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 to filter clogging, etc.
- Be sure to use a different refrigerant system for the backup indoor unit.

**Life-threatening consequences if air conditioner stops.**

**No need to worry.**

### Example 3

**Room Temperature Rise in Rooms with Small Heating Loads**

**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 switch 1-7 and 1-8 ON.)

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

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

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 an outdoor unit's refrigerant circuit and drains out through a multiple holes in a unit base. A method for handling this drain from an 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).
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 “pahuu” 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.)

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.
### 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.

### 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 flow 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.

*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.?
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.

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 "shhhuu" sound.

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

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.

Field-supplied M10 anchor bolt

Corner is not seated.
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.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Application</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt-tolerant Unit</td>
<td>A place not directly exposed to salt air but with similar atmosphere</td>
<td>1. Reinforced rust prevention of external panels (acrylic coating + polyester resin coating on inner &amp; 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</td>
</tr>
<tr>
<td>Sea breeze</td>
<td>Sea breeze</td>
<td></td>
</tr>
<tr>
<td>Salt-tolerant Unit</td>
<td>A place influenced by salt air</td>
<td>1. Reinforced rust prevention of external panels (acrylic coating + polyester resin coating on inner &amp; 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</td>
</tr>
<tr>
<td>Sea breeze</td>
<td>Sea breeze</td>
<td></td>
</tr>
</tbody>
</table>

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.

Troubles about indoor unit due to environmental substances

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.

**Example of 4-way ceiling cassette type**

- **Environment**
  - Factory using cutting oil or the like
- **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**
  - Refrain from installing an environment generating plasticizer component.
  - Provide sealing to prevent drain from stagnating inside the drain socket at the stop valve side.

**Example of 4-way ceiling cassette type**

- **Environment**
  - Factory using cutting oil or the like
- **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**
  - Refrain from installing an environment generating plasticizer component.
  - Provide sealing to prevent drain from stagnating inside the drain socket at the stop valve side.

**Example of ceiling cassette type**

- **Environment**
  - Factory of resin forming products such as glass frames
- **Possible troubles**
  - Damage of plastic parts
- **Mechanism of trouble**
  - Chemicals (plasticizing agent) from the forming resin products from the mould (plasticizer component)
- **Preventive maintenance**
  - Provide sealing to prevent drain from stagnating inside the drain socket at the stop valve side.

**Example of 4-way ceiling cassette type**

- **Environment**
  - Use of adhesive in drain piping work
- **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” 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.
### Troubles about indoor unit due to environmental substances 2

<table>
<thead>
<tr>
<th>Environment</th>
<th>Barber/Beauty parlor</th>
<th>Factors of troubles</th>
<th>Possible troubles</th>
<th>Mechanism of trouble</th>
<th>Preventive maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chemicals contained in cosmetics, hair lotions, etc. (plasticizer component)</td>
<td>Filter damage or dew splashing by chemicals placed and used in the barbershop</td>
<td>Detonated mesh due to chemical adhesion</td>
<td>Clean and rinse the air filter frequently</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### Troubles about indoor unit due to environmental substances 3

<table>
<thead>
<tr>
<th>Environment</th>
<th>Sewage treatment facility and the surrounding area</th>
<th>Factors of troubles</th>
<th>Possible troubles</th>
<th>Mechanism of trouble</th>
<th>Preventive maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chlorine group gas</td>
<td>Gas leak from the brazed part by absorbing gas generated from sewage treatment facility</td>
<td>&quot;Phosphorous selective corrosion&quot; generated at brazed spots by being wetted by cooling operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hydrogen sulfide (Sulfur group) gas</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Food processing factory</th>
<th>Factors of troubles</th>
<th>Possible troubles</th>
<th>Mechanism of trouble</th>
<th>Preventive maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sulfur group gas or organic acid gas generated from food materials or alcohol</td>
<td>Gas leak from copper piping due to gas generated from food materials or installation environment</td>
<td>A corrosion phenomenon called &quot;Formicary corrosion&quot; 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.</td>
<td>Do not operate air conditioners during disinfection work using alcohol (mainly ethanal).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pitting of harpin copper pipe, serious adhesion of black product, and heavy red rust on galvanized steel sheet.
### Problems Related to the Indoor Unit’s Ambient Temperature and Humidity Conditions

