Panasonic

Order No. SBPAC1806001CE

SERVICE MANUAL & TEST RUN SERVICE MANUAL

3WAY SYSTEM

R410A

Model No.
Outdoor Unit

Type	Outdoor Unit Type	Rated Capacity				
		8 HP	10 HP	12 HP	14 HP	16 HP
MF3	3WAY System	U-8MF3E8	U-10MF3E8	U-12MF3E8	U-14MF3E8	U-16MF3E8

REFERENCE NO. **SM830269-00**

Model No.
Indoor Units

Type	Indoor Unit Type	Rated Capacity						
		15	22	28	36	45	56	60
D1	1-Way Cassette			S-28MD1E5	S-36MD1E5	S-45MD1E5	S-56MD1E5	
L1	2-Way Cassette		S-22ML1E5	S-28ML1E5	S-36ML1E5	S-45ML1E5	S-56ML1E5	
U2	4-Way Cassette		S-22MU2E5A	S-28MU2E5A	S-36MU2E5A	S-45MU2E5A	S-56MU2E5A	S-60MU2E5A
Y2	4-Way Cassette 60 × 60	S-15MY2E5A	S-22MY2E5A	S-28MY2E5A	S-36MY2E5A	S-45MY2E5A	S-56MY2E5A	
K2	Wall-Mounted	S-15MK2E5A	S-22MK2E5A	S-28MK2E5A	S-36MK2E5A	S-45MK2E5A	S-56MK2E5A	
T2	Ceiling				S-36MT2E5A	S-45MT2E5A	S-56MT2E5A	
F2	Low Silhouette Ducted	S-15MF2E5A	S-22MF2E5A	S-28MF2E5A	S-36MF2E5A	S-45MF2E5A	S-56MF2E5A	S-60MF2E5A
M1	Slim Low Static Ducted	S-15MM1E5A	S-22MM1E5A	S-28MM1E5A	S-36MM1E5A	S-45MM1E5A	S-56MM1E5A	
P1	Floor Standing		S-22MP1E5	S-28MP1E5	S-36MP1E5	S-45MP1E5	S-56MP1E5	
R1	Concealed Floor Standing		S-22MR1E5	S-28MR1E5	S-36MR1E5	S-45MR1E5	S-56MR1E5	

Type	Indoor Unit Type	Rated Capacity				
		71 / 73	90	106	140	160
D1	1-Way Cassette	S-73MD1E5				
L1	2-Way Cassette	S-73ML1E5				
U2	4-Way Cassette	S-73MU2E5A	S-90MU2E5A	S-106MU2E5A	S-140MU2E5A	S-160MU2E5A
K2	Wall-Mounted	S-73MK2E5A		S-106MK2E5A		
T2	Ceiling	S-73MT2E5A		S-106MT2E5A	S-140MT2E5A	
F2	Low Silhouette Ducted	S-73MF2E5A	S-90MF2E5A	S-106MF2E5A	S-140MF2E5A	S-160MF2E5A
P1	Floor Standing	S-71MP1E5				
R1	Concealed Floor Standing	S-71MR1E5				

Type	Indoor Unit Type	Rated Capacity		
		180	224	280
E2	High Static Pressure Ducted	S-180ME2E5	S-224ME2E5	S-280ME2E5

IMPORTANT!
Please Read Before Starting

This air conditioner must be installed by the sales dealer or installer.
This information is provided for use only by authorized persons.

For safe installation and trouble-free operation, you must:

- Carefully read this instruction booklet before beginning.
- Follow each installation or repair step exactly as shown.
- This air conditioner shall be installed in accordance with National Wiring Regulations.
- This product is intended for professional use. Permission from the power supplier is required when installing the U-8MF3E8 outdoor unit that is connected to a 16 A distribution network.
- This equipment complies with EN/IEC 61000-3-12 provided that the short-circuit power Ssc is greater than or equals to the values corresponding to each model as shown in the table below at the interface point between the user's supply and the public system.
  It is the responsibility of the installer or user of the equipment to ensure; by consultation with the distribution network operator if necessary that the equipment is connected only to supply with a short-circuit power Ssc greater than or equals to the values corresponding to each model as shown in the table below.

	U-10MF3E8	U-12MF3E8
Ssc	1,600 kVA	1,600 kVA

	U-14MF3E8	U-16MF3E8
Ssc	2,000 kVA	2,150 kVA

- The product meets the technical requirements of EN/IEC 61000-3-3.
- Pay close attention to all warning and caution notices given in this manual.

WARNING This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

CAUTION This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

If Necessary, Get Help

These instructions are all you need for most installation sites and maintenance conditions. If you require help for a special problem, contact our sales/service outlet or your certified dealer for additional instructions.

In Case of Improper Installation

The manufacturer shall in no way be responsible for improper installation or maintenance service, including failure to follow the instructions in this document.

SPECIAL PRECAUTIONS

WARNING When Wiring

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ONLY A QUALIFIED, EXPERIENCED ELECTRICIAN SHOULD ATTEMPT TO WIRE THIS SYSTEM.

- Do not supply power to the unit until all wiring and tubing are completed or reconnected and checked.
- Highly dangerous electrical voltages are used in this system. Carefully refer to the wiring diagram and these instructions when wiring. Improper connections and inadequate grounding can cause **accidental injury or death.**
- Connect all wiring tightly. Loose wiring may cause overheating at connection points and a possible fire hazard.
- Provide a power outlet to be used exclusively for each unit.
- ELCB must be incorporated in the fixed wiring. Circuit breaker must be incorporated in the fixed wiring in accordance with the wiring regulations.

	Circuit breaker
U-8MF3E8	25 A
U-10MF3E8	25 A
U-12MF3E8	30 A

	Circuit breaker
U-14MF3E8	40 A
U-16MF3E8	40 A

- Provide a power outlet exclusively for each unit, and full disconnection means having a contact separation by 3 mm in all poles must be incorporated in the fixed wiring in accordance with the wiring rules.
- To prevent possible hazards from insulation failure, the unit must be grounded.
- This equipment is strongly recommended to be installed with Earth Leakage Circuit Breaker (ELCB) or Residual Current Device (RCD). Otherwise, it may cause electrical shock and fire in case of equipment breakdown or insulation breakdown.

When Transporting

- It may need two or more people to carry out the installation work.
- Be careful when picking up and moving the indoor and outdoor units. Get a partner to help, and bend your knees when lifting to reduce strain on your back. Sharp edges or thin aluminum fins on the air conditioner can cut your fingers.

When Installing…

Select an installation location which is rigid and strong enough to support or hold the unit, and select a location for easy maintenance.

…In a Room

Properly insulate any tubing run inside a room to prevent “sweating” that can cause dripping and water damage to walls and floors.

⚠ CAUTION Keep the fire alarm and the air outlet at least 1.5 m away from the unit.

…In Moist or Uneven Locations

Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the outdoor unit. This prevents water damage and abnormal vibration.

…In an Area with High Winds

Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable air baffle.

…In a Snowy Area (for Heat Pump-type Systems)

Install the outdoor unit on a raised platform that is higher than drifting snow. Provide snow vents.

When Connecting Refrigerant Tubing

Pay particular attention to refrigerant leakages.

⚠ WARNING

- When performing piping work, do not mix air except for specified refrigerant (R410A) in refrigeration cycle. It causes capacity down, and risk of explosion and injury due to high tension inside the refrigerant cycle.
- If the refrigerant comes in contact with a flame, it produces a toxic gas.
- Do not add or replace refrigerant other than specified type. It may cause product damage, burst and injury, etc.

- Ventilate the room immediately, in the event that is refrigerant gas leaks during the installation. Be careful not to allow contact of the refrigerant gas with a flame as this will cause the generation of toxic gas.
- Keep all tubing runs as short as possible.
- Apply refrigerant lubricant to the matching surfaces of the flare and union tubes before connecting them, then tighten the nut with a torque wrench for a leak-free connection.
- Check carefully for leaks before starting the test run.
- Do not leak refrigerant while piping work for an installation or re-installation, and while repairing refrigeration parts. Handle liquid refrigerant carefully as it may cause frostbite.

When Servicing

- Turn the power OFF at the main power box (mains), wait at least 10 minutes until it is discharged, then open the unit to check or repair electrical parts and wiring.
- Keep your fingers and clothing away from any moving parts.
- Clean up the site after you finish, remembering to check that no metal scraps or bits of wiring have been left inside the unit.

⚠ WARNING

- This product must not be modified or disassembled under any circumstances. Modified or disassembled unit may cause fire, electric shock or injury.
- Do not clean inside the indoor and outdoor units by users. Engage authorized dealer or specialist for cleaning.
- In case of malfunction of this appliance, do not repair by yourself. Contact to the sales dealer or service dealer for a repair and disposal.

⚠ CAUTION

- Ventilate any enclosed areas when installing or testing the refrigeration system. Leaked refrigerant gas, on contact with fire or heat, can produce dangerously toxic gas.
- Confirm after installation that no refrigerant gas is leaking. If the gas comes in contact with a burning stove, gas water heater, electric room heater or other heat source, it can cause the generation of toxic gas.

Others

When disposal of the product, comply with national regulations.

⚠ CAUTION

- Do not touch the air inlet or the sharp aluminum fins of the outdoor unit. You may get injured.
- Do not sit or step on the unit. You may fall down accidentally.
- Do not stick any object into the FAN CASE.
  You may be injured and the unit may be damaged.

Check of Density Limit

Check the amount of refrigerant in the system and floor space of the room according to the legislation on refrigerant drainage. If there is no applicable legislation, follow the standards described below.

The room in which the air conditioner is to be installed requires a design that in the event of refrigerant gas leaking out, its density will not exceed a set limit.

The refrigerant (R410A), which is used in the air conditioner, is safe, without the toxicity or combustibility of ammonia, and is not restricted by laws imposed to protect the ozone layer. However, since it contains more than air, it poses the risk of suffocation if its density should rise excessively. Suffocation from leakage of refrigerant is almost non-existent. With the recent increase in the number of high density buildings, however, the installation of multi air conditioner systems is on the increase because of the need for effective use of floor space, individual control, energy conservation by curtailing heat and carrying power, etc.
Most importantly, the multi air conditioner system is able to replenish a large amount of refrigerant compared to conventional individual air conditioners. If a single unit of the multi air conditioner system is to be installed in a small room, select a suitable model and installation procedure so that if the refrigerant accidentally leaks out, its density does not reach the limit (and in the event of an emergency, measures can be made before injury can occur).
In a room where the density may exceed the limit, create an opening with adjacent rooms, or install mechanical ventilation combined with a gas leak detection device. The density is as given below.

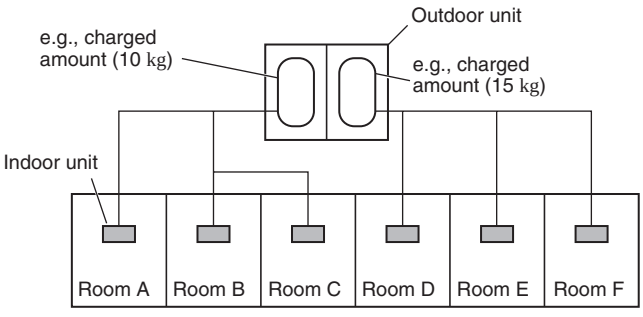
$$\frac{\text{Total amount of refrigerant (kg)}}{\text{Min. volume of the indoor unit installed room (m}^3\text{)}} \leq \text{Density limit (kg/m}^3\text{)}$$

The density limit of refrigerant which is used in multi air conditioners is 0.44 kg/m³ (ISO 5149).

NOTE

1. If there are 2 or more refrigerating systems in a single refrigerating device, the amount of refrigerant should be as charged in each independent device.

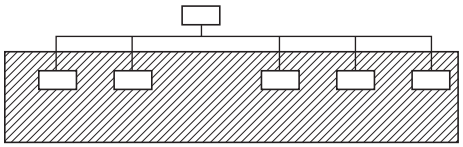
   For the amount of charge in this example:



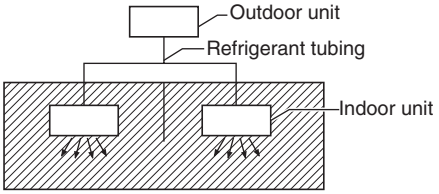
   The possible amount of leaked refrigerant gas in rooms A, B and C is 10 kg.
   The possible amount of leaked refrigerant gas in rooms D, E and F is 15 kg.

2. The standards for minimum room volume are as follows.

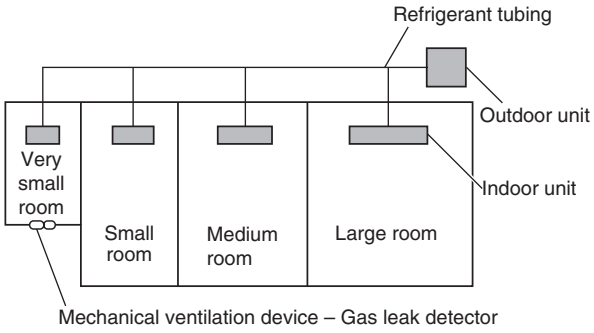
(1) No partition (shaded portion)



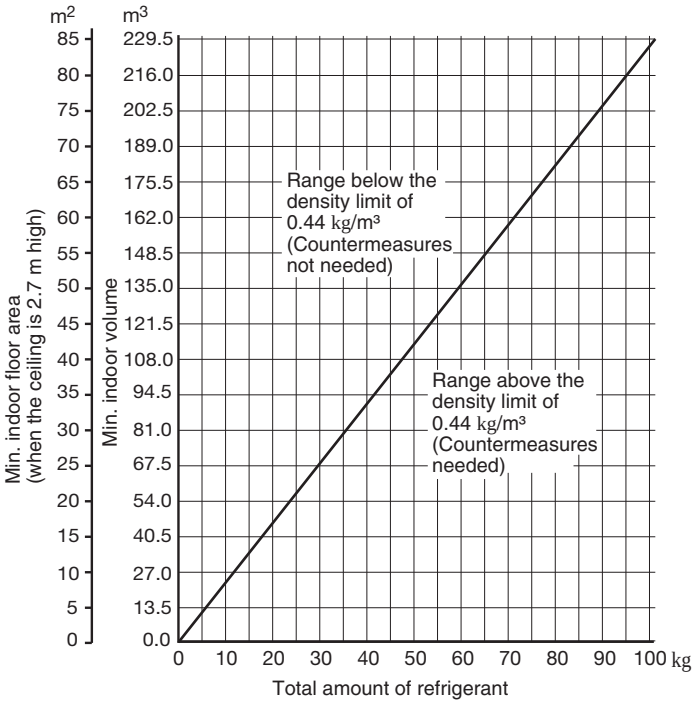
(2) When there is an effective opening with the adjacent room for ventilation of leaking refrigerant gas (opening without a door, or an opening 0.15% or larger than the respective floor spaces at the top or bottom of the door).



(3) If an indoor unit is installed in each partitioned room and the refrigerant tubing is interconnected, the smallest room of course becomes the object. But when mechanical ventilation is installed interlocked with a gas leakage detector in the smallest room where the density limit is exceeded, the volume of the next smallest room becomes the object.



3. The minimum indoor floor space compared with the amount of refrigerant is roughly as follows: (When the ceiling is 2.7 m high)



Precautions for Installation Using New Refrigerant

1. Care regarding tubing

1-1. Process tubing

- Material: Use seamless phosphorous deoxidized copper tube for refrigeration. Wall thickness shall comply with the applicable legislation. The minimal wall thickness must be in accordance with the table below. For tubes of ø22.22 or larger, use the material of temper 1/2H or H (Hard copper tube). Do not bend the hard copper tube.
- **Tubing size: Be sure to use the sizes indicated in the table below.**
- Use a tube cutter when cutting the tubing, and be sure to remove any flash. This also applies to distribution joints (optional).
- When bending tubing, use a bending radius that is 4 times the outer diameter of the tubing or larger.

CAUTION **Use sufficient care in handling the tubing. Seal the tubing ends with caps or tape to prevent dirt, moisture, or other foreign substances from entering. These substances can result in system malfunction.**

Unit: mm

Material		Temper - O (Soft copper tube)				
Copper tube	Outer diameter	6.35	9.52	12.7	15.88	19.05
	Wall thickness	0.8	0.8	0.8	1.0	1.2

Unit: mm

Material		Temper - 1/2 H, H (Hard copper tube)					
Copper tube	Outer diameter	22.22	25.4	28.58	31.75	38.1	41.28
	Wall thickness	1.0	1.0	1.0	1.1	over 1.35	over 1.45

1-2. Prevent impurities including water, dust and oxide from entering the tubing. Impurities can cause R410A refrigerant deterioration and compressor defects. Due to the features of the refrigerant and refrigerating machine oil, the prevention of water and other impurities becomes more important than ever.

2. Be sure to recharge the refrigerant only in liquid form.

2-1. Since R410A is a non-azeotrope, recharging the refrigerant in gas form can lower performance and cause defects in the unit.

2-2. Since refrigerant composition changes and performance decreases when gas leaks, collect the remaining refrigerant and recharge the required total amount of new refrigerant after fixing the leak.

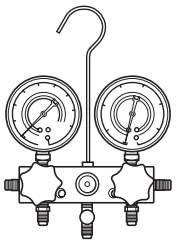
3. Different tools required

3-1. Tool specifications have been changed due to the characteristics of R410A.

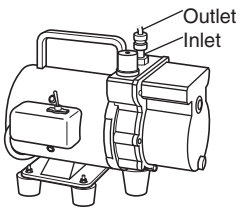
Some tools for R22- and R407C-type refrigerant systems cannot be used.

Item	New tool?	R407C tools compatible with R410A?	Remarks
Manifold gauge	Yes	No	Types of refrigerant, refrigerating machine oil, and pressure gauge are different.
Charge hose	Yes	No	To resist higher pressure, material must be changed.
Vacuum pump	Yes	Yes	Use a conventional vacuum pump if it is equipped with a check valve. If it has no check valve, purchase and attach a vacuum pump adapter.
Leak detector	Yes	No	Leak detectors for CFC and HCFC that react to chlorine do not function because R410A contains no chlorine. Leak detectors for HFC134a can be used for R410A.
Flaring oil	Yes	No	For systems that use R22, apply mineral oil (Suniso oil) to the flare nuts on the tubing to prevent refrigerant leakage. For machines that use R407C or R410A, apply synthetic oil (ether oil) to the flare nuts.

Manifold gauge



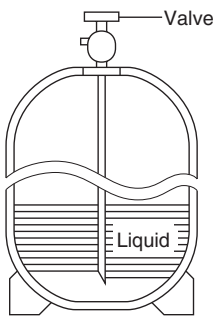
Vacuum pump



* Using tools for R22 and R407C and new tools for R410A together can cause defects.

3-2. Use R410A exclusive cylinder only.

Single-outlet valve
(with siphon tube)
Liquid refrigerant should be recharged with the cylinder standing on end as shown.



Important Information Regarding The Refrigerant Used

This product contains fluorinated greenhouse gases. Do not vent gases into the atmosphere.

Refrigerant type: R410A

GWP(1) value: 2088

(1)GWP = global warming potential

Periodical inspections for refrigerant leaks may be required depending on European or local legislation.
Please contact your local dealer for more information.

Please fill in with indelible ink,

■ ①: the factory refrigerant charge of the product

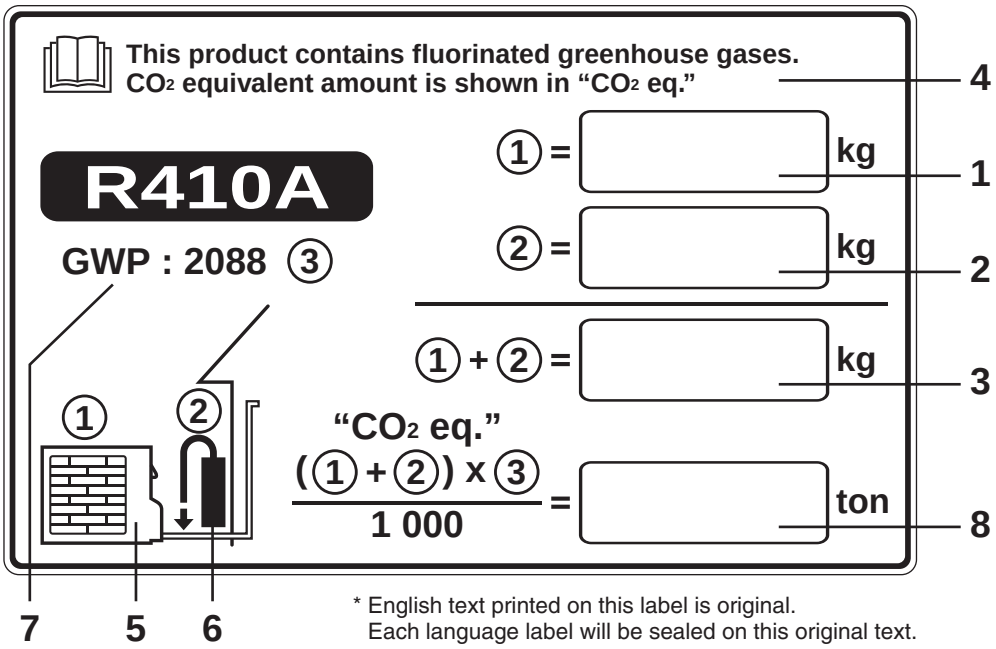
■ ②: the additional refrigerant amount charged in the field

■ ① + ②: the total refrigerant charge

■ (① + ②) x ③/1000: CO_2 equivalent in tons; multiply the total refrigerant charge by GWP value, then divided by 1000.

on the refrigerant charge label supplied with the product.

The filled out label must be adhered in the proximity of the product charging port (e.g. onto the inside of the service cover).



* English text printed on this label is original.
Each language label will be sealed on this original text.

1. Factory refrigerant charge of the product: see unit name plate
2. Additional refrigerant amount charged in the field*
3. Total refrigerant charge
4. Contains fluorinated greenhouse gases
5. Outdoor unit
6. Refrigerant cylinder and manifold for charging
7. GWP(global warming potential) of the refrigerant used in this product
8. CO_2 equivalent of fluorinated greenhouse gases contained in this product

CONTENTS

1. CONTROL FUNCTIONS - Outdoor unit

- The MF3 series outdoor units are systems that allows multiple outdoor units to be connected.
- All the outdoor units do not utilize the sub units that were used in earlier systems.
  The O/U.ADD of outdoor unit PCB where the unit is set to “1” becomes the main unit and activates as the CCU (command controller unit) functions that controls the entire system.

PCB Setting of Outdoor Unit

In order to determine the outdoor unit to be the main or sub unit, it is necessary to make settings at each PCB.

- Main outdoor unit
  The outdoor unit where the O/U.ADD is set to “1” activates the CCU (command controller unit) functions that controls the entire system. This outdoor unit is the main outdoor unit.
  * For the main outdoor unit, perform all the settings in the table (PCB setting of outdoor unit) below.
- Sub outdoor unit
  The outdoor unit where the unit No. is set to other than “1” is a sub outdoor unit.
  * The system will not operate if outdoor units have been set other than unit No. “1”.

PCB Setting of Outdoor Unit

		Factory preset mode	Main outdoor unit On-site setting	Sub outdoor unit On-site setting
O/U.ADD [SW5]	Outdoor units address	1	1	Setting other than 1 (Duplication prohibited)
R.C.ADD [SW1, SW2]	System address	1	System 1 ~ 30	Not necessary
NO.OF I/U [SW3, SW4]	No. of indoor units	1	System 1 ~ 52 units	Not necessary
NO.OF O/U [SW6]	No. of outdoor units	1	System 1 ~ 3 units	Not necessary

* This system can be exteded to connect a maximum of 3 outdoor units.

2-1. Outdoor Unit Operating Rules

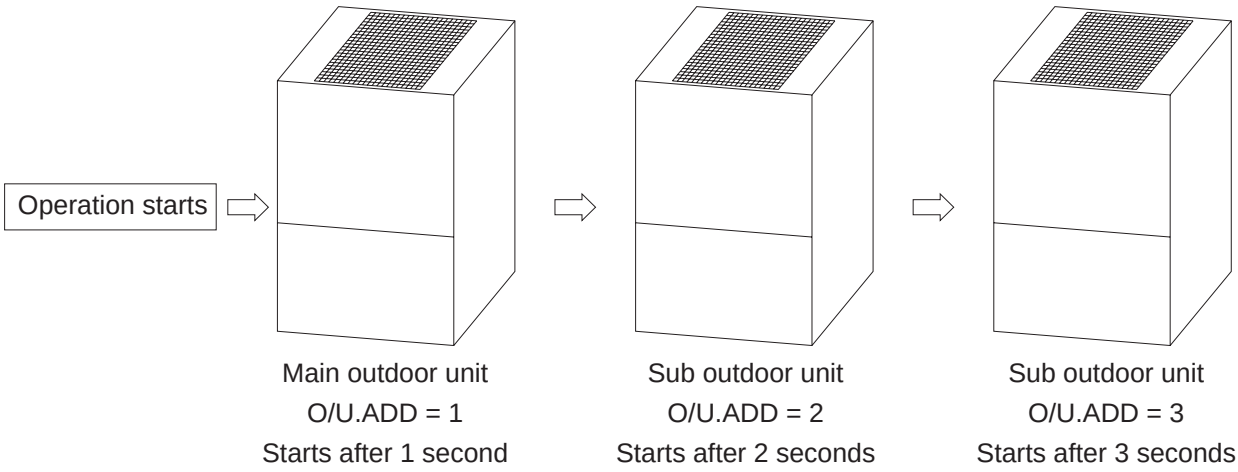
As a result of setting the main outdoor and sub outdoor units due to the O/U.ADD setting, the order of priority for the outdoor units is determined in small values of O/U.ADD sequence. Because in this system all outdoor units contain an inverter compressor, ordinarily there is no absolute order of priority for compressor operation.

2-2. Delayed Start of Outdoor Units

2-2-1. Delayed start of outdoor unit in the same system

If it is necessary to operate the compressors simultaneously at multiple outdoor units, each outdoor unit will start in order of unit No. every one second, beginning with unit No. 1.

* This is in order to reduce the load on the power supply equipment.



2-2-2. Delayed start for each system

When systems are linked with one communication cable and multiple systems are required to operate simultaneously by the central control device, all main outdoor units will begin operating simultaneously.
In this situation, the load of the power supply equipment increases temporarily.
To prevent the overload, the start timing of each system can be delayed.
In order to enable this delay time, it must be set in the EEPROM for each system (Main outdoor unit).
Those systems (Main outdoor units) where this setting has been made will start after a delay according to their system addresses.
To activate this delay start function, it is necessary to set it to EEPROM on main outdoor PCB.

EEPROM setting in main outdoor unit
CODE: 3E

Setting No.	Delay time
0 (factory preset mode)	No delay start for each system
1	(System address × 1 × 8) seconds delay
2	(System address × 2 × 8) seconds delay
3	(System address × 3 × 8) seconds delay

2-3. Outdoor Unit Stop Rules

2-3-1. Stopping of all outdoor units

When all outdoor units must stop, the units stop at the same time.

2-3-2. Stopping of individual outdoor units according to load of air-conditioning

- All cooling mode

  Outdoor air temperature ≥ 45°C: All outdoor units will be operated. However, there is the outdoor unit which has the stopped compressor according to load of air-conditioning.
  21°C < outdoor air temperature < 45°C: the outdoor unit which has the compressor with the shortest amount of operating time continues to run and rest of the outdoor units may be stopped according to load air-conditioning. The outdoor unit which has any compressors without operation may be stopped.
  Outdoor air temperature ≤ 21°C: The outdoor unit which has the compressor with the shortest amount of operating time continues to run and rest of the outdoor units may be stopped according to load air-conditioning. There is the outdoor unit which has only the operating compressor or uses only the heat exchanger with the stopped compressor according to some conditions.

- All heating mode

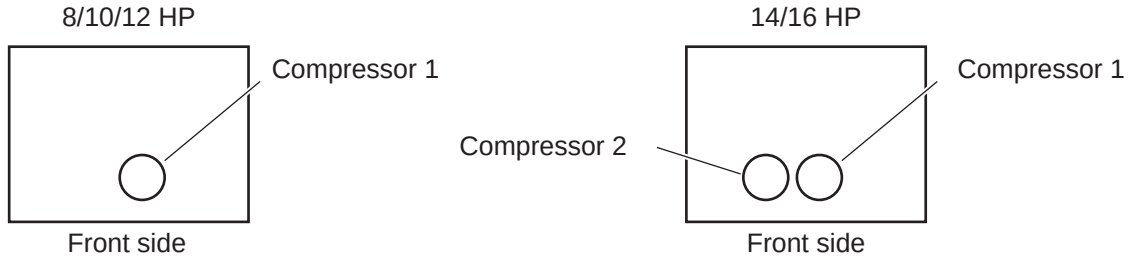
  The outdoor unit which has the compressor with the shortest amount of operating time continues to run and rest of the outdoor units may be stopped according to load air-conditioning.

- Mixed cooling/heating

  The outdoor unit which has the compressor with the shortest amount of operating time continues to run and rest of the outdoor units may be stopped according to load air-conditioning.
  There is the outdoor unit which has only the operating compressor or uses only the heat exchanger with the compressor stopped according to some conditions.

3-1. Compressors Mounted in the Outdoor Units

Placement of compressor seen from the top



3-2. Compressor Selection Rules

3-2-1. Priority order of compressors

A. Decide first priority order of compressor in each outdoor unit.
The compressor that has no trip counter, shorter operating time and smaller number of compressor will be taken first priority.
First priority order of inverter compressor in each outdoor unit > Other inverter compressor

B. Priority order of compressor trip counter = 0 is higher than that of compressor trip counter = 1.

C. Inverter compressor: Shorter operating time > Longer operating time

D. Compressor that "outdoor unit small address" installed in outdoor unit > Compressor that "outdoor unit large address" installed in outdoor unit

Priority order flow of all compressors

A First priority order of inverter compressor in each outdoor unit > Other inverter compressor *1

⇩

B Compressor trip counter =0 > Compressor trip counter =1

⇩

C Shorter operating time > Longer operating time

⇩

D "Outdoor unit small address" installed in outdoor unit > "Outdoor unit large address" installed in outdoor unit

*1 Select first priority order of compressor in each outdoor unit by following method.

Priority order flow of each outdoor unit

Compressor trip counter =0 > Compressor trip counter =1

⇩

Shorter operating time > Longer operating time

⇩

Compressor 1 > Compressor 2

3-2-2. Operating compressors

- When heat exchanger of the outdoor unit is condenser (All cooling mode or mixed cooling/heating)
  The compressor with higher priority order starts according to the priority order described on the compressor selection rules.
  Outdoor air temperature <10°C: More than one compressor among all outdoor units will be operated.
- When heat exchanger of the outdoor unit is evaporator (All cooling mode or mixed cooling/heating)
  At least, one inverter compressor operates when the system starts.
  The other compressors operate according to the priority order described on the compressor selection rules.

3-2-3. Stopping compressors

The compressor with lower priority order starts according to the priority order described on the compressor selection rules.

3-3. Operation When Starting 2 Compressors Mounted in Outdoor Unit

- When necessary capacity gradually increases and one more inverter compressor is additionally started under the present operating compressor, reduce the compressor frequency to 25Hz temporarily and then start an additional compressor.
- The operation noted above is performed when compressor 1 or compressor 2 is additionally started.
- If necessary capacity is initially higher and two compressors are started simultaneously, the operation noted above is not performed and both of them are regarded as the target frequency.

3-4. Operating Frequency Range of Inverter Compressor

The inverter compressor can operate within the range in the table below.

① When the high pressure is over 2.8MPa, the upper limit frequency is restricted.

② If the high pressure is over 3.3MPa and the minimum frequency operation is in progress, the system is stopped. (P25: Pre-trip)

③ If the low pressure is over 1.60MPa during operation of the inverter compressor, the system is stopped. (P27: Pre-trip)

④ If 2 inverter compressors are simultaneously operating in the same outdoor unit, the frequency of compressor 1 becomes 5Hz lower than that of compressor 2.

Type of outdoor unit	8 HP	10 HP	12 HP	14 HP	16 HP
Minimum frequency (Hz)	15	15	15	15	15
Maximum frequency (Hz)	80.0	89.0	100.0	78.3	88.0

* The frequency range in the table above is subject to change without notice.

3-5. Forced Stopping of Compressor

Once a compressor stops, it will not start for a period of 3 minutes (3-minute forced OFF).
However, this does not apply when the compressor was forced to stop as the result of a special control operation. (start control, defrost control, refrigerant oil recovery control, etc.)

3-6. Capacity Control (Roadmap control)

① The capacity control by the compressors is performed according to the pressure sensor attached to the outdoor unit and temperature thermistor attached to the indoor / outdoor unit heat exchanger.

* With roadmap control, the pressure detected by the pressure sensor is converted to saturation temperature before it is used by microcomputer. This converted temperature is called “pressure sensor temperature”.

② This control is performed every 30 seconds.

③ Required level of each indoor unit

Required level of indoor unit is calculated by difference between preset temperature in remote controller and intake temperature of indoor unit (TA), difference between preset discharge air temperature in EEPROM on indoor unit PCB and discharge air temperature of indoor unit (TF).

Required level has “0” to “30” phases. This level becomes “31” at the test run.

The target temperature of indoor unit heat exchanger is decided according to the maximum required level.

* Target temperature of all indoor units heat exchanger is same value because all indoor units are connected with the same pressure piping.

④ Definition of evaporation temperature and condensation temperature

- Evaporation temperature (Te):

  Shows the lowest temperature among the temperature sensors (E1 or E3) when the indoor unit heat exchanger is functioning as an evaporator.

  * When operating in mixed cooling/heating mode and the outdoor units are mixed evaporators, the outdoor unit heat exchanger temperature is not recognized as “Te”.

- Condensation temperature (Tc):

  Shows the highest temperature among the high-pressure saturated temperature in the system and indoor unit heat exchanger’s liquid tube temperature (E1) with the thermostat ON.

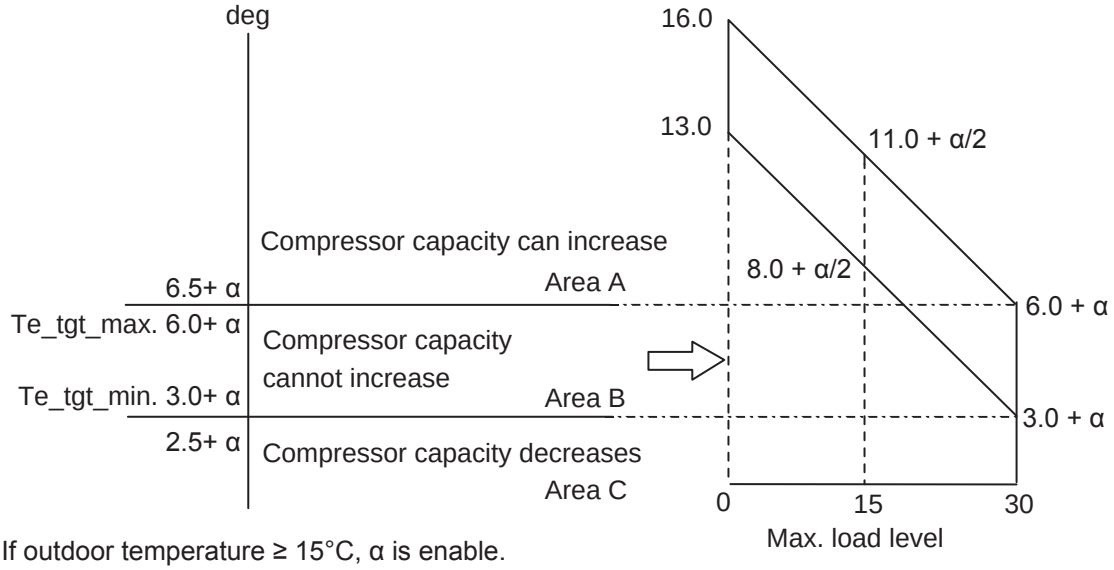
1

3-6-1. Evaporation temperature adjustment by roadmap control

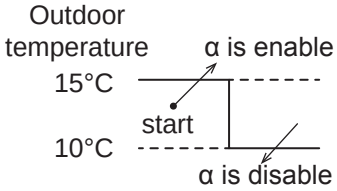
The cooling capacity is adjusted with this control. It prevents freezing of the indoor unit heat exchanger and the dew to the outside panel of the indoor unit. The capacity is adjusted according to the following figure.

