

Installation and Maintenance Manual

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

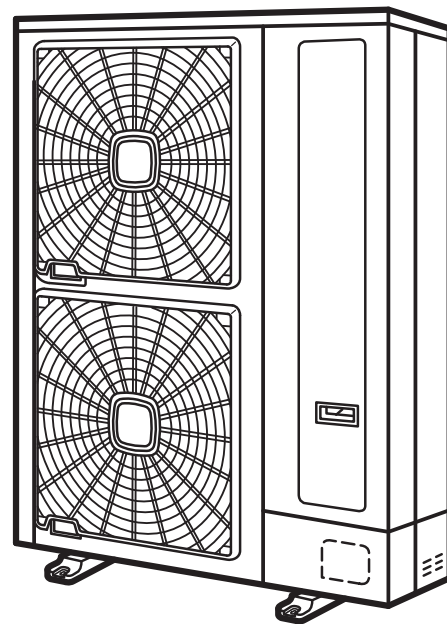
Models:

Outdoor Units;

(H,Y)VAHP036B21S

(H,Y)VAHP048B21S

(H,Y)VAHP060B21S



IMPORTANT:

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

P5416528

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)	23°F DB (-5°C DB) *3)
Heating Operation	Indoor	80°F DB (27°C DB)	59°F DB (15°C DB)
	Outdoor	59°F WB (15°C WB) *4)	-4°F WB (-20°C WB) *5)

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 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.
- *4) 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.
- *5) Operation in the outdoor temperature of 5~-4°F WB (-15~-20°C WB) is assumed to limited conditions such as start-up in early morning.
Long time operation in this condition may shorten the life of the compressor.

- 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 Outdoor Heat Pump Unit. Read this installation and maintenance 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	
 WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

General Precautions

 WARNING	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

 WARNING	To reduce the risk of serious injury or death, the following refrigerant precautions must be followed.
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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/ft³ (0.42 kg/m³) 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 +15°.

Electrical Precautions

 WARNING	<p>Take the following precautions to reduce the risk of electric shock, fire or explosion resulting in serious injury or death.</p>
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- 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 installation and maintenance 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 (0.82mm²), 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.
- Use a Ground Fault Circuit Interrupter (GFCI) to reduce the chance of an electric shock.

3. Before Installation

3.1 Necessary Tools and Instrument List for Installation

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

It is recommended to 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)

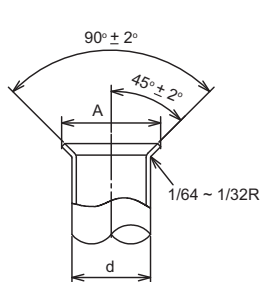
Measuring Instrument and Tool		Interchangeability with R22		Reason of Non-Interchangeability and Attention (★: Strictly Required)	Use
		R410A	R407C		
Refrigerant Pipe	Pipe Cutter, Chamfering Reamer	◇	◇	-	Cutting Pipe Removing Burrs
	Flaring Tool	◇ ●	◇	* The flaring tools for R407C are applicable to R22. * If using flaring tube, make dimension of tube larger for R410A.	Flaring for Tubes
	Extrusion Adjustment Gauge	●	-	* 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), wrench 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), wrench 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	◇	◇	★ It is required to mount a vacuum pump adapter (check valve) to prevent oil of the vacuum pump from being pulled when the vacuum pump stops.	Vacuum Pumping
	Adapter for Vacuum Pump (Check Valve)	* ●	◆		
	Manifold Valve	●	◆	★ Use manifold and charging hoses designed for each refrigerant as design pressure is different. Do not share manifold and charging hoses with other refrigerant type to prevent mixing of different type of refrigerant oil. (If use, it may cause cycle choking or compressor failure.) Standard of Connection Screw; R410A: UNF1/2, R407C: UNF7/16.	Vacuum Pumping, Vacuum Holding, Refrigerant Charging and Check of Pressures
	Charging Hose	●	◆		
	Charging Cylinder	X	X	* Use the weight scale.	-
	Weight Scale	◇	◇	-	Measuring Instrument for Refrigerant Charging
	Refrigerant Gas Leakage Detector	* ●	◆	* Use a detector designed for each refrigerant as detecting method is different.	Gas Leakage Check

*: Interchangeability with R407C.

3.2 Flaring and Joint

- Flaring Dimension

Perform the flaring work as shown below.



Diameter (φd)	inch (mm) A +0 -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 >

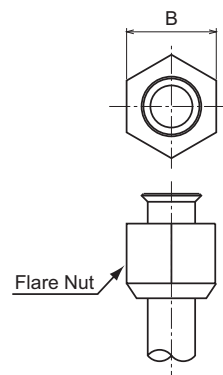
Diameter	inch (mm) R410A
φ1/4 (φ6.35)	0.020 (0.5)
φ3/8 (φ9.52)	0.024 (0.6)
φ1/2 (φ12.7)	0.028 (0.7)
φ5/8 (φ15.88)	0.031 (0.8)
φ3/4 (φ19.05)	0.031 (0.8)

NOTE:

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

< Flare Nut Dimension B >

Diameter	inch (mm) R410A
φ1/4 (φ6.35)	11/16 (17)
φ3/8 (φ9.52)	7/8 (22)
φ1/2 (φ12.7)	1 (26)
φ5/8 (φ15.88)	1-1/8 (29)
φ3/4 (φ19.05)	1-7/16 (36)



- 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.

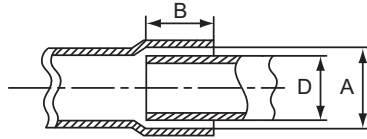
Outer Diameter	inch (mm) R410A	
	Thickness	Temper
1/4 (6.35)	0.03 (0.76)	Annealed
3/8 (9.52)	0.032 (0.81)	Annealed
1/2 (12.7)	0.032 (0.81)	Annealed
5/8 (15.88)	0.035 (0.89)	Annealed
3/4 (19.05)	0.035 (0.89)	Hard Temper (or Annealed)

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)	

3.3 Line-Up of Outdoor Unit

The outdoor unit can be used as heat pump system.

< 208/230V >

Capacity (MBH)	36	48	60
Model	(H,Y)VAHP036B21S	(H,Y)VAHP048B21S	(H,Y)VAHP060B21S

3.4 Combination of Indoor Unit and Outdoor Unit

Table 3.1 Indoor Unit Type List

Indoor Unit Type			Capacity (MBH)								
			6	8	12	15	18	24	30	36	48
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							○	○	○
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 as defined in Table 3.2:
Comply with the following conditions when installing the unit.

Table 3.2 System Combination

Outdoor Unit Capacity (MBH)	Minimum Capacity at Individual Operation (MBH)	Maximum Number of Connectable I.U.	Connectable Indoor Unit Capacity Ratio	
			Maximum *1)	Minimum
36	6	6	130%	60%
48		8	130%	60%
60		8	105%	60%

*1) 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%.








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 except for 60 MBH.
- A maximum number of connectable indoor units differs depending on the model, capacity, environment and installation location of connected indoor units. Refer to "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% of the outdoor unit capacity.
- 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 draft may occur during heating operation.
- Regarding the limitation of connected to Ducted (EconoFresh) type, refer to "Engineering Manual".

3.5 Factory-Supplied Accessories

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

Accessory	36 - 60 MBH	Remarks
Accessory Pipe	 × 1	For Gas Pipe
PVC Tube	 × 1	For Communication Cable ID: $\phi 1/2$ inch ($\phi 12$ mm) Length: 47 inch (1200mm)
Rubber Grommet	 × 1	For Communication Cable OD: $\phi 1-1/4$ inch ($\phi 32$ mm)
Cable Band	 × 3	For Fixing PVC Tube (Qty. 1: Spare)
Plate	 × 1	For Conduit
Screw (M5)	 × 2	For Conduit
Washer (M12)	 × 4	For Anchor Bolt

NOTE

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

4. Outdoor Unit Installation

4.1 Installation Location and Precautions



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 wall for wind prevention (field-supplied). Or install Wind Guard (optional).
 - A snowy area: Install the outdoor unit on a raised platform that is higher than drifting snow. Provide snow roof for snow prevention (field-supplied). Or install Snow Protection Hood (optional).
- 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.
- 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. Do not position the drain pipe for the indoor unit near any sanitary sewers where corrosive gases may be present.
- 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.

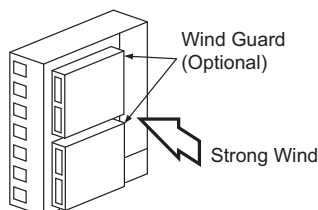
After installation work for the system has been completed, explain the "Safety Precautions," the proper use and maintenance of the unit to the customer according to the information in all manuals that came with the system. All manuals and warranty information must be given to the user or left near the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

< Installation in Place where Strong Wind Blows to Unit >

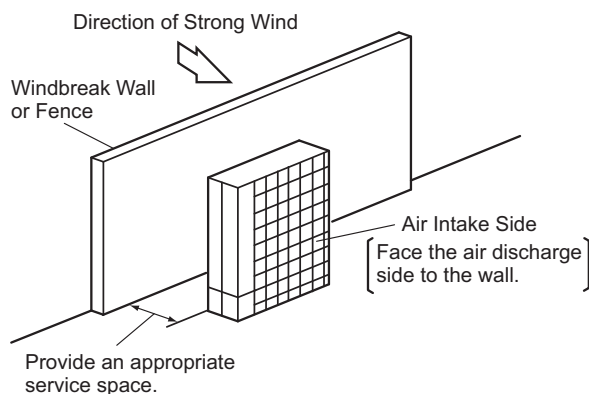
Install the outdoor unit at a location where there are not strong winds.
If a suitable location cannot be found, take the following measures.

(1) Prevent a strong wind blows to air inlet or outlet of the outdoor unit.

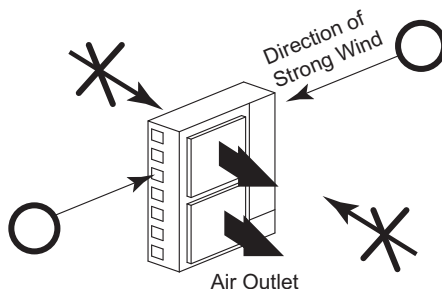
- In the Case of Blowing Strong Wind to Air Outlet
The wind guard (optional) is available to avoid strong wind.
(The snow protection hood (optional) is also available.)



- Installing Windbreak Wall / Fence
If installing windbreak wall or fence, make sure to provide sufficient space around the outdoor unit for operation and maintenance. Refer to the next page for service space.



- Select a direction where a strong wind does NOT blow to the air outlet surface and the air inlet surface.

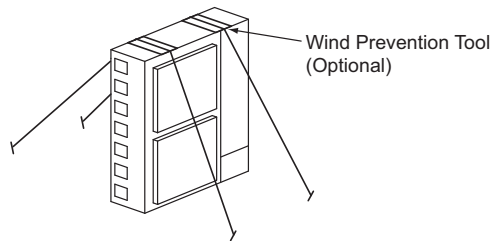


NOTES:

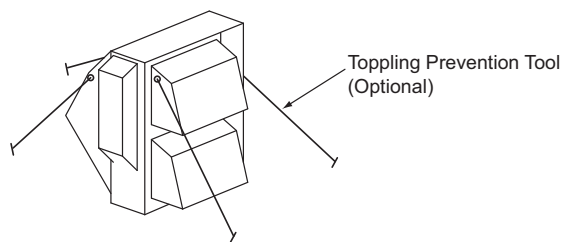
1. If blowing direct and strong wind to the air outlet, the needed airflow volume can not be maintained and the outdoor unit may be difficult to operate normally.
2. If excessively strong wind blows to the air outlet consecutively, it may cause the propeller fan or the fan motor breakage by high speed rotation or overload.

(2) Prevent the outdoor unit overturning.

- Secure the unit using wire rope of the Wind Prevention Tool (optional) to prevent overturning.



In the case of Installing Snow Protection Hood (optional), install Toppling Prevention Tool (optional) instead of Wind Prevention Tool.



* The snow protection hood should be utilized to protect from mal-defrost in low ambient temperature (below 23°F (-5°C)).

4.2 Service Space

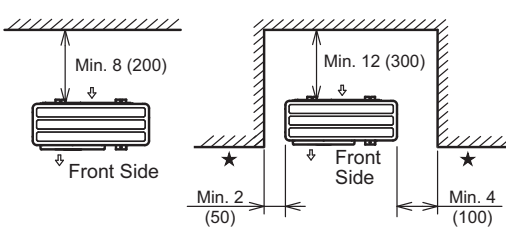
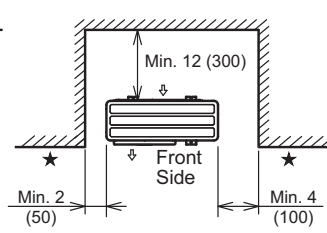
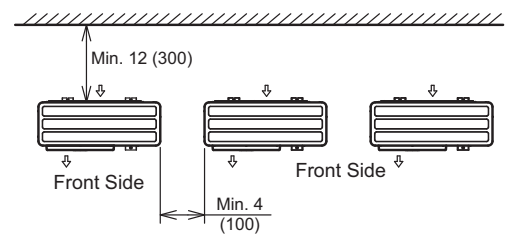
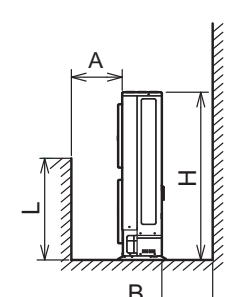
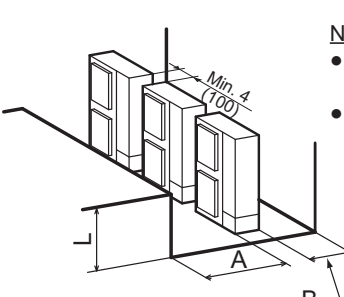
When an outdoor unit is installed, allow sufficient clearance as follows:

- 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.

