

# ***Installation and Maintenance Manual***

***INVERTER-DRIVEN  
MULTI-SPLIT SYSTEM  
HEAT PUMP  
AIR CONDITIONERS***

## **Models:**

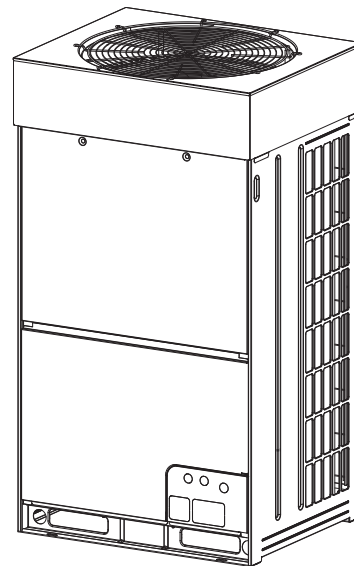
### **Outdoor Units (Low Ambient VRF Heat Pump);**

#### **<208/230V >**

(H,Y)VAHP072B31CW, (H,Y)VAHP096B31CW,  
(H,Y)VAHP144B31CW, (H,Y)VAHP168B31CW,  
(H,Y)VAHP192B31CW, (H,Y)VAHP288B31CW

#### **< 460V >**

(H,Y)VAHP072B41CW, (H,Y)VAHP096B41CW,  
(H,Y)VAHP144B41CW, (H,Y)VAHP168B41CW,  
(H,Y)VAHP192B41CW, (H,Y)VAHP288B41CW



### **IMPORTANT:**

***READ AND UNDERSTAND  
THIS MANUAL BEFORE  
USING THIS HEAT PUMP  
AIR CONDITIONER.  
KEEP THIS MANUAL FOR  
FUTURE REFERENCE.***

**P00877Q**



## Important Notice

- Johnson Controls Inc. pursues a policy of continuing improvement in design and performance in its products. As such, Johnson Controls Inc. reserves the right to make changes at any time without prior notice.
- Johnson Controls Inc. cannot anticipate every possible circumstance that might involve a potential hazard.
- This heat pump air conditioning unit is designed for standard air conditioning applications only. Do not use this unit for anything other than the purposes for which it was intended for.
- The installer and system specialist shall safeguard against leakage in accordance with local pipefitter and electrical codes. The following standards may be applicable, if local regulations are not available. International Organization for Standardization: (ISO 5149 or European Standard, EN 378). No part of this manual may be reproduced in any way without the expressed written consent of Johnson Controls Inc.
- This heat pump air conditioning unit will be operated and serviced in the United States of America and comes with a full complement of the appropriate Safety, Danger, and Caution, warnings.
- If you have questions, please contact your distributor or dealer.
- This manual provides common descriptions, basic and advanced information to maintain and service this heat pump air conditioning unit which you operate as well for other models.
- This heat pump air conditioning unit has been designed for a specific temperature range. For optimum performance and long life, operate this unit within the range limits according to the table below.

### Temperature

		Maximum	Minimum
Cooling Operation	Indoor	89°F DB/73°F WB (32°C DB/23°C WB)	69°F DB/59°F WB (21°C DB/15°C WB)
	Outdoor	118°F DB (48°C DB) *1, *2)	14°F DB (-10°C DB) *3), *4)
Heating Operation	Indoor	80°F DB (27°C DB)	59°F DB ( 15°C DB)
	Outdoor	59°F WB (15°C WB) *5)	-13°F WB (-25°C WB) *6), *7)

DB: Dry Bulb, WB: Wet Bulb

- \*1) When the outdoor air temperature is 100°F DB (38°C DB) or more and the outdoor unit operation capacity ratio is 100% or more, the outdoor unit will be Thermo-OFF to protect the compressor from failure.
- \*2) When the outdoor air temperature is 109°F (43°C) or more during the outdoor unit cooling operation, the maximum connectable indoor unit capacity ratio is 100%.
- \*3) When the outdoor air temperature is 23°F (-5°C) or less during the outdoor unit cooling operation, the minimum connectable indoor unit capacity is 18,000 Btu/h.  
In this case, installing the snow protection hood (optional part) is required.
- \*4) When operating the outdoor unit under the low cooling load conditions and in the low outdoor air temperature, (approx. 50°F DB (10°C DB) or less), the indoor unit will be Thermo-OFF to prevent the heat exchanger of the indoor unit from being frosted.
- \*5) When operating the outdoor unit under the low heating load conditions and the outdoor temperature is 59°F DB (15°C DB) or more, the outdoor unit will be Thermo-OFF to protect the compressor from failure.
- \*6) When the outdoor temperature is lower than 14°F (-10°C) select the combination of indoor units and outdoor unit as the total capacity of indoor units not to exceed the capacity of outdoor unit.
- \*7) If some indoor units start operating simultaneously at a low outdoor air temperature, the airflow may be less than the setting airflow on wired controller for maintaining indoor comfort.

Thermo-ON: The outdoor unit and some indoor units are running.

Thermo-OFF: The outdoor unit and some indoor units stay on, but don't run.

- This manual should be considered as a permanent part of the air conditioning equipment and should remain with the air conditioning equipment.

## **Product Inspection upon Arrival**

1. Upon receiving this product, inspect it for any damages incurred in transit. Claims for damage, either apparent or concealed, should be filed immediately with the shipping company.
2. Check the model number, electrical characteristics (power supply, voltage, and frequency rating), and any accessories to determine if they agree with the purchase order.
3. The standard utilization for this unit is explained in these instructions. Use of this equipment for purposes other than what it designed for is not recommended.
4. Please contact your local agent or contractor as any issues involving installation, performance, or maintenance arise. Liability does not cover defects originating from unauthorized modifications performed by a customer without the written consent of Johnson Controls, Inc. Performing any mechanical alterations on this product without the consent of the manufacturer will render your warranty null and void.

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## 1. Introduction

This manual concentrates on the Low Ambient VRF Heat Pump Outdoor Unit. Read this manual carefully before installation. Read over the installation manual for the Indoor Unit also.


This manual should be considered as a permanent part of the air conditioning equipment and should remain with the air conditioning equipment.

(Transportation/Installation Work) > (Refrigerant Piping Work) > (Electrical Wiring Work) > (Ref. Charge Work) > (Test Run) > (User)

## 2. Important Safety Instructions

Signal Words	
 <b>WARNING</b>	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
<b>NOTICE</b>	Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

### General Precautions

 <b>WARNING</b>	To reduce the risk of serious injury or death, read these instructions thoroughly and follow all warnings or cautions included in all manuals that accompanied the product and are attached to the unit. <i>Refer back to these safety instructions as needed.</i>
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- This system should be installed by personnel certified by Johnson Controls, Inc. Personnel must be qualified according to local, state and national building and safety codes and regulations. Incorrect installation could cause leaks, electric shock, fire or explosion. In areas where Seismic "Performance requirements are specified, the appropriate measures should be taken during installation to guard against possible damage or injury that might occur in an earthquake if the unit is not installed correctly, injuries may occur due to a falling unit.
- Use appropriate Personal Protective Equipment (PPE), such as gloves and protective goggles and, where appropriate, have a gas mask nearby. Also use electrical protection equipment and tools suited for electrical operation purposes. Keep a quenching cloth and a fire extinguisher nearby during brazing. Use care in handling, rigging, and setting of bulky equipment.
- When transporting, be careful when picking up, moving and mounting these units. Although the unit may be packed using plastic straps, do not use them for transporting the unit from one location to another. Do not stand on or put any material on the unit. Get a partner to help, and bend with your knees when lifting to reduce strain on your back. Sharp edges or thin aluminum fins on the air conditioner can cut fingers, so wear protective gloves.
- Do not touch or adjust any safety devices inside the indoor or outdoor units. All safety features, disengagement, and interlocks must be in place and functioning correctly before the equipment is put into operation. If these devices are improperly adjusted or tampered with in any way, a serious accident can occur. Never bypass or jump-out any safety device or switch.
- Johnson Controls will not assume any liability for injuries or damage caused by not following steps outlined or described in this manual. Unauthorized modifications to Johnson Controls products are prohibited as they...
  - May create hazards which could result in death, serious injury or equipment damage;
  - Will void product warranties;
  - May invalidate product regulatory certifications;
  - May violate OSHA standards;

## NOTICE

Take the following precautions to reduce the risk of property damage.

- Be careful that moisture, dust, or variant refrigerant compounds not enter the refrigerant cycle during installation work. Foreign matter could damage internal components or cause blockages.
- If air filters are required on this unit, do not operate the unit without the air filter set in place. If the air filter is not installed, dust may accumulate and breakdown may result.
- Do not install this unit in any place where silicon gases can coalesce. If the silicon gas molecules attach themselves to the surface of the heat exchanger, the finned surfaces will repel water. As a result, any amount of drainage moisture condensate can overflow from the drain condensate pan and could run inside of the electrical box, possibly causing electrical failures.
- When installing the unit in a hospital or other facility where electromagnetic waves are generated from nearby medical and/or electronic devices, be prepared for noise and electronic interference Electromagnetic Interference (EMI). Do not install where the waves can directly radiate into the electrical box, controller cable, or controller. Inverters, appliances, high-frequency medical equipment, and radio communications equipment may cause the unit to malfunction. The operation of the unit may also adversely affect these same devices. Install the unit at least 10 ft. (approximately 3m) away from such devices.
- When a wireless controller is used, locate at a distance of at least 3.3 ft. (approximately 1 meter) between the indoor unit and electric lighting. If not, the receiver part of the unit may have difficulty receiving operation commands.
- Do not install the unit in any location where animals and plants can come into direct contact with the outlet air stream. Exposure could adversely affect the animals and plants.
- Do not install the unit with any downward slope to the side of the drain adaptor. If you do, you may have drain water flowing back which may cause leaks.
- Be sure the drain hose discharges water properly. If connected incorrectly, it may cause leaks.
- Do not install the unit in any place where oil can seep onto the units, such as table or seating areas in restaurants, and so forth. For these locations or social venues, use specialized units with oil-resistant features built into them. In addition, use a specialized ceiling fan designed for restaurant use. These specialized oil-resistant units can be ordered for such applications. However, in places where large quantities of oil can splash onto the unit, such as a factory, even the specialized units cannot be used. These products should not be installed in such locations.

### Installation Precautions

## ⚠ WARNING

To reduce the risk of serious injury or death, the following installation precautions must be followed.


- When installing the unit into...
  - A wall: Make sure the wall is strong enough to hold the unit's weight. It may be necessary to construct a strong wood or metal frame to provide added support.
  - A room: Properly insulate any refrigerant tubing run inside a room to prevent "sweating" that can cause dripping and water damage to wall and floors.
  - Damp or uneven areas: Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the unit to prevent water damage and abnormal vibration.
  - An area with high winds: Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable air baffle.
  - A snowy area: Install the outdoor unit on a raised platform that is higher than drifting snow. Provide snow vents.
- Do not install the unit in the following places. Doing so can result in an explosion, fire, deformation, corrosion, or product failure.
  - Explosive or flammable atmosphere
  - Where fire, oil, steam, or powder can directly enter the unit, such as in close proximity or directly above a kitchen stove.
  - Where oil (including machinery oil) may be present.
  - Where corrosive gases such as chlorine, bromine, or sulfide can accumulate, such as near a hot tub or hot spring.
  - Where dense, salt-laden airflow is heavy, such as in coastal regions.
  - Where the air quality is of high acidity.
  - Where harmful gases can be generated from decomposition.



- Do not position the drain pipe for the indoor unit near any sanitary sewers where corrosive gases may be present. If you do, toxic gases can seep into breathable air spaces and can cause respiratory injuries. If the drainpipe is installed incorrectly, water leakage and damage to the ceiling, floor, furniture, or other possessions may result. If condensate piping becomes clogged, moisture can back up and can drip from the indoor unit. Do not install the indoor unit where such dripping can cause moisture damage or uneven locations: Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the unit to prevent water damage and abnormal vibration.
- Before performing any brazing work, be sure that there are no flammable materials or open flames nearby.
- Perform a test run to ensure normal operation. Safety guards, shields, barriers, covers, and protective devices must be in place while the compressor/unit is operating. During the test run, keep fingers and clothing away from any moving parts.
- Clean up the site when finished, remembering to check that no metal scraps or bits of wiring have been left inside the unit being installed.
- During transportation, do not allow the backrest of the forklift make contact with the unit, otherwise, it may cause damage to the heat exchanger and also may cause injury when stopped or started suddenly.
- Remove gas inside the closing pipe when the brazing work is performed. If the brazing filler metal is melted with remaining gas inside, the pipes will be blown off and it may cause injury.
- Be sure to use nitrogen gas for an airtight test. If other gases such as oxygen gas, acetylene gas or fluorocarbon gas are accidentally used, it may cause explosion or gas intoxication.

After installation work for the system has been completed, explain the "Safety Precautions," the proper use and maintenance of the unit to the customer according to the information in all manuals that came with the system. All manuals and warranty information must be given to the user or left near the Indoor Unit.

#### Refrigerant Precautions

 <b>WARNING</b>	<p>To reduce the risk of serious injury or death, the following refrigerant precautions must be followed.</p>
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- As originally manufactured, this unit contains refrigerant installed by Johnson Controls. Johnson Controls uses only refrigerants that have been approved for use in the unit's intended home country or market. Johnson Controls distributors similarly are only authorized to provide refrigerants that have been approved for use in the countries or markets they serve. The refrigerant used in this unit is identified on the unit's faceplate and/or in the associated manuals. Any additions of refrigerant into this unit must comply with the country's requirements with regard to refrigerant use and should be obtained from Johnson Controls distributors. Use of any non-approved refrigerant substitutes will void the warranty and will increase the potential risk of injury or death.
- If installed in a small room, take measures to prevent the refrigerant from exceeding the maximum allowable concentration in the event that refrigerant gases should escape. Refrigerant gases can cause asphyxiation (0.026 lbs/ft<sup>3</sup> (0.42 kg/m<sup>3</sup>) based on ISO 5149 for R410A). Consult with your distributor for countermeasures (ventilation system and so on). If refrigerant gas has leaked during the installation work, ventilate the room immediately.
- Check the design pressure for this product is 601 psi (4.15MPa). The pressure of the refrigerant R410A is 1.4 times higher than that of the refrigerant R22. Therefore, the refrigerant piping for R410A shall be thicker than that for R22. Make sure to use the specified refrigerant piping. If not, the refrigerant piping may rupture due to an excessive refrigerant pressure. Besides, pay attention to the piping thickness when using copper refrigerant piping. The thickness of copper refrigerant piping differs depending on its material.
- The refrigerant R410A is adopted. The refrigerant oil tends to be affected by foreign matters such as moisture, oxide film, (or fat). Perform the installation work with care to prevent moisture, dust, or different refrigerant from entering the refrigerant cycle. Foreign matter can be introduced into the cycle from such parts as expansion valve and the operation may be unavailable.
- To avoid the possibility of different refrigerant or refrigerant oil being introduced into the cycle, the sizes of the charging connections have been changed from R407C type and R22 type. It is necessary to prepare the following tools listed in Section 3 before performing the installation work.
- Use refrigerant pipes and joints which are approved for use with R410A.
- A compressor/unit comprises a pressurized system. Never loosen threaded joints while the system is under pressure and never open pressurized system parts.

- Before installation is complete, make sure that the refrigerant leak test has been performed. If refrigerant gases escape into the air, turn OFF the main switch, extinguish any open flames and contact your service contractor. Refrigerant (Fluorocarbon) for this unit is odorless. If the refrigerant should leak and come into contact with open flames, toxic gas could be generated. Also, because the fluorocarbons are heavier than air, they settle to the floor, which could cause asphyxiation.
- When installing the unit, and connecting refrigerant piping, keep all piping runs as short as possible, and make sure to securely connect the refrigerant piping before the compressor starts operating. If the refrigerant piping is not connected and the compressor activates with the stop valve opened, the refrigerant cycle will become subjected to extremely high pressure, which can cause an explosion or fire.
- Tighten the flare nut with a torque wrench in the specified manner. Do not apply excessive force to the flare nut when tightening. If you do, the flare nut can crack and refrigerant leakage may occur.
- When maintaining, relocating, and disposing of the unit, dismantle the refrigerant piping after the compressor stops.
- When pipes are removed out from under the piping cover, after the insulation work is completed, cover the gap between the piping cover and pipes by a packing (field-supplied). If the gap is not covered, the unit may be damaged if snow, rain water or small animals enter the unit.
- Do not apply an excessive force to the spindle valve at the end of opening. Otherwise, the spindle valve flies out due to refrigerant pressure. At the test run, fully open the gas and liquid valves, otherwise, these devices will be damaged. (It is closed before shipment.)
- If the arrangement for outdoor units is incorrect, it may cause flowback of the refrigerant and result in failure of the outdoor unit.
- The refrigerant system may be damaged if the slope of the piping connection kit exceeds  $\pm 15^\circ$ .

#### Electrical Precautions



Take the following precautions to reduce the risk of electric shock, fire or explosion resulting in serious injury or death.

- Highly dangerous electrical voltages are used in this system. Carefully refer to the wiring diagram and these instructions when wiring. Improper connections and inadequate grounding can cause serious injury or death.
- Perform all electrical work in strict accordance with this manual and all the relevant regulatory standards.
- Before servicing, open and tag all disconnect switches. Never assume electrical power is disconnected. Check with meter and equipment.
- Only use electrical protection equipment and tools suited for this installation.
- Use specified cables between units.
- The new air conditioner may not function normally in the following instances:
  - If electrical power for the new air conditioner is supplied from the same transformer as the device\* referred to below.
  - If the power source cables for this device\* and the new air conditioner unit are located in close proximity to each other.

Device\*: (Example): A lift, container crane, rectifier for electric railway, inverter power device, arc furnace, electric furnace, large-sized induction motor and large-sized switch.

Regarding the cases mentioned above, surge voltage may be inducted into the power supply cables for the packaged air conditioner due to a rapid change in power consumption of the device and an activation of a switch.

Check field regulations and standards before performing electrical work in order to protect the power supply for the new air conditioner unit.

- Communication cabling shall be a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper. Shielded cable must be considered for applications and routing in areas of high EMI and other sources of potentially excessive electrical noise to reduce the potential for communication errors. When shielded cabling is applied, proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements.
- Use an exclusive power supply for the air conditioner at the unit's rated voltage.













- Be sure to install circuit breakers (ground fault interrupter, isolating switch, molded case circuit breaker and so on), with the specified capacity. Ensure that the wiring terminals are tightened securely to recommended torque specifications.
- Clamp electrical wires securely with a cable clamp after all wiring is connected to the terminal block. In addition, run wires securely through the wiring access channel.
- When installing the power lines, do not apply tension to the cables. Secure the suspended cables at regular intervals, but not too tightly.
- Make sure that the terminals do not come into contact with the surface of the electrical box. If the terminals are too close to the surface, it may lead to failures at the terminal connection.
- Turn OFF and disconnect the unit from the power source when handling the service connector. Do not open the service cover or access panel to the indoor or outdoor units without turning OFF the main power supply.
- After ceasing operation, be sure to wait at least five minutes before turning off the main power switch. Otherwise, water leakage or electrical breakdown may result. Disconnect the power source completely before attempting any maintenance for electrical parts. Check to ensure that no residual voltage is present after disconnecting the power source.
- Do not clean with, or pour water into, the controller as it could cause electric shock and/or damage the unit. Do not use strong detergent such as a solvent. Clean with a soft cloth.
- Check that the ground wire is securely connected. Do not connect ground wiring to gas piping, water piping, lighting conductor, or telephone ground wiring.
- If a circuit breaker or fuse is frequently activated, shut down the system and contact your service contractor.
- Perform all electrical work in accordance with this manual and in compliance with all regulations and safety standards.
- Do not open a service access cover or panel of an indoor or outdoor unit without first turning OFF the power at the main power supply.
- Residual voltage can cause electric shock. At all times, check for residual voltage after disconnecting from the power source before starting work on the unit.
- This equipment can be installed with a Ground Fault Circuit Breaker (GFCI), which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers / fuses / overcurrent protection switches, and wiring in accordance with local, state and NEC codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements.

### 3. Before Installation

#### 3.1 Factory-Supplied Accessories

Check to ensure that the following accessories are packed with the outdoor unit.

inch (mm)

Accessory		72 Type	96 Type	Remarks
Cable Clamp	For Fixing Power Supply Wiring and PVC Tube	 x 1	 x 1	
Cable Band		 x 5	 x 5	
Screw (One for Fixing Cord Clamp, Two for Spare)		 x 3	 x 3	
PVC Tube		 x 2	 x 2	ID 1/2 (12)
Rubber Bushing	For Power Supply Wiring (Bottom Base)	 x 1	 x 1	OD 2-5/16 (58)
	For Communication Cable (Piping Cover)	 x 2	 x 2	OD 1-1/2 (38)

#### NOTE

If any of these accessories is not packed with the unit, please contact your distributor.

### 3.2 Necessary Tools and Instrument List for Installation

No.	Tool	No.	Tool	No.	Tool
1	Handsaw	8	Pliers	16	Wire Cutters
2	Phillips Screwdriver	9	Pipe Cutter	17	Gas Leak Detector
3	Vacuum Pump	10	Brazing Kit	18	Level
4	Refrigerant Gas Hose	11	Hexagon Wrench	19	Crimper for Solderless Terminals
5	Megohmmeter	12	Wrench	20	Hoist (for Indoor Unit)
6	Copper Pipe Bender	13	Scale	21	Ammeter
7	Manual Water Pump (for Indoor Unit)	14	Charging Cylinder	22	Voltage Meter
		15	Gauge Manifold		

Use specially designated tools for handling R410A refrigerant.

◇: Interchangeability is available with current R22  
 X: Prohibited

●: Only for Refrigerant R410A (No Interchangeability with R22)  
 ◆: Only for Refrigerant R407C (No Interchangeability with R22)

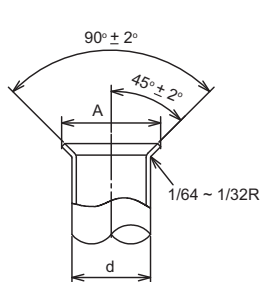
Measuring Instrument and Tool		Interchangeability with R22		Reason of Non-Interchangeability and Attention (★: Strictly Required)	Use
		R410A	R407C		
Refrigerant Pipe	Pipe Cutter, Chamfering Reamer	◇	◇	-	Cutting Pipe Removing Burrs
	Flaring Tool	◇ ●	◇	* The flaring tools for R407C are applicable to R22.	Flaring for Tubes
	Extrusion Adjustment Gauge	●	-	* If using flaring tube, make dimension of tube larger for R410A. * In case of hard temper pipe, flaring is not available.	Dimensional Control for Extruded Portion of Tube after Flaring
	Pipe Bender	◇	◇	* In case of hard temper pipe, bending is not available. Use elbow for bend and braze.	Bending
	Expanding Tool	◇	◇	* In case of hard temper pipe, expanding of tube is not available. Use socket for connecting tube.	Expanding Tubes
	Torque Wrench	●	◇	* For 1/2 inch D. (12.7mm), 5/8 inch D. (15.88mm), spanner size is up 3/32 inch (2mm).	Connection of Flare Nut
		◇	◇	* For 1/4 inch D. (6.35mm), 3/8 inch D. (9.52mm), 3/4 inch D. (19.05mm), spanner size is the same.	
	Brazing Tool	◇	◇	* Perform correct brazing work.	Brazing for Tubes
	Nitrogen Gas	◇	◇	* Strict Control against Contamin (Blow nitrogen during brazing.)	Prevention from Oxidation during Brazing
	Lubrication Oil (for Flare Surface)	●	◆	* Use a synthetic oil which is equivalent to the oil used in the refrigeration cycle. * Synthetic oil absorbs moisture quickly.	Applying Oil to the Flared Surface
Vacuum Drying • Refrigerant Charge	Refrigerant Cylinder	●	◆	* Check refrigerant cylinder color. ★ Liquid refrigerant charging is required regarding zeotropic refrigerant.	Refrigerant Charging
	Vacuum Pump	◇	◇	★ The current ones are applicable. However, it is required to mount a vacuum pump adapter which can prevent from reverse flow when a vacuum pump stops, resulting in no reverse oil flow.	Vacuum Pumping
	Adapter for Vacuum Pump	* ●	◆		
	Manifold Valve	●	◆	* No interchangeability is available due to higher pressures when compared with R22. ★ Do not use current ones to the different refrigerant. If used, mineral oil will flow into the cycle and cause sludges, resulting in clogging or compressor failure.	Vacuum Pumping, Vacuum Holding, Refrigerant Charging and Check of Pressures
	Charging Hose	●	◆	Connection diameter is different; R410A: UNF1/2, R407C: UNF7/16.	
	Charging Cylinder	X	X	* Use the weight scale to ensure proper charging of the unit.	-
	Weight Scale	◇	◇	-	Measuring Instrument for Refrigerant Charging
	Refrigerant Gas Leakage Detector	* ●	◆	* The current gas leakage detector (R22) is not applicable due to different detecting method.	Gas Leakage Check

\*: Interchangeability with R407C.

### 3.3 Flaring and Joint

- Flaring Dimension

Perform the flaring work as shown below.



Diameter (d)	inch (mm) A <sup>+0</sup> -0.02 (-0.4)
	R410A
1/4 (6.35)	0.36 (9.1)
3/8 (9.52)	0.52 (13.2)
1/2 (12.7)	0.65 (16.6)
5/8 (15.88)	0.78 (19.7)
3/4 (19.05)	(*)

(\*) It is impossible to perform flaring work with hard temper pipe.  
Use an accessory pipe with a flare.

- Joint Selection

If hard temper pipe is used, the flaring work cannot be performed. In this case, use a joint selected from the table below.