Evaporation temperature area

unit: °C



- If outdoor temperature ≥ 15°C, α is enable.
  Minimum α is enable in all indoor units.
- If outdoor temperature < 10°C, α is disable.



α : Correction Value of Te

	α	Indoor unit type
Gr 1	2	Type D1, L1
Gr 2	5	Type P1, R1
Gr 3	3	Indoor units inapplicable to Gr 1, Gr 2

* The evaporation temperature area changes depending on the maximum required level of each indoor unit as shown above.
* Area C is regarded as area B for 6 minutes after compressor starts.
* When the system operates in a minimum capacity, the system will continue operating for at least 6 minutes if the evaporation temperature area is area C.
* The evaporation temperature is not adjusted while specially controlling defrosting and the oil recovery, etc.
* The evaporation temperature is not adjusted when there are one or more indoor units that select the test run. If one or more indoor units are selected into test run, the system doesn't stop in all states except alarm appearing.
* The test run will finish automatically in about one hour.

3-6-2. Condensation temperature adjustment by roadmap control

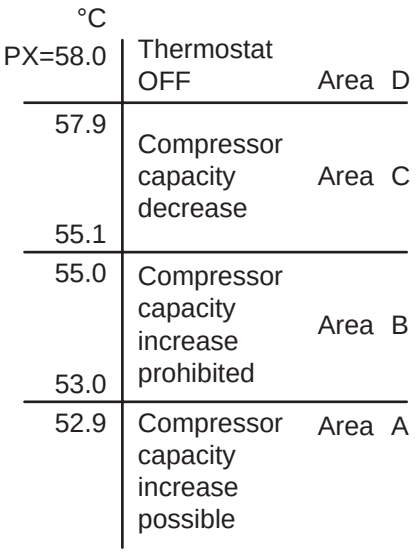
The area B target temperature is different due to cooling, heating and mixed cooling/heating operation.

	Target lower temperature (Tc_tgt_min)	Target upper temperature (Tc_tgt_max)
Cooling	53.0°C	55.0°C
Heating	48.0°C	51.0°C
Mixed cooling/heating	48.0°C	51.0°C

① Cooling mode

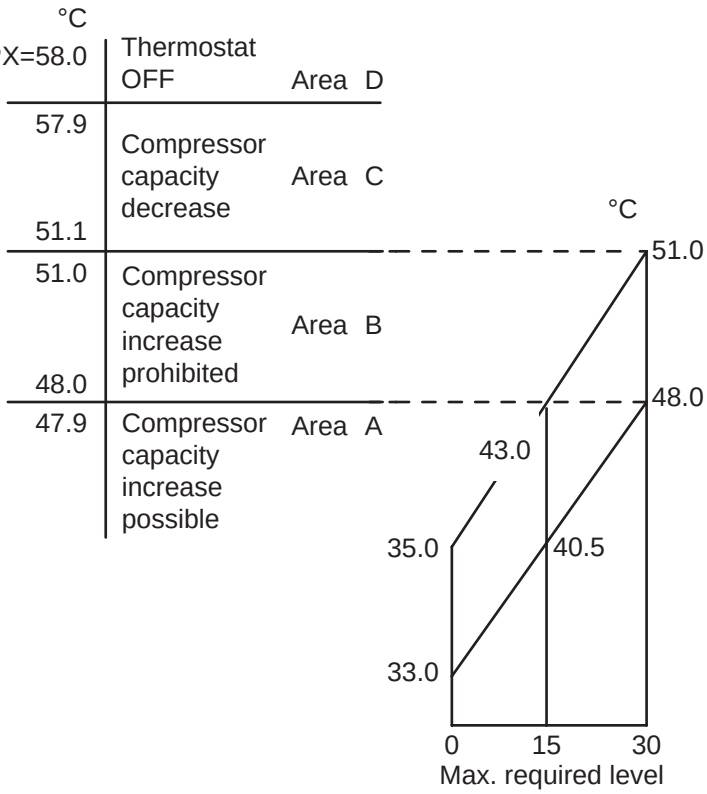
The purpose of this control at cooling is to prevent abnormal high-pressure.

・Standard setting (at the shipment)



② Heating mode and mixed cooling/heating mode

Heating capacity is adjusted with this control.
It also prevents abnormal high-pressure simultaneously.
The capacity is controlled in the following diagram.



* PX is usually fixed to 58°C. If the high pressure goes up rapidly after the compressor starts, the system experiences urgent stop. The next time the system will start with lower PX.
* In the area B, the compressor capacity changes depending on the refrigerant condition.
* When the system operates in a minimum capacity, the system will continue operating for at least 6 minutes if the condensation temperature area is area C.
* The condensation temperature is not adjusted when there are one or more indoor units that select the test run.

Limit pressure adjustment function

Operation pressure is able to be adjusted for existing old piping.
If area shift function is set, values below shift.
EEPROM setting in main outdoor unit
CODE : 4B

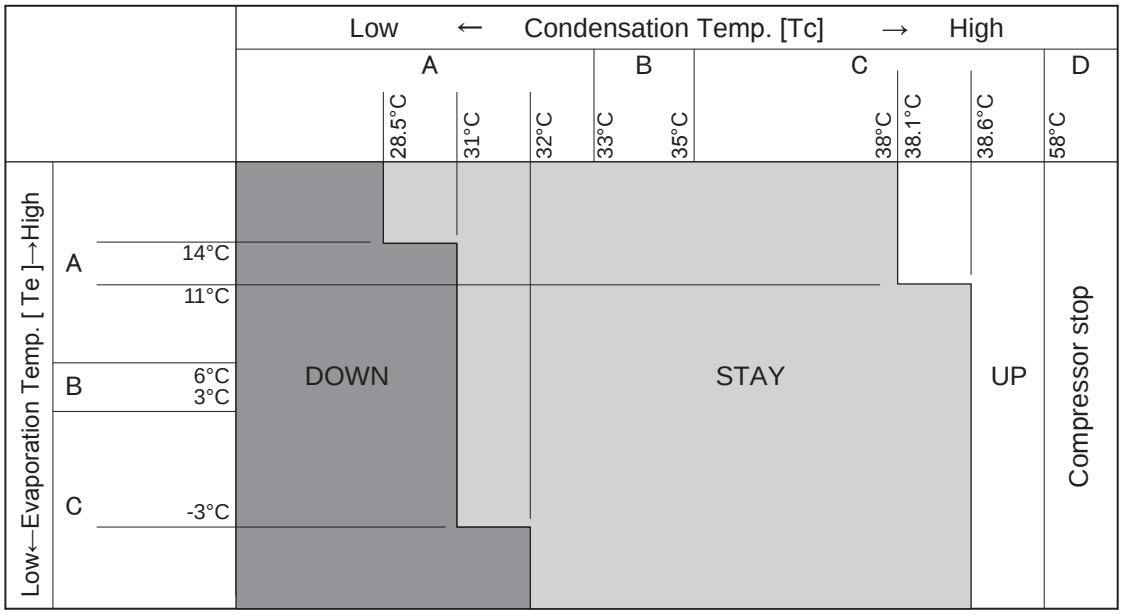
Setting No.	Limited pressure	PX °C	Cooling mode		Heating mode and mixed cooling/heating mode	
			Tc_tgt_min	Tc_tgt_max	Tc_tgt_min	Tc_tgt_max
0	3.3MPa	52.5	47.0	49.0	47.0	48.0
1	No use	-	-	-	-	-
2	3.8MPa	58.0	53.0	55.0	48.0	51.0
3	No use	-	-	-	-	-

3-6-3. Cooling operation with low ambient temperature

When operating in cooling mode with the ambient temperature less than 21°C, the unit is set in low ambient temperature cooling mode.
During low ambient temperature cooling mode, the heat exchanger capacity control is performed in addition to the compressor capacity control. The target condensation temperature (Tc_tgt) is controlled between 23°C ~ 25°C. Thereof, the heat exchanger may sometimes be used by half even if the operation is cooling in all indoor units.

(1) Capacity changes of compressor
Similar to control normal cooling operation
(2) Capacity changes of heat exchanger
* Condensation temperature (Tc) is high
The outdoor heat exchanger capacity is increased, increasing the system condensation capacity and lowering the condensation temperature (Tc).
* Condensation temperature (Tc) is low
The outdoor heat exchanger capacity is decreased, decreasing the system condensation capacity and raising the condensation temperature (Tc).

Outdoor Unit Heat Exchanger Control Table



3-6-4. Control of condensation temperature and evaporation temperature during mixed cooling/heating operation

During mixed cooling/heating operation, the control maintains a heat balance with a target evaporation temperature (Te) for the cooling mode indoor units of 3°C ~ 6°C and a target condensation temperature (Tc) for the heating mode indoor units of 48°C ~ 51°C.
Heat balance control is performed by varying the compressor capacity and heat discharge (heat intake) of the heat exchanger.

(1) Increasing/decreasing the compressor capacity

* When evaporation temperature (Te) is high and condensation temperature (Tc) is low.
This occurs when both the cooling capacity (heat intake) and the heating capacity (heat discharge) are low.
The compressor capacity and the circulation flow of refrigerant are increased in order to lower the evaporation temperature (Te) and raise the condensation temperature (Tc).

* When evaporation temperature (Te) is low and condensation temperature (Tc) is high

This occurs when both the cooling capacity (heat intake) and the heating capacity (heat discharge) are high.
The compressor capacity and the circulation flow of refrigerant are decreased in order to raise the evaporation temperature (Te) and lower the condensation temperature (Tc).
* Under conditions other than those listed above, the capacity of the outdoor unit heat exchanger is adjusted.
In some cases the heat exchanger capacity may also be adjusted at the same time when the compressor capacity is varied.

Compressor Control Table

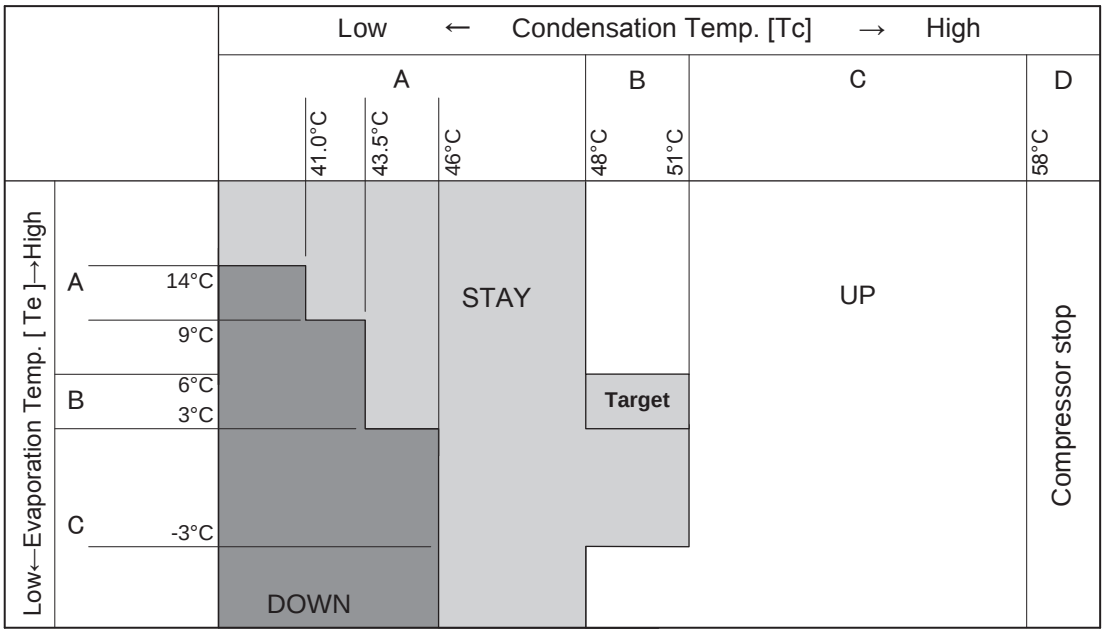
Low ← Condensation Temp. [Tc] → High					
		A	B	C	D
Low ← Evaporation Temp. [Te] → High	A	UP	not_UP		STOP
	B	slow_UP	Target		
	C	not_UP	DOWN		

Evaporation temperature (Te) and condensation temperature (Tc) areas A, B, C and D are the same as for evaporation temperature control and condensation temperature control.

(2) Increasing/decreasing the heat exchanger capacity (when the outdoor unit heat exchanger is functioning as a condenser)

- *Primarily when both the evaporation temperature (Te) and condensation temperature (Tc) are high*
  This occurs when the cooling capacity (heat intake) is low and the heating capacity (heat discharge) is high. The outdoor heat exchanger capacity is increased, increasing the system condensation capacity and lowering the condensation temperature (Tc). The amount of heat discharge at the outdoor unit heat exchanger is increased, increasing the heat intake at the cooling mode indoor units and lowering the evaporation temperature (Te).
- *Primarily when both the evaporation temperature (Te) and condensation temperature (Tc) are low*
  This occurs when the cooling capacity (heat intake) is high and the heating capacity (heat discharge) is low. The outdoor heat exchanger capacity is decreased, decreasing the system condensation capacity and raising the condensation temperature (Tc). The amount of heat discharge at the outdoor unit heat exchanger is decreased, decreasing the heat intake at the cooling mode indoor units and raising the evaporation temperature (Te).

Outdoor Unit Heat Exchanger Control Table (when the outdoor unit heat exchanger is functioning as a condenser)



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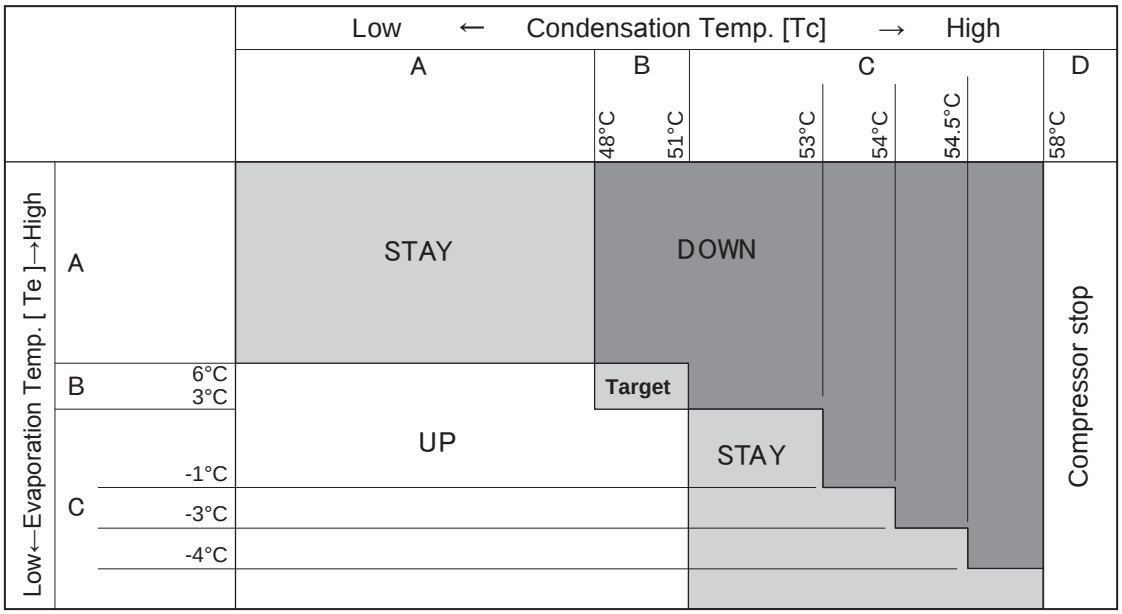
(3) Increasing/decreasing the heat exchanger capacity (when the outdoor unit heat exchanger is functioning as an evaporator)

- *Primarily when both the evaporation temperature (Te) and condensation temperature (Tc) are low*
  This occurs when the cooling capacity (heat intake) is high and the heating capacity (heat discharge) is low. The outdoor heat exchanger capacity is increased, increasing the system evaporation capacity and raising the evaporation temperature (Te). The amount of heat intake at the outdoor unit heat exchanger is increased, increasing the heat discharge at the heating mode indoor units and raising the condensation temperature (Tc).
- *Primarily when both the evaporation temperature (Te) and condensation temperature (Tc) are high*
  This occurs when the cooling capacity (heat intake) is low and the heating capacity (heat discharge) is high. The outdoor heat exchanger capacity is decreased, decreasing the system evaporation capacity and lowering the evaporation temperature (Te). The amount of heat intake at the outdoor unit heat exchanger is decreased, decreasing the heat discharge at the heating mode indoor units and lowering the condensation temperature (Tc).

Outdoor Heat Exchanger Control Table (when the outdoor heat exchanger is functioning as an evaporator)



3-7. Protection Control

3-7-1. Compressor discharge temperature protection

The compressor capacity is controlled according to the table below.

*Discharge temperature that is used for this control is the highest temperature among all compressors.

Discharge temp.

°C		
106	Stop	If this temperature is detected at regular intervals, alarm appears.
104	Compressor capacity decrease	Capacity goes down 2.0 hp
102		Capacity goes down 1.0 hp
100		Capacity goes down 0.5 hp
98	Compressor capacity increase prohibited	
	Compressor capacity increase possible	

hp = horsepower

3-7-2. Abnormal low pressure protection

The compressor capacity is controlled according to the table below.

Low pressure MPa	
0.25	No restriction
0.20	Capacity goes up slowly
0.17	Capacity increase prohibited
	Capacity goes down
0.06	H06 trip (Continuous for 2 minutes)
0.02	H06 trip

3-7-3. Current protection

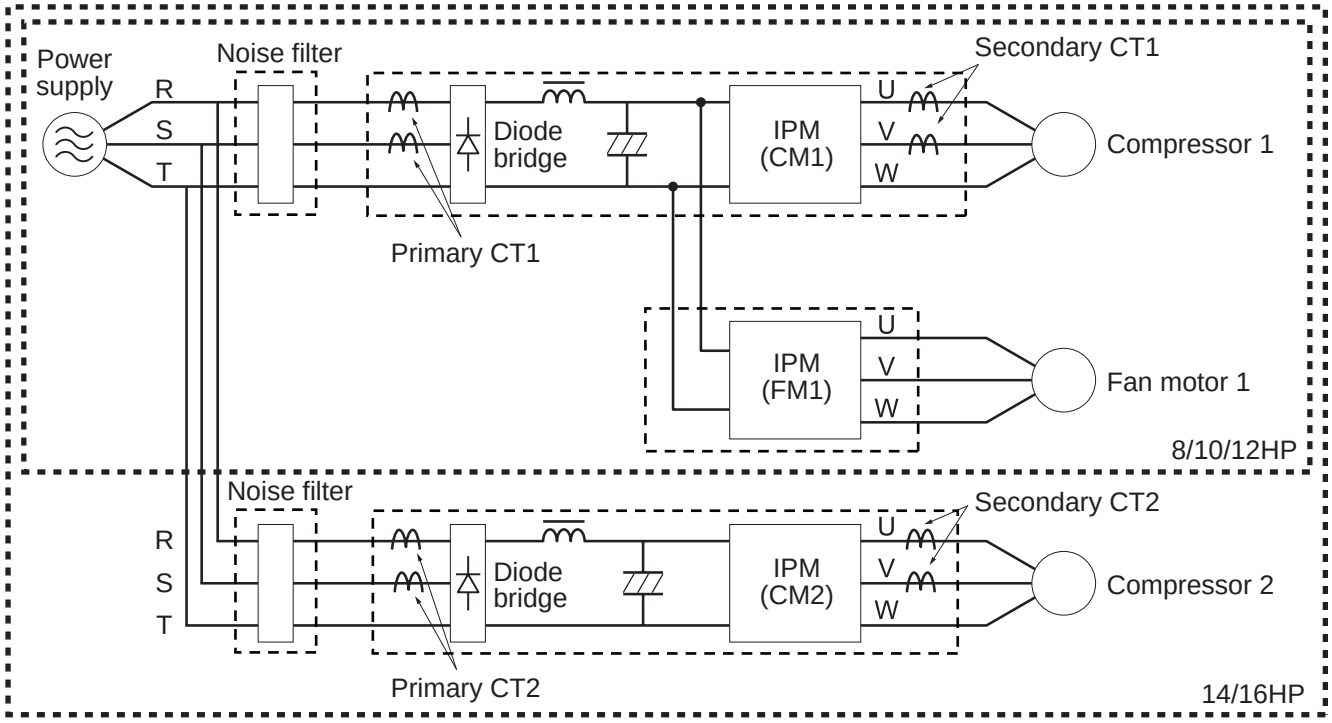
This restriction protects the compressor and controls the compressor electric current simultaneously.
The primary and secondary current values of compressor 1 and compressor 2 are measured.

Use the same values of inverter compressors 1 and 2. unit: Ampere

Type of outdoor unit		8HP	10HP	12HP	14HP	16HP
Primary	Current limit 1	18.0	21.0	23.0	18.0	19.0
	Maximum current 1 H	14.0	18.0	20.0	15.0	16.0
	Maximum current 1 L	13.0	17.0	19.0	14.0	15.0
Secondary	Current limit 2	22.8	22.8	24.3	21.0	21.0
	Maximum current 2 H	20.3	20.3	21.8	18.5	18.5
	Maximum current 2 L	19.3	19.3	20.8	17.5	17.5

Limit current 1, 2	Stop If this current is detected at regular intervals, alarm appears.
Max. current 1H, 2H	Frequency of inverter compressor goes down.
Max. current 1L, 2L	Frequency of inverter compressor cannot increase.
	Frequency of inverter compressor can increase.

Inverter layout



Item		Indication on PCB
Solenoid valve	Discharge valve 1	DCV1
	Discharge valve 2	DCV2
	Suction valve 1	SCV1
	Suction valve 2	SCV2
	Heat exchanger pressure balance valve 1	PBV1
	Heat exchanger pressure balance valve 2	PBV2
	Save valve	SAVE
	Refrigerant control valve	RCV
	Oil recovery valve	ORVR
	By-pass valve	BPV
	Accumulator valve	ACV
	O_2 valve	O_2
Expansion valve	MOV for heat exchanger 1	MOV1
	MOV for heat exchanger 2	MOV2
	SC circuit expansion valve	MOV4
Crankcase heater	Crankcase heater control 1	CH1
	Crankcase heater control 2	CH2

4-1. [DCV, SCV, PBV]

Turn DCV, SCV and PBV to ON/OFF.
Change the outdoor unit heat exchanger mode and/or control the heat exchanger capacity.
See the basic operation listed below.

		Status of heat exchanger	DCV1 *3	DCV2	SCV1 *3	SCV2	PBV1 *3	PBV2
All cooling mode	Normal	Condenser	ON	ON	OFF	OFF	OFF	OFF
	Low ambient temperature	Condenser	ON/OFF	ON	OFF	OFF	OFF	OFF
		Stop	OFF	OFF	OFF	OFF	OFF	OFF
All heating mode		Evaporator	ON	ON	ON	ON	ON	ON
	System stopped *1	Stop	OFF	OFF	OFF	OFF	OFF	OFF
	Other outdoor units operating *2	Stop	ON	ON	ON	ON	ON	ON
Mixed cooling/ heating mode	Heat exchanger [condenser] of outdoor unit	Condenser	ON/OFF	ON	OFF	OFF	OFF	OFF
		Stop	OFF	OFF	OFF	OFF	OFF	OFF
	Heat exchanger [evaporator] of outdoor unit	Evaporator	ON/OFF	ON	ON/OFF	ON	ON/OFF	ON
		Stop	OFF	OFF	OFF	OFF	OFF	OFF

*1 The system which is stopped in heating mode shows the status of all outdoor units stopped.
*2 When other outdoor units are operating in heating mode, the outdoor unit in stop mode is holding the pulse at 0 pulses of MOV1 and MOV2 in a situation in which the heat exchanger is evaporator.
*3 DCV1, SCV1 and PBV1 turn ON/OFF respectively due to the capacity control of the heat exchanger.

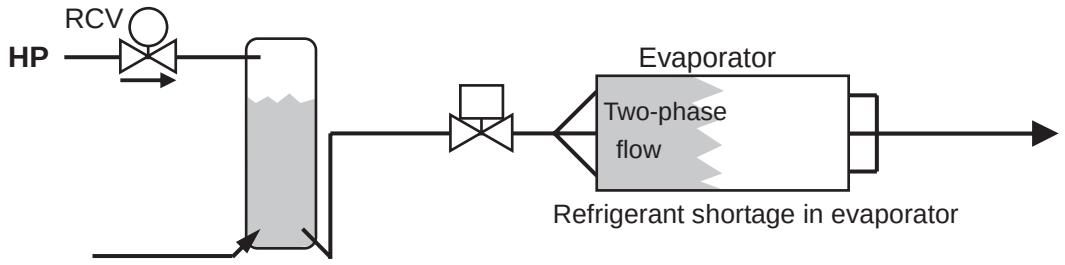
4-2. Save Valve [SAVE]

- This valve turns ON for 5 seconds before the inverter compressor starts.
  After the inverter compressor starts, the valve turns ON for 10 seconds. Then it turns OFF.
- This valve turns ON for 30 seconds after the outdoor unit stops. Then it turns OFF.
- This valve turns ON when high pressure sensor detects 3.42MPa to prevent abnormal pressure.
  This valve turns OFF when the high pressure goes down below 3.32MPa.
- This valve might turn ON when the system capacity is excessive although the inverter compressor operates at Min. frequency.
- This valve turns ON in the following status :
  (Compressor discharge temperature - High pressure saturation temperature) < 5deg C
- Under control of Tube Refrigerant Recovery Control
- Under control of heat exchanger select mode
- This valve turns ON when low pressure sensor goes down 0.17MPa to prevent abnormal pressure.
  This valve turns OFF when low pressure sensor increase 0.20MPa or over.

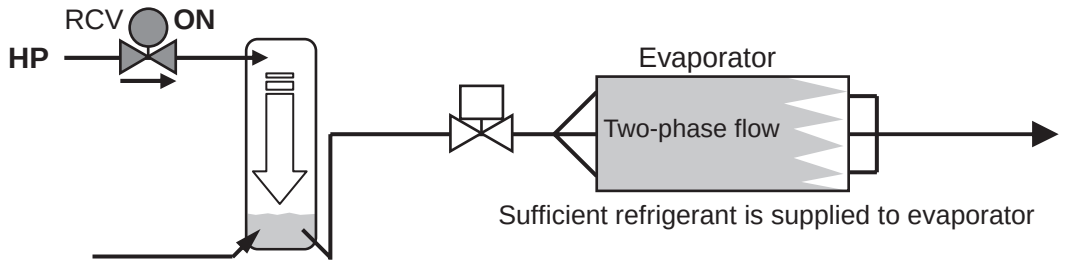
4-3. Refrigerant Control Valve [RCV]

The main purpose of this valve is to detect the flow of refrigerant (refrigerant volume) on the indoor unit when the outdoor unit heat exchanger is functioning as a condenser. When the valve determines that there are signs of a low refrigerant level, refrigerant is supplied from the receiver tank to the system.

- This valve turns ON when the evaporator is refrigerant shortage.
  The heat exchanger of indoor unit is evaporator in cooling operation.
  The heat exchanger of outdoor unit is evaporator in heating operation.
- This valve turns OFF when the excessive refrigerant is in the condenser.
  The heat exchanger of indoor unit is condenser in heating operation.
  The heat exchanger of outdoor unit is condenser in cooling operation.
- This valve turns OFF when the outdoor unit is stopped.
- This valve turns ON at stopped outdoor units when the heat exchanger at another outdoor unit is functioning as a condenser.



Receiver tank holds refrigerant



High pressure from RCV pushes the liquid refrigerant out of the receiver tank

4-4. Oil Recovery Valve [ORVR]

This valve is for recovering oil from the oil separator of its own outdoor unit or balance tube to the compressor of its own outdoor unit.

- This valve turns ON when the oil level of the compressor is “0” or “1”.
  In this situation, system performs Self oil recovery control, Inter-outdoor unit oil recovery control, or system oil recovery control.
- This valve turns ON for 2 minutes after the compressor starts.
- This valve is always OFF when outdoor unit is stopped.

* For oil level of compressor, see “Oil Control” section.

4-5. By-Pass Valve [BPV]

This valve is for pushing the oil in the balance piping into other outdoor unit.

- This valve turns ON when the oil level of compressor is “2” or “1” in its own outdoor unit and the oil level of compressor is “0” in other outdoor unit.

* This valve turns ON for 10 seconds and turns OFF for 20 seconds. This operation is repeated while oil is supplied to others.

* For more information on oil level of compressor, see “Oil Control” section.

4-6. Accumulator Valve [ACV]

The purpose of this valve is to recover oil and refrigerant from the accumulator to the compressor.

- This valve turns OFF when the compressor operation just started.
- This valve turns ON when the compressor is warmed up.
- This valve turns ON while the oil recovery among the systems and defrost control are in progress.
- This valve turns ON while the MOV4 is operating.

4-7. O_2 Valve [O_2*]

*O_2 valve is the field supply parts.

This valve works when the outdoor unit receives signal of the refrigerant leakage from the indoor unit.
The indoor unit that transmits the signal of the refrigerant leakage gives “P14” alarm.
To activate this function, it is necessary to set it to EEPROM on the main outdoor PCB and indoor PCB.

EEPROM setting in main outdoor unit

CODE: C1

Setting No.	
0	This function invalid (factory preset mode)
1	This valve is turned OFF when the system is normal. This valve is turned ON when the outdoor unit receives signal from the indoor unit.
2	This valve is turned ON when the system is normal. This valve is turned OFF when the outdoor unit receives signal from the indoor unit.

EEPROM setting in indoor unit

CODE: 0B

Setting No.	
0	Function of EXCT plug short-circuit
1	Indoor unit gives “P14” alarm and transmits the refrigerant leakage signal.

4-8. MOV for Heat Exchanger [MOV1, MOV2]

4-8-1. Type of expansion valves

MOV1	For upper side heat exchanger
MOV2	For lower side heat exchanger

4-8-2. Power Initialization

If no indoor units have started (even once) after the power supply to the outdoor unit, the MOV for heat exchanger holds the pulse at 480 pulses.

4-8-3. Expansion valves for heat exchanger control

The configuration of the heat exchangers is different depending on the capacity of the outdoor unit.

Operation of electronic control valves during normal unit operation

		Status of heat exchanger	MOV1	MOV2	Remarks
All cooling mode	Normal	Condenser	480	480	Maximum flow control
	Low ambient temperature	Condenser	0 ~ 480	0 ~ 480	Heat exchanger capacity control
		Stop	0	0	Refrigerant shut-off
All heating mode		Evaporator	12 ~ 480	12 ~ 480	SH control
	System stopped	Stop	0	0	Refrigerant shut-off
	Other outdoor units operating	Stop	0	0	Refrigerant shut-off
Mixed cooling/ heating mode	Heat exchanger [condenser] of outdoor unit	Condenser	0 ~ 480	0 ~ 480	Heat exchanger capacity control
		Stop	0	0	Refrigerant shut-off
	Heat exchanger [evaporator] of outdoor unit	Evaporator	12 ~ 480	12 ~ 480	SH control
		Stop	0	0	Refrigerant shut-off

When operating in all cooling or all heating mode, the heat exchangers of which the compressors are driving in the outdoor units are used.
However, when operating in cooling mode with low ambient temperature, the number of pieces for using the heat exchanger is changed according to the operating condition of indoor units and the status of outdoor units.
When operating in mixed cooling/heating mode, the condition and the number of pieces for using the heat exchanger are changed according to the operating condition of indoor units and the status of outdoor units.
The heat exchanger is selected in turn from the outdoor unit heat exchanger 2 as the shortest operating time of the inverter compressor.
SH control is controlled so that the difference of temperature between the liquid tube temperature and gas tube temperature should be set within the range as shown below.

Outdoor unit Capacity	Target value of SH control
All heating mode	-1deg C ~ 5deg C
Mixed cooling/heating mode (Heat exchanger [evaporator] of outdoor unit)	2deg C ~ 5deg C

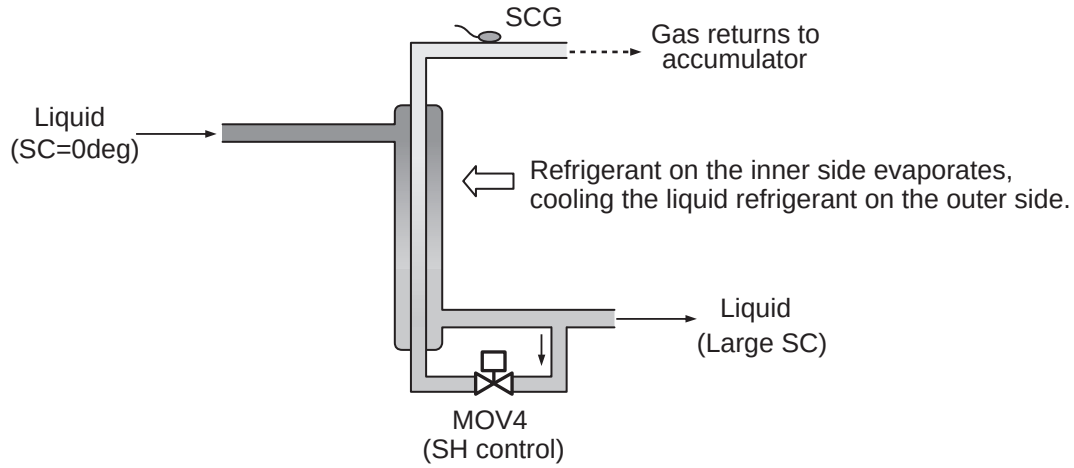
1

4-9. SC Circuit Expansion Valve [MOV4]

4-9-1. SC control (Cooling mode only)

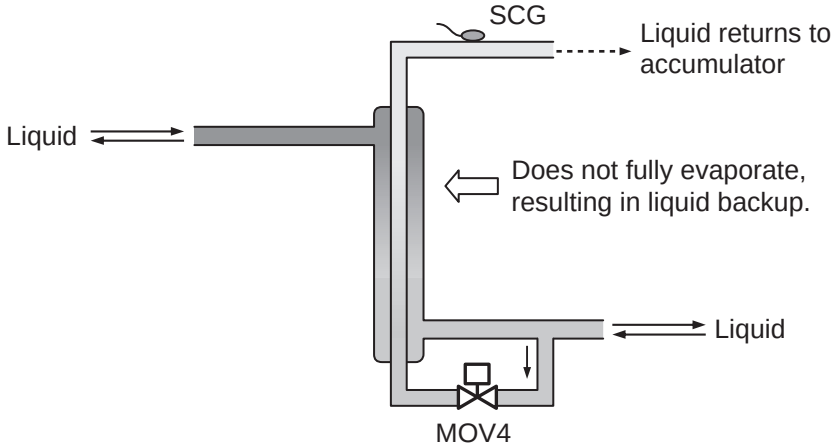
During cooling operation, the liquid refrigerant which condenses at the outdoor unit heat exchanger flows into the receiver tank, and SC (sub-cooling) approaches 0°C. When SC is small and the length of the tubing connecting the indoor and outdoor units is long, the refrigerant flow in the indoor unit will be reduced significantly. To prevent this trouble from occurring, MOV4 operates so as to increase supercooling in the double tube coil near the outlet of the outdoor unit.