(1) Obstacles on Inlet Side

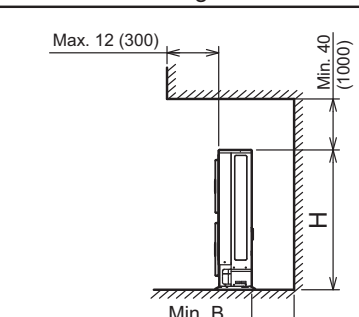
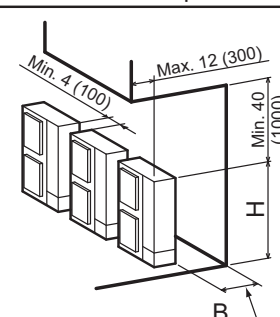
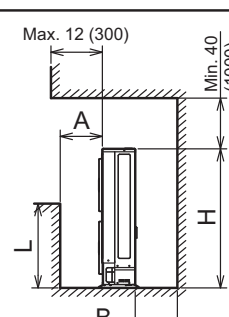
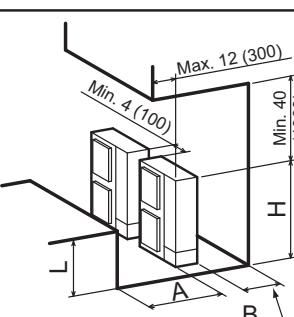
(a) Upper Side is Open.

inch (mm)

Single Installation	Multiple Installation
<p>* Around sides are open.</p>  <p>* Around sides are closed.</p>  <p>Fit positions "★" with unit front side.</p>	 <p>NOTE: Open both right and left sides.</p>
 <p>NOTES:</p> <ul style="list-style-type: none"> • Install Airflow Guide (optional) • Open both right and left sides. 	 <p>NOTES:</p> <ul style="list-style-type: none"> • Install Airflow Guide (optional) • Open both right and left sides.

(b) Obstacles on Upper Side

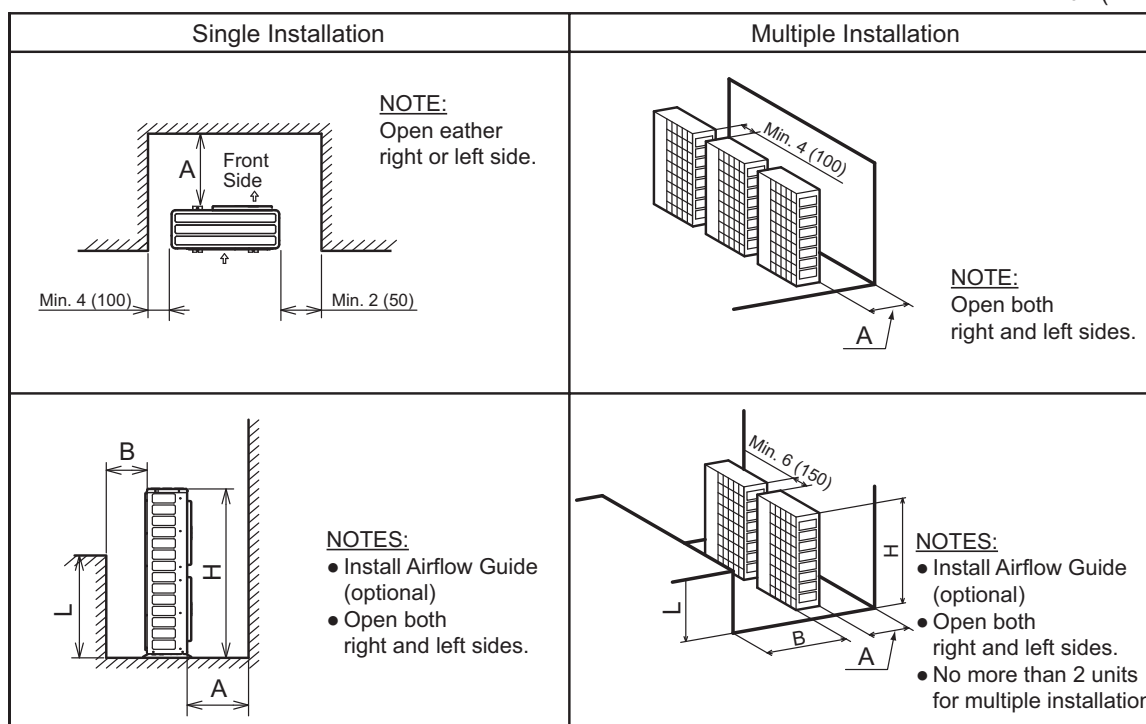
inch (mm)

Single Installation	Multiple Installation
	 <p>NOTE: Open both right and left sides.</p>
 <p>NOTES:</p> <ul style="list-style-type: none"> • Install Airflow Guide (optional) • Open both right and left sides. 	 <p>NOTES:</p> <ul style="list-style-type: none"> • Install Airflow Guide (optional) • Open both right and left sides. • No more than 2 units for multiple installation

(2) Obstacles on Outlet Side

(a) Upper Side is Open.

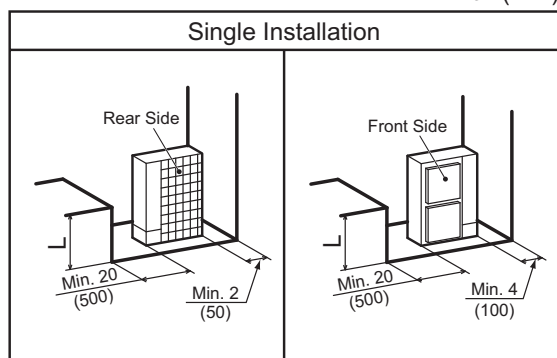
inch (mm)



(3) Obstacles on Right and Left Side

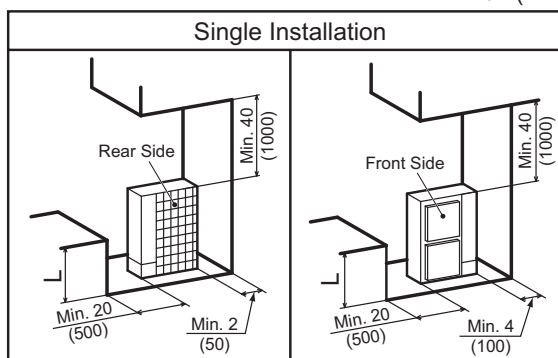
(a) Upper Side is Open.

inch (mm)



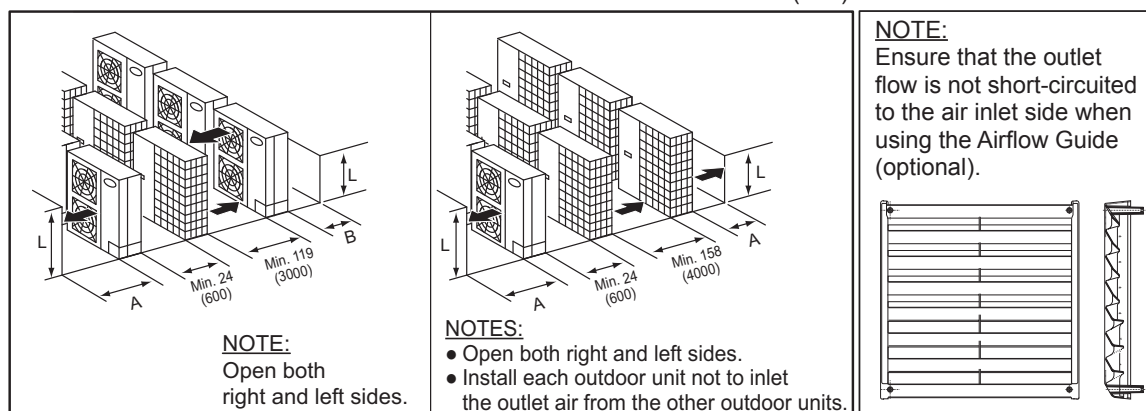
(b) Obstacles on Upper Side

inch (mm)



(4) Multi-Row and Multiple Installations

inch (mm)



NOTE

- If L is larger than H, mount the units on a base so that H is greater or equal to L.
Be sure to seal up every surface of the base. If the base allow the airflow to go through, it may cause short-circuit.

inch (mm)		
L	A	B
$0 < L \leq 1/2H$	24 (600) or more	12 (300) or more
$1/2H < L \leq H$	56 (1400) or more	14 (350) or more

- The Airflow Guide (optional) is required when there are interferences in both front and rear side of the outdoor unit.
 - The installation of multi-row and multiple outdoor units should be up to 3 outdoor units on a roof, etc. Use the Airflow Guide (optional) in order to prevent short-circuiting if more than 3 outdoor units are installed.
-

5. Transportation and Installation Work

5.1 Transportation

Transport the product as close to the installation location as practical before unpacking.

! CAUTION

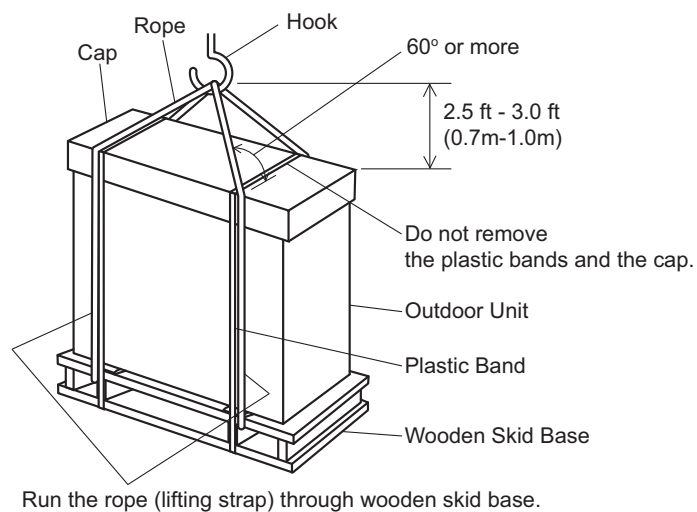
Do not put any material on the product.

Apply two lifting wires onto the outdoor unit, when lifting it by crane.

- Hanging Method

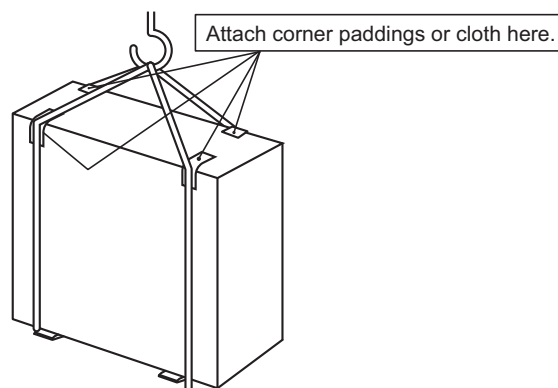
When hanging the unit, ensure a balance of the unit, check safety and lift up smoothly.

- (1) Do not remove any packing materials.
- (2) Hang the unit utilizing 2 ropes according to the figure.

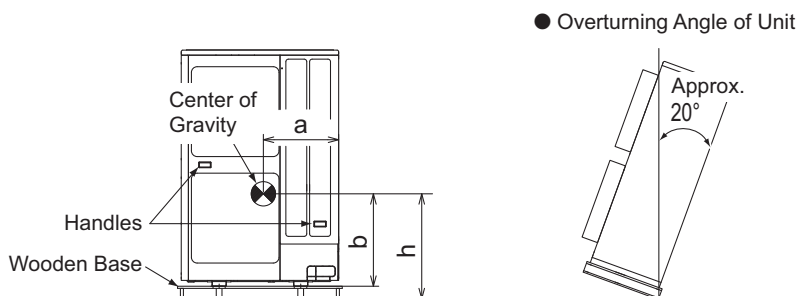


NOTES

- Make sure the unit is not tilted while lifting.
- Do not hook with cap of the corrugated paper frame or the plastic bands.
- If the unit is lifted after unpacking, protect the unit with the corner paddings or cloth.



(3) When handling the unit by handle,



Model	Packing Condition			Unpacking Condition		
	Gross Weight [lb (kg)]	Center of Gravity		Net Weight [lb (kg)]	Center of Gravity	
		a [in. (mm)]	h [in. (mm)]		a [in. (mm)]	b [in. (mm)]
(H,Y)VAHP036B21S	267 (121)	14-3/16 (360)	28-1/16 (713)	249 (113)	13-3/4 (350)	24-7/16 (620)
(H,Y)VAHP048B21S	267 (121)	14-3/16 (360)	28-1/16 (713)	249 (113)	13-3/4 (350)	24-7/16 (620)
(H,Y)VAHP060B21S	267 (121)	14-3/16 (360)	28-1/16 (713)	249 (113)	13-3/4 (350)	24-7/16 (620)

Pay attention to the following when handling the unit with handles. The outdoor units weight are shown in the table below.

- (a) Do not remove the wooden base during transportation.
- (b) The center of gravity is shown above.
- (c) The unit is heavy and requires a minimum of two people to move it.

