

INSTALLATION INSTRUCTIONS

Air Conditioner

Panasonic®

This air conditioner uses the refrigerant R32 or R410A.

Model No.

Indoor Units		Rated Capacity					
Type	Indoor Units Type	36	45	50	60	71	100
K2	Wall Mounted	S-36PK2E5B	S-45PK2E5B	S-50PK2E5B	S-60PK2E5B	S-71PK2E5B	S-100PK2E5B



ENGLISH

Read through the Installation Instructions before you proceed with the installation.
In particular, you will need to read under the "IMPORTANT!" section at the top of the page.

FRANÇAIS

Lisez les instructions d'installation avant de commencer l'installation.
En particulier, vous devez lire la section "IMPORTANT!" en haut de la page.

ESPAÑOL

Lea las Instrucciones de instalación antes de proceder con la instalación del equipo.
En concreto, deberá leer detenidamente la sección "¡IMPORTANTE!" situada al principio de la página.

DEUTSCH

Lesen Sie die Einbauanleitung, bevor Sie mit der Installation beginnen.
Insbesondere die Hinweise im Abschnitt "WICHTIG!" oben auf der Seite müssen unbedingt gelesen werden.

ITALIANO

Leggere le Istruzioni di installazione prima di procedere con l'installazione.
Prestare particolare attenzione alla sezione "IMPORTANTE!" all'inizio della pagina.

NEDERLANDS

Lees de installatie-instructies zorgvuldig door voor u begint met de installatie.
U moet vooral het gedeelte waar "BELANGRIJK!" boven staat heel goed lezen.

PORTUGUÊS

Leia cuidadosamente as instruções de instalação antes de prosseguir com a instalação.
Em particular, é necessário ler as informações na secção "IMPORTANTE!" na parte superior da página.

ΕΛΛΗΝΙΚΑ

Διαβάστε τις Οδηγίες εγκατάστασης πριν συνεχίσετε με την εγκατάσταση.
Συγκεκριμένα, θα χρειαστεί να διαβάσετε την ενότητα «ΣΗΜΑΝΤΙΚΟ!» στο πάνω μέρος της σελίδας.

БЪЛГАРСКИ

Прочетете инструкциите за инсталиране преди да продължите с инсталирането.
В частност, ще трябва да прочетете раздела „ВАЖНО!“ в горната част на страницата.

TÜRKÇE

Montaja başlamadan önce tüm Montaj Talimatlarını okuyun.
Özellikle sayfanın üstünde yer alan "ÖNEMLİ!" başlıklı bölümünü okumanız gerekir.

ENGLISH

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ESPAÑOL

DEUTSCH

ITALIANO

NEDERLANDS

PORTUGUÊS

ΕΛΛΗΝΙΚΑ

БЪЛГАРСКИ

TÜRKÇE

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:

- This Installation Instructions is for the indoor unit and read the Installation Instructions of the outdoor unit as well.
- 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.
- That compliance with national gas regulations shall be observed.
- 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.



WARNING

- Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
- The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).
- Do not pierce or burn.
- Be aware that refrigerants may not contain an odour.

- The following checks shall be applied to installations using flammable refrigerants.

Appliance shall be installed, operated and stored in a room with a floor area larger than [Amin] m².

As for [Amin], see the section "15. CHECK OF DENSITY LIMIT".


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.
- 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. 

- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects.
The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
- This equipment is strongly recommended to be installed with Earth Leakage Circuit Breaker (ELCB) or Residual Current Device (RCD). Otherwise, it may cause electrical shock and fire in case of equipment breakdown or insulation breakdown.

When Transporting

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

When storing...



WARNING

- The appliance shall be stored in a well-ventilated area where the room size corresponds to the room area as specified for operation.
- The appliance shall be stored in a room without continuously operating open flames (for example: an operating gas appliance) and ignition sources (for example: an operating electric heater).
- The appliance shall be stored so as to prevent mechanical damage from occurring.

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 cases that require mechanical ventilation, ventilation openings shall be kept clear of obstruction.
- An unventilated area where the appliance using flammable refrigerants is installed shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.

...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.

...At least 2.5 m

Recommended installation height for indoor unit shall be at least 2.5 m.

...In laundry rooms

Do not install in laundry rooms. Indoor unit is not drip proof.

When Connecting Refrigerant Tubing

Pay particular attention to refrigerant leakages.



WARNING

- When performing piping work, do not mix air except for specified refrigerant in refrigeration cycle. It causes capacity down, and risk of explosion and injury due to high tension inside the refrigerant cycle.
- If the refrigerant comes in contact with a flame, it produces a toxic gas.
- Do not add or replace refrigerant other than specified type. It may cause product damage, burst and injury, etc.
- Ventilate the room immediately, in the event that is refrigerant gas leaks during the installation. Be careful not to allow contact of the refrigerant gas with a flame as this will cause the generation of toxic gas.
- Keep all tubing runs as short as possible.
- Use the flare method for connecting tubing.
- 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.
- Under no circumstances shall potential sources of ignition be used in the searching or detection of refrigerant leaks.
- A halide torch (or any other detector using a naked flame) shall not be used.
- Electronic leak detectors may be used to detect refrigerant leaks but, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.)
- Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used.
- Leak detection equipment shall be set at a percentage of the lower flammable limit (LFL) of the refrigerant and shall be calibrated to the refrigerant employed and the appropriate percentage of gas (25 % maximum) is confirmed.
- Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.
- If a leak is suspected, all naked flames shall be removed/extinguished.
- If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

When Servicing

- Contact to the sales dealer or service dealer for a repair.
- Be sure to turn off the power before 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, do follow the precautions in "14. RECOVERY" and 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.  

NOTICE

The English text is the original instructions. Other languages are translations of the original instructions.






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1. GENERAL

This booklet briefly outlines where and how to install the air conditioning system. Please read over the entire set of instructions for the indoor units and make sure all accessory parts listed are with the indoor units before beginning.

The installation of pipe-work shall be kept to a minimum.

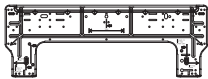



	WARNING	This symbol shows that this equipment uses a flammable refrigerant. If the refrigerant is leaked, together with an external ignition source, there is a possibility of ignition.
	CAUTION	This symbol shows type of flammable refrigerant contained in the system.
	CAUTION	This symbol shows that the Operating Instructions should be read carefully.
	CAUTION	This symbol shows that a service personnel should be handling this equipment with reference to the Technical Manual.
	CAUTION	This symbol shows that there is information included in the Operating Instructions and/or Installation Instructions.

1-1. Tools Required for Installation (not supplied)

1. Flathead screwdriver
2. Phillips head screwdriver
3. Knife or wire stripper
4. Tape measure
5. Carpenter's level
6. Sabre saw or keyhole saw
7. Hacksaw
8. Core bits
9. Hammer
10. Drill
11. Tube cutter
12. Tube flaring tool
13. Torque wrench
14. Adjustable wrench
15. Reamer (for deburring)

1-2. Accessories Supplied with Unit

Make sure all accessory parts listed are with the system before beginning.

Part Name	Figure	Q'ty	Remarks
Installation plate		1	
Screw (4x20)		5	For installation plate installation
Flare insulation		1	For flare nut insulation
Clamper		1	For fixing wires (optional)

1-3. Type of Copper Tube and Insulation Material

If you wish to purchase these materials separately from a local source, you will need:

1. Deoxidized annealed copper tube for refrigerant tubing. Cut each tube to the appropriate lengths +30 cm to 40 cm to dampen vibration between units.
2. Foamed polyethylene insulation for copper tubes as required to precise length of tubing. Wall thickness of the insulation should be not less than 8 mm.
3. Use insulated copper wire for field wiring. Wire size varies with the total length of wiring. Refer to **4. ELECTRICAL WIRING** for details.



CAUTION

Check local electrical codes and regulations before obtaining wire. Also, check any specified instructions or limitations.

1-4. Additional Materials Required for Installation

1. Refrigeration (armored) tape
2. Insulated staples or clamps for connecting wire (See your local codes.)
3. Putty
4. Refrigeration tubing lubricant
5. Clamps or saddles to secure refrigerant tubing
6. Scale for weighing

2. SELECTING THE INSTALLATION SITE

2-1. Indoor Unit

AVOID:

- areas where leakage of flammable gas may be expected.
- locations where sulfurous acid gas or corrosive gas occurs.
- places where large amounts of oil mist exist such as a kitchen of a Chinese restaurant or near a machinery equipment of the factory. The oil can be adhered to the surface of the heat exchanger or resin parts and this will cause a decrease in performance, spray or drip water and deformation or damages.
- direct sunlight.
- locations near heat sources which may affect the performance of the unit.
- locations where external air may enter the room directly. This may cause “condensation” on the air discharge ports, causing them to spray or drip water.
- locations where the remote controller will be splashed with water or affected by dampness or humidity.
- installing the remote controller behind curtains or furniture.
- locations where high-frequency emissions are generated.
- turning ON the power or operate the unit until work of refrigerant tubing and electrical wiring have been completed. Highly dangerous electrical voltages are used in this system.

DO:

- Install the unit to allow cool air (and warm air) to flow smoothly. Never place objects near the air inlet or the air outlet of the unit. This will reduce the efficiency of the unit.
- select an installation location which is rigid and strong enough to support or hold the unit.
- select a location which can support a load that is four times the indoor unit weight.
- select a location for drainage work properly. If it is improperly, this will cause damage to property.
 - Select a location where tubing and drain pipe have the shortest run to the outdoor unit.
 - Insulate the drain pipe running inside the building.
 - Pay attention to the drainage planning not to cause neighbors trouble.
- allow room for operation and maintenance as well as unrestricted air flow around the unit.
- keep the fire alarm and the air outlet at least 1.5 m away from the unit.
- recommended installation height for indoor unit shall be at least 2.5 m.
- when installing the unit in the hotel rooms or executive offices with a low-level noise, it is recommended that the external electronic expansion valve kit (optional) be installed.
- the limitation of the tubing length between the indoor and the outdoor units should be referred to the Installation Instructions of the outdoor unit.
- allow room for mounting the remote controller about 1 m off the floor, in an area that is not in direct sunlight or in the flow of cool air from the indoor unit.

