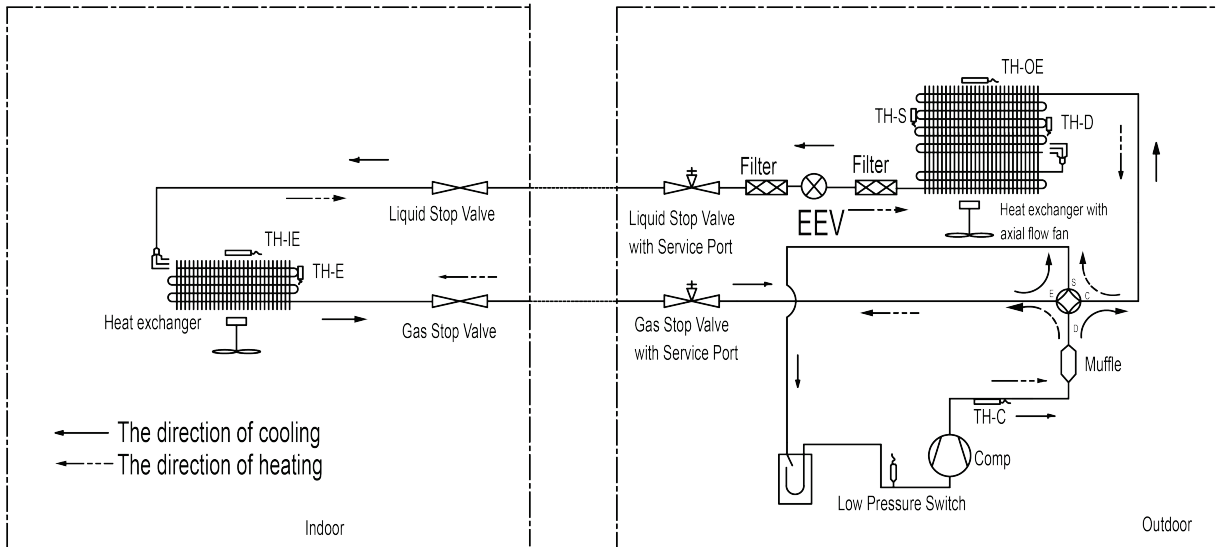


4. Maintenance

4.1 System Diagram



TH-IE Indoor Environment Thermal Bulb
TH-E Indoor Evaporator Thermal Bulb

TH-OE Outdoor Environment Thermal Bulb
TH-C Outdoor Condenser Thermal Bulb
TH-D Outdoor Compressor Discharge Thermal Bulb
TH-S Outdoor Speed Adjustment Thermal Bulb

4.2 Connection Pipe Vacuum Pumping



NOTICE

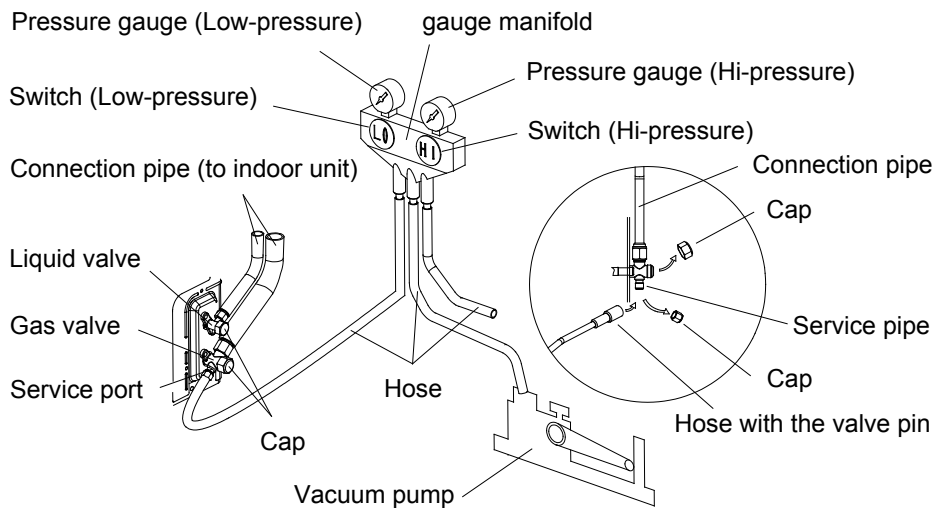
Make sure the outlet of vacuum pump is away from fire source and is well-ventilated.

- (1) Remove the caps of the liquid valve, gas valve and also the service port.
- (2) meanwhile the gas and liquid valves should be kept closed in case of refrigerant leak.
- (3) Connect the hose used for evacuation to the vacuum pump.
- (4) Open the switch at the lower pressure side of the manifold valve assembly and start the vacuum pump. Meanwhile, the switch at the high pressure side of the manifold valve assembly should be kept closed, otherwise evacuation would fail.
- (5) The evacuation duration depends on the unit's capacity, generally.

Model	Time(min)
GUD50W/NhB-S	20
GUD71W/NhB-S, GUD100W/NhB-S,	30
GUD125W/NhB-S, GUD140W/NhB-S, GUD160W/NhB-S, GUD160W/NhB-X	45

And verify if the pressure gauge at the low pressure side of the manifold valve assembly reads -0.1MPa (-750mmHg), if not, it indicates there is leak somewhere. Then, close the switch fully and then stop the vacuum pump.