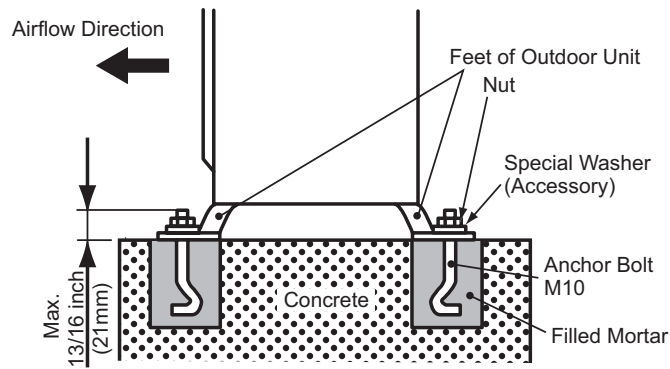
5.2 Handling of Outdoor Unit

! 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.

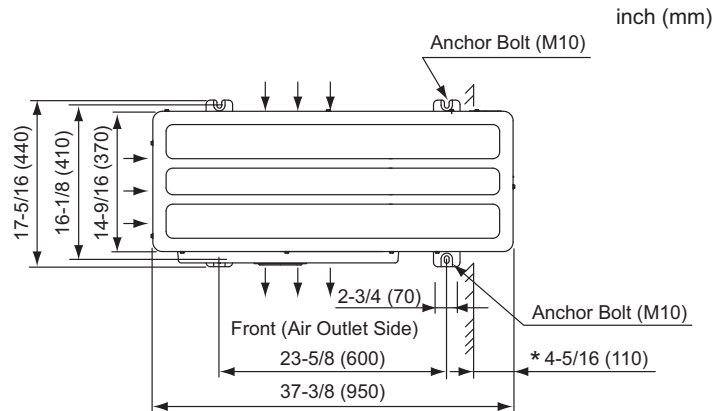
5.3 Installation Work

- (1) Secure the outdoor unit with the anchor bolts.



Secure the outdoor unit to the anchor bolts with special washer (accessories).

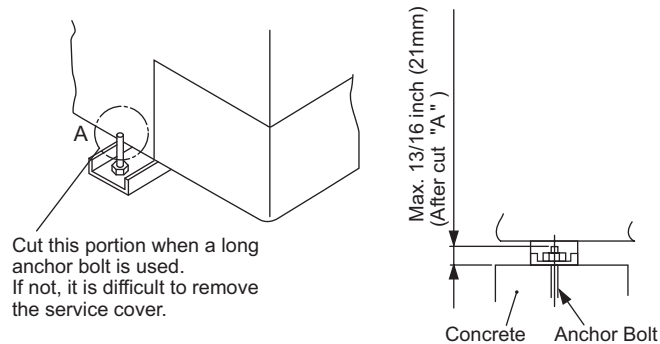
- (2) When installing the outdoor unit, secure the unit by anchor bolts.



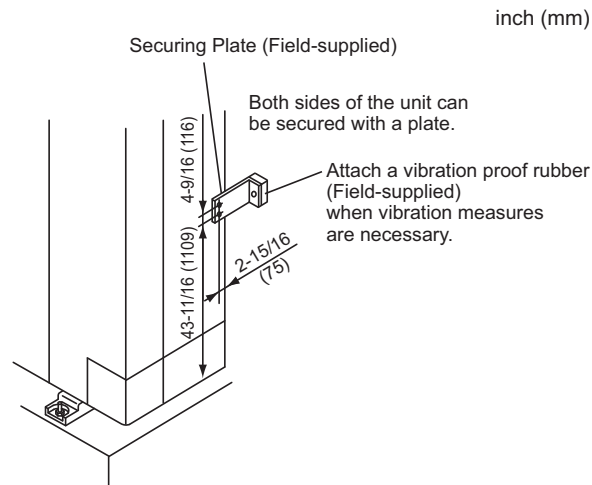
NOTE:

When connecting field refrigerant piping from the bottom side of the unit, provide the space (marked with *) for understructures such as foundation to avoid interference.

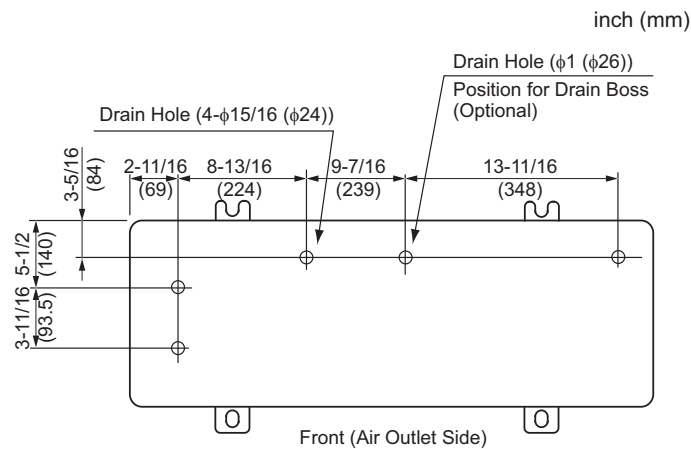
- (3) Example of securing outdoor unit by anchor bolts.



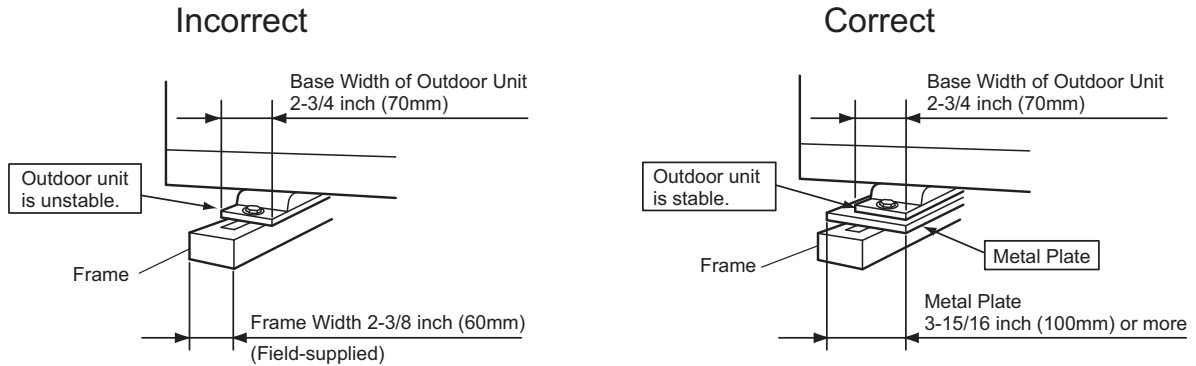
- (4) Make sure that the unit is anchored so it cannot fall over or be damaged from wind or other external impact.



- (5) The drain water is discharged during the heating and defrosting operation. Choose a place where well drainage is available, or provide a groove for draining.
- (6) When installing the unit, keep in mind that the unit will produce condensate in heating mode. Special attention needs to be given to the draining of this condensate as it will freeze in colder climates and may cause slippery surfaces if not properly managed.
- (7) Use the Drain Adapter (optional) when the drain piping work is required to the outdoor unit. Drain Adapter is not recommended in colder climates where freezing can occur.

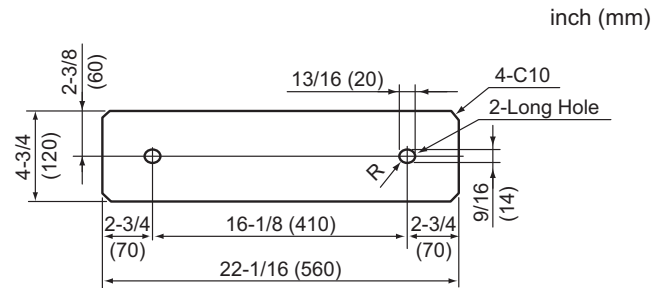


- (8) The whole of the base of the outdoor unit should be installed on a foundation. When using vibration-proof mat, it should also be positioned the same way.
When installing the outdoor unit on a field-supplied frame, use metal plates to adjust the frame width for stable installation.



Recommended Metal Plate Size (Field-Supplied)

Material: Hot-Rolled Mild Steel Plate (SPHC)
Plate Thickness: 5 Gauge (4.8mm)



CAUTION

Aluminum fins have very sharp edges. Pay attention to the fins to avoid any injury.

NOTE

Install the outdoor unit on a roof or in an area where only service engineers come in contact with the outdoor unit.

6. Refrigerant Piping Work

WARNING

- The design 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.
- Check to ensure that the stop valves are closed before removing the flare nut of the stop valves.

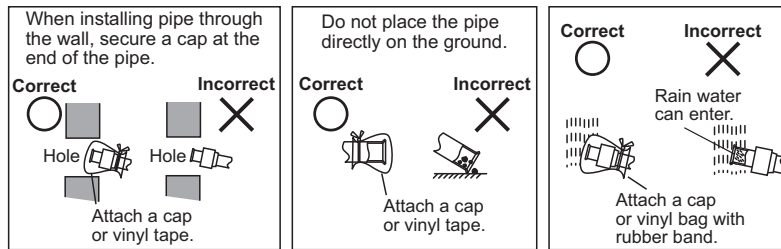
CAUTION

- Make sure to connect all piping among the units in the same refrigerant cycle.
- When handling the refrigerant, be sure to wear leather gloves to prevent injuries.

6.1 Piping Materials

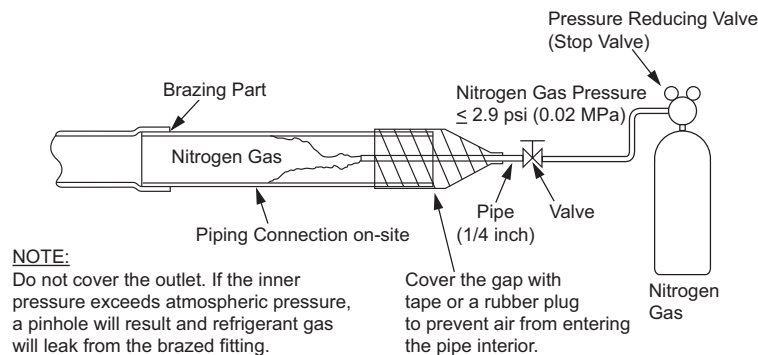
- (1) Obtain locally-supplied copper pipes.
- (2) Use the copper pipe for refrigerant piping.
- (3) Pay close attention to pipe thickness.
- (4) Use clean copper pipes. Make sure there is no dust or moisture inside the pipes. Blow nitrogen or dry, compressed air into the pipes to remove any dust or foreign materials before connecting them. Do not use any cutting tools which such as a grinder or saw which produce metal particles.
- (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 unit 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 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.
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, metal particles, gaps, or deformations at the flared end before making connections to the system.
- (2) Apply a light film of refrigerant oil on the sheet surface of the pipe and flare nut before performing flaring work. Tighten the flare nut to specified torque settings using two wrenches. Perform flaring work to the liquid piping side before treating the gas piping side. Verify that no gas leakage has occurred after completing flaring work.

NOTE:

Refrigerant oil is field-supplied.

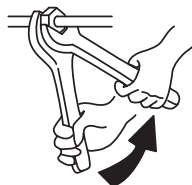
[Ethereal Oil: FVC68D (Idemitsu Kousan Co. Ltd.)]

Apply Refrigerant Oil.

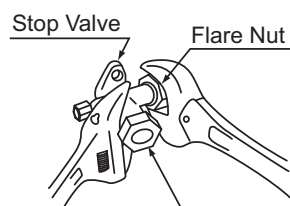


Do not apply refrigerant oil to exterior flared surfaces.

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



Use two wrenches as shown.



Do not apply the two wrenches work here. Refrigerant leakage shall occur.

Tightening Work for Stop Valve

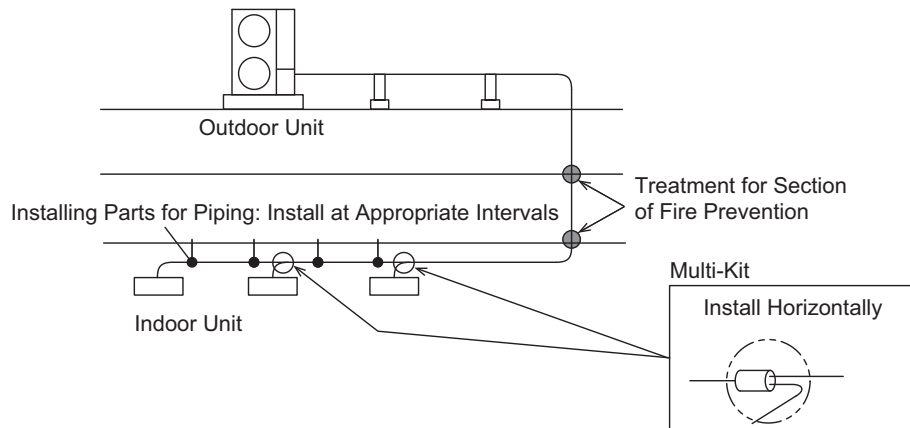
< Required Tightening Torque >

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)

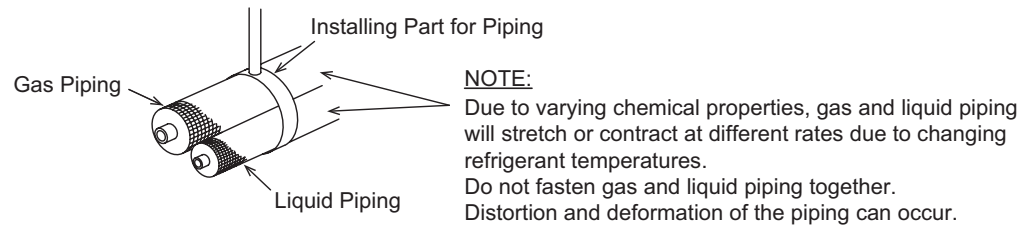
- (4) When the temperature and humidity inside the ceiling exceed 80°F (27°C)/RH80%, apply additional insulation of approximately 13/32 inch (10mm) in thickness to the accessory insulation. It prevents the formation of condensation on the surface of the insulation (refrigerant pipe only).
- (5) Perform 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, noise may be occur due to vibration in the piping.