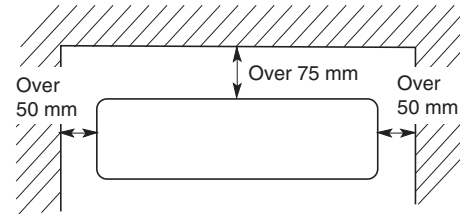
NOTE

Air delivery will be degraded if the distance from the floor to the ceiling is greater than 3 m.

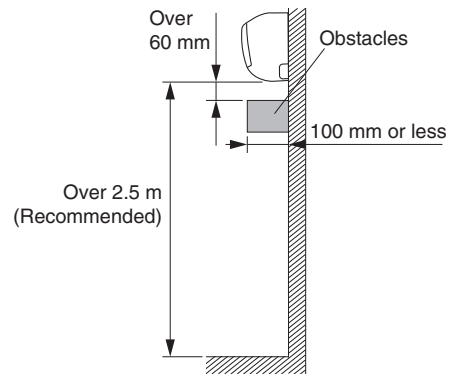
Wall Mounted

The air inlet and outlet of the indoor unit must be free of any obstructions to allow air to spread throughout the room.

1. The indoor unit must be within a maintenance space.



Front View



Side View

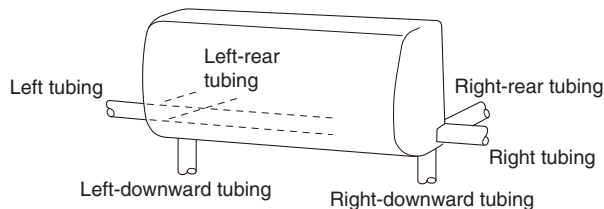
3. HOW TO INSTALL THE INDOOR UNIT

3-1. Starting the Installation

(1) Remove the rear panel.

NOTE

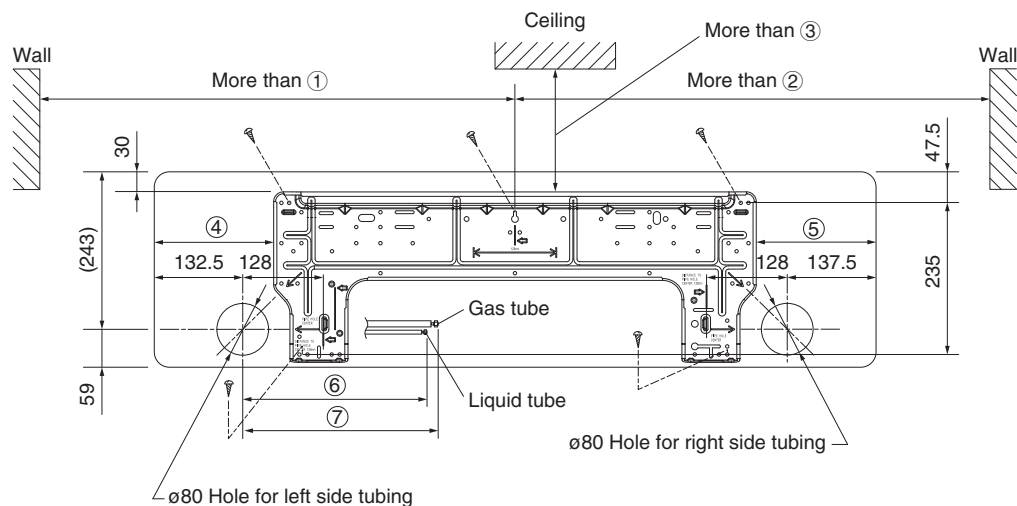
Tubing can be extended in 6 directions as shown below.
 Select the direction you need providing the shortest run to the outside unit.
 Tubing direction



3-2. How to Make a Hole

The mounting wall should be strong and solid enough to withstand the unit's vibration.

(1) Place the installation plate from the indoor unit on the wall at the location selected.



* Mount the installation plate with 5 screws completely.

unit: mm

Dimension						
①	②	③	④	⑤	⑥	⑦
607.5	612	105	183.5	188.5	400	450

Make sure the installation plate is horizontal, using a carpenter's level or tape measure to measure down from the ceiling. Wait until after cutting the hole before attaching the installation plate to the wall.

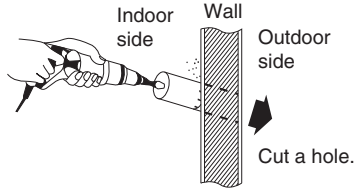
- * The center of installation plate should be at more than ① at right of the wall.
- * The center of installation plate should be at more than ② at left of the wall.
- * The distance from installation plate edge to ceiling should be more than ③.
- * From installation plate left side to unit's left side is ④.
- * From installation plate right side to unit's right side is ⑤.
- * For left side tubing, tubing connection for liquid should be about ⑥ from this line.
- * For left side tubing, tubing connection for gas should be about ⑦ from this line.

- (2) Before making the hole, check carefully that no studs or pipes are directly run behind the spot to be cut.

CAUTION Avoid areas where electrical wiring is located.

The above precautions are also applicable if tubing goes through the wall in any other location.

- (3) Using a sabre saw, keyhole saw or hole-cutting drill attachment, cut a hole of $\varnothing 80$ mm in the wall. Hole should be made at a slight downward slant to the outdoor side.

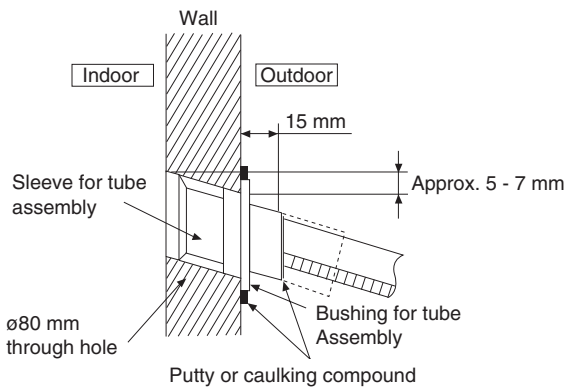


Hole Dia. (mm)
80

- (4) Place a plastic cover over the end of the pipe (for indoor side only) and insert the pipe in the wall. This will protect the tube from contacting the metal lath or wire lath, leakage due to condensation or entering small animals through the hole.

CAUTION

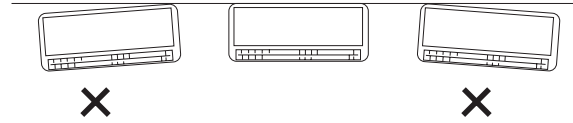
When the wall is hollow, please be sure to use the Piping sleeve assembly to prevent dangers caused by mice biting the connection cable.



3-3. Install the Installation Plate on the Wall

If Wooden Wall

- (1) Attach the installation plate to the wall with the 5 screws (4×20) provided.
- (2) Double check with a carpenter's level or tape measure that the panel is level. This is important to install the unit properly.



- (3) Make sure the panel is flush against the wall. Any space between the wall and unit will cause noise and vibration.

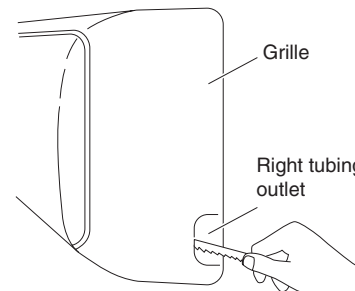
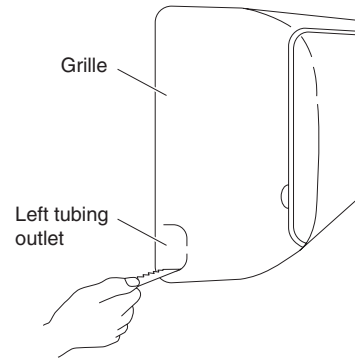
If Concrete Wall

- (1) When attaching the installation plate to the concrete wall, use the screws (field supply) for concrete or an optional anchor plug and fix to the hole of $\varnothing 5$ mm of the installation plate as shown in the figure under the section 3-2. When fixing with bolt, attach to the hole of $\varnothing 8$ mm.
- (2) Double check with a carpenter's level or tape measure that the plate is level. This is important to install the unit properly.
- (3) Make sure the installation plate is flush against the wall. Any space between the wall and unit will cause noise and vibration.

3-4. Indoor Side Tubing

Arrangement of tubing by direction

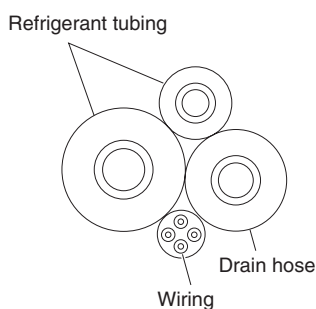
- 1) Left side, left bottom or right side, right bottom tubing
Cut out the corner of the right/left frame with a hacksaw or the like.



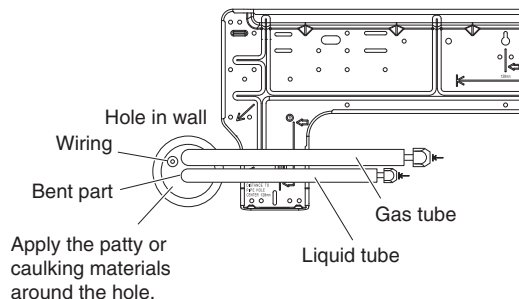
- 2) Right-rear or left-rear tubing
In this case, the corner of the frame need not be cut.

