MITSUBISHI ELECTRIC

AIR CONDITIONING SYSTEMS

Changes for the Better

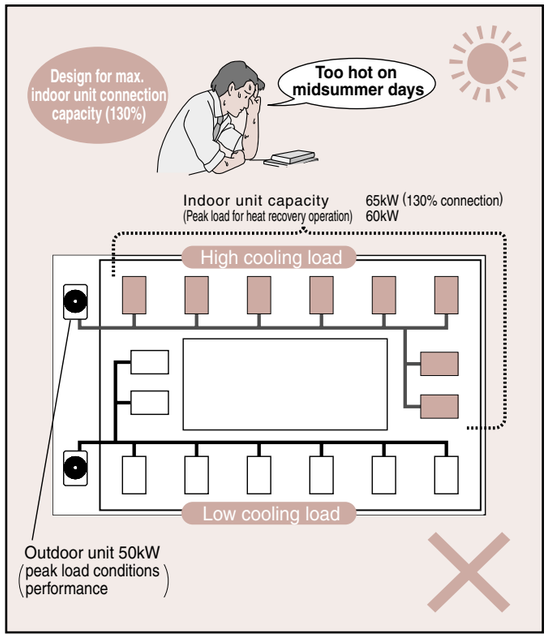
For Internal Training

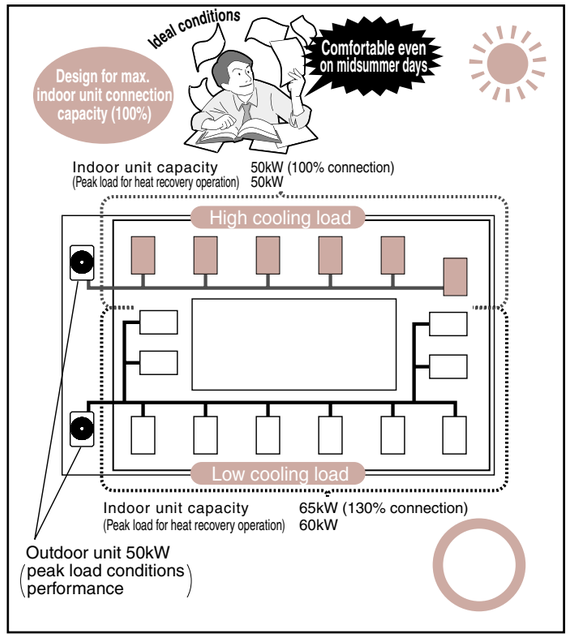
CITY MULTI

Guide to installation

CONTENTS

Example 1 Poor performance due to indoor unit capacity





Possible Problems

- Insufficient cooling when increasing the number of operating indoor units.
- Insufficient heating when increasing the number of operating indoor units.

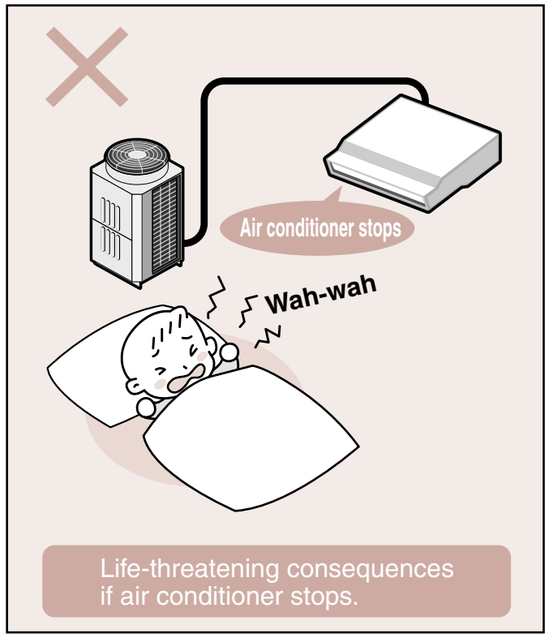
Cautions and Countermeasures

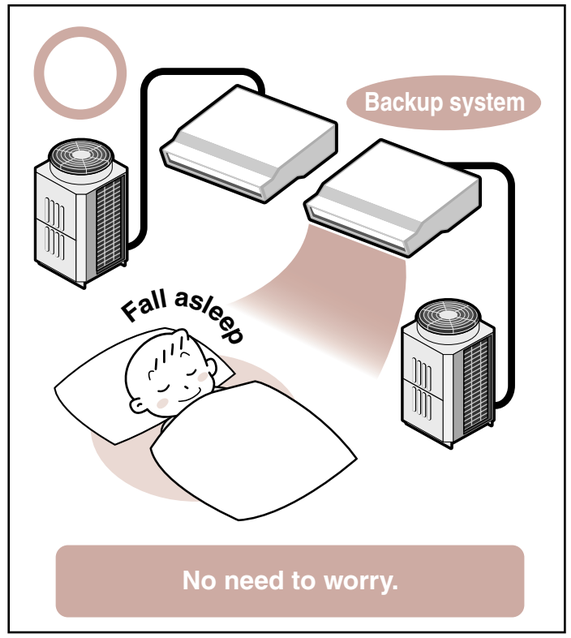
- Indoor unit performance will fall below the rating level if the total capacity of the indoor units in operation in a same refrigerant system exceeds the outdoor unit capacity.
- Refer to the Data Book for information regarding indoor unit performance changes related to the total capacity of the connected indoor units.
- The maximum capacity of indoor unit connection is 150% for the R2 Series.

▼

- It is recommended to design the system so that the capacity of indoor units operating simultaneously does not exceed the outdoor unit capacity.
- A 130% connection is not recommended in high-loaded areas (room direction/capacity). Where the load is high (hot regions / crowded areas). Install the units considering the load balance.

Example 2 Backup Air Conditioner





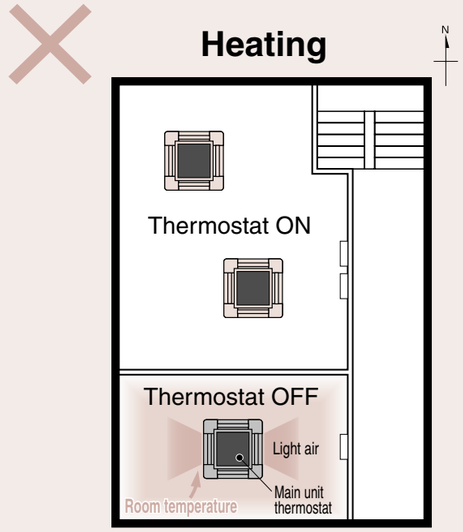
Possible Problems

- Room temperature changes during an air conditioner failure could cause health problems and illness.
- An air conditioner failure could cause secondary damage such as the loss of important data, and the disabling of vital equipment, etc.

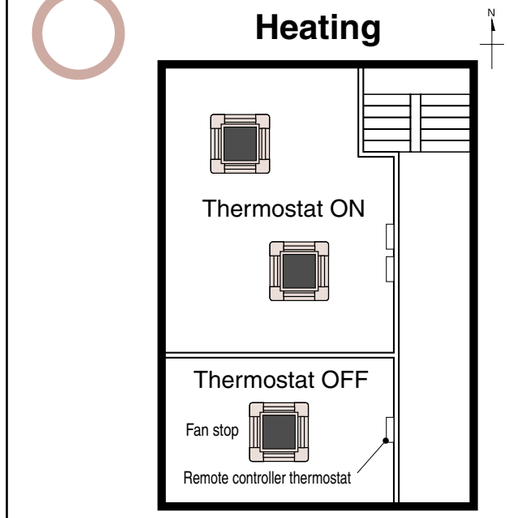
Cautions and Countermeasures

- Be sure to install a backup unit for indoor units where secondary damage could result from air conditioner shutdown due to repairs, or from reduced performance due or filter clogging, etc..
- Be sure to use a different refrigerant system for the backup indoor unit.

Example 3 Room Temperature Rise in Rooms with Small Heating Loads



Room temperature rise by light warm air blowing when thermostat is OFF.



Remote controller's built-in thermostat detects room temperature and Fan setting OFF when thermostat is OFF.

Possible Problems

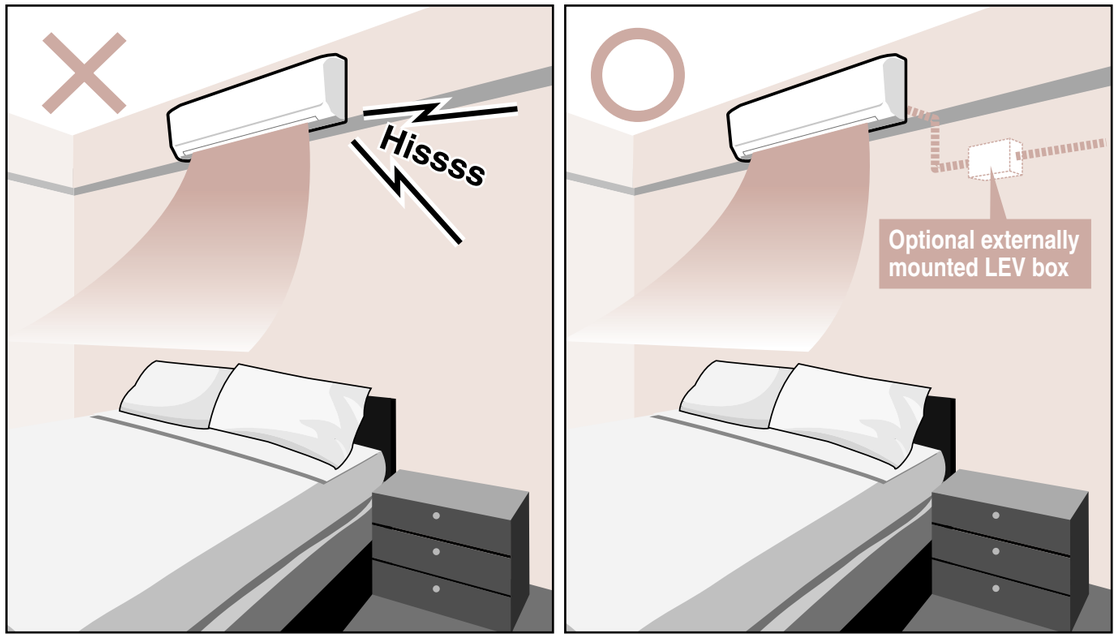
- Overheating

Cautions and Countermeasures

- When a small room (small heating load) is connected to the same refrigerant system as a large room, the small room's temperature may rise even though the thermostat is OFF. When thermostat is OFF, light air blows at the indoor unit to detect room temperature and refrigerant is slightly flowing to prevent accumulating inside the indoor unit. In cases where a room is small (small heating load), the light air blowing which occurs while the thermostat is OFF may rise the room temperature. (This does not apply to the R2 Series.)

- In cases where a room temperature rises (as described above), switch the room temperature sensor to built-in sensor(set indoor unit dip switch to 1-1 ON), and specify a setting which stops the air from blowing while the thermostat is OFF (set the indoor unit dip switch1-7 and 1-8 ON.)

Example 4 Refrigerant Flow Noise when the Heater Thermostat is Not ON (Thermo OFF, FAN, OFF)



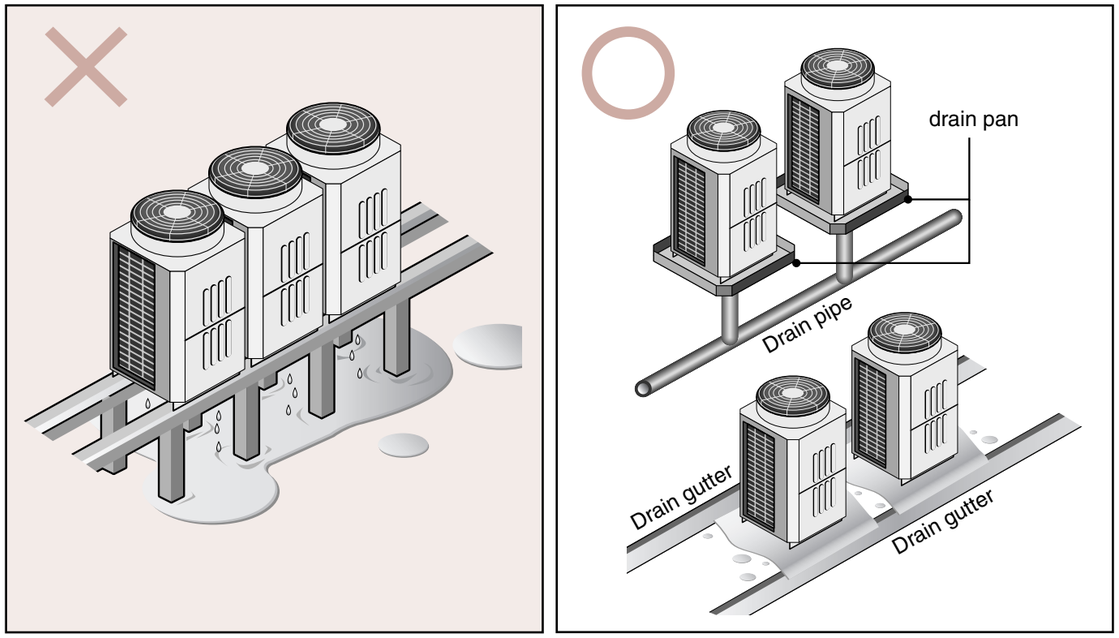
Possible Problems

- Refrigerant flowing noise.

Cautions and Countermeasures

- A refrigerant flow noise (hissing sound, running water sound, or gurgling sound, etc.) may be audible when the indoor unit is in a status other than Thermo-ON. This occurs because the expansion valve remains slightly open when the indoor unit is not Thermo-ON in order to prevent refrigerant accumulation inside the indoor unit. This is particularly noticeable at operation start and defrost recoveries, because the valve opening is relatively larger at those times, resulting in a louder refrigerant noise.
- Noise prevention measures such as selecting ceiling-concealed type units, etc., for environments where silence is required (hotels, hospital rooms, bedrooms, etc.). Consult with our sales representative for details.
  An optional externally mounted LEV box (PAC-SG95LE-E) is available for wall-mounted type model (PKFY-P VBM-E model only).

Example 5 Processing the Drain From Outdoor Units



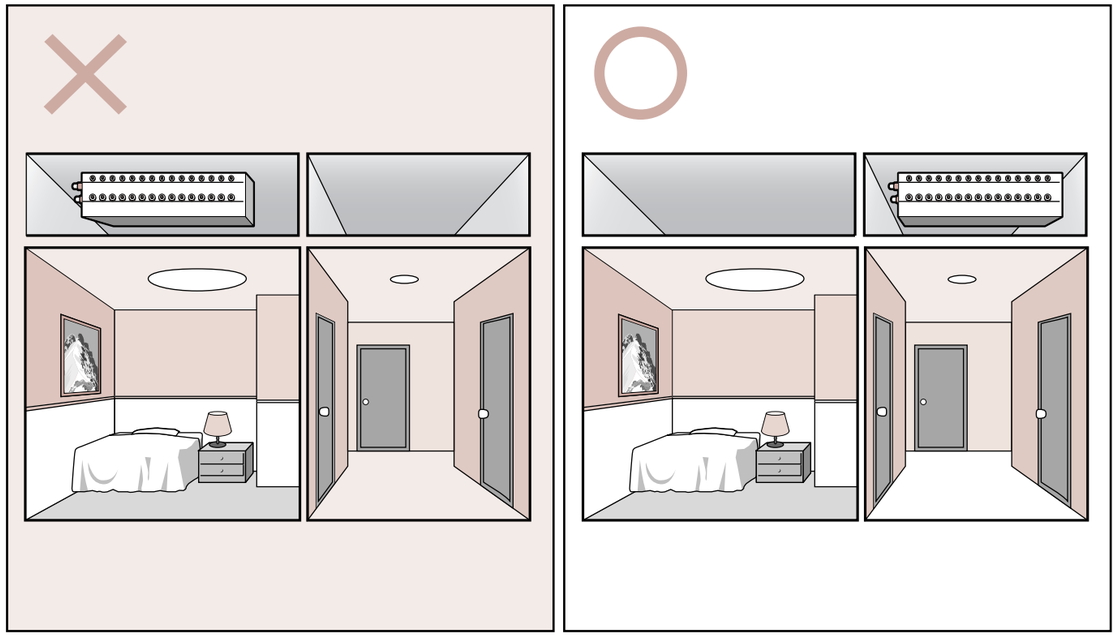
Possible Problems

- Drain dripping
- Algae formation
- Drain pan freezing (in cold regions)

Cautions and Countermeasures

- Condensation forms on a surface of a low-pressure part of a outdoor unit's refrigerant circuit and drains out through a multiple holes in a unit base. A method for handling this drain from a outdoor unit's bottom face should therefore be considered.
- Users are requested to consider using a drain pan with drainage piping, or have drainage gutters installed locally.
- Users in regions where the outside temperature is below zero should install a drain pan heater (procured locally).