#### < Minimum Thickness of Joint >

inch (mm)

Diameter	R410A
1/4 (6.35)	0.020 (0.5)
3/8 (9.52)	0.024 (0.6)
1/2 (12.7)	0.028 (0.7)
5/8 (15.88)	0.031 (0.8)
3/4 (19.05)	0.031 (0.8)
7/8 (22.2)	0.035 (0.9)
1-1/8 (28.58)	0.039 (1.0)
1-3/8 (34.93)	0.047 (1.2)
1-5/8 (41.28)	0.057 (1.45)

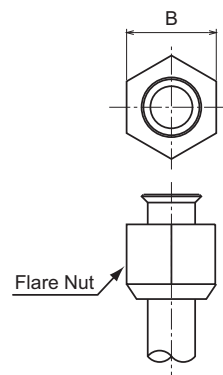
#### < Flare Nut Dimension B >

inch (mm)

Diameter	R410A
1/4 (6.35)	21/32 (17)
3/8 (9.52)	7/8 (22)
1/2 (12.7)	1-1/32 (26)
5/8 (15.88)	1-5/32 (29)
3/4 (19.05)	1-13/32 (36)

#### NOTE:

Do not use a thin joint other than the ones shown in the table at the left.



- Piping Thickness and Material

Use the pipe as below.

The thickness of refrigerant pipe differs depending on design pressure.

For copper pipe, pay attention to pipe selection, because the piping thickness differs depending on its material.

inch (mm)

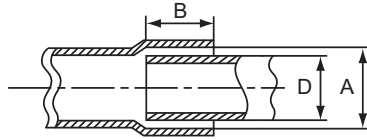
Outer Diameter	R410A	
	Thickness	Temper
1/4 (6.35)	0.03 (0.76)	Annealed
3/8 (9.52)	0.032 (0.81)	Annealed
1/2 (12.7)	0.032 (0.81)	Annealed
5/8 (15.88)	0.035 (0.89)	Annealed
3/4 (19.05)	0.035 (0.89)	Hard Temper (or Annealed)
7/8 (22.2)	0.045 (1.14)	Hard Temper
1-1/8 (28.58)	0.050 (1.27)	Hard Temper
1-3/8 (34.93)	0.065 (1.65)	Hard Temper
1-5/8 (41.28)	0.072 (1.83)	Hard Temper

#### NOTES:

- Do not use the pipe that allowable pressure is less than 601 psi (4.15MPa).
- The reference value of the refrigerant piping thickness is indicated in the table at left.  
Do not use the pipe which is considerably different from the reference value.

- Processing at Brazing Connection

To prevent gas leakage at the brazing connection, refer to the table for the insertion depth and the gap for joint pipe.



inch (mm)		
Diameter (D)	Min. Insertion Depth (B)	Gap (A - D)
$3/16 \leq D < 5/16$ ( $5 \leq D < 8$ )	1/4 (6)	0.002 - 0.014 (0.05 - 0.35)
$5/16 \leq D < 15/32$ ( $8 \leq D < 12$ )	9/32 (7)	
$15/32 \leq D < 5/8$ ( $12 \leq D < 16$ )	5/16 (8)	0.002 - 0.018 (0.05 - 0.45)
$5/8 \leq D < 31/32$ ( $16 \leq D < 25$ )	13/32 (10)	
$31/32 \leq D < 1-3/8$ ( $25 \leq D < 35$ )	15/32 (12)	0.002 - 0.022 (0.05 - 0.55)
$1-3/8 \leq D < 1-25/32$ ( $35 \leq D < 45$ )	9/16 (14)	



### 3.4 Line-Up of Outdoor Units

- (1) This outdoor unit series capacity range is from 72 MBH to 288 MBH. 144 MBH to 288 MBH are made of 72 MBH and 96 MBH combinations.
- (2) The outdoor unit of 144 to 288 MBH consists of the combination of two or three base units.  
The capacities not shown in the table below are unavailable.

< 208/230V >

Base Unit

Capacity (MBH)	72	96
Model	(H,Y)VAHP072B31CW	(H,Y)VAHP096B31CW

Combination of Base Units

Capacity (MBH)	144	168	192	288
Model	(H,Y)VAHP144B31CW	(H,Y)VAHP168B31CW	(H,Y)VAHP192B31CW	(H,Y)VAHP288B31CW
Combination	(H,Y)VAHP072B31CW	(H,Y)VAHP096B31CW	(H,Y)VAHP096B31CW	(H,Y)VAHP096B31CW
	(H,Y)VAHP072B31CW	(H,Y)VAHP072B31CW	(H,Y)VAHP096B31CW	(H,Y)VAHP096B31CW
	-	-	-	(H,Y)VAHP096B31CW

< 460V >

Base Unit

Capacity (MBH)	72	96
Model	(H,Y)VAHP072B41CW	(H,Y)VAHP096B41CW

Combination of Base Units

Capacity (MBH)	144	168	192	288
Model	(H,Y)VAHP144B41CW	(H,Y)VAHP168B41CW	(H,Y)VAHP192B41CW	(H,Y)VAHP288B41CW
Combination	(H,Y)VAHP072B41CW	(H,Y)VAHP096B41CW	(H,Y)VAHP096B41CW	(H,Y)VAHP096B41CW
	(H,Y)VAHP072B41CW	(H,Y)VAHP072B41CW	(H,Y)VAHP096B41CW	(H,Y)VAHP096B41CW
	-	-	-	(H,Y)VAHP096B41CW

### 3.5 Combinations of Indoor Units and Outdoor Units

Table 3.1 Indoor Unit Type List

Indoor Unit Type			Capacity (MBH)										
			6	8	12	15	18	24	30	36	48	72	96
Ducted	Ducted (High Static)	(H,Y)IDH_B21S					○	○	○	○	○	○	○
	Ducted (Medium Static)	(H,Y>IDM_B21S	○	○	○	○	○	○	○	○	○		
	Ducted (Slim)	(H,Y)IDS_B21S	○	○	○	○	○						
	Ducted (EconoFresh)	(H,Y>IDM_B21E							○	○	○		
	DOAS	(H,Y)DOA_B21S											○
Non-Ducted	Ceiling-Mounted 4-Way Cassette	(H,Y)IC4_B21S			○	○	○	○	○	○			
	Ceiling-Mounted 4-Way Cassette Mini	(H,Y)ICM_B21S		○	○	○	○						
	Ceiling-Mounted 2-Way Cassette	(H,Y)IC2_B21S					○	○					
	Ceiling-Mounted 1-Way Cassette	(H,Y)IC1_B21S	○	○	○	○							
	Wall-Mounted	TIWM_B21S	○	○	○	○	○	○					
	Ceiling Suspended	(H,Y)ICS_B21S				○		○	○	○			
	Floor Exposed	(H,Y)IFE_B21S	○	○	○	○							
	Floor Concealed	(H,Y)IFC_B21S	○	○	○	○							

○ : Available

- The number of indoor units that can be connected to an outdoor unit is defined in Table 3.2: Comply with the following conditions when selecting a system.
- A maximum and minimum total capacity against the nominal outdoor unit capacity can be obtained through combination of indoor units.

Table 3.2 System Combination

Outdoor Unit Capacity (MBH)	Minimum Capacity at Individual Operation (MBH)	Maximum Number of Connectable I.U.	Recommended Number of Connected I.U.	Connectable Indoor Unit Capacity Ratio *3)	
				Maximum *2)	Minimum
72	6 *1)	15	10	130%	60%
96		16	10	110%	60%
144		31	18	130%	60%
168		30	18	110%	60%
192		33	18	110%	60%
288		50	32	110%	60%

\*1) When the outdoor air temperature is 23°F (-5°C) or cooler during the outdoor unit cooling operation, the minimum connectable indoor unit capacity is 18,000 Btu/h. A snow protection hood (optional part) should be installed.

\*2) When the outdoor air temperature is 109°F (43°C) or warmer during the outdoor unit cooling operation, the maximum connectable indoor unit capacity ratio is 100%.

\*3) When the outdoor air temperature is lower than 14°F (-10°C) select the combination of indoor units and outdoor unit as the total capacity of indoors not to exceed the capacity of outdoor unit.

#### NOTES:

- The connectable indoor unit capacity ratio can be calculated as follows:  

$$\text{Connectable Indoor Unit Capacity Ratio} = \frac{\text{Total Indoor Unit Capacity}}{\text{Total Outdoor Unit Capacity}}$$
- For the system under which all the indoor units operate simultaneously, the total indoor unit capacity should be less than the outdoor unit capacity. Otherwise, a decrease in operating performance and an increase in the operating limit can result in an overload.
- For the system under which all the indoor units do not operate simultaneously, the total indoor unit capacity is available up to 130% against the outdoor unit capacity.
- A maximum number of connectable indoor units differs depending on the model, capacity, environment and installation location of connected indoor units. Refer to the "Engineering Manual" for the selection.
- When operating the outdoor unit in cold areas with temperatures of 14°F (-10°C), or under the high heating load conditions, the total indoor unit capacity should be less than 100% against the outdoor unit capacity and the total piping length should be less than 984.3ft (300m).
- If some indoor units start operating simultaneously at a low outdoor air temperature, the airflow may be less than the setting airflow on wired controller for maintaining indoor comfort.
- The airflow volume for indoor units of 6 and 8 MBH is set higher than that for indoor units of 12 MBH or more. Make sure to select appropriate indoor units for installation where cold drafts may occur during heating operation. If installing indoor units in such locations, refer to the recommended number of indoor units that can be connected.

### 3.6 Caution about Outdoor Unit Installation

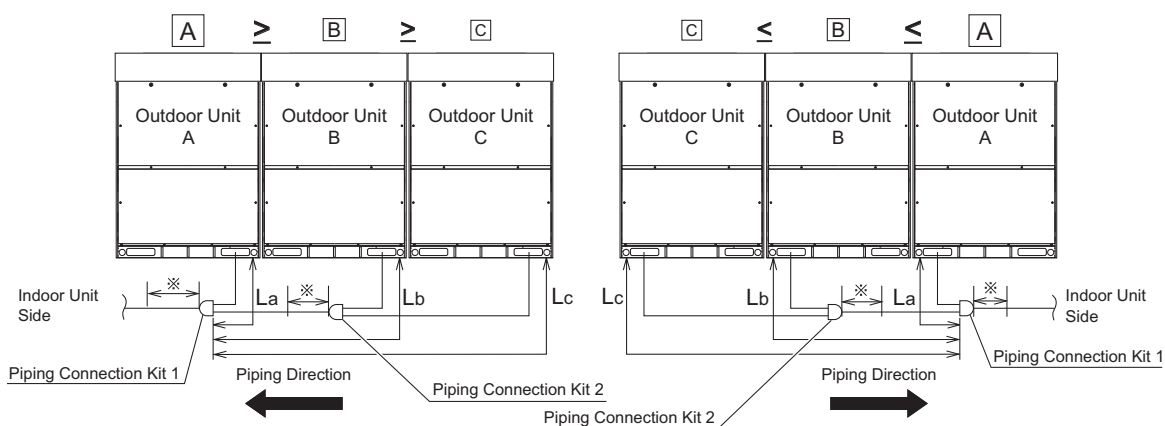
When the installation and piping work for the multiple outdoor units are performed, it is required that the arrangement for outdoor units and piping length be determined. Perform the installation work in strict accordance with the following restrictions.

## NOTICE

If the arrangement for outdoor units is incorrect, it may cause flowback of the refrigerant and result in failure of the outdoor unit.

#### < Restrictions for Two and Three Units Combination >

- (1) When using a combination of two and three outdoor units, align the outdoor units from largest capacity to smallest as  $A \geq B \geq C$  and outdoor unit "A" connected to the piping connection kit 1.
- (2) The piping length between the piping connection kit 1 and the outdoor unit should be  $L_a \leq L_b \leq L_c \leq 32.8 \text{ ft (10m)}$ .



※: Maintain a straight-line distance of 19-11/16 inch (500mm) or more for piping after the piping connection kit.

### 3.7 Piping Work between Outdoor Units

When installing a combination unit, a piping connection kit is needed for each additional unit but not for the base unit: (72, 96 types).

Applicable Outdoor Unit		Model	Piping Set
Outdoor Unit Capacity (MBH)	Outdoor Unit Number		
144 - 192	2	MC-NP20A1	1
288	3	MC-NP30A1	1

#### NOTE:

The piping connection kit (MC-NP\*\*A1) consists of branch pipes for gas and liquid. Interconnecting pipe is not included in these kits (Field-Supplied).

## 4. Outdoor Unit Installation

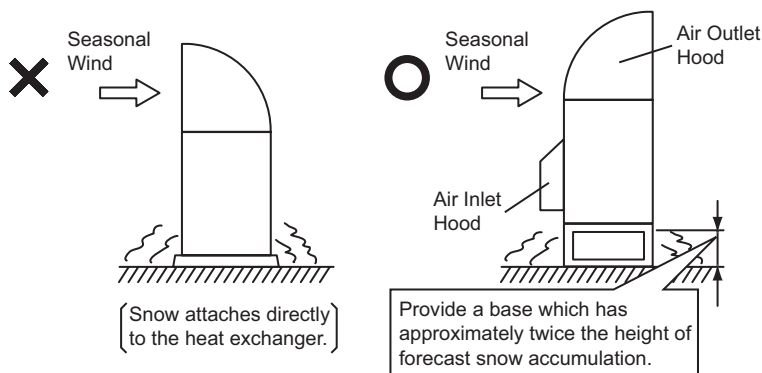
### 4.1 Installation Location and Precautions

#### **! WARNING**

To reduce the risk of serious injury or death, the following installation precautions must be followed.

- When installing the unit into...
  - A wall: Make sure the wall is strong enough to hold the unit's weight. It may be necessary to construct a strong wood or metal frame to provide added support.
  - A room: Properly insulate any refrigerant tubing run inside a room to prevent "sweating" that can cause dripping and water damage to wall and floors.
  - Damp or uneven areas: Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the unit to prevent water damage and abnormal vibration.
  - An area with high winds: Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable wind baffle (field-supplied).
  - A snowy area: Install the outdoor unit on a raised platform that is higher than drifting snow. Provide snow protection hood (optional part (\*)).
- Do not install the unit in the following places. Doing so can result in an explosion, fire, deformation, corrosion, or product failure.
  - Explosive or flammable atmosphere
  - Where a fire, oil, steam or powder can directly enter the unit, such as nearby or above a kitchen stove.
  - Where oil (including machinery oil) may be present.
  - Where corrosive gases such as chlorine, bromine, or sulfide can accumulate, such as near a hot tub or hot spring.
  - Where dense, salt-laden airflow is heavy, such as in coastal regions.
  - Where the air quality is of high acidity.
  - Where harmful gases can be generated from decomposition.
- During heating or defrosting operation, drain water is discharged. Provide adequate drainage around the foundation. If installing the unit on a roof or a balcony, provide the additional drainage around the foundation to prevent water dripping on a person or forming ice in winter.
- Before performing any brazing work, be sure that there are no flammable materials or open flames nearby.
- Perform a test run to ensure normal operation. Safety guards, shields, barriers, covers, and protective devices must be in place while the compressor/unit is operating. During the test run, keep fingers and clothing away from any moving parts.
- Clean up the site when finished, remembering to check that no metal scraps or bits of wiring have been left behind inside the unit being installed.

After installation work for the system has been completed, explain the "Safety Precautions," the proper use and maintenance of the unit to the customer according to the information in all manuals that came with the system. All manuals and warranty information must be given to the user or left near the Unit.

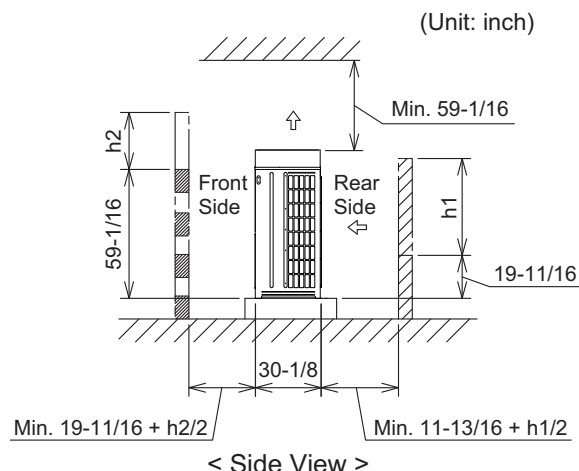


\* Refer to the "Engineering Manual" for details of the optional part.

## 4.2 Service Space

When an outdoor unit is installed, allow sufficient clearance as follows:

- If there is insufficient clearance for air inlets and outlets, it may result in a performance drop-off and mechanical issues due to insufficient air intake.
- Additionally, adequate clearance is required for service maintenance access.



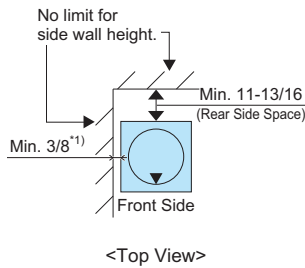
- If there are no walls on the front and rear sides, clearance for service access is required as follows:
  - \* Front Side: Minimum  $19\frac{11}{16}$  inch (500mm)
  - \* Rear Side: Minimum  $11\frac{13}{16}$  inch (300mm)
  - \* Right and Left Sides: Minimum  $\frac{3}{8}$  inch (10mm)

(In an instance where the snow protection hood (optional part) or the air outlet duct (field-supplied) is mounted to the unit, a minimum gap of  $1\frac{15}{16}$  inch (50mm) is required.)
- If the wall on the front side is over  $59\frac{1}{16}$  inch (1,500mm) high, a clearance of  $(19\frac{11}{16} \text{ inch (500mm)} + \frac{h_2}{2})$  for the front side is required.
- If the wall on the rear side is over  $19\frac{11}{16}$  inch (500mm) high, a clearance of  $(11\frac{13}{16} \text{ inch (300mm)} + \frac{h_1}{2})$  for the rear side is required.
- When the units are surrounded by walls on more than two sides, observe the necessary clearance indicated in the diagram above.
- For walls on more than two sides, secure adequate clearance for service access space as shown in the following illustrations.
- If the space between the unit and an obstacle above the unit is less than  $59\frac{1}{16}$  inch (1,500mm) or the space above the unit is closed, set up the duct at the air outlet side in order to prevent short circuit.
- Make sure there is enough space in case the unit needs to be serviced and any of the four sides would need to be opened or removed.

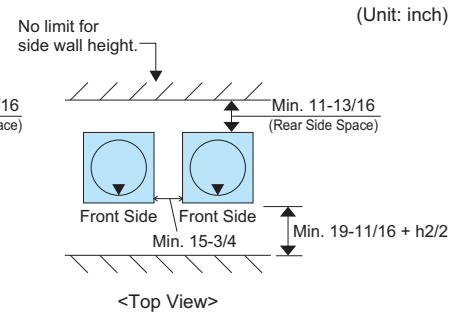
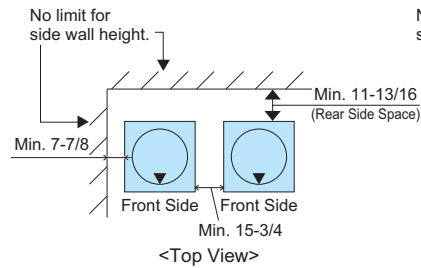
## 1) Walls on Two Sides

If units are installed adjacent to tall buildings where there are two open sides, the minimum rear side clearance must be at least 11-13/16 inch (300mm).

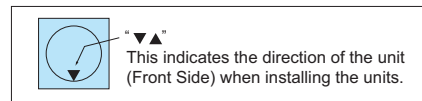
### • Single Installation



### • Multiple / Serial Installation

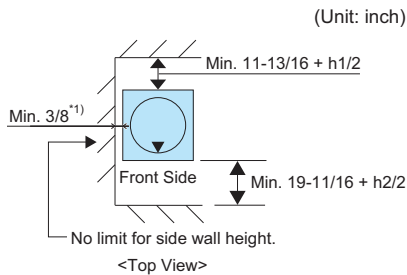


\*1): If using the snow protection hood (optional part) or the air outlet duct (field-supplied) is adopted, a minimum spacial clearance of 1-15/16 inch is required.



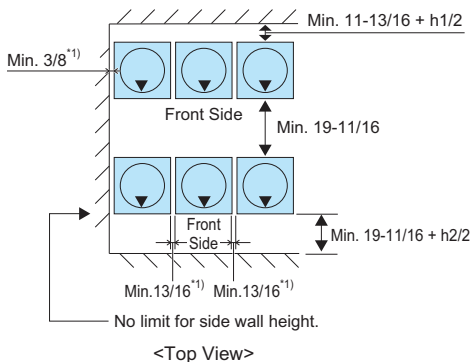
## 2) Walls on Three Sides

### • Single Installation

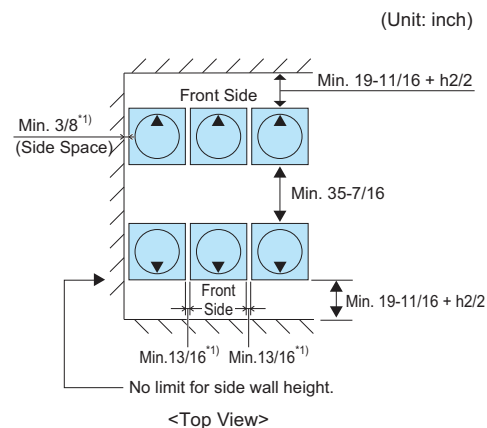


### • Multiple / Serial Installation

#### < Installation in the Same Direction >



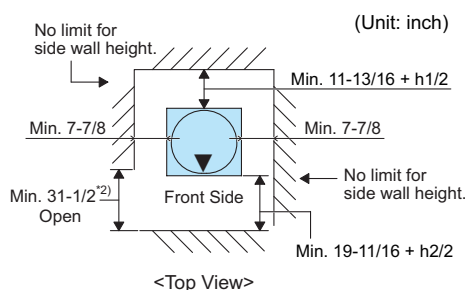
#### < Rear to Rear Installation >



\*1): If the snow protection hood (optional part) or the air outlet duct (field-supplied) is adopted, a minimum spacial clearance of 1-15/16 inch is required.

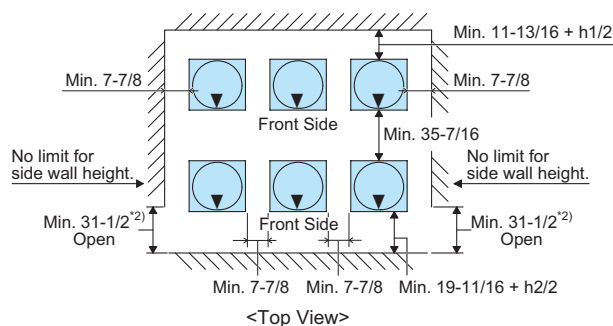
### 3) Walls on Four Sides

#### • Single Installation

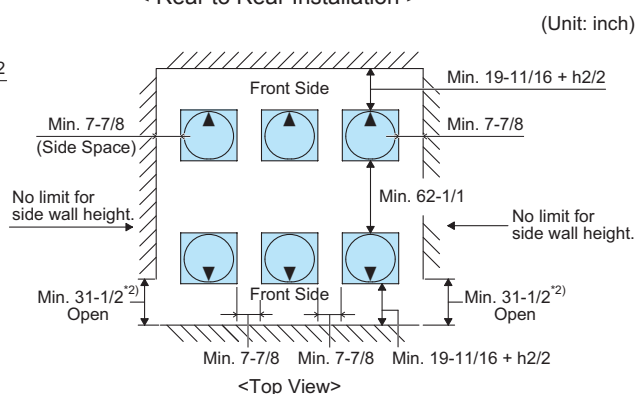


#### • Multiple / Serial Installation

##### < Installation in the Same Direction >



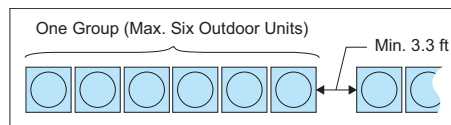
##### < Rear to Rear Installation >



\*2): Partly open a wall if the unit is surrounded by walls on four sides.

### NOTE

1. Keep the upper side open to prevent mutual interference of inlet and outlet air of each outdoor unit.
2. The figure dimensions indicate sufficient clearance dimensions around outdoor units for operation and maintenance at typical installation conditions as follows. [Operation Mode: Cooling Operation, Outside Temp.: 95°F (35°C)]  
In the following situations when compared to the installation condition, an appropriate clearance dimension is required by calculating airflow current.  
\* When the outdoor unit ambient temperature is higher.  
\* When there is a fear that a short circuit is likely to occur.
3. For multiple installations, one group will consist of a maximum of six outdoor units.  
Maintain a 3.3 ft (1m) spacial distance between each unit group.



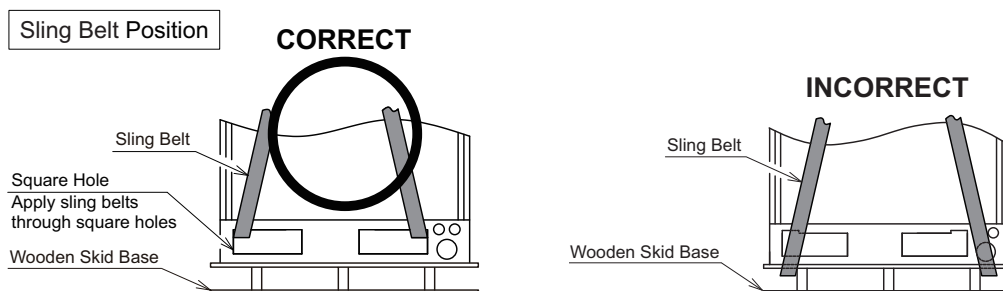
## 5. Transportation and Installation Work

### 5.1 Transportation

Transport the product as close to the installation location as practical before unpacking.  
When using a crane, hang the unit according to the description of the outdoor unit packing.

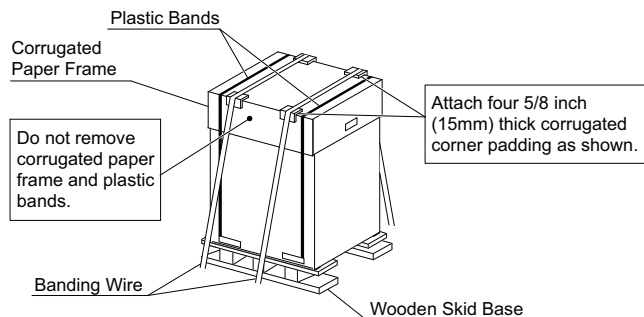
#### ! WARNING

- Do not hang the unit with the sling belts at the wooden skid base.