3-4-1. Right-rear side, right side, right-bottom side tubing

Be sure to insulate the drain hose and refrigerant tubing to run through the rooms.

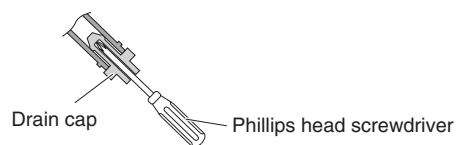
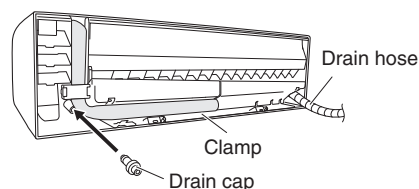
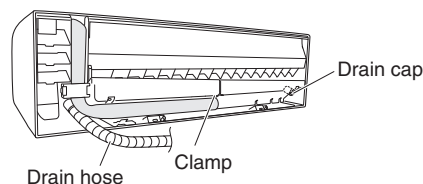
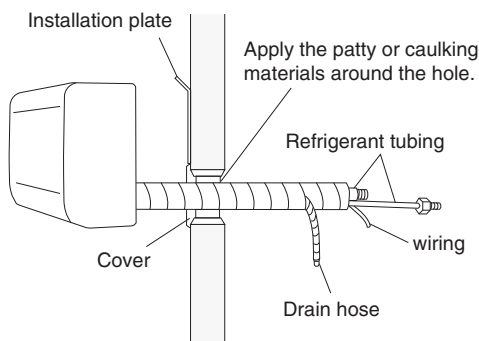


- Pull out the drain hose to remove it. When attaching it, slide the drain hose fully onto the drain pan outlet. (It will be easy to slide when water is added.) After attaching the drain hose, check that it is attached securely.

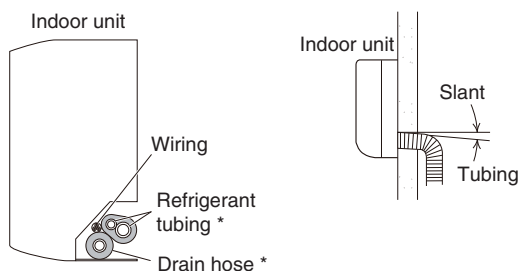


Mounting the indoor unit

- 1) Assemble the refrigerant tubing, drain hose and wiring together with the armoring tape. Do not wind the tape forcibly more than necessary. The drain hose should be positioned below the tubing not to apply too much tension. (Cross-section view)
- 2) Push the wiring, refrigerant tubing and drain hose through the hole in the wall. Mount the indoor unit to be seated so it is caught on the tabs of the installation plate.



Cross-section view



* Drain hose should be positioned below the refrigerant tubing.

(3) Mounting the indoor unit

- 1) Mount the indoor unit onto the tabs on the upper part of the installation plate.
- 2) Connect the refrigerant tubing, drain hose and wires led inside from outdoors. (When leading an optional drain hose into the room for expansion, the drain hose inside the room should be insulated. In the case of the right-rear side, right side or right-bottom tubing, see the section 3-4-1.)
- 3) After completing a leak test, bundle the tubing and wiring together with the armoring tape. Do not wind the tape forcibly more than necessary. Store the tubing and wiring inside the tubing storage area at the back of the indoor unit. Be sure the drain hose is placed underneath the tubing.

3-4-2. Left-rear side, left side, left-bottom side tubing

(1) Pulling tubes into indoors

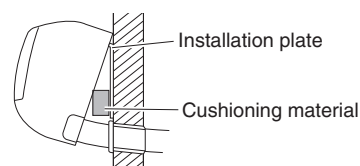
Adjust the tubing length so as to be placed at the same position of the liquid tube and gas tube.

(2) Switching drain hose and drain cap

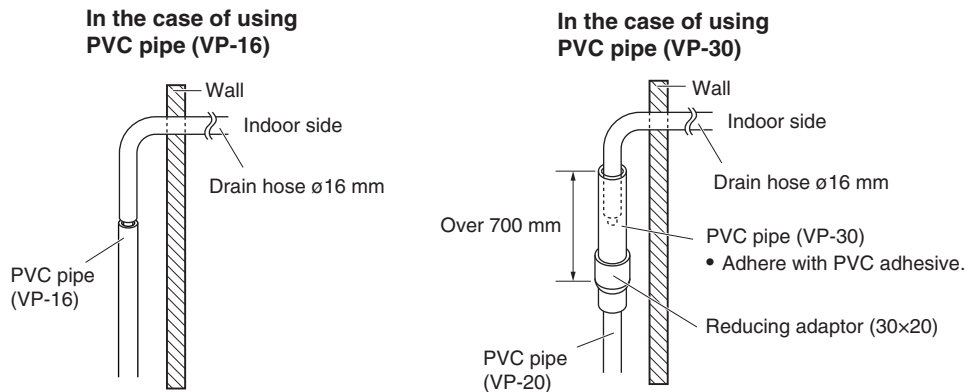
- Switch the drain hose and drain cap. When removing the drain cap, pinch it with the pliers and pull out the drain cap. When inserting the drain cap, use a Phillips head screwdriver to push the drain cap in firmly.

Left-rear side, left side, left-bottom side tubing

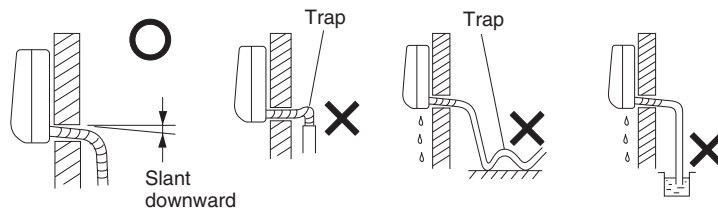
Piping can easily be made by lifting the indoor unit with a cushioning material between the indoor unit and the wall.



- (4) Connect the drain hose.
Do not enforce the base of the drain hose when making a connection.
- Insert securely the drain hose into the PVC pipe.
 - When installing the drain hose extension, connect with an optional drain hose. After connection, bundle with armoring tape.
 - Make sure not to make the drain hose trapped. Insulate the connected part of the drain hose with the tubing insulation and check whether or not the water drains.



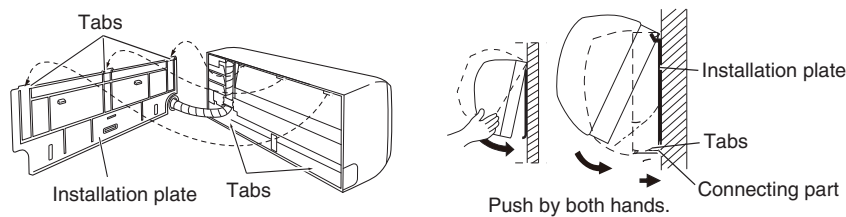
- (5) When there is a long horizontal drain hose runs with very little slope to the run, water is likely to remain inside the hose. Slant the drain hose downward slightly to the outdoors and insulate it with the insulation.
- Slant downward not to remain water inside the drain hose.
 - Make sure tubing does not become trapped.
 - Do not let the tip of the drain hose dip into the drain water.
 - Do not leave the drain hose in the sewerage. This will cause the heat exchanger erosion damage caused by the corrosive gas such as hydrogen sulfide occurred inside the sewerage and lead to a gas leak.



3-5. To mount and unmount indoor unit

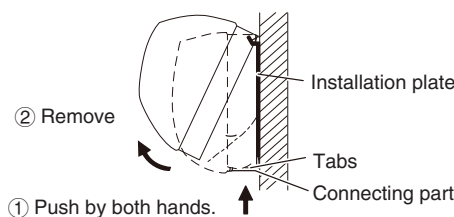
How to mount indoor unit

1. To install the indoor unit, mount the indoor unit onto the tabs on the upper part of the installation plate.
2. Hold down the air discharge outlet and press the lower part of the indoor unit until it clicks to securely fasten to the 2 tabs on the lower part of the installation plate.
3. Close the front panel and ensure that the panel is perfectly stable.



How to unmount indoor unit

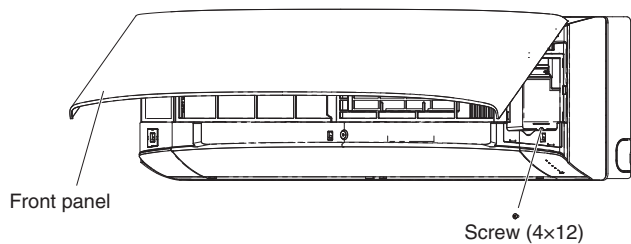
Press the 2 **PUSH** marks on the lower part of the indoor unit and unlatch the tabs. Then lift the indoor unit and unmount.



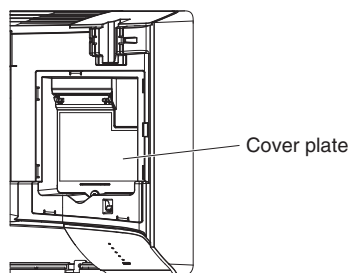
3-6. Wiring Instructions

<Power supply, Inter-unit control wiring, Remote control wiring>

(1) Open the front panel and remove the screw (x1).