Example 6 Installation of BC controller



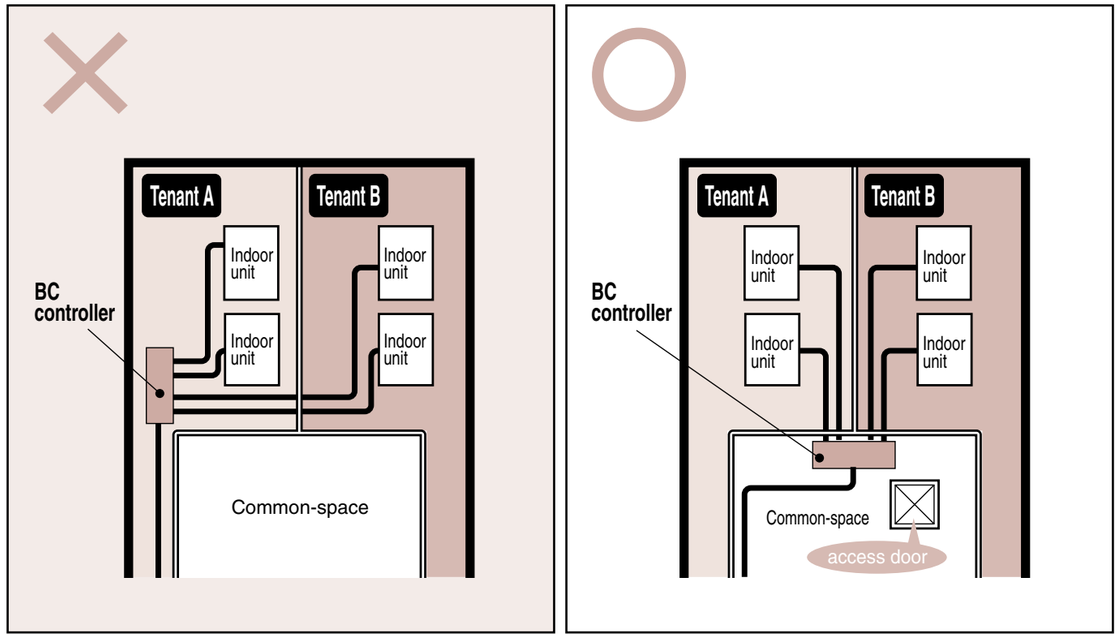
Possible Problems

- Noise produced by BC controllers can be disturbing.

Cautions and Countermeasures

- BC controllers are equipped with solenoid valves to change the refrigerant flow path and to bypass refrigerant. Depending on the operation conditions, fluid refrigerant will instantaneously evaporate to a gas refrigerant when solenoid valve operation occurs, resulting in a "pshuuu" sound.
- Install the unit in a location where the noise from the unit will not be a problem. (Install indoor unit and BC controller at least 5m away from each other when installed in a space with low background noise, e.g., hotel rooms).

Example 7 BC Controller Installation Position and Access door of Ceiling Concealed Type Indoor Unit



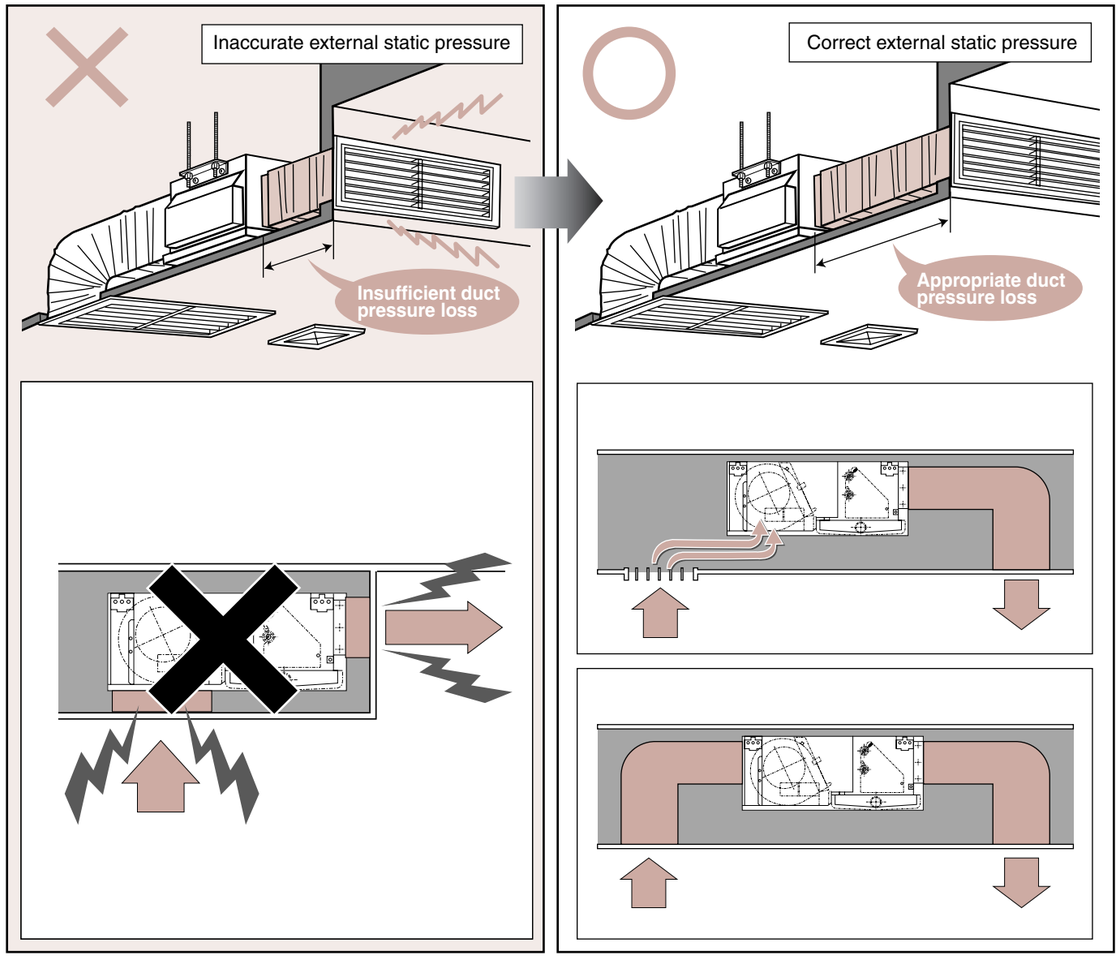
Possible Problems

- Complaints on operation noise.
- Maintenance trouble.

Cautions and Countermeasures

- BC controllers for heat recovery outdoor units should be installed in shared areas such as the ceiling of corridors, etc., where the effects of noise are minimal. In such systems, internal solenoid and expansion valve operation noise may occur unrelated to the indoor unit operation.
  (In hotels, etc., where silence is required, BC controller is recommended to be installed 5m or more away from the indoor unit.)
- Be sure to install an Access door at the prescribed location for BC controller maintenance purposes.
- Always install an Access door for ceiling concealed type units.

Example 8 Loud Air Outlet Sound at Ducted Indoor Unit



Possible Problems

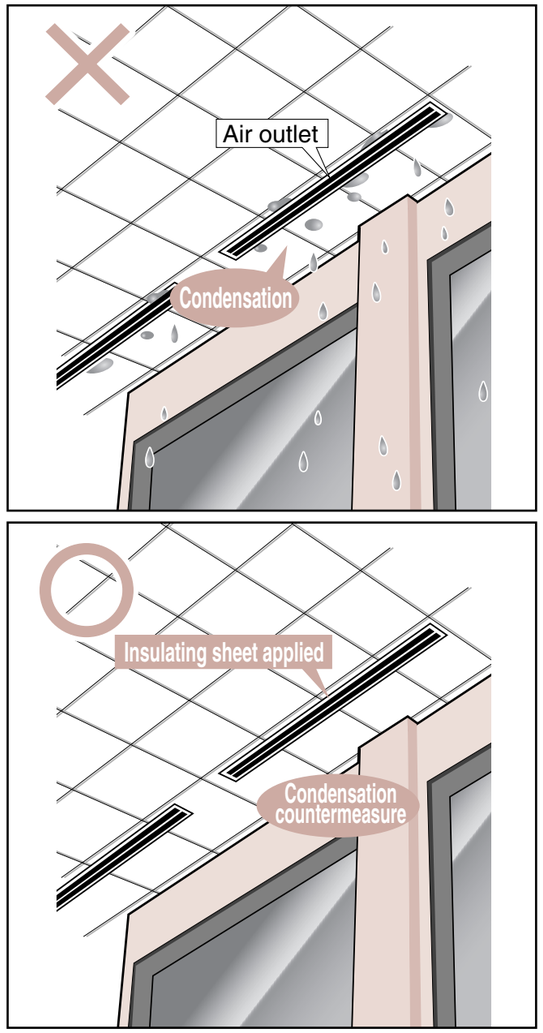
- If a duct resistance (pressure loss) is smaller than the air-conditioner's external static pressure increases the air flow rate, resulting in a loud sound.
- A loud sound occurs if no silencing measures are taken inside the duct, or if the wrong air outlet is selected.

Cautions and Countermeasures

- Consider both the overall air resistance (pressure loss) of the onsite duct system (duct + air outlet + air inlet + …) and the external static pressure of the air-conditioner which is connected to that duct system to ensure the balance between the two.
- To prevent vibration transmission with steel plate type duct, connect to the duct system by way of a canvass duct.
- A unit inspection port is required, and it may also be necessary to install another inspection port for duct air flow rate adjusting damper operation. Installing a damper will increase the external static pressure, and this must be added to the onsite duct resistance.

*Use only rust-resistant, nonflammable duct components, and give adequate consideration to the insulation and noise control when designing and installing the system.

Example 9 Condensation at Air Outlet



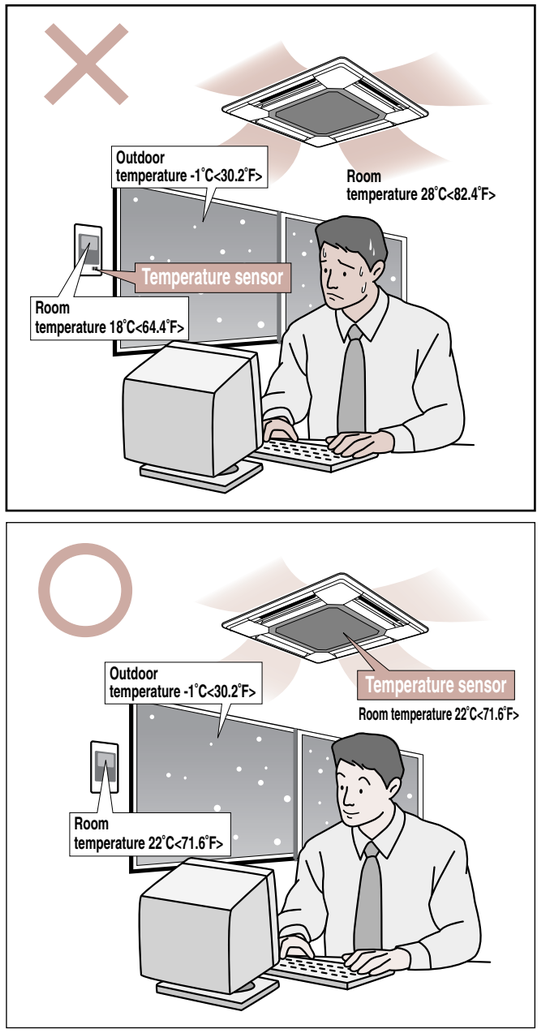
Possible Problems

- Condensation at air outlet.
- Mold at air outlet.

Cautions and Countermeasures

- A low air flow rate and a low-temperature air flow of an indoor unit could cause condensation on the air outlet equipment installed onsite. To avoid this, adjust the static pressure to operate at a standard air frow rate level equipment.
- Some air outlet equipment may allow outside air and humidity to enter around the air outlet area, causing condensation. Either install the air outlet equipment in a position which prevents this, or use an anti-condensation type fixture.

Example 10 Large Difference Between Temperature Detected by Remote Controller Sensor and Room Temperature



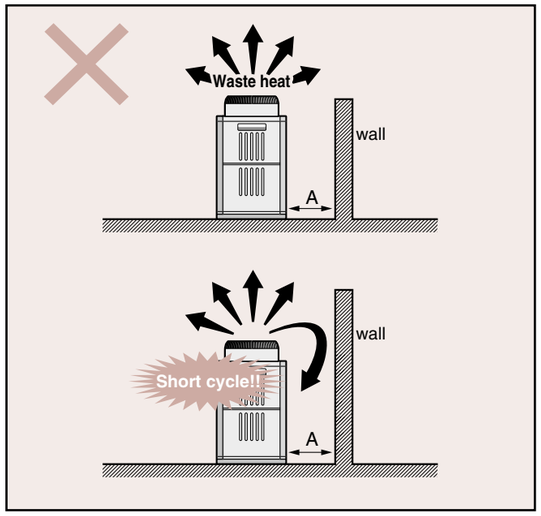
Possible Problems

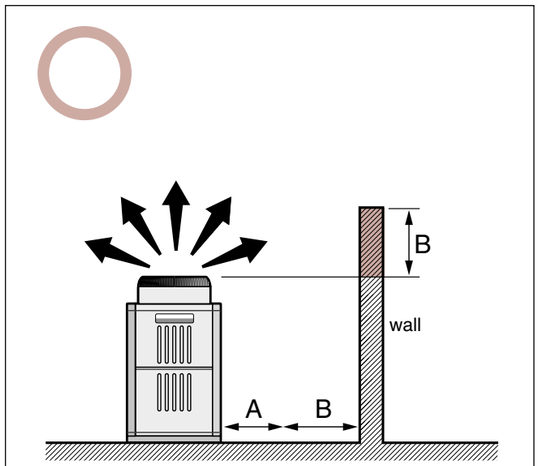
- The room being too cold or too warm.
- The room does not cool down or warm up.

Cautions and Countermeasures

- Attention should be given to the following when indoor unit control is based on the temperature detected by the remote controller sensor.
  - Is the wall surface temperature significantly different from the room temperature?
  - Is the air from the indoor unit blowing directly on the remote controller?
  - Is the remote controller exposed to direct sunlight?
  - Is the remote controller covered by a curtain, etc.?

Example 11 Installation space





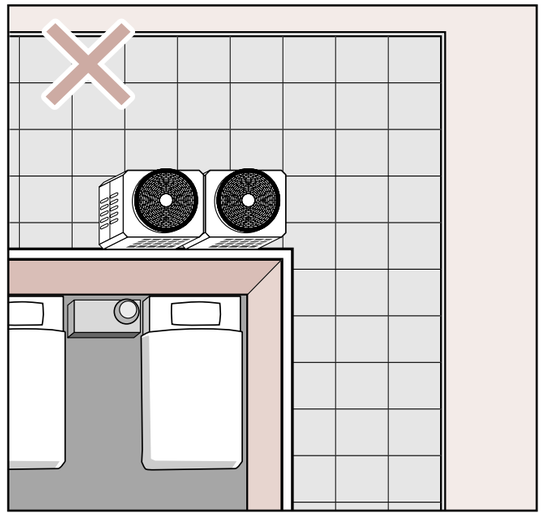
Possible Problems

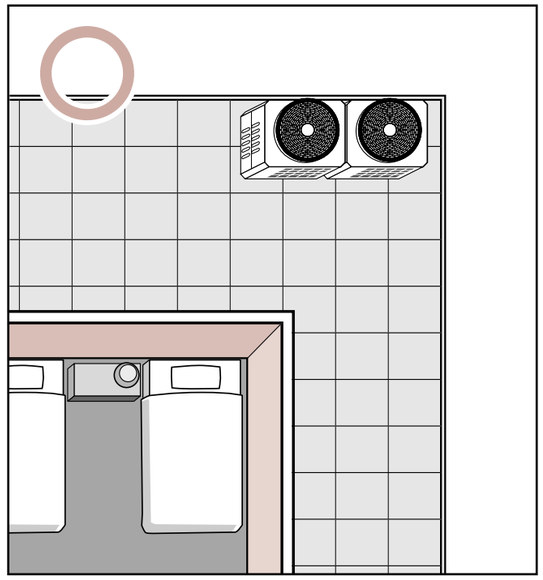
- Short cycle
- Low cooling capacity
- High pressure

Cautions and Countermeasures

- In order to prevent short operating cycles, do not install the unit near a wall which is higher than the unit.
  → For specific distances and installation details, refer to the Installation Manual.