#### ! CAUTION

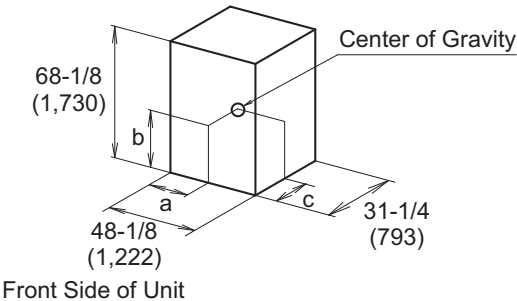
- Transportation and Storage:
  - \* The protective corrugated cardboard is not strong enough to resist rough handling.
  - \* Secure with two sling belts when hoisting the outdoor unit with a crane.
- Transportation and Banding Wire:
  - \* To protect the unit, do not remove any packing.
  - \* Do not stack or place any material on top of the product.
  - \* Apply banding wire to both sides of the packaged unit as shown at right.





Take special care when hanging or moving the outdoor unit because its center of mass is off-center and unbalanced. See the diagram below.

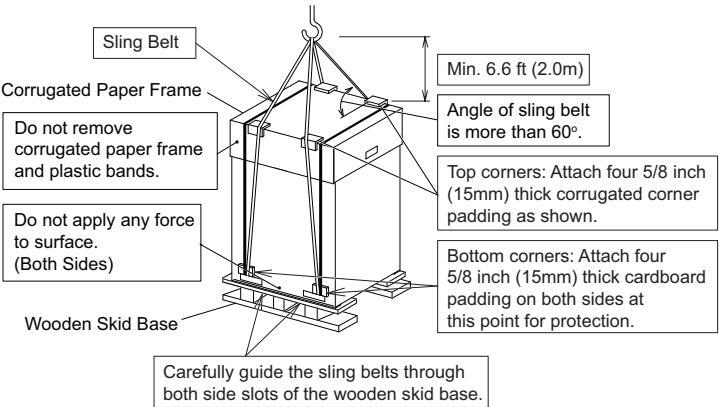
• Center of Gravity



Voltage Type	inch (mm)		
	a	b	c
208/230V	20-7/8 (530)	22-13/16 (580)	12 (305)
460V	19-11/16 (500)	21-5/8 (550)	11-13/16 (300)

• Hanging Method

- (1) Suspend the unit (with wooden skid base) in its packing with two sling belts as shown in Figure 5.1.
- (2) Do not use banding wire.
- (3) Ensure that the unit is balanced.
- (4) Ensure safety while hoisting the unit gently in order not to cause the unit to tip.



Voltage Type	lbs (kg)	
	Net Weight	Gross Weight
208/230V	699 (317)	756 (343)
460V	787 (357)	845 (383)

Figure 5.1 Hanging Unit on Wooden Skid Base for Transportation

- (5) Hang the unit without a wooden skid base with two sling belts as shown in Figure 5.2.

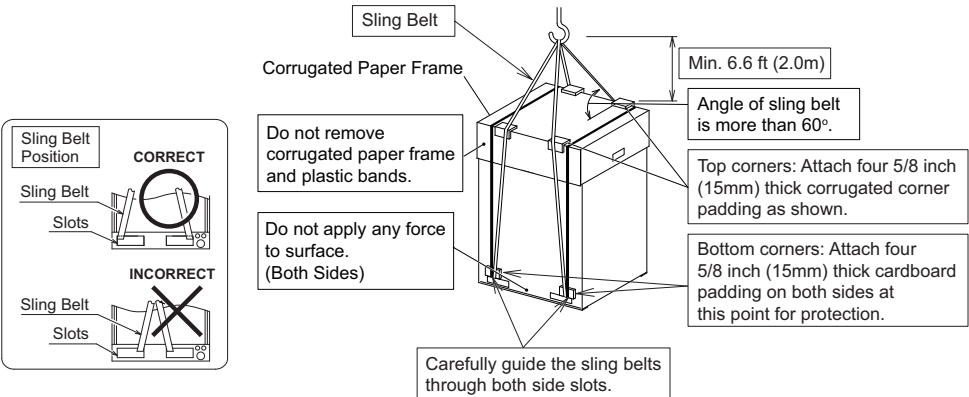
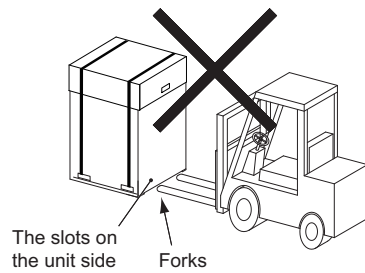


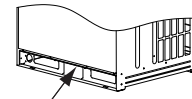
Figure 5.2 Hanging Unit without Wooden Skid Base

When using a forklift, do not insert forks into the slots at the unit side panels. The unit can sustain damage.



Do not apply excessive force to the squared slots with forks or other materials. The bottom of the unit can become deformed.

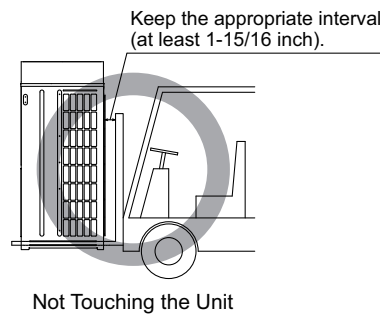
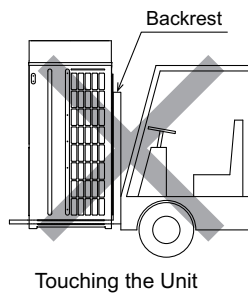
- \* Do not push the bottom base with forks.
- \* Do not use a roller.



Do not apply an excessive force.  
(Either Side)

## **! CAUTION**

During transportation, do not allow the backrest of the forklift to come into contact with the unit. Sudden forward movement on the forklift can cause damage to the unit heat exchanger.



## **NOTE**

If transporting after unpacking, protect the unit with corrugated material, styrofoam, bubble pack, or a tarp.

### 5.2 Handling of Outdoor Unit

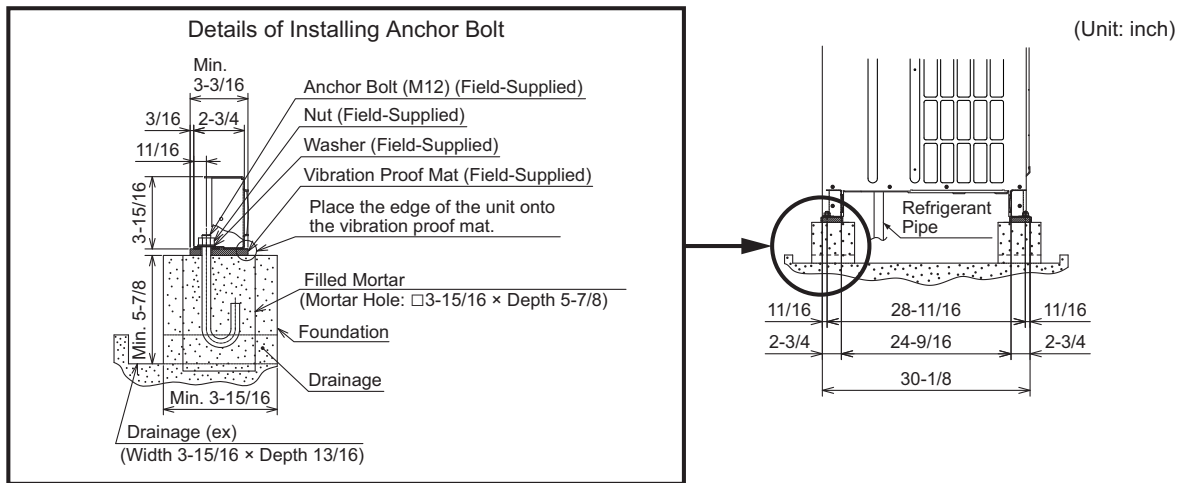
## **! WARNING**

Do not place or leave any foreign objects: (cables, tools), inside the outdoor unit or control module and verify that nothing remains there prior to installation and test run. Damage and fire can result due to carelessness.

## 5.3 Installation Work

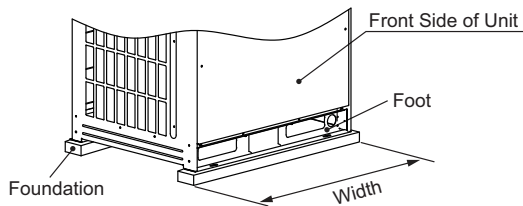
### 5.3.1 Concrete Foundations

- (1) The height of the foundation should be more than 5-7/8 inch (150mm) above the ground.
- (2) Provide adequate drainage around the foundation.



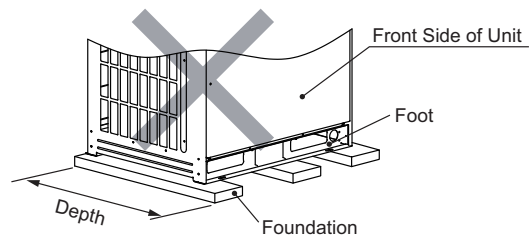
\* Provide a concrete foundation as shown below.

### CORRECT

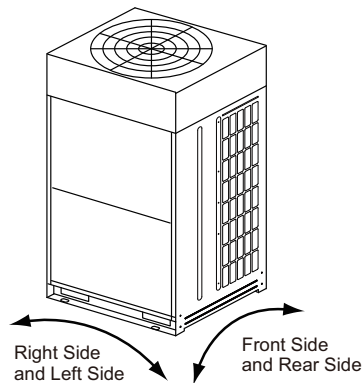


\* Do not use a concrete foundation such as seen here. The footing for the outdoor unit can become deformed.

### INCORRECT



- (3) Install the outdoor unit in the front-rear and right-left direction horizontally. (Use a level.) Verify that the gradient slope in all four directions (front, rear, right, and left) falls within 3/8 inch (10mm).



- (4) Provide a strong, level, and stable foundation so that:
  - a. The outdoor unit does not lean to one side.
  - b. Noises are not heard from within.
  - c. The outdoor unit remains stable and upright in the face of strong winds and seismic events.

- (5) When installing the outdoor unit, secure the unit with anchor bolts and field-supplied vibration-proof mats. Refer to Figure 5.3 for the location of holes for anchor bolts.

(Unit: inch)

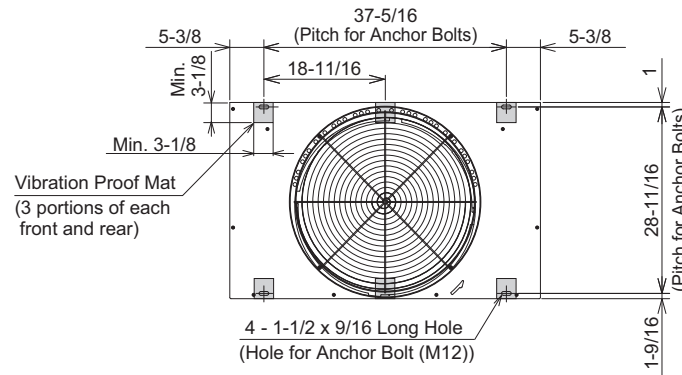


Figure 5.3 Positions of Anchor Bolts

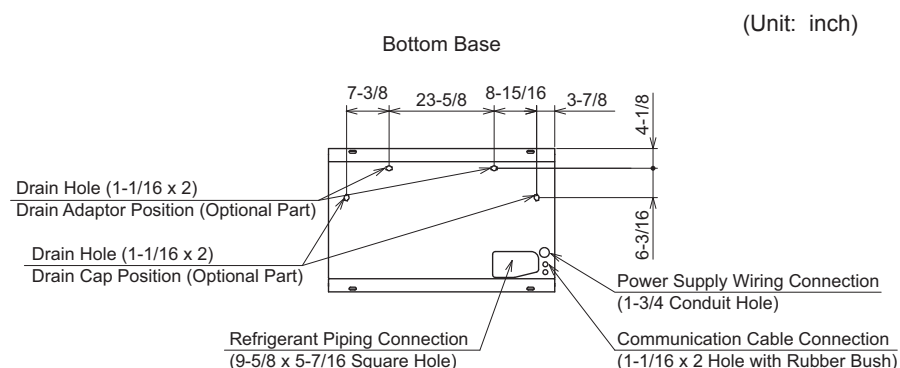
### 5.3.2 Condensate Treatment

Condensation is discharged during heating and defrosting operations. (Rain water is also discharged.) Comply with the following conditions.

- (1) Choose a place where good drainage is available, or provide a drainage ditch.
- (2) Do not install the unit over walkways. Condensation can spill onto people.  
If installing the unit in such a place, utilize the additional condensation drainage pan.
- (3) When drain piping is necessary for the outdoor unit, use the optional drain adaptor: (DBS-TP10A).  
Do not use the drain adaptor in the cold area. Condensate in the drain piping can freeze, resulting in a fractured pipeline.

#### NOTICE:

Even when the drain adaptor is used, moisture may drain slightly from screw holes. Provide a second condensation drainage pan under the outdoor unit as necessary.



#### • Drain Adaptor (Optional Parts)

A drain adaptor is used for a condensation pipe connection in order to use an outdoor unit bottom base as a condensation drainage pan.

Name	Model
Drain Adaptor	DBS-TP10A

#### Component Formation of Drain Adaptor

Model	Parts Name	Material / Color	Qty.	Application
DBS-TP10A	Drain Adaptor	PP / Black	2	Connecting for Drain Piping
	Drain Cap	PP / Black	2	Cover for Drain Hole
	Rubber Cap	CR / Black	4	Sealing for Adaptor and Cap

## 6. Refrigerant Piping Work

### **WARNING**

- The pressure for this product is 601 psi (4.15MPa). The pressure required for refrigerant R410A is 1.4 times higher than that of the refrigerant R22. That means that the refrigerant piping for R410A must be thicker than that for R22. Make sure to use specified refrigerant piping. Otherwise, the refrigerant piping may rupture due to an excessive refrigerant pressure. Pay close attention to the piping thickness when using copper refrigerant piping. The thickness of copper refrigerant piping differs depending on its material.
- Check to ensure that no pressure exists inside the stop valve before removing the flange.

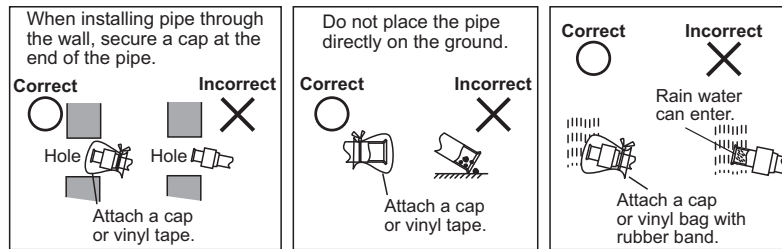
### **CAUTION**

- Ensure that the corresponding pipe connections for the liquid, and gas piping are properly connected to the equipment, as specified in the installation instructions.
- When handling the refrigerant, be sure to wear leather gloves to prevent injuries.

## 6.1 Piping Materials

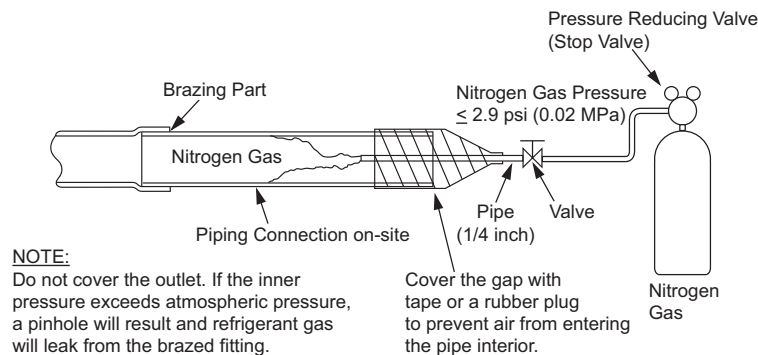
- (1) Obtain locally-supplied copper pipes.
- (2) Use the copper pipe for refrigerant piping.
- (3) Pay close attention to pipe thickness.
- (4) Use clean copper pipes. Make sure there is no dust or moisture inside the pipes. Blow nitrogen or dry compressed air into the pipes to remove any dust or foreign materials before connecting them. Do not use any tools which produce a lot of swarf such as a saw or grinder.
- (5) Take special care to prevent contamination or moisture settling on interior pipe surfaces during piping work.
- (6) Avoid performing the piping connection work for outdoor units in the rain.

### • Cautions for Refrigerant Pipe Ends



### • Brazing Work

- (1) Brazing work must be performed by an authorized installer in order to prevent any problems.
- (2) For piping connections, complete non-oxidation brazing with a nitrogen charge. If brazing the pipes without the nitrogen substitution, a large amount of oxidized scaling will be generated in the piping. This oxidized scaling can cause clogging inside the expansion valve, solenoid valve, accumulator, and compressor, which can prevent the unit from operating properly. Do not use the field-supplied antioxidant which can corrode pipes and degrade the refrigerant oil.



#### NOTES:

1. Make sure to use nitrogen. Nitrogen gas pressure shall be 2.9 psi (0.02 MPa) or less. **DO NOT** use the following gases.

Oxygen:	This is flammable and causes oxidation degradation of refrigerant oil.
Carbon Dioxide:	This can cause decreased performance over drier periods.
Freon Gas:	This emits harmful gases if exposed to fire.

2. Make sure to use the pressure-reducing valve.
3. Do not use field-supplied antioxidant.

- (3) Use a type of flux with a low chlorine concentration.
- (4) Remove all flux completely after completing brazing work.

#### NOTICE:

To avoid oxidation and scaling, perform brazing at the appropriate temperature.

- Cautions for Piping Connection Work

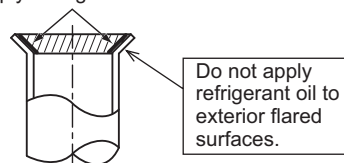
- (1) Verify that there are no scratches, swarf, gaps, or deformations at the flared end before making connections to the system.
- (2) Before tightening the flare nut, apply a small amount of oil (field-supplied) to the backside of the flare. (Do not apply any oil to the flare face or the threads.) Tighten the liquid pipe flare nut to the specified torque while using a back-up wrench to prevent damage to the unit. Ensure that the flare connections are leak free upon completion of the work.

**NOTE:**

Refrigerant oil is field-supplied.

[Ethereal Oil: FVC68D (Idemitsu Kousan Co. Ltd.)]

Apply Refrigerant Oil.



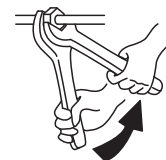
- (3) Be sure to use the accessory flare nuts for indoor unit connections.

< Required Tightening Torque >

Pipe Size	Tightening Torque
1/4 inch (6.35 mm)	10.3 - 13.3 ft·lbs (14 - 18 N·m)
3/8 inch (9.52 mm)	25.1 - 31.0 ft·lbs (34 - 42 N·m)
1/2 inch (12.7 mm)	36.1 - 45.0 ft·lbs (49 - 61 N·m)
5/8 inch (15.88 mm)	50.2 - 60.5 ft·lbs (68 - 82 N·m)
3/4 inch (19.05 mm)	73.8 - 88.5 ft·lbs (100 - 120 N·m)

**NOTE:**

As for the tightening torque for liquid stop valve, according to Section 6.2.1 "Stop Valve" < Liquid Valve > of the tightening torque table.



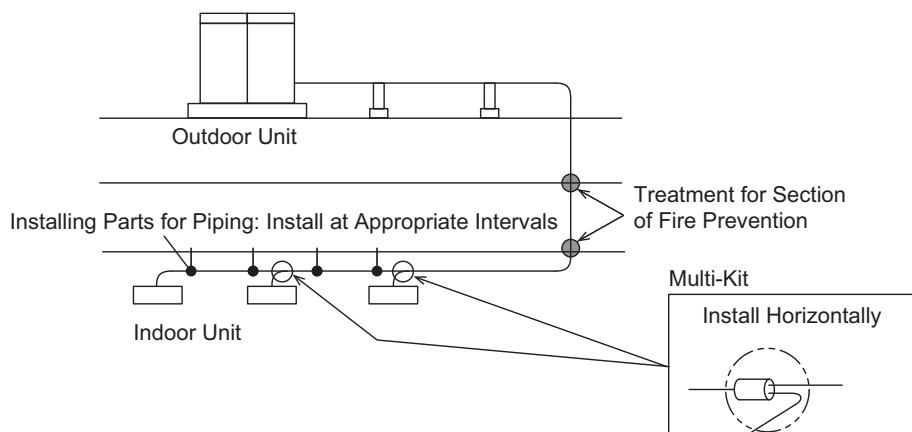
Use two wrenches as shown.

- (4) When the temperature and humidity inside the ceiling exceed 80°F (27°C)/RH80%, apply additional insulation of approximately 3/8 inch (10mm) in thickness to the accessory insulation. It prevents the formation of condensation on the surface of the insulation (refrigerant pipe only).
- (5) Perform the airtight test at (601 psi (4.15MPa) for the test pressure).
- (6) Perform cold insulation work by wrapping tape around flared and reducer connections. Also, insulate all the refrigerant pipes.
- (7) Connect the indoor/outdoor units with refrigerant piping. Secure the piping to prevent it from coming into contact with weak structures such as a wall or ceiling. Otherwise, strange noises may be heard due to vibration in the piping.

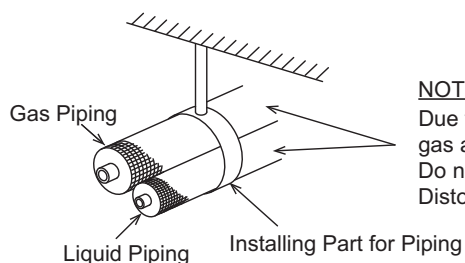


- Caution for Installing and Securing Piping

[ Example for Pipe Support ]



[ Secure for Liquid Piping, Gas Piping ]



**NOTE:**

Due to changing refrigerant temperatures, gas and liquid piping will stretch. Do not fasten gas and liquid piping together with tape. Distortion and deformation of the piping can occur.

**NOTICE:**

When assembling piping onsite with hidden elbow or socket joints, provide a service access doorway to facilitate close-up examination of interconnecting components.

Table 6.1 Piping Size of Outdoor Unit

Outdoor Unit Capacity (MBH)	inch (mm)	
	Gas	Liquid
72, 96	7/8 (22.2)	3/8 (9.52)
144 - 192	1-1/8 (28.58)	5/8 (15.88)
288	1-3/8 (34.93)	3/4 (19.05)

Table 6.2 Piping Size of Indoor Unit

Indoor Unit Capacity (MBH)	inch (mm)	
	Gas	Liquid
6 - 15	1/2 (12.7)	1/4 (6.35)
18 - 48	5/8 (15.88)	3/8 (9.52)
72	3/4 (19.05)	3/8 (9.52)
96	7/8 (22.2)	3/8 (9.52)

## 6.2 Piping Connection Work

Comply with the restrictions for refrigerant piping (permissible length, height difference) in Section 6.5 “Piping Work Conditions” and “Piping Branch Restriction”. If not, the outdoor unit can become damaged or fail. The stop valves will be closed completely (factory-setting) when refrigerant piping connections are performed. Do not open these stop valves until all the refrigerant piping connections, airtight testing, and vacuuming have been completed.

### 6.2.1 Stop Valve

#### < Gas Valve >

- (1) Make sure that all the spindles are closed completely.
- (2) Connect the charging hose to the service port and release the gas inside the piping.
- (3) Cut the end of the closing pipe and ensure that no residual gas exists inside the gas piping.
- (4) Remove the closing pipe from the brazing portion with a torch. Be careful that the flame doesn't burn the stop valve.

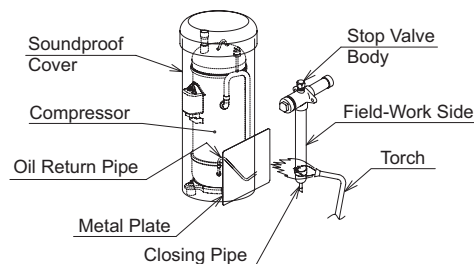
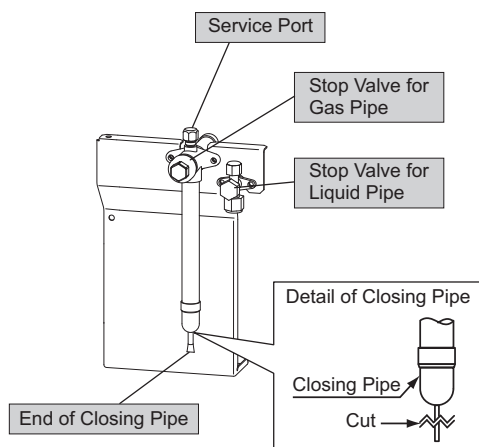


Figure 6.1

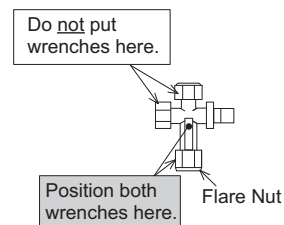
## ! WARNING

- Remove gas inside the closing pipe before the brazing work is performed. If the brazing filler metal melts with residual gas inside, the piping will explode and injuries can result.
- Do not expose surrounding parts and the oil return pipe of the compressor to flames when a torch is used. If the oil return piping is exposed to the fire, high temperature oil will spurt and cause a fire or injury.

#### < Liquid Valve >

Tighten the flare nut for the liquid stop valve according to the following torque. If excessive force is applied to the flare nut, refrigerant leakage may occur from the spindle part. (To prevent leakage, place two wrenches at the positions as shown at the right when removing and connecting piping.)

Model Type	Tightening Torque
72 and 96	24.3 - 31.0 ft·lbs (33 - 42 N·m)



## CAUTION

- Do not apply an excessive force to the spindle valve after fully opening the spindle.
- At the test run, fully open the spindle. If it is not fully opened, the devices will be damaged.

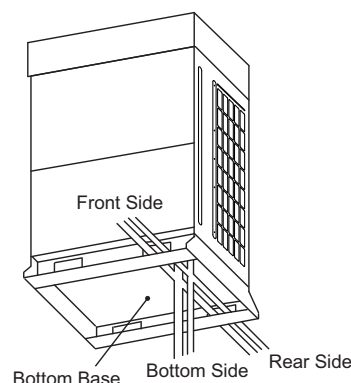
### 6.2.2 Piping Connection Method

Perform the piping connection work for each outdoor unit.