- Caution for Installing and Securing Piping

[Example for Pipe Support]



[Secure for Liquid Piping and Gas Piping]



NOTICE:

When assembling piping on-site 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
36 - 60	5/8 (15.88)	3/8 (9.52)

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)

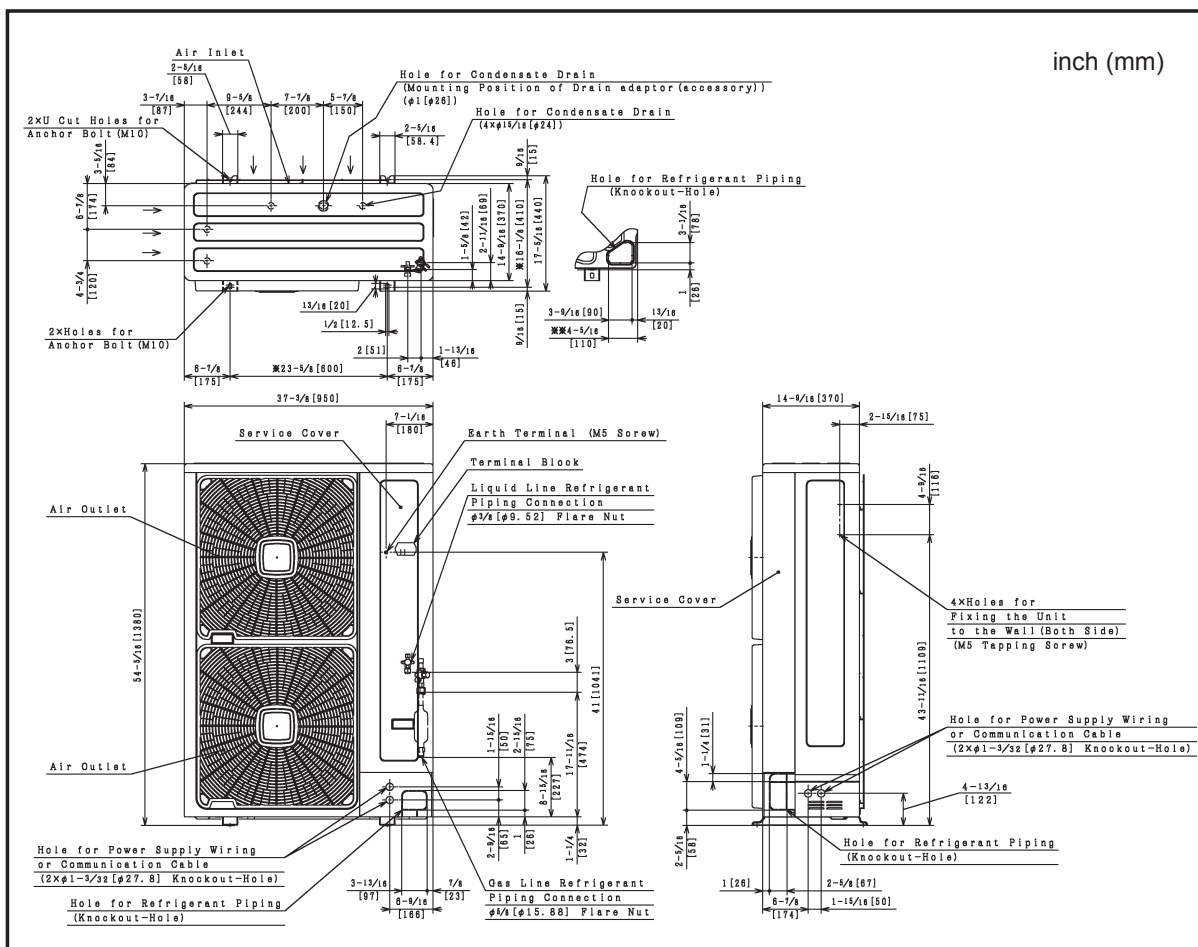
6.2 Piping Connection Work

Comply with the restrictions for refrigerant piping (permissible length, height difference) in Sections 6.4 “Piping Work Conditions” and “Piping Branch Restriction”. If not, the outdoor unit can be damaged.

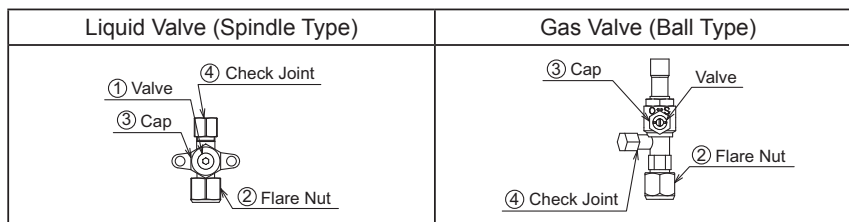
The stop valves should be closed completely (factory-setting) when refrigerant piping connections are performed. Do not open these stop valves until all the refrigerant piping connections, airtight testing, and vacuuming have been completed.

6.2.1 Stop Valve

● Stop Valves Position



● Tightening Torque



Item	Liquid Valve	Gas Valve
① Valve	5.2 - 6.6 ft·lbs (7 - 9 N·m) [5/32 inch (4mm) Hexagonal Wrench]	3.7 ft·lbs (5.0 N·m) or less [Slotted Screwdriver]
② Flare Nut	25.1 - 31.0 ft·lbs (34 - 42 N·m)	50.2 - 60.5 ft·lbs (68 - 82 N·m)
③ Cap	27 ft·lbs (37 N·m)	16.5 ft·lbs (22.5 N·m)
④ Check Joint	12 ft·lbs (16 N·m)	12 ft·lbs (16 N·m)

6.2.2 Piping Connection Method

Perform the piping connection for the outdoor unit.

- Pipes can be connected from 4 directions.

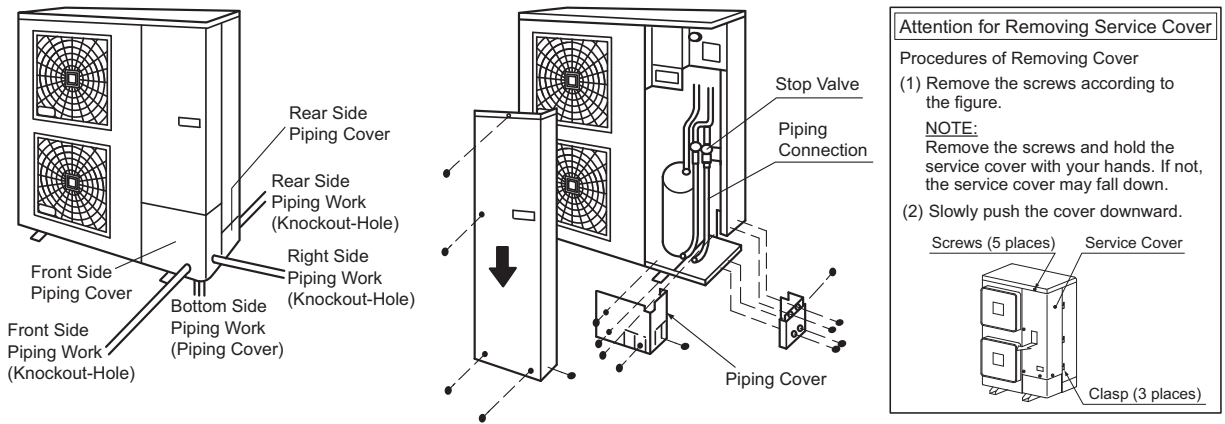
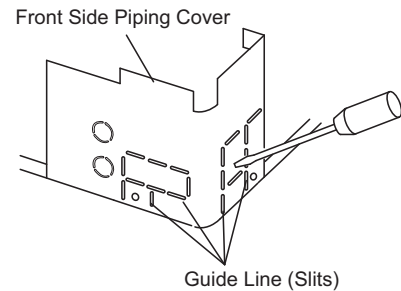


Figure 6.1 Piping Direction

- (1) The refrigerant piping can be installed in four directions (front, right, bottom or rear side) as shown in Figure 6.1. Make a knockout-hole in the front side pipe cover or bottom base to pass the pipe through the hole. After removing the pipe cover from the unit, punch out the holes following the guide line with a screwdriver and a hammer. Then, deburr the holes and attach insulation (Field-supplied) for protection of cables and pipes.



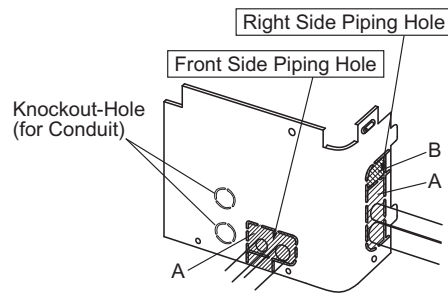
(a) Front and Right Side Piping Work

Select the correct knockout size depending on the size of liquid and gas piping, power wiring, or communication wiring.

The liquid or gas piping can be connected from "A" part.

NOTES:

- Protect cables and pipes from the edges of the cover with insulations, etc. (Field-supplied).
- "B" part is for communication cable. But conduit hole is recommended. (refer to Section 7.3 "Electrical Wiring for Outdoor Unit")

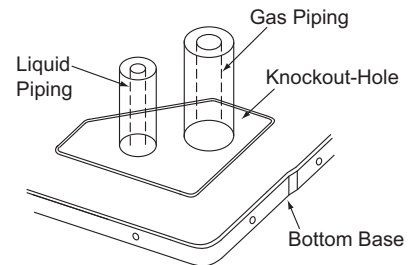


(b) Bottom Side Piping Work

After removing bottom of the knockout-hole, perform piping.

NOTE:

Prevent the cables from coming into direct contact with the piping work.

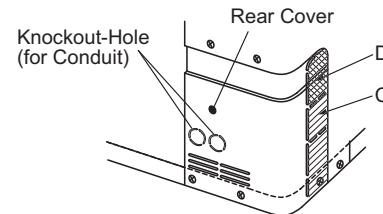


(c) Rear Side Piping Work

After removing the rear side piping cover, punch out "C" hole along the guide line.

NOTES:

- Protect cables and pipes from the edges of the cover with insulations, etc. (Field-supplied).
- "D" part is for communication cable. But conduit hole is recommended. (refer to Section 7.3 "Electrical wiring for Outdoor Unit")



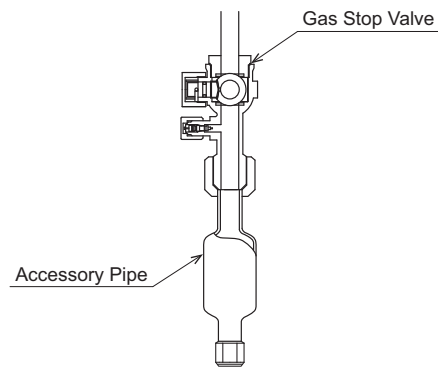
NOTICE

For the right side and rear side piping work, secure enough space for the piping.

- (2) Be sure to attach the piping cover to prevent rain water from entering the unit. Completely seal the penetration parts of the pipes with field-supplied insulation in order to prevent rain water from entering the conduit.
- To make it easier to attach the piping cover, cut the lower side guide line of the piping cover.
- (3) Use a pipe bender or an elbow (Field-supplied) for bending work while connecting pipes.

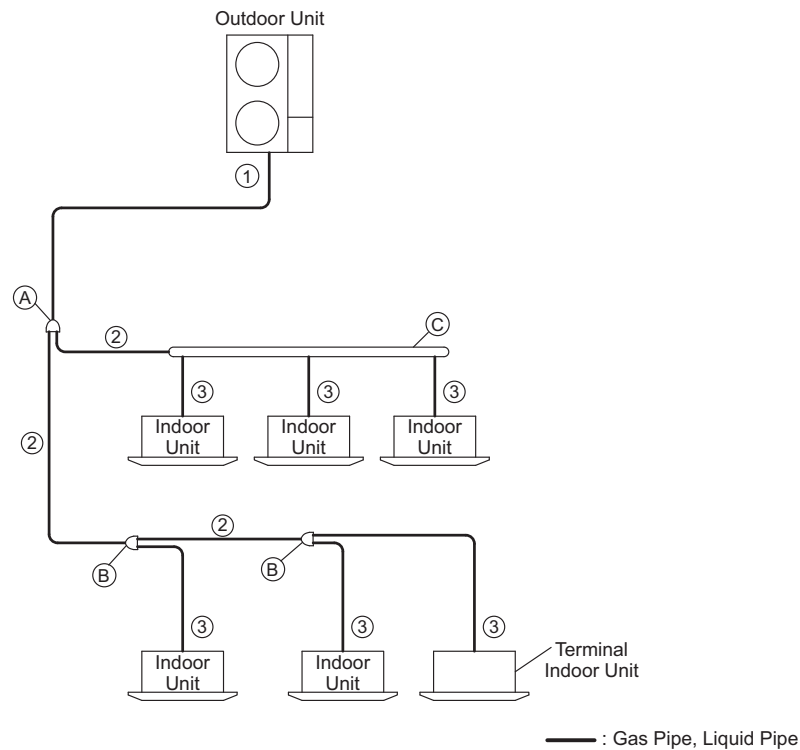
6.3 Connecting Refrigerant Pipings

- (1) The stop valve has been closed before shipment, however, make sure that the stop valves are closed completely.
- (2) Connect the accessory pipe to the gas stop valve.



- (4) Check gas leakage at flare connections.
- (5) Wrap insulations at the each flare nut connection and piping, and wind a tape for the insulation.

