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Installation Instructions

NOTE: For use with R-454B indoor units only. Read the entire instruction manual before starting the installation.

SAFETY CONSIDERATIONS

IMPORTANT: This appliance shall only be installed by EPA qualified personnel having appropriate certification. 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

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory–authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have a dry powder or CO2 fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian electrical code CSA 22.1.

Proper tools should be used that are designed for the refrigerant of the unit being installed. For A2L refrigerants, non-sparking tools are required. A refrigerant detector should be used prior to and during the installation process to check for leaks. Open flames or other ignition sources should not be present except during brazing. Brazing should only take place on refrigerant tubes that are open to the atmosphere or have been properly evacuated

Recognize safety information. This is the safety–alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety–alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than one disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never use air or any gas containing oxygen for leak testing or operating refrigerant compressors. Never allow compressor suction pressure to operate in a vacuum with service valves closed. See service manual for pump-down instructions.

GENERAL

NOTE: In some cases noise in the living area has been traced to gas pulsations from improper installation of equipment.

1. Maximum allowed elevation is 10,000 feet (3000 meters) above sea level.
2. Locate unit away from windows, patios, decks, etc. where unit operation sound may disturb customer.
3. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
4. Run refrigerant tubes with no bends with centerline bend radius less than 2.5 times the external pipe diameter..
5. Leave some slack between structure and unit to absorb vibration.
6. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon–based caulk (see Fig. 1).
7. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.

8. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap which comes in direct contact with tubing (see Fig. 1).
9. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
10. When necessary, use hanger straps which are 1 in. (25 mm) wide and conform to shape of tubing insulation (see Fig. 1).
11. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.
12. Provision shall be made for expansion and contraction of long runs of piping.
13. Piping and fittings shall be protected as far as possible against adverse environmental effects. For example, the accumulation of dirt and debris.
14. Piping should be installed to reduce the likelihood of hydraulic shock damaging the system.
15. Certified piping and components must be used in order to protect against corrosion.
16. Flexible pipe elements shall be protected against mechanical damage, excessive stress by torsion, or other forces. They should be checked for mechanical damage annually.
17. Piping material, routing, and installation shall include protection from physical damage in operation and service, and be in compliance with the national and local codes and standards of the installation site.
18. When setting up refrigerant piping, precautions shall be taken to avoid excessive vibration or pulsation.

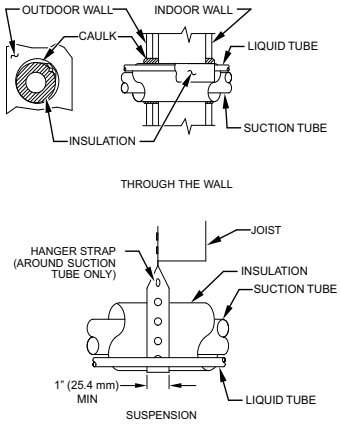

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Fig. 1 – Connecting Tubing Installation

Refrigerant Tubing Connection Outdoor

IMPORTANT: Maximum liquid–line size is 3/8–in. OD for all residential applications including long line. Refer to Residential Piping and Long Line Guideline for further information

IMPORTANT: Always install the factory–supplied liquid–line filter drier.

If replacing the filter drier, refer to Product Replacement Parts List for appropriate part number. Obtain replacement filter driers from your distributor or branch.

INSTALLATION

IMPORTANT: Effective January 1, 2023, all split system and packaged heat pumps must be installed pursuant to applicable regional efficiency standards issued by the Department of Energy.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Check Equipment and Job Site

Unpack Unit

Move to final location. Remove carton taking care not to damage unit.

Inspect Equipment

File claim with shipping company prior to installation if shipment is damaged or incomplete. Locate unit rating plate on unit corner panel. It contains information needed to properly install unit. Check rating plate to be sure unit matches job specifications.

Install on a Solid, Level Mounting Pad

If conditions or local codes require the unit be attached to pad, tie down bolts should be used and fastened through knockouts provided in unit base pan. Refer to unit mounting pattern in Fig. 2 to determine base pan size and knockout hole location.

For hurricane tie downs, contact distributor for details and PE Certification (Professional Engineer), if required.

On rooftop applications, mount on level platform or frame. Place unit above a load–bearing wall and isolate unit and tubing set from structure. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

Roof mounted units exposed to winds above 5 mph may require wind baffles. Consult the Application Guideline and Service Manual – Residential Split System Air Conditioners and Heat Pumps for wind baffle construction.

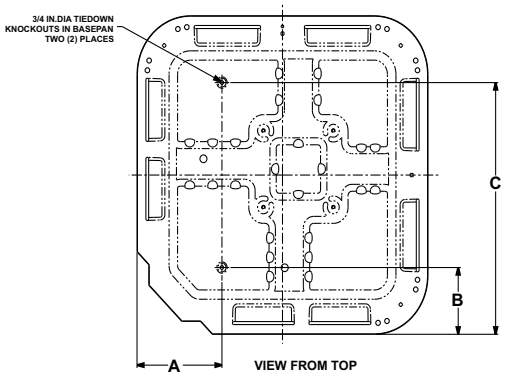
Unit must be level to within ±2° (±3/8 in/ft,±9.5 mm/m) per compressor manufacturer specifications.

Clearance Requirements

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 24 in. (610 mm) clearance to service end of unit and 48 in. (1219 mm) above unit. For proper airflow, a 6–in. (152 mm) clearance on 1 side of unit and 12–in. (305 mm) on all remaining sides must be maintained. Maintain a distance of 24 in. (610 mm) between units or 18 in. (457 mm) if no overhang within 12 ft. (4 m). Position so water, snow, or ice from roof or eaves cannot fall directly on unit.

NOTE: 18” (457 mm) clearance option described above is approved for outdoor units with wire grille coil guard only. Units with louver panels require 24” (610 mm) between units.

On rooftop applications, locate unit at least 6 in. (152 mm) above roof surface.



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UNIT BASE PAN Dimension in. (mm)	TIEDOWN KNOCKOUT LOCATIONS in. (mm)		
	A	B	C
31–1/2 X 31–1/2 (800 X 800)	9–1/8 (231.8)	6–9/16 (166.7)	24–11/16 (627.1)
35 X 35 (889 X 889)	9–1/8 (231.8)	6–9/16 (166.7)	28–7/16 (722.3)

Fig. 2 – Tiedown Knockout Locations

Operating Ambient

The minimum outdoor operating ambient in cooling mode without accessory is 55°F (13°C).

Check Defrost Thermostat

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

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

The appliance shall be stored in a room without continuously operating ignition sources (for example:

open flames, an operating gas appliance or an operating electric heater.

Do not pierce or burn.

Be aware that refrigerants do not contain an odor.

Check defrost thermostat to ensure it is properly located and securely attached. There is a liquid header with a distributor and feeder tube going into outdoor coil. At the end of the one of the feeder tubes, there is a 3/8 in. O.D. stub tube approximately 2 in. (50.8 mm) long (see Fig. 3). The defrost thermostat should be located on stub tube. Note that there is only one stub tube used with liquid header, and on most units it is the bottom circuit.

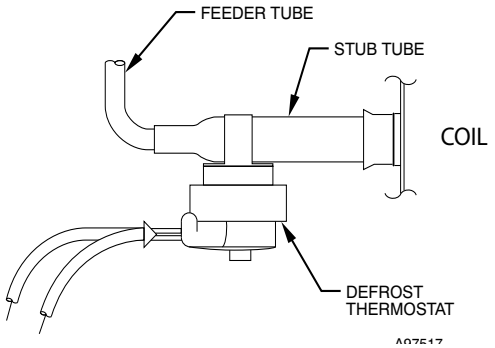

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Fig. 3 – Defrost Thermostat Location

Elevate Unit

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not allow water and/or ice to build up in base pan.

Elevate unit per local climate and code requirements to provide clearance above estimated snowfall level and ensure adequate drainage of unit.

Table 1 – Accessory Usage

Accessory	REQUIRED FOR LOW–AMBIENT COOLING APPLICATIONS (Below 55°F / 12.8°C)	REQUIRED FOR LONG LINE APPLICATIONS*	REQUIRED FOR SEA COAST APPLICATIONS (Within 2 miles / 3.22 km)
Accumulator	Standard	Standard	Standard
Ball Bearing Fan Motor	Yes†	No	No
Compressor Start Assist Capacitor and Relay	Yes	Yes	No
Crankcase Heater	Yes	Yes	No
Evaporator Freeze Thermostat	Yes	No	No
Hard Shutoff TXV	Yes	Yes	No
Isolation Relay	Yes	No	No
Liquid Line Solenoid Valve	No	See Long–Line Application Guideline	No
Motor Master® Control or Low Ambient Switch	Yes‡	No	No
Support Feet	Recommended	No	Recommended

*. For tubing line sets between 80 and 200 ft. (24.38 and 60.96 m) and/or 20 ft. (6.09 m) vertical differential, refer to Residential Piping and Long Line Guideline.
†. Additional requirement for Low–Ambient Controller (full modulation feature) MotorMaster® Control.
‡. In units equipped with ECM OD motor, motor needs to be replaced per unit accessory guide to work properly. This motor kit comes with a new defrost board that also needs to be installed. Unit will not meet AHRI rated efficiency once motor and control board are replaced to use this accessory.

Make Piping Connections

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Use all service ports and open all flow–control devices, including solenoid valves.

Federal regulations require that refrigerant is not vented into the atmosphere. Recover during system repair or final unit disposal.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If ANY refrigerant tubing is buried, provide a 6–in (152 mm) vertical rise at service valve. Refrigerant tubing lengths up to 36–in (914 mm). may be buried without further special consideration. Do not bury lines longer than 36 in (914 mm).

Outdoor units may be connected to indoor section using accessory tubing package or field–supplied refrigerant grade tubing of correct size and condition.

Rated tubing diameters shown in Table 2 are recommended up to 80 ft. (24 m). See Product Data for acceptable alternate vapor diameters and associated capacity losses.

For tubing requirements beyond 80 ft, substantial capacity and performance losses can occur. Following the recommendations in the Residential Piping and Long Line Guideline will reduce these losses. Refer to Table 1 for accessory requirements.

There are no buried–line applications greater than 36 in. (914 mm)

If refrigerant tubes or indoor coil are exposed to atmosphere, they must be evacuated to 500 microns to eliminate contamination and moisture in the system.

Refrigerant pipe should be installed with the minimum length possible and practical for the application. Piping should be protected from physical damage in operation and in service and be in compliance with national and local codes such as ASRHAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. When piping is installed through studs in a wall, steel plates should be used for protection with a minimum thickness of 16 gage.

All field joints shall be accessible for inspection prior to being covered or enclosed.

Outdoor Unit Connected To Factory Approved R-454B Indoor Unit

When outdoor unit is connected to factory–approved R-454B indoor unit, outdoor unit contains approximate system refrigerant charge for operation with AHRI rated indoor unit when connected by 15 ft. (5 m) of field–supplied or factory accessory tubing and factory supplied filter drier. For all sizes, adjust charge by adding or removing 0.6 oz/ft of 3/8 liquid line above or below 15 ft. (5 m) respectively..

Some indoor units require additional subcooling to achieve optimal heating performance.

Connect vapor and liquid tubes to fittings on vapor and liquid service valves (see Table 2). Use refrigerant grade tubing.

Table 2 – Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (In.)

UNIT SIZE	LIQUID		RATED VAPOR*	
	Connection Diameter	Tube Diameter	Connection Diameter	Tube Diameter
18, 24	3/8	3/8	5/8	5/8
30, 36	3/8	3/8	3/4	3/4
42, 48	3/8	3/8	7/8	7/8
60	3/8	3/8	7/8	1–1/8

*. Units are rated with 25 ft. (7.6 m) of lineset. See Product Data sheet for performance data when using different size and length linesets.
Notes:

1. Do not apply capillary tube indoor coils to these units.
2. For Tubing Set lengths between 80 and 200 ft. (24.38 and 60.96 m) horizontal or 20 ft. (6.09 m) vertical differential 250 ft. (76.2 m) Total Equivalent Length, refer to the Residential Piping and Long Line Guideline – Air Conditioners and Heat Pumps using Puron Advance refrigerant.
3. For alternate liquid line options, see Product Data or Residential Piping and Long Line Application Guideline

Service Valves

Service valves are closed and plugged from the factory. Outdoor units are shipped with a refrigerant charge sealed in the unit. Leave the service valves closed until all other refrigerant system work is complete or the charge will be lost. Leave the plugs in place until line set tubing is ready to be inserted.

Heat pumps require a piston metering device in the liquid service valve for proper heating operation. Piston is shipped in the piston body of the liquid service valve, temporarily held in place with a plastic cap. Do not remove the plastic cap until line set tubing is ready to be installed.

Refer to Fig. 4 and follow these steps for piston installation:

1. Remove plastic cap holding piston in piston body of liquid service valve.
2. Check that piston size (stamped on side of piston) matches with number listed on unit rating plate. Return piston to piston body of liquid service valve (either direction).
3. Find plastic bag taped to unit containing copper adapter tube, brass nut, and plastic washer.
4. Install plastic washer in the seat inside piston body.
5. Fit brass nut onto adapter tube and install tube onto liquid service valve. Tighten nut finger tight, then wrench additional ½ turn only [15-ft lbs (20.3 N-m)]. Over tightening may damage the plastic washer and service valve's piston body.

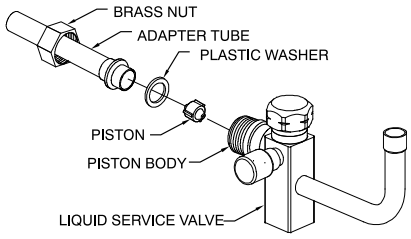

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Fig. 4 – Liquid Service Valve with Heating Piston and Adapter Tube

Brazing Connections

CAUTION

BURN HAZARD

Failure to follow this caution may result in personal injury.

Components will be HOT after brazing. Wear appropriate personal protective equipment and allow to cool before handling parts and equipment.

If using brazing connections, use a properly sized swedge tool to create a swedge (bell) on one of the two copper tubes being connected. Alternatively, a copper coupling can be used which will require two braze joints instead of one.

Clean line set tube ends with emery cloth or steel brush. Remove any grit or debris.

Connect vapor tube to fitting on outdoor unit vapor service valves (see Table 2). Connect liquid tubing to adapter tube on liquid service valve. Use refrigerant grade tubing.

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Service valves must be wrapped in a heat–sinking material such as a wet cloth while brazing.

Apply heat absorbing paste or heat sink product between service valve and joint. Wrap service valves with a heat sinking material such as a wet cloth.

After wrapping service valve with a wet cloth, tubing set can be brazed to service valve using either silver bearing or non–silver bearing brazing material. Do not use soft solder (materials which melt below 800°F/427°C). Braze joints using a Sil-Fos or Phos-copper alloy. Consult local code requirements.

Some outdoor units contain a mechanical fitting at the liquid distributor. This connection is not field serviceable and should not be disturbed.

For Liquid Service Valve - Braze lineset to adapter tube BEFORE bolting adapter to valve. This helps prevent overheating and damage to plastic washer or o-ring.

For Vapor Service Valve - remove valve core from schrader port on Service Valve BEFORE brazing. This helps prevent overheating and damage to valve seals (refer to Fig. 5). Replace valve core when brazing is completed.

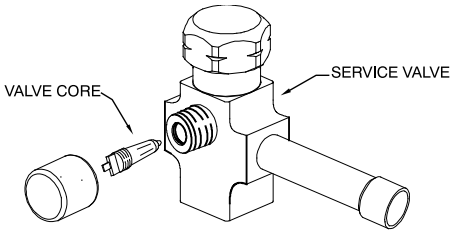

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Fig. 5 – Vapor Service Valve

WARNING

FIRE HAZARD

Failure to following this warning could result in personal injury, death and/or property damage.

Refrigerant and oil mixture could ignite and burn as it escapes and contacts brazing torch. Make sure the refrigerant charge is properly removed from both the high and low sides of the system before brazing any component or lines.

Mechanical Line Set Connections

If using mechanical or crimp-type line set connections, follow crimp tool manufacturer's instructions.

NOTE: Should the use of mechanical fittings cause failure of the fittings or failure of the equipment, such would not be covered under the equipment limited warranty.

Install Liquid Line Filter Drier Indoor

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Installation of filter drier in liquid line is required.

Filter drier must be wrapped in a heat-sinking material such as a wet cloth while brazing

Refer to Fig. 6 and install filter drier as follows:

1. Braze 5 in. (127 mm) liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to 5 in. (127 mm) long liquid tube from step 1.
4. Connect and braze liquid refrigerant tube to the filter drier.

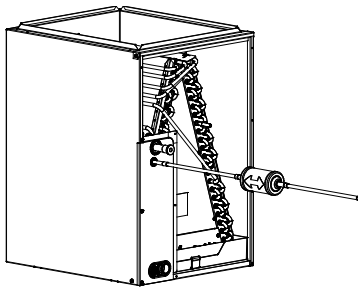

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Fig. 6 – Liquid Line Filter Drier

Mandatory Requirements

Pressure Proof Check

Refrigerant tubes and indoor coil should be pressure tested with an inert gas such as nitrogen. Pressurize the system with the inert gas to the Low Side Test Pressure listed on the outdoor unit rating plate

1. Perform a pressure check of the unit with a nitrogen charge of about 200psi.
2. The nitrogen holding charge must NOT decrease in pressure for 1 hour, as indicated by the test gauge. The measuring test gauge resolution not exceeding 5% of the holding charge.

Final Tubing Check

IMPORTANT: Check to be certain factory tubing on both indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to feeder tubes, makings sure wire ties on feeder tubes are secure and tight.

Pressure Test Tubing and Indoor Coil

Refrigerant tubes and indoor coil should be pressure tested with an inert gas such as nitrogen. Pressurize the system with the inert gas to the Low Side Test Pressure listed on the outdoor unit rating plate

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never exceed the test pressures listed on the rating plate when pressure testing an outdoor unit.

Leak Check

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gage capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. A tight dry system will hold a vacuum of 1000 microns after approximately 7 minutes. (See Fig. 7.)

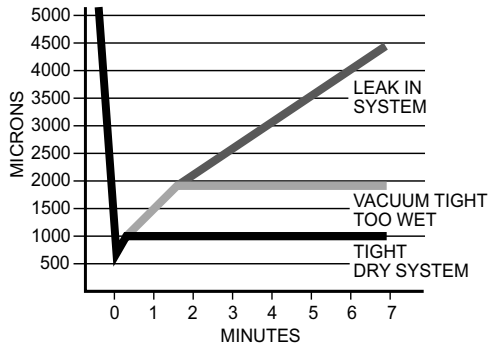

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Fig. 7 – Deep Vacuum Graph

⚠ WARNING

FIRE HAZARD

Failure to following this warning could result in personal injury, death and/or property damage.

DO NOT USE FLAMES OR IGNITION SOURCES TO LEAK CHECK.

Vacuum unit to 500 microns. When isolating the unit from the pump, the pressure shall not rise above 1500 microns in 10 minutes.

Evacuate Refrigerant Tubing and Indoor Coil

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Never use the system compressor as a vacuum pump.

Refrigerant tubes and indoor coil should be evacuated using the recommended deep vacuum method of 500 microns. The alternate triple evacuation method may be used (see triple evacuation procedure in service manual). Always break a vacuum with dry nitrogen.

Make Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Do not supply power to unit with compressor terminal box cover removed.

Be sure field wiring complies with local and national fire, safety, and electrical codes, and voltage to system is within limits shown on unit rating plate. Contact local power company for correction of improper voltage. See unit rating plate for recommended circuit protection device.

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect unit reliability. See unit rating plate. Do not install unit in system where voltage may fluctuate above or below permissible limits.

NOTE: Use copper wire only between disconnect switch and unit.

NOTE: Install branch circuit disconnect of adequate size per NEC to handle unit starting current. Locate disconnect within sight from and readily accessible from unit, per Section 440–14 of NEC. Refer to Product Data for breaker sizing.

Route Ground and Power Wires

Remove access panel to gain access to unit wiring. Extend wires from disconnect through power wiring hole provided and into unit control box.

Connect Ground and Power Wires

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with national and local electrical codes.

This appliance incorporates an earth connection for safety purposes only. Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Fig. 8.

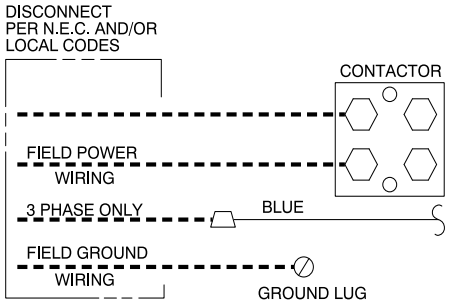

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Fig. 8 – Line Connections

In 3-phase units, a small circuit board is factory installed to monitor line voltage (see Fig. 9). A small LED will flash if a phase problem exists. See code descriptions on monitor.

If LED is flashing, disconnect power to unit and interchange 2 field-wiring leads on unit contactor.

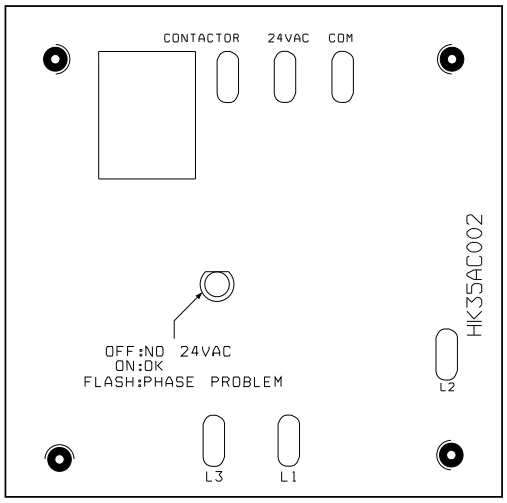

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Fig. 9 – 3–Phase Monitor Control (Applies to 3–Phase Units Only)

Table 3 – 3-Phase Monitor LED Indicators

LED	STATUS
OFF	No call for compressor operation
FLASHING	Reversed phase
ON	Normal

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Ensure compressor rotation is correct.

- 3-phase scroll compressors are rotation sensitive.
- A flash LED on phase monitor indicates reverse rotation. (See Table 3). This will not allow contractor to be energized.
- Disconnect power to unit and interchange 2 field-wiring leads on unit contactor

Connect Control Wiring

Route 24v control wires through control wiring grommet and connect leads to control wiring. See Thermostat Installation Instructions for wiring specific unit combinations. (See Fig. 10.)

Use No. 18 AWG color–coded, insulated (35°C minimum) wire. If thermostat is located more than 100 ft (31 m) from unit, as measured along the control voltage wires, use No. 16 AWG color–coded wire to avoid excessive voltage drop.

All wiring must be NEC Class 2 and must be separated from incoming power leads.

Use furnace transformer, fan coil transformer, or accessory transformer for control power, 24v/40va minimum.

NOTE: Use of available 24v accessories may exceed the minimum 40va power requirement. Determine total transformer loading and increase the transformer capacity or split the load with an accessory transformer as required.

NOTE: Factory Authorized Dissipation System must be installed with the indoor unit.

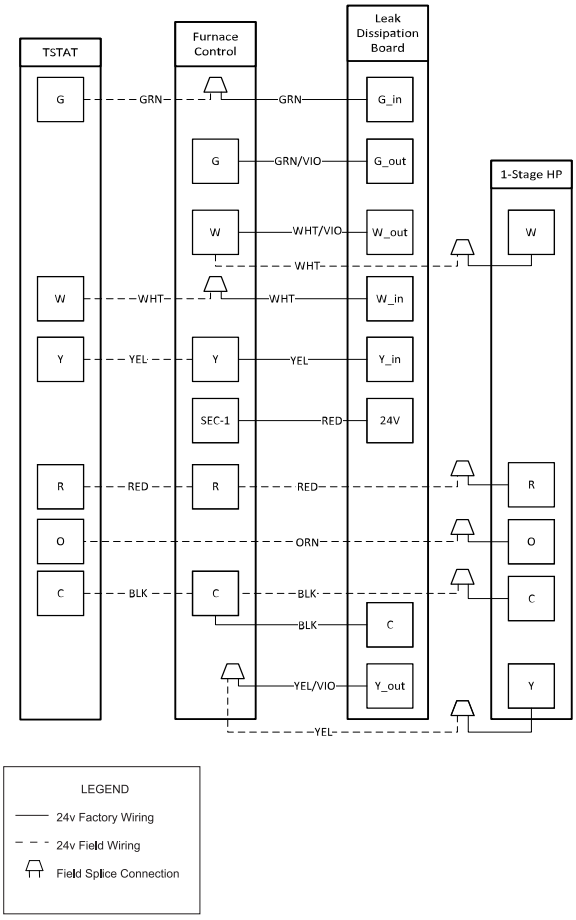

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Fig. 10 – Generic Wiring Diagram (See tstat Installation Instructions for specific unit combinations)

Final Wiring Check

IMPORTANT: Check factory wiring and field wire connections to ensure terminations are secured properly. Check wire routing to ensure wires are not in contact with tubing, sheet metal, etc.

Compressor Crankcase Heater

When equipped with a crankcase heater, furnish power to heater a minimum of 24 hr before starting unit. To furnish power to heater only, set thermostat to OFF and close electrical disconnect to outdoor unit.

A crankcase heater is required if refrigerant tubing is longer than 80 ft (24 m), or when outdoor unit is 20 ft (6 m) below indoor unit. Refer to the Residential Piping and Long Line Guideline and Service Manual.

Install Electrical Accessories

Refer to the individual instructions packaged with kits or accessories when installing.

⚠ WARNING

PERSONAL INJURY AND/OR PROPERTY DAMAGE HAZARD

Failure to follow this warning could result in personal injury and/or property damage.

For continued performance, reliability, and safety, the only approved accessories and replacement parts are those specified by the equipment manufacturer. The use of non-manufacturer approved parts and accessories could invalidate the equipment limited warranty and result in fire risk, equipment malfunction, and failure.

Please review the manufacturer's literature and replacement parts catalogs available from your equipment supplier.

Start–Up

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant and observe the following:

- Front seating service valves are equipped with Schrader valves.

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Federal regulations require that you do not vent refrigerant to the atmosphere. Recover during system repair or final unit disposal.

⚠ CAUTION

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this caution may result in personal injury, equipment damage or improper operation.

- Do not overcharge system with refrigerant.
- Do not operate unit in a vacuum or at negative pressure.
- Do not disable low pressure switch in scroll compressor applications.
- Compressor dome temperatures may be hot.

Follow these steps to properly start up system:

⚠ WARNING

PERSONAL INJURY HAZARD

Failure to follow this warning could result in personal injury or death.

Do not use power tools to open and close service valves.

Power tools can cause valve stem to suddenly be ejected from the valve body followed by a high pressure refrigerant leak.

1. After system is evacuated, fully open liquid and vapor service valves.
2. Unit is shipped with valve stem(s) front seated (closed) and caps installed. Replace stem caps after system is opened to refrigerant flow (back seated). Replace caps finger–tight and tighten with wrench an additional 1/12 turn.
3. Close electrical disconnects to energize system.
4. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature for cooling mode operation.
5. Set room thermostat to HEAT or COOL and fan control to ON or AUTO mode, as desired. Operate unit for 15 minutes. Check system refrigerant charge.

Sequence of Operation

Turn on power to indoor and outdoor units. Transformer is energized.

Cooling

On a call for cooling, thermostat makes circuits R–O and R–Y, and R–G. Circuit R–O energizes reversing valve, switching it to cooling position. Circuit R–Y energizes contactor, starting outdoor fan motor and compressor circuit. R–G energizes indoor unit blower relay, starting indoor blower motor on high speed.

When thermostat is satisfied, its contacts open, de–energizing contactor and blower relay. Compressor and motors should stop.

If indoor unit is equipped with a time–delay relay circuit, the indoor blower will run an additional 90 seconds to increase system efficiency.

Heating

On a call for heating, thermostat makes circuits R–Y and R–G. Circuit R–Y energizes contactor, starting outdoor fan motor and compressor. Circuit R–G energizes indoor blower relay, starting blower motor on high speed.

Should temperature continue to fall, R–W2 is made through second–stage room thermostat. Circuit R–W2 energizes a relay, bringing on first bank of supplemental electric heat and providing electrical potential to second heater relay (if used). If outdoor temperature falls below setting of outdoor thermostat (field installed option), contacts close to complete circuit and bring on second bank of supplemental electric heat.

When thermostat is satisfied, its contacts open, de–energizing contactor and relay. All heaters and motors should stop.

Quiet Shift-2

Quiet Shift-2 is a field selectable defrost mode (factory set to OFF), which will reduce the occasional noise that could be heard at the start of defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 on defrost board in the ON position.

When Quiet Shift-2 switch is placed in ON position, and defrost is initiated, the following sequence of operation will occur:

– The compressor will be de--energized for approximately 1 minute, then the reversing valve will be energized. A few seconds later, the compressor will be re-energized and the normal defrost cycle starts.

Once defrost termination conditions have been met, the following sequence will occur:

– The compressor will be de-energized for approximately 1 minute, then the reversing valve will be de-energized. A few seconds later, the compressor will be re-energized and the normal heating cycle starts.

Defrost

The defrost control is a time/temperature control which includes a field selectable time period between defrost cycles (30, 60, 90, or 120). The time period is selected using DIP switches located on the board. The setting is initial period only then varies with defrost length.

The defrost thermostat senses coil temperature throughout the heating cycle. When the coil temperature reaches the defrost thermostat setting of approximately 32°F (0°C), it will close, which energizes the DFT terminal and begins the defrost timing sequence. The timer runs only when the defrost thermostat is closed and the contactor is energized.

Defrost mode is identical to cooling mode except that outdoor fan motor stops and second-stage heat is turned on to continue warming conditioned spaces.

Defrost Speedup

Quiet Shift-2 Models

To initiate a forced defrost, speedup pins (J1) must be shorted with a flat head screwdriver for 5 seconds and **RELEASED**. If the defrost thermostat is open, a short defrost cycle will be observed (actual length depends on Quiet Shift-2 switch position). When Quiet Shift-2 is off, only a short 30 second defrost cycle is observed. With Quiet Shift-2 ON, the speedup sequence is approximately 3 minutes; 1 minute compressor off period followed by 30 seconds of defrost with compressor operation. When returning to heating mode, the compressor will turn off for an additional minute.

If the defrost thermostat is closed, a complete defrost cycle is initiated. If the Quiet Shift-2 switch is turned on, the compressor will be turned off for two 1-minute intervals as explained previously.

If Quiet Shift 2 is enabled, the variable defrost intervals will be disabled to provide options where using a specific setting is desired. In this case the 30, 60, 90, or 120 setting will not change unless the dipswitch is changed, and power is cycled.

NOTE: Forcing a defrost will reset the defrost interval to the DIP switch setting before resuming variable length intervals based on defrost cycle lengths.

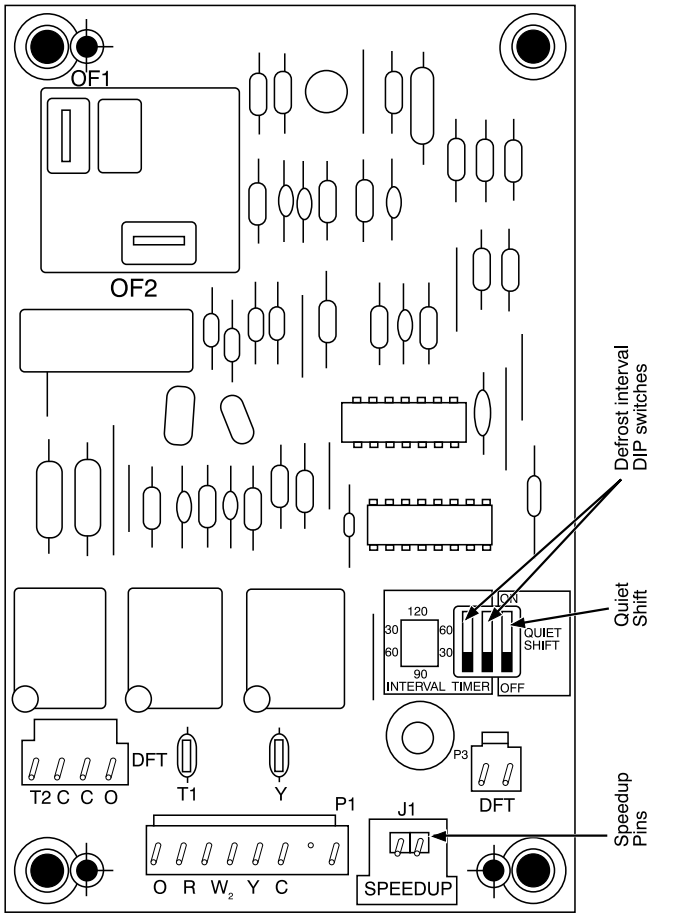

Fig. 11 – Quiet Shift-2 Control Board

Check Charge

Factory charge amount and desired subcooling are shown on unit rating plate. Additional subcooling may be required to achieve optimal heating performance based on the installed indoor unit..

Care should be taken to ensure proper refrigerant is used for charging. Refer to outdoor unit rating plate to determine proper refrigerant. Refrigerant cylinders used for charging should be kept in an appropriate position and grounded to earth before charging. Hose length should be kept to a minimum. Care should be taken to not overcharge the system.

Charging method is shown on information plate inside unit. For TXV, use subcooling method. For piston, use superheat method. To properly check or adjust charge, conditions must be favorable for subcooling or superheat charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.1°C and 37.8°C), and the indoor temperature is between 70°F and 80°F (21.1°C and 26.7°C). Follow the procedure below:

Unit is factory charged for 15ft (5 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft (.018 kg/m) of 3/8 liquid line above or below 15ft (5 m) respectively.

For standard refrigerant line lengths (80 ft/24 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by super heat method for fixed metering device and subcooling method for TXV. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is above 80°F (26.7°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.7°C) before attempting to check system charge by subcooling method as described above.

If the indoor temperature is below 70°F (21.1°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (5 m) only. Charge level should then be appropriate for the system to achieve rated capacity. The charge level could then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.

NOTE: If line length is beyond 80 ft (24 m) or greater than 20 ft (6 m) vertical separation, See Residential Piping and Long Line Guideline for special charging requirements.

Final charge should be recorded on the outdoor unit charging label with permanent and legible writing. Total refrigerant charge is factory charge plus any added charge. Verify that the indoor space served by the indoor unit, including spaces connected by ductwork, exceed the minimum room size as listed on the outdoor unit charging label. Refer to Table 4.

Table 4 – Minimum Room Area Charging Table

Total System Charge (lbs.)	Minimum Floor Area (sq. ft.)
4	61
5	76
6	91
7	106
8	122
9	137
10	152
11	167
12	182
13	198
14	213
15	228
16	243
17	258
18	274
19	289
20	304
21	319
22	335
23	350
24	365
25	380

Units with Cooling Mode TXV

Units installed with cooling mode TXV require charging by the subcooling method.

1. Operate unit a minimum of 15 minutes before checking charge.
2. Measure liquid service valve pressure by attaching an accurate gage to service port.
3. Measure liquid line temperature by attaching an accurate thermistor type or electronic thermometer to liquid line near outdoor coil.
4. Refer to unit rating plate for required subcooling temperature.
5. Refer to Table 5. Find the point where required subcooling temperature intersects measured liquid service valve pressure.
6. To obtain required subcooling temperature at a specific liquid line pressure, add refrigerant if liquid line temperature is higher than indicated or reclaim refrigerant if temperature is lower. Allow a tolerance of ±3°F (±1.7°C).

Heating Check Chart Procedure

To check system operation during heating cycle, refer to the Heating Check Chart on outdoor unit. This chart indicates whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system refrigerant charge may not be correct. Do not use chart to adjust refrigerant charge.

Table 5 – Required Liquid Line Temperature

Liquid (PSIG) Pressure at Service Valve	Required Subcooling Temperature °F					
	6	8	10	12	14	16
238	78	76	74	72	70	68
245	80	78	76	74	72	70
252	82	80	78	76	74	72
260	84	82	80	78	76	74
268	86	84	82	80	78	76
276	88	86	84	82	80	78
284	90	88	86	84	82	80
292	92	90	88	86	84	82
301	94	92	90	88	86	84
309	96	94	92	90	88	86
318	98	96	94	92	90	88
327	100	98	96	94	92	90
336	102	100	98	96	94	92
346	104	102	100	98	96	94
355	106	104	102	100	98	96
365	108	106	104	102	100	98
375	110	108	106	104	102	100
385	112	110	108	106	104	102
396	114	112	110	108	106	104
406	116	114	112	110	108	106
417	118	116	114	112	110	108
428	120	118	116	114	112	110
439	122	120	118	116	114	112
450	124	122	120	118	116	114

Final Checks

IMPORTANT: Before leaving job, be sure to do the following:

1. Ensure that all wiring is routed away from tubing and sheet metal edges to prevent rub–through or wire pinching.
2. Ensure that all wiring and tubing is secure in unit before adding panels and covers. Securely fasten all panels and covers.
3. Tighten service valve stem caps to 1/12–turn past finger tight.
4. Leave Owner's Manual with owner. Explain system operation and periodic maintenance requirements outlined in manual.
5. Fill out Dealer Installation Checklist and place in customer file.

Repairing Refrigerant Circuit

When breaking into the refrigerant circuit to make repairs, or for any other purpose, the following procedures shall be used.

1. Safely remove the refrigerant using a recovery pump certified for flammable refrigerants.

2. Purge the refrigerant circuit with nitrogen gas.

3. Evacuate the refrigerant circuit to 1500 microns.

4. Break vacuum with a nitrogen purge of the refrigerant circuit ensuring that the outlet of the vacuum pump is not near a potential ignition source.

5. Open the circuit by cutting or brazing.

Care and Maintenance

For continuing high performance and to minimize possible equipment failure, periodic maintenance must be performed on this equipment.

Frequency of maintenance may vary depending upon geographic areas, such as coastal applications. See Users Manual for information.

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37MARA
Outdoor Unit Single Zone Ductless System
Sizes 9K to 36K

SERVICE MANUAL

TABLE OF CONTENTS

SAFETY CONSIDERATIONS

Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.). Only trained, qualified installers and service mechanics should install, start-up, and service this equipment.

Untrained personnel can perform basic maintenance functions such as coil cleaning. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the product literature and on tags, stickers, and labels attached to the equipment.

Follow all safety codes. Wear safety glasses and work gloves. Keep a quenching cloth and fire extinguisher nearby when brazing. Use care in handling, rigging, and setting bulky equipment.

Read this manual thoroughly and follow all warnings or cautions included in the literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements. Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand these signal words: **DANGER**, **WARNING**, and **CAUTION**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in severe personal injury or death. **WARNING** signifies hazards which **could** result in personal injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the **OFF** position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage. Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.Do not bury more than 36 in. (914 mm) of refrigerant pipe in the ground. If any section of pipe is buried, there must be a 6 in. (152 mm) vertical rise to the valve connections on the outdoor units.

If more than the recommended length is buried, refrigerant may migrate to the cooler buried section during extended periods of system shutdown. This causes refrigerant slugging and could possibly damage the compressor at start-up.

INTRODUCTION

This service manual provides the necessary information to service, repair, and maintain the 37MARA family of heat pumps. This manual has an “APPENDIX” on page 90 with data required to perform troubleshooting. Use the “TABLE OF CONTENTS” on page 1 to locate a desired topic.

MODEL NUMBER NOMENCLATURE

SYSTEM TONS	BTUH	VOLTAGE	MODEL
1	12,000	115-1	37MARAQ12AA1
0.75	9,000	208/230-1	37MARAQ09AA3
1	12,000	208/230-1	37MARAQ12AA3
1.5	18,000	208/230-1	37MARAQ18AA3
2	24,000	208/230-1	37MARAQ24AA3
2.75	30.000	208/230-1	37MARAQ30AA3
3	36,000	208/230-1	37MARAQ36AA3

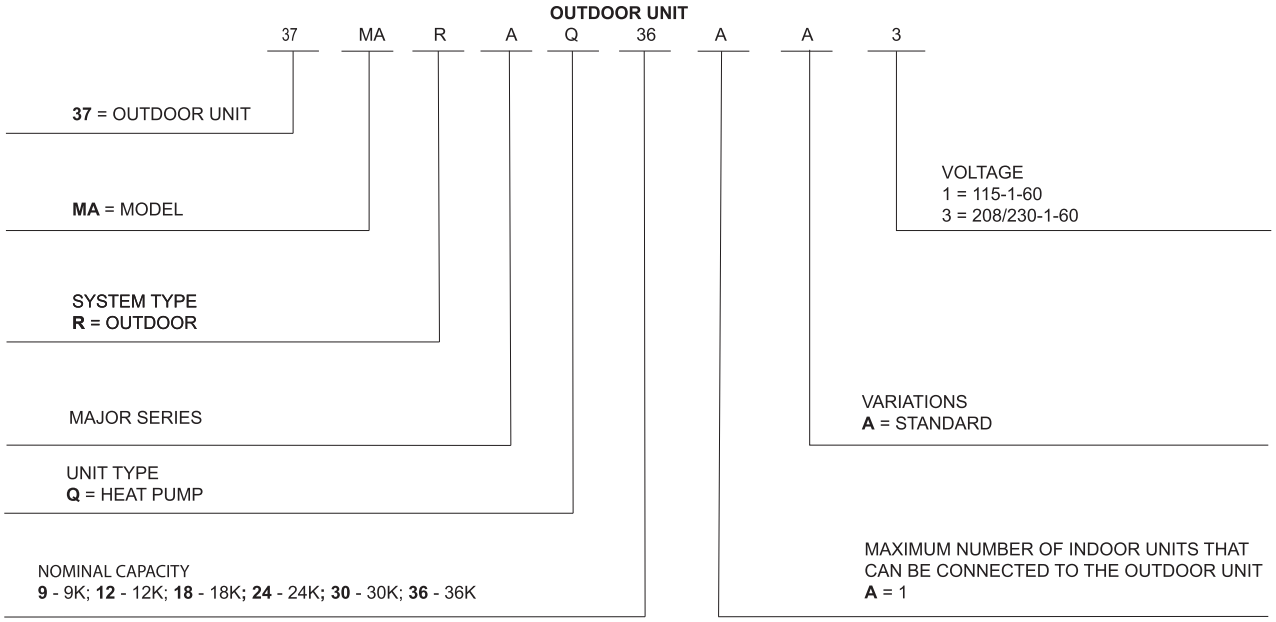


Fig. 1 —Nomenclature

For the Carrier/Bryant brands, the SERIAL NUMBER will be date coded by a two digit week, a two digit year followed by "V" followed with a 5 digit sequential number. The sequential number for MIDEA is between 10001 and 15000.

b. The SERIAL NUMBER will be as follows:

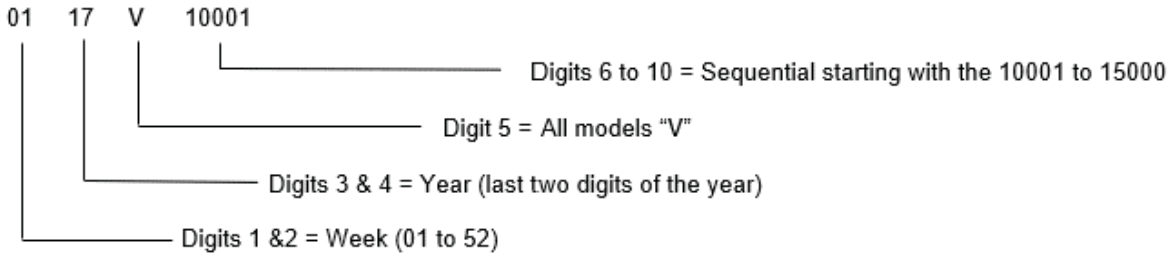


Fig. 2 —Serial Number Nomenclature

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program For verification of certification for individual products, go to www.ahridirectory.org.

WIRING

ELECTRICAL WIRING INSTALLATION

Wiring for the outdoor unit must conform to NEC (National Electrical Code) or CEC (Canadian Electrical Code) and local codes. Use Electrical Data table MCA (minimum circuit amps) and MOCP (maximum over current protection) to correctly size the wires and the disconnect fuse or breakers respectively.

All field wiring construction should be finished by a qualified electrician.

Air conditioning equipment must be grounded according to the local electrical codes.

Provide electrical disconnect per local codes.

NOTE: DO NOT connect the power wire to the terminal of the signal wire. Connection of power to any other terminal other than L1 or L2 will cause damage to the control board.

Any control signal cable should be run separately from the power wiring.

Use of metallic conduit or shielded cable is recommended. Maintain a distance of 12 inches(300mm) from the power wiring.

NOTE: DO NOT run the power wiring and control wiring in the same conduit.

Size the wiring in accordance to the NEC / CEC. Select different colors for different wire according to relevant regulations.

Ensure that the wire color of the outdoor and the terminal number are the same as those of the indoor unit.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Be sure to comply with local codes while running wire from the indoor unit to the outdoor unit.

Wires should be sized based on NEC and local codes.

Every wire must be connected firmly. Loose wiring may cause the terminal to overheat or result in unit malfunction. A fire hazard may also exist. Ensure all wiring is tightly connected.

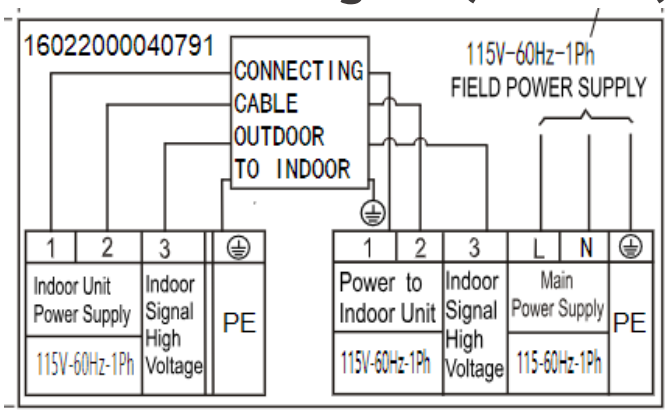
No wire should touch the refrigerant tubing, compressor or any moving parts.

Disconnecting means must be provided and shall be located within sight and readily accessible from the air conditioner.

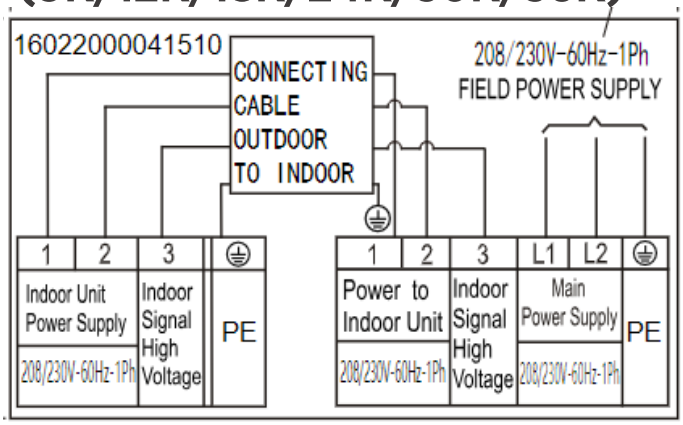
NOTE: Matches with multi-family and residential fan coils require separate power for the indoor and outdoor unit. A 24V interface kit is required for compatibility. Refer to the 24V Interface Kit installation manual.

CONNECTION DIAGRAMS

Connection Diagram (12K 115V)



Connection Diagram (9K/12K/18K/24K/30K/36K)



WIRING DIAGRAMS

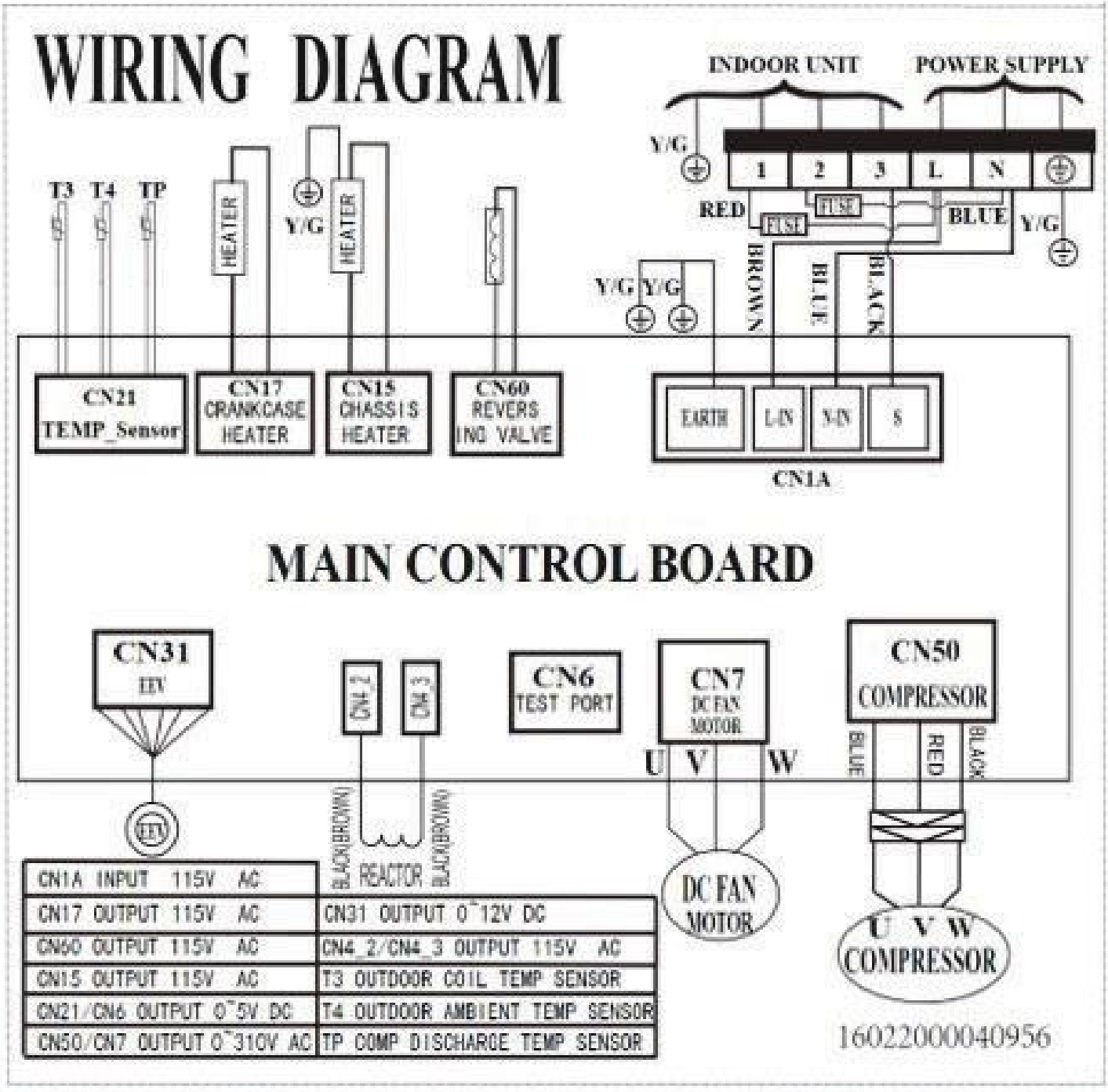


Fig. 3 —12K – 115V Wiring Diagram

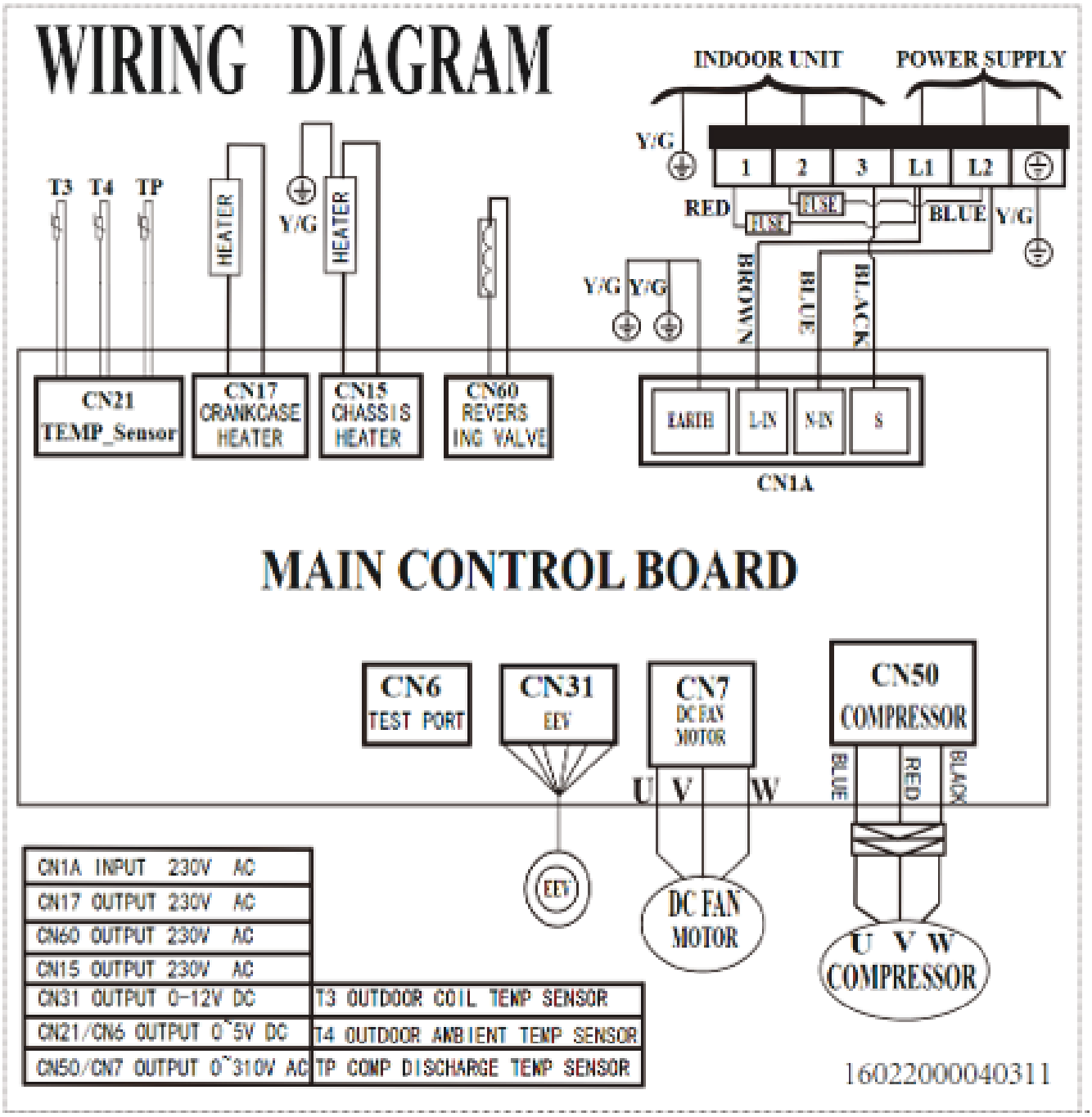


Fig. 4 —9K/12K – 208/230V Wiring Diagram

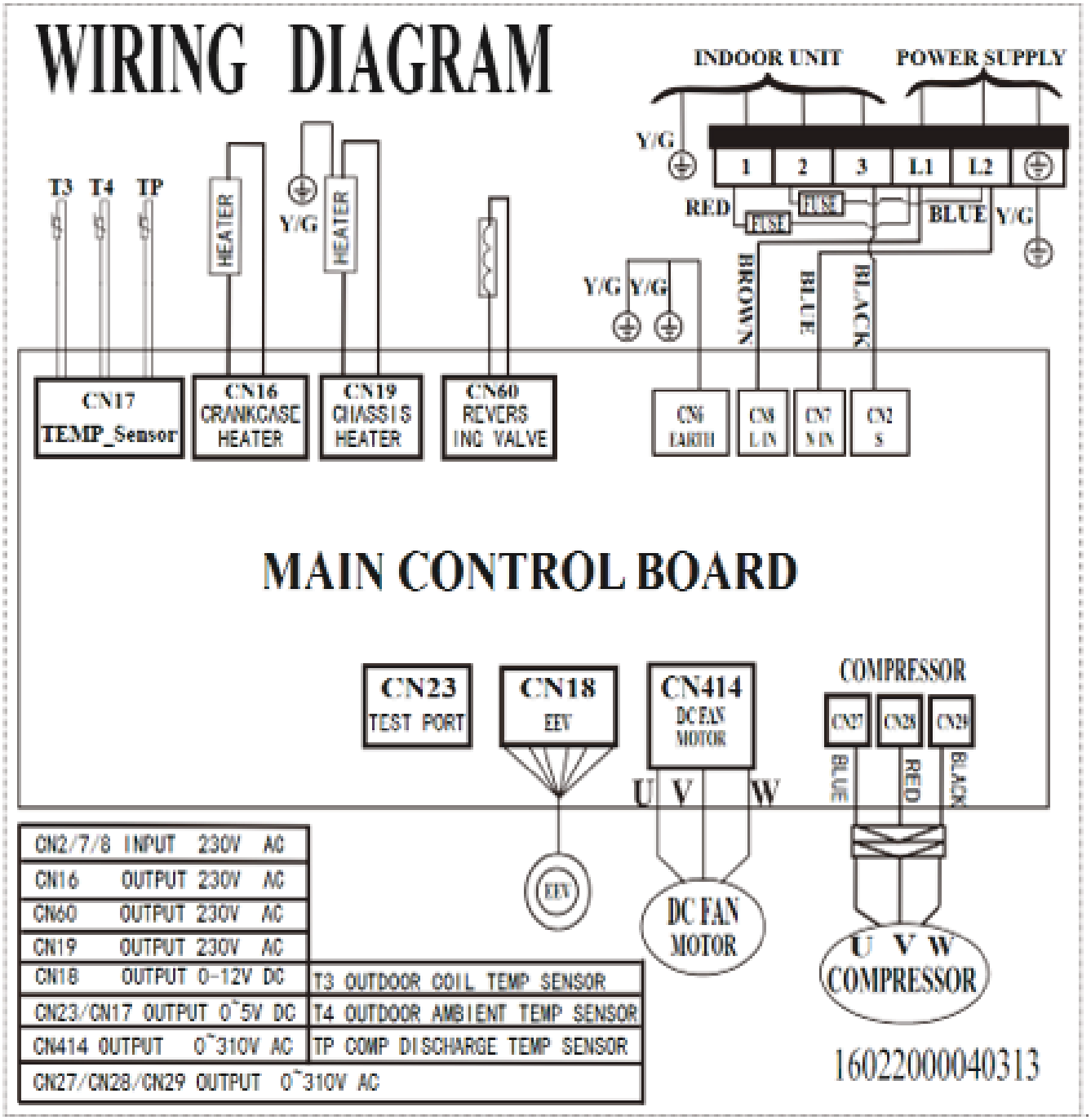
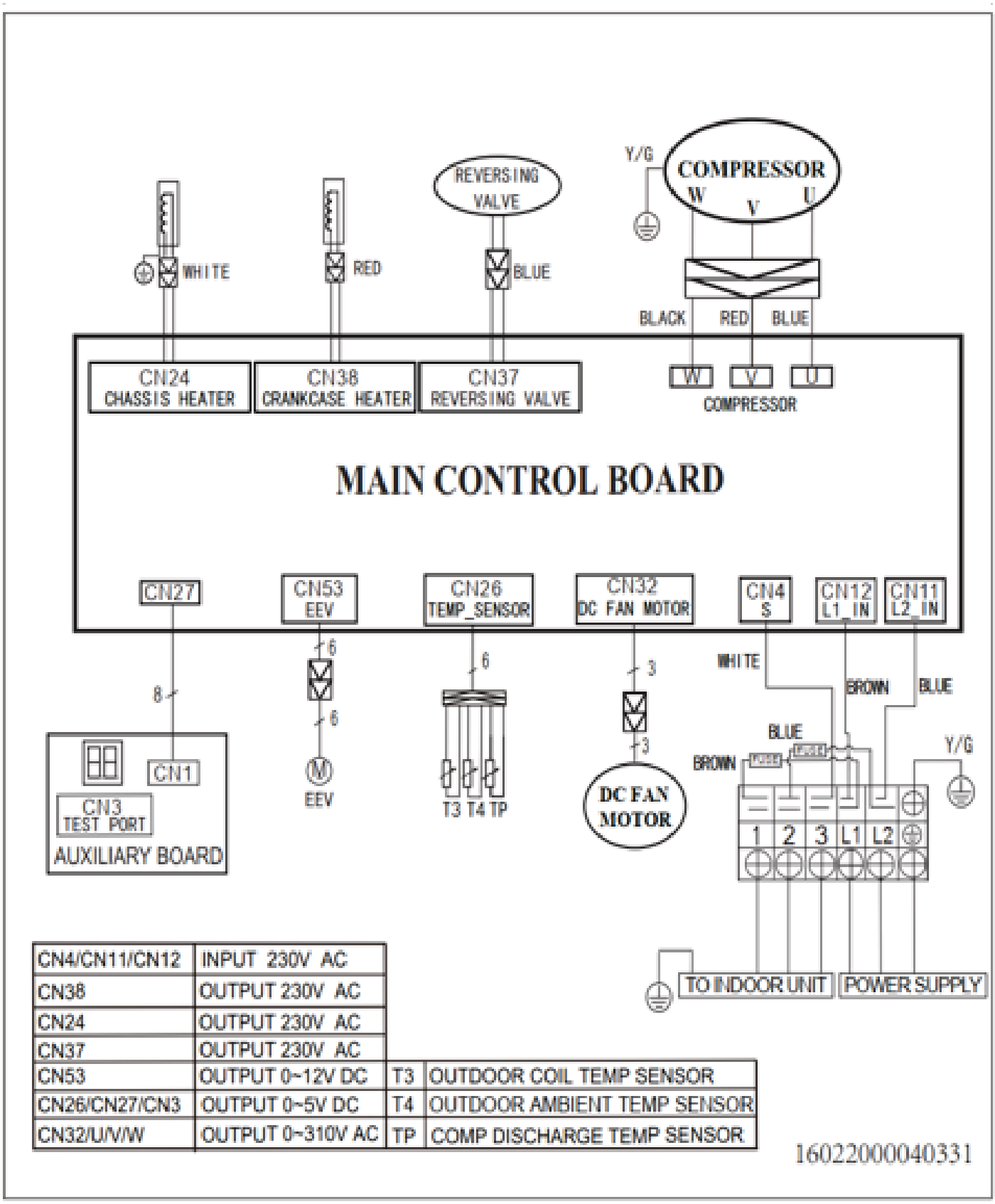
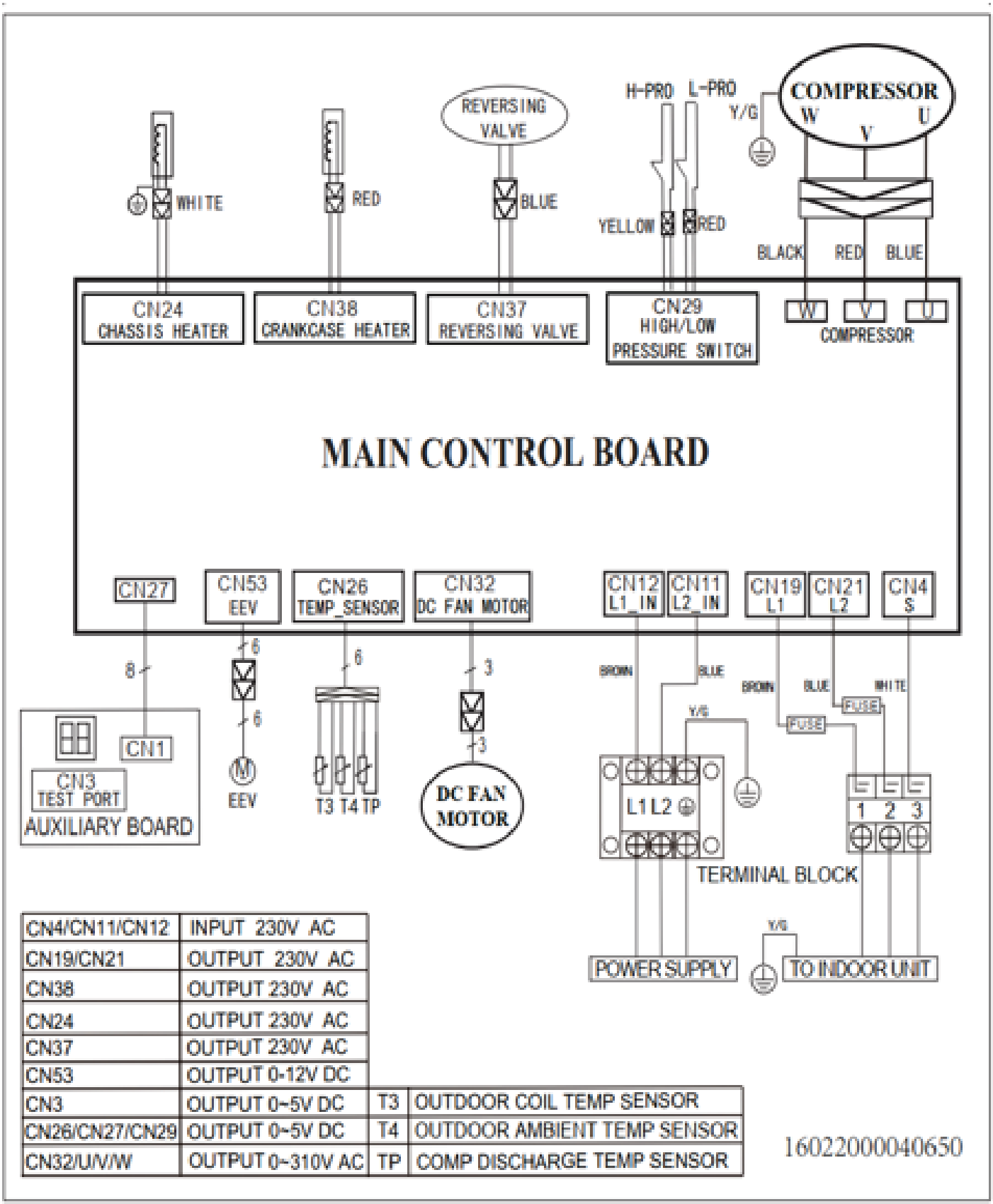


Fig. 5 —18K/24K – 208/230V Wiring Diagram



CN4/CN11/CN12	INPUT 230V AC		
CN38	OUTPUT 230V AC		
CN24	OUTPUT 230V AC		
CN37	OUTPUT 230V AC		
CN53	OUTPUT 0~12V DC	T3	OUTDOOR COIL TEMP SENSOR
CN26/CN27/CN3	OUTPUT 0~5V DC	T4	OUTDOOR AMBIENT TEMP SENSOR
CN32/U/V/W	OUTPUT 0~310V AC	TP	COMP DISCHARGE TEMP SENSOR

Fig. 6 —30K – 208/230V Wiring Diagram



CN4/CN11/CN12	INPUT 230V AC		
CN19/CN21	OUTPUT 230V AC		
CN38	OUTPUT 230V AC		
CN24	OUTPUT 230V AC		
CN37	OUTPUT 230V AC		
CN53	OUTPUT 0-12V DC		
CN3	OUTPUT 0~5V DC	T3	OUTDOOR COIL TEMP SENSOR
CN26/CN27/CN29	OUTPUT 0~5V DC	T4	OUTDOOR AMBIENT TEMP SENSOR
CN32/U/V/W	OUTPUT 0~310V AC	TP	COMP DISCHARGE TEMP SENSOR

Fig. 7 —36K – 208/230V Wiring Diagram

REFRIGERANT CYCLE DIAGRAM

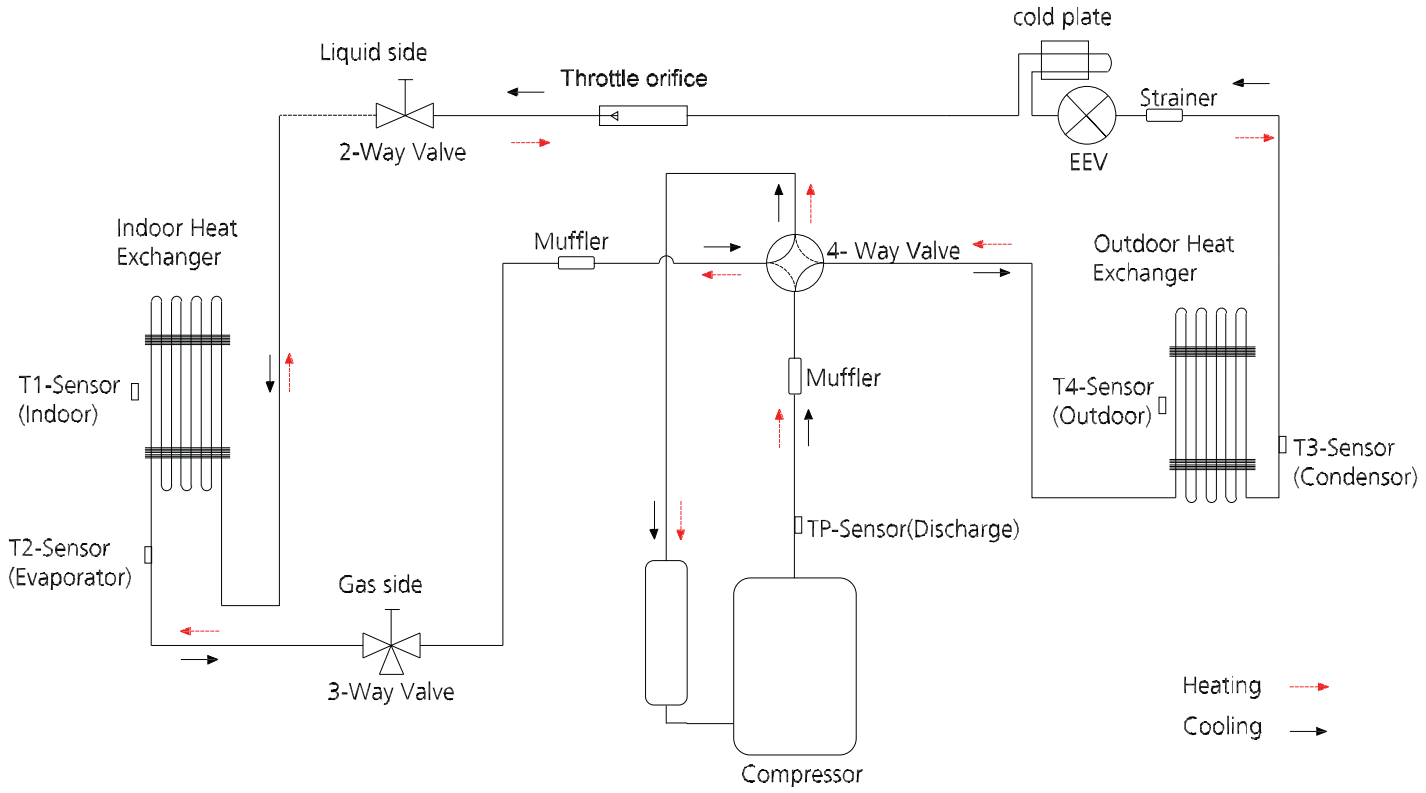


Fig. 8 —Refrigerant Cycle Diagram - Size 12K (115V)

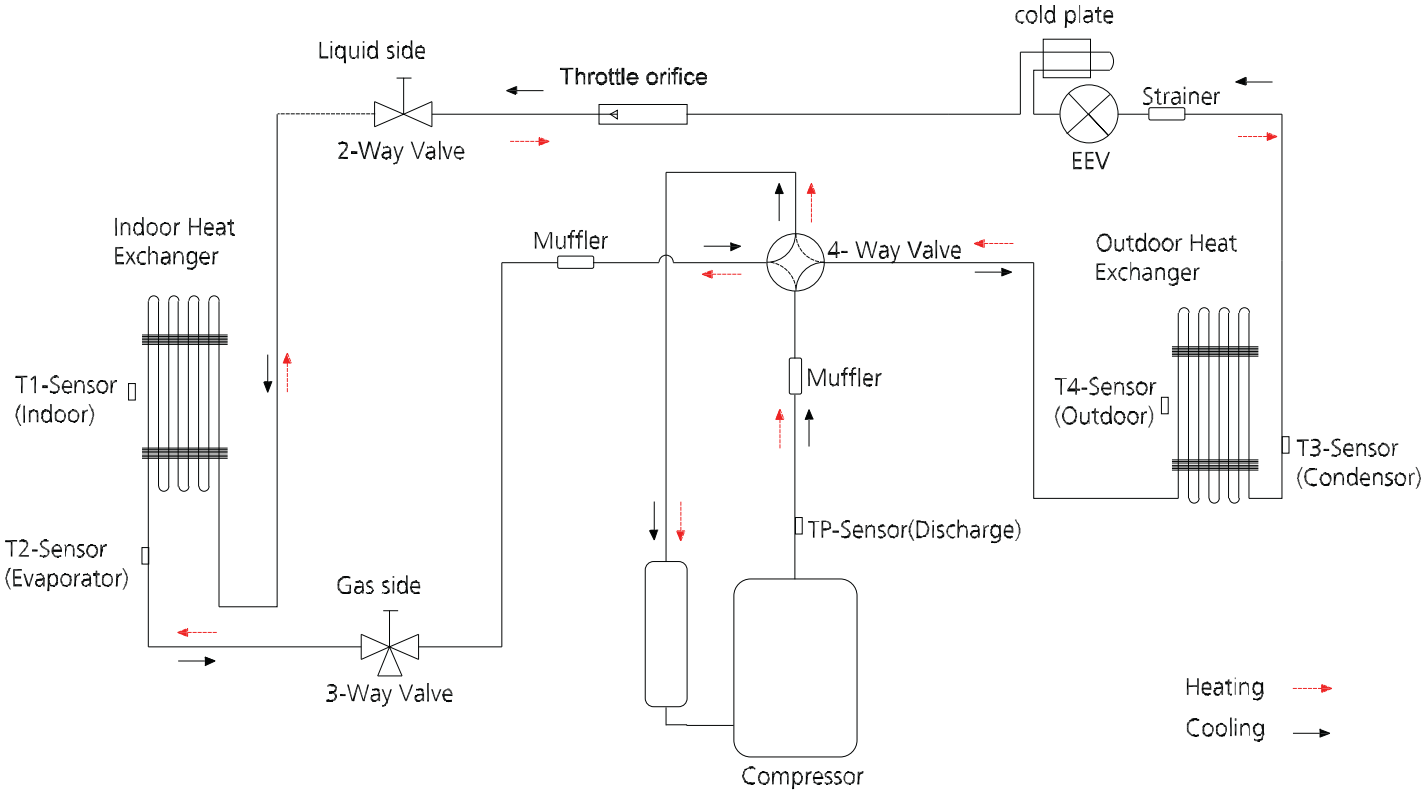


Fig. 9 —Refrigerant Cycle Diagram - Size 9K, 12K 208V/230V)

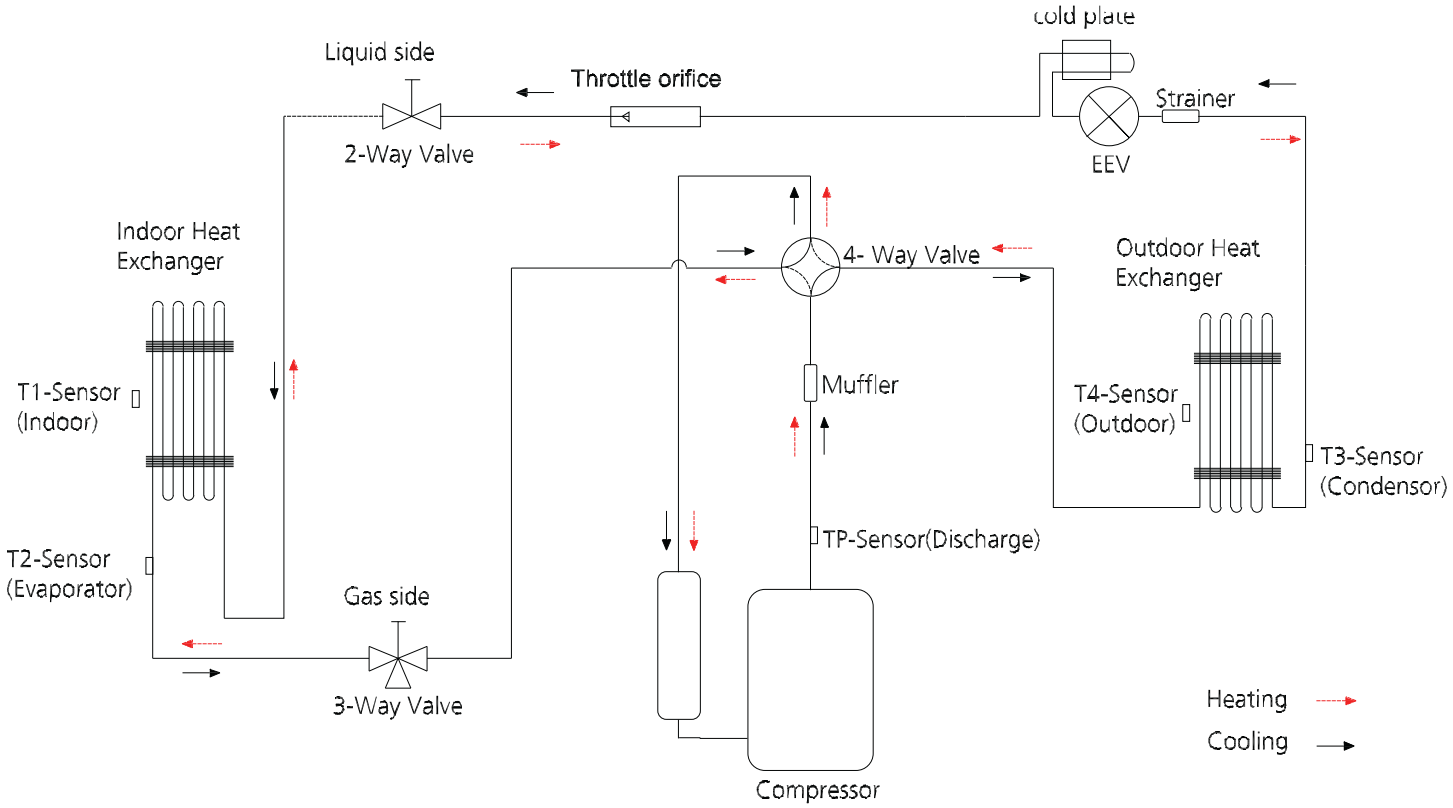


Fig. 10 —Refrigerant Cycle Diagram - Size 24K 208V/230V)

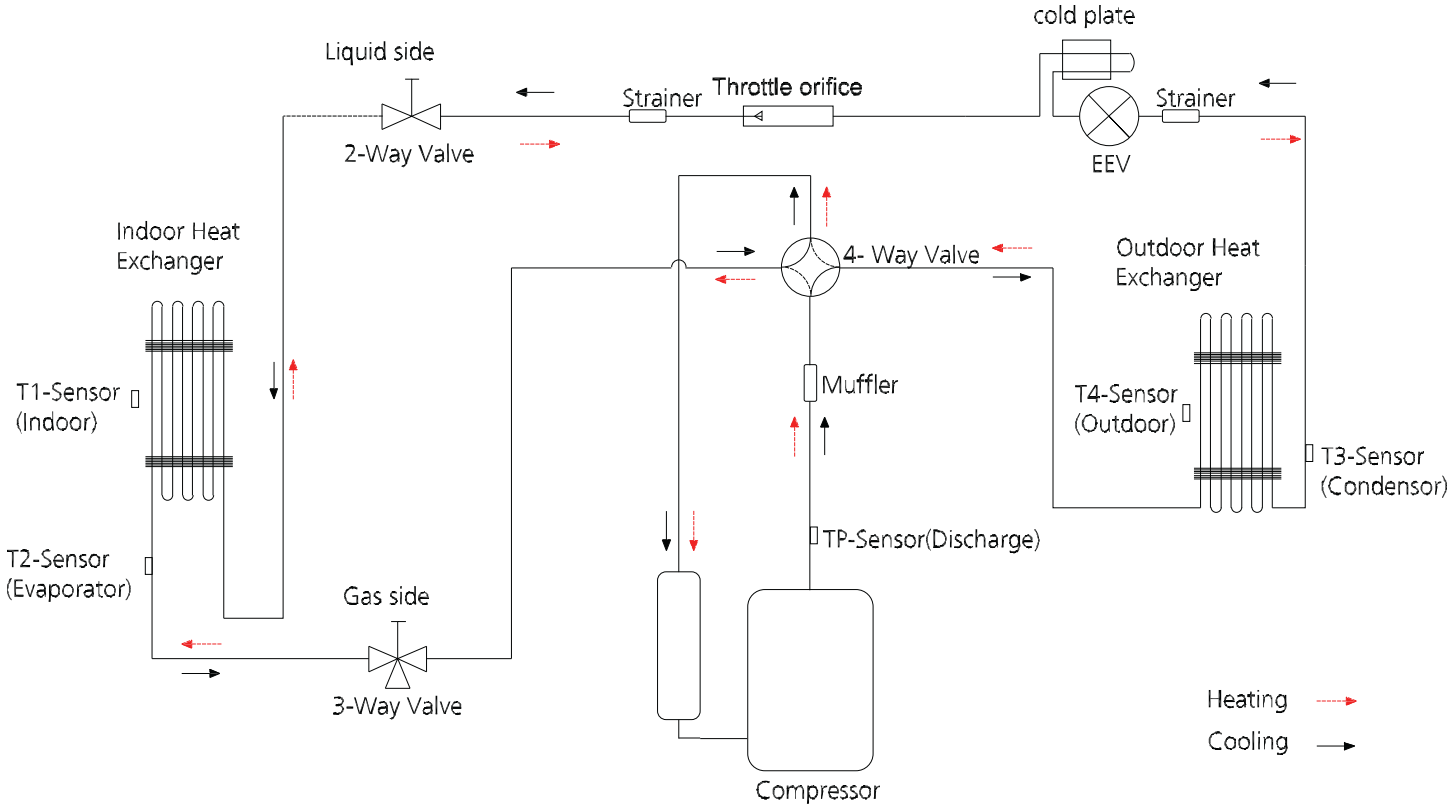


Fig. 11 —Refrigerant Cycle Diagram - Size 30K 208V/230V)

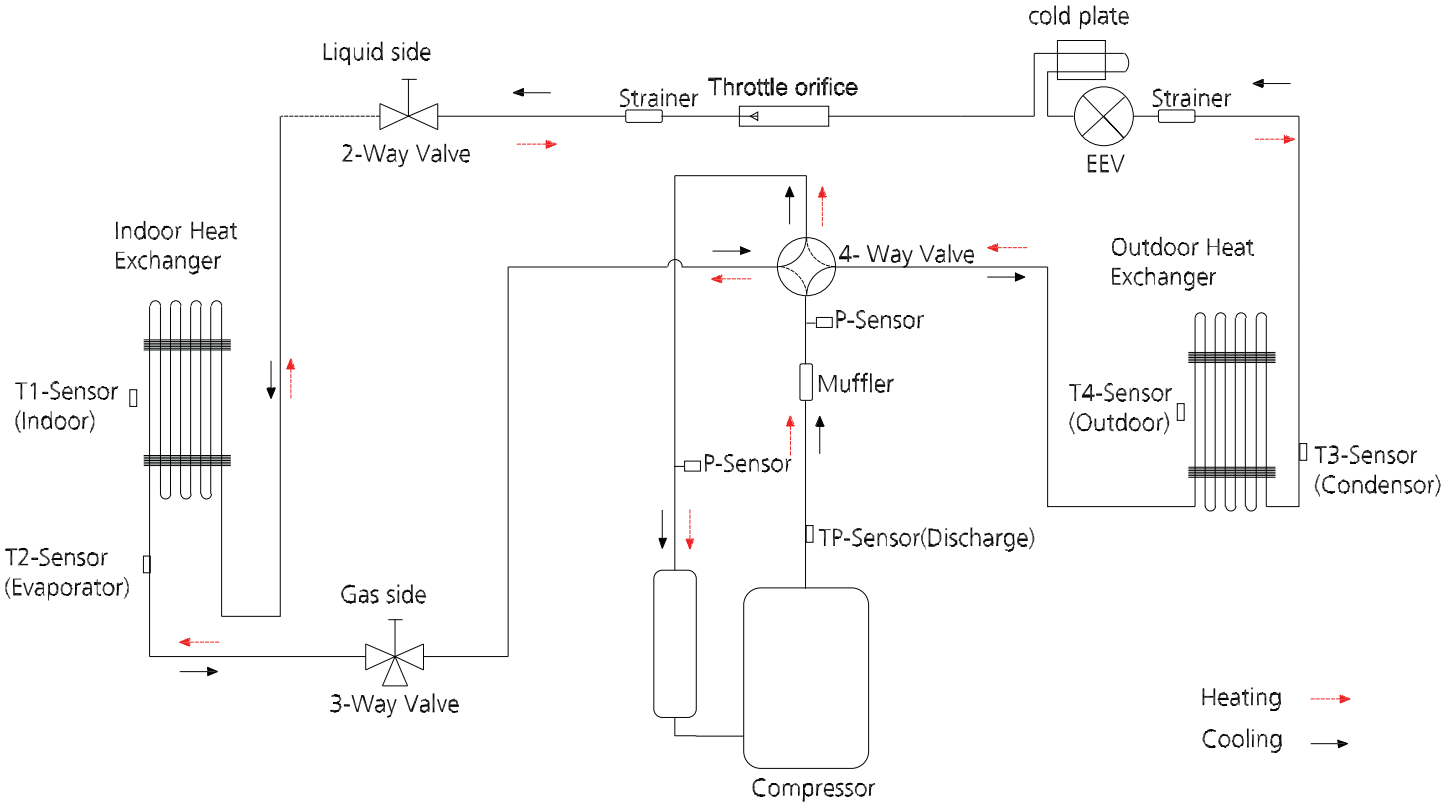


Fig. 12 —Refrigerant Cycle Diagram - Size 36K 208V/230V)

REFRIGERANT LINES

General Refrigerant Line Sizing

1. The outdoor units are shipped with a full charge of R-454B refrigerant. All charges, line sizing, and capacities are based on runs of 25ft. (7.6 m). For runs over 25 ft. (7.6 m), consult Table NOTE:, below, for the proper charge adjustments.
2. The minimum refrigerant line length between the indoor and outdoor units is 10 ft. (3 m).
3. Refrigerant lines should not be buried in the ground. If it is necessary to bury the lines, not more than 36 in (914 mm) should be buried. Provide a minimum 6in (152 mm) vertical rise to the service valves to prevent refrigerant migration.
4. Suction line must be insulated. Use a minimum of 1/2in. (12.7 mm) thick insulation. Closed-cell insulation is recommended in all long-line applications.
5. Special consideration should be given to isolating interconnecting tubing from the building structure. Isolate the tubing so vibration or noise is not transmitted into the structure.

NOTE: Table NOTE: displays the following maximum lengths allowed.

Table 1 – Max Length and Drop Height Based on Model

OUTDOOR MODEL		37MARAQ12AA1	37MARAQ09AA3	37MARAQ12AA3	37MARAQ18AA3	37MARAQ24AA3	37MARAQ30AA3	37MARAQ36AA3
POWER SUPPLY	V;Ph;Hz	115V;1Ph;60HZ	208/230V;1Ph;60 HZ	208/230V;1Ph;60 HZ	208/230V;1Ph;60 HZ	208/230V;1Ph;60 HZ	208/230V;1Ph;60 HZ	208/230V;1Ph;60 HZ
PIPING AND REFRIGERANT INFORMATION								
Refrigerant Type	Type	R454B	R454B	R454B	R454B	R454B	R454B	R454B
Charge Amount	lb. (kg)	2.09(0.95)	2.03(0.92)	2.03(0.92)	3(1.36)	4.41(2.0)	5.29(2.4)	7.05(3.2)
Additional refrigerant charge	Oz/ft (g/m)	0.16(15)	0.16(15)	0.16(15)	0.16(15)	0.32(30)	0.32(30)	0.32(30)
Liquid Pipe (size - connection type)	In (mm)	6.35mm(1/4in)	6.35mm(1/4in)	6.35mm(1/4in)	6.35mm(1/4in)	9.52mm(3/8in)	9.52mm(3/8in)	9.52mm(3/8in)
Suction Pipe (size - connection type)	In (mm)	9.52mm(3/8in)	9.52mm(3/8in)	9.52mm(3/8in)	12.7mm(1/2in)	15.9mm(5/8in)	15.9mm(5/8in)	15.9mm(5/8in)
Min. Piping Length	ft. (m)	9.8 (3)	9.8 (3)	9.8 (3)	9.8 (3)	9.8 (3)	9.8 (3)	9.8 (3)
Standard Piping Length	ft. (m)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)
Max. Piping Length with no additional refrigerant charge per System	ft. (m)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)	24.6 (7.5)
Total Maximum Piping Length per system	ft. (m)	82.02(25)	82.02(25)	82.02(25)	98.42(30)	164.04(50)	164.04(50)	213.25(65)
Max. outdoor-indoor height difference (OU higher than IU)	ft. (m)	49.21(15)	49.21(15)	49.21(15)	65.62(20)	82.02(25)	82.02(25)	98.43(30)
Max. outdoor-indoor height difference (IU higher than OU)	ft. (m)	49.21(15)	49.21(15)	49.21(15)	65.62(20)	82.02(25)	82.02(25)	98.43(30)

1.The charge amount listed in Table NOTE: is for piping runs up to 25 ft. (7.6 m).

2.For piping runs longer than 25 ft. (7.6 m), add the refrigerant up to the allowable length as specified in Table NOTE:.

Table 2 – Additional Charge

<table>
<tr><th rowspan="2">UNIT SIZE</th><th colspan="2">TOTAL LINE LENGHT FT (M)</th><th colspan="4">ADDOTIONAL CHARGE, OZ/FT FT (M)</th></tr>
<tr><th>MIN</th><th>MAX</th><th>10-25 (3-8)</th><th>>25-82 (8-25)</th><th>>82-98 (25-30)</th><th>>98-213 (30-65)</th></tr>
<tr><td>9</td><td rowspan="6">10 (3)</td><td rowspan="2">82 (25)</td><td rowspan="6">None</td><td rowspan="3">0.16</td><td rowspan="2"></td><td rowspan="3"></td></tr>
<tr><td>12</td></tr>
<tr><td>18</td><td>98 (30)</td><td>0.16</td></tr>
<tr><td>24</td><td rowspan="2">164 (50)</td><td colspan="3" rowspan="3">0.32</td></tr>
<tr><td>30</td></tr>
<tr><td>36</td><td>213 (65)</td></tr>
</table>

SYSTEM EVACUATION AND CHARGING

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Never use the system compressor as a vacuum pump.

Refrigerant tubes and the indoor coil should be evacuated using the recommended 500 micron deep vacuum method. The alternate triple evacuation method may be used if the procedure outlined below is followed.

NOTE: Always break a vacuum with dry nitrogen.

USING VACUUM PUMP

1. Completely tighten flare nuts A, B, C, D. Connect the manifold gage charge hose to a charge port of the low side service valve (see Fig. 24).
2. Connect the charge hose to vacuum pump.
3. Fully open the low side of manifold gage (see Fig. 13).
4. Start the vacuum pump.
5. Evacuate using either the deep vacuum or triple evacuation method.
6. After evacuation is complete, fully close the low side of manifold gage and stop the vacuum pump operation.
7. The factory charge contained in the outdoor unit is good for up to 25 ft. (8 m) of line length. For refrigerant lines longer than 25 ft. (8 m), add refrigerant, up to the allowable length.
8. Disconnect the charge hose from the charge connection of the low side service valve.
9. Fully open service valves B and A.
10. Securely tighten the service valve caps.

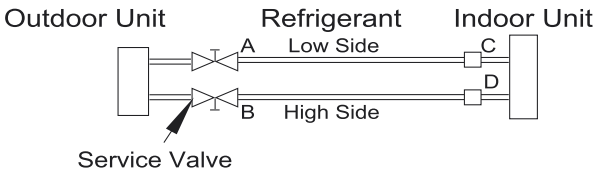


Fig. 13 —Service Valve

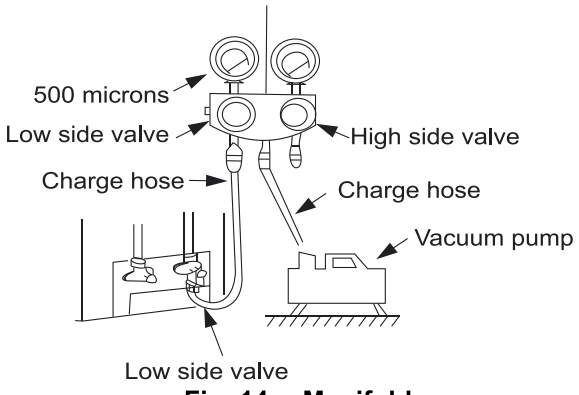


Fig. 14 —Manifold

EVACUATION

Evacuation of the system will remove air or nitrogen (non-condensables) as well as moisture. A proper vacuum will assure a tight, dry system before charging with refrigerant. The two methods used to evacuate a system are the deep vacuum method and the triple vacuum method.

