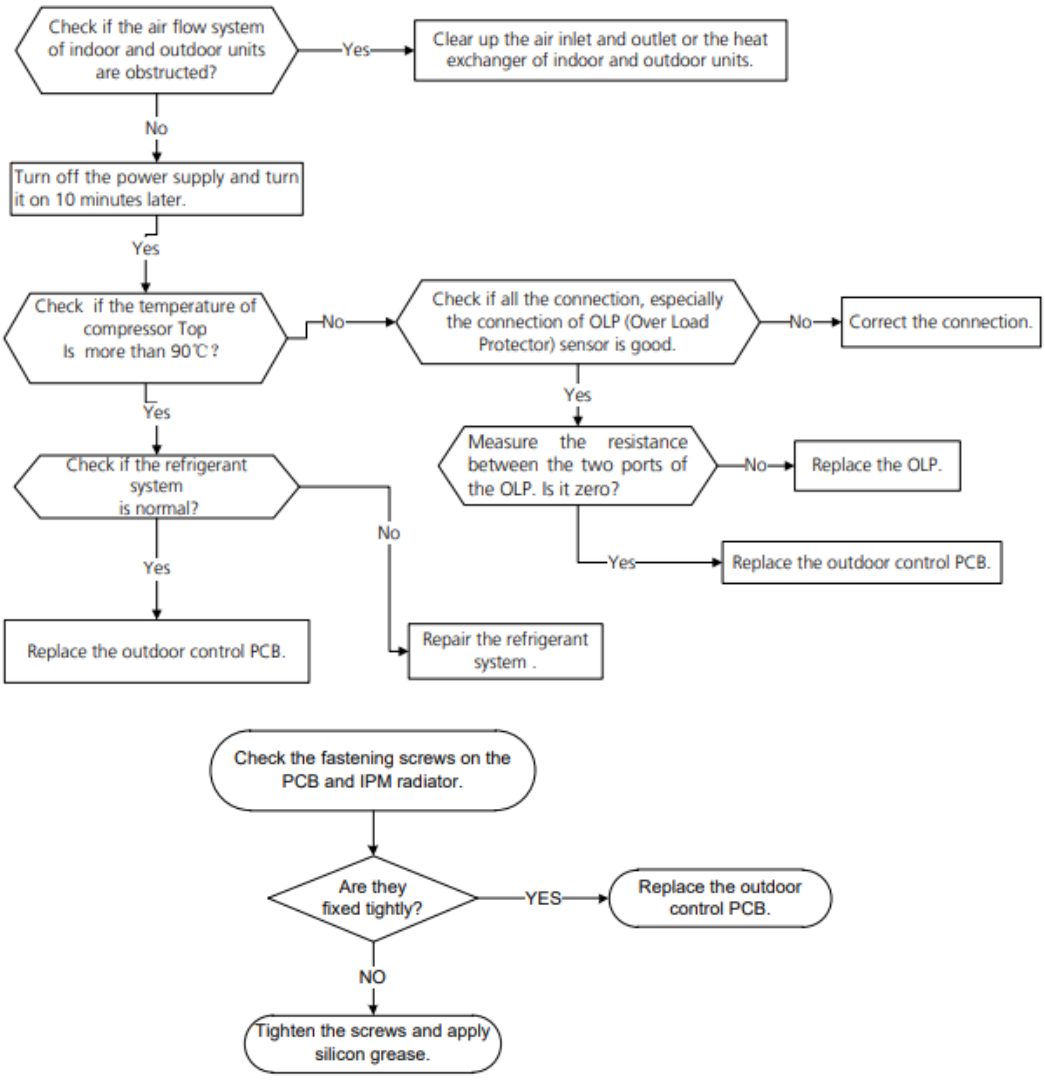
PC 02/ LC 06: Compressor top (or IPM) temp. protection diagnosis and solution.

Description: For some models with an overload protector, if the sampling voltage is not 5V, the LED will display a fault code. If the temperature of the IPM module is higher than a certain value, the LED will display a fault code. Models without an overload protector should be diagnosed according to the second flowchart.

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- IPM module board
- High pressure protector
- System blockages

Troubleshooting and repair:



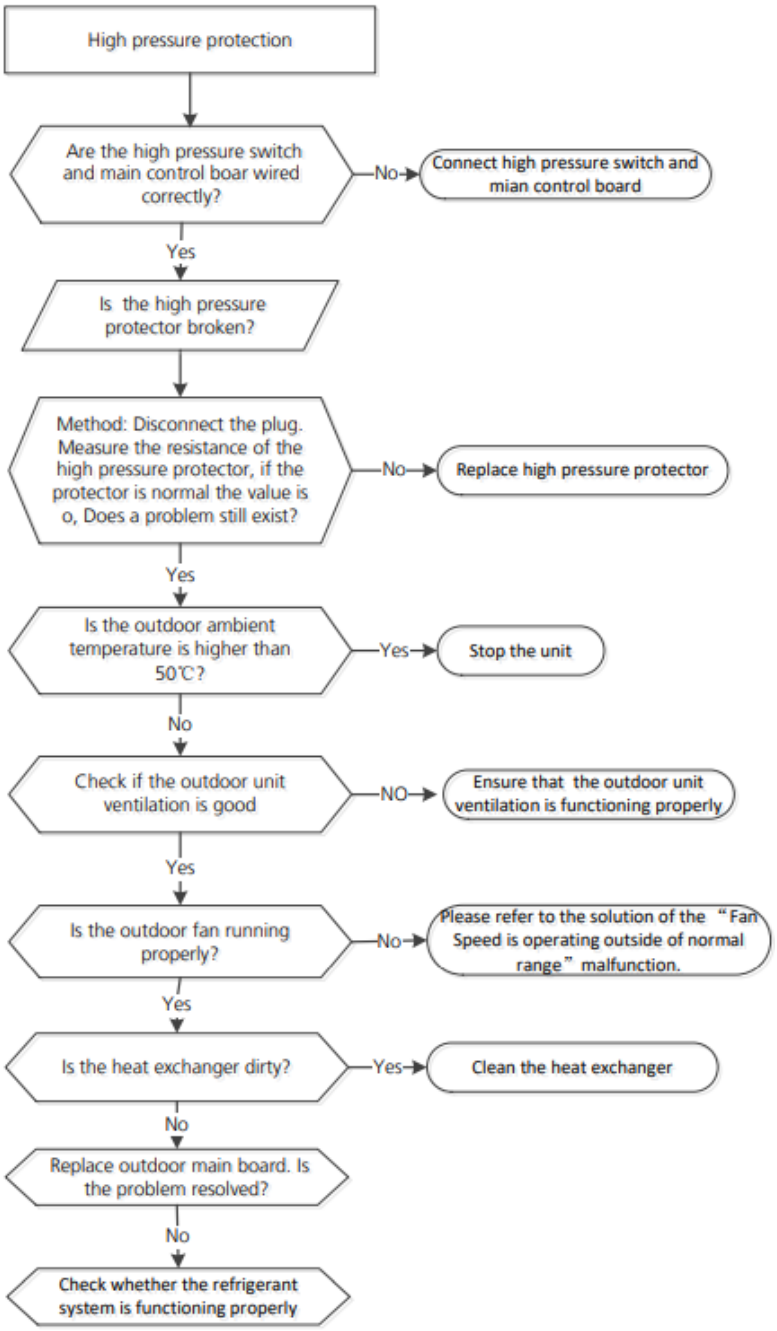
PC 30: System high pressure protection diagnosis and solution.

Description: The outdoor pressure switch cuts off the system because of high pressure (being higher than 638PSI (4.4MPA)) .

Recommended parts to prepare:

- Connection wires
- Pressure switch
- Outdoor fan
- Outdoor main PCB

Troubleshooting and repair:



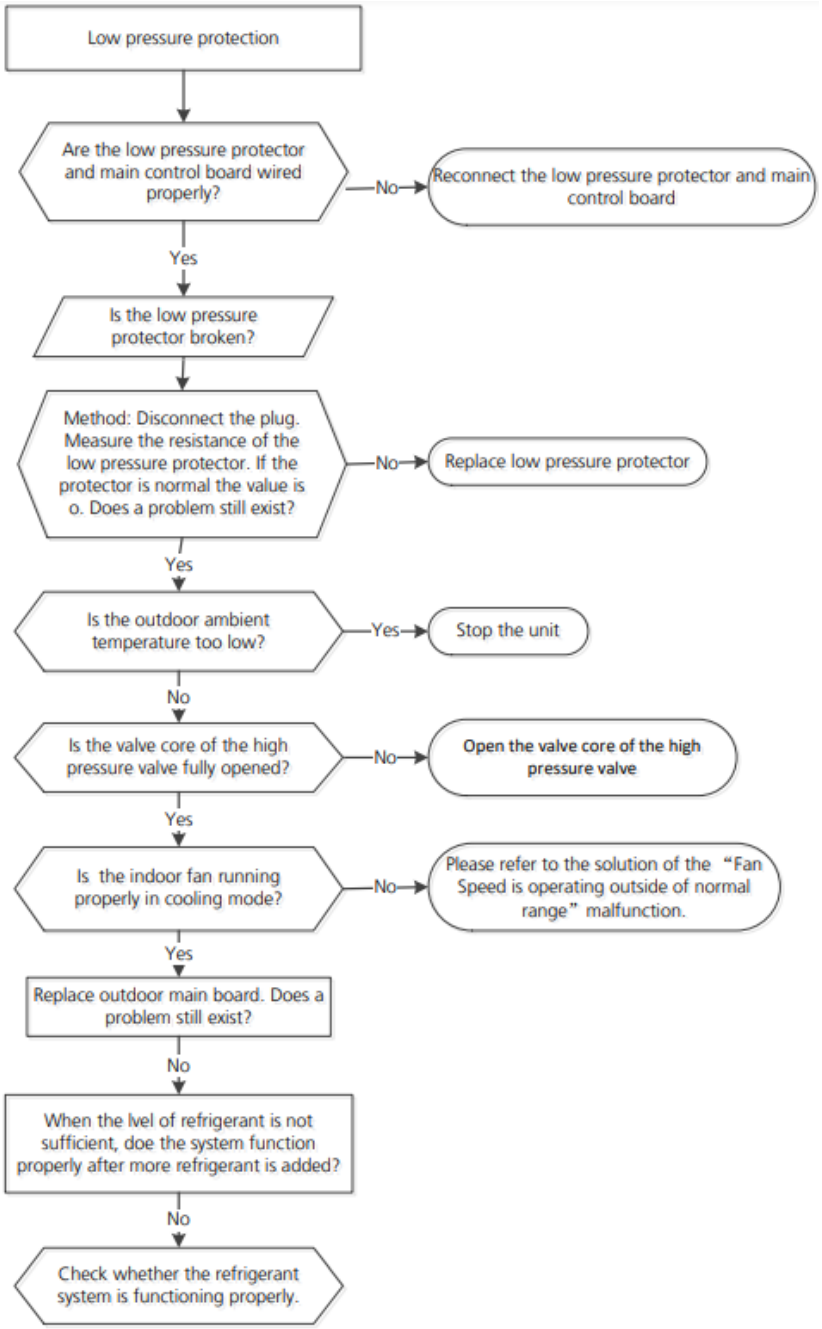
PC 31: System low pressure protection diagnosis and solution.