Example 12 Outdoor unit installation locations





Possible Problems

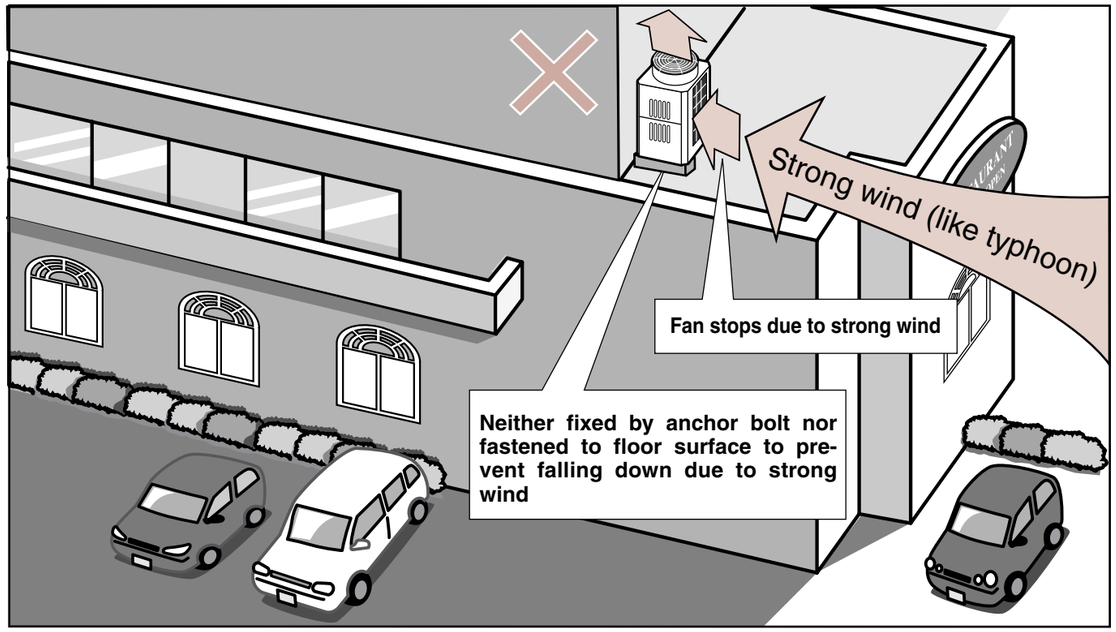
- Noise produced by outdoor units can be disturbing.

Cautions and Countermeasures

- Outdoor units are equipped with solenoid valves for heat exchange switching and for bypassing refrigerant. Depending on the operation conditions, fluid refrigerant will instantaneously evaporate to a gas refrigerant when solenoid valve operation occurs, resulting in a "pshuuu" sound.

  Choose the installation site with care in order to avoid noise disturbance problems.

Example 13 Influence of strong wind to outdoor unit



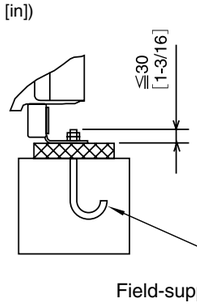
Possible Problems

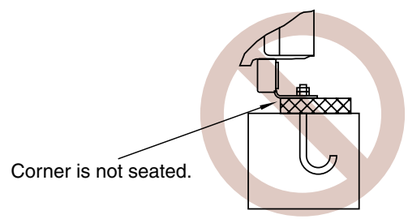
- If the air outlet is exposed to strong wind, there is a possibility of degraded capacity, low pressure fall, defrosting problems to occur due to uncontrollable pressure.
- If the outdoor unit is not secured or improperly installed, it may cause the unit to topple and result in injury or damage.

Cautions and Countermeasures

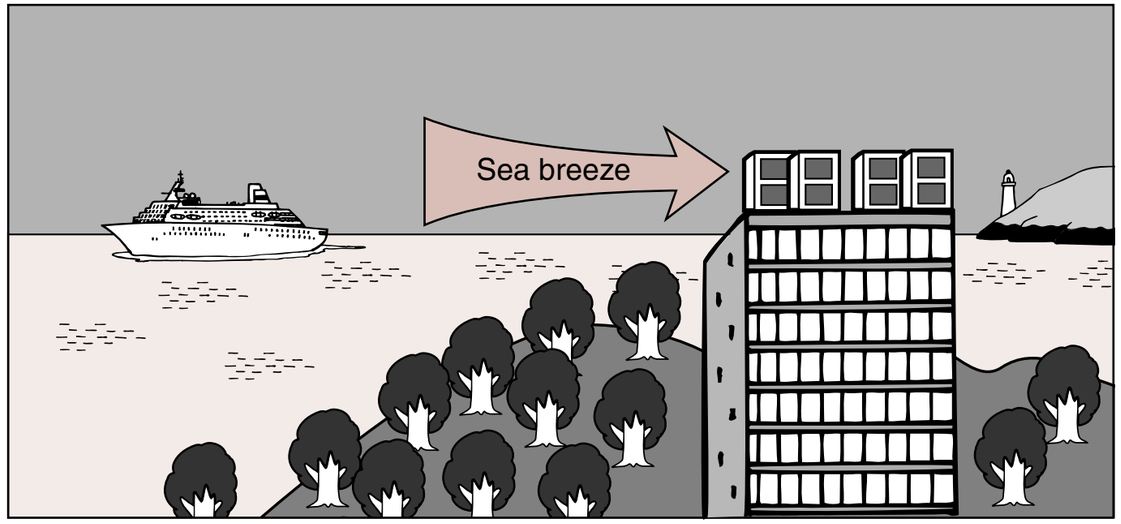
- Fix unit tightly with bolts so that unit will not fall down due to earthquakes or strong winds.
- Use concrete base or an angle bracket as the foundation of unit.
- Build the foundation in such way that the corner of the installation leg is securely supported as shown in the figure below.
  When using a rubber isolating cushion, please ensure it is large enough to cover the entire width of each of the unit's legs. If the corners are not firmly seated, the installation feet may be bent.

(unit: mm [in])





Example 14 Installation of outdoor unit in a region likely to be influenced by sea breeze

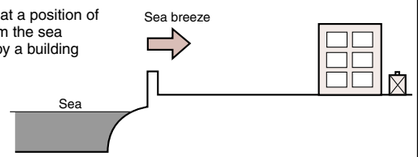
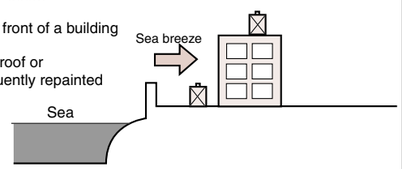


Possible Problems

● Installing the outdoor unit in a place exposed to salt air causes to rust and corrode the aluminum and copper of the heat exchanger in the outdoor unit, which may degrade the heat exchange capacity. In addition, the structural parts such as the external panel are likely to be rusted.

Cautions and Countermeasures

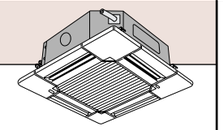
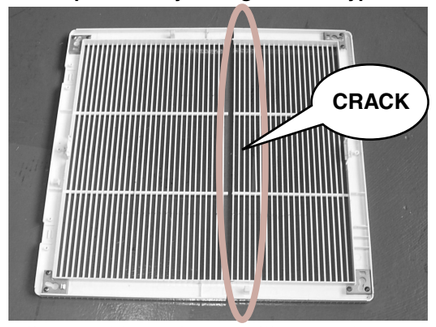
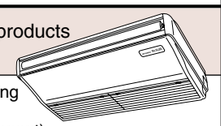
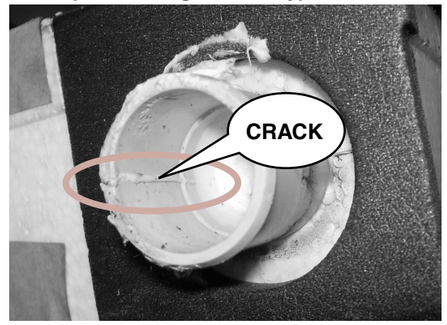
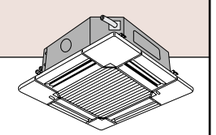
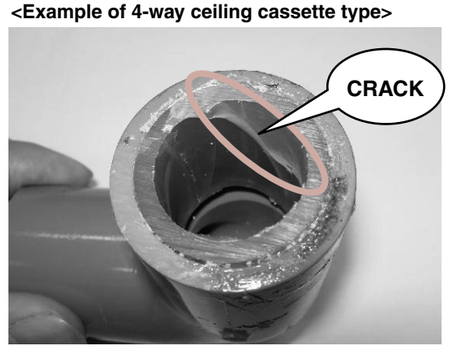
● For a seaside place likely to be influenced by salt air or places having similar atmosphere, the **"Salt-proof Outdoor Unit/Heavy Salt-proof Outdoor Unit is available at extra cost.**
Association.

Specification	Application	Treatment
Salt-tolerant Unit	**<A place not directly exposed to salt air but with similar atmosphere>** 1. A place where outdoor unit is exposed to direct rain 2. A place not exposed to salt air 3. A place where outdoor unit is installed at a position of more than 300m but less than 1km from the sea 4. A place where outdoor unit is shaded by a building 	1. Reinforced rust prevention of external panels (acrylic coating + polyester resin coating on inner & outer surfaces for once) 2. Epoxy resin coating at the end surfaces of motor support, separator and piping support 3. Anticorrosion/hydrophilic processing applied to aluminum fins
Heavily salt-tolerant Unit	**<A place influenced by salt air>** **but the equipment is not directly exposed to water containing salt** 1. A place where outdoor unit is not fully exposed to rain 2. A place directly exposed to salt air 3. A place where outdoor unit is installed at 300m or less from the sea 4. A place where outdoor unit is installed in front of a building (facing the sea side) 5. A place where the galvanized iron sheet roof or balcony iron part of the housing are frequently repainted 	1. Reinforced rust prevention of external panels (acrylic coating + polyester resin coating once for inner/outer surfaces, twice for outer surface) 2. Epoxy resin coating at the end surfaces of motor support, separator and piping support 3. Anticorrosion/hydrophilic processing applied to aluminum fins

● The standards applied above are based on Japan Refrigeration and Air-conditioning Industry Association Standard JRA9002, however, the conditions vary depending on the airflow direction and other installation environments. Please employ the salt-tolerant/heavy salt-tolerant specifications according to your local conditions.

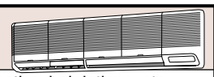
Example 15 Troubles about indoor unit due to environmental substances ①

The indoor unit of an air conditioner may be in a trouble caused by damaged plastic parts, or clogged heat exchangers due to the environmental load substances (soot of machine oil, organic solvent contained in paint, edible oil used by kitchens, roast meat and baked food shops, vinegar used by *sushi* bar, powder generated by tea manufacturing factory, etc.) existing in your installation environment. Please employ preventive maintenance (life prolonging measure) by referring to the examples below.

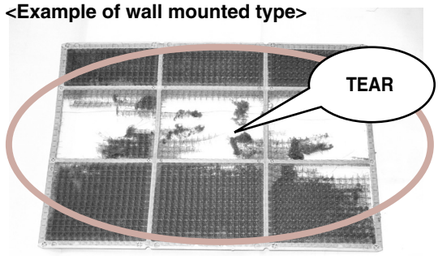
Factories	Environment	Factory using cutting oil or the like 	**<Example of 4-way ceiling cassette type>**  Cracking of the Inlet grille (ABS resin parts) due to the component contained in cutting oil
	Negative factors	・Fume of cutting oil ・Component of detergent	
	Possible troubles	・Damage of plastic parts	
	Mechanism of trouble	・"Environmental stress crack" produced by chemical (plasticizer) component contained in oil, or residual detergent with high alkalinity	
	Preventive maintenance	・The component of some detergents causes cracks. Please use the detergent recommended by our service company. ・Refrain from installing in an oily smoke environment. Otherwise install an air conditioner specifically designed for a system.	
	Environment	Factory of resin forming products such as glass frames 	**<Example of ceiling cassette type>**  Cracking of drain socket (at the stop valve side) due to chemicals contained in drain water
	Negative factors	・Chemicals used for separating formed resin products from the mould (plasticizer component)	
	Possible troubles	・Damage of plastic parts	
	Mechanism of trouble	・Chemicals (plasticizing agent) from the forming machines sucked and then diluted into drain water generates "Environmental stress crack" which is assisted with the stress of the stop valve additionally.	
	Preventive maintenance	・Refrain from installing in an environment generating plasticizer component. ・Provide sealing to prevent drain from stagnating inside the drain socket at the stop valve side. Otherwise install an air conditioner specifically designed for a system.	
Others	Environment	Use of adhesive in drain piping work 	**<Example of 4-way ceiling cassette type>**  Cracking of drain socket (at the valve side) due to organic solvent contained in adhesive.
	Negative factors	・Organic solvent contained in adhesive	
	Possible troubles	・Damage of hard PVC pipe by stress applied before drying of adhesive being used in drain piping work	
	Mechanism of trouble	・"Environmental stress crack" is generated by the stress of piping work applied immediately after using of adhesive.	
	Preventive maintenance	・Commence the next connection work only after the adhesive has been dried in the piping work. ・Be careful not to apply stress excessively to the connection parts.	

Example 15 Troubles about indoor unit due to environmental substances ②

Barbers/Beauty parlors

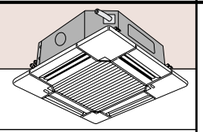
Environment	Barber/Beauty parlor 	
Factors of troubles	• Chemicals contained in cosmetics, hair lotions, etc. (plasticizer component)	
Possible troubles	• Filter damage or dew splashing by chemicals placed and used in the barbershop	
Mechanism of trouble	• Deteriorated mesh due to chemical adhesion for a long time caused by dirty air filter	• If the chemicals contained in spray adheres to the heat exchanger fin surface, the hydrophilic characteristic will be hindered. This causes to splash water drip being produced by condensation water.
Preventive maintenance	• Clean and rinse the air filter frequently.	• Install an air conditioner with a sufficient capacity to cover the air conditioning load fully.

<Example of wall mounted type>

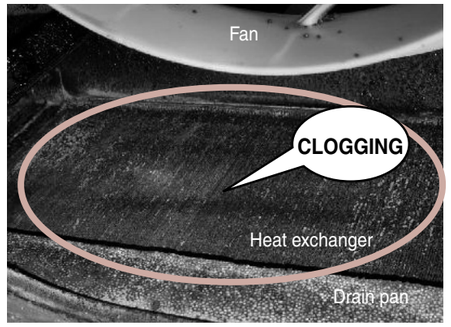


Chemicals used in barbershops will deteriorate and bore the PP honeycomb of the air filter.

Food processing factories/kitchens

Environment	Mess kitchen of factory 
Factors of troubles	• Smoke of vegetable oil used in the kitchen
Possible troubles	• Liquid back is occurred by serious clogging of the heat exchanger with oily smoke being absorbed by the unit in the kitchen
Mechanism of trouble	• The Air filter was cleaned in the past but the heat exchanger was not washed since its installation. This caused a serious clogging with oily smoke adhered.
Preventive maintenance	• Washing of heat exchangers being used for a long time is recommended regardless of the installation place. • Recommend concluding a maintenance contract for safety sake.

<Example of 4-way ceiling cassette type>

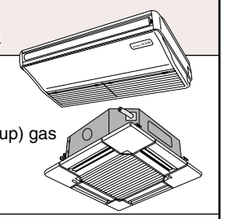


Clogging of heat exchanger due to oily smoke adhered

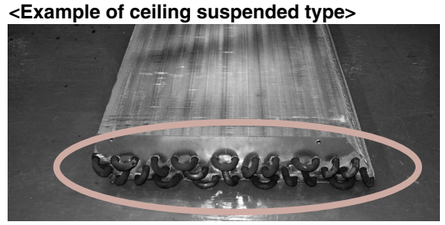
Example 15 Troubles about indoor unit due to environmental substances ③

Gas leak may be induced by the heat exchanger of air conditioners due to gas, disinfectant or the like existing in the installation environment, which possibly corrodes the metal parts like the copper part of coolers or the galvanized steel sheets.

Sewage treatment facilities

Environment	Sewage treatment facility and the surrounding area 
Factors of troubles	• Chlorine group gas • Hydrogen sulfide (Sulfur group) gas
Possible troubles	• Gas leak from the brazed part by absorbing gas generated from sewage treatment facility
Mechanism of trouble	• "Phosphorous selective corrosion" generated at brazed spots being wetted by cooling operation • The reasons other than "Phosphorous selective corrosion" can be anticipated depending on the type of gas. Phosphorous selective corrosion: indicates a phenomenon where the phosphoric acid component of phosphorous copper solder and hydrogen sulfide are reacted and deposited to deteriorate a brazed part. The brazed part becomes a sponge state leading to cause leakage.