DEEP VACUUM METHOD

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 micron and a vacuum gauge capable of accurately measuring this vacuum depth. This method is the most positive way of assuring a system is free of air and moisture (see Figure 15).

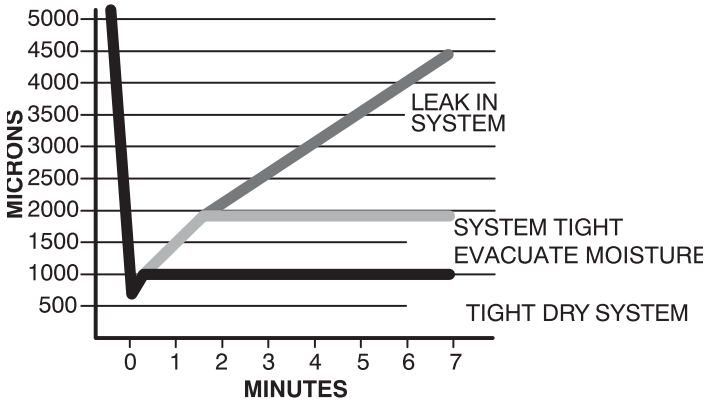


Fig. 15 —Deep Vacuum Graph

TRIPLE EVACUATION METHOD

The triple evacuation method should be used when vacuum pump is not capable of pumping down to 500 microns and system does not contain any liquid water. Refer to Fig. 16 and proceed as follows:

1. Attach refrigeration gauges and evacuate system down to 28 inches of mercury and allow pump to continue operating for an additional 15 minutes.
2. Close service valves and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and flow nitrogen until system pressure is 2 psig.
4. Close service valve and allow system to stand for 1 hour. During this time, dry nitrogen will be able to diffuse throughout the system absorbing moisture.
5. Repeat this procedure as indicated in Fig. 16. System is now free of any contaminants and water vapor.

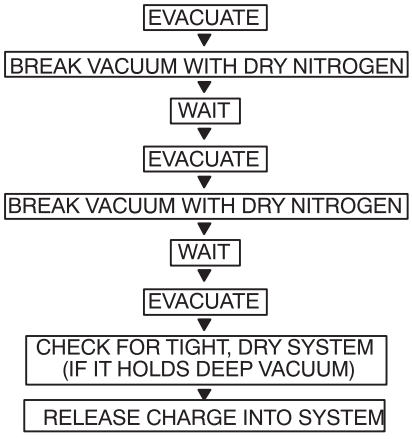


Fig. 16 —Triple Evacuation Method

FINAL TUBING CHECK

Check to be certain factory tubing on both the indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to the feeder tubes, making sure wire ties on feeder tubes are secure and tight.

ELECTRONIC FUNCTIONS

Abbreviation:

Table 3 – 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 temperature1
TCDE2	Exit defrost temperature2 (maintain for a period of time)
TIMING_DEFROST_ TIME_ADD	Enter defrost time
EE_TIME_DEFROST7_ST RONG	Enter enhanced defrost time
TCDE1_ADD_ STRONG	Exit enhanced defrost temperature1
TCDE2_ADD_ STRONG	Exit enhanced defrost temperature2 (maintain for a period of time)

NOTE: In this manual, terms such as CDIFTEMP, HDIFTEMP2, TCDE1, TCDE2, TIMING_DEFROST_TIME_ADD...etc., are EEPROM parameter settings.

FAN Mode

When fan mode is activated:

- Outdoor fan and compressor are stopped

COOLING Mode

Compressor Control

Reach the configured temperature:

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)

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 indoor room temperature (T1) is lower than or equal to (Tsc-CDIFTEMP).

NOTE: CDIFTEMP is EEPROM setting parameter. It is 4°F (2°C) usually.

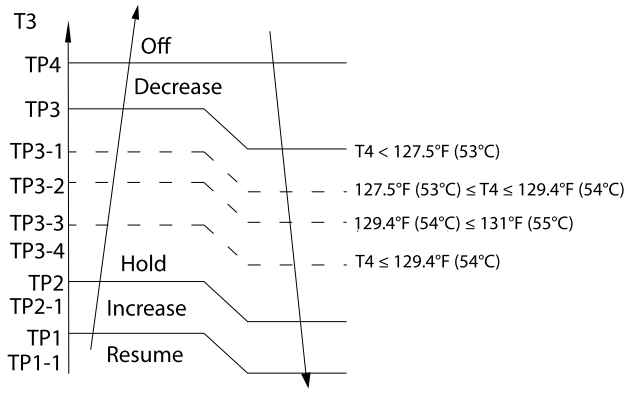
If one of the following conditions is satisfied, not judge protective time.

- Compressor running frequency is more than test frequency.
- When 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
- Various frequency limit shutdown occurs.

Outdoor Fan Control

- The outdoor unit will be run at different fan speed according to 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 (Heat Pump Modes)

Compressor Control

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 the EEPROM parameter setting. It is normally 4°F (2°C).

- If one of the following conditions is satisfied, 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

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

Outdoor Fan Control

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

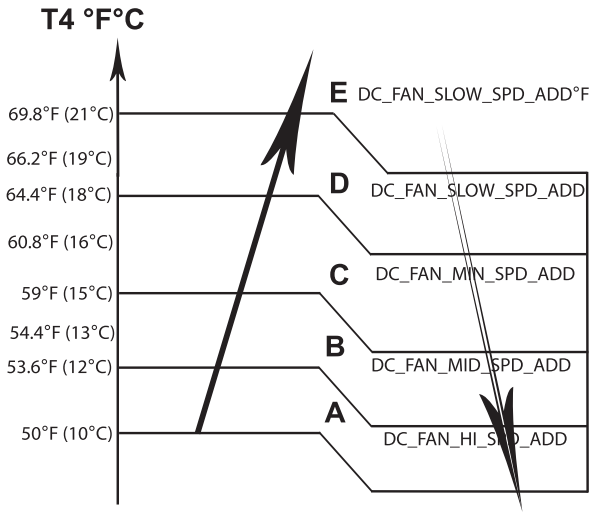


Fig. 17 —Outdoor Fan Running Rules

Indoor Fan Running Rules:

- In the COOLING mode, the indoor fan runs continuously and the user can select any of the following speeds: HIGH, MEDIUM, LOW and AUTO.
- When the setting temperature is reached, if the compressor stops operating, the indoor fan motor runs in the minimum or setting speed (see Fig. 18).

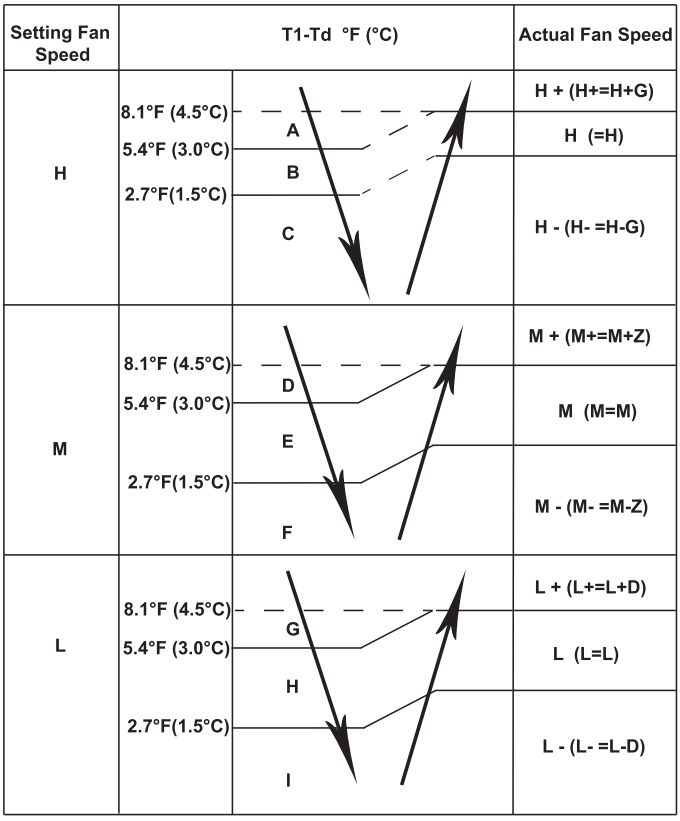


Fig. 18 —Indoor Fan Running Rules

The AUTO fan adheres to the following rules (see Fig. 19:)

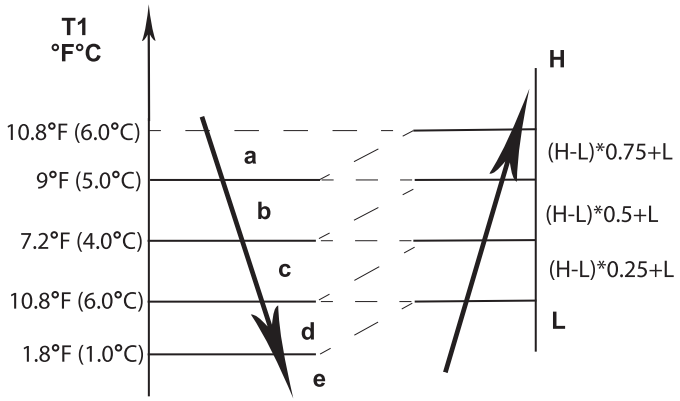


Fig. 19 —AUTO FAN Running Rules

Compressor Temperature Protection

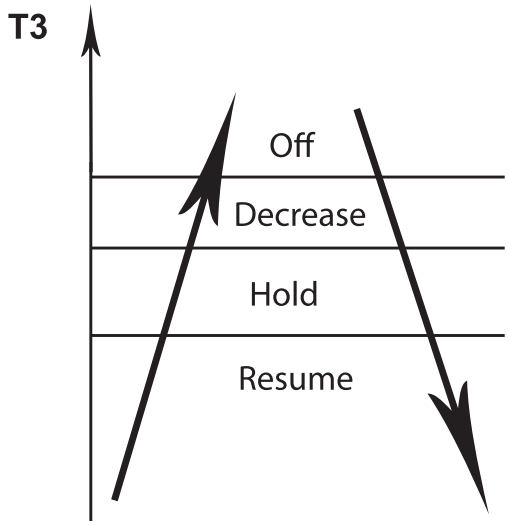


Fig. 20 —Compressor Temperature Protection

- Off: Compressor stops
- Decrease: Decrease the running frequency to the lower level
- Hold: Keep the current frequency
- Resume: No limitation for frequency

When the condenser temperature is higher than the setting value, the compressor stops.

Evaporator Temperature Protection

When the evaporator temperature is lower than the setting value the compressor stops.

HEATING Mode

Compressor Running Rules:

- When T1-Ts>-f'T, the compressor stops.
- When T1-Ts<f'T-1.5, the compressor is on. f'T is the programmed parameter for temperature compensation.
- When the AC runs in the MUTE mode, the compressor runs with a low frequency.
- When the current is more than the setting value, the current protection function activates and the compressor stops.

Outdoor Fan Running Rules:

The outdoor unit runs at a different fan speed according to T4. For different outdoor units, the fan speeds differ.

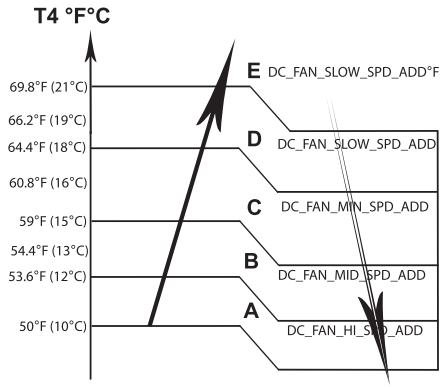


Fig. 21 —Outdoor Fan Running Rules

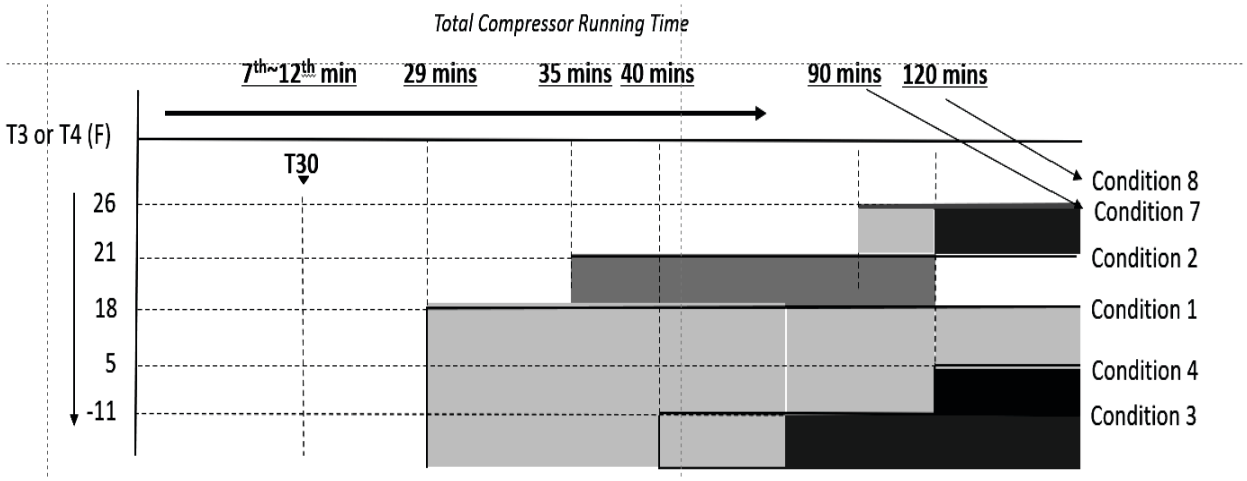
Defrosting mode

The unit enters defrosting mode according to the temperature value of 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 is 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 Outdoor ambient temperature (T4) is lower than or equal to -7.6°F (-22°C) and compressor running time is more than TIMING_DEFROST_TIME, if any one of the following conditions is 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 is satisfied, the unit enters defrosting mode
- If condenser temperature (T3) or outdoor ambient temperature (T4) is lower than -3°C for 30 seconds, Ts-T1 is lower than 5°C and compressor running time is more than EE_TIME_DEFROST7_ ADD.
- If condenser temperature (T3) or outdoor ambient temperature(T4) is lower than -3°C for 30 seconds and compressor running time is more than EE_ TIME_DEFROST7_ADD+30 minutes.
- If any one of the following conditions is satisfied, defrosting ends and the machine switches to normal heating mode:
  - Condenser temperature(T3) rises above TCDE1 7.2°F/+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.

Enhanced Defrost

Enhanced Defrost is a feature that is enabled by turning on dipswitch SW4 on the 24 volt ODU board. This feature is designed to be used for problem areas of defrosting (near water sources and areas of high humidity during cold outdoor conditions). When enabled, the total heating cumulative run time will be reduced to 40 minutes, allowing for defrosting to occur at the 40th minute providing the T3 or T4 temperature is 26F or cooler at that time. The defrost termination temperature at T3 will also increase to 77F to ensure better completion of defrost prior to terminating defrost.



Condition 1	Total compressor running time is 29 mins	T3 ≤ 18F, and T3 is less than/equal to T30 - 4.5F (2.5C), and T4＞-8F
Condition 2	Total compressor running time is 35 mins	T3 ≤ 21F, and T3 less than/equal to T30 -5.4F (3C), and T4＞-8F
Condition 3	Total compressor running time is 29 mins	T3 ≤ -11F and last for 3 mins, and T4＞-8F
Condition 4	Total compressor running time is 120 mins	T3 ≤ 5F and T4＞-8F
Condition 5	Cumulative running 30 mins	T4-T3 > (0.5T4 + 5F) and T3 ≤ 10F, T4＞-8F
Condition 6	Cumulative running 8 hours	T4≤ -8F, with T4 operating without malfunction
Condition 7	Cumulative running time 90 mins and diff. of Ts-T1 ≤ 9F Cumulative running time 120 minutes (if Ts-T1 diff. above not applicable)	T3 or T4 ≤ 26F last for 30 seconds
*Condition 8	If enhanced defrost is ON, cumulative running time is 40 minutes (T30 does not apply) *Only applies to Crossover ODU's. Enable enhanced defrost by turning on dipswitch 4 in the ODU.	T3 or T4 ≤ 26F last for 30 seconds

Evaporator Coil Temperature Protection

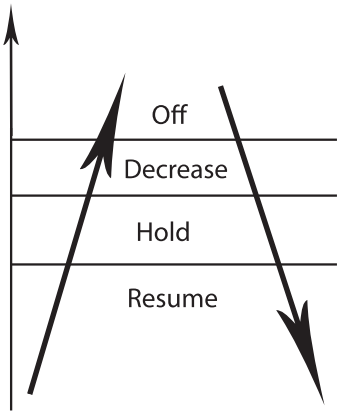


Fig. 22 —Evaporator Coil Temperature Protection

When the evaporator temperature is higher than the setting protection value, the compressor stops.

AUTO Mode

AUTO mode can be selected with the remote controller and the setting temperature can be changed between 60.0°F~86°F (16°C~30°C).

In the AUTO mode, the unit chooses either the COOLING, HEATING or the FAN-ONLY mode accT2, T4 and relative humidity.

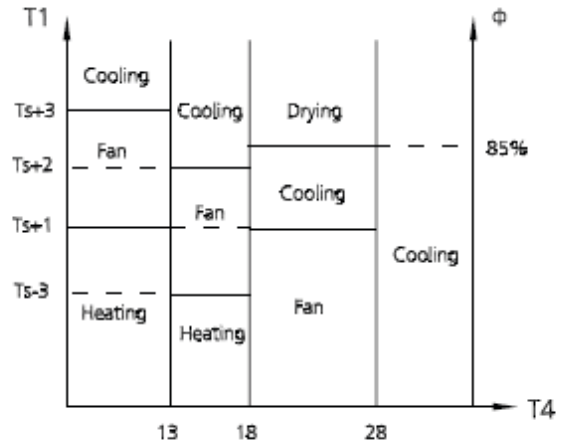


Fig. 23 —AUTO Mode

Heating*: COOLING ONLY models run at fan speed. The indoor fan runs in the AUTO fan speed for the relevant mode. The louver operates the same as in the relevant mode.

If the unit switches mode between HEATING and COOLING, the compressor repeatedly stops for a certain time and then chooses the mode according to T1-Ts. If the setting temperature is modified, the unit selects a running function again.

DRYING mode

The indoor fan speed is fixed at BREEZE and can not be changed. The louver angle is the same as in the COOLING mode.

Low Indoor Room Temperature Protection In the DRYING mode, if the room temperature is lower than 50°F(10°C),

the compressor stops and does not resume until the room temperature exceeds 53.6°F (12°C).

Evaporator anti-freezing protection, condenser high temperature protection and outdoor unit frequency limit are active and are the same as that in the COOLING mode. The outdoor fan operates the same as in COOLING mode.

FORCED OPERATION Function

Enter FORCED OPERATION function:

When the machine is off, press the auto function button at the indoor unit to engage the Forced Auto Mode. Press TOUCH again, within 5 seconds, to engage the FORCED COOLING mode. In FORCED AUTO, FORCED COOLING or any other operation mode, press TOUCH to turn off the unit.

In the FORCED OPERATION mode, all general protections and the remote controller are available.

Operation Rules:

FORCED COOLING mode:

The compressor runs at the F2 frequency and the indoor fan runs as a breeze. After running for 30 minutes, the unit enters the AUTO mode at a 75.2°F (24°C) setting temperature.

FORCED AUTO mode:

The FORCED AUTO mode is the same as the normal AUTO mode with a 75.2°F (24°C) setting temperature.

AUTO-RESTART function

The indoor unit is equipped with an AUTO-RESTART function, which is carried out through an auto-restart module. In case of a sudden power failure, the module memorizes the setting conditions before the power failure. The unit resumes the previous operation setting (not including the swing function) automatically 3 minutes after the power returns.

If the memorization condition is the FORCED COOLING mode, the unit runs in the COOLING mode for 30 minutes and enters the AUTO mode as 75.2°F (24°C) setting temp.

If the air conditioner turns off before the unit powers off and the air conditioner is required to restart immediately, the compressor delays for 1 minute when the power is on. Under other conditions, the compressor has a 3 minute delay when it restarts.

Refrigerant Leakage Detection

With this new technology, the display area displays EL0C when the outdoor

unit detects a refrigerant leak.

46°F (8°C) Heating

When the compressor is running, the indoor fan motor runs without the anti-cold air function. When the compressor is off, the indoor fan motor is off.

INQUIRY MODE

Accessing the INQUIRY Mode

⚠ CAUTION

Read and understand the function changes you wish to make in advance. Neither the indoor unit nor the remote control displays the new level of any of the changes made while in the INQUIRY mode. Be sure to document the changes you've made to the system's programming using the INQUIRY mode. Once you complete the changes and exit the INQUIRY mode, if additional changes are made to the programming, the system will not show the new previously set level(s).

For example, when you first access CODE 22, Heating Temperature Compensation, the remote control display defaults to 0. If you change it to -2, then save and exit out of the INQUIRY mode, the next time someone goes back in and accesses CODE 22, the remote's display will not display -2.

Instead it will show 0 because that's the default. If you are unsure of the previous changes, due to a lack of documentation, you could press the DOWN symbol to the maximum change range of -6, then press the UP symbol until you are back to 0, and make the new adjustments accordingly. Be sure to document the changes when you are done.

1. Simultaneously press ON/OFF and FAN SPEED for 8 seconds.
   a. The remote is now in the INQUIRY mode.
   b. The remote control remains in the INQUIRY mode for 1 minute if no other button is pressed.
   c. While in the INQUIRY Mode, the remote display cancels all icons except AUTO, COOL, DRY, HEAT and Battery Strength.
   d. The remote control digital display defaults to 0 upon entering the INQUIRY mode.
   e. In the INQUIRY mode, each digital code (from 0 to 30) is accessed by pressing the UP or DOWN arrows .
   f. The INQUIRY information appears on the high wall indoor unit display in approximately 1 second after accessing the digital code. Press OK to send as well.
   g. In the INQUIRY mode, all other buttons and operations are invalid except for UP, DOWN and OK or the operation to exit the INQUIRY mode.

Remote Controller Service Mode Functions

NOTE: While in the INQUIRY mode, refer to the following instructions to enter SERVICE mode for the applicable codes.

Below is a list of INQUIRY modes and serviceable functions.

a. Before using the remote's service functions, turn OFF the indoor unit with the remote.
b. Turn OFF the power to the outdoor unit for 2 minutes. Turn the power back ON.
c. Remove the batteries from the remote and wait for the remote screen to clear. Within 30 seconds of replacing the batteries, use UP or DOWN to scroll through the INQUIRY modes.
d. To enter the SERVICE mode for an applicable INQUIRY mode, press ON/OFF for 2 seconds.
e. After SERVICE adjustments have been made, press ON/OFF for 2 seconds to exit the SERVICE mode and return to the INQUIRY mode.
f. Once operations in the INQUIRY mode are complete, press ON/OFF and FAN SPEED for 2 seconds to exit. All buttons on the remote controller are disabled for 60 seconds
g. To ensure changes are locked, power down the outdoor unit for three (3) minutes after all the service mode changes are made.

Service Inquiry Codes

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
0		Error Code Check	SERVICE AND INQUIRY	Review error memory function. Displays "**Ch**". Press **OK** to send the query error code memory.	
1	T1	Indoor Ambient Temperature	SERVICE AND INQUIRY	Change the power off memory selection. This feature determines whether the unit memorizes the set conditions prior to a power failure. Displays **"Ch"**. Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings **1** and **0**.	Memory settings are off Memory settings are on
2	T2	Indoor Coil Temperature	SERVICE AND INQUIRY	Change the option to control the indoor fan operation after reaching the set temperature. Displays "**Ch**". Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings 1 through 11. Next, press **OK** to confirm the selection.	Stop the fan Minimum fan speed Set speed - intermittent fan-off 4 minutes/on 1 min Terminate after run time of 10 mins Terminate after run time of 15 mins Terminate after run time of 20 mins Terminate after run time of 30 mins Terminate after run time of 40 mins Terminate after run time of 50 mins Terminate after run time of 60 mins
3	T3	Outdoor Coil Temperature	SERVICE AND INQUIRY	Change the option to control the **COOLING** and **HEATING** modes available for use on the unit. Press **UP** or **DOWN** to cycle through the settings **CH**, **HH**, **CC** or **nU**. Press **OK** to confirm.	**CH** - **COOLING** and **HEATING**: **AUTO**, **COOLING**, **DRY**, **HEATING** and **FAN** modes available **HH** - **HEATING** Only: **HEATING** and **FAN** modes available **CC** - **COOLING** without **AUTO**: **COOLING**, **DRY** and **FAN** modes available **nU** - **COOLING** and **HEATING** without **AUTO**: **COOLING**, **DRY**, **HEATING** and **FAN** modes available
4	T4	Outdoor Ambient Temperature	SERVICE AND INQUIRY	Change the selection of the lowest set temperature. NOTE: Temperature range is 60°F ~ 75°F (16°C ~ 24°C). Press **UP** or **DOWN** to select temperature setting. Press **OK** to confirm.	
5	TP (T5)	Compressor Discharge Temperature	SERVICE AND INQUIRY	Change the selection of the highest set temperature. NOTE: Temperature range is 77°F ~ 86°F (25°C ~ 30°C). Press **UP** or **DOWN** to select the temperature setting. Press **OK** to confirm.	
6	FT	Compressor target frequency	INQUIRY ONLY		
7	Fr	Compressor run frequency	INQUIRY ONLY		
8	dL	Unit amperage	SERVICE AND INQUIRY	Change the static pressure selection. Displays "**Ch**". Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings **0** through **4** or **AF** (constant air volume test). Press **OK** to confirm.	Only available on ducted/AHU units. Refer to the ducted/AHU installation manuals for Fan performances at varying static pressures for airflow settings.
9	Uo	Unit voltage	INQUIRY ONLY		
10	Sn	Capacity test (special usage)	INQUIRY ONLY		
11	----	Not available	INQUIRY ONLY		
12	Pr	Indoor fan speed	SERVICE AND INQUIRY	Change the heating frequency lower limit selection. Displays "**Ch**". Press **OK** to return the current heating minimum frequency limit selection code. Press **UP** and **DOWN** to select the minimum heating frequency limit value. Press **OK** to confirm.	

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
13	Lr	Electronic Expansion Valve (EEV) opening	SERVICE AND INQUIRY	Change the maximum operating frequency of T4 Cooling Only intervals. Displays “**Ch**”. Press **OK** to return the current operating frequency code of the T4 Cooling Only intervals. Press **UP** or **DOWN** to select the limit value and then press **OK**.	
14	ir	Indoor fan speed	INQUIRY ONLY		Multiple the display number by 8 to calculate the actual RPM
15	HU	Relative Humidity	INQUIRY ONLY		Available in INQUIRY mode for the high tier/new mid tier units that have an RH sensor.
16	TT	Setpoint compensation temperature	INQUIRY ONLY		
17	dT	Dust concentration (not used)	INQUIRY ONLY		
18	WIFI	Wi-Fi signal strength	INQUIRY ONLY		The value is measured in **dBm**. The display values are 0, 1, 2, 3 and 4 (4 is the highest and 0 is the lowest)
19	----	Not available	SERVICE ONLY	Change the cooling frequency upper limit selection in Hz. Displays **“Ch”**. Press **OK** to return the current frequency limit. Press **UP** or **DOWN** to select the preferred frequency upper limit value (in Hz). Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 40 and 84 Hz. If set to 50, the unit will now be limited to operating between 40 and 50 Hz.
20	oT	Indoor fan target frequency	SERVICE AND INQUIRY	Change the heating frequency upper limit selection in Hz. Displays “**Ch**”; press **OK** to return the current frequency limit. Press **UP** or **DOWN** to select the preferred frequency upper limit value (in Hz). Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 40 and 84 Hz. If set to 50, the unit is limited to operating between 40 and 50 Hz.
21	----	Cooling Temperature Compensation	SERVICE ONLY	Change the cooling temperature compensation value. Displays “**Ch**”. Press **OK** to return the current temperature compensation value code. Press **UP** or **DOWN** to select the cooling temperature difference compensation value. Press **OK** to confirm.	This setting is used to adjust for temperature differences due to the height of the unit install. The offset value can be set at a range of -6° to +6°.
22	----	Heating Temperature Compensation	SERVICE ONLY	Change the heating temperature compensation value. Displays “**Ch**”. Press **OK** to return the current temperature compensation value code. Press **UP** or **DOWN** to select the heating temperature difference compensation value. Press **OK** to confirm.	This setting is used to adjust for temperature differences due to the height of unit installation. The offset value can be set at a range of -6° to +6°.
23	----	Maximum Cooling Fan Speed	SERVICE ONLY	Change the maximum cooling fan speed setting as it relates to RPM. Displays “**Ch**”. Press **OK** to return the current maximum cooling fan speed setting. Press **UP** or **DOWN** to select the maximum cooling fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 800, the unit is limited to operating between 300 and 800 RPM.
24	----	Minimum Cooling Fan Speed	SERVICE ONLY	Change the minimum cooling fan speed setting as it relates to RPM. NOTE: Changing this setting is not recommended as it may trigger unit protection protocols. Displays “**Ch**”. Press **OK** to return the current minimum cooling fan speed setting. Press **UP** or **DOWN** to select the minimum cooling fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 500, the unit is limited to operating between 500 and 1000 RPM.

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
25	----	Maximum Heating Fan Speed	SERVICE ONLY	Change the maximum heating fan speed setting as it relates to RPM. Displays "**Ch**". Press **OK** to return the current maximum heating fan speed setting. Press **UP** or **DOWN** to select the maximum heating fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 800, the unit will now be limited to operating between 300 and 800 RPM.
26	----	Minimum Heating Fan Speed	SERVICE ONLY	Change the minimum heating fan speed setting as it relates to RPM. Note: Changing this setting is not recommended as it may trigger unit protection protocols. Displays "**Ch**". Press **OK** to return the current minimum heating fan speed setting. Press **UP** or **DOWN** to select the minimum heating fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 500, the unit is limited to operating between 500 and 1000 RPM.
27	----	Not available			
28	----	Not available			
29	----	Not available			
30	----	Not available			

To exit the Inquiry Mode:

Press and hold together the On/Off and Fan buttons  for 2 seconds.

GENERAL TROUBLESHOOTING

SAFETY CAUTION

⚠ WARNING

Be sure to turn off all power supplies or disconnect all wires to avoid electric shock. While checking indoor/outdoor PCB, equip yourself with anti-static gloves or wrist strap to avoid damage to the board.

⚠ WARNING

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

NOTE: Remember to discharge the electrical power in capacitor.

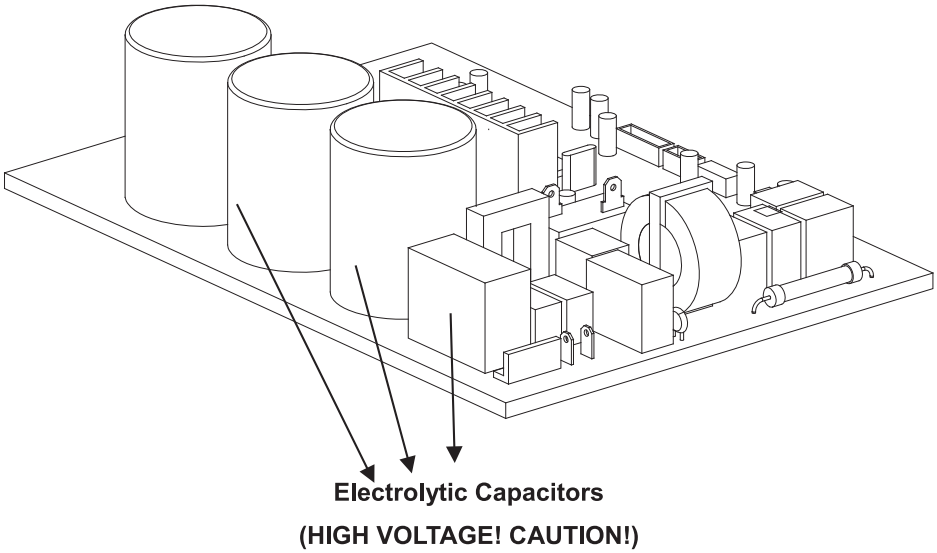


Fig. 24 —Electrolytic Capacitors

For other models, please connect discharge resistance (approximately 100ƒÇ 40W) or a soldering iron (plug) between the +, - terminals of the electrolytic capacitor on the contrary side of the outdoor PCB.

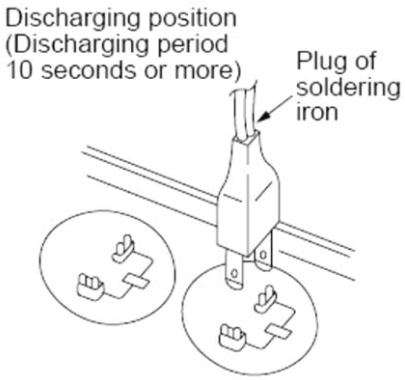
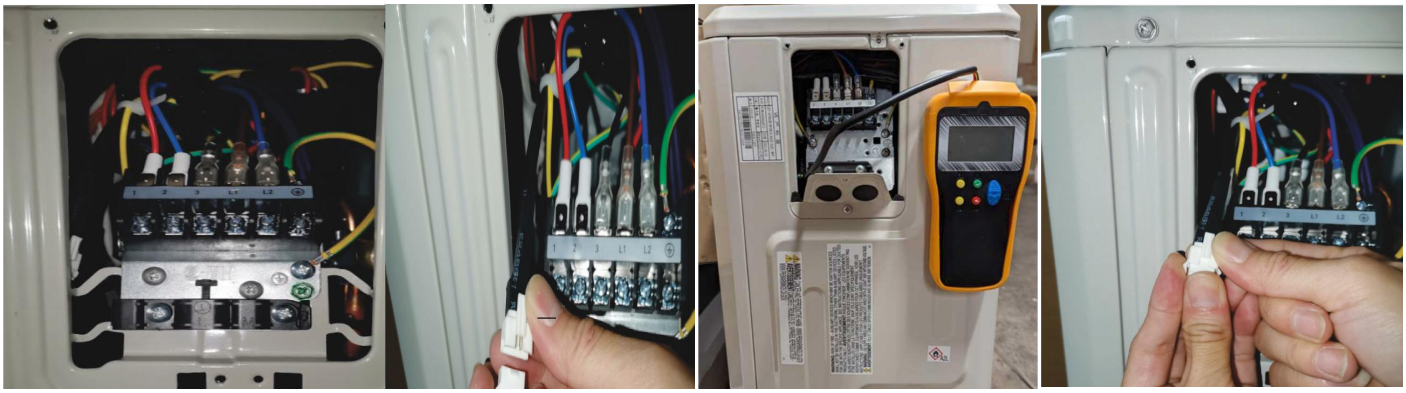


Fig. 25 —Discharge Position

NOTE: Figure is for reference only. The plug on your unit may differ.

NOTE: If using the inverter test tool for troubleshooting, shut off power, remove the electrical panel and locate the cable that is already connected to the test port on the outdoor unit. Connect the test tool to the cable with the connector provided with the test tool. After the maintenance is completed, insert the female end back into the port.

For the R454B single zone ODU with capacity less than 24K, there will be the test tool connector. For 24K HH and 30K-60K single zone ODU, there is a diagnosis/check board which has digital display on it, you can read the parameters from it directly.



Step 1 Step 2 Step 3 Step 4

Fig. 26 —Inverter Test Tool Maintenance

Connect the Dr. SMART tool to the white terminal as shown in Step 3 above.

Fig. 27 —Dr. SMART Tool

NOTE: These pictures is for reference only. Actual appearance may vary.

ERROR CODES

Error Display

Display	Indoor/Outdoor Code	Malfunction or Protection	Solution (Refer to Page)
$_{d}$f	N/A	Defrosting	Normal Display, not error code
FC	N/A	Forced cooling	
FH CC	IDU	Refrigerant Sensor Error	page 55
EC 03 / EC 07 / EC 71	ODU	Fan speed out of control	page 30
EC 51	ODU	EEPROM parameter error	page 26
EC 52	ODU	Coil temp. sensor(T3) error	page 33
EC 53	ODU	Ambient temp. sensor(T4) error	page 33
EC 54	ODU	COMP. discharge temp. sensor (TP) error	page 33
EC 55	ODU	IPM module temperature sensor malfunction	page 35
EL 0C	IDU & ODU	System Lacks Refrigerant Diagnosis and Solution	page 36
EH 00 / EH0A	IDU & ODU	EEPROM Malfunction Error Diagnosis and Solution	page 26
EH02	IDU	Zero Crossing Detection Error	page 29
EH b3	IDU	Communication Malfunction Between Wire and Master Control	page 54
EH bA	IDU & ODU	Communication Malfunction Between Wire and Master Control	page 54
EH C1	IDU	Refrigerant Sensor Detects Leakage	page 56
EH C2	IDU	Refrigerant Sensor is Out of Range and Leakage is Detected	page 56
EH CC / FH CC	IDU	Refrigerant sensor error or Refrigerant sensor is out of range	page 55
EH 3b	IDU & ODU	External Fan DC Bus Voltage is Too High	page 54
EH 06	IDU	IDU Main Control Board and Display Board Communication Error Diagnosis and Solution	page 57
EH 0E	IDU	Water-Level Alarm Malfunction Diagnosis and Solution	page 37
EH 60 / EH 61	IDU & ODU	Open circuit or Short Circuit Of Temperature Sensor	page 33
EC 57	ODU	Refrigerant pipe temperature sensor error	page 33
EC 5C	ODU	Suction Transducer Failure	page 32
EL 01	IDU & ODU	Communication error	page 27
EL 16	ODU	Communication malfunction between adapter board and ODU main board	page 58
FL 09	IDU & ODU	Mismatch between the new and old platforms diagnosis and solution	page 58
PC 00	ODU	IPM module protection	page 38
PC 02	ODU	Compressor top (or IPM) temp. protection	page 40
PC 04	ODU	Inverter Compressor Drive Error Diagnosis and Solution	page 43
PC 06	ODU	Discharge temperature protection of compressor	page 40
PC 08	ODU	Outdoor overcurrent protection	page 49
PC 0A	ODU	High temperature protection of condenser	page 51
PC 0F	ODU	PFC module protection	page 52
PC 0L	ODU	Low Ambient Temperature Protection	page 54
PC 10	ODU	Low AC voltage protection	page 53
PC 11	ODU	Main control board DC bus high voltage protection	page 53
PC 12	ODU	Main control board DC bus high voltage protection /341 MCE error	page 53
PC 03	IDU	* Pressure Protection (low or high pressure)	page 41
PC 30	ODU	System high pressure protection	page 41
PC 31	ODU	Low Pressure Protection	page 41

Display	Indoor/Outdoor Code	Malfunction or Protection	Solution (Refer to Page)
PC 40	ODU	Communication error between ODU main chip and compressor driven chip	page 44
PC 41	ODU	Compressor current sampling failure	page 45
PC 42	ODU	Compressor start failure of outdoor unit	page 49
PC 43	ODU	Compressor lack phase protection	page 46
PC 44	ODU	Zero speed protection	page 49
PC 45	ODU	IR chip drive failure	page 47
PC 46	ODU	Compressor speed has been out of control	page 49
PC 49	ODU	Compressor overcurrent failure	page 49
LC 06	ODU	High temperature protection of Inverter module (IPM)	page 40
PH 90	IDU & ODU	High temperature protection of evaporator	page 59
PH 91	IDU & ODU	Low temperature protection of evaporator	page 60

NOTE: PC03 Low pressure protection switch is open. Check the switch and repair or leak check the unit and recharge.

TROUBLESHOOTING BY ERROR CODE

EH 00/ EH 0A / 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:

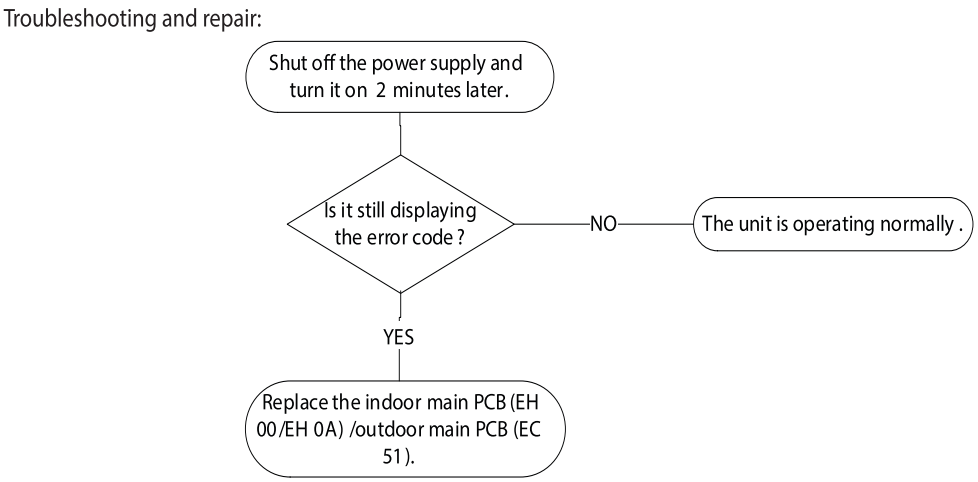


Fig. 28 —EC 51

Remarks:

EEPROM: A read-only memory whose contents can be erased and reprogrammed using a pulsed voltage.

The location of the EEPROM chip on the outdoor PCB is shown in the following image:

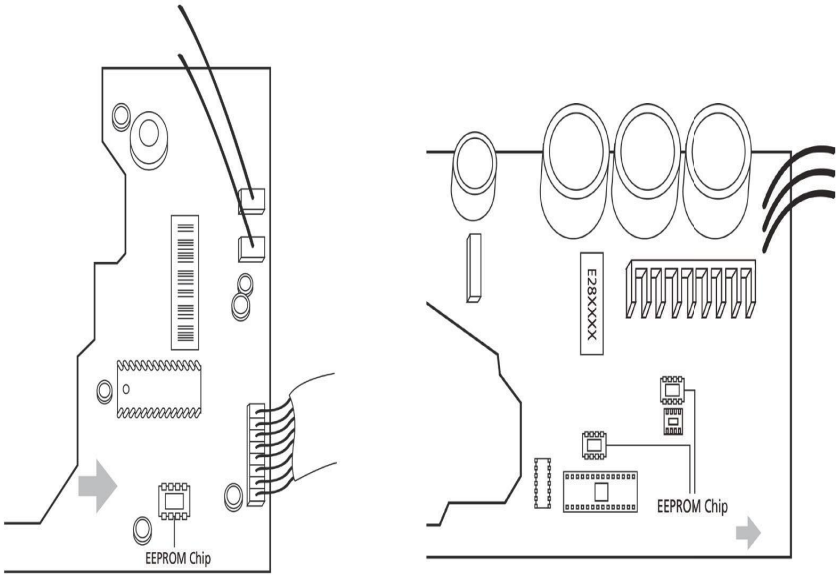


Fig. 29 —Location of EPROM Chip

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

IMPORTANT: Troubleshooting and repair of compressor driven chip EEPROM parameter error sand communication errors between outdoor main chip and compressor driven chip are same as EC 51.

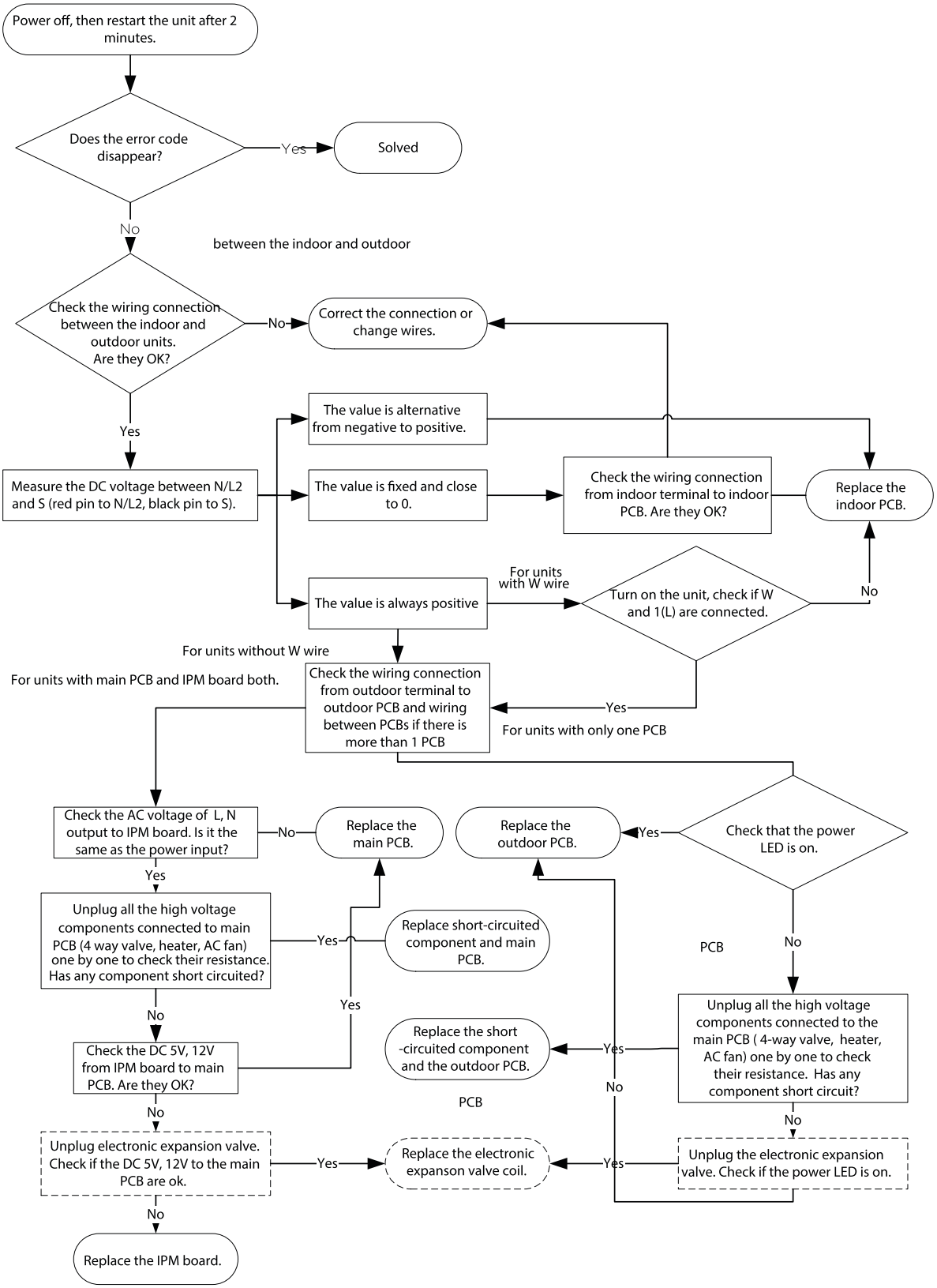
EL 01 (Indoor and Outdoor Unit Communication Error Diagnosis and Solution)

Description: Indoor unit can not communicate with outdoor unit.

Recommended parts to prepare: Indoor PCB, Outdoor PCB

Troubleshooting and repair:

:



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

EL 01 (Continued)

Remarks:

• Use a multimeter to test the DC voltage between the 2 port (or S or L2 port) and 3 port (or N or S port) of the outdoor unit.

• The multimeter's red pin connects with the 2 port (or S or L2 port) while the black pin is for the 3 port (or N or S port). If the unit is running normally, the voltage moves alternately as positive values and negative values.

• If the outdoor unit malfunctions, the voltage remains a narrow positive value.

• If the indoor unit malfunctions, the voltage value will be fixed.

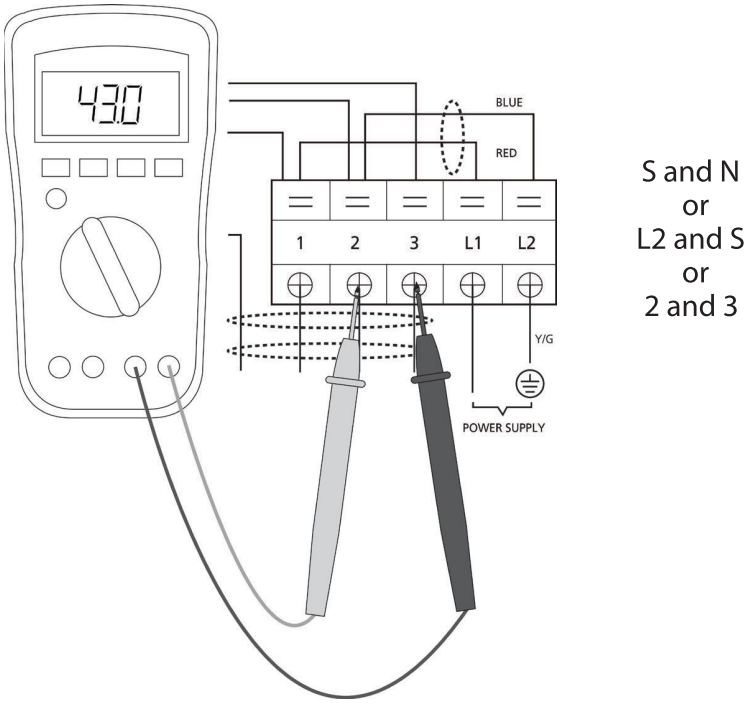


Fig. 30 —Measure Voltage Between Ports

Use a multimeter to test the reactor's resistance which does not connect with the capacitor.

• The normal value should be around zero ohm. Otherwise, the reactor has malfunctioned. Check the reactor to ensure it is not shorted to ground.

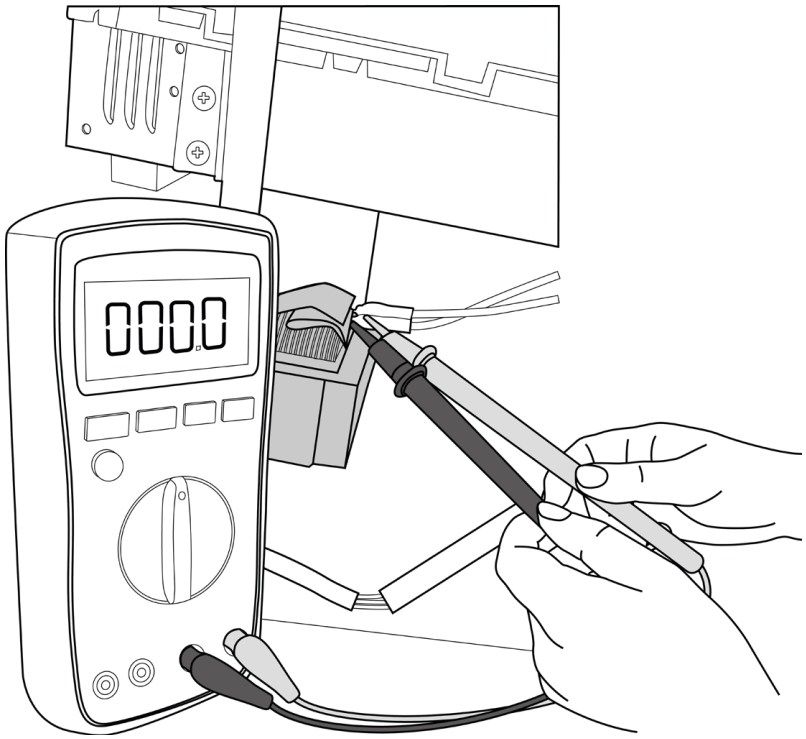


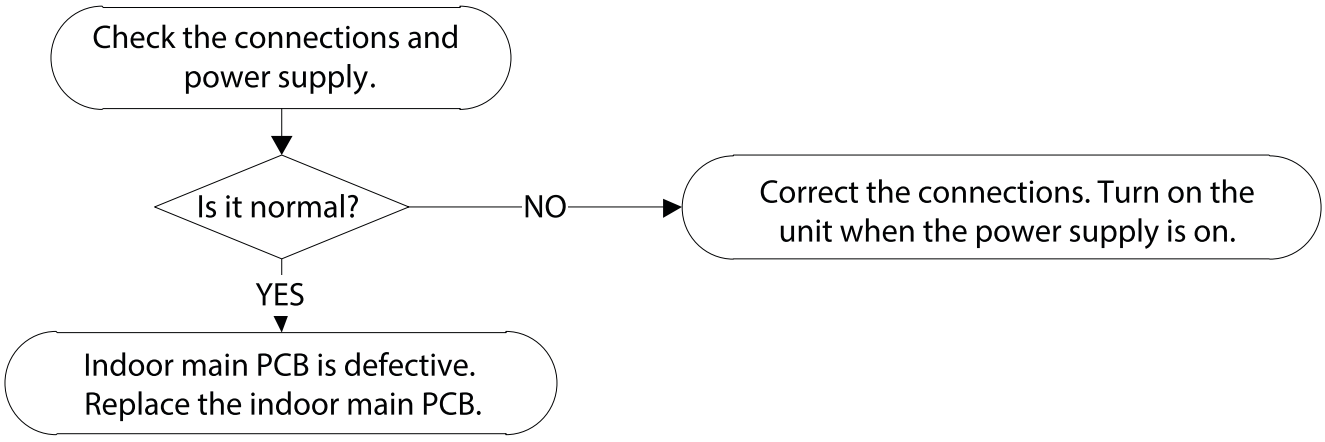
Fig. 31 —Test Reactor Resistance

EH 02 Zero Crossing Detection Error Diagnosis and Solution

Description: When the PCB does not receive a zero crossing signal feedback for 4 minutes or the zero crossing signal time interval is abnormal.

Recommended parts to repair: Connection wires, Indoor main PCB

Troubleshooting:



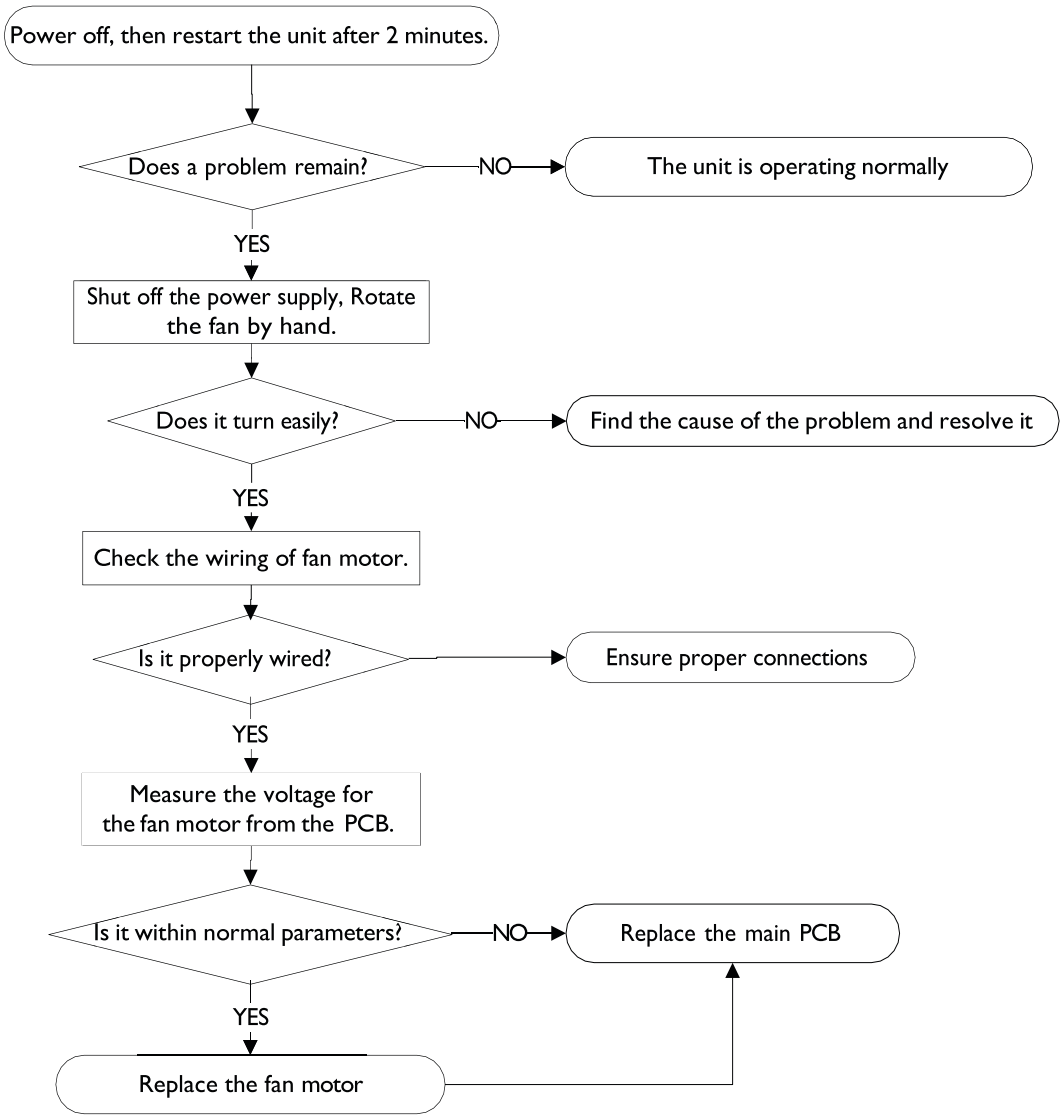
NOTE: A zero crossing detection error is only valid for a unit with an AC fan motor. For other models, this error does not apply.

EH03 / EC 07/ EC 71(Fan Speed Is Operating Outside of Normal Range Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, Fan assembly, Fan motor, PCB

Troubleshooting and repair:



Outdoor DC Fan Motor (DC motor that controls the chip on the PCB)

1. Release the UVW connector. Measure the resistance of U-V, U-W, V-W. If the resistance is not equal to each other, the fan motor is faulty and must be replaced. Otherwise, proceed to step 2.
2. Power on the unit and when the unit is in standby, measure the pin4-5 voltage in the feedback signal connector. If the value is not 5V, change the PCB. Otherwise, proceed to step 3.
3. Rotate the fan by hand, measure the pin1-5, pin 2-5 and pin 3-5 voltage levels in the feedback signal connector. If any voltage is not in the positive voltage fluctuation, the fan motor is faulty and must be replaced.

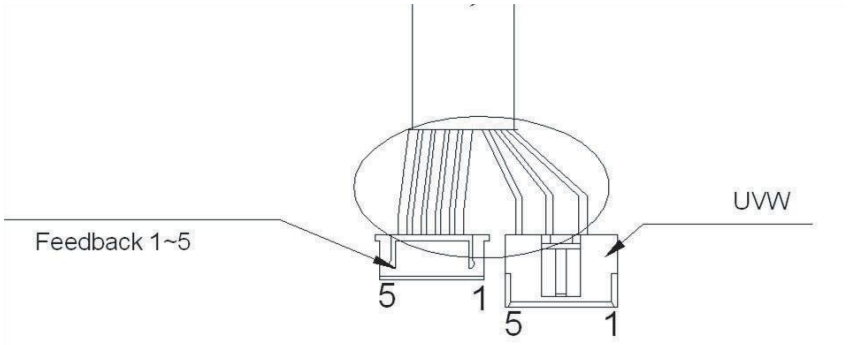


Fig. 32 —Outdoor DC Fan Motor (DC motor that controls the chip on the PCB)

NO.	1	2	3	4	5
COLOR	Orange	Grey	White	Pink	Black
SIGNAL	Hu	Hv	Hw	Vcc	GND

COLOR	Red	Blue	Yellow
SIGNAL	W	V	U

EC 5C (Suction Transducer is in open circuit or has short circuited) (For crossover units) diagnosis and solution

Description: If the sampling voltage is lower than 2V or higher than 254V, the LED displays the failure code.

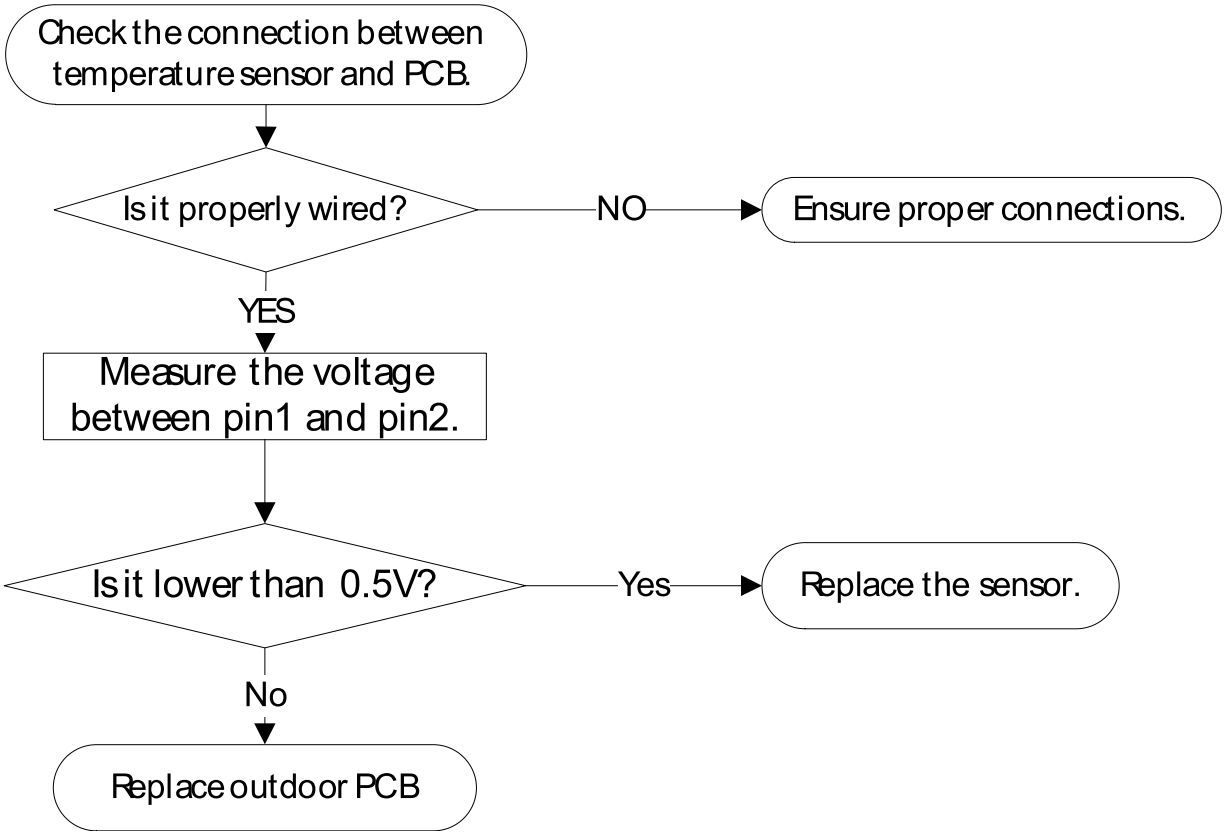
Recommended parts to prepare:

• Connection wires

• Sensor

• Outdoor PCB

Troubleshooting and repair:



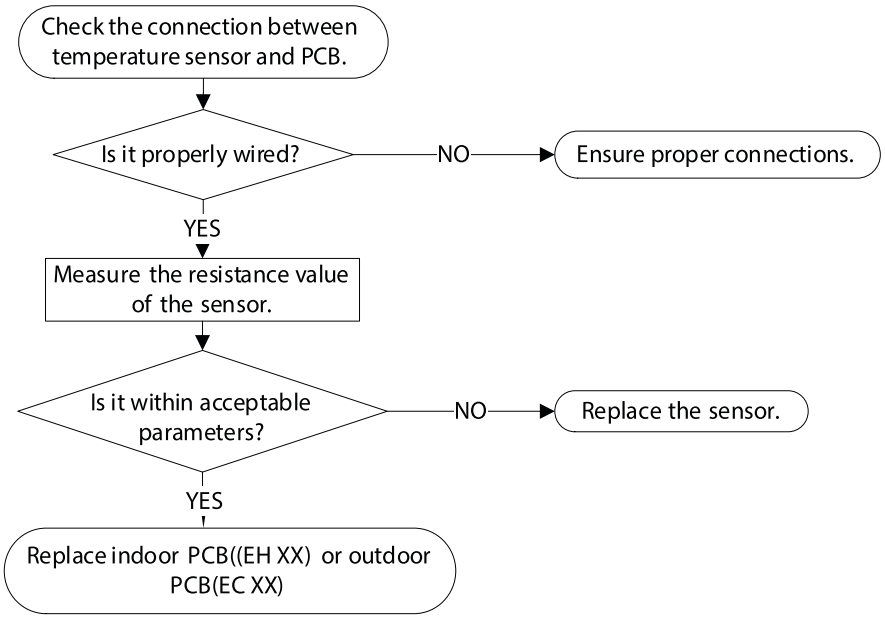
EC 53/ EC 52/ EC 54/ EC 56/ EC 57/ EC 50/ EH 60/ EH 61(Open Circuit or Short Circuit of Temperature Sensor Diagnosis and Solution)

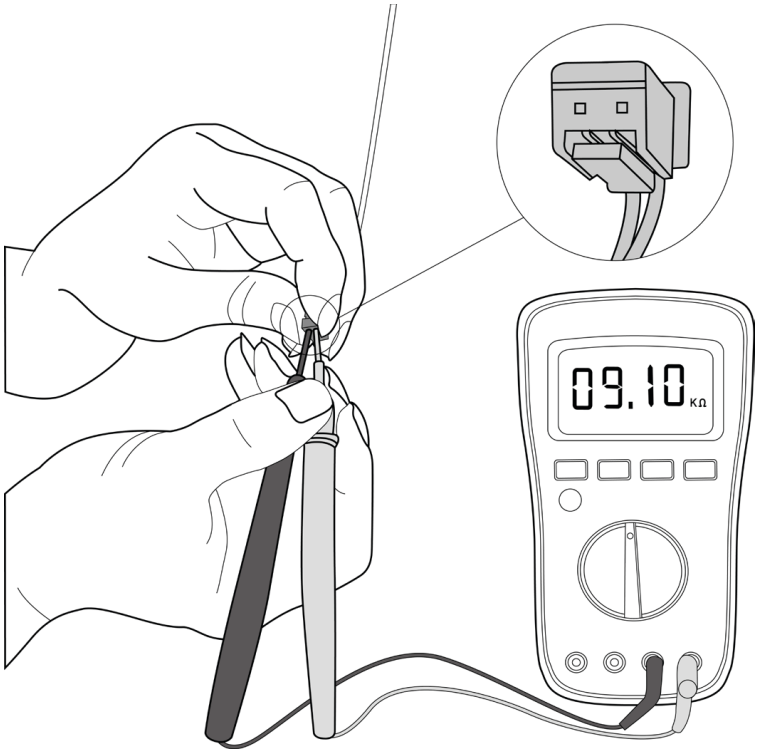
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED displays the failure.

Recommended parts to prepare: Connection wires, Sensors, PCB

Troubleshooting and repair:

Refer to Appendix, page 91.





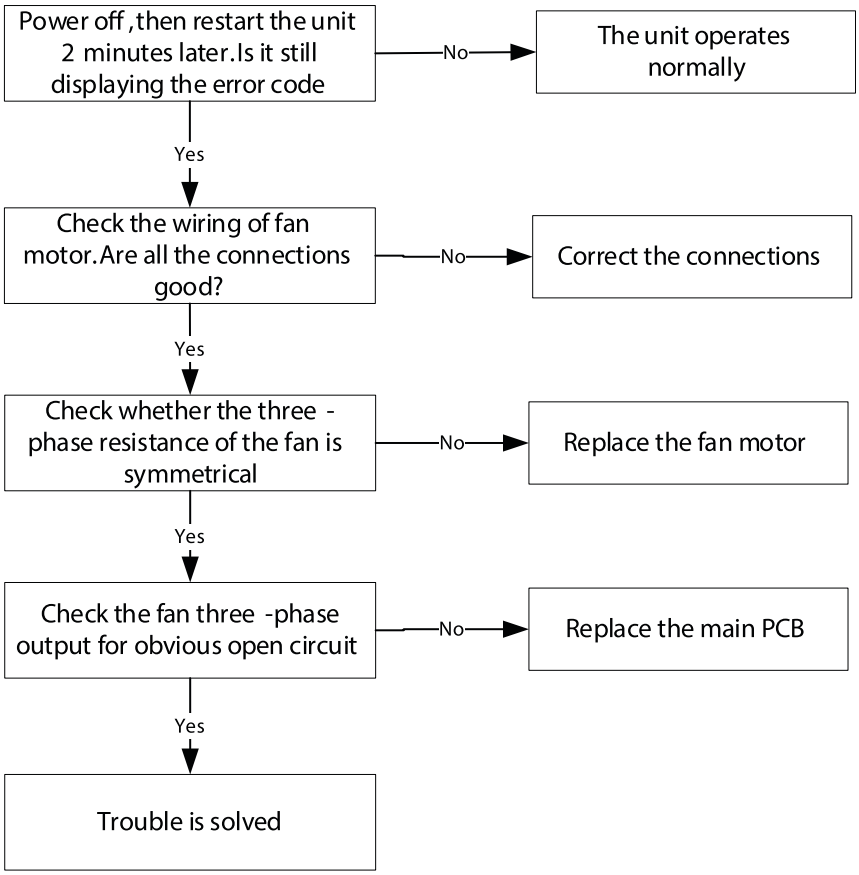
NOTE: This picture and the value are only for reference, actual appearance and value may vary.

EC 72 Lack phase failure of ODU 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 the failure code.

Recommended parts to prepare: Connection wire, Fan motor, Outdoor 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 the failure code.

Recommended parts to prepare:

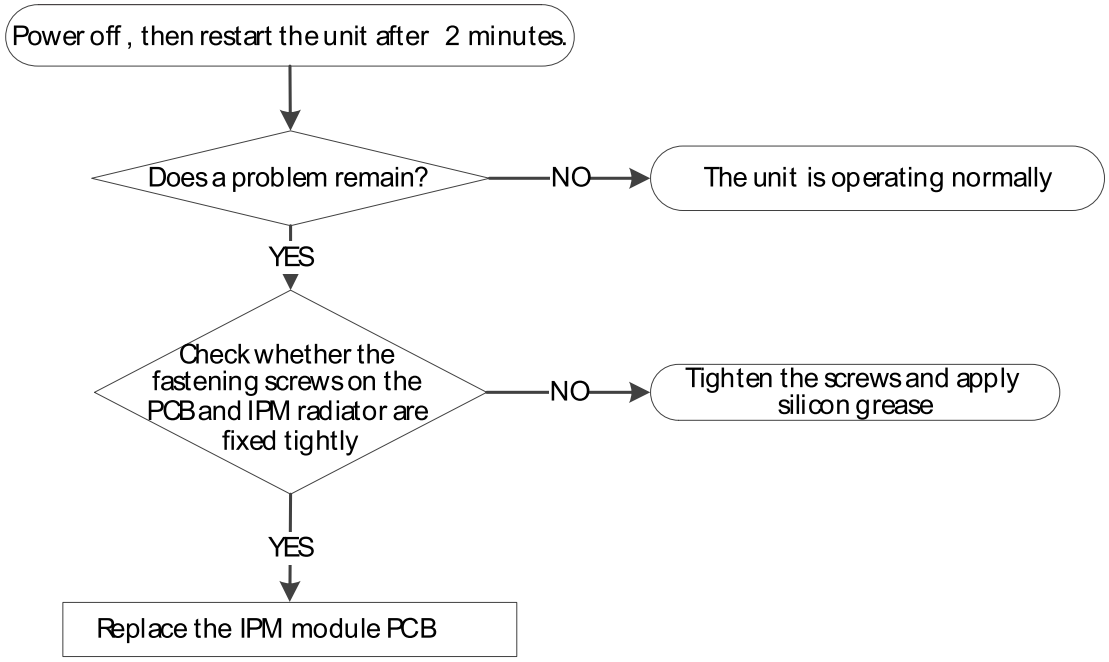
• IPM module PCB

• Connection wires

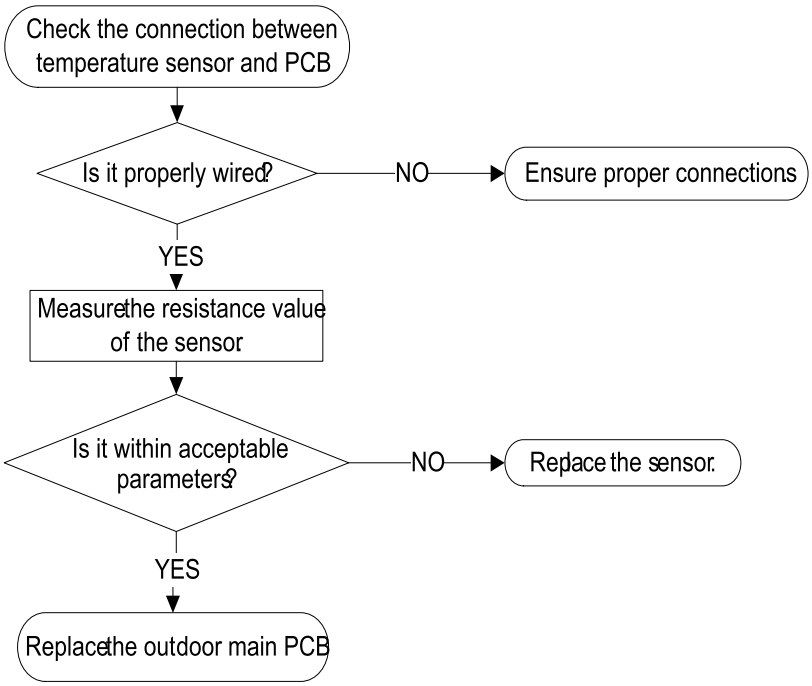
• Sensors

• 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:

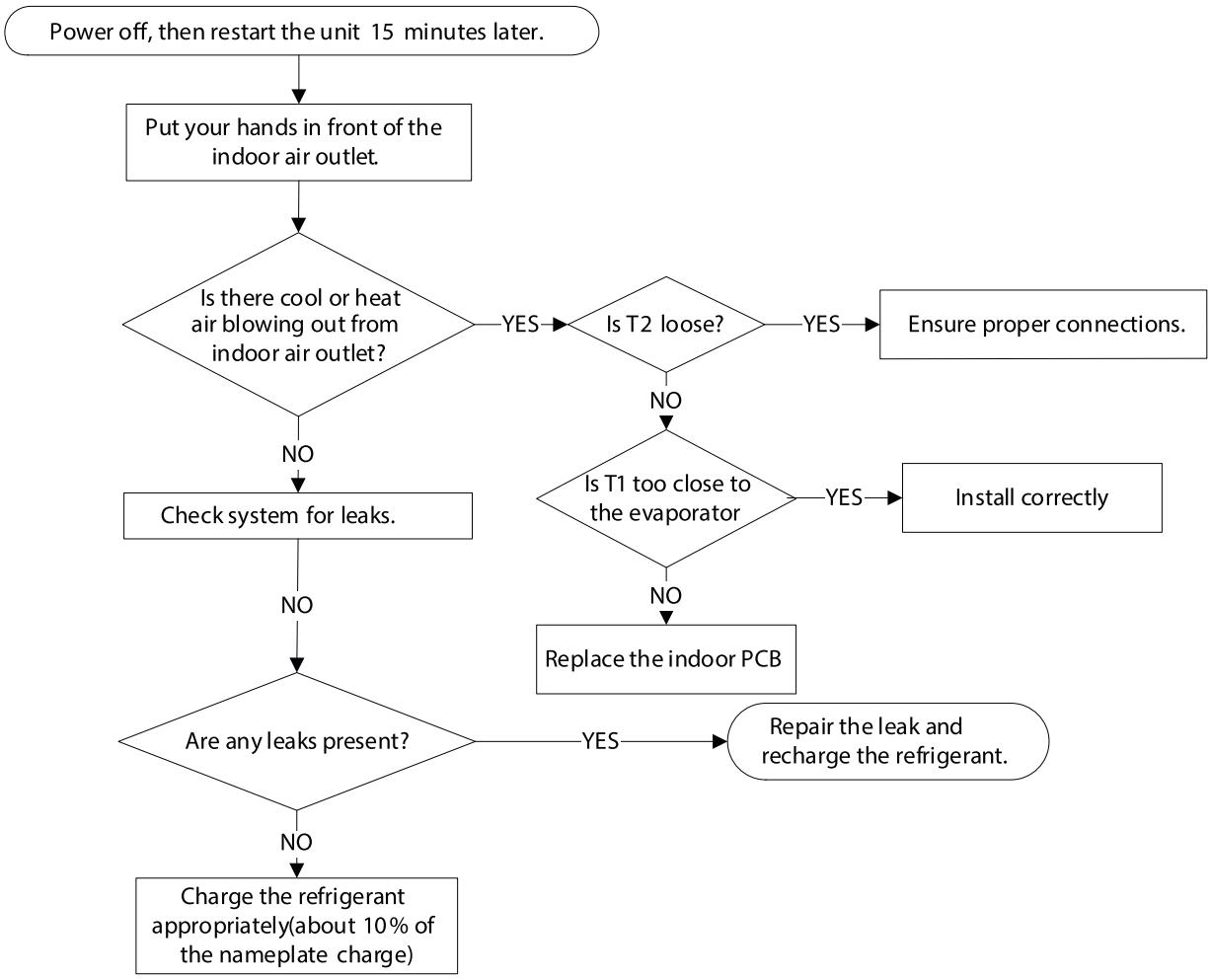


EL 0C (System Lacks Refrigerant Diagnosis and Solution)

Description: Judging the abnormality of the refrigeration system according to the number of compressor stops and the changes in operating parameters caused by excessive exhaust temperature.

Recommended parts to prepare: Indoor PCB, Additional refrigerant

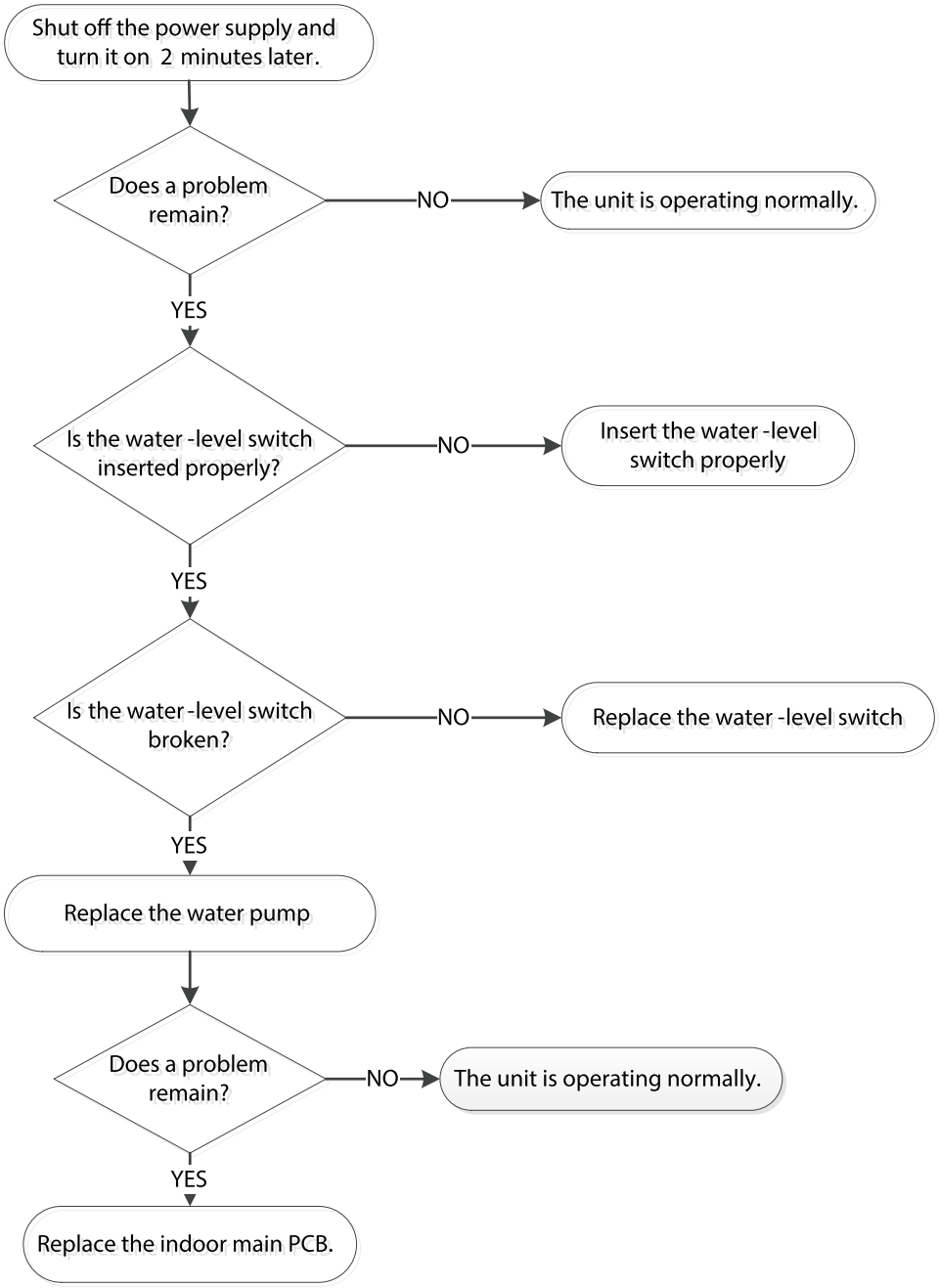
Troubleshooting and repair:



EH 0E (Water-Level Alarm Malfunction Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, Water-level switch, Water pump, Indoor PCB

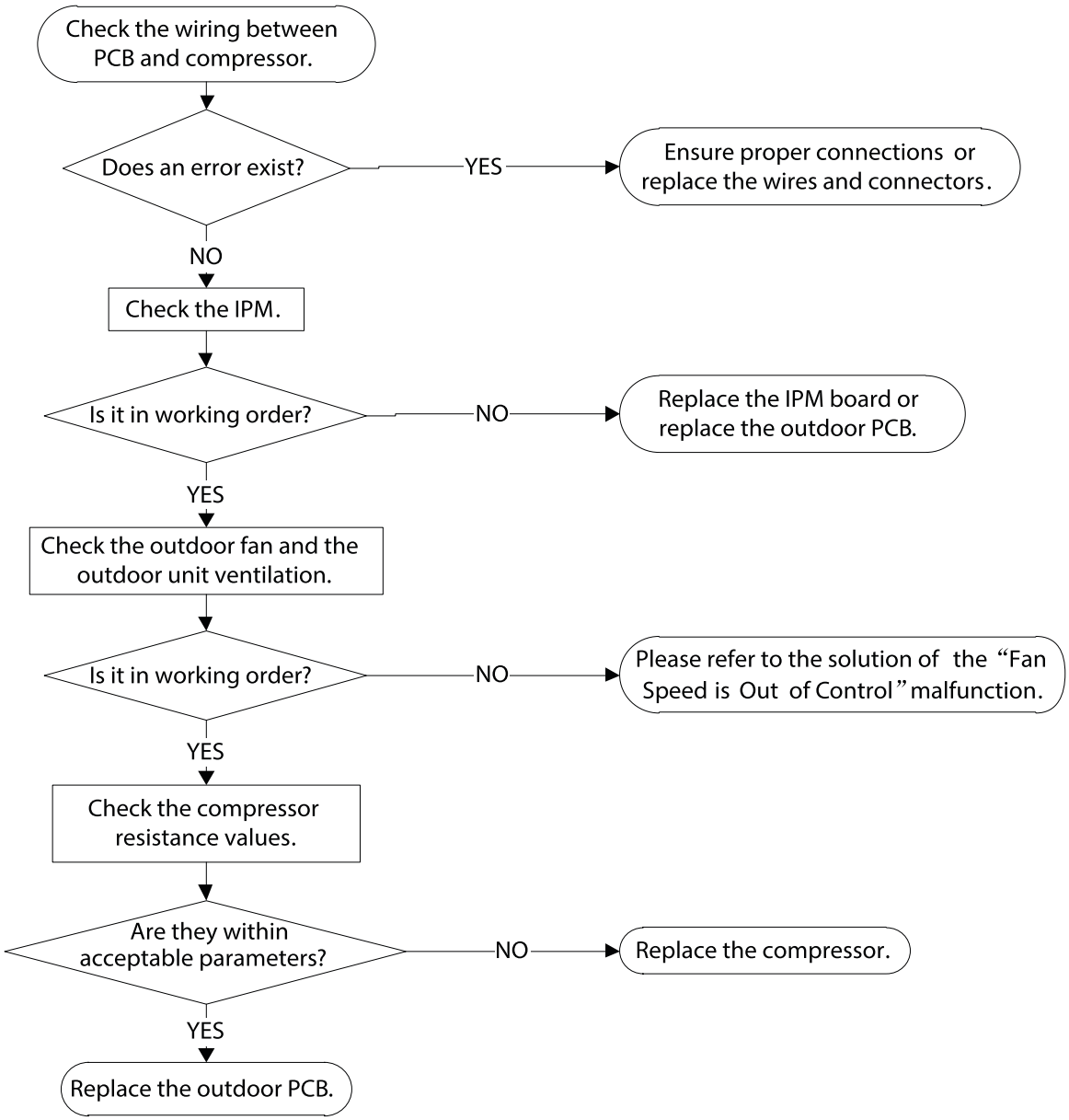


PC 00 (ODU IPM Module Protection Diagnosis and Solution)

Description: When the voltage signal the IPM sends to the compressor drive chip is abnormal, the display LED shows "PC 00" and the AC turn off.

Recommended parts to prepare: Connection wires, IPM module board, Outdoor fan assembly, Compressor, Outdoor PCB

Troubleshooting and repair:



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

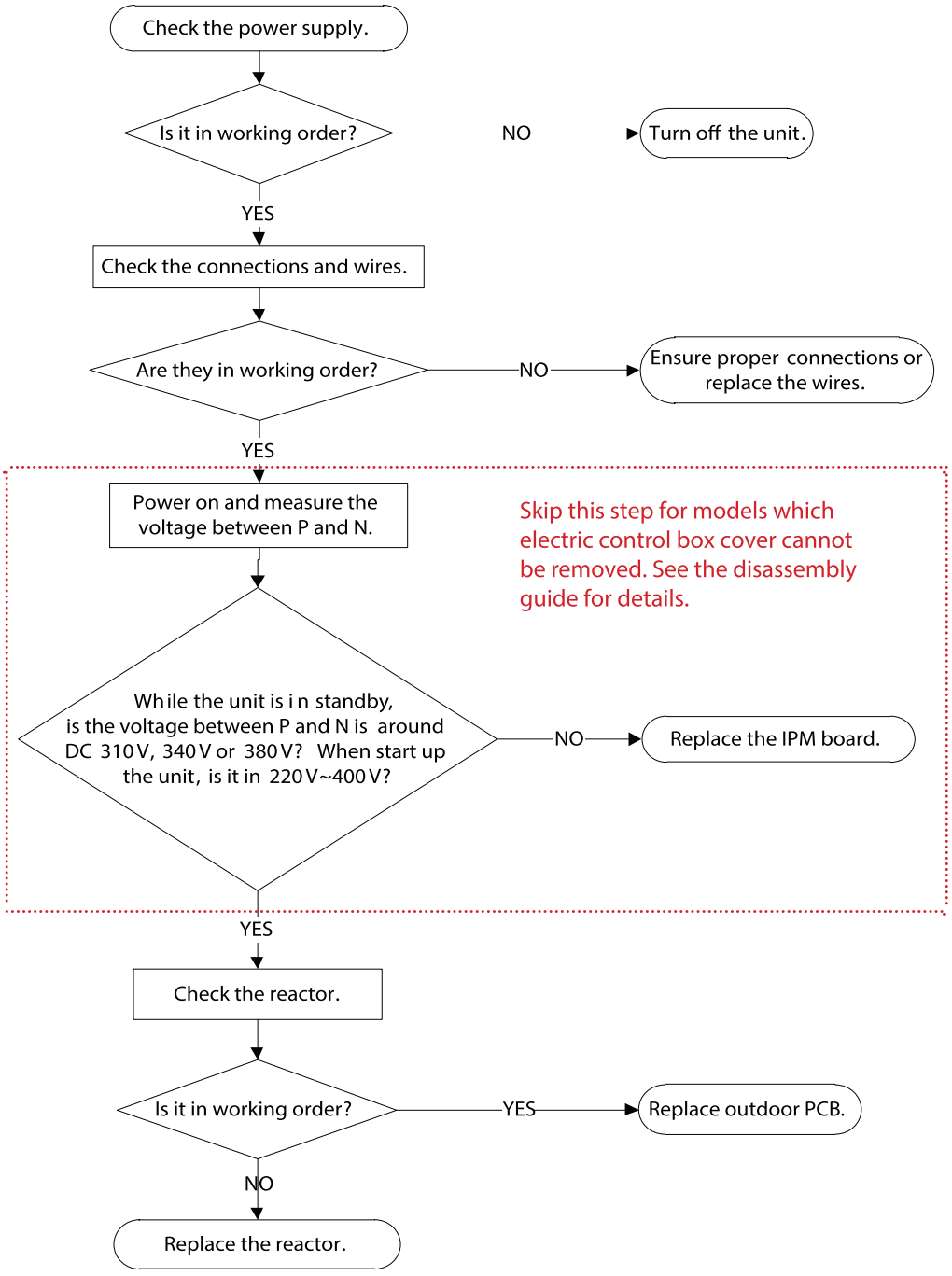
PC 10 / PC 11 / PC 12 (ODU Voltage Protection Diagnosis and Solution)

PC 10 (Outdoor unit low AC voltage protection) / PC 11 (Outdoor unit main control board DC bus high voltage protection) / PC 12 (Outdoor unit main control board DC bus high 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, PCB, Reactor

Troubleshooting and repair:



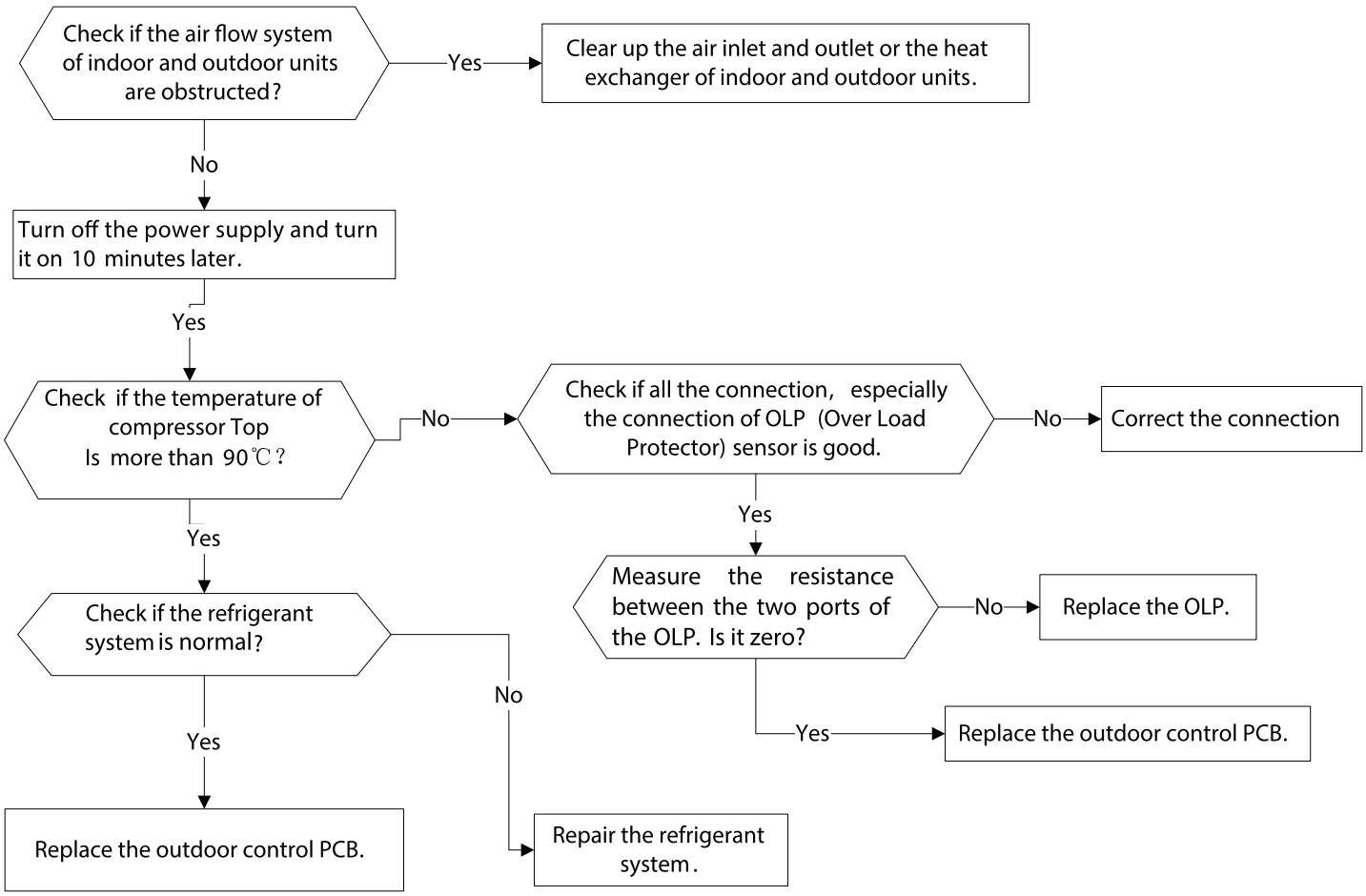
NOTE: For certain models, the outdoor PCB cannot be removed separately. In this case, the outdoor electric control box should be replaced as a whole.