In addition, MOV4 controls refrigerant flow volume so that it will not flow back to the compressor in the liquid state. SH in suction that is difference between the SCG temperature and low pressure sensor temperature is adjusted to 3deg C ~ 5deg C.



4-9-2. Discharge temperature control of compressor

When the discharge temperature increases to 90°C or more, MOV4 opens to 100 pulses to cool down the compressor. MOV4 operates according to the state of the discharge temperature between 20 - 480 pulses. This operation takes priority over SC control.



(Discharge temperature control of compressor.)

This operation is continued until discharge temperature decreases to 80°C or less.

4-9-3. Discharge temperature and high pressure control in defrost control

When reverse cycle defrost control operates, MOV4 opens to 100 pulses or over.
When outdoor unit cycle defrost control operates, MOV4 opens to 100 pulses or over.

4-10. Crankcase Heater Control [CH1, CH2]

When the compressor stops, the crankcase heater of its own compressor is turned ON in the following conditions.

- When the outdoor air temperature ≤ 15°C
- When the compressor stops and 70 minutes later.

5-1. Fan Mode

These outdoor units utilize a DC fan motor that can be controlled in a maximum of 15 steps (15 modes). However, fan modes 14 and 15 can only be used if high static pressure mode has been set.

* For information concerning EEPROM settings, refer to the field application functions.

The following table shows the maximum and minimum fan mode and fan forced mode for each unit.

			Type of outdoor unit	8HP	10HP	12HP	14HP	16HP
Maximum value	Standard	Condenser	Ambient temperature ≥ 38°C	11	12	12	12	12
			Ambient temperature < 38°C	10	11	12	12	12
		Evaporator	Ambient temperature > 10°C	10	11	12	13	13
			Ambient temperature ≤ 10°C	12	13	13	13	13
	High static pressure mode setting	Condenser	Ambient temperature ≥ 38°C	13	13	12	12	12
			Ambient temperature < 38°C	13	13	12	12	12
		Evaporator	Ambient temperature > 10°C	13	13	12	12	12
			Ambient temperature ≤ 10°C	15	15	13	13	13
Minimum value				1	1	1	1	1
Fan forced mode		Control for fan crack prevention		7	7	7	7	7
		Snowfall sensor control		9	9	8	8	8
Silent mode		Condenser	Silent mode 1	8	9	9	10	10
			Silent mode 2	7	8	9	10	10
		Evaporator	Silent mode 1	8	9	9	10	10
			Silent mode 2	7	8	7	10	10

* For the sake of protecting temperature of the electrical parts, the minimum values of the fan mode may sometimes increase in accordance with the ambient temperature or the amount of secondary current.

5-1-1. High static pressure mode

The outdoor unit allows a high static pressure changing the settings.
The maximum permissible static pressure is 80Pa.

EEPROM setting in each outdoor unit

CODE : 8F

Setting No.	
0	Invalid (factory preset mode)
1	High static pressure mode
2	Never use
3	Never use
4	Never use
5	Never use
6	Never use

However, maximum fan mode is upper limit.

1

5-1-2. Snow removal control

(1) Independent control of outdoor unit (control for fan crack prevention)

This control is intended to prevent snow from accumulating on stopped fans.

When the outdoor unit is stopped, the fan motor is forcibly started by the control for fan crack prevention's fan mode.

- Fan motor operates for 45 seconds and stops for 2 hours when ambient temperature is 5.1°C or more.
- Fan motor operates for 45 seconds and stops for 1.5 hours when ambient temperature is 0.1°C ~ 5.0°C.
- Fan motor operates for 45 seconds and stops for 1 hour when ambient temperature is 0.0°C or less.

(2) Control with snow detection sensor (Field supply)

If a snow detection sensor (field supply) is available, the snowfall-protection hood might be unnecessary excluding heavy snow region.

When set in this mode, the fan motor is forcibly started by the snowfall sensor control's fan mode.

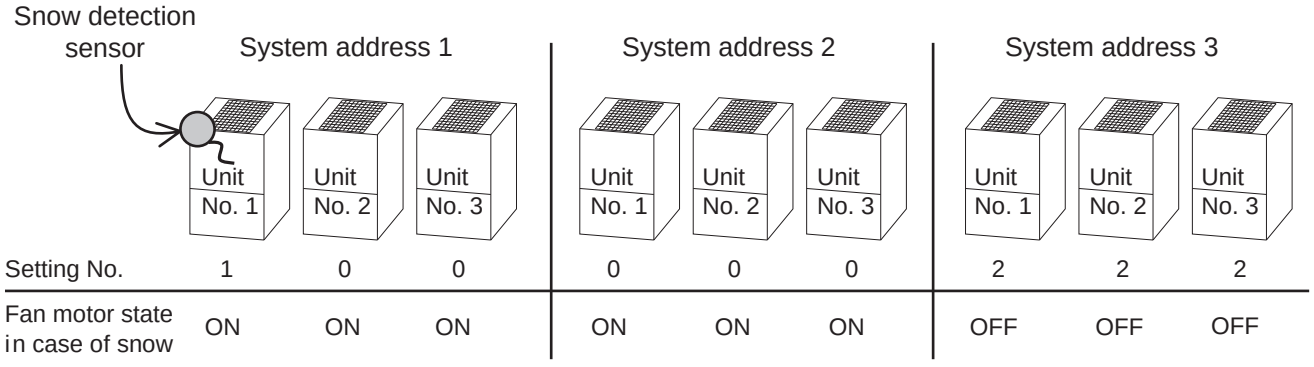
One snow detection sensor can control all outdoor units on the communications wiring.

The snow detection sensor must be connected to one of the main units (unit No.1) and it can control all outdoor units in communication wiring.

* To activate this function, it is necessary to set it to all EEPROMs on outdoor PCBs.

CODE: 04

Setting No.	Operation
0	Snow detection sensor is NOT connected with this unit. But this function is performed according to the signal of the sensor connected with other outdoor unit. (Factory preset mode)
1	Snow detection sensor is connected with this unit. And this function is performed according to the sensor signal.
2	Snow detection sensor is NOT connected with this unit. And this function is NOT performed.
3	Snow detection sensor is connected with this unit. But this function is NOT performed.



* All main outdoor units are connected with same communication wiring.

5-1-3. Silent mode

This unit includes 2 types of silent modes.

See the table under the section “5-1. Fan mode” for maximum fan mode in silent mode.

Selecting the silent mode results in operation that gives priority to reducing noise, because these modes involve restrictions on outdoor unit fan modes, the capacity will be somewhat reduced. (It may sometimes become a maximum of -5 hp.)

* Maximum fan mode and frequency in silent mode

			Type of outdoor unit	8HP	10HP	12HP	14HP	16HP
Silent mode	Silent mode 1 -3 dB mode	Condenser	Fan mode	8	9	9	10	10
			Compressor frequency (Hz)	44.5	50.1	73.4	45.0/50.0	45.5/50.5
		Evaporator	Fan mode	8	9	9	10	10
			Compressor frequency (Hz)	44.5	44.6	82.8	44.1/49.1	45.0/50.0
	Silent mode 2 -5 dB mode	Condenser	Fan mode	7	8	9	10	10
			Compressor frequency (Hz)	42.7	46.9	68.0	42.1/47.1	42.1/47.1
		Evaporator	Fan mode	7	8	7	10	10
			Compressor frequency (Hz)	44.5	44.6	78.1	42.1/47.1	42.1/47.1

* To activate this function, it is necessary to set it to each outdoor unit.

CODE: 05

Setting No.	Mode	External input to PCB	Silent mode
0	Invalidity (Factory preset mode)	-	-
1	Silent priority	Necessary	Silent mode 1
2			Silent mode 2
5		Unnecessary	Silent mode 1
6			Silent mode 2
9	Capacity priority	Necessary	Silent mode 1
10			Silent mode 2
13		Unnecessary	Silent mode 1
14			Silent mode 2
17	Controlled in moderation	Necessary	Silent mode 1
18			Silent mode 2
21		Unnecessary	Silent mode 1
22			Silent mode 2

* When the setting is "external input to PCB necessary", this function works by short circuiting "SILENT" pins.
* When the setting is "external input to PCB unnecessary", this function always works.
* When the setting is "silent priority", max. fan mode is decided in the following formula.
  Max. fan mode = 13 - (35 – Ambient temperature) / 2
  However, minimum fan mode is “6”, maximum is “13”. (When high static pressure mode, max is “15”)
* When the setting is "capacity priority", this function works excluding the following conditions.
  Condition that silent mode interrupts
  Heat exchanger [condenser] of outdoor unit: Ambient temperature ≥ 38°C
  Heat exchanger [evaporator] of outdoor unit: Ambient temperature ≤ 2°C
  This function will be useful for nighttime in summer.
* When the setting is "controlled in moderation", this function controls both "silent priority" and "capacity priority".
  Thereof, “silent priority” fan mode is set within the temperature range of “capacity priority”.
* Setting No. 3, 4, 7, 8, 11, 12, 15, 16, 19, 20, 23, 24 are Never use.

5-2. Fixed Initial Fan Mode

For the first 30 seconds after operation starts, the mode is fixed at the initial mode which was calculated from the relationship between the ambient temperature and the outdoor unit horsepower.
If the outdoor unit horsepower changes dramatically, the initial mode may be recalculated and may be again fixed for 30 seconds.

5-3. Operation after Fixed Initial Fan Mode

After the fixed initial fan mode, the fan mode is increased or decreased according to the operating conditions.

5-3-1. Cooling mode at all indoor units, or else mixed heating/cooling operation when outdoor unit is functioning as condenser

(1) Fan mode is increased when the pressure sensor temperature is high, and is decreased when the pressure sensor temperature is low.
  * The fan mode is always increased when the pressure sensor temperature is 46°C or higher (in the case of all cooling mode).
  * The fan mode is always increased when the pressure sensor temperature is 51°C or higher (in the case of mixed cooling/heating operation).
  * The fan mode is always increased when Maximum discharge temperature of inverter compressor in whole system < High pressure sensor temperature +10deg C.

5-3-2. Heating mode at all indoor units, or else mixed heating/cooling operation when outdoor unit is functioning as evaporator

(1) If the condensation temperature is low, the fan mode is increased at regular intervals.
(2) If the condensation temperature is high, the fan mode is decreased in order to prevent excessive loads.
(3) The fan mode may be increased when the outdoor liquid temperature drops to 7°C or below.

6-1. MOV of Indoor Unit

6-1-1. MOV of each indoor unit operation mode

Mode of indoor unit	Outdoor unit (system)	Thermostat ON/OFF	
Stop	Stop	-	20 pulses
	Operating	-	20 pulses
Fan	Stop	-	20 pulses
	Operating	-	20 pulses
Cooling	Stop	-	20 pulses
	Operating	ON	65 ~ 480 pulses (SH control *1)
	Operating	OFF	20 pulses
Heating	Stop	-	20 pulses
	Operating	ON	60 ~ 480 pulses (SC control *2)
	Operating	OFF	55 ~ 80 pulses (Accumulation prevention of refrigerant *3)
	Operating	OFF *4	20 pulses

* The meaning of outdoor unit “Operating” is functioning as a cooling or heating system at least more than one compressor operating simultaneously.

*1 SH control adjusts the difference between the liquid temperature and gas temperature in indoor unit.
SH = gas temperature (E3) ~ liquid temperature (E1)
Target SH is 1deg C ~ 3deg C when required level of indoor unit is “30” or “31(test run)”.

Note: When the refrigerant amount in the system is adjusted, it is necessary to select test run that the required level becomes "31".

*2 SC control adjusts the difference between the liquid temperature in indoor unit and condensation temperature in a system (Tc).
SC = Condensation temperature (Tc) - liquid temperature (E1)
Target SC is 5deg C ~ 15deg C according to operating condition.

*3 MOV pulse changes to 55 for 1 minute when valve pulse continues to be 55 or more 5 minutes.
The purpose is to decrease the flow volume of the refrigerant so that room temperature can be detected with less influence of heat from the refrigerant.

*4 Only for High Static Pressure Ducted Type Indoor Unit (Type E2)

In case of special controls, MOV performs special operation. For details, see the sections “7. Tube Refrigerant Recovery Control”, “8. Oil Control”, “9. Defrost Control”, “10. Discharge Tube Accumulated Refrigerant Recovery Control”.

6-2. Solenoid Valve Kit Control [SVK]

This device connects the solenoid valve kit which is used to switch between indoor unit cooling/heating for 3WAY types.
In case of special controls, solenoid valve kit performs special operation.
For details, see the sections “7. Tube Refrigerant Recovery Control”, “8. Oil Control”, “9. Defrost Control”, “10. Discharge Tube Accumulated Refrigerant Recovery Control”.

6-2-1. SVK of each indoor unit operation mode

Mode of indoor unit	Outdoor unit (system)	Thermostat ON/OFF	Discharge valve (D)	Suction valve (S)	Balance valve (B)	EP valve (E)
Stop	Stop	-	OFF	OFF	ON/OFF *1	OFF
	Operating	-	OFF	OFF	ON	OFF
	Operating	*2 (Cooling)	OFF	ON	ON	ON
	Operating	*3 (Heating)	ON	OFF	OFF	OFF
Fan	Stop	-	OFF	OFF	ON	OFF
	Operating	-	OFF	OFF	ON	OFF
	Operating	*2 (Cooling)	OFF	ON	ON	ON
	Operating	*3 (Heating)	ON	OFF	OFF	OFF
Cooling	Stop	-	OFF	OFF	ON	OFF
	Operating	ON	OFF	ON	ON	ON
	Operating	OFF	OFF	ON	ON	ON
Heating	Stop	-	OFF	OFF	ON/OFF *1	OFF
	Operating	ON	ON	OFF	OFF	OFF
	Operating	OFF	ON	OFF	OFF	OFF
	Operating	OFF *4	OFF	OFF	OFF	OFF

*1 When the outdoor unit is stopped, all valves of indoor units’ solenoid valve kit in the heating mode are closed. Next, when the cooling or heating operation is resumed, the valves will be opened.

*2 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the cooling mode within the same solenoid valve kit.

*3 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the heating mode within the same solenoid valve kit.

*4 Only for High Static Pressure Ducted Type Indoor Unit (Type E2)

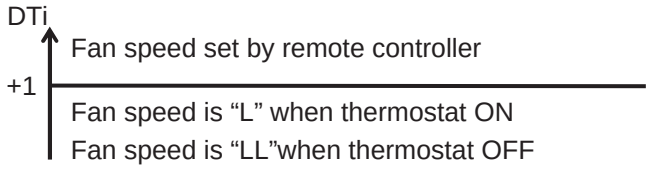
Checker software shows DSBE as the solenoid valve kit status of “0” and “1” instead of “OFF” and “ON” individually.
0 : OFF
1 : ON

6-3. Indoor Fan Speed Control

CCU intervenes in fan control of the indoor unit according to the state at the operating mode below.
The priority order of fan control by CCU is higher than that of indoor unit’s.
In case of special controls, indoor fan performs special operation.
For details, see the sections “7. Tube Refrigerant Recovery Control”, “8. Oil Control”, “9. Defrost Control”, “10. Discharge Tube Accumulated Refrigerant Recovery Control”.

6-3-1. Stop
When the outdoor unit is operating and cooling or heating thermostat ON is changed to OFF, the indoor unit fan stops after 1 minute drive with air speed “L”.

6-3-2. Dry mode
Indoor unit fan run in the dry mode is controlled from CCU as shown in the below figure.



DTi = (Intake temperature of indoor unit) - (Preset temperature in remote controller)

6-3-3. Heating mode
Indoor unit fan run in the heating mode is stopped from CCU at the following conditions.
● Discharge air temperature of indoor unit ≤ 20°C
● High pressure sensor temperature (HPS) in outdoor unit ≤ 25°C
● Liquid temperature (E1) in indoor unit ≤ 20°C

6-4. Drain Pump Control

CCU intervenes in drain pump control of the indoor unit according to the setting in EEPROM in the outdoor unit.
The drain pump operates from CCU control at the following conditions.
● DP counter ≥ 5
  * The DP counter counts Oil Recovery Control and Tube Refrigerant Recovery Control in cooling operation.
● Liquid temperature (E1) in the indoor unit which selected cooling mode < 0°C
  * Regardless of operating / stopped.
● Low Silhouette Ducted type indoor unit
  Low Silhouette Ducted types, dirt might be accumulated when water collects in the drain pan for a long period of time.
  Therefore, the drain pump works longer to drain water properly.
  * To activate this function, it is necessary to set it to EEPROM on the main outdoor PCB.

EEPROM setting in main outdoor unit
CODE: 0C

Setting No.		Indoor unit under this control
0	Invalid	All units (Mode, Operation / Stop Thermostat ON / OFF doesn't concern)
1	DP operates for 20 minutes and stops for 2 hours	
2	DP operates for 20 minutes and stops for 20 minutes	
3	DP always operates	
4	DP operates for XX minutes when indoor unit's operation changes; from thermostat ON → thermostat OFF or operation stopped.	Cooling mode Dry mode Heating mode
5	DP operates for XX minutes when indoor unit's operation changes; from thermostat ON or thermostat OFF → operation stopped.	
6	Both Setting No. 4 and 5 functions.	
7 (Factory preset mode)	DP operates for XX minutes when indoor unit's operation changes; from thermostat ON or thermostat OFF → operation stopped.	Cooling mode Dry mode

* When setting No. 4 – 7 is selected, this function works only for below indoor unit types.
* Types : F2, M1, E2
Operating time mentioned “XX” above is able to set in EEPROM of the main outdoor unit.

EEPROM setting in main outdoor unit
CODE: 2B

Setting No.	XX
20	20 minutes
30	30 minutes (factory preset mode)
40	40 minutes
50	50 minutes
60	60 minutes

* The drain pump always operates when the indoor unit is thermostat ON in cooling operation.
* Once the drain pump operates, it keeps operating for 20 minutes.
  In the above 2 cases, the drain pump operates by the signal of indoor PCB, not by CCU.

6-5. Discharge Air Temperature Control

For Type F2, M1, E2 indoor units, discharge air temperature is controlled from the CCU to prevent condensation on duct surface in cooling operation. The CCU monitors and adjusts ⊿ To of indoor unit. The adjustment is made by compressor capacity and MOV operation in the indoor unit.
*⊿ To: Cooling (Discharge air temperature) - (Preset discharge air temperature)
Heating (Preset discharge air temperature) - (Discharge air temperature)

Situation in which indoor unit stops by discharge air temperature control
- ⊿To ≤ -3.5deg C, and this condition continues 7 minutes
- ⊿To ≤ -2.0deg C, and this condition continues (20 + XX) minutes
  *The above mentioned “XX” is able to set in EEPROM of the main outdoor unit.

EEPROM setting in main outdoor unit
CODE: E1

Setting No.	XX
-20	-20
-19	-19
-18	-18
⋮	Interval of “1”
0	0 (factory preset mode)
⋮	⋮
10	10

* Discharge air temperature in cooling mode is 12°C.
* In heating operation, this function virtually does not work because preset discharge air temperature is 50°C and this is sufficiently higher than actual discharge temperature.

For preset discharge air temperature that is set in the indoor unit is able to change, refer to manual for indoor unit.

7. Tube Refrigerant Recovery Control

This control is intended to recover refrigerant if refrigerant has accumulated somewhere in the tubing when the units have been stopped for long periods, as well as to compensate for tubing thermal loss during heating start, and is also used for oil recovery.
Special control : Tube Refrigerant Recovery Control features one of the functions of special control.

7-1. Start of Tube Refrigerant Recovery Control

- When the microcomputer is initialized immediately after power-ON.
- After warning output occurs
- After a set amount of time has elapsed 60 minutes when all outdoor units are stopped.

7-2. Simplified Flow of Tube Refrigerant Recovery Control

- Whole Process

  Tube refrigerant recovery control shall be performed as the flow mentioned below.

  (0) Stopped

  (1) Tube refrigerant recovery control processing time *1

  (2) Post-processing time of tube refrigerant recovery control for 2 minutes or non stop operation

  (3) Normal operation

*1 Tube Refrigerant Recovery Control Process

- Control function when the outdoor unit heat exchanger is acting as a condenser.
  (when all units are in cooling mode or at start of mixed operation when the cooling load is high.)

Control time		2 minutes
Outdoor units		All outdoor units operate at maximum horsepower.
All Indoor Units	Expansion valve	Valves at all indoor units operate at a fixed pulse according to the indoor unit capacity.
	Solenoid valve kit	Valve kits at all indoor units operate in cooling mode (ON status).
	Fan	Fan runs at the set fan speed depending on the indoor unit operation mode.

* When the above operation is finished, normal operation starts at the horsepower determined by the indoor units where thermostats are ON.
* When the horsepower of cooling thermostat ON still remains greater than that of heating thermostat ON during control mentioned above, normal control is performed without stopping the compressor.
* When the horsepower of heating thermostat ON is getting greater than that of cooling thermostat ON during control mentioned above, once stop the outdoor unit after completion of control.
  Then change the heat exchanger acting as a condenser to an evaporator and resume the operation.

- Control when outdoor unit heat exchanger is acting as an evaporator (when all units are in heating mode or at start of mixed operation when heating load is high)

Control time		Minimum 1 minute – Maximum 20 minutes (Until Tc ≥ 35°C)
Outdoor units		All outdoor units operate at maximum horsepower.
All Indoor Units	Expansion valve	Valves at all indoor units operate at 250 pulses.
	Solenoid valve kit	Valve kits at all indoor units operate in heating mode (ON status)
	Fan	• As for heating thermostat ON indoor units, follow the indoor unit control system. • Fan and cooling (thermostat ON/OFF) and/or heating (thermostat OFF) operation of indoor unit will be stopped. • The fan speed of the heating thermostat OFF High Static Pressure Ducted type indoor unit (Type E2) is changed to LL.

* When the above operation is finished, normal operation starts at the horsepower determined by the indoor units where thermostats are ON.
* When the horsepower of heating thermostat ON still remains greater than that of cooling thermostat ON during control mentioned above, normal control is performed without stopping the compressor.
* When the horsepower of cooling thermostat ON is getting greater than that of heating thermostat ON during control mentioned above, once stop the outdoor unit after completion of control.
  Then change the heat exchanger acting as an evaporator to a condenser and resume the operation.

8-1. Oil Level

Oil level	Meaning	Conditions of oil	Judgement
2	Sufficient	The compressor contains sufficient oil.	There is no problem.
1	Slightly low	There will be a risk of oil shortage soon.	Confirm that oil is returned after performing the oil recovery control operation.
0	Extremely low	The compressor oil is short against required level for normal operation.	Confirm that oil level is recovered to the required level after performing the oil recovery control between systems.

At the time immediately after the oil level changes from 2 to 1, there is a specified amount of oil in the compressor. Namely, soon after the oil level is changed to 1, the oil in the compressor is sufficient.
If the oil level “0” indication continues for more than 5 to 10 minutes, it seems short of oil in the system.
Check valves related to oil recovery operation, the refrigerant tubing and for any oil leakage.

8-2. Oil Level Detection

The compressor oil in the crankcase is sent by bypass via a capillary tube to the low-pressure circuit.
The temperature detected by an oil sensor is used to determine whether it is oil (warm) or refrigerant (cold).

8-3. Self-Separator Oil Recovery Control

When a low oil level (1 or 0) is detected, oil is recovered from the oil separator to the compressor though ORVR.

8-4. Inter Outdoor Units Oil Recovery Control – Utilizing Balance Tubes

If the low oil level (1 or 0) continues, that outdoor unit (oil-receiving outdoor unit) receives oil from operating outdoor units where the oil level is not low (oil-supply outdoor units whose all compressor oil levels are 2).

- Control at the oil-receiving outdoor unit begins 30 seconds after an outdoor unit falls into oil level 0.
- Control at the oil-receiving outdoor unit begins 120 seconds after an outdoor unit falls into oil level 1.
  Oil supply is performed for a maximum of 5 minutes from each unit.
- When oil supply is ended, oil supply from that outdoor unit will not occur again for a period of [(No. of outdoor units minus 1) × 5 minutes]. In addition, oil supply is ended if the oil-receiving outdoor unit oil level changes to 2, or if the oil-supply outdoor unit oil level becomes "0".
- The supply of oil is received from 1 unit at a time, in sequence, according to the order of priority of their inverter compressors.
- Operation during unit refrigerant oil recovery
  [A] Oil-receiving outdoor unit
  ORVR turns ON and remains ON.
  [B] Oil-supply outdoor unit
  BPV turns ON and remains ON.
  BPV bypass valve repeatedly turns ON and OFF according to a constant cycle.

* This oil recovery might be performed regardless of oil level according to operating condition.

8-5. System Oil Recovery Control

Special control : System Oil Recovery Control features one of the functions of special control.

8-5-1. Start of system oil recovery control

- When operating compressor oil level 0
- When operating inverter compressor oil level less than 1 is counted with accumulation for up to 60 minutes.

8-5-2. Simplified flow of system oil recovery control

- Whole process

  System oil recovery control shall be performed as the flow mentioned below.

  (0) Normal operation
  (1) Pre-processing time of system oil recovery control for 2.5 minutes
  (2) System oil recovery control processing time *1
  (3) Post-processing time of system oil recovery control for 2 minutes
  (4) Normal operation

*1 System oil recovery control process

- Surely perform this system control by cooling cycle.
  Even if the outdoor unit heat exchanger is functioning as an evaporator (all heating mode or mixed cooling/heating operation), change the outdoor unit, indoor unit and solenoid valve kit to the cooling cycle and perform the system oil recovery control.

* If just before the operation is in heating mode or cooling/heating mixed operation mode, system oil recovery control may sometimes be performed by only heat exchanger 1 or all heat exchanger.

Control time		3 minutes
Outdoor units		All outdoor units operate at maximum horsepower.
All Indoor Units	Expansion valve	Valves at all indoor units operate at a fixed pulse according to the indoor unit capacity.
	Solenoid valve kit	Valve kits at all indoor units operate in cooling mode (ON status).
	Fan	・Stop and cooling (thermostat ON/OFF) and/or heating (thermostat ON) operation of indoor units will be followed the indoor unit control system. ・Fan and/or heating (thermostat OFF) operation of indoor unit will be stopped. ・The fan speed of the heating thermostat OFF High Static Pressure Ducted type indoor unit (Type E2) is changed to LL.

8-6. Oil Rotation Control

The oil rotation control system regularly exchanges oil among the outdoor units regardless of oil level.

- Oil rotation control is performed every one hour with accumulated operation time among the connected multiple outdoor units only.
- During oil rotation control, ORVR may open in the order of priority of outdoor unit inverter compressor operation every 5 minutes.

8-7. Indoor Unit Self Oil Recovery Control

The indoor unit self oil recovery control system can only be performed by the cooling indoor units.

- Divided into 8 groups in the order of indoor unit addresses and this oil recovery control is performed every 190 minutes with accumulated operation time per each group for 1 minute.
- The indoor unit expansion valve is opened according to the values determined by the indoor unit capacity with thermostat OFF.
- 10 pulses is opened from the pulse controlling the indoor unit expansion valve with thermostat ON. Then, the fan speed is changed to L.

9. Defrost Control

9-1. Defrost Methods

This system uses the following 2 defrosting systems.

System employs	Defrost control method
1 outdoor unit in the refrigerant system	Reverse cycle defrost
2 or more outdoor units in the refrigerant system	Outdoor unit cycle defrost

9-2. Constraint Conditions

- Frost detection does not occur for 10 minutes after operation starts.
- Defrost does not begin again for 40 minutes of operation after defrost was once completed.
- If all indoor units are stopped while defrosting, or if the outdoor unit is stopped due to protection control or another reason, then defrost control will not start for a minimum of 5 minutes after restart occurs.

Time until next defrost permission when defrost was completed is changed according to the ambient temperature.

Ambient temperature	To ≤ -10°C	-10°C < To ≤ -5°C	-5°C < To
Minute	XX + 6	XX + 3	XX

EEPROM setting in main outdoor unit
CODE: A3

Setting No.	XX
20	20
21	21
⋮	Interval of “1”
40	40 (factory preset mode)
41	Never use
⋮	
90	

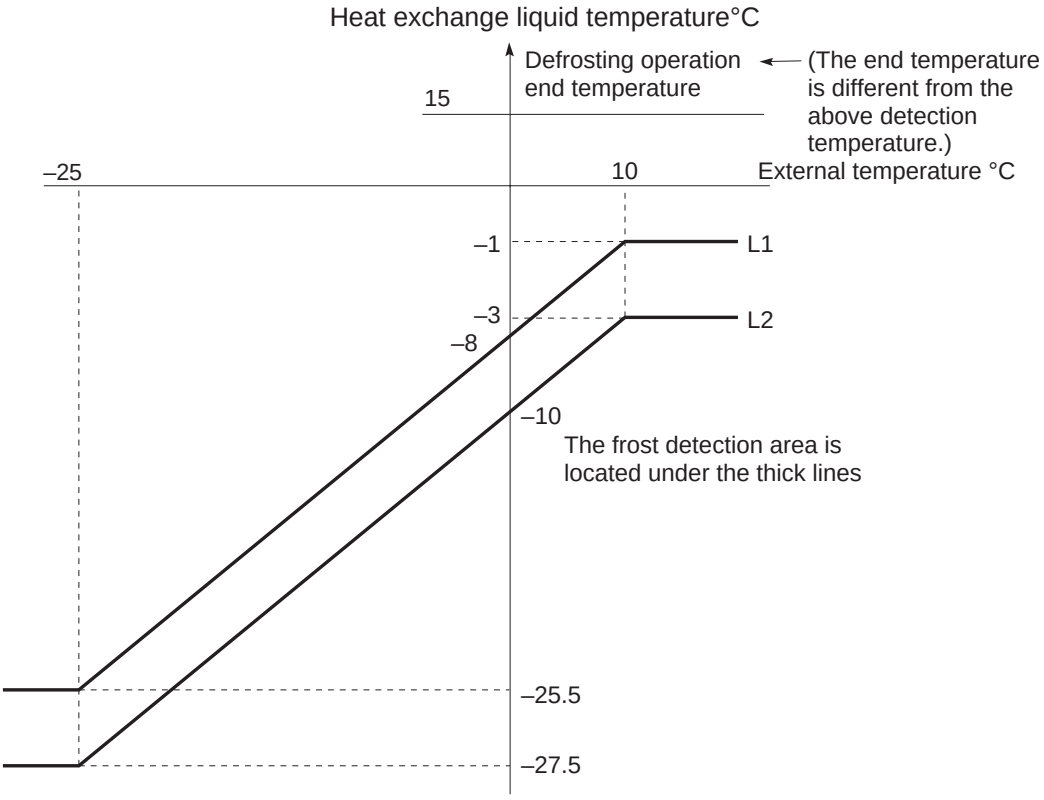
9-3. Frost Detection

(1) Frost detection does not occur for 5 minutes after operation starts.

(2) Frost is detected when either condition 1 or 2 below is met.

Condition 1: L2 line or below is detected twice, each time continuously for 4 minutes, when the compressor is operating.

Condition 2: L1 line or below is detected for a total of 60 minutes when the compressor is operating.



9-4. Reverse Cycle Defrost

Reverse cycle defrost is performed in systems where only 1 outdoor unit is connected to the refrigerant system.

Special control : Reverse Cycle Defrost features one of the functions of special control.

9-4-1. Start of reverse cycle defrost

- When conditions of section “9-2” and “9-3” contents are satisfied, defrost control is started.

9-4-2. Simplified flow of reverse cycle defrost

- Whole process

  Reverse cycle defrost shall be performed as the flow mentioned below.

  (0) Normal operation

  (1) Pre-processing time of reverse cycle defrost for 2.5 minutes

  (2) Reverse cycle defrost processing time *1

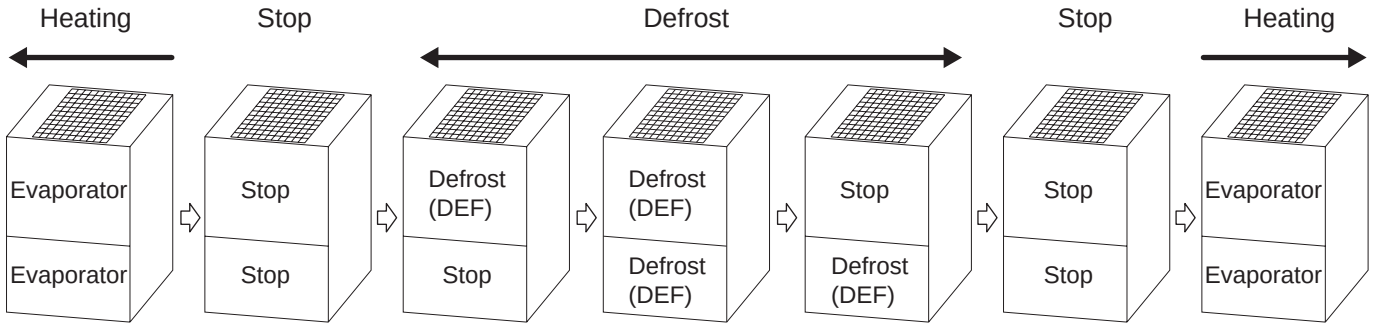
  (3) Post-processing time of reverse cycle defrost for 2 minutes

  (4) Normal operation

*1 Reverse cycle defrost process

This reverse cycle defrost process is performed after outdoor units, indoor units and solenoid valve kits are changed to the cooling cycle.

Control time		Minimum 1 minute – Maximum 15 minutes (Until all outdoor units' heat exchanger temperature ≥ 15°C)
Outdoor units		Outdoor unit operates at maximum horsepower.
All Indoor Units	Expansion valve	Valves at all indoor units operate at a fixed pulse according to the indoor unit capacity.
	Solenoid valve kit	Valve kits at all indoor units operate in cooling mode (ON status).
	Fan	• Stop and cooling operation of indoor units will be followed by the indoor unit control system. • Fan and heating operation of indoor units are changed to stop.



9-5. Outdoor Unit Cycle Defrost

Outdoor unit cycle defrost is performed in systems where 2 or more outdoor units are connected to the refrigerant system.
With this defrost method, when 1 outdoor unit operates in defrost mode (heat exchanger operating as a condenser), another outdoor unit operates as an evaporator in the same way as in ordinary heating mode.
In this way, the other outdoor unit is heating the unit where defrost is occurring.
When 1 outdoor unit completes defrost, the other outdoor unit performs defrost in the same way.
Because the amount of time that the unit operates as an evaporator is very short, there is little danger of frost forming again quickly.
Rather, because the heat source is very powerful, it is possible to shorten defrost operating time.

