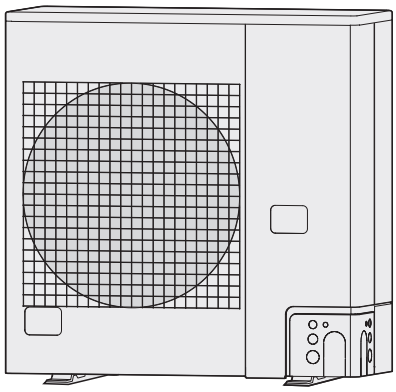
Panasonic

Order No. SBPAC1706004CE

SERVICE MANUAL & TEST RUN SERVICE MANUAL

Mini VRF SYSTEM

R410A



Model No.

Outdoor Units		HP = horsepower		
Type	Outdoor Unit Type	Rated Capacity		
		4 HP	5 HP	6 HP
LE2	mini VRF System	U-4LE2E5	U-5LE2E5	U-6LE2E5
		U-4LE2E8	U-5LE2E8	U-6LE2E8

REFERENCE NO. **SM830258-01**

Model No.

• To be connecting Indoor Unit

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	
K1	Wall-Mounted					S-45MK1E5A	S-56MK1E5A	
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
K1	Wall-Mounted	S-73MK1E5A		S-106MK1E5A		
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				

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-4LE2E8, U-5LE2E8, U-6LE2E8 outdoor units that are 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 equal to the following table 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 equal to the values in the table.

	U-4LE2E5	U-5LE2E5	U-6LE2E5
Ssc	3,000 kVA	4,550 kVA	4,750 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.

	U-4LE2E5	U-5LE2E5	U-6LE2E5
Circuit breaker	25 A	30 A	35 A

	U-4LE2E8	U-5LE2E8	U-6LE2E8
Circuit breaker	15 A	15 A	15 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 operating in emergency backup mode and switching from grid power to off-grid generator power or vice versa to provide power for the air conditioner, be sure to follow the guidelines below. Otherwise, the air conditioner may malfunction due to damage to the PCBs or other causes.
  (1) The electrical waveform of the generator must be a distortion free sine wave that is within the frequency and voltage tolerances defined by the equipment specifications.
  (2) When switching from grid power to off-grid generator power or vice versa, first reduce the supply voltage to 0V and confirm that the air conditioner has completely stopped before switching the power source.

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, 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.

WARNING

- Do not sit or step on the unit. You may fall down accidentally.

CAUTION

- Do not touch the air inlet or the sharp aluminum fins of the outdoor unit. You may get injured.
- 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.

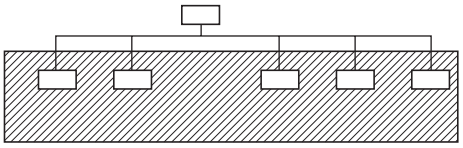
$$\frac{\text{Total amount of refrigerant (kg)}}{\text{Min. volume of the indoor unit installed room (m}^3\text{)}} \leq \text{Density limit (kg/m}^3\text{)}$$

The density limit of refrigerant which is used in multi air conditioners is 0.44 kg/m^3 (ISO 5149).

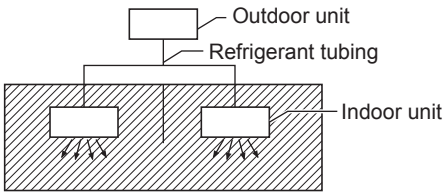
NOTE

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

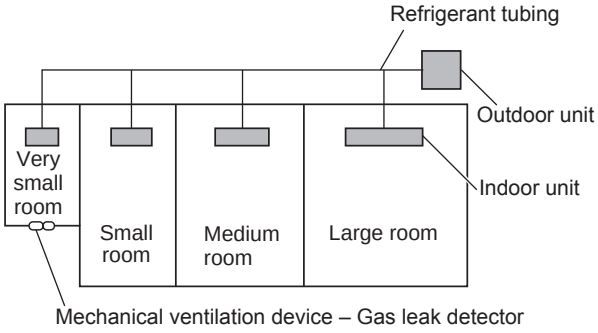
(1) No partition (shaded portion)



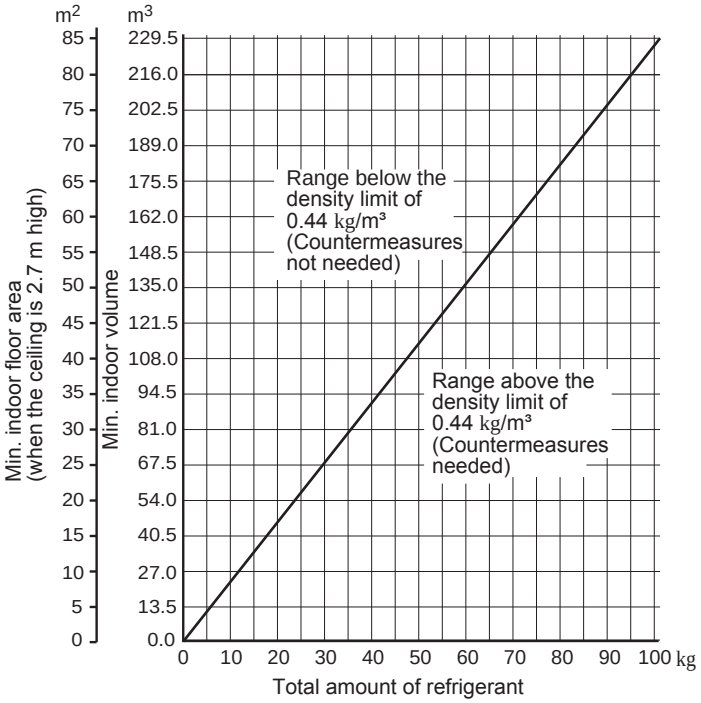
(2) When there is an effective opening with the adjacent room for ventilation of leaking refrigerant gas (opening without a door, or an opening 0.15% or larger than the respective floor spaces at the top or bottom of the door).



(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.



2. 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.
- **Tubing size: Be sure to use the sizes indicated in the table below.**
  For the renewal tubing size, refer to the Technical Data.
- 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

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.

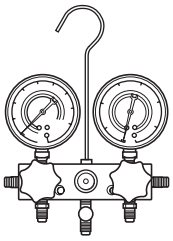
3. Different tools required

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

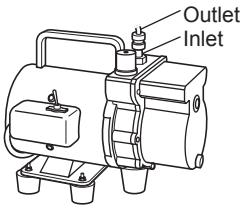
Some tools for R22- and R407C-type refrigerant systems cannot be used.

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



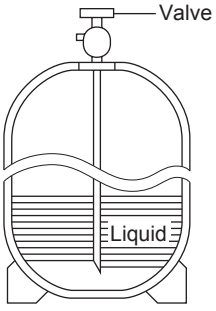
Vacuum pump



* 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

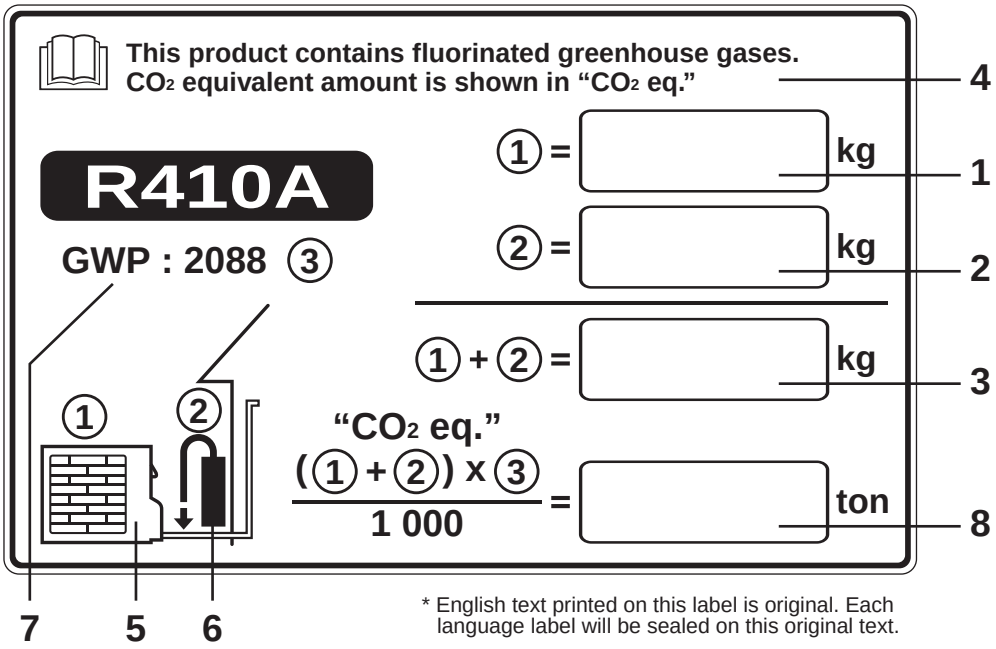
Periodical inspections for refrigerant leaks may be required depending on European or local legislation.
Please contact your local dealer for more information.

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

Mini VRF SYSTEM is a multi system that is connected to a single outdoor unit. The outdoor unit contains an inverter compressor.
To operate this system, the below settings must be made at the time of the test run.

Table 1-1

Setting item	At shipment from factory	Settable range
System address	1	System 1 – 30
No. of indoor units	1	1 – 12 units

Table 1-2

	4 HP	5 HP	6 HP
Maximum number of connected indoor units	7 (10)	8 (12)	9 (12)

The numbers in parenthesis are available with the capacity of 1.5 kW indoor unit connection.
Be sure to connect indoor units so that the resulting indoor-outdoor capacity ratio (total capacity of all indoor units compared with the outdoor unit capacity) is within the range of 50% – 130%.

(1) Compressors Mounted in the Outdoor Units

Type of outdoor unit		4HP	5HP	6HP
Compressor	Inverter compressor (High pressure rotary)	●	●	●

* The inverter compressor is operated according to the load and does not operate beyond outdoor unit capacity.

(2) 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 low pressure is over 1.6MPa during operation of the inverter compressor, the system is stopped. (P27: Pre-trip)

Type of outdoor unit	4HP	5HP	6HP
Minimum frequency (Hz) *1	15.0	15.0	15.0
Maximum frequency (Hz) *2	63.0	79.0	95.0

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

*1 The minimum Hz changes according to the outdoor air temperature during cooling operation.

*2

- The upper limit frequency is sometimes restricted to 54.0Hz until the compressor gets warmer.
- During special control (4-way valve adjustment control, system oil recovery control or defrost control) the maximum frequency is limited.
- In heating low temperature operation, the frequency may be larger than the value in the table.

(3) Forced Stopping of Compressor

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

(4) Capacity Control of Compressor (Roadmap Control)

① Capacity control of compressor (start & stop of compressor and increase & decrease of inverter frequency) are controlled according to the numerical value of the pressure sensor installed at the outdoor unit and the temperature sensor installed at the indoor unit heat exchanger.

* The pressure detected by the pressure sensor is converted to the saturated temperature.

- High pressure saturated temperature is converted from values detected by the high pressure sensor.
- Low pressure saturated temperature is converted from values detected by the low pressure sensor.

② This control is performed every 30 seconds.

③ When cooling operation, evaporation temperature (= antifreeze control) and condensation temperature (= high pressure prevention control) are applied.
When heating operation, condensation temperature (= high pressure prevention control) is applied.

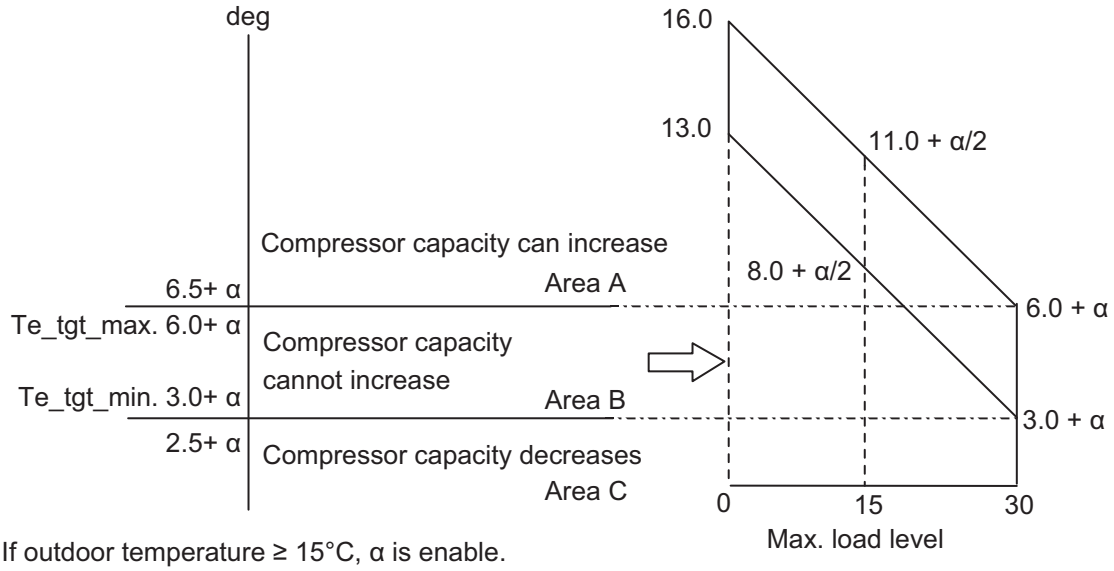
- Definition of evaporation temperature (Te)
  Lowest temperature of all indoor units' evaporation temperature (E1, E3) in the system including the stopped indoor units
- Definition of condensation temperature (Tc)
  Outdoor units' high pressure saturated temperature
- Load level varies from a minimum of 0 to a maximum of 30 on 1 to 1 basis up to 31 levels.
  When the indoor unit stops (including thermostat OFF), the level shows "0".
  In the case of test run mode, the actual level implies "30" even if a PC monitor indicates "31".
  * In the case that the compressor is stopped from such as special controls, load level does not turn to "0" even if the indoor unit is most likely to be in stopped state.
- The indoor unit demand level varies according to the following 2 conditions.
  - Intake temperature difference:
    Difference between indoor unit remote control set temperature and intake temperature (TA)
  - Discharge temperature difference:
    Difference between preset discharge setting temperature according to the type of indoor unit and actual discharge temperature (TF)
- Load level increases when the differential temperature noted above indicates plus (+) value and decreases when it indicates minus (-) value.
  However, the types of units which are set to control the discharge temperature vary according to the lowest value from the intake temperature difference and discharge temperature difference.
- Te target and Tc target are controlled by the maximum value of all indoor units load level.

4-1. Evaporation temperature (= Te) control

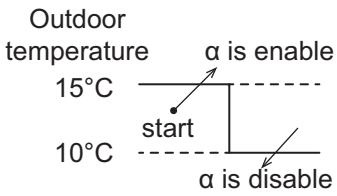
The cooling capacity is adjusted with this control. It prevents freezing of the indoor unit heat exchanger and the dew to the outside panel of the indoor unit. The capacity is adjusted according to the following figure.

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 load level in each indoor unit as shown on previous page.
- The 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.
- During special controls such as defrosting or oil recovering between the systems, the compressor capacity will not be controlled by the evaporation temperature control area.
- If the outdoor unit is stopped while the evaporation temperature is in Area C, the system may operate from the lower compressor capacity when starting next time.
- Test run mode

  Test run mode in cooling operation is used when the room temperature is low and the indoor unit thermostat is not turn ON. This mode is used for operation check when the outdoor unit is fully operated or additional refrigerant charge without stopping the system.

  * If the test run is continued for a long time, the mist may occur but it is not abnormal.
  - If more than 1 indoor unit is in test run mode, the evaporation temperature control is not applicable.
  - Once the indoor unit is selected for the test run, the thermostat will not be turned OFF.
  - After the last indoor unit is operated in the test run mode, the test run is automatically cancelled after 1 hour.

4-2. Condensation Temperature Control

Target temperature of the Area B is different between cooling and heating operation.

① In Cooling Mode

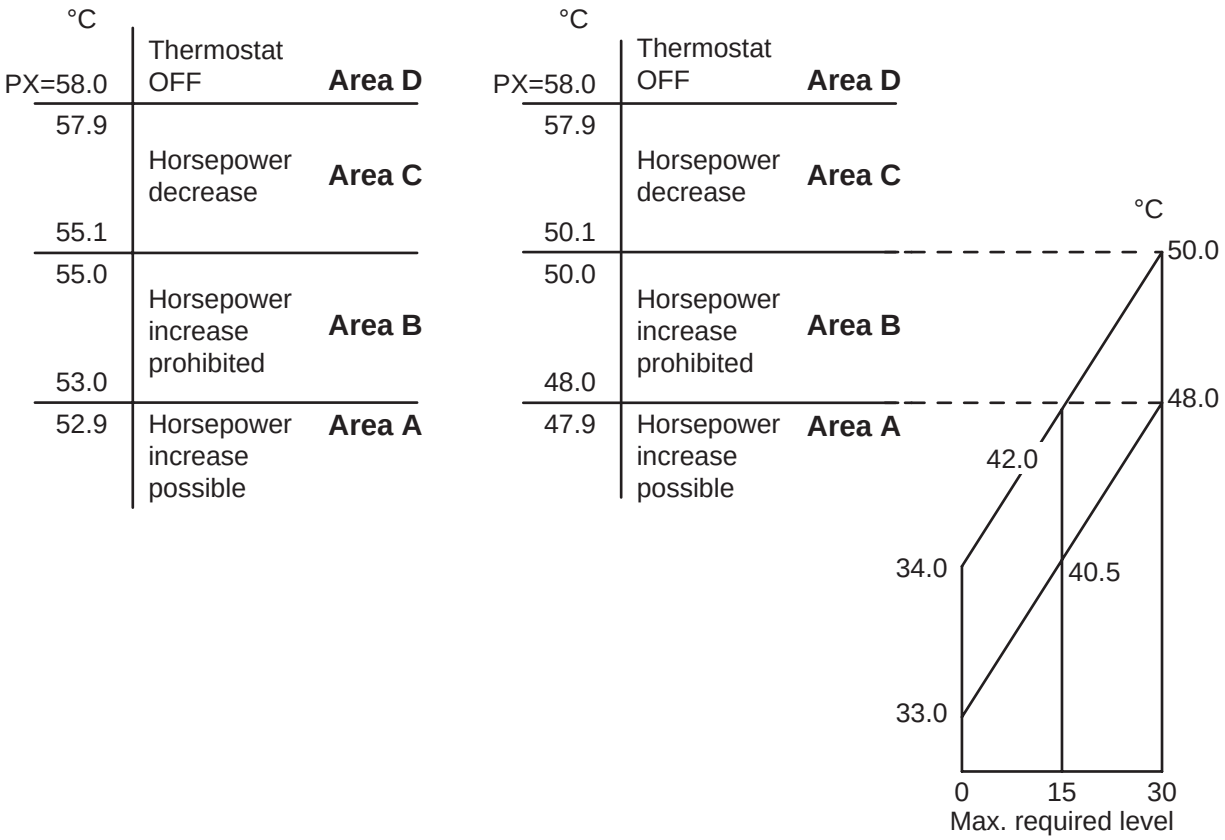
The purpose of this control at cooling is to prevent abnormal high-pressure.