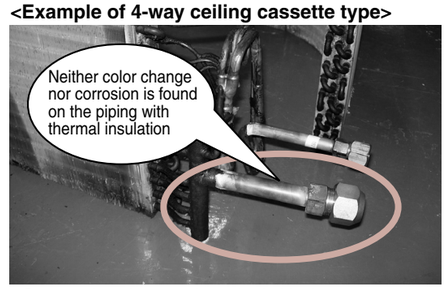
<Example of ceiling suspended type>



The hairpin side copper pipe changes the color in black. No gas leak is found as there is no brazed part.

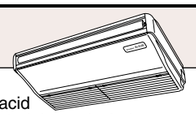
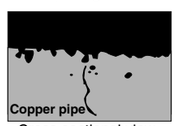
In the atmosphere of hydrogen sulfide, copper reacts against hydrogen sulfide degenerating copper sulfide in black color.

<Example of 4-way ceiling cassette type>

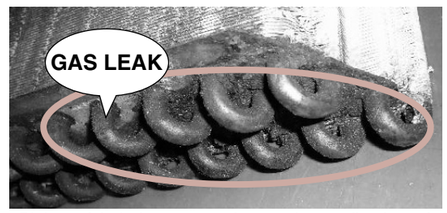


Copper pipe changes the color in black

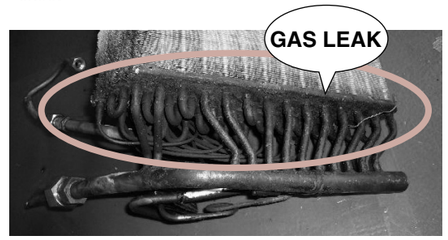
Food processing factories

Environment	Food processing factory (Bakery) 
Factors of troubles	• Sulfur group gas or organic acid gas generated from food materials or alcohol
Possible troubles	• Gas leak from copper piping due to gas generated from food materials or installation environment
Mechanism of trouble	• A corrosion phenomenon called "Formicary corrosion" where a symptom is repeated to produce copper sulfide (black corrosion product) through the reaction of sulfur with copper ion being dissolved from organic acid on wet parts. This symptom promotes pitting.  Cross sectional view of corrosion form
Preventive maintenance	• Do not operate air conditioners during disinfection work using alcohol (mainly ethanol).

<Example of ceiling suspended type>



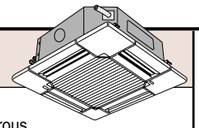
Pitting of hairpin copper pipe, serious adhesion of black product, and heavy red rust on galvanized steel sheet



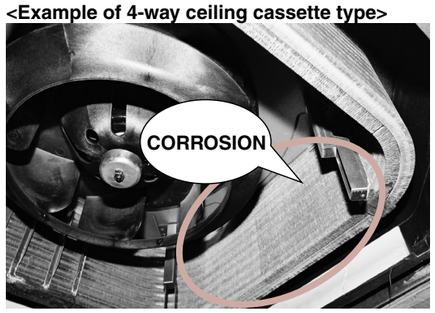
Same phenomenon occurs at the header pipe side

Example 15 Troubles about indoor unit due to environmental substances ④

Secondhand bookstores/Libraries	Environment	Secondhand bookstore/ Library
	Factors of troubles	• Hydrogen chloride produced by the reaction of drain water with phosphorous component being contained in fumigant for insect control
	Possible troubles	• White powder generated from unit installed inside the storage of antique documents due to the corroded aluminum fins by fumigation process (fumigant dusting)
	Mechanism of trouble	• Phosphorous component contained in fumigant is stable under dry atmosphere. But once it is contained in drain water, hydrogen chloride will be produced which corrodes aluminum.
	Preventive maintenance	• Stop the air conditioner and cover it with a sheet not to allow chemicals from being attached to the unit while fumigating the room. • When fumigant is dusted, operate your air conditioner only after ventilating the room fully.

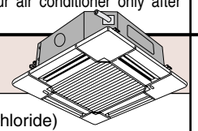


<Example of 4-way ceiling cassette type>

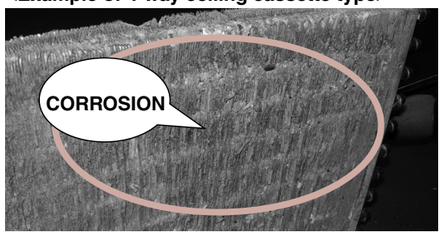


Wholly corroded aluminum fin produces and blows out the powder of aluminum oxide.

Hospitals/Pharmacies	Environment	Hospital/Pharmacy
	Factors of troubles	• Gas generated from medicines (chloride) used in hospital
	Possible troubles	• Corrosion of aluminum fin installed in a room near the nurse center of hospital
	Mechanism of trouble	• Chloride gas is absorbed during cooling operation and dissolved in water drips corroding aluminum
	Preventive maintenance	• Do not install the unit at a place where medicines are continually used.

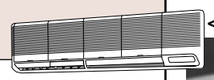


<Example of 4-way ceiling cassette type>

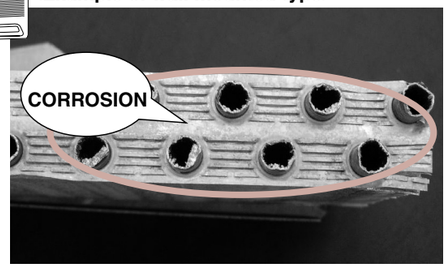


Aluminum fins of 50% are corroded.
Corrosion has grown at the side likely to absorb gas.

Boiler rooms	Environment	Environment where heavy oil is burnt like boiler room
	Factors of troubles	• Sulfur dioxide gas generated from heavy oil combustion
	Possible troubles	• Boiler installed in machine room uses heavy oil. The aluminum fins will be corroded by the combustion gas of the boiler
	Mechanism of trouble	• Sulfur group gas is absorbed during cooling operation and dissolved in the water drips which corrods aluminum.
	Preventive maintenance	• Prevent combustion gas of boilers or like from refluxing.

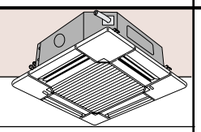


<Example of wall mounted type>

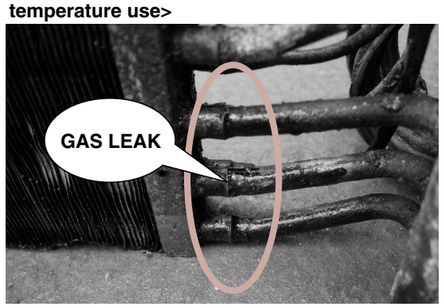


White powder of oxidized aluminum generated from corroded aluminum fins

Warehouses	Environment	Cacao beans storage
	Factors of troubles	• Sulfur group gas contained in cacao beans
	Possible troubles	• Gas leak from the brazed parts of unit installed in cacao beans storage
	Mechanism of trouble	• Despite of coating with anticorrosive paint "Alkyd resin" procured in the field, the "phosphorous selective corrosion" is generated at the brazed parts due to sulfur gas contained in cacao beans. • Alkyd resin paint has demerits of changing its color in yellow, tending to be damaged and contaminated when it is exposed to ultra-violet ray. Phosphorous selective corrosion: A phenomenon where brazed part is deteriorated due to the phosphorous component of copper phosphorous brazing metal being reacted with hydrogen sulfide and deposited. The brazed part becomes a sponge state leading to gas leak.

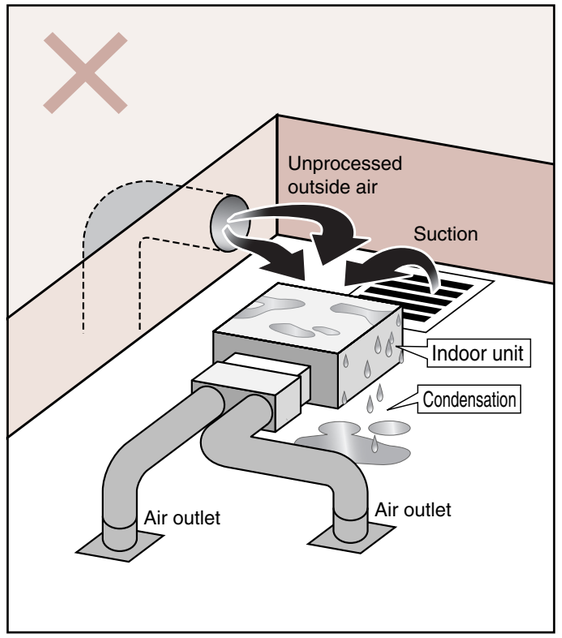


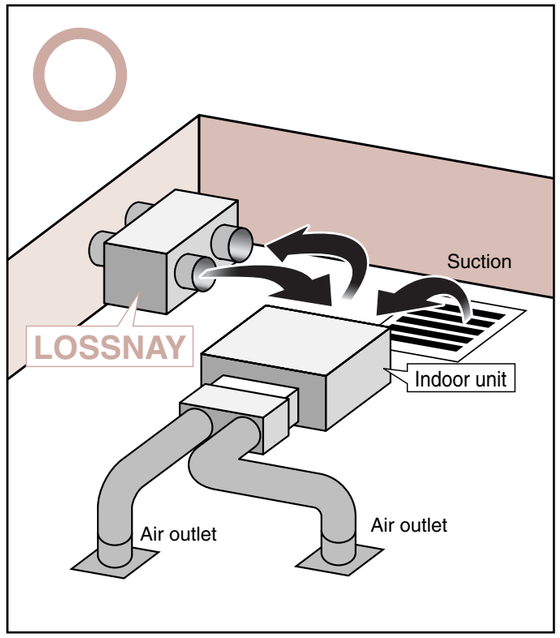
<Example of 4-way cassette type for medium temperature use>



Gas leak generated on brazed part
The coated film is likely to be peeled off by secular deterioration if the coating was made without cleaning the paint surface beforehand.

Example 16 Problems Related to the Indoor Unit's Ambient Temperature and Humidity Conditions





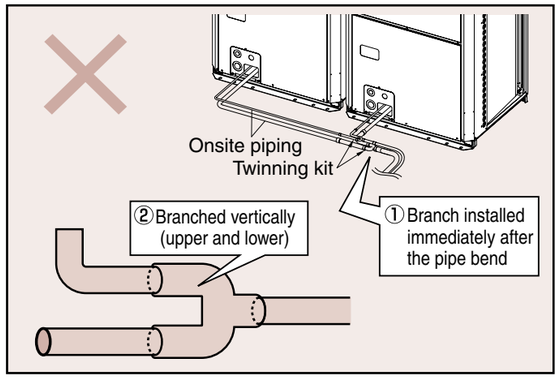
Possible Problems

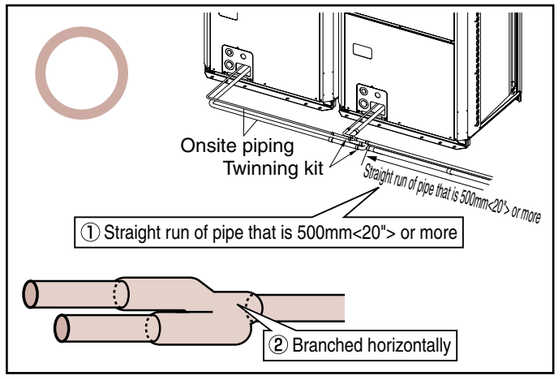
- Condensation on the outer surface of the indoor unit.
- Condensation dripping onto the ceiling.
- Too cold or too warm.

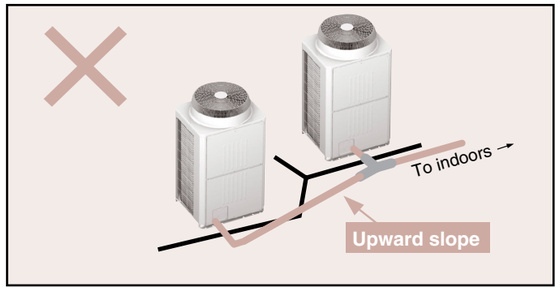
Cautions and Countermeasures

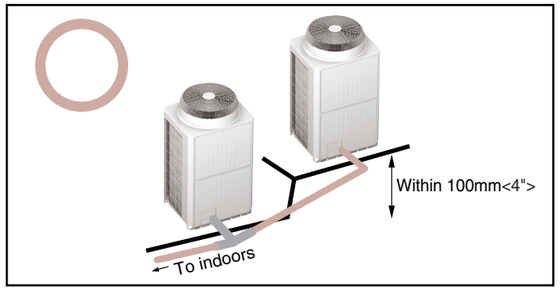
- Condensation may occur on the outer surface of the indoor unit if the unit's installation area is directly exposed to outside air.
- In cases where the indoor unit is installed in a ceiling chamber directly exposed to outside air which is sucked into the indoor unit, indoor air should be mixed with that outside air in order to ensure ambient conditions in which the indoor unit can operate.
- The ambient conditions for indoor unit operation call for a relative humidity of 80% or less, and a dew-point temperature of 26°C<78.8°F> or below.
- Check the difference between the temperature detected by the indoor unit's temperature sensor and the actual room temperature, and if a difference exists, use either the remote controller's thermostat or the room thermostat.

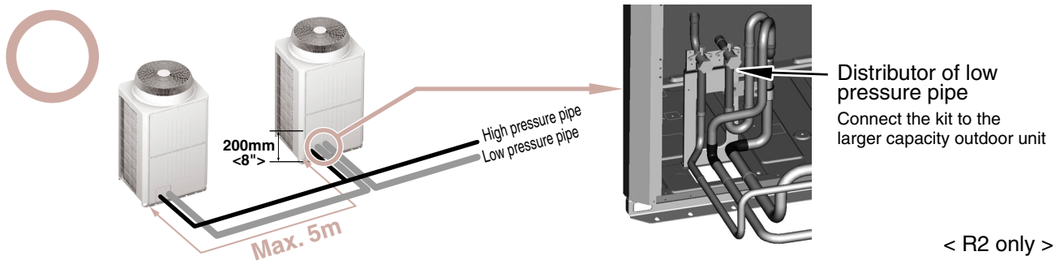
Example 17 Refrigerant pipe branching method at outdoor unit











< R2 only >

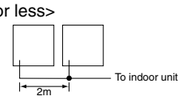
Possible Problems

- Poor cooling/heating.
- Component failure in refrigerant circuit.

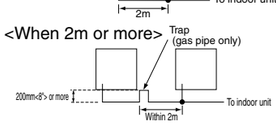
Cautions and Countermeasures

- Install the refrigerant piping branch horizontally so that both branches are the same height (Angle within ±15° to the ground).
- Before insulating the refrigerant piping, verify that the branch piping is installed horizontally.
- Install straight run of pipe that is 500mm<20"> or more.
- Observe the following cautions when connecting the twinning kit directly to the outdoor unit.
  If the piping length between the twinning kit and the outdoor unit exceeds 2m, install a trap (gas pipe only) at a position within 2m. The trap height must be 200mm<8"> or more. (* Trap is not required for R2.)

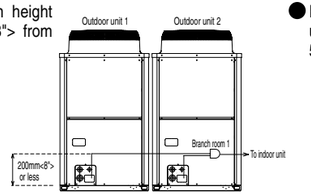
<When 2m or less>



<When 2m or more>

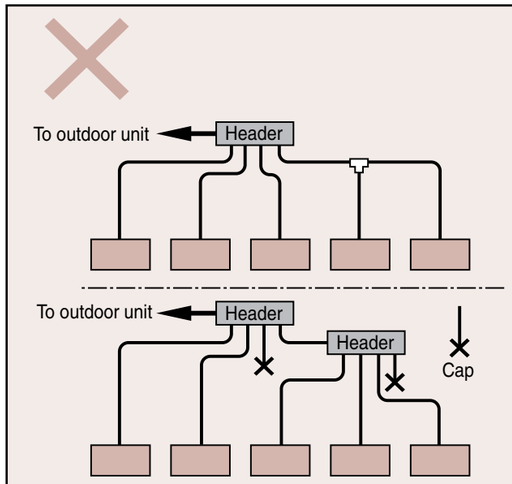


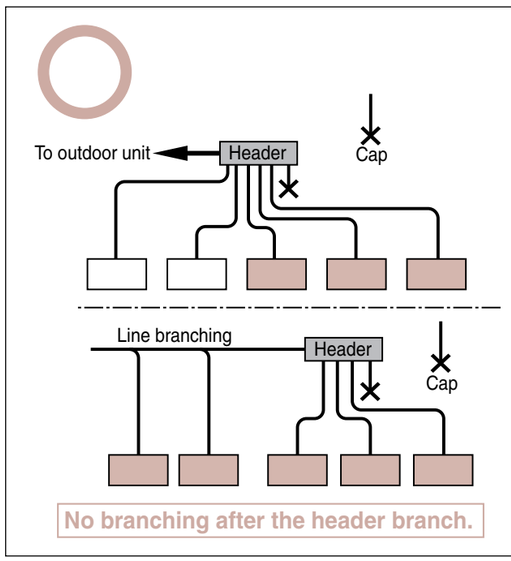
- The twinning kit installation height must not exceed 200mm<8"> from the outdoor unit base.