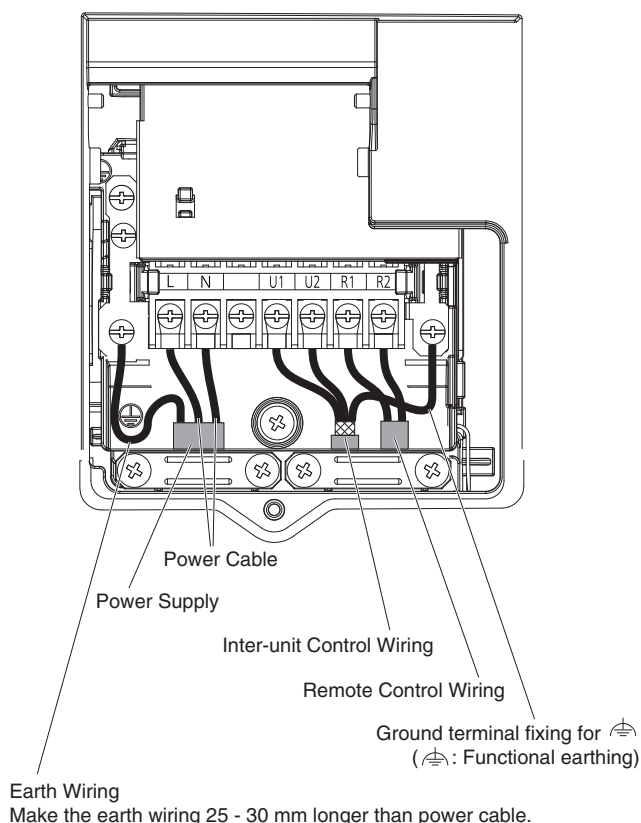
(2) Open the cover plate until it is in locked position.



(3) Make wiring.

See the section "4. ELECTRICAL WIRING".

Wiring sample

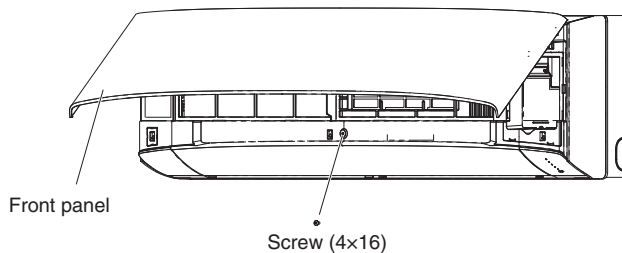


If the terminal screws on the terminal board are tightened too hard, the screws might be damaged. See the tightening torque values as shown below.

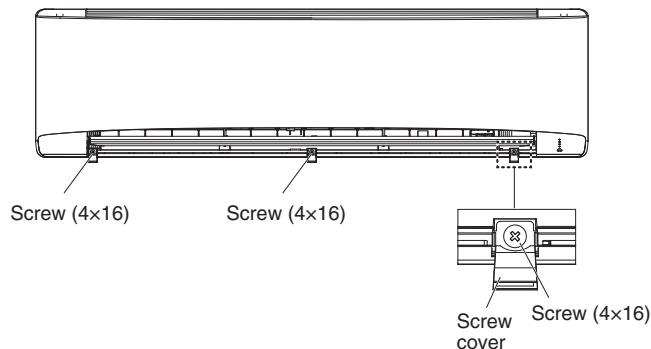
Tightening torques for terminal screws	1.0 - 1.4 N · m { 10 - 14 kgf · cm }
---	---

<Optional parts setting and wiring>

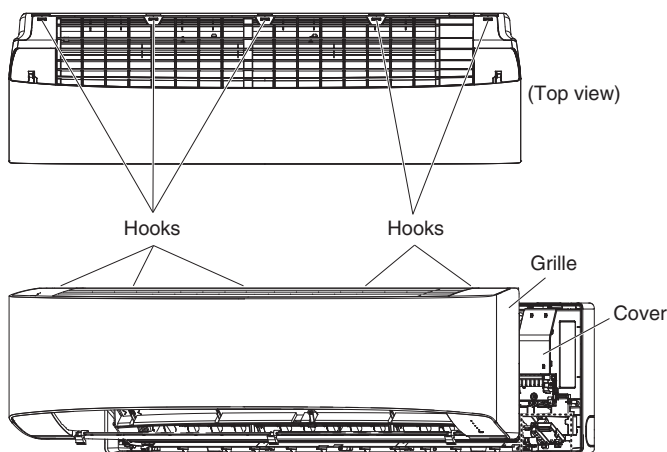
(1) Open the front panel and remove the screw (x1).
Then close the panel.



(2) Open the flap and then open the screw covers (x3).



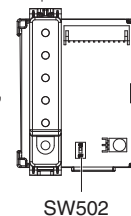
(3) Disengage the hooks holding and lifting both ends of the grille.
Remove the cover of electrical component box.



<When Using Wireless Remote Controller Instead of Wired Remote Controller>

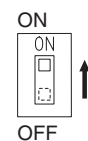
When the wireless remote controller is to be used, slide the switch (SW502) to the ON position.

- If this setting is not made, an alarm will occur. (The operation lamp on the display blinks.)



Setting status

- ON:** Wireless: main,
Wired: sub
- OFF:** Wired: main,
Wireless: sub (at shipment)



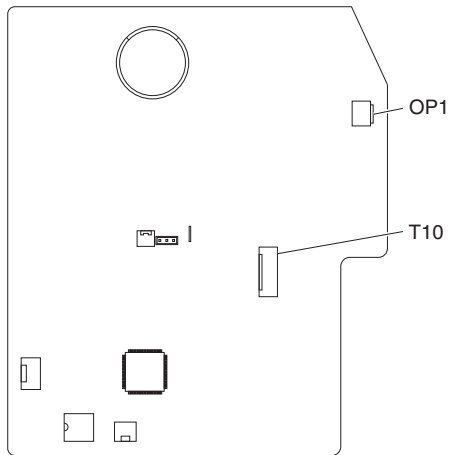
(4) Make wiring.

Refer to the instructions manual of optional parts as well.

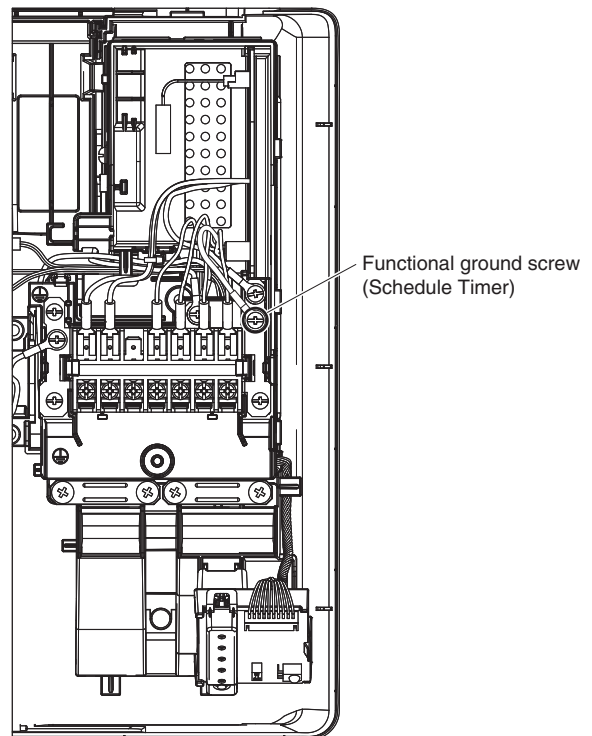
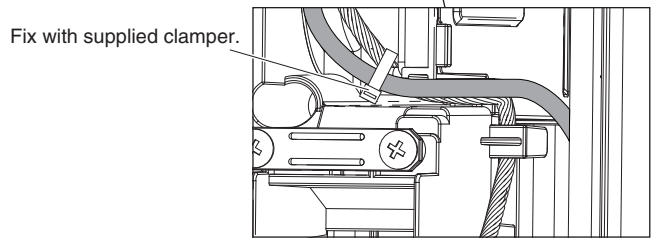
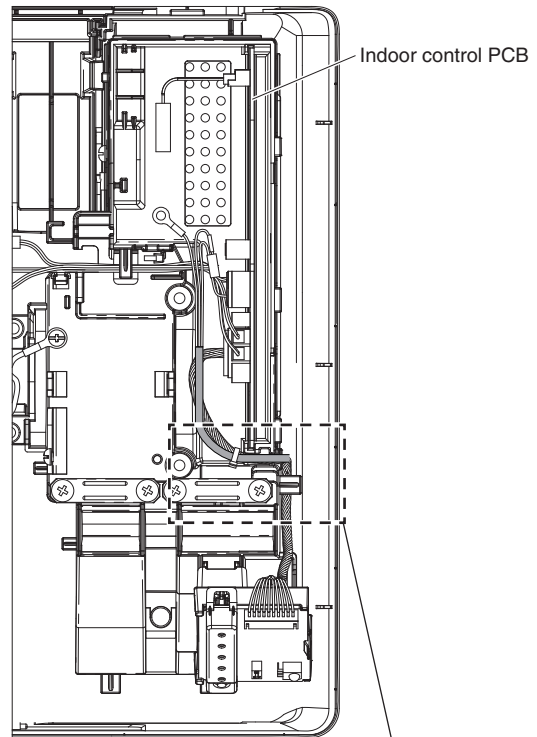
<When connecting to other optional parts>

- Connecting to schedule timer
Connect the wire from the schedule timer to the indoor control PCB T10 (CN061, Yellow) and functional ground screw.
- Connecting to T10 connector
Connect the wire to the indoor control PCB T10 (CN061, Yellow).

Indoor control PCB



**Wiring sample
(Schedule Timer)**



4. ELECTRICAL WIRING

4-1. General Precautions on Wiring

- (1) Before wiring, confirm the rated voltage of the unit as shown on its nameplate, then carry out the wiring closely following the wiring diagram.