② In Heating Mode

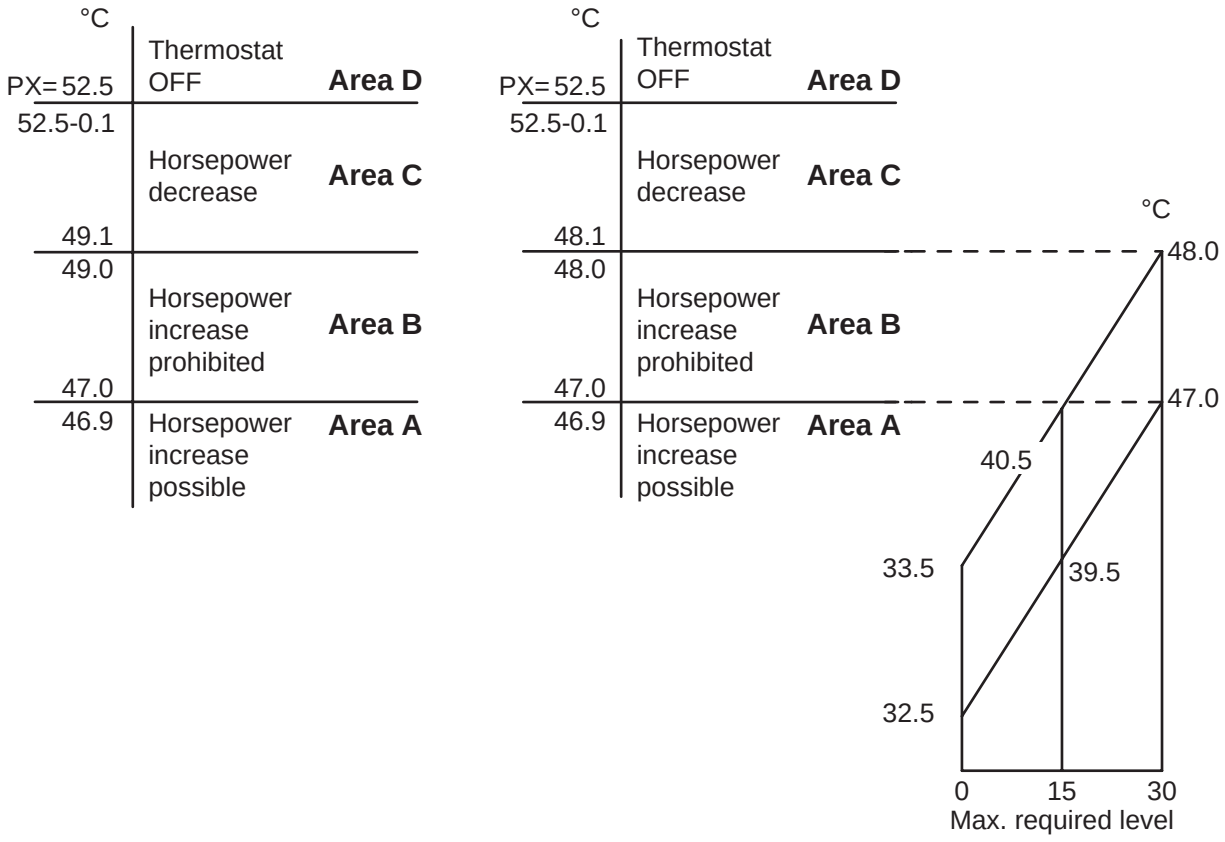
Heating capacity is adjusted with this control.
It also prevents abnormal high-pressure simultaneously.
The capacity is controlled in the following diagram.

1

・Standard setting (at the shipment)



・Renewal setting (JP001 cut on all outdoor unit PCB) * For details, see Section 9 of Technical Data.



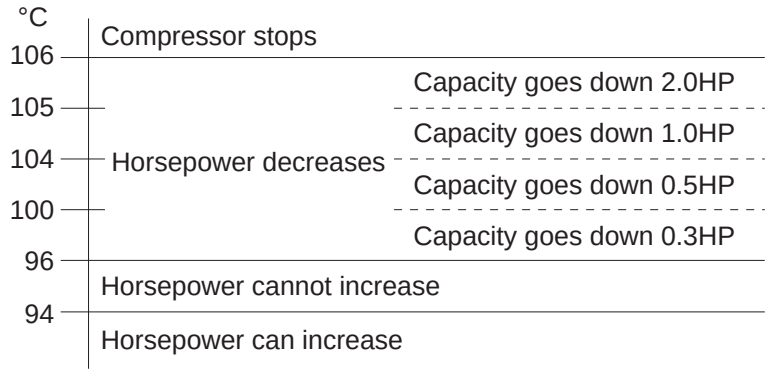
- When the temperature falls in the Area D (over PX temperature), the operation stops within 0 to 30 seconds at the interval of the roadmap control.
- After Tc falls in the Area D and the thermostat is turned OFF, the system may resume operating from the lower compressor capacity.
- When the system operates in a minimum capacity, the system will continue operating for at least 6 minutes if the condensation temperature area is the Area C.
  If it maintains in the Area C, the thermostat may turn OFF.
- Test Run
  Test run mode in heating operation is used when the room temperature is high and the indoor unit thermostat is not turned ON. This mode is used for operation check when the outdoor unit is fully operated or additional refrigerant charge without stopping the system.
  - Once the indoor unit is selected for the test run, the thermostat will not be turned OFF. However, condensation temperature control is performed in order to prevent the high load according to the figure shown on previous page.
  - After the last indoor unit is operated in the test run mode, the test run is automatically cancelled after 1 hour.

4-3. Protection Control

① Compressor discharge temperature protection

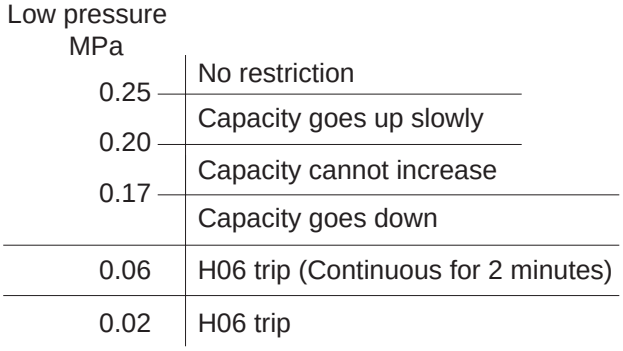
The compressor capacity is controlled according to the figure below.

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



② Low pressure protection control

In order to prevent the excessive decrease of low pressure, the compressor capacity is controlled according to the figure below.



③ Current protection

This restriction protects the compressor and controls the compressor electric current simultaneously. The current limitation value changes to “normal status” and “overload status” according to the outdoor temperature.

The primary and secondary current values of the inverter compressors are measured.

U-4LE2E5, U-5LE2E5, U-6LE2E5

unit: Ampere

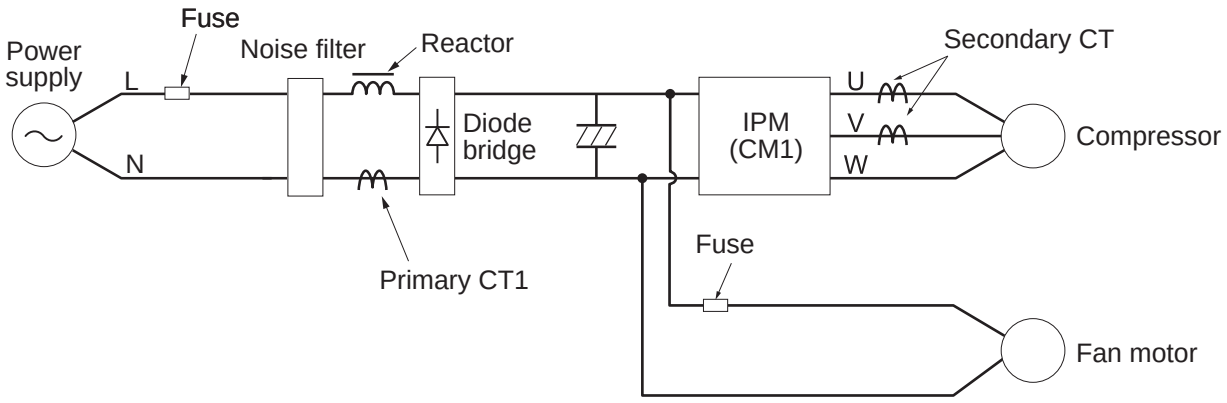
Type of outdoor unit		4HP	5HP	6HP
Primary	Limit current 1	32.2	32.2	32.2
	Maximum current 1 H	25.0	25.0	28.0
	Maximum current 1 L	24.0	24.0	27.0

* Normally, maximum current is limited in demand control shown on page 1-26.

Type of outdoor unit		4HP	5HP	6HP
Secondary	Limit current 2	24.5	24.5	24.5
	Maximum current 2 H	21.0	21.0	21.0
	Maximum current 2 L	20.0	20.0	20.0

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



U-4LE2E8, U-5LE2E8, U-6LE2E8

unit: Ampere

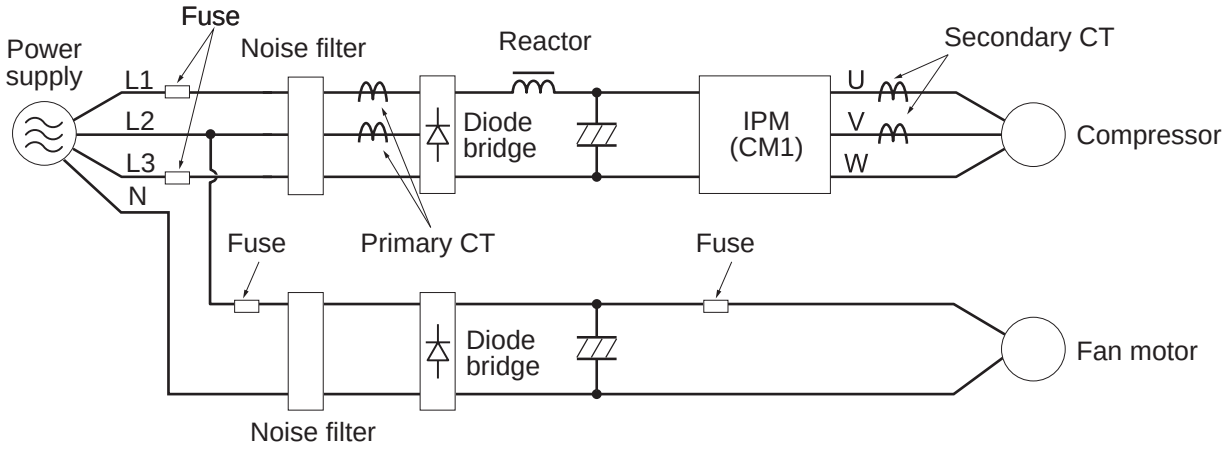
Type of outdoor unit		4HP	5HP	6HP
Primary	Limit current 1	14.0	14.0	14.0
	Maximum current 1 H	8.0	10.0	12.0
	Maximum current 1 L	7.0	9.0	11.0

* Normally, maximum current is limited in demand control shown on page 1-26.

Type of outdoor unit		4HP	5HP	6HP
Secondary	Limit current 2	15.2	15.2	15.2
	Maximum current 2 H	12.2	12.2	12.2
	Maximum current 2 L	11.2	11.2	11.2

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



Items	Remarks	Indication on PCB
Solenoid valve	4-way valve	20S
	Oil recovery valve	ORVR
	O_2 valve	O_2
Motor Operated Valve	MOV for heat exchanger	MOV1
	MOV for Sub cooler	MOV4
Crankcase heater	Crankcase heater	CH

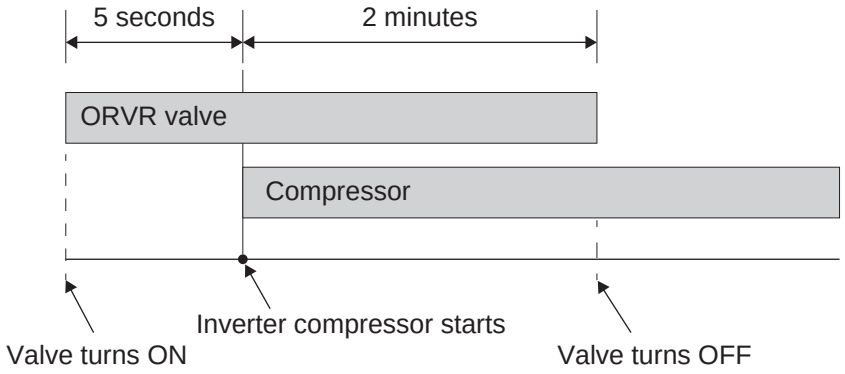
(1) 4-way Valve [20S]

- This valve turns OFF at cooling mode, and turns ON at heating mode.
- Regarding the operation in defrost control, see the section “8. Defrost Control”.
- When the outdoor unit stops, the 4-way valve maintains in the same state as before.

(2) Oil Recovery Valve [ORVR]

The purpose of this valve is to recover oil from the oil separator to the compressor and is to adjust the capacity and pressure.

- This valve is always OFF when outdoor unit is stopped.
- This valve turns ON for 5 seconds before the inverter compressor starts. After the inverter compressor starts, the valve is ON for 2 minutes. After that, it turns OFF.



- This valve turns ON for 30 seconds after the outdoor unit stops. After that, it turns OFF.
- This valve turns ON when the high pressure is too high.
  This valve turns OFF when the high pressure goes down.
- This valve turns ON when the high pressure switch is activated.
  This valve stays ON for 10 seconds after the high pressure switch returns in normal.
  After that, it turns OFF.
- This valve might turn ON when the system capacity is excessive although the inverter compressor operates at minimum frequency.
- This valve turns ON while the discharge temperature of the compressor is low.
- This valve turns ON during the operation of 4-way valve control.

(3) O_2 Valve [O_2] *O_2 valve is the local 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
3	Never use

EEPROM setting in indoor unit
CODE: 0B

Setting No.	Function of EXCT plug short-circuit
0	Indoor unit does thermostat OFF (factory preset mode)
1	Indoor unit gives “P14”alarm and transmits the refrigerant leakage signal.

(4) Electronic Control Valves [MOV1, MOV4]

4-1. Type of Electronic control valves

MOV1 is for adjusting refrigerant flow amount of outdoor heat exchanger.
MOV4 is for adjusting refrigerant flow amount of Sub cooler.

4-2. Power Initialization

If no indoor units have started (even once) after the power supply to the outdoor unit, the MOV holds the 480 pulses (fully open).

* When the indoor unit receives the signal for operation request from the control equipment, the pulse turns other than the 480 pulses (regardless of the thermostat ON/OFF or operating ON/OFF).
It is necessary to switch ON the power supply again if the 480 pulses are required.

4-3. Control of Electronic control valves

Electronic control valves for heat exchanger control according to the operation mode.

Mode of system	Stop	Cooling		Heating	
Compressor	Stop	Stop	Operation	Stop	Operation
MOV1 and MOV4 (pulse)	0	0*1	480	0*2	0 ~ 480*3

*1 However, 100 pulses remain for 2 minutes after unit stopped.
*2 When the outdoor unit stops and low pressure ≤ 0.16 MPa, 100 pulses remain for 30 seconds.
*3 If the outdoor unit is operating in heating mode, electronic control valves perform SH control.
SH control adjusts the difference of temperature between the liquid and gas temperature to -1 ~ 5 degrees Celsius.

(5) Crankcase Heater Control [CH]

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

- When the outdoor air temperature < 25°C :ON
- When the outdoor air temperature ≥ 27°C : OFF

4. Outdoor Unit Fan Control

(1) Number of Fan Motor

Type of outdoor unit	4, 5, 6 HP
Number of fan motor	1

(2) Fan Step

These outdoor units utilize a DC fan motor that can be controlled in 0～15 steps (0～15 modes) in ordinary mode. The control range is expanded to a maximum of 15 steps (15 modes) if high static-pressure mode has been set. The fan rotating numbers will be changed according to the fan steps.

(3) Minimum Fan Step and Maximum Fan Step

These outdoor units utilize a DC fan motor that can be controlled in a maximum of 15 steps (15 modes). However, fan modes 15 can only be used if high static pressure mode or high efficiency mode has been set.
* For information concerning EEPROM settings, refer to the field application functions.