Description: The outdoor pressure switch cuts off the system because of low pressure (being lower than 18.85PSI (0.13MPA)) .

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- Low pressure protector
- Refrigerant

Troubleshooting and repair:



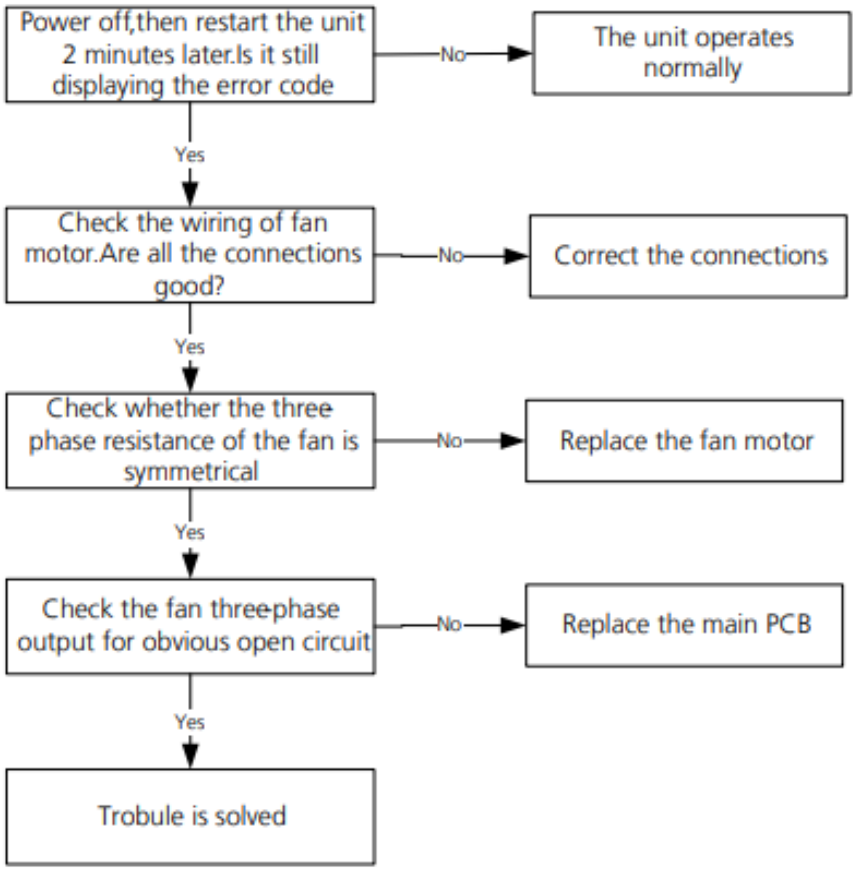
EC 72: Lack phase failure of the outdoor DC fan motor diagnosis and solution.

Description: When the three-phase sampling current of the DC motor is abnormal, especially when the current of one or more phases is always small and almost 0, the LED displays an error code.

Recommended parts to prepare:

- Connection wires
- Fan motor
- Outdoor PCB

Troubleshooting and repair:



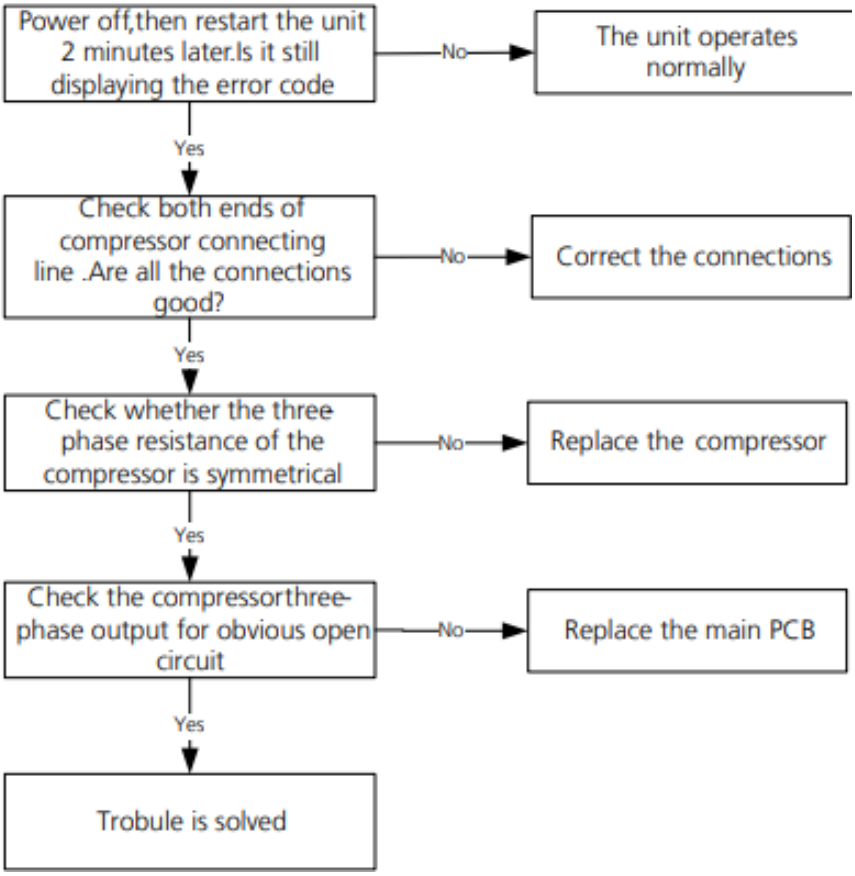
PC 43: ODU compressor lack phase protection diagnosis and solution.