#### NOTE:

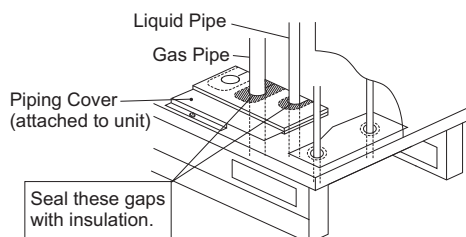
Ensure that the refrigerant pipe is connected to the same refrigerant system.

- Firmly secure the piping in order to avoid vibration and excessive force exerted on the valve.
- (1) Piping can be installed in three directions (front, rear, or bottom side) from the bottom base.  
For vibration protection, properly secure piping connections and check that no excessive force is applied to the stop valve.

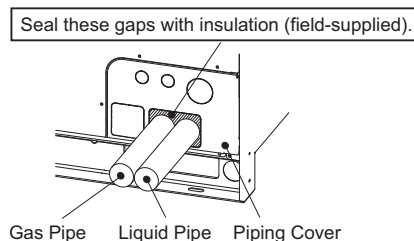


- (2) Follow the installation procedures in Section 6.2.1.
- (3) Connect the piping in accordance with Figures 6.1 and 6.2 on the following page.
- (4) Seal the gap between the bottom base or front piping cover and pipes with the insulation.

#### ● For Piping from Bottom Base

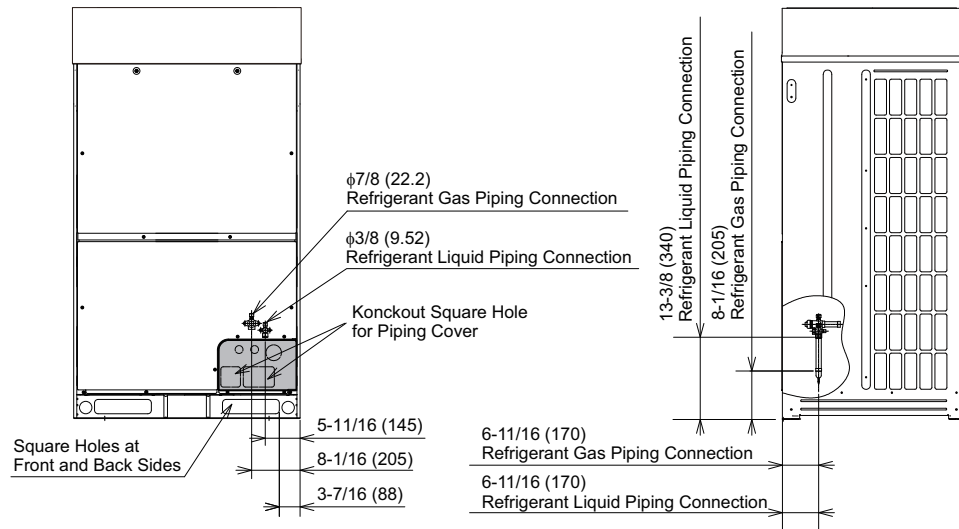


#### ● For Piping from Front Piping Cover

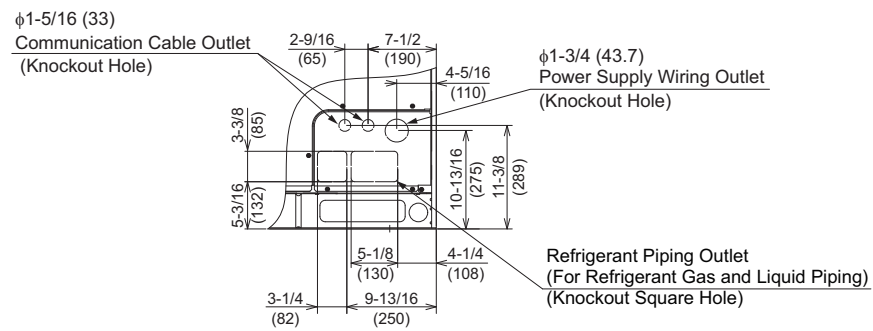


- Prepare refrigerant piping for assembly.  
Refer to Figure 6.2 for the position for piping connections.

Unit: inch (mm)



#### < Detail of Piping Cover >

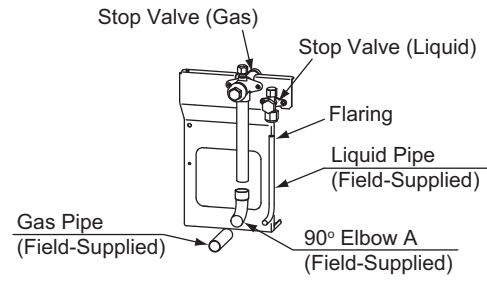


Field Piping (*)	
Gas	Liquid
7/8 (22.2)	3/8 (9.52)

(\*): Using the accessory pipe (refer to Section 3.1 "Factory-Supplied Accessories"), combine the piping size.

Figure 6.2 Refrigerant Piping Connection

- Details of Stop Valve Piping Connection



NOTES:

1. Ensure that the closing pipe of the gas stop valve is removed first.
2. Refer to Figure 6.1 above for the flaring work.

### 6.3 Piping Work between Outdoor Units

Select the pipe size according to Section 6.4 "Piping Size between Outdoor Units".

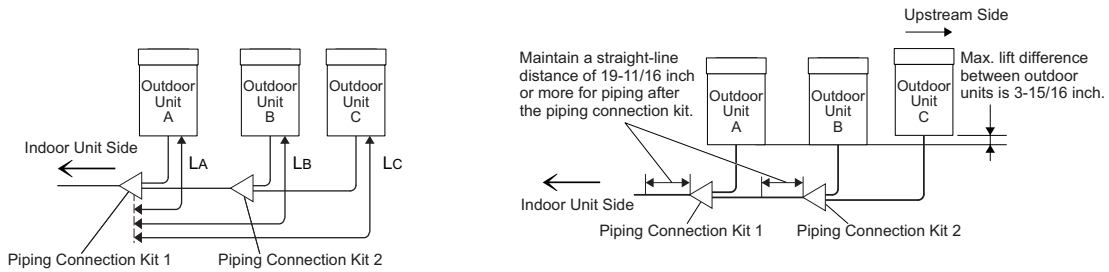
For refrigerant piping between multiple outdoor units, use the optional piping connection kit.

The arrangement for outdoor units should be determined depending on the piping direction when the refrigerant piping work and installation work are planned. When the outdoor unit is installed, perform the installation work according to the following restrictions.

- (1) Piping length between piping connection kit 1 and each outdoor unit should be

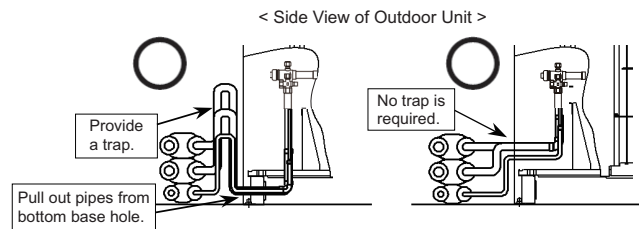
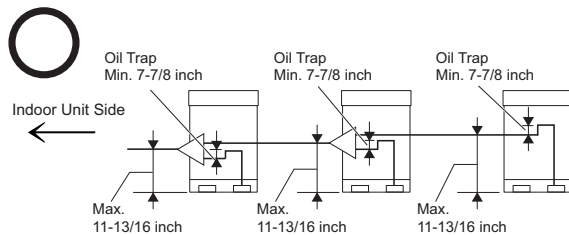
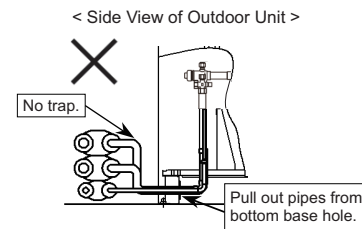
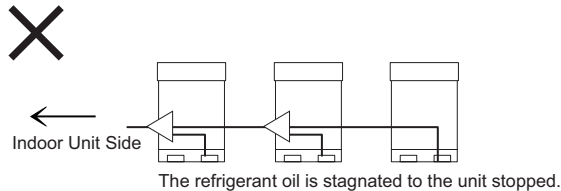
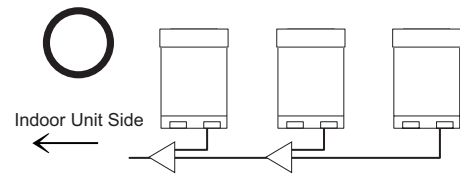
$$L_A \leq L_B \leq L_C \leq 32.8 \text{ ft (10m)}.$$

Maintain a straight-line distance of 19-11/16 inch (500mm) or more for piping after the piping connection kit 1.



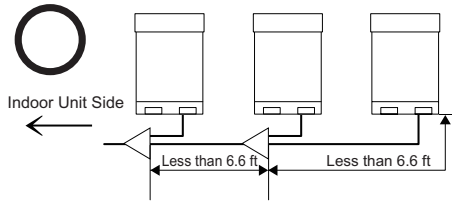
- (2) Place the piping connection kit lower than the outdoor unit piping connection.

When the piping connection kit is installed higher than the outdoor unit piping connection, maintain a maximum clearance of 11-13/16 inch (300mm) between the piping connection kit and the bottom of the outdoor unit. Also, install an oil trap (minimum 7-7/8 inch (200mm)) between the piping connection kit and the outdoor unit.

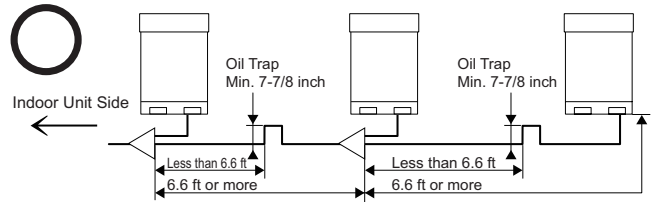


- (3) When piping length between outdoor units is 6.6 ft (2m) or more, an oil trap for the gas piping should be installed so that any accumulation of refrigerant oil cannot occur.

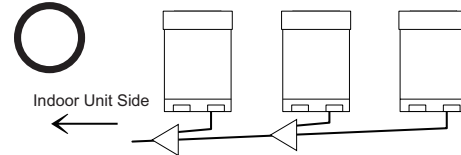
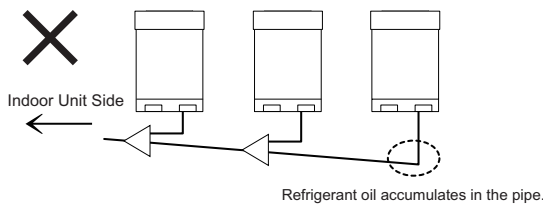
• Less than 6.6 ft (2m)



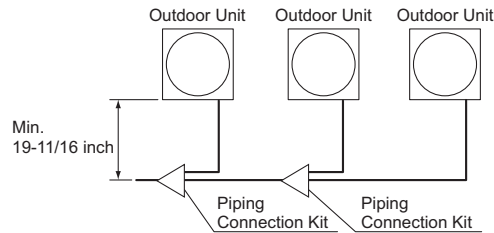
• 6.6 ft (2m) or More



- (4) Place the outdoor unit pipe horizontally or with the pipe slanted downward towards the indoor unit side so that accumulation of refrigerant oil does not occur in the pipe.

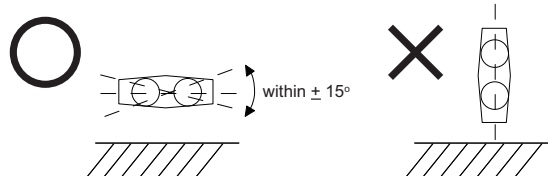


- (5) For servicing, if the pipe is installed in front of the outdoor unit, make sure minimum clearance of 19-11/16 inch (500mm) between the outdoor unit and piping connection kits. (When the compressor is replaced, minimum clearance of 19-11/16 inch (500mm) is required.)



- (6) Direction of Piping Connection Kit

Place the piping connection kit so it is vertical to the ground (the slope must be within  $\pm 15^\circ$ ) as shown in the figure.



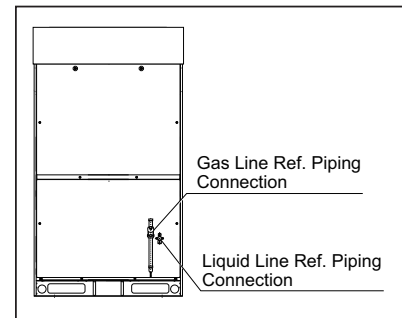
## NOTICE

The refrigerant system may be damaged if the slope of the piping connection kit exceeds  $\pm 15^\circ$ .

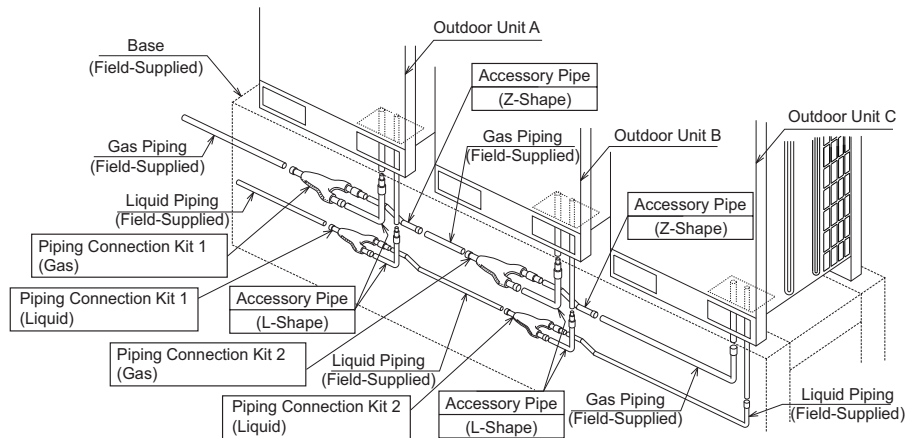
- Construction Example

The following figures show the examples of three units combination.

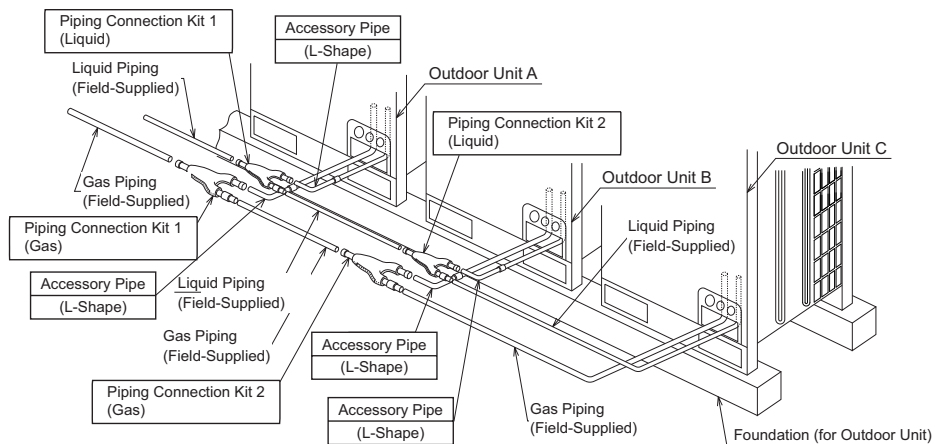
Regarding the piping work for Combination Unit, refer to the "Installation and Maintenance Manual" attached to the piping connection kit.



### < Downward Piping Connection >



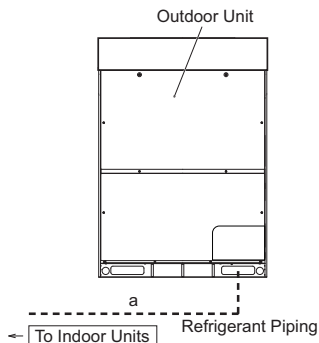
### < Front Side Piping Connection >





## 6.4 Piping Size between Outdoor Units

### Base Unit

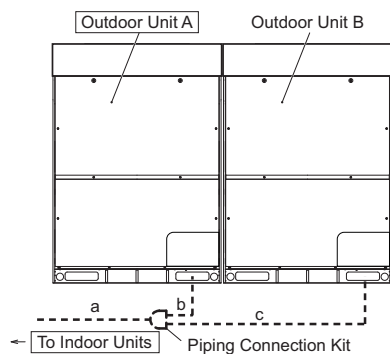


Model Type			72		96	
Piping Size	a	Gas	7/8 (22.2)		7/8 (22.2)	
		Liquid	3/8 (9.52)		3/8 (9.52)	

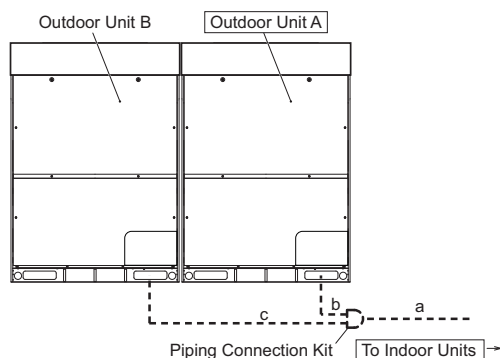
inch (mm)

### Two Units Combination

(Indoor Unit on Left Side)



(Indoor Unit on Right Side)



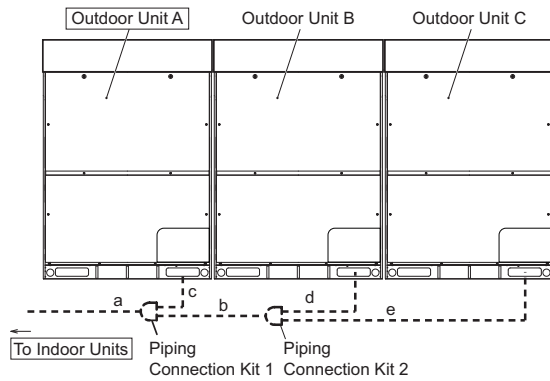
			inch (mm)		
Model Type			144	168	192
Combination Unit	Outdoor Unit A		72	96	96
	Outdoor Unit B		72	72	96
Piping Connection Kit			MC-NP20A1		
Piping Size	a	Gas	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)
		Liquid	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)
	b	Gas	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)
		Liquid	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)
	c	Gas	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)
		Liquid	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)

inch (mm)

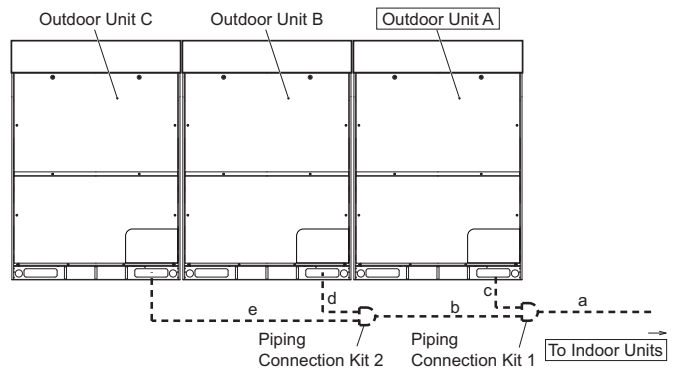
\* Install the outdoor unit and piping connections in accordance to whatever is applicable to your situation.  
Refer to the table for the outdoor unit model, the piping connection kit model, and the piping diameter.

### Three Units Combination

(Indoor Unit on Left Side)



(Indoor Unit on Right Side)



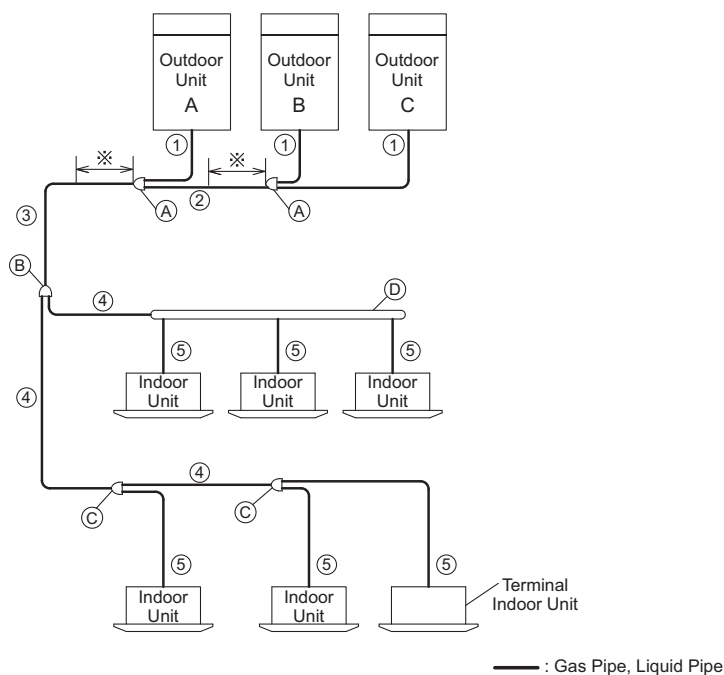
inch (mm)

Model Type		288
Combination Unit	Outdoor Unit A	96
	Outdoor Unit B	96
	Outdoor Unit C	96
Piping Connection Kit		MC-NP30A1
Piping Size	a	Gas 1-3/8 (34.93)
		Liquid 3/4 (19.05)
	b	Gas 1-1/8 (28.58)
		Liquid 5/8 (15.88)
	c	Gas 7/8 (22.2)
		Liquid 3/8 (9.52)
	d	Gas 7/8 (22.2)
		Liquid 3/8 (9.52)
	e	Gas 7/8 (22.2)
		Liquid 3/8 (9.52)

\* Install the outdoor unit and piping connections in accordance to whatever is applicable to your situation. Refer to the table for the outdoor unit model, the piping connection kit model, and the piping diameter.

## 6.5 Piping Size and Multi-Kit Selection

For selecting the pipe sizes ① between the outdoor unit and the piping connection kit, the piping size ② between the piping connection kits and piping connection kit (A), refer to Section 6.4 “Piping Size between Outdoor Units”.



※ Maintain a straight-line distance of 19-11/16 inch (500mm) or more for piping after the piping connection kit.

### Multi-Kit (Optional Parts)

#### < Line Branch >

##### ② First Branch

Outdoor Unit Capacity (MBH)	Model
72, 96	MW-NP282A2
144 - 192	MW-NP692A2
288	MW-NP902A2

#### < Header Branch >

##### ④ Header Branch

Total Indoor Unit Capacity (MBH)	No. of Header Branches	Model
36 - 60	4	MH-NP224A
36 - 72	8	MH-NP288A

##### ③ Line Branch after First Branch

Total Indoor Unit Capacity (MBH)	Model
≤ 86	MW-NP282A2
87 - 125	MW-NP452A2
126 - 185	MW-NP692A2
≥ 186	MW-NP902A2

#### NOTE:

If ③ “Line Branch after First Branch” is larger than ② “First Branch”, use the same model as ② “First Branch”.

Refer to the figure on the previous page.

Piping Size < inch (mm) >

- ③ [Main Pipe Diameter]  
(Base Unit or Piping Connection Kit 1 to First Branch)

Outdoor Unit Capacity (MBH)	Equivalent Piping Length			
	< 328.1 ft (100m)		≥ 328.1 ft (100m) *1)	
	Gas	Liquid	Gas	Liquid
72, 96	7/8 (22.2)	3/8 (9.52)	1-1/8 (28.58)	1/2 (12.7)
144 - 192	1-1/8 (28.58)	5/8 (15.88)	1-3/8 (34.93)	3/4 (19.05)
288	1-3/8 (34.93)	3/4 (19.05)	1-5/8 (41.28)	7/8 (22.2)

\*1): In some cases, it is required to prepare the reducer (field-supplied).

- ④ [Diameter of Pipe after First Branch]

Total Indoor Unit Capacity (MBH)	Piping Length between First Branch and Indoor Unit			
	≤ 131.2 ft (40m)		> 131.2 ft (40m) *1)	
	Gas	Liquid	Gas	Liquid
≤ 41	5/8 (15.88)	3/8 (9.52)	3/4 (19.05)	1/2 (12.7)
42 - 65	3/4 (19.05)	3/8 (9.52)	7/8 (22.2)	1/2 (12.7)
66 - 86	7/8 (22.2)	3/8 (9.52)	1-1/8 (28.58)	1/2 (12.7)
87 - 113	1-1/8 (28.58)	1/2 (12.7)	1-1/8 (28.58)	5/8 (15.88)
114 - 125	1-1/8 (28.58)	1/2 (12.7)	1-3/8 (34.93)	5/8 (15.88)
126 - 155	1-1/8 (28.58)	5/8 (15.88)	1-3/8 (34.93)	3/4 (19.05)
156 - 185	1-3/8 (34.93)	5/8 (15.88)	1-3/8 (34.93)	3/4 (19.05)
186 - 257	1-3/8 (34.93)	3/4 (19.05)	1-5/8 (41.28)	7/8 (22.2)
≥ 258	1-5/8 (41.28)	3/4 (19.05)	1-5/8 (41.28)	7/8 (22.2)

\*1): If piping length from the multi-kit at the first branch to the terminal indoor unit exceeds 131.2 ft (40m), according to "Piping Branch Restriction" in Section 6.5 when installing. In some cases, it is required to prepare the reducer (field-supplied).

**NOTE:**

If the size of ④ "Pipe after First Branch" is larger than the size of ③ "Main Pipe", adjust the size of ④ "Pipe after First Branch" to the same size as ③ "Main Pipe".

- ⑤ [Diameter of Pipe between Multi-Kit and Indoor Unit]

Indoor Unit Capacity (MBH)	Gas	Liquid
6 - 15	1/2 (12.7)	1/4 (6.35) *1)
18 - 48	5/8 (15.88)	3/8 (9.52)
72	3/4 (19.05)	3/8 (9.52)
96	7/8 (22.2)	3/8 (9.52)

\*1): When liquid piping length is longer than 49.2 ft (15m), use 3/8 inch (9.52mm) diameter piping with the reducer (accessory pipe for Multi-Kit).