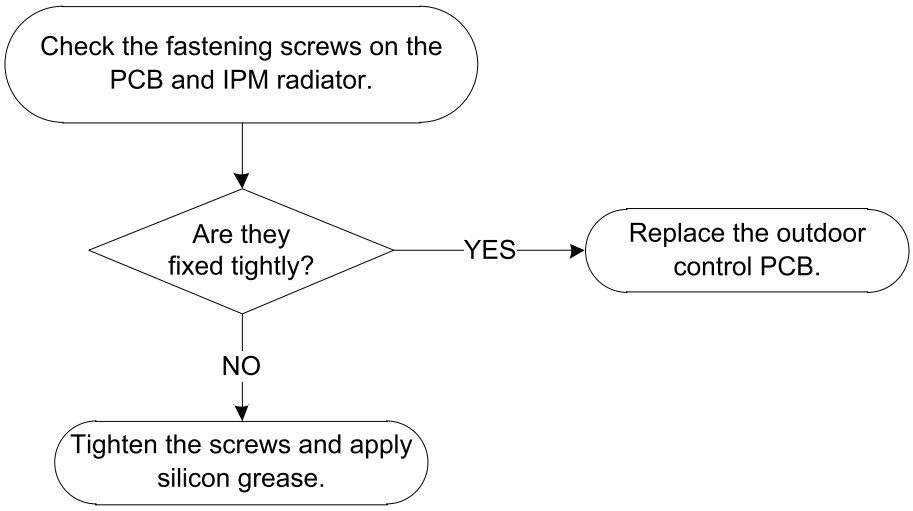
PC 02 / LC 06 (Compressor Top (or IPM) Temp. Protection Diagnosis and Solution)

Description: **For some models with overload protection, If the sampling voltage is not 5V, the LED will display the failure. If the temperature of IPM module is higher than a certain value, the LED displays the failure code.**

Recommended parts to prepare: Connection wires, Outdoor PCB, IPM module board, High pressure protector, System blockages

Troubleshooting and repair:



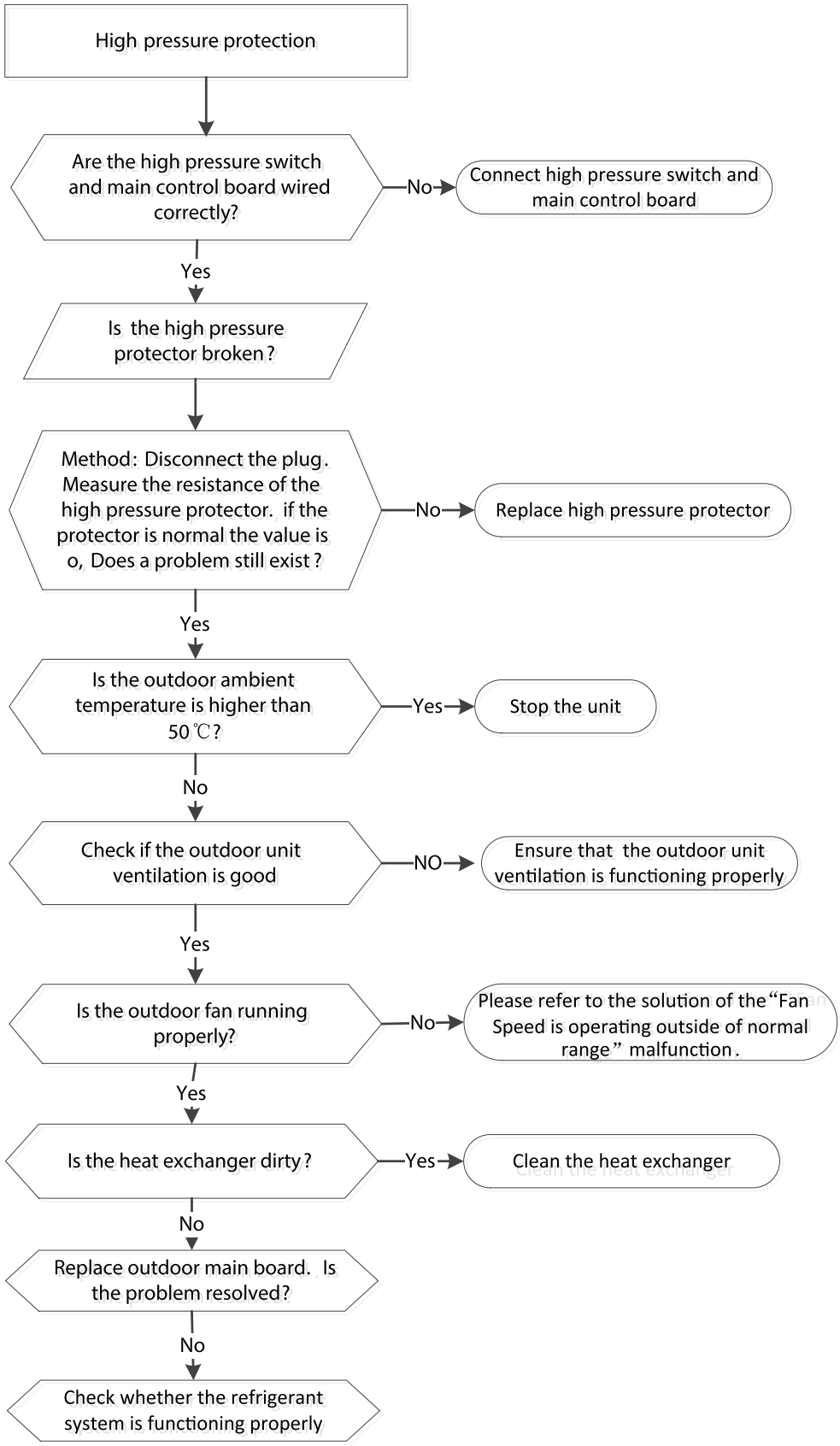


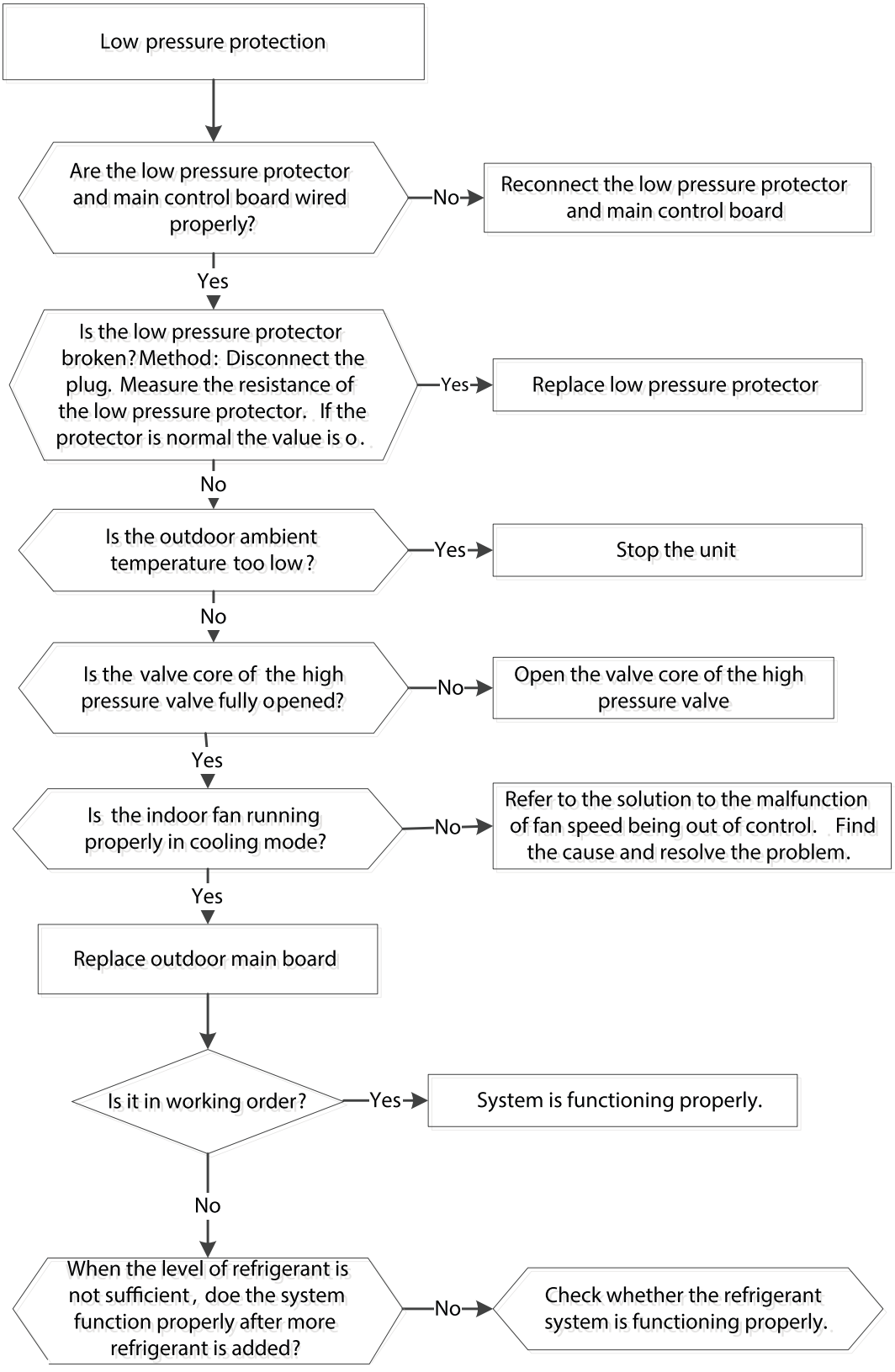
PC 03 Pressure Protection (low or high pressure), PC 30 High Pressure Protection, PC 31 Low Pressure Protection (Diagnosis and Solution)

Description: Outdoor pressure switch cut off the system because high pressure is higher than 4.4 MPa or outdoor pressure switch cut off the system because low pressure is lower than 0.13 MPa, the LED displays the failure code.

Recommended parts to prepare: Connection wires, Pressure switch, Outdoor fan, Outdoor main PCB, Refrigerant

Troubleshooting and repair:



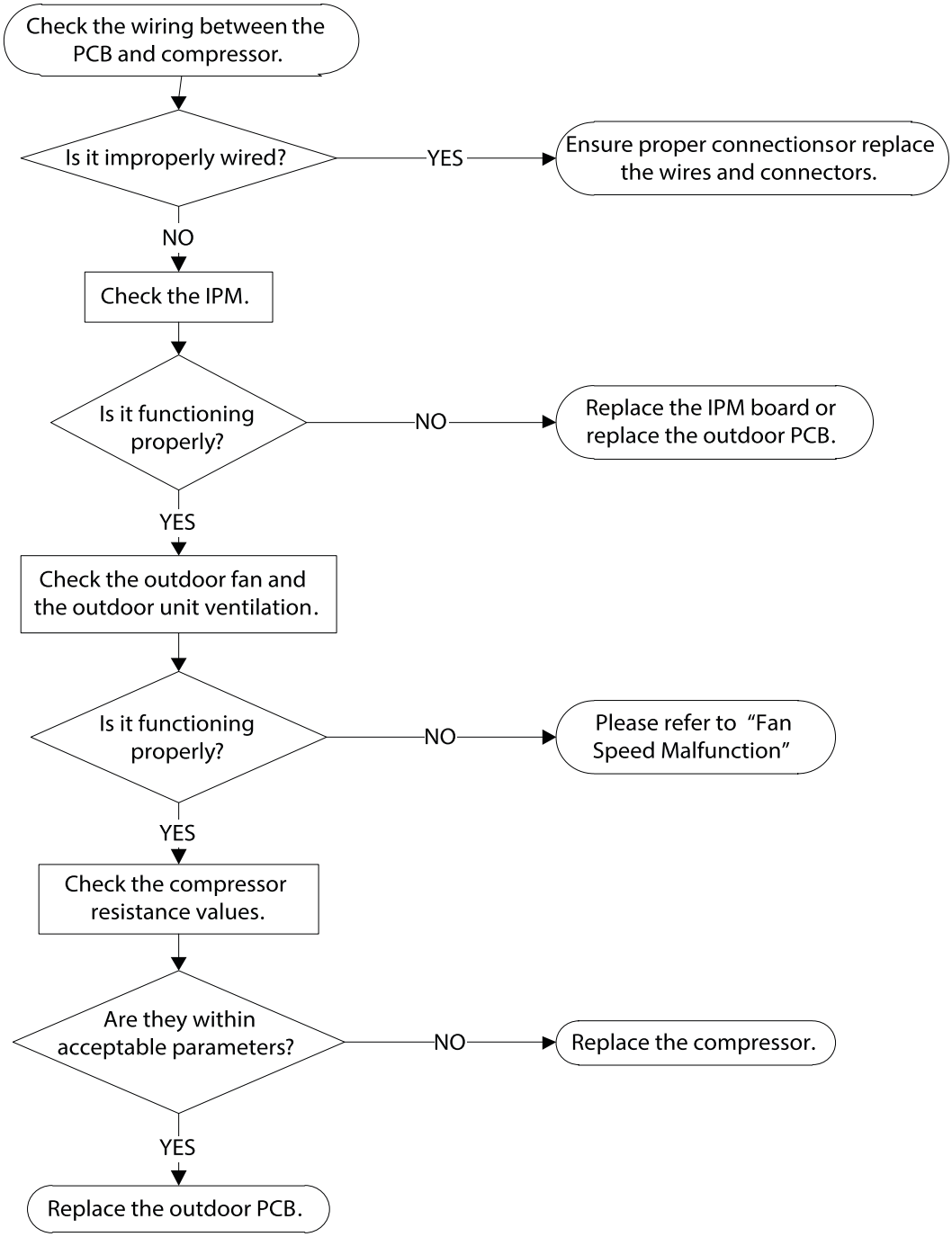

Low pressure protection
Are the low pressure protector and main control board wired properly?
No
Reconnect the low pressure protector and main control board
Yes
Is the low pressure protector broken? Method: Disconnect the plug. Measure the resistance of the low pressure protector. If the protector is normal the value is o.
Yes
Replace low pressure protector
No
Is the outdoor ambient temperature too low?
Yes
Stop the unit
No
Is the valve core of the high pressure valve fully opened?
No
Open the valve core of the high pressure valve
Yes
Is the indoor fan running properly in cooling mode?
No
Refer to the solution to the malfunction of fan speed being out of control. Find the cause and resolve the problem.
Yes
Replace outdoor main board
Is it in working order?
Yes
System is functioning properly.
No
When the level of refrigerant is not sufficient, doe the system function properly after more refrigerant is added?
No
Check whether the refrigerant system is functioning properly.

PC 04 (Inverter Compressor Drive Error Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, IPM module board, Outdoor fan assembly, Compressor, Outdoor PCB

Troubleshooting and repair:

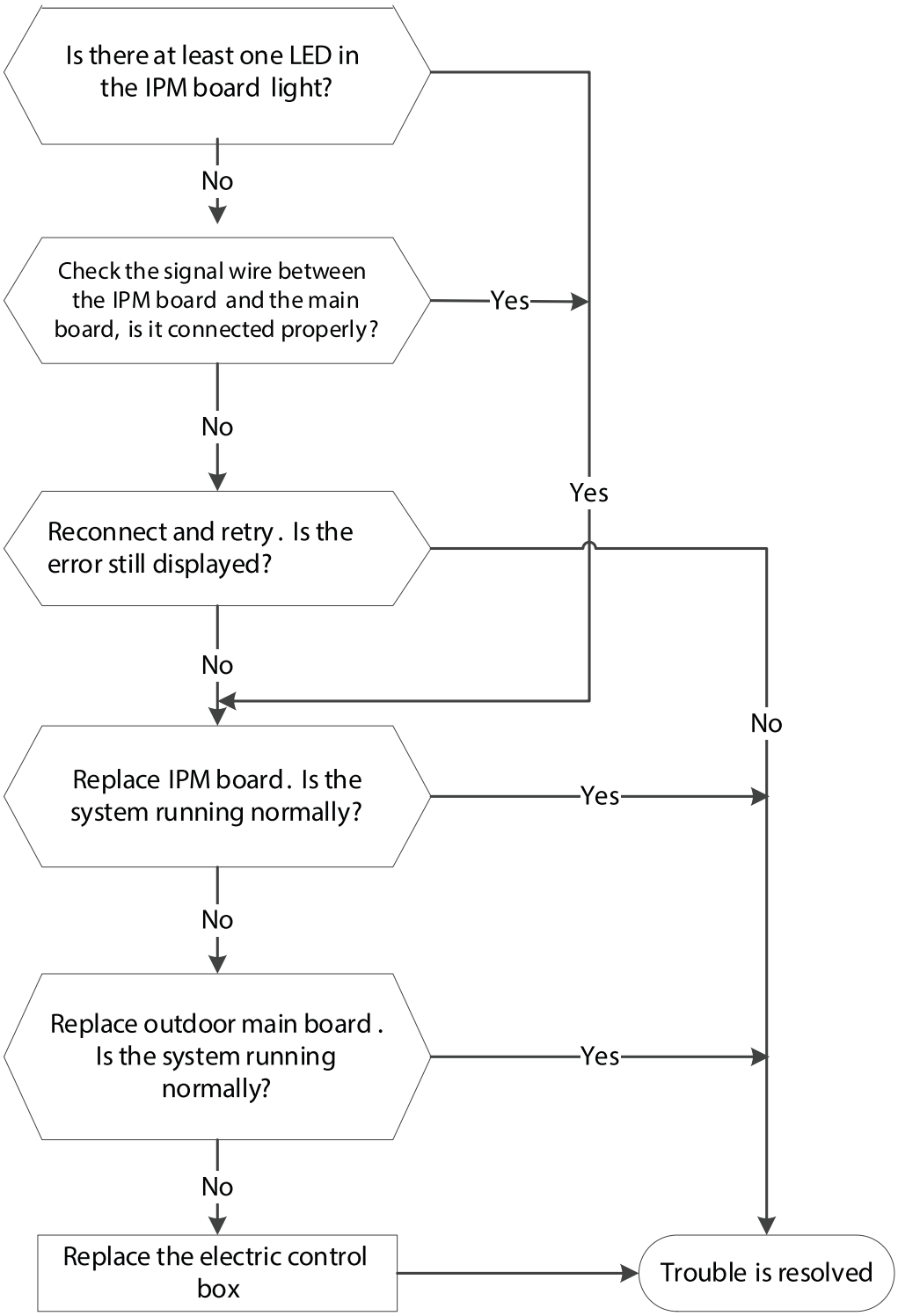


PC 40 (Communication error between ODU main chip and compressor driven chip diagnosis and solution)

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:

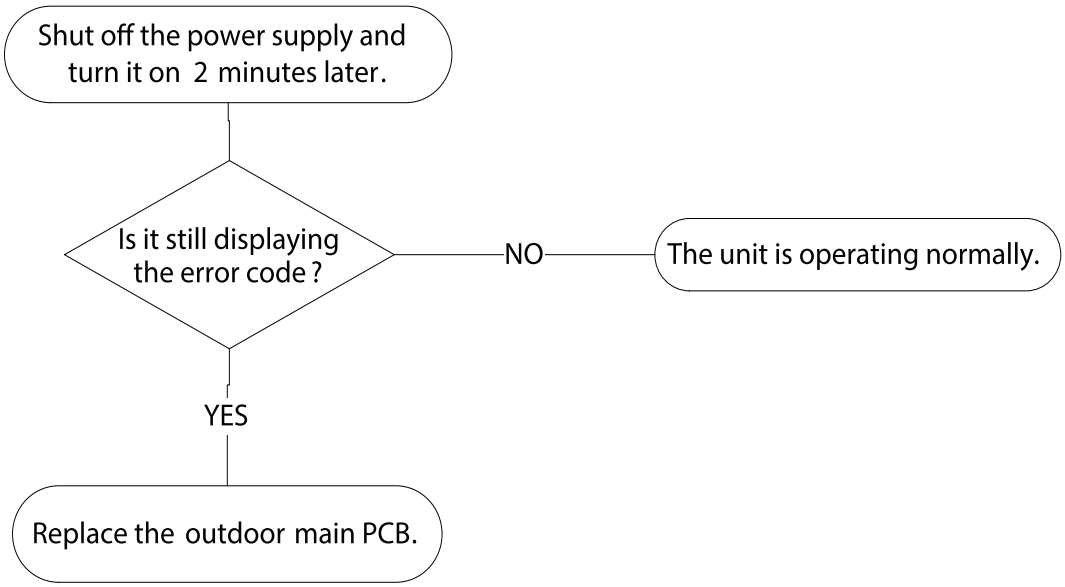


PC 41 (Outdoor compressor current sampling circuit failure diagnosis and solution)

Description: Three-phase sampling offset voltage error, the static bias voltage is normally 2.5V.

Recommended parts to prepare: Outdoor main PCB

Troubleshooting and repair:

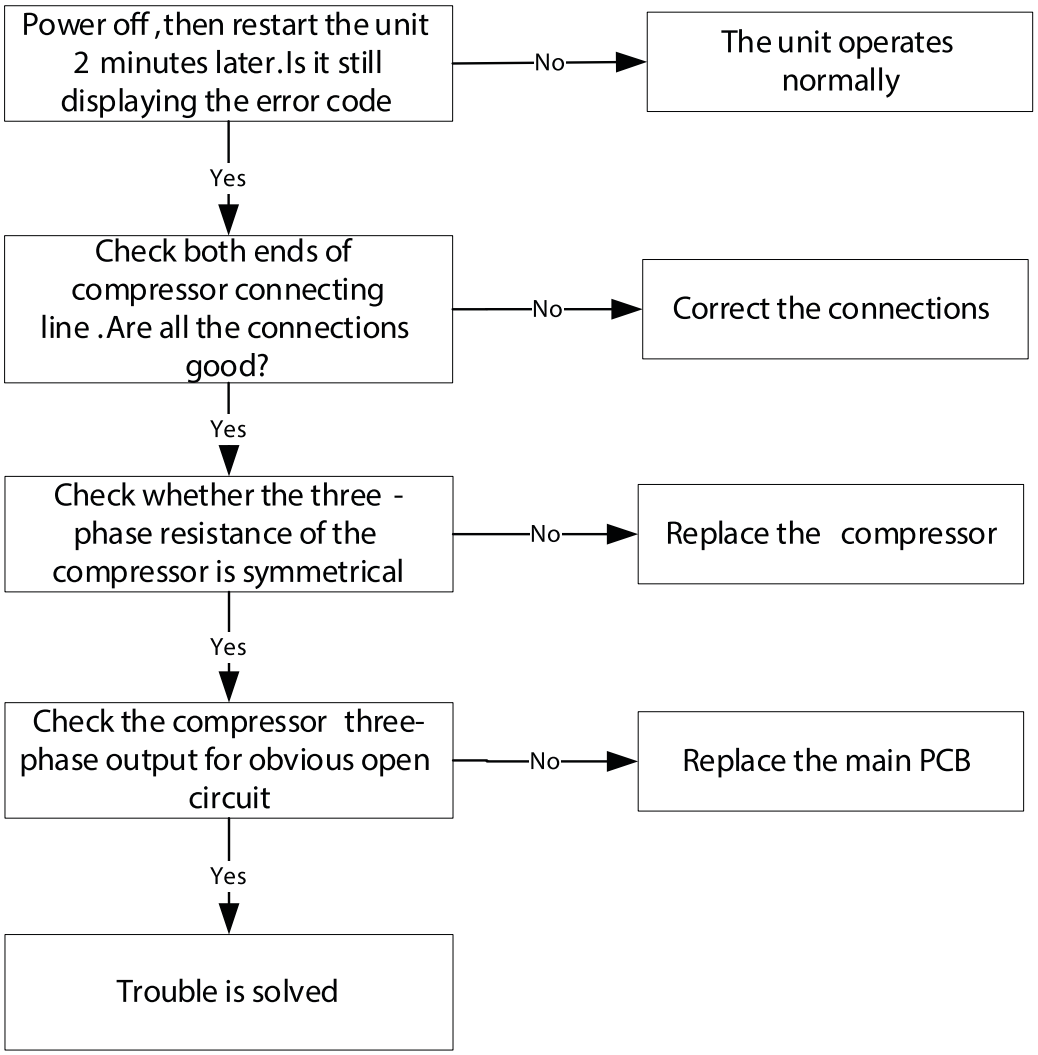


PC 43 (ODU compressor lack phase protection diagnosis and solution)

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

Recommended parts to prepare: Connection wire, Compressor, Outdoor PCB

Troubleshooting and repair:

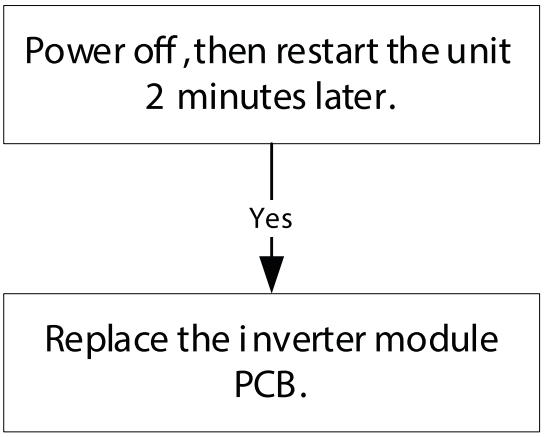


PC 45 (ODU IR chip drive failure diagnosis and solution)

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

Recommended parts to prepare: Inverter module PCB.

Troubleshooting and repair:

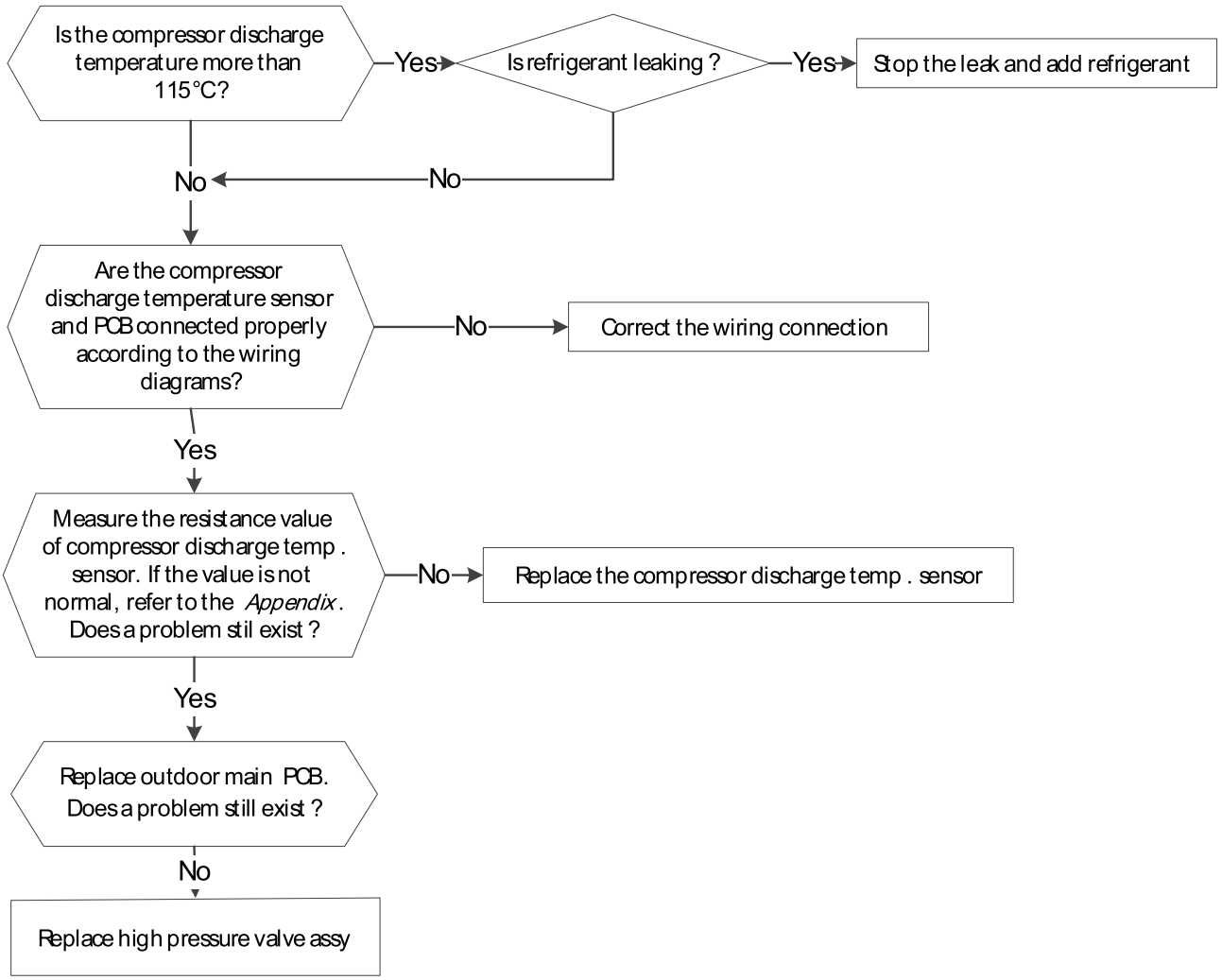


PC 06 (Discharge temperature protection of compressor diagnosis and solution)

Description: When the compressor discharge temperature (TP) is more than 115oC for 10 seconds, the compressor ceases operation and does not restart until TP is less than 90^{o}C

Recommended parts to prepare: Connection wires, Outdoor PCB, Discharge temperature sensor, Refrigerant

Troubleshooting and repair:

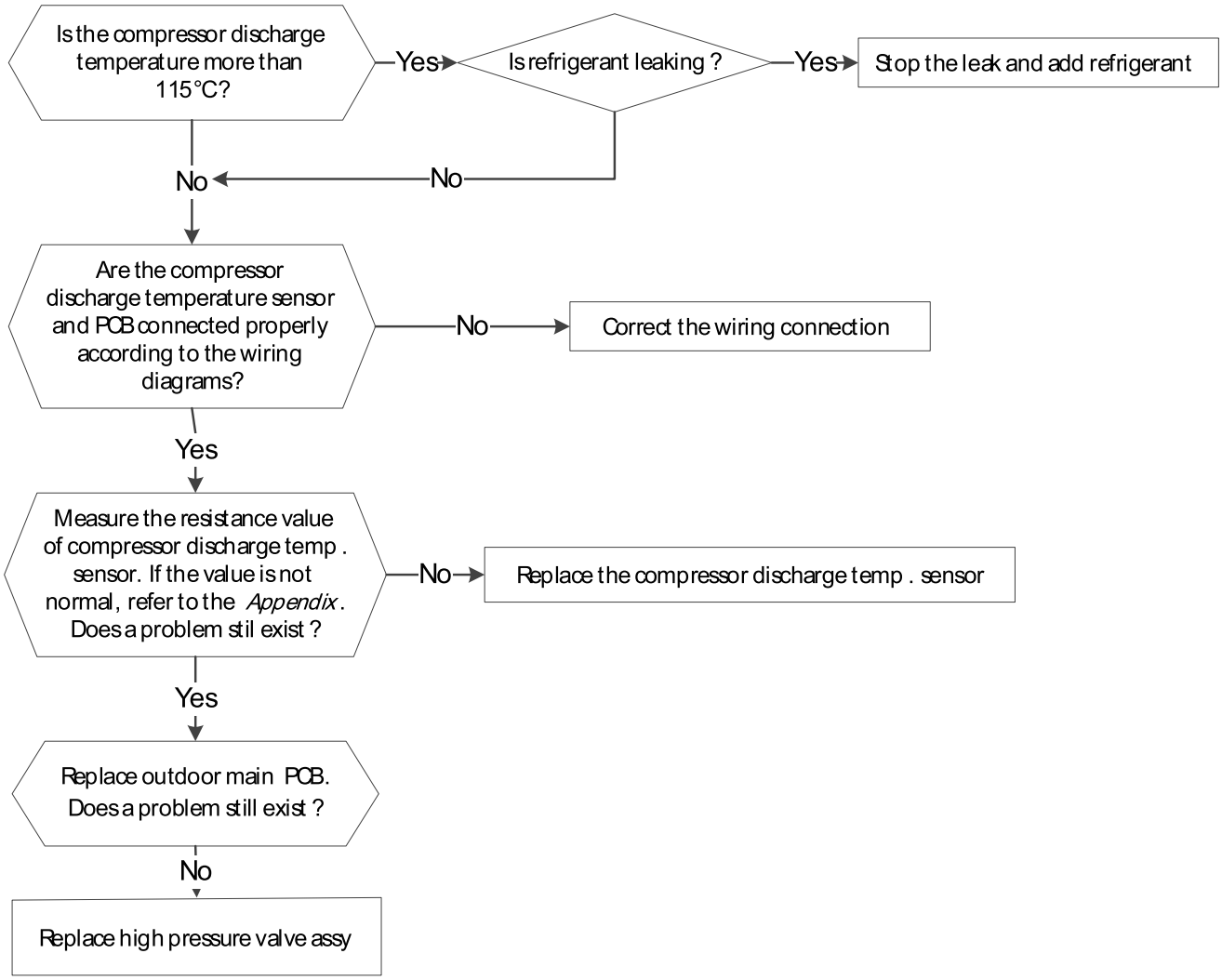


PC 08 (Current overload protection)/ PC 42 (Compressor start failure of outdoor unit)/ PC 44 (ODU zero speed protection) / PC 46 (Compressor speed has been out of control)/ PC 49 (Compressor overcurrent failure)

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, PM module board

Troubleshooting and repair:

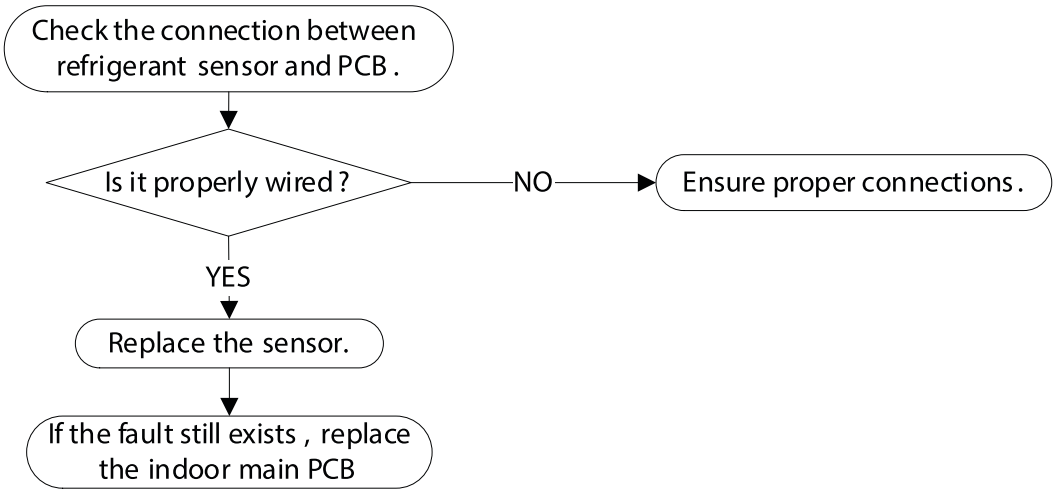


FH CC/ EH C3 Refrigerant sensor error or Refrigerant sensor is out of range diagnosis and solution

Description: Indoor unit receives fault signal for 10s or indoor unit does not receive feedback from refrigerant sensor for 150s.

Recommended parts to prepare: Connection wires, Sensors, Indoor main PCB

Troubleshooting and repair:



EH C1/ EH C2/ EC C1 Refrigerant sensor detects leakage or Refrigerant sensor is out of range and leakage is detected diagnosis and solution

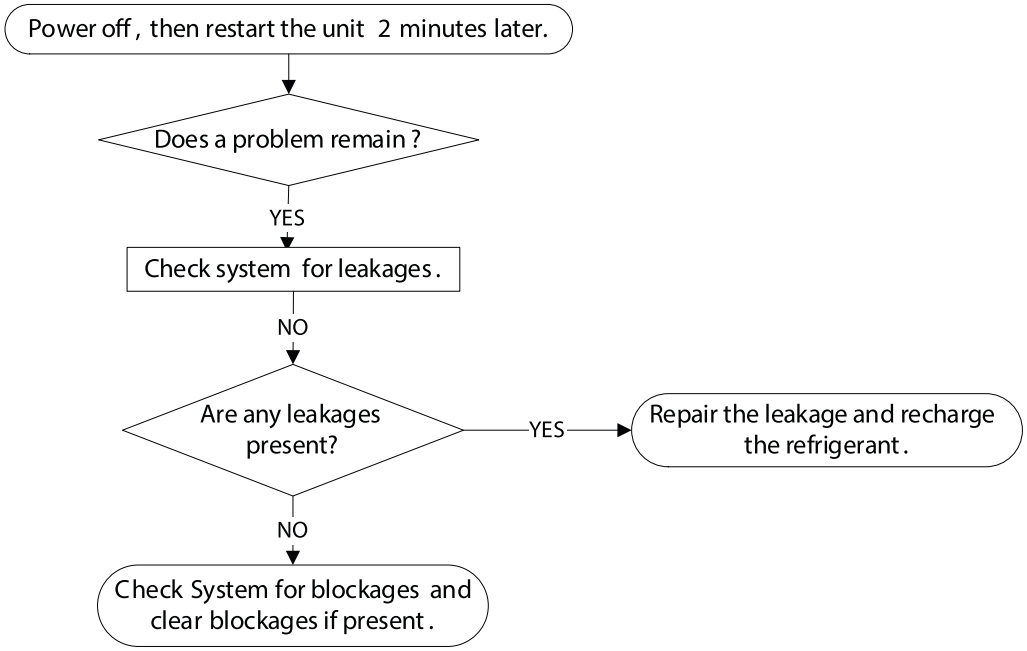
Description:

The refrigerant sensor detects a concentration higher than or equal to 10%*LFL for 10 seconds or the refrigerant sensor detects a concentration higher than or equal to 20%*LFL or the multi model receives the refrigerant leakage protection fault sent by the outdoor unit.

Multi-zone: Only the buzzer of the indoor unit that detects refrigerant leakage continues to sound the alarm, the shortest sound is 10 seconds, and the longest sound is 5 minutes (you can press any key such as remote control or wire control, APP and so on to eliminate the alarm), and the other non-refrigerant leakage fault indoor unit only displays ECC1, but the buzzer does not sound.

Recommended parts to prepare: Additional refrigerant

Troubleshooting and repair:

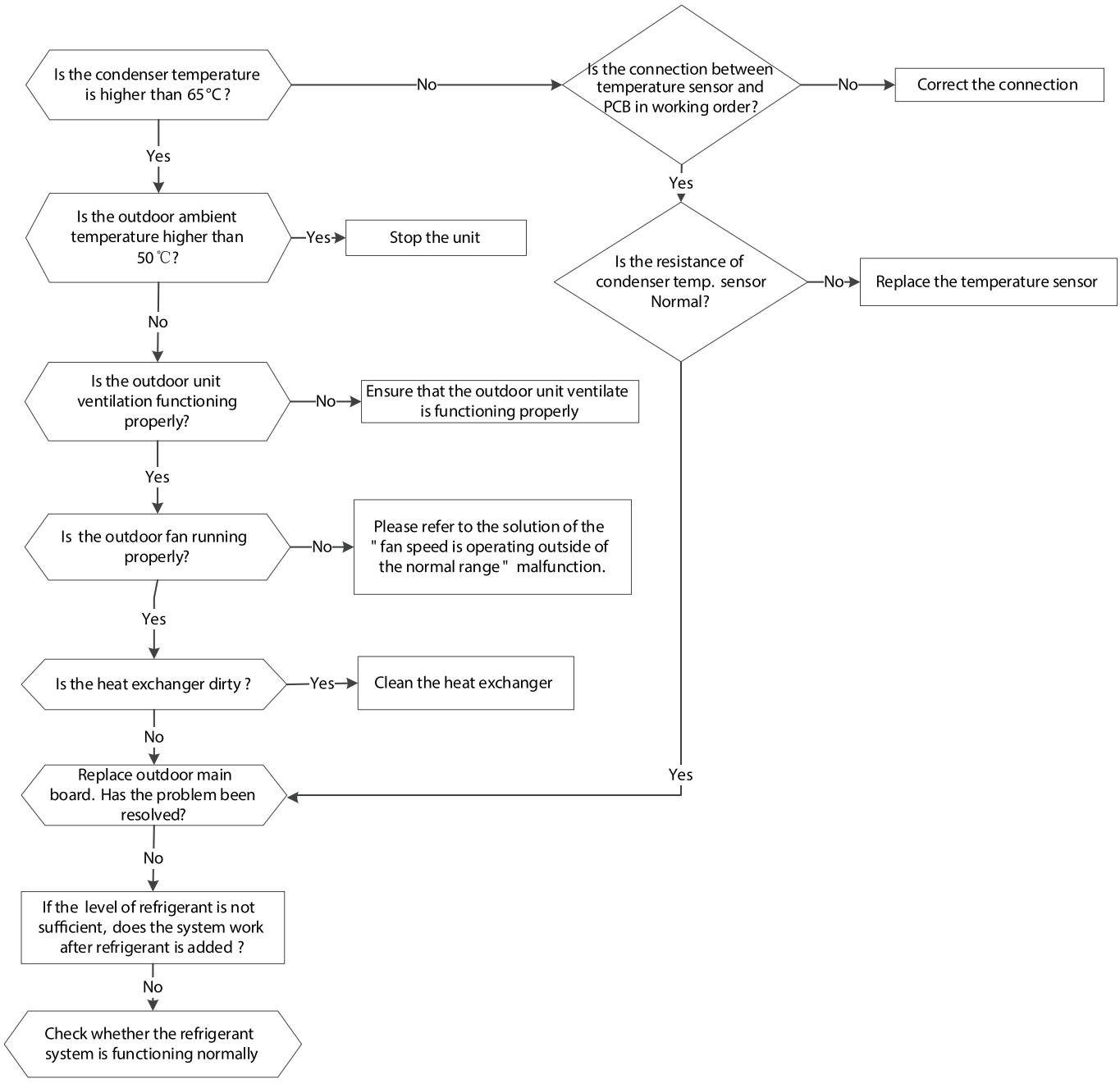


PC 0A (High temperature protection of condenser diagnosis and solution)

Description: The unit will stop when 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:

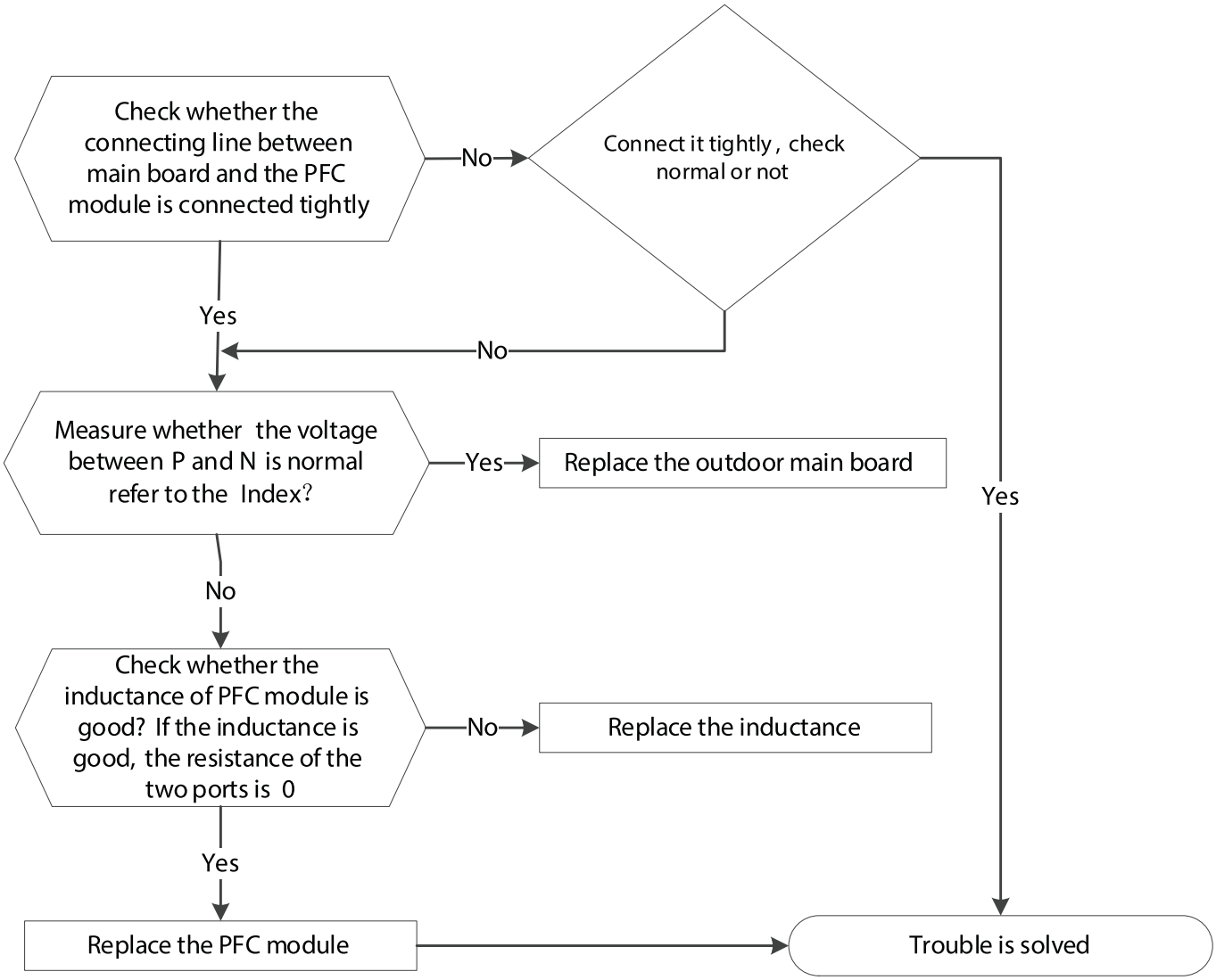


PC 0F (PFC module protection diagnosis and solution)

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:

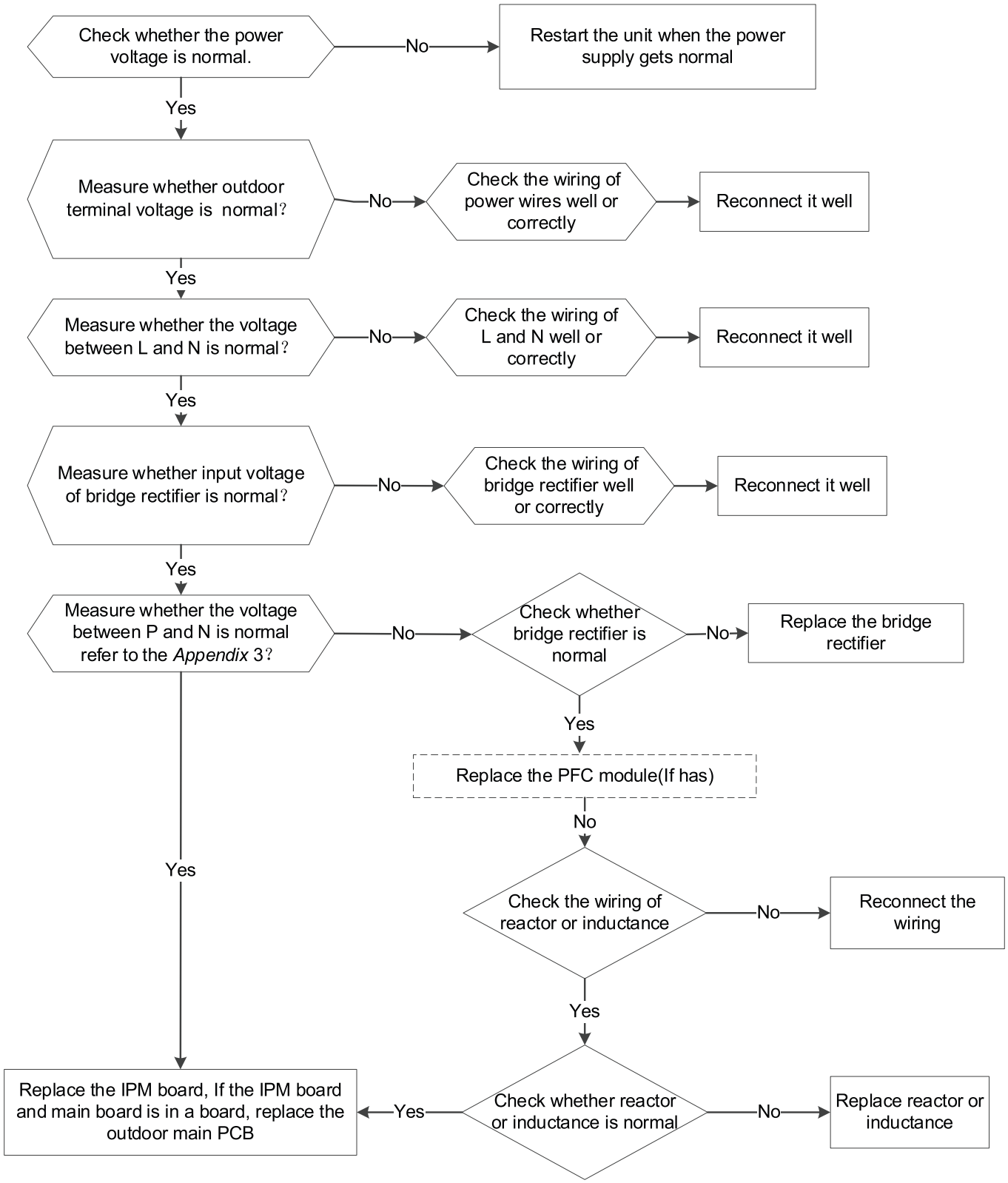


PC 10 (ODU low AC voltage protection)/ PC 11 (ODU main control board DC bus high voltage protection)/ PC 12 (ODU main control board DC bus high voltage protection /341 MCE error) Diagnosis and Solution

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 0L (Low Ambient Temperature Protection)

Description: It is a protection function. When compressor is off, outdoor ambient temperature(T4) is lower than -35oC. for 10s, the AC will stop and display the failure code.

When compressor is on, outdoor ambient temperature(T4) is lower than -40oC.for 10s, the AC will stop and display the failure code.

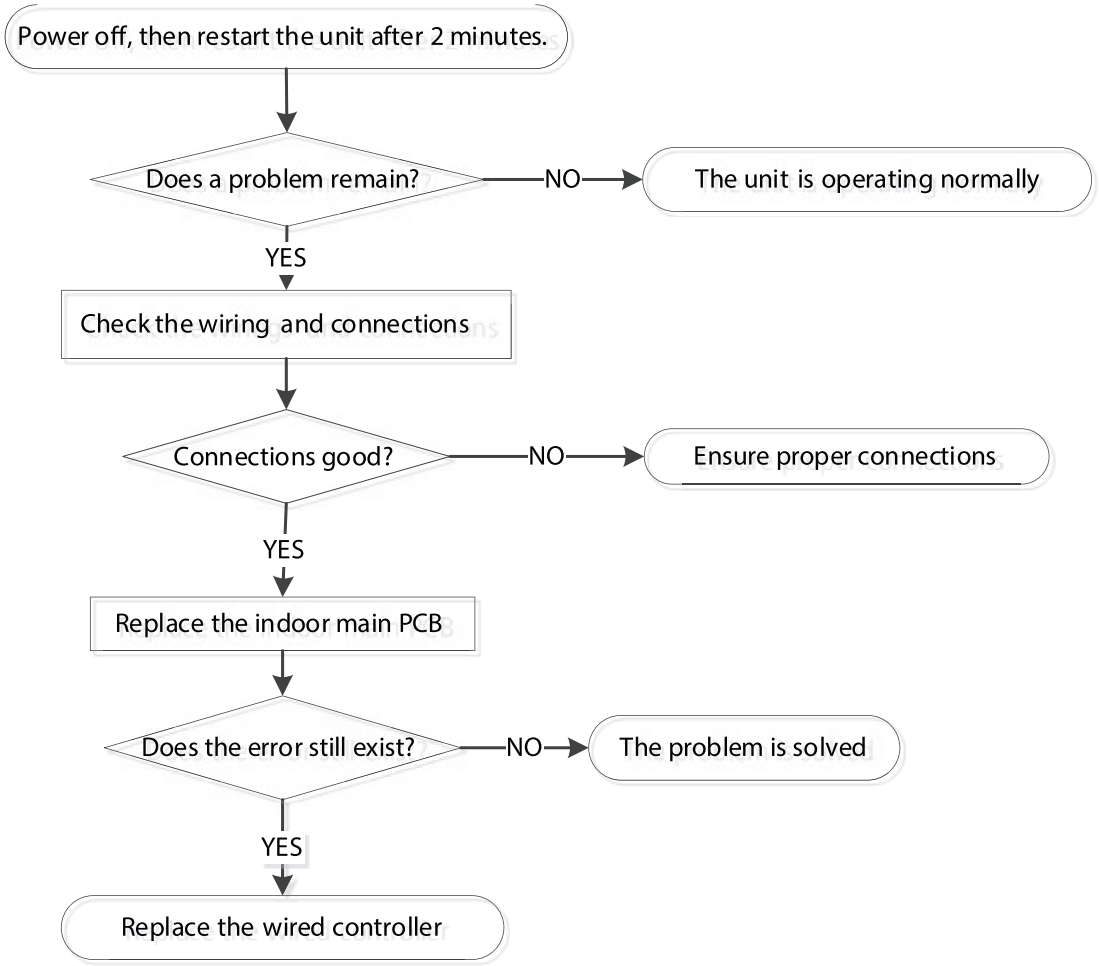
When outdoor ambient temperature(T4) is no lower than -32oC.for 10s, the unit will exit protection

EH b3 (Communication Malfunction Between Wire and Master Control) Diagnosis and Solution

Description: If Indoor PCB does not receive feedback from wired controller, the error displays on the wired controller

Recommended parts to prepare: Connection wires, Indoor PCB, Wired controller

Troubleshooting and repair:

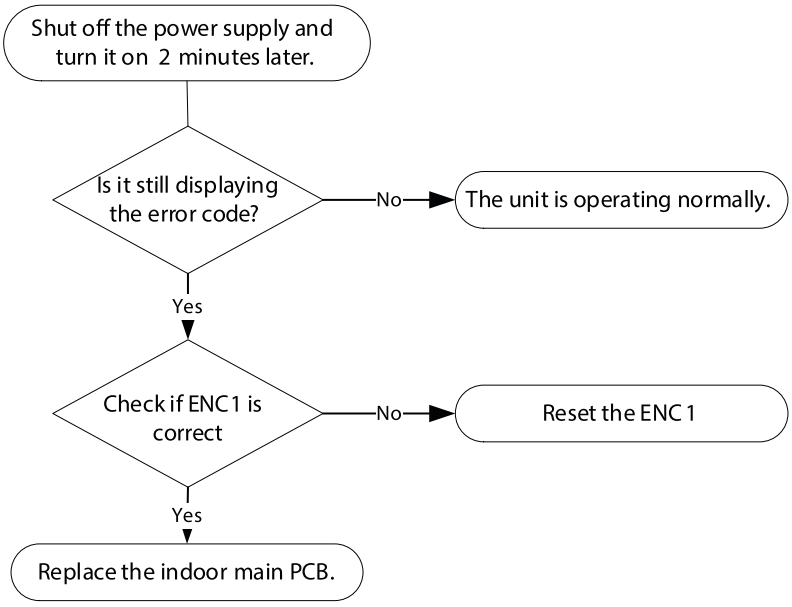


EH bA (Communication Malfunction Between Indoor Unit and External Fan Module)/ EH 3A(External Fan DC Bus Voltage Is Too Low Protection)/ EH 3b (External Fan DC Bus Voltage is Too High) Fault) Diagnosis and Solution

Description: Indoor unit does not receive the feedback from external fan module during 150 seconds. or Indoor unit receives abnormal increases or decreases in voltage from external fan module.

Recommended parts to prepare: Indoor main PCB

Troubleshooting and repair:

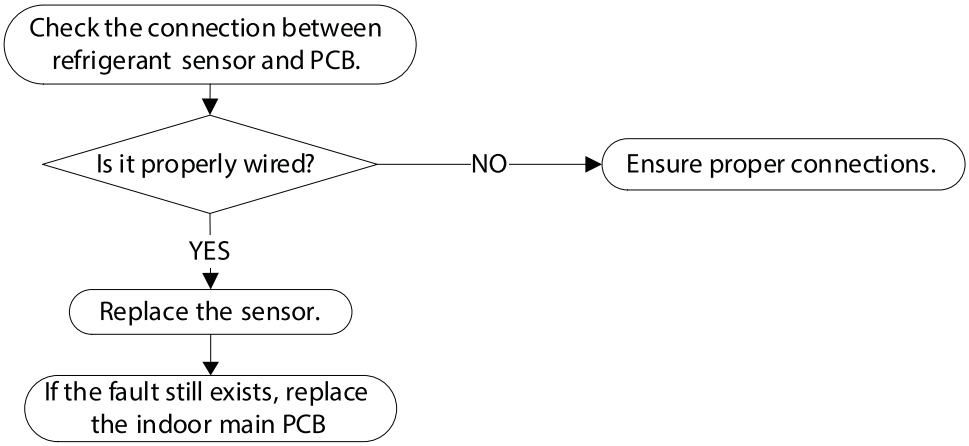


FH CC (Refrigerant Sensor Error) or EH C3(Refrigerant Sensor is Out of Range) Diagnosis and Solution

Description: Indoor unit receives fault signal for 10s or indoor unit does not receive feedback from refrigerant sensor for 150s.

Recommended parts to prepare: Connection wires, Sensors, Indoor main PCB

Troubleshooting and repair:



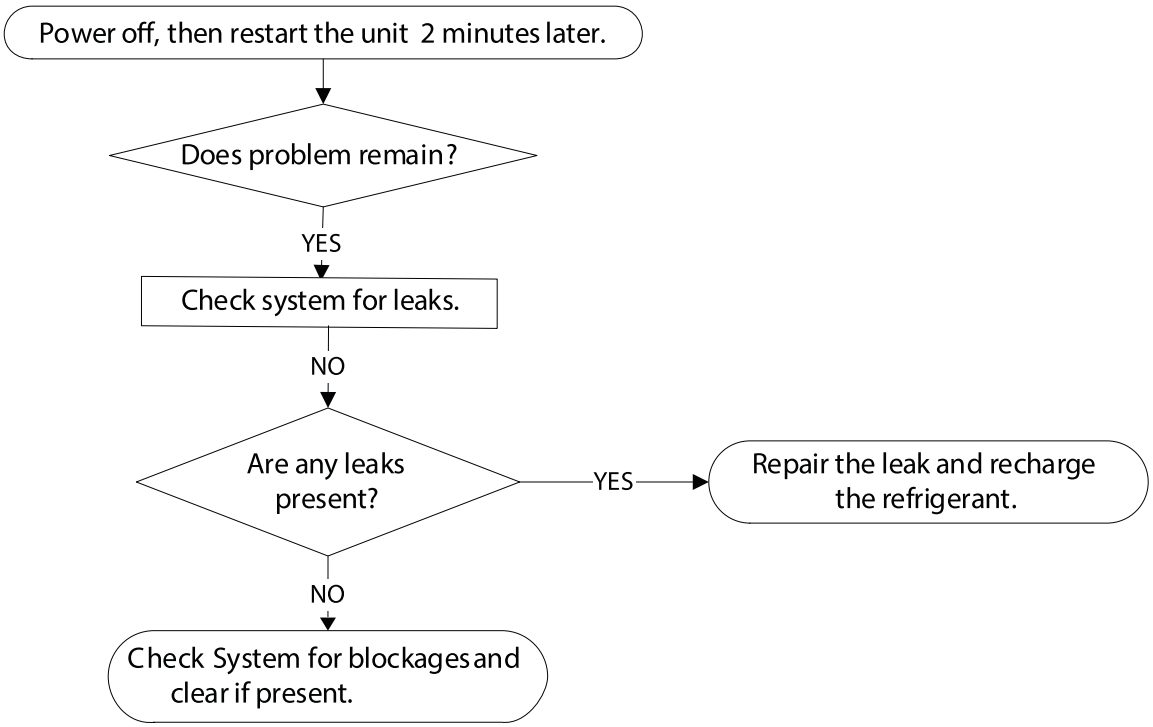
EH C1 (Refrigerant Sensor Detects Leakage) or EH C2 (Refrigerant Sensor is Out of Range and Leakage is Detected) Diagnosis and Solution

Description: The refrigerant sensor detects a concentration higher than or equal to 10%*LFL for 10 seconds or the refrigerant sensor detects a concentration higher than or equal to 20%*LFL or the multi model receives the refrigerant leakage protection fault sent by the outdoor unit.

Multi-zone: Only the buzzer of the indoor unit that detects refrigerant leakage continues to sound the alarm, the shortest sound is 10 seconds, and the longest sound is 5 minutes (you can press any key such as remote control or wire control, APP and so on to eliminate the alarm), and the other non-refrigerant leakage fault indoor unit only displays "ECC1", but the buzzer does not sound.

Recommended parts to prepare: Additional refrigerant

Troubleshooting and repair:

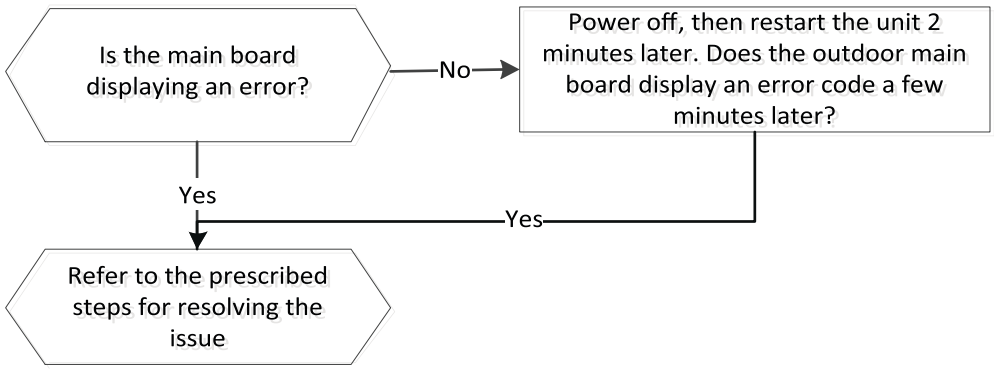


EC 0d (ODU Malfunction Diagnosis and Solution)

Description: The indoor unit detects the outdoor unit in error.

Recommended parts to prepare: Outdoor unit

Troubleshooting and repair:

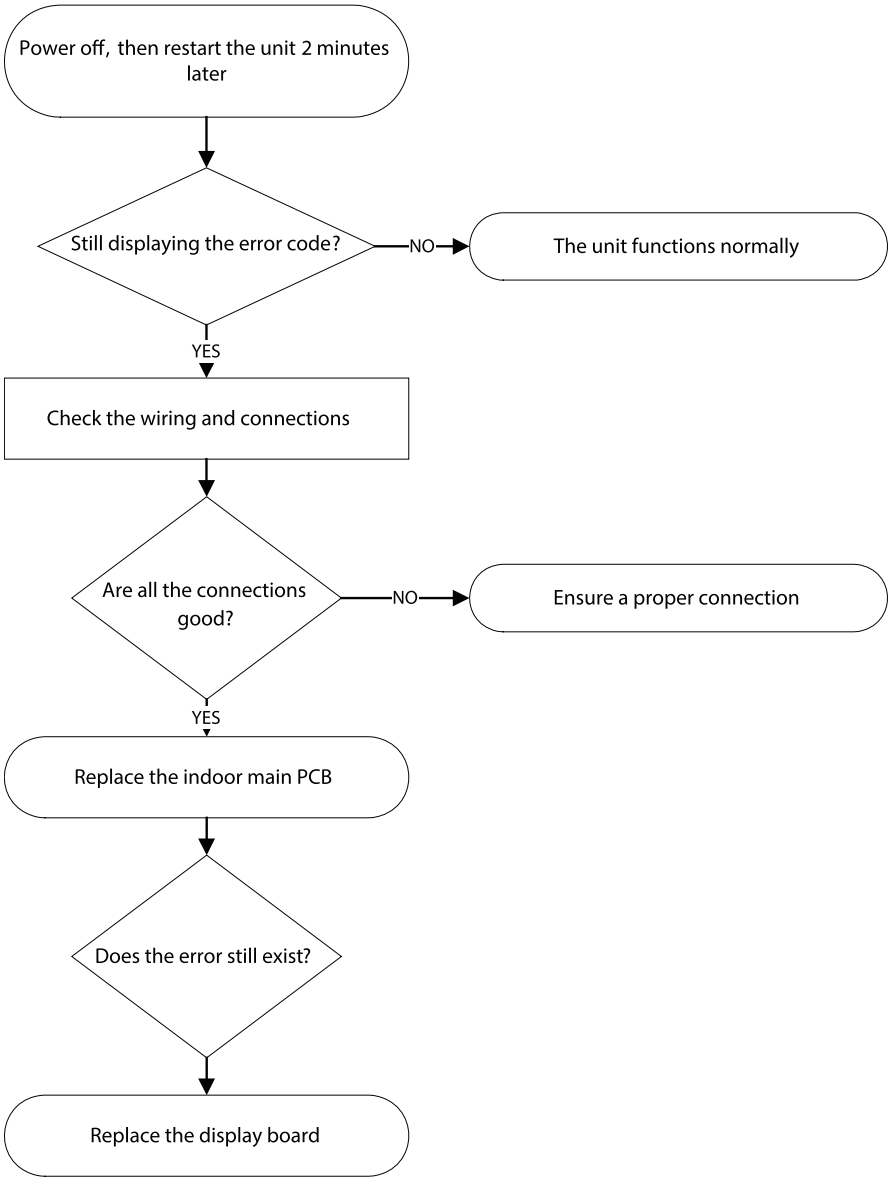


EH 06 (IDU Main Control Board and Display Board Communication Error Diagnosis and Solution)

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

Recommended parts to prepare: Communication wire, Indoor PCB, Display board

Troubleshooting and repair:

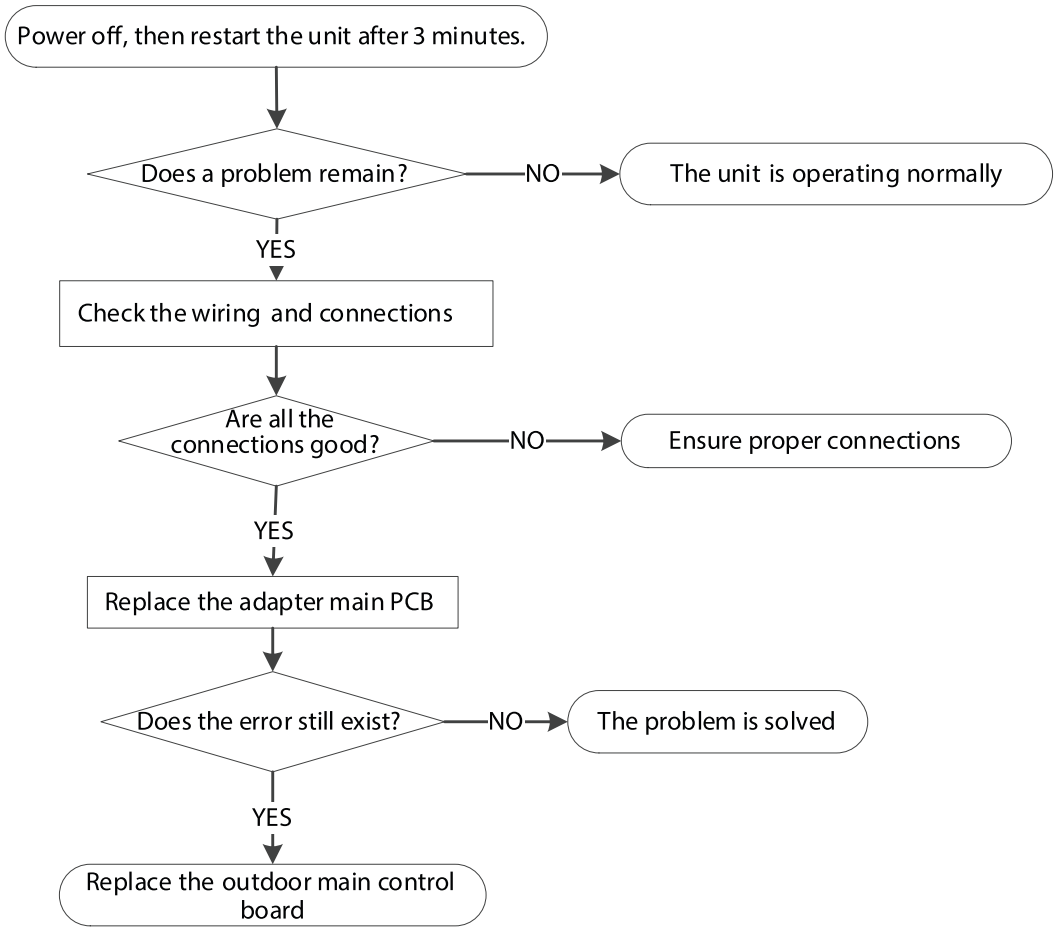


EL 16 (Communication Malfunction Between Adapter Board and Outdoor Main Board Diagnosis and Solution)

Description: The adapter PCB cannot detect the main control board.

Recommended parts to prepare: Connection wires, Adapter board, Outdoor main PCB

Troubleshooting and repair:



FL 09 (Mismatch between the new and old platforms diagnosis and solution)

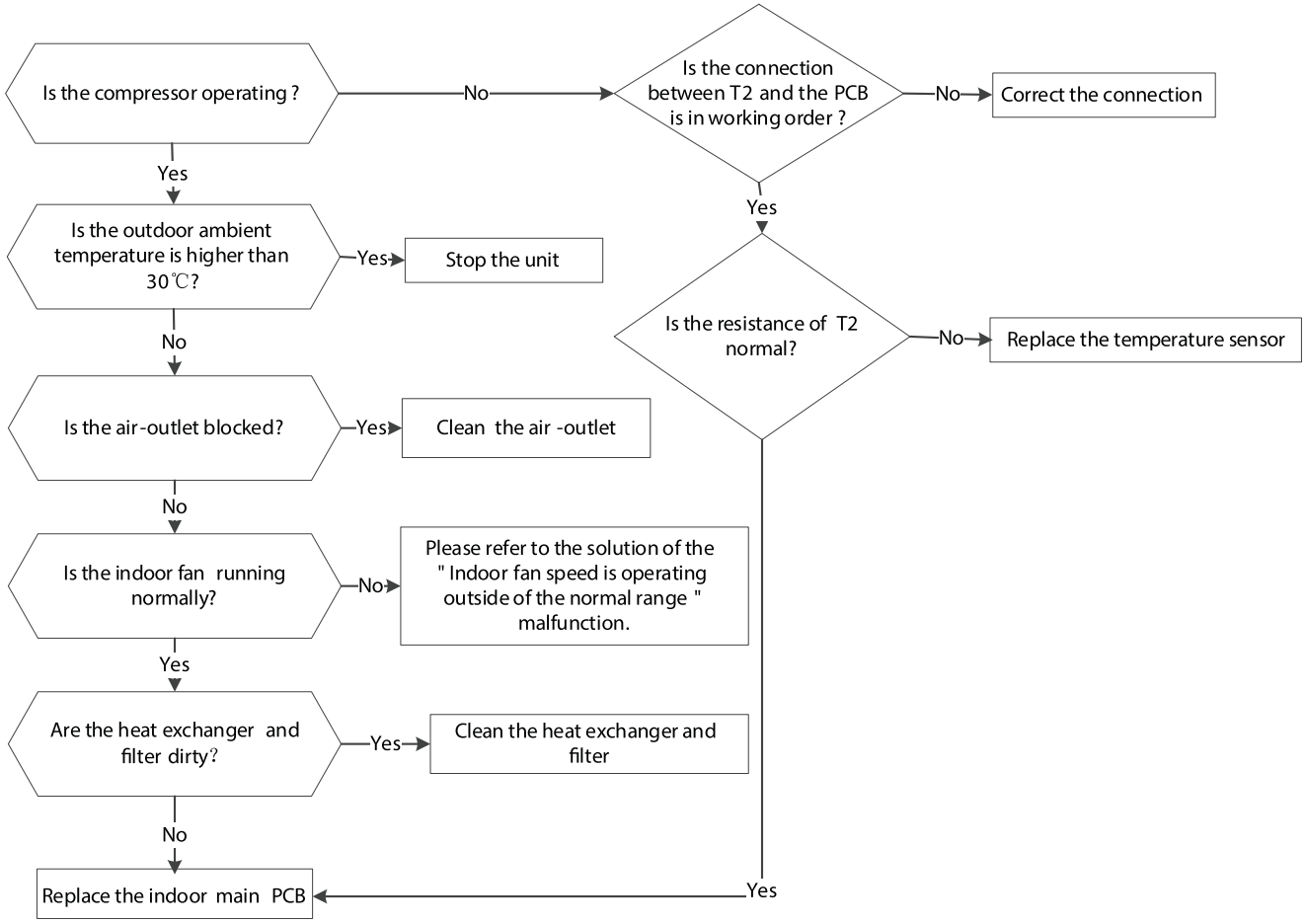
Description: Indoor and outdoor units are mismatched, the LED displays this code. Please replace the matching indoor or outdoor unit.

PH 90 (High temperature protection of evaporator diagnosis and solution)

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

Recommended parts to prepare: Connection wires, Evaporator coil temperature sensor (T2), Indoor fan, Indoor main PCB

Troubleshooting and repair:

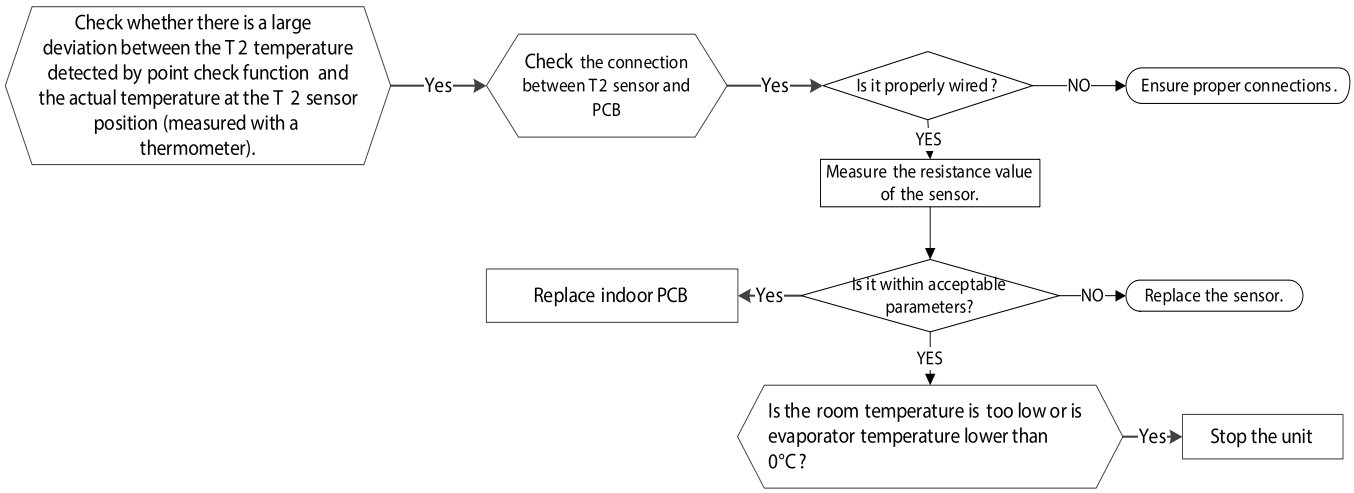


PH 91 (Low temperature protection of evaporator diagnosis and solution)

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

Recommended parts to prepare: Connection wires, Evaporator coil temperature sensor (T2), Indoor main PCB

Troubleshooting and repair:



CHECK PROCEDURES

Temperature Sensor Check

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

1. Disconnect the temperature sensor from the PCB.
2. Measure the sensor's resistance value with a multi-meter.
3. Check the corresponding temperature sensor resistance value table (see "Temperature Sensor Resistance Value Table for TP (°C - K)" on page 90 and "Other Temperature Sensors Resistance Value Table (°C - K)" on page 91).

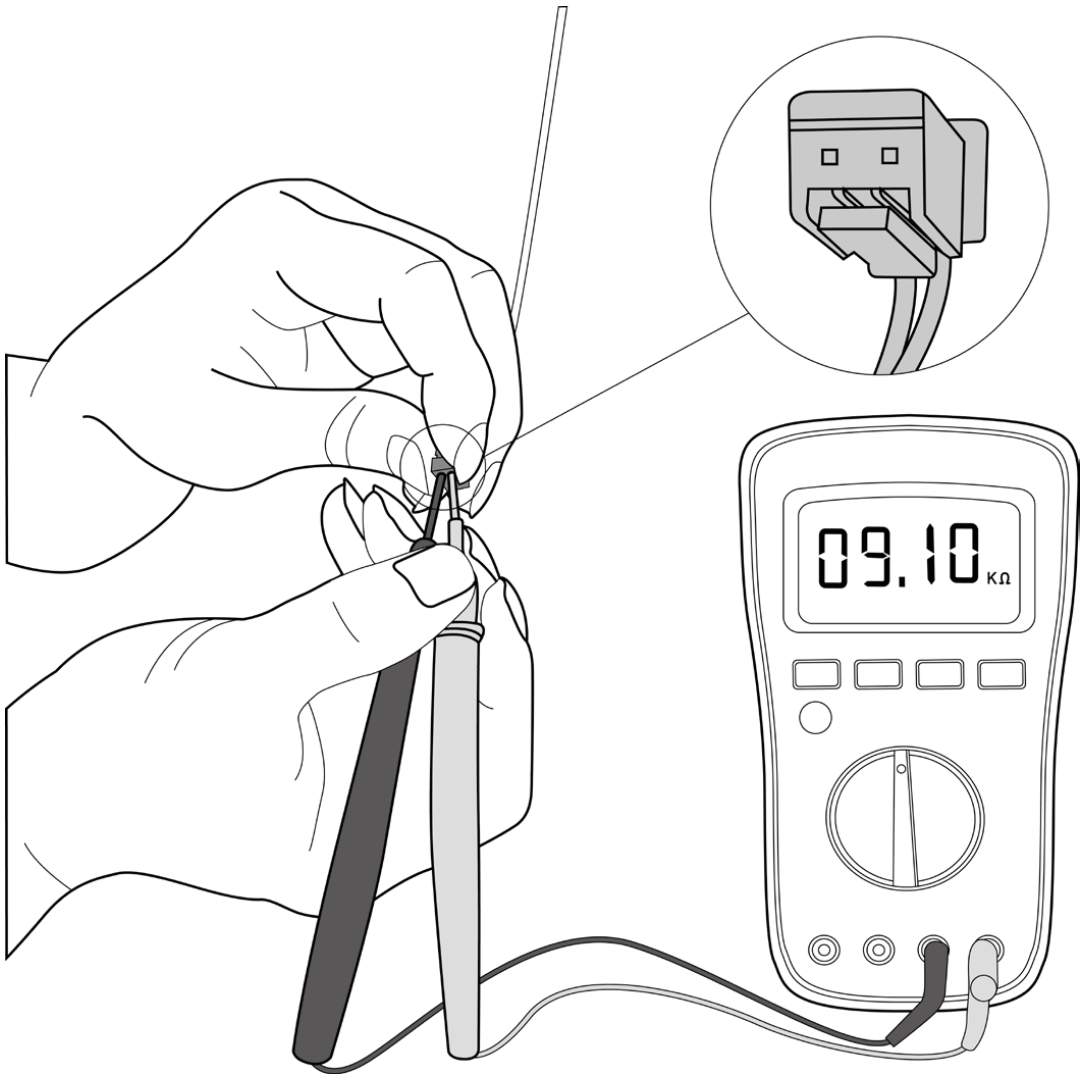


Fig. 33 —Measure the Sensor's Resistance Value

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 tables 9 through 12:

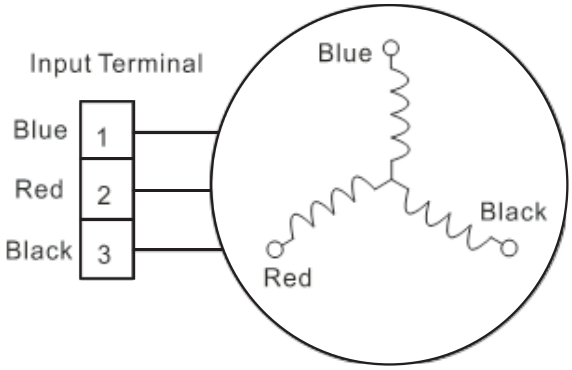


Fig. 34 —Compressor Check

Table 4 – Resistance Values

Resistance Value	KSN140D58UFZ	KTF250D22UMT	KTM240D46UKT2	KTF310D43UMT	MTH550UKPC8FU
Blue-Red	1.86Ω	0.75Ω	1.04Ω	0.65Ω	0.295Ω
Blue-Black					
Red-Black					

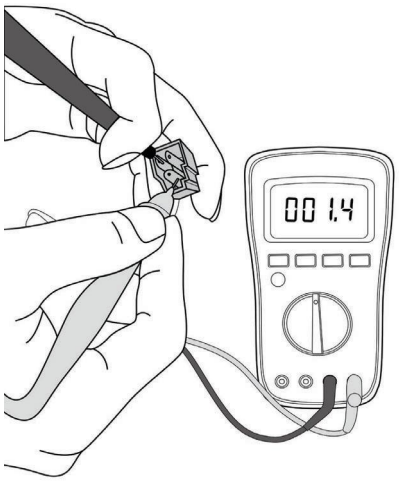


Fig. 35 —Resistance Check

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

IPM Continuity Check

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

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

Table 5 – Resistance Value

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

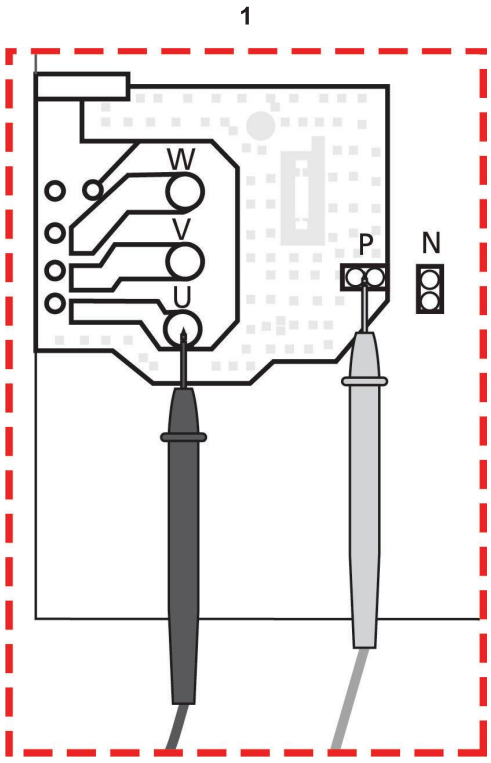


Fig. 36 —Resistance Value

Table 6 – Voltage Range

208-240V (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

4-Way Valve Check

1. Power on, use a digital tester to measure the voltage, when the unit operates in cooling, it is 0V. When the unit operates in heating, it is about equal to power supply voltage.
   If the value of the voltage is not in the range, the PCB must have problems and need to be replaced.

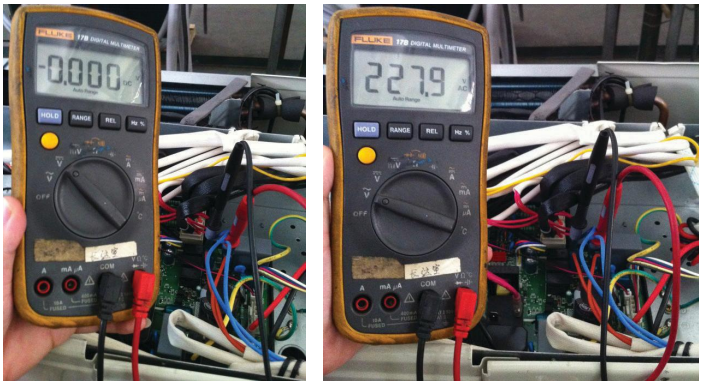


Fig. 37 —Measure the Voltage

2. Turn off the power, use a digital tester to measure the resistance. The value should be 1.8~2.5 KΩ.

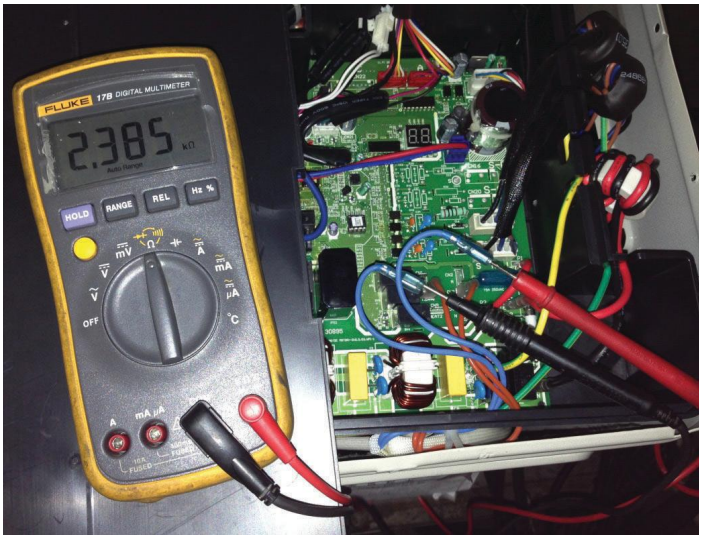


Fig. 38 —Use a Digital Tester to Measure Resistance

EXV Check

WARNING

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

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

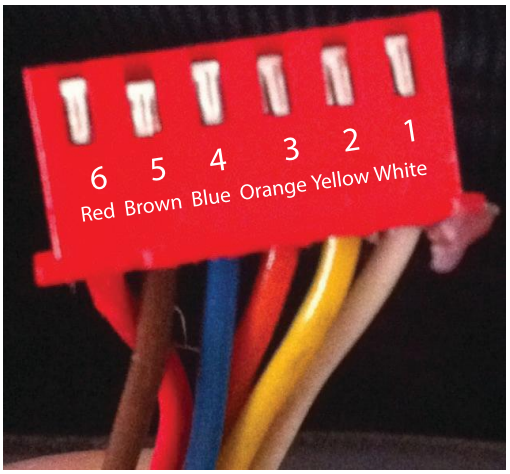


Fig. 39 —EXV Check

Resistance to EXV coil

Color of Lead Wire	Normal Value
Redd-Blue	About 500Ω
Red-Yellow	
Brown-Orange	
Brown-White	

Main Parts Check

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

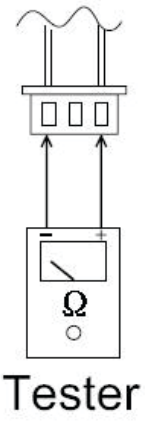
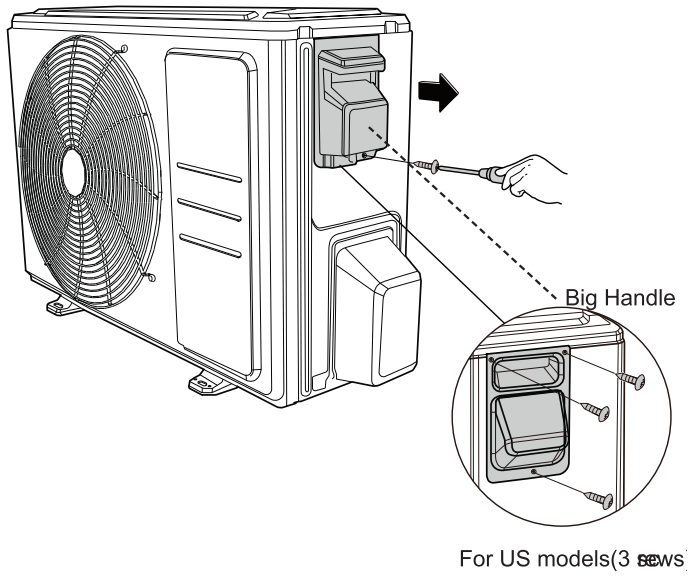
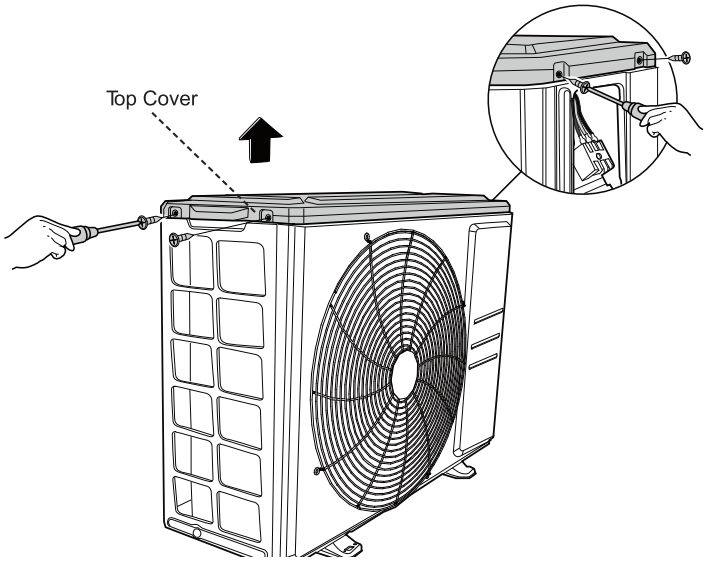


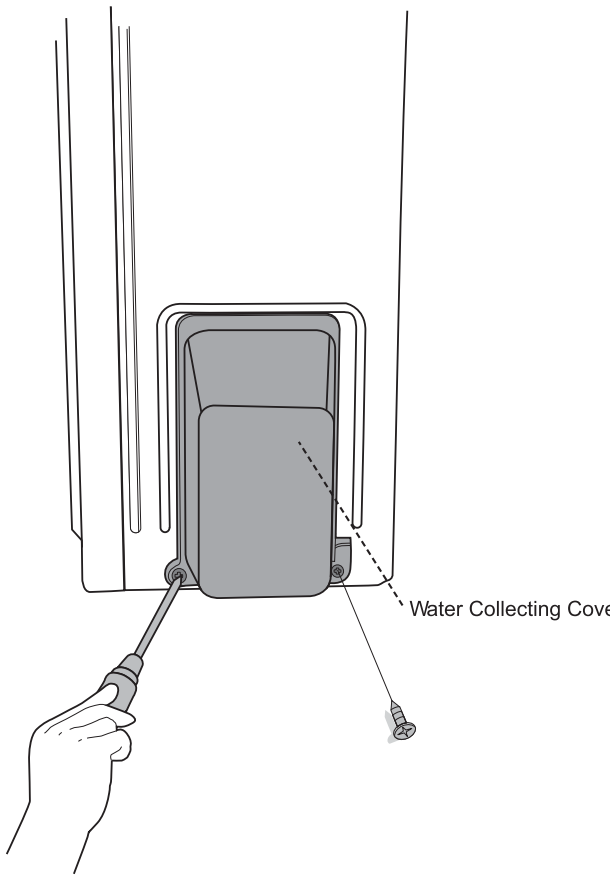
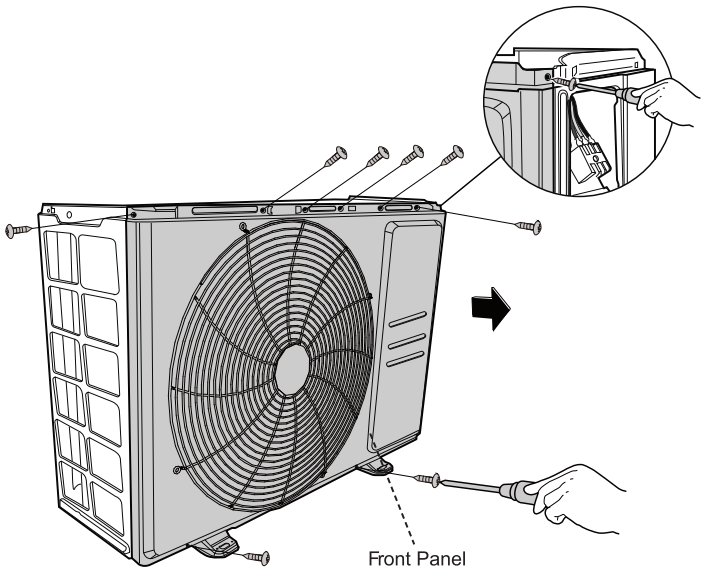
Fig. 40 —Sensor Test

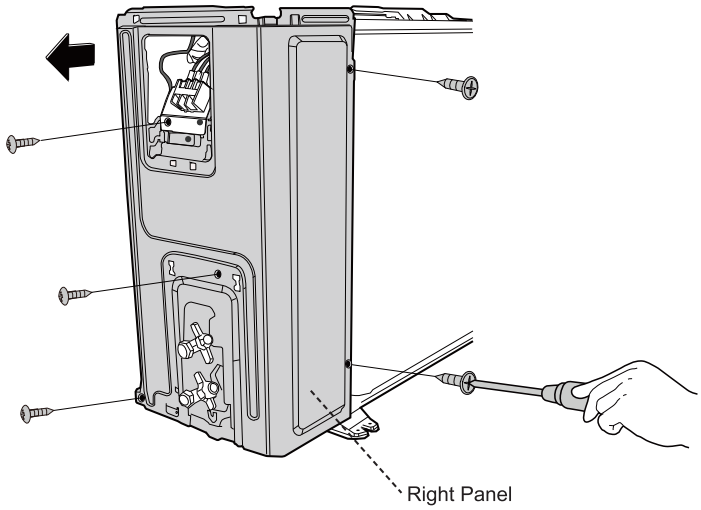
2. Temperature sensors
   a. Room temp. (T1) sensor,
   b. Indoor coil temp. (T2) sensor,
   c. Outdoor coil temp. (T3) sensor,
   d. Outdoor ambient temp. (T4) sensor,
   e. Compressor discharge temp. (T5) sensor.
   f. Measure the resistance value of each winding by using the multi-meter.