#### Environment
- Secondhand bookstore/Library
- Hospital/Pharmacy
- Environment where heavy oil is burnt like boiler room
- Cacao beans storage

#### Factors of Troubles
- Hydrogen chloride produced by the reaction of drain water with phosphorous component being contained in fumigant for insect control
- Gas generated from medicines (chloride) used in hospital
- Sulfur dioxide gas generated from heavy oil combustion
- Sulfur group gas contained in cacao beans

#### 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)
- Corrosion of aluminum fin installed in a room near the nurse center of hospital
- Corrosion of aluminum fin contained in the storage of antique documents due to gas leak from brazed parts of unit installed in cacao beans storage

#### 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.
- Chloride gas is absorbed during cooling operation and dissolved in water drips corroding aluminum.
- 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.

#### Preventive Maintenance
- 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.
- Do not install the unit at a place where medicines are continually used.
- Do not install the unit at a place where sulfur gas is generated.
- Prevent combustion gas of boilers or like from refluxing.

### Troubles about Indoor Unit due to Environmental Substances

#### Secondhand Bookstores/Library
- Hydrogen chloride produced by the reaction of drain water with phosphorous component being contained in fumigant for insect control

#### Hospitals/Pharmacies
- Gas generated from medicines (chloride) used in hospital
- Corrosion of aluminum fin installed in a room near the nurse center of hospital

#### Environment where heavy oil is burnt like boiler room
- Sulfur dioxide gas generated from heavy oil combustion

#### Cacao beans storage
- Sulfur group gas contained in cacao beans

#### Warehouses
- Gas leak from the brazed parts of unit installed in cacao beans storage

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

- 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.

#### Installation Work
- Preventive maintenance
- Installation check
Example 17
Refrigerant pipe branching method at outdoor unit

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.)
- Refrigerant piping between outdoor units must 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.
- Label the refrigerant piping and transmission lines with the names of their associated systems to prevent mismatches.
- Perform test operations in which each refrigeration system is operated independently in order to verify that the refrigerant piping and transmission lines are connected to the correct refrigerant system.
Condensation Caused by Insufficient Insulation Thickness at Refrigerant Piping

Example 21

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. Strictly 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°C<32°F> at gas piping (this varies depending 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<3/32” or more, Low-pressure piping 5mm<1/16” or more
    - Between BC controller and indoor unit: Pipe size 38.1mm<1-1/2” or more, 20mm<3/4” or more
  - For Y Series and WY Series
    - Between outdoor unit and outdoor unit: Pipe size 38.1mm<1-1/2” or more, 20mm<3/4” 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.
  - 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

Refrigerant Piping Work

Foreign Substance In The Refrigerant Circuit

Example 20

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.

Nitrogen substitution

After nitrogen substitution, attach a cap to keep out foreign substance.

Possible Problems

- Refrigerant circuit component failure.
- Refrigerant circuit clogging.

Cautions and Countermeasures

- After nitrogen substitution, attach a cap to keep out foreign substance.

Possible Problems

- Refrigerant circuit component failure.
- Refrigerant circuit clogging.

Cautions and Countermeasures

- After nitrogen substitution, attach a cap to keep out foreign substance.

Possible Problems

- Refrigerant circuit component failure.
- Refrigerant circuit clogging.

Cautions and Countermeasures

- After nitrogen substitution, attach a cap to keep out foreign substance.

Possible Problems

- Refrigerant circuit component failure.
- Refrigerant circuit clogging.

Cautions and Countermeasures

- After nitrogen substitution, attach a cap to keep out foreign substance.
Gas Leakage Due to Improper Flare Work

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.

Refrigerant Piping Work

Incorrect Additional Refrigerant Charging

Example of poor flare work

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

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

- 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 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.