**NOTE:**

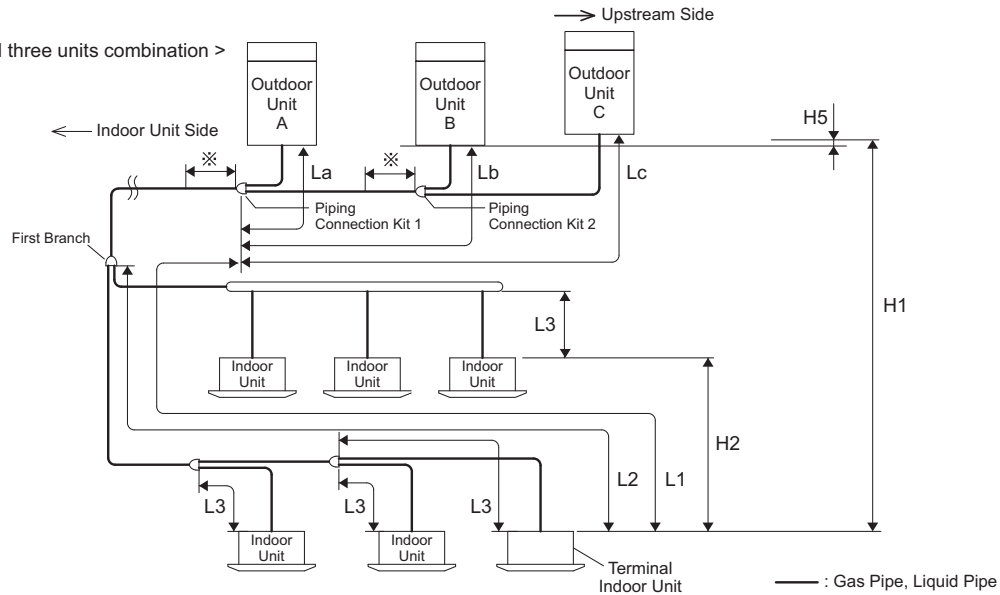
The pipe diameter should be the same as the indoor unit piping connection size.

- Piping Work Conditions

Comply with the following when installing the unit.

[ Example ]

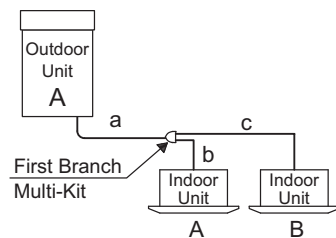
< For two and three units combination >



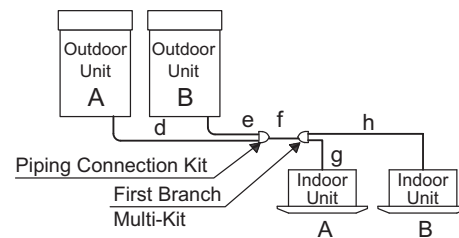
※ Maintain a straight-line distance of 19-11/16 inch (500mm) or more for piping after the piping connection kit.

Item	Mark	Details
Total Piping Length	Ex1	a+b+c
	Ex2	d+e+f+g+h
Maximum Piping Length	Ex1	a+c
	Ex2	f+h
Piping Length	-	The actual length of pipe that takes no account for equivalent lengths for pressure drops of elbows.
Equivalent Piping Length	-	The combination of the straight pipe length plus the equivalent length of elbows and other pressure drop calculations.

Example 1) If a Line Branch Including Main Branch



Example 2) If Utilizing a Piping Connection Kit



Item		Mark	Allowable Piping Length	
			≤ the recommended number of connected indoor unit	> the recommended number of connected indoor unit
Total Piping Length		-	≤ 1,640 ft (500m)	≤ 984 ft (300m)
Maximum Piping Length	Actual Length	L1	≤ 541 ft (165m)	≤ 541 ft (165m)
	Equivalent Length		≤ 623 ft (190m)	≤ 623 ft (190m)
Maximum Piping Length between Multi-kit of 1st Branch and Each Indoor Unit		L2	≤ 295 ft (90m)	≤ 131 ft (40m)
Maximum Piping Length between Each Multi-kit and Each Indoor Unit		L3	≤ 131 ft (40m)	≤ 98 ft (30m)
Piping Length between Piping Connection Kit 1 and Each Outdoor Unit		La, Lb, Lc	≤ 32 ft (10m)	≤ 32 ft (10m)
Height Difference between Outdoor Units and Indoor Units	O.U. is Higher	H1	≤ 164 ft (50m)	≤ 164 ft (50m)
	O.U. is Lower		≤ 131 ft (40m)	≤ 131 ft (40m)
Height Difference between Indoor Units		H2	≤ 98 ft (30m)	≤ 98 ft (30m)
Height Difference between Outdoor Units		H5	≤ 0.3 ft (0.1m)	≤ 0.3 ft (0.1m)

#### NOTICE

Comply with the following conditions when installing the unit.

1. For a combination of two or three outdoor units, the outdoor unit "A" should be connected to the piping connection of Kit 1. (Refer to Section 6.4 for outdoor unit models.) Refer to the Piping Kit Installation Manual for piping details.
2. The piping length between outdoor units should be  $L_a \leq L_b \leq L_c \leq 32.8 \text{ ft (10m)}$ .  
(If the piping length is incorrect, there may be a failure of outdoor units caused by a refrigerant back-up.)
3. Maintain a straight-line distance of 19-11/16 inch (500mm) or more for piping after the piping connection kit.
4. The condition of refrigerant piping installation is different depending on the connected number of indoor units. Refer to Table 3.2 "System Combination" above for details.
5. Allowable total piping length may not exceed 1,640 ft (500m) because of the limitation of maximum additional refrigerant amount as described in the following table. Make sure that the additional refrigerant volume does not exceed the maximum additional refrigerant amount as shown below.

Outdoor Unit Capacity (MBH)	72, 96	144 - 192	288
Max. Additional Refrigerant Charge: lbs (kg)	61.7 (28)	112.5 (51)	138.9 (63)

6. If the piping length (L3) between each multi-kit and indoor unit is considerably longer than other indoor unit, refrigerant may not flow well, lessening performance compared to other models.  
(Recommended Piping Length: Within 49.2 ft (15m))
7. When the piping length from the multi-kit to the first branch to the terminal indoor unit exceeds 131.2 ft (40m), refer to "Piping Branch Restrictions", Section 6.5.
8. When installing Energy Recovery Ventilation in the system, the piping length between Energy Recovery Ventilation and the outdoor unit must be within 49.2 ft (15m).
9. When completing on-site piping, install bent piping or horizontal loop piping to absorb any expansion or contraction due to changing temperatures.

- Piping Branch Restriction

In the following instances, there is no limit to the number of main piping branches.

If the piping length L2 from the Multi-Kit at the first branch to the farthest indoor unit is over 131.2 ft (40m), follow the instructions below when performing the field-supplied piping work.

(Example 1) : Installation with Main Piping Branch (\*)

Piping length from the Multi-Kit at the first branch to the terminal indoor unit is within 131.2 - 295.3 ft (40 - 90m).

- (1) If the pipe length L2 is over 131.2 ft (40m), the size of gas and liquid pipes “b and c” or “g and h” should be selected according to Table ④ below, “Diameter of Pipe after First Branch”.

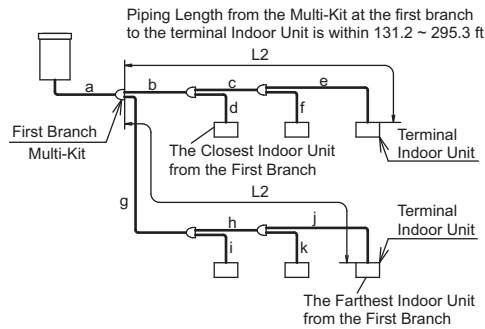
\* If the size of (a) is smaller than the size of (b, g) after selecting the size according to Table ④ below, “Diameter of Pipe after First Branch”, adjust the size of (a) so it is the same size as (b, g).

If the size of (a) is larger than the size indicated in Table ③ below, “Main Pipe Diameter” of (Equivalent Piping Length  $\geq 328.1$ ft), adjust the size of (a) so it is the same size according to Table ③ below, “Main Pipe Diameter” of (Equivalent Piping Length  $\geq 328.1$ ft).

In this instance, if the size of (b, c, g, h) is larger than the size of each before the branch, adjust the size of (b, c, g, h) to the same size as each before the branch.

- (2) The difference between the piping length from the first branch to the farthest indoor unit and the piping length from the first branch to the closest indoor unit must be within 131.2 ft (40m).

\*  $(g+h+j)-(b+d) \leq 131.2$  ft (40m)



(Example 2): Installation without Main Piping Branch (\*)

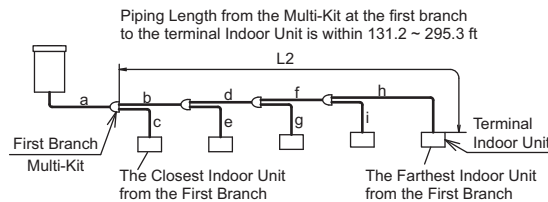
Piping length from the Multi-Kit at the first branch to the terminal indoor unit is within 131.2 - 295.3 ft (40 - 90m).

- (1) If the pipe length L2 is over 131.2 ft (40m), the size of gas and liquid pipes “b, d and f” should be selected according to Table ④ below, “Diameter of Pipe after First Branch”.

\* If the size of (a) is smaller than the size of (b) after selecting the size according to Table ④ below, “Diameter of Pipe after First Branch”, adjust the size of (a) so it is the same size as (b).

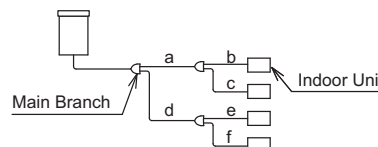
If the size of (a) is larger than the size indicated in Table ③ below, “Main Pipe Diameter” of (Equivalent Piping Length  $\geq 328.1$ ft), adjust the size of (a) so it is the size according to Table ③ below, “Main Pipe Diameter” of (Equivalent Piping Length  $\geq 328.1$ ft).

In this case, if the size of (b, d, f) is larger than the size of each before the branch, adjust the size of (b, d, f) to the same size as each before the branch.

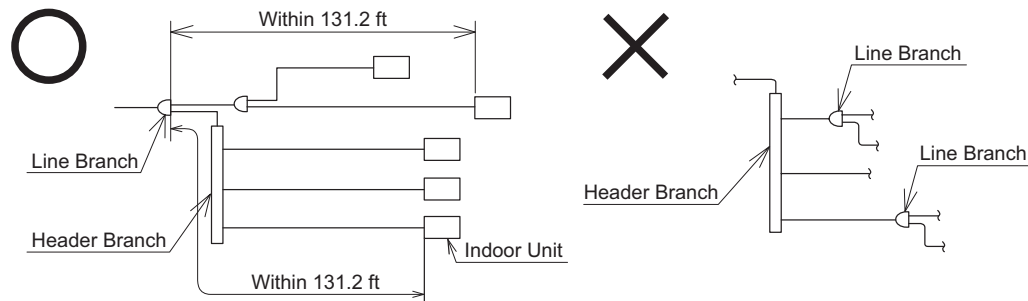


(\*): Main Piping Branch:

Both branches of piping from a Multi-Kit are connected to the next Multi-Kits.



A header branch can be used with a line branch at the three pipes segment and two pipes segment. A header branch can also be used after the second branch. Do not connect a line branch to a header branch. When using a header branch, make sure that the piping length L2 from the Multi-Kit at the first branch to the farthest indoor unit is within 131.2 ft (40m).



- The number of indoor units connectable to outdoor unit is as follows:  
Comply with the following conditions when installing the unit.
- A maximum total capacity and a minimum total capacity against the nominal outdoor unit capacity can be obtained by combination of the indoor units.

Outdoor Unit Capacity (MBH)	72	96	144	168	192	288
Maximum Number of Connectable I.U.	15	16	31	30	33	50
Recommended Number of Connectable I.U.	10	10	18	18	18	32

#### NOTES:

1. For a system under which all the indoor units are supposed to operate simultaneously, the total indoor unit capacity should be less than outdoor unit capacity. Otherwise, it may cause a decrease of operating performance and operating limit in overload operation.
2. For the system under which all the indoor units are not supposed to operate simultaneously, the total indoor unit capacity is available 100% or more against the outdoor unit capacity. Refer to Table 3.2 "System Combination" for detail.
3. When operating the outdoor unit in cold area with temperatures of 14°F (-10°C), or under the high heating load conditions, the total indoor unit capacity should be 100% or less against the outdoor unit capacity and the total piping length should be 984.3ft (300m) or less.
4. The airflow volume for indoor units of 6 and 8 MBH is set higher than that for indoor units of 12 MBH or more. Make sure to select appropriate indoor units when installing indoor units where cold draft may occur during heating operation. If installing indoor units in such places, refer to the recommended number of connectable indoor units.
5. When installing an Energy Recovery Ventilation (ERV) unit, the additional load must be considered when calculating the maximum units that can be attached.



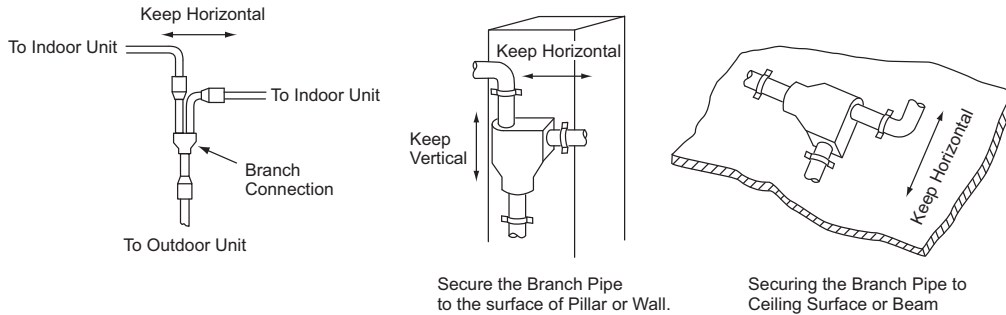
## 6.6 Multi-Kit Connection

Use the branch piping kit to ensure proper piping.

Do not use a T-Joint. Secure the branch pipes horizontally to a pillar, a wall, or a ceiling.

### NOTE:

When installing the piping by securing plates, wrap the branch pipe with an insulation or slip a cushioning between the pipe and the plate. Then secure it to the wall.



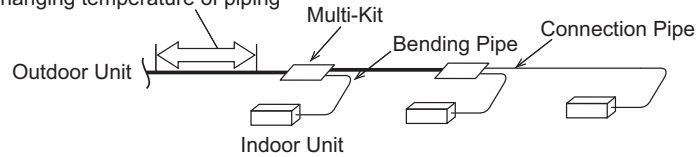
### < Installation Posture of Branch Piping >

<p>Upper Side</p> <p>Min. 1.6 ft</p> <p>Branch Pipe</p> <p>Branch Connection</p> <p>Main Pipe</p> <p>Bending Radius</p> <p><b>CORRECT</b></p>	<p>Upper Side</p> <p>Main Pipe</p> <p>Branch Connection</p> <p>Branch Pipe</p> <p><b>CORRECT</b></p>	<p>Upper Side</p> <p>Straight Length Min. 1.6 ft</p> <p>Main Pipe</p> <p>Branch Connection</p> <p>Branch Pipe</p> <p><b>CORRECT</b></p>	<p>Upper Side</p> <p>Branch Pipe</p> <p>Main Pipe</p> <p>Branch Connection</p> <p>Branch Pipe</p> <p><b>INCORRECT</b></p>
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### [ Piping Form from Multi-Kit to Indoor Unit ]

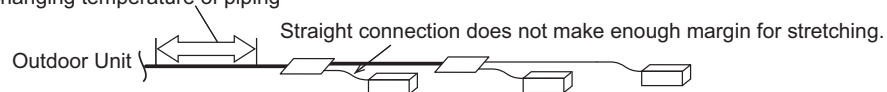
**Ex. Recommended** To prevent pipe damage, use bending pipes from each Indoor Unit to the Multi-Kit.

Piping stretches during operation because of changing temperature of piping



**Ex. Not Recommended**

Piping stretches during operation because of changing temperature of piping






### NOTICE:

When on-site piping, install the bend pipes or the horizontal loop pipes to absorb stretched pipes that is due to the changing temperature of refrigerant pipes.

## 7. Electrical Wiring

### WARNING

- The indoor unit fan may continue to operate for up to five minutes following the heating cycle to dissipate residual heat from the indoor unit.
- Check to ensure that the indoor fan and the outdoor fan have stopped before electrical wiring work or a periodical check is performed.
- Insulate electrical wiring, drain piping, and electrical components from threats posed by burrowing animals and temperature extremes. Failure to do so can over time, deteriorate system performance.
- Electrical cables should not come into contact with refrigerant piping, plate edges, and electrical components inside the unit.
- Use a medium sensing speed Ground Fault Circuit Interrupter (GFCI) with an activation speed of 0.1 second or less). If not, electric shock or a fire can result.
- Secure the cables. External forces on the terminals can lead to fire.
- Tighten screws according to the following torque.
  - M4: 0.7 to 1.0 ft·lbs (1.0 to 1.3 N·m)
  - M5: 1.5 to 1.8 ft·lbs (2.0 to 2.5 N·m)
  - M6: 3.0 to 3.7 ft·lbs (4.0 to 5.0 N·m)
  - M8: 6.6 to 8.1 ft·lbs (9.0 to 11.0 N·m)
  - M10: 13.3 to 17.0 ft·lbs (18.0 to 23.0 N·m)
- Set DSW7 on the PCB1 according to each power supply shown in the figure below.

DSW7	Power Supply Setting and Service Setting
208V Unit:	<input type="text" value="Setting is required."/>
230V, 460V Unit:	<input type="text" value="No setting is required."/>
208V, 230V Unit: 230V Setting Before Shipment 460V Unit: 460V Setting Before Shipment	
208V	230V
	
1 2 3 4	1 2 3 4
460V	
	
1 2 3 4	

- Use the specified cables for wiring between the outdoor unit and indoor units. Selecting incorrect cables will cause an electric shock or a fire. Communication cabling shall be a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper. Shielded cable must be considered for applications and routing in areas of high EMI and other sources of potentially excessive electrical noise to reduce the potential for communication errors. When shielded cabling is applied, proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements.
- Tightly secure the electrical wirings to the terminal block according to the specified torque. If tightening the terminals is not completed, heat generation, an electric shock or a fire will occur at the terminal connections.

## 7.1 General Check

- (1) Make sure that the field-supplied electrical components (main power switches, circuit breakers, wires, conduit connectors and wire terminals) have been properly selected according to the electrical characteristics indicated in Table 7.1. Make sure that the components comply with National Electrical Code (NEC) standards.
  - Supply electrical power to each outdoor unit. This equipment can be installed with a Ground Fault Circuit Interrupter (GFCI), which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers / fuses / overcurrent protection switches and wiring in accordance to local, state and NEC codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements. Failure to use a GFCI could result in electric shock or fire.
  - The power sources for the indoor unit and outdoor unit should be supplied respectively. Connect the power supply wiring to each indoor unit group connected to the same outdoor unit. This equipment can be installed with a Ground Fault Circuit Interrupter (GFCI), which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers / fuses / overcurrent protection switches and wiring in accordance to local, state and NEC codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements. Failure to use a GFCI could result in electric shock or fire.
- (2) Check to ensure that the power supply voltage is within  $\pm 10\%$  of the rated voltage. If the power supply voltage is too low, the system cannot start due to the voltage drop.
- (3) Check the size of the electrical wires.
- (4) Communication cabling should be a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper. Shielded cable must be considered for applications and routing in areas of high EMI and other sources of potentially excessive electrical noise to reduce the potential for communication errors. When shielded cabling is applied, proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements.
  - In an instance where the power source for the packaged air conditioner is supplied from the same power transformer as the device with high electricity consumption\*
  - In an instance where the power supply wiring for the device\* and for the packaged air conditioner are located close to each other.

\* Example: Lift, container crane, rectifier for electric railway, inverter power device, arc furnace, electric furnace, large-sized induction motor, and large-sized switch.

In the instances mentioned above, an induction surge of the power supply wiring for the packaged air conditioner could occur due to a rapid change in electricity consumption of the device and activation of the switch. Therefore, check the field regulations and standards before performing electrical work in order to protect the power supply wiring for the packaged air conditioner.
- (5) Check to ensure that the ground cable for the outdoor unit, and indoor unit are connected.

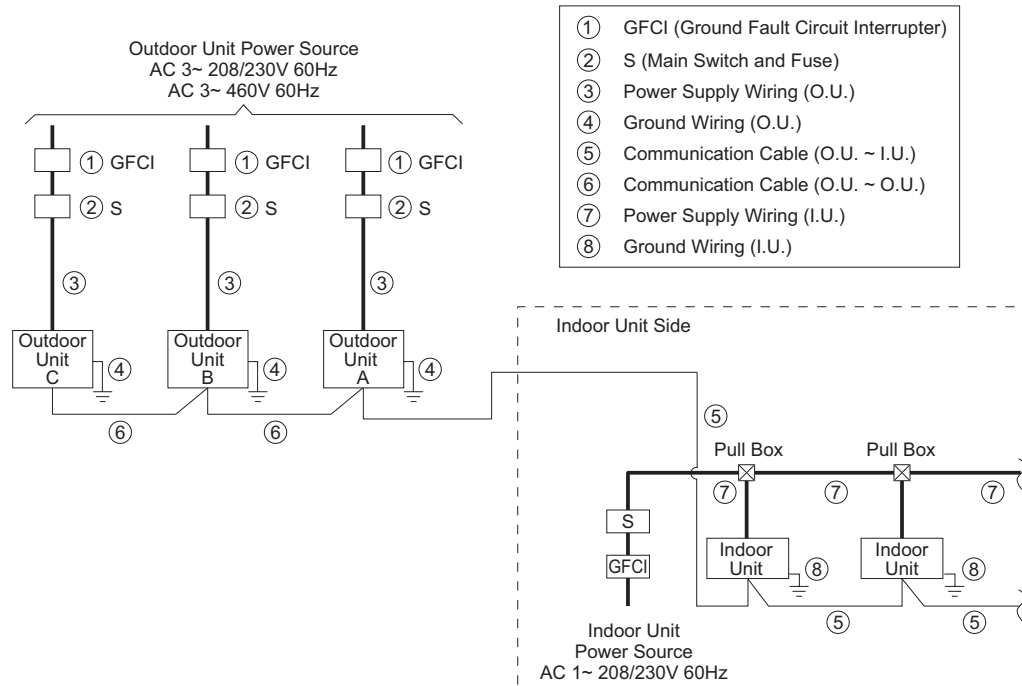
## 7.2 Electrical Wiring Connection

### **WARNING**

- **This equipment can be installed with a Ground Fault Circuit Interrupter (GFCI), which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers / fuses / overcurrent protection switches and wiring in accordance to local, state and NEC codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements. Failure to use a GFCI could result in electric shock or fire.**
- **Perform the electrical work according to the regulations of each region and this manual. A separate, dedicated electrical circuit must be used. If the electrical wiring work is performed incorrectly or there is a capacity shortage of the power circuit, it will cause an electric shock or a fire.**
- **Check that the ground wire is securely connected. If the unit is not correctly grounded, it may lead to an electrical shock.**  
**Do not connect the ground wiring to gas piping, water piping, lighting conductor, or telephone ground cables.**

# (1) Power Source Wiring

Supply the power sources to each outdoor unit and indoor unit group respectively.  
Using this method is a basic principle of power supply wiring.



## (2) Electrical Characteristics

Table 7.1 Electrical Characteristics and Recommended Wiring Size

Model	Outdoor Unit							INV Comp.	
	Hz (Hz)	Voltage (V)	Max. (V)	Min. (V)	MCA (A)	MOP (A)	Max. Fuse (A)	RLA (A)	LRA (A)
(H,Y)VAHP072B31CW	60	208/230	253	188	51/46	72/65	70/60	24.2/22.0	150
(H,Y)VAHP096B31CW	60	208/230	253	188	51/46	72/65	70/60	24.2/22.0	150
(H,Y)VAHP072B41CW	60	460	506	414	24	34	30	15.3	75
(H,Y)VAHP096B41CW	60	460	506	414	24	34	30	15.3	75

Model	Fix Speed Comp.		Fan Motor		Wiring Size		
	RLA (A)	LRA (A)	Output (kW)	FLA (A)	Power Supply Wiring (AWG)	Ground Wiring (AWG)	Communication Cable (AWG)
(H,Y)VAHP072B31CW	28.8/26.0	155	1.2	5.6/5.1	6	6	18
(H,Y)VAHP096B31CW	28.8/26.0	155	1.2	5.6/5.1	6	6	18
(H,Y)VAHP072B41CW	12.2	74	1.2	9	12	12	18
(H,Y)VAHP096B41CW	12.2	74	1.2	9	12	12	18

MCA: Minimum Circuit Ampacity (A)  
 MOP: Maximum Overcurrent Protective Device (A)  
 RLA: Rated Load Ampacity (A)  
 LRA: Locked Rotor Ampacity (A)  
 FLA: Full Load Ampacity (A)

### NOTES:

1. Select wire size based on the value of MCA.
2. MOP is used to select the fuse, circuit breaker, or a Ground Fault Circuit Interrupter (GFCI).
3. Communication cabling shall be a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper. Shielded cable must be considered for applications and routing in areas of high EMI and other sources of potentially excessive electrical noise to reduce the potential for communication errors. When shielded cabling is applied, proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements.

## CAUTION

**Install a multi-pole main switch with a space of 1/8 inch (3.5mm) or more between each phase.**

### NOTES:

1. When the power supply wiring is longer, select the minimum wiring size which the voltage drop is within 2%.
2. Power supply voltage should be satisfied with the followings.
  - Supply Voltage: Rated Voltage within  $\pm 10\%$
  - Starting Voltage: Rated Voltage within  $-15\%$
  - Operating Voltage: Rated Voltage within  $\pm 10\%$
  - Imbalance between Phases: within 3%
3. Do not connect the ground wiring to gas piping, water piping, or a lightening conductor.
  - Gas Piping: An explosion and ignition may occur if there is escaping gas.
  - Water Piping: There is no effective electrical ground provided when hard vinyl piping is used.
  - Lightning Conductor: The electrical potential of the earth increases when a lightening conductor is used.