DISASSEMBLY INSTRUCTIONS

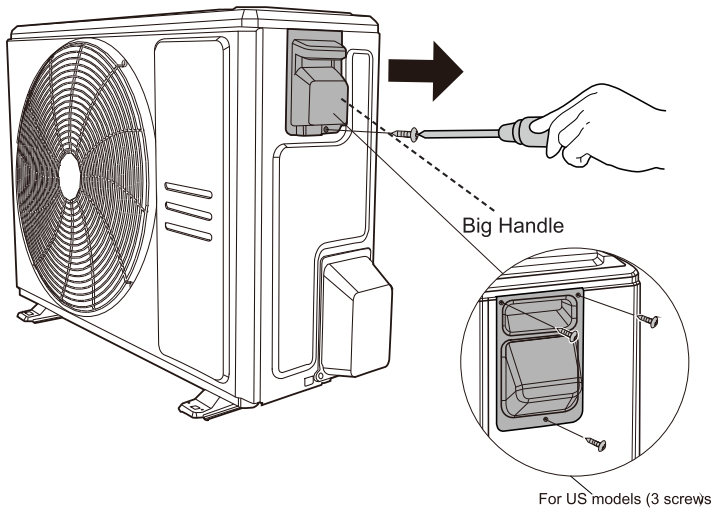
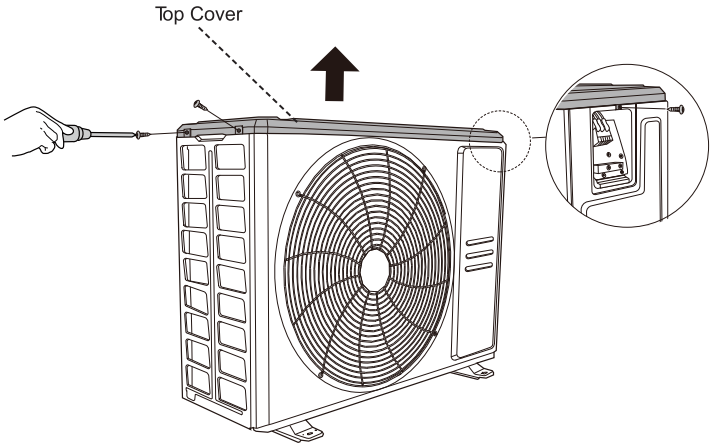
12K (115V) and 9-12K (208/230V) Unit Disassembly - Panel Plate

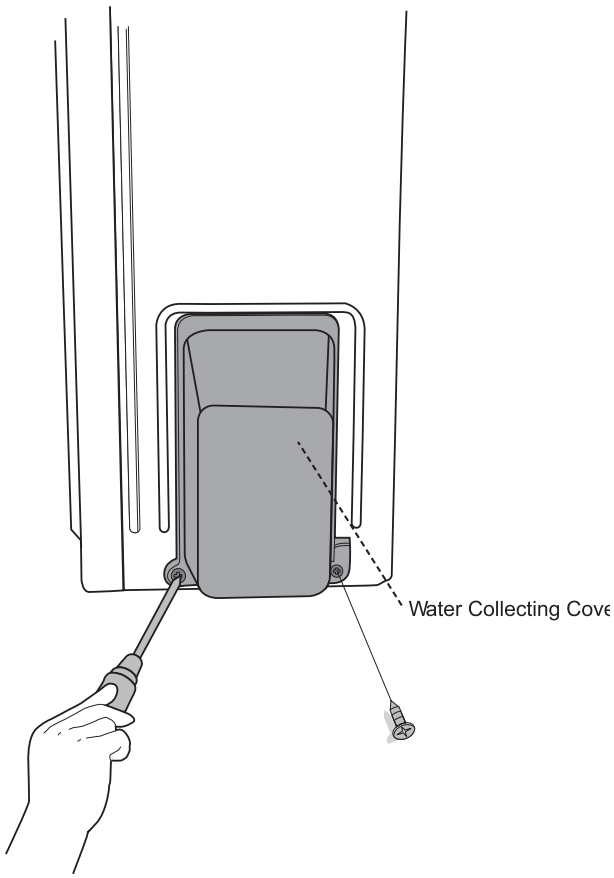
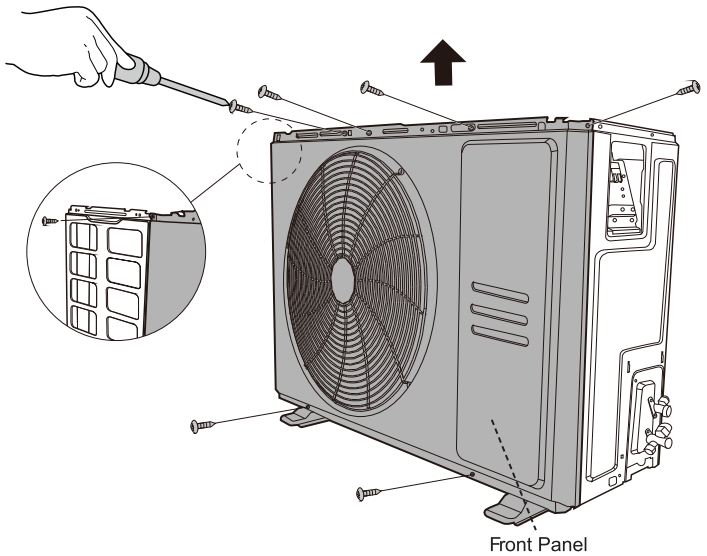
PROCEDURES	ILLUSTRATION
1. Turn off the air conditioner and the power breaker 2. Remove the screw of the big handle and then remove the big handle (3 screws) (see illustration)	
3. Remove the screws of the top cover and then remove the top cover (4 screws). One of the screws is located underneath the big handle. (see illustration)	

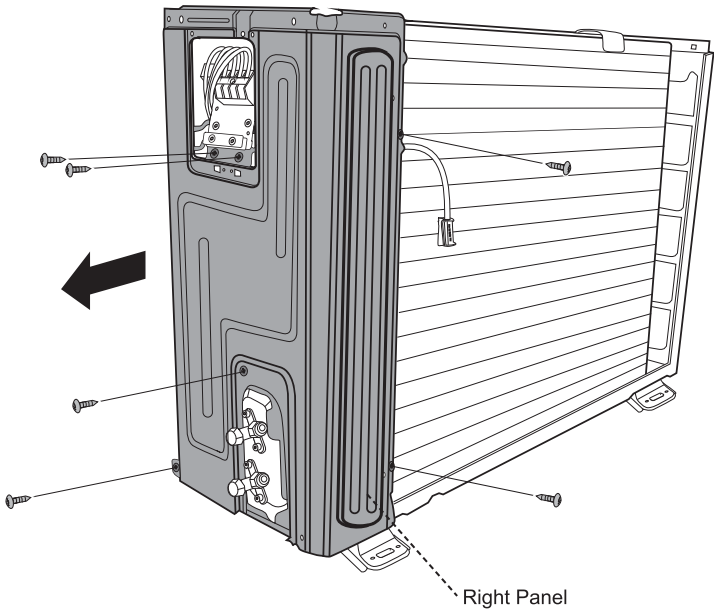
PROCEDURES	ILLUSTRATION
4. Remove the screws of water collecting cover and then remove the water collecting cover (2 screws).(see illustration)	
5. Remove the screws of the front panel and then remove the front panel (7 screws (on/off models) or 9 screws. (inverter models). (see illustration)	

PROCEDURES	ILLUSTRATION
6. Remove the screws of the right panel and then remove the right panel (5 screws) (see illustration)	

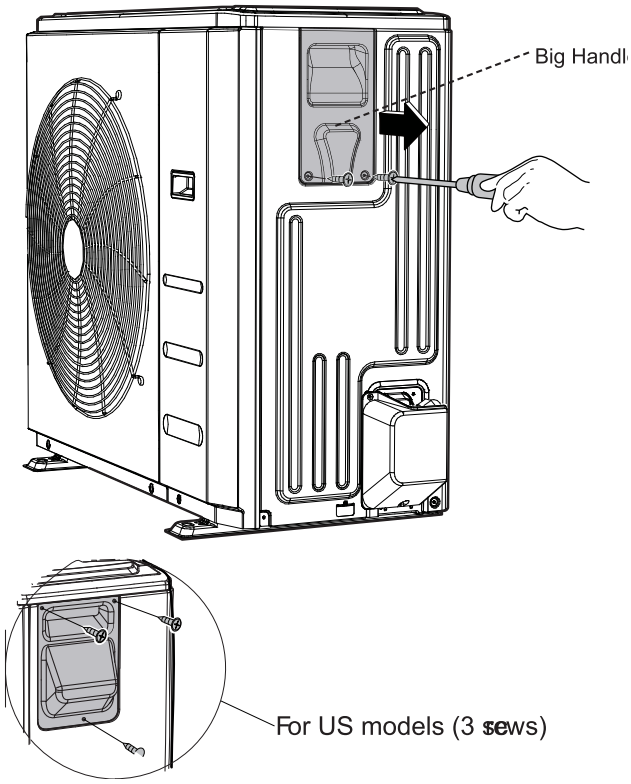
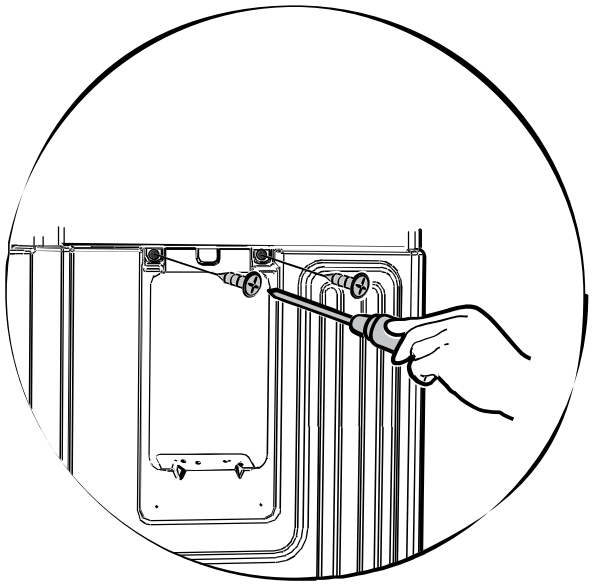
18K Unit Disassembly - Panel Plate

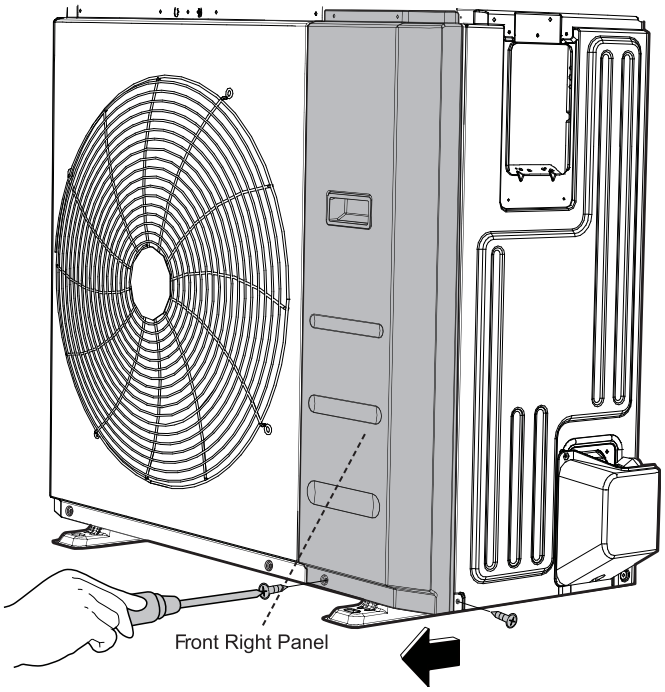
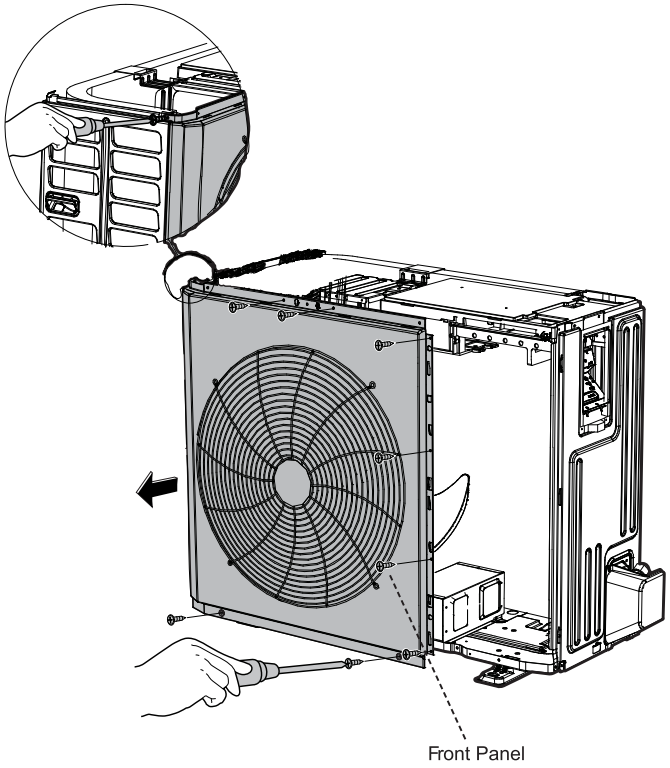
PROCEDURES	ILLUSTRATION
1. Turn off the air conditioner and the power breaker 2. Remove the screw of the big handle and then remove the big handle (3 screws) (see illustration)	
3. Remove the screws of the top cover and then remove the top cover (3 screws). One of the screws is located underneath the big handle. (see illustration)	

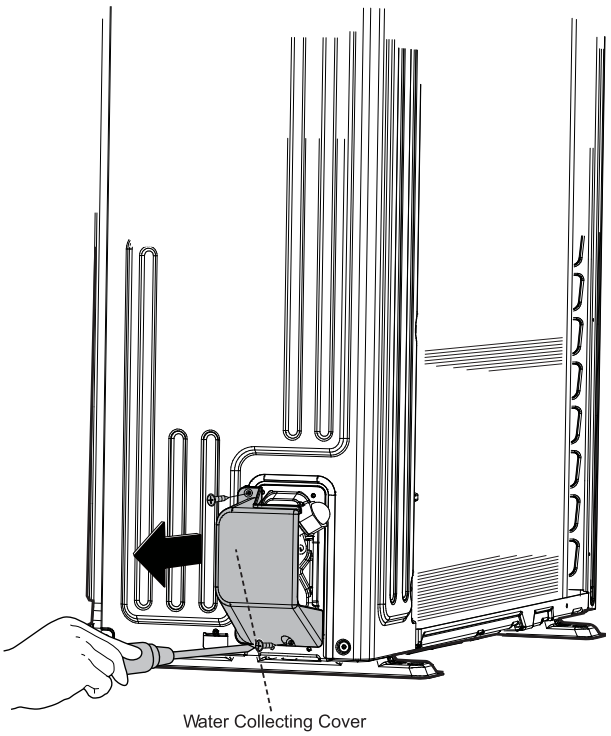
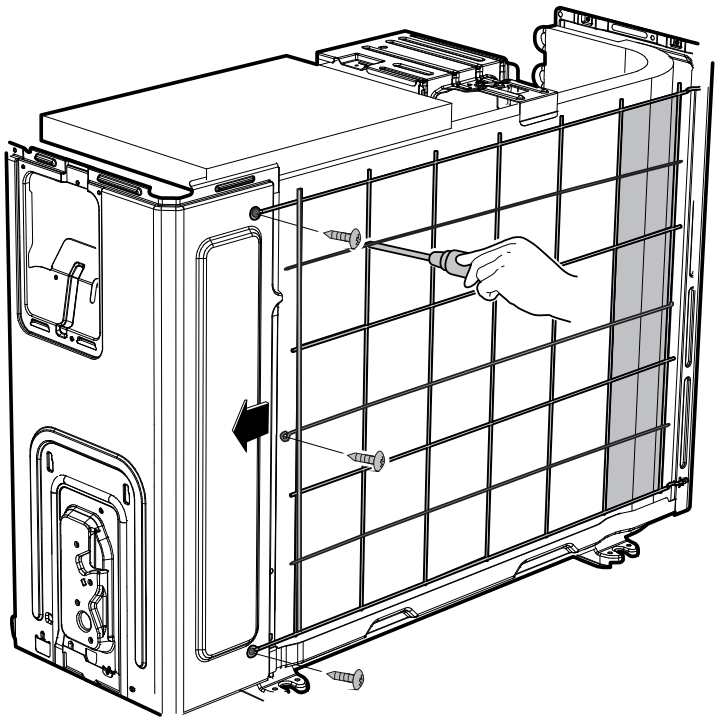
PROCEDURES	ILLUSTRATION
4. Remove the screws of water collecting cover and then remove the water collecting cover (2 screws).(see illustration)	
5. Remove the screws of the front panel and then remove the front panel (7 screws (on/off models) or 9 screws. (inverter models). (see illustration)	

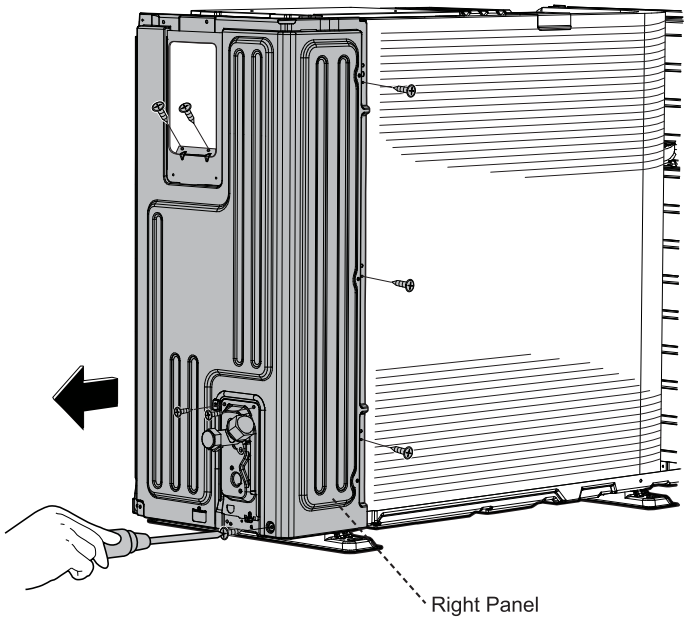
PROCEDURES	ILLUSTRATION
6. Remove the screws of the right panel and then remove the right panel (5 screws) (see illustration)	

24K - 36K Unit Disassembly - Panel Plate

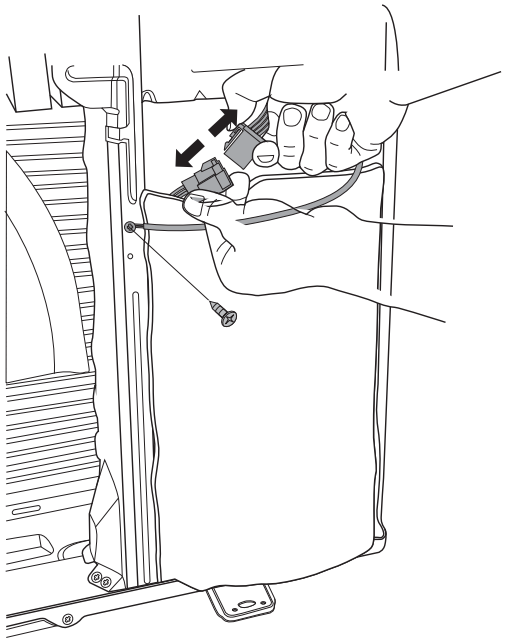
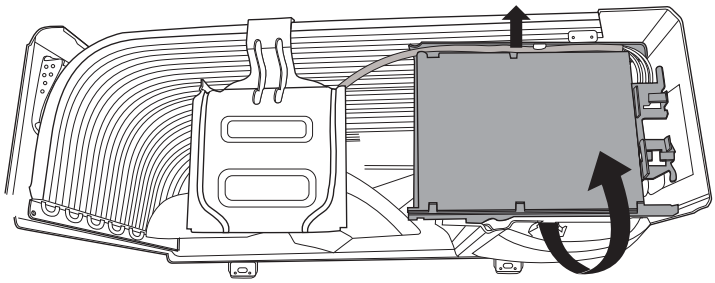
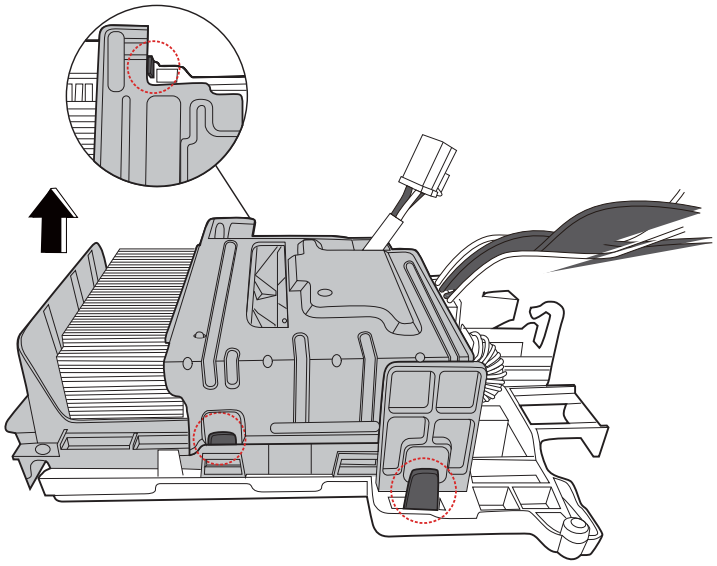
PROCEDURES	ILLUSTRATION
1. Turn off the air conditioner and the power breaker 2. Remove the screw of the big handle and then remove the big handle (2 screws) (see illustration)	
3. Remove the screws of the top cover and then remove the top cover (4 screws). One of the screws is located underneath the big handle. (see illustration)	

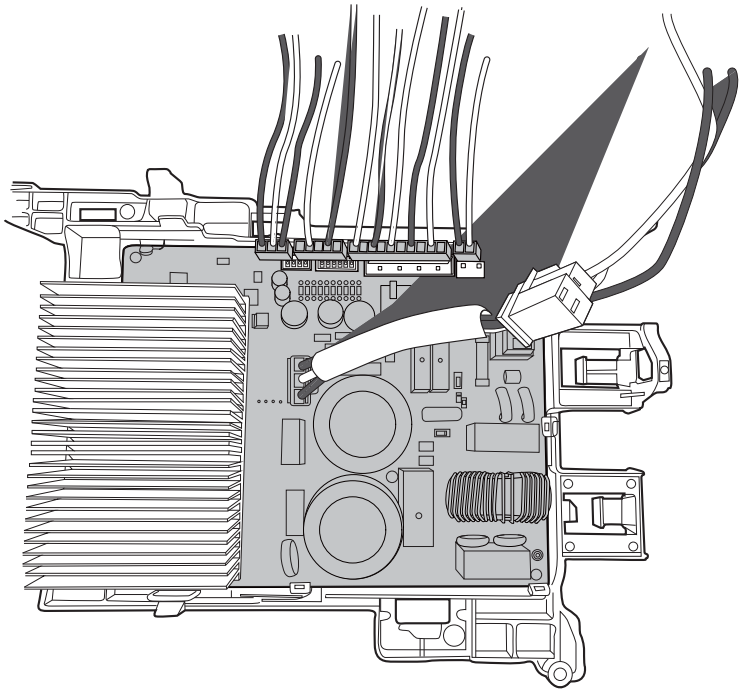
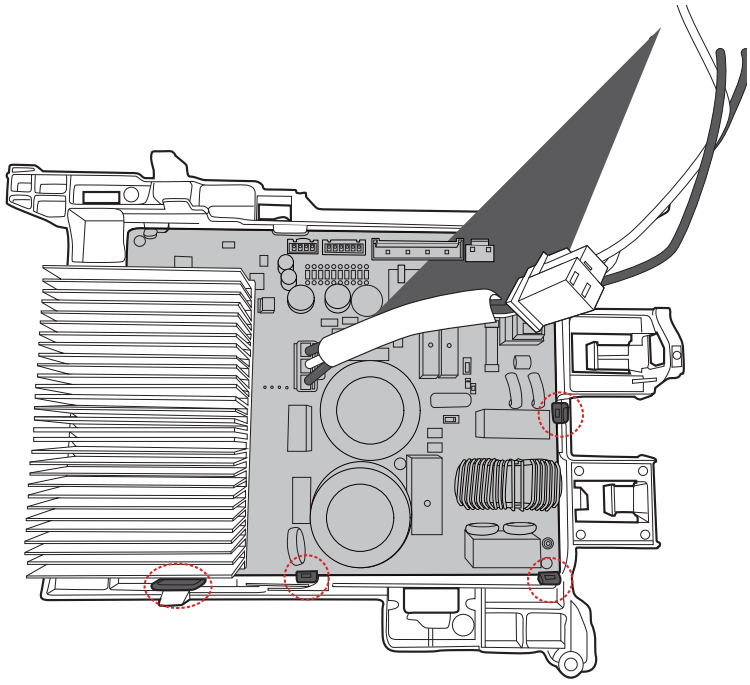
PROCEDURES	ILLUSTRATION
4. Remove the screws of the front right panel and then remove the front right panel (2 screws).(see illustration)	
5. Remove the screws of the front panel and then remove the front panel (9 screws). (see illustration)	

PROCEDURES	ILLUSTRATION
6. Remove the screws of water collecting cover and then remove the water collecting cover (2 screws) (see illustration)	
7. For some models, remove the screws of the rear net and then remove the rear net (3 screws) (see illustration)	

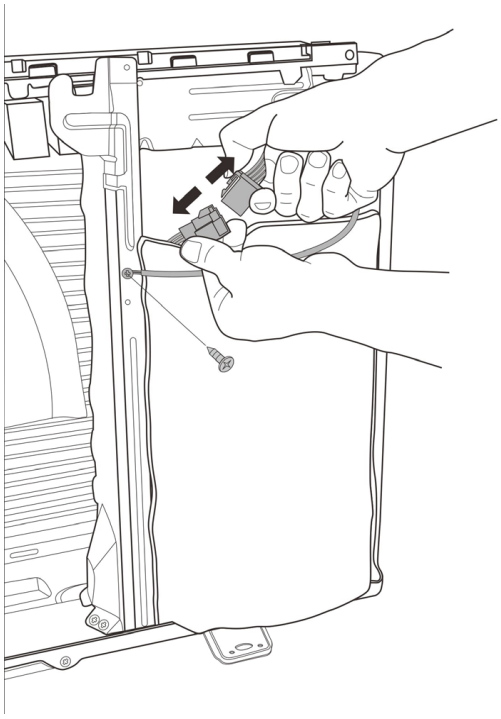
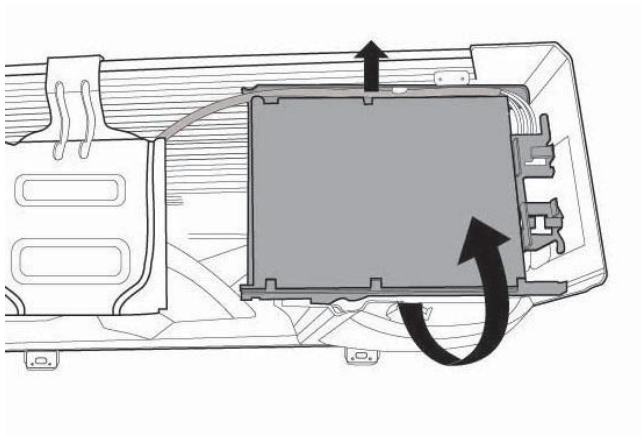
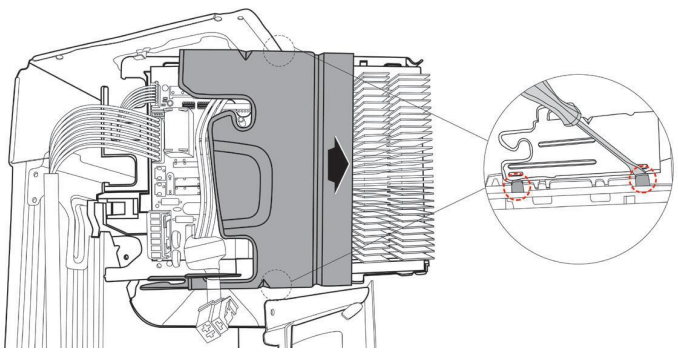
PROCEDURES	ILLUSTRATION
8. Remove the screws of the right panel and then remove the right panel (8 screws)	

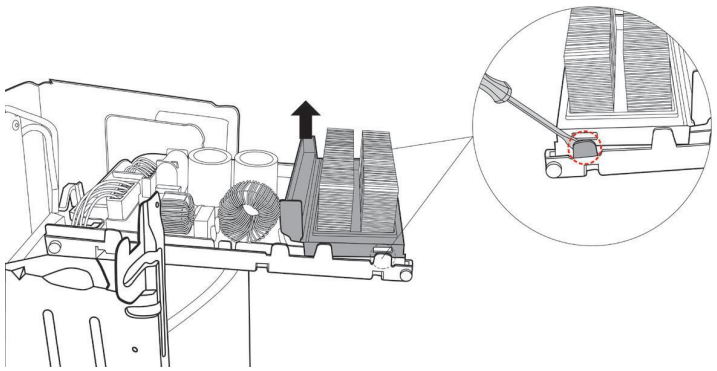
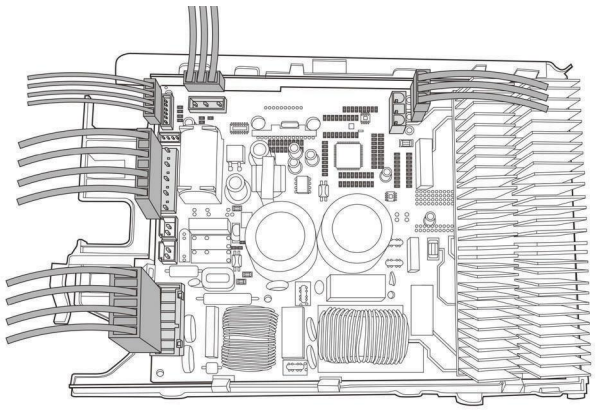
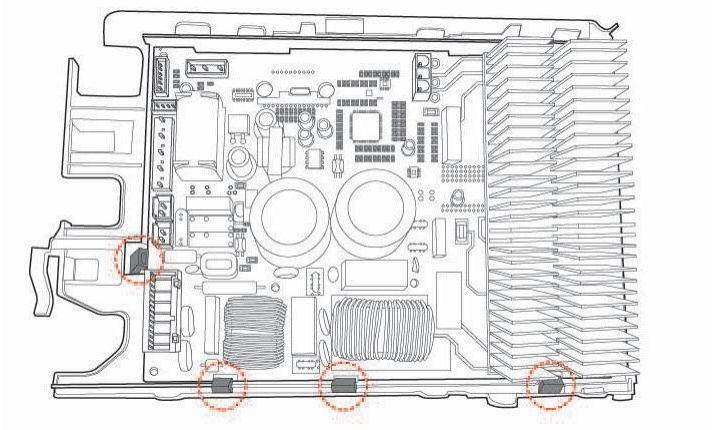
12K (115V) Disassembly - Electrical Parts

PROCEDURES	ILLUSTRATION
1. Disconnect the connector for compressor and release the ground wire(1 screw).(.(see illustration)	
2. Pull out the wires from electrical supporting plate and turn over the electronic control assembly. (see illustration) **NOTE:** Electric control box cover cannot be removed, so the voltage between P and N cannot be measured.	
3. Remove the electronic installing box subassembly (3 hooks)	

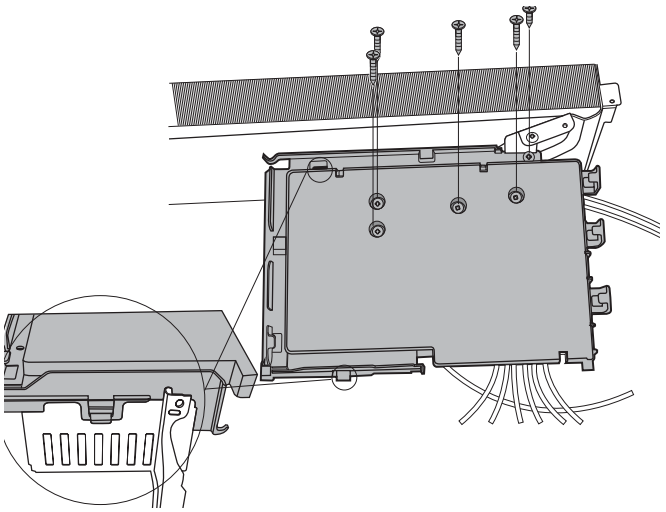
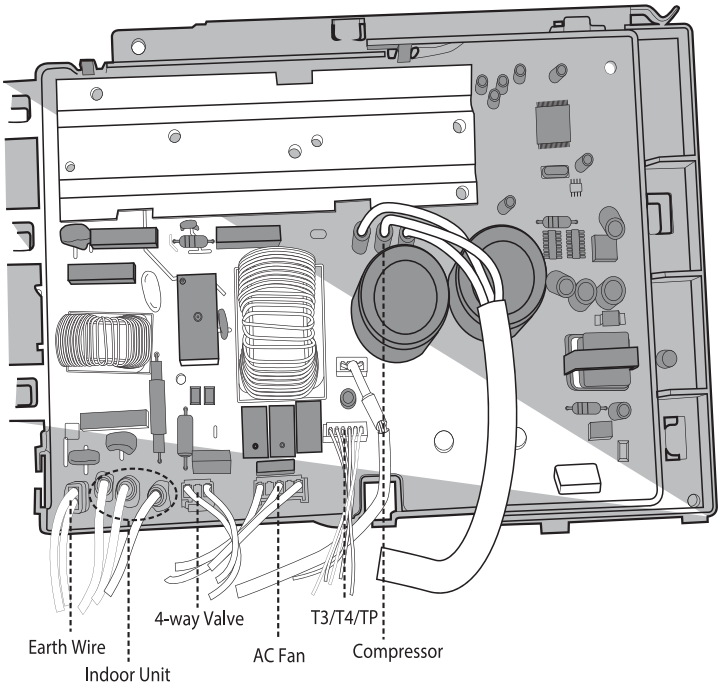
PROCEDURES	ILLUSTRATION
4. Disconnect the connectors from the electronic control board	
5. Then remove the electronic control board (4 hooks).	

9k - 12K (208V/230V) Disassembly - Electrical Parts

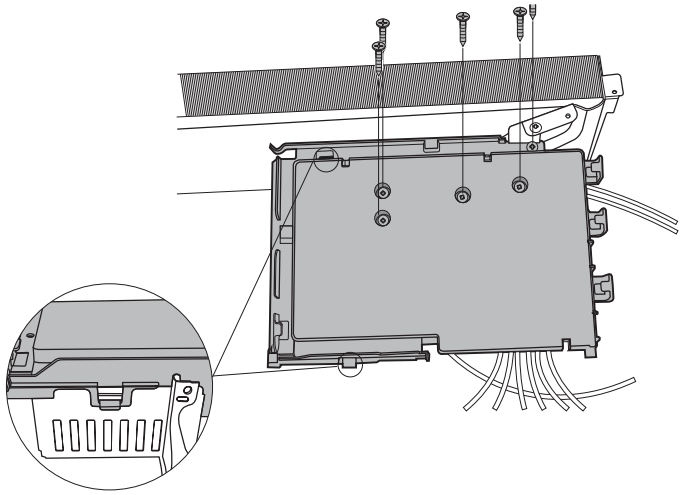
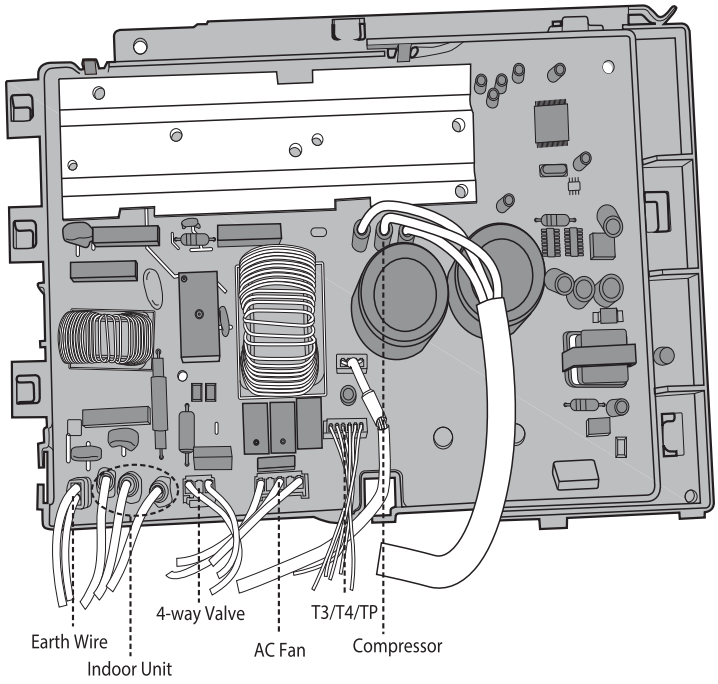
PROCEDURES	ILLUSTRATION
1. Disconnect the compressor connector and release the ground wire (1 screw)..(.(see illustration)	
2. Pull out the wires from the electrical supporting plate and turn over the electronic control assembly. (see illustration)	
3. Remove the electronic installing box subassembly (4 hooks).	

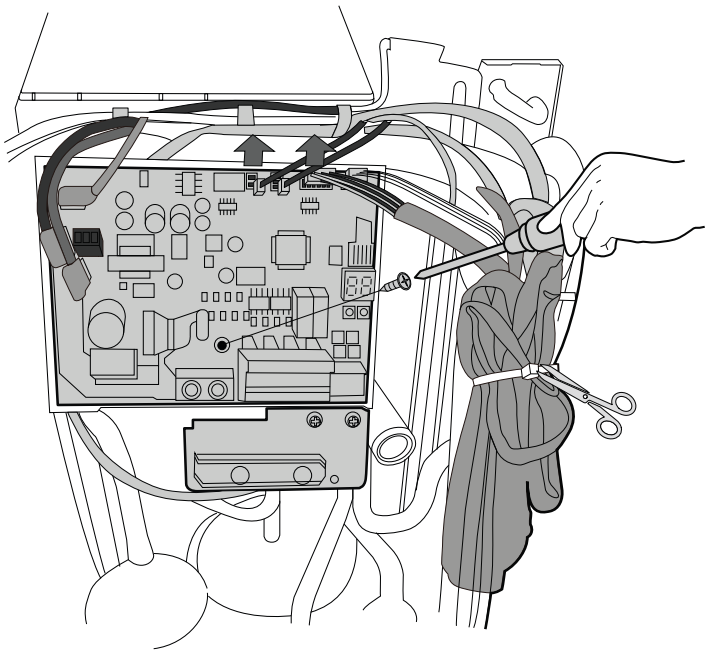
PROCEDURES	ILLUSTRATION
4. Remove the board (2 hooks).	
5. Disconnect the connectors from the electronic control board.	
6. Remove the electronic control board (4 hooks).	

18K Disassembly - Electrical Parts

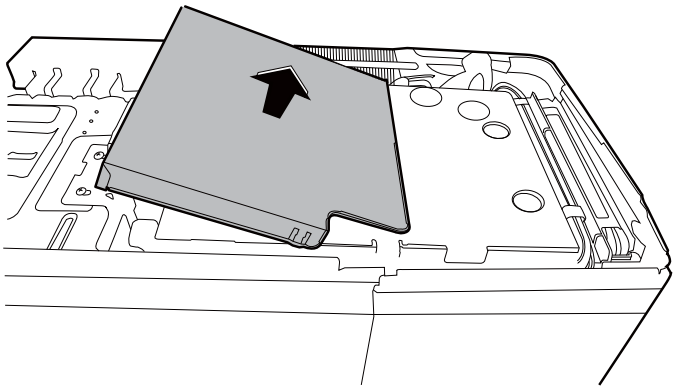
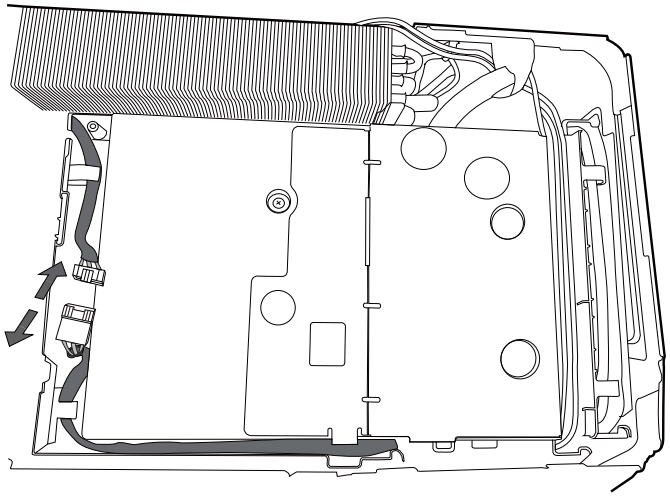
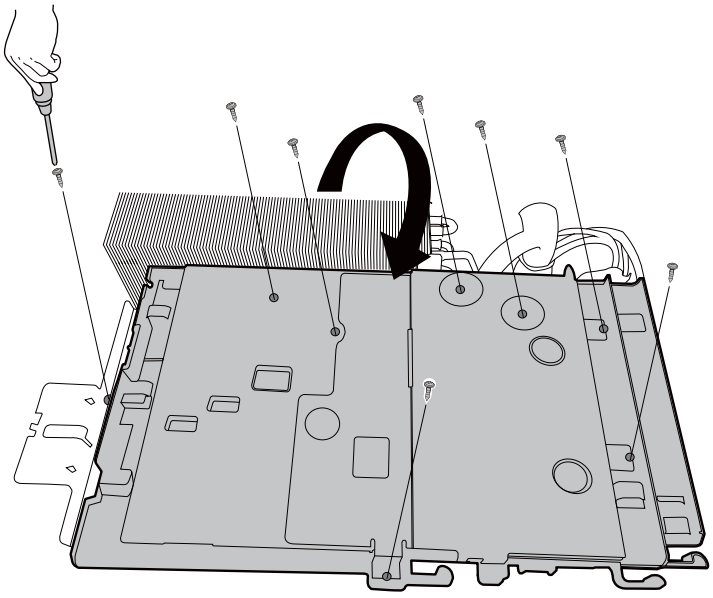
PROCEDURES	ILLUSTRATION
1. Remove the 5 screws and unfix two hooks.(.(see illustration) **NOTE:** Electric control box cover cannot be removed, so the voltage between P and N cannot be measured. **NOTE:** For some models, there might be a wiring diagram covering the screw.	
2. Disconnect the connector for fan motor from the electronic control board (see illustration) 3. Remove the connector for the compressor 4. Pull out the two blue wires connected with the four way valve 5. Pull out connectors of the condenser coil temp. sensor(T3),outdoor ambient temp. sensor(T4) and discharge temp. sensor (TP). 6. Disconnect the electronic expansion valve wire. 7. Remove the connector for the DR and reactor. 8. Then remove the electronic control board. **NOTE:** When replacing the electronic control board with a new one, pay attention to applying thermal paste on the heat sink.	

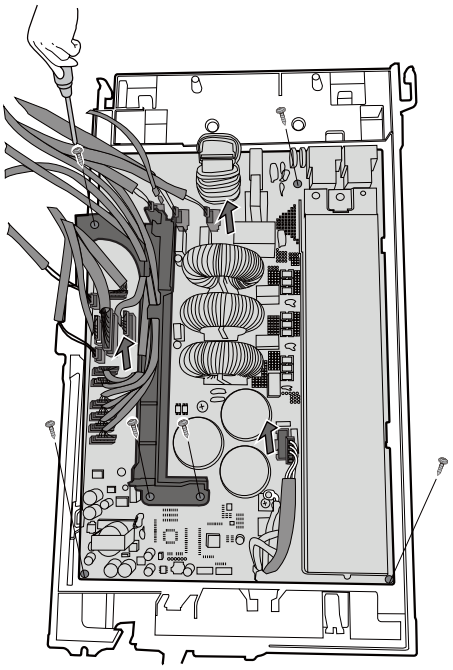
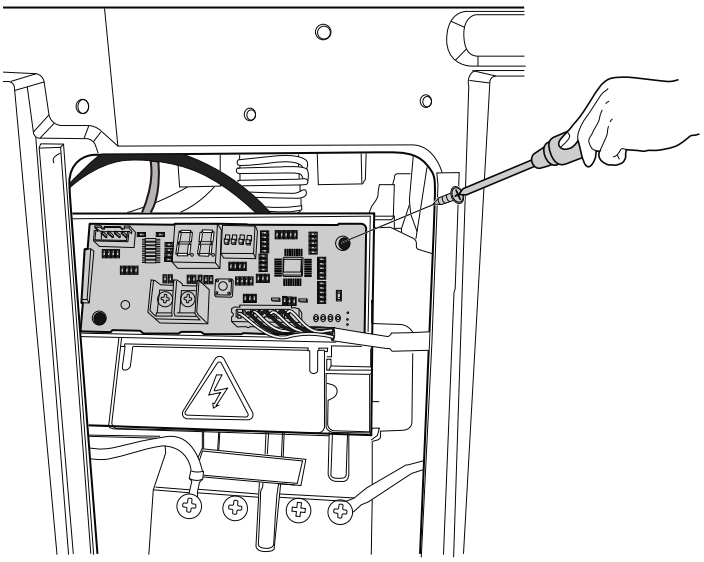
24K (208V/230V) Disassembly - Electrical Parts

PROCEDURES	ILLUSTRATION
1. Remove the 5 screws and unfix two hooks.(see CJ_ODU_PCB_003-1).(.(see illustration) **NOTE:** Electric control box cover cannot be removed, so the voltage between P and N cannot be measured. For some models, there might be a wiring diagram covering the screw.	
2. Disconnect the connector for fan motor from the electronic control board (see. (see illustration) 3. Remove the connector for the compressor 4. Pull out the two blue wires connected with the four way valve 5. Pull out connectors of the condenser coil temp. sensor(T3),outdoor ambient temp. sensor(T4) and discharge temp. sensor (TP) 6. Disconnect the electronic expansion valve wire 7. Remove the connector for the DR and reactor 8. Then remove the electronic control board. **NOTE:** When replacing the electronic control board with a new one, pay attention to applying thermal paste on the heat sink.	

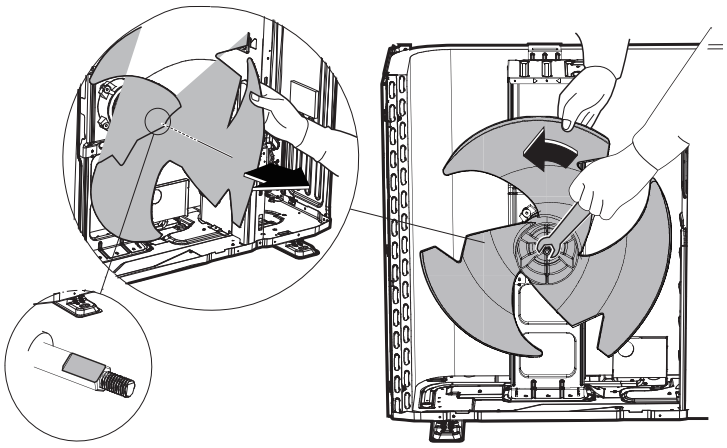
PROCEDURES	ILLUSTRATION
9. Remove the 1 screw and disconnect the wires and then remove the 24V board.(	

30k - 36K (208V/230V) Disassembly - Electrical Parts

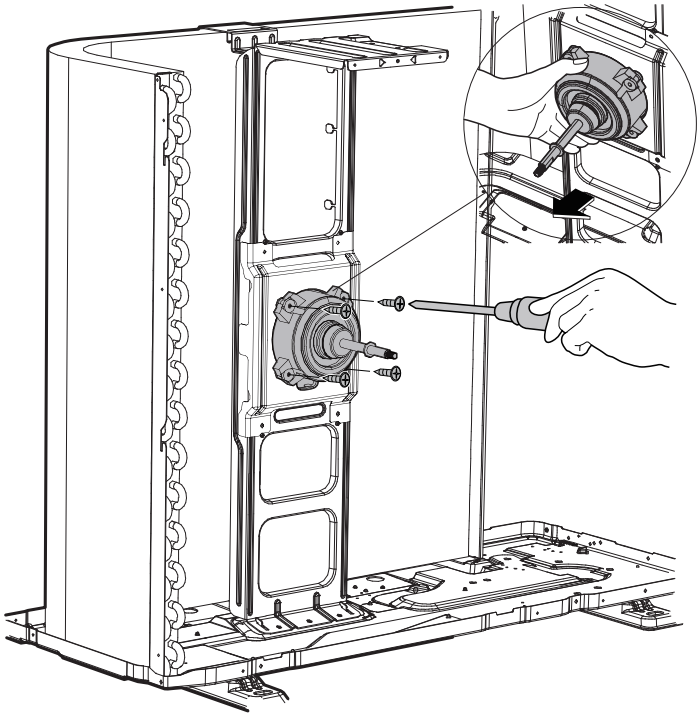
PROCEDURES	ILLUSTRATION
1. Remove the cover of electrical control box..(.(see illustration).	
2. Disconnect the fan motor connector. (see. (see illustration)	
3. Remove eight fixing screws. 4. Turn over the electronic control box subassembly.	

PROCEDURES	ILLUSTRATION
5. Remove 3 screws and then remove the bracket. 6. Disconnect the connectors from the electronic control board. 7. Remove 3 screws and then remove the electronic control board.	
8. Pull out the connector, remove one screw and then remove the key board subassembly on terminal board.	

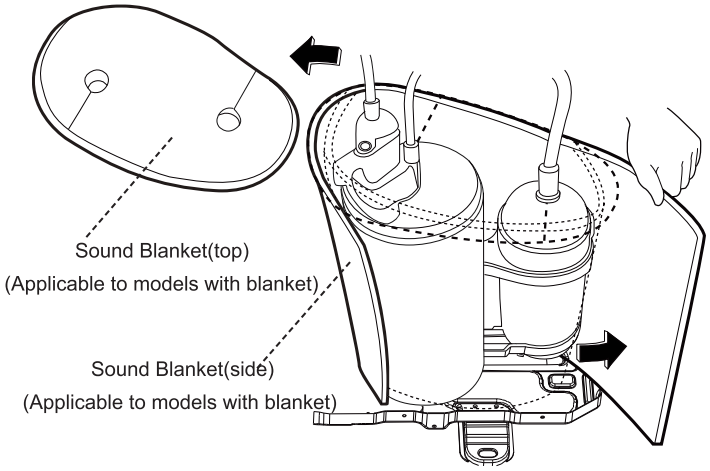
All Size Units, Disassembly - Fan Assembly

PROCEDURES	ILLUSTRATION
1. Remove the nut securing the fan with a spanner. 2. Remove the fan. (see illustration)	

All Size Units, Disassembly - Fan Motor

PROCEDURES	ILLUSTRATION
1. Remove the fixing screws of the fan motor (4 screws) 2. Remove the fan motor. (see illustration)	

All Size Units, Disassembly - Sound Blanket

PROCEDURES	ILLUSTRATION
1. Remove the sound blanket (side and top)) (see illustration)	

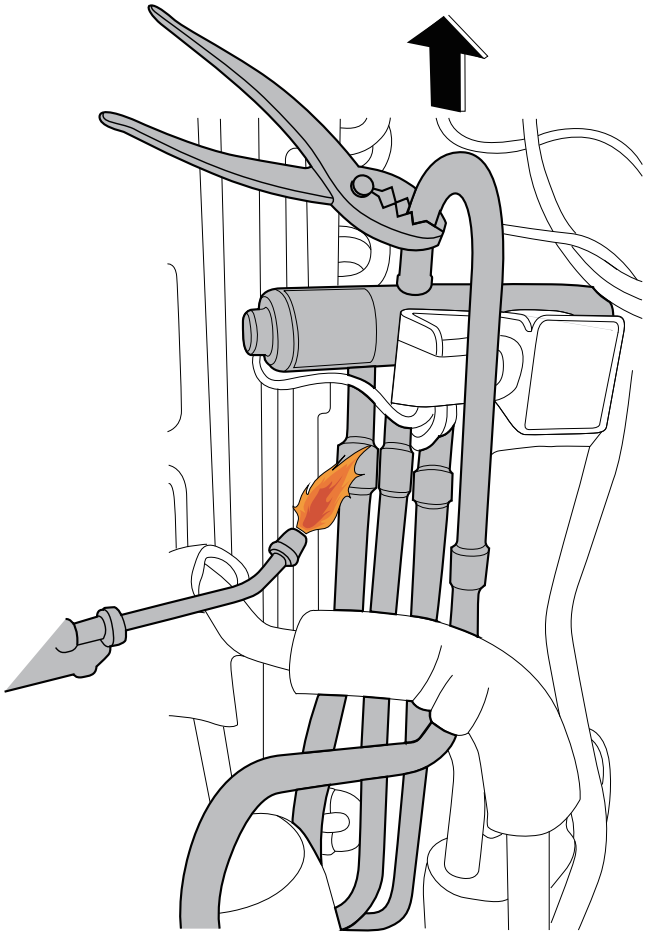
All Size Units, Disassembly - Four-Way Valve (For Heat Pump Models

⚠ WARNING

FIRE HAZARD

Evacuate the system and confirm that there is no refrigerant left in the system before removing the four-way valve and the compressor. (For R32 & R290, you should evacuate the system with the vacuum pump; flush the system with nitrogen; then repeat the two steps before heating up the brazed parts. The operations above should be implemented by professionals.)

NOTE: Remove the panel plate, connection of four-way valve on PCB (refer to “12K (115V) and 9-12K (208/230V) Unit Disassembly - Panel Plate” on page 65, “18K Unit Disassembly - Panel Plate” on page 68, “24K - 36K Unit Disassembly - Panel Plate” on page 71, or “24K - 36K Unit Disassembly - Panel Plate” on page 71 and “18K Disassembly - Electrical Parts” on page 79) before disassembling sound blanket.

PROCEDURES	ILLUSTRATION
1. Heat up the brazed parts and then detach the the four-way valve and the piper. (see illustration) 2. Remove the four-way valve assembly with pliers. (see illustration)	

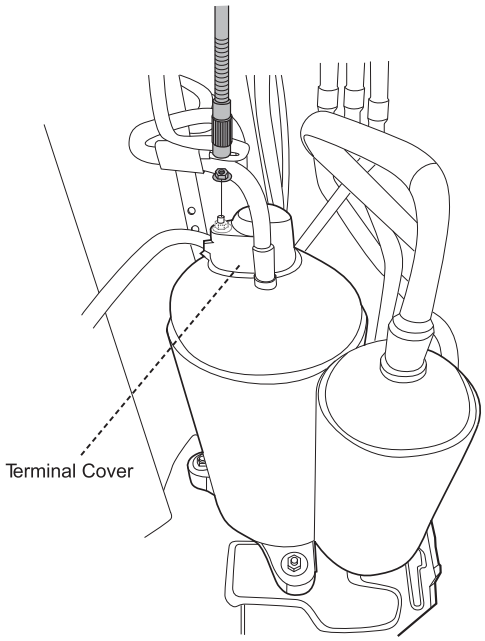
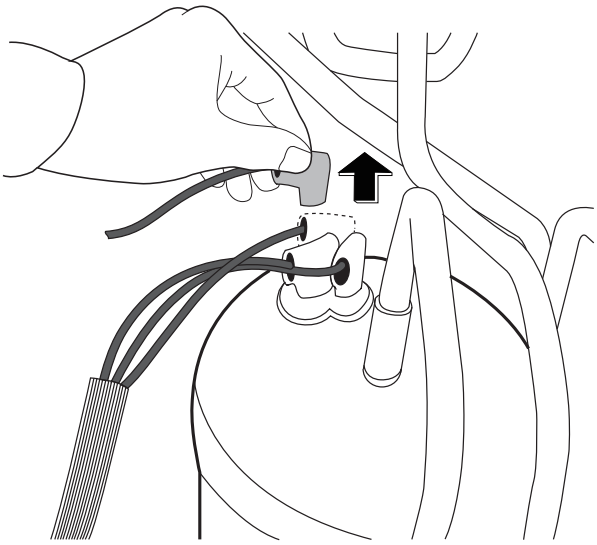
All Size Units, Disassembly - Compressor

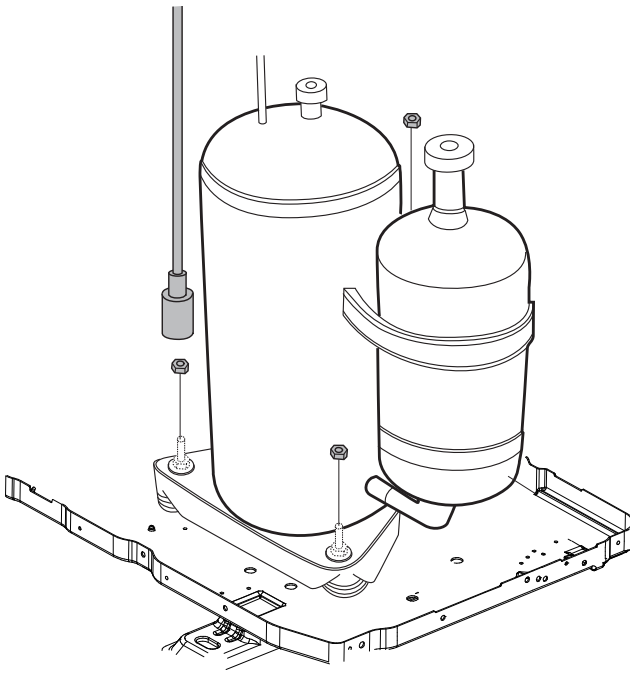
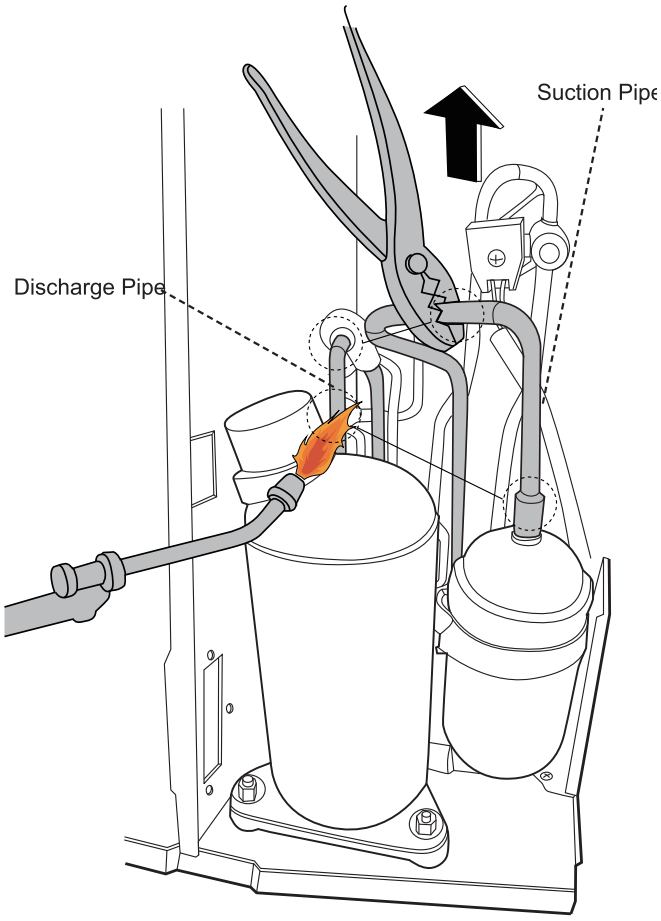
⚠ WARNING

EXPLOSION RISK

Evacuate the system and confirm that there is no refrigerant left in the system before removing the four-way valve and the compressor. (For R32 & R290, you should evacuate the system with the vacuum pump; flush the system with nitrogen; then repeat the two steps before heating up the brazed parts. The operations above should be implemented by professionals.)

NOTE: Remove the panel plate, connection of four-way valve on PCB (refer to "12K (115V) and 9-12K (208/230V) Unit Disassembly - Panel Plate" on page 65, "18K Unit Disassembly - Panel Plate" on page 68, "24K - 36K Unit Disassembly - Panel Plate" on page 71, or "24K - 36K Unit Disassembly - Panel Plate" on page 71 and "18K Disassembly - Electrical Parts" on page 79) before disassembling sound blanket.

PROCEDURES	ILLUSTRATION
1. Remove the flange nut of terminal cover and remove the terminal cover (see illustration)	
2. Disconnect the connectors (see illustration)	

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

APPENDIX

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

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

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

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	144.01	10	50
68.615	0.69	9.95	-57	-70.6	1022.8	10.23	148.34	11	51.8
72.402	0.72	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	314.91	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	338.81	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	2758.3	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 (Continued)

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	63.51	-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	150.8
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
827.48	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	165.2
907.35	9.07	131.60	7	44.6	4904.1	49.04	711.25	75	167

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45MAHA
HIGH WALL DUCTLESS SYSTEM
Sizes 06K to 36K

SERVICE MANUAL

TABLE OF CONTENTS

SAFETY CONSIDERATION

Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.). Only trained, qualified installers and service mechanics should install, start-up, and service this equipment.

Untrained personnel can perform basic maintenance functions such as coil cleaning. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the product literature and on tags, stickers, and labels attached to the equipment.

Follow all safety codes. Wear safety glasses and work gloves. Keep a quenching cloth and fire extinguisher nearby when brazing. Use care in handling, rigging, and setting bulky equipment.

Read this manual thoroughly and follow all warnings or cautions included in the literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements. Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand these signal words: **DANGER**, **WARNING**, and **CAUTION**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in severe personal injury or death. **WARNING** signifies hazards which **could** result in personal injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the **OFF** position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage. Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.Do not bury more than 36 in. (914 mm) of refrigerant pipe in the ground. If any section of pipe is buried, there must be a 6 in. (152 mm) vertical rise to the valve connections on the outdoor units.

If more than the recommended length is buried, refrigerant may migrate to the cooler buried section during extended periods of system shutdown. This causes refrigerant slugging and could possibly damage the compressor at start-up.

INTRODUCTION

This service manual provides the necessary information to service, repair, and maintain the **45MAHA** family of heat pumps. This manual has an “APPENDIX” on page 66 with data required to perform troubleshooting. Use the “TABLE OF CONTENTS” on page 1 to locate a desired topic.

⚠ WARNING

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.

⚠ WARNING

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. The product must be properly grounded at the time of installation, or electric shock may occur.

For all electrical work, follow all local and national wiring standards, regulations, and the Installation Manual. Connect the cables tightly, and clamp them securely to prevent external forces from damaging the terminal. Improper electrical connections can overheat and cause fire, and may also cause shock. All electrical connections must be made according to the Electrical Connection Diagram located on the panels of the indoor and outdoor units.

All wiring must be properly arranged to ensure that the control board cover can close properly. If the control board cover is not closed properly, it can lead to corrosion and cause the connection points on the terminal to heat up, catch fire, or cause electrical shock.

Disconnection must be incorporated in the fixed wiring in accordance with NEC, CSA, and Local Codes. Do not share the electrical outlet with other appliances. Improper or insufficient power supply can cause fire or electric shock.

If connecting power to fixed wiring, an all-pole disconnection device which has at least 3mm clearances in all poles, and have a leakage current that may exceed 10mA, the residual current device (RCD) having a rated residual operating current not exceeding 30mA, and disconnection must be incorporated in the fixed wiring in accordance with NEC, CSA, and Local Codes.

⚠ WARNING

Turn of the unit and disconnect the power before performing any installation or repairing. Failure to do so can cause electric shock.

Installation must be performed by an authorized dealer or specialist. Defective installation can cause water leakage, electrical shock, or fire. Installation must be performed according to the installation instructions.

Improper installation can cause water leakage, electrical shock, or fire. Contact an authorized service technician for repair or maintenance of this unit. This appliance shall be installed in accordance with national wiring regulations.

Only use the included accessories, parts, and specified parts for installation. Using non-standard parts can cause water leakage, electrical shock, fire, and can cause the unit to fail.

Install the unit in a firm location that can support the unit’s weight. If the chosen location cannot support the unit’s weight, or the installation is not done properly, the unit may drop and cause serious injury and damage. Install drainage piping according to the instructions in this manual. Improper drainage may cause water damage to your home and property.

For units that have an auxiliary electric heater, do not install the unit within 3 feet (1 meter) of any combustible materials.

If combustible gas accumulates around the unit, it may cause fire.

Do not turn on the power until all work has been completed.

When moving or relocating the unit, consult experienced service technicians for disconnection and re-installation of the unit.

How to install the appliance to its support, please read the information for details in "Indoor Unit Installation" and "Outdoor Unit Installation" sections.

NOTE: The air conditioner’s circuit board (PCB) is designed with a fuse to provide overcurrent protection. The specifications of the fuse are printed on the circuit board, for example: T3.15AL/250VAC, T5AL/250VAC, T3.15A/250VAC, T5A/ 250VAC, T20A/250VAC, T30A/250VAC,etc.

NOTE: Only the blast-proof ceramic fuse can be used.

⚠ WARNING

FOR FLAMMABLE REFRIGERANTS

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

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

Do not pierce or burn. Be aware that refrigerants may not contain an odor.

⚠ WARNING

PERSONAL INJURY AND PROPERTY DAMAGE HAZARD

For continued performance, reliability, and safety, the only approved accessories and replacement parts are those specified by the equipment manufacturer. The use of non-manufacturer approved parts and accessories could invalidate the equipment limited warranty and result in fire risk, equipment malfunction, and failure. Review the manufacturer's instructions and replacement parts catalogs available from your equipment supplier.

WARNING - RISK OF FIRE DUE TO FLAMMABLE REFRIGERANT USED. FOLLOW HANDLING INSTRUCTIONS CAREFULLY IN COMPLIANCE WITH NATIONAL REGULATIONS.

NOTE: Risk of Fire. Flammable refrigerant used. To be repaired only by trained service personnel. Do not puncture refrigerant tubing.

PRECAUTIONS

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

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

IN CASE OF ACCIDENT OR EMERGENCY

⚠ WARNING

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

⚠ CAUTION

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

PRE-INSTALLATION AND INSTALLATION

⚠ WARNING

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

⚠ CAUTION

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

OPERATION AND MAINTENANCE

⚠ WARNING

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

⚠ CAUTION

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

WARNING FOR USING FLAMMABLE REFRIGERANT

1. Installation (Space)
   – That the installation of pipe-work shall be kept to a minimum.
   – That pipe-work shall be protected from physical damage.
   – Where refrigerant pipes shall be compliance with national gas regulations.
   – That mechanical connections shall be accessible for maintenance purposes.
   – In cases that require mechanical ventilation, ventilation openings shall be kept clear of obstruction.
   – When disposing of the product is used, be based on national regulations, properly processed.
2. Servicing

   Any person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorizes their competence to handle refrigerants safely in accordance with an industry recognized assessment specification.
3. 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.
4. Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
5. 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).
6. Be more careful that foreign matter (oil, water, etc.) does not enter the piping. Also, when storing the piping, securely seal the opening by pinching, taping, etc.
7. Do not pierce or burn.
8. Be aware that refrigerants may not contain an odor.
9. All working procedure that affects safety means shall only be carried by competent persons.
10. Appliance shall be stored in a well -ventilated area where the room size corresponds to the room area as specific for operation.
11. The appliance shall be stored so as to prevent mechanical damage from occurring.
12. Joints shall 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 shall NOT be used in the indoor side of the unit (brazed, welded joint could be used).
13. When a FLAMMABLE REFRIGERANT is used, the requirements for installation space of appliance and /or ventilation requirements are determined according to
   – the mass charge amount (M) used in the appliance,
   – the installation location,
   – the type of ventilation of the location or of the appliance.
   – piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ASHRAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.
   – that protection devices, piping, and fittings shall be protected as far as possible against adverse environmental effects, for ex-ample, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris;

- that piping in refrigeration systems shall be so designed and installed to minimize the likelihood of hydraulic shock damaging the system;
- that steel pipes and components shall be protected against corrosion with a rustproof coating before applying any insulation;
- that precautions shall be taken to avoid excessive vibration or pulsation;
- the minimum floor area of the room shall be mentioned in the form of a table or a single figure without reference to a formula;
- after completion of field piping for split systems, the field pipe-work shall 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 shall be the low side design pressure and the minimum test pressure for the high side of the system shall 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 shall be pressure tested to the low side design pressure.
  - The test pressure after removal of pressure source shall be maintained for at least 1h with no decrease of pressure indicated by the test gauge, with test gauge resolution not exceeding 5% of the test pressure.
  - 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 min. The vacuum pressure level shall be specified in the manual, and shall be the lessor of 500 microns or 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 shall be tightness tested according to the following requirements: The test method shall 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 shall be detected.
- correct the minimum room area of the space Amin by multiplying by the altitude adjustment factor (AF) factor in the below table based on for building site ground level altitude (Halt) in meters.

Table 1 — Altitude Adjustment Factor

Halt	0	200	400	600	800	1000	1200	1400	1600
AF	1.00	1.00	1.00	1.00	1.02	1.05	1.07	1.10	1.12
Halt	1800	2000	2200	2400	2600	2800	3000	3200	
AF	1.15	1.18	1.21	1.25	1.28	1.32	1.36	1.40	

- Warning: keep any required ventilation openings clear of obstruction;
- Any servicing shall be performed only as recommended by the manufacturer

14. Qualification of workers

Any maintenance, service and repair operations must be required qualification of the working personnel. Every working procedure that affects safety means shall only be carried out by competent persons that joined the training and achieved competence should be documented by a certificate. The training of these procedures is 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 shall follow the ANNEX HH requirements of UL 60335-2-40 4rd Edition.

Examples for such working procedures are:

- breaking into the refrigerating circuit
- opening of sealed components
- opening of ventilated enclosures

INFORMATION SERVICING (FLAMMABLE MATERIALS)

CHECKS TO THE AREA

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

WORK PROCEDURE

Work shall 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.

GENERAL WORK AREA

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

CHECKING FOR PRESENCE OF REFRIGERANT

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

PRESENCE OF FIRE EXTINGUISHER

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

NO IGNITION SOURCE

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

VENTILATED AREA

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

CHECKS TO THE REFRIGERANT EQUIPMENT

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

- the 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 shall be checked for the presence of refrigerant;

– marking to the equipment continues to be visible and legible, marking and signs that are illegible shall be corrected;
– refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

CHECK TO ELECTRICAL DEVICES

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

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

SEALED ELECTRICAL COMPONENTS SHALL BE REPLACED

- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc.

  If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
  – Ensure that apparatus is mounted securely.
  – Ensure that seals or sealing materials have not degraded such that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

INTRISICALLY SAFE COMPONENTS MUST BE REPLACED

Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use. Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating. Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

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

CABLING

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

DETECTION OF FLAMMABLE REFRIGERANTS

– Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.
– 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 shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

NOTE Examples of leak detection fluids are:

- **bubble method,**
- **fluorescent method agents.**
  – If a leak is suspected, all naked flames shall be removed/extinguished.
  – If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut of valves) in a part of the system remote from the leak. See the following instructions of removal of refrigerant.

REMOVAL AND EVACUATION

- When breaking into the refrigerant circuit to make repairs or for any other purpose, conventional procedures shall be used. However, it is important that best practice is followed since flammability is a consideration.
- The following procedure shall be adhered to:
  – safely remove refrigerant following local and national regulations;
  – evacuate;
  – purge the circuit with inert gas (optional for A2L);
  – evacuate (optional for A2L);
  – continuously flush or purge with inert gas when using flame to open circuit; and open the circuit;
- The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall 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, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.
- The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

CHARGING PROCEDURES

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

- Works shall 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.
- Cylinders shall be kept upright.
- Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already). Extreme care shall be taken not to overfill the refrigeration system.
- Prior to recharging the system it shall be pressure tested with OFN. The system shall be leak tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

DECOMMISSIONING

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

- Become familiar with the equipment and its operation.
- Isolate system electrically.
- Before attempting the procedure ensure that:
  - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - all personal protective equipment is available and being used correctly;
  - the recovery process is supervised at all times by a competent person;
  - recovery equipment and cylinders conform to the appropriate standards.
- Pump down refrigerant system, if possible.
- If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- Make sure that cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with manufacturer's instructions.
- Do not overfill cylinders. (No more than 80% volume liquid charge).
- Do not exceed the maximum working pressure of the cylinder, even temporarily.
- When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

LABELING

Equipment shall be labeled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing FLAMMABLE REFRIGERANTS, ensure that there are labels on the equipment stating the equipment contains FLAMMABLE REFRIGERANT.

RECOVERY

- When removing refrigerant from a system, either for servicing or decommissioning,
- it is recommended good practice that all refrigerants are removed safely.
- When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are 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-of valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.
- The recovered refrigerant shall 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.
- 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 shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

TRANSPORTATION, MARKING AND STORAGE FOR UNITS

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

INDOOR UNIT SIZES

Capacity (Btu/h)	Voltage	Indoor units
12K	115V, 1 phase, 60Hz	45MAHAQ12XA1
6K	208/230V, 1 phase, 60Hz	45MAHAQ06XA3
9K		45MAHAQ09XA3
12K		45MAHAQ12XA3
18		45MAHAQ18XA3
24K		45MAHAQ24XA3
30K		45MAHAQ30XX3
33K		45MAHAQ33XX3
36K		45MAHAQ36XA3

MODEL NUMBER NOMENCLATURE

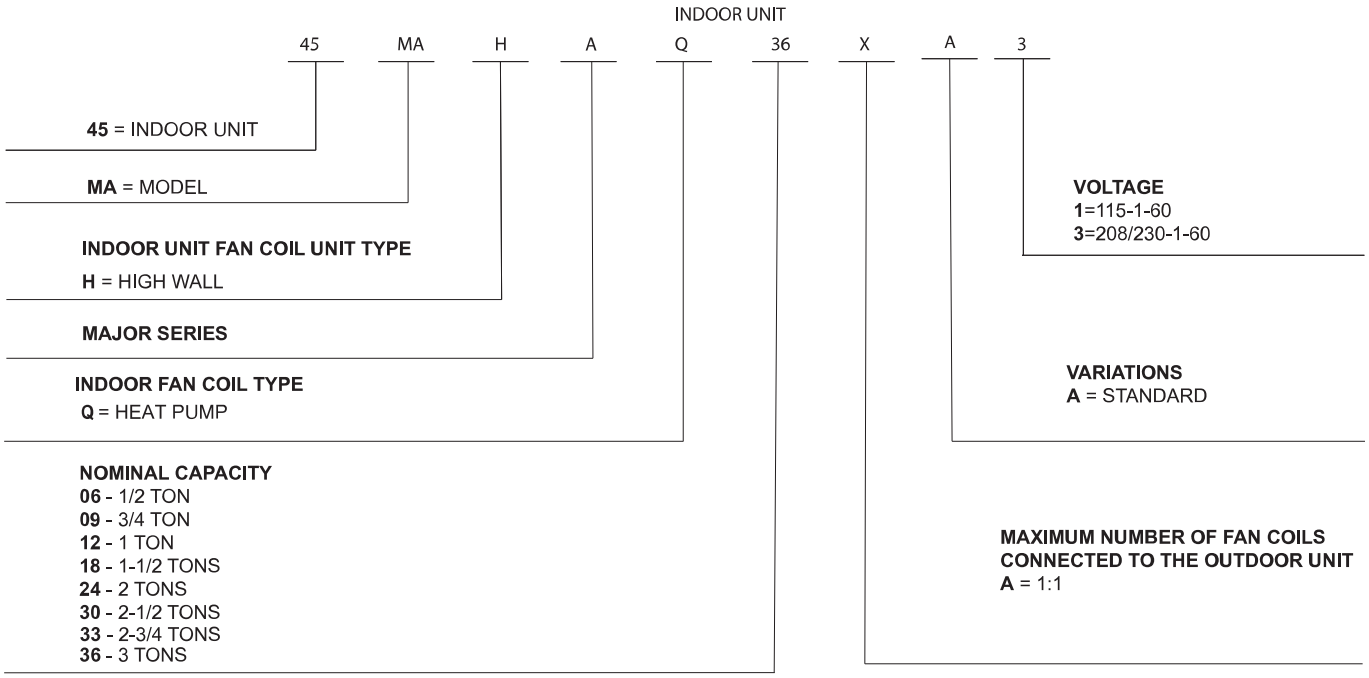


Fig. 1 —Model Number Nomenclature

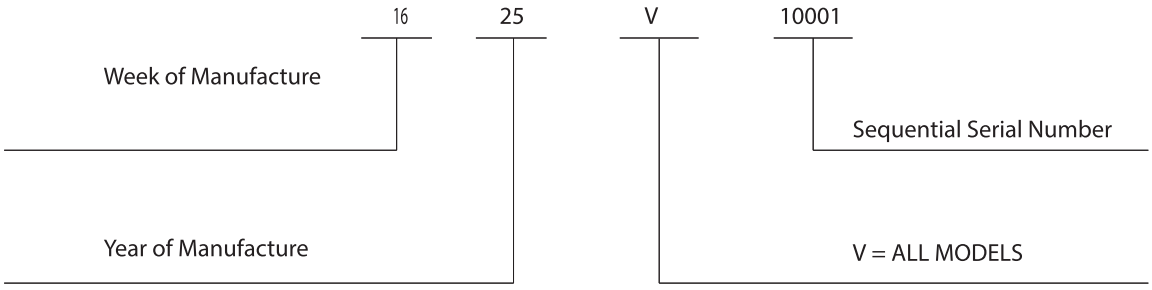


Fig. 2 —Serial Number Nomenclature

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program For verification of certification for individual products, go to www.ahridirectory.org.

WIRING

All wires must be sized per NEC (National Electrical Code) or CEC (Canadian Electrical Code) and local codes. Use the Electrical Data table

MCA (minimum circuit amps) and MOCP (maximum over current protection) to correctly size the wires and the disconnect fuse or breakers respectively.

Per the caution note, only stranded copper conductors with a 600 volt insulation rating wire must be used.

Recommended Connection Method for Power and Communication Wiring:

The main power is supplied to the outdoor unit. The field supplied 14/3 stranded wire with ground with a 600 volt insulation rating, power/ communication wiring from the outdoor unit to the indoor unit consists of four (4) wires and provides the power for the indoor unit.

Two wires are line voltage AC power: connect L1 to terminal (1), N or L2 to (2), Communication wire to (3), green ground wire to ground terminal.

Refer to the “CONNECTION DIAGRAMS” on page 10 for 115 volt or 208/230 volt connection.

If installed in a high electromagnetic field area (EMF) and communication issues exist, a 14/2 stranded shielded wire can be used to replace (2) and (3) (polarity sensitive) between the outdoor unit and the indoor unit landing the shield onto the ground in the outdoor unit only.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in damage or improper operation.

Wires should be sized based on NEC and local codes.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

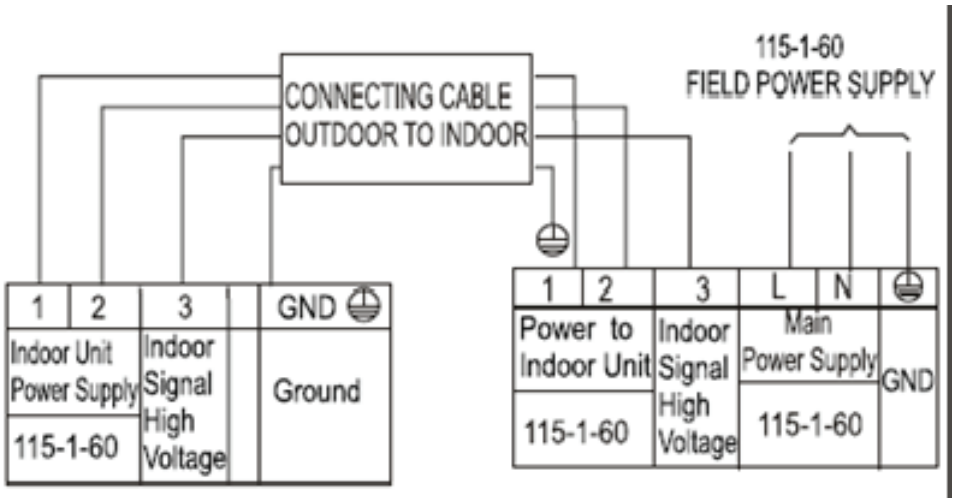
Be sure to comply with local codes while running wire from the indoor unit to the outdoor unit.

Every wire must be connected firmly. Loose wiring may cause the terminal to overheat or result in unit malfunction. A fire hazard may also exist. Ensure all wiring is tightly connected.

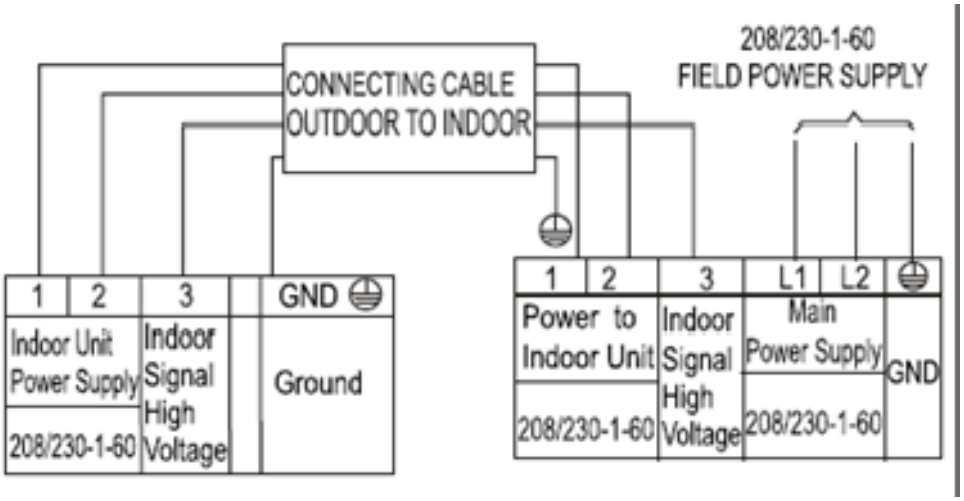
No wire should touch the refrigerant tubing, compressor or any moving parts.

Disconnecting means must be provided and shall be located within sight and readily accessible from the air conditioner. Connecting cable with conduit shall be routed through the hole in the conduit panel.

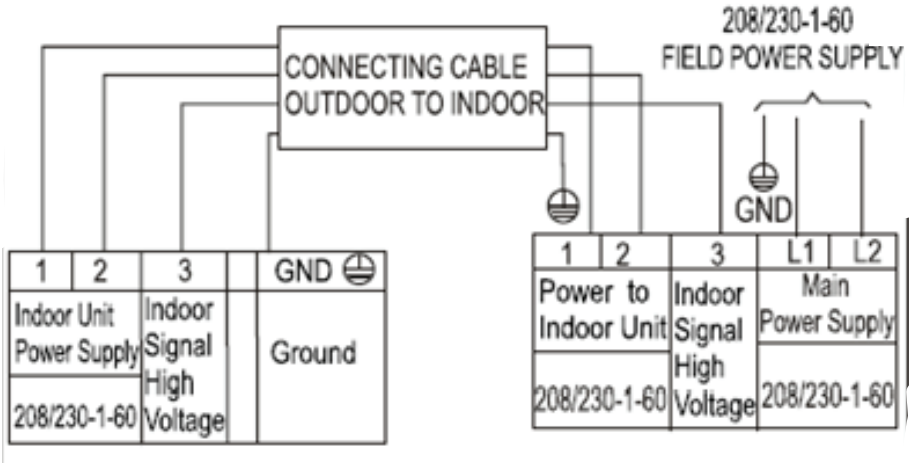
CONNECTION DIAGRAMS



Connection Diagram - 12K (115V)



Connection Diagram - 6K - 18K (208/230-1-60)



Connection Diagram - 24K - 36K (208/230-1-60)

Fig. 3 —Connection Diagrams

WIRING DIAGRAMS

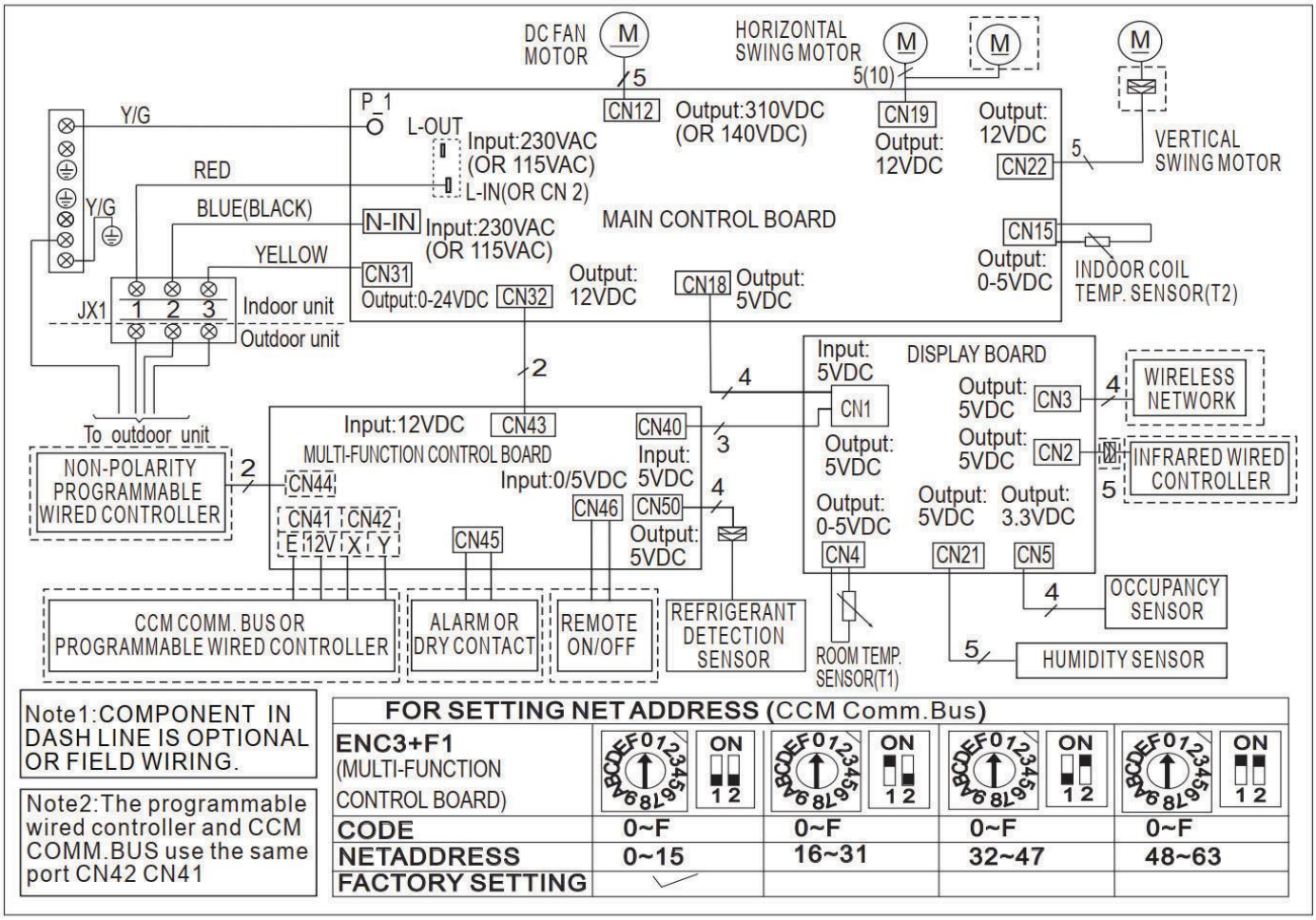
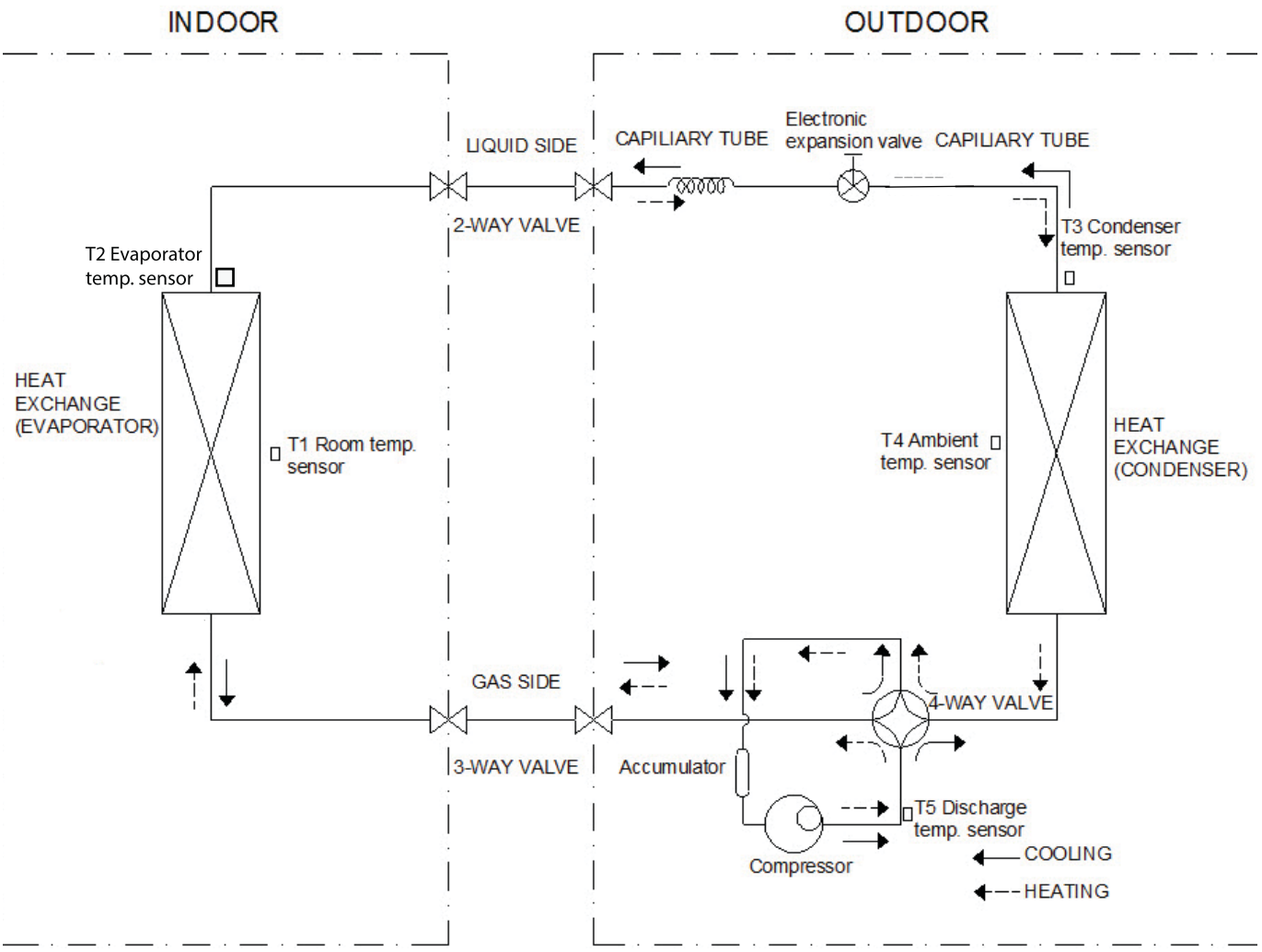


Fig. 4 —Indoor Unit Wiring Diagram (6K~36K)

REFRIGERANT CYCLE DIAGRAM



REFRIGERANT LINES

IMPORTANT: Both refrigerant lines must be insulated separately.