- Refrigerant piping between outdoor units musts not exceed 10m (Within 5m for R2).

Example 18 Additional Refrigerant Pipe Branching after The Branch Header





Possible Problems

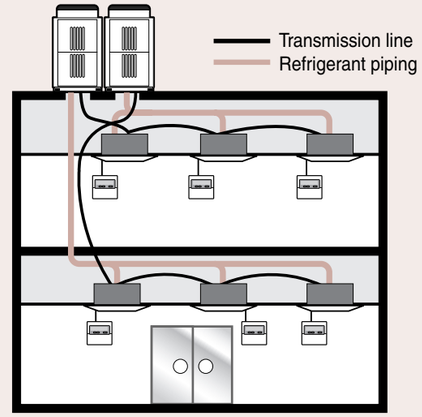
- Too cold or too warm
- Refrigerant noise

Cautions and Countermeasures

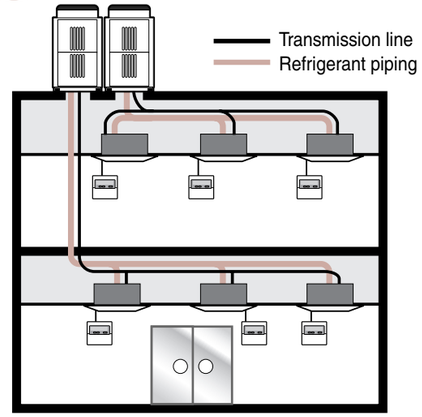
- The size of the header branch on the indoor side piping is only suitable for one indoor unit. There should be no additional branching at the header branch on the indoor unit side.

Example 19 Refrigerant Piping and Transmission Line Mismatch

Too cold when 2 units run simultaneously.



Prevent a mismatch by running each system individually in a test operation.



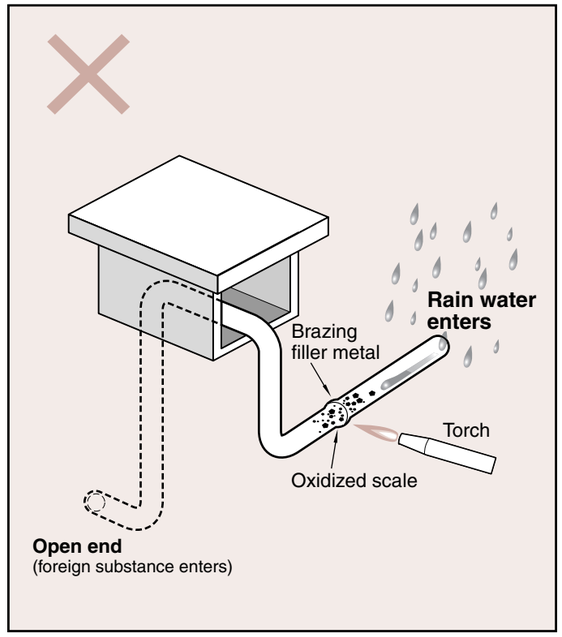
Possible Problems

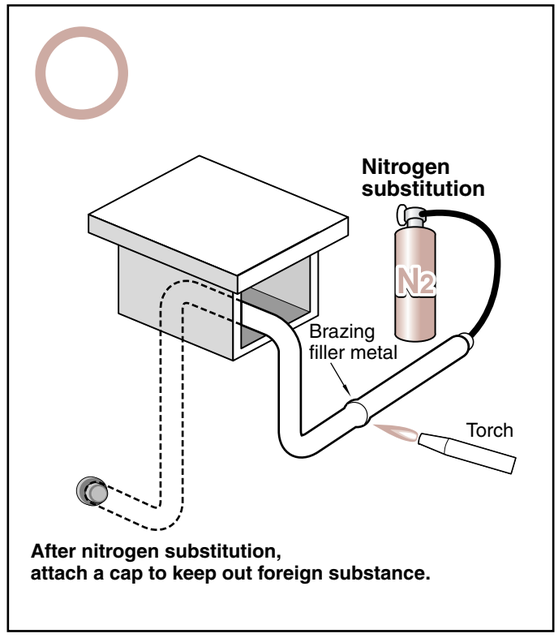
- Insufficient cooling/heating, and error stops.
- Refrigerant circuit component failure.

Cautions and Countermeasures

- Label the refrigerant piping and transmission lines with the names of their associated systems to prevent mismatches.
- Perform test operations in which each refrigerant system is operated independently in order to verify that the refrigerant piping and transmission lines are connected to the correct refrigerant system.

Example 20 Foreign Substance In The Refrigerant Circuit





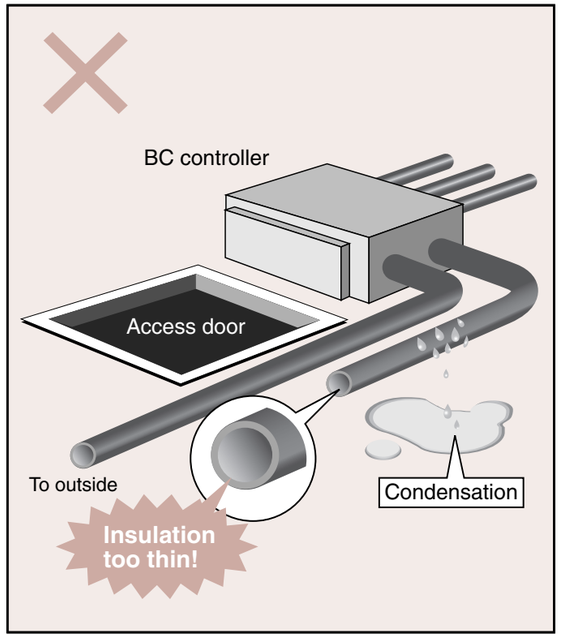
Possible Problems

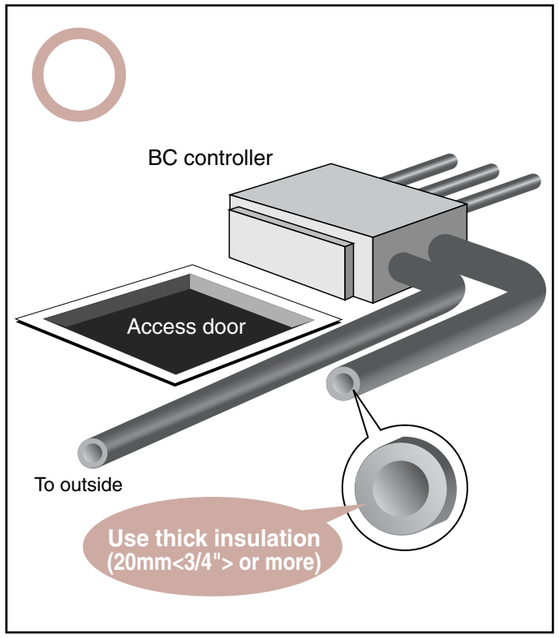
- Refrigerant circuit component failure.
- Refrigerant circuit clogging.

Cautions and Countermeasures

- Be sure that the onsite pipe brazing work is performed with non-oxide brazing. The presence of oxidized scale in the piping can cause compressor failure, etc.
- Use nitrogen for the non-oxide brazing operation. Do not use commercially available anti-oxidants, as these can leave foreign residue in the piping.
- The presence of water in the refrigerant piping can cause serious problems such as lubricant degradation, insufficient lubrication, and rusting inside the refrigerant circuit. When performing piping work, keep water out of the refrigerant piping, and prevent condensation inside the piping.

Example 21 Condensation Caused by Insufficient Insulation Thickness at Refrigerant Piping





Possible Problems

- Condensation dripping from the refrigerant piping insulation surface.
- Condensation dripping from the insulation on the low-pressure piping between the outdoor unit and the BC controller.

Cautions and Countermeasures

- Condensation and dripping could occur at the refrigerant piping insulation surface, depending the ambient conditions. Strickly observe the insulation thickness dimensions specified in the unit's installation manual.
- The low-pressure piping between R2 series outdoor units and BC controller is particularly susceptible to condensation because the temperature tends to be lower than other low-pressure piping, and therefore require an insulation thickness of 20mm<3/4">or more.

Refrigerant piping insulation cautions

In seasons, air conditioner is frequently used, piping temperature can be expected to drop to 10°C<50°F> at liquid piping and to 0°F<32°F> at gas piping (this varies depeding on model).
Therefore, polyethylene foam insulation of an appropriate thickness for liquid and gas piping must be used on the refrigerant piping between the indoor unit, BC controller, and between the insulation joints. Particular care should be taken regarding insulation used in ceilings, as improper work can cause condensation, etc.

Verify that the insulation being used conforms to the specifications shown below. These specifications assume that the insulation material is polyethylene foam.

● Insulation material thickness

For R2 Series and WR2 Series

Between outdoor unit and BC controller	High-pressure piping	10mm<13/32" >or more
	Low-pressure piping	20mm<3/4"> or more
Between BC controller and indoor unit	Piping size: 6.35mm<1/4"> to 25.4mm< 1">	10mm<13/32"> or more
	Piping size: 28.58mm<1-1/8">	20mm<19/32" > or more

For Y Series and WY Series

Between outdoor unit and indoor unit	Piping size: 6.35mm<1/4"> to 25.4mm< 1">	10mm<13/32"> or more
	Piping size: 28.58mm<1-1/8"> to 38.1mm<1/1/2">	20mm<19/32" > or more

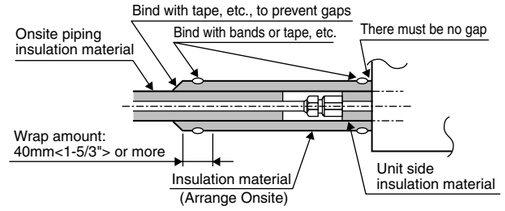
* When used on the top floor, etc., where conditions are hot and humid, a thicker insulation than that shown above may be required.

● Heat resistance temperature

100°C<212°F> or more

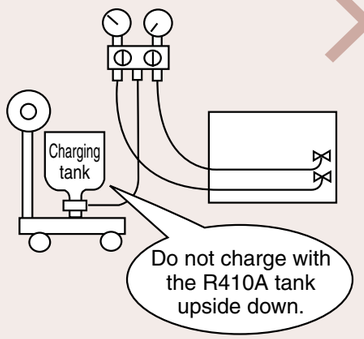
● Cautions related to other insulation work

Allow an insulation overlap margin at the onsite piping and the connection area (see figure below) in order to ensure that there are no gaps between the insulation materials.



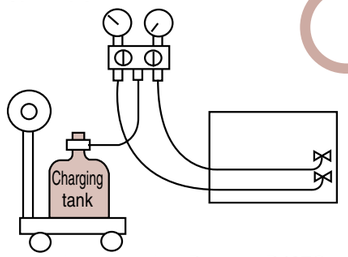
Example 22 Incorrect Additional Refrigerant Charging

■ **Charging with the R410A tank upside down** ×

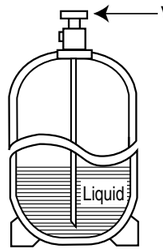


Refrigerant composition changes ×

■ **Tank with syphon pipe** ○



Tank color codes: Brown = R407C
Pink = R410A



Possible Problems

● The R407C and R410A refrigerants are mixtures of two or more refrigerant types which have differing evaporation temperatures. R410A tank is equipped with a syphon pipe, for when charging with gas, the quick-evaporating refrigerant is charged, and the slow-evaporating refrigerant remains in the charging tank. Turning a syphon-equipped tank upside down when charging can alter the refrigerant composition, resulting in reduced performance or malfunctions.

<Insufficient refrigerant amount>
Insufficient refrigerant causes performance loss and compressor heating which will cause the unit to make an emergency stop.

<Excessive refrigerant amount>
Over-charging with refrigerant will dilute oil by refrigerant, resulting in poor compressor lubrication and compressor failure due to liquid compression.

Cautions and Countermeasures

<Cautions before recharging>
(1) Verify the gas tank's refrigerant.
(2) Verify if the tank have a syphon pipe.
(3) Place the electronic force balance on a hard, flat surface.
(4) Do not use a charging cylinder as this could alter the refrigerant composition, resulting in performance loss.

<Cautions when recharging>
(1) Recharge from the stop valve after vacuumizing the extension pipe and the indoor unit. (when unit is not in operation)
(2) When recharging from the suction side check valve, use a safety charger, etc., to prevent the liquid refrigerant from being sucked in directly. (when unit is in operation)
(3) At the gauge manifold's sight glass, verify that liquid is charged. Note also that the charge hose vibrates if liquid is being charged. Grasp the charge hose to verify that it is vibrating. If gas is being charged, check the tank type.

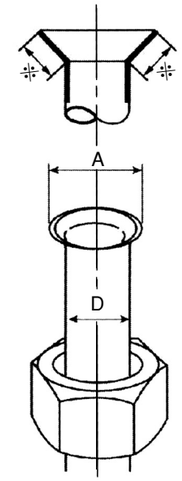
Example 23 Gas Leakage Due to Improper Flare Work

Example of poor flare work ×

A faulty connection will result in gas leakage, and must be repaired.

Insufficient burr removal	
Inner surface scratches due to cutting chips, etc.	
Insufficient flare dimension	
Excessive flare dimension	
Cracking	

○



* The perimeter length must be uniform.

Possible Problems

● Gas leakage will occur if connected with an improper flare.

Cautions and Countermeasures

1. Pipe cut
Use a pipe cutter, and cut the copper pipe gradually so as not to deform it.

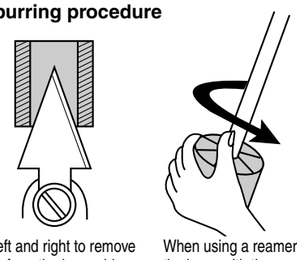
2. Deburr and cut surface cleaning
A poor end-face shape (after deburring) or cutting chips adhered to the flare area will cause refrigerant leakage. To prevent this, position the pipe with its cut face down, and gently clean off the cutting chips.

3. Use a R410A dedicated flare tool (clutch type) to perform the flare work.
[Check items]
The flare face must have a uniform width with a glossy surface.
The thickness of flare area must be uniform.
The flare size must be appropriate.

4. When reusing existing piping, be sure to rework the piping to the prescribed R410A flare requirements.

* The R410A working pressure is approximately 1.6 times that of R22, and gas leakage will therefore occur if the piping is not reworked.

■ **Deburring procedure**



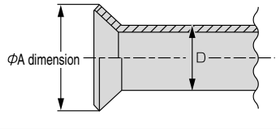
Rotate left and right to remove the burrs from the inner side of the copper pipe.

When using a reamer, remove the burrs with the copper pipe facing downward.

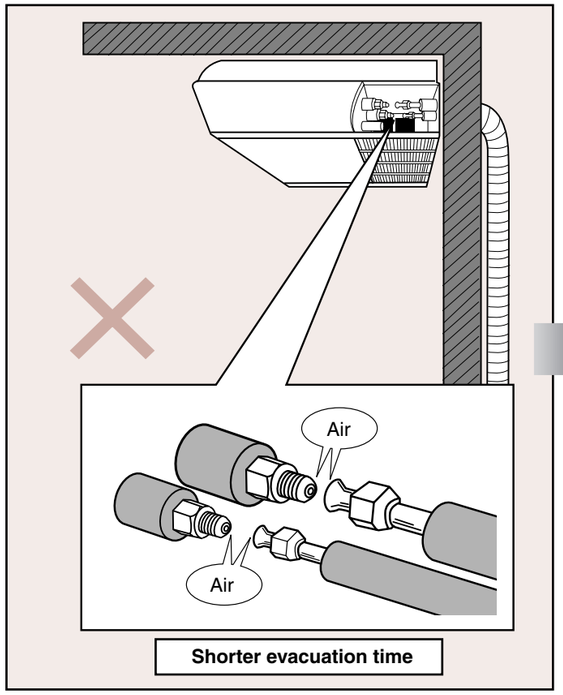
■ **Flare work dimensions** [mm<inch>]

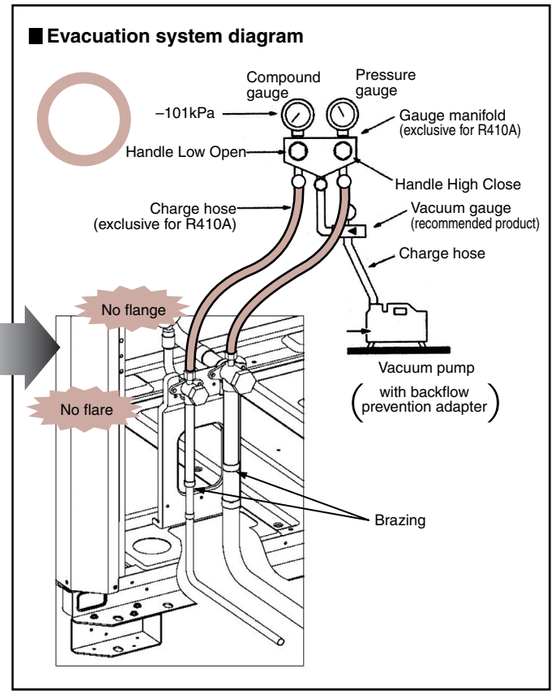
Pipe outer diameter D	A (+0 -0.4)	
	R410A	R22 · R407C
φ 6.35	9.1<0.364>	9.0<0.36>
φ 9.52	13.2<0.528>	13.0<0.52>
φ 12.7	16.6<0.664>	16.2<0.648>
φ 15.88	19.7<0.788>	19.4<0.776>
φ 19.05	24.0<0.96>	23.3<0.932>

■ **Flare work**



Example 24 Air mixed in refrigerant piping or air conditioning unit



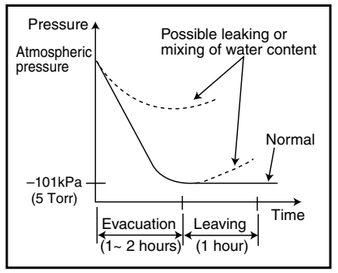


Possible Problems

● The condensing pressure increases abnormally during operation resulting in compressor loss, which may degrade the capacity or shorten the life of the compressor. In addition, the protective device tripped may stop the compressor.
If water content is mixed even in a very small amount, the water content freezes inside the expansion valve or capillary

Cautions and Countermeasures

For air purging at the installation of equipment, do not apply the gas purge method but apply the evacuation method for reliable operation.
When using pipe sold in the market, make sure to evacuate the pipe as it is containing air.