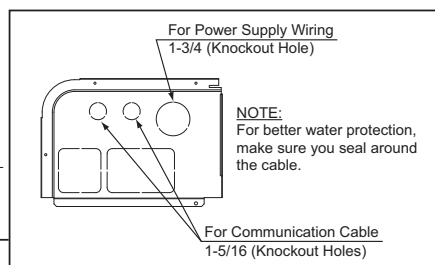
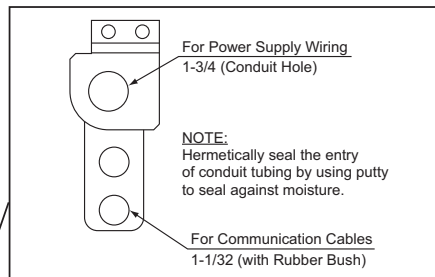
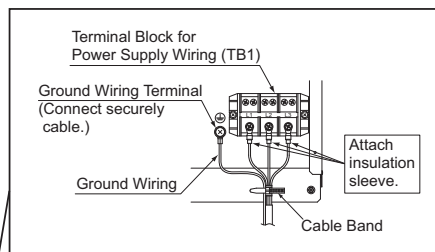
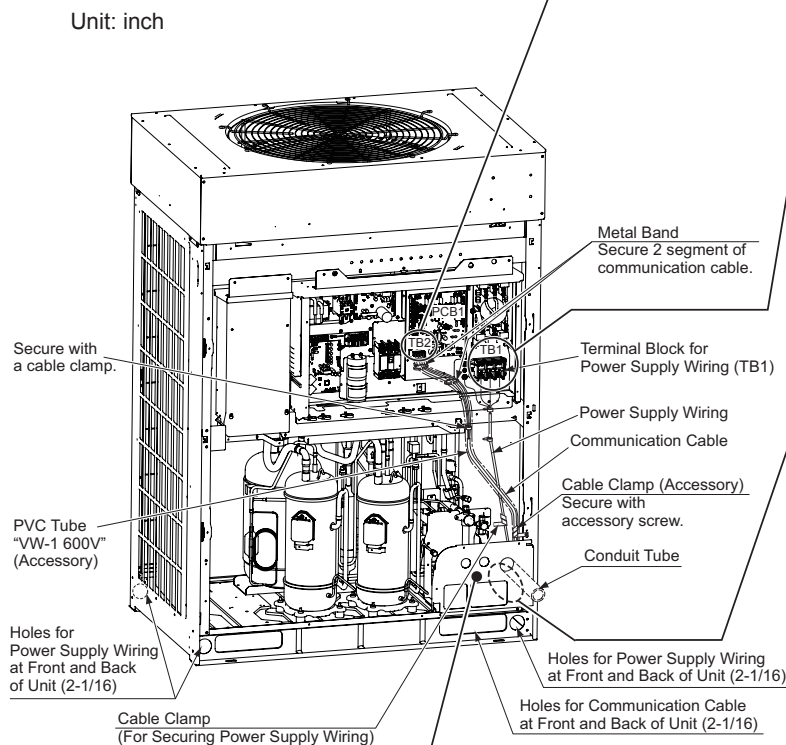
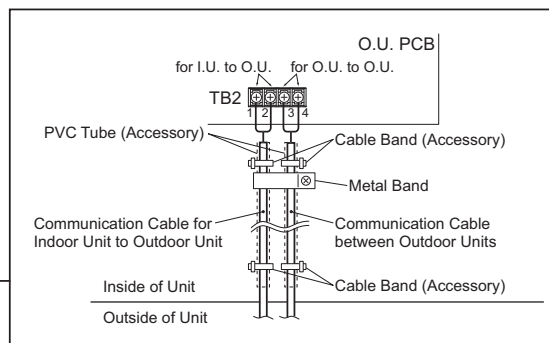
### 7.3 Electrical Wiring for Outdoor Unit

Connect the electrical wiring according to the following figure:

- (1) Connect the power supply wires to L1, L2 and L3 for the three-phase power source on the terminal block TB1 and ground wiring to the terminal in the electrical control box.
- (2) Connect the communication cables between the outdoor and indoor units to the TB2 terminals 1 and 2 on the PCB1. As for the communication cables between outdoor units in the same refrigerant system, connect them to the TB2 terminals 3 and 4 on the PCB1. When shielded cabling is applied (M4), proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements. Communication cabling shall be a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper.
- (3) Insert the communication cables into the PVC tube "VW-1 600V" (Accessory) to separate from the power supply wirings and the communication cables in the outdoor unit. Local codes will need to be followed.  
Then, tighten both ends of the PVC tubing with the cable bands (accessory) in order to secure the PVC tubing to the communication cables.  
When the rated voltage of the communication cables (local code) are 600V or more, it is not required to insert them into the PVC tube "VW-1 600V" (accessory).
- (4) Tighten screws for the terminal block according to the following table.

#### < Required Tightening Torque >

Size	Tightening Torque
M4	0.7 to 1.0 ft·lbs (1.0 to 1.3 N·m)
M5	1.5 to 1.8 ft·lbs (2.0 to 2.4 N·m)
M6	3.0 to 3.7 ft·lbs (4.0 to 5.0 N·m)
M8	6.6 to 8.1 ft·lbs (9.0 to 11.0 N·m)
M10	13.3 to 17.0 ft·lbs (18.0 to 23.0 N·m)



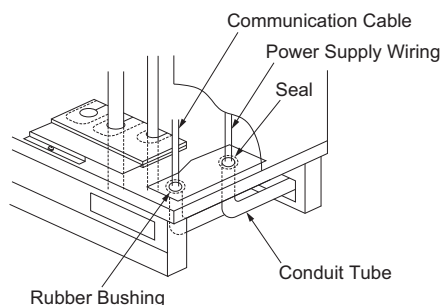
## **! CAUTION**

Be sure to note the following points when running cables under the unit using conduit tubing.  
(The pipe cover needs to be removed before performing piping and wiring.)

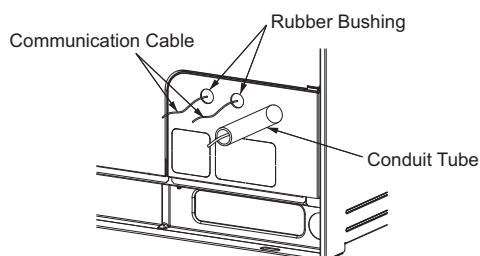
### NOTES:

1. When installing the power supply wiring, use the field-supplied conduit tube as shown below. Remove the rubber bushing from the unit for the conduit tubing installation.
2. When installing the communication cables, run them through the rubber grommet attached to the unit.
3. Maintain at least 5 inch (127mm) between the power supply wiring and communication cables.
4. Prevent cables from touching or rubbing up against refrigerant piping, plate edges, and electrical components inside the unit.
5. Completely seal the end of conduit tube with sealing materials to prevent the rain from entering the conduit tube. (In case of wiring from bottom base)
6. Create a drainage hole at the lowest part of the conduit tube. (In case of wiring from bottom base)

#### ● For Wiring from Bottom Base



#### ● For Wiring from Front Piping Cover



## **! CAUTION**

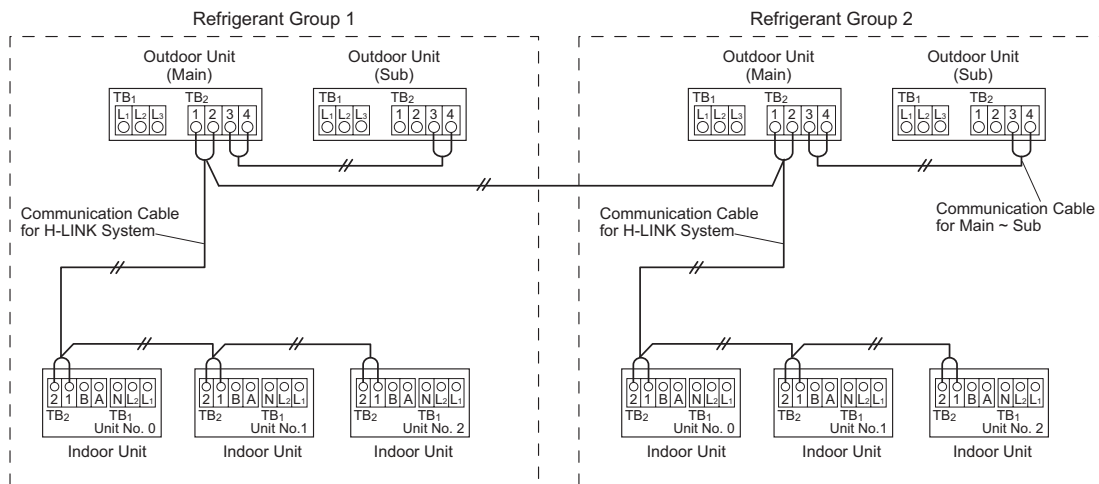
**Tightly secure the power supply wiring using a cable clamp inside the unit.**

### 7.4 Electrical Wiring Connections of Indoor Unit, and Outdoor Unit

- (1) Connect a power supply wiring to each outdoor unit. Connect a Ground Fault Circuit Interrupter (GFCI), fuse, and main switch (S) to each outdoor unit.
- (2) Connect a power supply wiring to each indoor unit group connected to the same outdoor unit. (Total operating current be less than 12A.)  
Connect a Ground Fault Circuit Interrupter (GFCI), fuse, and main switch (S) to each indoor unit group.
- (3) Connect the communication cable between indoor units, and outdoor units, as shown in Figure 7.1.
- (4) Connect the communication cables in the same refrigerant system unit. (If the refrigerant piping of indoor unit is connected to the outdoor unit, also connect the communication cables to the same indoor unit.) Connecting the refrigerant piping and communication cables to the different refrigerant systems may lead to malfunction.
- (5) Use communication cabling that is a minimum of AWG18 (0.82mm<sup>2</sup>), 2-Conductor, Stranded Copper. Shielded cable must be considered for applications and routing in areas of high EMI and other sources of potentially excessive electrical noise to reduce the potential for communication errors. When shielded cabling is applied, proper bonding and termination of the cable shield is required as per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements. (Do not use Tri-Core or anything beyond.)

- (6) Use the same kind of cables in the same H-LINK system.
- (7) Maintain at least 5 inch (127mm) between the communication cables and the power supply wiring, and also min. 5 ft (1.5m) between the communication cables and power supply wiring for other electrical device. If these cables are not secured, sleeve the power supply wiring into the metallic conduit tubing to separate them from the other cables. Make sure power supply wiring are well-grounded.
- (8) Connect the following communication cables to the terminals 1 and 2 on terminal block (TB2) in the outdoor unit A (main unit).
  - between outdoor unit and indoor unit
  - between outdoor unit and outdoor unit in other refrigerant systems
- (9) Do not connect the power supply wiring to the terminal block for transmission wiring (TB2).  
All the printed circuit boards in the same refrigerant system will be damaged.
- (10) Connect the ground wiring to the outdoor/indoor units. The ground wiring work under the condition of 100Ω (max.) ground resistance must be performed by a authorized personnel.
- (\*\*) Connect the communication cables between outdoor units in the same refrigerant system to the terminals 3 and 4 on TB2.

- Communication Cabling



**NOTES:**

1. For the combination units, DSW settings of Main and Sub are required.
2. An alarm occurs if the communication cables between main outdoor unit and sub outdoor units are connected to the terminals 1 and 2 for H-LINK system.
3. In an alarm is triggered on the LCD of Main outdoor unit, follow the "7-segment" display at the Main outdoor unit for verification purposes.
4. Perform a function setting at the Main outdoor unit.
5. Maximum number of refrigerant groups with one central controller is 64 (for H-LINK II).  
Maximum number of indoor units to be connected is 160 (for H-LINK II).





## 7.5 DIP Switch Setting of Outdoor Unit

Turn OFF all power sources before performing settings.

DIP switch settings cannot be set without first disconnecting from the power source. (However, No.1, 2, 4, and 6 pins of DSW4, No.4 pin of DSW7 and push switches can be operated when power source is ON.)

The darkened square "■" indicates the position of DIP switches.

### NOTE

- By using switch DSW4, the unit is started 10 to 20 seconds after the switch adjustment is made.
- To simplify service and maintenance, number this outdoor unit to help distinguish it from the other outdoor units.  
Record the unit number in the box right.

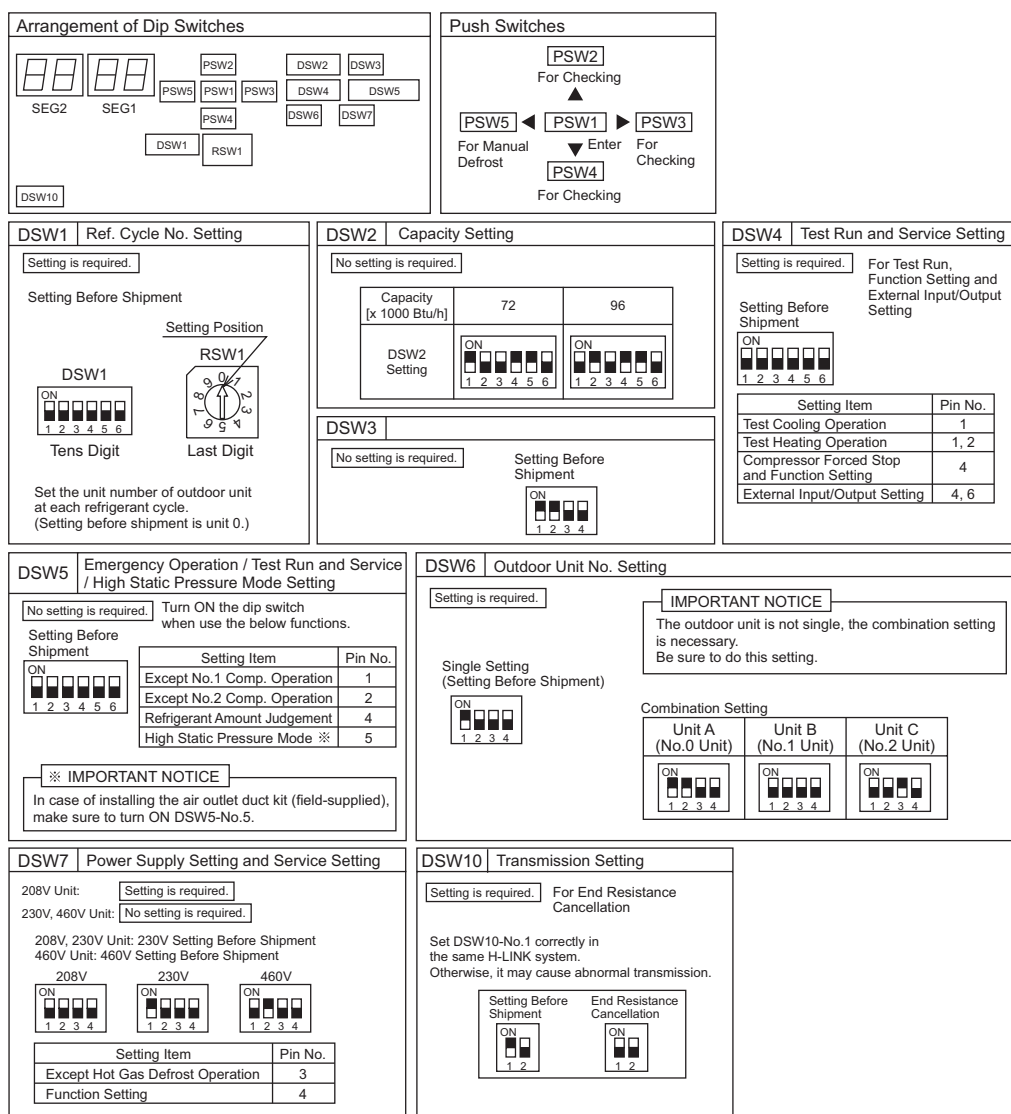
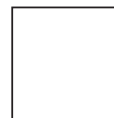


Figure 7.2 DSW Setting

### • High Static Pressure Setting (No.5 pin of DSW5: ON)

Turn ON the No.5 pin of DSW5 for the high static pressure setting.

This setting enables the high static pressure operation up to maximum of 0.24 in.W.G. (60Pa).

#### NOTES:

- In an instance where there are combined outdoor units, set this function for all the outdoor units.
- While the unit operates in a high static pressure mode, the operation sound value increases by 3dB from the nominal value.

- **Setting for Transmitting**

Setting the outdoor unit Nos., refrigerant system Nos. and end terminal resistance for this H-LINK system.

- **Setting of Outdoor Unit No.**

If there are combined outdoor units, set DSW6 as shown below.

Base Unit (Factory Setting)	Combination of Base Unit		
	Unit A (No.0)	Unit B (No.1)	Unit C (No.2)

- **Setting of Refrigerant System No.**

In the same refrigerant system, set the same refrigerant system No. for the outdoor unit and the indoor units as shown below.

Setting outdoor unit refrigerant system No. is required only for the main unit.

The sub unit settings are not required.

As for setting indoor unit refrigerant system No., set RSW2 and DSW5 on the indoor unit PCB.

	Setting Switch	
	10 digit	1 digit
Outdoor Unit	DSW1	RSW1
Indoor Unit (H-LINK II)	DSW5	RSW2

Example: If Setting Refrigerant System No. 25

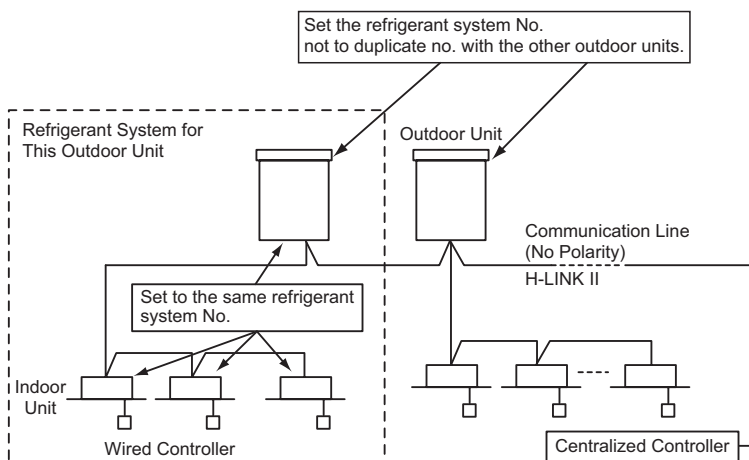
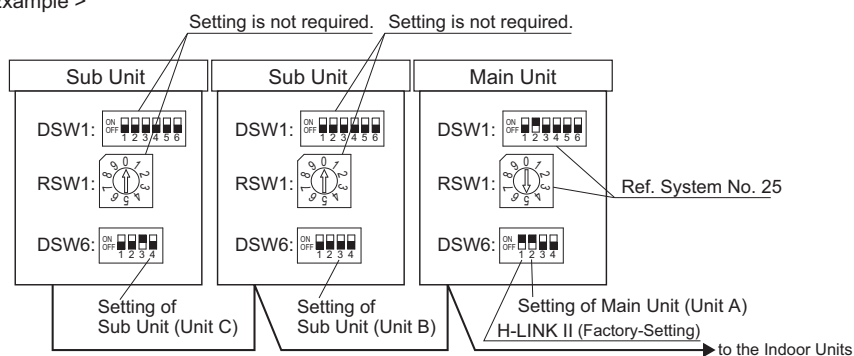


Turn ON No. 2 pin.

Set Dial No.5.

DSW and RSW setting before shipment is 0.  
Maximum in setting refrigerant system No. is 63.

< Setting Example >



Maximum Number of Connectable Outdoor Units and Indoor Units (for H-LINK II)

Outdoor Unit	64
Indoor Unit	160

**NOTE:**

For installing the outdoor unit and the indoor unit on the same communication cable, which cannot be used for H-LINK II, maximum number of connectable indoor units is 128.

### • DSW7 Setting for Rated Voltage

DSW7 is used for setting of rated voltage for the outdoor unit as shown at right.

When the site power source voltage is different from factory setting, a DSW7 setting is required.

#### NOTE:

The same voltage setting is required to the main unit and sub unit(s).

Voltage	DSW7 Setting
208V	<div>ON OFF</div> <div>1 2 3 4</div>
230V	<div>ON OFF</div> <div>1 2 3 4</div>
460V	<div>ON OFF</div> <div>1 2 3 4</div>

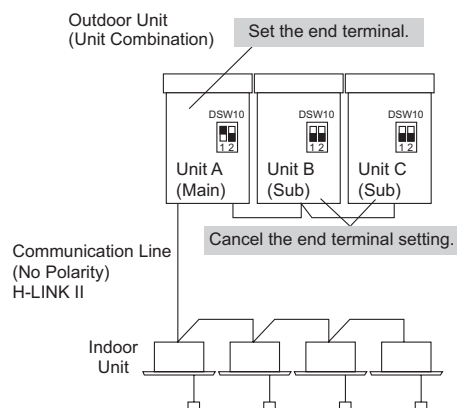
### • Setting of End Terminal Resistance

Before shipment, No.1 pin of DSW10 (for the setting of end terminal resistance) is in the “ON” position.

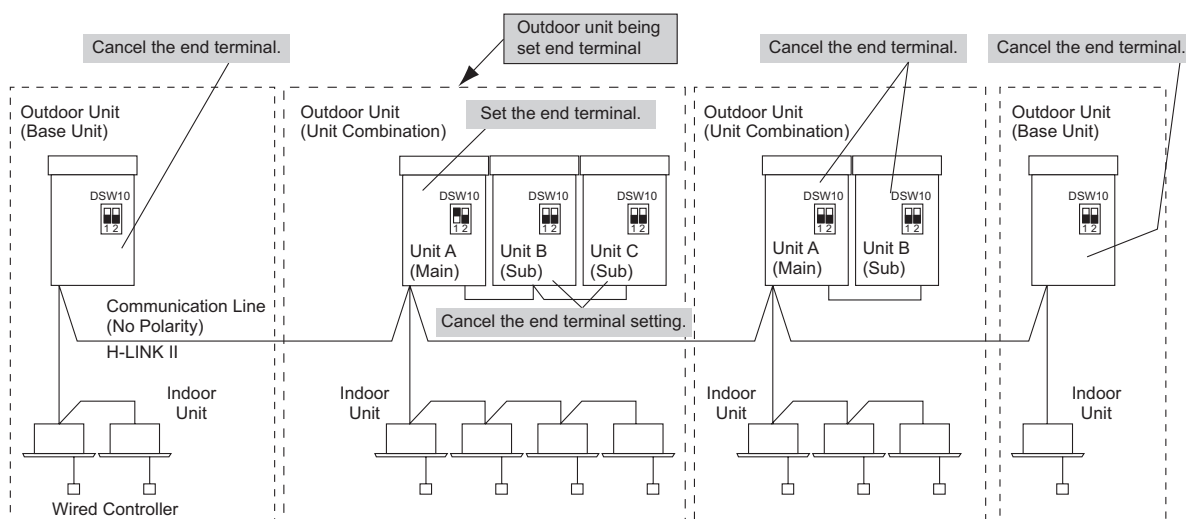
In the case of one refrigerant system in the same H-LINK II, set all No.1 pin of DSW10 in the “OFF” position except the main outdoor unit A.

Setting of End Terminal Resistance DSW10	
Before Shipment	Cancellation
<div>ON OFF</div> <div>1 2</div>	<div>ON OFF</div> <div>1 2</div>

In a situation of one refrigerant system in the same H-LINK II, set all No.1 pin of DSW10 in the “OFF” position except the main outdoor unit A.



If more than one refrigerant system is in the same H-LINK II, set all No.1 pin of DSW10 to the “OFF” position except the main outdoor unit A.



### • Automatic Simple Judgment System for Refrigerant Amount (No.4 pin of DSW5)

This function is NOT available for this outdoor unit.

If No.4 pin of DSW5 is turned ON, 7-segment display flashes “ $\square \square h \square \square$ ”, which means forced termination of this function.

## • Function Setting

### External Input/Output and Function Setting

Make sure to perform external input/output and function setting while the outdoor unit is stopped.  
It cannot be set while the outdoor unit is operating or check mode.

#### [ External Input/Output Setting ]

##### ■ Start of Setting

Turn ON DSW4-No.4.  
Turn ON DSW4-No.6.

External Input/Output Setting Mode

"io 5 f"

For the setting mode, refer to ① below.

##### ■ Exit Setting Mode

Turn OFF DSW4-No.6 during indicated  
External Input/Output Setting Mode.  
Turn OFF DSW4-No.4.

After setting, confirm DSW4 setting is same as setting before shipment,  
and DSW7 setting is correct.

#### [ Function Setting ]

##### ■ Start of Setting

Turn ON DSW4-No.4.  
Turn ON DSW7-No.4.

Function Setting Mode

"Func"

For the setting mode, refer to ② below.

##### ■ Exit Setting Mode

Turn OFF DSW7-No.4 during indicated  
Function Setting Mode.  
Turn OFF DSW4-No.4.

Details of Checking Mode should be  
according to the exhibit of  
"Checking Method by 7-Segment Display"  
attached to the back side of the service cover.

**NOTE:**  
Release "Menu Mode" after  
the setting is completed.  
Otherwise, the air conditioner  
may not operate appropriately.

#### ② [ Function Setting ]

By pressing the push-switches PSW3 (▶) and PSW5 (◀),  
the setting can be changed.  
PSW4 (▼): forward, PSW2 (▲): backward  
Refer to the Service Manual for more details.

Fill out the selected function setting No.  
in the space of the table as shown.

< Example >

1

#### ① [ External Input/Output Setting ]

By pressing the push-switches PSW3 (▶) and PSW5 (◀),  
the function No. can be selected.  
PSW4 (▼): forward, PSW2 (▲): backward

Fill out the selected function setting No.  
in the space of the table as shown.

< Example >

1

Item	SEG2	SEG1	SET
1 Input Setting 1 CN17 [1-2 pin]	1	1	
2 Input Setting 2 CN17 [2-3 pin]	2	2	
3 Input Setting 3 CN18 [1-2 pin]	3	3	
4 Output Setting 1 CN16 [1-2 pin]	0	1	
5 Output Setting 2 CN16 [1-3 pin]	0	2	

(Setting Before Shipment)

Before shipping, the input/output function settings are specified to each  
input/output terminal according to above table. The details of  
function No. and external input/output settings are as shown below.