6.4 Piping Size and Multi-Kit Selection



Multi-Kit (Optional Parts)

< Line Branch >

Ⓐ First Branch

Outdoor Unit Capacity (MBH)	Model
36 - 60	MW-NP282A2

Ⓑ Line Branch after First Branch

Total Indoor Unit Capacity (MBH)	Model
≤ 86	MW-NP282A2

< Header Branch >

Ⓒ Header Branch

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

Refer to the figure on the previous page.

Piping Size < inch (mm) >

① [Main Pipe Diameter]
(Outdoor Unit to First Branch)

Outdoor Unit Capacity (MBH)	Equivalent Piping Length			
	< 328 ft (100m)		≥ 328 ft (100m) *1)	
	Gas	Liquid	Gas	Liquid
36 - 60	5/8 (15.88)	3/8 (9.52)	3/4 (19.05)	3/8 (9.52)

*1): It is required to prepare the reducer (field-supplied).

② [Diameter of Pipe after First Branch]

Gas	Liquid
5/8 (15.88)	3/8 (9.52)

③ [Diameter of Pipe between Multi-Kit and Indoor Unit]

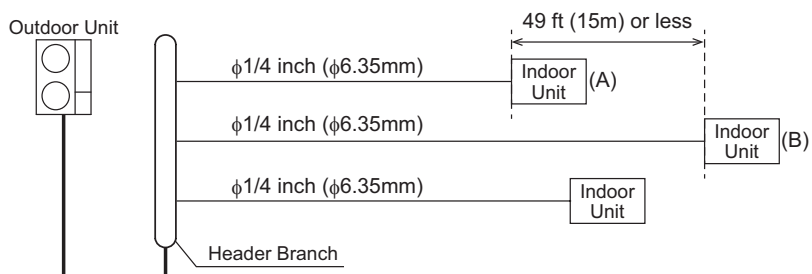
Indoor Unit Capacity (MBH)	Gas	Liquid
6 - 15	1/2 (12.7)	1/4 (6.35) *1)
18 - 48	5/8 (15.88)	3/8 (9.52)

*1): When liquid piping length is longer than 49 ft (15m), use 3/8 inch (9.52mm) diameter piping with the reducer (accessory pipe for Multi-Kit).

When satisfies all the following piping conditions, the diameter of the piping remains.

- Installation with one header branch.
- The pipe length between the nearest indoor unit and the farthest indoor unit from the outdoor unit is within 49 ft (15m).

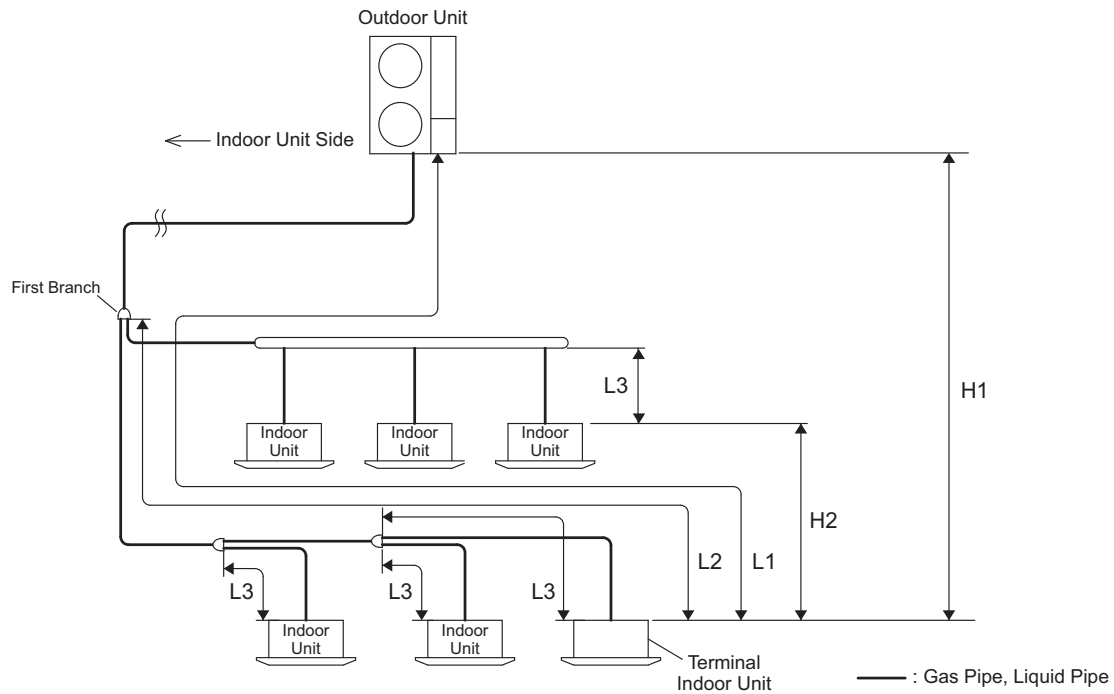
※ Not required to size up the liquid pipe.



- Piping Work Conditions

Comply with the following limitations when installing the unit.

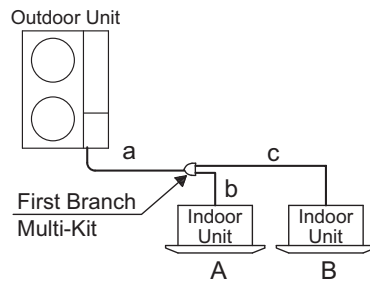
[Example]



Item		Mark	Allowable Piping Length
Total Piping Length		-	≤ 984 ft (300m)
Maximum Piping Length	Actual Length	L1	≤ 492 ft (150m)
	Equivalent Length		≤ 623 ft (190m)
Maximum Piping Length between Multi-kit of 1st Branch and Each Indoor Unit		L2	≤ 131 ft (40m)
Maximum Piping Length between Each Multi-kit and Each Indoor Unit		L3	≤ 131 ft (40m)
Height Difference between Outdoor Unit and Indoor Units	Outdoor Unit is Higher	H1	≤ 164 ft (50m)
	Outdoor Unit is Lower		≤ 131 ft (40m)
Height Difference between Indoor Units		H2	≤ 49 ft (15m)
Number of Main Branch	Including Header Branch	-	1 or less
	Not Including Header Branch	-	2 or less

Item	Mark	Details
Total Piping Length	$a+b+c$	The total amount of all piping actual length.
Maximum Piping Length	$a+c$	The actual piping length between the stop valve of the outdoor unit and the terminal indoor unit.
Piping Length	-	The actual length of pipe 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)



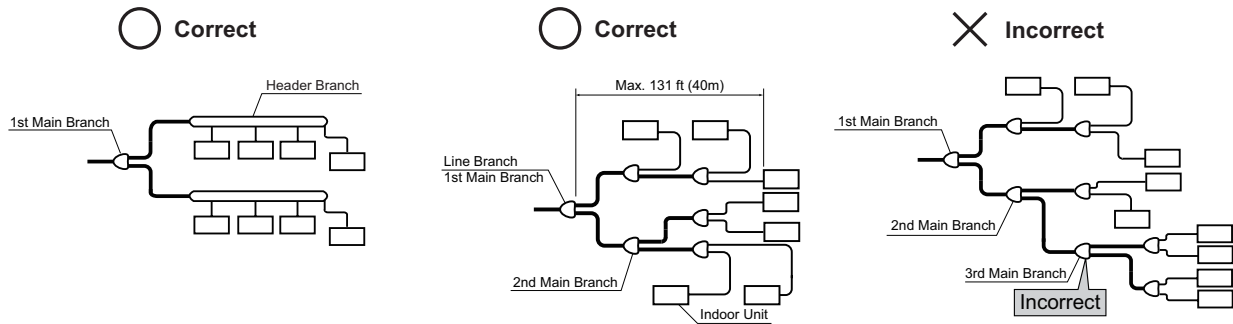
NOTICE

Comply with the following conditions when installing the unit.

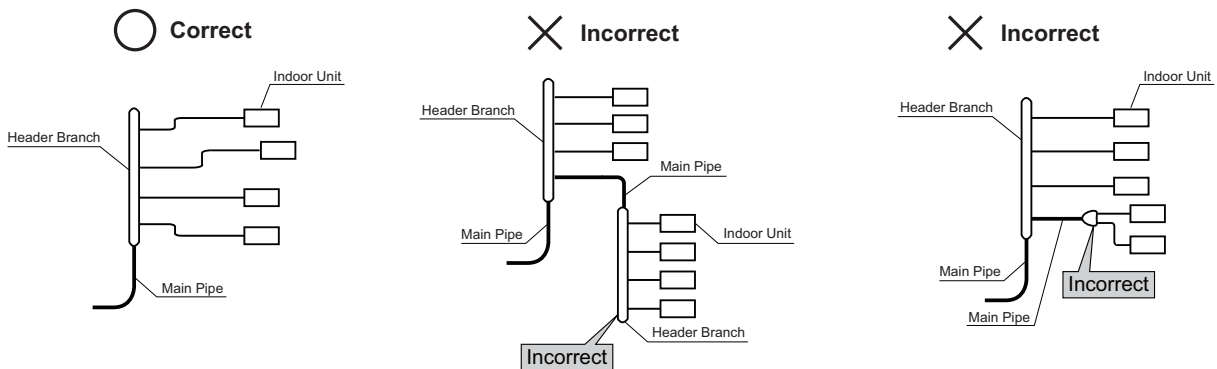
1. Allowable total piping length may not exceed 984 ft (300m) because of the limitation of maximum additional refrigerant amount as described in the following table. Make sure that the additional refrigerant volume does not exceed the maximum additional refrigerant amount as shown below.

Outdoor Unit Capacity (MBH)	36 - 60
Max. Additional Refrigerant Charge: lbs (kg)	18.5 (8.4)

2. 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.
3. When installing Energy Recovery Ventilation in the system, the piping length between Energy Recovery Ventilation and the outdoor unit must be within 49 ft (15m).
4. When completing on-site piping, install bent piping or horizontal loop piping to absorb any expansion or contraction due to changing temperatures.
5. It is possible to make the first or the second main pipe branch.
(In case of including header branch, it is possible to make the first main pipe branch.)
 - The word "Main Pipe Branch" indicates the pipe with both branches connected to another branch pipe.



6. A line branch and 2nd header branch cannot be connected to the 1st header branch.



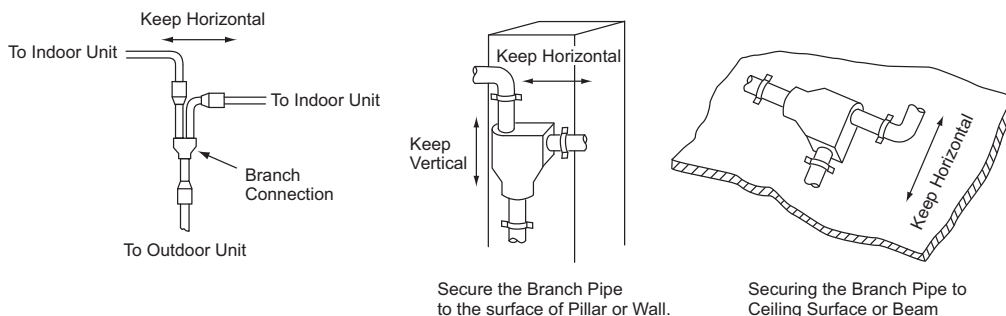
6.5 Multi-Kit Connection

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.



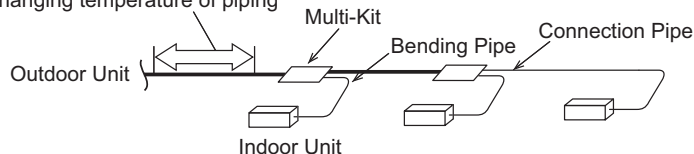
< Installation Posture of Branch Piping >

Upper Side	Upper Side	Upper Side	Upper Side
<p>Min. 1.6 ft</p> <p>Bending Radius</p> <p>Main Pipe</p> <p>Branch Pipe</p> <p>Branch Connection</p>	<p>Main Pipe</p> <p>Branch Pipe</p> <p>Branch Connection</p>	<p>Straight Length Min. 1.6 ft</p> <p>Main Pipe</p> <p>Branch Pipe</p> <p>Branch Connection</p>	<p>Main Pipe</p> <p>Branch Pipe</p> <p>Branch Connection</p>
CORRECT	CORRECT	CORRECT	INCORRECT

[Piping Form from Multi-Kit to Indoor Unit]

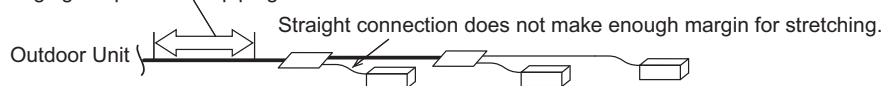
Ex. Recommended To prevent pipe damage, use bending pipes from each Indoor Unit to the Multi-Kit.

Piping stretches during operation because of changing temperature of piping



Ex. Not Recommended

Piping stretches during operation because of changing temperature of piping



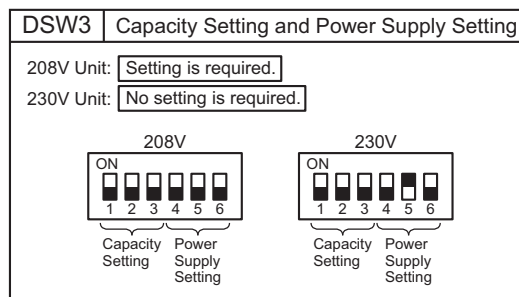
NOTICE:

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 DSW3 on the PCB1 according to each power supply shown in the figure below.



- 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 (0.82mm²), 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.
 - 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 shall be a minimum of AWG18 (0.82mm²), 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 wiring for the outdoor unit, and indoor unit are connected.