9-5-1. Start of outdoor unit cycle defrost

- When 1 or more connected outdoor units are satisfied with the conditions of section “9-2” and “9-3” contents, defrost control is started.
- Outdoor unit cycle defrost is performed in all connected outdoor units.

9-5-2. Simplified flow of outdoor unit cycle defrost

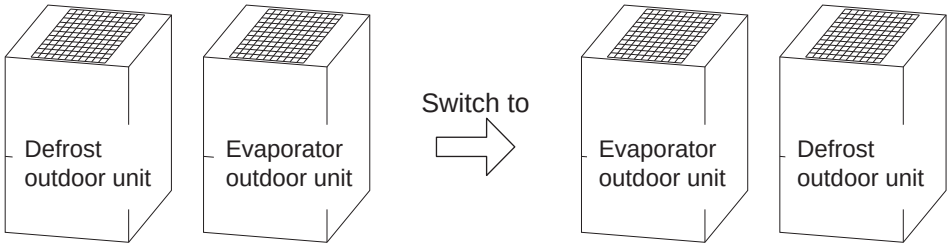
- Whole process

  Outdoor unit cycle defrost shall be performed as the flow mentioned below.

  (0) Normal operation
  (1) Outdoor unit cycle defrost processing time
  (2) Normal operation
- Outdoor unit cycle defrost process

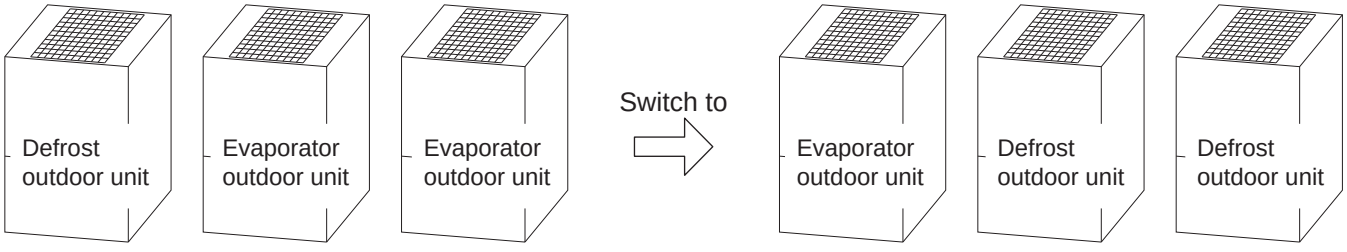
  Outdoor unit cycle defrost is always completed in 2 defrost operations.

  (1) When there are 2 outdoor units



First operation　　Second operation

  (2) When there are 3 outdoor units



First operation　　Second operation

1

E : Evaporator operation
C : Condenser operation
S : Stop or shut off the refrigerant
E→C : Switching from evaporator operation to condenser operation
C→E : Switching from condenser operation to evaporator operation

			Normal operation	Outdoor unit cycle defrost processing					Normal operation
				Outdoor unit delay-start control	1st Defrost group	Switch	2nd Defrost group	Switch	
Control time			-	1 min	Max 10 min	1 min	Max 10 min	1 min	-
Outdoor unit(s)	Defrost occurs first	Heat exchanger	E	E→C	C	C→E	E	E	E
		Compressor	ON	ON	ON	OFF	ON	OFF	ON
		Fan	ON	OFF	OFF	OFF	ON	OFF	ON
	Defrost occurs second	Heat exchanger	E or S	E	E	E→C	C	C→E	E or S
		Compressor	ON or S	ON	ON	OFF	ON	OFF	ON or S
		Fan	ON or S	ON	ON	OFF	OFF	OFF	ON or S
Indoor units	Mode	Thermostat							
	Stop	-	S	S	S	S	S	S	S
		*1(Cooling)	S	S	S	S	S	S	S
		*2(Heating)	S	S	S	S	S	S	S
	Fan	-	S	S	S	S	S	S	S
		*1(Cooling)	S	S	S	S	S	S	S
		*2(Heating)	S	S	S	S	S	S	S
	Cooling	ON	E	E	E	E	E	E	E
		OFF	S	S	S	S	S	S	S
	Heating	ON	C	S	S	S	S	S	C
		OFF	C	S	S	S	S	S	C
		OFF *3	S	S	S	S	S	S	S

*1 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the cooling mode within the same solenoid valve kit.
*2 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the heating mode within the same solenoid valve kit.
*3 Only for High Static Pressure Ducted Type Indoor Unit (Type E2)

● Indoor unit (expansion valve, solenoid valve kit, fan)

			Normal operation	Outdoor unit cycle defrost processing					Normal operation
				Indoor unit delay-start control	1st Defrost group	Switch	2nd Defrost group	Switch	
	Mode	Thermostat							
Expansion valve Unit : pulse	Stop	-	20	20	20	20	20	20	20
		*1(Cooling)	20	20	20	20	20	20	20
		*2(Heating)	55	55	60	60	60	60	55
	Fan	-	20	20	20	20	20	20	20
		*1(Cooling)	20	20	20	20	20	20	20
		*2(Heating)	55	55	60	60	60	60	55
	Cooling	ON	SH control	SH control	SH control	SH control	SH control	SH control	SH control
		OFF	20	20	20	20	20	20	20
	Heating	ON	SC control	SC control	60	60	60	60	SC control
		OFF	55	55	60	60	60	60	55
		*3 OFF	20	20	20	20	20	20	20
*5 Solenoid valve kit	Stop	-	0010	0010	0010	0010	0010	0010	0010
		*1(Cooling)	0111	0111	0111	0111	0111	0111	0111
		*2(Heating)	1000	0000	0000	0000	0000	0000	0000
	Fan	-	0010	0010	0010	0010	0010	0010	0010
		*1(Cooling)	0111	0111	0111	0111	0111	0111	0111
		*2(Heating)	1000	0000	0000	0000	0000	0000	0000
	Cooling	ON	0111	0111	0111	0111	0111	0111	0111
		OFF	0111	0111	0111	0111	0111	0111	0111
	Heating	ON	1000	0000	0000	0000	0000	0000	1000
		OFF	1000	0000	0000	0000	0000	0000	1000
		*3 OFF	0000	0000	0000	0000	0000	0000	0000
Fan	Stop	-	*4	*4	*4	*4	*4	*4	*4
		*1(Cooling)	*4	*4	*4	*4	*4	*4	*4
		*2(Heating)	*4	*4	*4	*4	*4	*4	*4
	Fan	-	*4	*4	*4	*4	*4	*4	*4
		*1(Cooling)	*4	*4	*4	*4	*4	*4	*4
		*2(Heating)	*4	*4	*4	*4	*4	*4	*4
	Cooling	ON	*4	*4	*4	*4	*4	*4	*4
		OFF	*4	*4	*4	*4	*4	*4	*4
	Heating	ON	*4	*4	Stop	Stop	Stop	Stop	*4
		OFF	*4	*4	*4	*4	*4	*4	*4
		*3 OFF	*4	*4	LL	LL	LL	LL	*4

*1 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the cooling mode within the same solenoid valve kit.

*2 Function when a common use solenoid valve kit is used and there are more than one (1) indoor unit in the heating mode within the same solenoid valve kit.

*3 Only for High Static Pressure Ducted Type Indoor Unit (Type E2)

*4 Fan runs at the set fan speed depending on the indoor unit operation mode.

*5 Individual number for DSBE indicates the status (OFF/ON) in turn from left respectively.
0 : OFF
1 : ON

10. Discharge Tube Accumulated Refrigerant Recovery Control

10-1. Start of Discharge Tube Accumulated Refrigerant Recovery Control

When any of them is completed, this control is implemented.
(1) More than 90 minutes, more than one indoor unit for judgment of discharge tube accumulated refrigerant
(2) More than 60 minutes, indoor unit for judgment of discharge tube accumulated refrigerant :
Indoor unit total amount ≥ 1/3 thermostat ON HP
(3) More than 30 minutes, indoor unit for judgment of discharge tube accumulated refrigerant :
Indoor unit total amount ≥ 1/3 thermostat ON HP

Judgment of discharge tube accumulated refrigerant
- Indoor unit operating mode with cooling thermostat ON
- Indoor unit electronic control valve opened more than 300 pulses
- Difference between suction temperature and discharge temperature is less than 3deg C.

10-2. Simplified Flow of Discharge Tube Accumulated Refrigerant Recovery Control

- Whole process

Discharge tube accumulated refrigerant recovery control shall be performed as the flow mentioned below.
(0) Normal operation
(1) Time before discharge tube accumulated refrigerant recovery control 3.0 minute stop
(2) Discharge tube accumulated refrigerant recovery control processing time *1
(3) Time after discharge tube accumulated refrigerant recovery control 4 minute stop
(4) Normal operation

*1 Discharge tube accumulated refrigerant recovery control process
This discharge tube accumulated refrigerant recovery control process is performed after outdoor units, indoor units and solenoid valve kits are changed to the heating mode.

	Control time	Minimum 1 minute – Maximum 5 minutes (Until all outdoor unit's HPT ≥ 20°C)
	Outdoor unit	Outdoor unit operates at maximum horsepower.
All Indoor Units	Expansion valve	Valves at all indoor units operate at 250 pulses.
	Solenoid Valve Kit	Valve kits at all indoor units operate in heating mode (ON status).
	Fan	· As for stop and heating indoor units, follow the indoor unit control system. · Fan and cooling indoor unit will be stopped.

11. Upper Current Limitation Mode (Demand control)

There are 2 types of control; demand control and infinity limit in the upper current limitation mode.
Either of them is controlled by the lower current limitation.

The standard value of the limit current is listed in the table below.

Type of outdoor unit	8 HP	10 HP	12 HP	14 HP	16 HP
Cooling mode	6.8 A	9.6 A	12.7 A	16.5 A	19.5 A
Heating mode	7.0 A	9.9 A	11.8 A	15.4 A	17.4 A
Mixed mode (Cooling/Heating)	6.8 A	9.6 A	11.8 A	15.4 A	17.4 A

11-1. Demand Control

Serial-parallel I/O must be connected in order to perform demand control.
The below input is received by serial-parallel I/O, and demand control is performed.

The demand values can be set as needed with serial-parallel I/O.

Upper current limitation setting		Control
Contact 1	Contact 2	
✕	✕	No control (Operates to maximum capacity)
○	✕	Operates to XX% of the upper limit for the rated current.
✕	○	Operates to YY% of the upper limit for the rated current.
○	○	Forced thermostat OFF setting

○ : Input present

✕ : Input not present

* The rated current indicates the current value that is listed in the catalog or similar material.

* XX and YY are able to set in EEPROM of main outdoor unit.

EEPROM setting in main outdoor unit

CODE: 1A

Setting No.	XX
0	0
40	40
45	45
⋮	Interval of “5”
100	100 (factory preset mode)
⋮	⋮
140	140
-1	No control

CODE: 1B

Setting No.	YY
0	0
40	40
45	45
⋮	Interval of “5”
70	70 (factory preset mode)
⋮	⋮
140	140
-1	No control

11. Upper Current Limitation Mode (Demand control)

It is able to display the present condition on the remote controller.

EEPROM setting in main outdoor unit

CODE: 1E

Setting No.	
0	No display
1	When demand control active, “demand - actived” displayed (factory preset mode).
2	When forced thermostat OFF with demand control active, “demand - actived” displayed.

11-2. When Using Demand Terminal Block*

*Demand Terminal Block is the field supply parts.

Demand terminal block must be connected in order to perform the demand control.
(It is also possible to connect the optional Seri-Para I/O unit (optional CZ-CAPDC2) and setup the system.)
The current limitation values can be set by changing either contact.

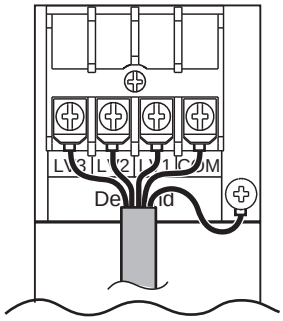
Demand terminal block	Seri-Para I/O unit		Control
COM short circuit	Contact 1	Contact 2	
Non	✕	✕	No control (Operates to maximum capacity.)
LV1	○	✕	Operates to 100% of the upper limit for the rated current
LV2	✕	○	Operates to 70% of the upper limit for the rated current
LV3	○	○	Forced thermostat OFF setting

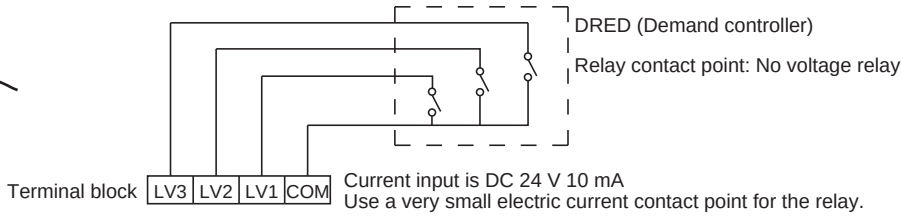
○ : Input present ✕ : Input not present

* The rated current indicates the current value that is listed in the catalog or service manual.

* In respect of connection method for demand terminal block and Seri-Para I/O unit, refer to the installation instructions supplied with the unit.

* During setting in LV1 - LV3, [CZ-RTC4] [CZ-RTC5B] (demand-activated) displays on the remote controller of the indoor unit.





12-1. Automatic Backup Operation

This system includes a function for automatic backup operation.
An alarm is displayed on the remote controller to inform the user that a failure has occurred.

12-1-1. Alarms that result in automatic backup operation

When the following alarm occurs, automatic backup operation is engaged.
Automatic backup operation is not engaged in cases of serious alarm such as communications alarms, etc.

● Alarm list 1 (Backup operation continues unless power supply of all outdoor units is turned off.)

Alarm display		
H01	Overcurrent in compressor 1	A
H11	Overcurrent in compressor 2	A
H03	Current sensor for the compressor 1 is disconnected or shorted	A
H13	Current sensor for the compressor 2 is disconnected or shorted	A
H31	HIC for compressor 1 has failure Overcurrent or overheat of HIC	A
H21	HIC for compressor 2 has failure Overcurrent or overheat of HIC	A
H07	Low on oil or the oil recovery circuit has restriction	B
P16	Overcurrent of compressor 1 on the secondary side of inverter circuit, or inverter failed to syncronize with rotation	A
P26	Overcurrent of compressor 2 on the secondary side of inverter circuit, or inverter failed to syncronize with rotation	A
P29	Inverter for compressor 1 failed to start or failed to syncronize with rotation	A
P19	Inverter for compressor 2 failed to start or failed to syncronize with rotation	A
P22	Fan motor or inverter drive of outdoor unit has failure	B

A : • When there is one outdoor unit in the system, only compressor that has sensor failure stops.
• When there are multiple outdoor units in the system, only the outdoor unit which contains the problem stops but the other outdoor units in the system operate normally.

B : • When there is one outdoor unit in the system, the backup operation does not work.
• When there are multiple outdoor units in the system, only the outdoor unit which contains the problem stops but the other outdoor units in the system operate normally.

NOTE :

After automatic backup operation caused by alarm listed in alarm list 1, it will not be canceled automatically when the repair of the failed outdoor unit is completed.
Automatic backup mode will be canceled only when the power on all outdoor unit is reset.
Therefore, after repair work is completed, be sure to check whether or not automatic backup mode has been canceled.

● Alarm list 2 (Backup operation continues as long as the problems are not solved.)

Alarm display		
F04	DISCH1 thermistor at the discharge of compressor 1 reading is abnormal	B
F05	DISCH2 thermistor at the discharge of compressor 2 reading is abnormal	B
F06	EXG1 thermistor at the gas side of heat exchanger 1 of the outdoor unit has failure (EXG1)	B
F07	EXL1 thermistor at the liquid side of heat exchanger 1 of the outdoor unit has failure (EXL1)	B
F08	TO thermistor for outdoor ambient air temperature has failure (TO)	B
F12	SCT thermistor at the suction refrigerant of compressors has failure (SCT)	B
F14	SCG thermistor at the outlet of subcooling heat exchanger in outdoor unit has failure (SCG)	B
F16	High pressure sensor of the outdoor unit has failure (HPS)	B
F17	Low pressure sensor of the outdoor unit has failure (LPS)	B
F23	EXG2 thermistor at the gas side of heat exchanger 2 of the outdoor unit has failure (EXG2)	B
F24	EXL2 thermistor at the liquid side of heat exchanger 2 of the outdoor unit has failure (EXL2)	B
H05	DISCH1 thermistor at the discharge of compressor 1 is disconnected, shorted or misplaced (DISCH1)	B
H08	OIL1 thermistor for the oil of compressor 1 has failure (OIL1)	B
H15	DISCH2 thermistor at the discharge of compressor 2 is disconnected, shorted or misplaced (DISCH2)	B
H27	OIL2 thermistor for the oil of compressor 2 has failure (OIL2)	B
P03	Compressor 1 discharge temperature too high	B
P17	Compressor 2 discharge temperature too high	B

A : • When there is one outdoor unit in the system, only compressor that has sensor failure stops.
• When there are multiple outdoor units in the system, only the outdoor unit which contains the problem stops but the other outdoor units in the system operate normally.

B : • When there is one outdoor unit in the system, the backup operation does not work.
• When there are multiple outdoor units in the system, only the outdoor unit which contains the problem stops but the other outdoor units in the system operate normally.

* Backup operation caused by an alarm listed in “alarm list 2” will finish automatically after 24 hours if the same alarm does not occur again for 24 hours.

12-1-2. Start of automatic backup operation

If the above alarms occur, the alarm is displayed on the remote controller, etc.
Pressing the remote controller button again starts automatic backup mode.

12-1-3. Backup operation information display

If a wired remote controller is present, ⚠ display blinks during operation.

12-1-4. Check for blinks when automatic backup setting

When operating the automatic backup by setting the outdoor unit EEPROM, blink check on the remote controller and centralized control systems is enabled to change for non-displayed.

EEPROM setting in main outdoor unit
CODE: 49

Setting No.	
0	Display (factory present mode)
1	Non-displayed

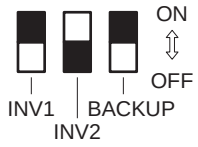
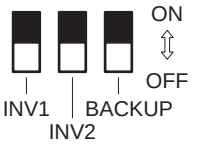
12-2. Manual Backup Operation

The manual backup can be used when it is necessary to close the service valve for maintenance, etc.

- **Backup operation procedure**

12-2-1. Disconnecting the failed outdoor unit

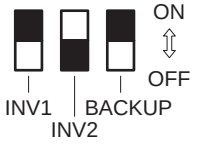
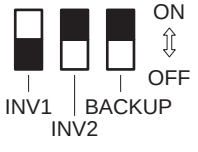
(1) Reduce the number of outdoor units set at outdoor unit No.1 by only the number of failed outdoor units.
(2) At the SW7 switch on the PCB of the failed outdoor unit, turn ON the switches for all compressor to disable, and turn ON the "BACKUP" switch.

Type of outdoor unit	8HP	10HP	12HP	14HP	16HP
SW7 switches to turn ON	INV1 + BACKUP 			INV1 + INV2 + BACKUP 	

(3) Close all service valves at the failed outdoor units.
(4) Reset the power at outdoor unit number 1.
* The outdoor unit that backed up all compressors is not controlled by CCU (main outdoor unit). Even if all compressors of the main outdoor unit are backed up, they are not controlled by CCU. However, the CCU function stays active.

12-2-2. Disabling operation of 1 compressor (Type: 14, 16HP)

At the SW7 switch on the PCB of the failed outdoor unit, turn ON the switch for the compressor to disable, and turn ON the "BACKUP" switch.

Type of outdoor unit		14HP	16HP
SW7 switches to turn ON	In the case of INV1 compressor		
	In the case of INV2 compressor		

13-1. Maintenance Function for Power Supply Stop of Indoor Unit (E06 ignore)

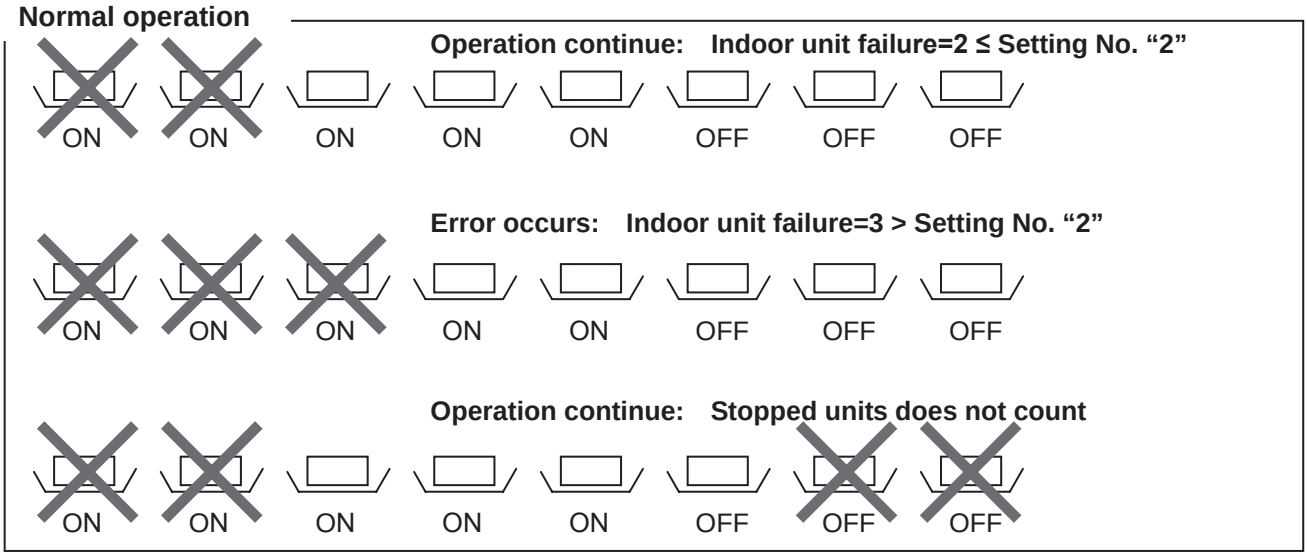
The system can continue operation even if outdoor unit cannot communicate with some indoor units.
It is necessary to set to EEPROM the allowed number of operating indoor units not to be able to communicate.
The system will continue operating until the following condition is made to be satisfied.
Value set by the code “23” ≥ No. of indoor units operated until the last moment because of communicative disorder caused by power supply stop (excluding stopped indoor units).
However, the upper limit value set by the code "23" must be less than 25% of the total number of indoor units of the system.

EEPROM setting in main outdoor unit
CODE: 23

Setting No.	Allowed number of missing indoor unit
-1	This function is invalid (factory preset mode)
0	0
1	1
2	2
⋮	Interval of “1”
13	13
14	Never use
⋮	
52	

* However, the upper limit value set by the code "23" must be less than 25% of the total number of indoor units of the system.

Examples :
In case of 8 indoor units, setting No. becomes “2”.



13-2. Setting when at Thermostat OFF

13-2-1. Thermostat OFF in cooling mode

When decreasing the indoor airflow volume at the cooling thermostat OFF or dry thermostat OFF, follow the setting procedure below.

EEPROM setting in main outdoor unit

CODE: ED

Setting No.	Indoor fan mode	Indoor unit expansion valve	SVK	Louver
0 (factory preset mode)	w/o force	w/o force	w/o force	w/o force
1	STOP *3	20	0111	w/o force
2	LL	20	0111	w/o force
3	Interval mode *4	20	0111	w/o force
4	Never use	-	-	-

*1 If setting at thermostat ON, the system will return to the normal indoor fan control or solenoid valve kit mode.

*2 Whenever changing thermostat ON and OFF, solenoid valve kit sounds ON and OFF.

*3 When setting at Stop mode, be sure to set the room sensor to the remote control thermostat.

EEPROM setting in indoor unit

CODE: 32

Setting No.	
0	Indoor unit sensor (factory preset mode)
1	Remote control sensor

*4 Operation when in the intermittent airflow setting

- When in the thermostat OFF, LL airflow and stop mode repeats alternately and the mechanical valve and solenoid valve kit remain in the forced condition.
- Interval intermittent operation can be changed by EEPROM setting.

EEPROM setting in indoor unit

CODE: 44

Setting No.	Indoor unit fan operating time [sec]
30	30
60 (factory preset mode)	60
90	90
⋮	⋮
210	210
240	240

CODE: 45

Setting No.	Indoor unit fan stopped time [min]
5 (factory preset mode)	5
10	10
15	15
20	20
25	25
30	30

13-2-2. Thermostat OFF in heating mode

If setting without hot air in heating thermostat OFF, follow the setting procedure below.

EEPROM setting in main outdoor unit

CODE: CD

Setting No.	Indoor unit expansion valve	SVK
0 (factory preset mode)	w/o force	w/o force
1	20	0000

*1 If setting at thermostat ON, the system will return to the normal indoor fan control or solenoid valve kit mode.

*2 Whenever changing thermostat ON and OFF, solenoid valve kit sounds ON and OFF.

14. Detailed Settings in EEPROM of Outdoor Unit

Never use the DN code unlisted in the following table. (P) : Factory preset mode

DN	Item	Setting No.
04	Operation for using snowfall sensor	0=No sensor & control (P) 1=Sensor & control 2=No Sensor & no control 3=Sensor & no control
05	Outdoor fan silent mode	0=Invalid (P) 1=Silent mode 1 2=Silent mode 2 ,,,,,
0C	Indoor unit drain pump forced operation	0=Invalid 1=stop for 2 hours and drive for 20 min. constantly 2=stop for 20 min. and drive for 20 min. constantly 3=Drive constantly 4-6=delay drive when thermostat OFF 7=delay drive when thermostat OFF (P)
0D	Measures against smell when indoor unit cooling thermostat OFF	0=Invalid (P) 1=Measures against smell
1A	Demand 1 current (%)	0=0% ,,,,,40=40% ,,,,,45=45% ,,,,,100=100% (P) ,,,,,140=140% -1=No control
1B	Demand 2 current (%)	0=0% ,,,,,40=40% ,,,,,70=70% (P) ,,,,,100=100% ,,,,,140=140% -1=No control
1E	Demand remote controller display	0=No display 1=When demand control active, “demand - actived” displayed (P) 2=When forced thermostat OFF with demand control active, “demand - actived” displayed
23	E06 ignore function	-1=invalid (P),,,,, 0=0,,,,, 1=1,,,,, 13=13 14-52=Never use
2A	Dew condensation prevention control of indoor unit	0=Invalid (P) 1=30 min, 2=40 min, 3=50 min, 4=60 min
2B	DP operation time for slime measures	20=20 min, 30=30 min (P), 40=40 min 50=50 min, 60=60 min
3E	PSccutgt delay-start setting	0=8 sec delay-start (P) 1=(system address ×1×8) sec delay-start 2=(system address ×2×8) sec delay-start 3=(system address ×3×8) sec delay-start
44	Indoor unit fan's intermittent operation and operating time when in cooling thermostat OFF	30=30 sec , 60=60 sec (P) ,,,,, 240=240 sec
45	Indoor unit fan's intermittent operation and stopped time when in cooling thermostat OFF	5=5 min (P) , 10=10 min , 15=15 min , 20=20 min , 25=25 min 30=30 min
49	Automatic backup mode setting	0=Display (P) 1=non-displayed
81	Outdoor unit capacity	0=Invalid , 1=22 , 2=25 , 3=28 , 4=32 , 5=36 , 6=40 , 7=45 , 8=50 , 9=56 , 10=63 , 11=71 , 12=80 , 13=90 , 14=100 , 15=112 , 16=125 , 17=140 , 18=160 , 19=180 , 20=210 , 21=224 , 22=250 , 23=280 , 24=335 , 25=355 , 26=420 , 27=450 , 28=500 , 29=560 , 30=600 , 31=630 , 32=670 , 33=710 , 34=800 , 35=840
8F	High static pressure setting	0=Invalid (P) 1=High static pressure mode 2-6=Never use
A3	The minimum operating time 1 until defrosting	20=20min, 21=21min ,,,,, 40=40min (P) 41 - 90=Never use
A7	Validity/invalidity of capacity control when cooling operation	0=Invalid (P), 1=Valid

14. Detailed Settings in EEPROM of Outdoor Unit

Never use the DN code unlisted in the following table. (P) : Factory preset mode

DN	Item	Setting No.
AC	Actuation of solenoid valve kit (EP closed)	0=Invalid (P), 1=Valid
C1	O_2 output change	0=Continuously set OFF (P) 1=Refrigerant leak prevention (normal OFF) 2=Refrigerant leak prevention (normal ON)
CD	Setting at heating thermostat OFF	0=Invalid (P) , 1=Heating airflow prevention mode
DD	Indoor fan mode setting when in discharge tube accumulated refrigerant recovery control	0=Invalid , 1=stop (P) , 2=LL
DE	Discharge tube accumulated refrigerant recovery control permission temperature	-25=-25°C, -20=-20°C, -15=-15°C ,,,,, 40=40°C ,,,,, 55=(55°C)
E1	Discharge air temperature control with thermostat OFF additional time	-20=-20 min , -19=-19 min ,,,,, 0=0 min (P) ,,,,, 10=10 min
ED	Indoor unit fan selection when in cooling thermostat OFF	0=Invalid (P) , 1=stop , 2=LL , 3=interval operation , 4=never use

15-5. Functions

A. ADD pin (2P, Black) (CN30)	Auto address setting pin • Short-circuit this pin for 1 second or longer to automatically set the addresses at the indoorunits that are connected to that outdoor unit and are within the same system. • The system address is "1" at the time of shipment. Auto address setting is necessary even for communications lines in a single system where the inter-unit control wiring does not cross to any other systems. • While auto address setting is in progress, the 2 LEDs (LED1, 2: Red) on the outdoor unit control PCB blink alternately. (Short-circuiting this pin while auto address setting is in progress will stop the auto address setting operation.)
SW1 Rotary switch (10 positions, Black)	Outdoor system address setting switch • The setting is "1" at the time of shipment. It is not necessary to change the setting if wiring is connected only to an outdoor unit and indoor units in a single system and the inter-unit control wiring does not cross multiple systems. • If wiring links the inter-unit control wiring for multiple systems to the same communications lines, then a different address must be set for each refrigerant tubing system. • If wiring links multiple systems, a maximum of 30 systems (up to 52 indoor units) can be connected. This setting can be set up to "39," however control will be for 30 systems even if the setting is set to higher than 30. An alarm will be displayed if system addresses are duplicated. (For details, see Table 1.)
SW2 DIP switch (2P, Black)	Switches for setting system address 10s digit and 20s digit • If 10 systems or more are set, the setting is made by a combination of this DIP switch and SW1. • If 10 - 19 systems are set, set switch 1 (10s digit) to ON. • If 20 - 29 systems are set, set switch 2 (20s digit) to ON, and set switch 1 (10s digit) to OFF. • If 30 systems are set, set both switch 1 (10s digit) and switch 2 (20s digit) to ON. (For details, see Table 1.)
SW3 Rotary switch (10 positions, Red)	Switch for setting the number of connected indoor units. In order to allow the outdoor unit to manage indoor units in the same refrigerant system, set the number of connected indoor units. (For details, see Table 2.)
SW4 DIP switch (3P, Black)	Switches for setting the 10s, 20s, and 30s digit for the number of connected indoor units • If 10 systems or more are set, the setting is made by a combination of this DIP switch and SW3. • If 10 - 19 systems are set, set only switch 1 (10s digit) to ON. • If 20 - 29 systems are set, set switch 2 (20s digit) to ON, and set switch 1 (10s digit) to OFF. • If 30 - 39 systems are set, set only switch 3 (30s digit) to ON.(For details, see Table 2.) • If 40 - 49 systems are set, set switch 3 (30s digit) to ON, and set switch 1 (10s digit) to ON. • If 50 - 52 systems are set, set switch 3 (30s digit) to ON, and set switch 2 (20s digit) to ON. (For details, see Table 2.)
SW5 DIP switch (3P, Black)	Unit address setting switch • The setting is "1" at the time of shipment. (For details, see Table 3.)
SW6 DIP switch (3P, Black)	Setting of the number of outdoor units • Turn the switches ON according to the number of outdoor units (1 - 3). (For details, see Table 4.)
SW7 DIP switch (3P, Black)	Backup operation switch If an INV1 compressor has malfunctioned, turn INV1 ON and BACKUP SW ON to operate the outdoor unit using only INV2 compressor. If an INV2 compressor has malfunctioned, turn INV2 ON and BACKUP SW ON to operate the outdoor unit using only the INV1 compressor.

Terminal pin (3P, Black) (CN67)	For communications circuit impedance matching • A connecting socket (3P, Black) is attached to the terminal plug at the time of shipment from the factory. • In the case of link wiring which combines the inter-unit control wiring for multiple systems into a single communications circuit, When using, refer to the item “4. Auto Address Setting” under the section “7. TEST RUN”.
LED1, 2 (Red)	• LED 1 and 2 blink alternately while auto address setting is in progress. • Display the alarm contents for alarms which were detected by the outdoor unit.
RUN pin (2P, Black) (CN27)	Start pin Short-circuit this pin and apply a pulse signal to start all indoor units in that refrigerant system.
STOP pin (2P, Black) (CN28)	Stop pin Short-circuit this pin and apply a pulse signal to stop all indoor units in that refrigerant system.
AP pin (2P, Black) (CN24)	Vacuuming pin • To perform vacuuming of the outdoor unit, short-circuit this pin and then turn the power ON. All solenoid valves turn ON and vacuuming begins smoothly. (Do not perform auto address setting at this time.) • Release the short-circuit to return the unit to normal status.
MODE pin (3P, Black) (CN40)	Indoor unit Heating/Cooling mode change pin • During the summer season, short-circuit this pin in the cooling mode. • Then, perform auto address setting. When auto address setting is completed, release the short-circuit to return the unit to normal status. • When cooling mode is short-circuited, cooling operation can be used. • When heating mode is short-circuited, heating operation can be used.
TEST pin (2P, Black) (CN22)	• This pin is used to test the PCB at the factory. • When the power is turned ON after this pin has been short-circuited, all output signals will be output in sequence . (Sequential output does not occur if this pin is short-circuited when the power is already ON.) Releasing this pin returns the unit to normal control.
CHK pin (2P, Black) (CN23)	When set to short-circuit, changes to test run mode. (Test run mode is automatically cancelled after an hour.) When short-circuit is cancelled, test run mode is cancelled.
DEF pin (2P, Black) (CN25)	When the pin of the main unit is short-circuit in heating mode, defrosting operation is started. Even if short circuited, defrosting will not be activated immediately.
SNOW plug (3P, Red) (CN34)	Can be used when installing a snowfall sensor device.
SILENT plug (2P, White) (CN33	Can be used when setting the outdoor unit fan in sound absorbing mode.
OC EMG terminal (3P, Black) (CN69)	If “TO INDOOR UNIT” accidently connected to high voltage, use the terminal base TM1. Method: 1. Replace the pins 1 and 2 of CN69 with the pins 2 and 3. 2. Disconnect JP11.
RC1 EMG terminal (3P, Black) (CN82)	If “TO OUTDOOR UNIT” accidently connected to high voltage, use the terminal base TM1. Method: 1. Replace the pins 1 and 2 of CN82 with the pins 2 and 3. 2. Disconnect JP12.