Description: When the three-phase sampling current of the DC motor is abnormal, especially when the current of one or more phases is always small and almost 0, the LED displays an error code.

Recommended parts to prepare:

- Connection wires
- Compressor
- Outdoor PCB

Troubleshooting and repair:



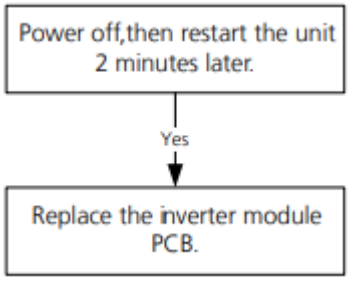
PC 45: ODU IR chip drive failure diagnosis and solution.

Description: When the IR chip detects its own parameter error, the LED displays the fault code when powered on.

Recommended parts to prepare:

- Inverter module PCB

Troubleshooting and repair:



EC 55: ODU IPM module temperature sensor malfunction diagnosis and solution.

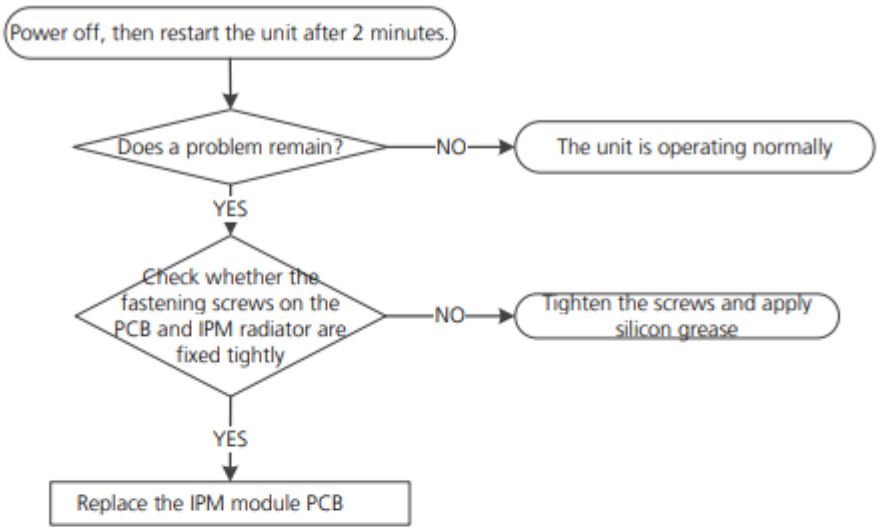
Description: If the sampling voltage is 0V or 5V, the LED displays a fault code.

Recommended parts to prepare:

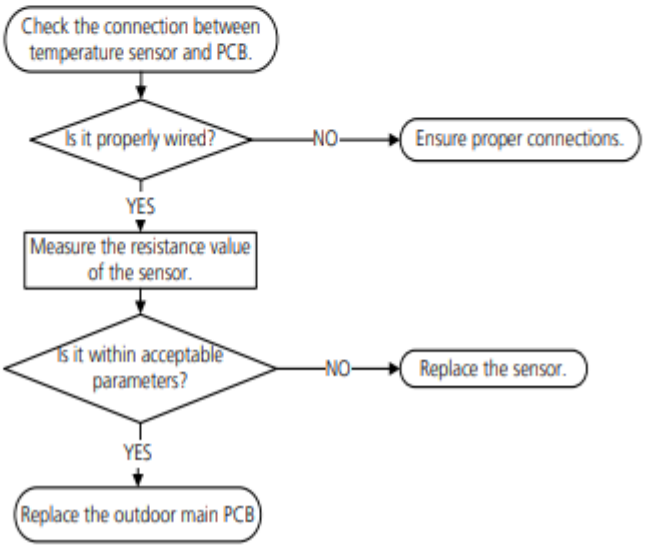
- IPM module PCB
- Connection wires
- Sensors
- Outdoor main PCB

Troubleshooting and repair:

If the radiator has no sensor, follow the steps below to resolve,



If the radiator has a sensor(TH), follow the steps below to resolve,



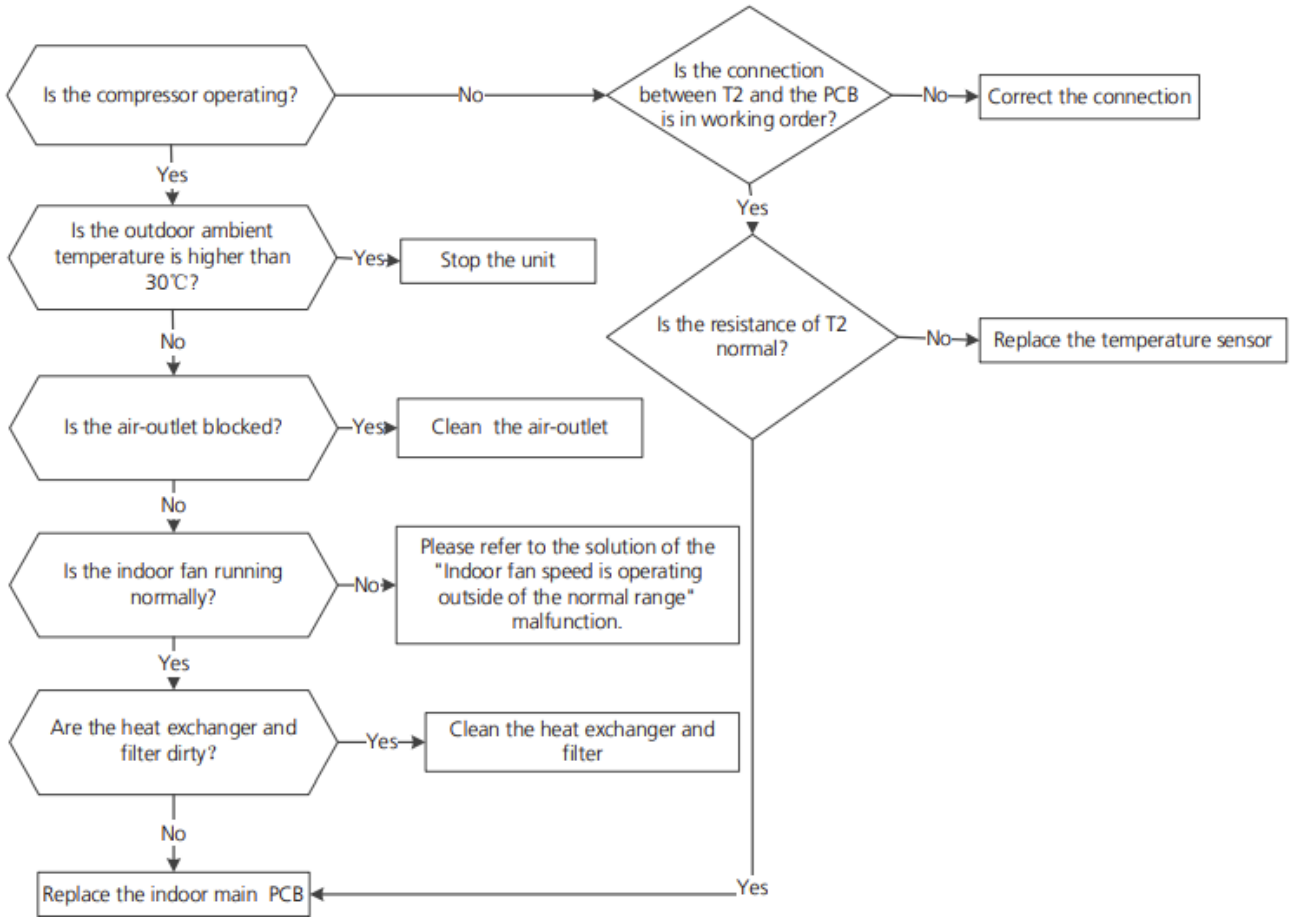
PH 90: High temperature protection of evaporator diagnosis and solution.

Description: When the evaporator coil temperature is more than 140°F (60°C) in heating mode the unit stops. It starts again only when the evaporator coil temperature is less than 125.6°F (52°C).

Recommended parts to prepare:

- Connection wires
- Evaporator coil temperature sensor (T2)
- Indoor fan
- Indoor main PCB

Troubleshooting and repair:



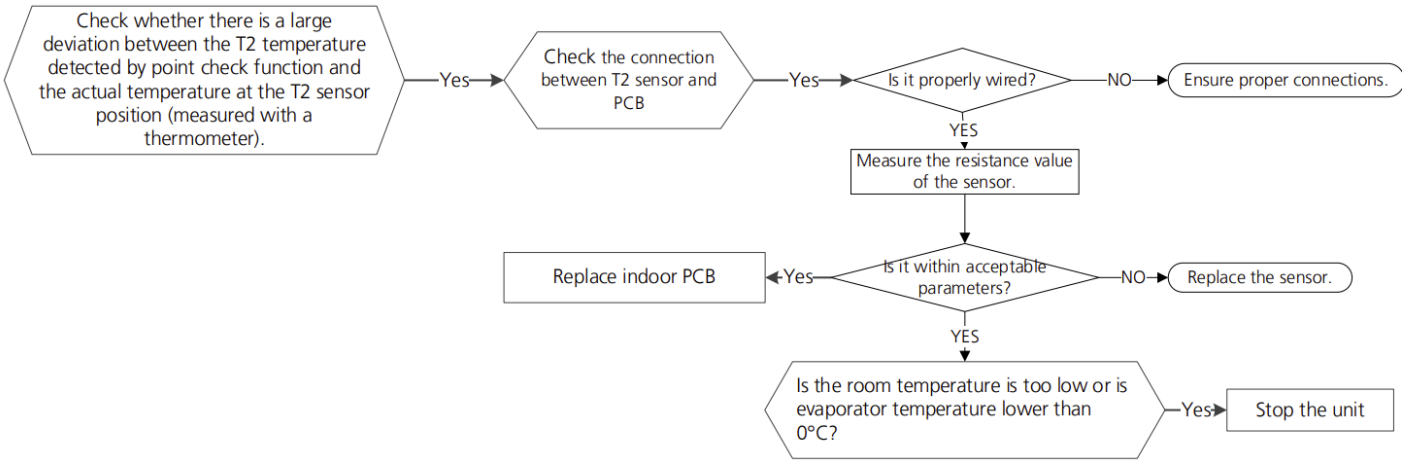
PH 91: Low temperature protection of evaporator diagnosis and solution.

Description: When the evaporator coil temperature is lower than 32°F (0°C) in cooling or drying mode the unit stops. It starts again only when the evaporator coil temperature is more than 41°F (5°C) .