		Status of heat exchanger		4HP	5HP	6HP
Maximum value	Standard	Condenser	Ambient temperature ≥ 38°C	11	12	12
			Ambient temperature < 38°C	10	11	11
		Evaporator	Ambient temperature ≥ 3	11	12	12
			Ambient temperature < 3	14	14	14
	High static pressure mode setting	Condenser		13	13	13
		Evaporator		15	15	15
	High efficiency mode setting	Condenser		12	13	13
		Evaporator		15	15	15
Minimum value				1	1	1

(4) Fixed Initial Fan Step

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

(5) Operation after Fixed Initial Fan Step

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

5-1. Cooling operation

- Fan step is increased when the detected high pressure saturated temperature is high, and is decreased when the high pressure saturated temperature is low.
  * The fan step is always increased when the detected high pressure sensor temperature is 46°C or higher.
- The fan step may be decreased when the system detects refrigerant shortage at an indoor unit.
- During cooling operation, if the fan step becomes “0” and this condition maintains for 3 minutes, the fan step is changed to “1”.

5-2. When all indoor units are operating in heating mode

- If the pressure sensor temperature is low, the fan step is increased at regular intervals.
- If the pressure sensor temperature is high, the fan step is decreased in order to prevent excessive loads.
- The fan step may be increased when the liquid temperature of outdoor unit heat exchanger drops to 1 degrees Celsius or below.

(6) Silent Mode

Selecting the silent mode results in operation that gives priority to reducing noise at the outdoor unit.
When the setting is in silent mode, the outdoor fan step and the maximum frequency is limited.
So the capacity will be decreased. However, the frequency is not limited during the special controls.

- Maximum fan step & maximum frequency in silent mode

Type of outdoor unit		4HP		5HP		6HP	
Silent effect		Cooling	Heating	Cooling	Heating	Cooling	Heating
-1.5dB mode	Fan step	9	11	10	13	10	12
	Compressor frequency (Hz)	63.0	63.0	79.0	79.0	95.0	95.0
-3dB mode	Fan step	8	10	8	10	7	10
	Compressor frequency (Hz)	43.8	48.6	51.8	64.6	58.2	64.6
-5dB mode	Fan step	7	8	6	9	6	9
	Compressor frequency (Hz)	43.8	48.6	51.8	48.6	55.0	48.6
-7dB mode	Fan step	6	7	6	8	6	8
	Compressor frequency (Hz)	43.8	43.8	48.6	48.6	53.4	48.6

The system entirely becomes to the silent mode by setting in the main outdoor unit.

EEPROM setting in main outdoor unit

CODE : 05

Setting No.	Mode	External input to PCB	Silent effect
0	Invalidity (Factory preset mode)	———	———
1	Capacity is given priority (*)	Necessary	-1.5dB
2	Capacity is given priority	Necessary	-3dB
3	Capacity is given priority	Necessary	-5dB
4	Capacity is given priority	Necessary	-7dB
5	Capacity is given priority (*)	Unnecessary	-1.5dB
6	Capacity is given priority	Unnecessary	-3dB
7	Capacity is given priority	Unnecessary	-5dB
8	Capacity is given priority	Unnecessary	-7dB
9	Silent is given priority (*)	Necessary	-1.5dB
10	Silent is given priority	Necessary	-3dB
11	Silent is given priority	Necessary	-5dB
12	Silent is given priority	Necessary	-7dB
13	Silent is given priority (*)	Unnecessary	-1.5dB
14	Silent is given priority	Unnecessary	-3dB
15	Silent is given priority	Unnecessary	-5dB
16	Silent is given priority	Unnecessary	-7dB

(*) Rated capacity is maintained under rated condition.

NOTE

- When the setting is “external input necessary”, this function works in either of the following way
  ① short circuiting “SILENT” plug on the PCB.
  ②-1 Change setting the outdoor unit EEPROM CODE: 78 to “01”.
  CODE: 78

Setting No.	Input by indoor unit remote controller
0	Invalid (Factory preset mode)
1	Valid

  ②-2 When setting in Quiet operation by the indoor unit address 1 remote controller (CZ-RTC5A / CZ-RTC5B):
  *Regarding the method of setting Quiet operation, see the Operating Instructions provided with the remote controller.
- When the setting is “external input to PCB unnecessary”, this function always works.
- When the setting is “Capacity is given priority”, this function is interrupted in the following conditions.
  Cooling operation: Ambient temperature ≥ 38°C
  Heating operation: Ambient temperature < 2°C
- In case of selecting silent priority mode (more than “9” setting) in high load situation, the system has possibility to stop to prevent high pressure cut.

(7) High Static Pressure Mode

The outdoor unit allows a high static pressure changing the settings.
The maximum permissible static pressure is 35Pa.

EEPROM setting in each outdoor unit
CODE:8F

Setting No.	
0	Invalid (factory preset mode)
1	High static pressure mode 1

However, maximum fan mode is upper limit.

(8)High Efficiency Mode

The outdoor unit allows a high efficiency mode changing the settings.

CODE:5F

Setting No.	
0	Invalid (factory preset mode)
1	Valid

Some actuators of indoor unit are controlled by CCU.

(1) MOV of Indoor Unit

1-1. Indoor unit without RAP valve kit unit : pulse

Operating mode of indoor unit	Operating mode of outdoor unit	Operating mode of compressor	Thermostat ON/OFF	MOV pulse of indoor unit
Stop	Cooling	Stop	—	20
		Operation	—	20
	Heating	Stop	—	85
		Operation	—	65 ~ 80 (prevent remaining refrigerant)
Fan (only)	Cooling	Stop	—	20
		Operation	—	20
	Heating	Stop	—	85
		Operation	—	65 ~ 80 (prevent remaining refrigerant)
Cooling	Cooling	Stop	—	20
		Operation	OFF	20
			ON	60 ~ 480 (SH control*1)
Heating	Heating	Stop	—	85
		Operation	OFF	55 ~ 80 (prevent remaining refrigerant, suction temperature control*2)
			ON	65 - 480 pulses (SC control*3)

*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 3 degrees Celsius when the load level of indoor unit is “30” or “31 (test run)”.
Target SH will be increased up to 17.5 degrees Celsius when the load level of indoor unit is low.
- When the refrigerant amount in the system is adjusted, it is necessary to select test run mode that the required level becomes “31”.

*2 MOV pulse changes to 55 for 1 minute when the MOV pulse continues to be 55 or more for 10 minutes.
The purpose of this control is to decrease the flow volume of the refrigerant so that room temperature can be detected with less influence of heat from the refrigerant.

*3 SC control adjusts the difference in temperature between the liquid temperature in indoor unit and high-pressure saturated temperature in outdoor unit.
SC = high-pressure sensor temperature (HPT) - liquid temperature (E1)
Target SC is 5 - 15 degrees Celsius according to the operating condition.

1-2. Indoor unit with RAP valve kit

unit : pulse

Operating mode of indoor unit	Operating mode of outdoor unit	Operating mode of compressor	Thermostat ON/OFF	MOV pulse of indoor unit
Stop	Cooling	Stop	—	20
		Operation	—	20
	Heating	Stop	—	20
		Operation	—	20
Fan (only)	Cooling	Stop	—	20
		Operation	—	20
	Heating	Stop	—	20
		Operation	—	20
Cooling	Cooling	Stop	—	20
		Operation	OFF	20
			ON	60 ~ 480 (SH control*1)
Heating	Heating	Stop	—	20
		Operation	OFF	20
			ON	65 - 480 pulses (SC control*3)

Go to previous page and see the comments with asterisks *1 and *3.
In the case of special controls, the MOV performs a special operation.
For details, see “3. Special Control” under this section.

(2) RAP Valve Kit

Operating mode of indoor unit	Operating mode of outdoor unit	Operating mode of Compressor	Thermostat ON/OFF	RAP valve kit ON/OFF
Stop	Cooling	Stop	—	OFF
		Operation	—	OFF
	Heating	Stop	—	OFF
		Operation	—	OFF
Fan (only)	Cooling	Stop	—	OFF
		Operation	—	OFF
	Heating	Stop	—	OFF
		Operation	—	OFF
Cooling	Cooling	Stop	—	OFF
		Operation	OFF	OFF
			ON	OFF
Heating	Heating	Stop	—	OFF
		Operation	OFF	OFF
			ON	ON

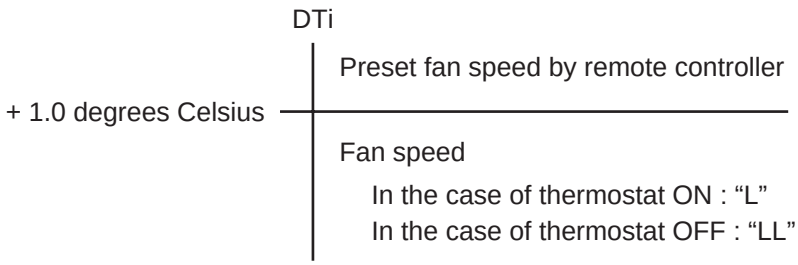
- RAP valve kit state (ON/OFF) is displayed on "D" in DSBE column when the Checker software is used.
  0 : OFF
  1 : ON
- In the case of special controls, the MOV performs a special operation.
  For details, see “3. Special Control” under this section.

(3) Indoor Fan Speed Control

The CCU intervenes in fan control of the indoor unit according to the status of the operating mode.
The priority order of fan control by the CCU is higher than that of indoor units.

3-1. Dry mode

Indoor unit fan operated in the dry mode is controlled from the CCU as shown in the figure below.



* DTi = (Air intake temperature of indoor unit) - (Preset temperature by remote controller)

3-2. Heating mode

The indoor unit fan in heating mode is stopped from the CCU in the following condition.

- Discharge air temperature of indoor unit ≤ 20°C
- High pressure saturated temperature (HPT) in outdoor unit ≤ 25°C
- Liquid temperature (E1) in indoor unit ≤ 20°C

(4) Drain Pump Control

The 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 the CCU control at the following condition.

- DP counter ≥ 5

* The DP counter counts each oil recovery control, and 4-way Valve Adjustment Control in cooling operation.

- Liquid temperature (E1) in the indoor unit which selected cooling mode < 0 °C

* Regardless of operating / stopped mode

- Low Silhouette Ducted type indoor unit

  In Low Silhouette Ducted types, dirt might be accumulated when water collects in the drain pan for a long term.
  Therefore, the drain pump works longer to drain water surely.

* To activate this function, it is necessary to set EEPROM on the main outdoor unit PCB.

EEPROM setting in main outdoor unit
CODE: 0C

Setting No.	Movement of drain pump	Indoor unit operation mode
0	Invalid	All mode
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	Cooling mode Dry mode Heating mode
4	DP operates for XX minutes when indoor unit's operation changes; from thermostat ON → thermostat OFF or operation stopped.	
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 any of setting Nos. 4 – 7 is selected, this function works only for the type of F2, M1.

* Operating time “XX” under the section “(4) Drain Pump Control” described on previous page 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 the CCU.

(5) Discharge Air Temperature Control

For Type F2 and M1 indoor units, discharge air temperature is controlled from the CCU to prevent dew condensation on duct surface in cooling operation.
It is able to use this function on cassette models but have to change the parameter in indoor unit.
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 thermostat OFF by discharge air temperature control

∆To ≤ - 3.5 degrees Celsius, and this condition continues for 7 minutes
∆To < - 2.0 degrees Celsius, and this condition continues for (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 (minutes)
-19	-19 (minutes)
-18	-18 (minutes)
...	...
0	0 (minutes) (factory preset mode)
...	...
10	10 (minutes)

* Regarding the preset discharge air temperature that is set in the indoor unit is able to change, see the section “5. REMOTE CONTROLLER FUNCTIONS” in this Service Manual.

(1) Self-separator Oil Recovery Control

Oil is recovered from the oil separator to the compressor through the ORVR.

(2) System Oil Recovery Control

All indoor units MOV are opened for recovering oil from indoor side to compressor.

2-1. Start of system oil recovery control

Amount of oil in the compressor is presumed from operation condition. If presumed oil shortage, system oil recovery control start.
This control is performed every 30 minutes - 5 hours.

2-2. Simplified flow of system oil recovery control

The system oil recovery control shall be performed as the flow mentioned below.
Normal operation → System oil recovery control → Normal operation

- In the case of cooling mode

Control time		For max 3 minutes
Outdoor units		All outdoor units operate at maximum horsepower.
Indoor units	MOV	MOV at all indoor units operate at a fixed pulse according to the indoor unit capacity.
	RAP valve kit	All indoor units operate in Cooling mode (OFF status).
	Fan	Fan rotates at the set fan speed depending on the indoor unit operation mode or at fan speed “LL”.

- In the case of heating mode

Control time		For 3 minutes
Outdoor units		All outdoor units operate at more than half horsepower.
Indoor units	MOV	MOV at all indoor units operate at 250 pulses.
	RAP valve kit	All indoor units operate in Heating mode (ON status.)
	Fan	Fan rotates at the set fan speed depending on the indoor unit operation mode or at fan speed “LL”.

(3) Indoor Unit Self Oil Recovery Control

This control is carried out regularly when the system is in cooling mode.

- During stopped, fan mode setting or thermostat OFF condition at the indoor unit, MOV of the indoor unit is opened regularly for 1 minute (at the interval of approximately 40 minutes).
- During the thermostat ON, MOV of the indoor unit is opened 20 pulses from the current status.

				EEPROM setting in main outdoor unit CODE: 24			
Type of indoor unit	Operating mode of indoor unit	Thermostat ON/OFF	Pulse of MOV	Setting No. 0		Setting No. 1	
				Fan speed	Flap	Fan speed	Flap
For D1, K1, K2	Stop	——	80 – 160	Stop	——	LL	Open
	Fan	——	80 - 160	LL	——	LL	Open
	Cooling	OFF	80 – 160	Set speed	——	Set speed	——
		ON	Present pulse+20	L	——	L	——
Except D1, K1, K2	Stop	——	80 – 160	Stop	——	Stop	——
	Fan	——	80 – 160	Stop	——	Stop	——
	Cooling	OFF	80 – 160	Set speed	——	Set speed	——
		ON	Present pulse+20	L	——	L	——

* MOV pulse might be different from the table listed above depending on the use conditions.

7. 4-Way Valve Adjustment Control

The purpose of this control is to change over the 4-way valve appropriately with big pressure difference.
This control is performed at the following conditions.

- The first operation after turning on power supply to outdoor unit.
- The first operation after all outdoor units stopped for 60 minutes.
- The mode of the system changes.

- Cooling operation

Control time		For 60 seconds
Outdoor units		All outdoor units operate at the maximum capacity.
Indoor units	MOV	MOV at all indoor units operate at a fixed pulse according to the indoor unit capacity.
	RAP valve kit	All indoor units operate in Cooling mode (OFF status).
	Fan	Fan rotates at the set fan speed depending on the indoor unit operation mode or at fan speed “LL”.

* When the above operation is finished, normal operation starts at the horsepower determined by the indoor units where thermostats are ON.

- Heating operation

Control time		Minimum 1 min - Maximum 20 min or detected HPT ≥ 25°C and continue this condition about 60 sec.
Outdoor units		All outdoor units operate at the maximum capacity.
Indoor units	MOV	MOV at all indoor units initially operates 250 pulses and then runs in SC control mode.
	RAP valve kit	All indoor units operate in heating mode (ON status).
	Fan	Fan rotates at the set fan speed depending on the indoor unit operation mode or at “LL” fan speed, or stops.

* When the above operation is finished, normal operation starts at the horsepower determined by the indoor units where thermostats are ON.

(1) Type of Defrost Control

This system uses the reverse cycle defrost.

(2) Forced Conditions

- Defrost does not begin again for 35 minutes of operation after defrost was once completed.
- If the outdoor unit is stopped while defrosting due to protection control or another reason, then defrost control will not start for a minimum of 10 minutes after restart occurs.
- Even if all indoor units are stopped while defrosting, defrost control continues until it ends.

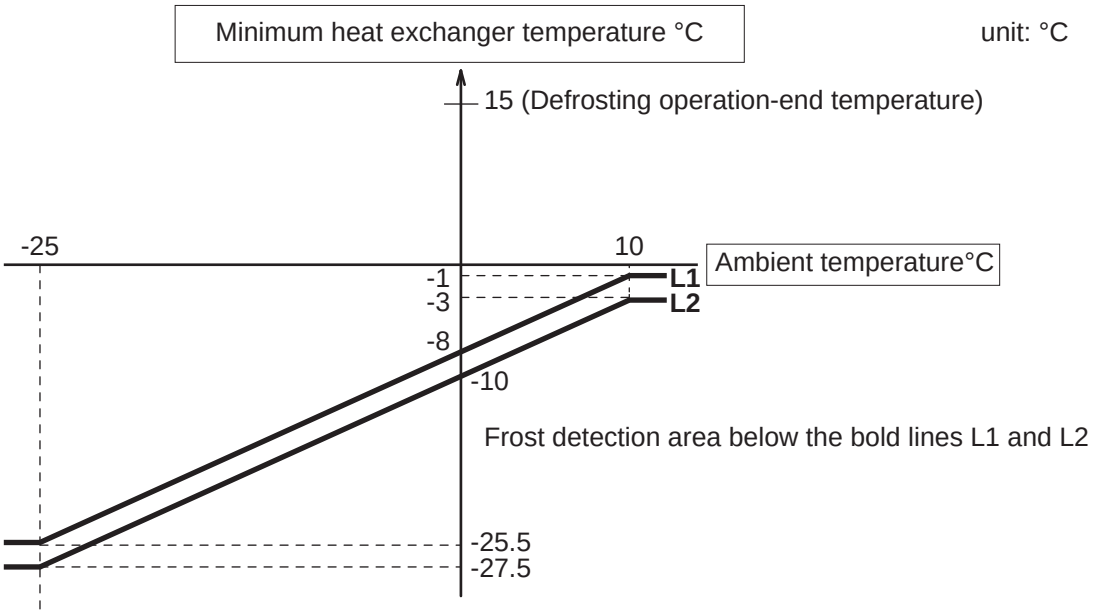
(3) Frost Detection

- Frost detection does not occur for 5 minutes after operation starts.
- Frost is detected when minimum heat exchanger temperature meets any one of the condition 1 - 3 below.