- (6) Wait for 10min to see if the system pressure can remain unchanged. If the pressure increase, there may be leakage.
- (7) Slightly open the liquid valve and let some refrigerant go to the connection pipe to balance the pressure inside and outside of the connection pipe, so that air will not come into the connection pipe when removing the hose. Notice that the gas and liquid valve can be opened fully only after the manifold valve assembly is removed.
- (8) Place back the caps of the liquid valve, gas valve and also the service port.



NOTICE:

For large-size units, there are maintenance ports for liquid valve and gas valve. During evacuation, you may connect the two hoses of the branch valve assembly to the maintenance ports to speed up the evacuation.

Refrigerant should be reclaimed into the appropriate storage tank. System should use oxygen-free nitrogen purging to ensure safety. This process may need to repeat several times. Do not use compressed air or oxygen in this process.

4.3 Refrigerant Charging

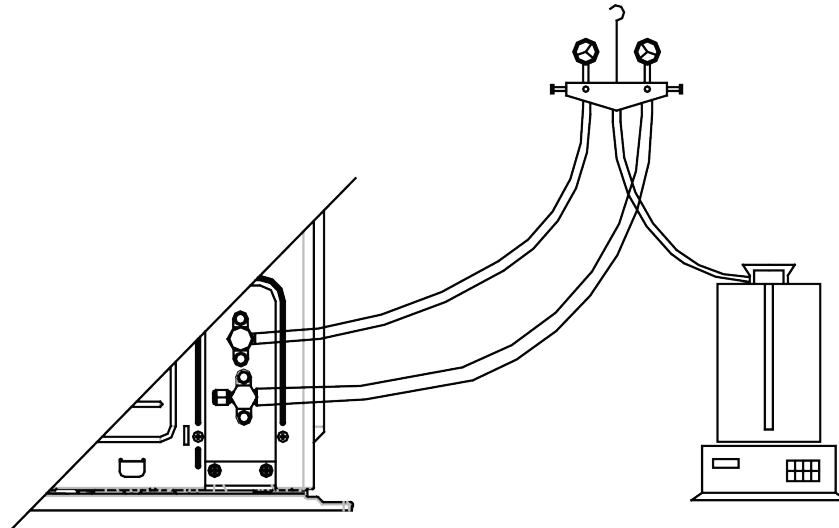
Pre-charging

Step 1: Connect the high pressure gauge line to the valve of liquid pipe and connect the low pressure gauge line to the valve of gas pipe. Connect the middle gauge line to the vacuum pump. Power on the vacuum pump and perform vacuum drying.

Step 2: After vacuum drying, close the high and low pressure gauge valves. Then remove the middle gauge line from the connector of vacuum pump. Then connect to the refrigerant tank.

Step 3: Loosen the middle gauge line from the connector of pressure gauge to a proper extent and slightly open the valve of refrigerant tank. Evacuate the middle gauge line. Then tighten up the connector again and completely open the valve of refrigerant tank at the same time.

Step 4: Keep the refrigerant tank erect and put it on an electronic scale. Record the current weight as m_1 .



Step 5: Open the high pressure gauge valve (Keep the low pressure gauge valve closed). Then charge refrigerant into the system. Meanwhile, record the weight of refrigerant tank as m_2 .

Step 6: $m_1 - m_2 = m$. If m equals to the required charging quantity M , close the valve of refrigerant tank at once. Then move to step 8.

Step 7: If you can't continue to charge refrigerant into the system and the quantity of charged refrigerant is less than the required charging quantity, then record the current quantity of charged refrigerant:

$$m = m_1 - m_2$$

$$m' = M - m$$

The remaining charging quantity is: $m' = M - m$

Step 8: After charging, remove the pressure gauge.

Refrigerant charging when unit is turned on:

Step 1: Close the valve of refrigerant tank. First remove the pressure gauge lines and connect the outdoor unit to the indoor unit. Then reconnect the pressure gauge lines. Connect the low pressure gauge line to the other joint of gas valve and connect the high pressure gauge line to the liquid valve. Connect the middle gauge line to the vacuum pump. Power on the vacuum pump and perform vacuum drying.

Step 2: After vacuum drying, close the high and low pressure gauge valves. Then remove the middle gauge line from the connector of vacuum pump. Then connect to the refrigerant tank.

Step 3: Loosen the middle gauge line from the connector of pressure gauge to a proper extent and slightly open the valve of refrigerant tank. Evacuate the middle gauge line. Then tighten up the connector again and completely open the valve of refrigerant tank at the same time.

Step 4: Turn on the air conditioner and let it run for a while.

Step 5: Open the low pressure gauge valve (Keep the high pressure gauge valve closed). Then charge in the remaining charging quantity m^{\cdot} .

Step 6: After all required refrigerant is charged in, close the valve of refrigerant tank.

Step 7: Remove the pressure gauge to finish the refrigerant charging work.

Procedure of refrigerant charging

Following is the supplementary requirement for refrigerant charging on the basis of normal procedure:

- 1) Make sure that when charging refrigerant into the system, no other types of refrigerant will be mixed.
The pipeline for refrigerant charging should be as short as possible to reduce the amount of refrigerant left in it.
- 2) The refrigerant tank should stand erect.
- 3) Make sure the refrigerating system is already grounded before refrigerant charging.
- 4) When charging is completed (or not yet completed), stick a label on the system.
- 5) Before re-charging refrigerant into the system, use oxygen-free nitrogen to perform pressure test. When charging is completed, perform leak test before trial running. Before leaving the workplace, perform a leak test again.