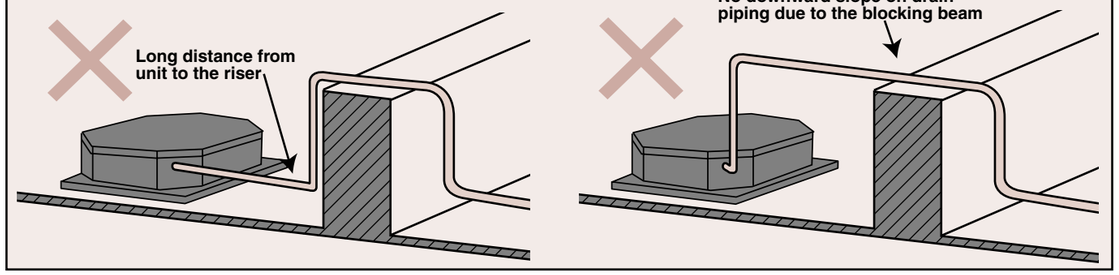
<Points of vacuum drying>

1. Evacuate from the service port of the stop valve by using a vacuum pump with high performance for a sufficient time [more than 1 hour after reaching –101kPa (5 Torr)] to perform vacuum drying inside the piping,
2. Checkup is required when the vacuum degree does not drop to –101kPa (5 Torr) after 1~2 hours, for there may be a leaking spot or water content entering the piping.
3. When the vacuum degree is high, mixing of water content may be assumed. In order to remove the water content inside the piping, pressurize nitrogen gas up to 0.5kgf/cm² and evacuate again. Repeat this operation until the pressure reaches below –101kPa(5 Torr) or the pressure rise is eliminated. (If nitrogen gas is not charged, water content cannot be removed as the water content inside the piping will freeze.)
4. The evacuation time differs depending on the capacity of a vacuum pump to be used or the amount of the water contained. Therefore you are requested to execute vacuum drying by observing the vacuum degree carefully not sticking to the time only.
5. Mixing of the vacuum pump oil into the HFC group refrigerant cycle by reverse flow will be a major cause to damage theequipment.

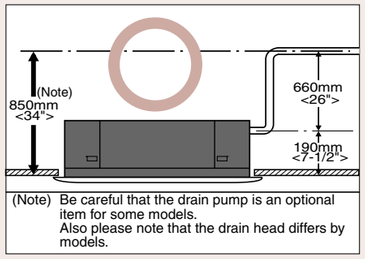
(Maintenance management of vacuum pump)
With many vacuum pumps, the water content contained in air may mix into oil frequently at discharging air inside the refrigerant piping. Therefore, checking of the vacuum pump for a proper oil quantity, and conducting of periodic oil replacement are essential. (Please provide a periodical maintenance by following the Instruction Manual of the vacuum pump.)

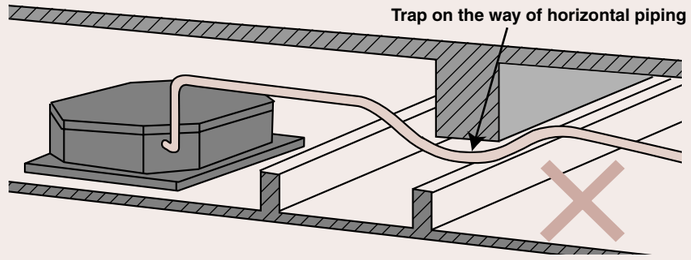
Example 25 Combining of horizontal drain piping

Riser of drain piping



Trap on drain piping



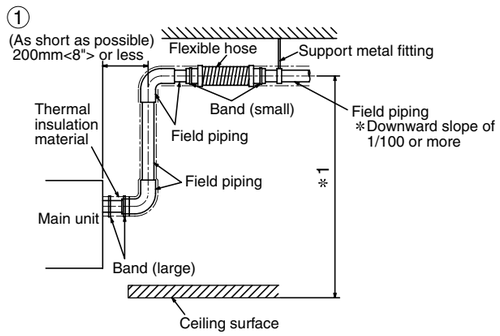


Possible Problems

●After raising the drain piping, a downward slope of more than 1/100 is to be provided. However, if a convex part is provided on the way, drain does not flow normally but flows reversely to the drain pan side leading to overflow. Arrange the distance from the unit to the riser part as short as possible, and posture the riser pipe at a right angle. Neglecting the above will cause overflow.

Cautions and Countermeasures

● Follow the instruction below to raise the drain piping.
● Make sure to bond the connection part of the piping.

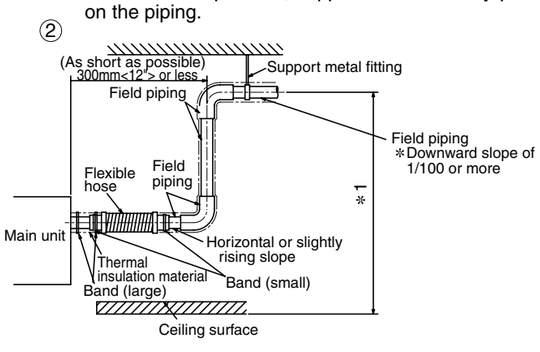


Possible Problems

●If there is a trap on the way of horizontal drain piping, the drain flow is hindered and sludge is bred from accumulated dust at the bottom of the trap. This generates clogging which may lead to overflow.

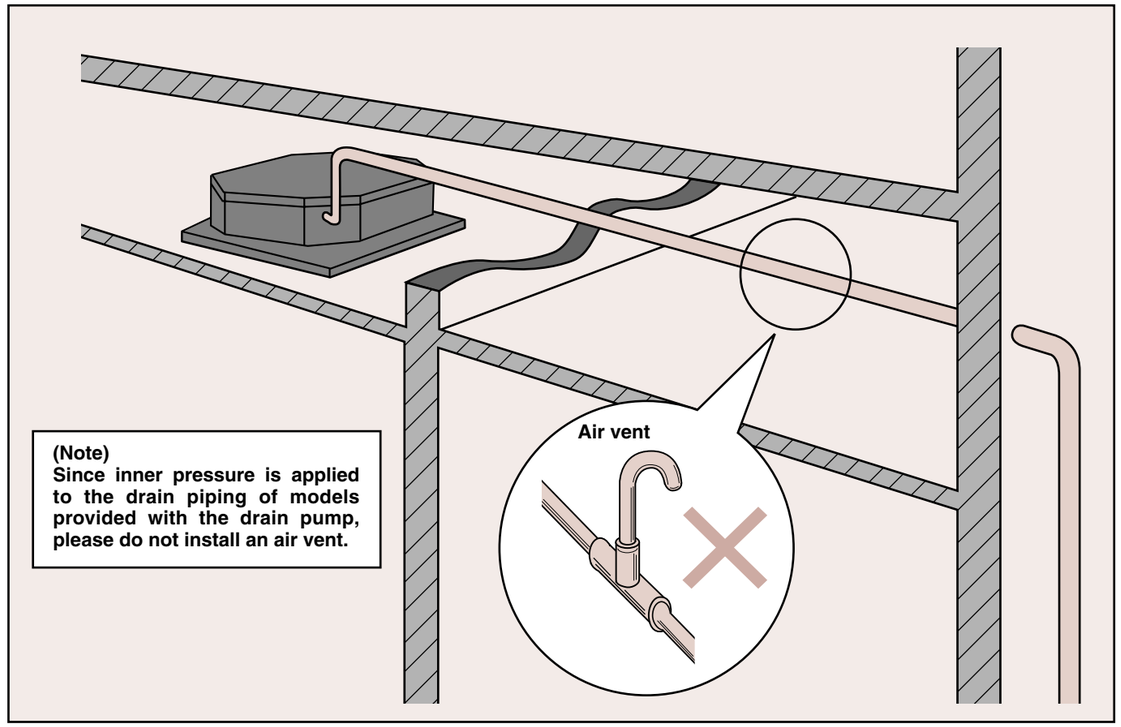
Cautions and Countermeasures

●Never provide a trap or deflection as shown above. Check the structure which will be an obstacle like a beam beforehand, and determine the position from which the piping is taken out for connection. When deflection is a problem, support the necessary points on the piping.



✻1. As the drain riser height differs depending on models, please consult the Installation Manual.
- 4-way ceiling cassette type (PLFY/V-BM): Within 850mm<34"> from the ceiling surface

Example 26 Troubles about horizontal drain piping

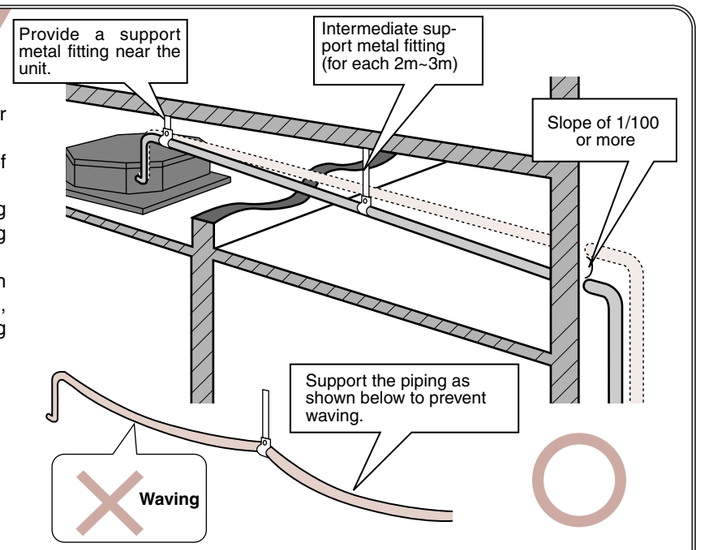


Possible Problems

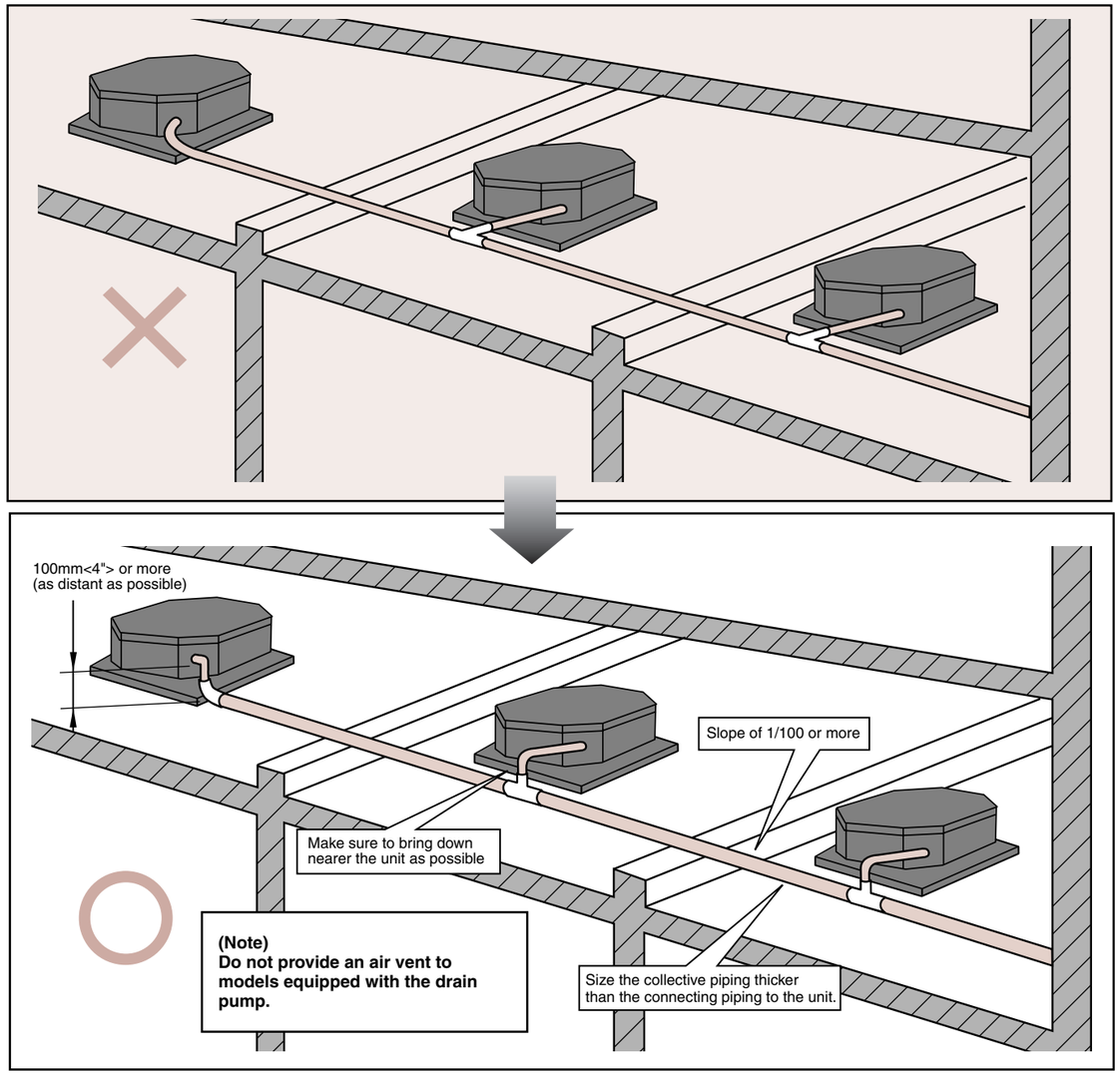
- As inner pressure is being applied by the drain water lift-up mechanism, installing of an air vent may cause to blow out water. During the stopping of the drain pump, in addition, drain water accumulated in the air vent may flow reversely causing overflow from the drain pan.

Cautions and Countermeasures

1. Make sure to provide a slope of 1/100 or more to the horizontal drain piping.
2. Make sure to bond the connections of piping.
3. Do not install an air vent to a model using the drain pump as inner pressure is being applied to piping.
4. Arrange the horizontal drain piping length less than 20m. (For a longer drain piping, install support metal fittings on the piping to eliminate the waving of it.)



Example 27 Combining of horizontal drain piping



Possible Problems

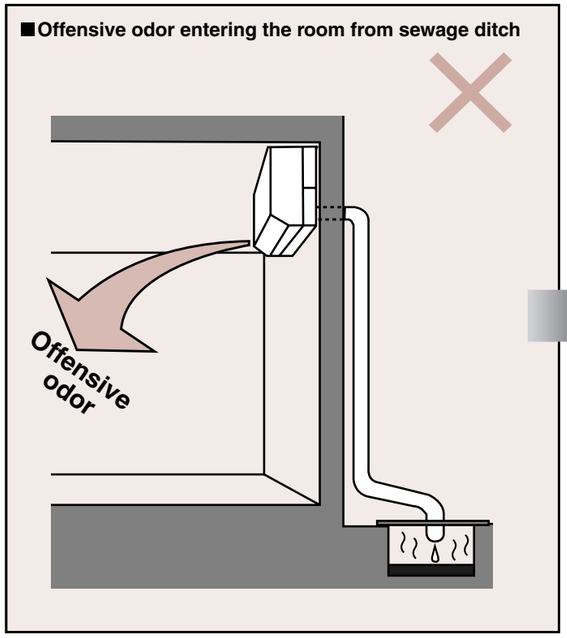
- At the stopping of the unit due to stagnated drain flow, the backflow of the drain causes overflow from the drain pan.