  Condition 1: Minimum heat exchanger temperature drops below L2 line shown in the figure below and detects twice for 4 minutes without interruption while the compressor is operating.

  Condition 2: Minimum heat exchanger temperature drops below L1 line shown in the figure below and detects for a total of 60 minutes while the compressor is operating.

  Condition 3: Minimum heat exchanger temperature drops below -3°C and detects for a total of 90 minutes while the compressor is operating.



(4) Heating Operation Set Time (Defrosting Operation Prohibiting Time)

When the heating operation time at system has exceeded “XX” minutes (35 minutes at initial setting), and at least one unit satisfies the decision of defrosting, the defrosting operation is effective.

* XX is able to set in EEPROM of main outdoor unit.

EEPROM setting in main outdoor unit
CODE: A3

Setting No.	XX
0	0 (minutes)
1	1 (minutes)
...	...
35	35 (minutes) (factory preset code)
...	...
60	60 (minutes)

* Defrost control is also performed at outdoor units where the outdoor unit heat exchanger is not functioning as an evaporator (such as stopped outdoor units).

(5) Defrost End Judgment Conditions

Defrost ends when either of the below defrost end judgment conditions is met.

Condition 1: The temperatures are 15°C or higher at all heat exchanger sensors installed on the outdoor unit.

Condition 2: One minute has elapsed under the condition that the temperatures are 10°C or higher at all heat exchanger sensors installed in the outdoor unit.

Condition 3: 13 minutes have elapsed.

(6) Reverse Cycle Defrost

If there is only 1 outdoor unit in the refrigerant system, a reverse cycle defrost will be carried out.

• Defrost flow E: Evaporator operation
C: Condenser operation
E → C: Switching evaporator operation to condenser operation
C → E: Switching condenser operation to evaporator operation

			Defrost preparation		Defrost in progress		Defrost end
Outdoor unit status			E → C		C		C → E
Compressor			Operating		Operating		Stopped
4-way valve			ON→OFF		OFF		OFF→ON
Indoor unit	Stopped		C→E		E	Defrost end judgment	E → C
	Fan (only)		C→E		E		E → C
	Cooling mode	Thermostat ON	C→E		E		E → C
		Thermostat OFF	C→E		E		E → C
	Heating mode	Thermostat ON	C→E		E		E → C
		Thermostat OFF	C→E		E		E → C
Time			40 seconds		Maximum 15 minutes		1 minute

It is possible to change the stopped time according to the setting.
For the maximum defrost time, see the table shown above.

(1) Usual Demand Control

Demand control is performed to suppress the horsepower not to make the primary current exceed the setting value.

U-4LE2E5, U-5LE2E5, U-6LE2E5

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

Type of outdoor unit	4HP	5HP	6HP
Cooling mode	13.3	17.0	20.3
Heating mode	12.2	18.1	19.1

unit:Amp.

HP=Horsepower

The system current value is controlled up to limit value or less without demand input as shown in the table below.

Type of outdoor unit		4HP	5HP	6HP
Limited ratio against standard value		145%	145%	145%
Limit value	Cooling mode	17.29	22.65	27.44
	Heating mode	15.69	24.25	25.70

unit:Amp.

HP=Horsepower

U-4LE2E8, U-5LE2E8, U-6LE2E8

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

Type of outdoor unit	4HP	5HP	6HP
Cooling mode	4.39	5.58	6.71
Heating mode	3.98	5.62	6.24

unit:Amp.

HP=Horsepower

The system current value is controlled up to limit value or less without demand input as shown in the table below.

Type of outdoor unit		4HP	5HP	6HP
Limited ratio against standard value		180%	180%	160%
Limit value	Cooling mode	7.90	10.04	10.74
	Heating mode	7.16	10.12	9.98

unit:Amp.

HP=Horsepower

(2) Energy Saving Button (CZ-RTC5A / CZ-RTC5B)

When the Energy Saving button of the indoor unit remote controller is pressed, demand control is performed according to EEPROM : 1A values.

Setting of Energy Saving button: Outdoor unit EEPROM Setting item DN18, DN19

Energy saving operation when the Energy Saving button is pressed provides 3 patterns of control.

Patterns:

A. Demand control is performed under the current limitation values set at the outdoor unit EEPROM setting (DN1A).
   In addition, the indoor unit controls the limitation of discharge air temperature.
B. Demand control is performed under the current limitation values set at the outdoor unit EEPROM setting (DN1A).
C. Discharge air temperature limitation control is performed set at the indoor unit EEPROM setting.

Outdoor unit EEPROM setting (DN18) :

The marking " ○ " indicated in the following table is applicable to the function of control.

Setting No.	Discharge air temperature control	Demand control	Remarks
0	×	×	No controls
1	○	×	Pattern "C": only discharge air temperature control
2	×	○	Pattern "B": only demand control
3 (Factory preset mode)	○	○	Pattern "A": demand control and discharge air temperature control

Outdoor unit EEPROM setting (DN19):

Setting of control validity range when pressing the Energy Saving button

Setting No.	Control range
0 (Factory preset mode)	Energy saving activates where Energy Saving button is pressed as a unit of indoor unit (group).
1	Energy saving activates where Energy Saving button is pressed as a unit of indoor unit including all refrigerant system.

* When the pattern "A" and "B" are selected, energy saving control becomes valid in the same range as the setting "1" although the Setting No. is set to "0".

NOTE

Since the pattern “A” and “B” perform the outdoor unit current demand control (compressor’s suppressive drive), it is easy to grasp energy saving amount.
However, it may cause the reduction of capacity in all indoor units of the same refrigerant system.
In order to make the indoor unit (group) only valid as the energy saving function where the Energy Saving button is pressed and not to influence to other indoor units, be sure to set the outdoor unit EEPROM setting DN18 to “1” and DN19 to “0”.

(3) Serial-parallel I/O

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 outdoor unit

CODE: 1A

Setting No.	XX
0	0
40	40
45	45
⋮	Interval of “5”
100	100 (factory preset mode)
⋮	⋮
130	130
-1	No control

CODE: 1B

Setting No.	YY
0	0
40	40
45	45
⋮	Interval of “5”
70	70 (factory preset mode)
⋮	⋮
130	130
-1	No control

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

EEPROM setting in outdoor unit

CODE: 1E

Setting No.	
0	No display
1	Information is displayed when input of demand control is set (factory preset mode).
2	Information is displayed only when the capacity is restricted by demand control.

(4) When Using Demand Terminal Block

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	Demand meaning
COM short circuit	Contact 1	Contact 2		
Non	✕	✕	No control	Operates to the maximum capacity.
LV1	○	✕	Operates to XX% of the upper limit for the rated current	Current is limited to the set values.
LV2	✕	○	Operates to YY% of the upper limit for the rated current	Current is limited to the set values.
LV3	○	○	Forced thermostat OFF setting	——

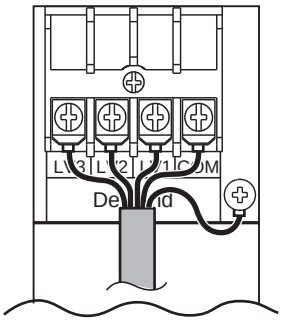
○ : Input present ✕ : Input not present

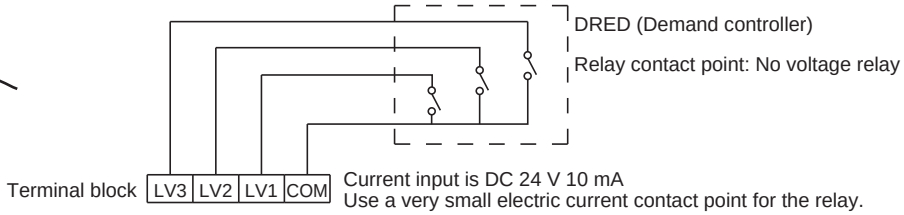
* The rated current indicates the current value that is listed in the catalog or service manual.

* 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-RTC5A / CZ-RTC5B] (demand-activated) displays on the remote controller of the indoor unit.
It is also possible to make setting that the display (symbol of demand-activated) is concealed as shown in the following table.

* XX and YY are able to set in EEPROM of outdoor unit.
Check " (3) Serial-parallel I/O " section.





(1) Auto Change over Cooling/Heating Function

It is possible to select auto charge over cooling/heating mode in each remote controller even in mini VRF system.
The system changes to cooling or heating operation according to number of thermostat ON mode.
The system selects the mode that has more number of units with thermostat ON.
(It is impossible to perform the simultaneous cooling/heating operation.)

While the system is operating, the system judges whether to switch the mode in XX minutes intervals.
While the system is stopped, change the mode immediately.

Case 1

Number of thermostat ON indoor units in cooling mode > Number of thermostat ON indoor units in heating mode
→ system selects cooling mode
The heating indoor units will be forced to thermostat OFF.

Case 2

Number of thermostat ON indoor units in cooling mode < Number of thermostat ON indoor units in heating mode
→ system selects heating mode
The cooling indoor units will be forced to thermostat OFF.

* "XX" is able to be set in EEPROM on the outdoor unit's PCB.

EEPROM setting in outdoor unit
CODE: 27

Setting No.	XX
0	Invalid (factory preset mode)
30	30
40	40
50	50
60	60
90	90
120	120
180	180
240	240

(2) Maintenance Function for Power Supply Stop of Indoor Unit (E06 ignore)

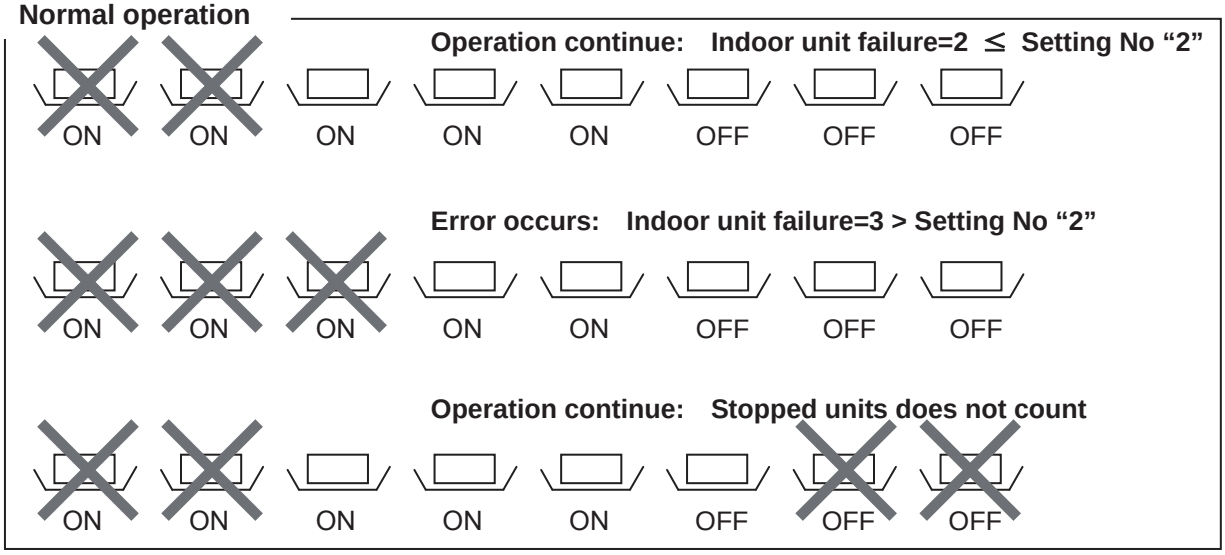
The system can continue operation even if outdoor unit cannot communicate with some indoor units.
It is necessary to set to EEPROM the allowed number of operating indoor units not to be able to communicate.
The system will continue operating until the following condition is made to be satisfied.
Value 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 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
3	3
4	Never use
⋮	
64	

* 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”.



(3) Setting when at 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	Louver
0 (factory preset mode)	w/o force	w/o force	w/o force
1	STOP *3	20	w/o force
2	LL	20	w/o force
3	Interval mode *4	20	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: 51

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

CODE: 52

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

11. 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.
05	Outdoor fan silent mode	0=Invalid (P) 1=Silent mode 1 2=Silent mode 2,,,,, 16=Silent mode 16 (For details, see "4. Outdoor Unit Fan Control (6)")
0C	Indoor unit drain pump forced operation	0=Invalid 1=stop for 2 hours and drive for 20 minutes constantly 2=stop for 20 minutes and drive for 20 minutes constantly 3=Drive constantly 4-6=delay drive when thermostat OFF 7=delay drive when thermostat OFF (P) (For details, see "5. Outdoor Unit CCU Control (4)")
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) ,,,,, 160=160% -1=No control (For details, see "9. Demand Control")
1B	Demand 2 current (%)	0=0% 40=40% 70=70% (P),,,,, 100=100% ,,,,, 160=160% -1=No control (For details, see "9. Demand Control")
1E	Demand remote controller display	0=No demand display 1=When demand ON, “ready to start” display (P) 2=When forced thermostat OFF with demand ON, “ready to start” display (For details, see "9. Demand Control")
23	E06 ignore function	-1=Invalid (P) 0=0 1=1 ,,,,, 13=13 14 - 52=Never use (For details, see "10. Other Functions")
27	Auto change over function for mini VRF system	0=Invalid (P) 30=30 minutes 40=40 minutes 50=50 minutes 60=60 minutes 90=90 minutes 120=120 minutes 180=180 minutes 240=240 minutes (For details, see "10. Other Functions (1)")
2B	DP operation time for slime measures	20=20 minutes 30=30 minutes (P) 40=40 minutes 50=50 minutes 60=60 minutes (For details, see "5. Outdoor Unit CCU Control (4)")
2C	Indoor unit fan stop temperature shift	-30=-30°C,,,,, 0=+0°C (P) ,,,,,50=+50°C
35	Condensation temperature adjustment Lower temperature of B area (Tc_B) for heating mode	-7=-7°C -6=-6°C,,,,, 0=0°C (P) ,,,,, 7=7°C
36	Condensation temperature adjustment Upper temperature of B area (Tc_B) for heating mode	-7=-7°C -6=-6°C,,,,, 0=0°C (P) ,,,,, 7=7°C
3E	PSccutgt delay-start setting	0=8 second delay-start (P) 1=(system address x1x8) second delay-start 2=(system address x2x8) second delay-start 3=(system address x3x8) second delay-start
3F	Evaporating temperature control lower limit shift	-9=-9°C,,,,,0=0°C (P), 1=1°C,,,,,20=20°C
40	Evaporating temperature control upper limit shift	-9=-9°C,,,,,0=0°C (P), 1=1°C,,,,,20=20°C
51	Indoor unit fan's intermittent operation and operating time when in cooling thermostat OFF	30=30 seconds , 60=60 seconds (P) ,,,, 240=240 seconds
52	Indoor unit fan's intermittent operation and stopped time when in cooling thermostat OFF	5=5 minutes (P), 10=10 minutes, 15=15 minutes, 20=20 minutes, 25=25 minutes, 30=30 minutes
5F	High efficiency mode setting	0=Invalid (P), 1=Valid (For details, see "4. Outdoor Unit Fan Control (8)")

11. 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.
81	Outdoor unit capacity (Setting when the data is not stored in the EEPROM. Do not change under normal conditions.)	0=Invalid 15=112 17=140 18=160
8F	High static pressure setting	0=Invalid (P) 1=High static pressure mode 1 (For details, see "4. Outdoor Fan Control (7)")
A3	The minimum operating time 1 until defrosting	20=20 minutes 21=21 minutes ,,,,, 40=40 minutes (P) 41 - 90=Never use (For details, see "8. Defrost Control (2)")
A6	Defrost fan speed select	0=Invalid (P) , 1=LL fan speed
A7	The minimum operating time 3 until defrosting	0=0 minute , 10=10 minutes ,,,,, 90=90 minutes (P) ,,,,, 120=120 minutes -1=Invalid
C1	O_2 output change	0=Continuously set OFF (P) 1=Refrigerant leak prevention (normal OFF) 2=Refrigerant leak prevention (normal ON) 3=Pumpdown control (For details, see "3. Special Control (3)")
CA	The defrost detection temperture setting	-3=-3°C (P) , -6=-6°C , -9=-9°C ,,,,, -30=-30°C
E1	Discharge air temperature control with thermostat OFF additional time	-20=-20 minutes -19=-19 minutes ,,,,, 0=0 minute (P) ,,,,, 10=10 minutes (For details, see "5. Outdoor Unit CCU Control (5)")
EF	Indoor unit auto restart setting	0=No control 1=capable of auto restart 2=incapable of auto restart

(3) Functions

A. ADD pin (2P, Black)	• Short circuited for over 1 second long → Auto address setting starts with open-circuit. • If short circuit lasts for over 1 second long during auto address setting, the setting is interrupted.
SW1 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 S002. • 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 1-4.)
SW2 Rotary switch (10 positions, Yellow)	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 64 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 1-4.)
SW3 DIP switch (1P, Black)	Switches for setting the 10s 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 SW4. • If 10 - 12 units are set, set only switch 1 (10s digit) to ON.
SW4 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 1-3.)