4.4 Maintenance of Major Components

4.4.1 Replacement of wired controller

Please refer to the instruction manual of wired controller XK75 or XK117.

4.4.2 How to replace the compressor

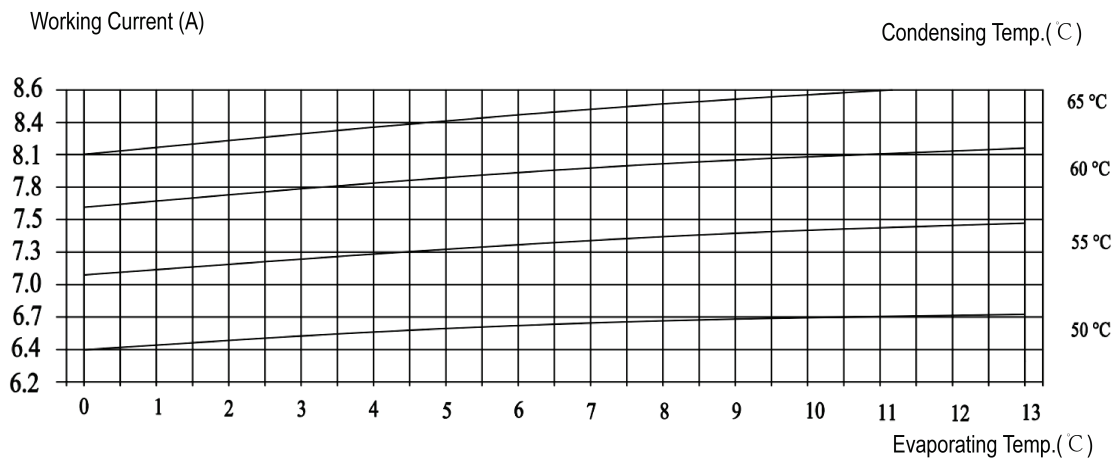
4.4.2.1 Diagnosis of compressor failure

A. On condition that the unit can be started up

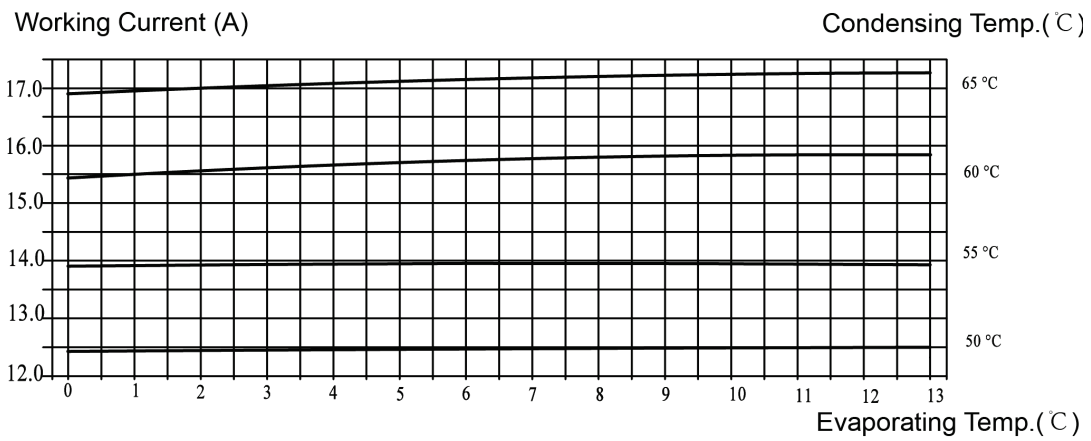
Step 1:

If the unit can be started up, then start it up to check the current of the faulted compressor. Use a pressure gauge to measure the pressure of the big and small valves. Connect with a computer to monitor the data. Refer to the following table based on the recommended working current. The electric current of an inverter compressor will be different under different rotation speed or different working conditions. If the compressor is working at 60Hz, the working current corresponding to different condensing temperature and evaporating temperature is shown below:

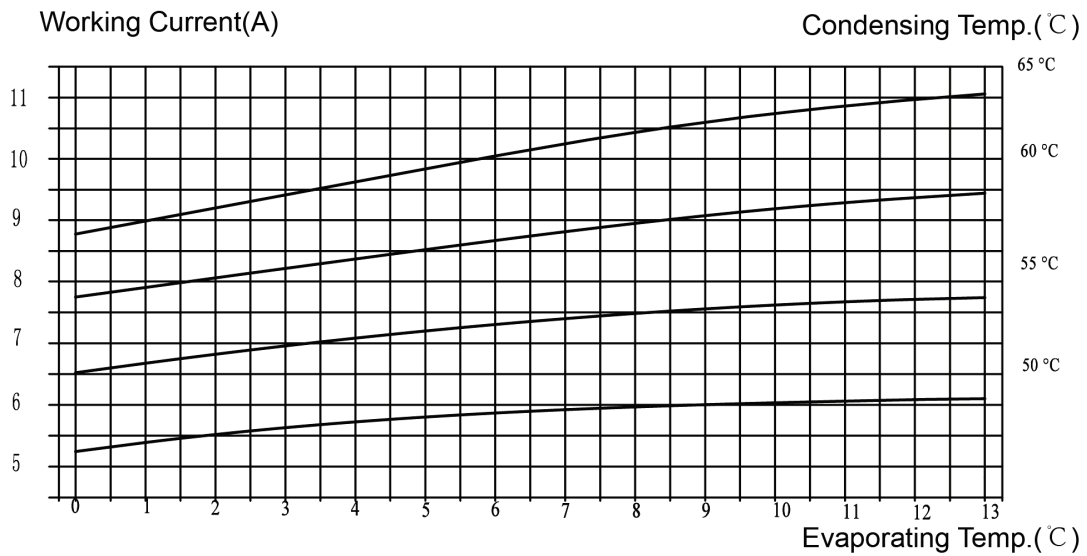
(1) Inverter compressor QXFS-B148zX030C



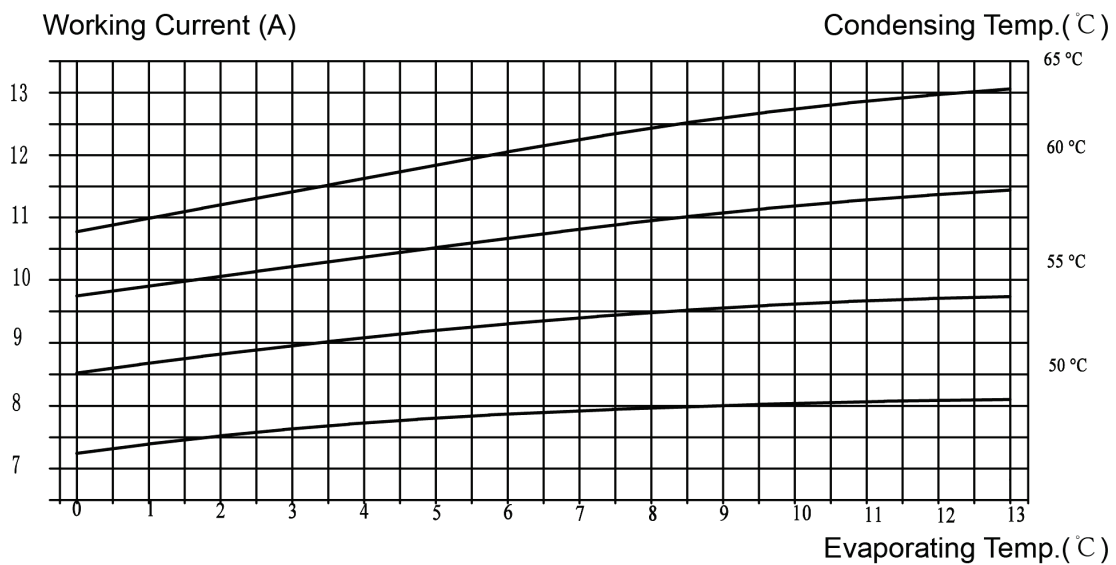
(2) Inverter compressor QXFS-D25zX090H



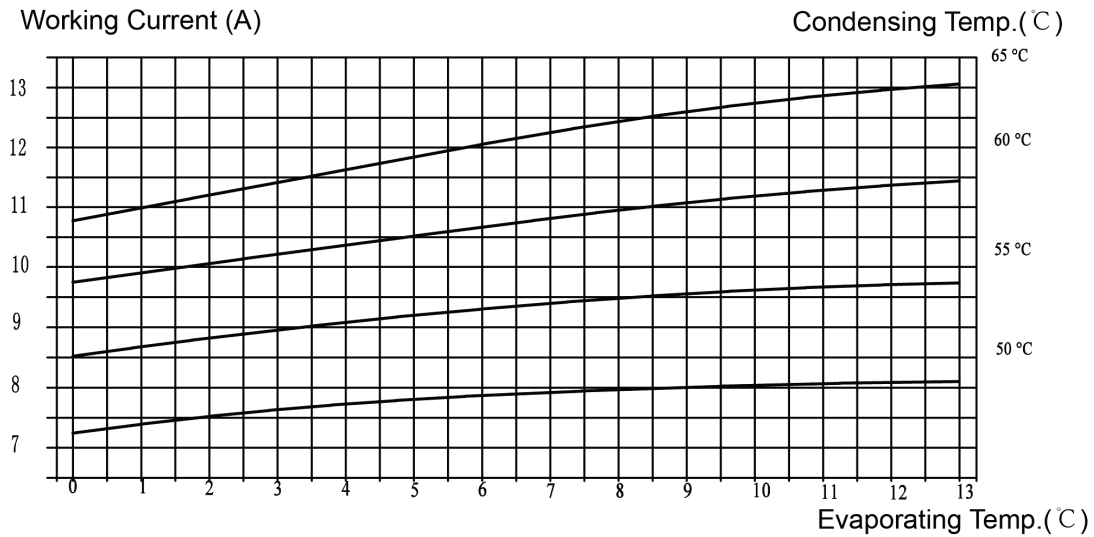
(3) Inverter compressor QXFS-D32zX090D



(4) Inverter compressor QXFS-F428zX450E



(5) Inverter compressor QXFS-F428zX450I



Step 2:

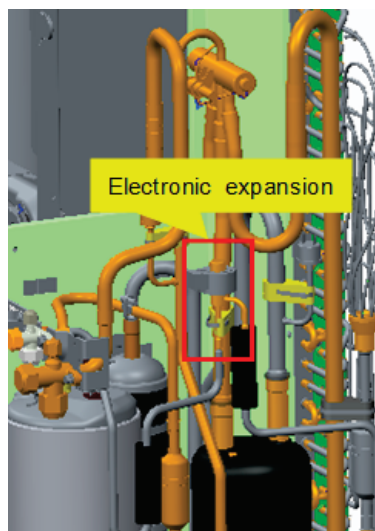
Judge whether the operating noise of the compressor is normal, and whether there is a sharp noise or obvious scraping. If there is a normal compressor working nearby, compare their operating noise.