WARNING

- (2) 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.
Earth Leakage Circuit Breaker (ELCB) must be incorporated in the fixed wiring in accordance with the wiring regulations. The Earth Leakage Circuit Breaker (ELCB) must be an approved 10-16 A, having a contact separation in all poles.
- (3) To prevent possible hazards from insulation failure, the unit must be grounded.
- (4) Each wiring connection must be done in accordance with the wiring system diagram. Wrong wiring may cause the unit to misoperate or become damaged.
- (5) Do not allow wiring to touch the refrigerant tubing, compressor, or any moving parts of the fan.
- (6) Unauthorized changes in the internal wiring can be very dangerous. The manufacturer will accept no responsibility for any damage or misoperation that occurs as a result of such unauthorized changes.
- (7) Regulations on wire diameters differ from locality to locality. For field wiring rules, please refer to your LOCAL ELECTRICAL CODES before beginning.
You must ensure that installation complies with all relevant rules and regulations.
- (8) To prevent malfunction of the air conditioner caused by electrical noise, care must be taken when wiring as follows:
- The remote control wiring and the inter-unit control wiring should be wired apart from the inter-unit power wiring.
 - Use shielded wires for inter-unit control wiring between units and ground the shield on both sides.
- (9) If the power supply cord of this appliance is damaged, it must be replaced by a repair shop designated by the manufacturer, because special-purpose tools are required.



CAUTION

Check local electrical codes and regulations before wiring. Also, check any specified instruction or limitations.

4-2. Recommended Wire Length and Wire Diameter for Power Supply System

Indoor unit

Type	(B) Power supply	Time delay fuse or circuit capacity
	2 mm ²	
K2	Max. 130 m	10-16 A

Control wiring

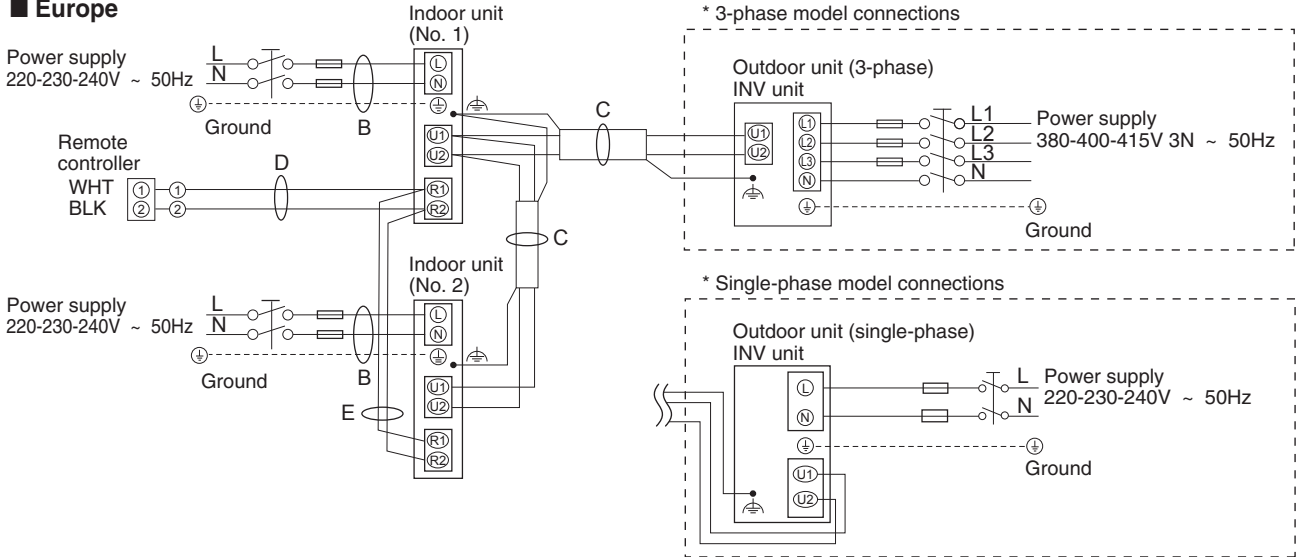
(C) Inter-unit (between outdoor and indoor units) control wiring	(D) Remote control wiring	(E) Control wiring for group control
0.75 mm ² (AWG #18) Use shielded wiring*	0.75 mm ² (AWG #18)	0.75 mm ² (AWG #18)
Max. 1,000 m	Max. 500 m	Max. 200 m (Total)

NOTE

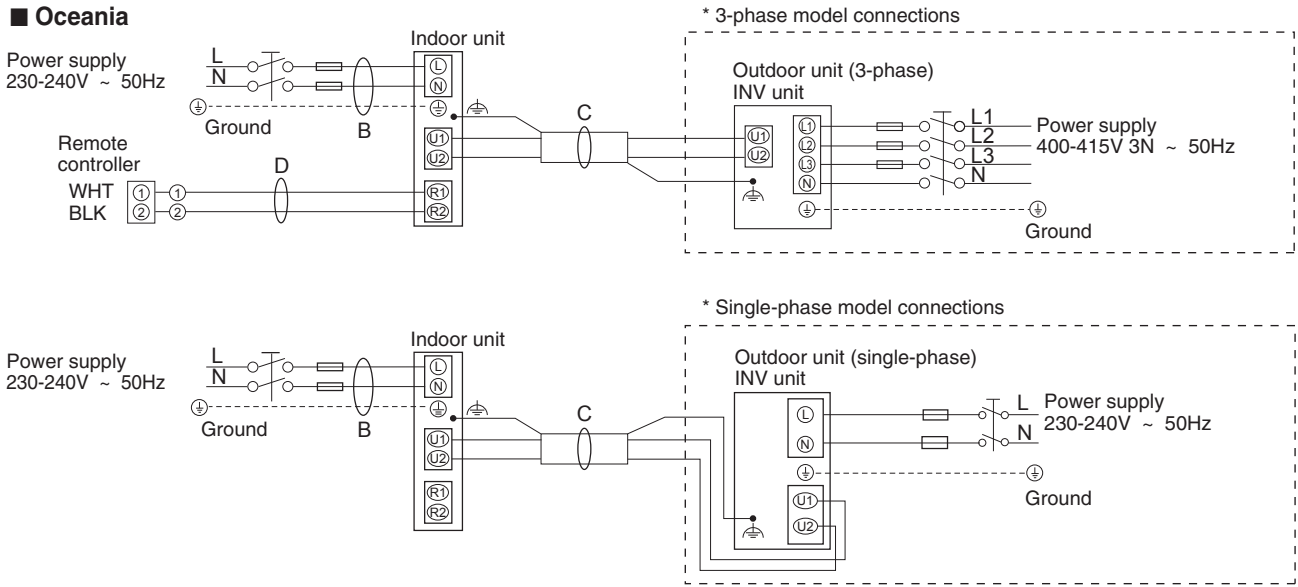
* With ring-type wire terminal.

4-3. Wiring System Diagrams

■ Europe



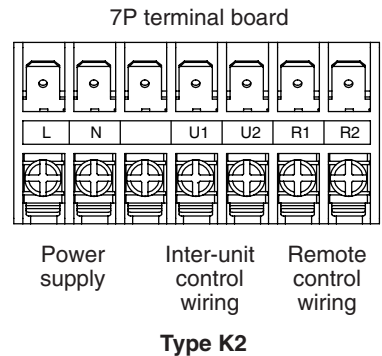
■ Oceania



(⏚ : Functional earthing)

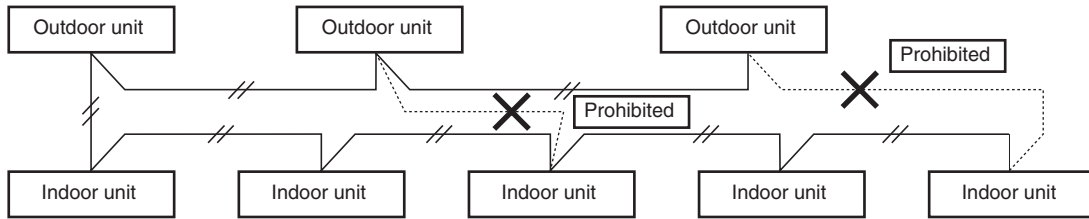
NOTE

- Refer to Section 4-2. "Recommended Wire Length and Wire Diameter for Power Supply System" for the explanation of "B", "C", "D" and "E" in the above diagram.
- The basic connection diagram of the indoor unit shows the terminal boards, so the terminal boards in your equipment may differ from the diagram.
- Refrigerant Circuit (R.C.) address should be set before turning the power on.
- Regarding R.C. address setting, refer to the installation instructions supplied with the remote controller (optional). Auto address setting can be executed by remote controller automatically.