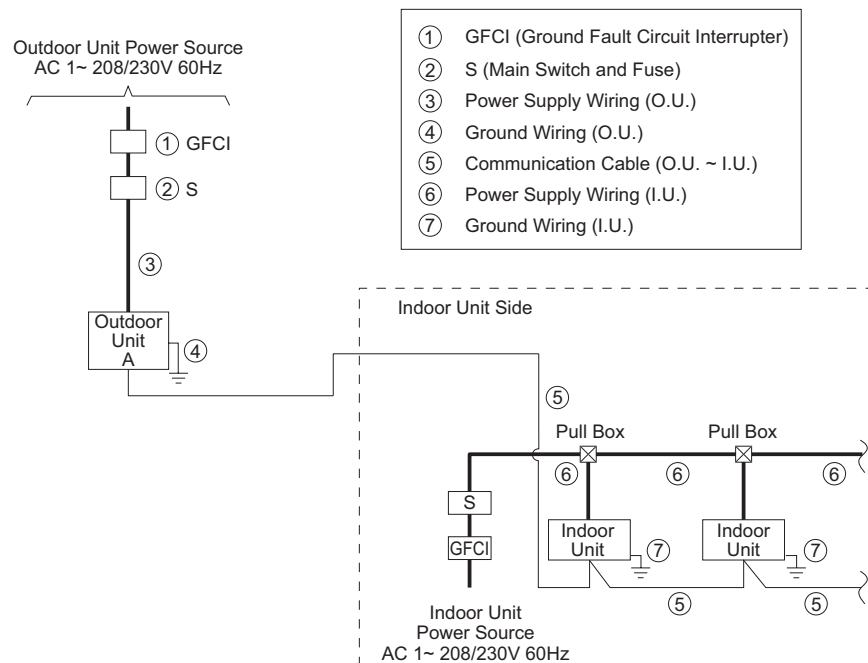
WARNING

- 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 installation and maintenance 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 wirings.

(1) Power Supply 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)VAHP036B21S	60	208/230	253	188	31	40	40	24	30
(H,Y)VAHP048B21S	60	208/230	253	188	31	40	40	24	30
(H,Y)VAHP060B21S	60	208/230	253	188	31	40	40	24	30

Model	Fan Motor		Wiring Size			Conduit Tube
	Output [kW]	FLA [A]	Power Supply Wiring [AWG]	Ground Wiring [AWG]	Communication Cable [AWG]	for Power Supply Wiring [in. (mm)]
(H,Y)VAHP036B21S	0.058+0.058	0.5+0.5	8	8	18	3/4 (19.05)
(H,Y)VAHP048B21S	0.058+0.058	0.5+0.5	8	8	18	3/4 (19.05)
(H,Y)VAHP060B21S	0.058+0.058	0.5+0.5	8	8	18	3/4 (19.05)

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 (0.82mm²), 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 $\pm 10\%$
3. Do not connect the ground wiring to gas piping, water piping, or a lightning 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 lightning conductor is used.

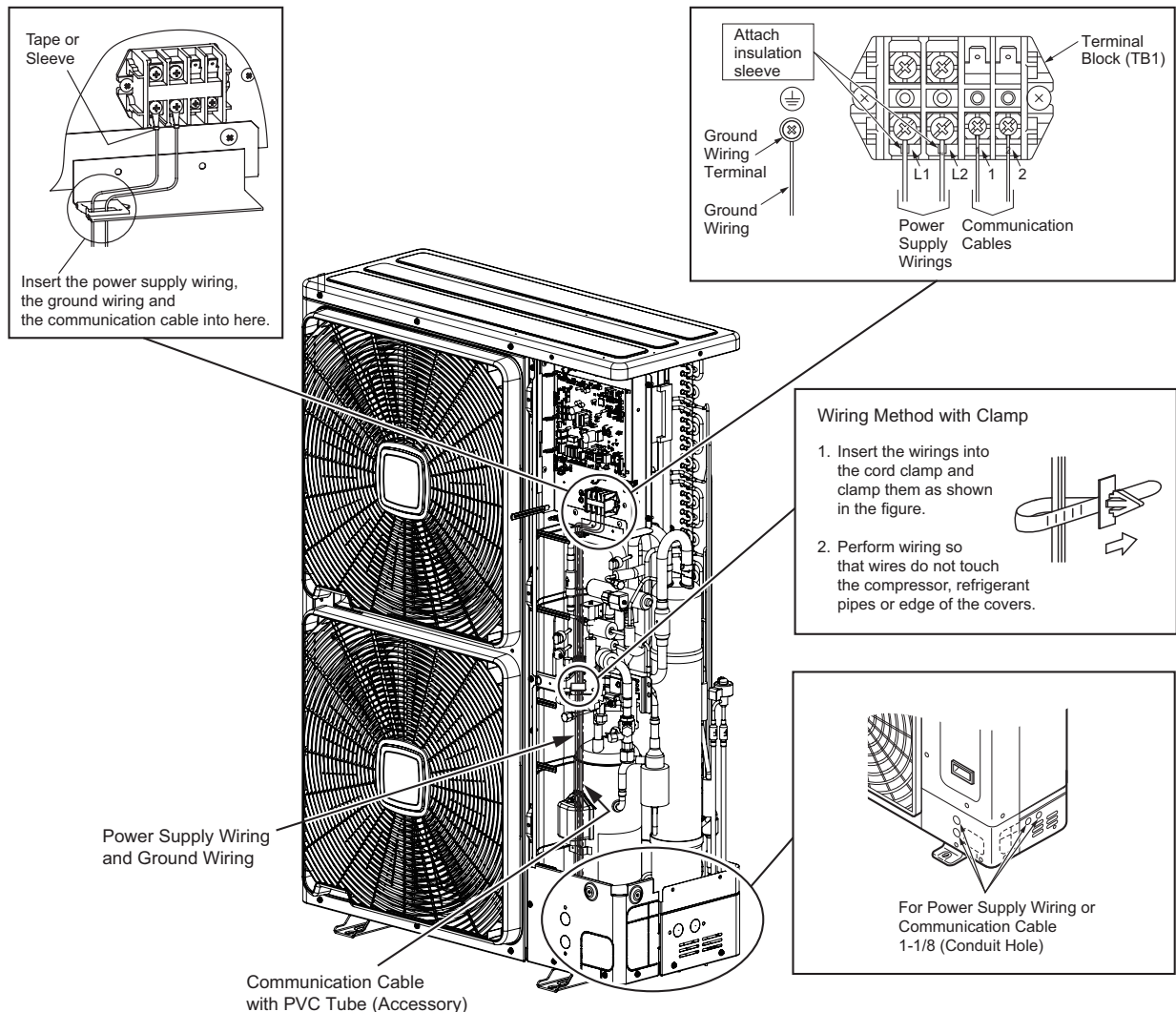
7.3 Electrical Wiring for Outdoor Unit

Connect the electrical wiring according to the following figure:

- (1) Connect the power supply wirings to L1 and L2 for the 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 unit and indoor units to the terminals 1 and 2 on the terminal block TB1. 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 cable shall be a minimum of AWG18 (0.82mm²), 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. Then, tighten both ends of the PVC tubing with the cable bands (accessory) in order to secure the PVC tubing to the communication cables.
- (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)

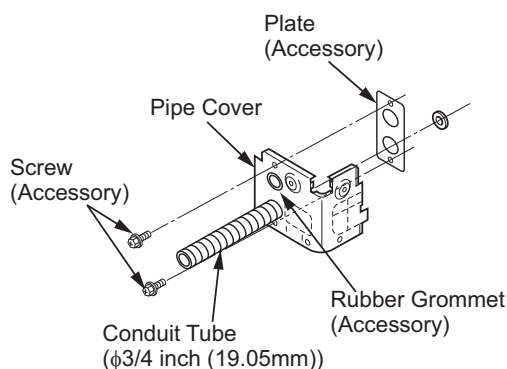


⚠ CAUTION

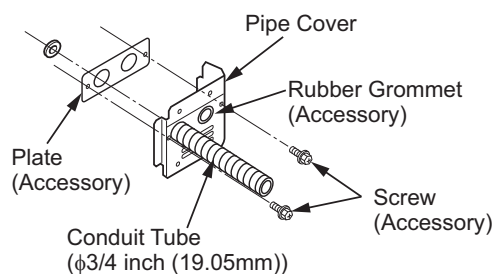
Be sure to note the following points when wirings under the unit using conduit tubing.

NOTES:

1. When installing the power supply wiring, use the field-supplied conduit tube and the plate (accessory) as shown below. The conduit tube can be connected in two direction (front and right side).
Open either side of the knockout-hole for conduit tube.
2. When installing the communication cables, run them through the rubber grommet (accessory).
(Require to make a hole in the rubber grommet)
3. Draw each individual cable through its corresponding hole.
4. Maintain at least 5 inch (127mm) between the power supply wiring and communication cables.
5. Attach the pipe cover to prevent small animals or insects from entering the unit.
6. Prevent cables from touching or rubbing up against refrigerant piping, plate edges, and electrical components inside the unit.
7. Completely seal the end of conduit tube with sealing materials to prevent the rain from entering the conduit tube.
8. Create a drainage hole at the lowest part of the conduit tube.



Front Side Connection



Right Side Connection

⚠ CAUTION

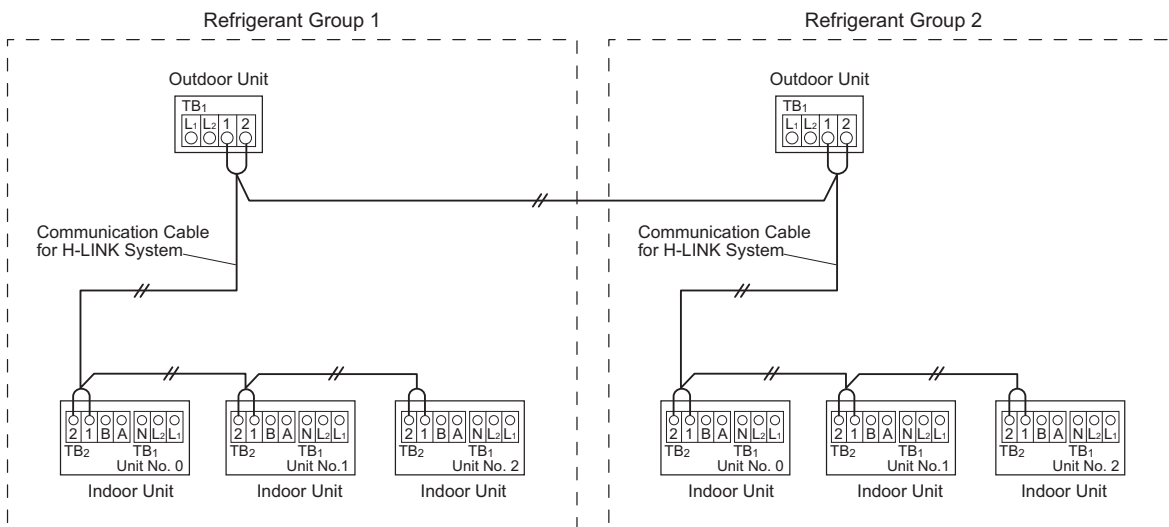
Tightly secure the power supply wiring using a cable clamp inside the unit.

7.4 Electrical Wiring Connections of Indoor Unit and Outdoor Unit

- (1) Connect a power supply wiring to the outdoor unit. Connect a Ground Fault Circuit Interrupter (GFCI), fuse, and main switch (S) to the outdoor unit.
- (2) Connect a power supply wiring to each indoor unit connected to the 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 unit, as shown in Figure 7.1.
- (4) Connect the communication cables in the same refrigerant cycle 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 cycle systems may lead to malfunction.
- (5) Use communication cabling that is a minimum of AWG18 (0.82mm²), 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 (TB1) in the outdoor unit.
 - between outdoor unit and indoor unit
 - between outdoor unit and outdoor unit in other refrigerant cycles
- (9) Do not connect the power supply wiring to the terminal block for communication cable (TB1). All the printed circuit boards in the same refrigerant cycle will be damaged.
- (10) Connect the ground wiring to the outdoor unit and indoor units. The ground wiring work under the condition of 100Ω (max.) ground resistance must be performed by a authorized personnel.

- Communication Cabling



NOTES:

1. If an alarm is indicated on the LCD of outdoor unit, follow the "7-segment" display at the outdoor unit for verification purposes.
2. Perform a function setting at the outdoor unit.
3. 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).