Recommended parts to prepare:

- Connection wires
- Evaporator coil temperature sensor (T2)
- Indoor main PCB

Troubleshooting and repair:



5.6 Check Procedures

WARNING

Be sure to turn off all power supplies or disconnect all wires to avoid electric shock. Operate only after the compressor and coil has returned to normal temperature in case of injury.

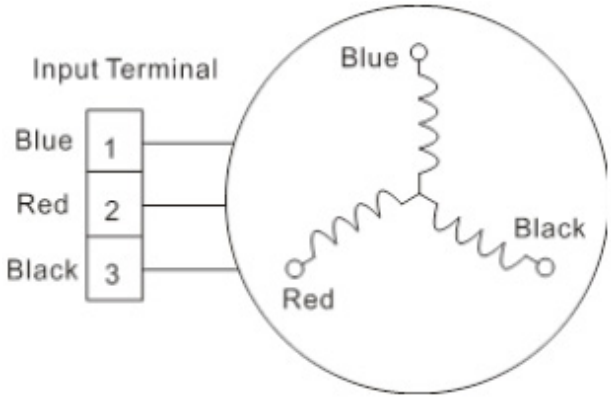
Temperature Sensor Check:

1. Disconnect the temperature sensor from the PCB.
2. Measure the resistance value of the sensor using a multi-meter.
3. Check corresponding temperature sensor resistance value table.

Note: The picture and the value are for reference only, actual condition and specific values may vary.

Compressor Check:

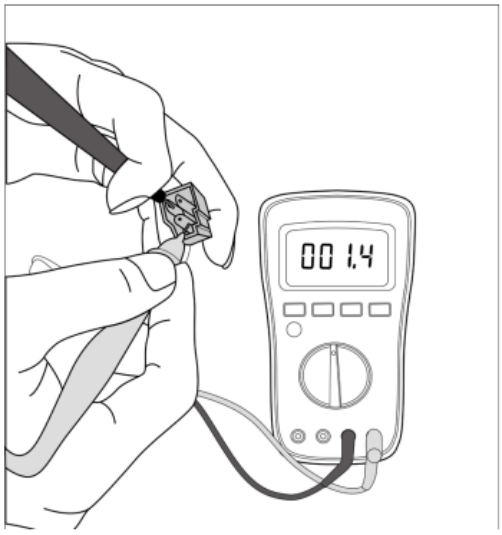
1. Disconnect the compressor power cord from the outdoor PCB.
2. Measure the resistance value of each winding using a multi-meter.
3. Check the resistance value of each winding in the following table.



Resistance Value	KSK103D33UEZ3	KSN140D58UFZ	KTF250D22UMT	KTN110D42UFZ	KTF420D62UNT
Blue-Red	2.13Ω	1.86Ω	0.75Ω	1.82Ω	0.86Ω
Blue-Black					
Red-Black					

Resistance Value	KTN150D30UFZA	KTM240D46UKT2	KTF310D43UMT	ETPQ420D1UMUA ETPQ440D1UMUB KTQ420D1UMU EKPQ440D1UMUB	MTH356UKRC8FQL
Blue-Red	1.02Ω	1.04Ω	0.65Ω	0.37Ω	0.487Ω
Blue-Black					
Red-Black					

Resistance Value	MTH550UKPC8FU				
Blue-Red	0.295Ω				
Blue-Black					
Red-Black					



Note: The picture and the value are for reference only, actual condition and specific values may vary.

IPM Continuity Check:

WARNING

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

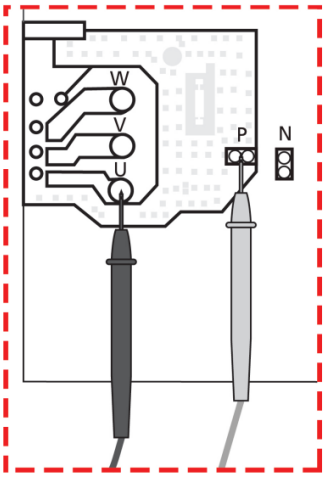
1. Turn off the outdoor unit and disconnect the power supply.
2. Discharge electronic capacitors and ensure all energy-storage units have been discharged.
3. Disassemble the outdoor PCB or disassemble the IPM board.
4. Measure the resistance value between P and U (U,W,N), U(V,W) and N.

Digital tester		Resistance Value	Digital Tester		Resistance Value
(+)Red	(-)Black		(+)Red	(-)Black	
P	N	∞	U	N	∞
	U		V		
	V	(Several MΩ)	W		(Several MΩ)
	W		-		

Or test the conductivity of IPM with diode mode.

Needle-type Tester		Normal Value	Needle-Type Tester		Normal Value
Red	Black		Red	Black	
P	U	Open-Circuit	N	U	0.3-0.5V
	V			V	
	W			W	

Needle-type Tester		Normal Value	Needle-Type Tester		Normal Value
Red	Black		Red	Black	
P	U	0.3-0.5V	N	U	Open-Circuit
	V			V	
	W			W	



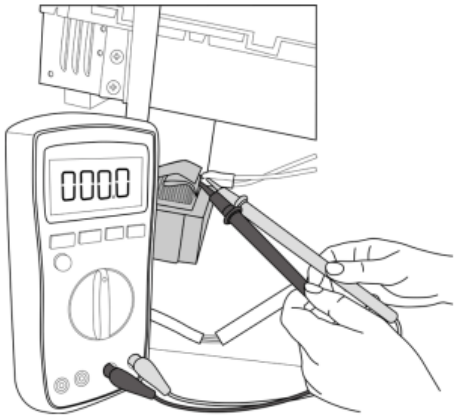
Note: The picture and the value are for reference only, actual condition and specific values may vary.