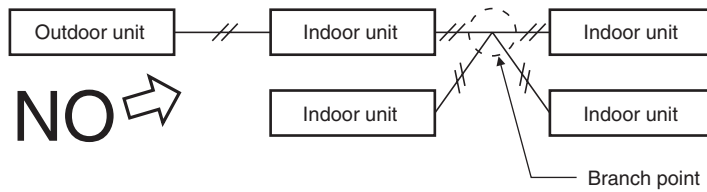


CAUTION

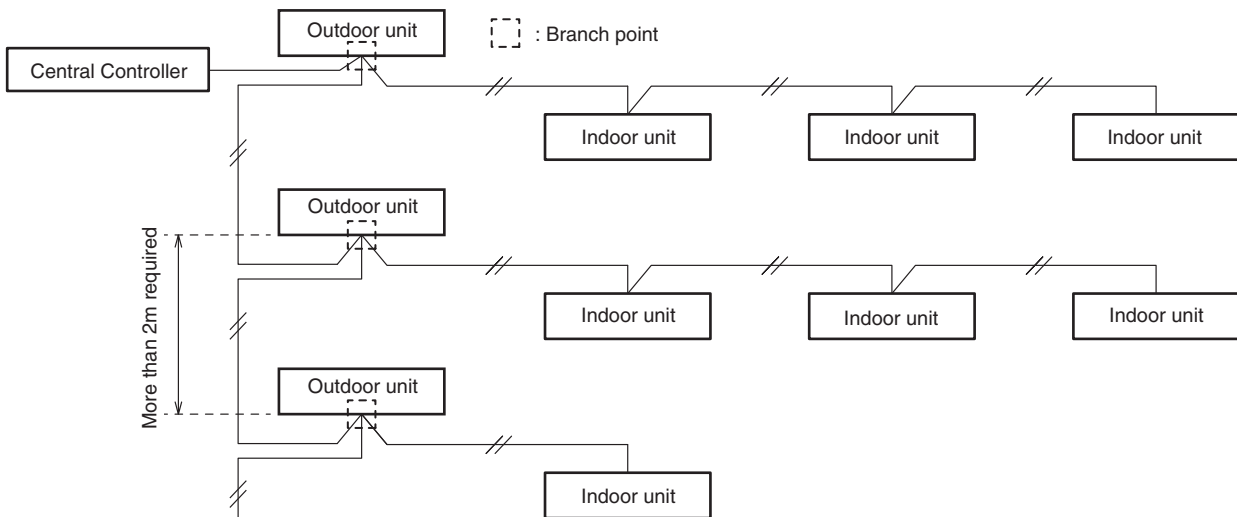
- (1) When linking the outdoor units in a network, disconnect the terminal extended from the short plug from all outdoor units except any one of the outdoor units.
(When shipping: In shorted condition.)
For a system without link (no wiring connection between outdoor units), do not remove the short plug.
- (2) Do not install the inter-unit control wiring in a way that forms a loop.



- (3) Do not install inter-unit control wiring such as star branch wiring. Star branch wiring causes mis-address setting.



- (4) If branching the inter-unit control wiring, the number of branch points should be 16 or fewer.

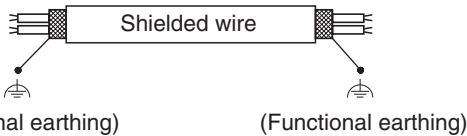


- (5) Use shielded wires for inter-unit control wiring (C) and ground the shield on both sides, otherwise misoperation from noise may occur.
Connect wiring as shown in Section "4-3. Wiring System Diagrams".

WARNING

Loose wiring may cause the terminal to overheat or result in unit malfunction. A fire hazard may also occur. Therefore, ensure that all wiring is tightly connected.

When connecting each power wire to the terminal, follow the instructions on "How to connect wiring to the terminal" and fasten the wire securely with the terminal screw.

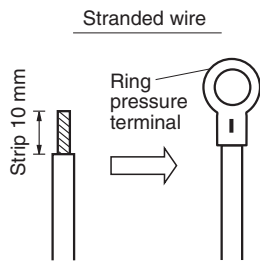


- (6) • Connecting cable between indoor unit and outdoor unit shall be approved polychloroprene sheathed 5 or 3 * 1.5 mm² flexible cord. Type designation 60245 IEC57 (H05RN-F, GP85PCP etc.) or heavier cord.
- Use the standard power supply cables for Europe (such as H05RN-F or H07RN-F which conform to CENELEC (HAR) rating specifications) or use the cables based on IEC standard. (60245 IEC57, 60245 IEC66)

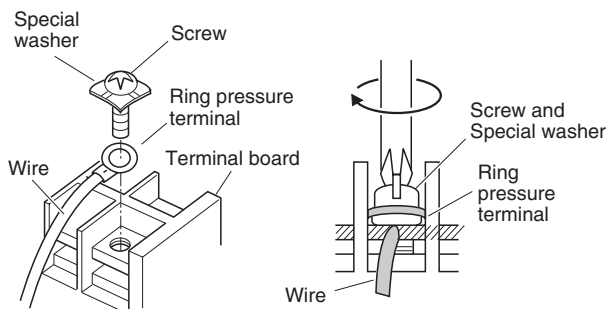
How to connect wiring to the terminal

■ For stranded wiring

- (1) Cut the wire end with cutting pliers, then strip the insulation to expose the stranded wiring about 10 mm and tightly twist the wire ends.



- (2) Using a Phillips head screwdriver, remove the terminal screw(s) on the terminal board.
- (3) Using a ring connector fastener or pliers, securely clamp each stripped wire end with a ring pressure terminal.
- (4) Place the ring pressure terminal, and replace and tighten the removed terminal screw using a screwdriver.

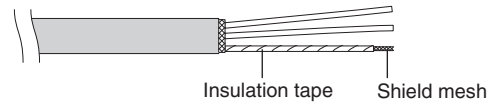


■ Examples of shield wires

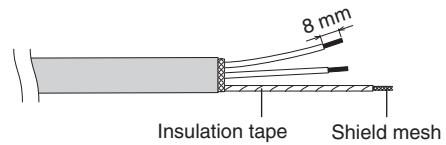
- (1) Remove cable coat not to scratch braided shield.



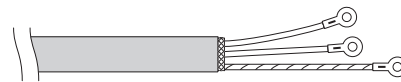
- (2) Unbraid the braided shield carefully and twist the unbraided shield wires tightly together. Insulate the shield wires by covering them with an insulation tube or wrapping insulation tape around them.



- (3) Remove coat of signal wire.



- (4) Attach ring pressure terminals to the signal wires and the shield wires insulated in Step (2).



5. HOW TO PROCESS TUBING

Must ensure mechanical connections be accessible for maintenance purposes.

5-1. Connecting the Refrigerant Tubing

NOTE

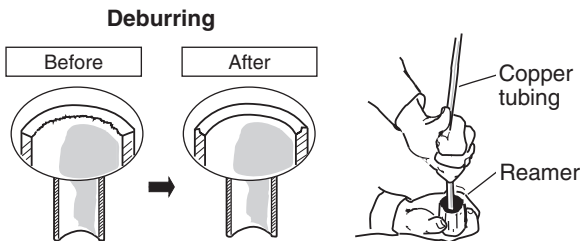
When connecting flare at indoor side, make sure that the flare connection is used only once. If torqued up and released, the flare must be remade. Once the flare connection was torqued up correctly and leak test was made, thoroughly clean and dry the surface to remove oil, dirt and grease by following instructions of silicone sealant. Apply neutral cure & ammonia-free silicone sealant that is non-corrosive to copper & brass to the external of the flared connection to prevent the ingress of moisture on both the gas & liquid sides. (Moisture may cause freezing and premature failure of the connection.)

Use of the Flaring Method

Many of conventional split system air conditioners employ the flaring method to connect refrigerant tubes that run between indoor and outdoor units. In this method, the copper tubes are flared at each end and connected with flare nuts.

Flaring Procedure with a Flare Tool

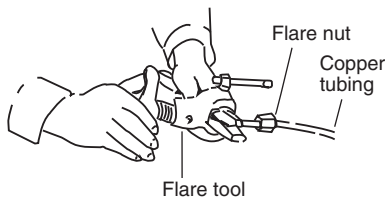
- (1) Cut the copper tube to the required length with a tube cutter. It is recommended to cut approx. 30 – 50 cm longer than the tubing length you estimate.
- (2) Remove burrs at each end of the copper tubing with a tube reamer or a similar tool. This process is important and should be done carefully to make a good flare. Be sure to keep any contaminants (moisture, dirt, metal filings, etc.) from entering the tubing.



NOTE

When reaming, hold the tube end downward and be sure that no copper scraps fall into the tube.

- (3) Remove the flare nut from the unit and be sure to mount it on the copper tube.
- (4) Make a flare at the end of the copper tube with a flare tool.



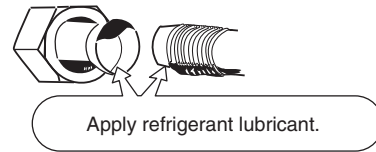
NOTE

When flared joints are reused, the flare part shall be re-fabricated. A good flare should have the following characteristics:

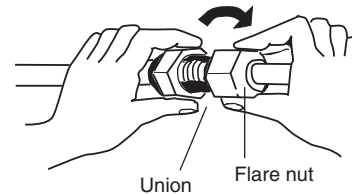
- inside surface is glossy and smooth
- edge is smooth
- tapered sides are of uniform length

Caution Before Connecting Tubes Tightly

- (1) Apply a sealing cap or water-proof tape to prevent dust or water from entering the tubes before they are used.
- (2) Be sure to apply refrigerant lubricant (ether oil) to the inside of the flare nut before making piping connections. This is effective for reducing gas leaks.



- (3) For proper connection, align the union tube and flare tube straight with each other, then screw on the flare nut lightly at first to obtain a smooth match.



- Adjust the shape of the liquid tube using a tube bender at the installation site and connect it to the liquid tubing side valve using a flare.

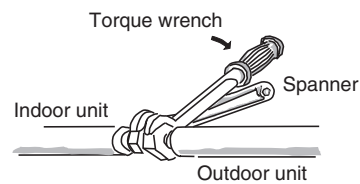
5-2. Connecting Tubing Between Indoor and Outdoor Units

- (1) Tightly connect the indoor-side refrigerant tubing extended from the wall with the outdoor-side tubing.

Indoor Unit Tubing Connection (l₁, l₂...l_{n-1})

Indoor unit type	36	45	50	60	71	100
Gas tubing (mm)	ø12.7			ø15.88		
Liquid tubing (mm)	ø6.35			ø9.52		

- (2) To fasten the flare nuts, apply specified torque.
- When removing the flare nuts from the tubing connections, or when tightening them after connecting the tubing, be sure to use a torque wrench and a spanner. If the flare nuts are over-tightened, the flare may be damaged, which could result in refrigerant leakage and cause injury or asphyxiation to room occupants.



- For the flare nuts at tubing connections, be sure to use the flare nuts that were supplied with the unit, or else flare nuts for R410A, R32 (type 2). The refrigerant tubing that is used must be of the correct wall thickness as shown in the table below.