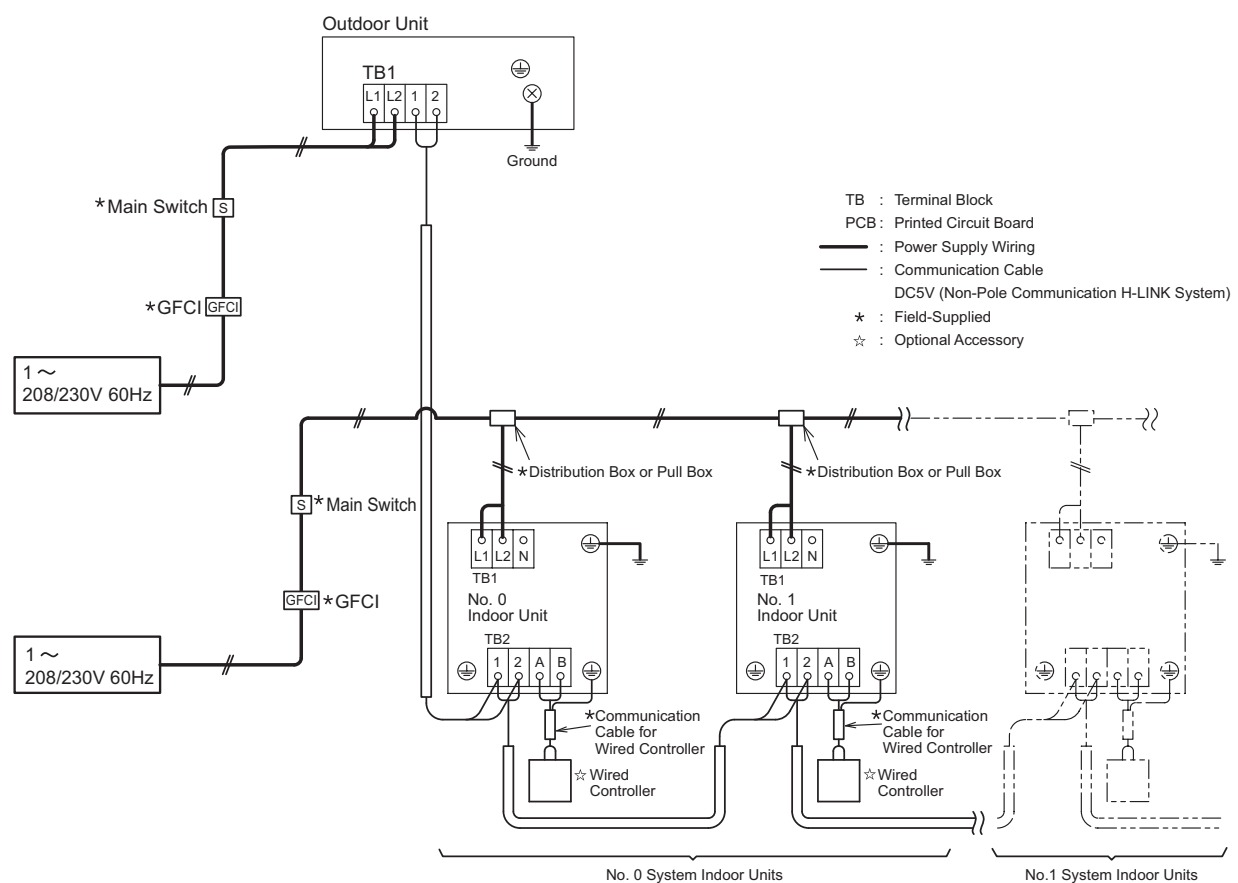


Figure 7.1 Instruction for Electrical Wiring Connection

7.5 DIP Switch Setting of Outdoor Unit

Turn OFF all power sources before performing settings.

DIP switch settings cannot be changed without first disconnecting from the power source.

(However, No.1, 2, and 4, pins of DSW1, No.5 and 6 pin of DSW2 and push switches can be operated when power source is ON.)

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

NOTE

- By using switch DSW1, 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.



Arrangement of DIP Switches and Push Switches

DSW1 | Test Run

Setting is required. For Test Run

Setting Before Shipment	Setting Item	Pin No.
ON	Test Cooling Operation	1
	Test Heating Operation	1, 2
	No setting is required	3
	Compressor Forced Stop and Function Setting	4

DSW2 | Function Setting

Setting is required.

Setting Before Shipment	Setting Item	Pin No.
ON	No setting is required	1
		2
		3
		4
	Function Setting	5
	External Input/Output Setting	6

DSW3 | Capacity and Power Supply Setting

Power Supply	Capacity (MBH)		
	036	048	060
208V	ON	ON	ON
Setting is required.			
230V	ON	ON	ON
No setting is required.			

DSW4 | Ref. Cycle No. Setting

Setting is required.

Setting Before Shipment

DSW4

ON

1 2 3 4 5 6

Tens Digit

Setting Position

RSW1

0 1 2 3 4 5 6 7 8 9

Last Digit

Set the unit number of outdoor unit at each refrigerant cycle.
(Setting before shipment is unit 0.)

DSW5 | Communication Setting

Setting is required. For End Terminal Resistance Cancellation

Set No.1 pin of DSW5 correctly in the same H-LINK system. Otherwise, it may cause abnormal transmission. Refer to "Setting of End Terminal Resistance"

Setting Before Shipment

ON

1 2

End Resistance Cancellation

ON

1 2

DSW6 | -

No setting is required.

Setting Before Shipment

ON

1 2 3

DSW7 | -

No setting is required.

Setting Before Shipment

ON

1 2

Figure 7.2 DSW Setting

- **Setting for Transmitting**

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

- **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.

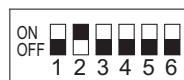
Setting outdoor unit refrigerant system No. is required.

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
		<p>Setting Position Set by inserting slotted screwdriver into the groove.</p>
Outdoor Unit	DSW4	RSW1
Indoor Unit (H-LINK II)	DSW5	RSW2

Example: If Setting Refrigerant System No. 25

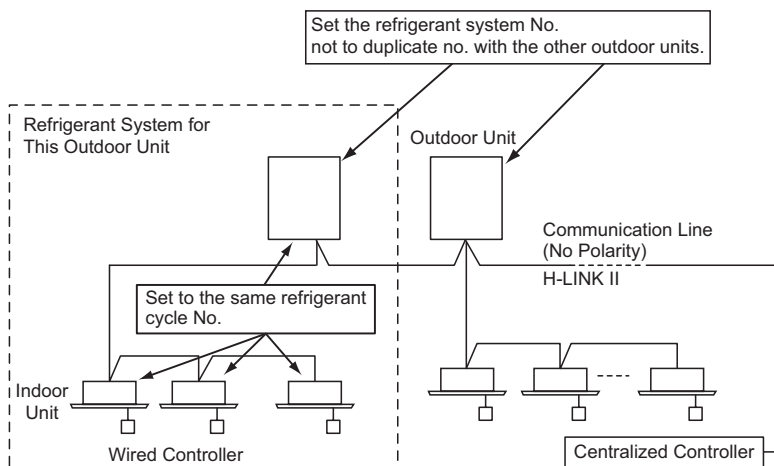


Turn ON No. 2 pin.



Set Dial No.5.

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



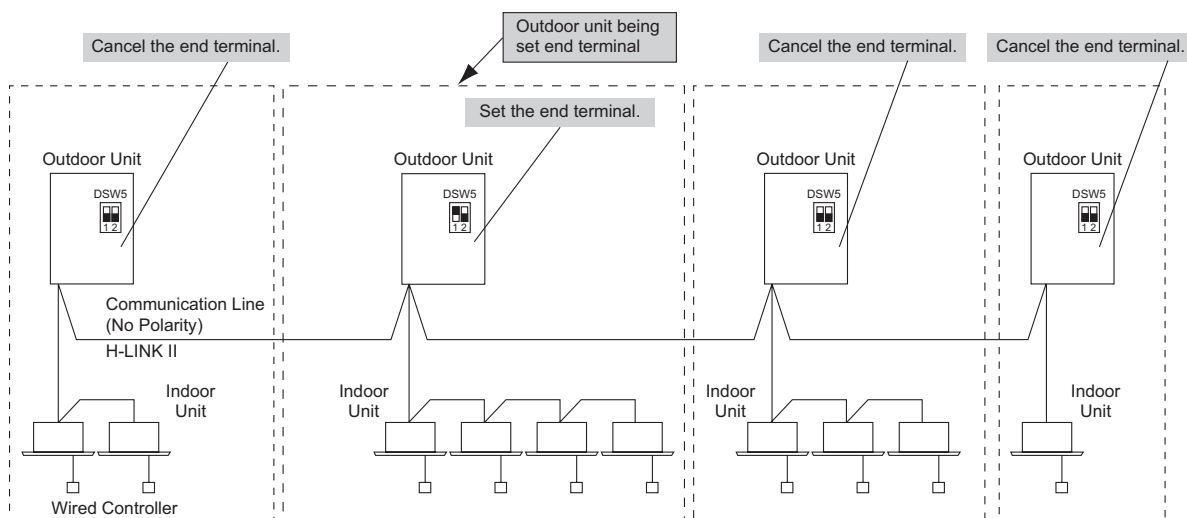
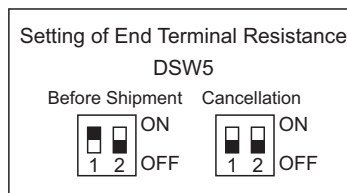
NOTE:

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 160.

● Setting of End Terminal Resistance

Before shipment, No.1 pin of DSW5 (for the setting of end terminal resistance) is in the “ON” position.

In the case that the outdoor units quantity in the same H-LINK II is 2 or more, set No. 1 pin of DSW5 at “OFF” side from the 2nd refrigerant group outdoor unit. If only one outdoor unit is used, no setting is required.



• 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 DSW1-No.4
Turn ON DSW2-No.6

For the setting mode, refer to ① below.

■ Exit Setting Mode

Turn OFF DSW2-No.6 during indicated External Input/Output Setting Mode.
Turn OFF DSW1-No.4.

After setting, confirm DSW1 setting is same as setting before shipment, and DSW2 setting is correct.

[Function Setting]

■ Start of Setting

Turn ON DSW1-No.4
Turn ON DSW2-No.5

For the setting mode, refer to ② below.

■ Exit Setting Mode

Turn OFF DSW2-No.5 during indicated Function Setting Mode.
Turn OFF DSW1-No.4.

NOTE:

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

② [Function Setting]

By pressing PSW1 (▶) the setting can be changed. PSW2 (▼): forward, PSW3 (▲): 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 PSW1 (▶), the function No. can be selected. PSW2 (▼): forward, PSW3 (▲): backward

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

< Example >

1

Item	Indication	SET
1 Input Setting 1 CN1 [1-2 pin]	11	
2 Input Setting 2 CN1 [2-3 pin]	12	
3 Input Setting 3 CN2 [1-2 pin]	13	
4 Output Setting 1 CN7 [1-2 pin]	01	
5 Output Setting 2 CN7 [1-3 pin]	02	

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	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	Indication	SET
1 Circulator Function at Heating Thermo-OFF	FR	
2 Night-Shift (Low Noise)	NI	
3 Cancellation of Outdoor Ambient Temperature Limit	OS	
4 Change of Defrost Condition	JO	
5 SLo (Fan Speed) Defrost Setting	bu	
6 Cancellation of Hot Start	HR	
7 Priority Capacity Mode	NU	
8 Compressor Frequency Control Target Value for Cooling	Hc	
9 Compressor Frequency Control Target Value for Heating	Hh	
10 Compressor Frequency Fixed mode	Sc	
11 Indoor Expansion Valve Opening during Heating Operation Stoppage	Si	
12 Indoor Expansion Valve Opening during Heating Thermo-OFF	So	
13 Indoor Expansion Valve Initial Opening during Heating Thermo-NO	ci	
14 Sound Reduced Function	db	
15 Demand Function Setting	de	
16 Wave Function Setting	ue	
17 Protection of Decrease in Outlet Temperature of Cooling	Fb	

Item	Indication	SET
18 Outlet Temperature Control (DOAS)	Ff	
19 Not Prepared	E1	
20 Thermo-OFF Setting for Outdoor Unit After Defrosting Operation	d5	
21 Intermittent Operation of Outdoor Fan Motor (Snow Prevention)	F1	
22 Not Prepared	F2	
23 Not Prepared	F3	
24 Invalid Expansion Valve Opening Difference Protection	F4	
25 Not Prepared	F5	
26 Not Prepared	F6	
27 Not Prepared	F7	
28 Crankcase Heater Control during Stoppage	F8	
29 Invalid Motion Sensor during Prepare Defrost	F9	
30 Convert unit in Checking mode	Fc	
31 Not Prepared	Fd	
32 Permit Indoor Fan Operation during Forced Stoppage	Fe	
33 Not Prepared	Ff	
34 Not Prepared	Fg	

NOTE:

Fill in the setting conditions in the box of the function setting and external input/output setting on the nameplate attached to the reverse surface of the service cover.

(Reset according to the record when exchange the PCB)

8. Additional Refrigerant Charge

8.1 Airtight Test

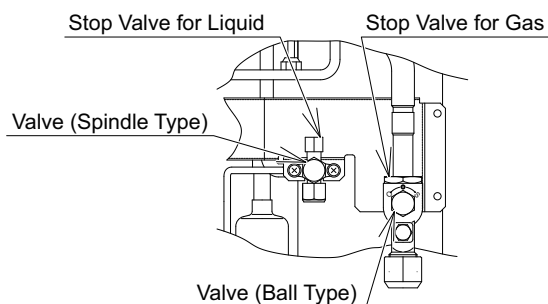
- (1) Check to ensure that spindles of the stop valves for gas and liquid pipes are closed completely before airtight test.
- (2) The refrigerant used for this outdoor unit is R410A. Use the manifold gauge and the charging hose for exclusive use of R410A.

< Tightening Check of Stop Valves >

After connecting the pipe, remove the caps on stop valves for gas and liquid. Tighten the valve in the closing direction according to next page.

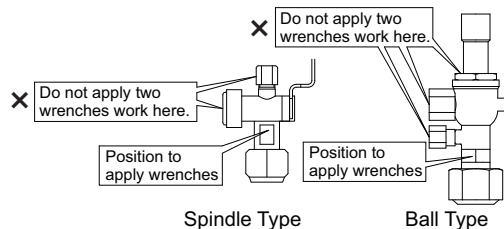
● Caution for Operation of Stop Valves

- (a) Remove the stop valve caps before performing the airtight test after connecting the refrigerant piping. Tighten the valve in clockwise direction (close direction).
- (b) Perform the work after warming the valve 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 ball valve (Tightening Torque: < 3.7 ft·lbs (5.0 N·m)).
- (d) Tighten caps securely according to the below torque specifications after each valve is opened.