Table 1.
Setting the System Address
[SW1: Rotary switch (Black), SW2: 2P DIP (Black)]

	Outdoor system address	SW1 setting	SW2 setting	
			1P (10s digit)	2P (20s digit)
Link wiring	1	1	OFF	OFF
	2	2	OFF	OFF
	3	3	OFF	OFF
	4	4	OFF	OFF
	5	5	OFF	OFF
	6	6	OFF	OFF
	7	7	OFF	OFF
	8	8	OFF	OFF
	9	9	OFF	OFF
	10	0	ON	OFF
	11	1	ON	OFF
	12	2	ON	OFF
	13	3	ON	OFF
	14	4	ON	OFF
	15	5	ON	OFF
	16	6	ON	OFF
	17	7	ON	OFF
	18	8	ON	OFF
	19	9	ON	OFF

	Outdoor system address	SW1 setting	SW2 setting	
			1P (10s digit)	2P (20s digit)
Link wiring	20	0	OFF	ON
	21	1	OFF	ON
	22	2	OFF	ON
	23	3	OFF	ON
	24	4	OFF	ON
	25	5	OFF	ON
	26	6	OFF	ON
	27	7	OFF	ON
	28	8	OFF	ON
	29	9	OFF	ON
	30	0	ON	ON

Table 2.
Setting the Number of Indoor Units
[SW3: Rotary switch (Red), SW4: 3P DIP (Black)]

Number of Indoor Units	SW3 Setting	SW4 Setting		
		1	2	3
1	1	OFF	OFF	OFF
2	2	OFF	OFF	OFF
3	3	OFF	OFF	OFF
9	9	OFF	OFF	OFF
10	0	ON	OFF	OFF
11	1	ON	OFF	OFF
19	9	ON	OFF	OFF
20	0	OFF	ON	OFF
21	1	OFF	ON	OFF
29	9	OFF	ON	OFF
30	0	OFF	OFF	ON
31	1	OFF	OFF	ON
39	9	OFF	OFF	ON
40	0	ON	OFF	ON
41	1	ON	OFF	ON
49	9	ON	OFF	ON
50	0	OFF	ON	ON
51	1	OFF	ON	ON
52	2	OFF	ON	ON

Table 3.
Setting the Outdoor Unit address
[SW5: DIP switch (Black)]

Outdoor Unit Address	SW5 Setting		
	1	2	3
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF

Table 4.
Setting the Number of Outdoor Units
[SW6: DIP switch (Black)]

Number of Outdoor Units	SW6 Setting		
	1	2	3
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF

1

(1) Electric Wiring Diagram U-8MF3E8, U-10MF3E8, U-12MF3E8

ACXF22-06750

NOTE : SW SETTING ON CONTROL CIRCUIT BOARD

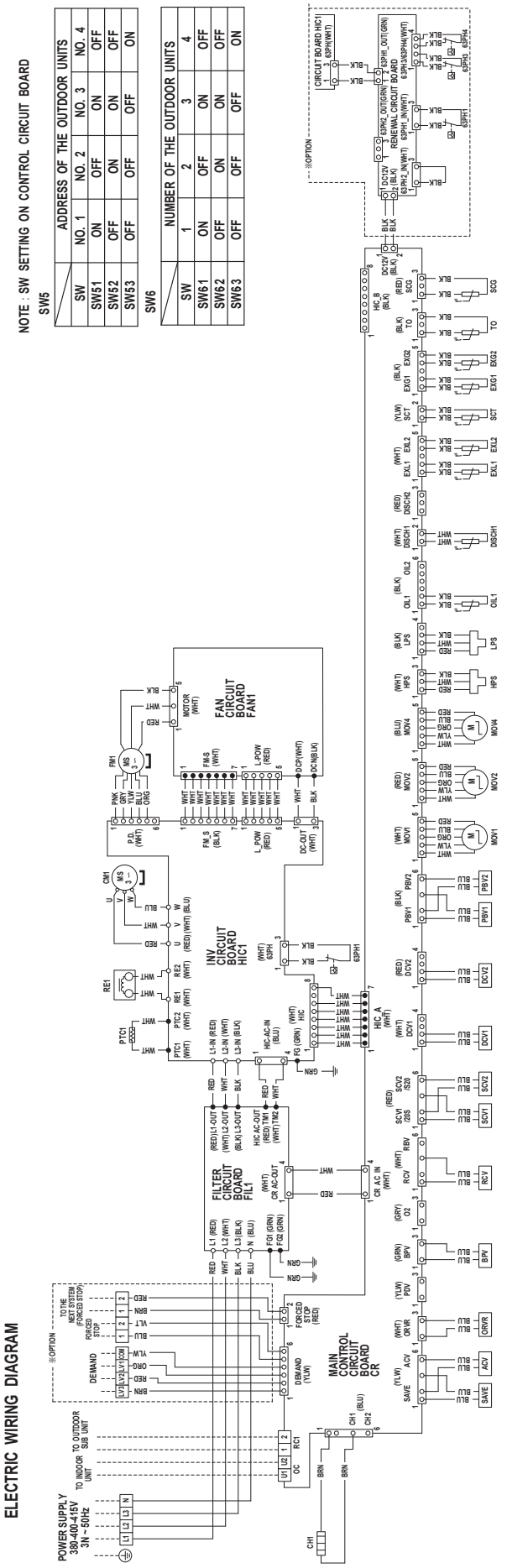
SW5

SW	ADDRESS OF THE OUTDOOR UNITS			
	NO. 1	NO. 2	NO. 3	NO. 4
SW51	ON	OFF	ON	OFF
SW52	OFF	ON	ON	OFF
SW53	OFF	OFF	OFF	ON

SW6

SW	NUMBER OF THE OUTDOOR UNITS			
	1	2	3	4
SW61	ON	OFF	ON	OFF
SW62	OFF	ON	ON	OFF
SW63	OFF	OFF	OFF	ON

ELECTRIC WIRING DIAGRAM



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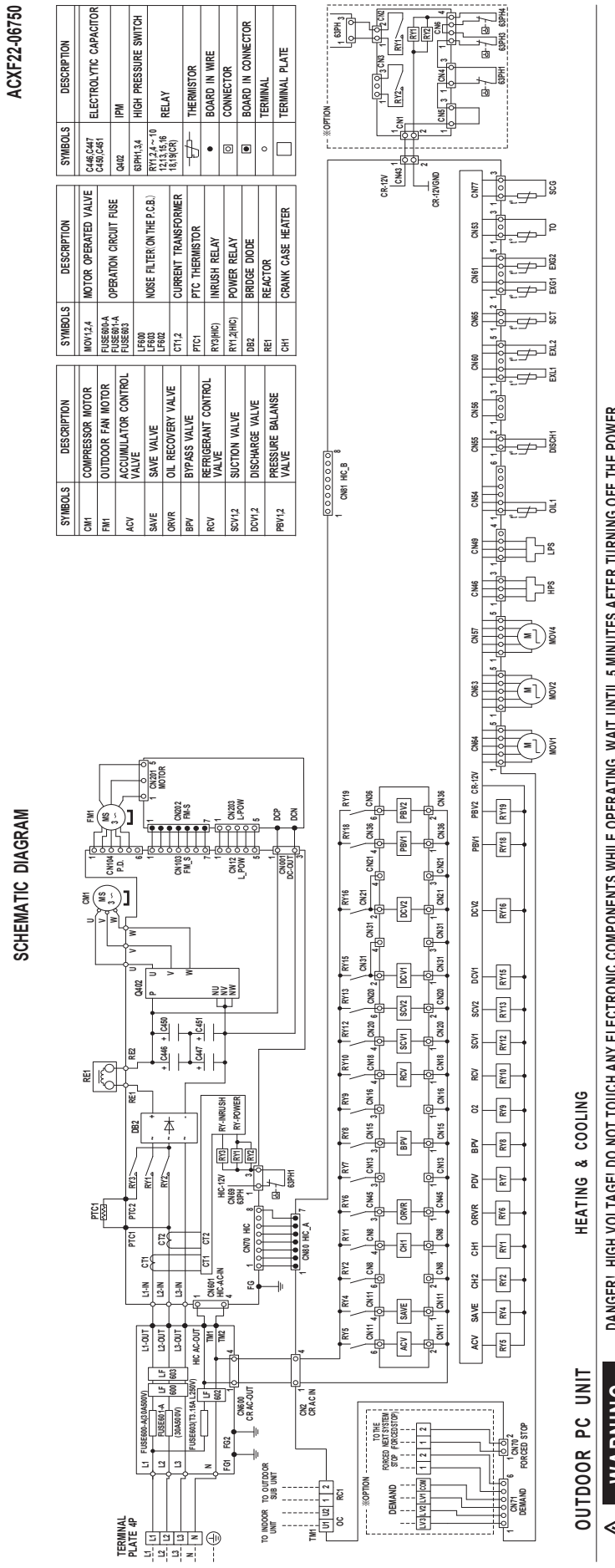
Schematic Diagram U-8MF3E8, U-10MF3E8, U-12MF3E8



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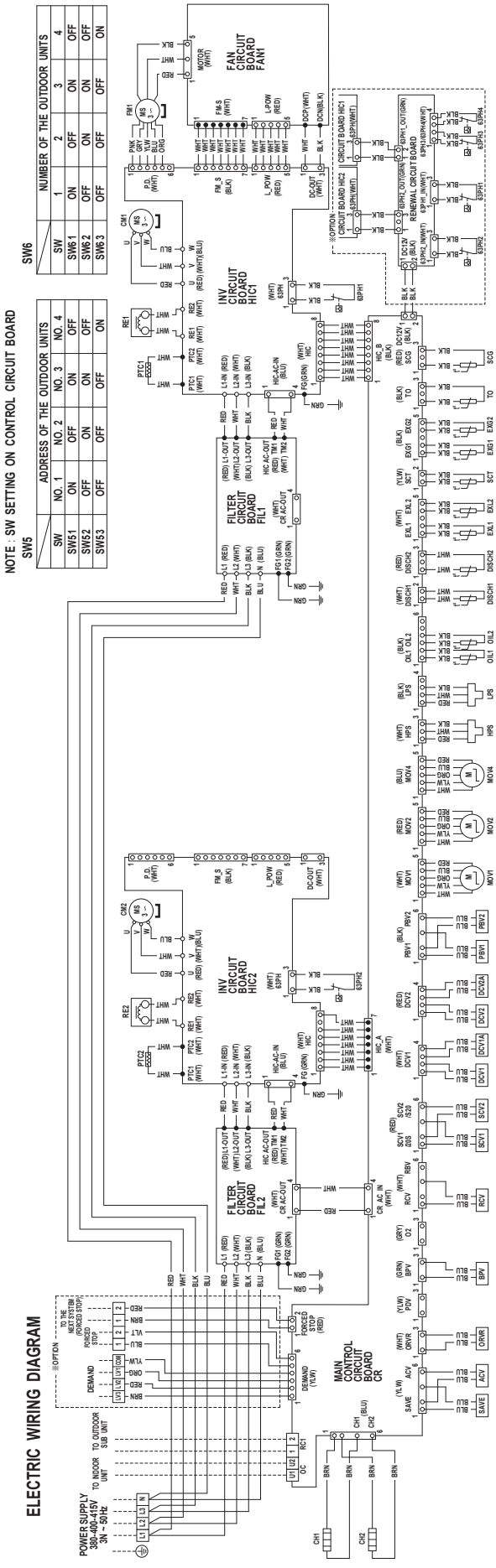
(2) Electric Wiring Diagram U-14MF3E8, U-16MF3E8



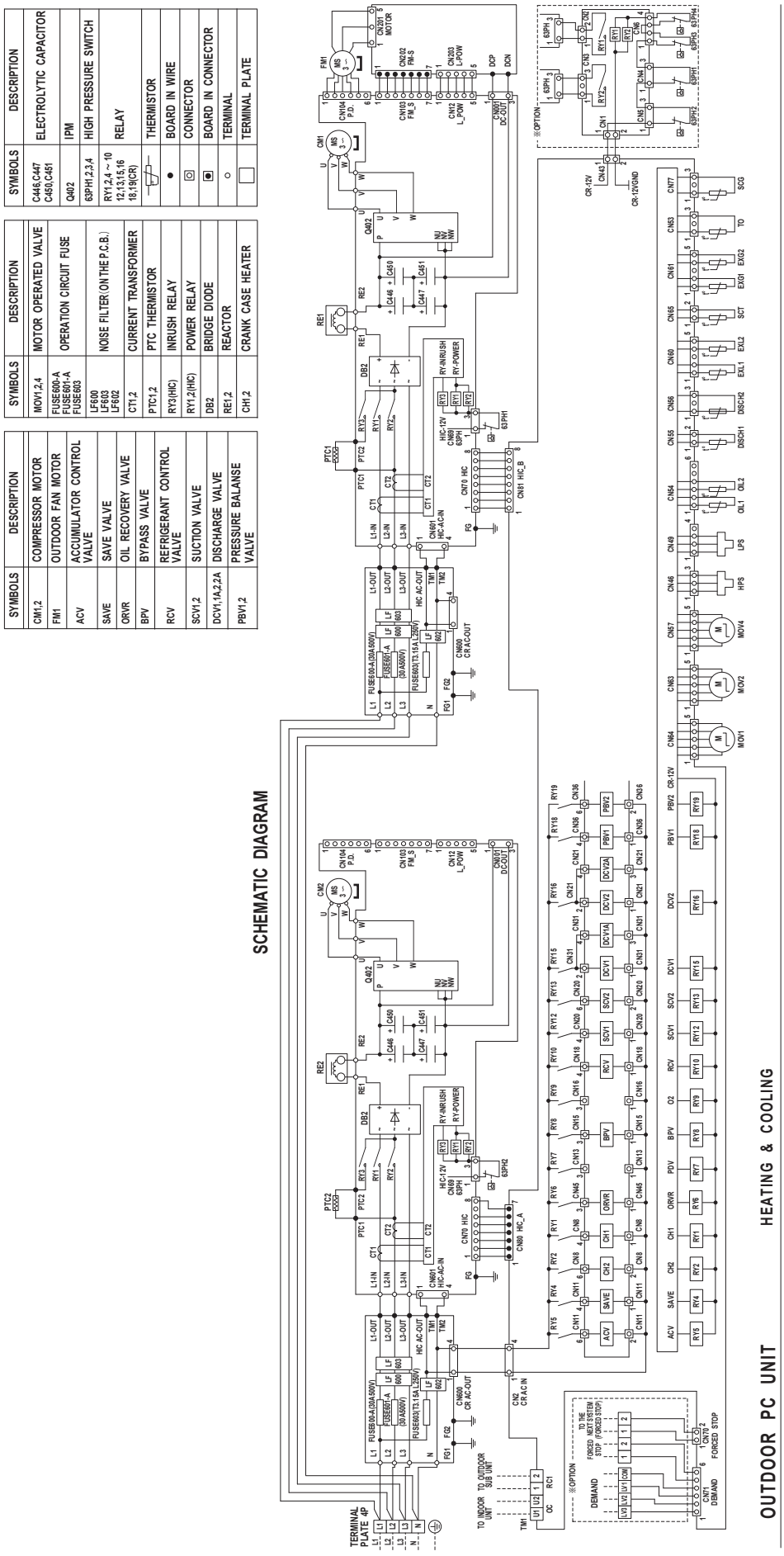
Schematic Diagram U-14MF3E8, U-16MF3E8

ACXF22-06760

SYMBOLS	DESCRIPTION
CM1,2	COMPRESSOR MOTOR
FM1	OUTDOOR FAN MOTOR
ACV	ACCUMULATOR CONTROL VALVE
SAVE	SAVE VALVE
ORVR	OIL RECOVERY VALVE
BPV	BYPASS VALVE
RCV	REFRIGERANT CONTROL VALVE
SCV1,2	SUCTION VALVE
DCV1,1A,2,2A	DISCHARGE VALVE
PBV1,2	PRESSURE BALANSE VALVE

SYMBOLS	DESCRIPTION
MOV1,2,4	MOTOR OPERATED VALVE
FUSE600-A FUSE601-A FUSE603	OPERATION CIRCUIT FUSE
LF600 LF603 LF602	NOISE FILTER(ON THE P.C.B.)
CT1,2	CURRENT TRANSFORMER
PTC1,2	PTC THERMISTOR
RY3(HIC)	INRUSH RELAY
RY1,2(HIC)	POWER RELAY
DB2	BRIDGE DIODE
RE1,2	REACTOR
CH1,2	CRANK CASE HEATER

SYMBOLS	DESCRIPTION
C446,C447 C450,C451	ELECTROLYTIC CAPACITOR
Q402	IPM
63PH1,2,3,4	HIGH PRESSURE SWITCH
RY1,2,4 ~ 10 12,13,15,16 18,19(ICR)	RELAY
	THERMISTOR
●	BOARD IN WIRE
◙	CONNECTOR
◘	BOARD IN CONNECTOR
○	TERMINAL
□	TERMINAL PLATE



2. CONTROL FUNCTIONS - Indoor Unit

1. Room Temperature Control

● The body sensor or remote controller sensor detects temperature in the room. The detected temperature is called the room temperature. The body sensor is the one contained in the indoor unit.

	Body sensor is enabled	Remote controller sensor is enabled
Set temp.	Set temp. in remote controller	Set temp. in remote controller
Detected temp. by sensor	Detected temp. by body sensor	Detected temp. by remote controller sensor
Room temp.	Detected temp. by body sensor - *correction temp.	Detected temp. by remote controller sensor

● The thermostat is turned ON or OFF according to the following ΔT.

ΔT (Cooling)	ΔT = room temp. – set temp. (set temp. in remote controller)
ΔT (Heating)	ΔT = set temp. – room temp.

※ Correction temperature (only during heating)

If the indoor unit is installed on the ceiling, temperature near the ceiling is higher than near the floor. When the body sensor is enabled, lower temperature near the floor must be considered. To correct this difference in temperature, the correction temperature is used.

The factory setting for the correction temperature is different depending on the model. See “13. Parameter”.

Example: Cooling temperature correction
4-Way cassette (correction temperature: 0 degrees)
Body sensor is enabled

Set temp. in remote controller	28℃	28℃	28℃
Detected temp. by sensor	30.0℃	27.5℃	27.0℃
Detected temp. by body sensor	30.0℃	27.5℃	27.0℃
Detected temp. by remote controller sensor	30.0℃	27.5℃	27.0℃
Room temp. = temp. detected by body sensor	30.0℃ =30.0	27.5℃ =27.5	27.0℃ =27.0
Δ T	+2.0deg	-0.5deg	-1.0deg
	Thermostat ON	Thermostat ON	Thermostat OFF

Example: Heating temperature correction
4-Way cassette (correction temperature: 4 degrees)
Body sensor is enabled

Set temp. in remote controller	20℃	20℃	20℃
Detected temp. by sensor	17.0℃	22.0℃	25.0℃
Detected temp. by body sensor	17.0℃	22.0℃	25.0℃
Detected temp. by remote controller sensor	13.0℃	18.0℃	21.0℃
Room temp. = temp. detected by body sensor – 4 deg	13.0℃ =17.0-4 deg	18.0℃ =22.0-4 deg	21.0℃ =25.0-4 deg
Δ T	+7.0deg	+2.0deg	-1.0deg
	Thermostat ON	Thermostat ON	Thermostat OFF

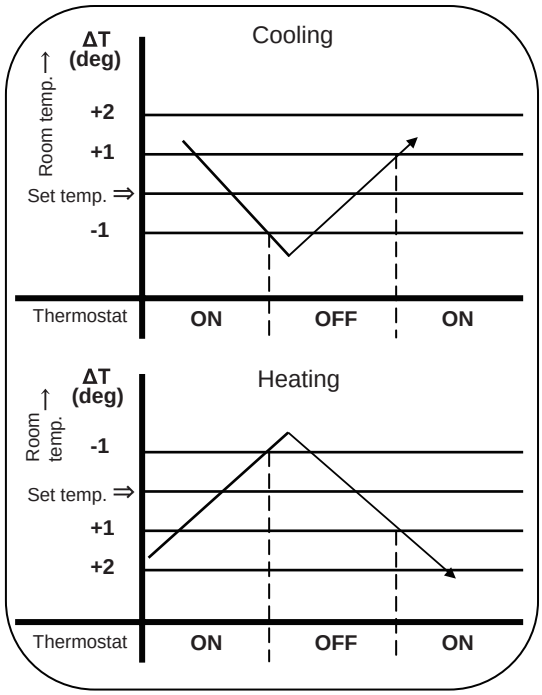
Remote controller sensor is enabled

Set temp. in remote controller	28℃	28℃	28℃
Detected temp. by sensor	30.0℃	27.5℃	27.0℃
Detected temp. by body sensor	30.0℃	27.5℃	27.0℃
Detected temp. by remote controller sensor	30.0℃	27.5℃	27.0℃
Room temp. = temp. detected by remote controller sensor	30.0℃ =30.0	27.5℃ =27.5	27.0℃ =27.0
∆ T	+2.0deg	-0.5deg	-1.0deg
	Thermostat ON	Thermostat OFF	Thermostat OFF

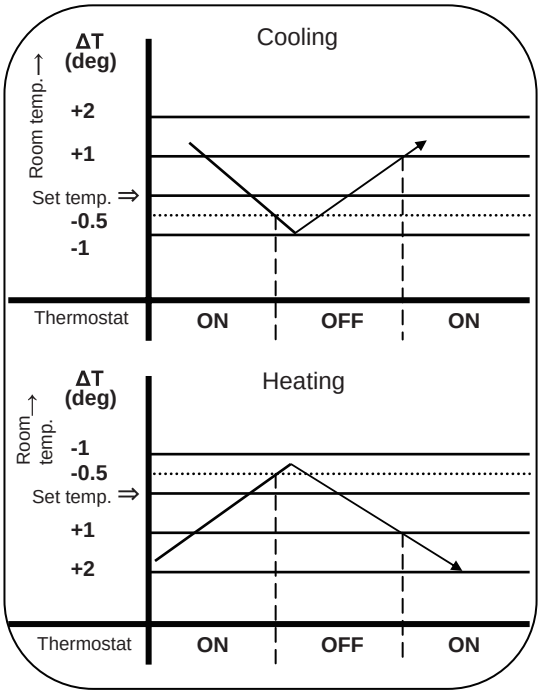
Remote controller sensor is enabled

Set temp. in remote controller	20℃	20℃	20℃
Detected temp. by sensor	17.0℃	20.5℃	21.0℃
Detected temp. by body sensor	21.0℃	24.5℃	25.0℃
Detected temp. by remote controller sensor	17.0℃	20.5℃	21.0℃
Room temp. = temp. detected by remote controller sensor	17.0℃ =17.0	20.5℃ =20.5	21.0℃ =21.0
∆ T	+3.0deg	-0.5deg	-1.0deg
	Thermostat ON	Thermostat OFF	Thermostat OFF

Body sensor is enabled



Remote controller sensor is enabled



① The thermostat does not turn OFF for 3 minutes after it turns ON.

② The thermostat does not turn ON 1 to 3 minutes after it turns OFF.

③ The thermostat does not turn OFF for 60 minutes during the test run mode. (Forced thermostat ON) *However, the thermostat turns OFF if an alarm occurs.

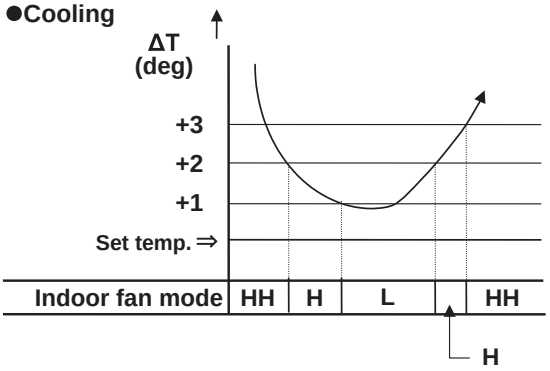
2. Heating Standby

● Refer to the indoor unit service manual.

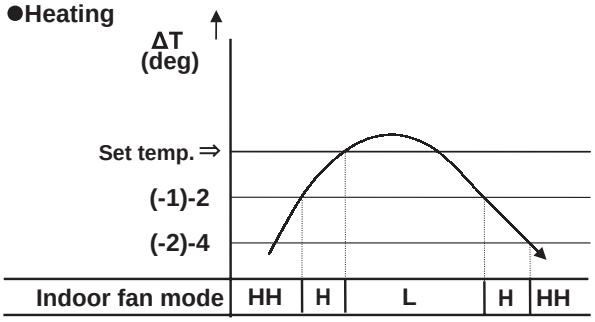
3. Automatic Fan Speed Control

① The indoor fan mode is controlled as shown below during the automatic fan mode.
② The fan mode does not change for 3 minutes during cooling operation and 1 minute during heating operation once it is changed.
③ The values in the parenthesis are when the remote controller sensor is enabled.

●Cooling



●Heating



4. Indoor Unit MOV Control

● For details, see the Section 1.

※ The MOV is at 480 pulses in the following cases.

① At the time of factory shipment
② Just after the indoor unit power cord is connected.

5. Drain Pump Control

The drain pump operates in the following conditions.

① Cooling thermostat ON
② The float switch worked.
③ The drain pump may often operate for a while when the cooling thermostat turns OFF or the indoor unit is stopped.
④ The drain pump can be turned on when the cooling thermostat is OFF if the setting is made to prevent water collected in the drain pan for a long time. For details, see the item "5-2. Detailed Settings Function" under the Section 5.
⑤ The indoor unit heat exchanger liquid temperature (E1) is less than 0˚C when the cooling thermostat is OFF or the indoor unit is stopped.

※ The drain pump operates for 20 minutes once it starts operating.

6. Automatic Heating / Cooling Control

- This function is only valid as long as one indoor unit is installed within one refrigerant system or all indoor units are controlled within a group control.
- When operating in a group control, the sub-indoor units become the same operation mode of the main unit.
- As for the indoor units in a group control, install them in the same air conditioning circumstances.
- Use the temperature sensor which is built-in sensor of the indoor unit.

① When operation starts, heating or cooling is selected according to the set temperature and the room temperature.
- Room temperature ≥ Set temperature + 1 → Cooling
- Set temperature – 1 < Room temperature ≤ Set temperature + 1 → Monitoring mode (*1)
- Room temperature < Set temperature – 1 → Heating

*1: If the difference between the room temperature and set temperature is small when operation starts, the cooling thermostat remains in standby status (OFF) until the temperature difference increases. When the temperature difference increases, either cooling operation or heating operation is selected. This standby status is known as "monitoring mode."

② After operation starts in the selected operating mode, the set temperature is automatically shifted by +2°C (*3) (cooling operation) or –2°C (*3) (heating operation).

Example: Temperature set on the remote controller is 20°C.

Control temp. for cooling	22˚C	* 20°C (temperature set) + 2°C (*3)
Remote controller display	20˚C	
Control temp. for heating	18˚C	* 20°C (temperature set) – 2°C (*3)

③ Operating mode changes (heating → cooling, cooling → heating) which occur during operation as a result of temperature changes are handled as shown below.
- Heating → cooling: Room temperature → Shifted set temperature (set temperature + 2°C (*3)) + 0.5°C
- Cooling → heating: Room temperature → Shifted set temperature (set temperature – 2°C (*3)) – 1.0°C

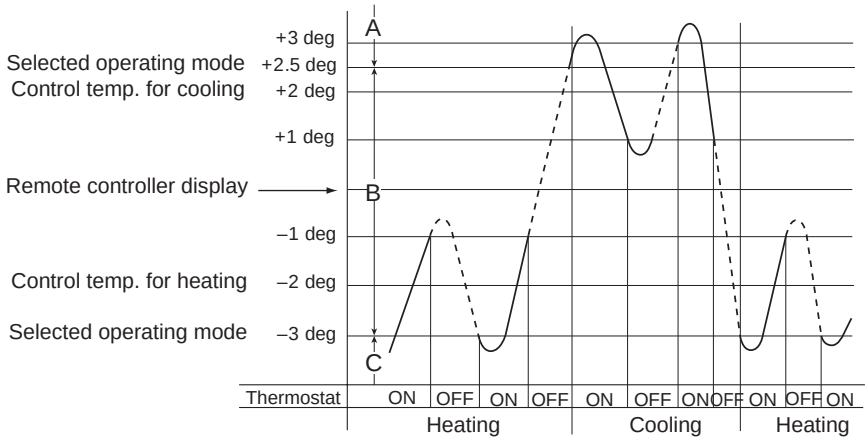
Example: Temperature set on the remote controller is 20°C.

	Operating mode change	Shifted set temp.
1	Heating → Cooling	20 + 2 (*3) + 0.5 = 22.5°C or higher (*2)
2	Cooling → Heating	20 – 2 (*3) – 1.0 = 17°C or lower

*2: During heating operation when the body sensor is used, a temperature shift is applied to the intake temperature detected by the sensor, in consideration of the difference in temperature at the top and bottom of the room. (Refer to the "Room Temperature Control" item.) If this intake shift temperature is 4°C, then the heating → cooling change occurs when the temperature detected by the body sensor is 26.5°C or higher.

④ Cooling (heating) operation does not change if the room temperature changes from area C → A (or A → C) within 10 minutes after the compressor turns OFF. (Monitoring mode is excepted.)

⑤ When the heating/cooling change occurs, the 4-way valve switches approximately 30 to 50 seconds after the compressor turns ON.



*3: Correction temp. is different depending on the model.
See the right column [Indoor item code "1E"] under the section "13. Parameter".

7. Discharge Air Temperature Control

Discharge air temperature is controlled using the indoor unit discharge air temperature sensor. The discharge air temperature is set in the EEPROM on the PCB. The setting is different depending on the model.

Discharge air temperature setting (at the time of factory shipment)

Indoor unit type	Discharge air temperature setting	
	Cooling	Heating
Y2, F2, M1, E2, K2, U2	12˚C	50˚C

● Condition for Thermostat ON → OFF under discharge air temperature control

① Temperature less than “Discharge air temperature setting – 2˚C” is continuously detected for 20 minutes in cooling mode

② Temperature more than “Discharge air temperature setting + 2˚C” is continuously detected for 20 minutes in heating mode

③ Temperature less than “Discharge air temperature setting – 3.5˚C” is continuously detected for 7 minutes in cooling mode

④ Temperature more than “Discharge air temperature setting + 3.5˚C” is continuously detected for 7 minutes in heating mode

※ There is no priority order between the room temperature control and discharge air temperature control.

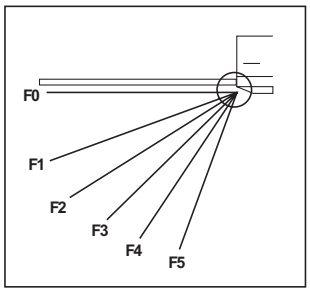
● Relation between thermostat ON / OFF and room temperature control / discharge air temperature control

Thermostat turns OFF: Either room temperature control or discharge air temperature control satisfies thermostat OFF condition.

Thermostat turns ON: Both of room temperature control and discharge air temperature control satisfy thermostat ON condition.

8. Automatic Flap Control

● The flap position can be selected from 5 positions.



Operating mode	Flap position
Cooling / Dry	F1・F2・F3
Fan	F1・F2・F3・F4・F5
Heating	F1・F2・F3・F4・F5

2

① The flap moves to the following position automatically when the indoor unit is stopped.
F0 (close): Types K2, T2, D1, U2, Y2
F5: Models other than the above

② The flap closes once and moves to the set position when the operating mode is changed.

※ If the flap position cannot be adjusted because of a problem, only the swing operation can be used. Check the flap and flap motor.

※ The swing operation can be set for the flap.

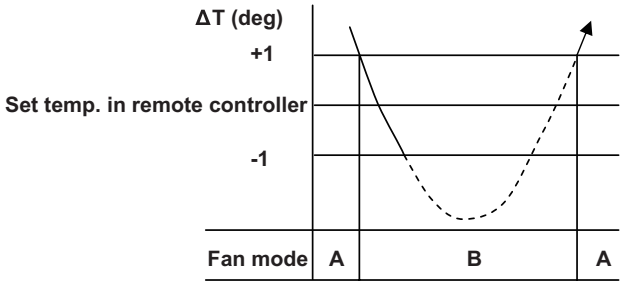
9. Filter Sign

① When accumulated operating time of the indoor unit reaches the set time, the filter sign appears on the remote controller. Clean the filter.
See page 5-5.

② After cleaning the filter, press the filter button on the remote controller once. The filter sign turns off.

10. Fan Control during Dry Mode

The fan control during dry mode is as follows.



A: Fan mode set in the remote controller

B: Fan mode is L during thermostat ON, LL during thermostat OFF

※ For details on ΔT, see “1. Room Temperature Control”.

11. Ventilation Fan Output

- The output of ventilation turns ON when the indoor unit turns ON. Also, when the indoor unit turns OFF, the output of the ventilation turns OFF.
- The ventilation fan can also be turned ON and OFF using the ventilation button on the remote controller.

Refer to the operating instractions supplied with the remote controller.

To enable this function, set the indoor EEPROM DN31 to “0001” in advance.

12. T10 Terminal

Using the T10 terminal, each indoor unit can be operated or stopped separately. Also, operating condition can be checked.

13. Parameter

Type	Model		Indoor item code “06”	Indoor item code “1E”
			Heating intake temperature shift	Temperature shift for cooling / heating change in auto heat / cool mode
			Setting at time of factory shipment	Setting at time of factory shipment
U2	4-Way Cassette		4 deg	2 deg
Y2	4-Way Cassette 60×60		4 deg	2 deg
L1	2-Way Cassette		4 deg	2 deg
D1	1-Way Cassette		4 deg	2 deg
F2	Low Silhouette Ducted		4 deg	2 deg
T2	Ceiling		4 deg	2 deg
K2	Wall Mounted	Type 15 - 36	3 deg	2 deg
		Type 45 - 106	2 deg	
M1	Slim Low Static Ducted		4 deg	2 deg
E2	High Static Pressure Ducted		4 deg	2 deg
	High Static Pressure Ducted (FRESH AIR INTAKE MODE)		0 deg	5 deg
P1	Floor Standing		0 deg	2 deg
R1	Concealed Floor Standing		0 deg	2 deg

3. OUTDOOR UNIT REPAIR PROCEDURES

1. Removing Panels

CAUTION Be sure to turn off the power before maintenance work.
Then start working when 5 minutes or longer has passed after turning off the power.

(1) Front panels removal
- Remove 2 front (upper and lower) panels.

(2) Power outlet panel & tubing cover removal
- Remove the power outlet panel.
- Remove the tubing cover.