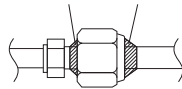
Tube diameter	Tightening torque (approximate)	Tube thickness
ø6.35 (1/4")	14 – 18 N · m {140 – 180 kgf · cm}	0.8 mm
ø9.52 (3/8")	34 – 42 N · m {340 – 420 kgf · cm}	0.8 mm
ø12.7 (1/2")	49 – 55 N · m {490 – 550 kgf · cm}	0.8 mm
ø15.88 (5/8")	68 – 82 N · m {680 – 820 kgf · cm}	1.0 mm

Because the pressure is approximately 1.6 times higher than conventional refrigerant R22 pressure, the use of ordinary flare nuts (type 1) or thin-walled tubes may result in tube rupture, injury, or asphyxiation caused by refrigerant leakage.

- In order to prevent damage to the flare caused by over-tightening of the flare nuts, use the table above as a guide when tightening.
- When tightening the flare nut on the liquid tube, use an adjustable wrench with a nominal handle length of 200 mm.

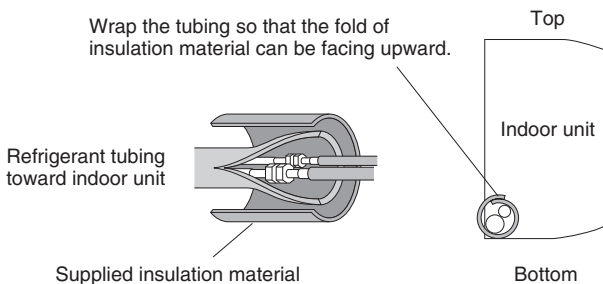
Neutral cure & ammonia-free silicone sealant is only to be applied after pressure testing and cleaning up by following instructions of sealant, only to the outside the connection. The aim is to prevent moisture from entering the connection joint and possible occurrence of freezing. Curing sealant will take some time. Make sure the sealant will not peel off when wrapping the insulation.

Apply neutral cure & ammonia-free silicone sealant along its circumference.



5-3. Insulating the Refrigerant Tubing

Unless the insulation is made, condensation can cause damage to the interior of a property. Use the supplied insulation material.

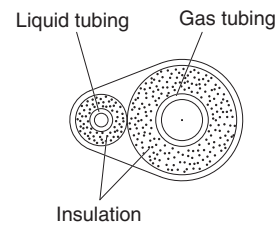


Tubing Insulation

Must ensure that pipe-work shall be protected from physical damage.

- Thermal insulation must be applied to all units tubing, including distribution joint (field supply).

Two tubes arranged together



- * For gas tubing, the insulation material must be heat resistant to 120°C or above. For other tubing, it must be heat resistant to 80°C or above.

Insulation material thickness must be 10 mm or greater.

If the conditions inside the ceiling exceed DB 30°C and RH 70%, increase the thickness of the gas tubing insulation material by 1 step.



CAUTION

If the exterior of the outdoor unit valves has been finished with a square duct covering, make sure you allow sufficient space to access the valves and to allow the panels to be attached and removed.

NOTE

Gas Leakage Detector

Note that the gas leakage detector should be capable of detecting the refrigerant R410A, R32.

Air Purging

Refer to "AIR PURGING" in the separate Installation Instructions for the outdoor unit in regard to air purging with a vacuum pump (for test run) preparation.

Taping the flare nuts

Cover up the tubing connections with the supplied flare insulator. Then fasten the insulator at both ends with the vinyl clamps (field supply).

Insulation material

The material used for insulation must have good insulation characteristics, be easy to use, be age resistant, and must not easily absorb moisture.



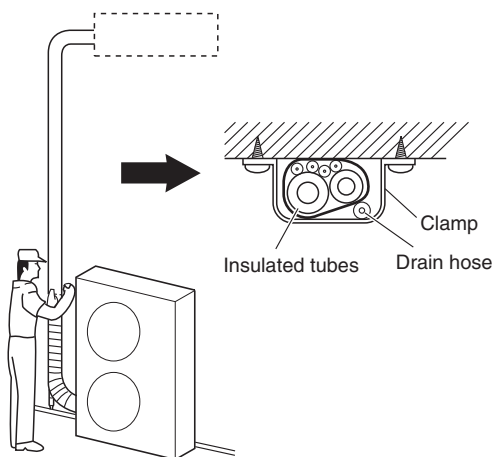
CAUTION

After a tube has been insulated, never try to bend it into a narrow curve because it can cause the tube to break or crack. Never grasp the drain or refrigerant connecting outlets when moving the unit.

5-4. Taping the Tubes

- (1) At this time, the refrigerant tubes (and electrical wiring if local codes permit) should be taped together with armoring tape in 1 bundle. To prevent condensation from overflowing the drain pan, keep the drain hose separate from the refrigerant tubing.
- (2) Wrap the armoring tape from the bottom of the outdoor unit to the top of the tubing where it enters the wall. As you wrap the tubing, overlap half of each previous tape turn.

- (3) Clamp the tubing bundle to the wall, using 1 clamp approx. each meter.

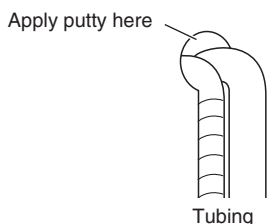


NOTE

Do not wind the armoring tape too tightly since this will decrease the heat insulation effect. Also ensure that the condensation drain hose splits away from the bundle and drips clear of the unit and the tubing.

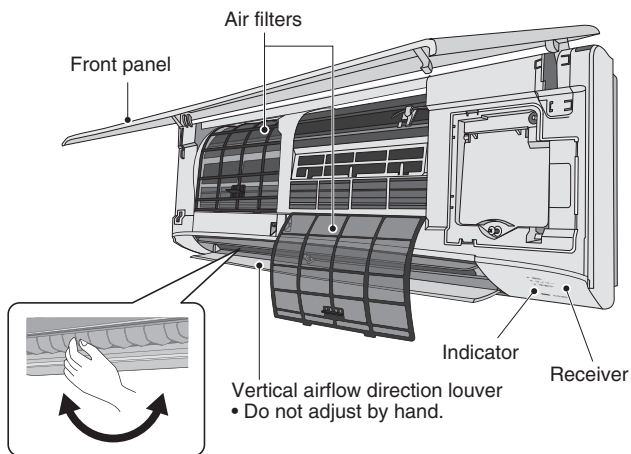
5-5. Finishing the Installation

After finishing insulating and taping over the tubing, use sealing putty to seal off the hole in the wall to prevent rain and draft from entering.



6. BEFORE SWITCHING ON

- Check if the filter is installed properly.
- Check if the horizontal airflow direction louver works properly.



Horizontal airflow direction louver
• Manually-operated adjustable louvers

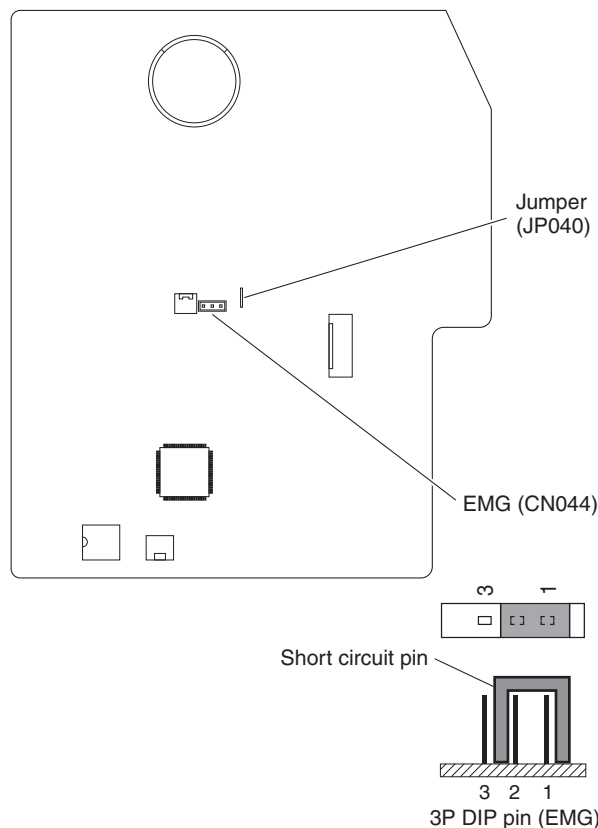
7. HOW TO INSTALL TIMER REMOTE CONTROLLER OR HIGH-SPEC WIRED REMOTE CONTROLLER (OPTIONAL PART)

NOTE

Refer to the Installation Instructions attached to the optional Timer Remote Controller or optional High-Spec Wired Remote Controller.

8. PRECAUTIONS ON TEST RUN

- Request that the customer be present when the test run is performed. At this time, explain the operation manual and have the customer perform the actual steps.
- Check that the 220 – 240 V AC power is not connected to the inter-unit control wiring connector terminal.
* If 220 – 240 V AC is accidentally applied, the indoor unit control PCB fuse will blow in order to protect the PCB. In this case, make the wiring correctly. Then reconnect the connector to pins 2 and 3 from pins 1 and 2 on the 3P DIP pin (EMG).
If the operation is not activated even if the short circuit pin is reconnected, cut the jumper on the indoor unit PCB. (Be sure to turn the power OFF before performing this work.)