- Insufficient refrigerant amount

- Excessive refrigerant amount

- Refrigerant composition changes

- 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

<table>
<thead>
<tr>
<th>Pipe outer diameter D (mm/inch)</th>
<th>R410A</th>
<th>R22</th>
<th>R407C</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.35</td>
<td>9.1±0.36±</td>
<td>9.0±0.36±</td>
<td></td>
</tr>
<tr>
<td>9.52</td>
<td>13.2±0.52±</td>
<td>13.0±0.52±</td>
<td></td>
</tr>
<tr>
<td>12.7</td>
<td>16.6±0.64±</td>
<td>16.3±0.64±</td>
<td></td>
</tr>
<tr>
<td>15.89</td>
<td>19.7±0.78±</td>
<td>19.4±0.78±</td>
<td></td>
</tr>
<tr>
<td>19.05</td>
<td>24.0±0.96±</td>
<td>23.3±0.96±</td>
<td></td>
</tr>
</tbody>
</table>
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 after 1~2 hours, for there may be a leaking spot or water content entering the piping.

4. The evacuation time differs depending on the capacity of a vacuum pump to be used or the amount of the water content 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 the equipment. When using pipe sold in the market, make sure to evacuate the pipe as it is containing air.

(Maintenance management of vacuum pump)

With many vacuum pumps, the water content contained in air may mix into oil 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.)
Combining of horizontal drain piping

Possible Problems

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 downhill 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.

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

Troubles about horizontal drain piping

Possible Problems

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.)

Cautions and Countermeasures

1. 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.
2. Make sure to locate the collective piping more than 100mm-4” lower than the connecting piping with the unit.
3. Make sure to apply adhesive jointing to the connection of the drain 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.)

(Note) Since inner pressure is applied to the drain piping of models provided with the drain pump, please do not install an air vent.

Air vent

Support the piping as shown below to prevent waving.

Provide a support metal fitting near the unit.

Intermediate support metal fitting (for each 2m-3m)

Slope of 1/100 or more

Waving

Support the collective piping thicker than the connecting piping to the unit.

Make sure to bring down nearer the unit as possible.

Slope of 1/100 or more

Provide a support metal fitting near the unit.

(Note) Do not provide an air vent to models equipped with the drain pump.

Air vent

100mm-4” or more
(as distant as possible)
### Example 28

**Entry of odor/corrosive gas from drain piping**

**Possible Problems**
- Offensive odor (corrosive gas) will be brought into the room through drain piping if the drain piping is led down into a sewage 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 leading drain piping directly to a spot likely generating offensive odor.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Drain pipe is led down into a sewer ditch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem cause</td>
<td>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.</td>
</tr>
<tr>
<td>Possible problem</td>
<td>Hydrogen sulfide (sulfur system) gas.</td>
</tr>
<tr>
<td>Problem mechanism</td>
<td>Corrosion (phosphorous selective corrosion) in brazing area where water leakage occurred when cooling.</td>
</tr>
<tr>
<td>Preventive measures</td>
<td>Use a corrosion-resistant item with epoxy resin applied to the copper pipe (including brazing areas).</td>
</tr>
<tr>
<td>Preventive measures</td>
<td>Install a dedicated for drain water.</td>
</tr>
</tbody>
</table>

**Example for ceiling-suspended type**

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

### Example 29

**Water Leakage From Drain Pipe Connection Area**

**Possible Problems**
- Water (drain) leakage.

**Cautions and Countermeasures**
- Be sure to use a prescribed adhesive (for hard vinyl chloride pipe) when connecting the indoor unit’s accessory drain hose. Using other adhesives could result in water leakage.
Malfunctions Due To Using the Same Power Supply and Ground Devices as the Outdoor Unit

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.

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 power supply when having two devices.
Incorrect ME Remote Controller Wiring

**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 each terminal.

Poor Contact at Transmission Line Connection

**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.

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

<table>
<thead>
<tr>
<th>Tenant</th>
<th>TG-2000A</th>
<th>Meter Increase Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenant A</td>
<td>72kWh</td>
<td>70kWh</td>
</tr>
<tr>
<td>Tenant B</td>
<td>28kWh</td>
<td>20kWh</td>
</tr>
<tr>
<td>Total</td>
<td>100kWh</td>
<td>90kWh</td>
</tr>
</tbody>
</table>

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**

Possible Problems
- Compressor failure

Cautions and Countermeasures
- 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.
- Following a heating thermostat OFF, the cooling thermostat switches ON when the temperature rises 1.5°C (34.7°F) above the setting temperature.
Guide to installation

The specifications, designs and information in this brochure are subject to change without notice.

November. 2008, Printed in Japan