CN-TERMINAL pin (3P, Black)	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 (2P, 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)	When short circuited and pulse signal is given, all indoor units operate in the same refrigerant system.
STOP pin (2P, Black)	When short circuited and pulse signal is given, all indoor units stop in the same refrigerant system. (When short circuited, operation cannot be performed by the indoor unit’s remote controller.)
AP pin (2P, Black)	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)	Changes to cooling/heating mode. • When in normal operation: When short circuited the COOL side, indoor unit operation in the same refrigerant system changes to all cooling mode. When short circuited the HEAT side, indoor unit operation in the same refrigerant system changes to all heating mode. • When in auto address setting: Changes to heating mode with open-circuit.
TEST pin (2P, Black)	• 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)	When short circuited, test run begins. (If the remote controller is connected in test run mode, it is automatically cancelled after 1 hour.) Also, if short-circuit is cancelled, test run mode is cancelled.
DEF pin (2P, Black)	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.
SILENT plug (2P, White)	Can be used when setting the outdoor unit fan in sound absorbing mode.
OC EMG terminal (3P, Black)	If “TO INDOOR UNIT” accidently connected to high voltage, use the following method. 1. Replace the wire CN-OC with the wire CN-EMG. 2. Cut off SA1.

Table 1-3

● **The number of indoor units settings (SW3, SW4)**

Number of indoor units	Indoor unit setting (SW3) (1P DIP switch) 10	Indoor unit setting (SW4) (Rotary switch)
1 - 9 unit (factory setting : 1 unit)	ON / OFF 	 Set to 1 - 9
10 - 12 unit	ON / OFF 	 Set to 0 - 2

DO NOT exceed the maximum number of indoor units when making connections.

The indoor unit address setting should also be set less than “12”.

In the event of setting more than “13”, the communication cannot be made between the outdoor and indoor units.

Table 1-4

● **Examples of refrigerant circuit (R.C.) address settings (required when link wiring is used) (SW1, SW2)**

System address No.	System address (SW1) (2P DIP switch) 10 20	System address (SW2) (Rotary switch)
System 1 (factory setting)	Both OFF 	 Set to 1
System 11	1 ON 	 Set to 1
System 21	2 ON 	 Set to 1
System 30	Both ON 	 Set to 0

Table 1-5

● **Setting the System Address**

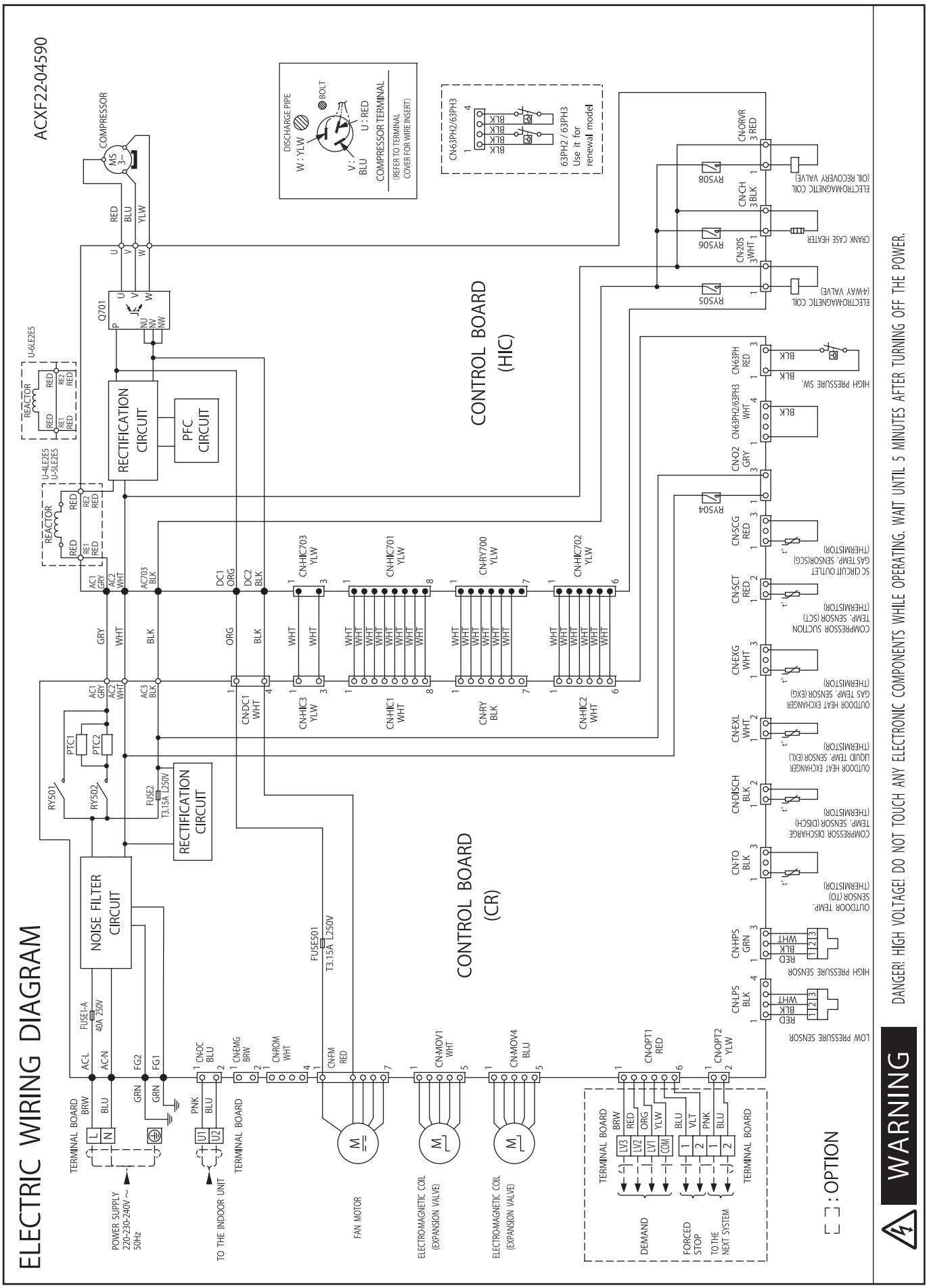
[SW2: Rotary switch (Yellow), SW1: 2P DIP (Black)]

	Outdoor system address	SW2 setting	SW1 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

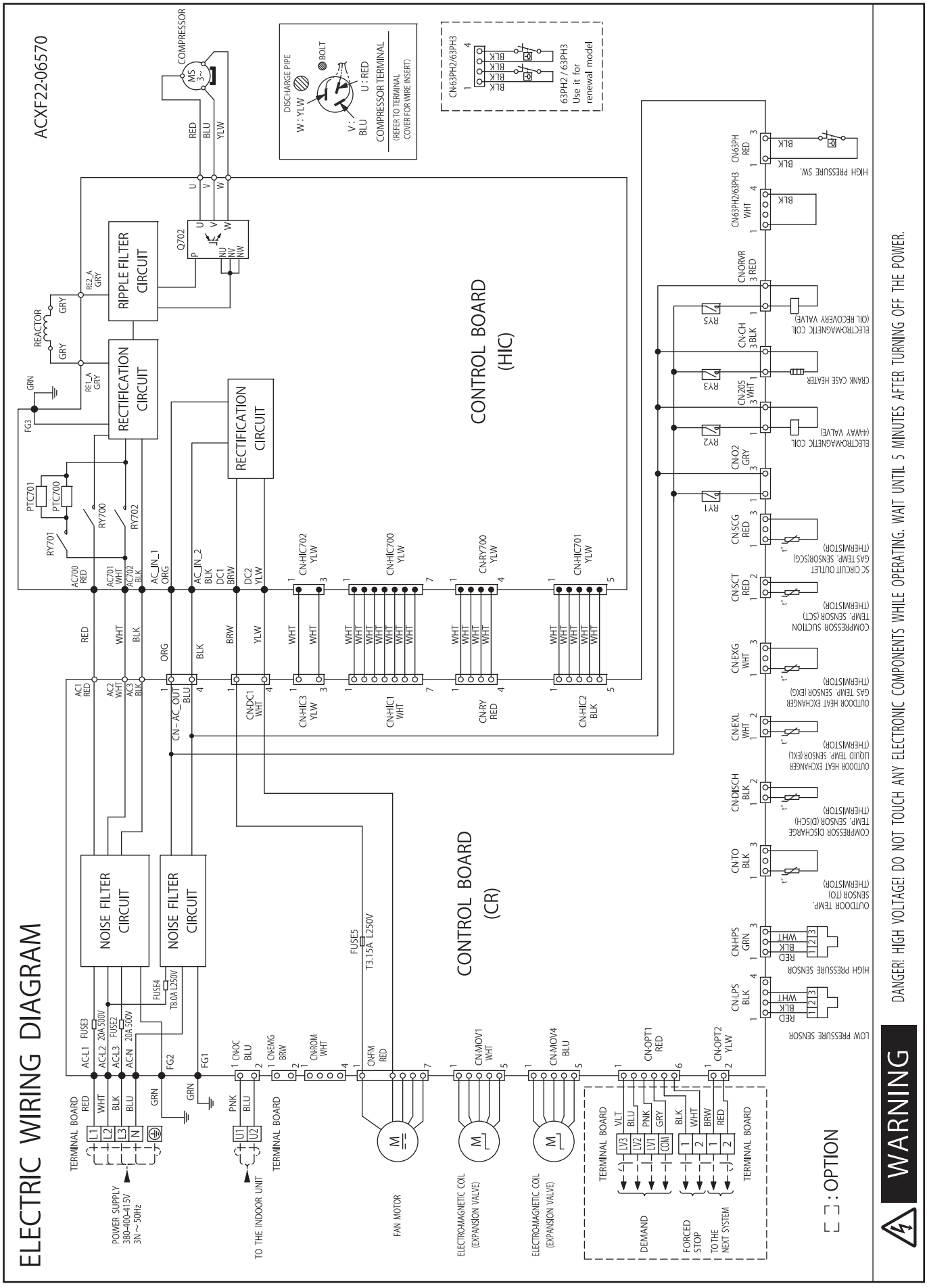
	Outdoor system address	SW2 setting	SW1 setting	
			1P (10s digit)	2P (20s digit)
Link wiring	20	0	OFF	ON
	21	1	OFF	ON
	22	2	OFF	ON
	23	3	OFF	ON
	24	4	OFF	ON
	25	5	OFF	ON
	26	6	OFF	ON
	27	7	OFF	ON
	28	8	OFF	ON
	29	9	OFF	ON
	30	0	ON	ON

1

(1) Electric Wiring Diagram U-4LE2E5, U-5LE2E5, U-6LE2E5



(2) Electric Wiring Diagram U-4LE2E8, U-5LE2E8, U-6LE2E8



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 “14. 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

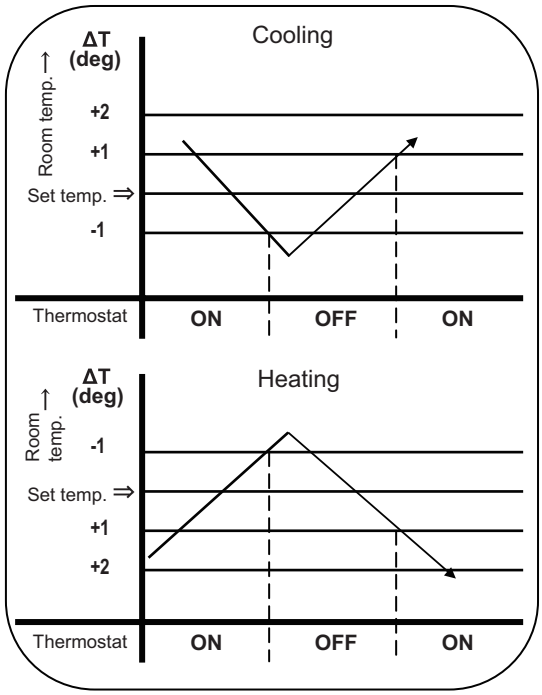
Remote controller sensor is enabled

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

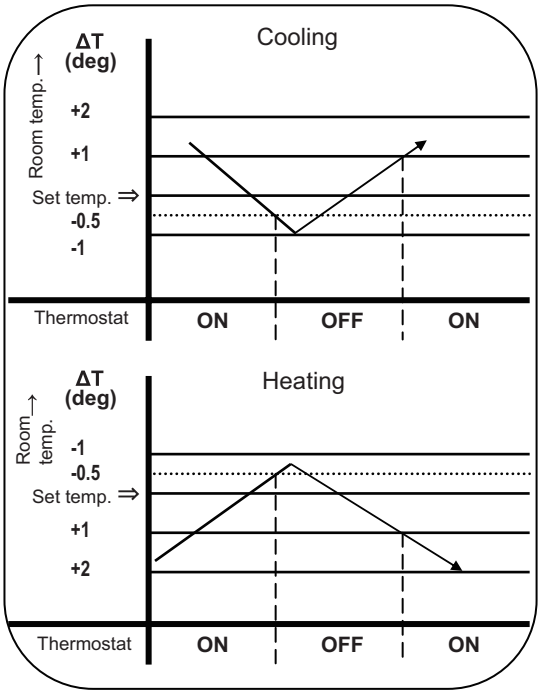
Remote controller sensor is enabled

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.

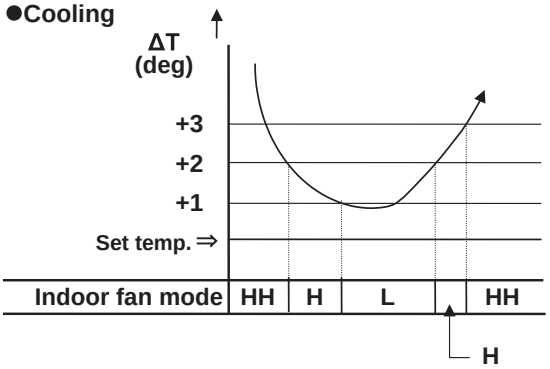
2. Heating Standby

● Refer to the indoor unit service manual.

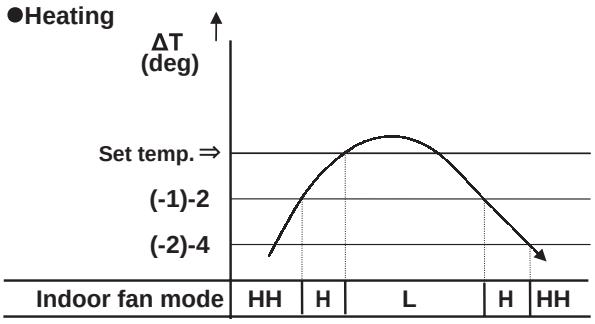
3. Automatic Fan Speed Control

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

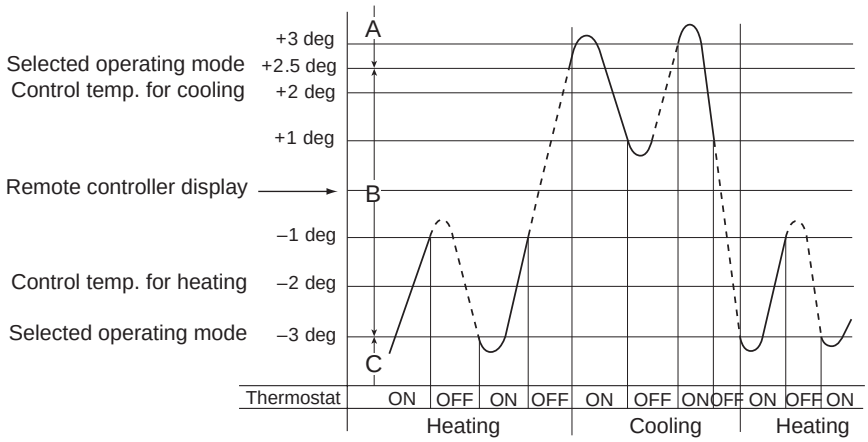
Example: Temperature set on the remote controller is 20°C.

	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 "14. 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, 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. RAP Valve Kit Control

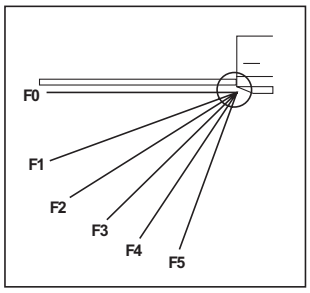
※ The RAP valve kit is sometimes used in the 2WAY system.

The RAP valve kit prevents refrigerant from collecting in the indoor heat exchanger when the indoor unit is stopped. The following table shows the RAP valve kit operation.

Operating mode		RAP valve kit
Stopped		OFF
Fan		OFF
Cooling	Thermostat ON	OFF
	Thermostat OFF	OFF
Heating	Thermostat ON	ON
	Thermostat OFF	OFF

9. 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

① The flap moves to the following position automatically when the indoor unit is stopped.
F0 (close): Types K1, 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.

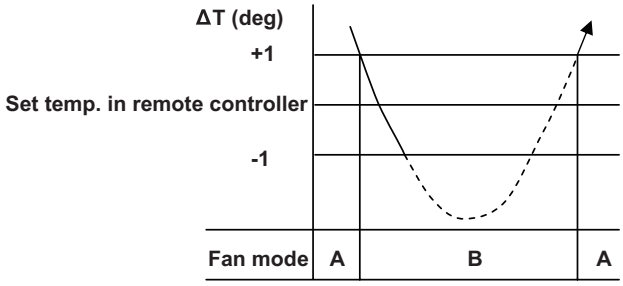
10. Filter Sign

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.

11. 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”.

12. 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.

13. T10 Terminal

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

14. 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
K1	Wall Mounted		2 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
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. When the power is turned off, wait for 5 minutes without any work. Then start working.**

(1) Front panel removal

- Remove the front panel (remove 2 screws).

(2) Cover A removal

- Remove the cover A (remove 1 screw).