Type 8HP / 10HP / 12HP

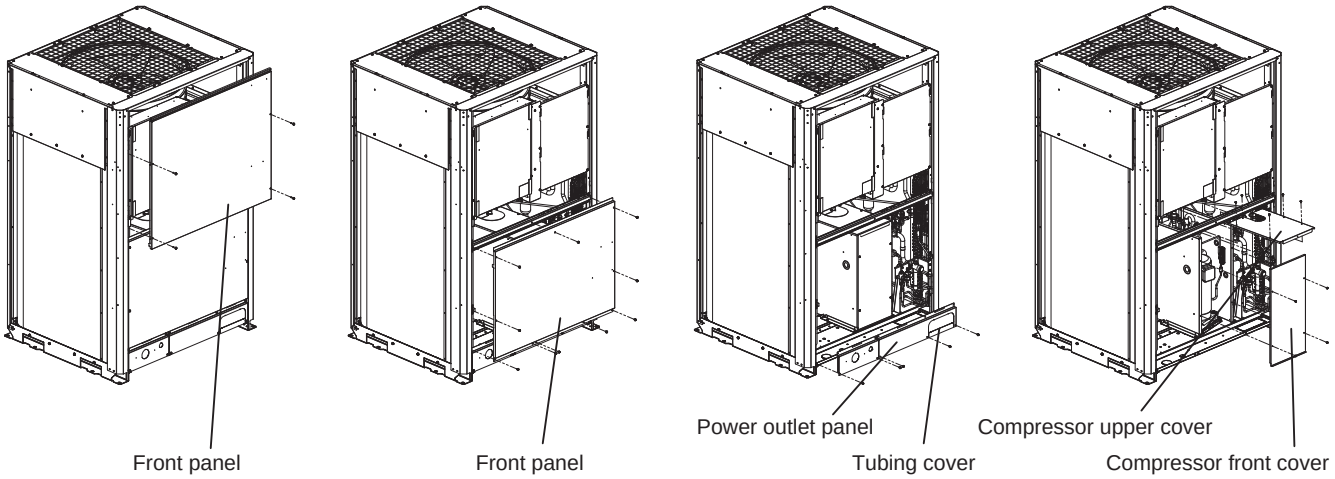


Fig. 1-a

Type 14HP / 16HP

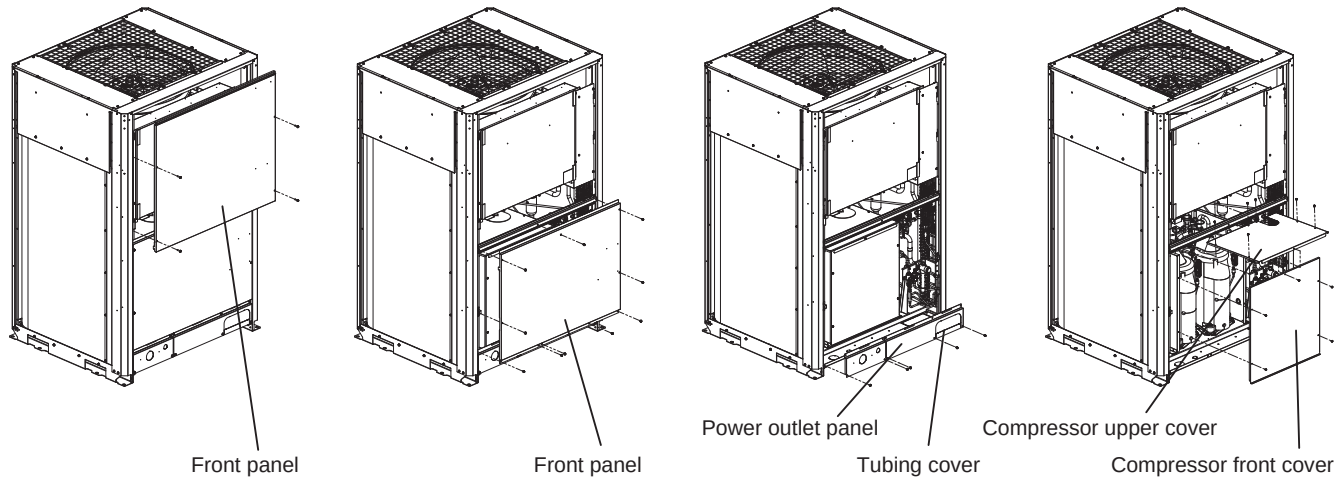


Fig. 1-b

2. Discharging Compressor Oil

Sampling of discharged oil can be used for checking the condition of the system. Based on the appearance and color of the discharged oil, a judgment can be made on whether the system is operating normally or not.

2-1. Discharging Oil from Oil Separator

Recover the refrigerant from the outdoor unit following the procedure given in “4. Recovering Refrigerant”.

- In the case of 1 outdoor unit in a system
  Open the balance tube using the flathead screwdriver.
- In the case of more than 2 outdoor units in a system
  Close other outdoor unit balance valves.

Install hoses as indicated on the equipment and feed nitrogen gas gradually to provide pressure to the system from the low-pressure outlet and collect oil in a pan or container. (Figs. 2-a and 2-b)

CAUTION

- The low-pressure outlet port is nearly at the center area in the unit.
- A faulty outdoor unit may remain pressurized. The oil outlet port employs a Schrader-type push-to-release valve. Be careful to avoid accidental oil release when using the port.

Type 8HP / 10HP / 12HP

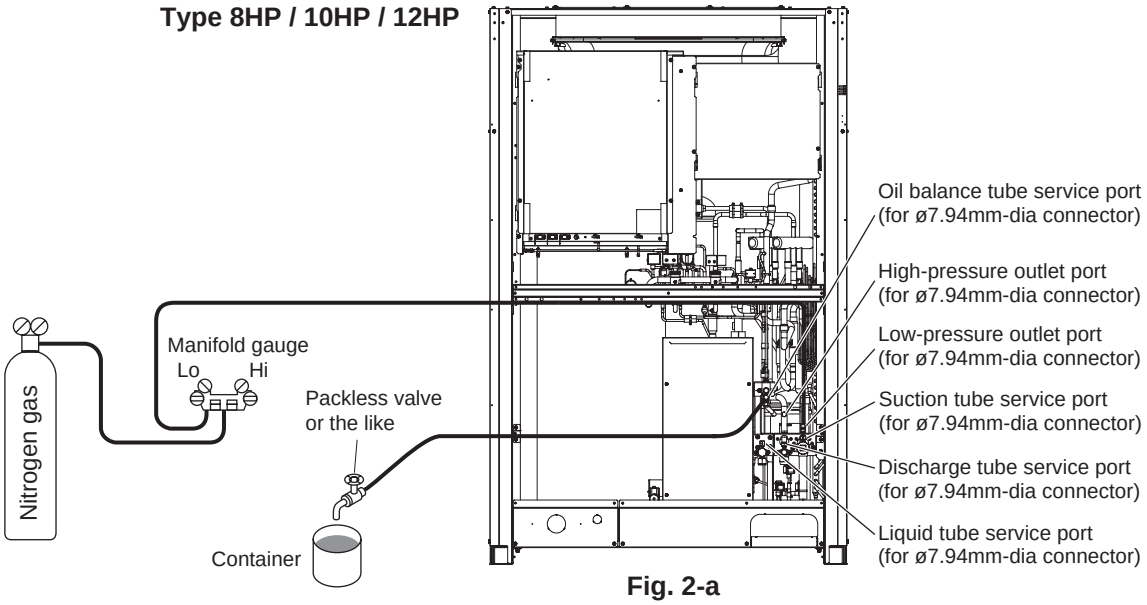


Fig. 2-a

Type 14HP / 16HP

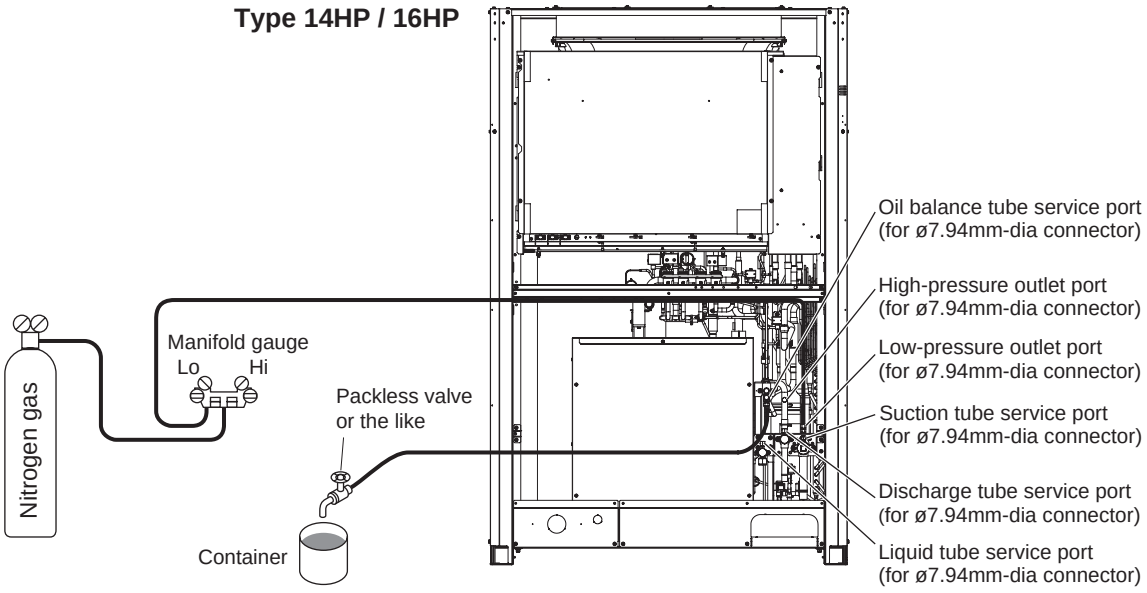


Fig. 2-b

2-2. Discharging Oil in Compressor

Recover the refrigerant in the outdoor unit following the procedures in “4. Recovering Refrigerant.” Remove the compressor and discharge the oil in it. See “9. Compressor” for detailed procedures.

2-3. Checking the Oil

Acceptance/rejection criteria for the oil

<table>
<tr><th rowspan="2">Condition of refrigeration cycle</th><th colspan="2">Condition of oil</th><th colspan="2">Judgment criteria for changing oil*</th></tr>
<tr><th>Color</th><th>Odor</th><th>Total acid value</th><th>Hue</th></tr>
<tr><td>Normal</td><td>Yellowish</td><td>None</td><td>0.02 or less</td><td>3.5 or less</td></tr>
<tr><td rowspan="2">Abnormal overheat-operation</td><td rowspan="2">Brownish</td><td rowspan="2">Smells somewhat (not as strong as below)</td><td>0.06 or over</td><td>4.0 or over</td></tr>
<tr><td colspan="2">Changing the oil and system cleaning with dry-cores are necessary.</td></tr>
<tr><td>Motor burnout</td><td>Brownish / blackish</td><td>Pungent / burnt odor</td><td colspan="2">Changing the oil and system cleaning with dry-cores are necessary.</td></tr>
</table>

* It is difficult to measure the total acid value in the field, therefore oil hue and odor are the rule of thumb. Checking for carbon deposits and abrasive metal powder can additionally be used to assess the system condition.

This system includes an emergency automatic backup function that allows the air conditioner to operate during the period after trouble occurs until repairs are made. However, during repair and at other times, use manual backup operation.

3-1. Automatic Backup

For details, see the item “12. Backup Operation” under the section 1.

After the alarm details are sent to the control device, control for automatic backup operation begins when the ON/OFF button of the wired remote controller is pressed again (operation is started after the alarm is cleared). During this operating mode, “⚠” blinks on the wired remote controller only to inform the user that operation is in backup mode. However, this is not displayed on any other control devices.

- In order to cancel automatic backup mode, it is necessary to reset the power of all the outdoor units in the system.

CAUTION **If the power is not reset on the control PCB of the No. 1 outdoor unit (main unit), backup mode operation will continue after the repairs are completed.**

Backup operation is intended as emergency operation until repairs are completed.
Have repairs made as soon as possible.

3-2. Manual Backup

This backup operation is the conventional method of backup operation. It involves disconnecting the failed outdoor unit from the system, and operating only the normal outdoor units.
For details, see “(2) Manual Backup Operation” of “12. Backup Operation” under the section 1.

3-2-1. Backup operation by disconnecting the outdoor unit

(1) Changing the outdoor unit control PCB settings

- Settings at No. 1 unit (main unit)

Switch on outdoor unit control PCB	Action
System address (SW2, SW1)	No change
No. of indoor units (SW4, SW3)	No change
No. of outdoor units (SW6)	Subtract the number of failed units from the current setting.
Outdoor unit No. (SW5)	No change

- Settings at normal outdoor units other than the No. 1 unit

  No particular changes

- Settings at the failed outdoor unit

  No particular changes

  However, close all service valves (suction tube, discharge tube, liquid tube, and balance tube) at the failed outdoor unit, and disconnect the communication wiring between the outdoor units.

CAUTION After recovery work is completed, wire the communication lines between indoor and outdoor units again. If it not finished yet, an alarm is emitted immediately.

(2) Adjusting the refrigerant for backup operation

During backup operation, all of the service valves on the failed unit are closed. However, if a check of the backup operating conditions shows that the level of gas is low, recover the refrigerant from the failed outdoor unit.
If the level of gas is too high, collect refrigerant at the failed outdoor unit.

- Recovering refrigerant

  With the normal outdoor units operating, monitor the operating condition and open/close the suction tube service valve on the failed outdoor unit where all the service valves were closed.
  In this way, recover refrigerant from the failed outdoor unit in order to adjust the amount of refrigerant in the system. After adjusting the amount of refrigerant, close the suction tube valve at the failed outdoor unit.

- Collecting refrigerant in the failed outdoor unit
  - Short-circuit the AP pin (CN24) on the control PCB of the failed outdoor unit where the service valves are closed, then turn the power ON. Also disconnect the wiring between the outdoor units.
  - With the normal outdoor units operating, monitor the operating condition and open/close the liquid tube service valve on the failed outdoor unit where all the service valves were closed.
    In this way, collect refrigerant in the failed outdoor unit in order to adjust the amount of refrigerant in the system.
  - After adjusting the amount of refrigerant, turn OFF the power at the failed outdoor unit, release the short-circuit at the AP pin (CN24), and close the liquid tube valve at the failed outdoor unit.

    * Refrigerant recovery is not affected by the power status of the failed outdoor unit. However, collecting refrigerant in the failed outdoor unit is affected by whether the power at that outdoor unit can be turned ON. If the power cannot be turned ON, use a refrigerant recovery device and recover the refrigerant into a recovery cylinder in order to adjust the amount of refrigerant in the system.

The following equipment and tools are required:

Jumper wire with clips, adjustable wrench, set of manifold gauge valves specially designed for refrigerant R410A only, vacuum pump, refrigerant recovery unit, pre-purged refrigerant cylinder for recovery, flathead screwdriver, and outdoor unit maintenance remote controller.

4-1. Refrigerant Recovery Procedures (from Outdoor Units)

(1) Turn off the power of the outdoor unit beforehand (at power mains).

(2) Fully close all the service valve of the outdoor unit.

(3) Connect the outdoor unit's high-pressure and low-pressure outlet ports with the Hi and Lo sides of the manifold gauge valves using hoses. (Figs. 3-a, 3-b)

CAUTION The remaining refrigerant in the faulty outdoor unit may create internal pressure. Before connecting hoses, be sure to confirm that each of the manifold gauge valves is tightly closed. Note that the connection ports employ Schrader-type push-to-release valves.

(4) Connect the manifold gauge valves, refrigerant recovery unit, and recovery cylinder using hoses. To avoid the entry of air into the refrigerant tube, carry out this connection work carefully. (Figs. 3-a, 3-b)

CAUTION For detailed procedures such as connecting the refrigerant recovery unit with the recovery cylinder and methods used for recovery, follow the specific instructions that came with the refrigerant recovery unit.

(5) Locate the AP pin (CN24) on the control PCB in the faulty outdoor unit and short them using the clips of the jumper wire. Then restore electrical power to the outdoor unit.

CAUTION By short-circuiting the AP pin (CN24), each solenoid valve in the outdoor unit is forcibly opened as soon as power comes on, which releases all remaining refrigerant into the recovery cylinder.
Since neglecting this procedure may leave some refrigerant in the system, it is important that you carry out this step.

(6) Carry out refrigerant recovery.

CAUTION To determine the completion of refrigerant recovery, follow the instructions that CAUTION came with the refrigerant recovery unit.

Type 8HP / 10HP / 12HP

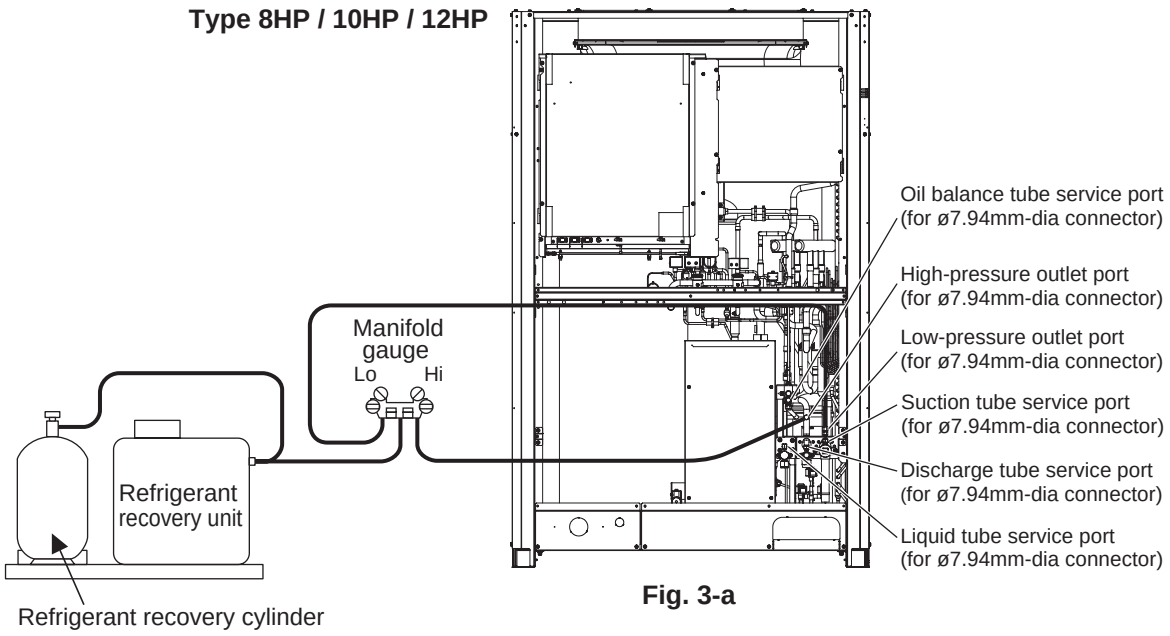


Fig. 3-a

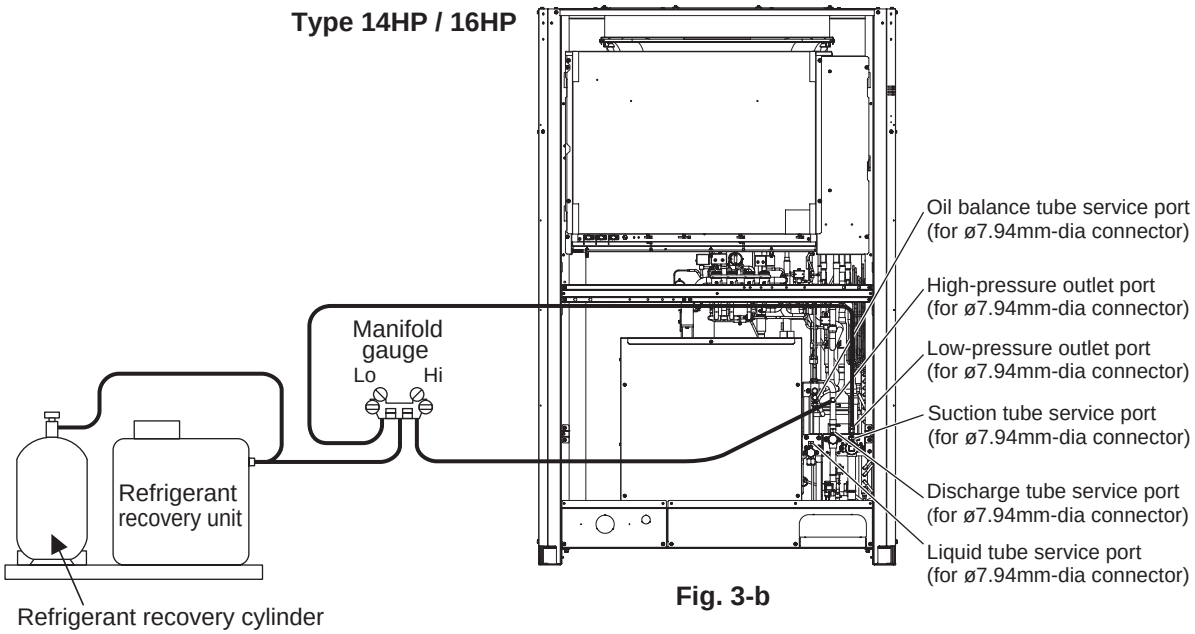
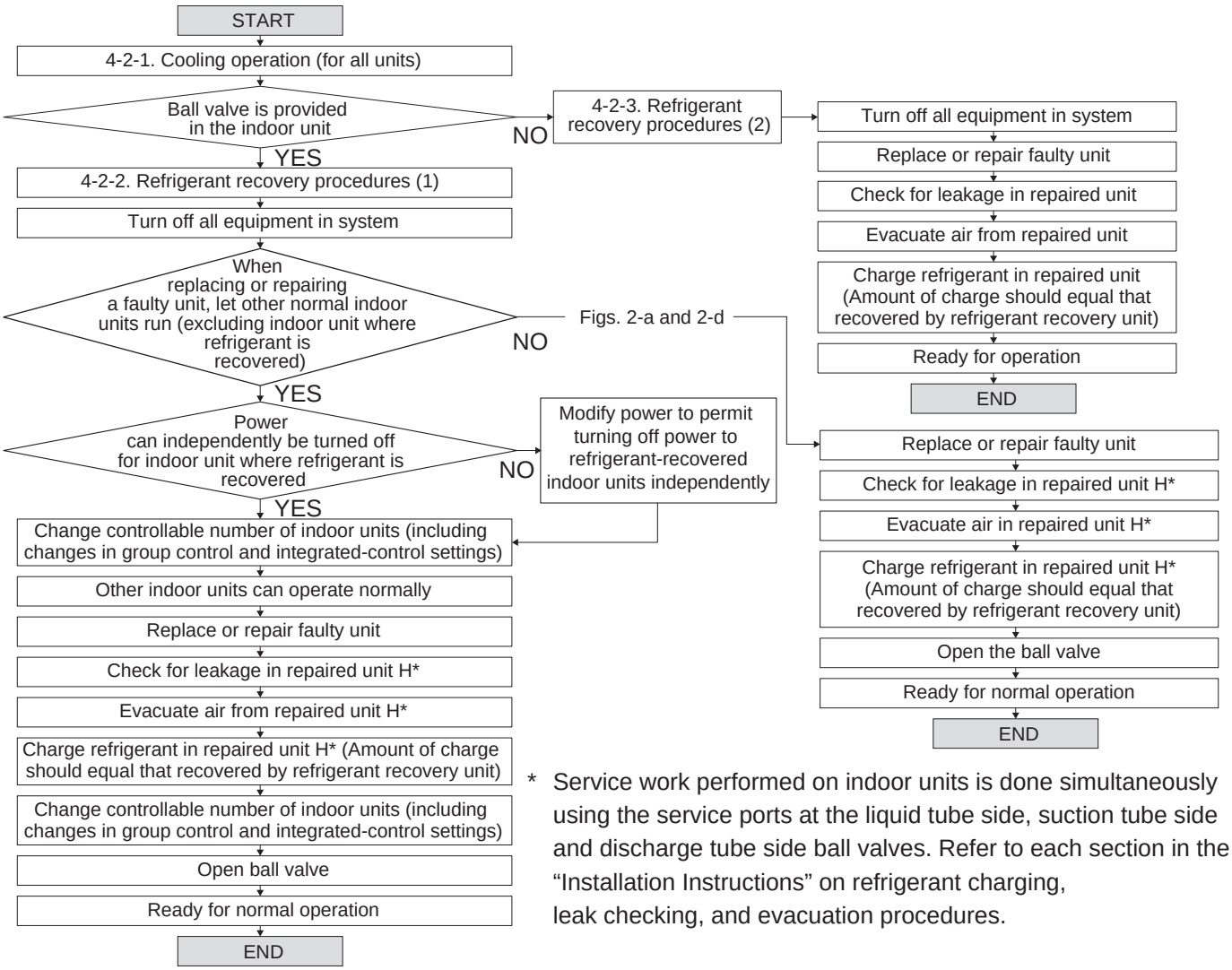


Fig. 3-b

4-2. Refrigerant Recovery Procedures (Indoor Unit)

The flowchart below shows the refrigerant recovery procedures you must follow when replacing or repairing the indoor unit due to trouble in the refrigerant circuit.



* Service work performed on indoor units is done simultaneously using the service ports at the liquid tube side, suction tube side and discharge tube side ball valves. Refer to each section in the “Installation Instructions” on refrigerant charging, leak checking, and evacuation procedures.

4-2-1. Cooling operation (for all units)

(1) If the remote controller is used for maintenance of the outdoor unit

1. Connect the outdoor unit maintenance remote controller to the RC connector (3P) (BLU) (CN73) on any one of the outdoor unit control PCBs. Then start a test run of all units. (Press and hold the (CHECK) button for 4 seconds or longer.)
2. Press the (MODE) button and change to cooling operation and ensure that the cooling is performed. See the Section 3 for the detail of the outdoor maintenance remote controller operation.
   It may be possible to determine whether operation is cooling or heating by touching the suction tube or discharge tube.
   Cooling : low temperature (20 °C or lower)
   Heating : high temperature (60 °C or higher)

CAUTION The discharge tube becomes hot (60 °C or higher) in heating mode. Be careful so as not to be burnt when touching the tube.

(2) If the remote controller is not available for maintenance of the outdoor unit.

1. Determine the outdoor unit where the unit No. setting (SW5) (3P DIP switch) (Blue) on the outdoor unit control PCB is set to No. 1.
2. Short-circuit the MODE pin (“COOL” side of CN40) on the main outdoor unit control PCB.
3. Short-circuit the CHK pin (CN23) on the PCB to start test run operation.

4-2-2. Refrigerant recovery procedures (1) (using indoor unit ball valve)

(1) If a ball valve with a service port has been provided in the indoor unit as shown in Fig. 4, follow the instructions given in (2) through (7) below. If the service port is instead located in the outdoor side, follow the instructions in “4-2-3. Refrigerant recovery procedures (2)”.

(2) Close the discharge tube ball valve.

(3) After running the unit in Cooling mode for about 5 minutes as described in “4-2-1. Cooling operation (for all units)”, fully close the liquid tube ball valve.

(4) Run the unit in Cooling mode for 10 to 20 minutes more.

(5) Fully close the suction tube ball valve, and stop the operation of all units.

(6) Use hoses to connect the manifold gauge valves, refrigerant recovery unit, and refrigerant recovery cylinder with each other. (Fig. 4) Do each connection quickly to prevent air from entering the tube.

CAUTION Remaining refrigerant may create internal pressure, therefore care should be taken when connecting the hoses.

(7) Recover the remaining refrigerant from the indoor unit using the refrigerant recovery unit.

NOTE

To determine completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

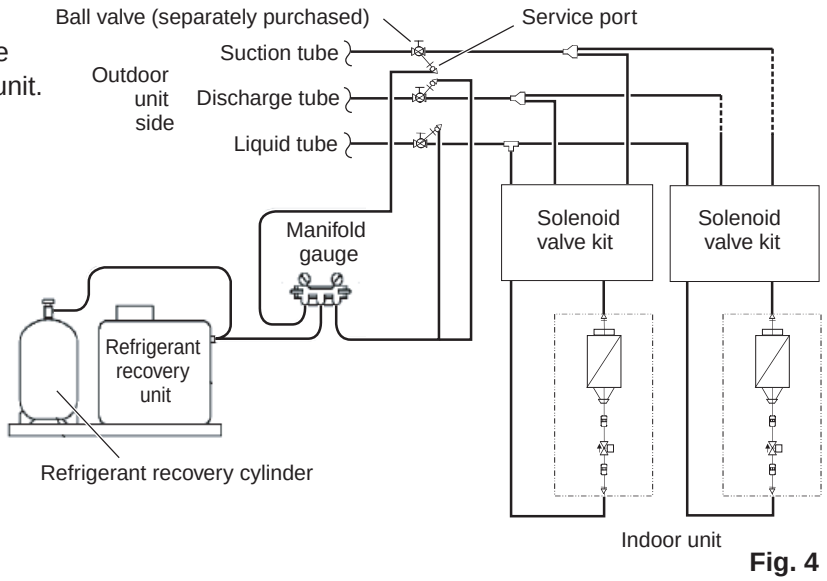


Fig. 4

4-2-3. Refrigerant recovery procedures (2): (Indoor unit with no ball valve equipped)

Refrigerant in all indoor units and the refrigerant tubing circuit must be pumped into the outdoor unit.
The maximum refrigerant storage capacity per a single outdoor unit is approx. 15 ~ 20kg.
Thus, in order to collect all refrigerant from the system, a separate refrigerant recovery unit is necessary.
Follow these procedures to correctly perform pump down.

Perform work correctly, according to the work procedures given below.

(1) Connect the manifold gauge to the high- and low-pressure outlet ports on the outdoor unit where pump down will be performed. Be sure that no air enters the tube at this time.
(2) Close the discharge tube valve.
(3) Follow the instructions in “4-2-1. Cooling operation (for all units)” and operate all units in Cooling mode for approximately 5 minutes. Then fully close the liquid tube valve on the outdoor unit where pump down will be performed.
(4) When the high-pressure gauge reaches 2.8 MPa or higher, or the low-pressure gauge reaches 0.5 MPa or below, at the outdoor unit where pump down is being performed, press the ON/OFF button on the outdoor unit maintenance remote controller to stop operation at all units. Then immediately fully close the suction tube valve on the outdoor unit where pump down is being performed.
    * When not using the outdoor unit maintenance remote controller, short-circuit the STOP pin (CN28).

CAUTION It is not necessary to recover the refrigerant from the balance tube.
Therefore do not operate the balance tube valve.

(5) Turn off power to all equipment in the system. Then pull out the RC1 connector (3P) (BLU) (CN75) on the outdoor control PCB in the outdoor unit for which pump down has been completed.
    * By pulling out the RC1 connector, communication between the main and the sub outdoor units will be isolated.
(6) Change the setting of controllable outdoor unit numbers (reduce by 1 unit).
    * If the setting is incorrect, the E30 alarm (outdoor unit serial communication signal error) occurs and the unit will not operate.
(7) Turn on power for all equipment in the system and let the remaining outdoor units run in Cooling mode.
(8) Repeat steps “(1)” and “(3)” and complete pump down for all outdoor units.
(9) Using hoses with Schrader-type push-to-release valves, connect the manifold gauge valves to the suction tube service port, the discharge tube service port and the liquid tube service port in the next outdoor unit to undergo pump down. (Figs. 5-a, 5-b)

CAUTION Remaining refrigerant in the system may cause internal pressure.
Check that each valve on the manifold gauge is tightly closed.
A Schrader-type push-to-release valve is provided for each connection port.

(10) Use hoses to connect the manifold gauge valves, refrigerant recovery unit, and refrigerant recovery cylinder. Quickly connect each part to prevent air from entering the tube.
(11) Recover remaining refrigerant from the inter-unit tube and indoor units using the refrigerant recovery unit.

NOTE

To determine the completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

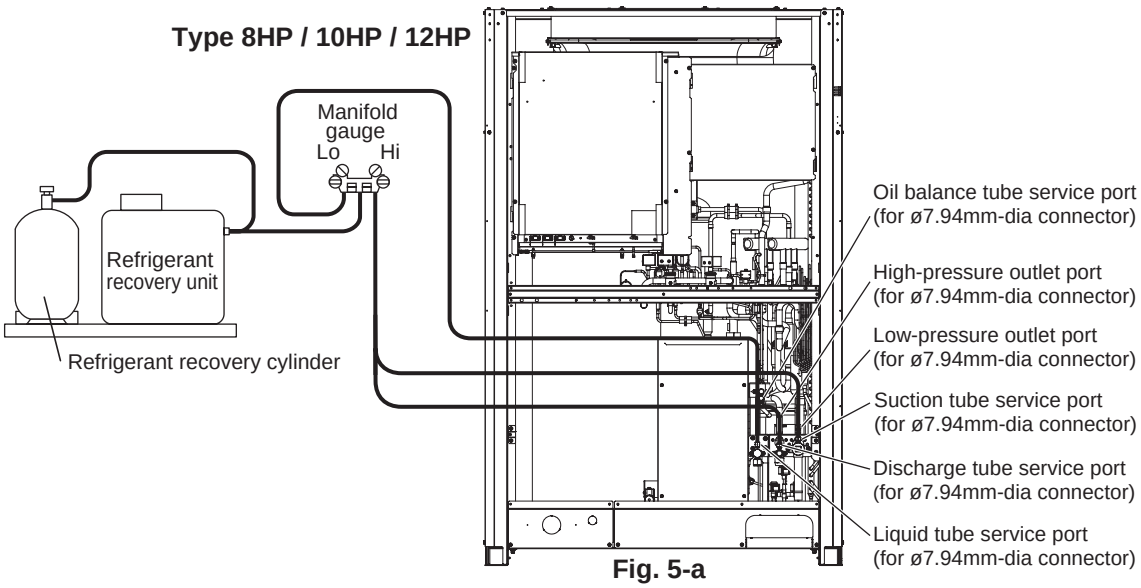


Fig. 5-a

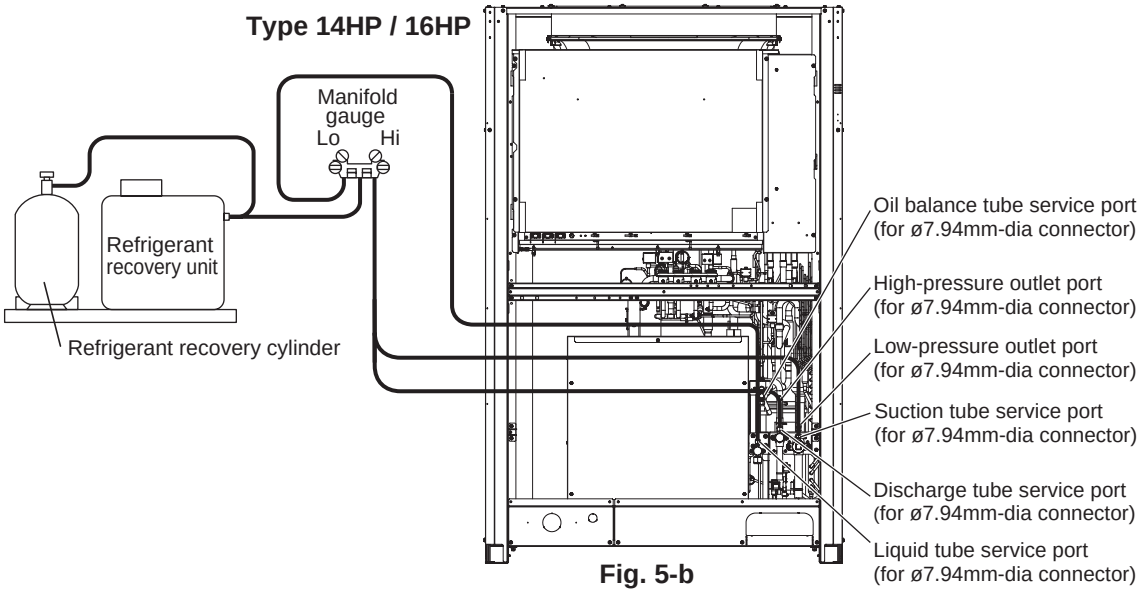


Fig. 5-b

4-3. Recovery of Refrigerant from Entire System

(1) Turn off power to the entire outdoor system.