Step 3:

Examine whether the electronic expansion valve of the outdoor unit is active and whether the 4-way valve works or not. How to examine:

(1) Electronic expansion valve:

The electronic expansion valve will be reset every time when the unit is powered on or off. Touch the valve and you can feel the movement of the valve spool. In the last stage of the reset process, you will hear the click of the valve and feel its vibration.

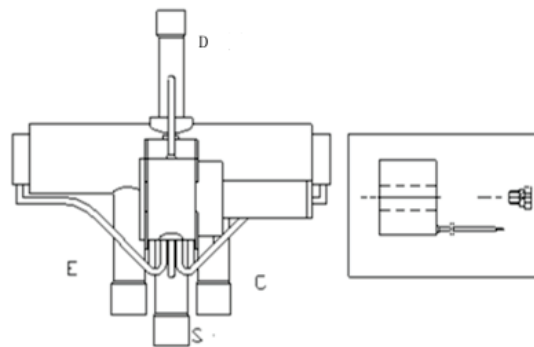
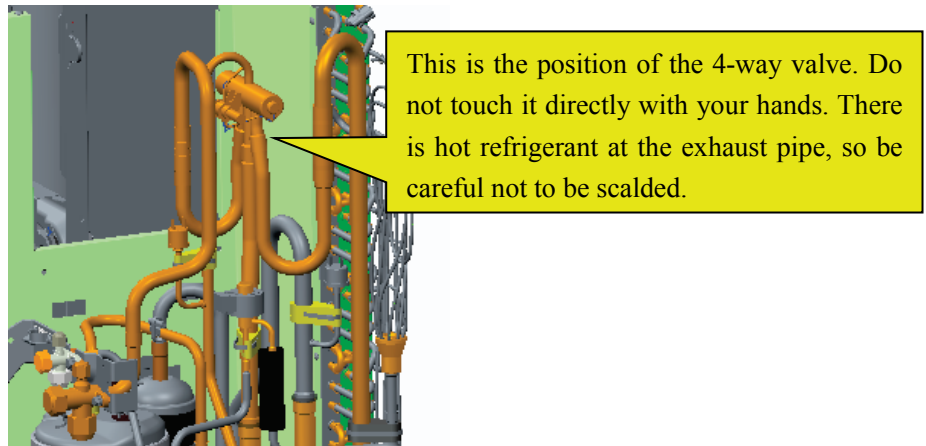


Touch the electronic expansion valve:

- Touch the top of the electronic expansion valve and you can feel its move as it is reset upon startup.
- Make sure the coil is fixed firmly.

(2) 4-way valve:

During normal operation, the 4 copper tubes that connect to the valve will have different temperature. When the 4-way valve is working, it will generate some noise and vibration.



D- Connect to the exhaust side

Caution! High temperature!

Labels on the 4-way valve:

D-connect to the exhaust side; E-connect to the evaporator of indoor unit;

S-connect to the inhalation side of the liquid separator; C-connect to the condenser;

When the system is in cooling mode, C-the pipeline is with high pressure and high temperature; E, S-the pipeline is with low pressure and low temperature;

When the system is in heating mode, E-the pipeline is with high pressure and high temperature; C, S-the pipeline is with low pressure and low temperature;

Because D is connected to the exhaust side, it is with high pressure and high temperature regardless of the operating mode. When the unit is powered on, in defrosting or oil return mode, the 4-way valve will produce some noise. Do not touch the pipes directly with your hands and be cautious of the hot temperature.

Step 4:

Check the drive board of compressor, i.e. the IPM module.

Please refer to the IPM checking method in the section of troubleshooting.

Check the drive board of compressor, i.e. the IPM module.

Please refer to the IPM checking method in the section of troubleshooting.

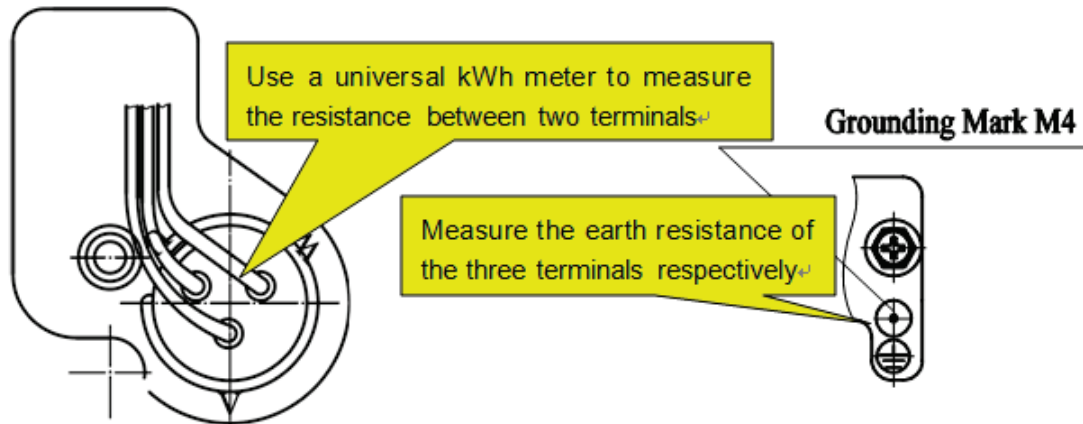
B. On condition that the unit cannot be started up

Step 1:

Cut off the power supply and detach the cover of the wiring box of the compressor. Check the wiring of the compressor.