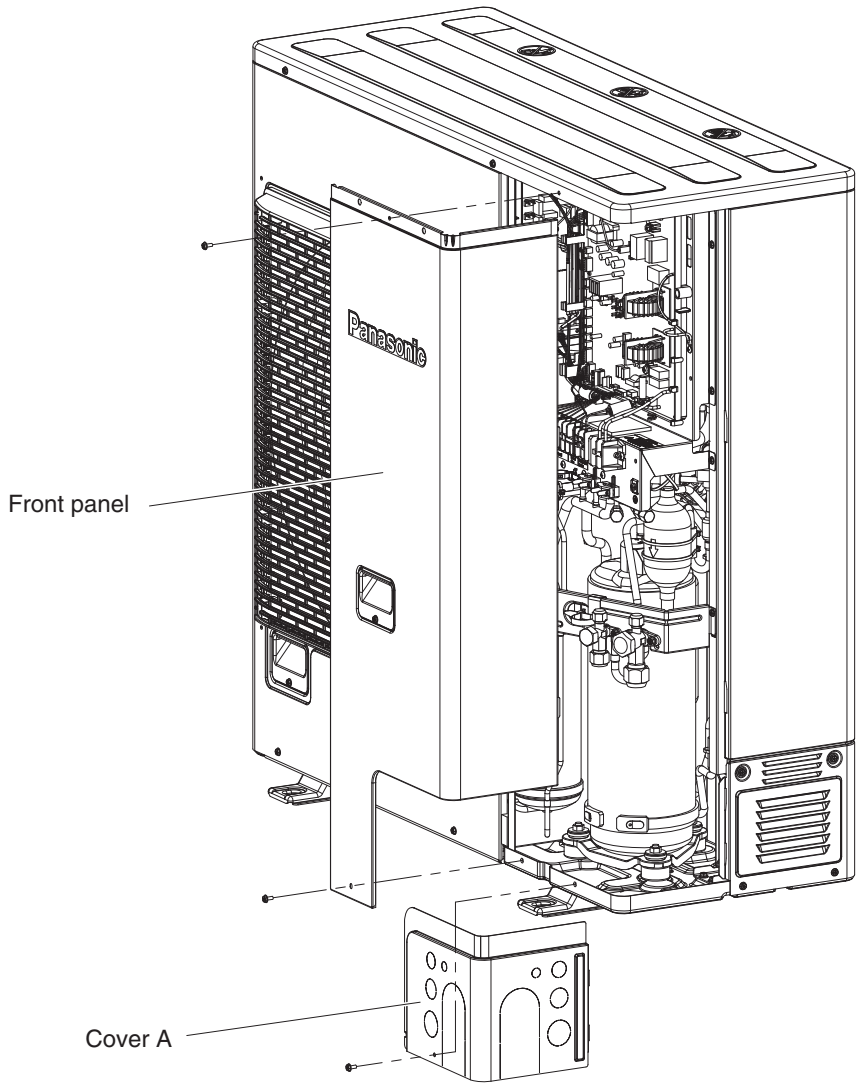


Fig. 1

2-1. Discharging Oil in Compressor

Recover the refrigerant in the outdoor unit following the procedures in “3. Recovering Refrigerant.” Remove the compressor and discharge the oil in it. See the section “8. Compressor” for detailed procedures.

2-2. Checking the Oil

Acceptance/rejection criteria for the oil

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

* 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.

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.

3-1. Refrigerant Recovery Procedures (from outdoor unit)

(1) Turn off the power of the outdoor unit beforehand (at power mains).
(2) Fully close each service valve on the liquid tube and gas tube 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. (Fig. 2)

⚠ 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 tubing, carry out this connection work carefully. (Fig. 2)

⚠ 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 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, 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 came with the refrigerant recovery unit.

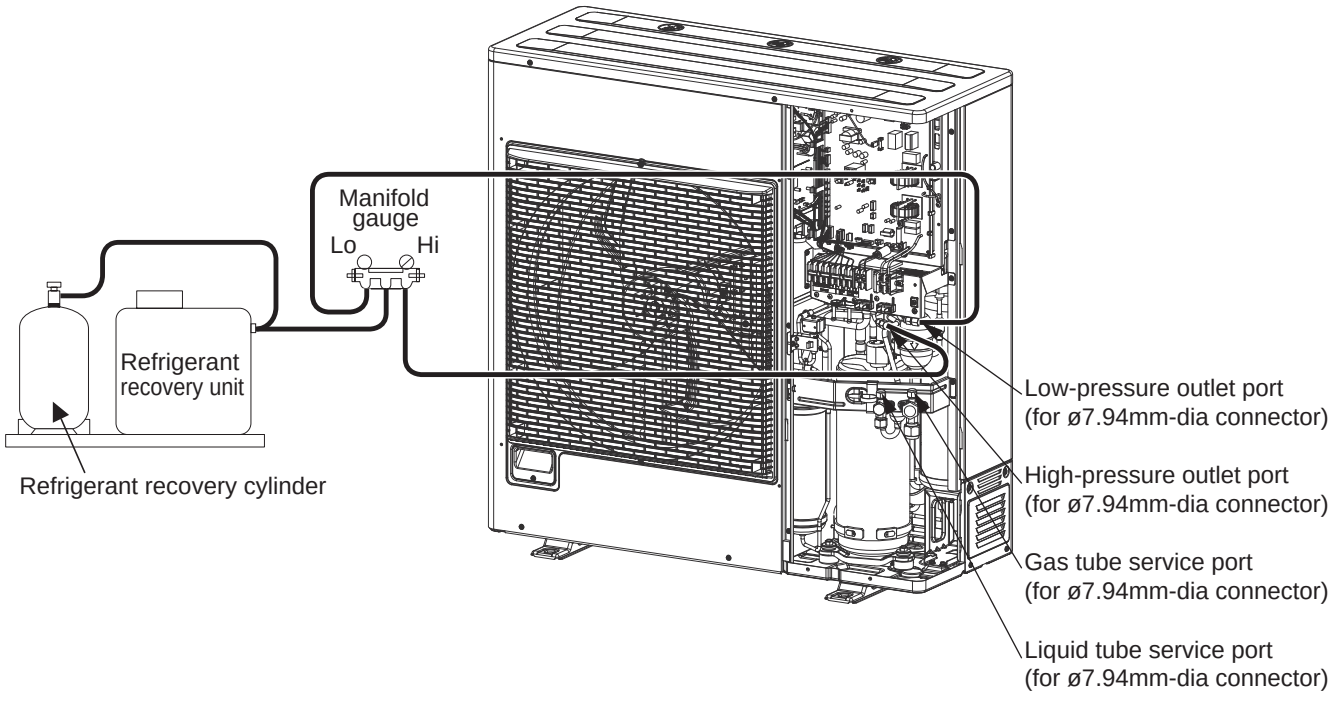
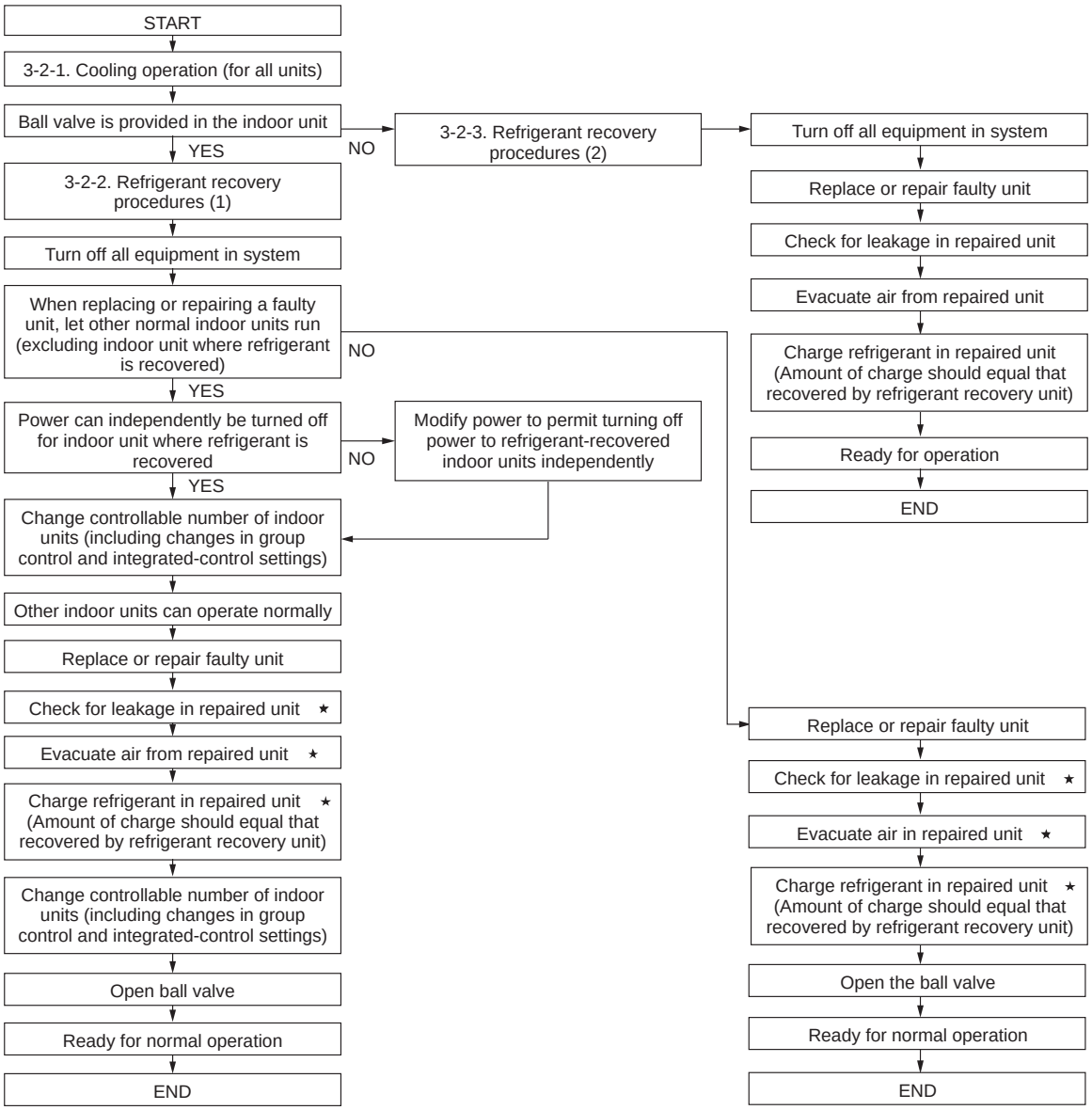


Fig. 2

3-2. 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 (narrow tube) side and the gas (wide tube) side ball valves. Refer to each section in the "Installation Instructions" on refrigerant charging, leak checking, and evacuation procedures.

3-2-1. 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 on 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 4 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 gas tubing.

Cooling : low temperature (20℃ or lower)

Heating: high temperature (60℃ or higher)

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

(2) If the remote controller is not available for maintenance of the outdoor unit
① Short-circuit the MODE pin ("COOL" side) on the outdoor unit control PCB.
② Short-circuit the CHK pin on the PCB to start test run operation.

3-2-2. 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. 3, follow the instructions given in (2) through (6) below. If the service port is instead located in the outdoor side, follow the instructions in "3-2-3. Refrigerant recovery procedures (2)."
(2) After running the unit in Cooling mode for about 5 minutes as described in "3-2-1. Cooling operation (for all units)," fully close the liquid tube ball valve.
(3) Run the unit in Cooling mode for 10 to 20 minutes more.
(4) Fully close the gas tube ball valve, and stop the operation of all units.
(5) Use hoses to connect the manifold gauge valves, refrigerant recovery unit, and refrigerant recovery cylinder with each other. (Fig. 3) Do each connection quickly to prevent air from entering the tubing.

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

(6) 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.

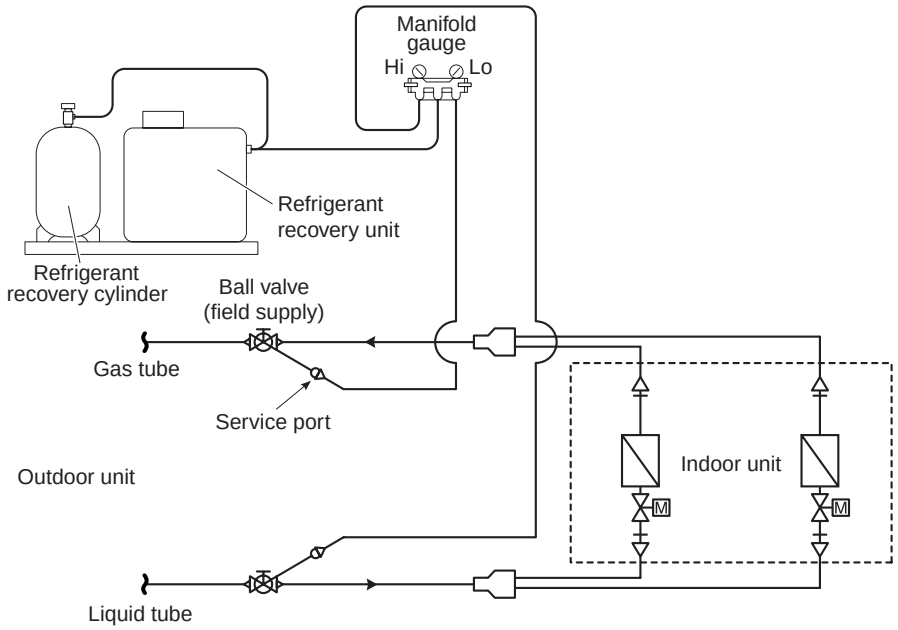


Fig. 3

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

Refrigerant in all indoor units and the refrigerant tubing circuit can be pumped into the outdoor unit. The maximum refrigerant storage capacity per a single outdoor unit is approx. 6.7 kg. 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 tubing at this time.

② Follow the instructions in "3-2-1. Cooling operation (for all units)" and operate all units in Cooling mode for approximately 10 minutes. Then fully close the liquid tube valve on the outdoor unit where pump down will be performed.

③ 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 gas tube valve on the outdoor unit where pump down is being performed.

* If the outdoor unit maintenance remote controller is unavailable, short-circuit the STOP pin.

④ Using hoses with Schrader-type push-to-release valves, connect the manifold gauge valves to the gas tube service port, the liquid tube service port to undergo pump down. (Fig. 4)

⚠ 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.

⑤ 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 tubing.

⑥ Recover remaining refrigerant from the inter-unit tubing 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.

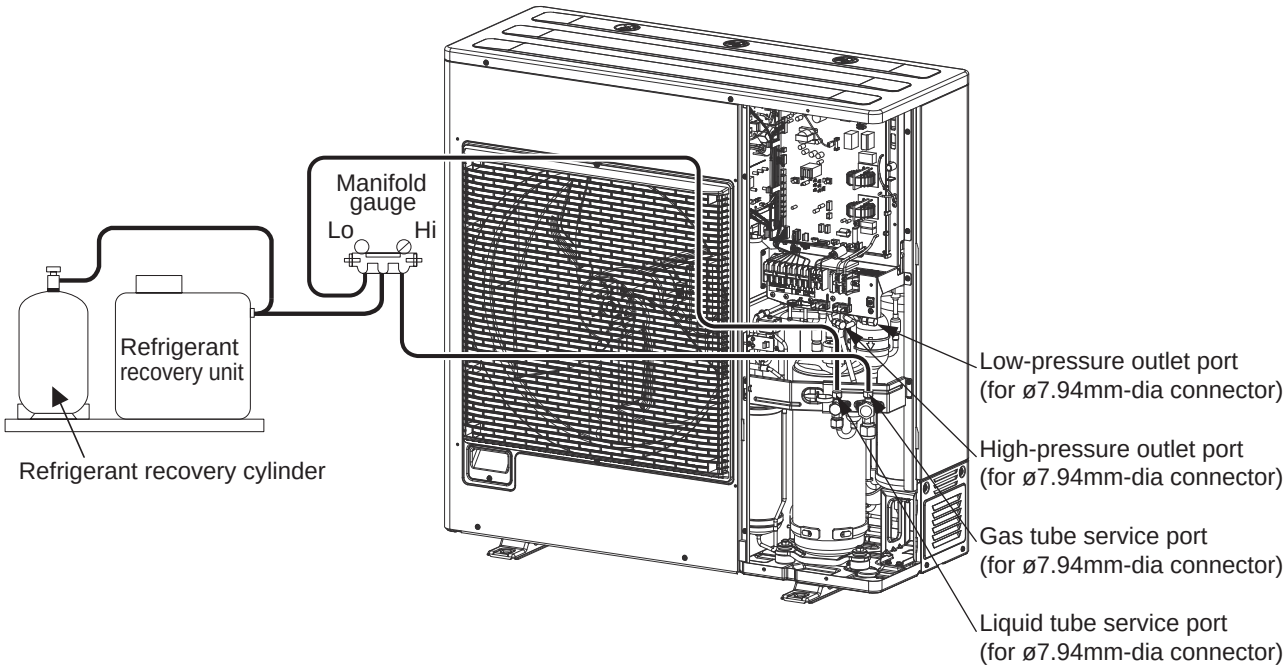


Fig. 4

3-3. Refrigerant recovery from Entire System

(1) Turn off power to the outdoor unit.

(2) Short-circuit the AP pin on the outdoor control PCB, then supply power to the outdoor unit.

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

(3) Connect the manifold gauge to the high- and low-pressure outlet ports (Schrader-type valves) on the outdoor unit. (Fig. 4)

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

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

(5) Check that each service valve of the gas tube and liquid tube for the outdoor unit has opened, then perform refrigerant recovery.