(2) Short-circuit the AP pin (CN24) on the outdoor control PCB of all outdoor units, then supply power to the outdoor units.

* By short-circuiting the AP pin (CN24) and supplying power to the outdoor units, the solenoid valve in each unit is forcibly opened and all remaining refrigerant can be recovered.

(3) If any unit has encountered a power failure, follow the instructions in “4-1. Refrigerant Recovery Procedures (from Outdoor Units)” and perform refrigerant recovery for the faulty outdoor unit.

(4) Connect the manifold gauge to the high- and low-pressure outlet ports (Schrader-type valves) on any outdoor unit. (Figs. 5-a, 5-b)

CAUTION
Remaining refrigerant may cause internal pressure.
Check that each valve on the manifold gauge valves is tightly closed.
The connection port uses a Schrader-type push-to-release valve.

(5) Connect the manifold gauge valves, refrigerant recovery unit, and refrigerant recovery cylinder. Quickly connect each part to prevent air from entering the tube.

(6) Check that each service valve of the suction tube, discharge tube, liquid tube, and the balance tube for the outdoor unit has opened, then perform refrigerant recovery.

* If only a single outdoor unit is installed, the balance tube is not used. Therefore, leave this valve closed.

NOTE To determine the completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

5-1. Pressure Check for Leakage of Outdoor Unit

After completing repair of the outdoor unit, carry out the following leakage check.

(1) Check that all service valves for suction tube, discharge tube, liquid tube, and balance tube in the repaired outdoor unit (units necessary to carry out the pressurized leak check) are fully closed.

(2) Connect the manifold gauge valves to the high- and low-pressure outlet ports of the outdoor unit.

(3) Feed nitrogen gas into the circuit until 3.80 MPa pressure is reached. If it is apparent that the nitrogen gas is not entering the repaired section, interrupt the feeding. Short-circuit the AP pin (CN24) on the outdoor unit control PCB, turn on power to run the outdoor unit, then resume feeding nitrogen.

(4) Apply soapy water to the repaired part (such as a newly brazed part), and briefly inspect for any leakage. If there are any leaks, bubbles will show on the tubing surface.

* To continue the air-tight check after the brief leak inspection, turn on power while short-circuiting the AP pin (CN24).
Again feed nitrogen gas to obtain a system pressure of 3.80 MPa. Then measure both the outdoor ambient temperature and the pressure in the system. Leave the system in this state for 1 full day and night, and again measure the outdoor ambient temperature and pressure (to determine any reduced values).
During the inspection, it is recommended that an awning or cover be used to shield the unit in case of rain.
If no problem is found, purge all nitrogen from the system.

Type 8HP / 10HP / 12HP

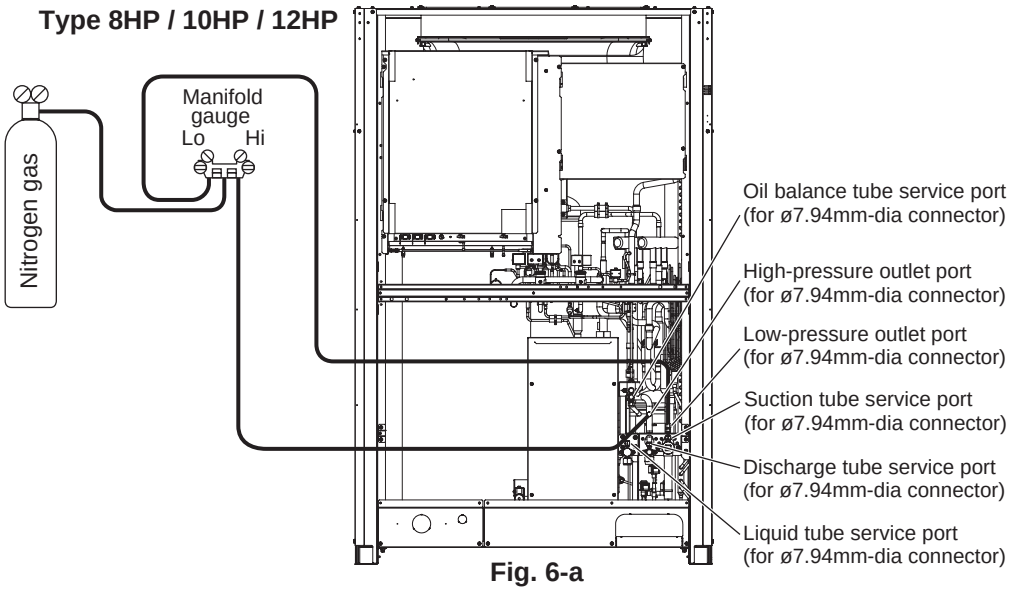


Fig. 6-a

Type 14HP / 16HP

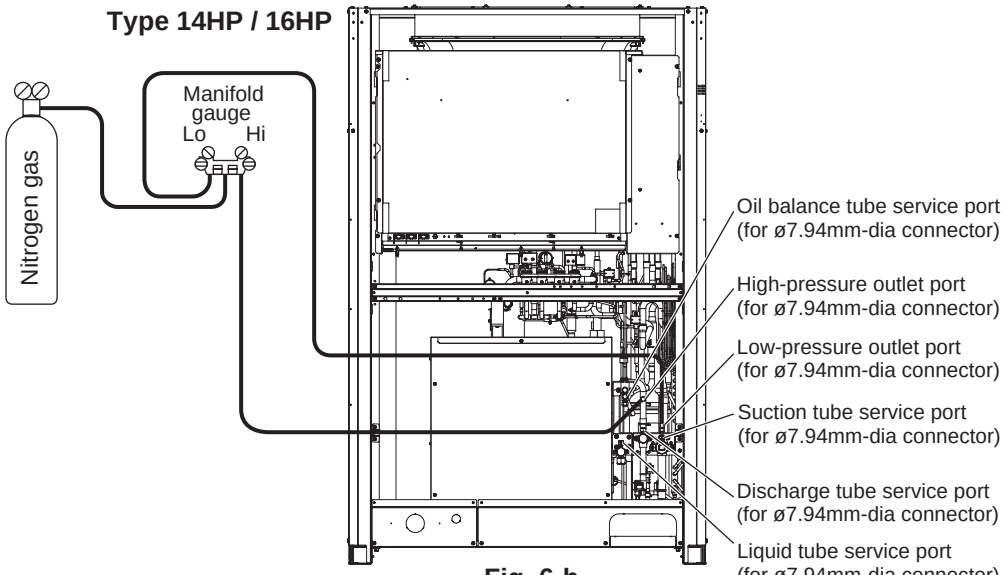


Fig. 6-b

5-2. Checking for Leakage in Refrigerant Tube Between Indoor and Outdoor Units

Refer to the “Installation Instructions” that came with the outdoor unit.

This procedure is carried out to ensure there is no remaining refrigerant or other gases (nitrogen, etc.) in the repaired outdoor unit and tube.

6-1. Evacuating Repaired Outdoor Unit

(1) Check that all service valves in the outdoor unit are fully closed.

(2) Connect the manifold gauge valves to the high-pressure and low-pressure sensor outlets of the outdoor unit. (Figs. 7-a, 7-b)

(3) Connect the manifold gauge valves to the vacuum pump.

* If the AP pin (CN24) on the outdoor control PCB have already been short-circuited, step (4) is not necessary.

(4) Turn off power to the repaired outdoor unit and short-circuit the AP pin (CN24) on the outdoor control PCB.

CAUTION By short-circuiting the AP pin (CN24) and turning on power to the outdoor unit, all electronic valves in the outdoor unit are forcibly opened and any remaining nitrogen gas can be recovered. Failure to perform this procedure may result in nitrogen gas remaining in the refrigerant circuit and causing operating problems. Therefore, never skip this step.

(5) Turn the power ON at the outdoor unit where vacuum will be applied. Then run the vacuum pump and continue evacuation until the vacuum condition falls to less than –101 kPa {–755 mmHg, 5 Torr}.

CAUTION To ensure proper evacuation, refer to the operating instructions that came with the vacuum pump.

Type 8HP / 10HP / 12HP

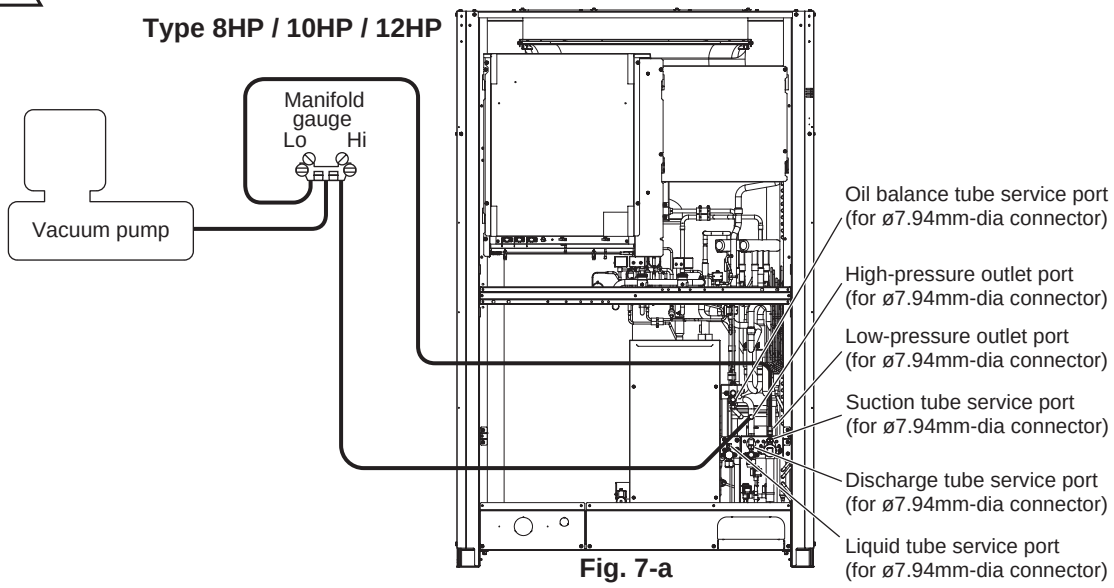


Fig. 7-a

Type 14HP / 16HP

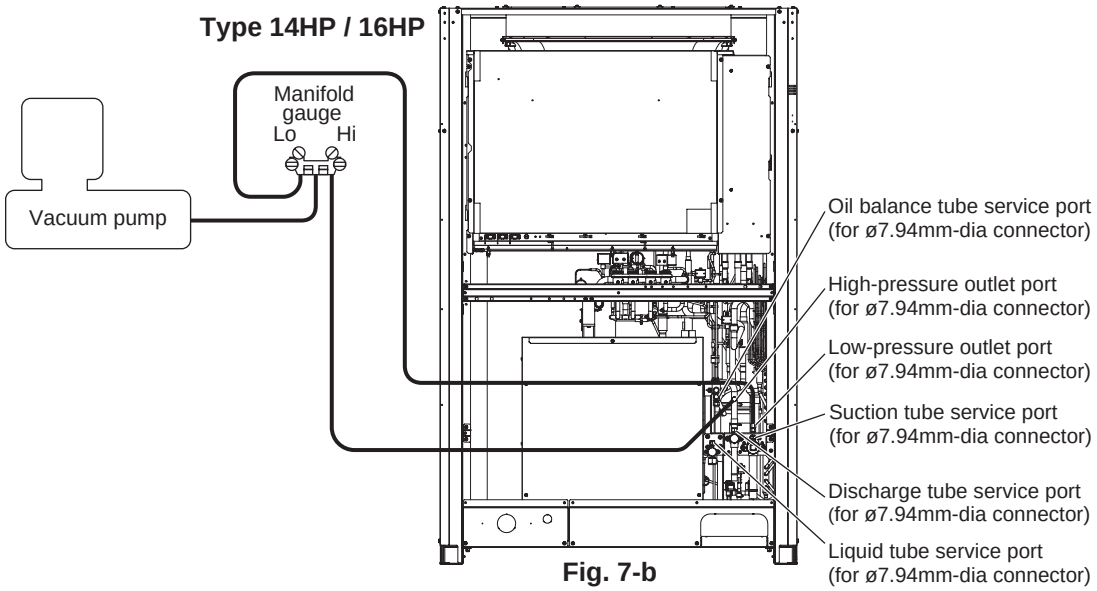


Fig. 7-b

6-2. Evacuating Refrigerant Tube Between Indoor and Outdoor Units

Refer to the “Installation Instructions” that came with the outdoor unit.

7-1. If Refrigerant Has Already Been Charged to Outdoor Unit

Be sure to use an exclusive oil-charging tank for charging compressor oil. Prior to charging, carry out vacuum drying inside the tank and take care that no air (in the form of bubbles) is permitted to enter the tank.

The oil charging procedures are given below.

* The receiver tank used for maintenance may be used as an exclusive oil-charging tank.

When installing the oil-charging tank to the refrigerant system to serve as a safety bypass circuit for refrigerant, connect it to the suction tube service port carefully to avoid releasing refrigerant into the atmosphere.

CAUTION Perform oil charging work carefully so that no liquid refrigerant enters the charging tank.

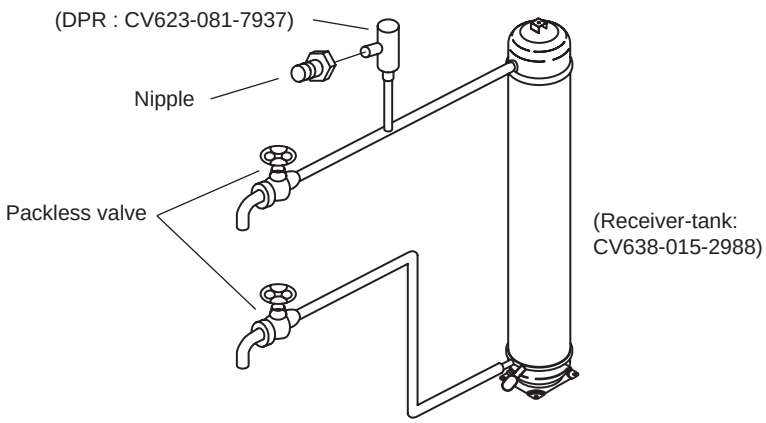


Fig. 8

(1) Evacuation drying in oil-charging tank

With the lower side valve fully closed, open the upper side valve and connect it to the vacuum pump via the manifold gauge valves as shown below. Run the vacuum pump and evacuate the tank until the pressure falls to below –101 kPa {–755 mmHg, 5 Torr} for the evacuation drying. After the evacuation drying is finished, fully close the upper valve. Next, fully close the manifold gauge valves and stop the vacuum pump.

CAUTION To ensure proper evacuation, refer to the operating instructions that came with the vacuum pump.

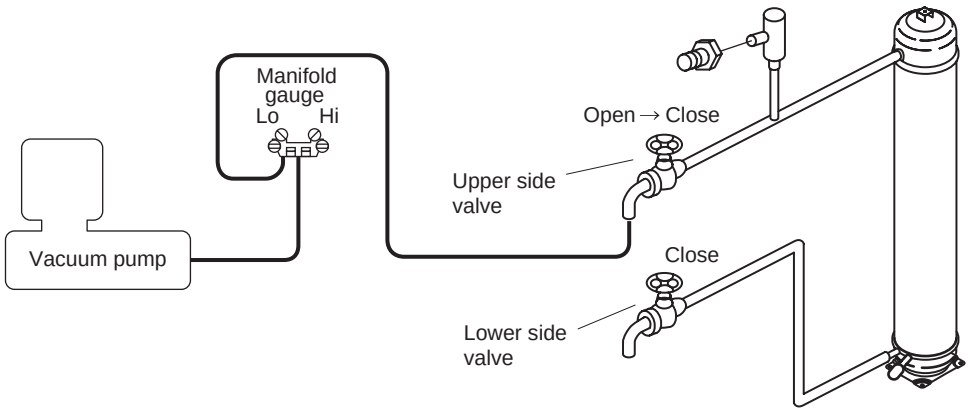


Fig. 9

(2) Charging compressor oil into oil-charging tank

Connect a piece of pipe to the lower valve and then insert the other end deeply into the bottom of the oil container. Make sure you avoid letting any air be sucked into the tube. Next, run the vacuum pump and open the manifold gauge valves, then open the upper and lower valves to begin charging oil into the charging tank.

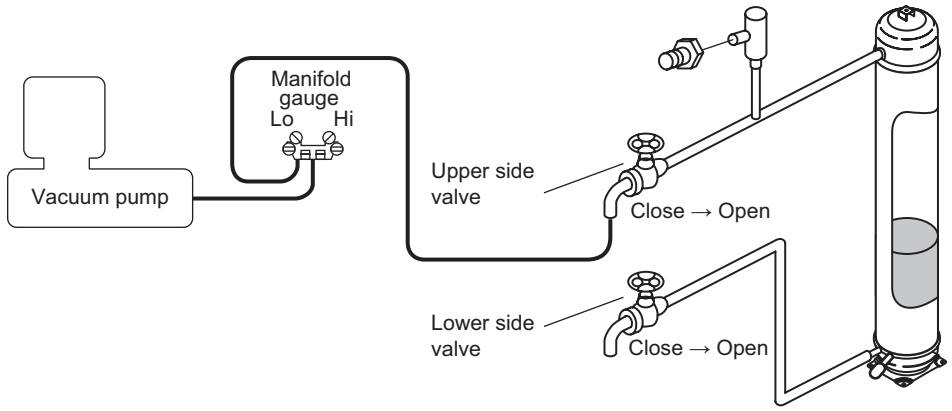


Fig. 10

When the predetermined amount of oil has been charged into the oil-charging tank, immediately close the lower valve. Next, run the vacuum pump until the system pressure reaches lower than –101 kPa {–755 mmHg, 5 Torr}. Close the upper valve and then, stop the vacuum pump.

CAUTION Do this operation quickly because compressor oil easily absorbs moisture from the air.

(3) Charging compressor oil into outdoor unit

Connect the lower valve to the low-pressure outlet (with Schrader-type push-to-release valve) in the outdoor unit to be oil-charged, and then connect the high-pressure outlet (with push-to-release valve) to the upper valve via the manifold gauge valves (at Hi-pressure gauge side). In addition, connect the suction tube service port (with push-to-release valve) to the DPR (Discharge Pressure Regulator). Carry out the connection work quickly to avoid letting air enter.

CAUTION

- The hoses may be subject to internal pressure from the refrigerant inside the outdoor unit. A Schrader-type push-to-release valve is provided at each connection port.
- Since the DPR valve opens at pressures of 2.5 MPa and above, be sure to connect the DPR to the suction tube service port (low-pressure side).

Type 8HP / 10HP / 12HP

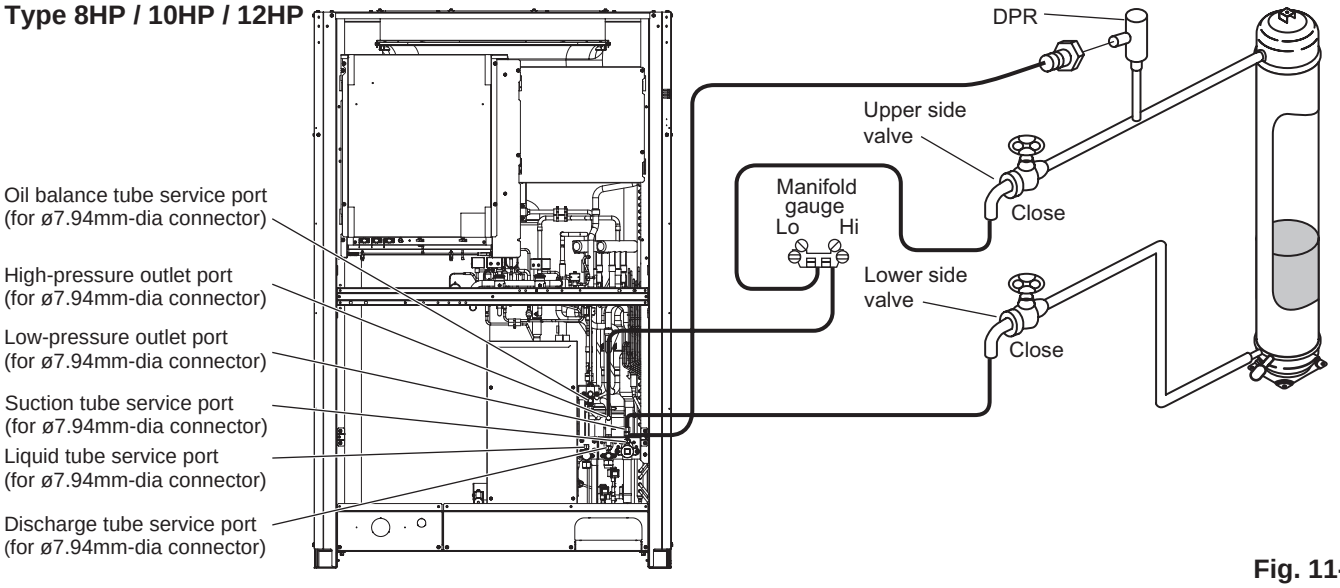


Fig. 11-a

Type 14HP / 16HP

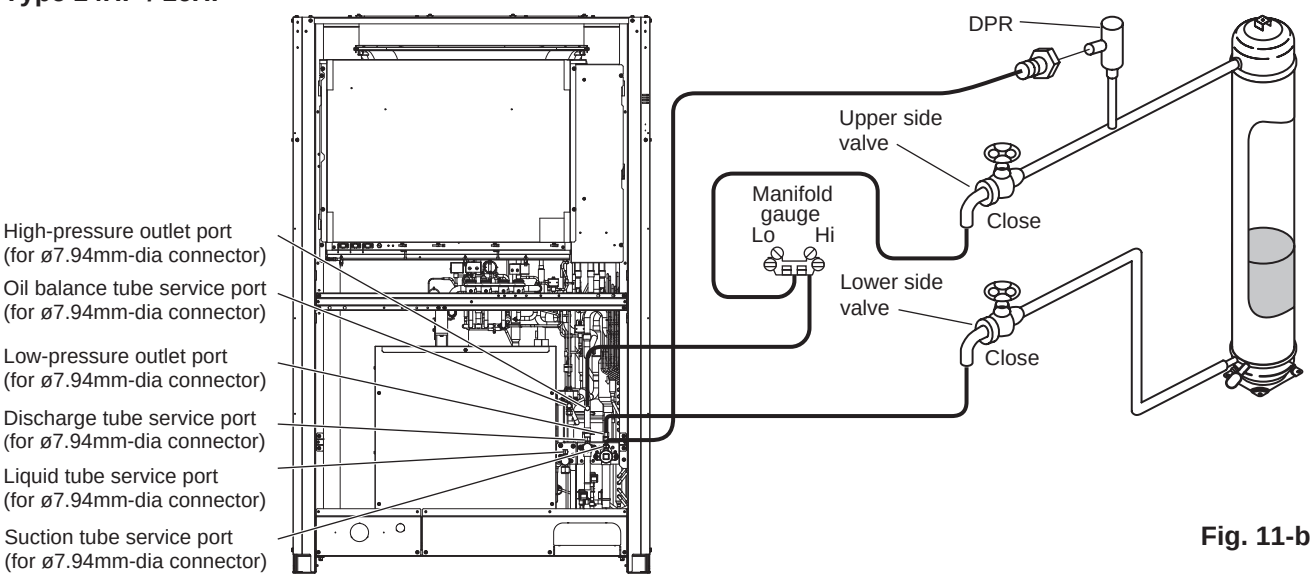


Fig. 11-b

Next, follow the instructions in “4-2-1. Cooling operation (for all units)” at the outdoor unit where oil will be charged, and start cooling operation at all units. After the operating conditions were stabilized, open each valve (Hi-side manifold gauge, upper valve and lower valve) in sequence as follows.

1. Open the valve on the high-pressure side of the manifold gauge.
2. Open the upper valve.
3. Open the lower valve.

When this is done, the refrigerant pressure from operation forces the oil out of the oil charge tank, and oil is charged into the outdoor unit from the low-pressure outlet port. Occasionally close the upper valve on the top of the oil charge tank (only this valve) and shake the tank to check the amount of remaining oil.

Process	Operating valve			
	Hi-side manifold gauge	Lo-side manifold gauge	Upper valve	Lower valve
Oil charging	Open	Close (No connection)	Open	Open
Oil charge completed	Close*	Close (No connection)	Open	Close after approx. 60 seconds
Refrigerant recovery (oil-charging tank inside)	Close	Open (Connect to refrigerant recovery tank)	Open	Close

Type 8HP / 10HP / 12HP

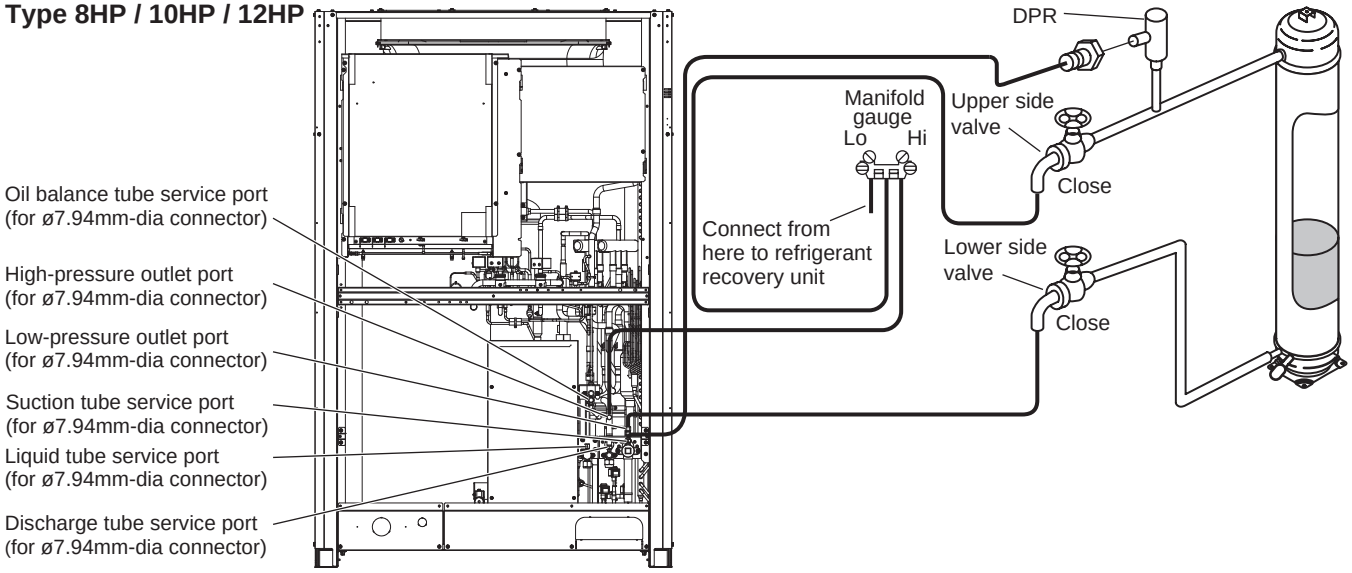


Fig. 12

Completing oil-charging

To terminate the oil charging work, do as follows:
To end the charge process, first close the valve on the Hi-side manifold gauge. Then wait approximately 60 seconds in order to vaporize the refrigerant in the charge tank. Then fully close the lower valve.

Refrigerant recovery (oil-charging tank inside)

Finally, connect the refrigerant recovery unit to the Lo-side manifold gauge, shut down all indoor and outdoor units, and then recover the remaining refrigerant in the oil-charging tank. Perform these procedures quickly and securely so that no air can enter them. Then, charge the necessary amount of new refrigerant by referring to the “Installation Instructions” that came with the outdoor unit.

NOTE

To determine the completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

7-2. If Outdoor Unit Has Not Been Charged with Refrigerant

When a compressor has been replaced or in any other case where the outdoor unit has not been charged with refrigerant, first charge with refrigerant then follow the instructions in “7-1. If Refrigerant Has Already Been Charged to Outdoor Unit” and charge with oil.

Or, alternatively, follow the procedure below.

(1) Connect a tube to the oil outlet port on the outdoor unit to be charged with oil. Insert the other end of the tube into the oil container.

(2) Follow the instructions in “6. Evacuating System,” and apply vacuum to the outdoor unit to be charged with oil. When this is done, oil is charged into the outdoor unit through the oil outlet port.

(3) When the unit has been charged with the designated amount of oil, stop the vacuum pump.

CAUTION **The oil absorbs moisture readily. This work must be completed quickly.**

Type 8HP / 10HP / 12HP

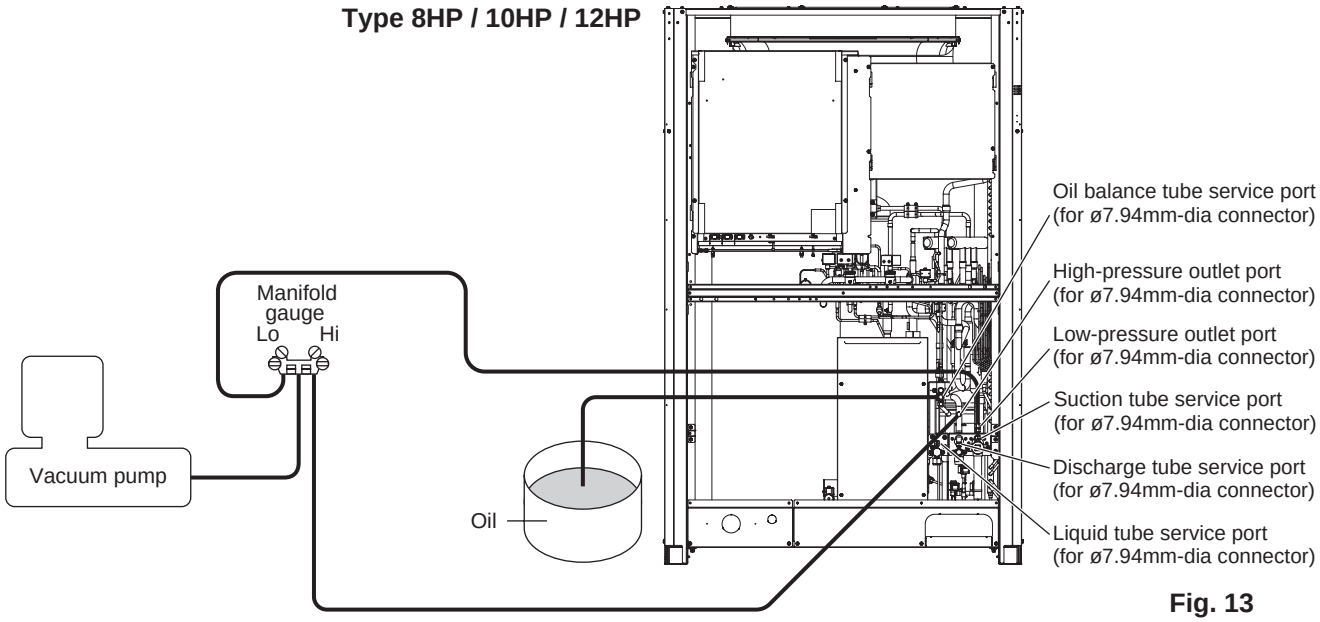


Fig. 13

7-3. Charging Additional Compressor Oil (after replacing compressor)

The rated weight of compressors as given below:

Outdoor Unit Type	Compressor model	Weight (OIL IN) [kg]
All Units	5JD650ZCA22	27.1

When replacing a faulty compressor, be sure to first measure the weight of the compressor.
If the surplus oil is removed along with the compressor, add the same amount of new oil.

For example:
Additional oil to be charged: 27.3 kg (removed compressor weight) – 27.1 kg (new compressor weight) = 0.2 kg ≒ 0.2 L

* If the result is a negative weight (removed compressor weight is less than the rated weight), it is not necessary to discharge the extra oil from the system.

For the method used for additional oil charging after compressor replacement, see the section “7-1. If Refrigerant Has Already Been Charged to Outdoor Unit.”

Required equipment and tools: Jumper wire with clips, adjustable wrench, set of manifold gauge valves for the refrigerant R410A, refrigerant recovery unit, pre-purged refrigerant cylinder for recovery, flathead screwdriver, and outdoor unit maintenance remote controller.
This work is performed in order to collect the refrigerant from an outdoor unit where repairs (other than compressor replacement) will be performed into other outdoor units and indoor units, and the refrigerant tubing.

8. Pumping Out Refrigerant from Outdoor Unit

8-1. If Remote Controller is Used for Maintenance of Outdoor Unit

(1) See “3. Backup Operation” and perform backup operation.

(2) Connect the manifold gauge valves at the Lo side to the low-pressure outlet port of the outdoor unit to be repaired. Also connect the refrigerant recovery cylinder to any one of the normal outdoor units at the liquid tube service port (Schrader-type push-to-release valve). Perform the connection work quickly so that no air is allowed to enter. (Fig. 14)

* Connecting the refrigerant recovery cylinder is done to prevent pressure from rising excessively during backup operation by recovering the refrigerant from the outdoor unit to be repaired.
(Measure the weight of the refrigerant and cylinder itself beforehand and provide sufficient safety measures, such as installing a high-pressure cutout in the circuit.)

CAUTION The hoses may be subject to internal pressure from the refrigerant inside the outdoor unit. Check that the manifold gauge valves are fully closed beforehand.
A Schrader-type push-to-release valve is provided at each connection port.

(3) Connect the outdoor unit maintenance remote controller to the RC connector (3P) (BLU) (CN73) on the outdoor unit control PCB of the outdoor unit to be repaired. Then start a test run of all units.
(Press and hold the (CHECK) button for 4 seconds or longer.)