Cautions and Countermeasures

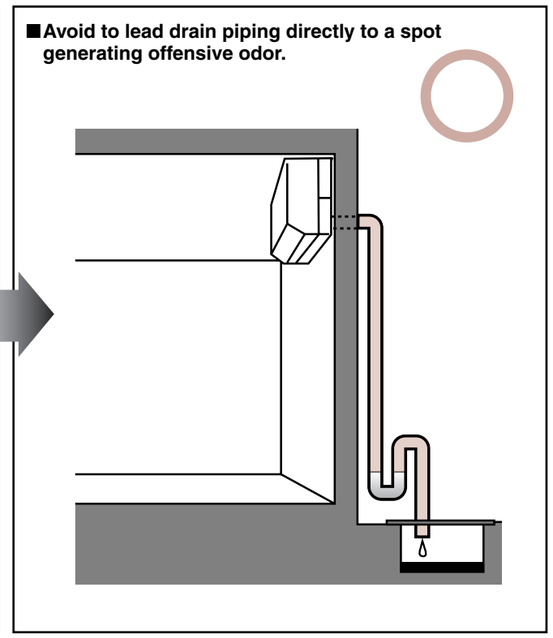
1. **For the collective piping, use 1-rank thicker piping than the connecting piping with the unit**.
2. Make sure to locate the collective piping more than 100mm<4"> lower than the connecting piping with the unit.
3. Provide a downward slope of more than 1/100 to the collective piping.
4. Do not install an air vent as inner pressure is applied to piping by the drain pump.
5. Make sure to apply adhesive jointing to the connection of the drain piping.

Example 28 Entry of odor/corrosive gas from drain piping

■**Offensive odor entering the room from sewage ditch**



■**Avoid to lead drain piping directly to a spot generating offensive odor.**



Possible Problems

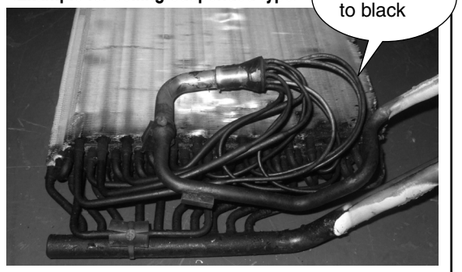
- Offensive odor (corrosive gas) will be brought into the room through drain piping if the drain piping is led down into a sewer ditch where offensive odor is likely to be generated.
- Some types of gas will corrode the heat exchanger, which may lead to gas leak.

Cautions and Countermeasures

- It is essential to avoid from leading drain piping directly to a spot likely generating offensive odor.

Environment	**Drain pipe is led down into a sewer ditch.**
Problem cause	● Draining the water into a sewer ditch can cause gas leakage at the brazing area due to corrosive gas which flows from the drain pipe.
Possible problem	● Hydrogen sulfide (sulfur system) gas.
Problem mechanism	● Corrosion (phosphorous selective corrosion) in brazing area where water leakage occured when cooling.
Preventive measures	● Use a corrosion-resistant item with epoxy resin applied to the copper pipe (including brazing areas). ● Install a dedicated for drain water.

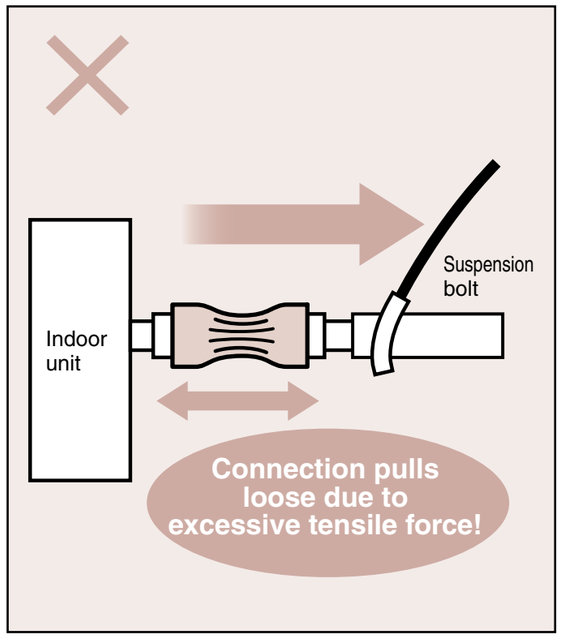
<Example for ceiling-suspended type>

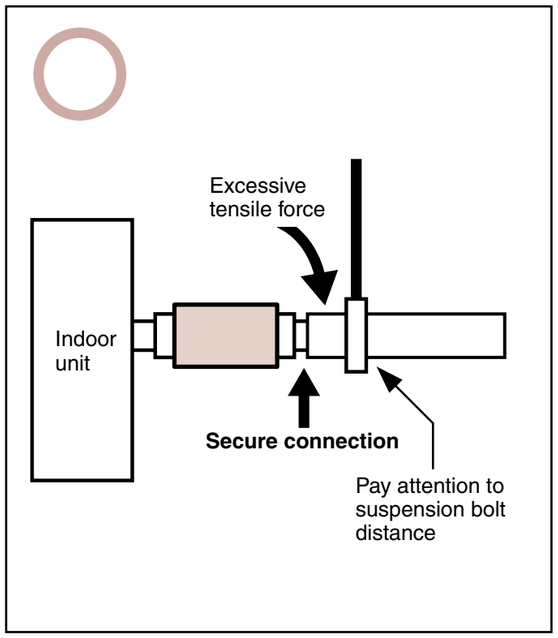


▲ A blackened copper pipe indicates gas leakage from the brazing area (occurs most often at ceiling-suspended types).

▲ Brazing filler steel peeling

Example 29 Water Leakage From Drain Pipe Connection Area





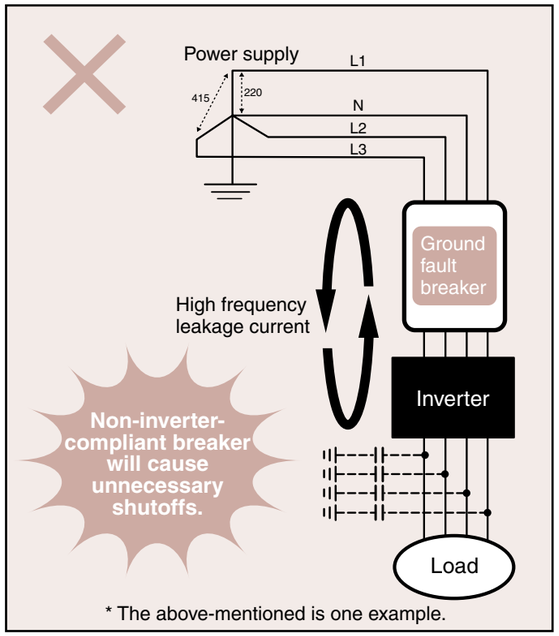
Possible Problems

- Water (drain) leakage.

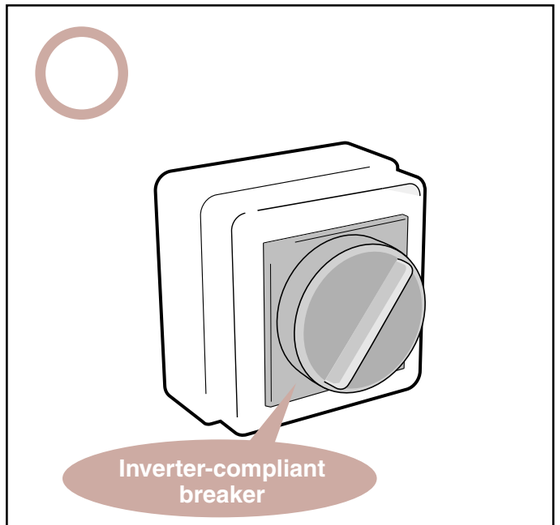
Cautions and Countermeasures

- Be sure to use a prescripted adhesive (for hard vinyl chloride pipe) when connecting the indoor unit's accessory drain hose. Using other adhesives could result in water leakage.

Example 30 Selecting a Breaker For Ground fault



* The above-mentioned is one example.



* For details, contact the breaker manufacturer.

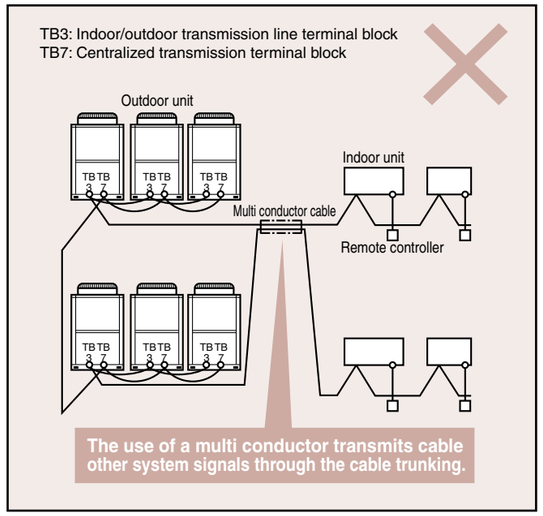
Possible Problems

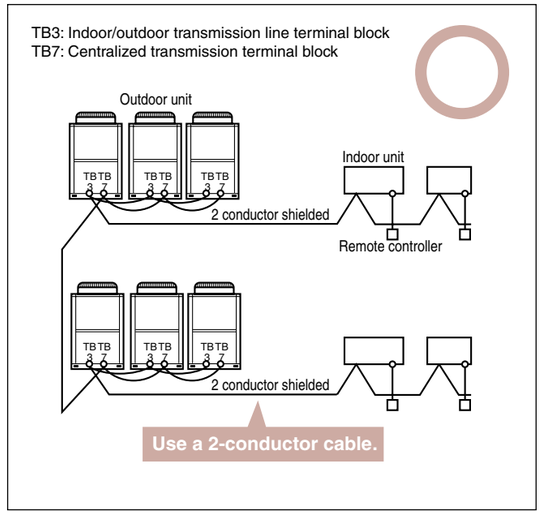
- Ground fault breaker is tripped at inverter operations.

Cautions and Countermeasures

- Be sure to install a ground Fault breaker.
- The leakage current increases with inverter devices.
  Inverter models first convert the AC power supply to DC, then convert it to the desired frequency AC with ON/OFF of high-speed switching element. The current leakage in these models are therefore greater than that in constant-speed models (non-inverter models), and may cause unnecessary shutoffs due to the capacitive coupling to the ground.
  To prevent such unnecessary shutoffs, use a ground fault breaker which is resistant to high-frequency current leakage (known as high-frequency surge resistant breakers, etc.).
- Because the amount of current leakage varies according to the power cable size and length, kefer to instllation Manual or instraction book for specific breaker value.
- Special care should be taken when changing from a constant-speed device to an inverter device.

Example 31 Transmission Errors Related to the Transmission Line Type and Length





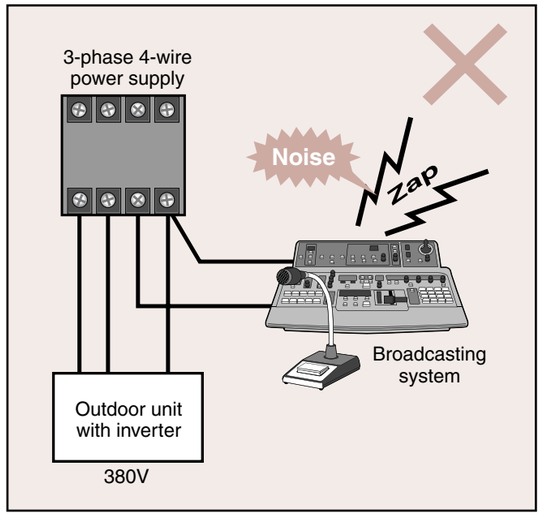
Possible Problems

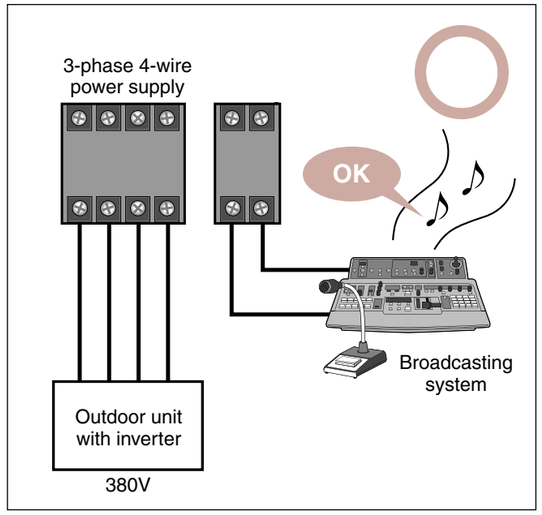
- Transmission error.

Cautions and Countermeasures

- Using a multiconductor cable in transmission lines for multiple refrigerant systems can cause transmission errors.
- Loop unnecessary transmission lines in the ceiling, and keep the lines as short as possible in order to prevent signal attenuation and error stops.
- Use shielded cables for M-NET transmission lines.

Example 32 Malfunctions Due To Using the Same Power Supply and Ground Devices as the Outdoor Unit





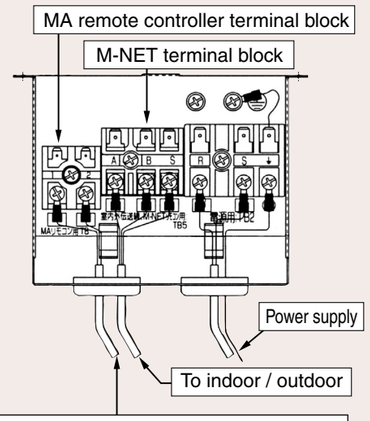
Possible Problems

- Malfunctions, etc., occur during air-conditioner operation at units which share a power supply or ground device.
- Noise interference occurs on sound systems during air-conditioner operation.

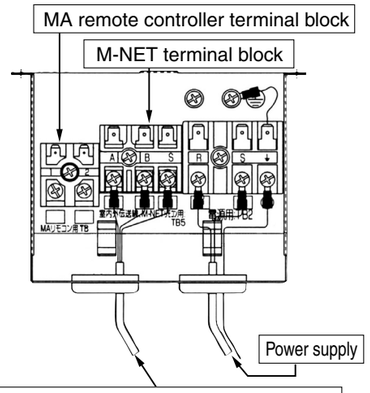
Cautions and Countermeasures

- Noise is transmitted via the power supply and ground. In VRF systems, use a dedicated power supply and ground device for each unit.
- Separate and do not share powersupply when having two devices.

Example 33 Incorrect ME Remote Controller Wiring



ME remote wiring is incorrectly connected to the MA remote control terminal block.



To TB5
Nonpolar DC24~30V when using indoor/outdoor transmission line and M-NET remote controller.

After connecting the crossover wiring at a position prior to the indoor unit terminal block, insert only one wire to each terminal.

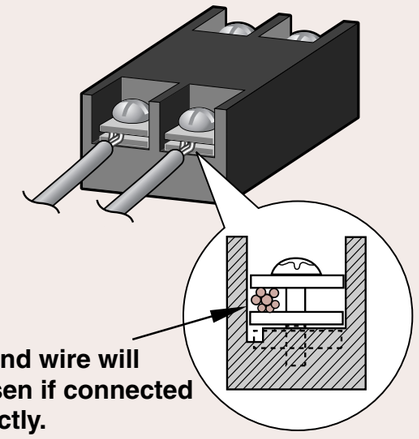
Possible Problems

- Remote controller fails to start up and operate.

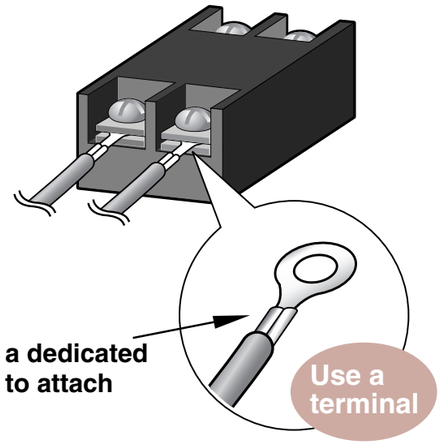
Cautions and Countermeasures

- The indoor unit has separate transmission line terminal blocks for a ME remote controller and MA remote controller. The ME remote controller terminal block is used for both indoor units and outdoor unit's transmission line connection terminal block.
- When using the same terminal block for multiple transmission line connections, make the external connections first, then connect only 1 wire to the terminal block.

Example 34 Poor Contact at Transmission Line Connection



Strand wire will loosen if connected directly.