Step 2:

Check the resistance between the wiring terminals (U, V, W) of compressor.



Refer to the following table for the resistance between any two terminals:

Compressor model	UV Winding resistance	VW Winding resistance	WU Winding resistance
QXFS-B148zX030C	1.28±7%Ω	1.28±7%Ω	1.28±7%Ω
QXFS-D25zX090H	1.11±7%Ω	1.11±7%Ω	1.11±7%Ω
QXFS-D32zX090D	0.85±7%Ω	0.85±7%Ω	0.85±7%Ω
QXFS-F428zX450E	0.63±7%Ω	0.63±7%Ω	0.63±7%Ω
QXFS-F428zX450I	0.79±7%Ω	0.79±7%Ω	0.79±7%Ω

Measure the earth resistance of each wiring terminal. The resistance should be above 10 megohm. If not, we can judge that the compressor is faulted inside.

Step 3:

On condition that the unit cannot be started up, we also need to check the solenoid valve assembly of the system, including the electronic expansion valve. The checking method is the same as instructed above.

Step 4:

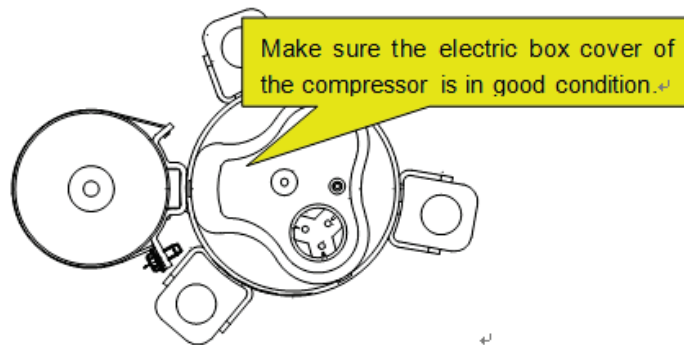
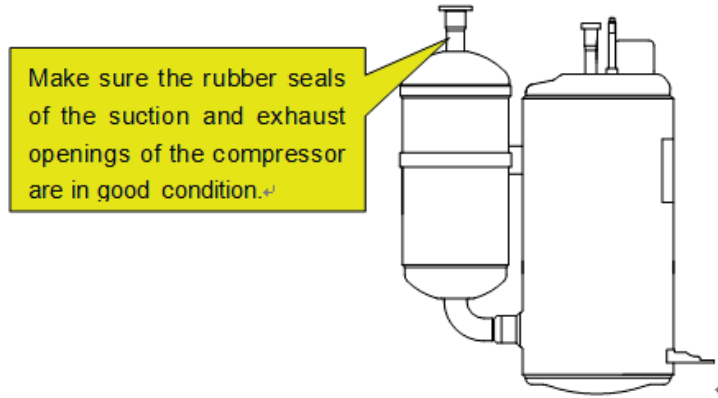
Check whether the IPM module is normal. Please refer to the IPM checking method in the section of troubleshooting.

4.4.2.2 Replacement of compressor

Step 1: Preparation

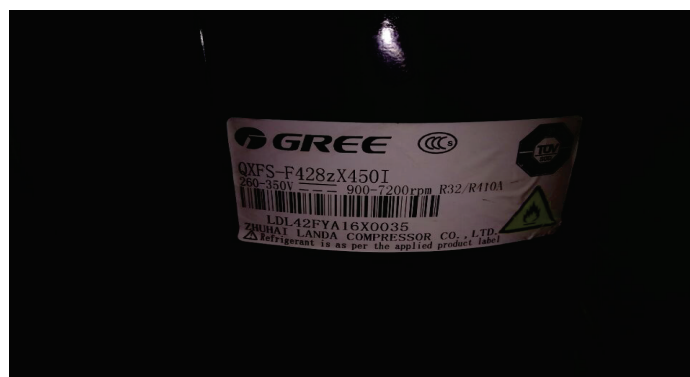
(1) Prepare the components for replacement

When carrying the old and new compressors, do not place the compressors horizontally or upside down. The angle of inclination should be within $\pm 30^\circ$. Make sure the lubricant inside the compressors will not flow from the oil balance mouth. The suction and exhaust openings of the compressors must be sealed. If a rubber seal is missing, use adhesive tape to seal the opening. This is to prevent the compressor oil from contacting the air.



Caution!

Before replacement, make sure the nameplates and models of the compressors are identical.



Make sure the rubber seal of the liquid separator is complete. If it is lost during transport, use adhesive tape to seal the opening at once. The container must be dry inside and well sealed.



Caution!

Make sure the lubricant is sealed inside the compressors.