NOTE

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

4-1. 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 gas tube and liquid 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 3.8 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 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. Again feed nitrogen gas to obtain a system pressure of 3.8 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.

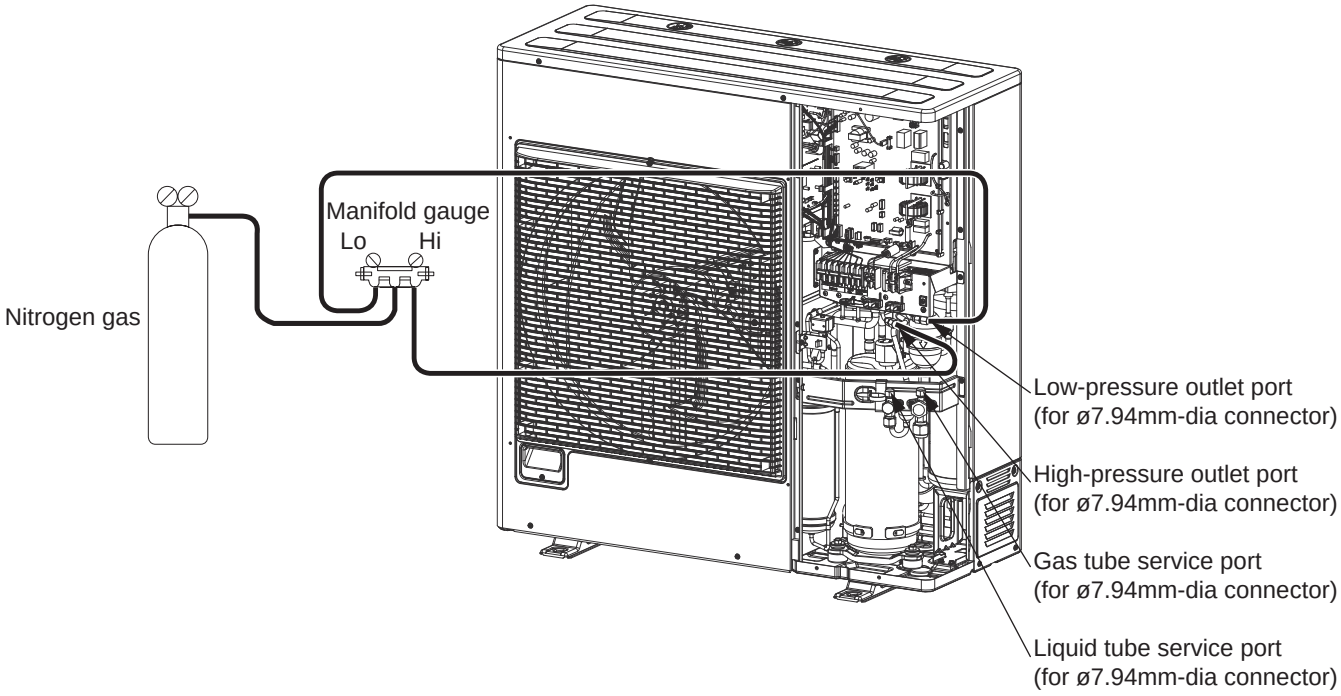


Fig. 5

4-2. Checking for Leakage in Refrigerant Tubing 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 tubing.

5-1. Evacuating Repaired Outdoor Unit

(1) Check that each service valve of the gas tube and liquid tube 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. (Fig. 6)
(3) Connect the manifold gauge valves to the vacuum pump.
* If the AP pin on the outdoor control PCB has already been short-circuited, step (4) is not necessary.
(4) Turn off power to the repaired outdoor unit and short-circuit the AP pin on the outdoor control PCB.

⚠ CAUTION

By short-circuiting the AP pin 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 –101kPa {–755 mmHg, 5 Torr}.

⚠ CAUTION

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

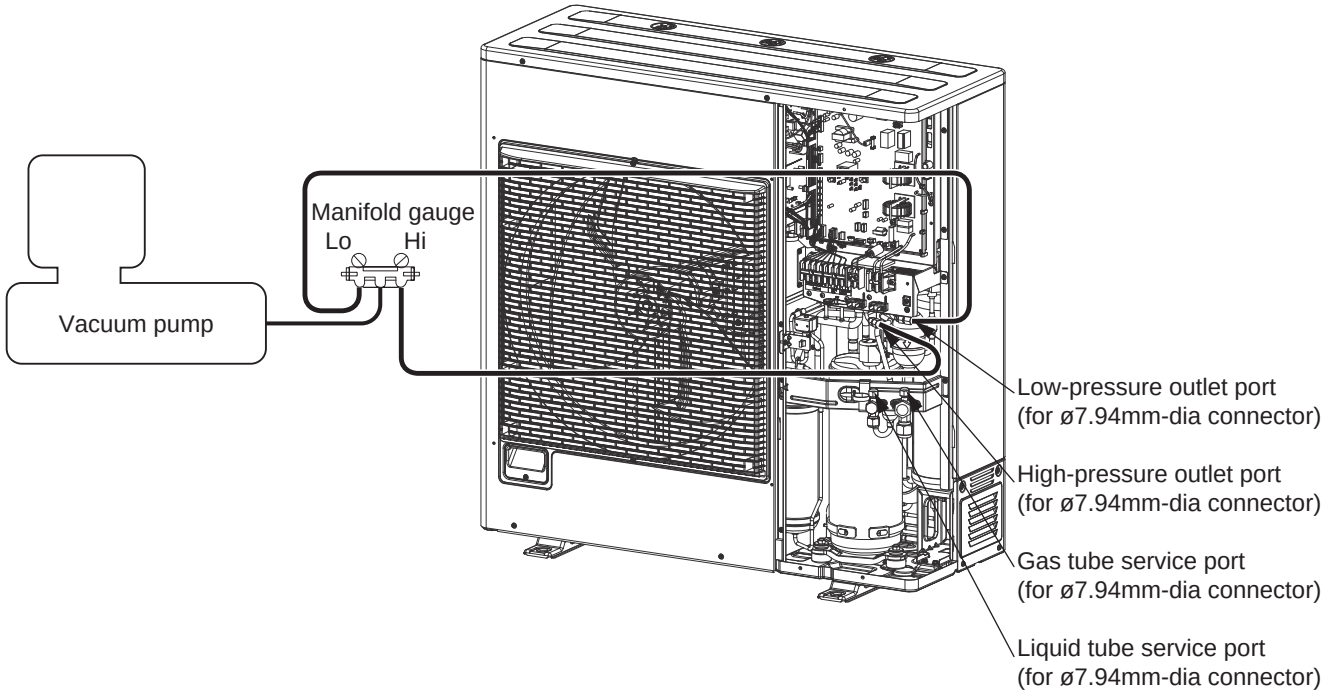


Fig. 6

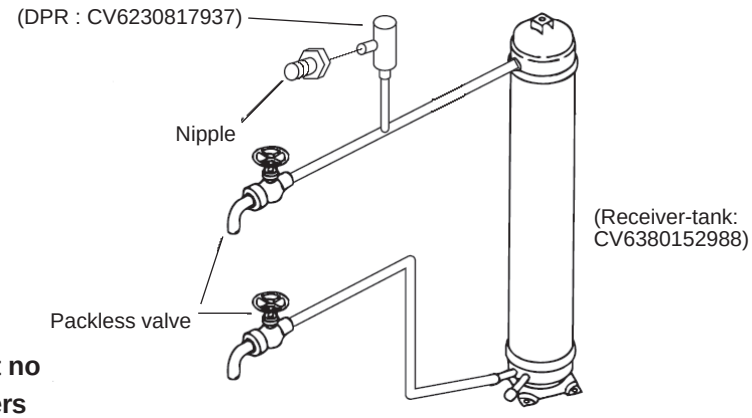
5-2. Evacuating Refrigerant Tubing Between Indoor and Outdoor Units

For details, refer to the “Installation Instructions” that came with the outdoor unit.

6-1. 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 gas tube service port carefully to avoid releasing refrigerant into the atmosphere.



⚠ CAUTION

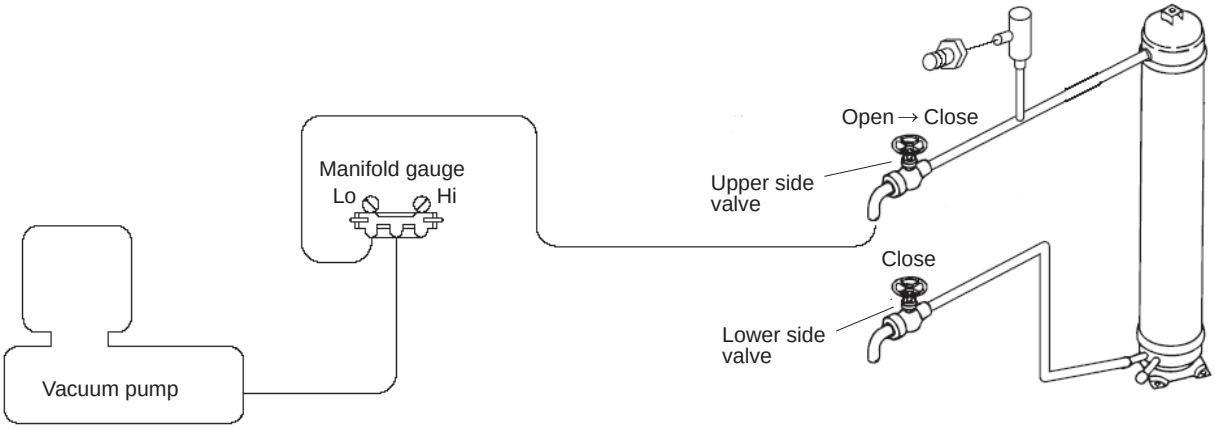
Perform oil charging work carefully so that no liquid refrigerant enters the charging tank.

(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 –101kPa {–755mmHg, 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.

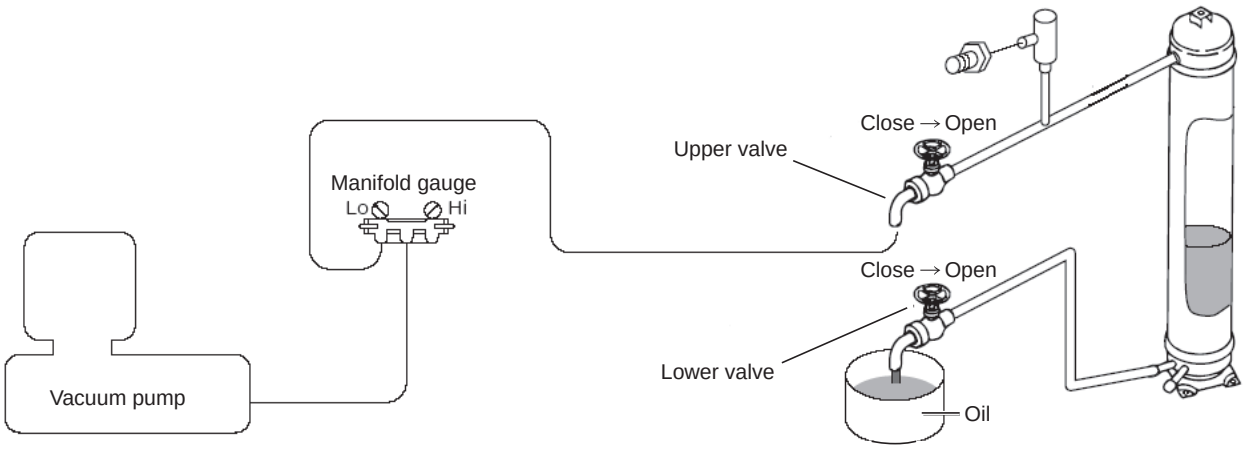
⚠ CAUTION

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



(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.



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 -101kPa {-755mmHg, 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

(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 gas 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 the tube.

⚠ 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 gas tube service port (low-pressure side).**

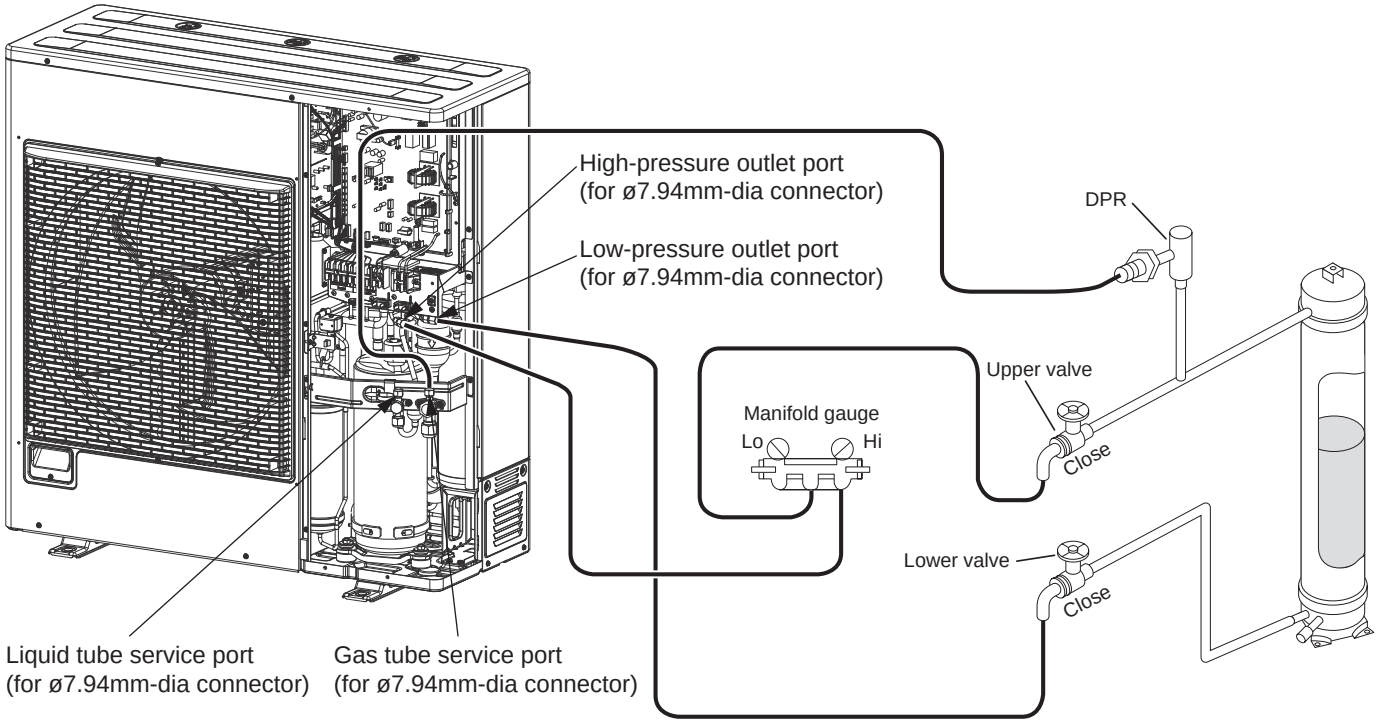


Fig. 7

Next, follow the instructions in “3-2-1. 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

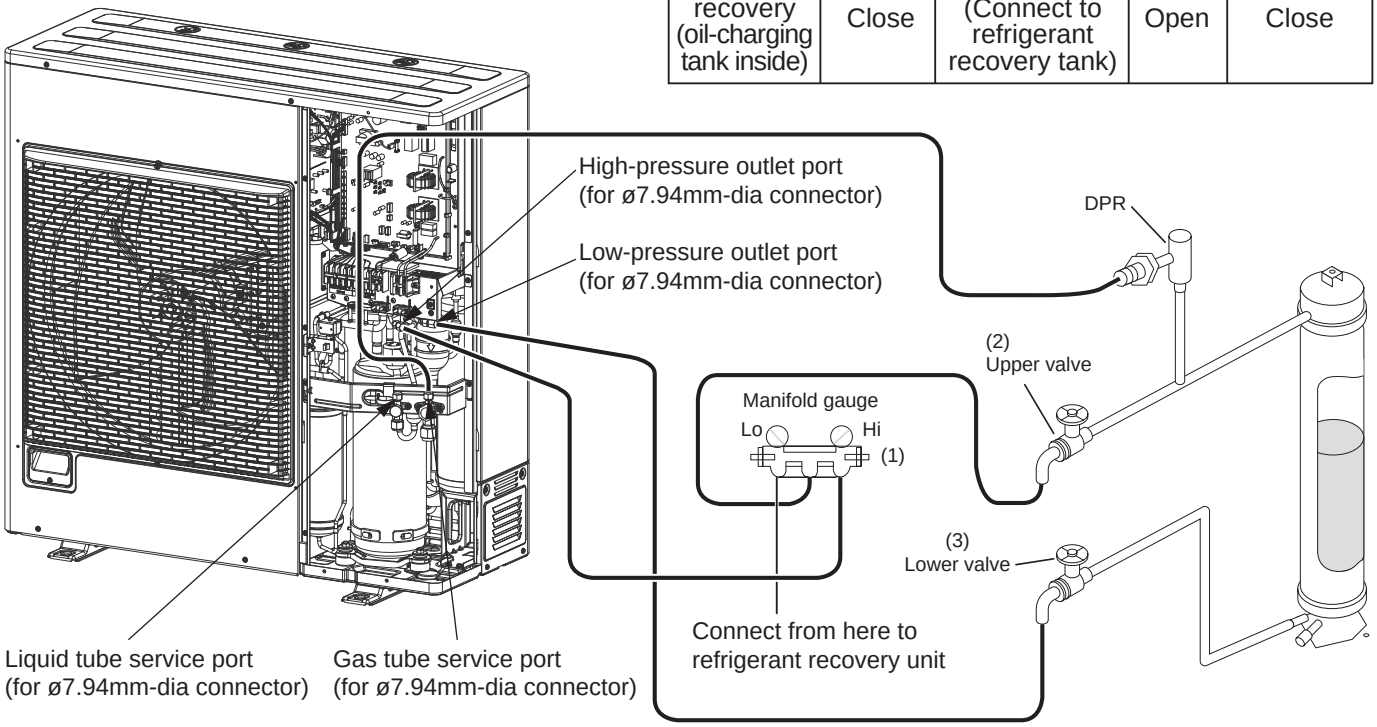


Fig. 8

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.