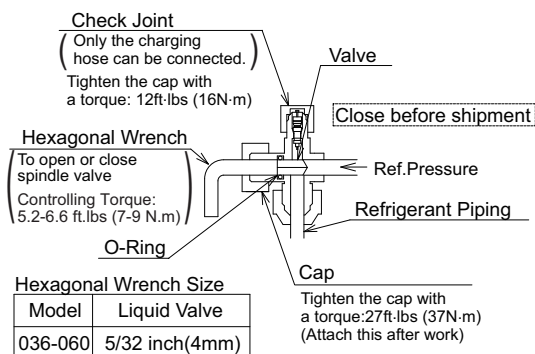


< Operational of the Stop Valve >

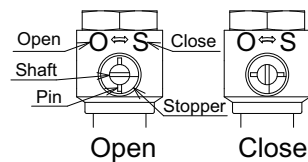
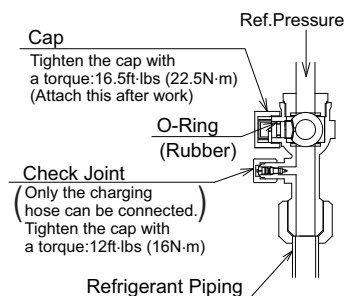
Use securely two wrenches at the following position when removing or installing the pipe. (If not, refrigerant leakage may occur.)



Liquid Valve (Spindle Type)



Gas Valve (Ball Type)

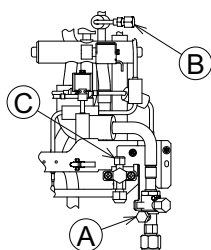


- (1) This valve is open or closed by rotating 90 degrees at the ball valve part.
- (2) Rotate the shaft until the pin touches the stopper. Do not apply extra force. Use a slotted screwdriver to control the shaft.
(Controlling torque is 3.7 ft·lbs (5.0 N·m) or less)

< Pressure Measurement by Check Joint >

When the pressure is measured, use the check joint of gas stop valve (A) in the figure) and use the check joint of piping (B) in the figure).

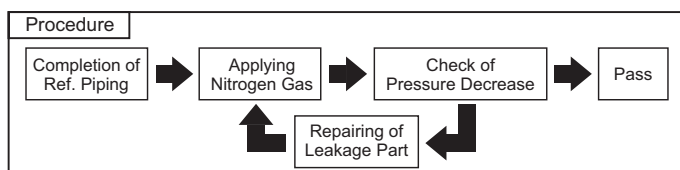
At that time, connect the pressure gauge according to the table below because of high pressure side and low pressure side change by operation mode.



	Cooling Operation	Heating Operation
Check Joint for Gas Stop Valve (A)	Low Pressure	High Pressure
Check Joint for Piping (B)	High Pressure	Low Pressure
Check Joint for Liquid Stop Valve (C)	Exclusive for Vacuum Pump and Refrigerant charge	

< 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 a leak detector or forming agent. If there is 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 liquid line side). If not performed in this manner, the expansion valve for the outdoor unit, and indoor unit can close up, making any airtight test impossible.

! WARNING

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

< 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) Mount the piping cover equipped with the outdoor unit after connecting the pipe.
Completely seal the point of penetration at the bottom of the pipes with insulation in order to prevent rain water from entering the conduit.
- (3) Seal the gap between the piping cover and pipes with the field-supplied packing after insulation work is completed.

NOTICE:

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

8.2 Vacuuming

- (1) Connect a manifold gauge and vacuum pump to the check joints of 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 stop 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 valve.

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.

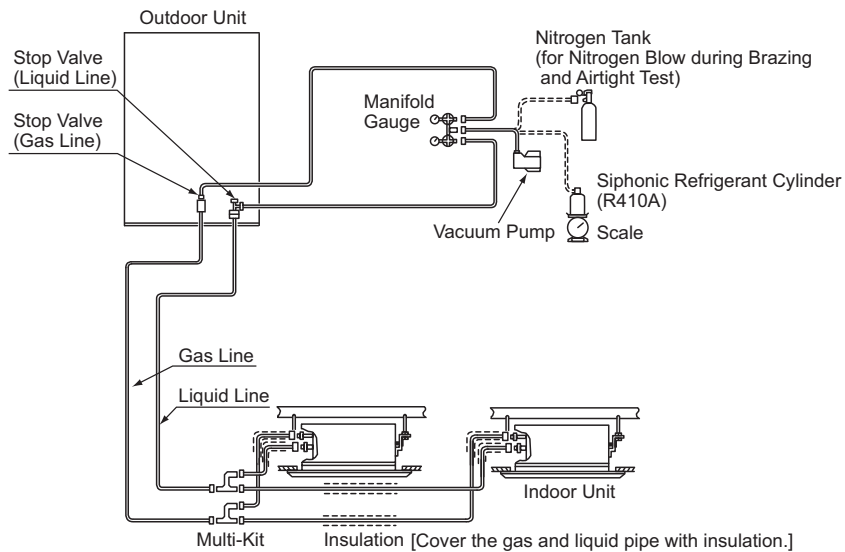
NOTICE

Do not apply excessive force to the valve after fully opening the valve. Otherwise, the valve will blow out due to refrigerant pressure. At the test run, fully open the liquid stop valve and gas stop 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 ball valve (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 after each 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. At this time, keep the liquid stop valve slightly open. An acceptable error must fall within ± 1.1 lbs (± 0.5 kg).
- (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 as liquid.
- (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. If the refrigerant comes into contact with open flames, toxic gas could be generated.

8.4 Additional Refrigerant Charge Calculation

Although this unit has been charged with refrigerant, additional refrigerant charge is required depending on total piping length for the system.

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

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

Table 8.1 Additional Refrigerant Charge Calculation

①	Additional Refrigerant Charge Calculation	Liquid Piping Diameter [in. (mm)]	Refrigerant Amount For 1ft. Pipe [lbs./ft. (kg/m)]	Total Piping Length [ft. (m)]		Additional Charge [lbs. (kg)]	
		ϕ3/8 (9.52)	0.034 x (0.05 x)	<input type="text"/>	(<input type="text"/>)	<input type="text"/>	(<input type="text"/>)
		ϕ1/4 (6.35)	0.014 x (0.02 x)	<input type="text"/>	(<input type="text"/>)	<input type="text"/>	(<input type="text"/>)
		Additional Refrigerant Charge		<input type="text"/>	(<input type="text"/>)	<input type="text"/>	(<input type="text"/>)
②	Refrigerant Charge Amount of O.U. Before Shipment			Model		Precharge [lbs. (kg)]	
				036 - 060		7.9 (3.6)	
③	Total Refrigerant Charge Amount			③ = ① + ②		Total Charge [lbs. (kg)]	
						<input type="text"/>	(<input type="text"/>)

NOTE:

Ensure that the total additional charge ① does not exceed the maximum additional refrigerant charge quantity as shown in the table below.

< Max. Additional Refrigerant Charge Quantity Allowed >

Outdoor Unit Capacity (MBH)	36 - 60
Max. Additional Ref. Charge Quantity: lbs (kg)	18.5 (8.4)

< Initial Ref. Charge Amount of O.U. (Before Shipment) (② lbs) >

Outdoor Unit Capacity (MBH)	36 - 60
W0 Outdoor Unit Ref. Charge: lbs (kg)	7.9 (3.6)

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 Total Charge

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

$$\text{③ Total Ref. Charge} = \text{① lbs} + \text{② lbs} = \text{ } \text{lbs} (\text{ } \text{kg})$$

NOTES:

- When refrigerant is recovered or charged due to repairs, operating, or adjusting the unit, record the refrigerant quantity again.
- Record the refrigerant charge amount on the nameplate attached to the reverse surface of the service cover as well.

NOTICE

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

- Special Attention Regarding Refrigerant Gas Leakage

Make sure that the entire VRF system meets ASHRAE Standard 15 or, any local codes, regarding Safety. The ASHRAE Standard 15-2013 provides safeguards for life, limb, health, property, and prescribes safety requirements.

The standard is recognized as the main guide for personal safety involving refrigeration systems. It strives to ensure a safe application of refrigerant systems by limiting the maximum charge as follows so that a complete discharge due to a leak into a small, occupied, and enclosed room can never exceed the allowable limit.

$$\frac{\text{Total Refrigerant Charge Amount in System [lbs]}}{\text{Room Space for each Indoor Unit [Mcf]}} \leq \text{RCL}$$

RCL: The Maximum Refrigerant Concentration Limit

According to ASHRAE Standard 15-2013, RCL for R410A is 26lbs/Mcf (420g/m³).

But if indoor units are installed for institutional occupancies, such as asylums, nursing homes, hospitals and spaces containing locked cells, the limit is reduced to 13lbs/Mcf (210g/m³).

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 this 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 cycle. If not, the result will be abnormal operation with a potentially serious accident.
Verify that all DIP switch settings for the refrigerant cycle 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 cycle 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 apply the voltage on the terminals for communication lines. Otherwise, failure can result.
- (3) Verify that each wire, L1, and L2, is correctly connected at the power source.
If any one of those is incorrectly connected, the unit will not operate.
- (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.

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. For other controllers, refer to 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.
- (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 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 in 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 is 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 "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	23°F DB (-5°C DB) *	-4°F WB (-20°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 Rtn

- (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 unusual sounds are generated, press “◁” or “▷” again to halt the auto-swing operation.
- (e) Though the temperature adjustments using detected temperatures 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 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 and is normal.

! 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 (Before Shipment)

The darkened squares indicate the position of the DIP switch.

DSW1	
Switch for Setting of Service Operation and Function	
	ON
	OFF
1	2
3	4
1. Test Run 2. COOL/HEAT Setting (ON: Heating Operation) 3. OFF (Fixed) 4. Manual Compressor OFF	

! 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 DSW1 OFF when the test run operation is completed.





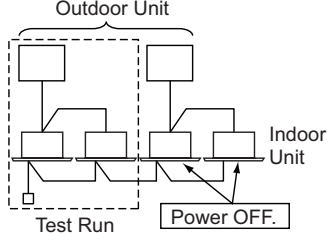


	DIP Switch Setting	Operation	Remarks
Test Run	<p>1. Setting of Operation Mode</p> <p>Cooling: Set No.2 pin of DSW1 OFF.</p>  <p>1 2 3 4</p> <p>Heating: Set No.2 pin of DSW1 ON.</p>  <p>1 2 3 4</p> <p>2. Starting Test Run</p> <p>Set No.1 pin of DSW1 ON and the operation is started after a few ~ 20 seconds.</p> <p>When heating operation,  leave No.2 pin of DSW1 at ON.</p>  <p>1 2 3 4</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 DSW1 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 DSW1 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 DSW1 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 DSW1 ON.</p>  <p>1 2 3 4</p> <p>2. Canceling</p> <p>*Compressor ON: Set No.4 pin of DSW1 OFF.</p>  <p>1 2 3 4</p>	<p>1. When No.4 pin of DSW1 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 DSW1 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 unit fan correct? ☐
2. Is the rotation direction of the outdoor unit fans correct? ☐
3. Are there any abnormal compressor sounds? ☐
4. Has the unit been in operation 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 ₁ -L ₂ 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 correct? ☐
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 mounted? ☐
17. Are all cabinet panels free from rattles? ☐
18. Is the indoor unit filter clean? ☐
19. Are the indoor unit heat exchanger and outdoor unit 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, Disconnect Wire, Blowout of Fuse, Outdoor Unit Power OFF
04		Problem between Inverter PCB and Outdoor PCB	Inverter PCB - Outdoor PCB Communication Failure (Loose Connector, Wire Breaking, Blown of 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
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)
11	Sensor on Indoor Unit	Inlet Air Thermistor	Incorrect Wiring, Disconnecting 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
20	Sensor on Outdoor Unit	Discharge Gas Thermistor on Top of Compressor	Incorrect Wiring, Severed or Disconnecting Wiring, Short Circuit
21		High Pressure Sensor	
22		Outdoor Air Thermistor	
24		Heat Exchanger Liquid Pipe Thermistor	
29		Low Pressure Sensor	
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
38		Problem with Protective Pickup Circuit in Outdoor Unit	Failure of Protection Detecting Device (Incorrect Wiring of Outdoor PCB)

Code	Category	Content of Abnormality	Leading Cause
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
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 Cycle Number	There are 64 or More Number is Set for Address or Refrigerant Cycle.
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) Crankcase Heater: This band type heater protects against oil foaming during cold starting, as it is energized while the compressor is stopped.

Model		(H,Y)VAHP036B21S	(H,Y)VAHP048B21S	(H,Y)VAHP060B21S
High Pressure Increase Protection		Automatic Reset, Non-Adjustable		
High Pressure Increase Protection Control	psi (MPa)	515 (3.55)	515 (3.55)	515 (3.55)
Pressure Switch	Cut-Out	(for each compressor)		
		psi (MPa)	psi (MPa)	psi (MPa)
		601 -7 -21 (4.15 -0.05) -0.15)	601 -7 -21 (4.15 -0.05) -0.15)	601 -7 -21 (4.15 -0.05) -0.15)
	Cut-In	psi (MPa)	psi (MPa)	psi (MPa)
		464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
Inverter Compressor		Automatic Reset, Non-Adjustable		
Over Current				
Inverter Current Protection Control	A	21.5	21.5	21.5
Breaker	A	30.0	30.0	30.0
Over Heat		Automatic Reset, Non-Adjustable		
Discharge Temperature		°F	°F	°F
Increase Protection Control	(°C)	206 (97)	206 (97)	206 (97)
Fan Motor		Automatic Reset, Non-Adjustable		
Over Current Protection Control	A	1.72	1.72	1.72
Fuse	A	5	5	5