(2) Prepare relevant tools

- 1) Prepare nitrogen. Please strictly follow the nitrogen welding standards during the welding process. Make sure there is sufficient nitrogen. The nitrogen pressure should be above 2.0MPa;
- 2) Prepare welding rods. Prepare some welding rods of common specifications and some special welding rods that contain more than 5% silver. They are used to weld the compressor. The suction and exhaust openings of the compressor are all connected to copper-plated steel pipes, so we need to use special welding rods and solder;
- 3) Prepare applicable welding tools. Please evaluate how much oxygen and acetylene should be used according to the current welding condition. Try to avoid repeated welding.
- 4) Prepare a complete set of tools, including an internal hexagonal wrench, diagonal pliers, pincer pliers, nipper pliers, a universal meter, a pressure gauge, cross screwdriver, straight screwdriver, more than two wrenches, insulating tape and wire cables.

Step 2: Disconnect power

If the compressor needs to be replaced after judging as above, then switch off the outdoor unit and disconnect the power cable of the outdoor unit. Use insulating tape to wrap the power cable and put a notice board on the power switch to remind people to be cautious of electric shock.

Step 3: Neaten the electric components

When you detach the compressor wires, temperature sensors and electric heaters, mark them correspondingly for the convenience of reconnecting them.

Step 4: Discharge refrigerant

Discharge refrigerant from the system. Discharge simultaneously from the high pressure side and low pressure side. Do not discharge too fast (It should take more than 12h to completely discharge the refrigerant); otherwise, large quantity of lubricant will escape from the system together with the refrigerant.

Step 5: Detach the compressor



1. 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. non-sparking, adequately sealed or intrinsically safe.

2. 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.

Check the condition of the damaged compressor, including its position and model.

If the information of the compressor is confirmed, check the oil quality.

(a) If the oil is clear and impurities-free, we consider that the oil of the system is not polluted. Meanwhile, if we confirm that the valves and pipes are also normal, then we can replace the compressor only. For the removal of compressor, please refer to the section: Removal of Major Components.

How to check oil quality:

- (1) After the compressor is detached, put it on a solid ground and shake it at an angle of 30~45° to ensure that the contaminant at the bottom of the compressor can be poured out.
- (2) Place the compressor at a position above the ground level and then pour out the oil from the air outlet of the compressor. Collect the oil in a transparent container. The amount of oil should be over 150ml.

Note:

- 1) The axial direction of the compressor should not slant at an angle larger than 20° to the horizontal direction.
- 2) Prevent the compressor from falling.
- 3) Put a transparent container (over 150ml in volume) under the exhaust pipe to collect the compressor oil, thus we can see the oil quality.
- (3) Put the container of compressor lubricant in a bright location and see if there is impurity and discoloration. Sniff at the compressor lubricant. Normally, there is no pungent smell.

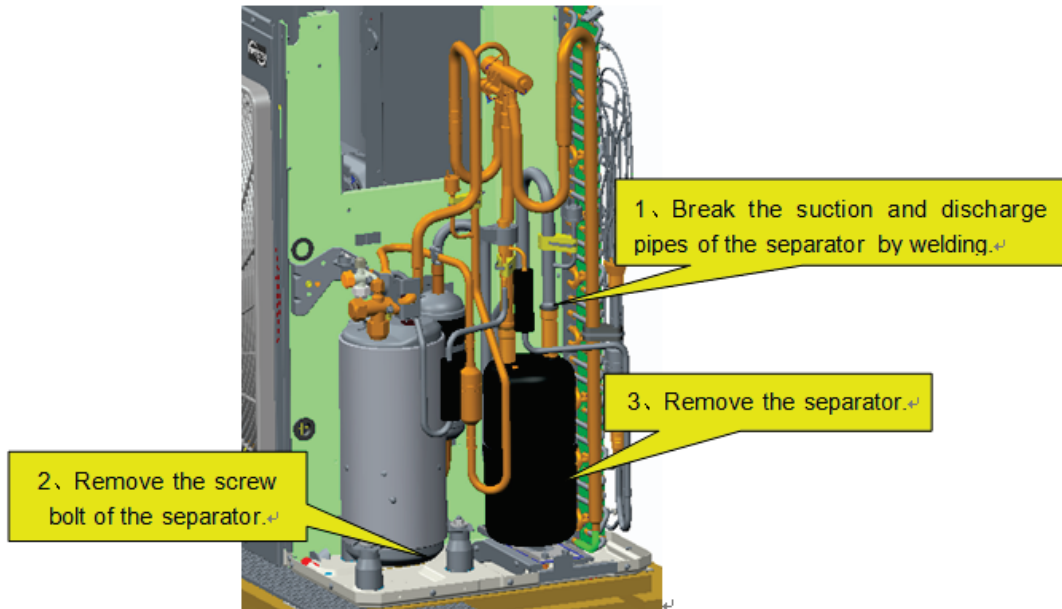
(b) If the oil is contaminated, replace the compressor and the gas-liquid separator.

Note: Confirm whether the compressor needs to be replaced. The pipe mouths of the faulted compressor must be sealed by adhesive tape as soon as the compressor is detached. Make sure the compressor is well preserved for the ease of future analysis.

Step 6: Check the components

If the oil is contaminated, check the components of the unit, including the gas-liquid separator.

Check the gas-liquid separator



When the separator is detached, check whether there are impurities inside. Below is the checking method:

Note: When pouring the liquid from the separator, make sure the discharge pipe is at the lower position. Slant at an angle not larger than 20°

Use a transparent container to collect the content inside the separator. Check its color, seal it well and return it to the factory for inspection.

Note: If the compressor is damaged and needs to be replaced, the gas-liquid separator should also be replaced, whether or not there are impurities in the separator or other abnormal conditions.