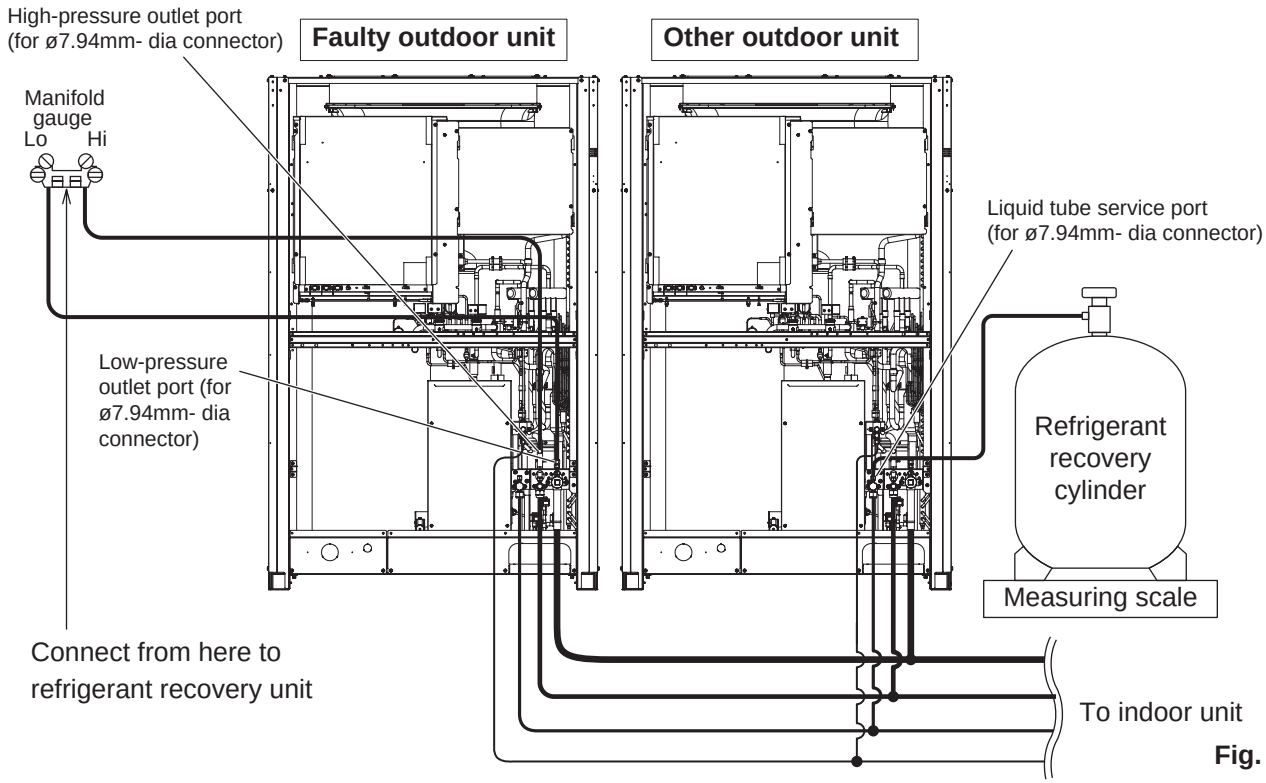


Fig. 14

(4) Use the outdoor unit maintenance remote controller to check the operating status of the indoor units.
Check that all units are operating in Heating mode.
For details concerning operation of the outdoor unit maintenance remote controller, see the section “Outdoor unit maintenance remote controller”.
It is also possible to check the operating conditions either in cooling or heating mode by touching the suction tube, discharge tube.

Cooling mode : low temperature (20°C or lower)
Heating mode : high temperature (60°C or higher)

CAUTION The discharge tube becomes hot (60°C or higher) in heating mode.
Be careful so as not to be burnt when touching the tube.

(5) Close the suction tube and balance tube on the outdoor unit to be repaired. Then slowly close the liquid tube service valve.

(6) When the low pressure at the outdoor unit to be repaired reaches 0.5 MPa or below, press the  (ON/OFF) button on the outdoor unit maintenance remote controller to stop all the units.
Then immediately fully close the discharge tube valve on that outdoor unit.

CAUTION While closing the valves, the rise in discharge temperature or another factor may cause a protective device to activate, stopping the operation of the outdoor unit.
If this occurs, immediately fully close the discharge tube valve on the outdoor unit to be repaired.

(7) Connect the high-pressure gauge side of the manifold gauge to the high-pressure outlet port on the outdoor unit to be repaired, and connect the manifold gauge to the refrigerant recovery device. Be sure that no air enters the tube at this time.

(8) Short-circuit the AP pin (CN24) on the outdoor unit control PCB of the unit to be repaired. Then turn ON the outdoor unit power.

CAUTION When the AP pin (CN24) is short-circuited and the power is turned ON, all solenoid valves in the outdoor unit are forced open, allowing the refrigerant to be recovered from all tubes which are separated by solenoid valves. If this work is not performed, it will not be possible to recover all of the refrigerant at the refrigerant recovery device. Be sure to perform this step.

* Open both Hi- and Lo-side valves on the manifold gauge valves, and recover the refrigerant remaining in the outdoor unit. After that, measure the amount of recovered refrigerant.

NOTE To determine the completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

8-2. If Remote Controller is Not Available for maintenance of Outdoor Unit

(1) See “3. Backup Operation” and perform backup operation.

(2) Connect the manifold gauge valves at the Lo side to the low-pressure outlet port of the outdoor unit to be repaired. Also connect the refrigerant recovery cylinder to any one of the normal outdoor units at the liquid line service port (Schrader-type push-to-release valve). Perform the connection work quickly so that no air is allowed to enter. (Fig. 15)

* Connecting the refrigerant recovery cylinder is done to prevent pressure from rising excessively during the backup operation by recovering the refrigerant from the outdoor unit to be repaired.
(Measure the weight of the refrigerant and cylinder itself beforehand and provide sufficient safety measures, such as installing a high-pressure cutout in the circuit.)

CAUTION The hoses may be subject to internal pressure from the refrigerant inside the outdoor unit. Check that the manifold gauge valves are fully closed beforehand.
A Schrader-type push-to-release valve is provided at each connection port.

(3) Determine the outdoor unit where the unit No. setting (SW5) (3P DIP switch) (BLU) on the outdoor unit control PCB is set to No.1.

(4) Short-circuit the MODE pin (“HEAT” side of CN40) on the outdoor unit control PCB of the No. 1 unit.

* Switching of the 4-way valve occurs immediately before operation starts. Therefore it does not change at this time. (Mode change cannot be judged from the sound.)

(5) Short-circuit the CHK pin (CN23) to start operation, leave the unit running for a while. Touch the suction tube, discharge tube with fingers to determine whether the unit is running in cooling mode.

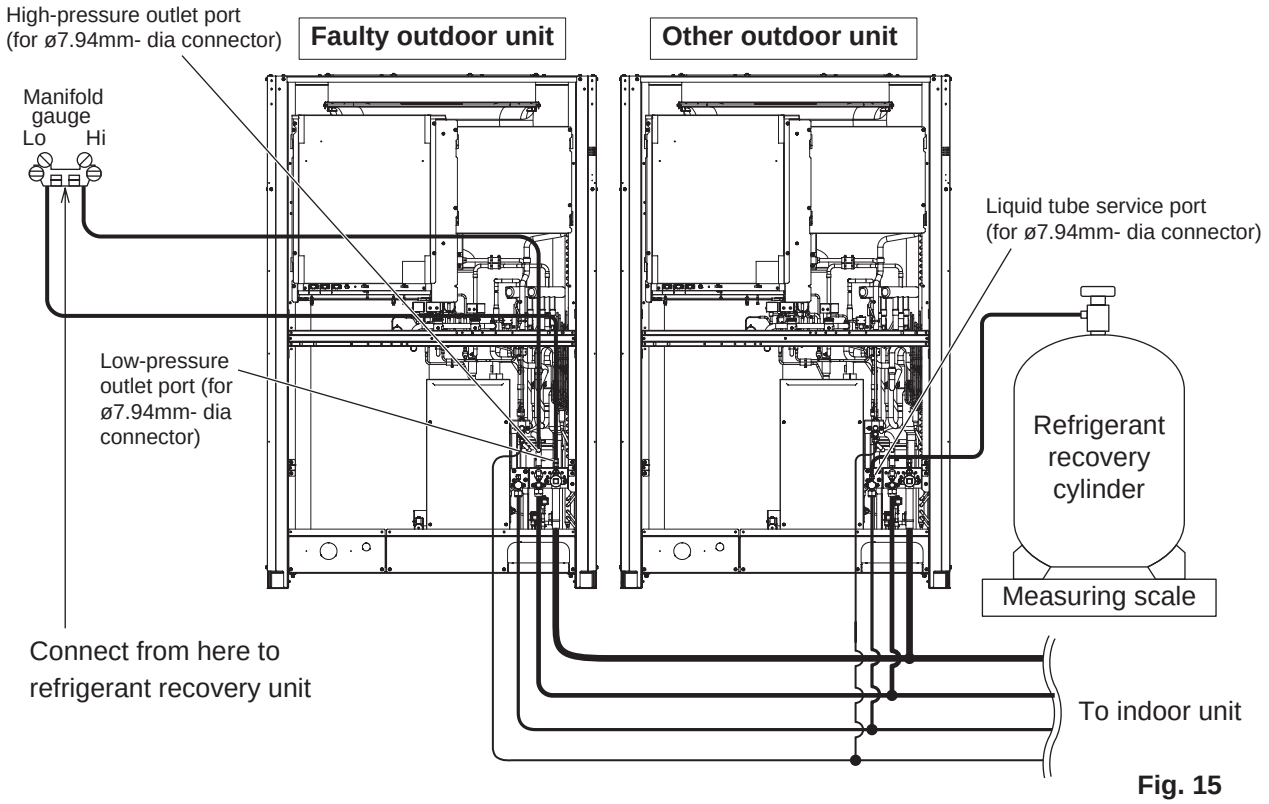


Fig. 15

(6) Close the discharge tube and balance tube on the outdoor unit to be repaired. Then slowly close the liquid tube service valve.
* When the low pressure at the outdoor unit to be repaired reaches 0.5 MPa or below, pull out the SCT connector (2P) (YEL) (CN65) from the outdoor unit control PCB of that outdoor unit. Then immediately fully close the suction tube valve on that outdoor unit.
* Pulling out the SCT connector immediately stops all of the outdoor units.

CAUTION
While closing the valves, the rise in discharge temperature or another factor may cause a protective device to activate, stopping the operation of the outdoor unit.
If this occurs, immediately fully close the suction tube valve on the outdoor unit to be repaired.

(7) Connect the high-pressure gauge side of the manifold gauge to the high-pressure outlet port on the outdoor unit to be repaired, and connect the manifold gauge to the refrigerant recovery device. Be sure that no air enters the tube at this time.

(8) Open both Hi- and Lo-side valves on the manifold gauge valves, and recover the refrigerant remaining in the outdoor unit. After that, measure the amount of recovered refrigerant.

NOTE To determine the completion of refrigerant recovery, follow the instructions that came with the refrigerant recovery unit.

9-1. Compressor Trouble Diagnosis and Check Methods

Generally, compressor failures can be classified into the following categories.

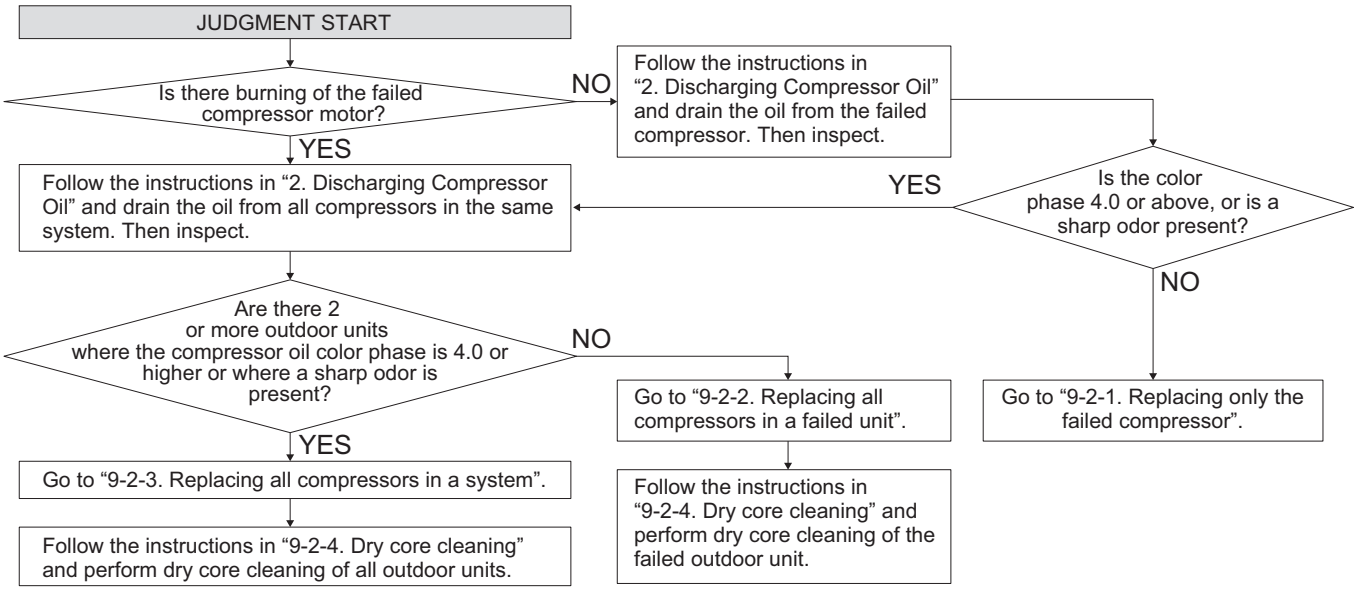
(1) Mechanical trouble → (A) Locking (intrusion of foreign objects, galling, etc.)
(B) Pressure rise failure (damaged valve, seal, bearing, or other component)
(C) Noise (damaged stator rotor, valve, or other component)
(2) Electrical trouble → (A) Coil burning
(B) Open circuit
(C) Insulation failure
(D) Short circuit

Trouble diagnosis is based on the following remote controller displays:

[P16] [P29] : Compressor 1, right side when viewed from front
[P19] [P26] : Compressor 2, left side when viewed from front

A judgment is made based on factors that include the following: coil resistance (varies depending on the compressor), insulation resistance, current, leakage breaker operation, oil and refrigerant fouling, odor, pressure, and noise.

Reference: Insulation resistance (Use a DC 500 V insulation resistance meter and measure the insulation resistance between the electrified and non-electrified parts.)
(1) Motor → Min. 300 MΩ
(2) Compressor → Min. 100 MΩ (servicing part)
(3) Unit → Min. 10 MΩ (This is due to the presence of refrigerant, which decreases the insulation resistance.)
* Minimum insulation resistance as required by generally accepted requirements is 1 MΩ.



Reference: Symptoms of motor burning
1. Ground fault results in breaker operation.
2. Short circuit results in different coil resistance at different phases.
3. Open circuit

9-2. Replacing the Compressor(s)

9-2-1. Replacing only the failed compressor

(1) If backup operation is required, follow the instructions in “3. Backup Operation” and engage backup operation.
(2) Follow the instructions in “9-3. Removing and Installing Compressors” and replace the failed compressor.
(3) Fully close the high- and low-pressure gauge valves on the manifold gauge, then stop the vacuum pump.
(4) Disconnect the manifold gauge from vacuum pump.
Connect the manifold gauge to the cylinder where the refrigerant was recovered.
At this time, be careful that air does not enter the tube.
(5) Open the valve on the refrigerant recovery cylinder and the high-pressure gauge valve on the manifold gauge to charge with refrigerant.
At this time, the low-pressure gauge valve on the manifold gauge remains fully closed.

CAUTION If the recovered refrigerant becomes mixed with another refrigerant or another gas (such as nitrogen or air), do not use the recovered refrigerant for charging. Charge with the designated amount of new refrigerant.

(6) When charging has been completed with an amount of new refrigerant equal to the amount of recovered refrigerant, or when charging with the same amount of new refrigerant has not been completed but no more refrigerant will enter the unit, fully close the high-pressure gauge valve on the manifold gauge.
Next, turn the power OFF at the repaired outdoor unit, then remove the short circuit at the AP pin (CN24).
Finally, fully open all valves on the suction tube, discharge tube, liquid tube, and balance tube.
However, leave the balance tube fully closed if only a single outdoor unit is installed.
(7) If backup operation was engaged, follow the instructions in “3. Backup Operation” and perform backup operation recovery.
(8) If charging with an amount of new refrigerant equal to the amount of recovered refrigerant was not possible, fully close the high-pressure gauge valve on the manifold gauge. Then, while the unit is operating in “4-2-1. Cooling operation (for all units)”, open the low-pressure gauge valve on the manifold gauge and charge with the designated amount of refrigerant.

CAUTION When charging with liquid refrigerant, add refrigerant a little at a time in order to prevent liquid back-flow.

(9) Fully close the low-pressure gauge valves on the manifold gauge, follow the instructions in “7. Charging Compressor Oil”, and charge with oil if necessary.
(10) Remove the manifold gauge.

CAUTION The connecting port employs a Schrader-type push-to-release valve. When disconnecting the hose, pressure will be applied from the refrigerant in the outdoor unit.

9-2-2. Replacing all compressors in a failed unit

(1) Follow the instructions in “2. Discharging Compressor Oil” and drain the oil from the oil separator in the failed unit. Measure the amount of drained oil.
(2) If backup operation is required, follow the instructions in “3. Backup Operation” and engage backup operation.
(3) Follow the instructions in “9-3. Removing and Installing Compressors” and replace all compressors in the failed unit.
(4) Fully close the high- and low-pressure gauge valves on the manifold gauge, then stop the vacuum pump.
(5) Disconnect the manifold gauge from the vacuum pump. Connect the manifold gauge to the refrigerant cylinder. At this time, be careful that air does not enter the tube.

CAUTION Do not reuse the recovered refrigerant. Use a refrigerant cylinder that contains new refrigerant.

(6) Open the valve on the refrigerant cylinder, and open the high-pressure gauge valve on the manifold gauge (with the low-pressure gauge valve closed). When charging has been completed with an amount of new refrigerant equal to the amount of recovered refrigerant, or when charging with the same amount of new refrigerant has not been completed but no more refrigerant will enter the unit, fully close the high-pressure gauge valve on the manifold gauge. Next, turn the power OFF at the repaired outdoor unit, then remove the short circuit at the AP pin (CN24).
Finally, fully open all valves on the suction tube, discharge tube, liquid tube, and balance tube.
However, leave the balance tube fully closed if only a single outdoor unit is installed.
(7) If backup operation was engaged, follow the instructions in “3. Backup Operation” and perform backup operation recovery.
(8) If charging with an amount of new refrigerant equal to the amount of recovered refrigerant was not possible, fully close the high-pressure gauge valve on the manifold gauge. Then, while the unit is operating according to “4-2-1. Cooling operation (for all units)”, open the low-pressure gauge valve on the manifold gauge and charge with the designated amount of refrigerant.

CAUTION When charging with liquid refrigerant, add refrigerant a little at a time in order to prevent liquid back-flow.

(9) Fully close the low-pressure gauge valves on the manifold gauge, follow the instructions in “7. Charging Compressor Oil”, and charge with the necessary amount of oil. Also add an amount of oil that is equivalent to the amount that was drained from the oil separator.
(10) Remove the manifold gauge.

CAUTION The connecting port employs a Schrader-type push-to-release valve. When disconnecting the hose, pressure will be applied from the refrigerant in the outdoor unit.

(11) Follow the instructions in “9-2-4. Dry core cleaning” and perform dry core cleaning of the outdoor unit that failed.

9-2-3. Replacing all compressors in a system

(1) Follow the instructions in “2. Discharging Compressor Oil” and drain the oil from the oil separators in all outdoor units. Measure the amount of drained oil.
(2) Follow the instructions in “9-3. Removing and Installing Compressors” and replace all compressors in the system.
(3) Follow the instructions in “5. Checking for Leakage After Repair” and check for leaks at all outdoor units and in the tube.
(4) Follow the instructions in “6. Evacuating System” and apply vacuum to all outdoor units and tube.
(5) Fully close the high- and low-pressure gauge valves on the manifold gauge, then stop the vacuum pump.
(6) Disconnect the manifold gauge from vacuum pump. Connect the manifold gauge to the refrigerant cylinder. Be especially careful that air does not enter the tube.

CAUTION Do not reuse the recovered refrigerant. Use a refrigerant cylinder that contains unused refrigerant.

(7) Open the valve on the refrigerant cylinder, and open the high-pressure gauge valve on the manifold gauge. When charging has been completed with an amount of new refrigerant equal to the amount of recovered refrigerant, or when charging with the same amount of new refrigerant has not been completed but no more refrigerant will enter the unit, first turn the power OFF at the repaired outdoor unit, then remove the short circuit at the AP pin (CN24). Then fully open all valves on the suction tube, discharge tube, liquid tube, and balance tube.
However, leave the balance tube fully closed if only a single outdoor unit is installed.
(8) If backup operation was engaged, follow the instructions in “3. Backup Operation” and perform backup operation recovery.
(9) If charging with an amount of new refrigerant equal to the amount of recovered refrigerant was not possible, fully close the high-pressure gauge valve on the manifold gauge. Then, while the unit is operating according to “4-2-1. Cooling operation (for all units)”, open the low-pressure gauge valve on the manifold gauge and charge with the designated amount of refrigerant.

CAUTION When charging with liquid refrigerant, add refrigerant a little at a time in order to prevent liquid back-flow.

(10) Fully close the low-pressure gauge valves on the manifold gauge, follow the instructions in “7. Charging Compressor Oil”, and charge with the necessary amount of oil. Also add an amount of oil that is equivalent to the amount that was drained from the oil separators.
(11) Remove the manifold gauge.

CAUTION The connecting port employs a Schrader-type valve. When disconnecting the hose, pressure will be applied from the refrigerant in the outdoor unit.

(12) Follow the instructions in “9-2-4. Dry core cleaning” and perform dry core cleaning of all outdoor units.

9-2-4. Dry core cleaning

If burning or other failures occur repeatedly at compressors within the same system, in many cases the cause is acid, sludge, carbon, or other substances that remain in the refrigeration cycle as the result of insufficient cleaning. If, when the oil is inspected, there is an outdoor unit where the oil color phase is 4.0 or higher, or where a sharp odor is present, carry out all steps below to perform dry core cleaning.
And use the bidirectional dry core for refrigerant R410A.

(A) If a ball valve is installed on the outdoor unit

(1) See “4-2-1. Cooling operation (for all units)” and operate all outdoor units in either Heating or Cooling mode.

(2) If all units are operated in Cooling mode, close first the liquid tube service valve then the ball valve on all outdoor units where dry cores will be attached.
If all units are operated in Heating mode, close first the ball valve then the liquid tube service valve on all outdoor units where dry cores will be attached.
* This step is performed in order to expel refrigerant from the tube between the liquid tube service valve and the ball valve. Approximately 4 – 5 seconds is a sufficient interval between closing each of the 2 valves.

(3) Press the  (ON/OFF) button on the outdoor unit maintenance remote controller to stop the operation of all units.
* If the outdoor unit maintenance remote controller is not available, use the following method to stop the operation of all units:
Pull out the SCT connector (2P) (YEL) (CN65) from the outdoor unit control PCB of the unit where pump-down is being performed. When the SCT connector is pulled out, alarm F12 (sensor trouble) immediately occurs and all outdoor units stop operating. Be sure that you do NOT grasp the lead wire when pulling out the connector. Removing any other connector may not cause the units to stop. Therefore be sure to pull out only the SCT connector.

(4) Connect a refrigerant recovery device to the liquid tube service port (Schrader-type valve) of all outdoor units where dry cores will be attached, then recover the refrigerant from the tube. Be sure that no air enters the tube at this time.

CAUTION

When the hose is connected, internal pressure is applied by the remaining refrigerant in the inter-unit tube. The connection port employs a Schrader-type valve.
To determine when refrigerant recovery is complete, follow the instructions in the instruction manual of the refrigerant recovery device.

(5) As shown in Fig. 16, disconnect the tube that runs from the liquid tube valve to the ball valve on all outdoor units where dry cores will be attached. Then attach the dry cores.

(6) At all outdoor units where dry cores are attached, pressurize with 3.80 MPa of nitrogen from the liquid tube service port and check for leaks.

(7) After evacuating all nitrogen gas from the tube, apply vacuum from the liquid tube service port to all outdoor units where dry cores are attached until the pressure is –101 kPa {–755 mmHg, 5 Torr} or less.

(8) Fully open the liquid tube valve and ball valve on all outdoor units where dry cores are attached.

(9) Operate all outdoor units for approximately 3 hours (in either Heating or Cooling mode or mixed Cooling and Heating mode).

(10) Follow the above procedure, and replace all dry cores with new dry cores.

(11) Operate all outdoor units for approximately 20 minutes (in either Heating or Cooling mode or mixed Cooling and Heating mode).

(12) Follow the instructions in “2. Discharging Compressor Oil” and drain a small amount of the oil from the oil separators of all outdoor units where dry cores are attached. Check the color phase, odor, and other characteristics.

(13) If the results show that dry core cleaning is still necessary (for example, a color phase of 4.0 or higher)*, return to Step (11) and repeat until the results are normal (including a color phase of 3.5 or less)*.

* Color sample sheet for degree of stain

CAUTION Perform another dry core replacement after approximately 30 hours of system operation.

(14) Perform steps (1) – (4), and remove all dry cores. Then connect the tube between the liquid tube valves and the ball valves.

(15) At all outdoor units where dry cores were removed, pressurize with 3.34 MPa of nitrogen from the liquid tube service port and check for leaks.

(16) After evacuating all nitrogen gas from the tube, apply vacuum to all outdoor units where dry cores were removed until the pressure is –101 kPa {–755 mmHg, 5 Torr} or less.

(17) **INSTALLATION:** Refer to the Installation Instructions for further information.
Charge with an amount of refrigerant equal to the amount that was recovered.

(B) If a ball valve is not installed on the outdoor unit

(1) See “4-2-3. Refrigerant recovery procedures (2) : Indoor unit with no ball valve equipped”. Perform pump down of the refrigerant from all indoor units and inter-unit tube to the outdoor unit side.

(2) Cut the liquid tube at all outdoor units where dry cores will be attached, then attach the dry cores and ball valves as shown in Fig. 16.

(3) For the next steps, see the steps (6) – (17) in “(A) If a ball valve is installed on the outdoor unit” on the previous page.

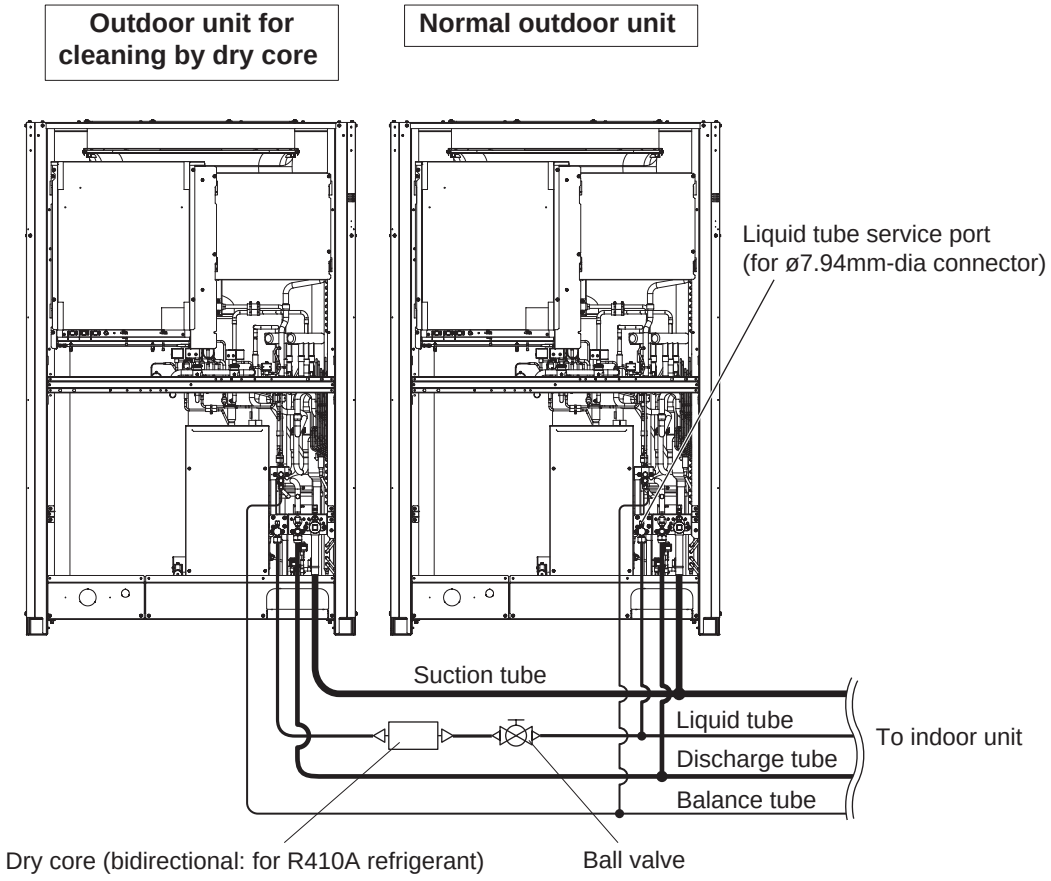


Fig. 16

9-3. Removing and Installing Compressors

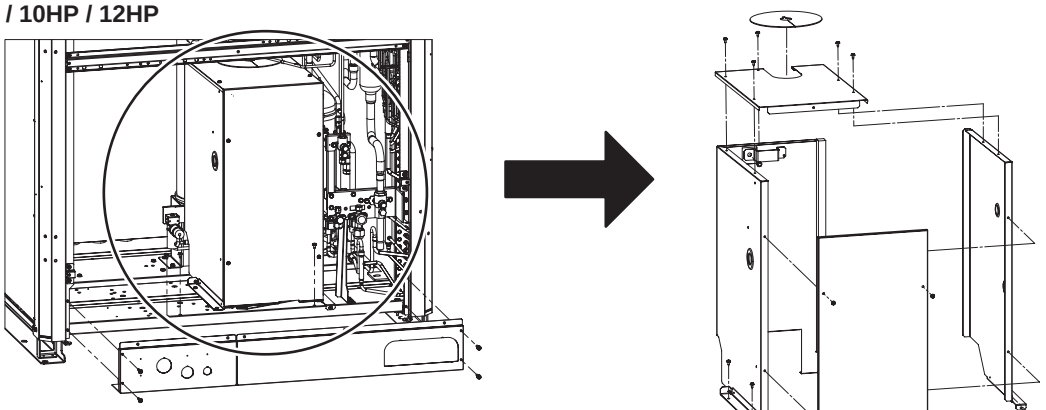
When removing and installing compressors, use sufficient caution to ensure that moisture or other substances do not enter the refrigerant tubing system.

9-3-1. Replacing Inverter compressors

■ Removal

(1) Connect a manifold gauge to the high- and low-pressure outlet ports at the outdoor unit where the compressor will be replaced. Connect the manifold gauge to a nitrogen cylinder and perform nitrogen gas replacement in the outdoor unit tubes.
(2) Follow the instructions in “1. Removing Panels” and remove the corresponding parts from the outdoor unit where the compressor will be replaced.
(3) Remove the caps and insulator surrounding the compressor.
(4) Remove the terminal cap on the compressor. Then disconnect the power terminal.
(5) Remove the crankcase heater.

Type 8HP / 10HP / 12HP



Type 14HP / 16HP

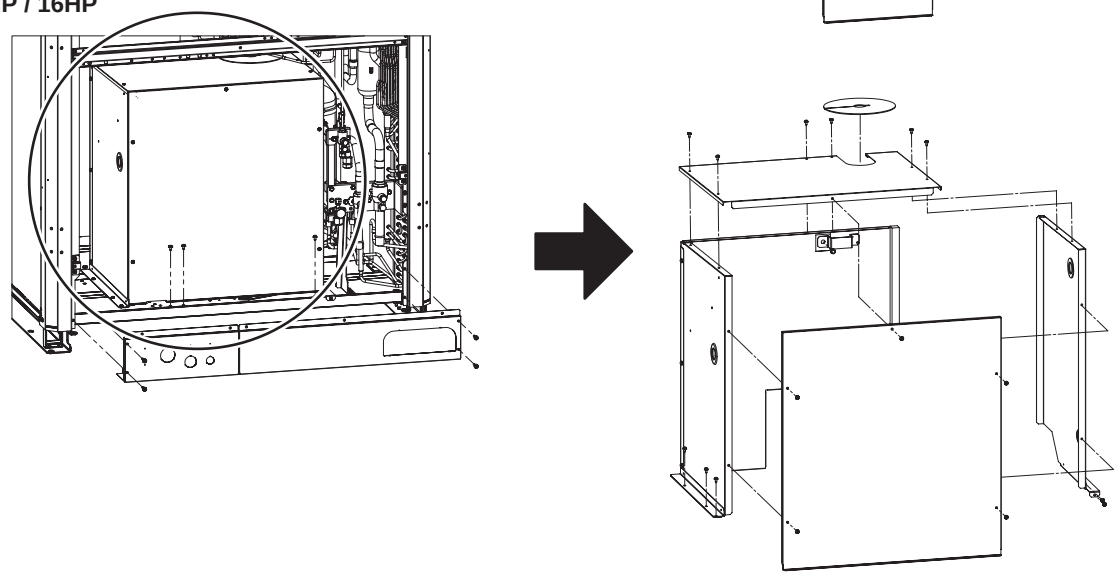


Fig. 17

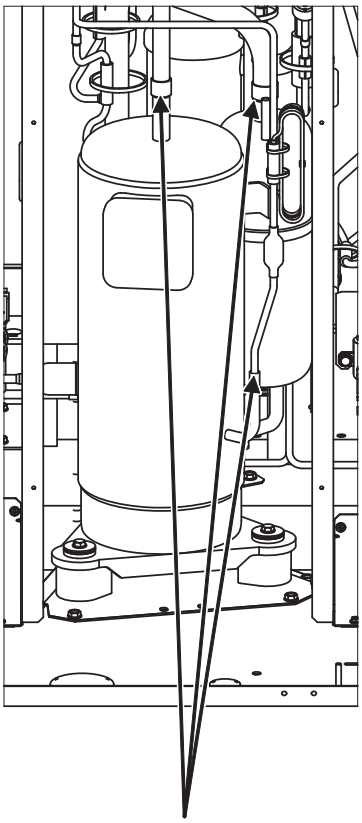
(6) Remove the bolts (3 locations) on the foot of the compressor.
Then remove the washers and rubber spacers.

(7) Remove the welded parts (3 locations) as shown in the figure.

CAUTION **Protect the sensors and the surrounding plates, rubber, lead wires, clamps, and other items.**

(8) Pull the compressor toward you.

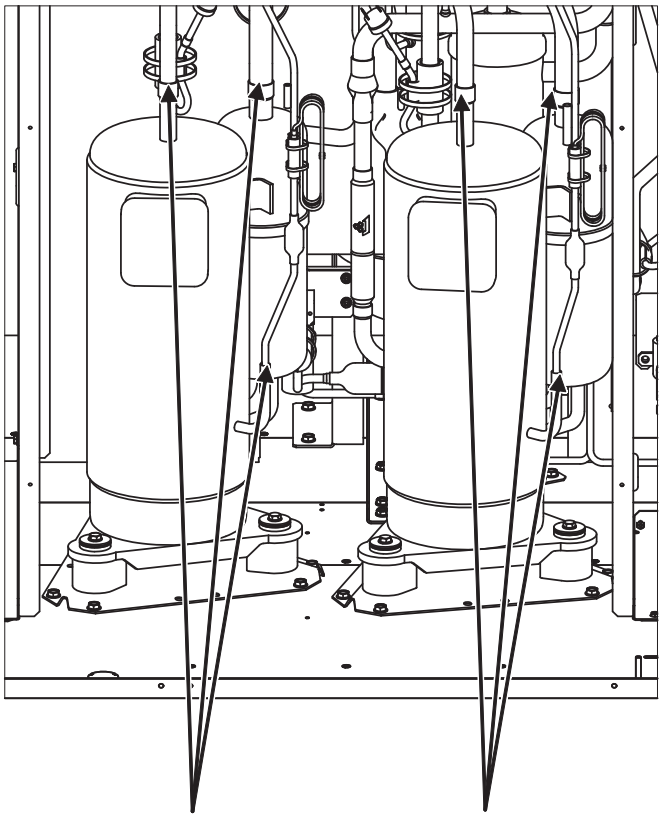
Type 8HP / 10HP / 12HP



Welded parts (3 locations)

INV compressor

Type 14HP / 16HP



Welded parts (3 locations)

INV compressor

Welded parts (3 locations)

INV compressor

4. OUTDOOR UNIT MAINTENANCE REMOTE CONTROLLER