Refer to the outdoor unit's installation instructions for other allowed piping lengths and refrigerant information.

SPECIFICATIONS

Table 2 – Fan and Motor Specifications

Indoor Unit Model			45MAHAQ06XA3	45MAHAQ09XA3	45MAHAQ12XA1	45MAHAQ12XA3	45MAHAQ18XA3	45MAHAQ24XA3	45MAHAQ30XA3	45MAHAQ33XA3	45MAHAQ36XA3
Power supply V;Ph;Hz			208/230V;1Ph;60HZ		115V;1Ph; 60HZ	208/230V;1Ph;60HZ					
INDOOR FAN SPECIFICATIONS	Material	-	Acrylontrile Styrene +30%G								
	Type	-	GL-98*638-IN				GL-98*758-IN	GL-121*883-IN			
	Diameter	inch	3.9	3.9	3.9	3.9	3.9	4.8	4.8	4.8	4.8
		mm	98	98	98	98	98	121	121	121	121
	Height	inch	25.1	25.1	25.1	25.1	29.8	34.8	34.8	34.8	34.8
		mm	638	638	638	638	758	883	883	883	883
INDOOR MOTOR SPECIFICATIONS	Model	-	ZKFP-20-8-6-7		ZKFP-20-8 -113	ZKFP-20-8-6 -7	ZKFP-30-8-3 -10	ZKFP-58-8-1-10		ZKFP-58-8-20L	ZKFP-58-8-1 -10
	Type	-	DC								
	Input	W	50	50	35	50	36	58	58	86.2	58
	Max. input	W	70	70	65.8	70	70	102	102	112.5	102
	Output	W	37.5	37.5	26	37.5	27	43.5	43.5	58	43.5
	FLA	A	0.6	0.6	0.6	0.6	0.81	1.32	0.65	1.63	0.65
	Rated HP	HP	0.05	0.05	0.03	0.05	0.04	0.06	0.06	0.08	0.06
	Range of current	Amps	0.067~0.24	0.067~0.24	0.043~0.467	0.067~0.24	0.11~0.275	0.27~0.96	0.27~0.96	0.385~0.97	0.27~0.96
	Rated current	Amps	0.16	0.16	0.257	0.16	0.11	0.780	0.780	0.740	0.780
	Speed	rev/min	1100/850/700		1200/900/700	1100/850/700	1190/994/896	1000/850/630	1050/880/630	1300/1070/960	1050/880/630
	Rated RPM	rev/min	1100	1100	1200	1100	1190	1000	1050	1300	1050
	Insulation class	-	E								
	Safe class	-	IPX0	IPX0	IP20	IPX0	IPX4	IP20	IP20	IP20	IP20

Table 3 – Indoor Refrigerant Coil Specifications

Indoor Unit Model		45MAHAQ06XA3	45MAHAQ09XA3	45MAHAQ12XA1	45MAHAQ12XA3	45MAHAQ18XA3	45MAHAQ24XA3	45MAHAQ30XA3	45MAHAQ33XA3	45MAHAQ36XA3
Power supply	**V;Ph;Hz**	**208/230V;1Ph;60HZ**		**115V;1Ph; 60HZ**	**208/230V;1Ph;60HZ**					
Number of rows	Rows	2	2	2	2	2	3	3	3	3
Tube outside dia.	inch	0.276								
	mm	Φ7								
Nominal Tube Wall	Inch (mm)	0.00945 (0.24)								
Tube Enhancement	(Yes/No)	Yes								
Tube Material		Copper								
Tube pitch(a)x row pitch(b)	inch	0.83x0.53								
	mm	21x13.37								
Fin Spacing	FPI	20								
	mm	1.3								
Fin type		Louvered								
Fin Material		Gold hydrophilic aluminum								
Coil length x height x width	inch	25x3.31x1.05+25x4.96x1.05+25x4.13x1.05	25x3.31x1.05+25x4.96x1.05+25x4.13x1.05	25x3.31x1.05+25x4.96x1.05+25x4.13x1.05	25x3.31x1.05+25x4.96x1.05+25x4.13x1.05	29.92x3.31x1.05+29.92x4.96x1.05+29.92x4.96x1.05	34.84x4.96x1.58+34.84x4.96x1.58+34.84x4.96x1.58	34.84x4.96x1.58+34.84x4.96x1.58+34.84x4.96x1.58	34.84x4.96x1.58+34.84x4.96x1.58+34.84x4.96x1.58	34.84x4.96x1.58+34.84x4.96x1.58+34.84x4.96x1.58
	mm	635x84x26.74+635x126x26.74+635x105x26.74	635x84x26.74+635x126x26.74+635x105x26.74	635x84x26.74+635x126x26.74+635x105x26.74	635x84x26.74+635x126x26.74+635x105x26.74	760x84x26.74+760x126x26.74+760x126xx26.74	885x126x40.11+885x126x40.11+885x126x40.11	885x126x40.11+885x126x40.11+885x126x40.11	885x126x40.11+885x126x40.11+885x126x40.11	885x126x40.11+885x126x40.11+885x126x40.11
Face area	ft2	2.15	2.15	2.15	2.15	2.75	3.6	3.6	3.6	3.6
Number of circuits	#	3	3	3	3	4	7	7	7	7

SYSTEM EVACUATION AND CHARGING

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Never use the system compressor as a vacuum pump.

Refrigerant tubes and the indoor coil should be evacuated using the recommended 500 micron deep vacuum method. The alternate triple evacuation method may be used if the procedure outlined below is followed.

NOTE: Always break a vacuum with dry nitrogen.

USING VACUUM PUMP

1. Completely tighten flare nuts A, B, C, D. Connect the manifold gage charge hose to a charge port of the low side service valve (see Fig. 6).
2. Connect the charge hose to vacuum pump.
3. Fully open the low side of manifold gage (see Fig. 5).
4. Start the vacuum pump.
5. Evacuate using either the deep vacuum or triple evacuation method.
6. After evacuation is complete, fully close the low side of manifold gage and stop the vacuum pump operation.
7. The factory charge contained in the outdoor unit is good for up to 25 ft. (8 m) of line length. For refrigerant lines longer than 25 ft. (8 m), add refrigerant, up to the allowable length.
8. Disconnect the charge hose from the charge connection of the low side service valve.
9. Fully open service valves B and A.
10. Securely tighten the service valve caps.

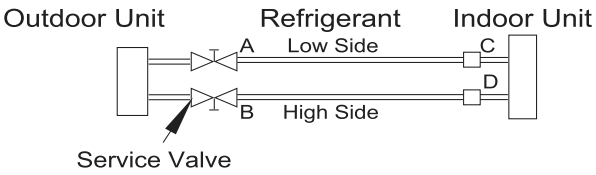


Fig. 5 —Service Valve

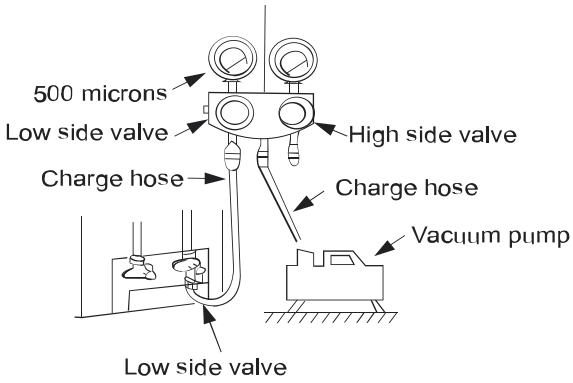


Fig. 6 —Manifold

EVACUATION

Evacuation of the system will remove air or nitrogen (non-condensables) as well as moisture. A proper vacuum will assure a tight, dry system before charging with refrigerant. The two methods used to evacuate a system are the deep vacuum method and the triple vacuum method.

DEEP VACUUM METHOD

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 micron and a vacuum gauge capable of accurately measuring this vacuum depth. This method is the most positive way of assuring a system is free of air and moisture (see Figure 7).

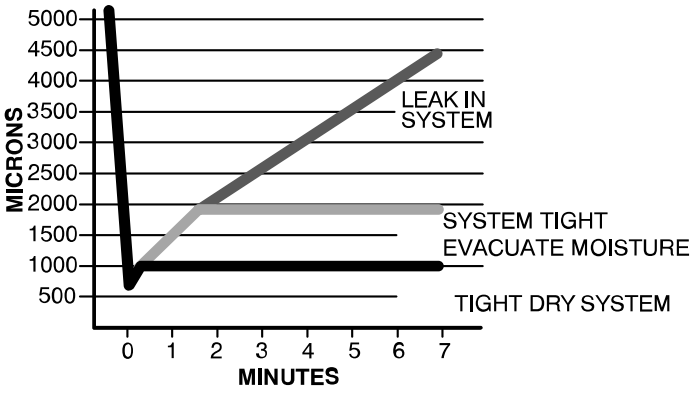


Fig. 7 —Deep Vacuum Graph

TRIPLE EVACUATION METHOD

The triple evacuation method should be used when vacuum pump is not capable of pumping down to 500 microns and system does not contain any liquid water. Refer to Fig. 8 and proceed as follows:

1. Attach refrigeration gauges and evacuate system down to 28 inches of mercury and allow pump to continue operating for an additional 15 minutes.
2. Close service valves and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and flow nitrogen until system pressure is 2 psig.
4. Close service valve and allow system to stand for 1 hour. During this time, dry nitrogen will be able to diffuse throughout the system absorbing moisture.
5. Repeat this procedure as indicated in Fig. Fig. 8. System is now free of any contaminants and water vapor.

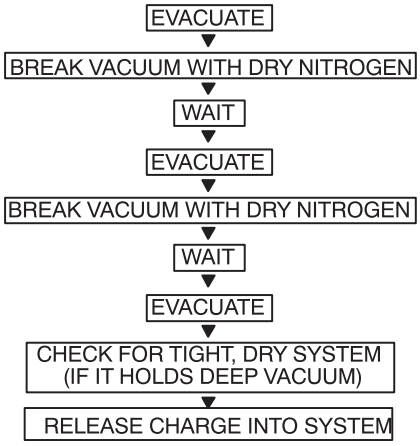


Fig. 8 —Triple Evacuation Method

FINAL TUBING CHECK

Check to be certain factory tubing on both the indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to the feeder tubes, making sure wire ties on feeder tubes are secure and tight.

Main Protection

Fan speed is out of control

When the indoor fan speed is too low (300RPM) or too high (1500RPM) for a certain time, the unit stops and the LED displays a failure.

Inverter module protection

The inverter module has a protection function for current, voltage and temperature. If any of these protections engage, the corresponding code displays on the indoor unit and the unit stops working.

Indoor fan delayed open function

When the unit starts up, the louver activates immediately and the indoor fan opens 10s later. If the unit is running in the HEATING mode, the indoor fan is controlled by the anti-cold wind function.

Zero crossing detection error protection

If the AC detects that the time interval is not correct for a continuous 240s, the unit stops and the LED displays the failure. The correct zero crossing signal time interval should be between 6-13ms. Sensor protection at open circuit and breaking disconnection If only one temperature sensor malfunctions, the air conditioner continues to work however the error code appears on the LED, in the event of any emergency use. If more than one temperature sensor malfunctions, the air conditioner stops working.

Operation Modes and Functions

FAN Mode

1. Outdoor fan and compressor stop
2. Temperature setting function is disabled and no setting temperature appears.
3. Indoor fan can be set to high/med/low/auto
4. The louver operates the same as in the COOLING mode.

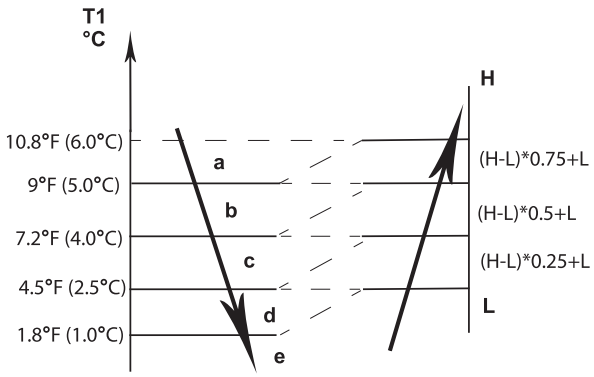


Fig. 9 —AUTO FAN Mode

COOLING Mode

Indoor Fan Running Rules:

In the COOLING mode, the indoor fan runs all the time and the speed can be selected as HIGH, MEDIUM, LOW and AUTO. When the setting temperature is reached, if the compressor stops running, the indoor fan motor runs at the minimum or setting speed. The indoor fan is controlled by the rules shown in Fig. 10.

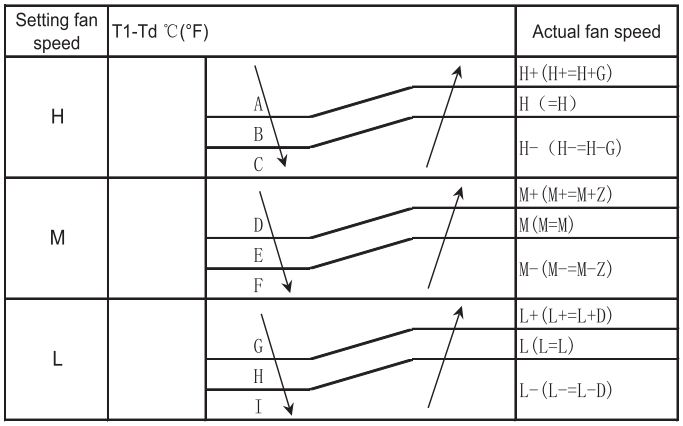


Fig. 10 —Indoor Fan Running Rules

The AUTO fan is controlled by the rules shown in Fig. 11.

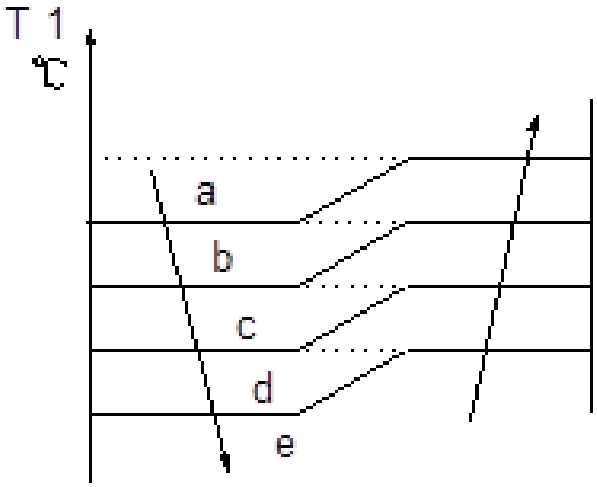


Fig. 11 —AUTO FAN Running Rules

Evaporator Temperature Protection

When the evaporator temperature is less than the setting value, the compressor stops.

HEATING Mode

Indoor Fan Running Rules:

When the compressor is on, the indoor fan can be set to HIGH, MEDIUM, LOW, AUTO, MUTE. When the indoor unit coil temperature is low, the anti-cold air function starts and the indoor fan motor runs at a low speed and the speed cannot be changed. When the temperature is lower than the setting value, the indoor fan motor stops.

When the indoor temp reaches the setting temperature, the compressor stops and the indoor fan motor runs at the minimum speed or setting speed. The anti-cold air function is valid. The indoor fan is controlled as shown in Fig. 12.

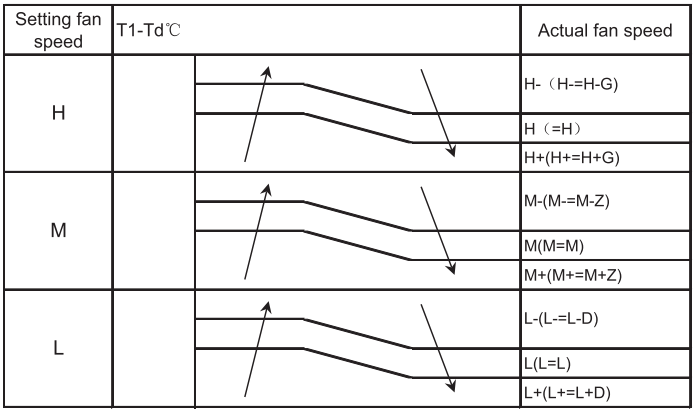


Fig. 12 —HEATING Fan Running Rules

AUTO Fan Action in HEATING Mode

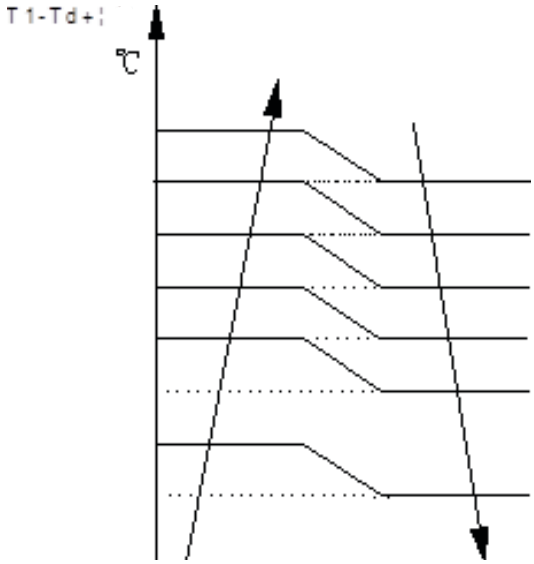


Fig. 13 —AUTO Fan Action in HEATING Mode

DEFROSTING Mode

The air conditioner enters the DEFROSTING mode according to the T3 temperature value and the T3 temperature change value range plus the compressor running time. During the DEFROSTING mode, the compressor continues to runs, the indoor and outdoor motors stop, and the indoor unit defrost lamp illuminates and "dF" appears.

Evaporator Anti-Freezing Protection

The evaporator anti-freezing protection condenser high temperature

Evaporator Coil Temperature Protection

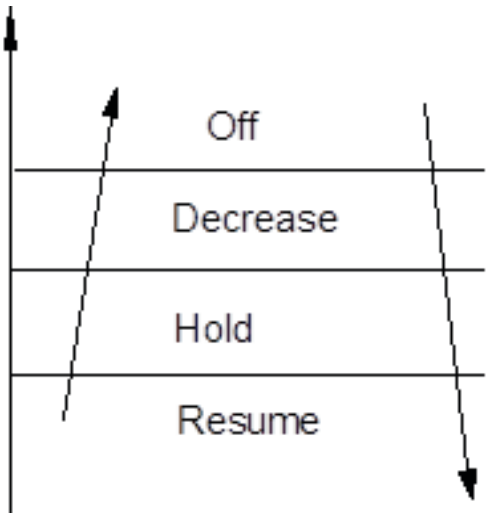


Fig. 14 —Evaporator Coil Temperature Protection

When the evaporator temperature is higher than the setting protection value, the compressor stops.

AUTO Mode

In the AUTO mode, the machine selects COOLING, HEATING or FAN ONLY on the basis of T1-Ts. Outdoor ambient temperature (T4) and relative humidity (Φ).

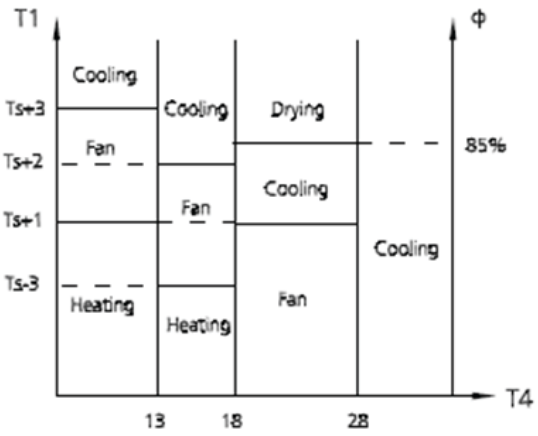


Fig. 15 —AUTO Mode

The indoor fan runs under AUTO fan in the relevant mode. The louver operates the same as in relevant mode. If the air conditioner switches between the HEATING and COOLING mode, the compressor stops for a certain period of time and then chooses the mode according to T1-Ts. If the setting temperature is modified, the air conditioner chooses the running function again.

DRYING Mode

Indoor Fan Speed is Fixed

Indoor fan speed is fixed at BREEZE and can not be changed. The louver angle is the same as in the COOLING mode.

Low Indoor Room Temperature Protection

In the DRYING mode, if the room temperature is lower than 50^0F (10^0C), the compressor stops and will not resume until the room temperature exceeds 53.6^0F (12^0C).

protection and outdoor unit frequency limit are active and the same as that in the COOLING mode.

Outdoor Fan

The outdoor fan operates the same as in the COOLING mode.

Forced Operation Function

When the air conditioner is off, press TOUCH to engage the Forced AUTO mode. Press TOUCH again within 5 seconds to engage the Forced COOLING mode. In the Forced AUTO, Forced COOLING or any other operation mode, press TOUCH to turn off the air conditioner.

Forced Operation Mode

In the Forced OPERATION mode, all the general protections and the remote controller are available.

Operation Rules

Forced Cooling Mode

The compressor runs at the F2 frequency and the indoor fan runs in the BREEZE mode. After running for 30 minutes. the air conditioner enters the AUTO mode at the 75.2^0F(24^0C) setting temperature.

Forced Auto Mode:

The Forced AUTO mode is the same as the normal AUTO mode with a 75.2^0F(24^0C) setting temperature.

Forced DEFROSTING Mode:

1. Press and hold AUTO/COOL for 5s to enter the mode. The indoor fan stops and the defrosting lamp illuminates. Use the remote controller to exit this mode and turn off the air conditioner to stop the normal DEFROSTING mode.
2. To exit the Forced DEFROSTING mode, press and hold AUTO/COOL for 5s again.

AUTO-RESTART Function

The indoor unit is equipped with the AUTO-RESTART function, which is carried out through an auto-restart module. In the event of a sudden power failure, the module memorizes the setting conditions prior to the power failure. The air conditioner resumes the previous operation setting (not including the SWING function) automatically three (3) minutes after the power returns.

If the memorization condition is the Forced COOLING mode, the air conditioner runs in the COOLING mode for 30 minutes and turns to the AUTO mode at the 75.2^0F(24^0C) setting temperature. If the air conditioner is off before the power turns off and the air conditioner is required to start up, the compressor delays start-up for 1 minute before powering on. In other instances, the compressor waits three (3) minutes before restarts.

Refrigerant Leakage Detection - Basic

With this new technology, the display area displays '**EL0C**' when the outdoor unit detects a refrigerant leak. This function is only active in the COOLING mode. The function can further prevent the compressor from being damaged by a refrigerant leak or a compressor overload.

- Open Condition: When the compressor is active, the value of the coil temperature of evaporator T2 experiences no to very little change.

Louver Position Memory Function

When starting the air conditioner again after a shut down, the louver returns to the angle originally set by the user, however the precondition is that the angle must be within the allowable range. If the louver exceeds the allowable range, the air conditioner memorizes the maximum angle of the louver. During operation, if the power fails or the end user shuts down the air conditioner in the TURBO mode, the louver returns to the default angle.

46^0F (8^0C) Heating

When the compressor is running, the indoor fan motor runs without the ANTI.COLD air function. When the compressor is off, the indoor fan motor is off.

Silence Operation

Press SILENCE on the remote controller to initiate the SILENCE function. When SILENCE is activated, the compressor running frequency remains lower than F2 and the indoor unit emits a faint breeze, which reduces the noise to the lowest level and creates a quiet and comfortable room for the user.

Inquiry Mode

Press and hold together the On/Off and Fan buttons for 8 seconds. The remote control remains in Inquiry Mode for 1 minute if no button is pressed. In the Inquiry Mode, the remote display cancels all icons except AUTO, COOL, DRY, HEAT and battery strength. The digital display defaults to '0' upon entering the Inquiry Mode. In Inquiry Mode, each digital code (from 0 to 30) is accessed by pressing the UP or DOWN arrow.

Refrigerant Leakage Detection - Leakage Sensor

The indoor unit is equipped with a refrigerant dissipation sensor. When a leak is detected either error code EH C1 (Leak Detected), or EH C2 (Leak Detected Sensor out of range) will be displayed on indoor display. The outdoor unit will shut off and the indoor fan will run at turbo speed, and louvers will fully open. An audible alarm will be triggered.

For single zone application, if refrigerant leak drops below LFL threshold audible alarm will reset after two minutes and the error code will clear after five minutes. Power cycling the outdoor unit (ODU) for five minutes will reset the audible alarm and the error code.

For multi-zone applications the outdoor unit will shut off, an emergency shutoff valve will close in the outdoor unit, all EEVs will close, and all indoor units will run at turbo fan speed. EH C1 or EH C2 will be displayed at the indoor unit detecting the leak. EC C1 will be displayed at indoor units not detecting a leak. An audible alarm will be triggered at indoor unit detecting the leak. If leak drops below LFL threshold the audible alarm will reset after two minutes, error codes will clear after five minutes, and emergency shutoff valve will automatically open after two and one half hours.

The shutoff valve time-lock can be bypassed by pushing and holding the point check button in the MZU for 10 seconds provided no leak is being detecting. Power cycling the MZU will not reset the time lock.

INQUIRY MODE

Accessing the INQUIRY Mode

⚠ CAUTION

Read and understand the function changes you wish to make in advance. Neither the indoor unit nor the remote control displays the new level of any of the changes made while in the INQUIRY mode. Be sure to document the changes you've made to the system's programming using the INQUIRY mode. Once you complete the changes and exit the INQUIRY mode, if additional changes are made to the programming, the system will not show the new previously set level(s).

For example, when you first access CODE 22, Heating Temperature Compensation, the remote control display defaults to 0. If you change it to -2, then save and exit out of the INQUIRY mode, the next time someone goes back in and accesses CODE 22, the remote's display will not display -2.

Instead it will show 0 because that's the default. If you are unsure of the previous changes, due to a lack of documentation, you could press the DOWN symbol to the maximum change range of -6, then press the UP symbol until you are back to 0, and make the new adjustments accordingly. Be sure to document the changes when you are done.

1. Simultaneously press ON/OFF and FAN SPEED for 8 seconds.
   a. The remote is now in the INQUIRY mode.
   b. The remote control remains in the INQUIRY mode for 1 minute if no other button is pressed.
   c. While in the INQUIRY Mode, the remote display cancels all icons except AUTO, COOL, DRY, HEAT and Battery Strength.
   d. The remote control digital display defaults to 0 upon entering the INQUIRY mode.
   e. In the INQUIRY mode, each digital code (from 0 to 30) is accessed by pressing the UP or DOWN arrows .
   f. The INQUIRY information appears on the high wall indoor unit display in approximately 1 second after accessing the digital code. Press OK to send as well.
   g. In the INQUIRY mode, all other buttons and operations are invalid except for UP, DOWN and OK or the operation to exit the INQUIRY mode.

Remote Controller Service Mode Functions

NOTE: While in the INQUIRY mode, refer to the following instructions to enter SERVICE mode for the applicable codes.

Below is a list of INQUIRY modes and serviceable functions.

a. Before using the remote's service functions, turn OFF the indoor unit with the remote.
b. Turn OFF the power to the outdoor unit for 2 minutes. Turn the power back ON.
c. Remove the batteries from the remote and wait for the remote screen to clear. Within 30 seconds of replacing the batteries, use UP or DOWN to scroll through the INQUIRY modes.
d. To enter the SERVICE mode for an applicable INQUIRY mode, press ON/OFF for 2 seconds.
e. After SERVICE adjustments have been made, press ON/OFF for 2 seconds to exit the SERVICE mode and return to the INQUIRY mode.
f. Once operations in the INQUIRY mode are complete, press ON/OFF and FAN SPEED for 2 seconds to exit. All buttons on the remote controller are disabled for 60 seconds
g. To ensure changes are locked, power down the outdoor unit for three (3) minutes after all the service mode changes are made.

Service Inquiry Codes

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
0		Error Code Check	SERVICE AND INQUIRY	Review error memory function. Displays "**Ch**". Press **OK** to send the query error code memory.	
1	T1	Indoor Ambient Temperature	SERVICE AND INQUIRY	Change the power off memory selection. This feature determines whether the unit memorizes the set conditions prior to a power failure. Displays **"Ch"**. Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings **1** and **0**.	Memory settings are off Memory settings are on
2	T2	Indoor Coil Temperature	SERVICE AND INQUIRY	Change the option to control the indoor fan operation after reaching the set temperature. Displays "**Ch**". Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings 1 through 11. Next, press **OK** to confirm the selection.	Stop the fan Minimum fan speed Set speed - intermittent fan-off 4 minutes/on 1 min Terminate after run time of 10 mins Terminate after run time of 15 mins Terminate after run time of 20 mins Terminate after run time of 30 mins Terminate after run time of 40 mins Terminate after run time of 50 mins Terminate after run time of 60 mins
3	T3	Outdoor Coil Temperature	SERVICE AND INQUIRY	Change the option to control the **COOLING** and **HEATING** modes available for use on the unit. Press **UP** or **DOWN** to cycle through the settings **CH**, **HH**, **CC** or **nU**. Press **OK** to confirm.	**CH** - **COOLING** and **HEATING**: **AUTO**, **COOLING**, **DRY**, **HEATING** and **FAN** modes available **HH** - **HEATING** Only: **HEATING** and **FAN** modes available **CC** - **COOLING** without **AUTO**: **COOLING**, **DRY** and **FAN** modes available **nU** - **COOLING** and **HEATING** without **AUTO**: **COOLING**, **DRY**, **HEATING** and **FAN** modes available
4	T4	Outdoor Ambient Temperature	SERVICE AND INQUIRY	Change the selection of the lowest set temperature. NOTE: Temperature range is 60°F ~ 75°F (16°C ~ 24°C). Press **UP** or **DOWN** to select temperature setting. Press **OK** to confirm.	
5	TP (T5)	Compressor Discharge Temperature	SERVICE AND INQUIRY	Change the selection of the highest set temperature. NOTE: Temperature range is 77°F ~ 86°F (25°C ~ 30°C). Press **UP** or **DOWN** to select the temperature setting. Press **OK** to confirm.	
6	FT	Compressor target frequency	INQUIRY ONLY		
7	Fr	Compressor run frequency	INQUIRY ONLY		
8	dL	Unit amperage	SERVICE AND INQUIRY	Change the static pressure selection. Displays "**Ch**". Press **OK** to return the current setting. Press **UP** or **DOWN** to cycle through settings **0** through **4** or **AF** (constant air volume test). Press **OK** to confirm.	Only available on ducted air handler units. Refer to the ducted air handler installation manuals for Fan performances at varying static pressures for airflow settings.
9	Uo	Unit voltage	INQUIRY ONLY		
10	Sn	Capacity test (special usage)	INQUIRY ONLY		
11	----	Not available	INQUIRY ONLY		
12	Pr	Indoor fan speed	SERVICE AND INQUIRY	Change the heating frequency lower limit selection. Displays "**Ch**". Press **OK** to return the current heating minimum frequency limit selection code. Press **UP** and **DOWN** to select the minimum heating frequency limit value. Press **OK** to confirm.	

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
13	Lr	Electronic Expansion Valve (EEV) opening	SERVICE AND INQUIRY	Change the maximum operating frequency of T4 Cooling Only intervals. Displays “**Ch**”. Press **OK** to return the current operating frequency code of the T4 Cooling Only intervals. Press **UP** or **DOWN** to select the limit value and then press **OK**.	
14	ir	Indoor fan speed	INQUIRY ONLY		Multiple the display number by 8 to calculate the actual RPM
15	HU	Relative Humidity	INQUIRY ONLY		Available in INQUIRY mode for the high tier/new mid tier units that have an RH sensor.
16	TT	Setpoint compensation temperature	INQUIRY ONLY		
17	dT	Dust concentration (not used)	INQUIRY ONLY		
18	WIFI	Wi-Fi signal strength	INQUIRY ONLY		The value is measured in **dBm**. The display values are 0, 1, 2, 3 and 4 (4 is the highest and 0 is the lowest)
19	----	Not available	SERVICE ONLY	Change the cooling frequency upper limit selection in Hz. Displays **“Ch”**. Press **OK** to return the current frequency limit. Press **UP** or **DOWN** to select the preferred frequency upper limit value (in Hz). Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 40 and 84 Hz. If set to 50, the unit will now be limited to operating between 40 and 50 Hz.
20	oT	Indoor fan target frequency	SERVICE AND INQUIRY	Change the heating frequency upper limit selection in Hz. Displays “**Ch**”; press **OK** to return the current frequency limit. Press **UP** or **DOWN** to select the preferred frequency upper limit value (in Hz). Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 40 and 84 Hz. If set to 50, the unit is limited to operating between 40 and 50 Hz.
21	----	Cooling Temperature Compensation	SERVICE ONLY	Change the cooling temperature compensation value. Displays “**Ch**”. Press **OK** to return the current temperature compensation value code. Press **UP** or **DOWN** to select the cooling temperature difference compensation value. Press **OK** to confirm.	This setting is used to adjust for temperature differences due to the height of the unit install. The offset value can be set at a range of -6° to +6°.
22	----	Heating Temperature Compensation	SERVICE ONLY	Change the heating temperature compensation value. Displays “**Ch**”. Press **OK** to return the current temperature compensation value code. Press **UP** or **DOWN** to select the heating temperature difference compensation value. Press **OK** to confirm.	This setting is used to adjust for temperature differences due to the height of unit installation. The offset value can be set at a range of -6° to +6°.
23	----	Maximum Cooling Fan Speed	SERVICE ONLY	Change the maximum cooling fan speed setting as it relates to RPM. Displays “**Ch**”. Press **OK** to return the current maximum cooling fan speed setting. Press **UP** or **DOWN** to select the maximum cooling fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 800, the unit is limited to operating between 300 and 800 RPM. (reserved for AHUs and slim ducts)
24	----	Minimum Cooling Fan Speed	SERVICE ONLY	Change the minimum cooling fan speed setting as it relates to RPM. NOTE: Changing this setting is not recommended as it may trigger unit protection protocols. Displays “**Ch**”. Press **OK** to return the current minimum cooling fan speed setting. Press **UP** or **DOWN** to select the minimum cooling fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 500, the unit is limited to operating between 500 and 1000 RPM.

CODE	INQUIRY	INQUIRY DESCRIPTION	SERVICE/ INQUIRY	FOR SERVICE, PRESS ON/OFF FOR 2 SECONDS TO:	SELECTION GUIDE/NOTES
25	----	Maximum Heating Fan Speed	SERVICE ONLY	Change the maximum heating fan speed setting as it relates to RPM. Displays "**Ch**". Press **OK** to return the current maximum heating fan speed setting. Press **UP** or **DOWN** to select the maximum heating fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 800, the unit will now be limited to operating between 300 and 800 RPM. (reserved for AHUs and slim ducts)
26	----	Minimum Heating Fan Speed	SERVICE ONLY	Change the minimum heating fan speed setting as it relates to RPM. Note: Changing this setting is not recommended as it may trigger unit protection protocols. Displays "**Ch**". Press **OK** to return the current minimum heating fan speed setting. Press **UP** or **DOWN** to select the minimum heating fan speed. Press **OK** to confirm.	For example, the unit may be factory set to fluctuate between 300 and 1000 RPM. If set to 500, the unit is limited to operating between 500 and 1000 RPM.
27	----	Not available			
28	----	Not available			
29	----	Not available			
30	----	Not available			

To exit the Inquiry Mode:

Press and hold together the On/Off and Fan buttons  for 2 seconds.

GENERAL TROUBLESHOOTING

SAFETY

WARNING

ELECTRICAL SHOCK HAZARD

Be sure to turn off all power supplies or disconnect all wires to avoid electric shock. While checking indoor/outdoor PCB, equip yourself with anti-static gloves or wrist strap to avoid damage to the board. Follow lockout procedures and all safety measures.

WARNING

ELECTRICAL SHOCK HAZARD

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

NOTE: Remember to discharge the electrical power in capacitor.

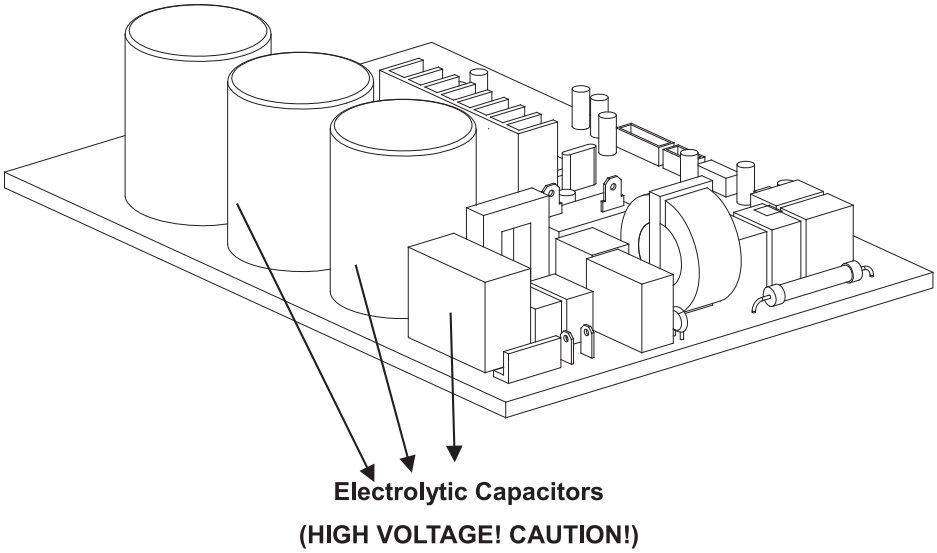


Fig. 16 —Electrolytic Capacitors

For other models, please connect discharge resistance (approximately 100ƒÇ 40W) or a soldering iron (plug) between the +, - terminals of the electrolytic capacitor on the contrary side of the outdoor PCB.

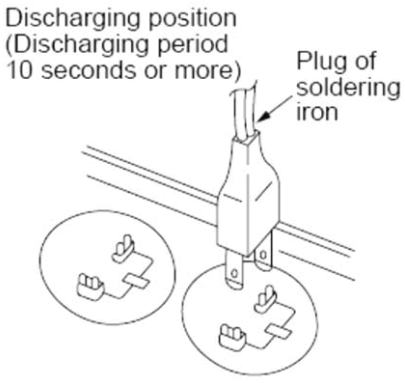


Fig. 17 —Discharge Position

NOTE: Figure is for reference only. The plug on your unit may differ.

Inverter Test Tool

NOTE: If using the inverter test tool for troubleshooting, shut off power, remove the electrical panel and locate the cable that is already connected to the test port on the outdoor unit. Connect the test tool to the cable with the connector provided with the test tool. After the maintenance is completed, insert the female end back into the port.

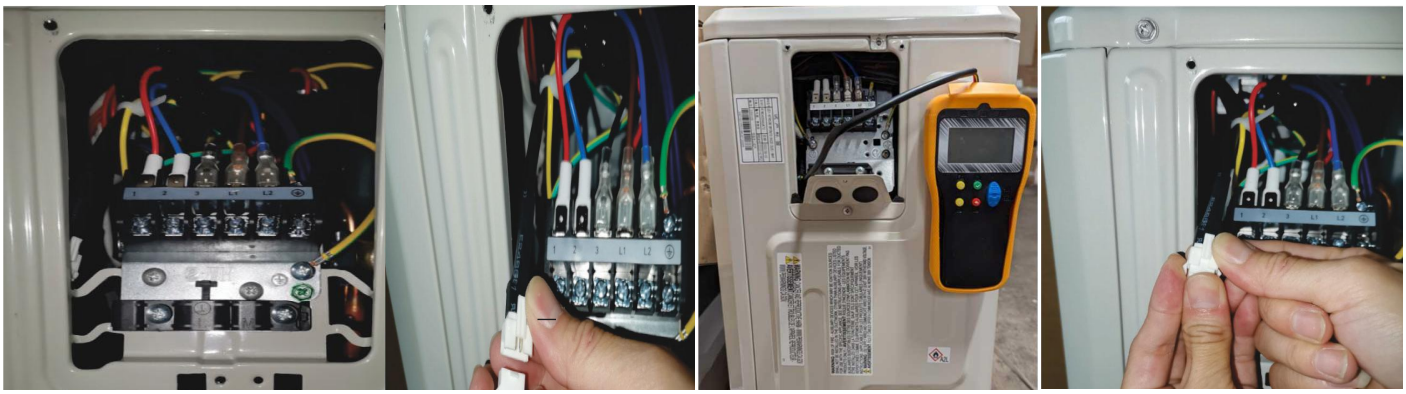


Fig. 18 —Inverter Test Tool Maintenance

Connect the Dr. SMART tool to the white terminal as shown in Step 3 above.

Fig. 19 —Dr. SMART Tool

NOTE: These pictures is for reference only. Actual appearance may vary.

INDOOR UNIT DIAGNOSTIC GUIDES

When the indoor unit encounters a recognized error, the operation lamp will flash in a corresponding series, the timer lamp may turn on or begin flashing, and an error code will be displayed.

Table 4 — Error Codes

DISPLAY	MALFUNCTION AND PROTECTION INDICATION
EC07	ODU fan speed out of control
EC0d	ODU malfunction
EC51	ODU EEPROM parameter error
EC52	ODU coil temp sensor error
EC53	ODU ambient temp sensor error
EC54	COMP. discharge temp sensor error
EC5b	IDU coil outlet temp sensor error
ECC1	Other IDU refrigerant sensor detects leakage (multi-zone)
EH00	IDU EEPROM malfunction
EH03	IDU fan speed out of control
EH0A	IDU EEPROM parameter error
EH0b	IDU main control and display boards communication error
EH0E	Water-level alarm malfunction
EH3A	External fan DC bus voltage is too low protection
EH3b	External fan DC bus voltage is too high fault
EH60	IDU room temp. sensor (T1) error
EH61	IDU coil temp. sensor (T2) error
EH62/EH66	Evaporator coil inlet temp. sensor (T2B) is in open circuit or short circuit
EH65	Evaporator coil inlet temp. sensor (T2A) is in open circuit or short circuit
EHbA	Communication error between indoor unit and external fan module
EHb3	Communication malfunction between wire and master control
EHC1	Refrigerant sensor detects leakage
EHC2	Refrigerant sensor is out of range and leakage is detected
EHC3	Refrigerant sensor is out of range
EL01	IDU & ODU communication error
EL0C	System lacks refrigerant
EL16	Communication malfunction between adapter board and outdoor main board
FHCC	Refrigerant sensor error
FL09	Mismatch between the new and old platforms
PC00	ODU IPM module protection
PC01	ODU voltage protection
PC02	Compressor top (or IPM) temp. protection
PC03/PC30 PC31	PC03 Pressure Protection, PC30 (High Pressure), and PC31 (Low Pressure)
PC04	Inverter compressor drive error
PC0L	Low ambient temp. protection
NOTE: The digital tube will show DF in defrost mode and FC in forced cooling mode. DF and FC are not error codes.	

Table 5 — Refrigerant Leak Detection Error Codes

EHC1	Refrigerant Sensor detects a leak
EHC2	Working condition of the refrigerant sensor is out of range and a leak is detected

If **you receive one of the codes in Table 5, call a technician as soon as possible. No need to panic, the unit goes into TURBO mode until the error code clears. There is a "beeping" noise coming from the indoor unit, which is normal in this case.**

QUICK MAINTENANCE BY ERROR CODE

Part Requiring Replacement	Error Code									
	EH 00/ EH 0A	EL 01	EH 02	EH 03	EH 60	EH 61	EH 0b	EL 0C	EC 56	FH CC
Indoor PCB	√	√	√	√	√	√	√	√	x	√
Outdoor PCB	x	√	x	x	x	x	x	x	√	x
Display board	x	x	x	x	x	x	√	x	x	x
Indoor fan motor	x	x	x	√	x	x	x	x	x	x
T1 sensor	x	x	x	x	√	x	x	x	x	x
T2 Sensor	x	x	x	x	x	√	x	√	x	x
T2B Sensor	x	x	x	x	x	x	x	x	√	x
Refrigerant sensor	x	x	x	x	x	x	x	x	x	√
Reactor	x	√	x	x	x	x	x	x	x	x
Compressor	x	x	x	x	x	x	x	x	x	√
Additional refrigerant	x	x	x	x	x	x	x	√	x	x

Part Requiring Replacement	EC 53	EC 52	EC 54	EC 51	EC 07	PC 00	PC 01	PC 02	PC 03	PC 04
Outdoor PCB	√	√	√	√	√	√	√	√	√	√
Indoor fan motor	x	x	x	x	x	x	x	x	x	x
Outdoor fan motor	x	x	x	x	√	√	x	√	x	√
T3 Sensor	x	√	x	x	x	x	x	x	x	x
T4 Sensor	√	x	x	x	x	x	x	x	x	x
TP Sensor	x	x	√	x	x	x	x	x	x	x
Reactor	x	x	x	x	x	x	√	x	x	x
Compressor	x	x	x	x	x	√	x	x	x	√
IPM module board	x	x	x	x	x	√	√	√	x	√
High pressure protector	x	x	x	x	x	x	x	√	x	x
Low pressure protector	x	x	x	x	x	x	x	x	√	x
Additional refrigerant	x	x	x	x	x	x	x	x	√	x

Part Requiring Replacement	pc 06	pc 08/44/ 49	pc 0a	pc 0f	PC 40
Outdoor PCB	✓	✓	✓	✓	✓
Outdoor fan motor	x	✓	✓	x	x
T3 Sensor	x	x	✓	x	x
TP Sensor	✓	x	x	x	x
Pressure sensor	x	x	x	x	x
Reactor	x	✓	x	✓	x
Compressor	x	x	x	x	x
IPM module board	x	✓	x	x	✓
High pressure valve assy	✓	x	x	x	x
High pressure protector	x	x	x	x	x
Low pressure protector	x	x	x	x	x
Additional refrigerant	✓	x	✓	x	x
Electric control box	x	x	x	x	✓

Part Requiring Replacement	PC 41	PC 43	PC 10/11/12	PC 30	PC 31
Outdoor PCB	✓	✓	✓	✓	✓
Outdoor fan motor	x	x	x	✓	x
T3 Sensor	x	x	x	x	x
TP Sensor	x	x	x	x	x
Pressure sensor	x	x	x	x	x
Reactor	x	x	✓	x	x
Compressor	x	✓	x	x	x
IPM module board	x	x	✓	x	x
High pressure valve assy	x	x	x	x	x
High pressure protector	x	x	x	✓	x
Low pressure protector	x	x	x	x	✓
Additional refrigerant	x	x	x	x	✓

TROUBLESHOOTING BY ERROR CODE

EH 00/ EH 0A / 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:

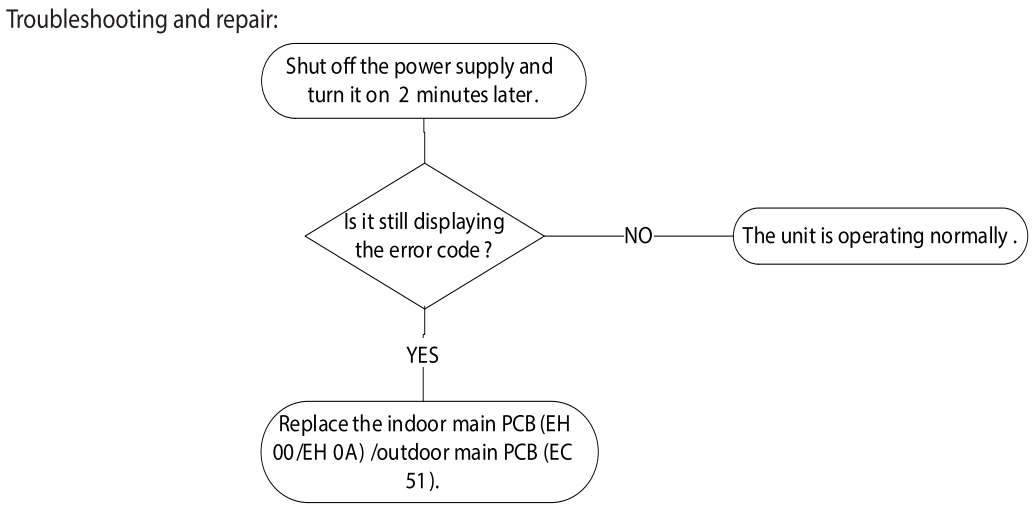


Fig. 20 —EC 51

Remarks:

EEPROM: A read-only memory whose contents can be erased and reprogrammed using a pulsed voltage.

The location of the EEPROM chip on the outdoor PCB is shown in the following image:

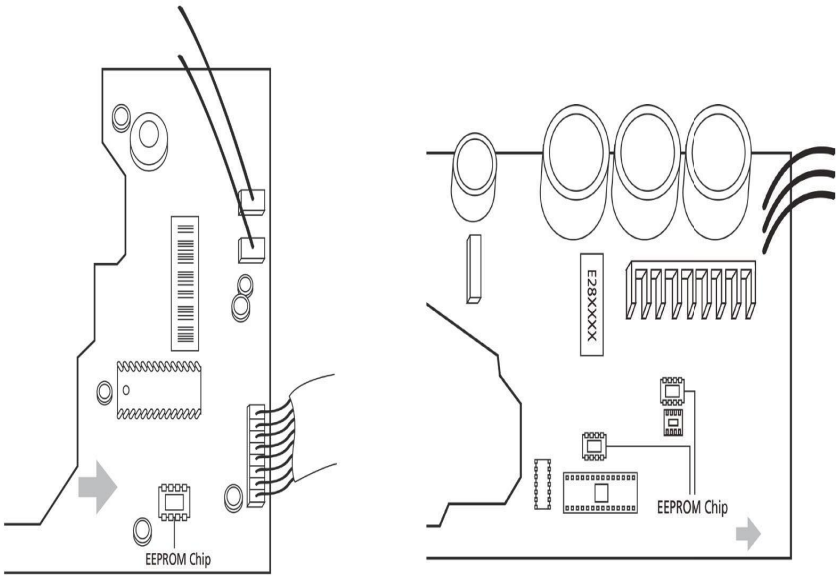


Fig. 21 —Location of EPROM Chip

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

IMPORTANT: Troubleshooting and repair of compressor driven chip EEPROM parameter error sand communication errors between outdoor main chip and compressor driven chip are same as EC 51.

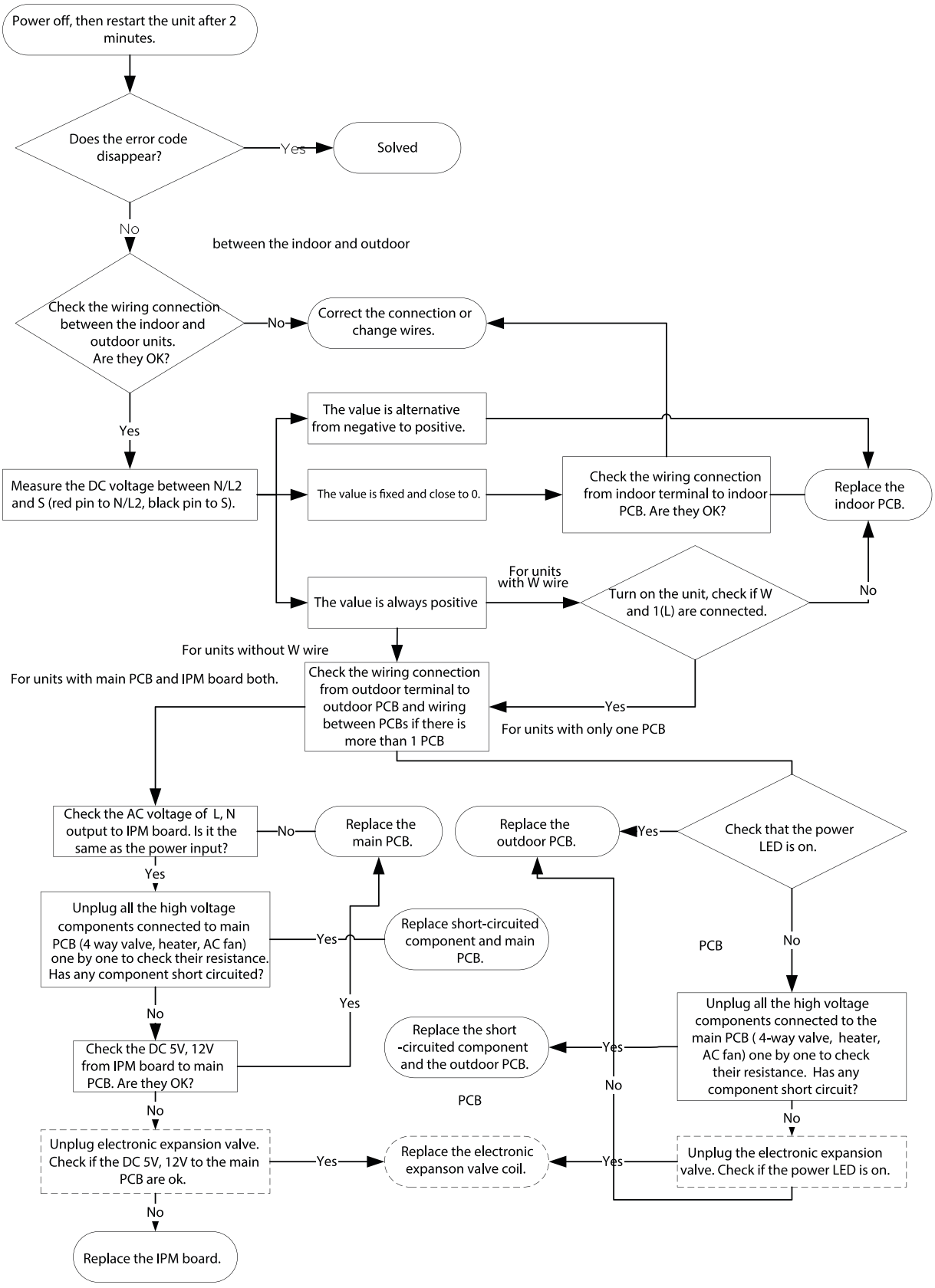
EL 01 (Indoor and Outdoor Unit Communication Error Diagnosis and Solution)

Description: Indoor unit can not communicate with outdoor unit

Recommended parts to prepare: Signal Wires, Magnetic Ring, Indoor PCB, Outdoor PCB

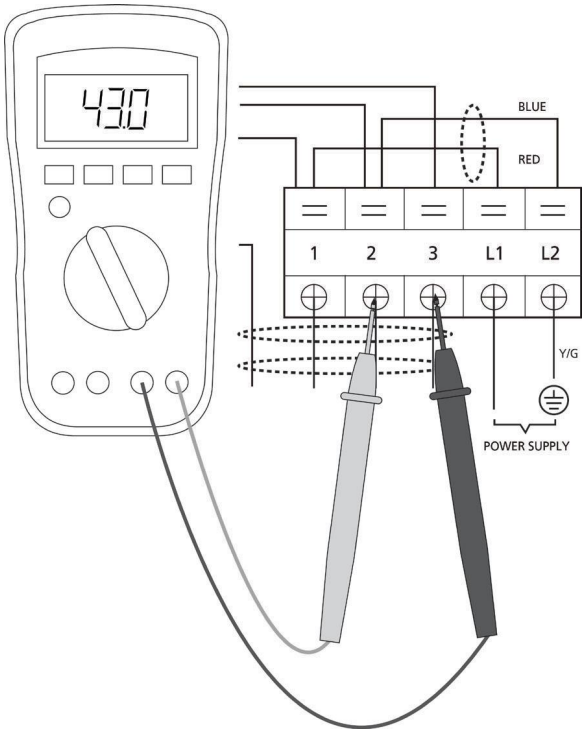
Troubleshooting and repair: RS 485 Communication

:



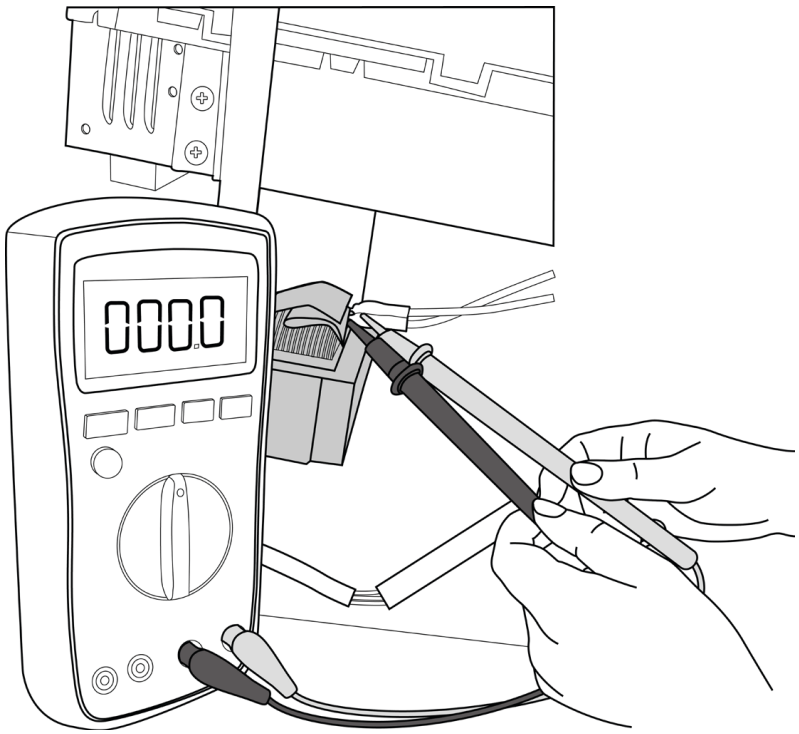
Remarks:

- Use a multimeter to test the DC voltage between the 2 port (or S or L2 port) and 3 port (or N or S port) of the outdoor unit.
- The red pin of multimeter connects with 2 port (or S or L2 port) while the black pin is for 3 port (or N or S port) the unit is running normal, the voltage is moving alternately as positive values and negative values.
- If the outdoor unit malfunctions, the voltage remains in a narrow positive value.
- If the indoor unit malfunctions, the voltage maintains a fixed value.



S and N
or
L2 and S
or
2 and 3

- Use a multimeter to test the reactor's resistance which does not connect with capacitor.
- The normal value should be around zero ohm. Otherwise, the reactor has malfunctioned. Check the reactor and make sure it is not shorted to the ground.

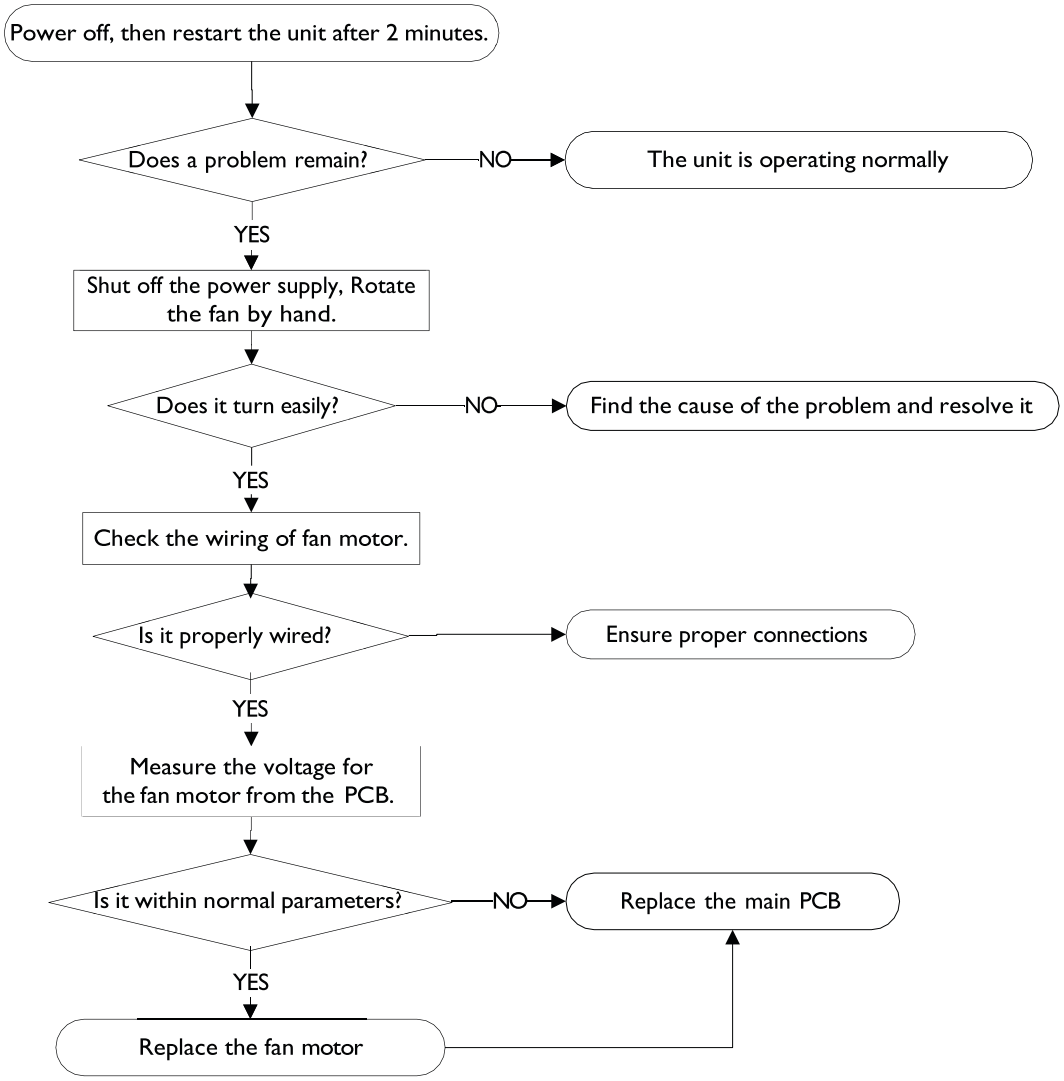


EH03 / EC 07 (Fan Speed Is Operating Outside of Normal Range Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, Fan assembly, Fan motor, PCB

Troubleshooting and repair:



Index

1. Indoor or Outdoor DC Fan Motor (control chip is in fan motor)
   With the power on and when 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 shown in below table, the PCB needs 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

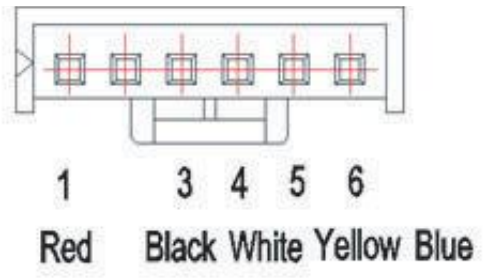


Fig. 22 —Fan Motor Connector, Pin Location

2. Outdoor DC Fan Motor (control chip is in outdoor PCB)
   Release the UVW connector. Measure the resistance of U-V, U-W, V-W. If the resistances are not equal to each other, the fan motor needs to be replaced. Otherwise, the PCB needs to be replaced.

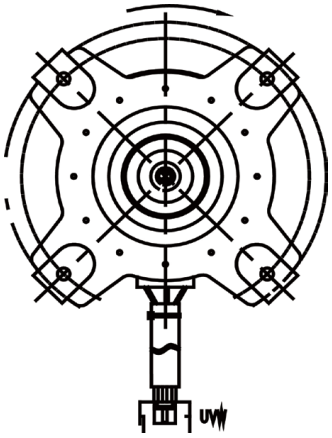


Fig. 23 —UVW Connector

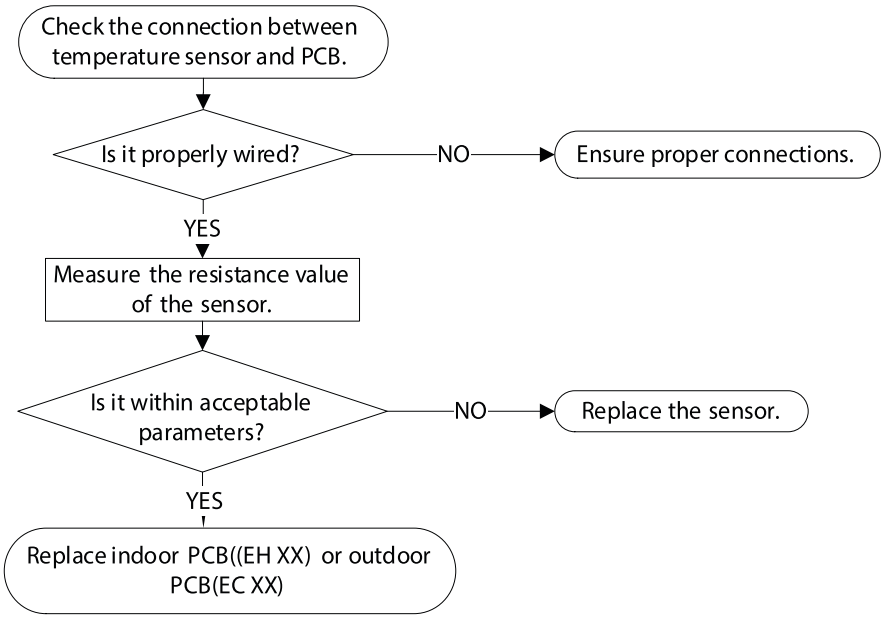
EH 60/EH 61/EH 62/EH 66/EH 65/EC 53/EC 52/EC 54/EC 56 (Open Circuit or Short Circuit of Temperature Sensor Diagnosis and Solution)

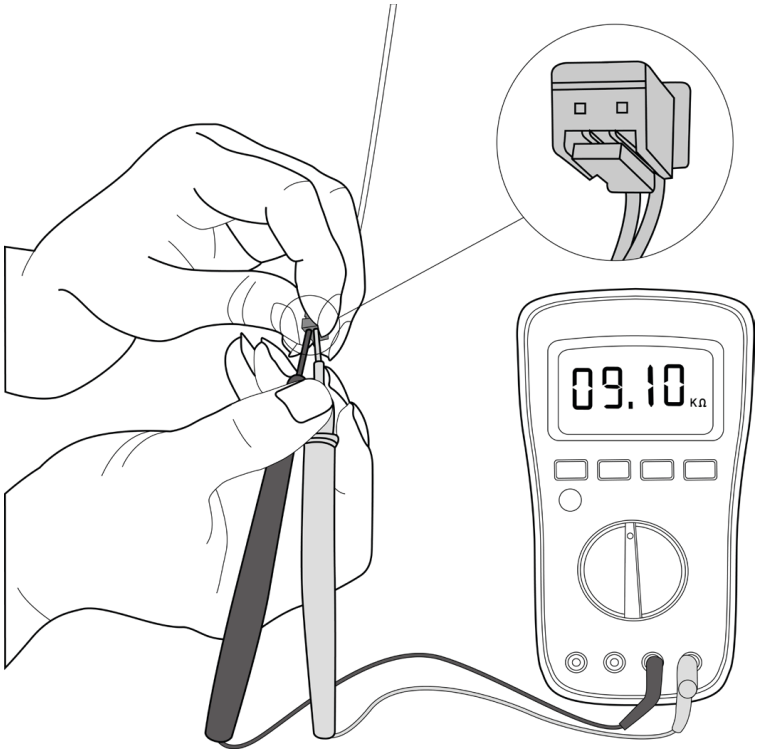
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED displays the failure.

Recommended parts to prepare: Connection wires, Sensors, PCB

Troubleshooting and repair:

Refer to Appendix, page 67.





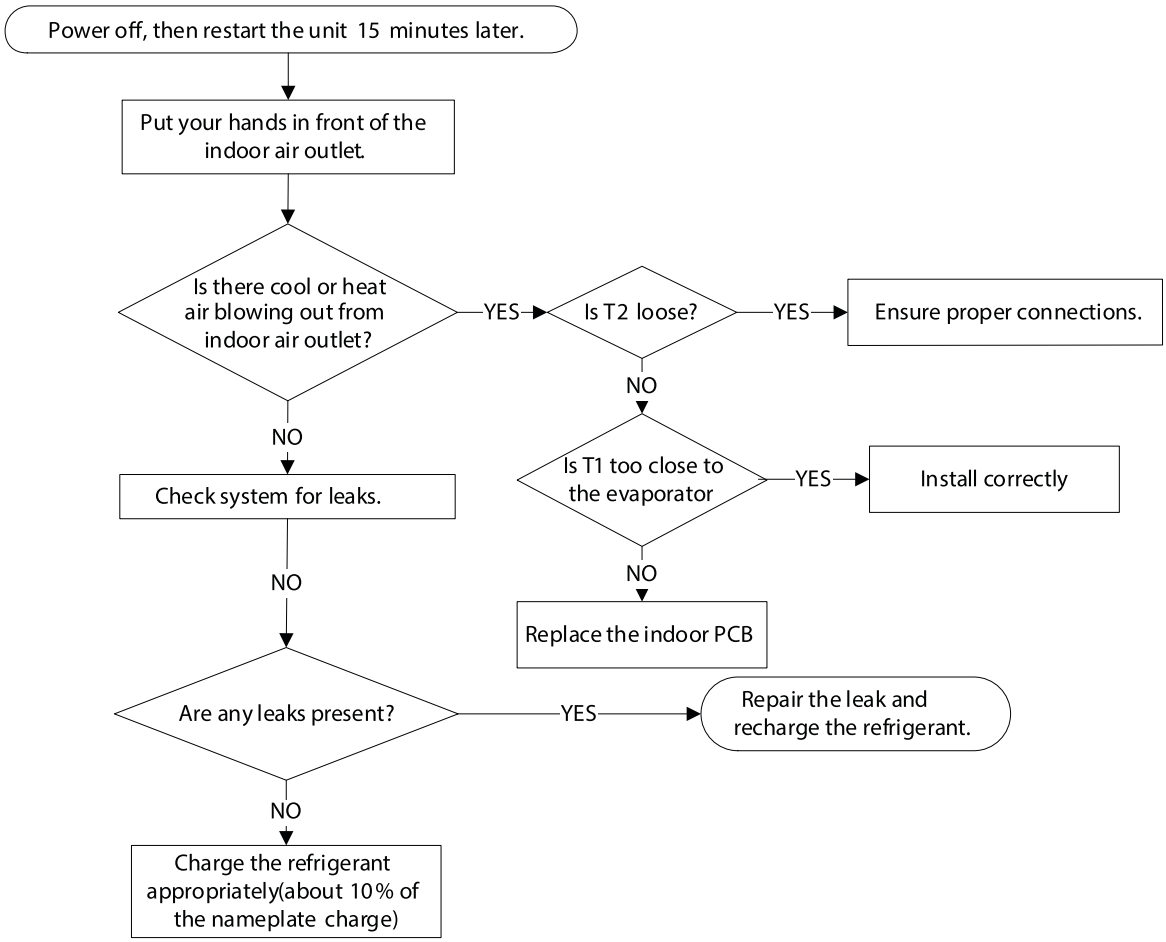
NOTE: This picture and the value are only for reference, actual appearance and value may vary.

EL 0C (System Lacks Refrigerant Diagnosis and Solution)

Description: Judging the abnormality of the refrigeration system according to the number of compressor stops and the changes in operating parameters caused by excessive exhaust temperature.

Recommended parts to prepare: Indoor PCB, Additional refrigerant

Troubleshooting and repair:



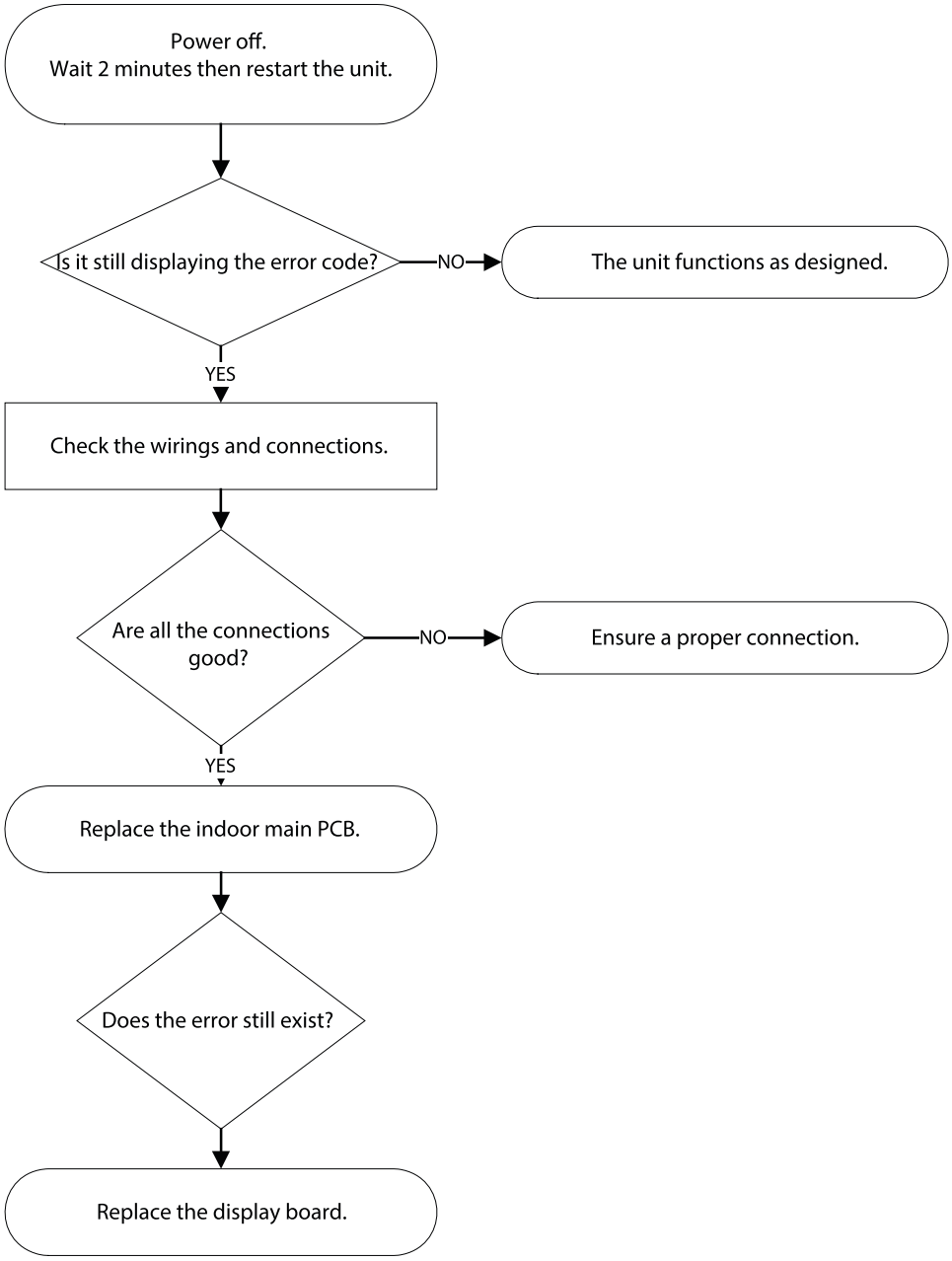
EH 06

Indoor PCB/Display Board Communication Error (EH06)

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

Recommended parts to repair: Communication wire, Indoor PCB, Display board

Troubleshooting

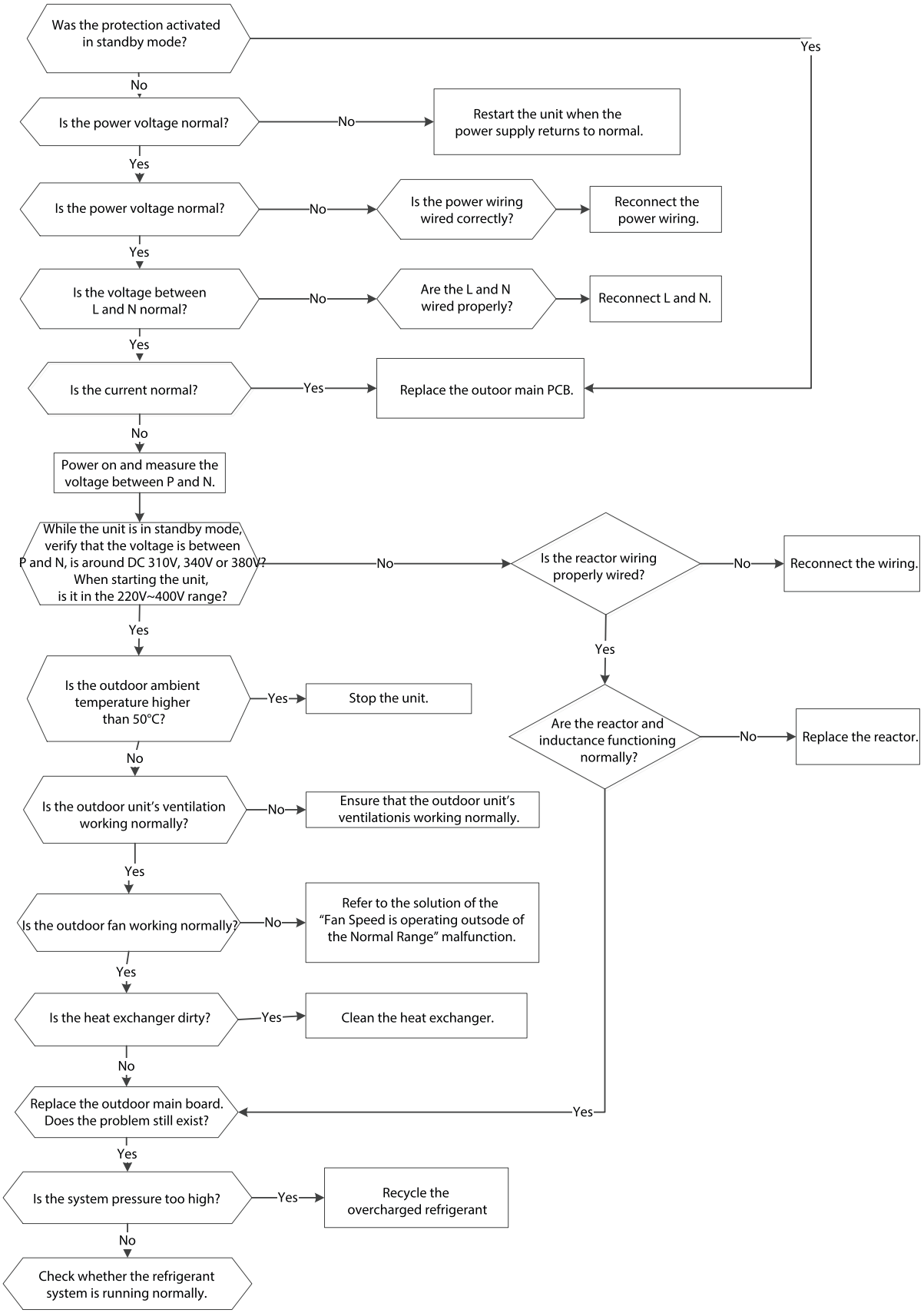


PC 08 Current Overload Protection

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

Recommended parts to repair: Communication wires, Reactor, Outdoor fan, Outdoor PCB

Troubleshooting

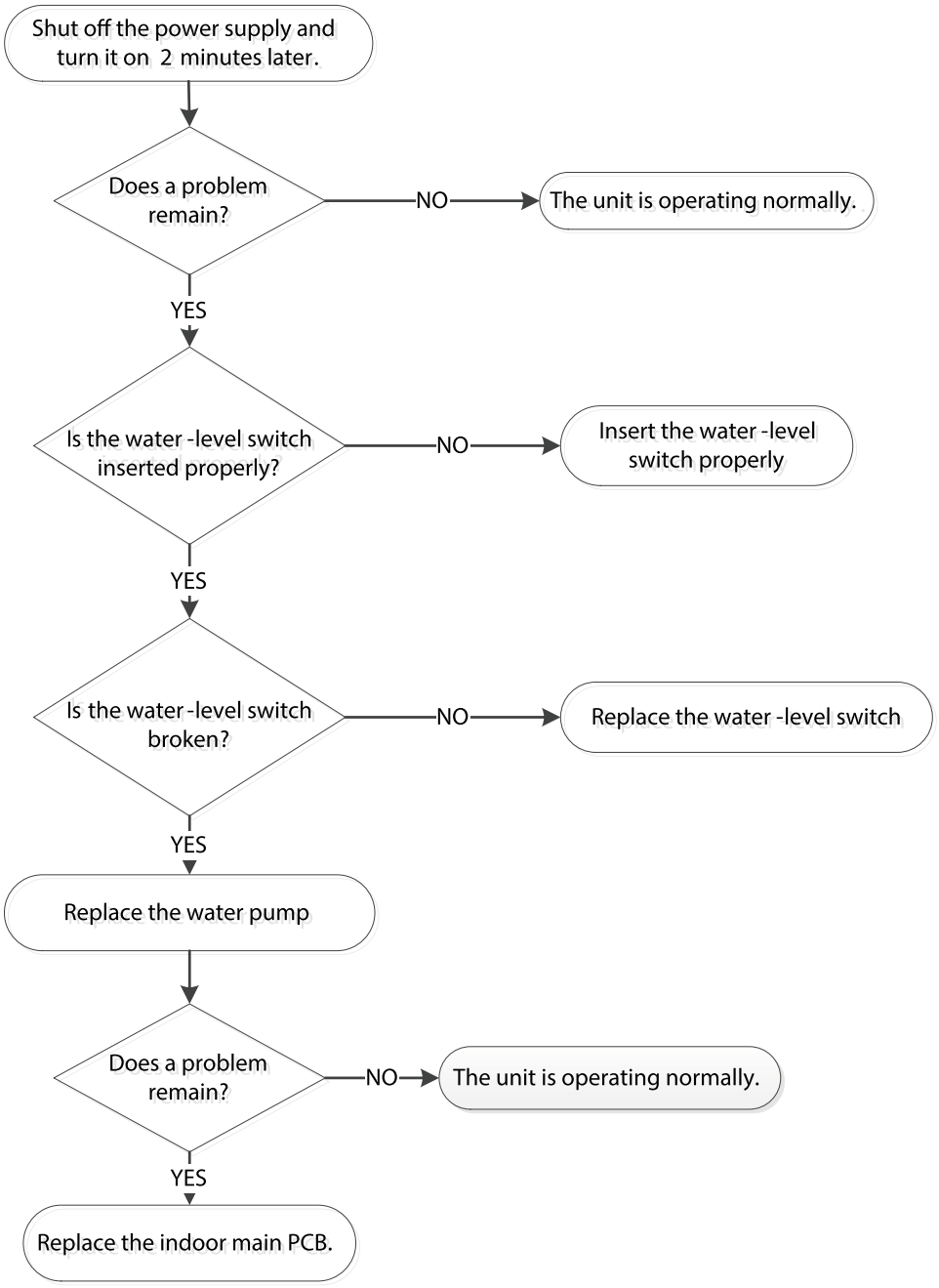


EH 0E (Water-Level Alarm Malfunction Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, Water-level switch, Water pump, Indoor PCB

Troubleshooting and repair:

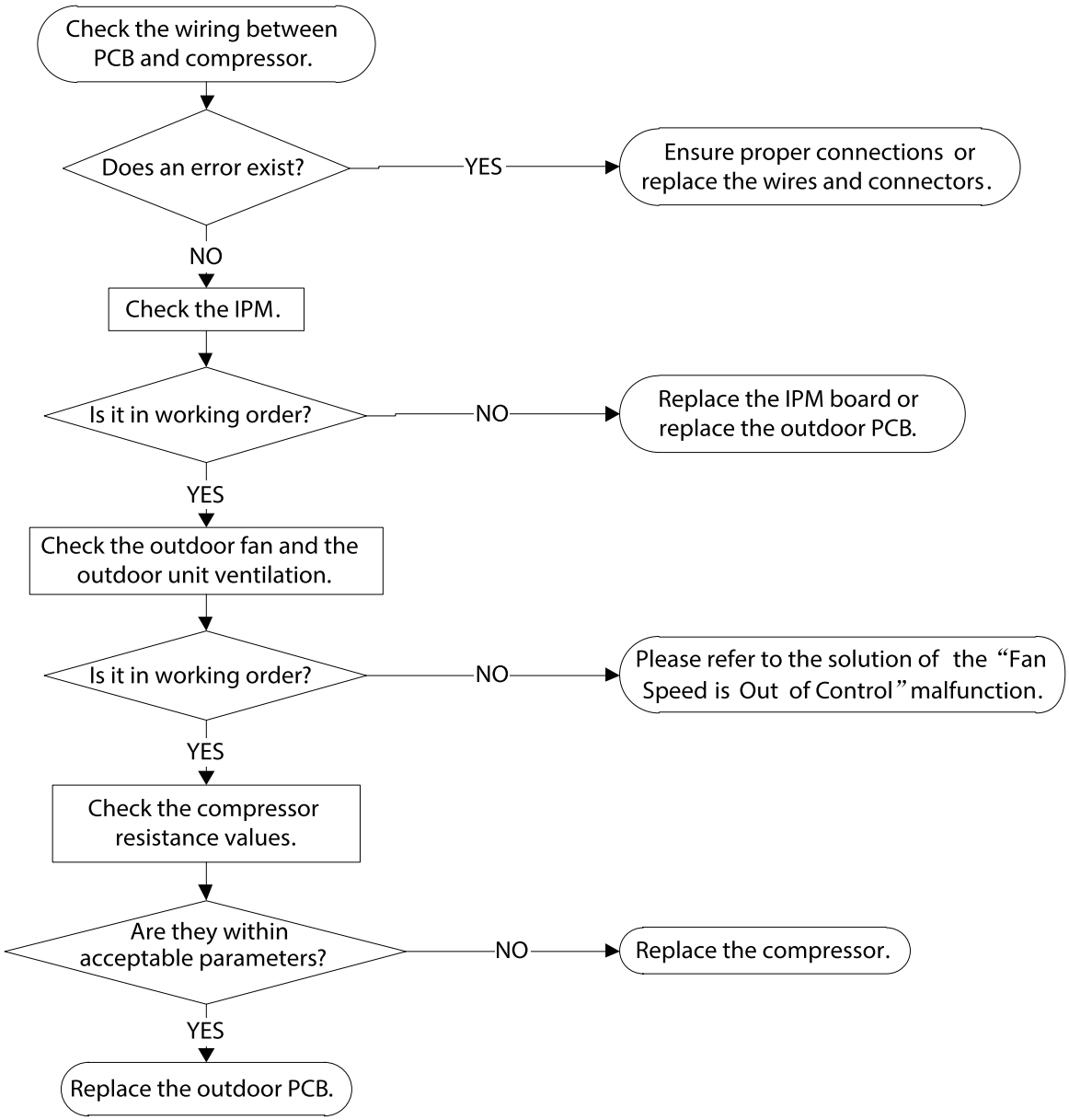


PC 00 (ODU IPM Module Protection Diagnosis and Solution)

Description: When the voltage signal the IPM sends to the compressor drive chip is abnormal, the display LED shows "PC 00" and the AC turn off.

Recommended parts to prepare: Connection wires, IPM module board, Outdoor fan assembly, Compressor, Outdoor PCB

Troubleshooting and repair:



IPM Continuity Check

⚠ WARNING

ELCTRICAL SHOCK HAZARD

Electricity remains in the 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 the electrolytic capacitors and ensure all the energy storage has been discharge.
3. Disassemble the outdoor PCB or disassemble the IPM board.
4. Measure the resistance value between P and U (V,W,N), U (V,W) and N.

Table 6 – Resistance Value

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

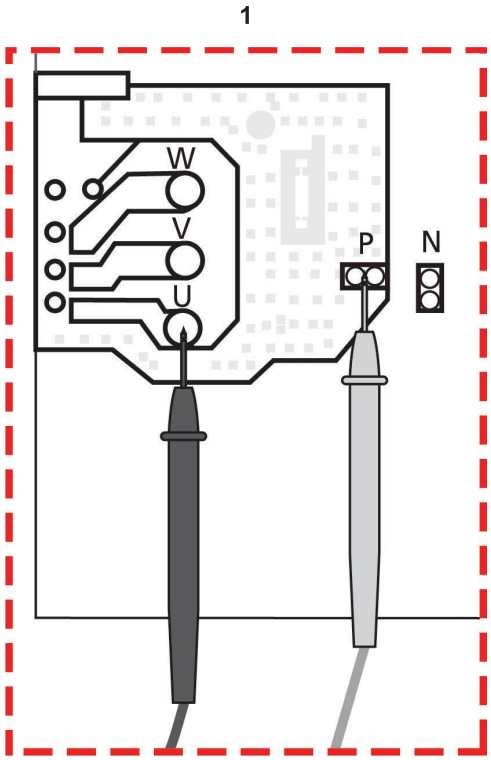


Fig. 24 —Resistance Value

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 tables 9 through 12:

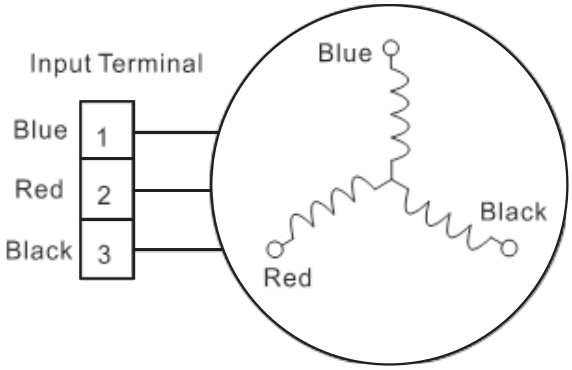


Fig. 25 —Compressor Check

Table 7 – Resistance Values

Resistance Value	KSN140D58UFZ	KTF250D22UMT	KTM240D46UKT2	KTF310D43UMT	MTH550UKPC8FU
Blue-Red	1.86Ω	0.75Ω	1.04Ω	0.65Ω	0.295Ω
Blue-Black					
Red-Black					

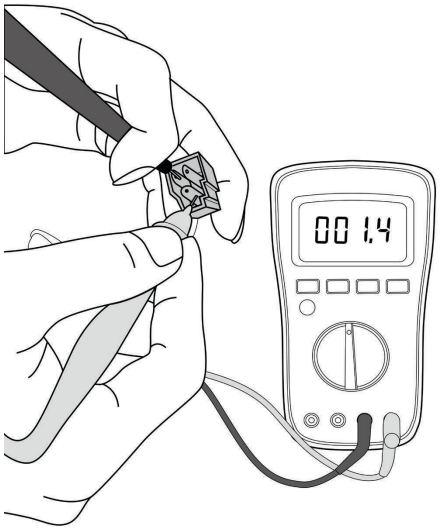


Fig. 26 —Resistance Check

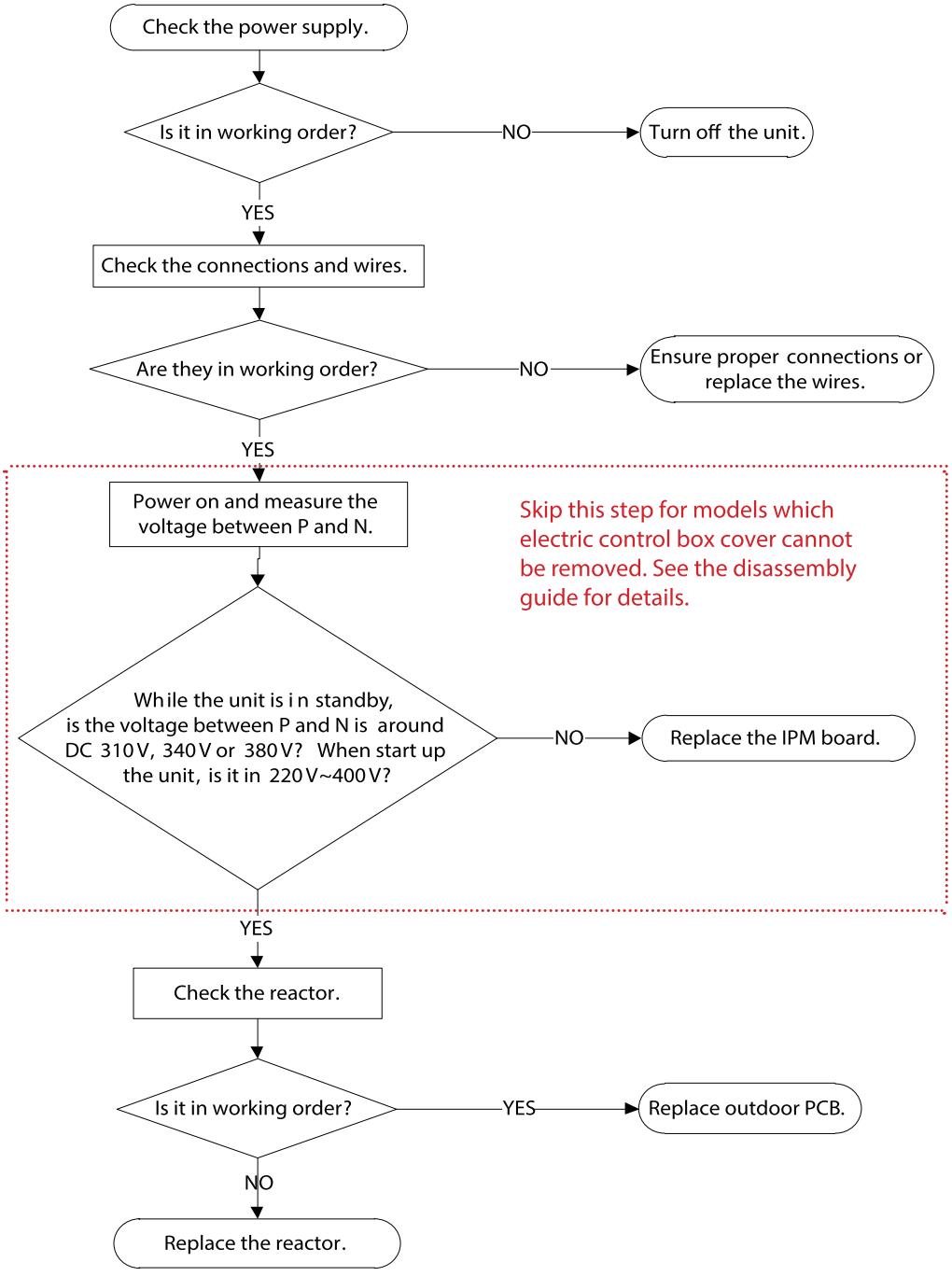
NOTE: The picture and the value are only for reference, actual condition and specific value may vary.