#### Setting of External Input/Output Function

Function No.	Input	Output
1	Fixing Heating Operation Mode	Operation Signal
2	Fixing Cooling Operation Mode	Alarm Signal
3	Demand Stoppage	Compressor ON Signal
4	Outdoor Fan Motor Start/Stop	Defrost Signal
5	Forced Stoppage	-
6	Demand Current Control 40%	-
7	Demand Current Control 60%	-
8	Demand Current Control 70%	-
9	Demand Current Control 80%	-
10	Demand Current Control 100%	-
11	Low Noise Setting 1	-
12	Low Noise Setting 2	-
13	Low Noise Setting 3	-
0	No Setting	No Setting

The same input/output function setting cannot be set to different  
input/output terminals.  
If set, a setting of larger function number becomes invalid.

Example: When setting of input 1 and input 2 are same, input 2 will be invalid.

Item	SEG2	SEG1	SET
1 Circulator Function at Heating Thermo-OFF	FA	0	
2 Night-Shift (Low Noise)	01	0	
3 Cancellation of Outdoor Ambient Temperature Limit	05	0	
4 Not Prepared	00	0	
5 SLo (Fan Speed) Defrost Setting	04	0	
6 Cancellation of Hot Start	0F	0	
7 Priority Capacity Mode	0U	0	
8 Compressor Frequency Control Target Value for Cooling	0C	0	
9 Compressor Frequency Control Target Value for Heating	0H	0	
10 Indoor Expansion Valve Control Target Value for Cooling	5C	0	
11 Indoor Expansion Valve Control Target Value for Heating	5H	0	
12 Indoor Expansion Valve Opening during Heating Operation Stoppage	51	0	
13 Indoor Expansion Valve Opening Limit during Heating Thermo-OFF	50	0	
14 Indoor Expansion Valve Initial Opening during Heating Thermo-ON	01	0	
15 Indoor Expansion Valve Initial Opening for Cooling	06	0	
16 Outdoor Expansion Valve Initial Opening for Heating	07	0	
17 Sound Reduced Function	0B	0	
18 Demand Function Setting	0E	0	
19 Wave Function Setting	0E	0	
20 Protection of Decrease in Outlet Temperature for Cooling	06	0	
21 Outlet Temperature Control (DOAS)	0F	0	
22 Adjustment of Fan Rotation (for multiple installation)	00	0	
23 Not Prepared	0F	0	
24 Thermo-OFF Setting for Outdoor Unit After Defrosting Operation	05	0	
25 Energy Saving Mode	01	0	
26 Crankcase Heater Control during Stoppage	02	0	
27 Changing Time for Indoor Fan Hot Start	03	0	
28 Intermittent Operation of Outdoor Fan Motor	04	0	
29 Indoor Expansion Valve Control Target Value for Cooling (Only for 4-Way Cassette Type)	05	0	
30 Indoor Expansion Valve Opening Limit during Heating SW-OFF	06	0	
31 Invalid Capacity Control by Compressor for Cooling	07	0	
32 Forced Defrosting after Enforced Stoppage during Defrosting Cycle	08	0	
33 Changing Application Range for Hot Gas Defrost Operation	09	0	
34 Changing Available Operating Range for Demand Control	0C	0	
35 Changing Unit	0D	0	

## 8. Additional Refrigerant Charge

### 8.1 Airtight Test

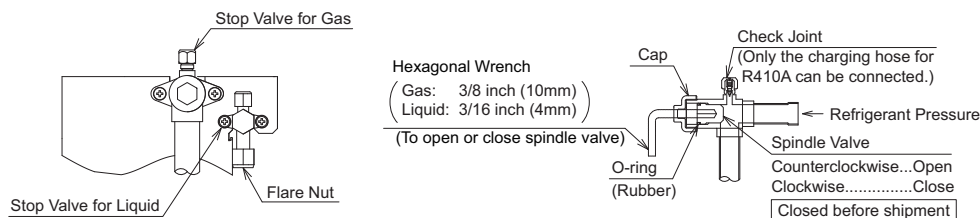
- (1) Check to ensure that spindles of the stop valves for gas and liquid pipes are closed completely before airtight test.
- (2) The refrigerant used for this outdoor unit is R410A. Use the manifold gauge and the charging hose for exclusive use of R410A.

#### < Tightening Check of Stop Valves >

After connecting the pipe, remove the caps of stop valves for gas and liquid. Tighten the open-close spindle in the closing direction according to the following tightening torque.

#### • Caution for Operation of Stop Valves

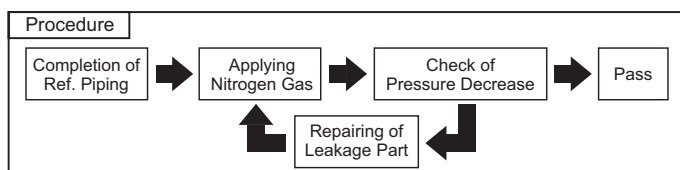
- (a) Remove the stop valve caps before performing the airtight test after connecting the refrigerant piping. Tighten the spindle (valve) in clockwise direction.
- (b) Perform the work after warming the spindle with a hair dryer etc. when controlling the stop valve in a cold area. (The spindle O-ring will harden at low temperature, causing the O-ring material to contract by volume, and refrigerant leakage can occur.)
- (c) Do not apply excessive force after fully opening the spindle (Tightening Torque: < 3.7 ft·lbs (5.0 N·m)). (A back seat (hard stop), is not provided, allowing complete removal of the valve stem.)
- (d) Tighten caps securely according to the following torque specifications after each spindle valve is opened.



ft·lbs (N·m)						
Spindle (Valve)		Flare Nut	Cap		Check Joint	
Gas Valve	Liquid Valve	Liquid Valve	Gas Valve	Liquid Valve	Gas Valve	Liquid Valve
18 (25)	5 (7)	26 (35)	31 - 35 (42 - 47)	19 (25)	6 - 7 (8 - 10)	8 (11)

### < Airtight Test Method >

- (1) Connect the manifold gauge to the check joints of the liquid line and the gas line stop valves using charging hoses with a vacuum pump or a nitrogen cylinder.  
Perform the airtight test.  
Do not open the stop valves. Apply nitrogen gas pressure of 601 psi (4.15MPa).  
For checking gas leakage, use the leak detector or forming agent. If there is any leakage, fix the leaking part.
- (2) For checking gas leakage, do not use a forming agent which generates ammonia.  
Additionally, do NOT use any household detergent as forming agent with potentially unknown or harmful ingredients.  
The recommended forming agent to detect leaking refrigerant gas is shown below.



Recommended Forming Agent	Manufacturer
Güproflex	Yokogawa & CO.,Ltd

### NOTE:

Nitrogen Gas should be sufficiently charged for each check joints (gas line side, and for liquid line side).  
If not performed in this manner, the expansion valve for the outdoor unit, or indoor unit can close up, making any airtight test impossible.

## ! WARNING

**Be sure to use nitrogen gas for the airtight test. If other gases such as oxygen gas, acetylene gas or fluorocarbon gas are accidentally used, it may cause an explosion or gas asphyxiation.**

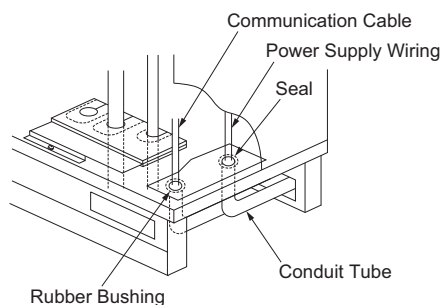
### < Insulation Work >

- (1) Securely insulate the gas piping side and liquid piping side individually.  
Make sure to insulate the union flare nut for the piping connection as well.
- (2) Seal the gap between the bottom base or front piping cover and pipes with the insulation.

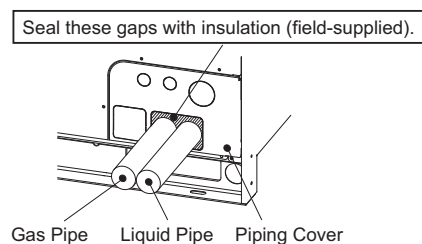
### NOTICE:

If the gap is not sealed, damage can occur from rain, snow, animals, or insects that can gain entry.

#### ● For Wiring from Bottom Base



#### ● For Piping from Front Piping Cover



## 8.2 Vacuuming

- (1) Connect a manifold gauge and vacuum pump to the check joints (Gas Stop Valve and Liquid Stop Valve).
- (2) Continue vacuum pumping work until the pressure reaches -14.5 psi (-0.1MPa, -756mmHg) or lower for one to two hours.  
Once the desired vacuum pressure has been reached, turn OFF the pump and leave the gauge for one hour. Verify that the pressure inside the manifold gauge has not increased.
- (3) Tighten the caps on the check joint according to torque specs (as indicated in Section 8.1-(2)-(d), after vacuum pumping work is complete.
- (4) If the pressure inside the gauge does not reach -14.5 psi (-0.1MPa, -756mmHg), a gas leak is suspected.
- (5) Inspect for any gas leakage once again. If no leakage exists, resume vacuum pumping for another one to two hours. If moisture remains inside the piping, the compressor may be damaged.

## NOTICE

1. Use tools or measuring instruments exclusively devised for use with R410A.
2. DO NOT perform vacuum pumping work with the valves of the outdoor units open. Otherwise, refrigerant charged before shipment can leak out and the operation can result in failure.

## 8.3 Charging Work

- (1) An additional refrigerant charge is required according to total piping length. Refer to Table 8.1.
- (2) After vacuum pumping work, check that the gas valve, and liquid stop valve are fully closed. Charge the additional refrigerant from the check joint of liquid stop valve (acceptable error must be within 1.1 lbs (0.5 kg)).
- (3) After refrigerant has been charged, fully open the liquid stop valve and gas stop valves.

### NOTE:

Gas remaining at the O-ring or screw component may emit a hissing sound when removing the spindle cap. However, this is not leaking gas.

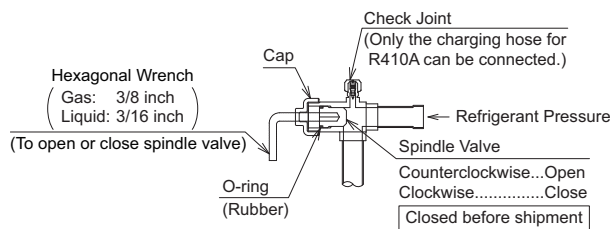
- (4) If it proves impossible to dispense the specified (charged) quantity of refrigerant, follow the procedure below.
  - (a) Fully open the stop valve at the gas line side.

## NOTICE

Do not apply excessive force to the spindle valve after fully opening the spindle. Otherwise, the spindle valve will blow out due to refrigerant pressure. At the test run, fully open the spindle valve. Otherwise, these devices will be damaged. (It is closed before shipment.)

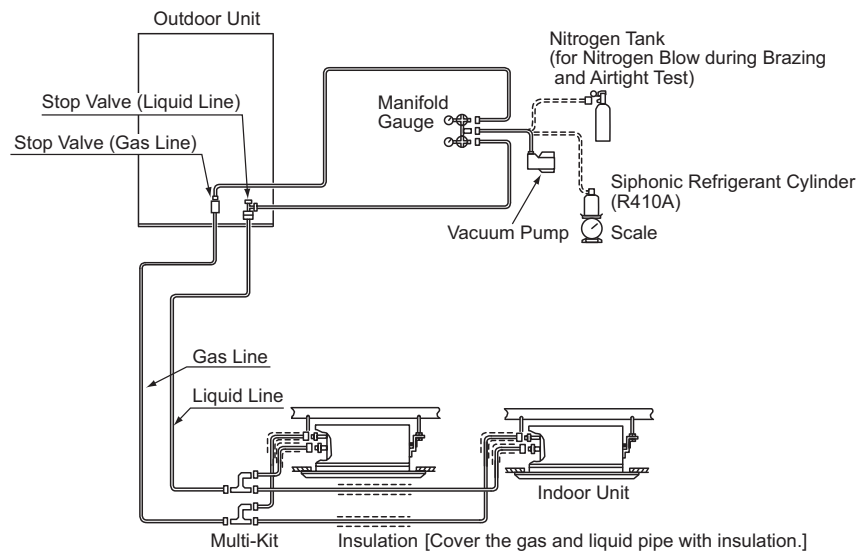
### < Caution for Opening Stop Valve >

1. Do not apply an excessive force after fully opening the spindle (Tightening Torque: < 3.7 ft·lbs (5.0 N·m)). (This valve does not have a hard stop when opening, and allows for the complete removal of the valve stem.)
2. Securely tighten the caps according to the torque specs (Section 8.1-(2)-(d) after each spindle valve is opened.





- (b) Operate the compressor in the cooling mode and charge the additional refrigerant from the check joint of the liquid stop valve. An acceptable error must fall within 1.1 lbs (0.5 kg). At this time, keep the liquid stop valve slightly open.
- (c) After the refrigerant is charged, fully open the liquid stop valve and the gas stop valve.
- (d) Carefully calculate any additional refrigerant quantity for charging. If the quantity of additional refrigerant is not correct, it might cause a compressor failure. The additional refrigerant must be charged in a liquid condition.
- (e) Refrigerant charge from the check joint on the gas stop valve can lead to compressor failure. Be sure to charge refrigerant from the check joint on the liquid stop valve.



Charge the correct refrigerant quantity according to Table 8.1. If not, a compressor may be damaged due to an excess or insufficient refrigerant charge.

Refrigerant charge from check joint of gas stop valve may lead to compressor failure. Be sure to charge refrigerant from the check joint of liquid stop valve.

Insulate the liquid piping and gas piping completely to avoid decreasing of performance and dewing on the surface of the pipe.

Insulate the flare nut and union of the piping connection with insulation.

Check to ensure that there is no gas leakage. If a large refrigerant leakage occurs, it will cause difficulty with breathing or harmful gases would occur if a fire was being used in the room.

## 8.4 Additional Refrigerant Charge Calculation

Table 8.1 Additional Refrigerant Charge Calculation

Although this unit has been charged with refrigerant, an additional refrigerant charge is required according to piping length.

Determine what additional quantity of refrigerant according to the following procedures, and charge it into the system. Record the additional refrigerant quantity to facilitate maintenance and servicing activities thereafter.

### (1) Calculating Method of Additional Refrigerant Charge (WT lbs)

No.	Symbol	Contents	Additional Charge																																														
1	W1	<div>① Additional Refrigerant Charge Calculation for Liquid Piping (W1 lbs)</div> <table><tr><th>Pipe Diameter inch (mm)</th><th>Total Piping Length (ft)</th><th>Refrigerant Amount for 1 ft Pipe</th><th>Additional Charge (lbs)</th></tr><tr><td>7/8 (22.2)</td><td></td><td>× 0.24 =</td><td></td></tr><tr><td>3/4 (19.05)</td><td></td><td>× 0.17 =</td><td></td></tr><tr><td>5/8 (15.88)</td><td></td><td>× 0.11 =</td><td></td></tr><tr><td>1/2 (12.7)</td><td></td><td>× 0.074 =</td><td></td></tr><tr><td>3/8 (9.52)</td><td></td><td>× 0.038 =</td><td></td></tr><tr><td>1/4 (6.35)</td><td></td><td>× 0.016 =</td><td></td></tr><tr><td colspan="3">Total Additional Charge For Liquid Piping =</td><td></td></tr></table> <div>② Minimum Additional Refrigerant Change for Liquid Piping (lbs)</div> <table><tr><th>Outdoor Unit Type (x 1,000 Btu/h)</th><td>72</td><td>96</td><td>144</td><td>168</td><td>192</td><td>288</td></tr><tr><th>Minimum Additional Refrigerant Charge</th><td>4.4</td><td>4.4</td><td>8.8</td><td>8.8</td><td>8.8</td><td>13.2</td></tr></table> <p>In case the calculated quantity (①) is less than the minimum quantity (②) then add ② as the additional refrigerant charge quantity for liquid piping (W1).</p>	Pipe Diameter inch (mm)	Total Piping Length (ft)	Refrigerant Amount for 1 ft Pipe	Additional Charge (lbs)	7/8 (22.2)		× 0.24 =		3/4 (19.05)		× 0.17 =		5/8 (15.88)		× 0.11 =		1/2 (12.7)		× 0.074 =		3/8 (9.52)		× 0.038 =		1/4 (6.35)		× 0.016 =		Total Additional Charge For Liquid Piping =				Outdoor Unit Type (x 1,000 Btu/h)	72	96	144	168	192	288	Minimum Additional Refrigerant Charge	4.4	4.4	8.8	8.8	8.8	13.2	lbs
Pipe Diameter inch (mm)	Total Piping Length (ft)	Refrigerant Amount for 1 ft Pipe	Additional Charge (lbs)																																														
7/8 (22.2)		× 0.24 =																																															
3/4 (19.05)		× 0.17 =																																															
5/8 (15.88)		× 0.11 =																																															
1/2 (12.7)		× 0.074 =																																															
3/8 (9.52)		× 0.038 =																																															
1/4 (6.35)		× 0.016 =																																															
Total Additional Charge For Liquid Piping =																																																	
Outdoor Unit Type (x 1,000 Btu/h)	72	96	144	168	192	288																																											
Minimum Additional Refrigerant Charge	4.4	4.4	8.8	8.8	8.8	13.2																																											
2	W2	<p>Depending on connection of indoor unit type, additional refrigerant charge is required. Select adequate refrigerant amount from the table below.</p> <p>Additional Refrigerant Charge for Each Indoor Unit Connected (W2 lbs)</p> <table><tr><th>Capacity (x 1,000 Btu/h)</th><td>6</td><td>8</td><td>12</td><td>15</td><td>18</td><td>24</td><td>30</td><td>36</td><td>48</td></tr><tr><th rowspan="2">Indoor Unit Type</th><td>(H,Y)IDM***B21S</td><td>0</td><td>0</td><td>0.26</td><td>0.35</td><td>0.55</td><td>0.66</td><td>1.1</td><td>0</td></tr><tr><td>(H,Y)IC4***B21S</td><td>-</td><td>-</td><td colspan="2">0.55</td><td colspan="2">1.1</td><td colspan="2">-</td></tr></table> <p><b>NOTE:</b> Maximum additional refrigerant charge must not exceed 4.4 lbs.</p>	Capacity (x 1,000 Btu/h)	6	8	12	15	18	24	30	36	48	Indoor Unit Type	(H,Y)IDM***B21S	0	0	0.26	0.35	0.55	0.66	1.1	0	(H,Y)IC4***B21S	-	-	0.55		1.1		-		lbs																	
Capacity (x 1,000 Btu/h)	6	8	12	15	18	24	30	36	48																																								
Indoor Unit Type	(H,Y)IDM***B21S	0	0	0.26	0.35	0.55	0.66	1.1	0																																								
	(H,Y)IC4***B21S	-	-	0.55		1.1		-																																									
3	W3	<p>Calculation Method for Additional Refrigerant Charge (W3 lbs)</p> <p>The additional refrigerant charge must be 2.2 lbs per indoor unit which is 072 MBH or more.</p> <div><div></div> unit × 2.2 lbs/unit = <div></div></div>	lbs																																														
4	W4	<p>The Ratio of Indoor Unit Connection Capacity (Indoor Unit Total Capacity/Outdoor Unit Capacity) Additional Charge (W4 lbs)</p> <p>Determine the ratio of indoor unit connection capacity.</p> <table><tr><th>Condition</th><th>Refrigerant Amount</th></tr><tr><td>I.U. Capacity Ratio is less than 100%</td><td>0.0 lbs</td></tr><tr><td>I.U. Capacity Ratio is 100% or more</td><td>1.1 lbs</td></tr></table>	Condition	Refrigerant Amount	I.U. Capacity Ratio is less than 100%	0.0 lbs	I.U. Capacity Ratio is 100% or more	1.1 lbs	lbs																																								
Condition	Refrigerant Amount																																																
I.U. Capacity Ratio is less than 100%	0.0 lbs																																																
I.U. Capacity Ratio is 100% or more	1.1 lbs																																																
5	WT	<p>Calculation of Additional Charge (WT lbs) = W1 + W2 + W3 + W4 =</p> <p><b>NOTE:</b> When the total capacity of the following indoor unit connected is 50% or more of the outdoor unit capacity, then add <b>1.2 times</b> of the above total additional refrigerant charge (WT).</p> <ul style="list-style-type: none"><li>● 4-Way Cassette Type: (H,Y)IC4***B21S</li><li>● 1-Way Cassette Type: (H,Y)IC1***B21S</li><li>● Wall Mount Type: TIWM***B21S</li></ul>	lbs																																														

**NOTE:**

Ensure that the total additional charge WT does not exceed the maximum additional refrigerant charge quantity as shown in the table on the following page.

< Max. Additional Refrigerant Charge Quantity Allowed >

Outdoor Unit Capacity (x 1,000 Btu/h)	72, 96	144 - 192	288
Max. Additional Ref. Charge Quantity (lbs)	61.7	112.5	138.9

< Initial Ref. Charge Amount of O.U. (Before Shipment) (W0 lbs) >

Outdoor Unit Capacity (x 1,000 Btu/h)	72, 96
W0 Outdoor Unit Ref. Charge (lbs)	17.0

**NOTE:**

W0 is the outdoor unit refrigerant charge prior to shipment.

If there is a combination of base units, calculate the total refrigerant charge prior to shipment of those combined outdoor units.

(2) Record of Additional Charge

Total refrigerant charge of this system is calculated in the following formula.

$$\text{Total Ref. Charge} = \text{WT lbs} + \text{W0 lbs} = \boxed{\phantom{000}} \text{ lbs}$$

**NOTE:**

When refrigerant is recovered or charged due to repairs, operating, or adjusting the unit, record the refrigerant quantity again.

## NOTICE

1. Emissions of the fluorocarbons without any reason are prohibited.
2. For disposal and maintenance of this product, recovery of fluorocarbons is required.

### 8.5 Automatic Simple Judgment System for Refrigerant Amount

#### NOTE

1. This function is applicable when outdoor air temperature is 32 to 109°F DB (0 to 43°C DB) and indoor air temperature is 50 to 90°F DB (10 to 32°C DB).
2. An operation check or condition check shall be performed by checking the PCB1 for the outdoor unit. During the checking, do not remove the front cover. Otherwise, the checking will not be conducted normally due to pressure increase. For combination outdoor unit, the inspection shall be conducted at Unit A. Service covers for Unit B, or C must be closed.

- (1) Refrigerant quantity check operation can be performed using the automatic judgment function after completing refrigerant charging, but depending on the installation and conditions, the result may be judged as excessive refrigerant, insufficient refrigerant, or abnormal termination. Therefore, charge with the refrigerant amount calculated in the previous section regardless of this automatic judgment function result.

< Procedure of Refrigerant Quantity Check Operation >

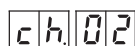
- (a) Reassemble all cover except for the electrical control box cover and service cover of Unit A.  
 (b) Turn ON the power supply of indoor unit and outdoor unit in the refrigerant system to perform the refrigerant quantity check operation. (Apply power to the outdoor unit(s) at least 12 hours prior to operation of the system for preheating of the compressor oil.)  
 (c) Turn ON the No.4 pin of DSW5 (PCB1).  
 The 7-segment display will be indicated as follows.



- (d) Check the 7-segment display and press PSW1. The outdoor fan and compressor will be in standby mode and the 7-segment display will indicate as follows: (Maximum five minutes)

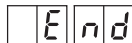





The outdoor fan and compressor will activate and the 7-segment display will indicate as follows:



- (2) Judgment takes 30 to 40 minutes. Refer to the table below for results.  
 When the judgment result is excessive refrigerant, insufficient refrigerant, or abnormal termination, find out the cause of irregularity and perform the refrigerant quantity check again.

< Judgment Result Indication >

7-segment Indication	Result	Remarks
	Sufficient Refrigerant	The refrigerant quantity is sufficient. * Turn No.4 pin of DSW5 OFF and perform Test Run.
	Excessive Refrigerant	The refrigerant quantity is excessive. * Calculate the additional refrigerant quantity according to the piping length. Collect the excess refrigerant and charge with the correct amount of refrigerant.
	Insufficient Refrigerant	The refrigerant quantity is insufficient. * Check if the additional refrigerant has been charged. * Calculate the additional refrigerant quantity according to the piping length and charge the refrigerant. <b>NOTE:</b> If the deficit reading still does not disappear, charge the additional refrigerant . In that case, standard additional refrigerant quantity is 1.1 lb (0.5kg) per one time.
	Abnormal Termination	Find out the cause of abnormal termination as shown below. After resolving the cause of abnormal termination, restart the check refrigerant quantity operation. (1) Was the No.4 pin of DSW5 ON before the power supply was turned ON? (2) Are all indoor units ready and waiting, before the No.4 pin of DSW5 is turned ON? (3) Was the outdoor ambient air temperature within the acceptable range (32 to 109°F DB (0 to 43°C DB)? (In some cases, when the connected indoor unit number exceeds the recommended number and the outdoor ambient air temperature exceeds 95°F DB (35°C DB), this check refrigerant quantity operation cannot be performed.) (4) Is the indoor ambient air temperature within the acceptable range (50 to 90°F DB (10 to 32°C DB)? (5) Is the total indoor units operation capacity ratio 30% (indoor units capacity ratio), or less? Especially, if the indoor ambient air temperature is 15% or less, the total indoor unit operation capacity will be 30% (indoor units capacity ratio) or less and if this is the case, sometimes this refrigerant quantity check cannot be performed. (6) Is switch No.4 pin of DSW4 (compressor-forced stoppage) OFF?

- (3) Turn OFF the No.4 pin of DSW5 when the refrigerant quantity becomes sufficient.  
Wait for at least three minutes after turning OFF the No.4 pin of DSW5 OFF and then the outdoor unit is ready to run.

**NOTE:**

During the check of refrigerant quantity operation, the 7-segment display may change over to display the protection control code by the activation of protection control. However, this is normal. As for the protection control code, refer to the spec sheet attached to the inside of the outdoor unit service cover.

- Special Attention Regarding Refrigerant Gas Leakage

Pay attention to the critical gas concentration to avoid accidental refrigerant gas leakage before installing air conditioning systems.

$$\frac{\text{Totally Charged Refrigerant Quantity in System (lbs)}}{\text{Room Space for each Indoor Unit (ft}^3\text{)}} \leq \text{Critical Concentration (lbs/ft}^3\text{)}$$

0.019 lbs/ft<sup>3</sup> (0.3 kg/m<sup>3</sup>) \*

↑

\* In case of KHK S 0010, this value should be decided according to each country's regulation.