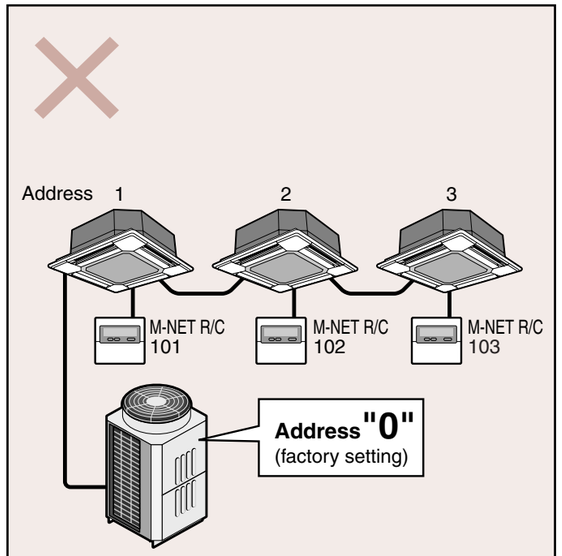
Possible Problems

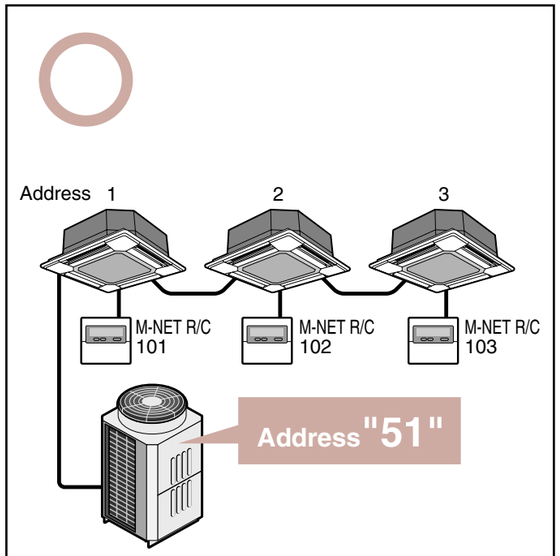
- Transmission related error will be displayed (error code 6***)

Cautions and Countermeasures

- Use a terminal to connect the wiring to the terminal block. Not using a terminal can cause the connection to loosen, resulting in a contact fault and an error stop.
- Always use the dedicated tool when attaching the terminal to the wiring.

Example 35 Address Setting Error





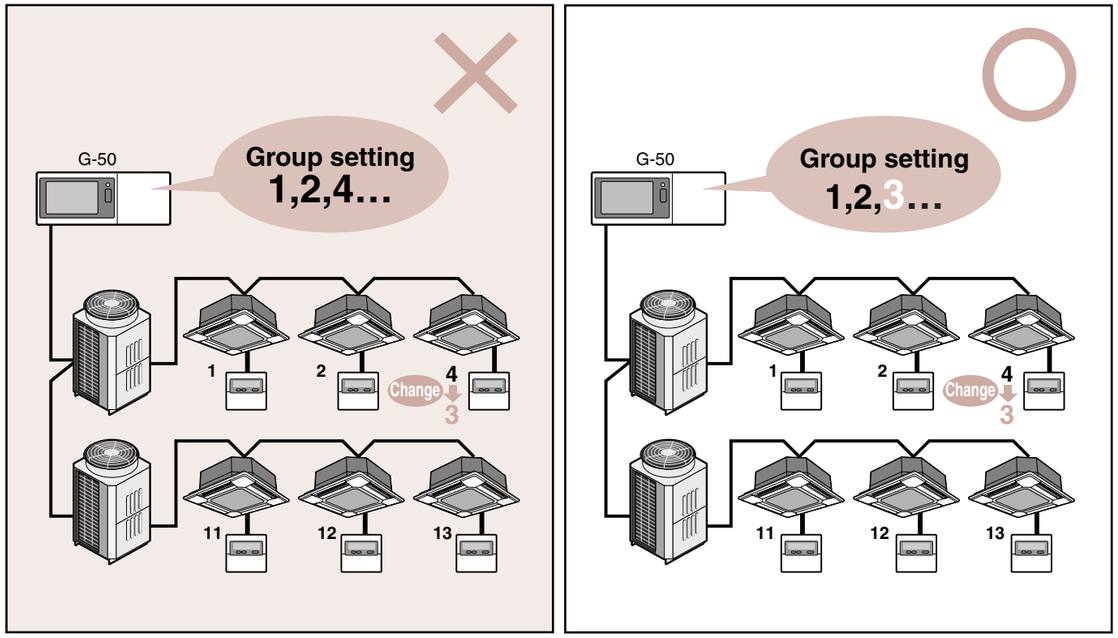
Possible Problems

- An error display indicating a transmission related fault occurs, and operation is disabled.
- An error display indicating a system setting fault occurs, and operation is disabled.

Cautions and Countermeasures

- In a single refrigerant system where the MA remote controller is used, no address settings are required for the indoor unit, outdoor unit, and the remote controller.
- Address settings are required in systems where the ME remote controller is used.
  Indoor units: 1 to 50 (indoor units connected to the main branch controller must have lower address values than the addresses of indoor units connected to the sub branch controller.)
  Outdoor units: 51 to 100 (In single refrigerant systems, the outdoor unit addresses must be specified in a sequential manner.)
  BC controller (main): 52 to 100.
  BC controller (sub): 53 to 100 ([lowest address of indoor unit connected to the sub branch controller] + 50)
  Remote controller: 101 to 150 ([lowest address of connected indoor unit] + 100)
- A remote controller connection information search can be performed to find the addresses of indoor units which are connected to the remote controller.
  * To establish the remote controller connection information search mode, press both the [Filter] and [Louver] buttons simultaneously for 2 secs. or longer. The address of each indoor unit connected to the remote controller then displays each time the [Timer Select] button is pressed. The [Operation Select] button can then be pressed to establish the operation setting information search mode. For details, refer to the remote controller operation manual.

Example 36 Mismatch When Changing the Address Setting



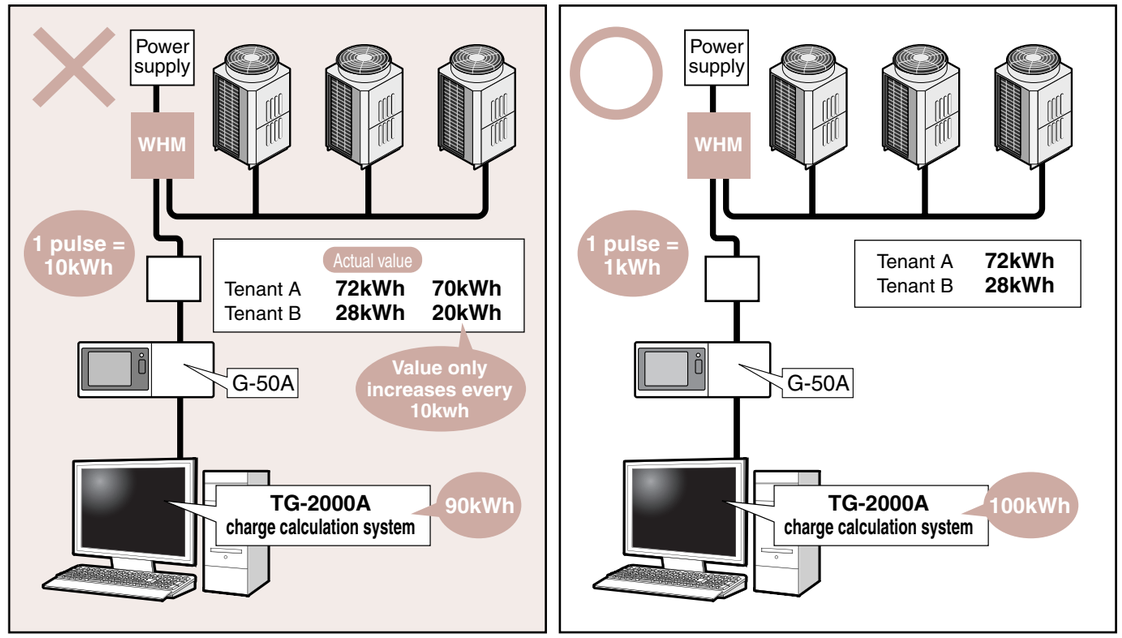
Possible Problems

- Transmission error.
- System error.

Cautions and Countermeasures

- When changing an address (for indoor unit, outdoor unit, remote controller, branch controller) in a system where a centralized controller is used, be sure to also change the group setting at the centralized controller. After revising the setting, reset the centralized controller.
- Failing to change the centralized controller's group setting will result in an error at the centralized controller.
- At test operations, check each unit's operation individually first without the centralized controller, then check each unit's operation individually again with the centralized controller.

Example 37 Incorrect MELANS System Configuration



Possible Problems

- Selecting the wrong power meter (with pulse generating function) will result in a mismatch between the power meter reading used in the charge calculation system and the actual consumption.
- Error (mismatch) between the charge calculation system output and the power meter reading.

Cautions and Countermeasures

- If the power amount per pulse is large on power meters with pulse generating functions, the amount of error in the air-conditioning charge calculation system's output will also be large.
- The air-conditioning charge calculation management value represents the power meter (with pulse generating function) value which is proportionally divided in accordance with their operating conditions among all the air-conditioners connected to a power supply. Therefore, the calculate value may differ from the power meter value for each unit.
- Test operation should be performed in accordance with the installation manuals, with all the items listed on the charge calculation test operation check-sheet (wiring, devices used, settings, etc.) being thoroughly checked.

■ Illustration Explanation

- If the WHM amount increases 100kWh, the TG-2000A may register this as only 90kWh at a "1 pulse = 10kWh" WHM.

	1 pulse =1kWh	1 pulse =10kWh	Meter Increase Amount
Tenant A	72kWh	70kWh	
Tenant B	28kWh	20kWh	
Total	100kWh	90kWh	100kWh

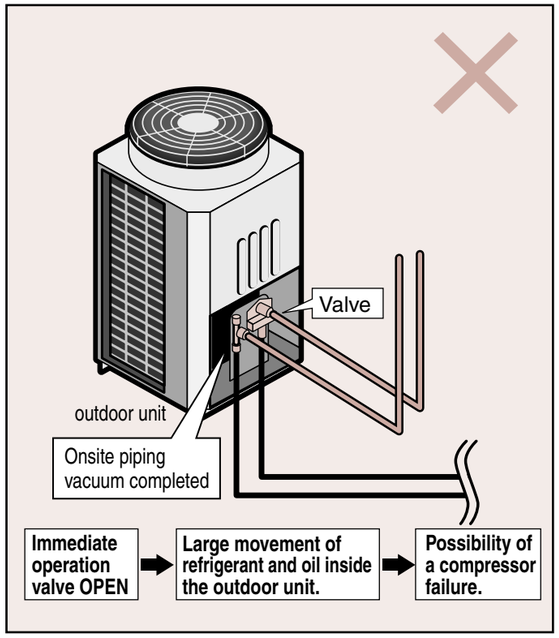
10kWh difference

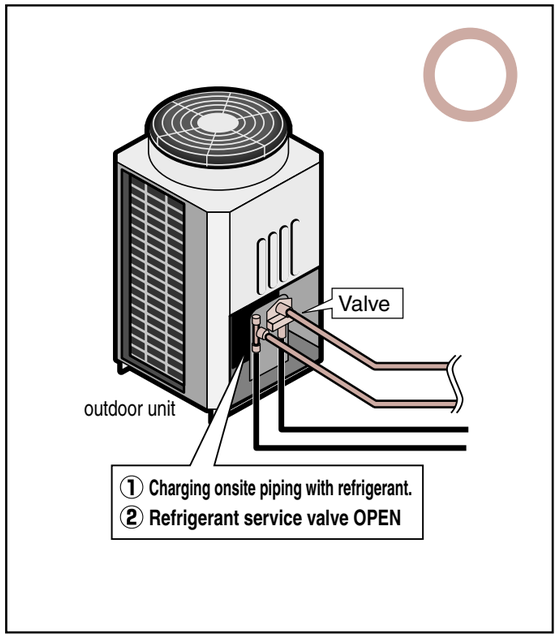
■ Other cases

- Incorrect pulse units setting

  If a "1 pulse = 10kWh" WHM is set at the TG-2000 as a "1 pulse = 1kWh" WHM, the TG-2000 output will be only 1/10 of the actual power consumption.

Example 38 Valve Operation After Vacuumizing the Onsite Piping





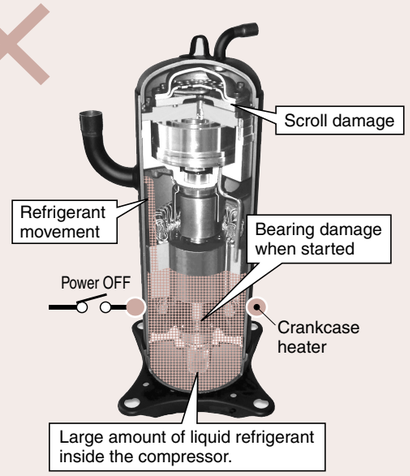
Possible Problems

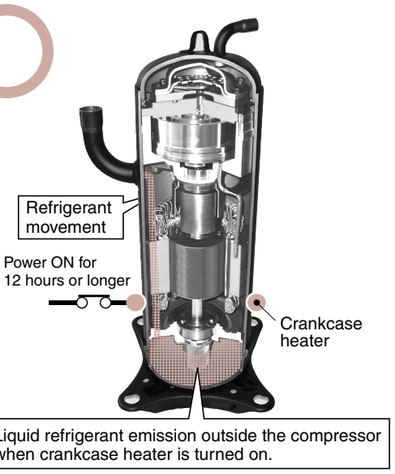
- Compressor failure

Cautions and Countermeasures

- Opening the outdoor unit's valve before the vacuumized onsite piping has been charged with refrigerant will result in an abrupt pressure change inside the outdoor unit, causing the compressor to expel its internal oil. This could result in a bearing lubrication fault when the compressor starts.

Example 39 Compressor Failure Immediately After Power ON





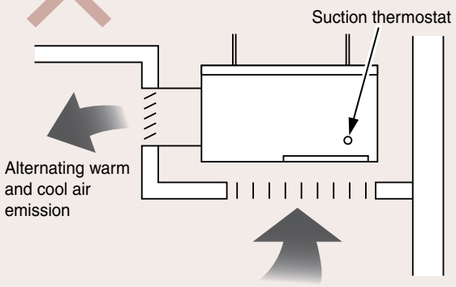
Possible Problems

- Compressor failure.

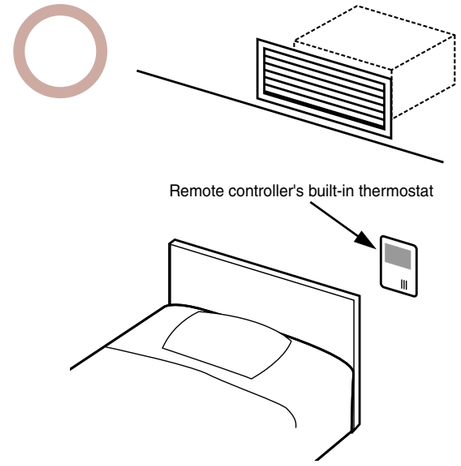
Cautions and Countermeasures

- In VRF systems turn the outdoor unit power on 12 hours before operation to allow the compressor crankcase heater to heat the crankcase and expel the liquid refrigerant which has collected in the compressor.
- Starting the compressor with liquid refrigerant collected inside will cause the bearing to be insufficiently lubricated and cause liquid compression.

Example 40 Using AUTO Cooling/Heating Mode



Following a heating thermostat OFF, the cooling thermostat switches ON when the temperature rises 1.5°C<34.7°F> above the setting temperature.



Possible Problems

- When using ceiling cassette or ceiling concealed type indoor units in the AUTO heating/cooling mode, cool blowing air may be felt during the heating season.

Cautions and Countermeasures

- When using ceiling cassette or ceiling concealed type indoor units in the AUTO heating/cooling mode, "use remote thermostat (optional item: PAC-SE41TSA) or the remote controller thermostat setting.

Guide to installation

FM 33568 / ISO 9001;2000

The Air Conditioning & Refrigeration Systems Works acquired ISO 9001 certification under Series 9000 of the International Standard Organization (ISO) based on a review of Quality , management for the production of refrigeration and air conditioning equipment.

ISO Authorization System
The ISO 9000 series is a plant authorization system relating to quality management as stipulated by the ISO. ISO 9001 certifies quality management based on the "design, development, production, installation and auxiliary services" for products built at an authorized plant.

Certificate Number EC97J1227

The Air Conditioning & Refrigeration Systems Works acquired environmental management system standard ISO 14001 certification.

The ISO 14000 series is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

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