PC 01 (ODU Voltage Protection Diagnosis and Solution)

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

Recommended parts to prepare: Power supply wires, IPM module board, PCB, Reactor

Troubleshooting and repair:

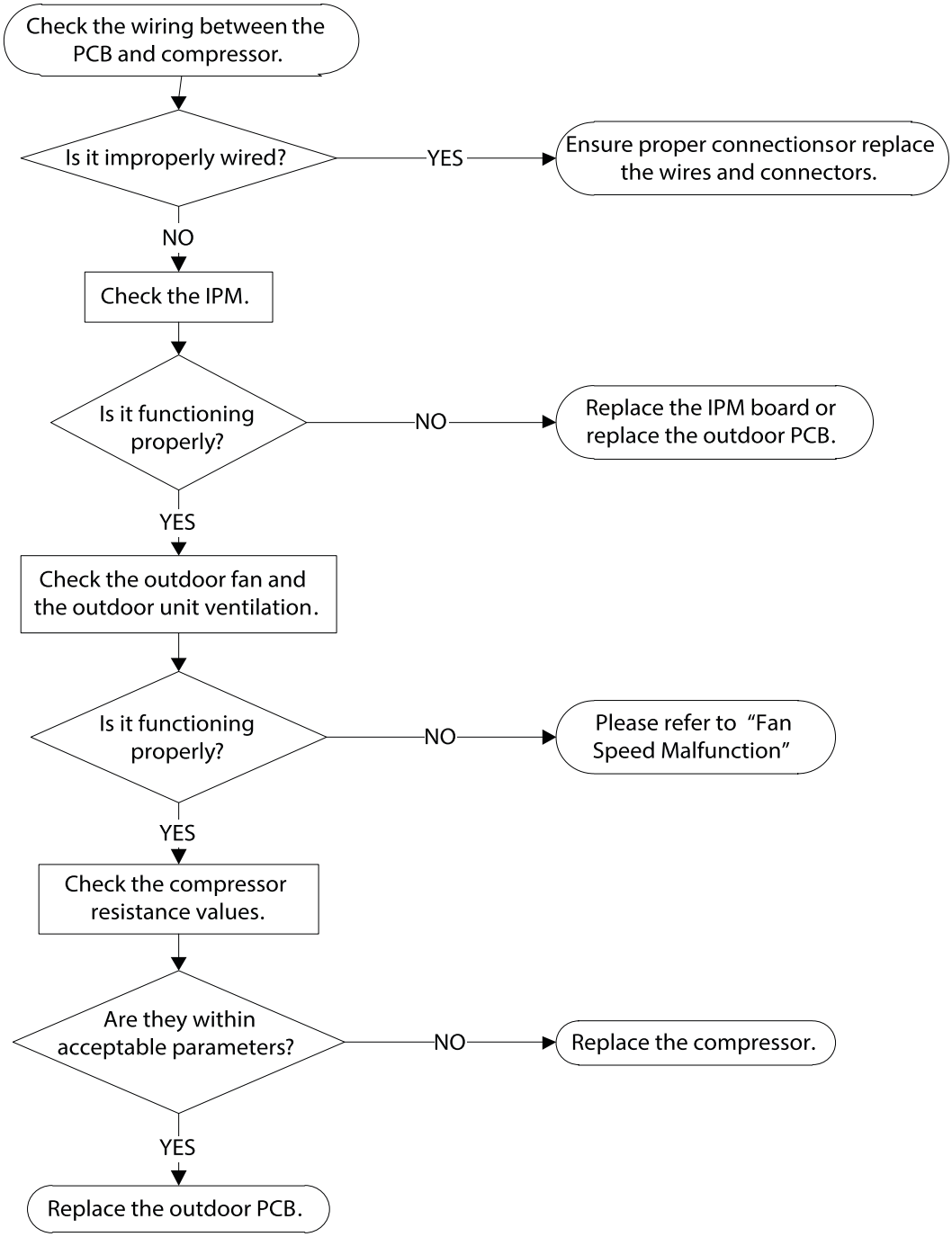


PC 04 (Inverter Compressor Drive Error Diagnosis and Solution)

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

Recommended parts to prepare: Connection wires, IPM module board, Outdoor fan assembly, Compressor, Outdoor PCB

Troubleshooting and repair:

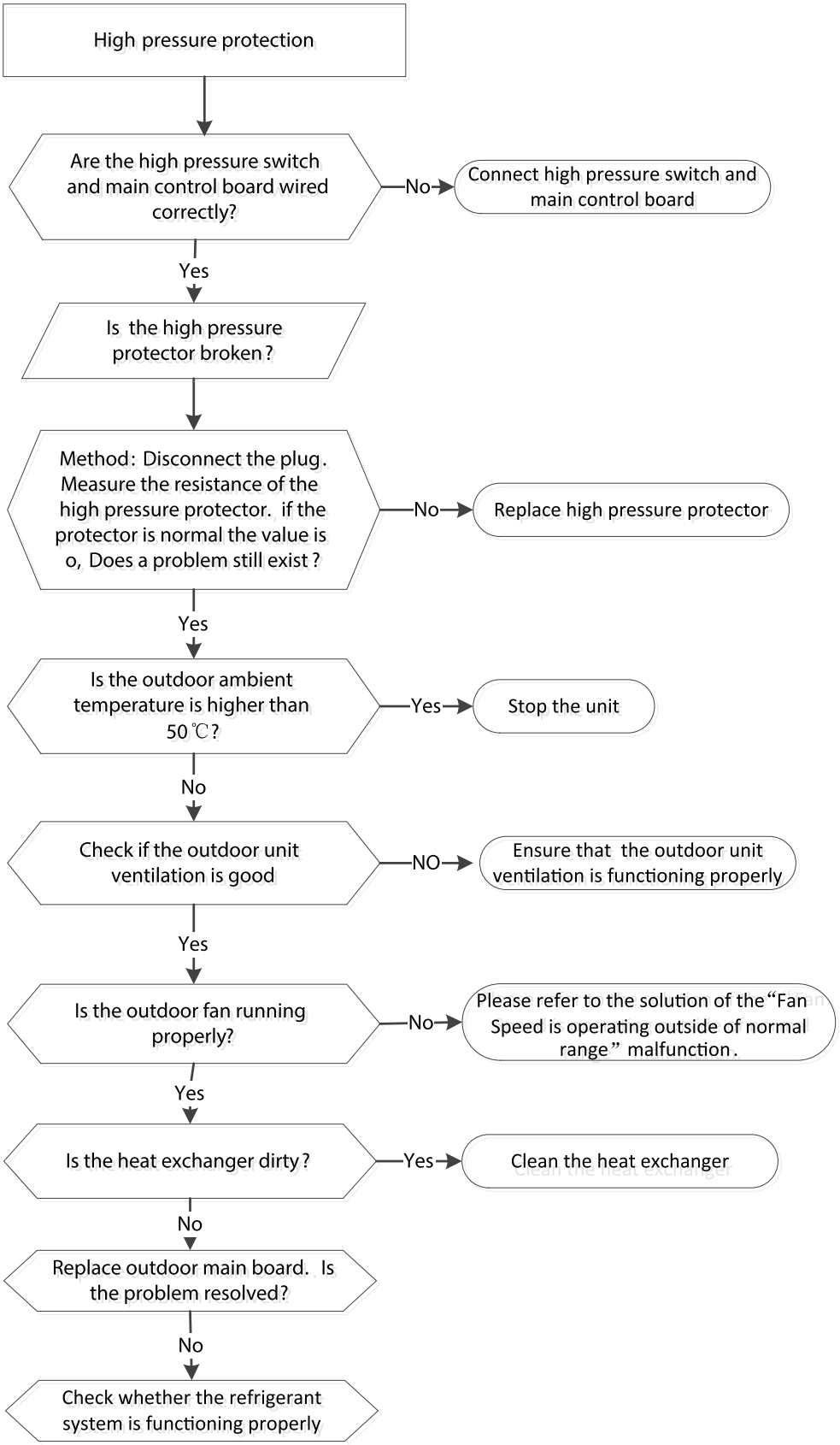


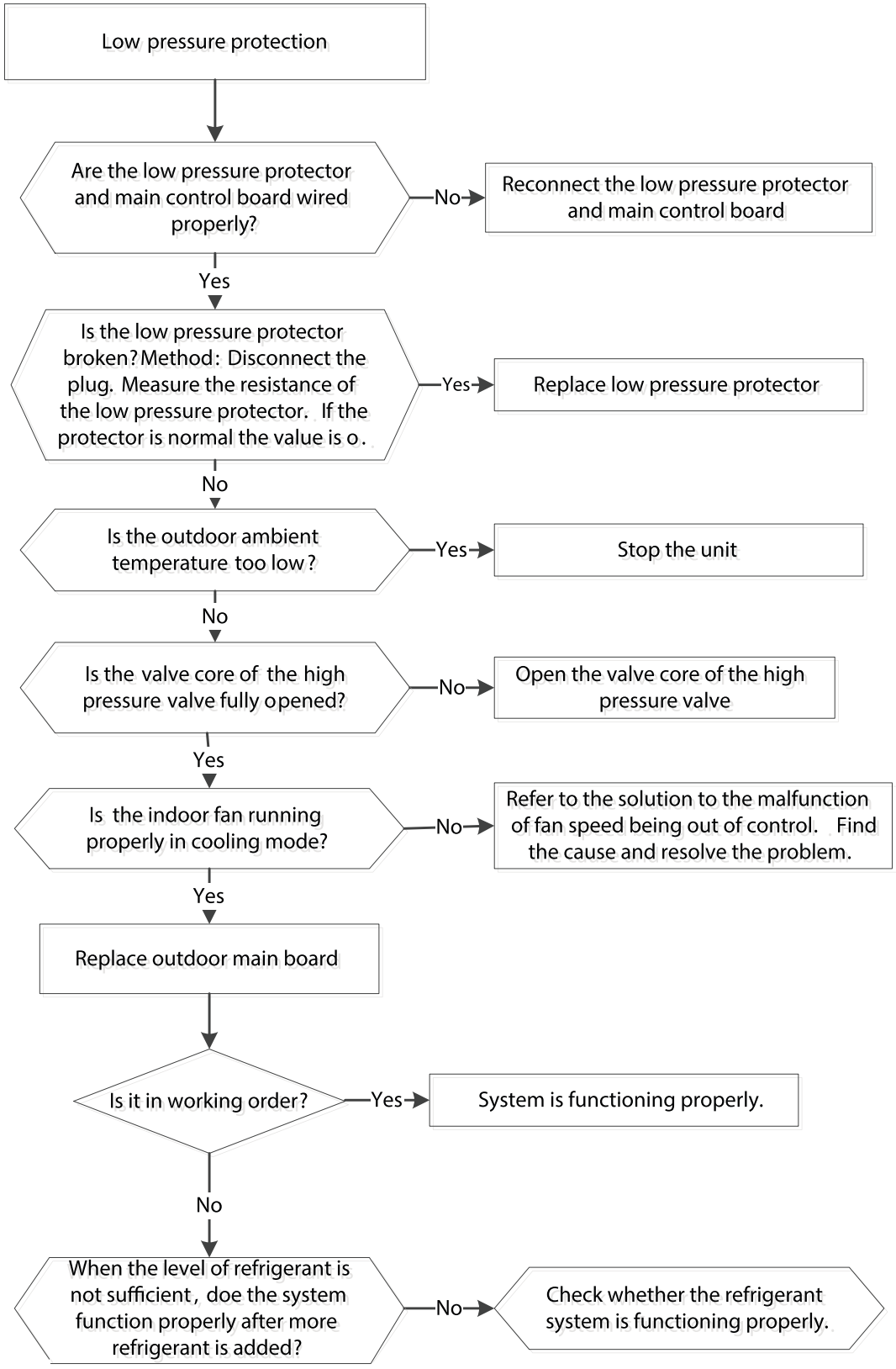
PC 03 Pressure Protection, PC30 (High Pressure), and PC31 (Low Pressure) Diagnosis and Solution

Description: Outdoor pressure switch cut off the system because high pressure is higher than 638 PSI /4.4MPA or outdoor pressure switch cut off the system because low pressure is lower than 19 PSI / 0.13 MPA, the LED displays the failure code.

Recommended parts to prepare: Connection wires, Pressure switch, Outdoor fan, Outdoor main PCB, Refrigerant

Troubleshooting and repair:



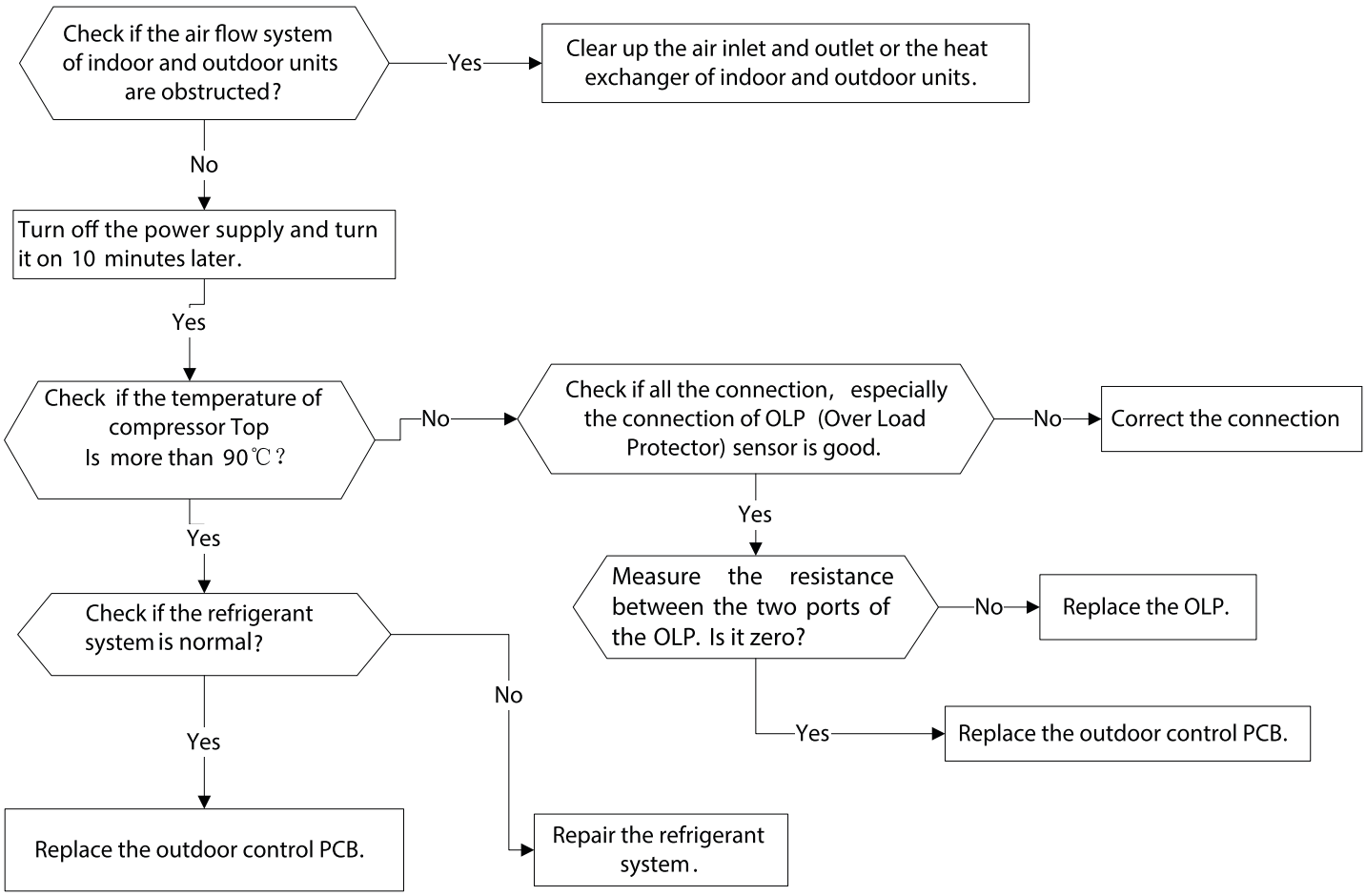

Low pressure protection
Are the low pressure protector and main control board wired properly?
No
Reconnect the low pressure protector and main control board
Yes
Is the low pressure protector broken? Method: Disconnect the plug. Measure the resistance of the low pressure protector. If the protector is normal the value is o.
Yes
Replace low pressure protector
No
Is the outdoor ambient temperature too low?
Yes
Stop the unit
No
Is the valve core of the high pressure valve fully opened?
No
Open the valve core of the high pressure valve
Yes
Is the indoor fan running properly in cooling mode?
No
Refer to the solution to the malfunction of fan speed being out of control. Find the cause and resolve the problem.
Yes
Replace outdoor main board
Is it in working order?
Yes
System is functioning properly.
No
When the level of refrigerant is not sufficient, doe the system function properly after more refrigerant is added?
No
Check whether the refrigerant system is functioning properly.

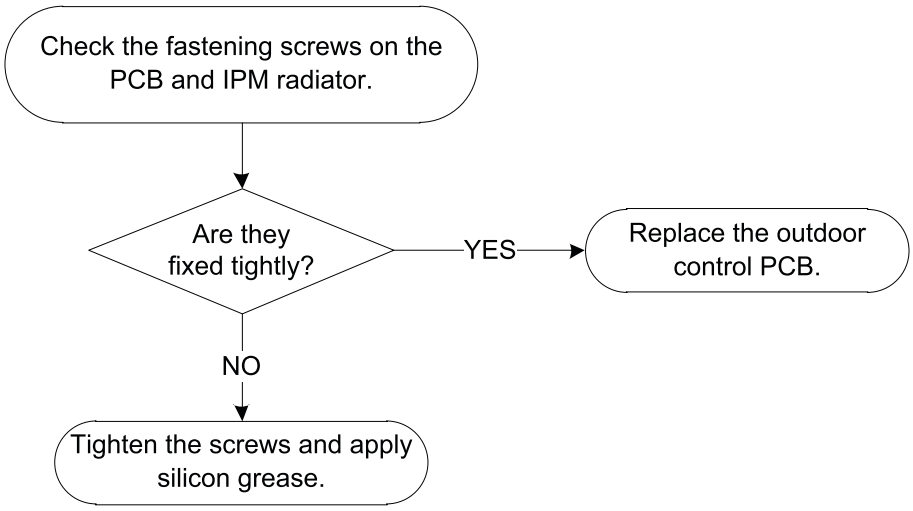
PC 02 (Compressor Top (or IPM) Temp. Protection Diagnosis and Solution)

Description: For some models with overload protection, If the sampling voltage is not 5V, the LED will display the failure. If the temperature of IPM module is higher than a certain value, the LED displays the failure code.

Recommended parts to prepare: Connection wires, Outdoor PCB, IPM module board, High pressure protector, System blockages

Troubleshooting and repair:





PC 0L (Low Ambient Temperature Protection)

Description: It is a protection function. When compressor is off, outdoor ambient temperature(T4) is lower than -35oC. for 10s, the AC will stop and display the failure code.

When compressor is on, outdoor ambient temperature(T4) is lower than -40oC.for 10s, the AC will stop and display the failure code.

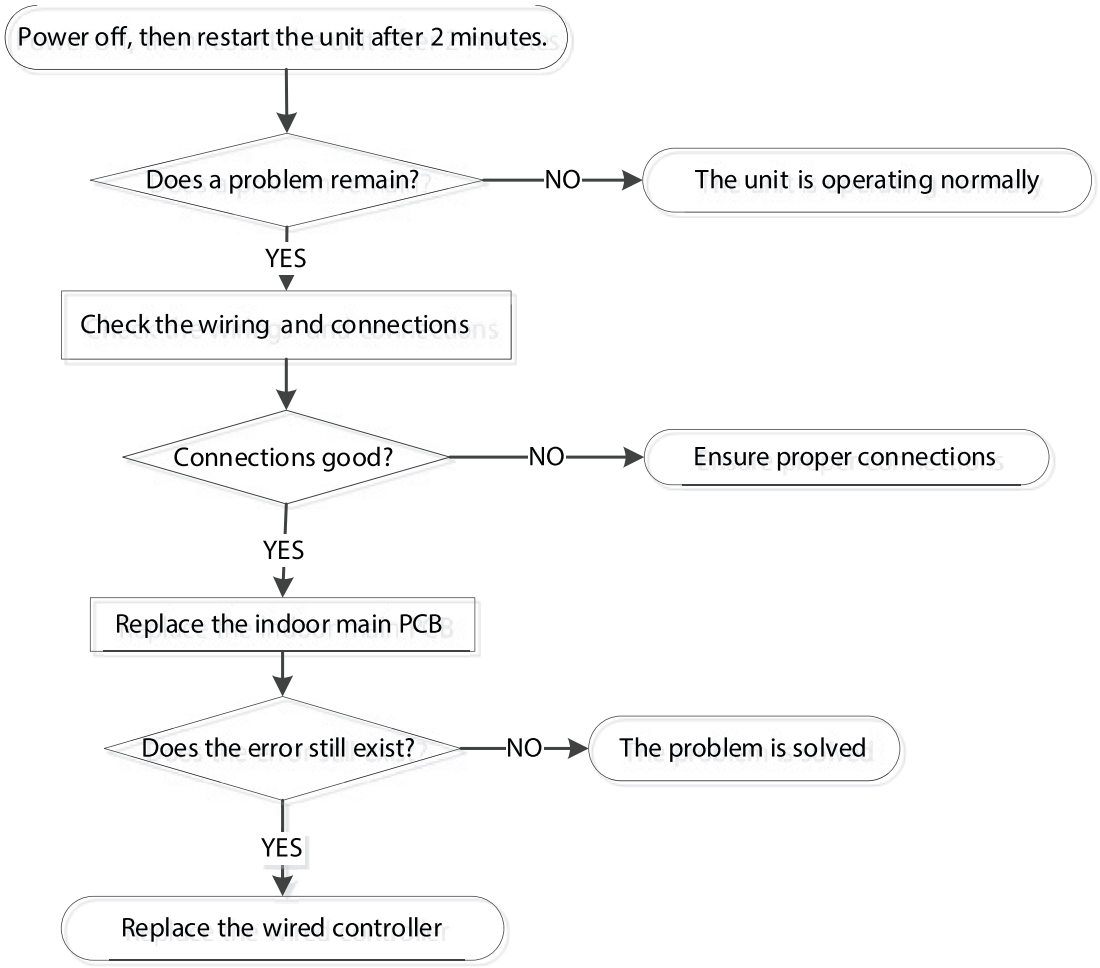
When outdoor ambient temperature(T4) is no lower than -32oC.for 10s, the unit will exit protection.

EH b3 (Communication Malfunction Between Wire and Master Control) Diagnosis and Solution

Description: If Indoor PCB does not receive feedback from wired controller, the error displays on the wired controller

Recommended parts to prepare: Connection wires, Indoor PCB, Wired controller

Troubleshooting and repair:

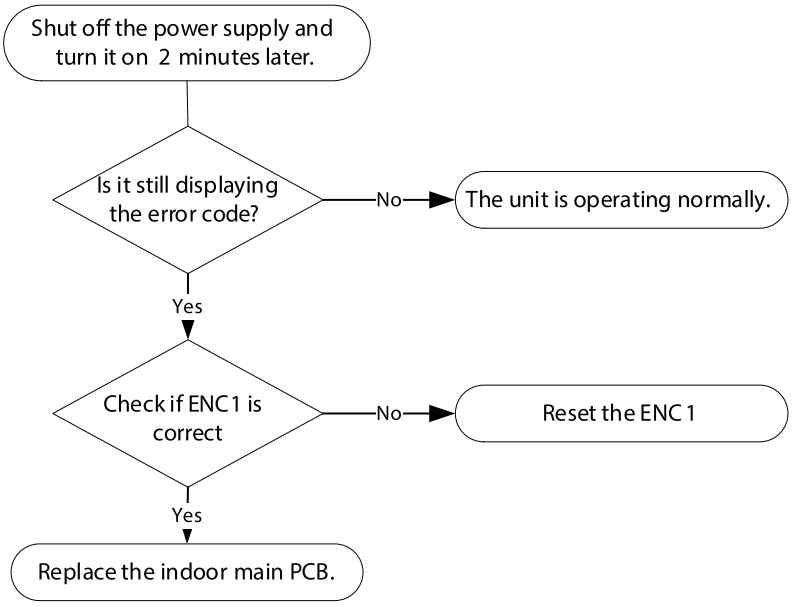


EH bA (Communication Malfunction Between Indoor Unit and External Fan Module)/ EH 3A(External Fan DC Bus Voltage Is Too Low Protection)/ EH 3b (External Fan DC Bus Voltage is Too High) Fault) Diagnosis and Solution

Description: Indoor unit does not receive the feedback from external fan module during 150 seconds. or Indoor unit receives abnormal increases or decreases in voltage from external fan module.

Recommended parts to prepare: Indoor main PCB

Troubleshooting and repair:

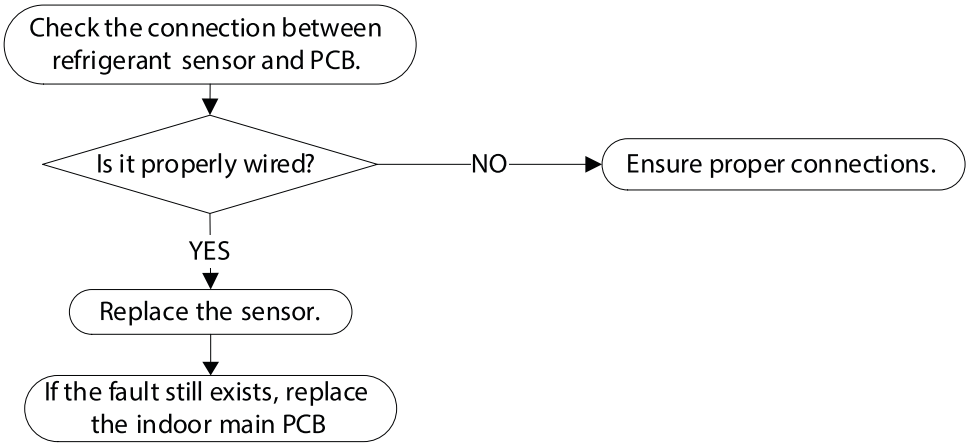


FH CC (Refrigerant Sensor Error) or EH C3(Refrigerant Sensor is Out of Range) Diagnosis and Solution

Description: Indoor unit receives fault signal for 10s or indoor unit does not receive feedback from refrigerant sensor for 150s.

Recommended parts to prepare: Connection wires, Sensors, Indoor main PCB

Troubleshooting and repair:



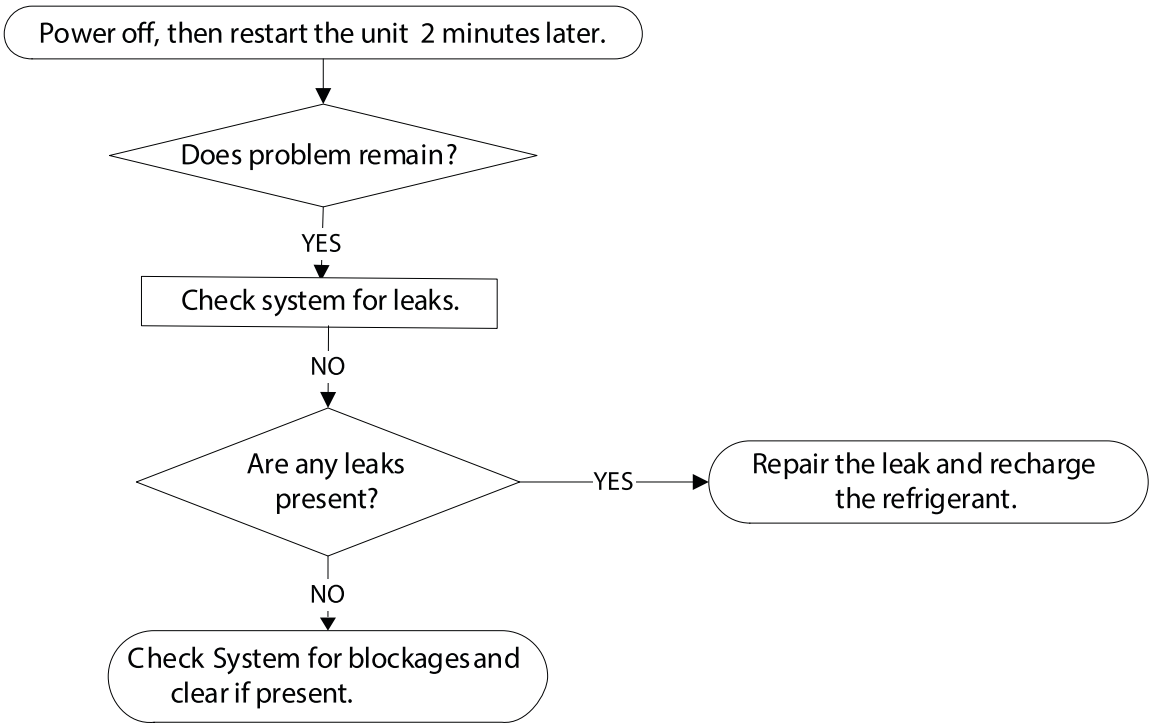
EH C1 (Refrigerant Sensor Detects Leakage) or EH C2 (Refrigerant Sensor is Out of Range and Leakage is Detected) Diagnosis and Solution

Description: The refrigerant sensor detects a concentration higher than or equal to 10%*LFL for 10 seconds or the refrigerant sensor detects a concentration higher than or equal to 20%*LFL or the multi model receives the refrigerant leakage protection fault sent by the outdoor unit.

Multi-zone: Only the buzzer of the indoor unit that detects refrigerant leakage continues to sound the alarm, the shortest sound is 10 seconds, and the longest sound is 5 minutes (you can press any key such as remote control or wire control, APP and so on to eliminate the alarm), and the other non-refrigerant leakage fault indoor unit only displays "ECC1", but the buzzer does not sound.

Recommended parts to prepare: Additional refrigerant

Troubleshooting and repair:

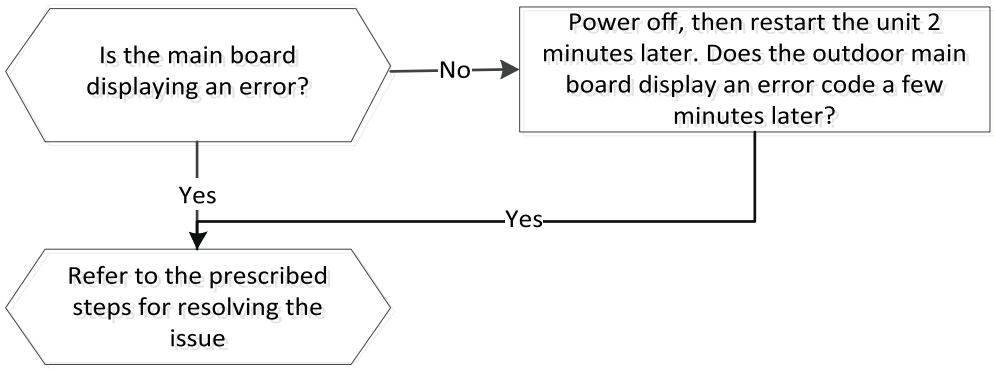


EC 0d (ODU Malfunction Diagnosis and Solution)

Description: The indoor unit detects the outdoor unit in error.

Recommended parts to prepare: Outdoor unit

Troubleshooting and repair:

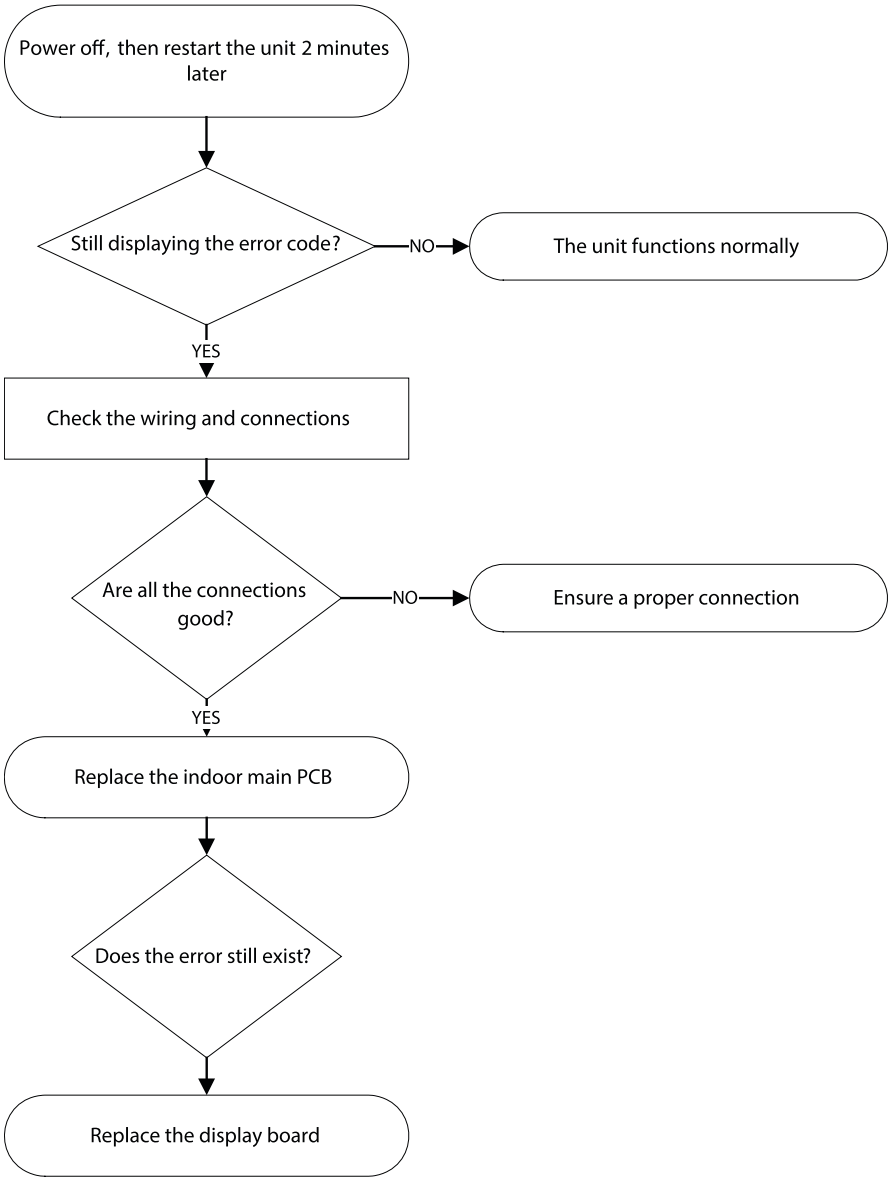


EH 0b(IDU Main Control Board and Display Board Communication Error Diagnosis and Solution)

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

Recommended parts to prepare: Communication wire, Indoor PCB, Display board

Troubleshooting and repair:

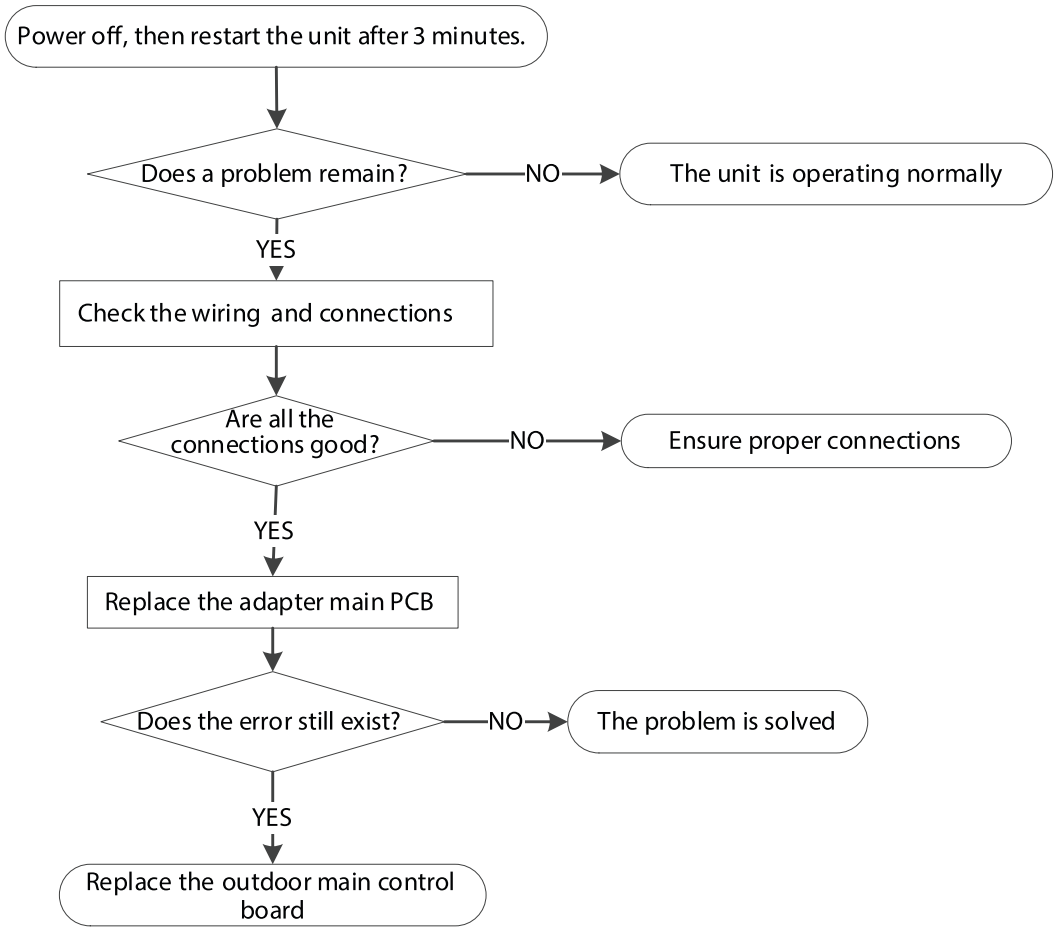


EL 16(Communication Malfunction Between Adapter Board and Outdoor Main Board Diagnosis and Solution)

Description: The adapter PCB cannot detect the main control board.

Recommended parts to prepare: Connection wires, Adapter board, Outdoor main PCB

Troubleshooting and repair:



FL 09(Mismatch between the new and old platforms diagnosis and solution)

Description: Indoor and outdoor units are mismatched, the LED displays this code. Please replace the matching indoor or outdoor unit.

Indoor Units Mode Conflict (match with multi outdoor unit)

Description: The indoor units cannot operate in the COOLING mode and HEATING mode simultaneously. The HEATING mode is the priority.

Examples:

- If indoor unit A is operating in the COOLING mode or the FAN mode, and indoor unit B is set to the HEATING mode, unit A will power off and unit B will continue to operate in the HEATING mode.
- If indoor unit A is operating in the HEATING mode and indoor unit B is set to the COOLING mode or fan mode, unit B will change to STANDBY mode and unit A will not change modes.

Table 8 – Mode Conflicts

	COOLING MODE	HEATING MODE	FAN	OFF
COOLING MODE	No	Yes	No	No
HEATING MODE	Yes	No	Yes	No
FAN	No	Yes	No	No
OFF	No	No	No	No

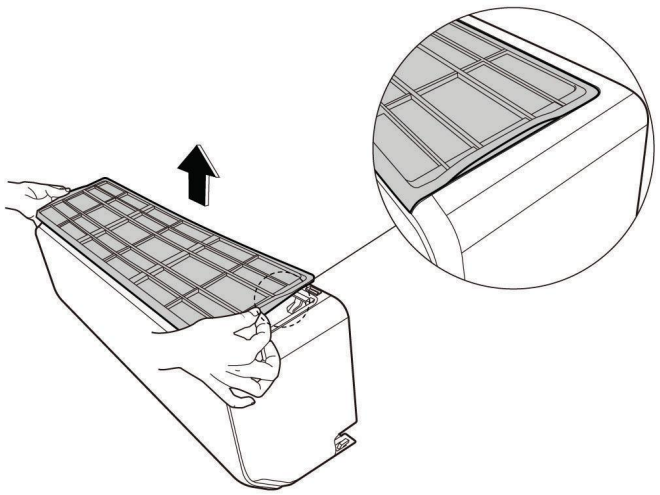
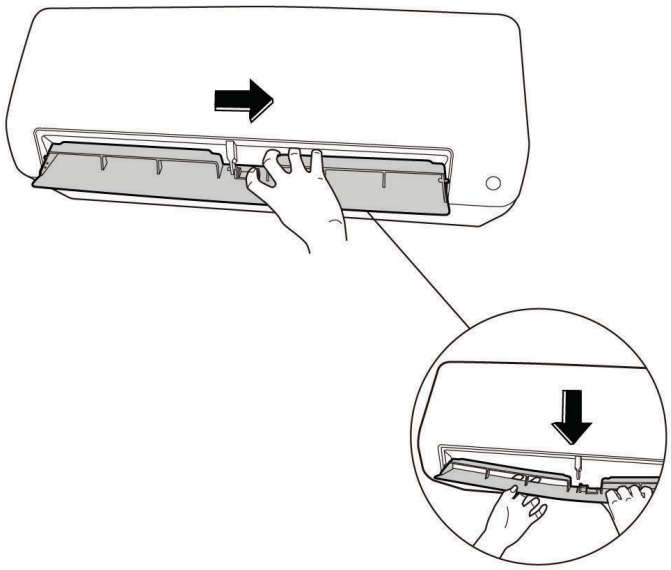
NOTE:

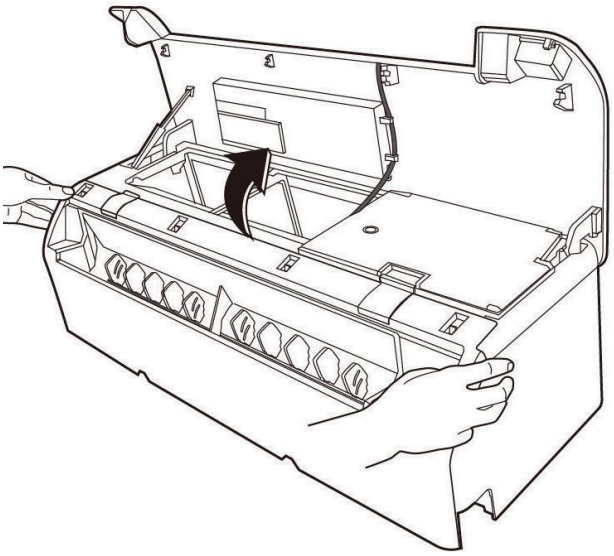
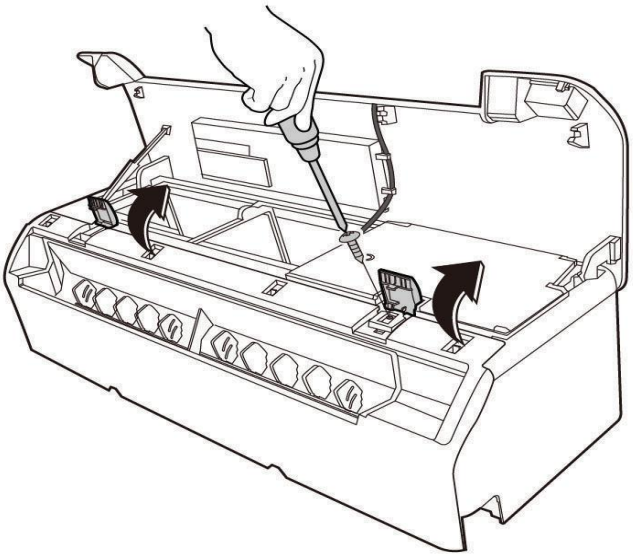
No: No mode conflict

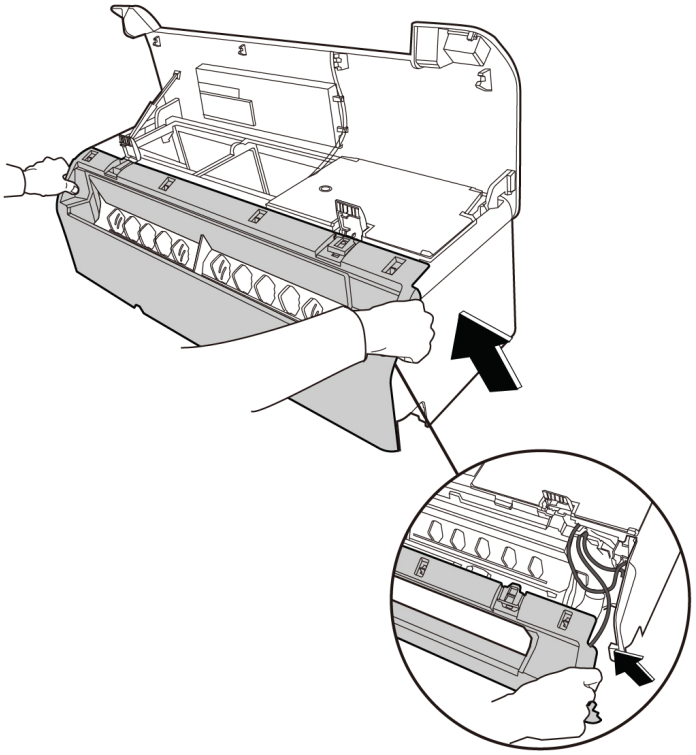
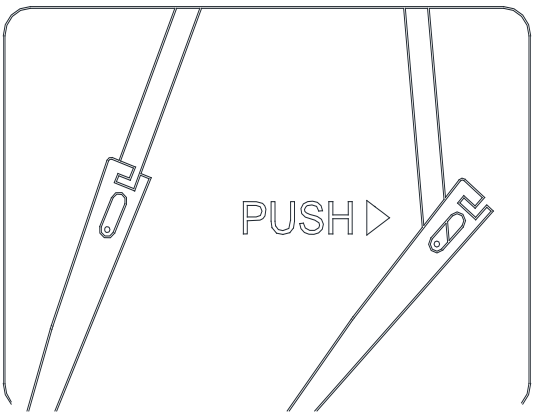
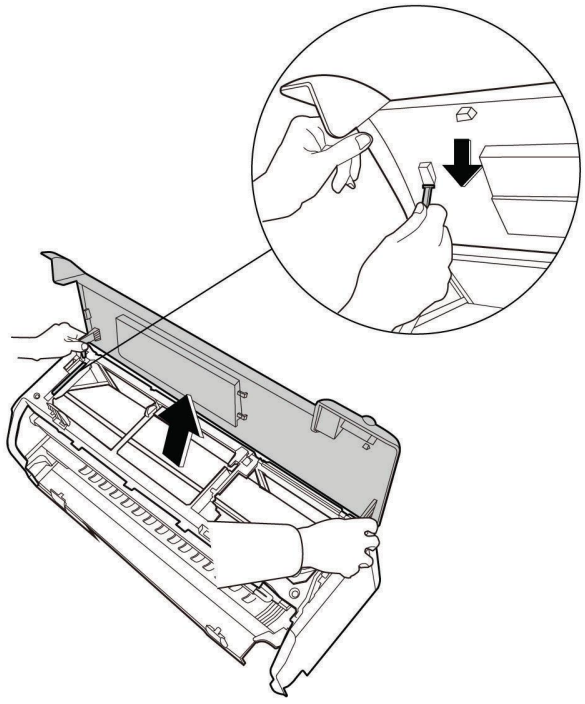
Yes: Mode conflict

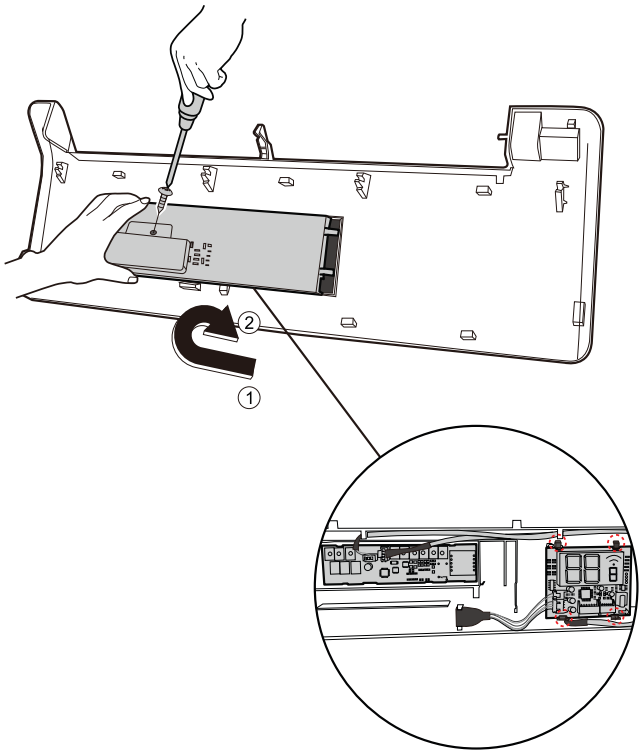
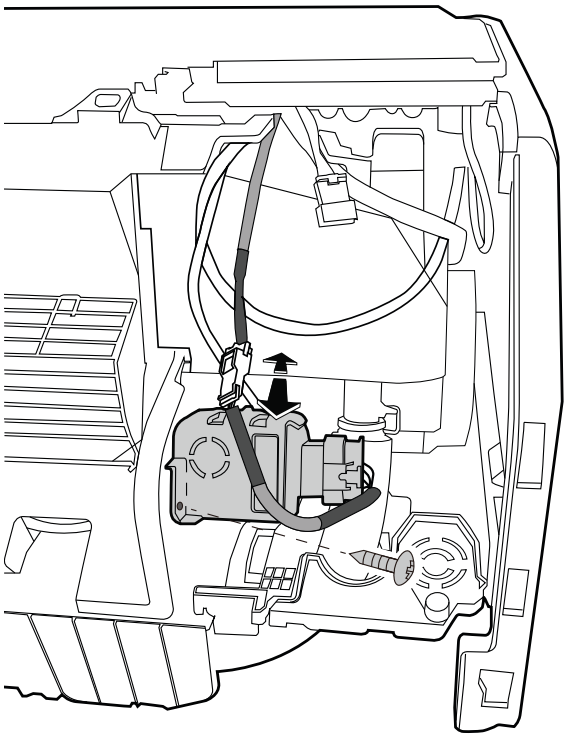
DISASSEMBLY INSTRUCTIONS

Unit Disassembly - Front Panel

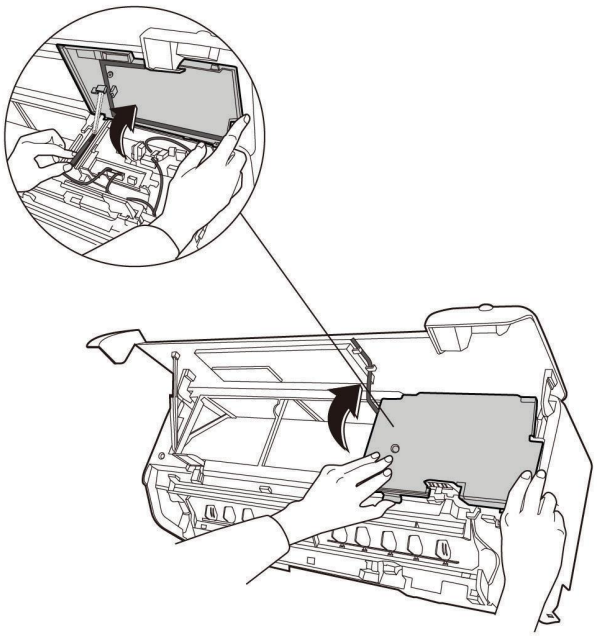
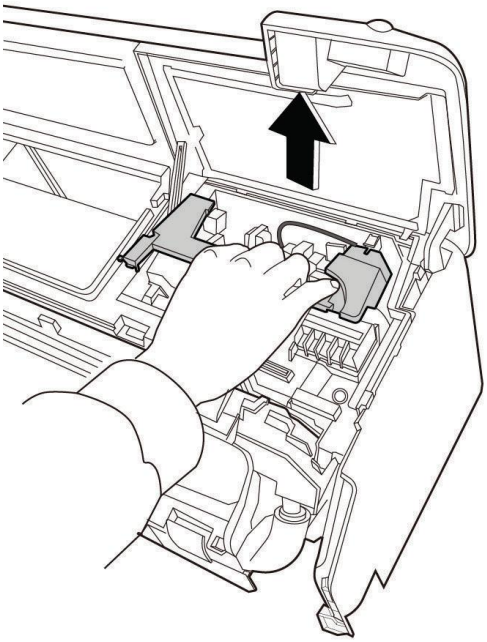
PROCEDURES	ILLUSTRATION
1. Place your hands along the filter's sides, pull the filter gently along the vertical direction, and then remove it. (see illustration)	
2. Open the horizontal louver and push the locker towards the right to open.. (see illustration) 3. Bend the horizontal louver slightly to loosen the hooks, then remove the horizontal louver.	

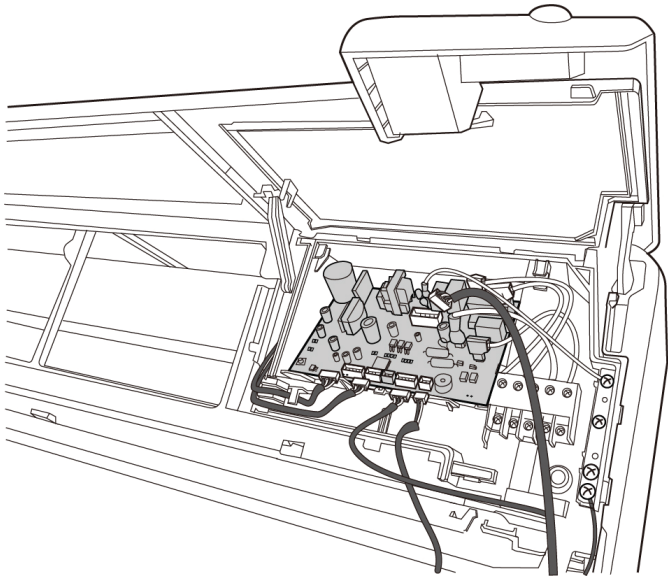
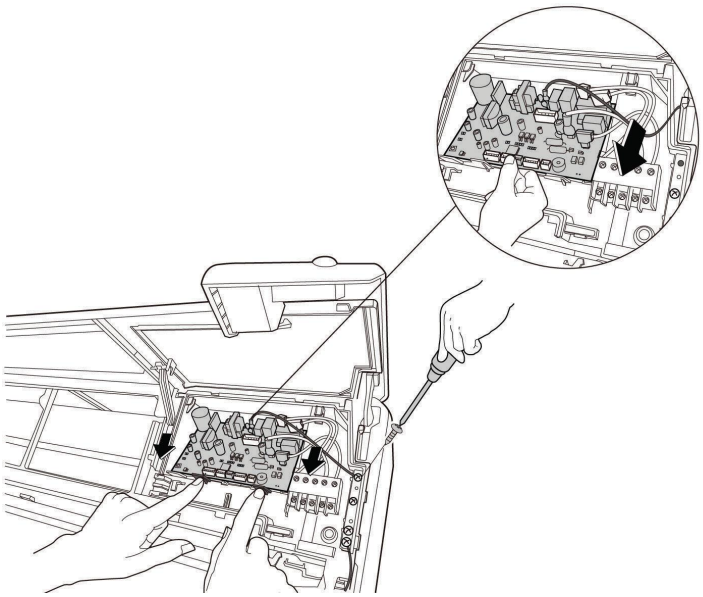
PROCEDURES	ILLUSTRATION
4. Open the panel assembly, move the slider to secure the panel. (see illustration)	
5. Open the two stop blocks of the panel frame assembly (see illustration) 6. Remove 1 screw in the panel frame.	

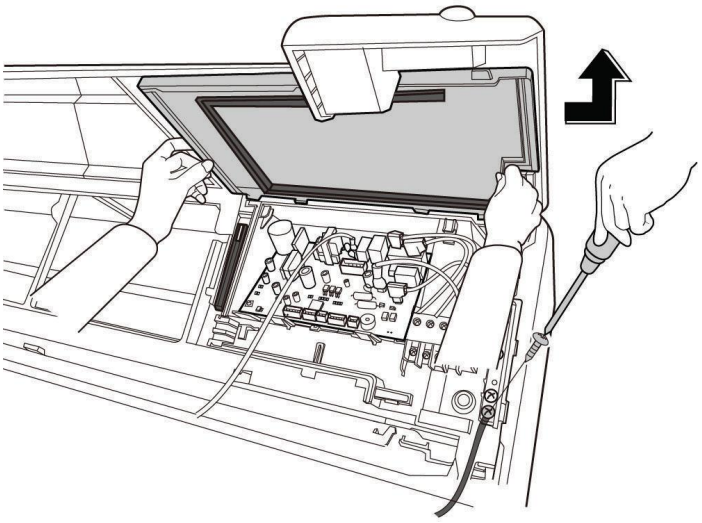
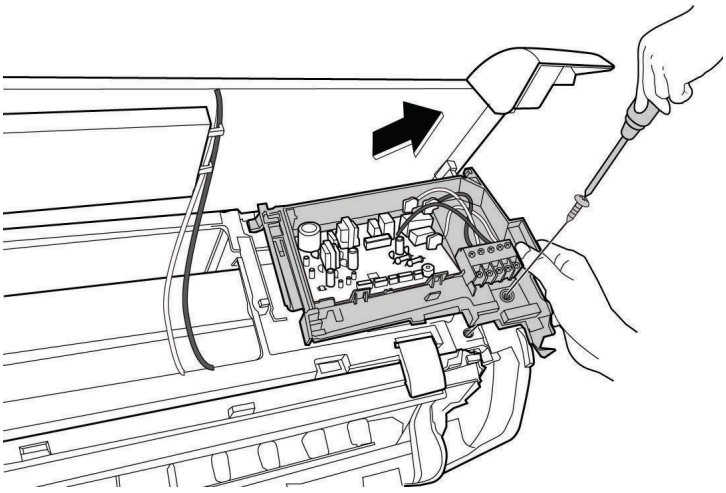
PROCEDURES	ILLUSTRATION
7. Pull the two sides of the bottom panel along the direction shown in the image to the right to remove it. (see illustration)	
8. Pull the panel's support bar to remove it. 9. Remove the panel assembly. **Caution: If you want to close the panel, you must bend the middle of the support bar, otherwise it will break. For 6K~18K models, the support bar is located on the left of the unit. For 24K and up, it is located in the middle of the unit.** 	

PROCEDURES	ILLUSTRATION
10. Remove 1 screw from the display board. 11. Rotate the display board subassembly in the direction shown in the picture to the right. 12. Pull the four clips to remove the display board. 13. Pull the two clips to remove the adapter board subassembly.(	
14. Remove 1 screw and remove the refrigerant sensor.	

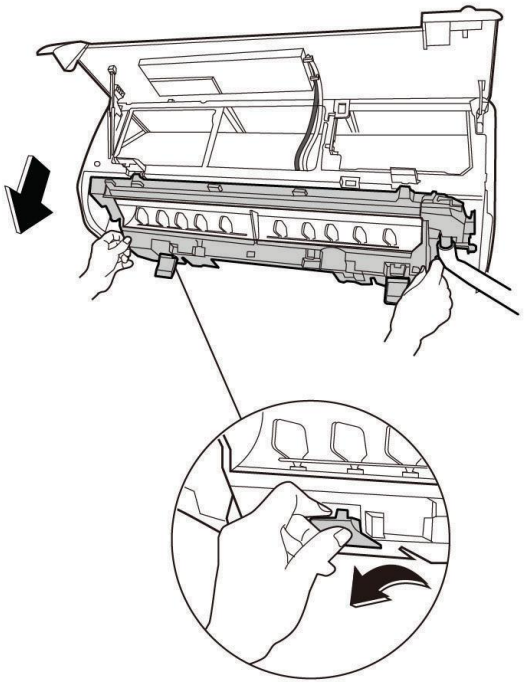
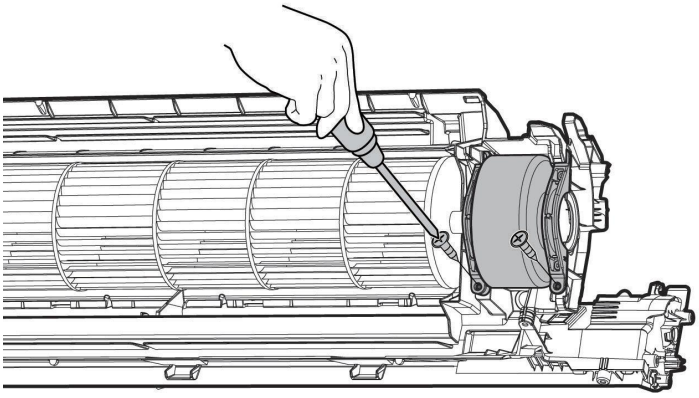
Electrical Parts (Anti static gloves must be worn.)

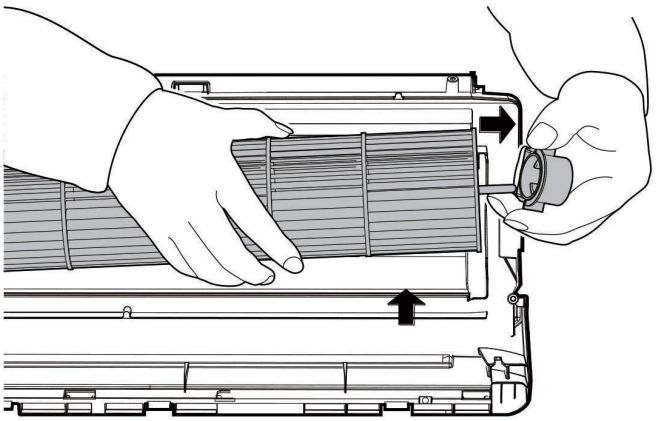
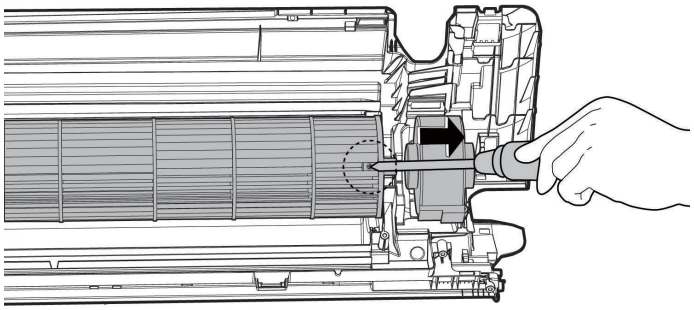
PROCEDURES	ILLUSTRATION
1. Pull the two ends of the electronic control box cover with your thumbs to open.. (see illustration) 2. Raise the support bar to secure the cover.	
3. Pull the electrical control box holder to remove it.. (see illustration))	

PROCEDURES	ILLUSTRATION
4. Disconnect the wires..(see illustration)	
5. Remove one screw used for the ground connection. 6. Pull two clips of the electronic control box along the direction shown in the picture to the right to remove the main control board.(see illustration) **If you want to repair the main control board assembly, perform steps 1 through 6. If you want to repair the electrical control box subassembly, perform steps 7-10.**	

PROCEDURES	ILLUSTRATION
7. Remove the other screw used for the ground connection. (see illustration) 8. Collapse the support bar. 9. Pull the electronic control box cover along the direction shown in the image to the right to remove it.	
10. Remove one screw then pull out the electronic control box subassembly.(see illustration)	

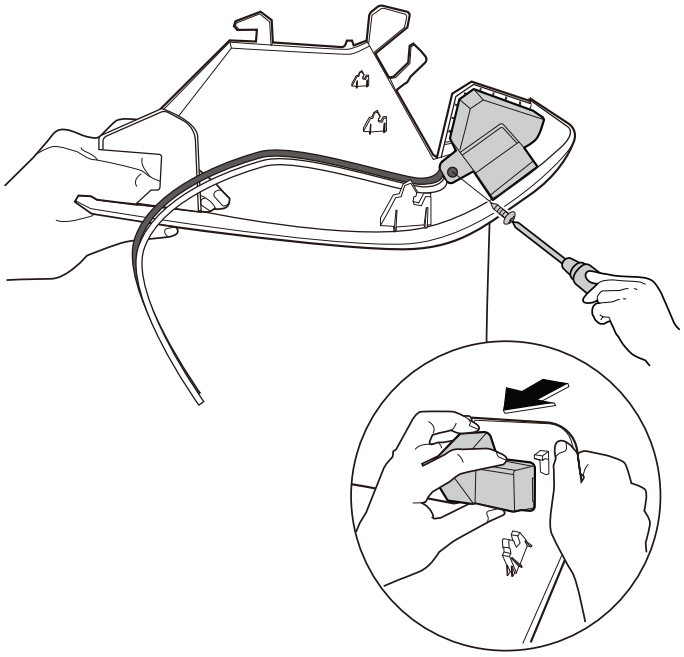
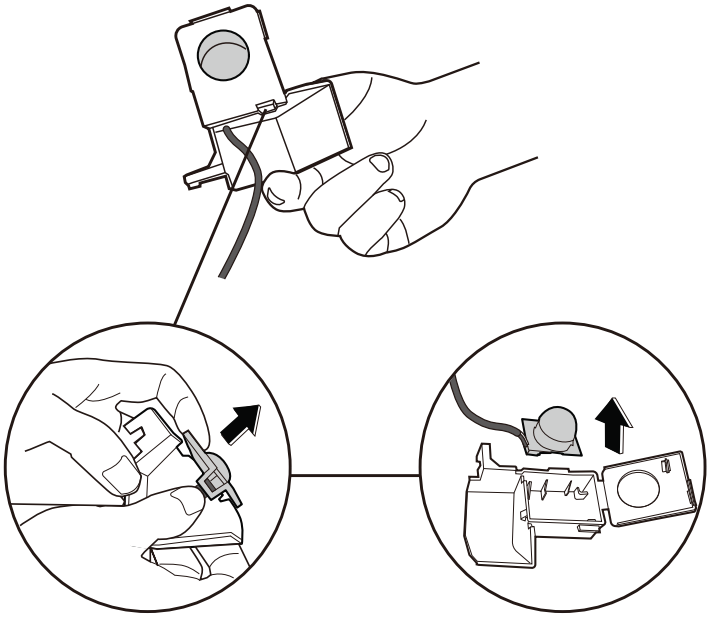
Fan Motor and Fan

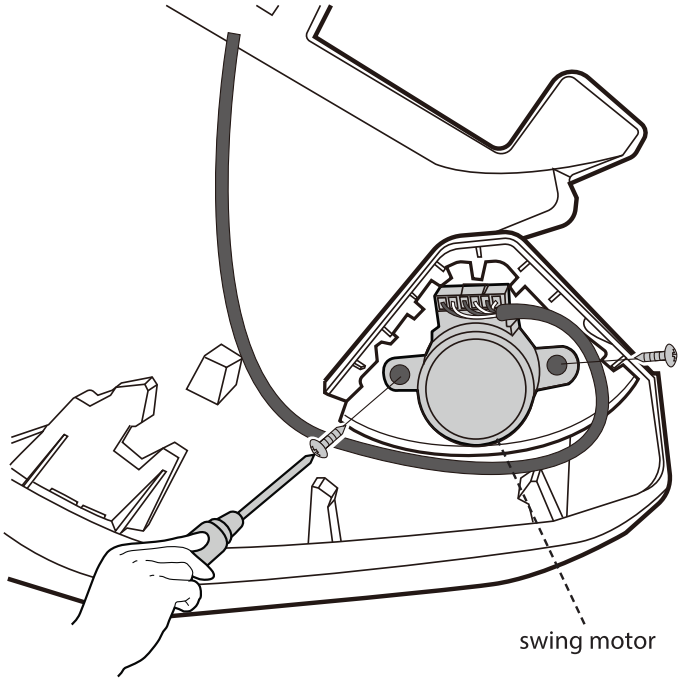
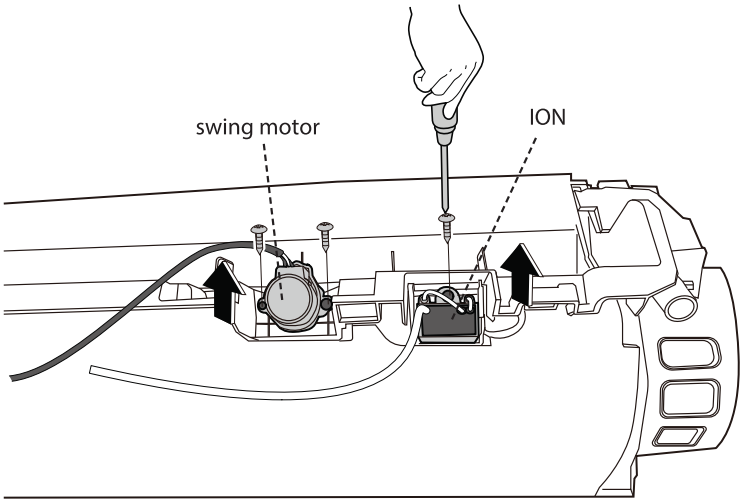
PROCEDURES	ILLUSTRATION
1. Open the two stop blocks of the chassis assembly (see illustration) 2. Remove the chassis assembly (below) along the direction (see illustration)	
3. Remove the two screws and remove the fan motor board. (see illustration)	

PROCEDURES	ILLUSTRATION
4. Remove the bearing sleeve. (see illustration)	
5. Remove the screw. (see illustration) 6. Pull out the fan motor and the fan assembly from the side.	

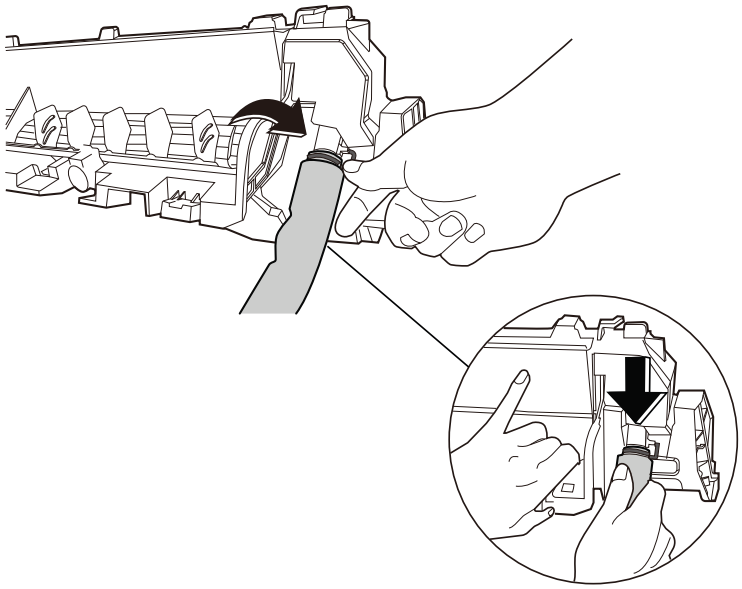
Step Motor

NOTE: Remove the front panel and chassis assembly(below) (refer to Front panel and Fan motor and fan) before disassembling step motor.

PROCEDURES	ILLUSTRATION
1. Remove one screw to remove cover of louver motor. (see illustration)	
2. Open the cover of louver motor, pull out intelligent eye subassembly. (see illustration)	

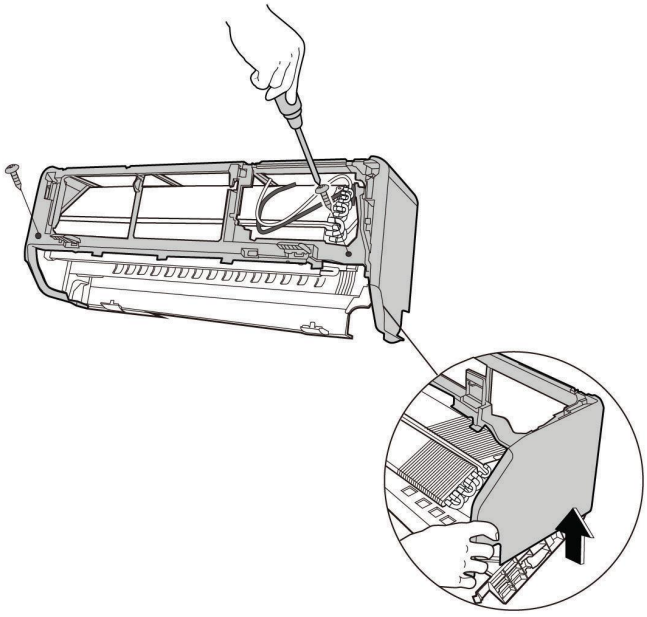
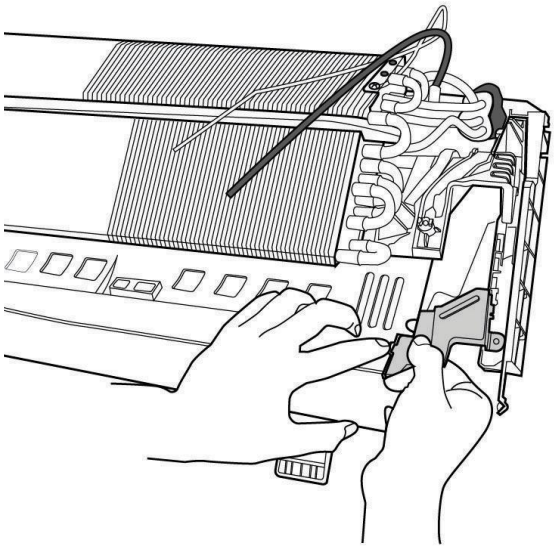
PROCEDURES	ILLUSTRATION
3. Remove the two screws, then remove the horizontal swing motor (see illustration) **NOTE:** The horizontal swing motor is located in panel assembly.	
4. Remove 2 screws, then remove the vertical swing motor (see illustration) 5. Remove 1 screw, then remove the ionizer generator **NOTE:** The vertical swing motor and ionizer generator are located in chassis assembly (below).	

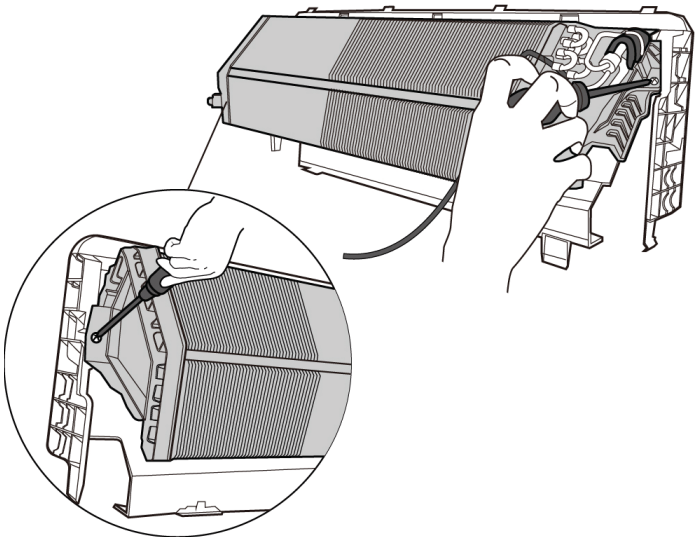
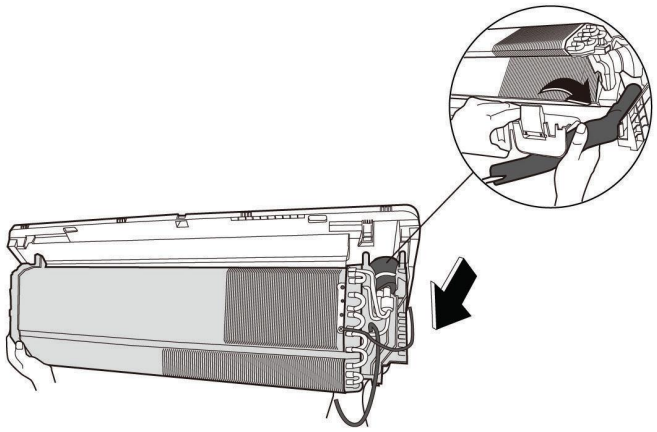
Drain Hose

PROCEDURES	ILLUSTRATION
1. Rotate the fixed wire clockwise indicated in right image. (see illustration) 2. Pull up the drain hose to remove it.	

Evaporator

NOTE: Remove the front panel, electrical parts and the fan first.

PROCEDURES	ILLUSTRATION
1. Remove the 2 screws and then remove the panel frame assembly.(see illustration)	
2. Disassemble the pipe clamp board. (see illustration)	

PROCEDURES	ILLUSTRATION
3. Remove the screw (1) on the evaporator located at the left fixed plate. (see illustration) 4. Remove the screw (1) on the evaporator located on the right side.	
5. Bend the piping carefully, separate the chassis assembly (above) and the evaporator, then remove the evaporator. (see illustration)	

APPENDIX

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

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

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

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	144.01	10	50
68.615	0.69	9.95	-57	-70.6	1022.8	10.23	148.34	11	51.8
72.402	0.72	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	314.91	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	338.81	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	2758.3	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 (Continued)

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	63.51	-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	150.8
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
827.48	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	165.2
907.35	9.07	131.60	7	44.6	4904.1	49.04	711.25	75	167

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Catalog No: **45MAHA-01SM**
Replaces: New

FB, FE, FF1E, FFM, FG, FH, FJ, FMA, FT, FV, FX, FY, FZ, F54, PF
Residential Fan Coil Units

Service and Maintenance Instructions

NOTE: Read the entire instruction manual before starting the installation.

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing and work gloves. Have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and the current editions of the National Electrical Code (NEC) NFPA 70.

In Canada, refer to the current editions of the Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instruction manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ WARNING

UNIT OPERATION AND SAFERTY HAZARD

Failure to follow this warning could result in personal injury or death.

R-454B systems operate at higher pressures than R-410A systems. Do not use R-410A service equipment or components on R-454B equipment. Ensure service equipment is rated for R-454B.

⚠ WARNING

PERSONAL INJURY AND PROPERTY DAMAGE HAZARD

Failure to follow this warning could result in property damage, personal injury, or death.

For continued performance, reliability, and safety, the only approved accessories and replacement parts are those specified by the equipment manufacturer. The use of non-manufacturer approved parts and accessories could invalidate the equipment limited warranty and result in fire risk, equipment malfunction, and failure. Please review manufacturer's instructions and replacement part catalogs available from your equipment supplier.

⚠ CAUTION

HOT TUBE WARNING

Failure to follow this caution could result in personal injury and/or property damage.

Refrigerant lines can reach or exceed 130 °F (54 °C). Avoid contact with the vapor header or vapor line, especially in Heating Mode. Do not service A2L refrigerant (ex; R-454B) fan coils while these components are hot to avoid risk of ignition source.

INTRODUCTION

These fan coil units are designed for flexibility in a variety of applications that meet upflow, horizontal, or downflow requirements. Units are available in 1-1/2 through 5 ton nominal cooling capacities. Factory-authorized, field-installed electric heater packages are available in 3 through 30 kilowatts.

FMA family Fan Coils are designed with application flexibility in mind and are suitable for closet and flush mount installations. Units are available with field-installed electric heat with circuit breaker. Units are used indoors as the fan coil for split-system heat pumps or air conditioners. The FMA5L uses a refrigerant piston metering device and a 3 speed PSC Motor. FMA5X uses a TXV and a 5 speed multi-tap ECM Motor for efficiency. Units are available in 18,000 through 36,000 Btuh nominal cooling capacities.

NOTE: Nuisance sweating may occur if the unit is installed in a humid location with low airflow.

Units are designed for upflow application only. Local codes may linit this free-air-return type unit to installation in single-level applications.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing unit, always turn off all power to unit. There may be more than one disconnect switch. Turn off accessory heater power if applicable. Lock out and tag switch with a suitable warning label.

Fan Coil Description and Troubleshooting

FY5, FH4, PF4 (even sizes) and FF1E (even sizes)

Fan Motor

The motor is two or three speed direct drive. High-speed lead is black, low-speed lead is red, and common lead is yellow. Be sure proper blower speed has been selected.

The motor is turned on through two different routes. The first occurs when thermostat calls for the fan in cooling, heat pump, or fan-only mode. A 24VAC signal is sent to relay, causing relay to close its normally open contacts, turning fan on.

The second occurs when there is a call for electric heat. A 24VAC signal is sent to heater sequencer/relay, causing it to close, directing 230V through the normally closed contact of fan relay, turning fan on. The fan remains on until sequencer/relay opens.

If motor does run, test motor for an open winding or a winding shorted to motor case. If either is present, replace motor.

Electric Heater Service

Service can be completed with heater in place. Shut off power before servicing.

Limit Switch

Refer to the (Electric Heater Function and Troubleshooting on p24) section of this manual.

Sequencer

Refer to the (Electric Heater Function and Troubleshooting on p24) section of this manual.

Transformer

A 40-VA transformer supplies 24V power for control circuit. Check for 208/230V on primary side of transformer. If present, check for 24V on secondary side.

NOTE: Transformer is fused. Do not short circuit.

Fan Relay

Relay coil is 24V. Check for proper control voltage. Replace relay if faulty.

Cleaning or Replacing Refrigerant Flow-Control Device

Refer to Fig. 28 and instructions given in (Piston Body Cleaning and Replacement on p30).

The refrigerant flow-control device is protected by a wire mesh strainer. It is located inside the 3/8-in. liquid tube at field braze joint next to flow-control device. Access to strainer is through field braze joint.

Sequence of Operation

Condensing Unit

COOLING—When thermostat calls for cooling, the circuit between R and G is complete and single-pole single-throw relay FR is energized. The normally open contacts close causing blower to operate.

The circuit between R and Y is also complete. This completed circuit causes contactor in outdoor unit to close which starts compressor and outdoor fan.

HEATING—When thermostat calls for heating and FAN switch is set on AUTO, the circuit between R and W is complete. The heater sequence SEQ is energized which closes contacts of relay. There will be a time delay. This completed circuit energizes all heating elements HTR and blower motor.

Heat Pump

COOLING—On a call for cooling, the thermostat makes circuits R-O, R-Y, and R-G. Circuit R-O energizes reversing valve, switching it to cooling position. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor unit blower relay starting indoor blower motor.

When thermostat is satisfied, its contacts open de-energizing contactor reversing valve and blower relay. This stops compressor and fan motors.

HEATING—On a call for heating, the thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor blower relay starting blower motor.

Should temperature continue to fall, R-W circuit is made through second-stage room thermostat bulb. Circuit R-W energizes a sequencer bringing on supplemental electric heat.

When thermostat is satisfied, its contacts open de-energizing contactor and sequencer. All heaters and motors should stop.

CES013003-00, 01 (HK61EA002, HK61EA006) Control Boards

This section examins the functional operation of the PCB components.

Printed Circuit Board (PCB) Component

Layout of the actual PCB is depicted inFig. 1 and Fig. 2.

1. The low-voltage stripped leads are used to connect the 24V side of transformer to indoor thermostat and outdoor section.
2. A 5A fuse is used to protect the low-voltage transformer secondary.
3. The fan relay is controlled by thermostat and turns fan on and off.
4. A plug is used as the connection for PCB power and electric heaters. Note the pin numbers on plug.
5. A time-delay relay circuit keeps fan motor running for approximately 90 seconds after G is de-energized. The time-delay can be defeated by cutting jumper JW1.

Unit Functions

Transformer

1. Proper Wiring of Transformer Primary or High Side
   Yellow wire from Molex plug is wired to C terminal on transformer and black wire from PCB relay (normally-open) terminal is wired to 208V or 230V terminal on transformer. Units are factory wired at 230V terminal.
2. Proper Wiring of Transformer Secondary or 24V Side
   Red wire of transformer is wired to T terminal on PCB and brown wire of transformer is wired to C terminal on PCB.

NOTE: T terminal on PCB is used to protect the transformer. T terminal is connected through the fuse to R terminal on PCB.

Indoor Fan

1. Wiring
   Indoor fan motor yellow lead is wired to C terminal on transformer. The red, blue, or black speed lead is wired to SPT terminal on fan relay part of PCB. Units are factory wired on medium speed (blue lead connected).

NOTE: Unused fan speed leads must be capped or taped off to prevent direct short to cabinet surface.

2. Functional Control
   a. Thermostat and Relay Control
      When thermostat calls for the fan in cooling, heat pump, heating, or fan-only mode, a 24VAC signal is sent to relay. This causes

the relay to close its normally-open contacts, turning on fan. When thermostat no longer calls for the fan, the signal sent to relay is turned off and relay opens causing fan to turn off after a 90-second fan-off delay.

b. Sequencer/Electric Heat Relay Interlock
The fan will also operate whenever there is a call for electric heat, even if fan relay is not energized. This happens because fan is interlocked with first stage of electric heat through the normally-closed contact of fan relay.

NOTE: The fan interlock is only connected to first stage electric heat (W2). W3 and E do not contain an interlock with fan. See outdoor thermostat installation instructions when electric heat staging is desired.

Electric Heat

When thermostat calls for electric heat, a 24VAC signal is sent to sequencer/heat relay through W2, causing first stage to turn on. W3 and E also receive signal if wired in with W2. If W3 and E are not wired to W2, the sequencers/heat relays can be controlled individually to stage additional electric heat. The sequence control is described in the following section:

1. **W2**
When thermostat sends a signal to W2, a 24VAC signal is applied across sequencer/relay No. 1, causing it to close. When sequencer/relay No. 1 closes, first stage of electric heat is energized. In straight electric heat, fan is also energized through the normally closed contacts of fan relay. In cooling, heat pump, or manual fan mode, fan will already be running since fan relay would have been energized. When thermostat stops calling for electric heat, the 24VAC signal to sequencer/relay No. 1 turns off and sequencer opens after a delay of 60 to 90 seconds. Heaters equipped with relays will be de-energized immediately. When sequencer/relay opens, first stage of heat turns off along with fan, providing thermostat is not calling for the fan.
2. **W3**
When a signal is sent to W3, a 24VAC signal to sequencer/relay No. 2 causes it to close, with second stage of electric heat turning on. The 24VAC signal applied to sequencer/relay No. 1 causes fan to operate. Timing is such that sequencer/relay No. 1 will turn on before sequencer/relay No. 2. When signal to W3 is turned off, sequencer/relay No. 2 opens. If W2 is also satisfied, first stage of electric heat and fan will also turn off, providing thermostat is not calling for the fan.
3. **E**
When thermostat sends a signal to E, a 24VAC signal is sent to sequencer/relay No. 3. The 24VAC signal applied to sequencer/relay No. 3 turns on third stage of electric heat. The 24VAC signal applied to sequencer/relay No. 1 turns on first stage of electric heat and fan. When thermostat stops calling for electric heat, the signal to sequencers/relays 1, 2, and 3 are turned off, and sequencers/relays open. This causes electric heat to turn off with fan, providing thermostat is not calling for the fan.

NOTE: Electric heaters are factory wired with all stages tied together. If independent staging is desired, consult outdoor thermostat installation instructions, or corporate thermostat instructions.

Troubleshooting the Printed Circuit Board (CES013000-00, 01 / HK61EA002 / HK61EA006)

Use wiring schematics shown in Fig. 1 and Fig. 2 as a guide in troubleshooting PCB unless otherwise noted.

If Fan Will Not Turn On from Thermostat:

- IF THERE IS NO HIGH VOLTAGE TO TRANSFORMER:
  (1.) Check plug/receptacle connection. This supplies power from heaters to PCB Fan Relay. Be sure plug is connected properly.
  (2.) Check sequencer/relay No. 1 and plug wiring. Yellow wire should be connected to Pin No. 9 of plug and to limit switch. Black wire should be connected to Pin No. 7 of plug and to sequencer/relay No. 1.
  (3.) Check field power leads L1 and L2. If these are not receiving power, system cannot function.
- IF TRANSFORMER HAS HIGH VOLTAGE APPLIED TO IT:
  (1.) Check low-voltage transformer leads R (red) and C (brown). Be sure they are wired to correct locations.
  (2.) Check output voltage of transformer secondary side R (red) and C (brown). Be sure transformer output is between 18VAC and 30VAC. If transformer output is incorrect and transformer is receiving correct input voltage (208V or 230V), then transformer needs to be replaced with recommended transformer. If no problem exists with transformer secondary, proceed to items 3 and 4.
  (3.) Check low-voltage fuse shown in Fig. 1 or Fig. 2. If fuse is blown, replace it with an identical 5A fuse. The transformer cannot supply power to board with fuse blown or loose. If fuse blows when unit has power applied to it, the system most likely has one of the following problems:
  - Check all 24V wiring for an electrical short.
  - The maximum load on transformer is 40VA. If load on transformer is excessive, the low-voltage 5A fuse will blow to protect transformer. If load exceeds VA rating of transformer, a larger VA rated transformer needs to be installed. Check sequencers/relays for excessive current draw.
  - Check wiring of heaters. If a heater is miswired, fuse may blow. If a heater is miswired, correct miswiring by comparing it to heater wiring label.

  (4.) Check connections on primary side of transformer. If they are not connected properly, the transformer secondary cannot supply the 24V signal to energize fan relay. If transformer is receiving correct primary voltage but is not putting out correct secondary voltage, transformer needs to be replaced.

If Electric Heat Stages Will Not Turn On But Fan Will Turn On:

- IF THERE IS NO HIGH VOLTAGE TO TRANSFORMER:
  (1.) Check plug connection between heaters and board. This supplies power to transformer and fan. Be sure plug is connected properly.
  (1.) Check sequencer/relay No. 1 and plug wiring. Yellow wire should be connected to Pin No. 9 of plug and to limit switch. Black wire should be connected to Pin No. 7 of plug and to sequencer/relay No. 1.
  (1.) Check incoming high-voltage power leads. If these are not receiving power, system cannot function.
- IF TRANSFORMER HAS VOLTAGE APPLIED TO IT:
  (1.) Check low-voltage transformer leads R (red) and C (brown). Make sure they are wired to correct location. The unit will not function without proper connections.
  (1.) Check output voltage of transformer secondary side R (red) and C (brown). If transformer output is low (less than 18VAC), refer to items 3 and 4 of previous "IF TRANSFORMER HAS HIGH VOLTAGE APPLIED TO IT" section.
- IF TRACES ARE OVERHEATED ON BACK OF PCB:

Usually whenever a trace is blown on PCB, it means either there has been a high-voltage short or high voltage has been applied to low-voltage circuit. This can be prevented by making sure PCB is wired correctly before PCB has power applied to it.

- If Transformer Fuse Keeps Blowing:

When low-voltage fuse blows, it means transformer would have blown if fuse had not been in circuit to protect it. The fuse usually

blows when there is a high current draw on transformer, high voltage applied to low-voltage circuit, or a direct secondary short. When there is a high current draw on transformer, it is most likely because transformer has been shorted or system is trying to draw more VA than transformer rating allows. When fuse blows because of high voltage, the system has mixed high- and low-voltage signals.

(1.) Check wiring of sequencers/relays as shown in Fig. 1 and Fig. 2. Be sure transformer is not shorting out because thermostat wires are miswired.

(1.) Check wiring of relays as shown in Fig. 1 and Fig. 2. Be sure low-voltage and high-voltage wiring is correct.

(1.) Check VA draw on transformer. If VA draw is more than VA rating of transformer, fuse will blow. If this is the case, replace transformer with one that has a higher VA rating and meets system specifications.