Normal Voltage of P and N:

208-230V (1-phase)		
In Standby		
Around 310VDC		
In Operation		
With passive PFC module	With partial active PFC module	With fully active PFC module
>200VDC	>310VDC	>370VDC

Reactor Check:

Measure the resistance of the reactor. The normal resistance should be around 0.1 ohm and if not the reactor has a malfunction.



4-Way Valve Check:

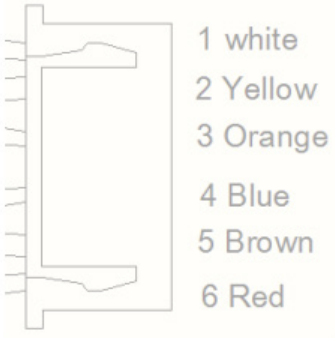
1. Power on, use a digital tester to measure the voltage. When the unit is operating in cooling it is 0V. When the unit operates in heating it is about equal to the power supply voltage. (If the value of the voltage is not in range, the PCB has a problem and needs to be replaced).
2. Turn off the power and use a digital tester to measure the resistance. The value should be 1.8~2.5KΩ.

EXV (EEV) Check:

1. Turn off the outdoor unit and disconnect the power supply.
2. Disconnect the connectors of the EXV.
3. Measure the resistance value between Red and Blue(Yellow); Brown and Orange(White).

Resistance to EXV coil:

Color of Lead Winding	Normal Value
Red-Blue	About 50Ω
Red-Yellow	
Brown-Orange	
Brown-White	



6 TEMPERATURE SENSOR RESISTANCE TABLE

Temperature Sensor Resistance Value Table (°C-K)

°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	1.171
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			

Other Temperature Sensor Resistance Value Table (°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	1.89627	107	225	0.51426
-12	10	70.1698	28	82	8.71983	68	154	1.83003	108	226	0.49989
-11	12	66.0898	29	84	8.3356	69	156	1.76647	109	228	0.486
-10	14	62.2756	30	86	7.97078	70	158	1.70547	110	230	0.47256
-9	16	58.7079	31	88	7.62411	71	160	1.64691	111	232	0.45957
-8	18	56.3694	32	90	7.29464	72	162	1.59068	112	234	0.44699
-7	19	52.2438	33	91	6.98142	73	163	1.53668	113	235	0.43482
-6	21	49.3161	34	93	6.68355	74	165	1.48481	114	237	0.42304
-5	23	46.5725	35	95	6.40021	75	167	1.43498	115	239	0.41164
-4	25	44	36	97	6.13059	76	169	1.38703	116	241	0.4006
-3	27	41.5878	37	99	5.87359	77	171	1.34105	117	243	0.38991
-2	28	39.8239	38	100	5.62961	78	172	1.29078	118	244	0.37956
-1	30	37.1988	39	102	5.3689	79	174	1.25423	119	246	0.36954
0	32	35.2024	40	104	5.17519	80	176	1.2133	120	248	0.35982
1	34	33.3269	41	106	4.96392	81	178	1.17393	121	250	0.35042
2	36	31.5635	42	108	4.76253	82	180	1.13604	122	252	0.3413
3	37	29.9058	43	109	4.5705	83	181	1.09958	123	253	0.33246
4	39	28.3459	44	111	4.38736	84	183	1.06448	124	255	0.3239
5	41	26.8778	45	113	4.21263	85	185	1.03069	125	257	0.31559
6	43	25.4954	46	115	4.04589	86	187	0.99815	126	259	0.30754
7	45	24.1932	47	117	3.88673	87	189	0.96681	127	261	0.29974
8	46	22.5662	48	118	3.73476	88	190	0.93662	128	262	0.29216
9	48	21.8094	49	120	3.58962	89	192	0.90753	129	264	0.28482
10	50	20.7184	50	122	3.45097	90	194	0.8795	130	266	0.2777
11	52	19.6891	51	124	3.31847	91	196	0.85248	131	268	0.27078
12	54	18.7177	52	126	3.19183	92	198	0.82643	132	270	0.26408
13	55	17.8005	53	127	3.07075	93	199	0.80132	133	271	0.25757
14	57	16.9341	54	129	2.95896	94	201	0.77709	134	273	0.25125
15	59	16.1156	55	131	2.84421	95	203	0.7537	135	275	0.24512
16	61	15.3418	56	133	2.73823	96	205	0.73119	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	2.4467	99	210	0.64862	139	282	0.22231