6-2. 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 “6-1. 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 “5. 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.**

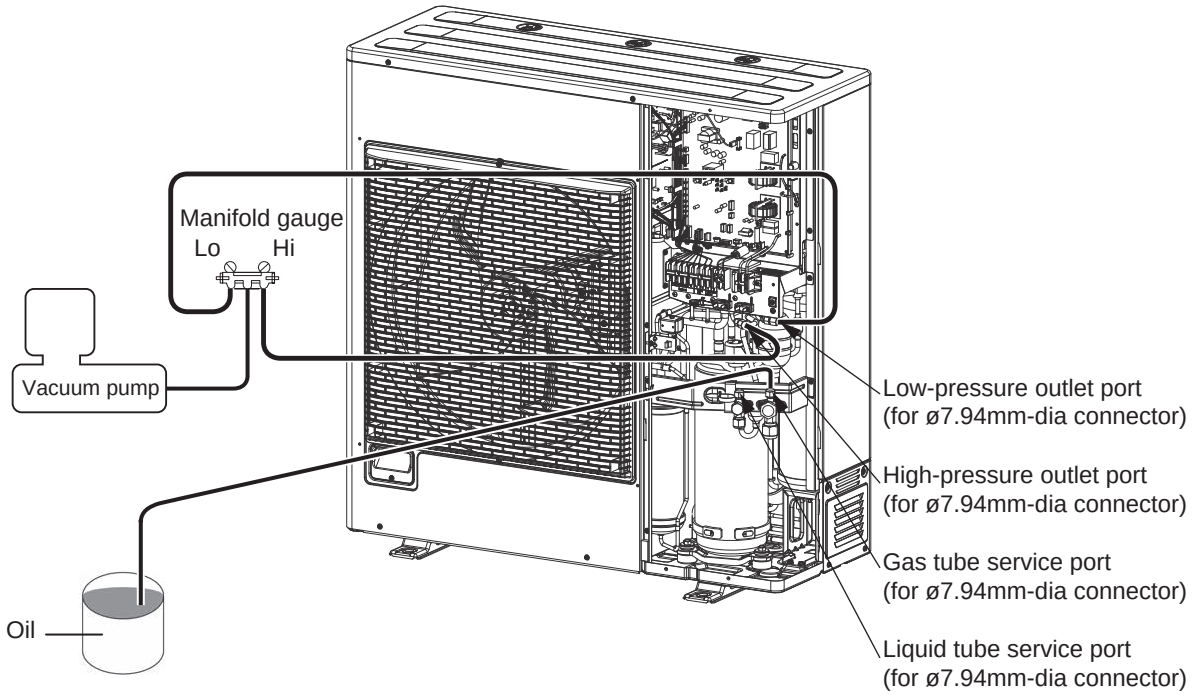


Fig. 9

6-3. Charging Additional Compressor Oil (after replacing compressor)

The rated amount of compressors as given below:

Model name	Compressor model	Q'ty	Weight (OIL IN) [kg]
U-*LE2E5	5VD420XEB21	1	22.1
U-*LE2E8	5VD420XFA21	1	22.1

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: 22.3 kg (removed compressor weight) – 22.1 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.

7. Pumping Out Refrigerant from Outdoor Unit

For the method used for additional oil charging after compressor replacement, see the section “6-1. 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.

7-1. If Remote Controller is Used for Maintenance of Outdoor Unit

(1) Connect the manifold gauge valves at the Lo side to the low-pressure outlet port of the outdoor unit. Also connect the refrigerant recovery cylinder 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 them. (Fig. 10)

* 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.**

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

(3) 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 gas tube.

Cooling mode: low temperature (20℃ or lower)

Heating mode: high temperature (60℃ or higher)

⚠ CAUTION **The gas tubing becomes hot (60°C or higher) in heating. Be careful so as not to be burnt when touching the tubing.**

(4) Then slowly close the liquid tube service valve.

(5) 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 gas 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 gas tube valve on the outdoor unit to be repaired.**

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

(7) Short-circuit the AP pin on the outdoor unit control PCB. Then turn ON the outdoor unit power.

⚠ CAUTION

When the AP pin 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.

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

NOTE

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

7-2. If Remote Controller is Not Available for Maintenance of Outdoor Unit

(1) Connect the manifold gauge valves at the Lo-side to the low-pressure outlet port of the outdoor unit. Also connect the refrigerant recovery cylinder 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 them. (Fig. 10)

* Connecting the refrigerant recovery cylinder is done to prevent pressure from rising excessively during the 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.

(2) Short-circuit the MODE pin ("HEAT" side) on the outdoor unit control PCB.

(3) Short-circuit the CHK pin to start operation, leave the unit running for a while. Touch the gas tubing with fingers to determine whether the unit is running in heating.

(4) 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 from the outdoor unit control PCB of that outdoor unit. Then immediately fully close the gas 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 gas tube valve on the outdoor unit to be repaired.

(5) Connect the high-pressure gauge side of the manifold gauge to the high-pressure outlet port on the outdoor unit, and connect the manifold gauge to the refrigerant recovery device. Be sure that no air enters the tubing at this time.
(6) Short-circuit the AP pin on the outdoor unit control PCB. Then turn ON the outdoor unit power.

⚠ CAUTION

When the AP pin 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.

(7) 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.

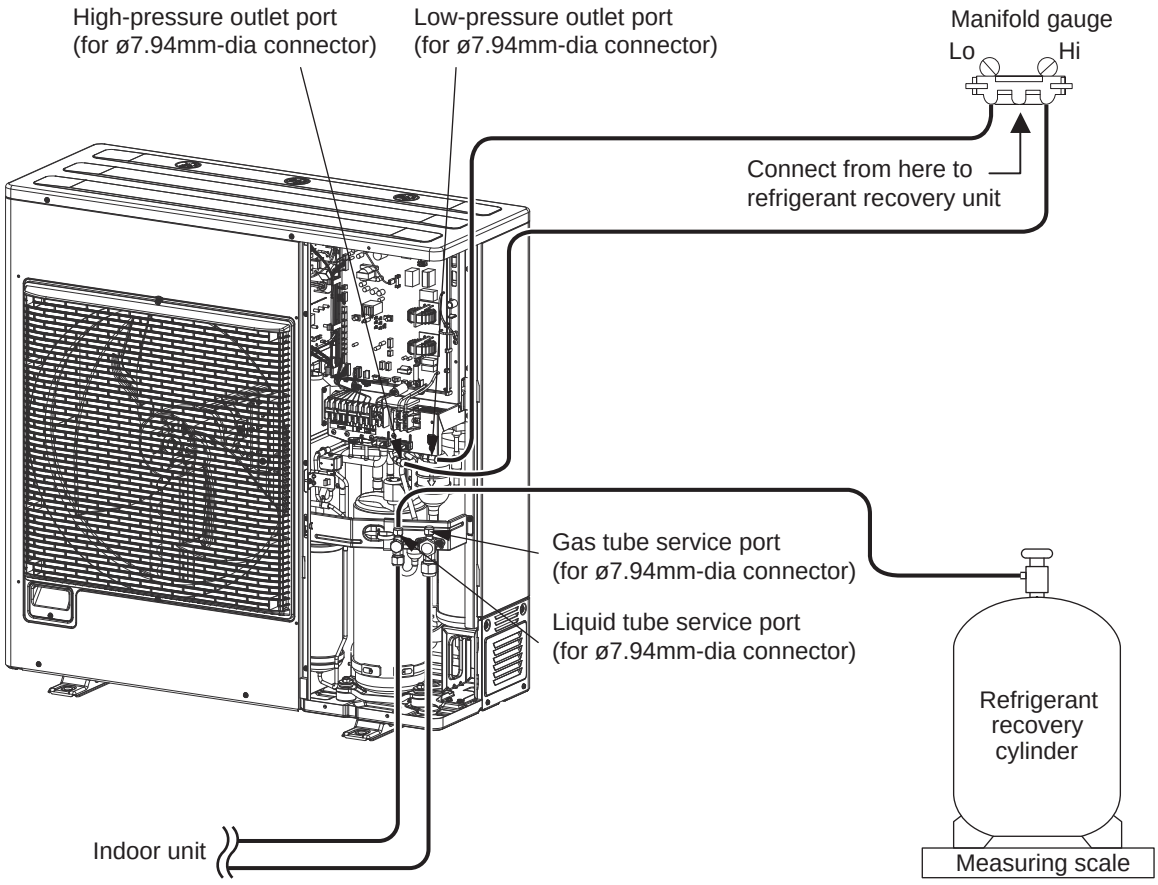


Fig. 10

8-1. 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]

A judgment is made based on factors that include the following:

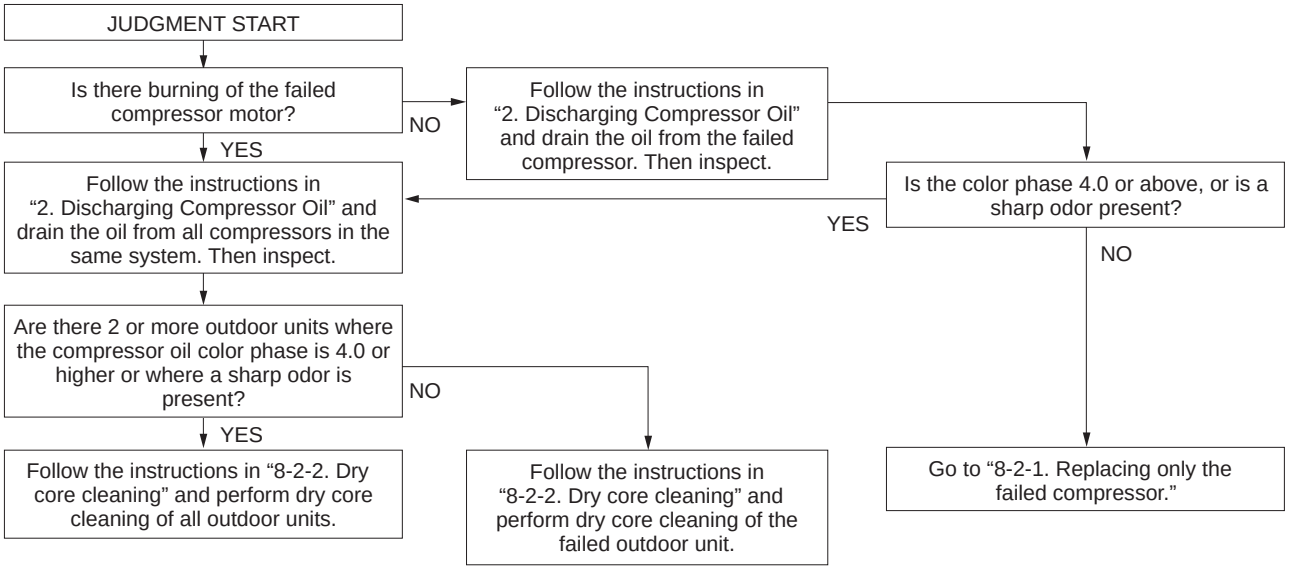
Coil resistance (varies depending on the compressor), insulation resistance, current, leakage breaker operation, oil and refrigerant fouling, odor, pressure, and noise

Reference:

Insulation resistance (Use a DC 500 V insulation resistance meter and measure the insulation resistance between the electrified and non-electrified parts.)

(a) Motor → Min. 300 MΩ
(b) Compressor → Min. 100 MΩ (servicing part)
(c) 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

8-2. Replacing the Compressor(s)

8-2-1. Replacing compressor

(1) Follow the instructions in “8-3. Removing Compressor” and replace the failed compressor.
(2) Fully close the high- and low-pressure gauge valves on the manifold gauge, then stop the vacuum pump.
(3) 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 tubing.
(4) 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.

(5) 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. Finally, fully open all valves on the gas tube and liquid tube.
(6) 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 “3-2-1. 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.

(7) If necessary, follow the instructions in “6. Charging Compressor Oil,” and charge with oil.
(8) 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.

8-2-2. Dry core cleaning

If burning or other failures occur repeatedly at compressors, 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) All units are operated in either Cooling or Heating mode.
For Cooling operation, see the Section 3-2-1. For Heating operation, see the Section 7-1 and 7-2.

(2) If all units are operated in Cooling mode, close the liquid tube service valve then the ball valve.
If all units are operated in Heating mode, close the ball valve then the liquid tube service valve.
* This step is performed in order to expel refrigerant from the tubing 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 from the outdoor unit control PCB. 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 outdoor unit where dry cores will be attached, then recover the refrigerant from the tubing. Be sure that no air enters the tubing at this time.

⚠ CAUTION **When the hose is connected, internal pressure is applied by the remaining refrigerant in the inter-unit tubing. 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. 11, disconnect the tube that runs from the liquid tube valve to the ball valve on outdoor unit where dry cores will be attached. Then attach the dry cores.

(6) At outdoor unit where dry cores are attached, pressurize with 3.8 MPa of nitrogen from the liquid tube service port and check for leaks.

(7) After evacuating all nitrogen gas from the tubing, apply vacuum from the liquid tube service port to outdoor unit where dry cores are attached until the pressure is –101kPa {–755 mm Hg, 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 units for approximately 3 hours (in either Heating or Cooling mode).

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

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

(12) Follow the instructions in “2. Discharging Compressor Oil” and drain a small amount of the oil from the oil separators of outdoor unit 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 return to 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 tubing between the liquid tube valves and the ball valves.

(15) At outdoor unit where dry cores were removed, pressurize with 3.8 MPa of nitrogen from the liquid tube service port and check for leaks.

(16) After evacuating all nitrogen gas from the tubing, apply vacuum to outdoor unit where dry cores were removed until the pressure is –101kPa {–755 mm Hg, 5 Torr} or less.
(17) 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 the section “3-2-3. Refrigerant recovery procedures (2) : Indoor unit with no ball valve equipped”. Perform pump down of the refrigerant from all indoor units and inter-unit tubing 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. 11.
(3) For the next steps, see the steps (6) – (17) in **(A)** on the previous page.

Cleaning dry core

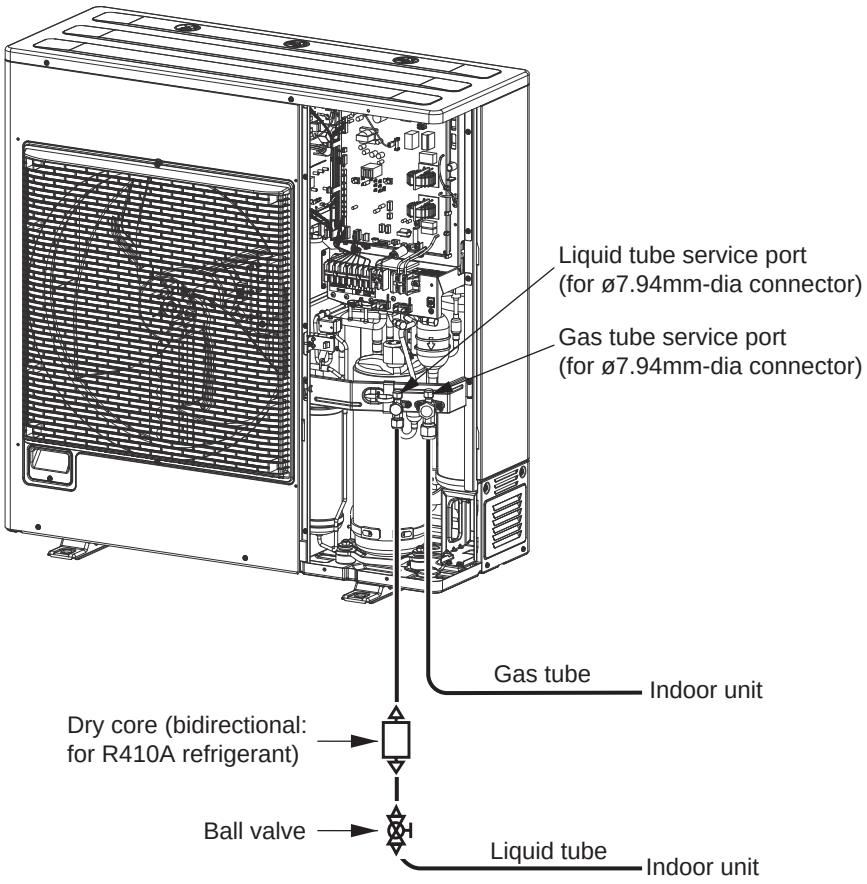


Fig. 11

8-3. Removing Compressors

Use caution to prevent water or foreign particles from invading the refrigerant tube while removing and installing the compressor.

8-3-1. Removing Compressors

(1) After recovering refrigerant in the system, replace the nitrogen gas through the service valve port.
(2) Remove the valve stay.
(3) Remove the insulator containing the compressor.
(4) Remove the compressor terminal cap and then take out the supply terminal.
(5) Remove the crankcase heater.
(6) Remove the hexagonal nuts with washer from three locations.
(7) Cut out the tube on the compressor side because the suction tube showing in the figure is rigid and unmovable.
(8) Remove each brazed part on the discharge side (one location) showing in the figure.

NOTE

Protect the sensor part, sheet-metal area, lubber, lead wire, clamper, etc.

(9) Pull the compressor toward you.
(10) Remove the brazed part on the suction side of the cut-out tube of the compressor side attached to the suction tube.