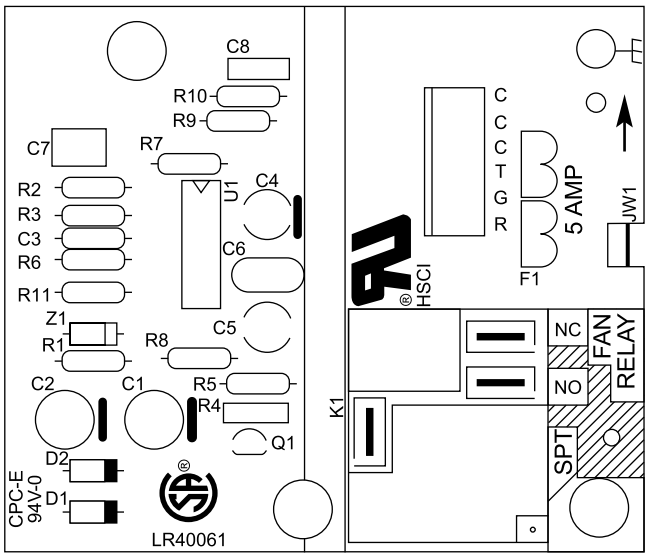
If Fan Runs Continuously:

(1.) If PCB has no low-voltage power, check blue and black fan leads. These may be switched at sequencer/relay.

(1.) If PCB has low-voltage power, check fan relay to see if it is opening and closing. It may be stuck in the normally closed position due to debris in relay.

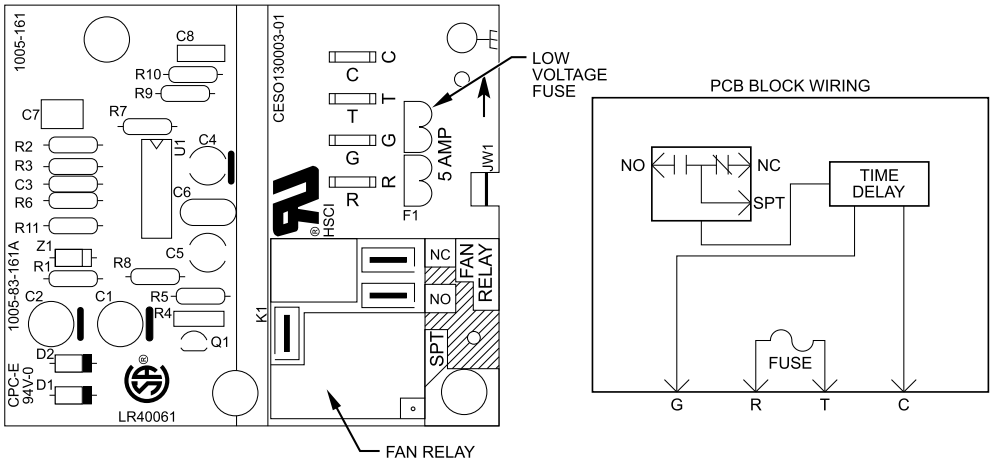
Transformer Failure:

Check 208V and 230V transformer connections. They may be miswired.



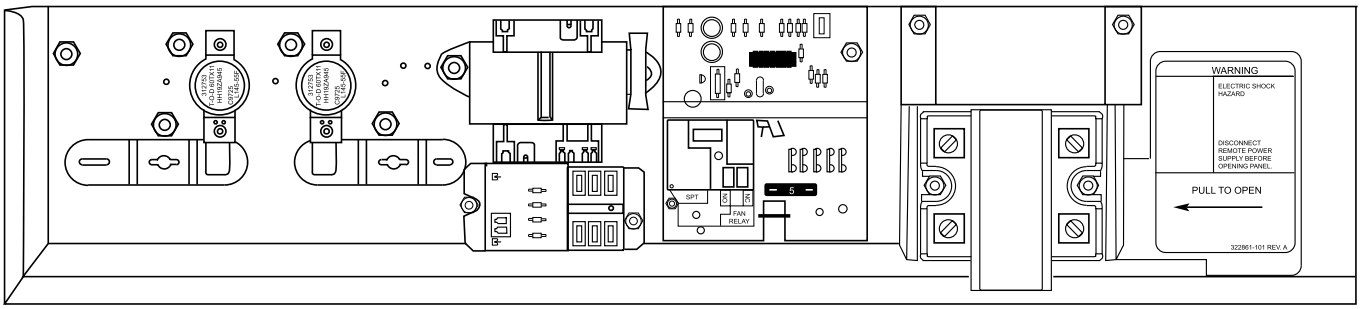
A03010

Fig. 1 – Fan Coil Printed Circuit Board (HK61EA006)



A97020

Fig. 2 – Fan Coil Printed Circuit Board (CES013003-00, 01 / HK61EA002)



FF1E CONTROL BOX

A13032

Fig. 3 – Electric Heater Control Box

FB4C, FJ4, FX4D, F54, PF4, FF1E, and FZ (odd sizes)

Fan Motor

The multi-speed ECM motor used with this product contains two parts: the control module and the motor winding section. Do not assume the motor or module is defective if it will not start. Go through the steps described below before replacing control module or entire motor. The control module is available as a replacement part.

1. It is normal for the motor to rock back and forth on startup. Do not replace the motor if this is the only problem identified.

   (1.) If the motor is not running:

   • Check for proper high voltage and ground at the L,G, and N connections at the motor. Correct any voltage issue before proceeding to the next step.

- The motor is communicated through 24VAC signals to the 1, 2, 3, 4, 5 and C (common) terminals. Not all taps are programmed, if low voltage is applied to an non-programmed terminal, the motor will not operate, which is normal. Verify the part number of the motor matches the correct replacement motor part number for the unit model number.
- Initiate a demand from the thermostat and check the voltage between C (common) and terminal 1- 5. If voltage is present and the motor isn't operating, then the motor/control module is failed.

(2.) Prior to installing the replacement control module, the motor section condition needs to be verified.

- Check to see if the blower wheel spins freely.
- To check for short to ground, use an ohmmeter to measure the resistance from any one of the motor connector pins to the aluminum end plate of the motor. This resistance should be greater than 100,000 ohms.
- Check the motor phase-to-phase resistance between each of the leads in the three-pin motor connector. The lead-to-lead resistance across any two leads should be less than 20 ohms. Each lead-to-lead resistance should be the same within ± 10 percent.
- If any motor fails any of the three tests, do not install a new control module. The new control can fail if placed on a defective motor.

The prior fan coil models with multi-speed ECM blower motors used a printed circuit board, similar to the PSC models. The current fan coils do not use the printed circuit board and rely on the motor control programming to provide the off-delay timing.

Another design aspect of the control board was to provide a resistor in the "G" circuit in case a power stealing thermostat was used. This resistor is no part of the wiring harness, as shown on wiring diagram. The resistor is a 2W, 1500-ohm resistor.

If the resistor has failed open, a likely cause is due to the power stealing thermostat. Connecting C (common) may resolve the issue. Having an open resistor should not affect the operation of the motor.

Fan Speed Selection

The fan speed selection is done at the motor connector. Units with or without electric heaters require a minimum CFM. Refer to the unit wiring label to ensure that the fan speed selected is not lower than the minimum fan speed indicated.

To change motor speeds disconnect the BLUE fan lead from motor connector terminal No. 2 (factory default position) and move to desired speed-tap; 1, 2, 3, or 5.

Speed-taps 1, 2, and 3 have a 90-second blower off time delay pre-programmed into the motor. Speed-tap 4 is used for electric heat only (with 0 second blower time delay) and the WHITE wire should remain on tap 4. Speed-tap 5 is used for high static applications, but has a 0-second blower time delay pre-programmed into the motor. See Airflow Performance tables for actual CFM. Also, see Fig. 4 for motor speed selection location.

NOTE: In low static applications, lower motor speed tap should be used to reduce possibility of water being blown off coil.

Tap 1	Low	90 sec off delay
Tap 2	Medium	90 sec off delay
Tap 3	High	90 sec off delay
Tap 4	Electric heat †	0 sec off delay
Tap 5	Max ‡	0 sec off delay

† electric heat airflow is same CFM as Tap 3, except 0 sec off delay
‡ high static applications, see airflow tables for max airflow

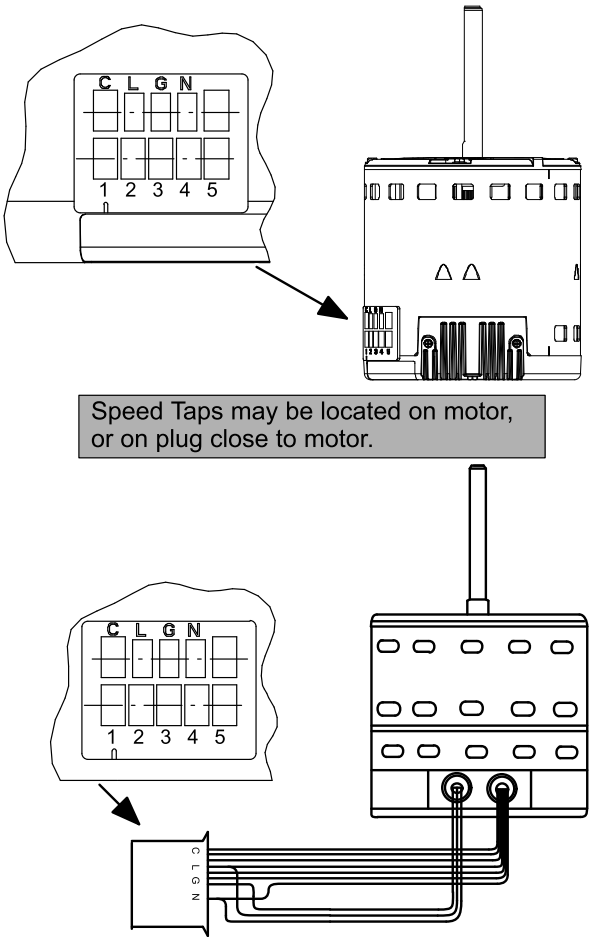


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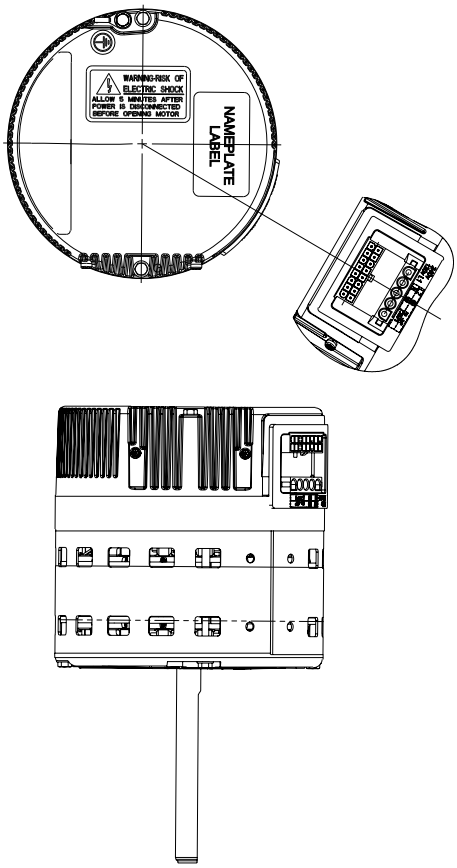
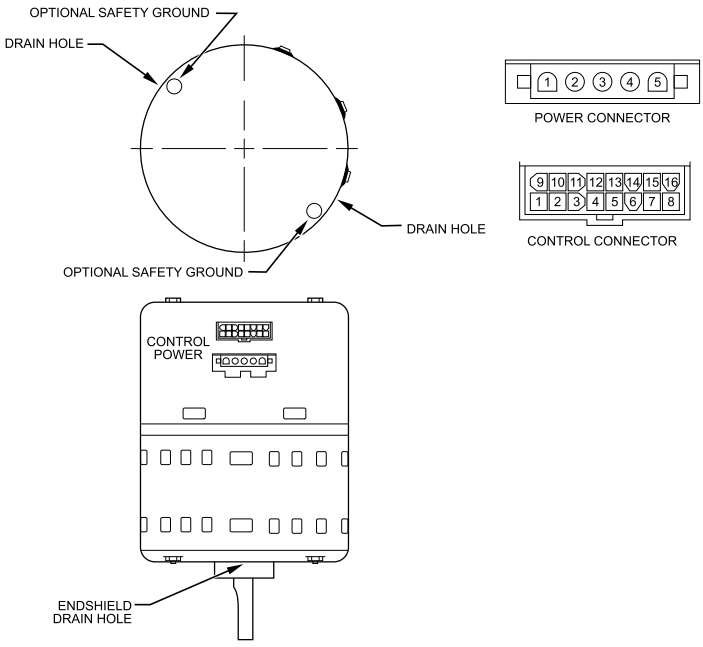
Fig. 4 – Motor Speed Selection for FB4C, FJ4, FX4D, FZ4A, F54 & PF4 (odd sizes)



A13028

Fig. 5 – FV4 Motor / ECM5.0 Motor (pre-2023)



A98201

Fig. 6 – FV4 Motor / ECM2.3 Motor (pre-2023)

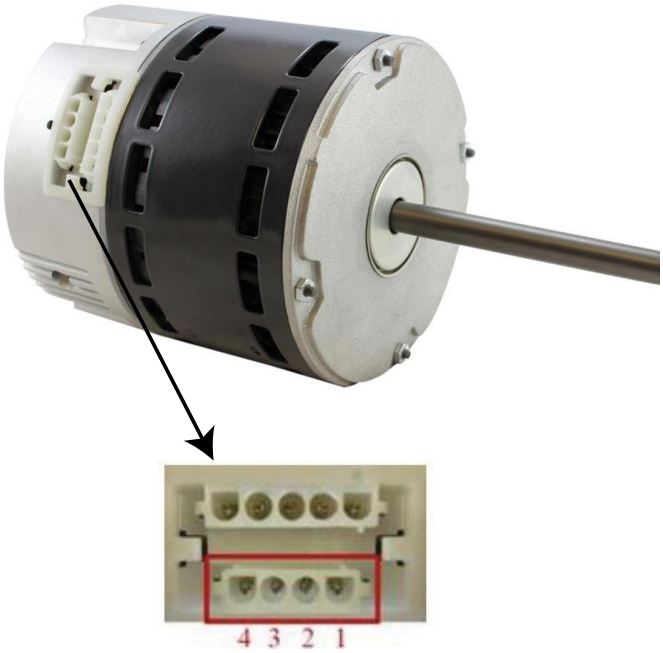


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Fig. 7 – ECM Motor, post-2023

FV, FT4, FG4

Constant Air Flow

Unlike fan coils using induction motors where static pressure affects airflow, these fan coils are constant airflow units. The blower delivers requested airflow regardless of static pressure. Consult fan coil Product Data for static pressure limits. The ECM2.3/5.0 is pre-programmed and contains airflow tables for all modes of operation. Blower characteristics (requested airflow, torque, and speed) are known from laboratory testing If any two characteristics are known, the third is defined.

Requested airflow is known from Easy Select board configuration and thermostat signals. Torque is known because it is directly related to stator current, which is measured by motor control. Speed is measured by counting back EMF pulses from stator windings. This information is entered into an expression that calculates torque from speed and airflow numbers. If calculation does not match stored blower characteristics, torque is adjusted until agreement is reached. This calculation and adjustment is performed every 0.8 seconds while motor is in operation. There is no direct measure of static pressure, but unit does react to a change in static to maintain constant airflow. A change in pressure will result in a change in stator speed and torque. The motor will begin to adjust on the next sampling, calculate new desired speed and torque, and adjust as necessary.

Integrated Controls and Motor ECM2.3/5.0

An ECM2.3/5.0 is fed high voltage AC power through the 5-pin connector (Fig. 6 or Fig. 5). The AC power is then internally rectified to DC by a diode module. After rectification, DC signal is electronically communicated and fed in sequential order to three stator windings. The frequency of these commutation pulses determines motor speed. The rotor is permanently magnetized.

An ECM2.3/5.0 is powered with high voltage at all times. The motor will not run with high voltage alone. Low voltage must be applied to control plug to run motor.

ECM2.3/5.0 Control Power

The ECM2.3/5.0 control power is supplied from R circuit through printed circuit runs to motor control Connector-Pin 8, through motor control harness to motor. The C side of low-voltage control power circuit is connected by printed circuit runs to motor Connector pins 9, 10, and 11, then through motor control harness to motor.

Low-Voltage Circuit Fusing and Reference

The low-voltage circuit is fused by a board-mounted 5A automotive-type fuse placed in series with transformer SEC2 and R circuit. The C circuit of transformer is referenced to chassis ground through a printed circuit run at SEC1 connected to metal standoff marked.

For FT: The low-voltage circuit is fused by a board-mounted 5A automotive fuse placed in series with the transformer SEC1 (24VAC) and the R circuit. The C circuit of the transformer is referenced to chassis ground through a printed circuit run at SEC2 (COM) connected to metal standoff marked with ground symbol.

NOTE: The PCB must be mounted with two screws and motor ground lead secured to blower housing or erratic motor operation can result.

Transformer, Motor, and Electric Heater Power Connection

Transformer high voltage supplied from electric heater package or high voltage leads through 12-pin heater connector plug/recp2. The ECM2.3/5.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

PCB Layout and Description (FT4, FV4)

NOTE: Layout of actual PCB is depicted in Fig. 8.

The Easy Select Board is the interface between the ECM motor and other system components. The board offers choices of electric heater size, outdoor unit size and type, comfort or efficiency settings, on and off delay profiles, and continuous fan speed. The installer should select the correct size of components that are being installed in each installation. If no selections are made, the factory default settings are for the largest heater, largest outdoor unit, AC system type, nominal airflow adjust, and 0/90 time delay.

A 16x4 motor signal translator is present for the translation of data from the board to the motors and is mounted on the back of the PCB bracket.

NOTE: Outdoor unit model should have an AHRI rating with the variable speed fan coil. Some outdoor unit models will not work properly with this fan coil.

- Power for system is supplied from a 230VAC, 60-Hz line. Class 2 voltage (24VAC nom.), used for thermostat connections, is derived from transformer located in close proximity to PCB.
  - The 24VAC secondary circuit includes 5A automotive type fuse.
- Connection to heater panel is made through 12-pin connector PL-1. Connections to thermostat are made at screw terminals. Twenty-one pin terminals comprise field select taps for motor.
- Fuse Data: 5A automotive-type ATC/ATO (tan)
- 32V
- 200 percent current opening time of five seconds maximum

Electrical Connections

Twenty-one 0.110-in pin terminals are used to provide programming selections for operating modes of ECM2.3/5.0. The selection modes are listed below. For additional information, refer to Easy Select Configuration Taps section.

- AUX Heat Range—(Violet Wire)
- AC/HP Size—(Blue Wire) Type—(Orange Wire)
- AC/HP CFM Adjust—(Black Wire)
- AC/HP Time Delay—(Grey Wire)
- Continuous Fan—(Yellow Wire)

Sequence of Operation (FT4, FV4)

Continuous Fan Mode

The thermostat closes circuit R to G. The unit delivers the airflow selected for fan only operation.

Cooling Mode—Single Speed or Two-Speed High

Thermostat closes circuits R to G, R to Y/Y2 and R to O (heat pump only). A circuit R to Y1 is required for two-speed high operation. Airflow delivered the airflow selected by AC/HP SIZE selection and CFM ADJUST selection.

Cooling Mode—Two-Speed Low

Thermostat closes R to G and R to Y1 and R to O (heat pump only). Unit delivers two-speed low airflow for AC/HP SIZE and CFM ADJUST selected.

Cooling + Dehumidify Mode (Thermidistat or Comfort Zone II-B and Single-Speed Outdoor Unit Installed)

J1 jumper must be pulled from Easy Select Board. Control closes R to G, R to Y/Y2, and R to O (heat pump only) and open R to DH. Dehumidification is active when 24VAC is removed from DH terminal. Unit delivers 20 percent less airflow.

SuperDehumidify Mode (Thermidistat or Comfort Zone II-B indoor control, Single-Speed Outdoor Unit)

This mode is only activated by the indoor control when COOL to DEHUMIDIFY and SUPERDEHUMIDIFY are configured at the control and there is a call for dehumidfication without a call for cooling. The control closes R to Y/Y2, R to O (heat pump only) and opens R to DH and R to G. This signals the fan coil to run at minimum airflow for maximum humidity removal. The control will cycle the equipment 10 minutes on and 10 minutes off until satisfied.

NOTE: Super Dehumidification and Thermidistat functionality is not available with certain thermostat models. Verify with the thermostat manufacturer if this functionality is critical to the application.

Table 1 – Motor and Modules

Model Size	Motor Type	Current Blower Motor P/N	Required Control Module Replacement Kit Number
FV4B_002	ECM2.3	HD44AE131	RMOD44AE131
FV4B_003	ECM2.3	HD44AE132	RMOD44AE132
FV4B_005	ECM2.3	HD44AE133	RMOD44AE133
FV4B_006	ECM2.3	HD46AE244	RMOD46AE244
FV4C_002 (Series A)	ECM2.3	HD44AR131	RMOD44AR131
FV4C_003 (Series A)	ECM2.3	HD44AR132	RMOD44AR132
FV4C_005 (Series A)	ECM2.3	HD44AR133	RMOD44AR133
FV4C_006 (Series A)	ECM2.3	HD46AR244	RMOD46AR244
FV4C_002 (Series B)	ECM5.0	HD44AR120	HK44ER120
FV4C_003 (Series B)	ECM5.0	HD44AR121	HK44ER121
FV4C_005 (Series B)	ECM5.0	HD44AR122	HK44ER122
FV4C_006 (Series B)	ECM5.0	HD46AR223	HK46ER223

Table 2 – Motor and Modules – post-2023 (Mid and Deluxe Tier)

Configuration	Fan Coil Model Family	Size	Motor Type	Motor P/N	Motor Signal Translator P/N	Control Module P/N
Singular	FT4, FT5	24	ECM	HD44RM600	HK43EJ001	HK38EA060
Singular	FT4, FT5	36	ECM	HD44RM600	HK43EJ002	HK38EA060
Singular	FT4, FT5	48	ECM	HD46RM600	HK43EJ003	HK38EA060
Modular	FT4, FT5	60	ECM	HD44RM600	HK43EJ002	HK38EA060
Modular	FT4, FT5	48	ECM	HD46RM600	HK43EJ003	HK38EA060
Modular	FT4, FT5	60	ECM	HD46RM600	HK43EJ004	HK38EA060
Singular	FG4, FG5	24	ECM	HD44RM600	HK43EJ001	HK61EA024
Singular	FG4, FG5	36	ECM	HD44RM600	HK43EJ002	HK61EA024
Singular	FG4, FG5	48	ECM	HD46RM600	HK43EJ003	HK61EA024
Modular	FG4, FG5	60	ECM	HD46RM600	HK43EJ004	HK61EA024
Singular	FE4, FE5	24	ECM	HD44RM600	n/a	HK38EA061
Singular	FE4, FE5	36	ECM	HD44RM600	n/a	HK38EA061
Singular	FE4, FE5	48	ECM	HD46RM600	n/a	HK38EA061
Modular	FE4, FE5	36	ECM	HD44RM600	n/a	HK38EA061
Modular	FE4, FE5	48	ECM	HD46RM600	n/a	HK38EA061
Modular	FE4, FE5	60	ECM	HD46RM600	n/a	HK38EA061

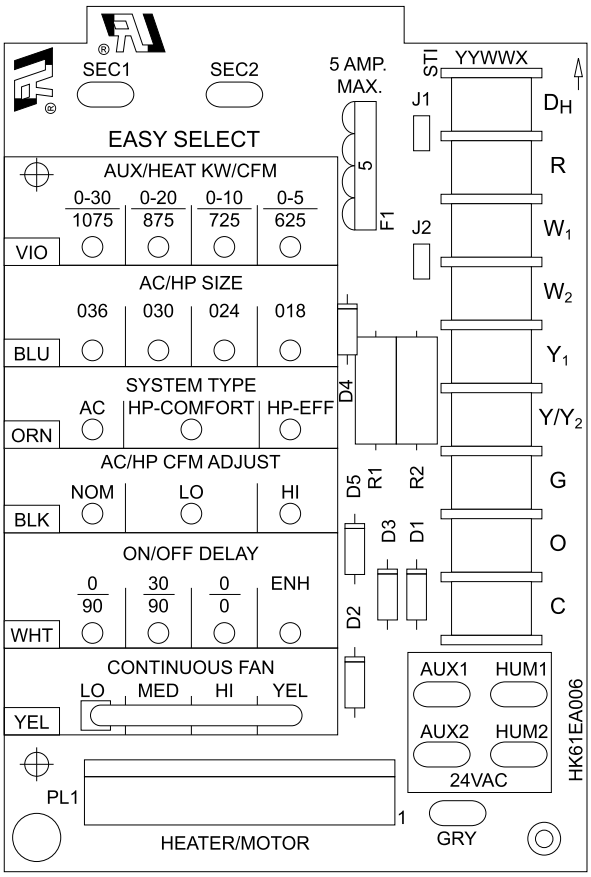

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Fig. 8 – Easy Select Board
(for non-Limitless models; see Table 1 and Table 2 for P/N)

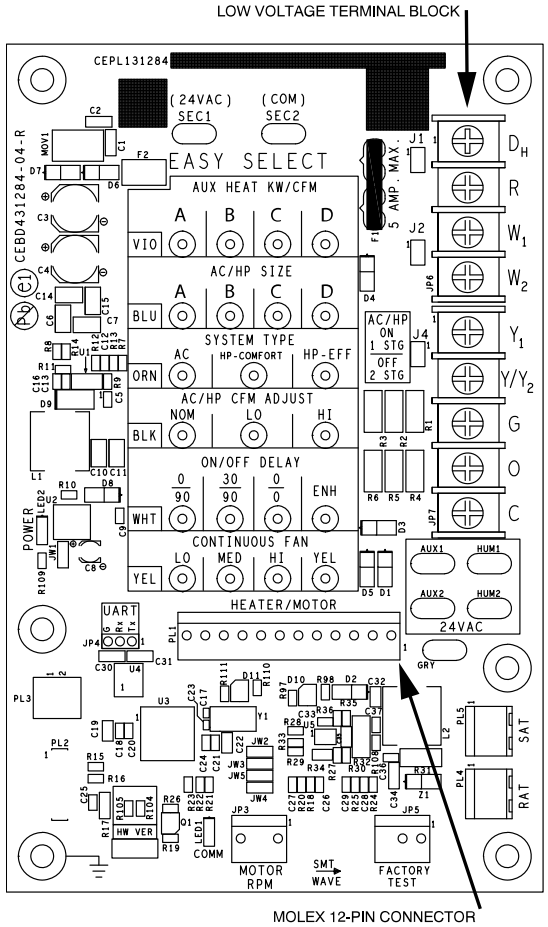

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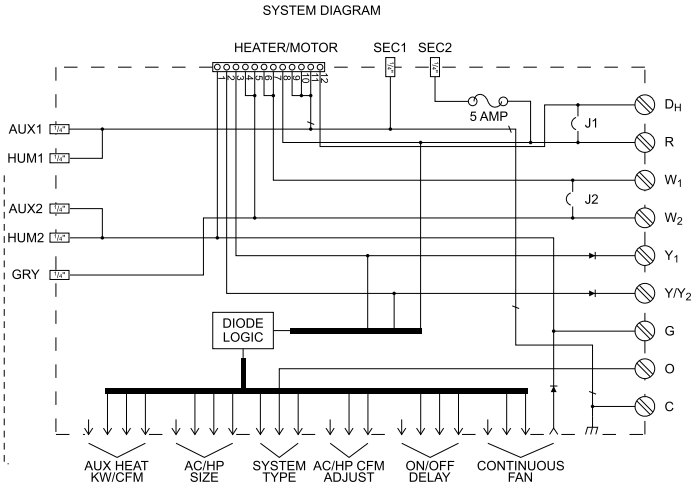
Fig. 9 – Detail of Limitless Printed-Circuit Board
(FT4B/FT5 only; see Table 2 for P/Ns) and Table 5 for Adjustments



NOTE: On FT4, SEC1 and SEC2 are reversed in the above image. See (Low-Voltage Circuit Fusing and Reference on p7)

A96431

Fig. 10 – Easy Select Board Schematic

Table 3 – Connections and Connectors (FK4, FV4)

Type Connection	Type Connector	Pin No.	Description
Heater Connection	12-Pin	Pin 1	Common to screw terminal G
		Pin 2	Common to screw terminal Y/Y2 through diode D3
		Pin 3	Common through Y1 through diode D2
		Pin 4	Common to W2 screw terminal
		Pin 5	Common to W2 screw terminal
		Pin 6	Common to W1 screw terminal
		Pin 7	Common to W1 screw terminal
		Pin 8	R 24Vac
		Pin 9	Common to transformer C
		Pin 10	Common to transformer C
		Pin 11	Common to transformer C
		Pin 12	Common to DH screw terminal

Table 4 – Typical Operating Modes

Operating Mode	Terminals Energized
Heat Pump Only Heating	R, Y/Y2, G, DH
Heat Pump Only Heating + Super Comfort Heat Mode	R, Y/Y2, DH
Heat Pump Heating + Auxiliary Heat (non-staged)	R, Y/Y2, G, DH, W2
Cooling	R, Y/Y2, G, DH, O
Cooling + Dehumidification	R, Y/Y2, G, O

Heat Pump Heating Mode — Single Speed or Two-Speed High

Thermostat closes R to Y/Y2 and R to G. A circuit R to Y1 is required for two-speed high operation. The unit delivers airflow selected by AC/HP SIZE selection and CFM ADJUST selection. Selected delay profile is active in this mode.

Heat Pump Heating Mode — 2-Speed Low

Thermostat closes R to G and R to Y1. Unit delivers two-speed low airflow for AC/HP SIZE and CFM ADJUST selected. Selected delay profile is active in this mode.

Non-Staged Auxiliary with Heat Pump Heating Mode

Thermostat should already have closed R to G, R to Y2 for heat pump heating operation. With J2 jumper in place, energizing either W1 or W2 will produce the W2 airflow. This is the greater of heat pump heating and auxiliary heat airflow plus an additional 15 percent. The elected delay profile is not active in this mode.

Staged Auxiliary Heat with Heat Pump Heating Mode

The auxiliary heat can be staged by removing the J2 jumper that ties W1 and W2 terminals together. Staging can be done by using outdoor thermostats or by using the Intelligent Heat Staging option where the indoor control can be configured for three-stage electric heat. The unit will automatically adjust airflow when the different stages of heat are energized. The airflow delivered will depend on the heat pump size selected and electric heat size selected. The greater of the two airflows will be delivered. The selected delay profile is not active in this mode.

Electric Heat without Heat Pump

Thermostat closes R to W and thermostat should be set up to energize G with W. This is due to the Super Comfort Heat programming in the

motor. Energizing W without G will result in 25% lower airflow delivery. The selected delay profile is not active in this mode.

Super Comfort Heat Mode

This is a special heating mode only available on FV4 fan coils combined with a Thermidistat Control or Comfort Zone II-B. When this option is selected, the indoor control will monitor the outdoor temperature. The control will drop the G signal to the fan coil when the outdoor temperature is between 10° and 40° F. This triggers the motor to slow to approximately 213 CFM per ton. The heaters will stage as needed during this mode and the motor will adjust airflow as required. Below 10° F, the W1 control output will automatically energize on a call for heat. The ECM2.3/5.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

Easy Select Configuration Taps

The Easy Select taps are used by installer to configure system. The ECM2.3/5.0 uses selected taps to modify its operation to a pre-programmed table of airflows. Airflows are based on system size and mode of operation and those airflows are modified in response to other inputs such as the need for de-humidification (Fig. 8).

The FV4 and FT4 Fan Coils must be configured to operate properly with system components with which it is installed. To successfully configure a basic system (see information printed on circuit board located next to select pins), move the six select wires to pins which match components used, along with homeowner preferences.

Auxiliary Heat Range

The installer must select the auxiliary heat airflow approved for application with kW size heater installed. Each select pin is marked with a range of heaters for which airflow (also marked) is approved. For increased comfort select the narrowest kW range matching the heater size, for example, 0-10 for a 10-kW heater. This airflow must be greater than the minimum CFM for electric heater application with the size system installed for safe and continuous operation. Note that airflow marked is the airflow which will be supplied in emergency heat mode and heating mode on air conditioners when electric heat is primary heating source. To ensure safe heater operation in heat-pump heating mode, when electric heaters are energized, the ECM2.3/5.0 will run the higher of heat pump airflow and electric heater airflow. The factory default selection is largest heater range approved (Fig. 8).

AC/HP Size

The factory default setting for air conditioner or heat pump size is largest unit meant for application with model of fan coil purchased. The installer needs to select air conditioner or heat pump size to ensure that airflow delivered falls within proper range for size of unit installed in all operational modes (Fig. 8).

The letters A, B, C, D may be marked on the silk screen. In that case, use the unit's installation instructions to determine the Aux heat and AC/HP size. See Fig. 9.

Table 5 – Airflow Adjustment Table

Unit Size	AUX Heat Range (kW/CFM)			
VIO	A	B	C	D
24	0-20 / 1200	0-15 / 1050	0-10 / 750	0-5 / 700
36	0-20 / 1225	0-15 / 1050	0-10 / 750	0-5 / 700
48	0-30 / 1500	0-20 / 1350	0-15 / 1200	0-10 / 1000
60	0-30 / 1750	0-20 / 1350	0-15 / 1250	0-10 / 1200
	AC/HP Size			
BLU	A	B	C	D
24	036	030	024	018
36	042	036	030	024
48	048	042	036	030
60	060	048	042	036

Unpack unit and move to final location. Remove carton taking care not to damage unit. Inspect equipment for damage prior to installation. File claim with shipping company if shipment is damaged or incomplete.

Locate unit rating plate which contains proper installation information. Check rating plate to be sure unit matches job specifications.

System Type

The type of system must be selected.

1. AC—air conditioner (approx. 350 CFM/ton)
2. HP-COMFORT—provides lower airflow than air conditioner selection (approximately 315 CFM/ton) in heating mode. In cooling mode supplies 350 CFM/ton.
3. HP-EFF—provides same airflow for heat pump heating and cooling modes (approximately 350 CFM/ton).

The factory setting is AC (Fig. 8).

AC/HP CFM Adjust

Select low, nominal, or high airflow. The factory selection is NOM. The adjust selections HI/LO will regulate airflow supplied for cooling and heat pump heating modes only, +15 percent and -10 percent respectively. The adjust selection options are provided to adjust airflow supplied to meet individual installation needs for such things as noise, comfort, and humidity removal (Fig. 8).

ON/OFF Delay

NOTE: ON/OFF Delay is active only in cooling and heat pump only heating modes. In auxiliary heat mode or emergency heat mode, the ON delay is 0 seconds and the OFF delay is fixed and cannot be overridden.

Select desired time delay profile. Four motor-operation delay profiles are provided to customize and enhance system operation (Fig. 8). The selection options are:

1. The standard 90-seconds OFF delay (factory setting 0/90).
2. No delay option used for servicing unit or when a thermostat is utilized to perform delay functions (0/0).
3. A 30–seconds ON / 90–seconds OFF delay profile is used when it is desirable to allow system coils time to heat up/cool down prior to airflow. This profile will minimize cold blow in heat pump operation and could enhance system efficiency (30/90).
4. ENH, enhanced selection provides a 30–seconds ON / 150–seconds at 70 percent airflow and no OFF delay.

Continuous Fan

Select desired continuous-fan profile LO, MED, or HI. Airflow are provided to customize and enhance the continuous fan functions (Fig. 8). The possible selections are:

1. LO – provides 50 percent of Y/Y2 Cool airflow.

2. MED – provides 80 percent of Y/Y2 Cool airflow.
3. HI – provides 100 percent of Y/Y2 Cool airflow.

The factory setting is LO.

NOTE: If applied to two-speed unit, do not select continuous fan as HI since low speed cooling will also run at HIGH airflow and insufficient dehumidification may result.

Easy Select Board Jumpers

J1 – This jumper must be pulled to activate dehumidification mode. The jumper connects R to DH. With the jumper in, the DH terminal is always energized. With the jumper pulled, the DH terminal is de-energized. A control such as the Thermidistat must be used to supply the 24V signal when there is no call for dehumidification, and turn off the 24V when there is a call for dehumidfication.

J2 – This jumper activates heat staging. The jumper connects the W1 and W2 terminals together. If either is energized, W2 airflow is delivered. With the jumper pulled, there are separate airflows for W1 and W2.

J4 – This jumper is for InteliSense™ operation (FT4B/FT5). As shipped, Y1 is connected to Y/Y2 by a field-removable jumper J4. With the jumper in place, in single stage operation InteliSense™ communication is enabled. For 2-stage application, remove jumper J4.

Airflow Delivery

These units deliver airflow depending on the system size selections and operating mode. The thermostat energizes a combination of terminals on the Easy Select Board which tells the motor what CFM to deliver. The following are typical operating modes and the terminals that should be energized on the Easy Select Board.

NOTE: The DH terminal on the Easy Select Board is for dehumidification. It is de-energized on a call for dehumidification.

Variable Speed Motor Logic Sequence:

The ECM motors in these fan coils are programmed to deliver a variety of airflows. The motor goes through:

COOLING – The nominal cooling airflow for these fan coils is 350 CFM per ton. Selecting the HI adjust tap increases the airflow to 400 CFM per ton. The LO tap decreases airflow to 315 CFM per ton. The low adjustment is only active during normal cooling mode. Removing the signal from the DH terminal reduces the airflow to 80 percent of cooling airflow. Removing the G signal for Superdehumidify reduces the airflow to 50 percent of cooling.

HEATING – The base heat pump only heating airflow is determined by the SYSTEM TYPE selection on the Easy Select Board. If HP-EFFICIENCY is selected, the airflow is the same as Cooling. IF HP-COMFORT is selected, the airflow is 315 CFM per ton. The airflow will adjust up if necessary when auxiliary heating is required. When both the Y/Y2 and W1 or W2 terminals are energized, the motor will run the higher of the heat pump or electric heat airflows. During Super Comfort Heat mode, the indoor control removes the G signal from the board. This slows the motor to 75 percent of heat pump airflow. If the CFM adjust is set to LO, it will deliver 67.5 percent of heat pump airflow during Super Comfort Heat mode.

Troubleshooting

Troubleshooting Easy Select Board (FV, FT4)

If Traces Are Overheated on Back of PCB:

Usually whenever there is a trace broken on PCB, it means either there has been a high-voltage short or high voltage has been applied to low-voltage circuit. This can be prevented by making sure PCB is wired correctly before fan coil has power applied to it.

If PCB Fuse Keeps Blowing:

When low-voltage fuse blows, it means transformer would have blown if fuse had not been in circuit to protect it. The fuse usually blows when there is a high current drawn on transformer, high voltage applied to low-voltage circuit, or a direct secondary short. When there is a high current drawn on transformer, it is most likely because transformer has been shorted or system is trying to draw more VAC than transformer rating allows. When fuse blows because of high voltage, the system has mixed high and low-voltage signals.

1. Check transformer and thermostat wiring (Fig. 8). Be sure transformer is not shorting out because thermostat wires are miswired.
2. Check wiring of relays (Fig. 8). Be sure low-voltage and high-voltage wiring are connected to proper sequencers.
3. Check VA draw on transformer. If VA draw is more than VA rating of transformer, fuse will blow. If this is the case, replace transformer with one that has a higher VA rating.

Troubleshooting Common Problems

Airflow Too Low:

- Y1 instead of Y/Y2 on single-speed air conditioner or heat pump application. Y1 input is only for two-speed applications. Using this terminal will deliver about 60 percent of full cooling airflow.
- Wrong Easy Select Board selection. Selecting an outdoor unit or electric heater smaller than actually installed will result in low airflow for the application.
- G not energized with call for cooling or heating. This triggers Super Comfort Heat or SuperDehumidify mode which delivers 50 percent of cooling airflow.
- J1 jumper pulled with no thermidistat or dehumidistat installed. The J1 jumper ties the DH terminal to R and is installed at the factory. When pulled, a Thermidistat or dehumidistat supplies a 24V signal to DH when there is no call for dehumidification (reverse logic). When there is no signal on DH, the motor reduces airflow to 80 percent for better dehumidification.

Airflow Too High:

- Wrong Easy Select Board selection. Fan coil is factory set for the largest outdoor unit and largest electric heater. Select sizes that are actually installed.
- Continuous fan set too high for two-speed applications. Set to MED or LO.

Motor Will Not Stop:

- Allow time for off delay to time out. In units built before serial number 0101A, any W call will have a two-minute off delay independent of delay selection. This is programmed into the motor and cannot be overridden.
- In units built after 0101A, the off delay on any W call is one minute and cannot be overridden.
- Some power-stealing thermostats could bleed enough voltage to cause motor to run slowly when there is no heating or cooling call. Disconnect thermostat wires and wait two minutes to see if motor stops. If it stops, replace thermostat, or install resistor per thermostat installation instructions.

Motor Will Not Start:

- See following section, “Troubleshooting ECM2.3/5.0 Motor and Controls.”

Troubleshooting ECM2.3/5.0 Motor and Controls

⚠ CAUTION

ELECTRICAL OPERATIONS HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

High voltage is always present at motor. Disconnect power to unit before removing or replacing connectors or servicing motor. Wait at least five minutes after disconnecting power before opening motor.

The ECM/ICM motor used with this product contains two parts: the control module and the motor winding section. Do not assume the motor or module is defective if it will not start. Go through the steps described below before replacing control module, Easy Select Board or entire motor. The control module is available as a replacement part.

If Motor Turns Slowly:

1. It is normal operation to run noticeably slower if G terminal is not energized in cooling or heat pump heating modes.
2. Attach blower access panel. Motor may appear to run slowly if access panel is removed.

If Motor Does Not Run:

Turn power off, wait five minutes and check the following:

1. With power turned off, check 5A fuse on Easy Select Board.
2. Check all plugs and receptacles for any deformation or corrosion that could cause bad connections. Be sure plugs are fully seated.

⚠ CAUTION

ELECTRICAL OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

DO NOT remove or apply 5-pin plug on motor with power on. Arcing could occur, which can damage control module.

Turn power back on and check the following:

3. Check for 24VAC on SEC1 and SEC2. If no voltage is present, check transformer.
4. Verify that approximately 230VAC is present at motor.
5. Verify low voltage control signals to motor according to procedure below.

Use following procedure to check low voltage signals:

The ECM motor in these fan coils receive low voltage signals from the Easy Select Board through the wiring harness assembly. The combination of pins energized at the motor determines the speed the motor will run. The procedure below isolates the fan coil from all external devices such as a thermostat, condensing unit, humidifier or electronic air cleaner. There is also a specific troubleshooting example to demonstrate the process. Table 6 provides information needed to verify that the correct voltages are present at the motor and the Easy Select Board.

THERMOSTAT:

1. Remove all thermostat and accessory wires from Easy Select Board.
2. On Easy Select Board, jumper screw terminals (1 at a time): R-G, R-Y/Y2, R-Y1, R-W1, R-W2. If motor runs in all cases, check thermostat outputs. Thermostat wires may be broken, or thermostat may be miswired, configured incorrectly, or defective. If the motor does not run, or runs in some cases, but not others, continue this procedure to check wiring harness and circuit board.

WIRING HARNESS:

1. Remove 16-pin/4-pin plug from motor.
2. Check for appropriate voltages on 16-pin/4-pin connector with screw terminals jumpered (Table 3).
3. If signals check correctly, and motor does not run, inspect wiring harness for loose pins or damaged plastic that could cause poor connections.
4. If connections are good, either control module or motor is defective.
5. If proper signals are not present, check circuit board using procedure below:
6. If the unit contains a motor signal translator box (16X4), repeat these steps with the connections on these connectors.

12-PIN PLUG (PL-1) ON EASY SELECT BOARD:

1. Completely disconnect wire harness from Easy Select Board.
2. Jumper the screw terminals one at a time; R-G, R-Y/Y2, R-Y1, R-W1, R-W2 and check for appropriate voltages on the Easy Select Board pins. If proper signals are not present, replace Easy Select Board. If proper signals are present at the pins and not at 16-pin connector to the motor, the wiring harness is defective.

TROUBLESHOOTING EXAMPLE:

Motor is not running on a call for heat pump heating after jumpering the Easy Select Board screw terminals as described in Thermostat section above.

With all thermostat wires removed from Easy Select Board, place a jumper wire between R and Y/Y2 low-voltage screw terminals on the Easy Select Board.

1. Check Table 6 for pin number on 16-pin connector associated with the Y/Y2 signal. The correct pin is No. 14. The far right column of the table shows that (-)12VDC should be present between Pin No. 14 and Pin No. 1 (common) on the 16-pin connector.
2. Set meter to read DC voltage. Place meter leads between Pins No. 1 (common) and No. 14 and check for (-)12VDC. If signal is present, the problem is in the module or motor. If signal is not present, the problem is either in wiring harness or Easy Select Board.

These steps can be repeated for other modes of operation.

To check Easy Select Board:

1. Leave jumper wire in place between R and Y/Y2.
2. Check Table 6 under "Volt Meter on Easy Select Board Plug" column and row for Pin No. 14 on motor plug to see pin number on Easy Select Board that should have voltage. The correct pin is No. 2. The column on far right will show voltage that should be present between Pin No. 2 and Pin No. 9 (common).
3. Place meter leads between Pins No. 2 and No. 9 on Easy Select Board and check for (-)12VDC.
4. If voltage is present, the wiring harness is bad. If not, the Easy Select Board is bad.

Verify Motor Winding Section:

Before proceeding with module replacement, check the following to ensure motor winding section is functional. With control module removed and unplugged from winding section:

1. The resistance between any two motor leads should be similar.
2. The resistance between any motor lead and the unpainted motor end plate should be greater than 100,000 ohms.

If motor winding fails one of these tests, it is defective and must be replaced.

Accessories

AUXILIARY TERMINALS—The AUX and HUM terminals on the Easy Select Board are tied directly to the G terminal, and provide a 24VAC signal whenever the G terminal is energized (Fig. 10). During Superdehumidify mode, the G signal is not present and the auxiliary terminals are not energized. If the installation includes the use of this operating mode, do not use these terminals to control accessories. See Electronic Air Cleaner and Humidifier sections for further information.

ELECTRONIC AIR CLEANER CONNECTIONS—The AUX1 and AUX2 terminals are not always energized during blower operation, as described above. When using an electronic air cleaner with the FV4 fan coil, use an Airflow Sensor or Airflow Verification switch. The airflow sensor turns on the electronic air cleaner when the fan coil blower is operating.

HUMIDIFIER/HUMIDISTAT CONNECTIONS—Easy Select Board terminals HUM1 and HUM2 are provided for direct connection to the

low-voltage control of a humidifier through a standard humidistat. These terminals are energized with 24VAC when G thermostat signal is present. Alternately, the 24VAC signal may be sourced from the W and C terminal block connections when electric heaters are used as primary heating source. When using a Thermidistat™ Control, Zone Perfect Plus, or Comfort Zone II, the 24VAC signal may be source directly from the Thermidistat HUM terminal.

Dehumidify Mode

NOTE: Humidistat must open on humidity rise.

Latent capacities for systems using the FK4, FT4, FV4, and 40FK fan coils are better than average systems. If increased latent capacity is an application requirement, the field wiring terminal block provides connection terminals for use of a standard humidistat. The FK4, FT4, FV4, and 40FK fan coils will detect the humidistat contacts opening on increasing humidity and reduce its airflow to approximately 80 percent of nominal cooling mode airflow. This reduction will increase the system latent capacity until the humidity falls to a level which causes the humidistat to close its contacts. When the contacts close, airflow will return to 100 percent of the selected cooling airflow. To activate this mode, remove jumper J1 and wire in a standard humidistat. Carefully consult product airflow data for cooling and dehumidification modes.

Table 6 – FV4/FT4 Motor Control Test Values (With 16-pin connector at motor unplugged)

Terminals Jumpered	Volt Meter on 16-pin Harness Plug		Volt Meter on 12-pin Easy Select Board Plug		Voltage
	+	–	+	–	
R to W1	Pin 2	Pin 1	Pin 7	Pin 9	24VAC
R to W2	Pin 13	Pin 1	Pin 4	Pin 9	24VAC
R to Y1	Pin 6	Pin 1	Pin 3	Pin 9	(-)12VDC
R to Y/Y2	Pin 14	Pin 1	Pin 2	Pin 9	(-)12VDC
R to G (LO)	Pin 15	Pin 1	Pin 3	Pin 9	0VAC
R to G (MED)	Pin 6	Pin 1	Pin 3	Pin 9	(-)12VDC
R to G (HI)	Pin 14	Pin 1	Pin 2	Pin 9	(-)12VDC

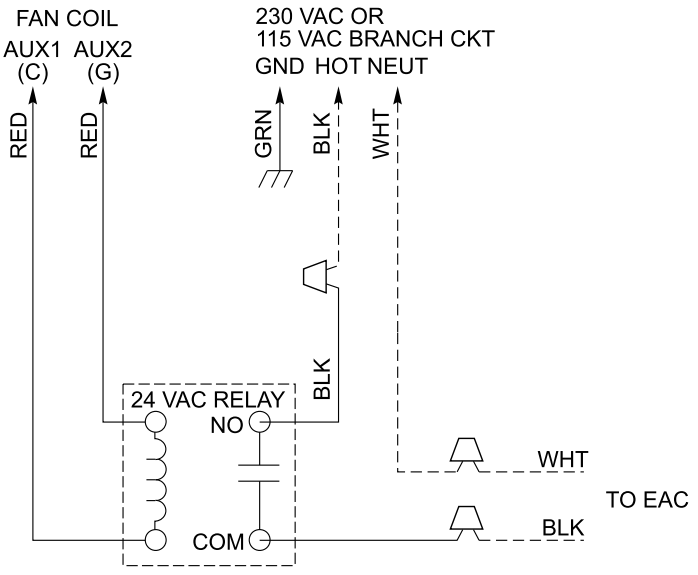


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Fig. 11 – KFAIR0201ACR Relay Kit Wiring Schematic

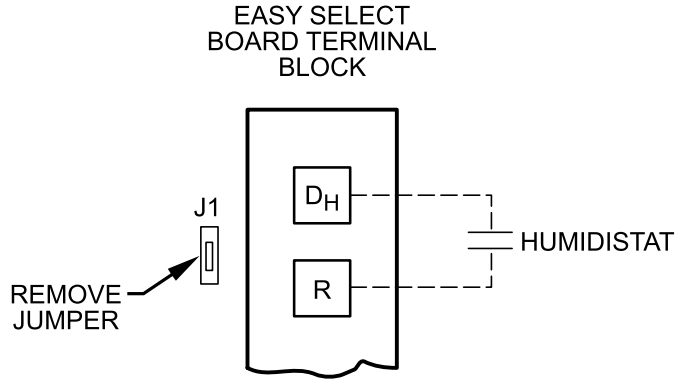

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Fig. 12 – Humidistat Wiring for De-Humidify Mode

InteliSense™ Technology (FT4, FT5)

This unit is InteliSense capable when used with an InteliSense thermostat. InteliSense allows for the collection of performance data in the cloud. The unit comes with two interchangeable sensors: a Return Air Temperature (RAT) sensor and a Supply Air Temperature (SAT) sensor for installation in the field. Make sure the sensors are connected to the appropriate terminals for proper temperature data collection when used with the InteliSense board. See installation instructions for detailed information on RAT/SAT placement and installation.

The InteliSense board uses the existing Easy Select layout for airflow selection with additional circuitry to manage the InteliSense data collection. Refer to the thermostat instructions for Easy Select operation details.

NOTE: When installing and servicing electronic equipment use appropriate safety PPE and avoid damaging system components by utilizing electrostatic discharge protection.

Connected Portal and Service Tech App

The Carrier Connected portal and Service Tech App provide a connection between the dealer/service tech and the homeowner's system. They can provide information about the homeowner's account, equipment configuration, operating performance and fault code history, current equipment status, and allow you to view and update thermostat settings. They can perform remote service diagnostics using real time suction line temperature and pressure w/ superheat calculation, liquid line temperature and pressure with subcooling calculation, outdoor air temperature, supply and return air temperatures, and blower motor RPMs. The dealer's unique contractor PIN can be located through either of these applications.

Power On LED/Board States

The amber LED is illuminated solid when there is power to the product. The green LED is illuminated solid when there is communication between the board and the InteliSense-enabled thermostat.

Table 7 – Diagnostic Code List*

Code	Description
30.1	InteliSense Communication Loss
30.2	InteliSense Communication Board Fault
52.1	Supply Air Temperature Open Fault
52.2	Supply Air Temperature Short Fault
53.1	Return Air Temperature Open Fault
53.2	Return Air Temperature Short Fault

*. Refer to the Service Tech App or Connected Portal for more information. Timestamps shall be applied to the fault when it occurs. Fault codes can be read through the dealer portal or through the service tech app.

How to Troubleshoot

RAT/SAT Functionality

One method of determining RAT/SAT functionality is to compare the actual resistance of the sensor with the nominal resistance at sample temperatures. The table below indicates several example values in the operating range of the sensors.

Communication Loss and Board Fault

Refer to thermostat advanced installation and configuration instructions found at carrier.hvacpartners.com/InteliSense.

Table 8 – RAT/SAT Sensor Values

Temperature (°F)	Nominal Resistance (K-ohms)	Tolerance (± %)
23	42.6	5.92
32	32.8	2.85
41	25.5	2.76
50	19.9	2.68
59	15.7	2.59
68	12.5	2.51
77	10.0	2.44
86	8.1	2.37
95	6.5	2.30
104	5.3	4.48

How Does the Service Tech Know when the System is Functioning Properly?

InteliSense is fully functioning when communication is established (indicated by LED or through the thermostat) and the thermostat has successfully fully learned all of the equipment and data is being displayed on the Connected Portal/service tech app.

FE, FT

Model FE and FT fan coil is designed to be installed with a communicating user interface. The FE and FT fan coil will provide airflow at a rate commanded by the User Interface. The nominal airflow/ton rate is 350 CFM/ton. The User Interface will modify the commanded airflow under certain operating modes. Refer to the User Interface literature for further system control details. This fan coil will not respond to commands from a common thermostat except under certain emergency situations explained in this document.

Electronically Commutated Motor ECM

An ECM motor is fed high voltage AC power through the 5-pin connector. The AC power is then internally rectified to DC by a diode module. After rectification, DC signal is electronically communicated and fed in sequential order to 3 stator windings. The frequency of these communication pulses determines motor speed. The rotor is permanently magnetized.

ECM Control Power

The ECM control power is supplied from R circuit through printed circuit runs to motor control connector Plug 1, Pin 1, through motor control harness to motor. The C side of low-voltage control power circuit is connected by printed circuit runs to motor connector Plug 1, Pin 2 then through motor control harness to motor. A digital signal is sent from Plug 1, Pins 3 and 4 to communicate with the motor including all airflow requirements.

Low-Voltage Circuit Fusing and Reference

The low-voltage circuit is fused by a board-mounted 5A automotive type fuse placed in series with transformer SEC2 and R circuit. The C circuit of transformer is referenced to chassis ground through a printed circuit run at SEC1 connected to metal standoff.

NOTE: The PCB must be mounted with two screws and motor ground lead secured to blower housing or erratic motor operation can result.

Transformer, Motor, and Electric Heater Power Connection

Transformer high voltage supplied from electric heater package or high voltage leads through 12-pin heater connector plug/recp2. The ECM 3.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

Troubleshooting (FE4/FE5A/FE5B)

NOTE: Always check high and low voltage supply to the fan coil components. Check the integrity of the plug receptacle connections and fan coil wiring harness prior to assuming a component failure.

LED Description

LEDs built into fan coil control provide installer or service person information concerning operation and/or fault condition of the fan coil control and ECM motor. This information is also available at system User Interface in text with basic troubleshooting instructions. Careful use of information displayed will reduce the need for extensive manual troubleshooting.

The amber LED located at bottom center of control adjacent to motor harness plug is Motor Status LED, and it is labeled MOTOR. A second amber LED, located in upper right center of control adjacent to System Communications connector (A,B,C,D) is the System Status LED, and it is labeled STATUS. The green LED labeled COMM is also located adjacent to System Communications connector, below STATUS LED, and is used as an indicator of system communications status. Status Codes will be displayed on the STATUS LED using the following protocol:

1. The number of short flashes indicates first digit of code.
2. The number of long flashes indicates second digit of code.
3. A short flash is 0.25 seconds on. A long flash is one second on.
4. The time between flashes is 0.25 seconds.
5. The time between last short flash and first long flash is 1 second.
6. The LED will be off for 2.5 seconds before repeating code.

Fan Coil Control Start-Up and System Communications Troubleshooting

On power up, green COMM LED will be turned off until successful system communications are established (this should happen within 10 seconds). Once communications with User Interface are successful, COMM LED will be lit and held on. At the same time, amber STATUS LED will be lit and held continuously on until a request for operating mode is received. The STATUS LED will be on any time fan coil is in idle mode.

If, at any time, communications are not successful for a period exceeding two minutes, fan coil control will only allow emergency heating or cooling operation using a common thermostat, a non-communicating

outdoor unit and the R, C, Y, O, W outdoor unit terminal strip connections and will display Status Code 16, System Communication Fault, on amber STATUS LED. No further fan coil troubleshooting information will be available at User Interface until communications are re-established.

If COMM LED does not light within proper time period and status code is not displayed:

1. Check system transformer high and low voltage to be sure the system is powered.
2. Check fuse on fan coil control to be sure it is not blown. If fuse is open, check system wiring before replacing it to be sure a short does not cause a failure of replacement fuse.

If COMM LED does not light within proper time period and status code is displayed:

Check system wiring to be sure User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications.

NOTE: Shorting or mis-wiring low voltage system wiring will not cause damage to fan coil control or User Interface but may cause low voltage fuse to open.

Table 9 – Troubleshooting Status Codes

Code	Description / Procedure Link to Text
16	(STATUS CODE 16, SYSTEM COMMUNICATION FAULT: on p17)
45	(STATUS CODE 45, CONTROL BOARD TEST FAULT: on p16)
37	(STATUS CODE 37, HEATER OUTPUT SENSED “ON” WHEN NOT ENERGIZED: on p16)
44	(STATUS CODE 44, MOTOR COMMUNICATION FAULT: on p16)
25	(STATUS CODE 25, INVALID MOTOR / MODEL SELECTION: on p16)
27	(STATUS CODE 27, INVALID OUTDOOR UNIT SIZE: on p16)
26	(STATUS CODE 26, INVALID HEATER SIZE: on p16)
36	(STATUS CODE 36, HEATER OUTPUT NOT SENSED WHEN ENERGIZED: on p17)
41	(STATUS CODE 41, BLOWER MOTOR FAULT: on p17)
46	(STATUS CODE 46, BROWNOUT CONDITION: on p17)
53	(STATUS CODE 53, OUTDOOR AIR TEMPERATURE SENSOR FAULT: on p17)

ECM Motor Troubleshooting

The ECM motor used in this product consists of two parts: the control module and the motor winding section. Do not assume motor or module is defective if it will not start. Use the designed-in LED information aids and follow troubleshooting steps described below before replacing motor control module or entire motor. Motor control module is available as a replacement part.

motor will shut itself down and wait for communications to be reestablished.

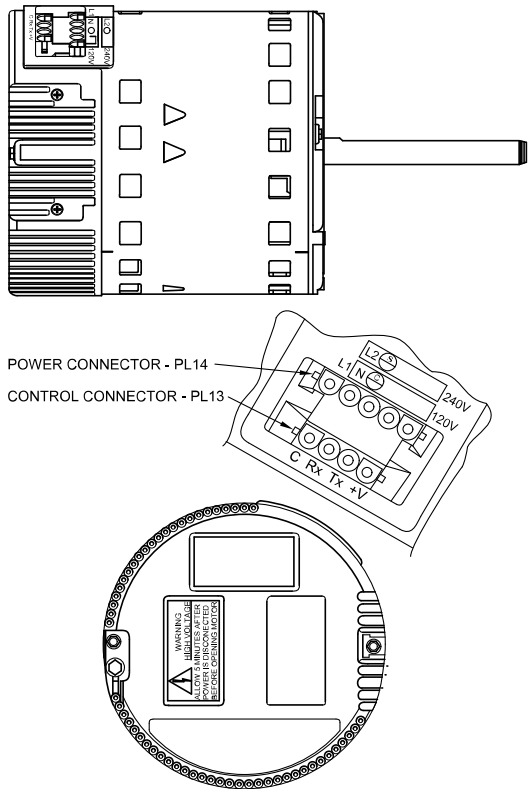

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Fig. 13 – FE4/FE5 ECM Motor

Vefify Motor Winding Section

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death or possible equipment damage.

After disconnecting power from the ECM motor, wait at least five minutes before removing the control section. Internal capacitors require time to discharge. Minor injury from electrical shock may result from early contact with live metal parts.

Before proceeding to replace a motor control module:

1. Check motor winding section to be sure it is functional.
2. Remove motor control module section and unplug winding plug. Motor shaft should turn freely, resistance between any two motor leads should be similar and resistance between any motor lead and unpainted motor end should exceed 100,000 ohms.
3. Failing any of these tests, entire ECM motor must be replaced.
4. Passing all of the tests, motor control module alone can be replaced.

Motor Turns Slowly

1. Low static pressure loading of blower while access panel is removed will cause blower to run slowly. Particularly at low airflow requests. This is normal, do not assume a fault exists.
2. Recheck airflow and system static pressure using User Interface service screens with access panel in place.

NOTE: Blower motor faults will not cause a lockout of blower operation. Fan coil control will attempt to run the blower motor as long as User Interface maintains a demand for airflow. Fan coil control will not operate electric heaters while a fault condition exists. The fan coil control communicates with the motor at least once every five seconds, even when the motor is idle. If, during operation, the fan coil control does not communicate with the motor for more than 25 seconds, the

Using Motor LED in Troubleshooting

The MOTOR LED is connected to the blower motor communication line and works with the fan coil control microprocessor and the STATUS LED to provide fan coil operation and troubleshooting information. When the motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor. When the motor is commanded to stop, the MOTOR LED will be turned off.

If the MOTOR LED is lit, flashing and the motor is running or if the MOTOR LED is off and the motor is stopped, operation is normal and no motor fault exists.

If the MOTOR LED is lit, flashing and the motor does not run, or if the MOTOR LED is off and the motor is running, check the STATUS LED for the Status Code. Refer to the troubleshooting instructions for the indicated Status Code in Section E, Fan Coil Troubleshooting.

Fan Coil Troubleshooting

Fan coil faults indicated by flashing codes on the amber system STATUS LED can be resolved using troubleshooting information provided below. Codes are listed in order of their priority, highest to lowest. Though multiple faults can exist at any time, only the highest priority code will be displayed on STATUS LED. Clearing the indicated fault when multiple faults exist will cause the next highest priority Status Code to be flashed. All existing faults, as well as a fault history, can be viewed at User Interface.

STATUS CODE 45, CONTROL BOARD TEST FAULT:

Fan coil control has failed internal start-up tests and must be replaced. No other service procedure will correct.

STATUS CODE 37, HEATER OUTPUT SENSED "ON" WHEN NOT ENERGIZED:

Fan coil control is provided with circuitry to detect presence of a 24VAC signal on Electric Heater stage 1 and stage 2 outputs.

If fan coil control detects a 24VAC signal on either heater stage output and it is not supplying signal, Status Code 37 will be displayed on STATUS LED. Fan coil control will turn off output and command blower motor to supply an airflow determined to be safe for current operation mode with electric heaters energized.

To find the fault:

1. Stop all system operations at User Interface and check heater stage 24VAC outputs.
2. Disconnect electric heater at plug/receptacle 2 and check heater wiring for faults. See Status Code 36 for more information.

STATUS CODE 44, MOTOR COMMUNICATION FAULT:

The MOTOR LED is connected to the blower motor communication line and works with the fan coil control microprocessor and STATUS LED to provide fan coil operation and troubleshooting information.

When motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor.

When the motor is commanded to stop, the MOTOR LED will be turned off. The MOTOR LED will not flash to indicate communications when it is turned off.

Fan coil control is constantly communicating with the motor, even when the motor and MOTOR LED are off. If motor does not acknowledge receipt of communications, the control will display Status Code 44 on STATUS LED and continue to try to communicate with the motor. If motor acknowledges communication, status code will be cleared.

If MOTOR LED is lit and flashing and motor does not run:

1. Check the STATUS LED. If STATUS LED is indicating a Status 44 code, check the motor wiring harness for proper connection to control and motor receptacles.
2. Check motor wiring harness to be sure all wiring complies with wiring diagram description, makes a complete circuit from connector to connector and is not shorted.
3. Check 12VDC low-voltage supply to motor at Pins 1 (+) and 2 (-) of motor header connection to fan coil control.

If all checks are normal, fan coil control is good and control module on motor may need replacement. Check motor and Motor Control Module following the instructions in (ECM Motor Troubleshooting on p15).

Shorted or mis-wiring of the low voltage motor harness wiring will not cause damage to fan coil control or to motor control module.

If the MOTOR LED is off, STATUS LED is indicating a Status Code 44 and motor is running:

Disconnect the motor harness at the fan coil control. If motor continues to run, fan coil control is good and control module on motor may need replacement

STATUS CODE 25, INVALID MOTOR / MODEL SELECTION:

On initial start-up, fan coil control shall poll motor for its size data and check fan coil size data stored in fan coil control memory.

1. If motor size is incorrect for fan coil size or fan coil size data is invalid, Status Code 25 will be displayed on STATUS LED.
2. If model size data is missing (as is the case when a replacement fan coil control is installed), system User Interface will prompt installer to enter correct model size from a list of valid sizes.
3. If motor size is incorrect for model size, motor must be replaced with proper size motor. Fan coil control will not respond to operation requests until this fault condition is resolved.

STATUS CODE 27, INVALID OUTDOOR UNIT SIZE:

On initial power-up, fan coil control will write into memory outdoor unit size as provided by User Interface in a fully communicating system.

1. If outdoor unit size is invalid, Status Code 27 will be displayed on STATUS LED.
2. User Interface will prompt the installer to choose size from a list of valid sizes for application with fan coil.
3. Check communications wiring to be sure User Interface has established communications with outdoor unit or select proper size from valid size list provided at User Interface.
4. Check motor and motor control module following the instructions in (ECM Motor Troubleshooting on p15).

STATUS CODE 26, INVALID HEATER SIZE:

On initial power-up, fan coil control will write into memory electric heater size as read from heater if heater is provided with Identifier Resistor (IDR). Heater size must be valid for combination of indoor and outdoor components installed. Fan coil control will read IDR value connected to Pins 5 and 8 of heater harness connector. If no resistor is found, system User Interface will prompt installer to verify that no heater is installed.

Verifying that this is correct will establish that fan coil is operating without an electric heater accessory. Upon choosing negative option, installer will be prompted to select heater size installed from a list of valid heater sizes for fan coil and outdoor unit size installed.

If heater ID resistor value read is invalid, Status Code 26 will be displayed on STATUS LED.

If heater installed is equipped with a resistor connected to Pins 5 and 8 of heater harness connector and Status Code 26 is displayed on STATUS LED:

1. Check wiring harness connections to be sure connections are secure.
2. If symptoms persist, disconnect wiring harness at fan coil control heater header and check for a resistance value greater than 5000 ohms.
3. Check for proper wiring of resistor assembly.

4. Make sure heater size installed is an approved size for outdoor unit and fan coil sizes installed.

NOTE: Fan coil control will not operate electric heater until this Status Code is resolved. If the heater size is set through the User Interface, the heater will be operated as a single stage heater. If staging is desired, the IDR value must be read in by the fan coil control.

Table 10 – FE4/FE5 Self-identifying Resistor Values

Heater Size kW	Resistor Ohms Nominal
No heater	Open
9	11k
15	18k
20	24k
24	33k
30	39k
Hydronic Heat	270k

STATUS CODE 36, HEATER OUTPUT NOT SENSED WHEN ENERGIZED:

Fan coil control is provided with circuitry to detect presence of a 24VAC signal on Electric Heater stage 1 and stage 2 outputs.

If fan coil control energizes either heater stage and does not detect the 24VAC signal on output, Status Code 36 will be displayed on the STATUS LED Fan coil control will continue to energize heater output(s) and adjust blower operation to a safe airflow level for energized electric heat stage(s).

To find the fault, check for 24VAC on heater stage outputs. Fan coil control or sensing circuit may be bad.

NOTE: It may be useful as an electric heater troubleshooting procedure to disconnect the system communications to force Status Code 16 enabling of emergency heat mode. It is difficult to know which heater output is energized or not energized in normal operation. When fan coil is operated in emergency heat mode using electric heaters, both outputs are energized and de-energized together. Terminal strip inputs to control can then be connected R to W to turn on both electric heat outputs. Heater output sensing circuits can then be checked to resolve Status Code 36 or 37 problems.

STATUS CODE 41, BLOWER MOTOR FAULT:

If MOTOR LED is lit and flashing and motor does not run:

1. Check STATUS LED. If STATUS LED is indicating Status Code 41, motor control has detected that the motor will not come up to speed within 30 seconds of being commanded to run or that the motor has been slowed to below 250 rpm for more than 10 seconds after coming up to speed. Motor wiring harness and fan coil control are operating properly, do not replace.
2. Check to be sure that the blower wheel is not rubbing the housing.
3. Check motor to be sure that the motor shaft is not seized (motor control module must be removed and electronics disconnected from windings to perform this check properly).
4. Check motor windings section following instructions in (ECM Motor Troubleshooting on p15).

If all these checks are normal, the motor control module may need replacement.

STATUS CODE 16, SYSTEM COMMUNICATION FAULT:

If, at any time, system communications are not successful for a period exceeding two minutes, the fan coil control will only allow emergency heating or cooling operation using a common thermostat, a non-communicating outdoor unit, and the R, C, Y, O,W outdoor unit terminal strip connections and will display Status Code 16 on the amber STATUS LED. See (Emergency Heating and Cooling Modes on p17).

No further fan coil troubleshooting information will be available at the User Interface until communications are reestablished.

Check system wiring to be sure the User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications. Correcting wiring faults will clear the code and reestablish communications.

Shorting or mis-wiring the low voltage system wiring will not cause damage to fan coil control or to User Interface but may cause the low voltage fuse to open.

STATUS CODE 46, BROWNOUT CONDITION:

If the secondary voltage of the transformer falls below 15VAC for a period exceeding four seconds, Status Code 46 will be displayed on STATUS LED.

If system includes a non-communicating outdoor air conditioner or heat pump, the User Interface will command the fan coil to turn off Y output controlling compressor.

When secondary voltage rises above 17VAC for more than four seconds, the brownout condition is cleared and normal system operation will resume subject to any minimum compressor off delay function which may be in effect. Brownout does not affect blower or electric heater operation.

STATUS CODE 53, OUTDOOR AIR TEMPERATURE SENSOR FAULT:

If an OAT sensor is found at power-up, input is constantly checked to be within a valid temperature range. If sensor is found to be open or shorted at any time after initial validation, Status Code 53 will be displayed at amber STATUS LED.

Check for faults in wiring connecting sensor to OAT terminals. Using an Ohmmeter, check resistance of thermistor for a short or open condition.

If thermistor is shorted or open, replace it to return the system to normal operation. If fault is in the wiring connections, correcting the fault will clear the code and return the system to normal operation.

NOTE: If fault condition is an open thermistor or a wiring problem that appears to be an open thermistor and the power to the fan coil control is cycled off, the fault code will be cleared on the next power-up but the fault will remain and system operation will not be as expected. This is because on power-up, the fan coil control cannot discern the difference between an open sensor or if a sensor is not installed.

Emergency Heating and Cooling Modes

Fan coil control can provide emergency heating or cooling using a common heat/cool thermostat in the event that there are no system communications, fault is in User Interface and no replacement is immediately available.

To activate these modes, the thermostat and outdoor unit must be wired as a common heating/cooling system to fan coil control RYWC terminals. Fan coil control must be powered and displaying Status Code 16, System Communication Fault.

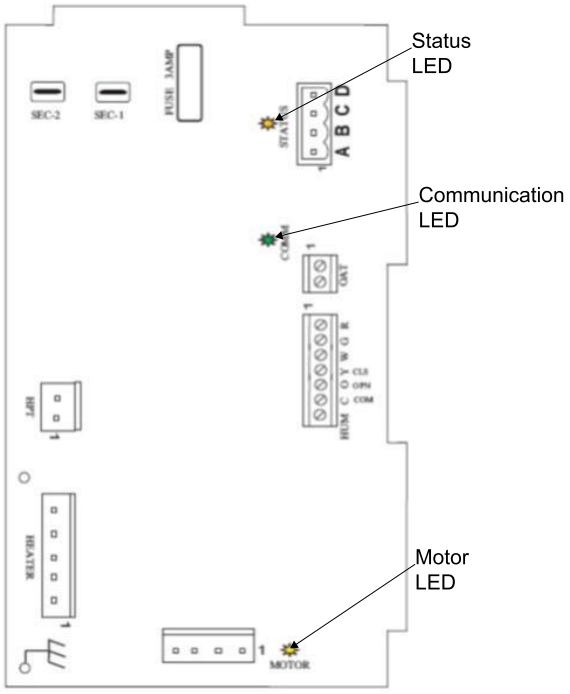
NOTE: These emergency modes do not provide the level of comfort and efficiency expected by the consumer and should only be activated when User Interface cannot be replaced immediately.

SEQUENCE OF OPERATION

The FE4/FE5 fan coil is designed for installation with a communicating User Interface. This fan coil will not respond to commands provided by a common thermostat except under certain emergency situations described in the Start Up and Troubleshooting sub-section.

The User Interface uses temperature; humidity and other data supplied from indoor and outdoor system components to control heating or cooling system for optimum comfort.

ADVANCED TROUBLESHOOTING:



A13030

Fig. 14 – Circuit Board LED Locations

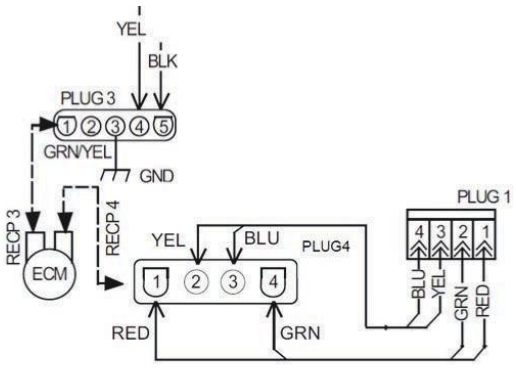
Troubleshooting the FE4/FE5 Fan Coil Circuit Board:

- Production Unit circuit board Fan Coil part number HK38EA061
- RCD Replacement circuit board HK38EA061
- Older circuit board part numbers HK38EA006, HK38EA009, and HK38EA011

Primary test that should be performed:

Motor Line Voltage Check

1. Turn off power (240V).
2. Remove Plug 3 from ECM motor
3. Turn on power.
4. Check Plug 3, terminals 4 and 5, to ensure there are 240V.
5. Turn off power.
6. Reconnect Plug 3 to motor.



A13031

Fig. 15 – ECM / Plug Wiring Diagram

The following troubleshooting techniques will assist in determining the correct component to replace when the Fan Coil Board presents a Fault Code 44 or 41:

1. Disconnect power from the unit (240V).
2. Disconnect the ABCD connector from the board.
3. Disconnect Plug 1 from the board (Fig. 15).
4. Turn on power (240V).
5. After reestablishing power, you should receive Fault Code 44, and the motor LED should be off.
6. Place a jumper across the R and G terminals on the low voltage terminal block
7. Fault Code 44 should still be flashing.
8. The Motor LED should be flashing, indicating the board is able to transmit a signal to the motor.
9. If Motor LED is not flashing, check to ensure that 24V is present across R and C on the low voltage terminal block and that there is a good connection with the R and G jumper.
10. If 24V is present and the jumper/connections are good,
11. Replace the board.

Check Board

1. If Fault Code 44 and the Motor LED are both flashing, place a DC voltmeter across terminals PL1-1 Red (+) to PL1-2 Green (-) (Fig. 15).
2. Across terminal PL1-1 and PL1-2, a 12VDC should be present. If 12VDC is not present, replace circuit board.
3. If Fault Code 44 is flashing and the Motor LED is flashing, place a DC voltmeter across terminal PL1-3 (+) and PL1-2 (-).
4. Across terminal PL1-3 (+) and PL1-2 (-), the DC volt meter should display 5VDC. The voltage should be very stable and should not fluctuate more than 0.02VDC. If the voltage fluctuates, get a different voltmeter before proceeding to the following steps.
5. Reconnect Plug 1 to circuit board and connect DC voltmeter across terminals PL1-3 Yellow (+) and PL1-2 Green (-). Does the voltage appear to fluctuate more than in step 15? Typical voltmeters will show a fluctuation of 0.2VDC to 1VDC. The amount of fluctuation is not important. You could see even more fluctuation depending on the voltmeter used.
6. Check the blower motor serial output signal. The blinking LED on the control board represents the serial output signal. You can measure the signal with a DC voltmeter by removing Plug 1 from the circuit board and connecting the DC voltmeter across PL1-4 (+) and PL1-2 (-). The voltage should be near 0VDC but it will fluctuate briefly several times per second. If you have an analog voltmeter, the needle briefly will go high several times per second. If you have a digital voltmeter with a bar graph, it will show a large change in magnitude on the bar graph several times per second. If you have a plain, digital voltmeter, it will show a brief fluctuation in voltage, and the magnitude may vary depending on the voltmeter used.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all power to the unit before servicing the field wires or removing the control package. The disconnect (when used) on the access panel does not disconnect power to the line side of the disconnect, but does allow safe service to all other parts of the unit.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary. An inspection port is provided on all A-coil delta plates. Remove plastic plug to inspect. Replace plug after inspection.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.

4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Filter Assembly

To clean or replace air filter, push plastic connectors toward center of unit and remove filter access panel outward. Push filter up and back into unit. Then slide filter out.

Clean filter by using cold water and mild detergent. Rinse and allow filter to dry. No oiling or coating of filter is required. New filters are available from your local distributor. Place filter in slot with cross-mesh binding up or facing cooling coil and replace filter access panel.

Cooling Coil, Drain Pan, and Condensate Drain

The cooling coil is easily cleaned when it is dry. Inspect the coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove coil access panel. If coil is coated with dirt or lint, vacuum it with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil thoroughly with clear water. Be careful not to splash water on insulation.

FFM and FMA

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before installation or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable. Lock out and tag switch with a suitable warning label.

Fan Motor

The FFMANP (018,024,030,036), FMA4P and FMA5L motor is three-speed PSC direct drive. High-speed lead is black, medium-speed lead is red, low-speed lead is blue, and common lead is purple. The FFMANP (019,025,031,037) and FMA4X/5Xmotor is a five speed ECM direct drive. The cooling speed tap is selected by connecting the green wire to the desired motor tap number indicated on the motor plug. For the electric heat fan speed selection connect the white wire to the desired motor tap number indicated on the motor plug. Be sure proper blower speed has been selected.

The blower motor in this unit has blower-off delays. The blower-off delay is 30–90 seconds and will keep the motor running after a heating or cooling call ends.

The motor is turned on through two different routes. The first occurs when thermostat calls for the fan in cooling, heat pump, or fan-only mode. A 24VAC signal is sent to relay, causing relay to close its normally open contacts, turning fan on.

The second occurs when there is a call for electric heat. A 24VAC signal is sent to heater sequencer/relay, causing it to close, directing 230V through the normally closed contact of fan relay, turning fan on. The fan remains on until sequencer/relay/PCB opens.

FMA5 only—has a third way to start the fan motor. If the dissipation system detects a refrigerant leak, G is energized and completes the circuit to the indoor blower motor.

If motor does not run, test motor for an open winding or a winding shorted to motor case. If either is present, replace motor.

Time Delay

FFMANP (019,025,031,037) and FMA4X/5X have time delay built into the motor logic. FFMANP (018,024,030,036), FMA4P and FMA5L units with date codes prior to 1715V have sequencers. FFMANP (018,024,030,036), FMA4P and FMA5L units with date codes 1715V or later have a time delay printed circuit board.

The Time Delay Printed Circuit Board (PCB) s a logic controlled time delay activated by low-voltage control signal (G) from thermostat. The PCB includes a normally open relay which closes to energize the blower motor when the G terminal is energized. Then when the G terminal is de-energized the relay energizing the blower motor remains closed for 90–100 seconds before opening.

NOTE: Aluminum coil models with PSC motor can be wired to different OFF time delay. See installation instructions for wiring diagram.

FMA5X units have time delay built into the motor logic. See the Motor Speed Taps table in the installation instructions. FMA5L have the time delay functionality integrated into the control board.

Table 11 – Speed Tap and Off -Delay Time (FMA4)

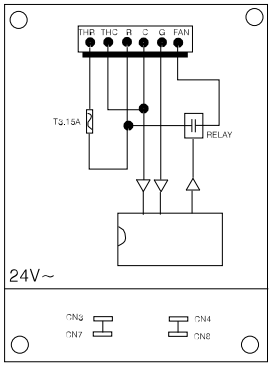
Speed Tap	Off-Delay Time	18	24	30	36
Tap 1	30	-	-	-	-
Tap 2	90	Default	-	Default	-
Tap 3	30	-	-	-	-
Tap 4	90	-	Default	-	Default
Tap 5	30	-	-	-	-

Table 12 – FMA5X ECM Motor Speed Taps Delay Off Time Setting

Tap	18	24	30	36
Tap 1	30	30	30	30
Tap 2	30	30	30/90*	30/90
Tap 3	90*	90	90/30	90/30
Tap 4	90/0	90/0	90	90*
Tap 5	90	90*	90/0	90/0

*. Default setting

Where two numbers are shown, left represents Minor series 1 and right represents Minor series 2.



Comments:

1. The THR and THC are connected to transformer output.
2. When the G has signal, the FAN will supply 24VAC power to control fan relay.
3. Whe the G signal is gone, the FAN will stop 24 VAC output after 90 seconds.
4. CN3, CN7 are dummy connection terminals.

A150455B

Fig. 1 – Time Delay PCB Schematic

NOTE: The following sequence of operation is based on units installed with PSC motor and Time Delay Printed Circuit Board (PCB), and all FMA5L units. For units with ECM motor, the off-delay is programmed into the motor. Follow Table 11 below, ECM Motor Speed Taps & the corresponding blower OFF delays for each speed tap. For FMA5X units, see the Motor Speed Taps table in the Installation Instructions.

Continuous Fan

Thermostat closes R to G. G energizes and completes circuit to indoor blower motor. When G is de-energized, there is a 90-second blower off-delay.

Cooling Mode

Thermostat energizes R to G, R to Y, and R to O (heat pump only). G energizes and completes indoor blower motor. Y energizes outdoor unit (O is energized for heat pump). When cooling call is satisfied, G is de-energized, there is a 90-second blower off-delay.

Heat Pump Heating Mode

Thermostat energizes R to G and R to Y. G energizes and completes circuit to indoor blower motor. When heating call is satisfied, G is de-energized, there is a 90-second blower off-delay.

Heat Pump Heating with Auxiliary Electric Heat

Thermostat energizes R to G, R to Y, and R to W1. G energizes and completes circuit to indoor blower motor. W1 energizes electric heat relay(s) which completes circuit to heater element(s). When W1 is de-energized, electric heat relay(s) open, turning off heater elements. When G is de-energized there is a 90-second blower off-delay.

Electric Heat or Emergency Heat Mode

Thermostat closes R to W1. W1 energizes electric heat relay(s) which completes circuit to heater element(s). Blower motor is energized through normally closed contacts on fan relay. When W1 is de-energized, electric heat relay(s) opens, there is no blower off-delay. (units with ECM motor will have a blower off-delay based on motor speed tap selection).

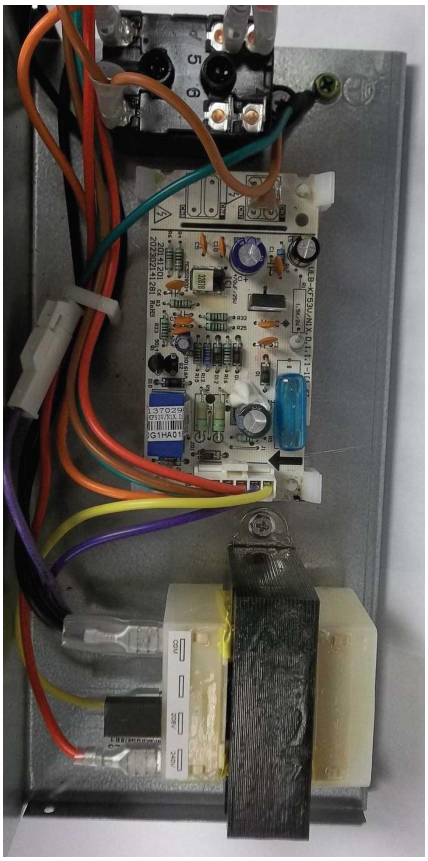


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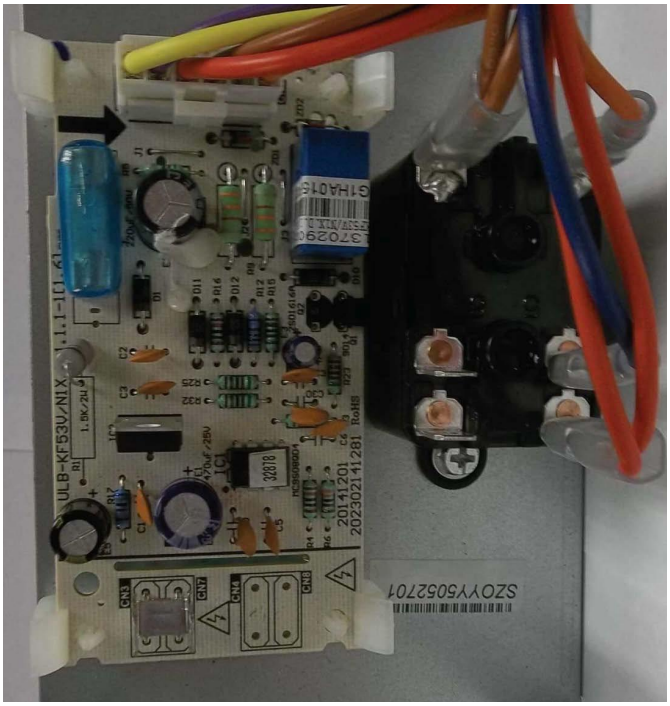
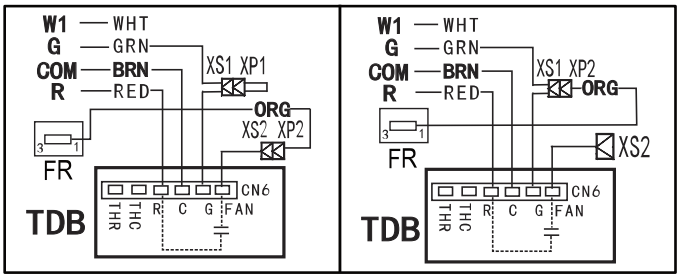
Fig. 16 – FMA4 Size 18 & 24 PCB



A150463

Fig. 17 – SMA4 Size 30 & 36 PCB



A180074

Fig. 18 – Time Delay Schematic

Electric Heater Service

Service can be completed with heater in place. Shut off power before servicing.

Limit Switch

Refer to (Electric Heater Function and Troubleshooting on p24).

Sequencer

Early EHK2 heater kits included sequencers instead of relays. Refer to (Electric Heater Function and Troubleshooting on p24).

Transformer

A 40VA transformer supplies 24V power for control circuit. Check for 208/230V on primary side of transformer. If present, check for 24V on secondary side.

NOTE: Transformer is fused. Do not short circuit.

Fan Relay

Later EHK2 heater kits included relays instead of sequencers. Relay coil is 24V. Check for proper control voltage. Replace relay if faulty.

Cleaning or Replacing Refrigerant Flow-Control Device

FFM, FMA4P

The piston can be removed and cleaned if believed to be plugged. This unit's piston is unique and replacements are available from RCD.

The filter drier should be located on the liquid line at the indoor unit to prevent particulate from plugging the piston.

FFM, FMA4X, FMA5L, FMA5X

These fan coils use a TXV. The TXV's are preset at the factory and do not need adjustment for reliable operation. Reference the outdoor unit instructions to properly charge the unit to the correct subcooling. For optimal performance, adjust the TXV so that 6º F of superheat is measured at the outdoor unit's vapor service valve when the indoor return air is 80º F DB/67º F WB and outdoor ambient is 82º F DB. To increase superheat turn the TXV adjustment stem clockwise no more than one rotation at a time. After an adjustment is made, wait until the superheat temperature has been stable for 15 minutes before making further adjustments.

Sequence of Operation

Condensing Unit

COOLING—When thermostat calls for cooling, the circuit between R and G is complete and single-pole single-throw relay FR is energized. The normally open contacts close causing blower to operate.

The circuit between R and Y is also complete. This completed circuit causes contactor in outdoor unit to close which starts compressor and outdoor fan. When thermostat is satisfied, its contacts open de-energizing contactor and blower relay. This stops compressor and outdoor fan motor. The indoor fan motor will stop after 90-100 seconds on the FFMANP(018,024,030,036) and FMA4P, and 30 or 90 seconds on the FFMANP(019,025,031,037), FMA4X, and FMA5L/X.

HEATING—When thermostat calls for heating and FAN switch is set on AUTO, the circuit between R and W is complete. The heater sequence SEQ is energized which closes contacts of relay. There will be a time delay. This completed circuit energizes all heating elements HTR and blower motor. When thermostat is satisfied, its contacts open de-energizing heat relay. This de-energizes the sequencer. All heaters should stop. The indoor fan motor will stop after 90-100 seconds on the FFMANP(018,024,030,036) and FMA4P, and 30 or 90 seconds on the FFMANP(019,025,031,037), FMA4X and FMA5L/X.

Heat Pump

COOLING—On a call for cooling, the thermostat makes circuits R-O, R-Y, and R-G. Circuit R-O energizes reversing valve, switching it to cooling position. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor unit blower relay starting indoor blower motor.

When thermostat is satisfied, its contacts open de-energizing contactor reversing valve and blower relay. This stops compressor and outdoor fan motor. The indoor fan motor will stop after 90-100 seconds on the FFMANP(018,024,030,036) and FMA4P, and 30 or 90 seconds on the FFMANP(019,025,031,037), FMA4X and FMA5L/X.

HEATING—On a call for heating, the thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor blower relay starting blower motor.

Should temperature continue to fall, R-W circuit is made through second-stage room thermostat bulb. Circuit R-W energizes a sequencer bringing on supplemental electric heat.

When thermostat is satisfied, its contacts open de-energizing contactor and sequencer. All heaters should stop. The indoor fan motor will stop after 90-100 seconds on the FFMANP(018,024,030,036) and FMA4P, and 30 or 90 seconds on the FFMANP(019,025,031,037) and FMA4X.

FMA5L and FMA5X units are equipped with an R-454B refrigerant dissipation system. This system comes with a leak detection sensor located behind the slope coil. While a leak event is being detected by the sensor, the EHK2 (heater kit) will be inoperable until the unit is no longer in dissipation mode.