System Pressure Table-R454B

Pressure			Temperature		Pressure			Temperature	
Kpa	Bar	PSI	°C	°F	Kpa	Bar	PSI	°C	°F
58.196	0.58	8.44	-60	-76	935.23	9.35	135.64	8	46.4
61.517	0.62	8.92	-59	-74.2	963.75	9.64	139.78	9	48.2
64.988	0.65	9.43	-58	-72.4	992.93	9.93	14401	10	50
68.615	0.69	9.95	-57	-70.6	1022.8	10.23	148.34	11	51.8
72.402	.072	10.50	-56	-68.8	1053.3	10.53	152.76	12	53.6
76.354	0.76	11.07	-55	-67	1084.5	10.85	157.29	13	55.4
80.478	0.80	11.67	-54	-65.2	1116.4	11.16	161.91	14	57.2
84.776	0.85	12.30	-53	-63.4	1149	11.49	166.64	15	59
89.256	0.89	12.95	-52	-61.6	1182.3	11.82	171.47	16	60.8
93.923	0.94	13.62	-51	-59.8	1216.3	12.16	176.40	17	62.6
98.781	0.99	14.33	-50	-58	1251.1	12.51	181.45	18	64.4
103.84	1.04	15.06	-49	-56.2	1286.6	12.87	186.60	19	66.2
109.1	1.09	15.82	-48	-54.4	1322.8	13.23	191.85	20	68
114.56	1.15	16.61	-47	-52.6	1359.9	13.60	197.23	21	69.8
120.25	1.20	17.44	-46	-50.8	1397.7	13.98	202.71	22	71.6
126.15	1.26	18.30	-45	-49	1436.3	14.36	208.31	23	73.4
132.28	1.32	19.18	-44	-47.2	1475.7	14.76	214.02	24	75.2
138.64	1.39	20.11	-43	-45.4	1515.9	15.16	219.85	25	77
145.24	1.45	21.06	-42	-43.6	1557	15.57	225.82	26	78.8
152.09	1.52	22.06	-41	-41.8	1598.9	15.99	231.89	27	80.6
159.18	1.59	23.09	-40	-40	1641.6	16.42	238.09	28	82.4
166.54	1.67	24.15	-39	-38.2	1685.2	16.85	244.41	29	84.2
174.15	1.74	25.26	-38	-36.4	1729.7	17.30	250.86	30	86
182.04	1.82	26.40	-37	-34.6	1775	17.75	257.43	31	87.8
190.2	1.90	27.59	-36	-32.8	1821.3	18.21	264.15	32	89.6
198.65	1.99	28.81	-35	-31	1868.4	18.68	270.98	33	91.4
207.39	2.07	30.08	-34	-29.2	1916.5	19.17	277.95	34	93.2
216.42	2.16	31.39	-33	-27.4	1965.6	19.66	285.08	35	95
225.76	2.26	32.74	-32	-25.6	2015.5	20.16	292.31	36	96.8
235.41	2.35	34.14	-31	-23.8	2066.5	20.67	299.71	37	98.6
245.37	2.45	35.59	-30	-22	2118.4	21.18	307.24	38	100.4
255.67	2.56	37.08	-29	-20.2	2171.3	21.71	314.19	39	102.2
266.29	2.66	38.62	-28	-18.4	2225.2	22.25	322.73	40	104
277.25	2.77	40.21	-27	-16.6	2280.2	22.80	330.70	41	105.8
288.56	2.89	41.85	-26	-14.8	2336.1	23.36	38.81	42	107.6
300.22	3.00	43.54	-25	-13	2393.2	23.93	347.09	43	109.4
312.24	3.12	45.28	-24	-11.2	2451.3	24.51	355.52	44	111.2
324.63	3.25	47.08	-23	-9.4	2510.4	25.10	364.09	45	113
337.39	3.37	48.93	-22	-7.6	2570.7	25.71	372.84	46	114.8
350.54	3.51	50.84	-21	-5.8	2632.1	26.32	381.74	47	116.6
364.08	3.64	52.80	-20	-4	2694.7	26.95	390.82	48	118.4
378.02	3.78	54.83	-19	-2.2	2758.33	27.58	400.04	49	120.2
392.37	3.92	56.91	-18	-0.4	2823.2	28.23	409.46	50	122
407.13	4.07	59.05	-17	1.4	2889.3	28.89	419.04	51	123.8

System Pressure Table-R454B Cont.

Pressure			Temperature		Pressure			Temperature	
Kpa	Bar	PSI	°C	°F	Kpa	Bar	PSI	°C	°F
422.31	4.22	61.25	-16	3.2	2956.5	29.57	428.79	52	125.6
437.92	4.38	63.5	-15	5	3025	30.25	438.72	53	127.4
453.98	4.54	65.84	-14	6.8	3094.7	30.95	448.83	54	129.2
470.47	4.70	68.23	-13	8.6	3165.7	31.66	459.13	55	131
487.43	4.87	70.69	-12	10.4	3238.1	32.38	469.63	56	132.8
504.84	5.05	73.22	-11	12.2	3311.7	33.12	480.30	57	134.6
522.73	5.23	75.81	-10	14	3386.7	33.87	491.18	58	136.4
541.1	5.41	78.48	-9	15.8	3463	34.63	502.25	59	138.2
559.95	5.60	81.21	-8	17.6	3540.7	35.41	513.52	60	140
579.31	5.79	84.02	-7	19.4	3619.9	36.20	525.00	61	141.8
599.16	5.99	86.90	-6	21.2	3700.5	37.01	536.69	62	143.6
619.54	6.20	89.85	-5	23	3782.7	37.83	548.61	63	145.4
640.43	6.40	92.88	-4	24.8	3866.3	38.66	560.74	64	147.2
661.86	6.62	95.99	-3	26.6	3951.5	39.52	573.10	65	149
683.82	6.84	99.18	-2	28.4	4038.3	40.38	585.69	66	450.28
706.34	7.06	102.44	-1	30.2	4126.8	41.27	598.52	67	152.6
729.41	7.29	105.79	0	32	4217	42.17	611.60	68	154.4
753.06	7.53	109.22	1	33.8	4309	43.09	624.95	69	156.2
777.28	7.77	112.73	2	35.6	4402.9	44.03	638.56	70	158
802.08	8.02	116.33	3	37.4	4498.7	44.99	652.46	71	159.8
827.47	8.27	120.01	4	39.2	4596.5	45.97	666.64	72	161.6
853.49	8.53	123.78	5	41	4696.5	46.97	681.15	73	163.4
880.11	8.80	127.64	6	42.8	4798.9	47.99	696.00	74	165.5
907.35	9.07	131.60	7	44.6	4904.1	49.04	711.25	75	167

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Service Manual