If the calculated critical concentration is higher than 0.019 lbs/ft<sup>3</sup> (0.3kg/m<sup>3</sup>), take the following actions:

- 1) Provide a gas leakage detector and exhaust fan(s) controlled by its gas leakage detector.
- 2) Provide each effective opening at the wall or door for ventilation to next door so that the critical gas concentration can be maintained lower than the above value.  
(Provide an opening of more than 0.15% of the floor surface at the lower part of a door.)

## ⚠ CAUTION

1. Maximum Permissible Concentration of HFC GAS R410A

The refrigerant R410A is an incombustible and non-toxic gas.

However, if leakage occurs and gas fills a room, it may cause suffocation. The maximum permissible concentration of HFC gas, R410A in air is 0.019 lbs/ft<sup>3</sup> (0.3 kg/m<sup>3</sup>), according to the refrigeration and air conditioning facility standard (KHK S 0010) by the KHK (High Pressure Gas Protection Association) Japan. Therefore, some effective measure must be taken to lower the R410A concentration in air below 0.019 lbs/ft<sup>3</sup> (0.3 kg/m<sup>3</sup>), in case of leakage.

As for R410A, this consideration is applied similarly.

2. Calculation of Refrigerant Concentration

- (1) Calculate the total quantity of refrigerant R (lbs) charged into the system connecting all the indoor units, rooms.
- (2) Calculate the room space where this unit is to be installed V (ft<sup>3</sup>) of each room.
- (3) Calculate the refrigerant concentration C (lbs/ft<sup>3</sup>) of the room according to the following equation.

$$\frac{R: \text{Total Quantity of Charged Refrigerant (lbs)}}{V: \text{Room Space Where This Unit Is to Be Installed (ft}^3\text{)}} = C: \text{Refrigerant Concentration} \leq 0.019 \text{ lbs/ft}^3 (0.3 \text{ kg/m}^3) *$$

If local codes or regulations are specified, follow them.

## 9. Test Run

Test Run should be performed in accordance with Section 9.2. Use Table 9.1 for recording the Test Run.

### **WARNING**

**An electrical shock will occur if there is residual voltage.**

**Turn OFF power at the power source completely before attempting any electrical maintenance work. Verify that no residual voltage exists after turning OFF the power at the power source.**

### **NOTICE**

Do not activate the system until all issues have been examined and cleared.

Test Run of indoor unit: refer to the installation and maintenance manual which is attached to the indoor unit.

### 9.1 Before Test Run

- (1) Check to ensure that the refrigerant piping and communication lines between indoor and outdoor units are connected into the same refrigerant system. If not, the result will be abnormal operation with a potentially serious accident.  
Verify that all DIP switch settings for the refrigerant system numbers: (DSW1 and RSW1 [O.U.], DSW5 and RSW2 [I.U.]) and the unit number (RSW) for indoor units are applicable to the system.  
Confirm that all DIP switch settings on the printed circuit board for indoor and outdoor units are correct. Pay special attention to the setting for outdoor unit number, the refrigerant system number, and end terminal resistance. Refer to Section 7; "Electrical Wiring".
- (2) Verify that electrical resistance is more than 1 megaohm, by measuring the resistance between ground and the terminal for electrical components. If the electrical resistance is less than 1 megohm, do not operate the system until the source of electrical current outflow is found and fixed; (Refer to "Caution for Insulation Resistance" for details.)  
Do not impress the voltage on the terminals for communication lines; (Outdoor Unit: TB2 1, 2, 3, 4 / Indoor Unit: TB2 A, B, 1, 2). Otherwise, failure can result.
- (3) Verify that each wire, L1, L2, and L3, is correctly connected at the power source.  
If any one of those is incorrectly connected, the unit will not operate and the wired controller will display the alarm code "05". In this case, check and change the phase of the power source according to the spec sheet attached to the reverse back surface of the service cover.
- (4) Apply power to outdoor unit(s) at least 12 hours prior to operation of the system to allow for adequate pre-heating of the compressor oil.  
The outdoor unit does not operate for at most four hours after power supply (Stoppage Code d1-22). If operation resumes within four hours, release the protection control as follows:
  1. Supply power to the outdoor unit.
  2. Wait for 30 seconds.
  3. Push PSW5 on the outdoor PCB for more than three seconds in order to release the d1-22.If using a wired controller for release:
  - \* Press and hold "Menu" and "Back/Help" simultaneously for at least 3 seconds. The test run menu will be displayed.
  - \* Press "Δ" or "▽" to select "Cancel Preheating Control". Press "OK" and cancel the pre-heating control.

**NOTE:**  
As for other controllers, refer to the "Installation and Maintenance Manual" attached to each controller.
- (5) Be sure to close the service cover at the front lower side when the test run is performed.

## **CAUTION**

### **Caution for Insulation Resistance**

If the total unit insulation resistance is lower than one megaohm, the compressor insulation resistance may be lower, due to refrigerant being retained in the compressor. This can occur if the unit has not been used over prolonged periods of time.

1. Disconnect the cables to the compressor and measure the insulation resistance of the compressor itself. If the resistance value is over one megaohm, then an insulation failure has occurred in other electrical parts.
2. If the insulation resistance is less than one megaohm, reconnect the compressor cables from the inverter PCB. Then, turn on the main power to apply current to the crankcase heater.  
After applying current for more than three hours, measure insulation resistance again. (Depending on the air conditions, length of piping, or refrigerant conditions, it may be necessary to apply the current for a longer period of time.)

If the GFCI (Ground Fault Circuit Interrupter) is activated, check the recommended size shown in Table 7.1.

## **NOTICE**

Confirm that field-supplied electrical components (main switch fuse, fuse-free breaker, Ground Fault Circuit Interrupters (GFCI's) breakers, wires, conduit connectors and wire terminals) have been properly selected according to the electrical data shown in Table 7.1, and ensure that these components comply with national and local electrical codes.

## 9.2 Test Run

This test run method is for the wired controller. As for other controllers, refer to the "Installation and Maintenance Manual" attached to each controller.

- (1) Check to ensure that stop valves for gas and liquid of the outdoor unit are fully opened.  
(In the case of combined outdoor units, check to ensure that all stop valves of the outdoor units are fully opened.)
- (2) Perform the test run of indoor units one by one sequentially, and then check the accordance of the refrigerant piping system and the electrical wiring system. (If the multiple indoor units are operated simultaneously, the system accordance cannot be inspected.)
- (3) Perform the test run according to the following procedure. Ensure that the unit operates without any problem.

**NOTE:**

In the case that two controllers (main and sub) are installed to the system, perform the test run from the main controller.

< Test Run by Wired Controller >

- (a) Press and hold "Menu" and "Back/Help" simultaneously for at least 3 seconds. The test run menu will be displayed.

- (b) Select "Test Run" by pressing " $\Delta \nabla$ " and press "OK".

The test run screen will be displayed.

- The total number of indoor units connected are displayed on the Liquid Crystal Display (LCD). A twin combination (one set with two indoor units) is identified as "2 units", and a triple combination (of one set with three indoor units) is identified as "3 units".

**NOTE:**

When a "00 unit" is identified, the auto-address function may be activated. Cancel "Test Run" mode and reset it.

- If the indicated number is not equal to the actual number of connected indoor units, the auto-address function is not performed correctly due to incorrect wiring, or electronic noise (EMI). Turn OFF the power supply, and correct the wiring after checking the following areas: (Do not repeat turning ON and OFF within 10 seconds.)

\* The power supply for the indoor unit is NOT turned ON or there is incorrect wiring.

\* A loose connection between indoor units or the wired controller.

\* Incorrect Setting of Indoor Unit Address (The indoor unit address is overlapped.)

- (c) Start the Test Run.

- Press " $\text{⏻}$  On/Off". The Test Run operation will start. The operation mode, the airflow volume, the airflow direction and the Test Run time can be set on the Test Run screen. Select the item by pressing " $\Delta \nabla$ " and set the detail by pressing "< >".

The default setting for the Test Run time is a two-hour OFF timer.

- Check the temperature conditions.  
Unit operation cannot be performed if the conditions are out of range.  
Refer to the table below for a working range.

< Example >

The cooling operation is not performed if the outdoor temperature is below 14°F DB (-10°C DB).

		Cooling Operation	Heating Operation
Indoor Temperature	Minimum	69°F DB/59°F WB (21°C DB/15°C WB)	59°F DB (15°C DB)
	Maximum	89°F DB/73°F WB (32°C DB/23°C WB)	80°F DB (27°C DB)
Outdoor Temperature	Minimum	14°F DB (-10°C DB) *	-13°F WB (-25°C WB) *
	Maximum	118°F DB (48°C DB) *	59°F WB (15°C WB) *

DB: Dry Bulb, WB: Wet Bulb

\*: Refer to "Page i" for details.

Test Run Screen



Test Run Setting: 2 units

**MODE** : ◀ **COOL** ▶

**SPEED** : AUTO

◀ Sel. ◀ Adj. ⏻ ON Back Rtrn



- (d) Press “△” or “▽”, select “LOUV.” and select “” (auto swing) by pressing “◁” or “▷”.  
The auto-swing operation will start. Check the operating sound at the louvers.  
If an abnormal sound emanates from the louvers, it may be caused by a deformation in the decorative panel due to incorrect installation. In this case, carefully reinstall the decorative panel without further damage. If no weird sounds are generated, press “◁” or “▷” again to halt the auto-swing operation.
- (e) Though the temperature detections by the thermistors are invalid, the protection devices are valid during the Test Run. If an alarm is triggered, refer to Table 9.2, Alarm Code and perform troubleshooting. Then perform the Test Run again
- (f) According to the label “Checking Method by Seven-Segment Display” attached to the back side of the service cover of the outdoor unit, check the temperature, the pressure and the operation frequency of the specified portions, and check the number of the connected indoor units on 7-segment displays.
- (g) To finish the Test Run, wait two hours (as a default setting) or press “ On/Off” switch again.
- With the operation LED flashing two seconds ON and two seconds OFF, this is an indication that the system is searching for irregularities in communication between indoor units and the wired controller. This could boil down to loose or disconnected wires, components, and incorrect wiring.
  - A small sound may be heard from the outdoor unit after turning ON at the power source because the electrical expansion valve is activated to adjust the opening. Therefore, there is no mechanical fault with the unit.
  - Sound may be emitted from the outdoor unit for a few seconds after running or stopping the compressor, starting or finishing the defrosting, and so on. It generates because of the pressure difference inside the compressor piping. Therefore, there is no problem with the unit.

## ! WARNING

**Do NOT run the air conditioner units to check the electrical wiring until the Test Run preparations have been completed.**

### < Test Run from Outdoor Unit Side >


The procedures for the test run from the outdoor unit side are shown below. Setting this DIP switch is possible with the power source ON.

#### Setting of DIP Switch (Factory Setting)

The darkened square indicates the position of the DIP switch.

DSW4

Switch for Setting of Service Operation and Function



ON  
OFF

123456

1. Test Run
2. COOL/HEAT Setting  
(ON: Heating Operation)
3. OFF (Fixed)
4. Manual Compressor OFF
5. OFF (Fixed)
6. OFF (External Input/Output Setting)

## ! WARNING

- Do not touch any other electrical part when operating switches on the PCB.
- Do not attach or detach a service cover when the power source for the outdoor unit is supplied and the outdoor unit is operated.
- Turn all DIP switches of DSW4 OFF when the test run operation is completed.



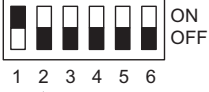
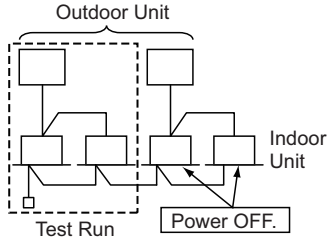


	DIP Switch Setting	Operation	Remarks
Test Run	<p>1. Setting of Operation Mode</p> <p>Cooling: Set No.2 pin of DSW4 OFF.</p>  <p>1 2 3 4 5 6</p> <p>Heating: Set No.2 pin of DSW4 ON.</p>  <p>1 2 3 4 5 6</p> <p>2. Starting Test Run</p> <p>Set No.1 pin of DSW4 ON and the operation is started after a few ~ 20 seconds.</p> <p>Example: Cooling Operation</p>  <p>1 2 3 4 5 6</p> <p>↑ If heating operation leave No.2 pin of DSW4 at ON.</p>	<p>1. The indoor unit automatically starts operating when the test run of the outdoor unit is set.</p> <p>2. The ON/OFF operation can be performed from the wired controller or No.1 pin of DSW4 of the outdoor unit.</p> <p>3. The operation continues for two hours without Thermo-OFF.</p>	<p>* Note that indoor units operate in conjunction with the test run operation for the outdoor unit.</p> <p>* If the test run is started from the outdoor unit and stopped from the wired controller, the test run function of the wired controller is canceled. However, the test run function of the outdoor unit is not canceled. Check to ensure that the No.1 pin of DSW4 of the outdoor unit PCB is turned OFF.</p> <p>* If multiple indoor units are connected with one wired controller, perform the test run operation individually for each refrigerant system, one by one. Then, make sure to turn the power source OFF for the indoor units in other refrigerant systems not selected for the test run operation.</p>  <p>* A setting of DSW4 is not required for the test run from the wired controller.</p>
Manual OFF of Comp.	<p>1. Setting</p> <p>*Compressor Manual OFF: Set No.4 pin of DSW4 ON.</p>  <p>1 2 3 4 5 6</p> <p>2. Canceling</p> <p>*Compressor ON: Set No.4 pin of DSW4 OFF.</p>  <p>1 2 3 4 5 6</p>	<p>1. When No.4 pin of DSW4 is ON during compressor operation, the compressor shuts down immediately and the indoor unit assumes the condition of Thermo-OFF.</p> <p>2. Once No.4 pin of DSW4 is placed back into the off position, the compressor will be enabled for restart following a three minute safety delay.</p>	<p>* Do not repeat compressor ON/OFF frequently.</p>

Table 9.1 Test Run and Maintenance Record

MODEL:	SERIAL. No.	COMPRESSOR MFG. No.
CUSTOMER'S NAME AND ADDRESS:	DATE:	

1. Is the rotation direction of the indoor fan correct? ☐
2. Is the rotation direction of the outdoor fan correct? ☐
3. Are there any abnormal compressor sounds? ☐
4. Has the unit been operated at least twenty (20) minutes? ☐

5. Check Room Temperature

Inlet:	No. 1 DB	/WB	°F,	No. 2 DB	/WB	°F,	No. 3 DB	/WB	°F,	No. 4 DB	/WB	°F
Outlet:	DB	/WB	°F,	DB	/WB	°F,	DB	/WB	°F,	DB	/WB	°F
Inlet:	No. 5 DB	/WB	°F,	No. 6 DB	/WB	°F,	No. 7 DB	/WB	°F,	No. 8 DB	/WB	°F
Outlet:	DB	/WB	°F,	DB	/WB	°F,	DB	/WB	°F,	DB	/WB	°F

6. Check Outdoor Ambient Temperature

Inlet:	DB	°F,	WB	°F
Outlet:	DB	°F,	WB	°F

7. Check Refrigerant Temperature

Liquid Temperature:	°F
Discharge Gas Temperature:	°F

8. Check Pressure

Discharge Pressure:	Psi
Suction Pressure:	Psi

9. Check Voltage

Rated Voltage:	V
Operating Voltage:	L <sub>1</sub> -L <sub>2</sub> V, L <sub>1</sub> -L <sub>3</sub> V, L <sub>2</sub> -L <sub>3</sub> V
Starting Voltage:	V
Phase Imbalance:	$1 - \frac{V}{V_m} =$

10. Check Compressor Input Running Current

Input:	kW
Running Current:	A

11. Is the refrigerant charge adequate? ☐
12. Do the operation control devices operate correctly? ☐
13. Do the safety devices operate correctly? ☐
14. Has the unit been checked for refrigerant leakage? ☐
15. Is the unit clean inside and outside? ☐
16. Are all cabinet panels fixed? ☐
17. Are all cabinet panels free from rattles? ☐
18. Is the filter clean? ☐
19. Is the heat exchanger clean? ☐
20. Are the stop valves open? ☐
21. Does the drain water flow smoothly from the drain pipe? ☐

Table 9.2 Alarm Code

Code	Category	Content of Abnormality	Leading Cause
01	Indoor Unit	Activation of Protection Device (Float Switch)	Activation of Float Switch (High Water Level in Condensation Drainage Pan, Problem with Drain Piping, Float Switch, or Condensation Drainage Pan)
02	Outdoor Unit	Activation of Protection Device (High Pressure Cut)	Activation of PSH (Pipe Clogging, Excessive Refrigerant, Inert Gas Mixing)
03	Communication	Operational Irregularities between Indoor and Outdoor	Incorrect Wiring, Loose Terminals, Disconnected Wire, Blown Fuse, Outdoor Unit Power OFF
04		Problem between Inverter PCB and Outdoor PCB	Inverter PCB - Outdoor PCB Communication Failure (Loose Connector, Wire Breaking, Blown Fuse)
04.		Problem between Fan Controller and Outdoor PCB	Fan Controller - Outdoor PCB Communication Failure (Loose Connector, Wire Breaking, Blown Fuse)
05	Supply Phase	Problem of Power Source Phases	Incorrect Power Source, Connection to Reversed Phase, Open-Phase
06	Voltage	Abnormal Inverter Voltage	Outdoor Voltage Drop, Insufficient Power Capacity
06.		Abnormal Fan Controller Voltage	Outdoor Voltage Drop, Insufficient Power Capacity
07	Cycle	Decrease in Superheated Discharge Gas	Excessive Refrigerant Charge, Failure of Thermistor, Incorrect Wiring, Incorrect Piping Connection, Expansion Valve Locking at Opened Position (Disconnect Connector)
08		Increase in Discharge Gas Temperature	Insufficient Refrigerant Charge, Pipe Clogging, Failure of Thermistor, Incorrect Wiring, Incorrect Piping Connection, Expansion Valve Locking at Closed Position (Disconnect Connector)
0A	Communication	Problem between Outdoor and Outdoor	Incorrect Wiring, Broken Wire, Loose Terminals
0b	Outdoor Unit	Incorrect Outdoor Unit Address Setting	Duplication of Address Setting for Outdoor Units (Sub Units) in Same Refrigerant System
0C		Incorrect Outdoor Unit Main Unit Setting	Two (or more) Outdoor Units Set as "Main Unit" Exist in Same Refrigerant System
11	Sensor on Indoor Unit	Inlet Air Thermistor	Incorrect Wiring, Disconnected Wiring Breaking Wire, Short Circuit
12		Outlet Air Thermistor	
13		Freeze Protection Thermistor	
14		Gas Piping Thermistor	
15		Outdoor Air Thermistor (ECONO)	
16		Remote Sensor (DOAS)	
17		Thermistor Built-in Remote Controller (DOAS)	
19	Fan Motor	Activation of Protection Device for Indoor Fan	Fan Motor Overheat, Lockup
21	Sensor on Outdoor Unit	High Pressure Sensor	Incorrect Wiring, Severed or Disconnected Wiring, Short Circuit
22		Outdoor Air Thermistor	
23		Discharge Gas Thermistor on Top of Compressor	
24		Heat Exchanger Liquid Pipe Thermistor	
25		Heat Exchanger Gas Pipe Thermistor	
29		Low Pressure Sensor	

Code	Category	Content of Abnormality	Leading Cause
31	System	Incorrect Capacity Setting of Outdoor Unit and Indoor Unit	Incorrect Capacity Code Setting of Combination Excessive or Insufficient Indoor Unit Total Capacity Code
35		Incorrect Setting of Indoor Unit No.	Duplication of Indoor Unit No. in same Refrigerant Group
36		Incorrect Indoor Unit Combination	Indoor Unit is Designed for R22
38		Problem with Protective Pickup Circuit in Outdoor Unit	Failure of Protection Detecting Device (Incorrect Wiring of Outdoor PCB)
39	Compressor	Problem with Running Current at Constant Speed Compressor	Overcurrent, Blown Fuse, Current Sensor Failure, Instantaneous Power Failure, Voltage Drop, Abnormal Power Supply
3A	Outdoor Unit	Problem with Running Outdoor Unit Capacity	Outdoor Unit Capacity > 360 MBH
3b		Incorrect Setting of Outdoor Unit Models Combination or Voltage	Incorrect Setting of Main and Sub Unit(s) Combination or Voltage
3d		Communication Problem between Main Unit and Sub Unit(s)	Incorrect Wiring, Disconnected Wire, Broken Wire, PCB Failure
3E		Communication Problem between Inverter PCB and Outdoor PCB	Incorrect Combination between Inverter PCB and Outdoor PCB
43	Protection Device	Activation of Compression Ratio Decrease Protection Device	Defective Compression (Failure of Compressor of Inverter, Loose Power Supply Connection)
44		Activation of Low Pressure Increase Protection Device	Overload at Cooling, High Temperature at Heating, Expansion Valve Locking (Loose Connector)
45		Activation of High Pressure Increase Protection Device	Overload Operation (Clogging, Short-Pass), Pipe Clogging, Excessive Refrigerant, Inert Gas Mixing
47		Activation of Low Pressure Decrease Protection Device (Vacuum Operation Protection)	Insufficient Refrigerant, Refrigerant Piping, Clogging, Expansion Valve Locking at Open Position (Loose Connector)
48		Activation of Inverter Overcurrent Protection Device	Overload Operation, Compressor Failure
51	Sensor	Problem with Inverter Current Sensor	Current Sensor Failure
53	Inverter	Inverter Error Signal Detection	Driver IC Error Signal Detection (Protection for Overcurrent, Low Voltage, Short Circuit)
54		Abnormality of Inverter Fin Temperature	Abnormal Inverter Fin Thermistor, Heat Exchanger Clogging, Fan Motor Failure
55		Inverter Failure	Inverter PCB Failure
57	Fan Controller	Activation of Fan Controller Protection	Driver IC Error Signal Detection (Protection for Overcurrent, Low Voltage, Short Circuit), Instantaneous Overcurrent
5A		Abnormality of Fan Controller Fin Temperature	Fin Thermistor Failure, Heat Exchanger Clogging, Fan Motor Failure
5b		Activation of Overcurrent Protection	Fan Motor Failure
5C		Problem with Fan Controller Sensor	Failure of Current Sensor (Instantaneous Overcurrent, Increase of Fin Temperature, Low Voltage, Ground Fault, Step-Out)
EE	Compressor	Compressor Protection Alarm (It can not be reset from Wired Controller)	This alarm code appears when the following alarms* occurs three times within 6 hours. *02, 07, 08, 39, 43 to 45, 47
b1	Outdoor Unit No. Setting	Incorrect Setting of Unit and Refrigerant System Number	There are 64 or more numbers Set for Address or Refrigerant System.
b5	Indoor Unit No. Setting	Incorrect Indoor Unit Connection No. Setting	There are 17 or More Non-Corresponding to H-LINK II Units are Connected to One System.

## 10. Safety and Control Device Setting

- Compressor Protection

The compressor is protected by the following devices and their combinations.

- (1) High Pressure Switch: This switch cuts out the operation of the compressor when the discharge pressure exceeds the setting.
- (2) Oil Heater: This band type heater protects against oil foaming during cold starting, as it is energized while the compressor is stopped.

< 208/230V 60Hz >

Model		(H,Y)VAHP072B31CW	(H,Y)VAHP096B31CW
High Pressure Increase Protection		Automatic Reset, Non-Adjustable	
High Pressure Increase Protection Control	psi (MPa)	551 (3.80)	551 (3.80)
Pressure Switch		(for each compressor)	
Cut-Out	psi	601 -7 -21	601 -7 -21
	(MPa)	(4.15 -0.05) -0.15	(4.15 -0.05) -0.15
Cut-In	psi (MPa)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
For Inverter Compressor		Automatic Reset, Non-Adjustable	
Over Current			
Inverter Current Protection Control	A	45.0	45.0
Breaker	A	50.0	50.0
Over Heat		Automatic Reset, Non-Adjustable	
Discharge Temperature Increase Protection Control	for 5sec °F	284	284
	(°C)	(140)	(140)
	for 10min °F	270	270
	(°C)	(132)	(132)
For Fixed Speed Compressor		Automatic Reset, Non-Adjustable	
Over Current			
Abnormality Running Current Control	208V A	32	32
Breaker	230V A	29	29
	A	32	32
Over Heat		Automatic Reset, Non-Adjustable	
Discharge Temperature Increase Protection Control	for 5sec °F	284	284
	(°C)	(140)	(140)
	for 10min °F	270	270
	(°C)	(132)	(132)
For Fan Motor		Automatic Reset, Non-Adjustable	
Over Current Protection Control	A	7	7
Fuse	A	16	16

< 460V 60Hz >

Model		(H,Y)VAHP072B41CW	(H,Y)VAHP096B41CW
High Pressure Increase Protection		Automatic Reset, Non-Adjustable	
High Pressure Increase Protection Control	psi (MPa)	551 (3.80)	551 (3.80)
Pressure Switch		(for each compressor)	
Cut-Out	psi	601 -7 -21	601 -7 -21
	(MPa)	(4.15 -0.05) -0.15	(4.15 -0.05) -0.15
Cut-In	psi (MPa)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
For Inverter Compressor		Automatic Reset, Non-Adjustable	
Over Current			
Inverter Current Protection Control	A	23.5	23.5
Breaker	A	30.0	30.0
Over Heat		Automatic Reset, Non-Adjustable	
Discharge Temperature Increase Protection Control	for 5sec °F	284	284
	(°C)	(140)	(140)
	for 10min °F	270	270
	(°C)	(132)	(132)
For Fixed Speed Compressor		Automatic Reset, Non-Adjustable	
Over Current			
Abnormality Running Current Control	A	14.5	14.5
Breaker	A	15	15
Over Heat		Automatic Reset, Non-Adjustable	
Discharge Temperature Increase Protection Control	for 5sec °F	284	284
	(°C)	(140)	(140)
	for 10min °F	270	270
	(°C)	(132)	(132)
For Fan Motor		Automatic Reset, Non-Adjustable	
Over Current Protection Control	A	7	7
Breaker	A	10	10