9. CHECKLIST AFTER INSTALLATION WORK

Work List	No.	Content	Check <input checked="" type="checkbox"/>	Possibility of Failure & Checkpoint
Installation	1	Are the indoor units installed following the content of the section "2. SELECTING THE INSTALLATION SITE"?	<input type="checkbox"/>	There is a possibility of light injure or loss of property.
Tubing & Wiring	2	Is the earth leakage circuit breaker (all-pole switching function provided) installed?	<input type="checkbox"/>	Power failure or short circuit may cause electric shock or fire. Check installation work and ground wire work.
	3	Is there any wrong installation of optional parts or wrong wiring?	<input type="checkbox"/>	
	4	Was the ground wire work performed?	<input type="checkbox"/>	
	5	Are there any wrong power supply wiring, wrong connection wire, wrong signal wire or loose screw?	<input type="checkbox"/>	
	6	Is the thickness of wire in accordance with rule?	<input type="checkbox"/>	
	7	Is the power-supply voltage range equal to the nameplate of the unit?	<input type="checkbox"/>	
	8	Was the check of the airtight test, flared tube fitting and gas leakage on the welded portion performed?	<input type="checkbox"/>	If the gas leakage occurs, the unit quality not only becomes inferior but affects environment. Repair it as quickly as possible.
Drain Check	9	Has the adhesive been applied to the drain connecting portion (resin portion) of the indoor unit?	<input type="checkbox"/>	The resin portion cracks after a few months and it may cause water drain.
	10	Is there water leakage?	<input type="checkbox"/>	Since there is a possibility of water drain, repair the drain pipe if the drain failure or water drain occurs.
	11	Indoor unit drain pipe has a downward gradient (1/100 or more) by rule. Is the drain water flowing smoothly?	<input type="checkbox"/>	
Heat Insulation	12	Was the heat insulation work at a suitable location including the flared tube fitting (refrigerant tube & drain pipe) performed properly?	<input type="checkbox"/>	The quality of unit not only becomes inferior but there is a possibility of the water drain. So, perform the heat insulation work properly.
Test Run	13	Did the abnormal sound occur?	<input type="checkbox"/>	Check if there is a fan contact or distortion of the indoor unit.
	14	Did the cool and warm airflow discharge from the indoor unit?	<input type="checkbox"/>	Check if the unit does not operate or there is a wrong tubing or wiring connection with another system.

Important Information Regarding The Refrigerant Used

NOTE

Refer to the Installation Instructions attached to the outdoor unit.

10. SERVICING



CAUTION

- Any qualified person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorizes their competence to handle refrigerants safely in accordance with an industry recognised assessment specification.
 - Servicing shall only be performed as recommended by the equipment manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.
 - Servicing shall be performed only as recommended by the manufacturer.
 - Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimised. For repair to the refrigerating system, (2) to (6) shall be completed prior to conducting work on the system.
- (1) Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed.
 - (2) All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided. The area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.
 - (3) The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.
 - (4) If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO₂ fire extinguisher adjacent to the charging area.
 - (5) No person carrying out work in relation to a refrigeration system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.
 - (6) Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
 - (7) Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.
 - The charge size is in accordance with the room size within which the refrigerant containing parts are installed.
 - The ventilation machinery and outlets are operating adequately and are not obstructed.
 - Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
 - Refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.
 - (8) Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

 - That no live electrical components and wiring are exposed while charging, recovering or purging the system.
 - That there is continuity of earth bonding.
- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc.
 - Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
 - Ensure that apparatus is mounted securely.
 - Ensure that seals or sealing materials have not degraded such that they no longer serve the purpose of preventing the ingress of flammable atmospheres.
 - Replacement parts shall be in accordance with the manufacturer's specifications.

NOTE:

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

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

11. REMOVAL AND EVACUATION



CAUTION

- When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:
 - Remove refrigerant.
 - Purge the circuit with inert gas.
 - Evacuate.
 - Purge again with inert gas.
 - Open the circuit by cutting or brazing.
- The refrigerant charge shall be recovered into the correct recovery cylinders.
- The system shall be “flushed” with Oxygen free nitrogen (OFN) to render the unit safe.
- This process may need to be repeated several times.
- Compressed air or oxygen shall not be used for this task.
- Flushing shall be achieved by breaking the vacuum in the system with Oxygen free nitrogen (OFN) and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum.
- This process shall be repeated until no refrigerant is within the system.
- When the final Oxygen free nitrogen (OFN) charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.
- This operation is absolutely vital if brazing operations on the pipe work are to take place.
- Ensure that the outlet for the vacuum pump is not close to any ignition sources and there is ventilation available.

12. CHARGING PROCEDURES

NOTE

Refer to the Installation Instructions attached to the outdoor unit.

13. DECOMMISSIONING



CAUTION

- Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its details.
- It is recommended good practice that all refrigerants are recovered safely.
- Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of reclaimed refrigerant.
- It is essential that electrical power is available before the task is commenced.
 - a) Become familiar with the equipment and its operation.
 - b) Isolate system electrically.
 - c) Before attempting the procedure ensure that:
 - Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
 - All personal protective equipment is available and being used correctly.
 - The recovery process is supervised at all times by a competent person.
 - Recovery equipment and cylinders conform to the appropriate standards.
 - d) Pump down refrigerant system, if possible.
 - e) If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
 - f) Make sure that cylinder is situated on the scales before recovery takes place.
 - g) Start the recovery machine and operate in accordance with manufacturer’s instructions.
 - h) Do not overfill cylinders. (No more than 80 % volume liquid charge).
 - i) Do not exceed the maximum working pressure of the cylinder, even temporarily.
 - j) When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
 - k) Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.
- Electrostatic charge may accumulate and create a hazardous condition when charging or discharging the refrigerant. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before charging / discharging.

14. RECOVERY

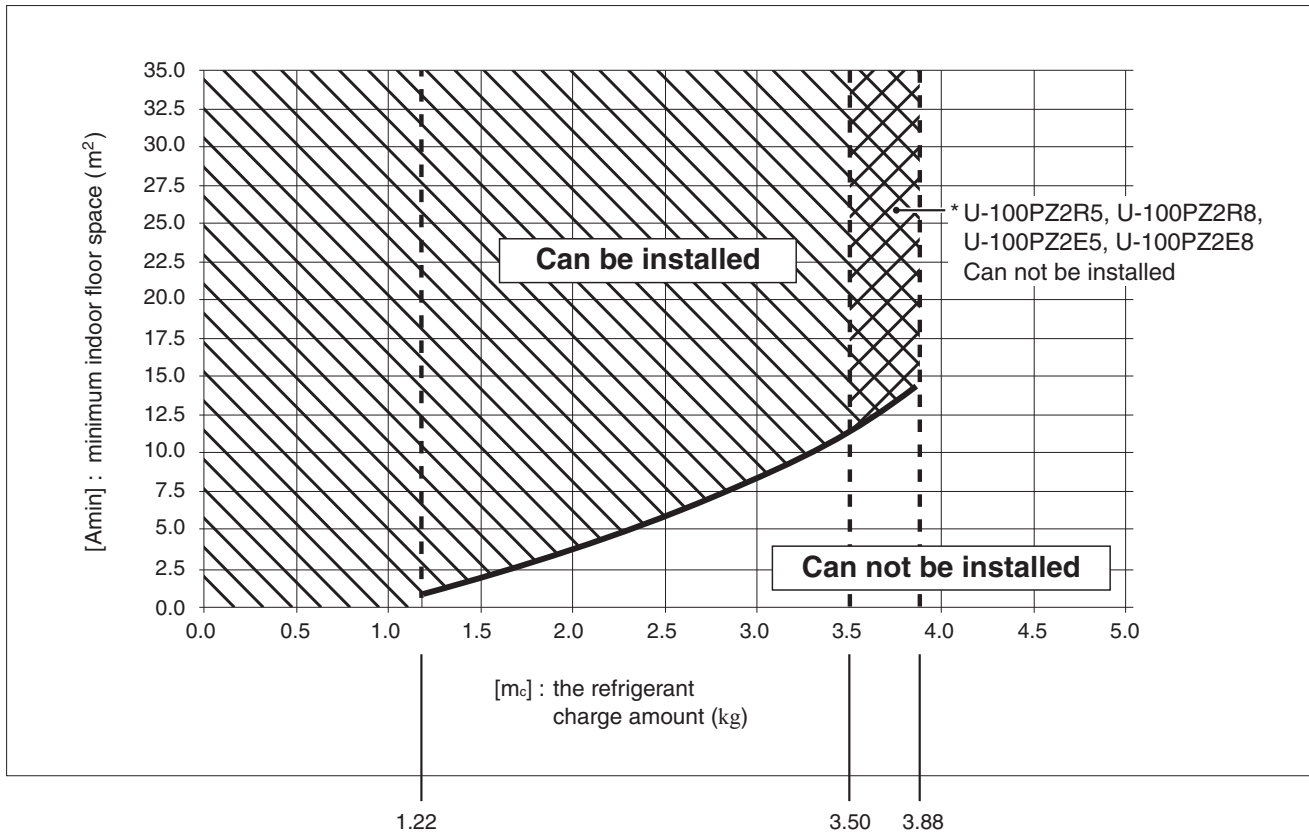
NOTE

Refer to the Installation Instructions attached to the outdoor unit.

15. CHECK OF DENSITY LIMIT

The refrigerant (R32), which is used in the air conditioner, is a flammable refrigerant. So the requirements for installation space of appliance are determined according to the refrigerant charge amount [m_c] used in the appliance.

The minimum indoor floor space compared with the amount of refrigerant is roughly as follows:



[m_c] : The refrigerant charge amount (Total of refrigerant at shipment and refrigerant charge amount in the field).
 [m_{max}] : Maximum refrigerant charge amount

	U-100PZ2R5 U-100PZ2R8	U-100PZ2E5 U-100PZ2E8	U-125PZ2E5 U-125PZ2E8	U-140PZ2E5 U-140PZ2E8
[m _{max}]	3.50	3.50	3.88	3.88

- [m_c] ≤ 1.22 : Can be installed
- 1.22 < [m_c] ≤ [m_{max}] : Installation possible with in the range of slanted line part
- [m_c] > [m_{max}] : Can not be installed

– NOTE –