Confirm which parts of the system should be replaced. Make sure the pipe mouths of the damaged parts or components are sealed by adhesive tape as soon as they are detached. Keep them in the original condition for future analysis.

Step 7: Clear the pipeline

After confirming which parts of the system should be replaced, check the pipeline of the system. Blow through the main pipeline with nitrogen. After clearing the pipeline, if the components are not replaced immediately, seal the pipeline with adhesive tape to prevent the system from being contaminated by water and impurities in the air.

Step 8: Replace the compressor

For the removal of compressor, please refer to the section: Removal of Major Components.

Step 9: Check/Replace the gas-liquid separator

Note: If a compressor is damaged and needs to be replaced, its gas-liquid separator should also be replaced. This is to avoid the abnormal condition of the separator from affecting the safe and reliable operation of the system.

For the removal of gas-liquid separator, please refer to the section: Removal of Major Components.

Step 10: Check the system for leaks

- (1) First of all, check each welding point. Check whether the welding points are smooth and whether there is any obvious welding hole or other abnormal condition.
- (2) Next, fill high-pressure nitrogen into the system for leak detection. If it is only the outdoor unit that needs to be repaired and the indoor unit is confirmed normal, then it's OK to charge high-pressure nitrogen into the outdoor unit only. Fill in the nitrogen simultaneously from the high pressure side and low pressure side. We recommend charging the nitrogen from the big and small valves at the same time. The pressure of nitrogen should be above 20kgf. Then use soapy water to check for leaks. Check the welding points particularly.
- (3) Finally, retain the pressure of the system. Fill high-pressure nitrogen into the system and maintain the pressure above 25kgf. Close the big and small valves and keep the pressure of indoor and outdoor units for more than 12h. If the pressure remains unchanged, then start vacuum pumping; otherwise, check the system for leaks again.

Temperature should be considered when judging the pressure change. If temperature changes by 1°C, pressure will change by 0.01MPa or so.

For example, if temperature is 30°C when nitrogen of 2.5MPa is charged, and temperature changes to 25°C after 12h, we consider that the system is qualified if the pressure is found at 2.43MPa or above.

Step 11: Evacuate the system and charge refrigerant

Please refer to the section of maintenance: vacuum pumping and refrigerant charging.

Step 12: Connect electric components

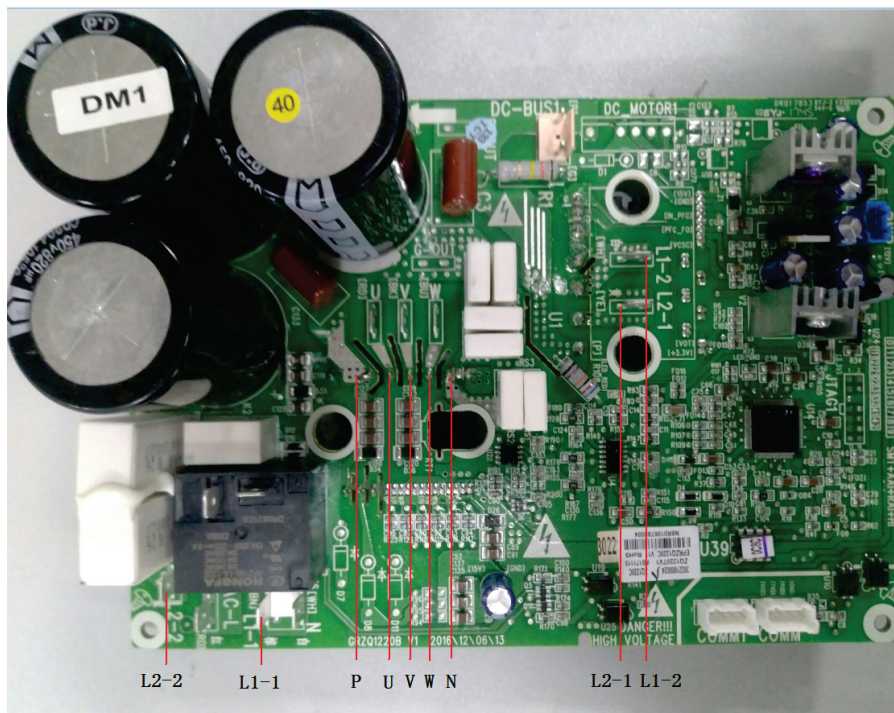
Connect cables, compressor wires and the electric heating belt according to the signs marked before and the wiring diagram on the cover of the electric box.

4.4.3 How to replace the drive module of compressor

Step 1: First, make sure that power is cut off. Set the universal meter at the AC voltage and measure the voltage between L1, L2, L3, and N. If each time the voltage is 0V (Errors may occur to the universal meter, sometimes the voltage may not be 0V), proceed with the next step and put a sign on the power switch that reads "Under maintenance, don't switch on".

Step 2: Measure the voltage between DC bus P and N on the drive board of the compressor. Set the universal meter at the DC voltage and measure the voltage between P and N as shown below. If the voltage is below 36V, proceed with the next step. In case that a universal meter is not available, disconnect power for 20min and then continue with the next step.

Step 3: Remove all the wires on the drive board of the compressor.



Step 4: Remove the screws on the drive board of the compressor. The screws are located in the white circles as shown above in the picture.

Step 5: Replace with a new compressor drive board. Before replacement, apply some silica gel on the IPM module.

Step 6: Install the new compressor drive board. Fix the screws and connect the wires correctly.