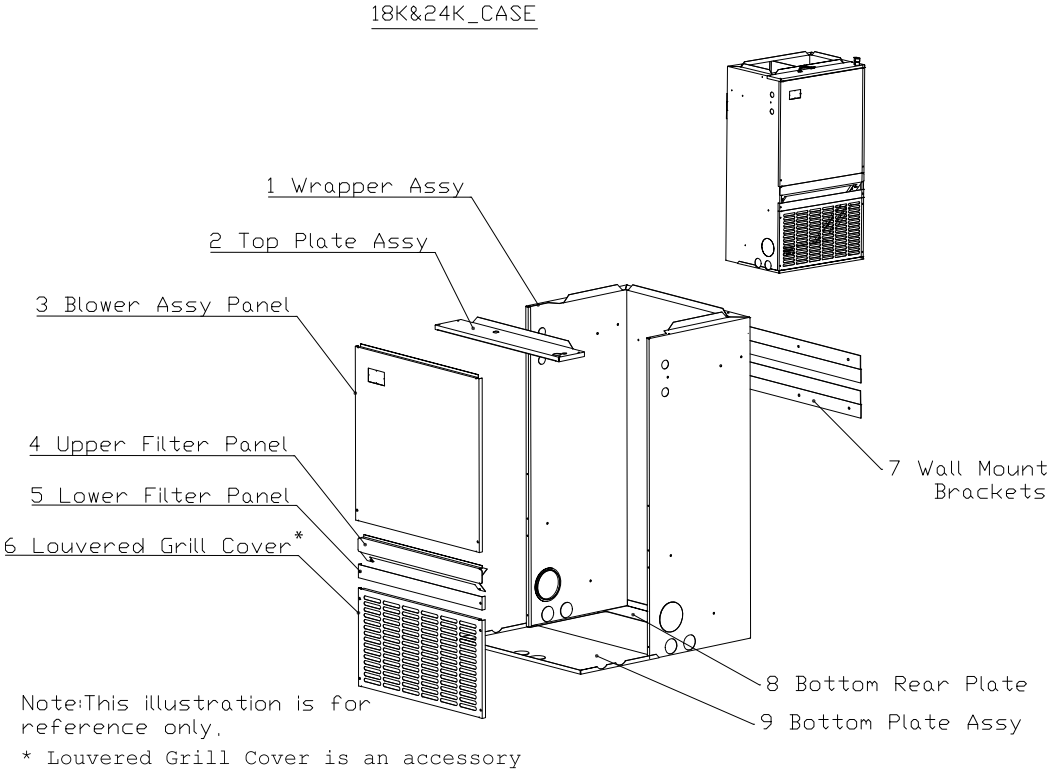


Fig. 19 – FFMA, FMA4, FMA5 (Sizes 18 & 24) Expanded View - Case

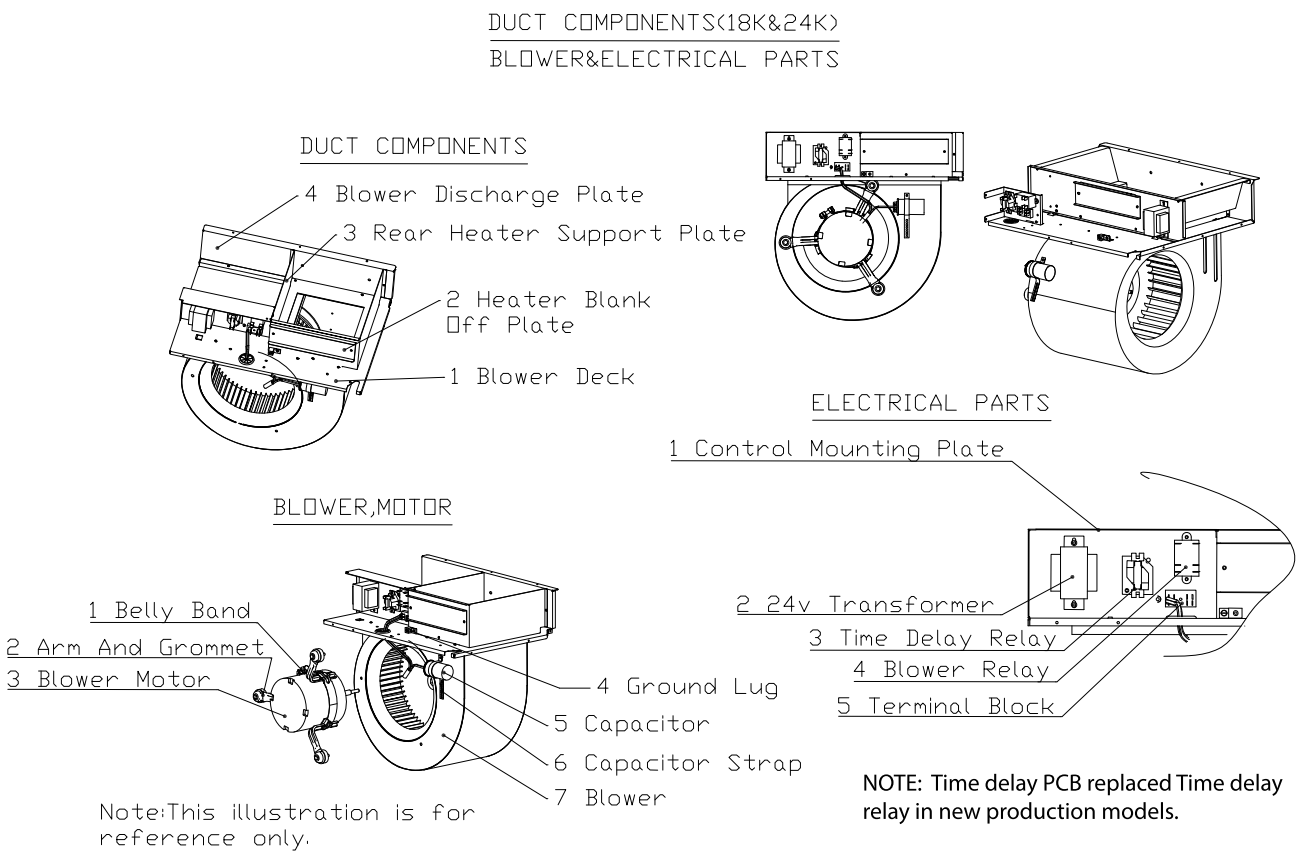


Fig. 20 – FFMA, FMA4, FMA5 (Sizes 18 & 24) Expanded View - Duct Components, Blower & Electrical Parts

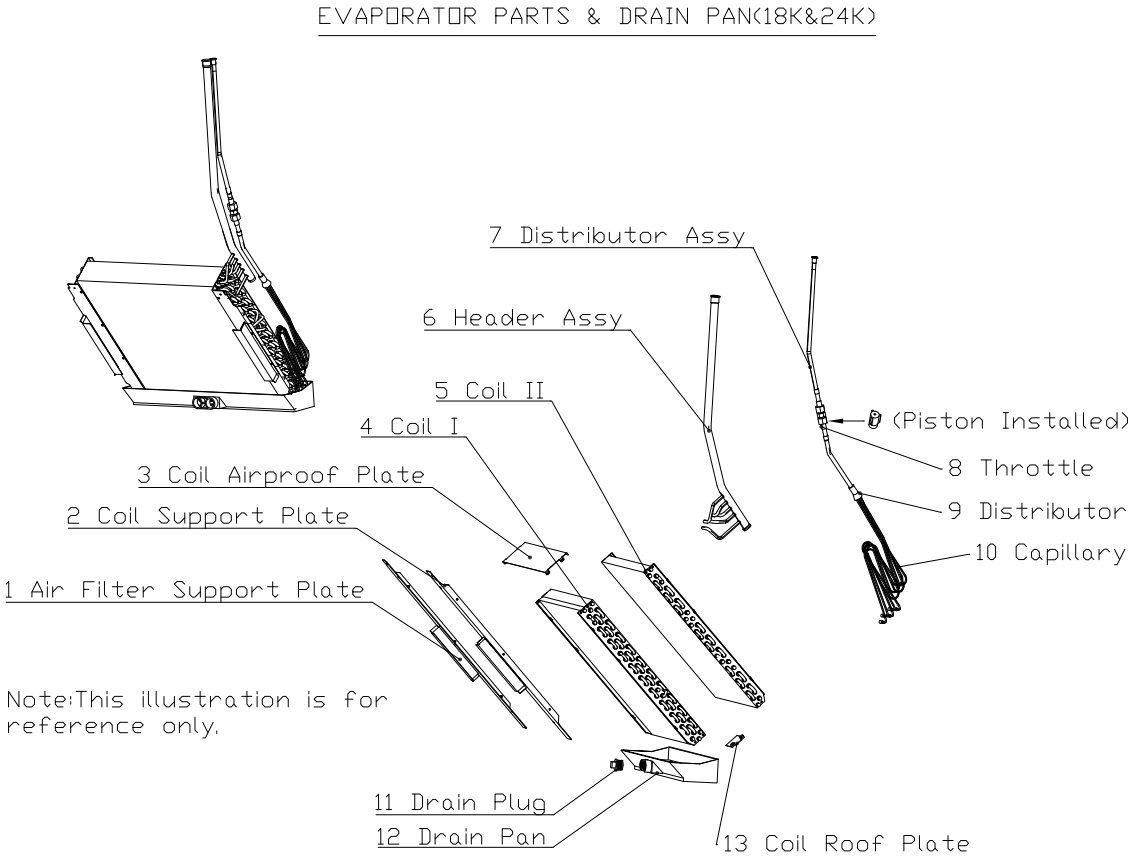


Fig. 21 – FFMA, FMA4, FMA5 (Sizes 18 & 24) Expanded View - Evaporator Parts & Drain Pan

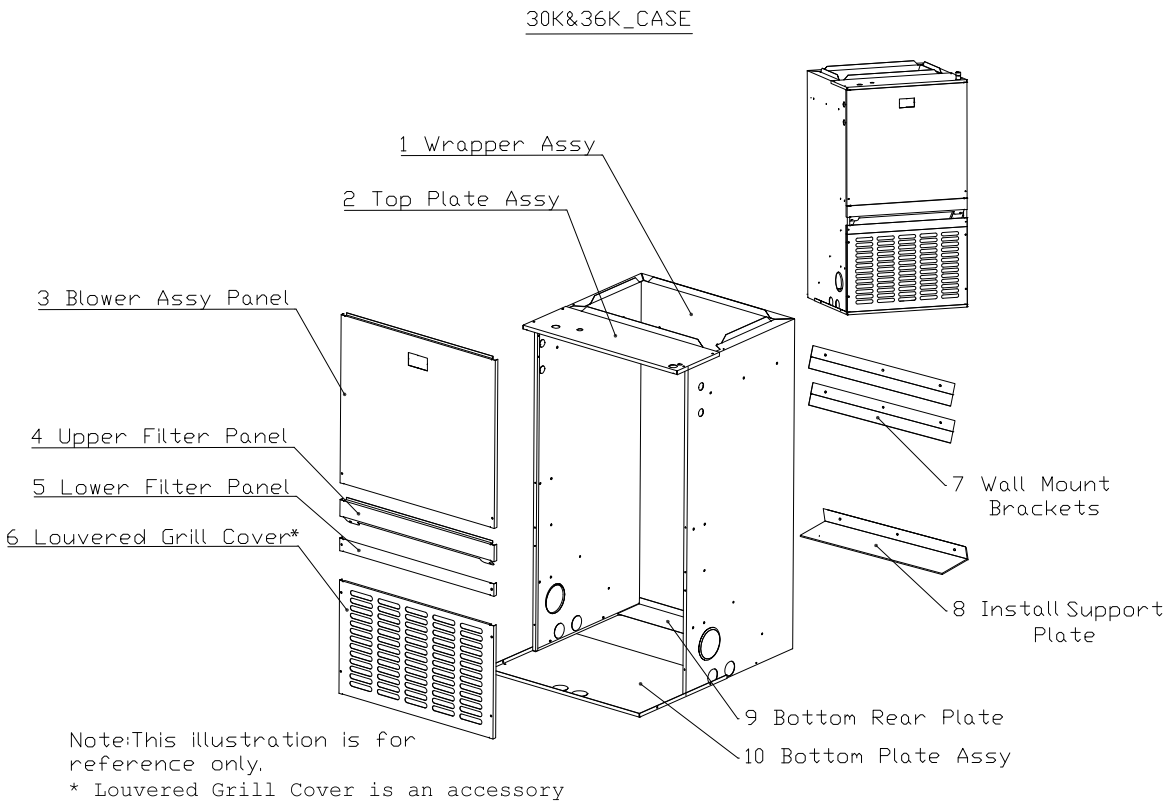


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Fig. 22 – FFMA, FMA4, FMA5 (Sizes 30 & 36) Expanded View - Case

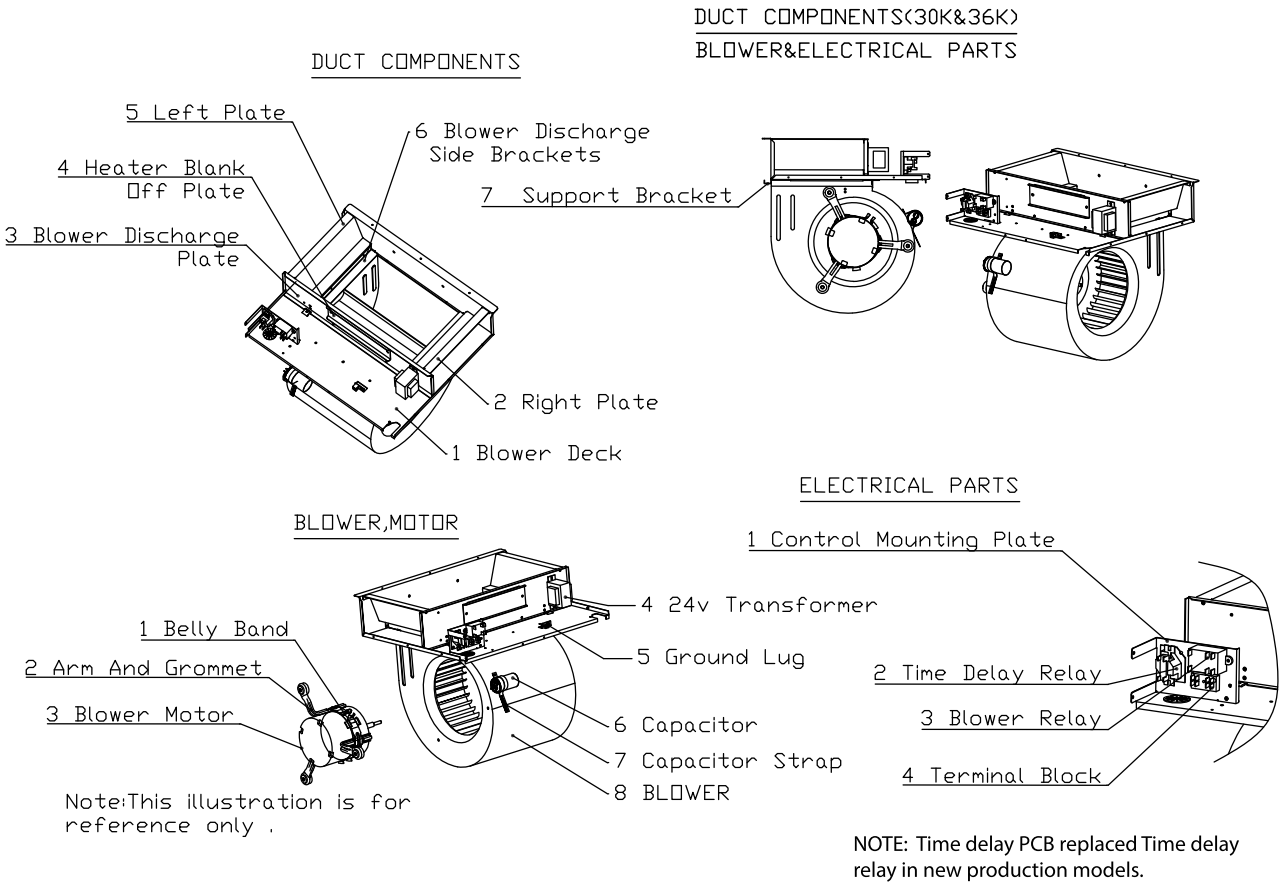

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Fig. 23 – FFMA, FMA4, FMA5 (Sizes 30 & 36) Expanded View - Duct Components, Blower & Electrical Parts

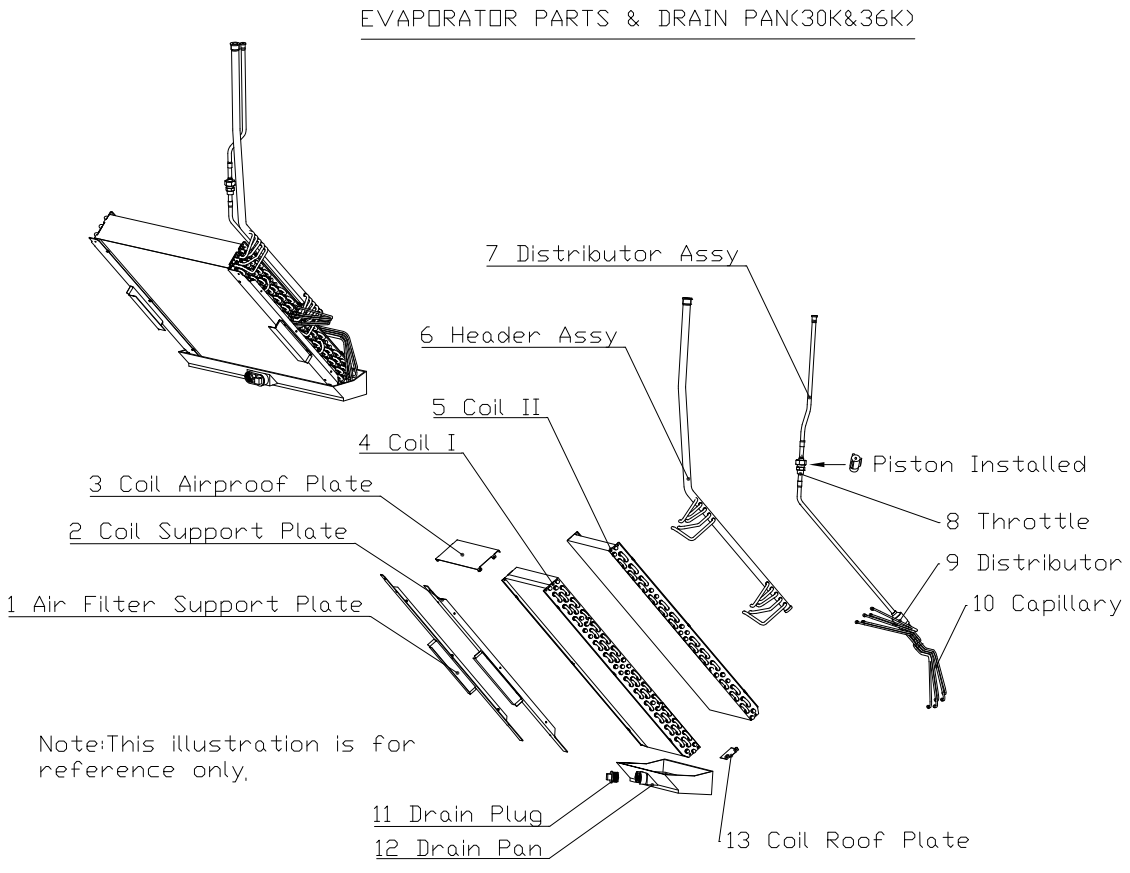

Fig. 24 – FFMA, FMA4, FMA5 (Sizes 30 & 36) Expanded View - Evaporator Parts & Drain Pan

Electric Heater Function and Troubleshooting

FB4, FE4, FE5B, FF1E, FG5, FH4, FJ4, FJ5, FT4, FT5, FV4, FX4, FZ, PF4, PF5

IMPORTANT: 2023 model fan coils (FJ4/5, FT4/5, FE4B/FE5) are designed to use KFFEH electric heaters, and are not compatible with KFCEH heaters – they use different and incompatible plugs and polarities.

This section describes KFC, and KFD series electric heaters in exclusion of Smart Heat by examining the functional operation of these heaters.

Description of Electric Heater Components

Limit Switch

The limit switch is a temperature sensitive control whose function is to prevent system from overheating in abnormal conditions. The temperature settings often vary from heater to heater due to variations in airflow patterns and element radiant heat conditions.

The devices are sized to remain on-line under heat pump conditions (115° air off coil) and minimum CFM, but trip to prevent outlet air conditions above 200° F or excessive component or duct temperatures.

The device itself consists of a bimetallic disc, which when overheated ”snaps through” to open a normally closed high-voltage, high-current switch. When system temperatures cool sufficiently, the switch will automatically reset to its closed position. Normal failure mode for this switch is open.

If a limit switch has been determined to be defective, NEVER BYPASS THE LIMIT SWITCH. When replacing limit switch, ensure that it is replaced with a limit switch of identical opening temperature and closing differential. Limit switches are typically color coded to identify their range.

KFC and KFD Electric Heat Relay

KFC and KFD electric heater packages have relays controlling the heater elements instead of sequencers. A small rectifier PCB is mounted to each relay which converts the incoming 24VAC control signal to DC.

In addition to the rectifier circuit, the second and third stage relays contain a time-on delay circuit of five seconds for second stage, and eight seconds for third stage. When the control signal is removed from the relays, all relays will open with no time-off delay.

Troubleshooting KFC and KFD Series Electric Heaters

Discolored Wire Insulation at Terminal

Check quick-connect terminal at discoloration. Connection may be loose, creating a high resistance through connection point.

Fuse Failure

1. Check for shorted wire. Replace wire. Never try to fix wire using electrical tape.
2. Check shorted element. If element is shorted, replace heater.

No Heat

1. Check fuse for failure. If fuse has failed, refer to (Fuse Failure on p24).
2. Check for faulty transformer. Check output voltage of transformer secondary side R (red) and C (brown). Make sure output is between 18VAC and 30VAC. If output voltage is low and input voltage tests normal, replace transformer.
3. Check for miswired heater plug harness.
4. Check limit switch or sequencer failure. These switches should have failed in open position. If output voltage is zero volts, replace switch.
5. Check heater relay and PCB. Control voltage input to PCB should be 24VAC. Output to relay should be 18VDC minimum. If input is

present but no output, replace PCB. If output is present, replace relay.

Heater Will Not Turn Off

1. Check low-voltage wiring for miswire.
2. Check for shorted elements to ground.
3. Replace sequencer/relays. They may be stuck closed.

Nuisance Trips

1. Check for low airflow due to dirty filters, blocked registers, or undersized duct.
2. Check blower motor and wheel for proper operation. Excessive current draw of motor will cause internal overload to trip.
3. The fan speed may be low.

FFM, FMA

This section describes EHK2 series electric heaters by examining functional operation of this heater.

Service can be completed with heater in place. Shut off power before servicing.

Description of Electric Heater Components

Limit Switch

The limit switch is a temperature sensitive control that's function is to prevent system from overheating in abnormal conditions. The temperature settings often vary from heater to heater due to variations in airflow patterns and element radiant heat conditions.

The devices are sized to remain on-line under heat pump conditions (115° F air off coil) and minimum CFM, but trip to prevent outlet air conditions above 200° F or excessive component or duct temperatures. The device itself consists of a bimetallic disc, which when overheated "snaps through" to open a normally closed high-voltage, high-current switch. When system temperatures cool sufficiently, the switch will automatically reset to its closed position. Normal failure mode for this switch is open.

If a limit switch has been determined to be defective, NEVER BYPASS THE LIMIT SWITCH. When replacing limit switch, ensure that it is replaced with a limit switch of identical opening temperature and closing differential. Limits switches are typically color-coded to identify their range.

Sequencer

Early production EHK2 heaters have sequences controlling the heater elements. The sequencer is essentially a thermally-activated time-delay relay normally activated by low-voltage control signals from thermostat. The typical sequencer is a 1- or 2-pole normally open device which energizes within 30 to 70 seconds after application of control signal and de-energizes 60 to 90 seconds after control signal is removed.

In simplistic terms, the sequencers which we use are nothing more than normally open limit switches which sit on top of a small resistive heater. When voltage is applied to this heater, a positive temperature coefficient resistor (PTC), heat is supplied to a bimetallic disc which "snaps through" and closes switch.

The time required for PTC to heat to a sufficient point controls ON timing of device. The time required for disc to cool down when power is removed controls OFF time of device. The PTC can be varied to provide varied timing. Typically a short ON equates to a long OFF.

Because this is a thermally-activated device, ambient conditions affect the ON/OFF cycle. Higher ambient temperature means shorter ON times and longer OFF times.

Application of these devices is such that the first switch ON not only turns on first heater element, but also ensures that indoor fan is energized, because first ON is last OFF. This ensures fan remains ON until the last heater de-energizes. The Time Delay Printed Circuit Board (PCB) is a logic controlled time delay activated by low-voltage control signal (G) from thermostat. The PCB includes a normally open relay which closes to energize the blower motor when the G terminal is energized. Then when the G terminal is de-energized the relay energizing the blower motor remains closed for 90 – 100 seconds before opening.

Relays

Later production EHK2 heaters have relays controlling the heater elements instead of sequencers. A small rectifier PCB is mounted to each relay which converts the incoming 24VAC control signal to DC.

In addition to the rectifier circuit, the second and third stage relays contain a time-on delay circuit of five seconds for second stage, and eight seconds for third stage. When the control signal is removed from the relays, all relays will open with no time-off delay.

Leak Dissipation System

Operation (Models with R-454B Refrigerant)

When no leak is detected, G, Y, and W pass through the dissipation board and operate normally. In this state, the Dissipation Board Status LED remains solid yellow. When the A2L Detection Sensor reaches a threshold of detected R-454B refrigerant, the Status LED flashes one time and the dissipation board enters dissipation mode. While the detected refrigerant is over the threshold, the Status LED will continue to flash a Fault Code of 1. After the level is lower than the threshold, the Status LED flashes a code of 3 as the dissipation board completes its dissipation actions. These actions include de-energizing Y and W and energizing G for 15 minutes. After the 15 minutes if the refrigerant detected is below the threshold, there is a 5 minute delay before returning to normal operation. If the refrigerant detected is above the threshold, G continues to be energized until refrigerant is below the threshold. At that point the 5-minute delay begins.

After dissipation is complete, the unit returns to normal operation with the Status LED being solid.

System Self-Test

Power on the unit and verify proper functioning of equipment. The yellow LED on the dissipation board should be steady. If flash codes are present, see (Troubleshooting on p26).

NOTE: Operation of the Test Mode is only possible if no faults exist on the dissipation board.

IMPORTANT: Press the Test button for roughly ONE SECOND to enter Test Mode. Pressing the Test button for a longer periods enables different functions (Table 13).

Press the Test button on the dissipation system control board to ensure proper dissipation system operation under each test condition listed below. After pressing the Test button, system will enter Dissipation Mode for 60 seconds to help verify correct operation.

Table 13 – Dissipation Board Test Button Functions

Hold Button Time (sec)	Function
1 - 4	Dissipation Mode for 60 seconds
5 - 29	Display flash code history
30+	Flash code 6
3 rapid presses	Clear flash code history

Ensure that the fan coil is able to meet the minimum required dissipation mode airflows. These required minimum airflow rates during Dissipation Mode are listed in Table 15. They are based on the total system refrigerant charge quantity.

Table 14 – Required Operational Checks to Ensure Proper Dissipation System Function

Normal Operation				
Test #	**T-Stat Call**	**Compressor**	**Indoor Fan**	**Electric/Gas Heat**
1	None	Off	Off	Off
2	Cool	On	On	Off
3	Heat	Off	On	On
Dissipation Activated				
4	None	Off	On	Off
5	Cool	Off	On	Off
6	Heat	Off	On	Off

Table 15 – Required Minimum Dissipation Mode Airflows, based on Total System Refrigerant Charge Quantity

Total System Charge (lb)	Minimum Required Dissipation Airflow (CFM)	Total System Charge (lb)	Minimum Required Dissipation Airflow (CFM)
5	133	16	426
6	160	17	452
7	186	18	479
8	213	19	505
9	239	20	532
10	266	21	559
11	293	22	585
12	319	23	612
13	346	24	639
14	372	25	665
15	399		

Troubleshooting

For all flash codes, first try power cycling the system to remove the code. Refer to Table 16 and Table 17.

No power

Verify the wiring to/from pins 1 and 8 on the power harness plug. Check the 24V system wiring from the transformer.

Flashing 1

Check for refrigerant leaks using an independent R-454B detector. If no leaks are present, replace the sensor.

Flashing 2

Check both ends of the sensor wire harness to ensure proper attachment. Power cycle the system to check whether the flash code has been removed. If the flash code is still present, replace the sensor.

Flashing 3

Check for refrigerant leaks using an independent R-454B detector.

Flashing 4

If the code does not clear after power cycling the system, replace the dissipation board.

Flashing 5

If the code does not clear after power cycling the system, replace the sensor.

Flashing 6

Press the test button repeatedly. Power cycle the system. If the button cannot be reset, replace the dissipation board.

Flashing 7

Verify wiring of all "Y" and "W" wires in the applicable wiring diagram.

Flashing 8

Verify wiring of all "Y" and "W" wires in the applicable wiring diagram.

Table 16 – Flash Code Chart

Yellow LED	Reason	Mode
Solid	Normal Operation	Normal Operation
Flashing 1	Sensor >= 20% LFL	Dissipation
Flashing 2	Sensor Open	Dissipation
Flashing 3	Normal Mitigation after Leak	Dissipation
Flashing 4	No Power to G Output	Dissipation with no Blower
Flashing 5	Fault with A2L Digital Sensor	Dissipation
Flashing 6	Test Button Stuck (>30 s)	Dissipation
Flashing 7	Y or W Wiring Inverted	Normal Operation
Flashing 8	Y or W Shorted	Normal Operation

Table 17 – Wall-Hung FMA5 Control Board Test Functions

LED Status	Description
Steady ON	Normal Operation
OFF	Power Supply Failure
Steady Flashing	Dissipation Mode Active
3 Flash / Cycle	A2L Sensor Error
4 Flash / Cycle	A2L Sensor Communication Error
8 Flash / Cycle	A2L Sensor Over Service Life

Care and Maintenance

To continue high performance, and minimize possible equipment failure, it is essential periodic maintenance be performed on this equipment.

The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. The only consumer service recommended or required is filter maintenance (Filter Assembly on p27)

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all power to the unit before servicing the field wires or removing the control package. The disconnect (when used) on the access panel does not disconnect power to the line side of the disconnect, but does allow safe service to all other parts of the unit.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Filter Assembly

To clean or replace air filter, push plastic connectors toward center of unit and remove filter access panel outward. Push filter up and back into unit. Then slide filter out.

Clean filter by using cold water and mild detergent. Rinse and allow filter to dry. No oiling or coating of filter is required. New filters are available from your local distributor. Place filter in slot with cross-mesh binding up or facing cooling coil and replace filter access panel.

Cooling Coil, Drain Pan, and Condensate Drain

The cooling coil is easily cleaned when it is dry. Inspect the coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove coil access panel. If coil is coated with dirt or lint, vacuum it with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil thoroughly with clear water. Be careful not to splash water on insulation.

Inspect drain pan and condensate drain at the same time cooling coil is checked. Clean drain pan and condensate drain by removing any foreign matter from pan. Flush pan and drain tube with clear water.

If drain tube is restricted, it can generally be cleared by high-pressure water. Cut plastic line and work outside condensate pan and away from coil to clean drain tube.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Do not use caustic household drain cleaners in the condensate pan or near the coil. Drain cleaners can quickly destroy a coil.

Blower Motor and Wheel

Clean blower motor and wheel when cooling coil is cleaned.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect electrical power before removing any access panels. Lock out and tag switch with a suitable warning label.

To clean blower motor or blower wheel:

1. Remove blower access panel.
2. Remove motor leads from fan coil control. Note lead location for ease of reassembly.
3. Remove the two outside screws holding blower/motor assembly against blower deck flange and slide assembly out of cabinet.
   - Servicing the blower assembly may require the removal of two screws that attach the blower housing to the fan deck. It is not necessary to reinstall these screws after service.
4. (If applicable) Remove screw in strap holding motor capacitor to blower housing and slide capacitor out from under strap. Remove screw with green wire from blower housing. Mark blower wheel, motor, and motor support in relation to blower housing before disassembly to ensure proper reassembly. Note position of blades on wheel.
5. Loosen setscrew holding blower wheel onto motor shaft.
6. Remove the three bolts holding motor mount to blower housing and slide motor and mount out of housing. Further disassembly should not be necessary as adequate clearance is available.
7. Remove blower wheel from housing by removing cutoff plate from blower housing outlet. Note wheel orientation and cutoff location for reassembly. The blower motor and wheel may be cleaned by using a vacuum with a soft brush attachment.
8. Remove grease with a mild solvent such as hot water and detergent. Be careful not to disturb balance weights (clips) on blower-wheel vanes. Also, do not drop or bend wheel, as balance will be affected.

To reassemble blower:

1. Place blower wheel back into housing. Be sure to position correctly for proper location.
2. Reassemble cutoff plate to housing using identified holes from disassembly procedure.
3. Position motor and mount in same position as when blower housing was in unit. Secure motor mount on housing, using removed bolts. Make sure mount or motor is grounded to blower housing.
4. Locate blower wheel setscrew over flat on motor shaft. Rotate wheel in housing. It should not rub housing and should be centered in inlet opening. If not, loosen setscrew and align as necessary.
5. Attach green wire to blower housing with screw.
6. (If applicable). Secure motor capacitor under strap and tighten strap screw.
7. Slide blower assembly to blower deck. Be sure (once blower is within the unit casing) to force blower assembly toward control box while sliding assembly into unit to ensure that blower assembly engages deck properly.
8. Fasten blower assembly to deck with screws previously removed.
9. Reconnect electrical leads to fan coil control.
10. Reconnect electrical power to unit and test fan for proper rotation.

FF1E, FFMA, FMA

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.
5. **FMA5 units only**—verify dissipation system is in normal operation by verifying the status LED on the control board is Steady ON and not blinking or OFF.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Air Filter

The air filter should be replaced as needed.

NOTE: Refer to the installation instructions and product data for filter dimensions. 2023 product has been designed to accommodate common sized filters.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Never operate unit without a filter.

Cooling Coil, Drain Pan, and Condensate Drain

The cooling coil is easily cleaned when it is dry. Inspect coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove blower/heater access panel to gain full access to cooling coil. If coil is coated with dirt or lint, vacuum with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil with clear water.

Be careful not to splash water onto insulation.

Inspect drain pan and condensate drain at same time cooling coil is checked. Clean drain pan and condensate drain by removing any foreign matter from pan. Flush pan and drain tube with clear water.

If drain tube is restricted, it can generally be cleared by high-pressure water. Cut plastic line and work outside condensate pan and away from coil to clear drain tube.

NOTE: There MUST be a trap in the condensate line. The trap must be at least 3-in. deep, not higher than the bottom of unit condensate drain opening, and pitched downward to an open drain or sump.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Do not use caustic household drain cleaners in the condensate pan or near the coil. Drain cleaners can quickly destroy a coil.

Blower Motor and Wheel

Clean blower motor and wheel when cooling coil is cleaned.

To clean or service wheel or motor, proceed as follows:

1. Pull unit disconnect (when used) and remove blower access panel.
2. Disconnect motor electrical leads from control box and capacitor. Mark location of wires for reassembly.
3. Remove the three bolts holding motor mount to blower housing while supporting motor shell with hand.
4. Pull motor inlet ring and blower wheel assembly out of blower housing.
5. With blower wheel, inlet ring, and motor mount still attached to motor, place motor on flat, horizontal surface, shaft up. Mark position of wheel on motor shaft for reassembly.
6. Loosen blower wheel setscrew and remove blower wheel from motor shaft.

NOTE: Further disassembly of motor and mount is not necessary as adequate clearance is available to clean motor.

7. Clean blower motor and wheel using a vacuum with a soft brush attachment. Remove grease with a mild solvent such as hot water and detergent. Be careful not to disturb balance weights (clips) on blower wheel vanes. Do not drop or bend wheel as balance will be affected.

To reassemble unit, proceed as follows:

1. Place motor with mount attached on flat, horizontal surface with shaft up.
2. Set inlet ring on top of motor mount grommets. Center inlet ring flush on all three grommets.
3. Slide blower wheel onto motor shaft with setscrew upward and aligned with shaft flat portion. Vertically position wheel along shaft to position marked during disassembly.

NOTE: If previous shaft was not marked or if replacing previous motor, set blower wheel position by sliding blower wheel along motor shaft to 1-1/8-in. above rubber grommets (Fig. 25).

4. Hold blower wheel in place and carefully tighten setscrew.
5. Position motor and blower wheel assembly to blower housing as originally oriented.
6. Secure motor mount to blower housing using bolts previously removed.
7. Attach green wire to blower housing with screw.
8. Connect electrical and capacitor leads to original terminals.
9. Replace blower access door and tighten all four screws.
10. Reinsert disconnect pullout only after blower access door is secured. Test blower for proper operation.

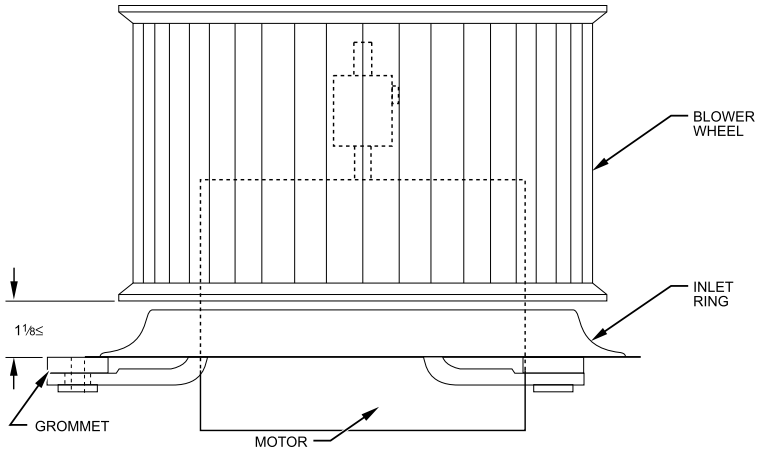

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Fig. 25 – Motor, Inlet Ring, and Blower Wheel Assembly

Refrigerant Flow-Control Devices

Thermostatic Expansion Valves (TXV)

NOTE: 2023 models (FE4B, FE5B, FJ4, FJ5, F54, FT4, FT5, PF5) and beyond (R-454B models) use a mechanical TXV. Refer to the TXV Installation Instructions. Torque the equalizer fitting to 10–20ft-lb; do not exceed 20 ft-lb.

All Fan Coils with a TXV are factory equipped with a hard shutoff (HSO) TXV. The hard shutoff TXV has no bleed port and allows no bleed-through after system is shutdown.

The TXV is a bi-flow metering device that is used in condensing and heat pump systems to adjust to changing load conditions by maintaining a preset superheat temperature at the outlet of the evaporator coil. The volume of refrigerant metered through the valve seat is dependent upon the following:

1. Superheat temperature is sensed by a sensing bulb on the suction tube at the outlet of the evaporator coil. As long as this bulb contains some liquid refrigerant, this temperature is converted into pressure pushing downward on the diaphragm, which opens the valve via push rods.

2. The suction pressure at the outlet of the evaporator coil is transferred via the external equalizer tube to the underside of the diaphragm.

The bi-flow TXV is used on split system heat pumps. In cooling mode, the TXV operates the same as a standard TXV previously explained. However, when the system is switched to heating mode of operation, refrigerant flow is reversed.

The bi-flow TXV has an additional internal check valve and tubing. These additions allow refrigerant to bypass TXV when refrigerant flow is reversed with only a 1-psig to 2-psig pressure drop through device.

When heat pump switches to defrost mode, refrigerant flows through a completely open (not throttled) TXV. The bulb senses the residual heat of outlet tube of coil that had been operating in heating mode (about 85° F and 155 psig). This temporary, not-throttled valve decreases indoor pressure drop, which in turn increases refrigerant flow rate, decreases overall defrost time, and enhances defrost efficiency.

Problems Affecting TXV

Low Suction Pressure

1. Restriction in TXV
2. Low refrigerant charge
3. Low indoor load
4. Low evaporator airflow

High Suction Pressure

1. Overcharging
2. Sensing bulb not secure to vapor tube
3. High indoor load
4. Large evaporator face area

NOTE: When installing or removing TXV, wrap TXV with a wet cloth. When reattaching TXV, make sure sensing bulb is in good thermal contact with suction tube.

5. The needle valve on pin carrier is spring-loaded, which also exerts pressure on underside of diaphragm via push rods, which closes valve. Therefore, bulb pressure equals evaporator pressure at outlet of coil plus spring pressure. If load increases, temperature increases at bulb, which increases pressure on topside of diaphragm, which pushes pin carrier away from seal, opening valve and increasing flow of refrigerant. The increased refrigerant flow causes increased leaving evaporator pressure which is transferred via the equalizer tube to underside of diaphragm, with which the pin carrier spring pressure closes valve. The refrigerant flow is effectively stabilized to load demand with negligible change in superheat.

Aluminum Coil Unit TXV's

The distributor used on the all-aluminum coils is also made of aluminum. The TXV connection to the distributor is accomplished with a 3/4" Chatleff nut (Fig. 26). The threads are coated with Loctite Heavy Duty Anti-Seize which is a graphite/calcium fluoride formulation, for applications that is free from copper, lead and sulfur. This product is typically used in applications with an operating range of -20° F to +2400° F. When replacing a TXV it is recommended to reapply with the same thread sealer.

Extra care should be taken during brazing of copper equalizer on the aluminum coils to prevent the braze material from splattering on the aluminum. Also, route the copper equalizer so that it doesn't touch the aluminum components.

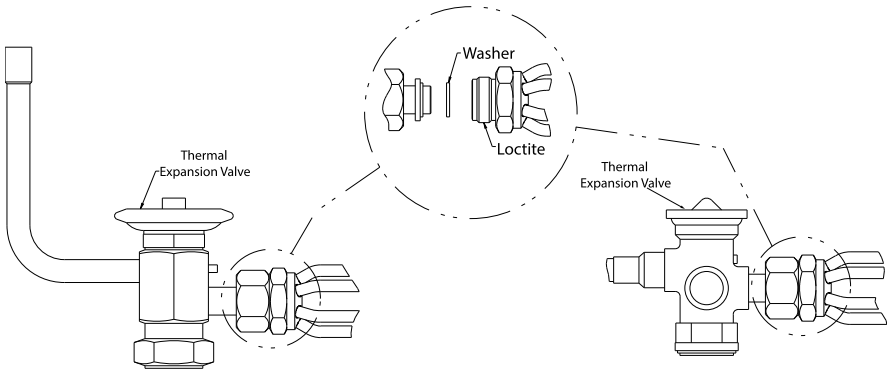

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Fig. 26 – Aluminum Coil Unit TXV's

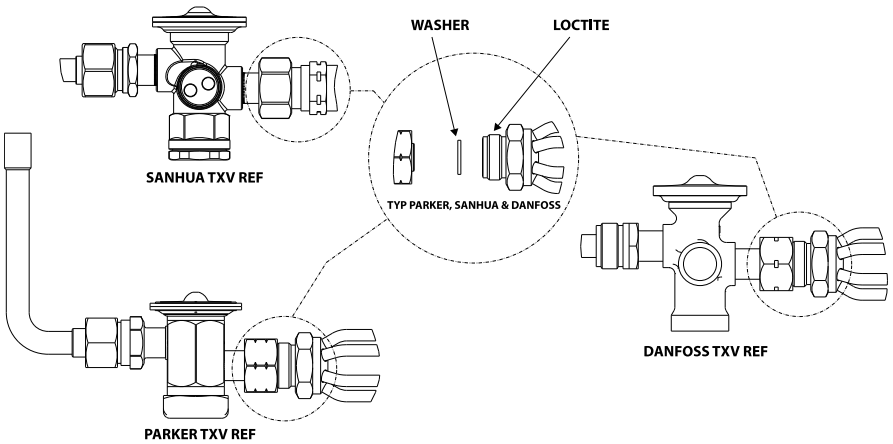

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Fig. 27 – TXV Examples (Mechanical)

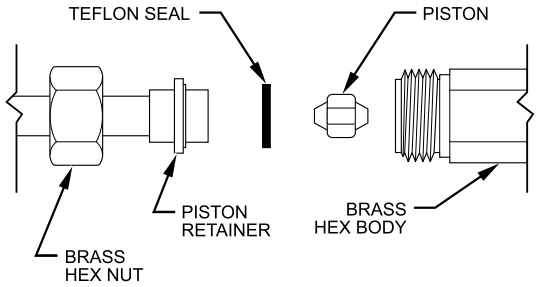

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Fig. 28 – Refrigerant Flow-Control Device (For FB and FMA4P)

Piston Body Cleaning and Replacement

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Do not vent refrigerant to atmosphere. Recover during system repair or final unit disposal.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

Damage may occur to the scroll compressor if operated at a negative suction pressure during a system pumpdown.

1. Pump down outdoor unit. Close service valves at outdoor unit.
2. Recover remaining refrigerant from tubing and coil through gage port on vapor-tube service valve. Disconnect refrigerant (liquid) tube from piston body (Fig. 28).
3. Avoid damaging seal ring or machined surfaces on piston, bore, and retainer.
4. Using small wire with a hook on end of it, remove piston from body.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

When cleaning the piston orifice, be careful not to scratch or enlarge the opening, as this will affect operation.

1. Install new or cleaned piston into body.
2. Replace seal ring on retainer.
3. The threads are coated with Loctite Heavy Duty Anti-Seize. It is recommended to reapply with the same thread sealer.
4. Reconnect refrigerant tube to piston body.
5. Pressurize tubing and coil, then leak check.
6. Evacuate tubing and coil as necessary.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

Use a backup wrench and do not over tighten, as deformation of the piston body will occur, causing the piston to lodge in a partially open or closed position.

Liquid Tube Strainer

In R-22 all units, the TXV and refrigerant flow-control device is protected on the indoor coil by a wire mesh strainer. It is located inside the 3/8" liquid tube at field braze joint just outside unit casing. Access to strainer is through field braze joint.

Aluminum Coil Repair

Repairing leaks on aluminum coils is possible using the aluminum brazing method. Specific braze and flux material designed for aluminum are necessary for aluminum brazing. A kit containing all materials necessary for making and aluminum braze repair is available through Replacement Components (kit No. 337748-751).

Do not use a previously-used wire brush to clean copper when preparing an aluminum braze site. Copper particles in contact with an aluminum coil may cause premature failure. Service aluminum coils are also available as a coil repair option.

NOTE: Replacement of an indoor slope or A-coil must include recovery and recycling of refrigerant currently in the system. Provided the refrigerant has not been contaminated with moisture, acid, solid particulate, or non-condensibles, it may be recovered by following the procedures listed below. However, if the refrigerant is contaminated, recycling or reclaiming methods are required. If leaks are present in the system, meaning the refrigerant may be contaminated, recycling or reclaiming methods MUST be used. Installation of new filter drier(s) is required. The filter drier-type will depend upon the contaminants in the system. See Split-System Residential Air Conditioners and Heat Pumps Service Manuals for further information.

⚠ WARNING

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Relieve pressure and recover all refrigerant before system repair or final unit disposal to avoid personal injury or death. Use all service ports and open all flow-control devices, including solenoid valves.

Pre-Installation

Except for coils only used with TXV fan coils, all-aluminum replacement coils are shipped with a piston body distributor, piston, and 90 degree inlet tube with piston retainer (including Teflon seal). Coil sizes used only with TXV fan coils include the TXV as part of the replacement coil.

Before installation of replacement coil, verify the piston is the correct orifice size. The correct size should be on the outdoor unit rating plate. If in doubt, reuse the piston from the old indoor coil.

Use two wrenches to separate the 13/16" Chatleff nut from the distributor body. The threads will contain Loctite anti-seize, do not remove this from the threads.

Install the piston and reattach nut to finger tight plus 1/2 turn.

The distributor used on the all-aluminum replacement coil is also made of aluminum. The distributor threads are coated with Loctite Heavy Duty Anti-Seize which is a graphite/calcium fluoride formulation, for applications that are free from copper, lead and sulfur. This product is typically used in applications with an operating range of -20° F to +2400° F (Fig. 29). When replacing a TXV it is recommended to reapply with the same thread sealer. Extra care should be taken during brazing of copper equalizer on the aluminum coils to prevent the braze material from splattering on the aluminum. Also, route the copper equalizer so that it doesn't touch the aluminum components.

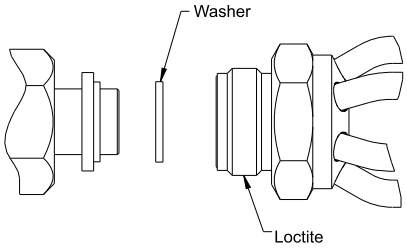

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Fig. 29 – TXV Thread (Sealer) Location

Old Copper or Tin-Plated Coils with TXV

The all-aluminum replacement coil with piston will also be used for TXV style coils by reusing the original TXV. An adapter is provided to connect the replacement coil distributor to the original TXV (Fig. 30). Insulation is also provided to wrap the copper adapter tube and brass nuts to prevent any copper or brass particles from coming in contact with the aluminum coil. Even if the adapter tube is not in contact with the aluminum coil dripping condensation from the adapter tube can be a mechanism of particulate transport.

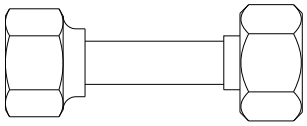

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Fig. 30 – Replacement Coil Distributor Adapter

If it is preferred to install the old TXV external to the cabinet due to access, follow the steps below:

1. Field fabricate a piece of 3/8" OD copper tubing with flare and nut to attach to the TXV outlet.
2. The piston in the replacement coil must be removed. Use two wrenches to separate the 13/16" Chatleff nut from the distributor body. The threads will contain Loctite anti-seize, do not remove this from the threads.
3. Remove the piston
4. Reattach the inlet tube and tighten the nut finger tight plus 1/2 turn.
5. Remove the old coil and install replacement coil per instructions below. Reinstall the fitting door to the cabinet.
6. Field fabricate a 3/8" OD copper tubing with flare and nut.
7. Braze this tubing and nut onto the liquid stub out.
8. Attach flare and nut to TXV outlet by tightening to finger tight plus 1/2 turn with two wrenches.
9. Drill equalizer hole into suction line and braze the equalizer into the hole.
10. Attach the TXV bulb onto the suction line and insulate.
11. Insulate the entire TXV body and outlet tubing to prevent sweating.

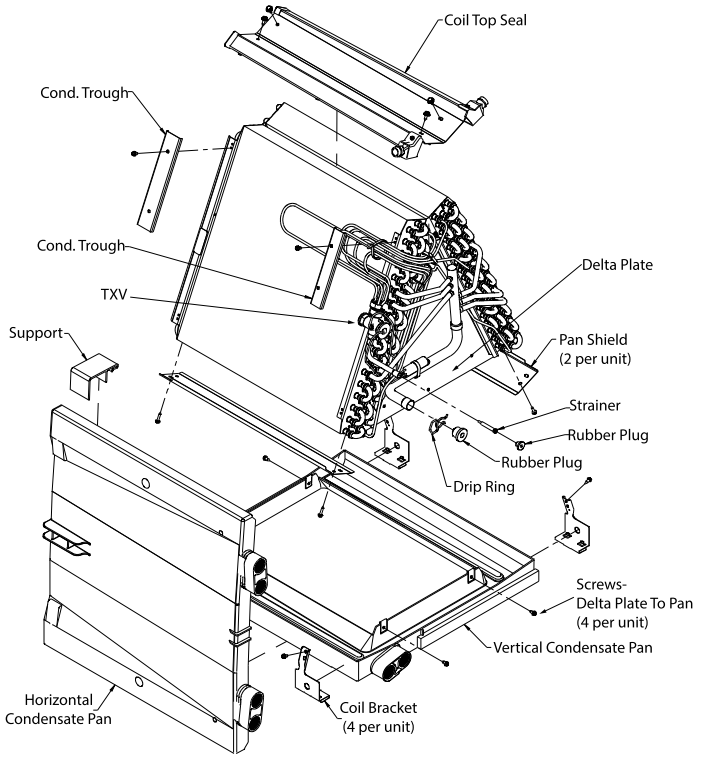
Old All-Aluminum Coils with TXV

When replacing a previous all-aluminum coil that contains a TXV, the old TXV can be reused and mounted inside the cabinet.

1. After removal of the distributor inlet tube and piston, the old TXV is attached to the distributor with 13/16" Chatleff nut. The threads contain Loctite anti-seize that can be reused.
2. Tighten the nut finger tight plus 1/2 turn.
3. The vapor header contains a small diameter stub tube for the equalizer line.
4. Cut the end of the stub tube.
5. Insert TXV equalizer and braze together. Caution must be taken to avoid braze splatter from the aluminum surfaces of the new coil. Caution must be taken to avoid heating the factory joint of the stub tube to the vapor header.
6. The vapor header contains an indentation for the TXV bulb. Attach the bulb and insulate.

Installation – A-Coil Units Only

1. Recover system refrigerant.
   a. Attach gage/manifold set to service valves.
   b. Start unit in cooling mode.
   c. Front seat (close) liquid line service valve.
   d. Operate unit until vapor pressure reaches 5 psig (35kPa), or until suction line LPS opens.
   e. Turn off electrical supply to outdoor unit.
   f. Front seat (close) vapor service valve.
   g. Recover any remaining refrigerant.



A13359

Fig. 31 – A-Coil Component Location

NOTE: All condenser coils hold only a factory-supplied amount of refrigerant. Excess refrigerant, such as in long-line applications, may cause compressor internal pressure relief valve to open (indicated by sudden rise in vapor pressure) before refrigerant is recovered. If this occurs, turn off electrical supply to outdoor unit immediately, front seat (close) vapor service valve, and recover any remaining refrigerant.

2. Turn off electrical supply to indoor unit.

3. Disconnect condensate drain line.

WARNING

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Use of torch may cause oil to catch fire, resulting in personal injury or death. To remove components use tubing cutter only.

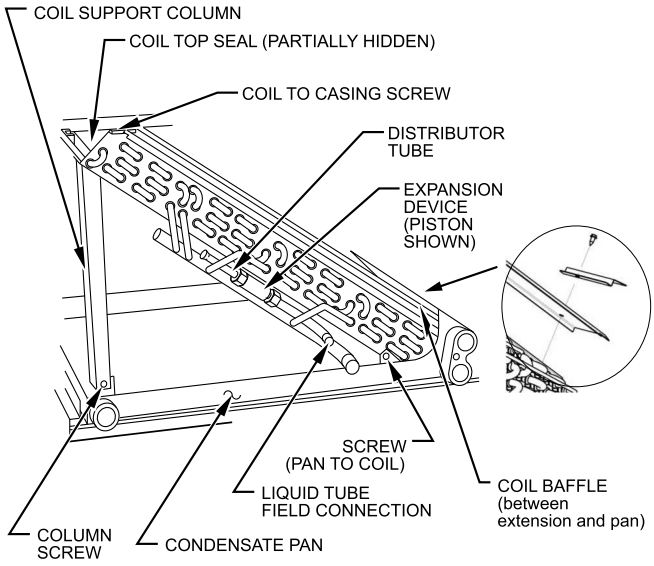
4. Disconnect liquid and vapor lines from indoor coil. Use a tubing cutter to cut the lines.
5. Remove coil access panel.
6. Remove clip securing fitting panel to condensate drain pan and remove fitting panel.
7. Remove all shipping clips (if present), including horizontal pan clip. Slide coil and condensate pan assembly out of unit.
8. Remove horizontal condensate drain pan from coil (if present) and condensate pan assembly (Fig. 31).
9. Remove 4 coil brackets if present (Fig. 31).
10. Remove screws at delta plates and remove coil from vertical condensate drain pan (Fig. 31).
11. Horizontal Applications Only—Remove drain connections and J-shaped tube from original coil, and install them in same position on new coil (Fig. 31).
12. Place coil assembly in plastic condensate pan and secure with 4 screws through delta plate (Fig. 31).
13. Horizontal and Upflow Applications Only—Attach 4 coil brackets to coil and pan assembly (Fig. 31).
14. Horizontal Applications Only—Place horizontal condensate pan into position on coil and pan assembly.

NOTE: Installation of horizontal condensate pan is not necessary for upflow or downflow applications.

15. Slide completed assembly into unit.
16. Reinstall fitting panel and reconnect clip securing fitting panel to condensate drain pan.
17. Horizontal Applications Only—Reinstall horizontal pan clip and secure with 1 screw (Fig. 31).
18. Reinstall coil access panel.
19. Reconnect liquid and vapor refrigerant lines and condensate drain line. Install new filter drier(s).

NOTE: If a torch is used to unbraze the line set, protect the fitting panel with a wet cloth or braze shield as necessary.

20. Evacuate line set and indoor coil to 500 microns, back seat (open) liquid and vapor service valves.
21. Turn on electrical supplies to indoor and outdoor units.
22. Check system refrigerant charge and operation. See Split-System Residential Air Conditioners and Heat Pump Service Manuals for further information.



A14304

Fig. 32 – Slope Coil Component Location (Prior to 1996)

Installation – Slope Coil Units Only

1. Recover system refrigerant.
   a. Attach gage/manifold set to service valves.
   b. Start unit in cooling mode.
   c. Front seat (close) liquid line service valve.
   d. Operate unit until vapor pressure reaches 5 psig (35kPa), or until suction line LPS opens.
   e. Turn off electrical supply to outdoor unit.
   f. Front seat (close) vapor service valve.
   g. Recover any remaining refrigerant.

NOTE: All condenser coils hold only a factory-supplied amount of refrigerant. Excess refrigerant, such as in long-line applications, may cause compressor internal pressure relief valve to open (indicated by sudden rise in vapor pressure) before refrigerant is recovered. If this occurs, turn off electrical supply to outdoor unit immediately, front seat (close) vapor service valve, and recover any remaining refrigerant.

2. Turn off electrical supply to indoor unit.
3. Disconnect condensate drain line.
4. Disconnect liquid and vapor lines from indoor coil. Use a tubing cutter to cut the lines.
5. Remove coil access and fitting panels.

WARNING

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Use of torch may cause oil to catch fire, resulting in personal injury or death. To remove components use tubing cutter only.

6. Remove 1 screw securing coil to unit casing.
7. Remove coil/pan assembly from unit.
8. Place assembly on a flat surface. On units manufactured prior to 1996, remove two screws securing coil support columns to pan (Fig. 32).
9. Rotate columns 90°, pull away from coil, and remove columns from assembly.
10. Remove two screws securing coil to condensate pan (Fig. 32 and Fig. 33).
11. Remove coil from condensate pan.
12. Attach new painted Top Seal to new coil using brass colored screws included with packaging (Fig. 32 and Fig. 33).

13. 1Remove screw at bottom of coil extension and reuse to attached Coil Baffle in same location. Long side of baffle toward pan (Fig. 32 and Fig. 33).
14. Install new coil into condensate pan using two original screws and two support columns.
15. Install new coil pan assembly into unit and secure with one screw previously removed from unit casing (Fig. 32).
16. Reinstall coil access panel.
17. Reconnect liquid and vapor refrigerant lines and condensate drain line. Install new filter drier(s).

NOTE: If a torch is used to unbraze the line set, protect the fitting panel with a wet cloth or braze shield as necessary.

18. Evacuate line set and indoor coil to 500 microns, back seat (open) liquid and vapor service valves.
19. Turn on electrical supplies to indoor and outdoor units.
20. Check system refrigerant charge and operation. See Split- System Residential Air Conditioners and Heat Pump Service Manuals for further information.

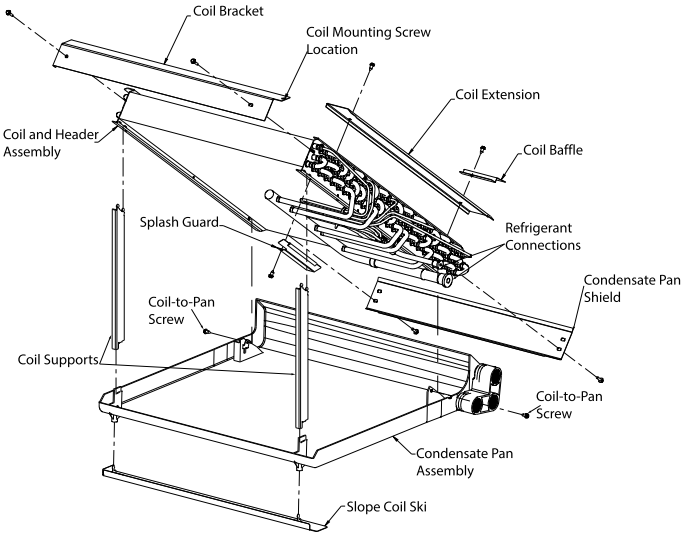


Fig. 33 – Slope Coil Component Location (1996 and Later)

GREENHECK
Building Value in Air.

Document 474680
Model SP
Model CSP
Ceiling Exhaust and Inline Fans

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model SP

Model SP is a direct drive ceiling exhaust fan designed for clean air applications where low sound levels are required. Many options and accessories are available such as lights, motion detectors, ceiling radiation dampers and speed controls. Capacities range from 25 to 1,600 cfm (42 to 2,718 m^3/hr) and 1 in. wg (248 Pa). AMCA Licensed for Sound and Air Performance.

ENERGY STAR® Certified models include: SP-A, 50, 70, 90, 200, 250, 290 and 410; SP-B, 50, 70, 80 and 90.

WARNING!

To reduce the risk of fire, electric shock, or injury to persons, observe the following:

- Suitable for use with solid state speed controls.
- Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
- Before servicing or cleaning unit, switch power off at service panel and lock service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
- Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
- Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent back drafting. Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and the local code authorities.
- When cutting or drilling into wall or ceiling, do not damage electrical wiring or other hidden utilities.
- Acceptable for use over a bathtub or shower when installed in a GFCI protected branch circuit. (Up through size SP-A390)
- Never place a switch where it can be reached from a tub or shower.
- Ducted fans must always be vented to the outdoors.
- These fans are not recommended for cooking exhaust applications. They are designed primarily for low temperature, clean air applications only. The diagram shows the minimum distance these fans should be placed in relation to cooking equipment.
- Fan/Light combination not to be installed in a ceiling thermally insulated to a value greater than R40.

CAUTION!

- For general ventilating use only. Do not use to exhaust hazardous or explosive materials and vapors.

Model CSP

Model CSP is a direct drive inline exhaust fan designed for clean air applications where low sound levels are required. Capacities range from 70 to 3,800 cfm (119 to 6,456 m^3/hr) and 1 in. wg (248 Pa). AMCA Licensed for Air Performance.

AVERTISSEMENT!

Pour réduire le risque d'incendie, de choc électrique ou de blessure corporelle, respecter cd qui suit:

- Appareil pouvant être utilisé avec un régulateur de vitesse à semi-conducteurs.
- Utiliser cet appareil exclusivement comme prévu par le fabricant. En cas de questions, communiquer avec le fabricant à l'adresse ou au numéro de téléphone figurant dans la garantie.
- Avant tout entretien ou nettoyage de l'appareil, couper l'alimentation sur le tableau électrique et verrouiller le dispositif de sectionnement pour empêcher toute mise sous tension accidentelle. Si le dispositif de sectionnement ne peut pas être verrouillé, attacher un moyen de mise en garde bien visible, tel qu'un panonceau, au tableau électrique.
- La pose et le câblage électrique doivent être effectués par des personnes qualifiées en conformité avec les codes et normes en vigueur, y compris pour la résistance au feu du bâtiment.
- Une quantité d'air suffisante est nécessaire pour la bonne combustion et l'extraction des gaz brûlés par le conduit d'évacuation (cheminée) d'appareils à combustible afin d'éviter le refoulement. Veiller à suivre les indications du fabricant du matériel de chauffe, les normes de sécurité telles que celles publiées par la National Fire Protection Association (NFPA) et l'American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) et la réglementation en vigueur.
- Lors de la découpe ou du perçage de murs ou plafonds, ne pas endommager les câbles électriques et autres conduites masquées.
- Pose admissible au-dessus d'une baignoire ou d'une douche sous réserve de raccordement à un circuit de dérivation à protection GFCI (disjoncteur différentiel). (Jusqu'à la taille SP-A390 incluse)
- Ne jamais placer d'interrupteur à un emplacement à portée d'une baignoire ou d'une douche.
- Les caissons d'extraction à gaine doivent toujours être évacués vers l'extérieur.
- Ces caissons ne sont pas conseillés pour les applications d'aspiration de vapeurs de cuisson. Ils sont conçus essentiellement pour l'aspiration d'air propre à basse température. Le schéma indique la distance minimale de placement de ces caissons par rapport à l'équipement de cuisson.
- Le combiné ventilateur/luminaire ne devra pas être installé dans un plafond ayant une isolation thermique d'une valeur supérieure à R40.

ATTENTION!

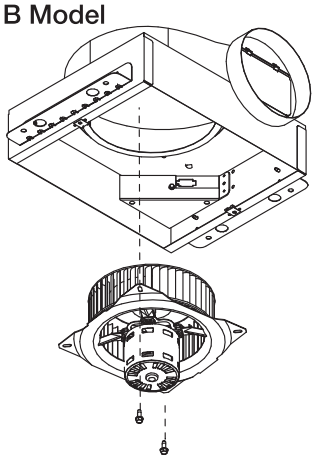
- À utiliser pour la ventilation générale uniquement. Ne pas utiliser pour l'aspiration de matières et vapeurs dangereuses ou explosives.

Prepare the fan

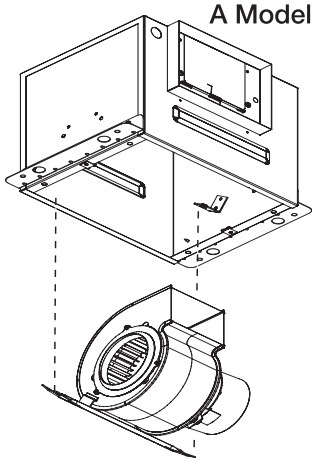
Power Assembly

If power assembly (motor, wheel, and scroll) is not installed in housing, insert the electrical plug into fan socket, then slide scroll end of power assembly into fan housing. Attach by using two sheet metal screws provided.

B Model

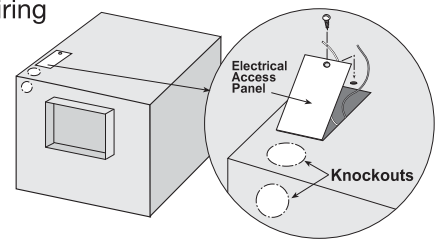


A Model



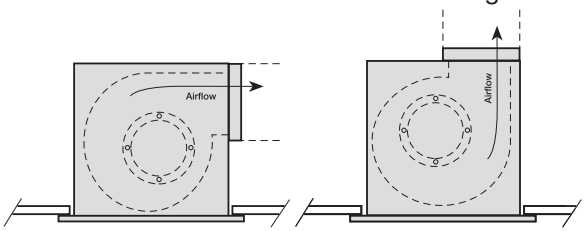
Remove Wiring Knockout

Remove either top or side wiring knockout, depending on wiring direction, by bending it back and forth to break tabs.



Ductwork

Check ductwork to see if the fan's discharge requires rotation from horizontal to vertical discharge.

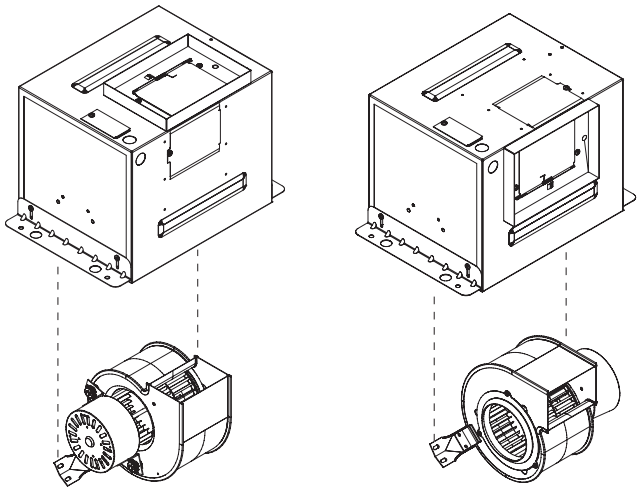


Fan Rotation

To rotate from horizontal to vertical discharge
A-Models Only

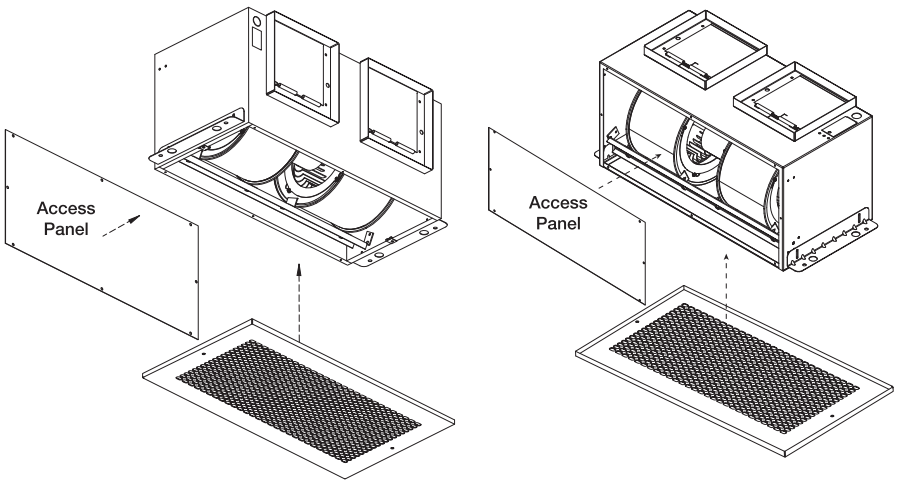
A-50-500, 710, 780 Models

Remove the two screws holding the power assembly in and pull power assembly out. Rotate power assembly 180 degrees and put back into fan. Use the same screws to reattach power assembly to fan housing. Flip fan over and remove the four screws holding the discharge duct and damper assembly. Exchange the assembly with plate mounted on top of fan, as shown in these illustrations.



A-700, 900-1500 Models

Remove the eight screws holding the access panel or collar as shown in picture. Rotate the fan housing so the discharge is facing up. Replace access panel or collar and screws.

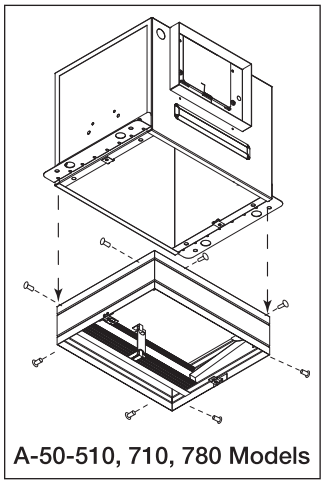


Ceiling Radiation Damper (CRD)

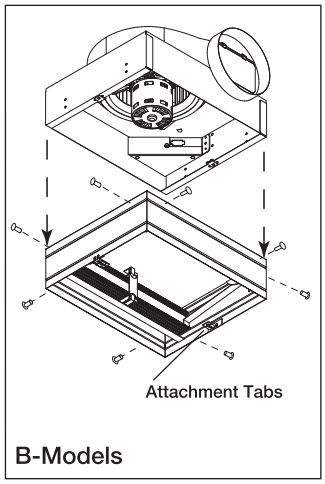
If fan is to be used in a fire resistive membrane ceiling, a ceiling radiation damper must be used.

If the ceiling radiation damper is already mounted to the fan from the factory, proceed to Install the Fan.

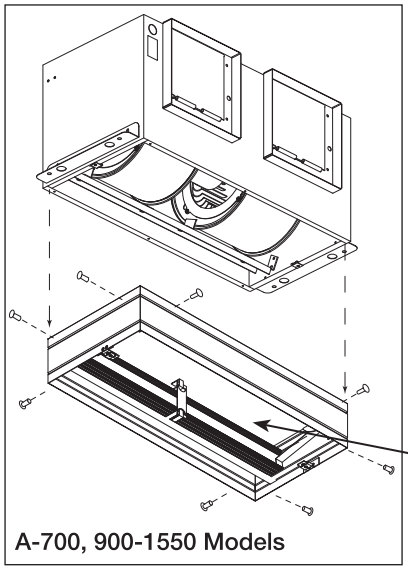
To mount the ceiling radiation damper to fan, make sure grille attachment tabs are facing down. Then place the inlet part of the fan into the ceiling radiation damper collar, and use self-tapping sheet metal screws (by others) to screw through the damper collar and into the fan housing. If the fan/light combination is being used, make sure ceiling radiation damper has an electrical plug in it. The electrical plug must be inserted into the fan. Make sure the electrical wire will not interfere with damper operation as shown in figure below.



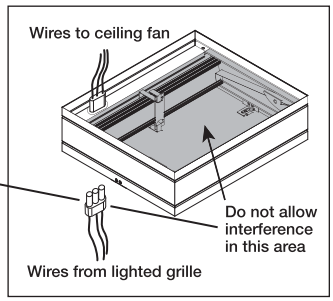
A-50-510, 710, 780 Models



B-Models

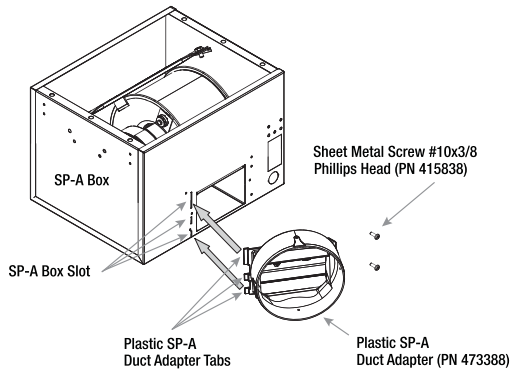


A-700, 900-1550 Models

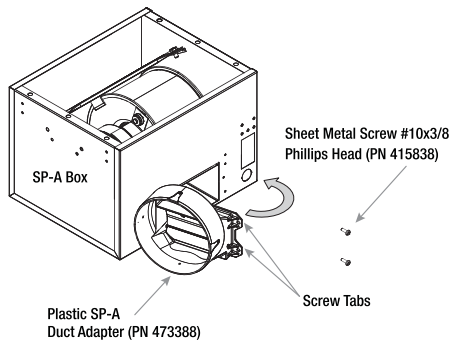


Discharge Installation SP-A 50-90 Models

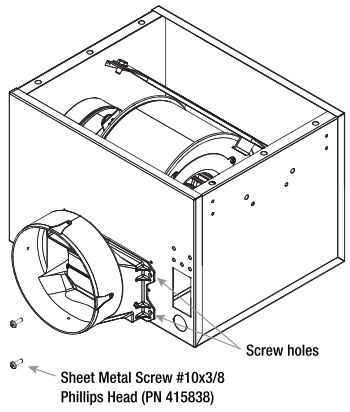
1 Insert plastic duct tab into SP-A box slots.



2 Rotate plastic SP-A duct adapter (PN 473388) until the screw tabs meets SP-A box.

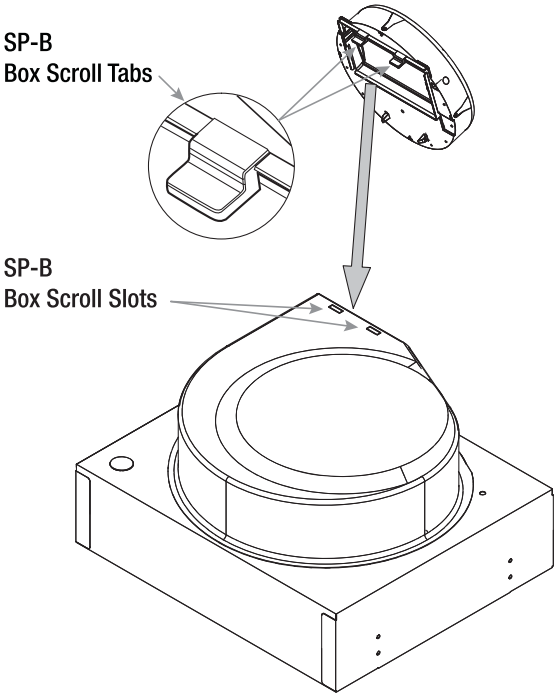


3 Install screws provided to secure discharge.

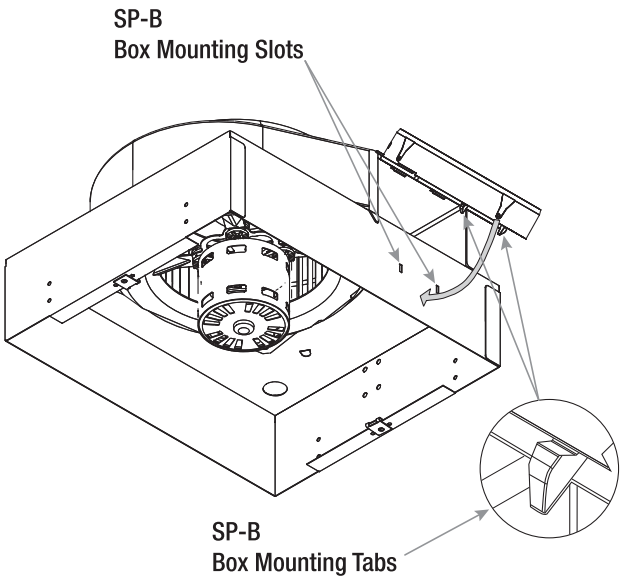


Discharge Installation SP/CSP-B 50-200 Models

1 Insert SP-B box scroll tab into SP-B box scroll slots.

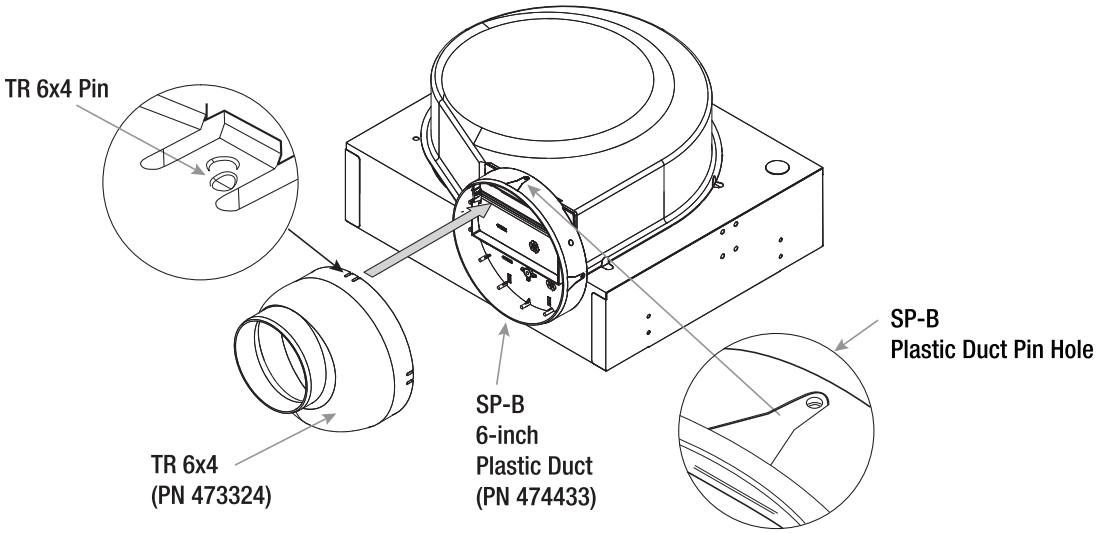


2 Rotate plastic SP-B duct adapter (PN 474433) until the two SP-B mounting tabs fully engage into the two SP-B box mounting slots.



3 **OPTIONAL**

Align the pins on the TR 6x4 adaptor to the duct pin hole on the SP-B 6-inch duct. Push until the adaptor snaps into place.



Install the Fan

1. For best performance, choose a location with the shortest possible duct run and minimum number of elbows. Do not mount near cooking equipment, as shown in Fig. 1.

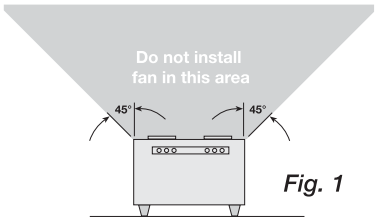


Fig. 1

2. Attach adjustable mounting brackets to fan, but leave the screws loose until proper height is determined, shown in Fig. 2. Cut hole to dimensions shown in table below:

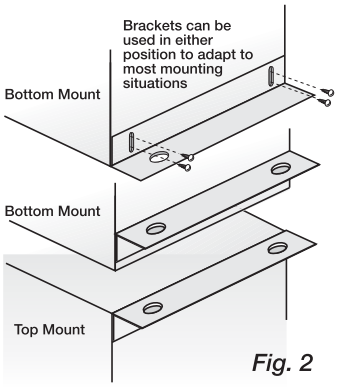


Fig. 2

Ceiling Openings		
Sizes	Fan or Fan/Light	Fan/CRD
SP-A50, A70, A90 SP-A110, A125, A190	10⅞ x 13⅜	11⅛ x 13⁷⁄₁₆
SP-A200, A250, A290, A390	12⅛ x 14¼	12¼ x 14⅜
SP-A700	23¾ x 11¾	24⅛ x 12¼
SP-A410, A510, A710, A780	14¾ x 18⅜	14⅞ x 18⁷⁄₁₆
SP-A900, A1050, A1410, A1550	14¾ x 24	14⅞ x 24⅛
SP-B 50 - 200	14⅛ x 11¾	14⅜ x 12¼

NOTE

Model SP-A 50-90 are standard with a round duct. Should Model SP-A 110-190 require a round duct, Model RDC (Round Duct Connector) may be ordered from Greenheck for field installation.

For Frame Construction:
Position unit between joists. Position brackets such that bottom edge of housing will be flush with finished ceiling, and tighten the adjustable mounting brackets, shown in Fig. 3.

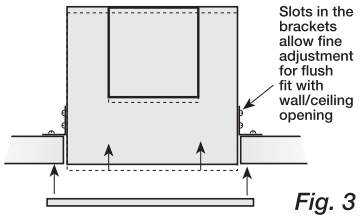


Fig. 3

For Hanging Installations:
Use Greenheck's optional vibration isolator kit Part Number VI Kit. Using the fan's standard adjustable mounting brackets and 10 by 32 threaded rod (by others), hang unit as shown in Fig. 4.

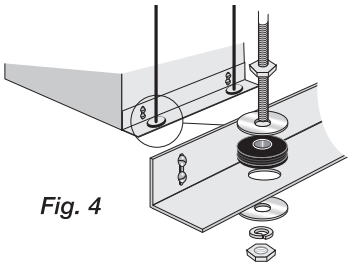
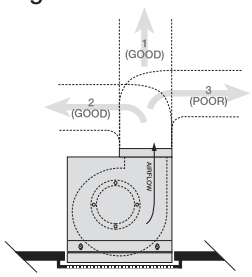


Fig. 4

3. Installation of ductwork is critical to the performance of the fan, shown in Fig. 5. Straight ductwork (1) or ductwork that turns in the same direction as the wheel (2) is recommended. Ductwork turning opposite the wheel direction (3) will cause turbulence and back pressure resulting in poor performance.

Fig. 5



4. Slide ductwork over the fan's discharge collar and securely attach it with sheet metal screws.

Make sure the screws do not interfere with damper operation. Check damper to make sure it opens freely.

Wire the Fan

1. If installed, remove wiring cover. If fan/light combination is being used, make sure the fan plug is connected to the fan receptacle and the light plug is connected to the light receptacle, shown in Fig. 6. Using proper wire connectors, wire the fan as shown in Fig. 7a. For wiring of light proceed to Fig. 7b.

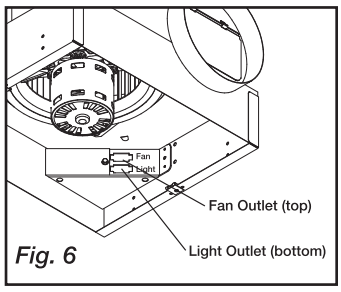


Fig. 6

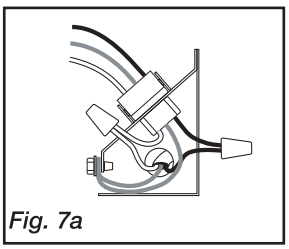


Fig. 7a

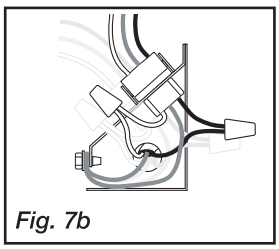


Fig. 7b

115 & 277 Volt
Black wire is "Hot"
White wire is "Neutral"
Green wire is "Ground"

220 - 240 Volt
Black wire is "Hot"
White wire is "Hot"
Green wire is "Neutral/Ground"

2. Push all wiring into the unit's cover and replace wiring cover.

Attach the Grille

1. If lighted grille is being used, plug wire into fan socket.

   If lighted grille and ceiling radiation damper are being used, plug wire from lighted grille into ceiling radiation damper socket. Do not plug wire directly into the fan socket. Make sure the wire does not interfere with the ceiling radiation damper operation.
2. Attach grille with two screws provided. Make sure not to over tighten; over tightening will damage grille.
3. Slide attachment screw covers over the attachment screws, shown in Figure 8 and 9.
4. If lighted grille is being used, install light bulb(s) into light socket(s). For incandescent lights, use maximum 100 watt bulb (by others). For fluorescent lights, use 27W GU24 bulbs. Greenheck has replacement 27W GU24 bulbs call 1-800-355-5354 to order.
5. If lighted grille is being used, snap lens into place, by pushing on the outside edges of lens, shown in Fig. 9. To remove lens, use small screw driver and pry on one side of lens.
6. Turn on power and check fan and light operation.

Fig. 8

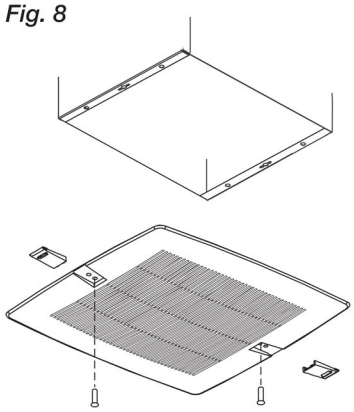
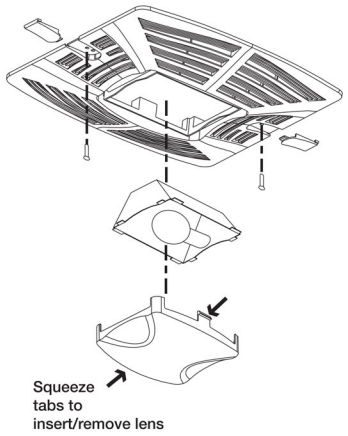


Fig. 9



Converting from ceiling to cabinet design for Model SP fans

All SP convertible sizes will be shipped with grille and duct collar cover.

Conversion Kit Parts List

- Qty. of 1 Blower Box Cover

Tools Required

- Phillips Head Screwdriver

Step 1: Remove grille (A) by removing the two grille screws (B).

Step 2: Remove duct collar cover (C) by removing the four duct collar screws (D).

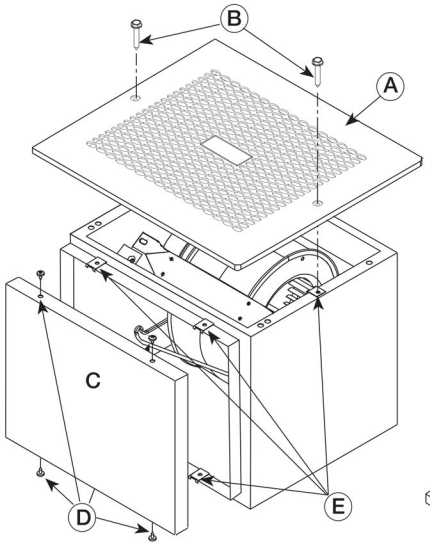
Step 3: Discard grille (A), two grille screws (B), and duct collar cover (C).

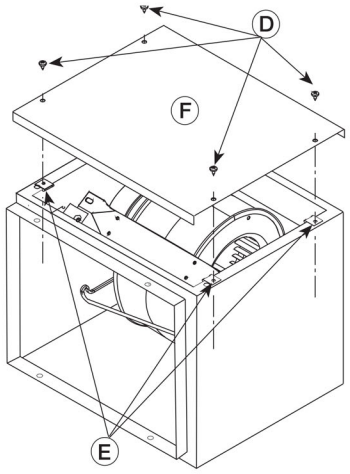
Step 4: Remove the six (6) tinnerman clips (E) by twisting them to one side and pulling straight out. Discard two of the six tinnerman clips.

Step 5: Insert the remaining four tinnerman clips (E) on grille opening side.

Step 6: Place blower box cover (F) over tinnerman clips (E), which were inserted in step 5.

Step 7: Screw the blower box cover (F) into place with four blower box cover screws (D).





SP/CSP models shown are UL and cUL listed E 33599

Other Installation Considerations

Ductwork and Noise

Fiberglass ductboard is a better choice than metal ductwork for reducing fan noise and is highly recommended for low sound applications. Where metal duct is used, sound transmission can be reduced with flexible duct connections between the fan and the duct.

Sound and Location

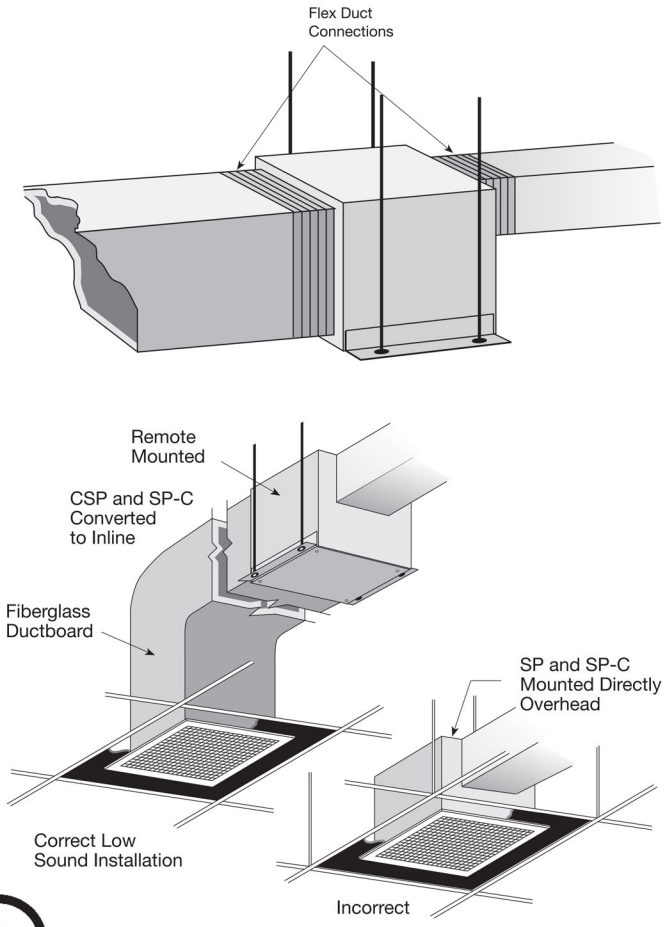
The location of these fans must be taken into consideration before installation. In critical sound installations, insulated ductwork, flexible duct connections or placing the fan in a remote section of ductwork are solutions to meeting the required fan sound levels.

Filters

The addition of an intake filter is highly recommended for these fans, even in clean air environments excess dirt can accumulate on wheels and motors causing reduced performance and imbalance.

Filters, once installed, should be checked and cleaned periodically to maintain performance.

Greenheck offers washable aluminum mesh filters specifically designed for these fans. Please consult our SP/CSP catalog for more information.



c UL US SP/CSP models shown are UL and cUL listed E 33599

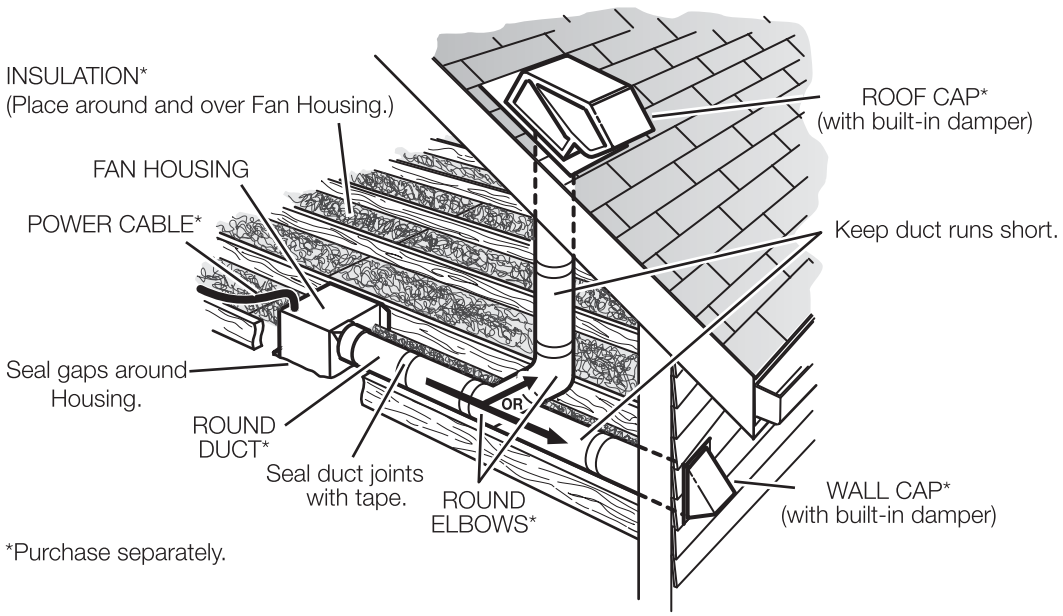
General Maintenance Suggestions

Model SP/CSP ceiling exhaust fans require very little maintenance. But since small problems over time left unchecked could lead to loss of performance or early motor failure, we do recommend that the unit be inspected periodically (once or twice a year).

The fan motor and wheel should be checked for dust and dirt accumulations. Dirt buildup can lead to loss of performance and motor overheating. Cleaning can be accomplished by brushing off any dust that may have accumulated. Even filtered units can accumulate build-up and should be checked when cleaning filters.

The motor should be checked for lubrication at this time. Lubricate only those motors which have an oil hole provided. A few drops of all purpose oil (SAE 20) will be sufficient.

Typical Installation



Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck's Centrifugal Ceiling and Cabinet Exhaust Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Warranty Statement for Centrifugal Ceiling and Cabinet Exhaust – SP and CSP

Greenheck Fan Corporation warrants its SP/CSP products to be free of any defect in material or workmanship for a period of three years from the date of shipment. In the event of such a defect during the warranty period, Greenheck Fan Corporation agrees, at its option, to either repair or replace the defective product free of charge.

This warranty runs to the original purchaser of such SP/CSP products for a period of three years from the date of shipment. Any product repaired or replaced under this warranty will, itself, be warranted only for the remainder of the warranty period of the original product being repaired or replaced.

All light bulbs are excluded under this limited warranty. Greenheck Fan Corporation is not responsible for any removal, installation, or transportation cost.

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