

Installation and Maintenance Manual

INVERTER-DRIVEN MULTI-SPLIT SYSTEM HEAT RECOVERY AIR CONDITIONER

Models:

Outdoor Units;

208/230V

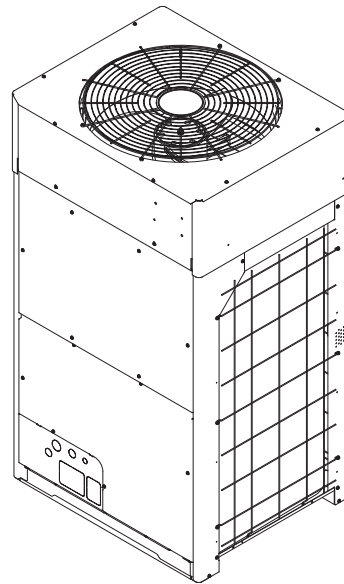
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IMPORTANT:

***READ AND UNDERSTAND
THIS MANUAL BEFORE
INSTALLING THIS HEAT
RECOVERY AIR CONDITIONER.
KEEP THIS MANUAL FOR
FUTURE REFERENCE.***

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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 recovery 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 codes. No part of this manual may be reproduced in any way without the expressed written consent of Johnson Controls Inc.
- This heat recovery 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 and warnings.
- If you have questions, please contact your distributor or contractor.
- This manual provides common descriptions, basic and advanced information to maintain and service this heat recovery air conditioning unit which you operate as well for other models.
- This heat recovery 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

Cooling Operation Range		Indoor	°F WB (°C WB)	59 (15) to 73 (23)
		Outdoor ^{1, 2, 3, 6, 10}	°F DB (°C DB)	23 (-5) to 122 (50)
		with Snow Protection Hood ^{4, 6}	°F DB (°C DB)	14 (-10) to 109 (43)
		with Low Ambient Kit ^{5, 6, 8}	°F DB (°C DB)	-10 (-23) to 109 (43)
Heating Operation Range		Indoor	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor ^{7, 8, 9}	°F WB (°C WB)	-13 (-25) to 59 (15)
Cooling & Heating Operation Range	Cooling	Indoor	°F WB (°C WB)	59 (15) to 73 (23)
		Outdoor ^{1, 2, 3, 6, 10}	°F DB (°C DB)	23 (-5) to 75 (24)
		with Snow Protection Hood ^{4, 6}	°F DB (°C DB)	14 (-10) to 75 (24)
		with Low Ambient Kit ^{5, 6, 8}	°F DB (°C DB)	-10 (-23) to 75 (24)
	Heating	Indoor	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor ^{7, 10}	°F WB (°C WB)	22 (-6) to 59 (15)
		with Snow Protection Hood ^{4, 6}	°F WB (°C WB)	12 (-11) to 59 (15)
		with Low Ambient Kit ^{5, 6, 8}	°F WB (°C WB)	-11 (-24) to 59 (15)

DB: Dry Bulb, WB: Wet Bulb

1. When the system meets the following conditions, the outdoor unit may be Thermo-OFF to prevent the compressor from failure.
 - Total capacity of the operating indoor unit is larger than capacity of outdoor unit; and
 - Outdoor air temperature is 100°F DB (38°C DB) or more.
 2. If the installation takes place under either one of the following conditions, the maximum connectable indoor unit capacity ratio is 100%.
 - Outdoor air temperature is 109°F (43°C) or more during cooling operation; or
 - Outdoor air temperature is 14°F (-10°C) or less during cooling operation.
 3. When installing the snow protection hood or low ambient kit, the upper limit of outdoor air temperature must be 109°F (43°C).
 4. When the outdoor air temperature is 23°F (-5°C) or less during the outdoor unit cooling operation, the minimum connectable indoor unit capacity is 18MBH.
In this case, install the snow protection hood (optional part).
 5. When the outdoor air temperature is 14°F (-10°C) or less during the outdoor unit cooling operation, the minimum connectable indoor unit capacity is 18MBH.
In this case, install the Low Ambient Kit (optional part).
 6. 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 frost.
Depending on the operating condition, the outlet air temperature of the indoor unit may be excessively low.
Pay attention to the direction of the outlet air. Do not place items near the air outlet and under the indoor unit as they may be damaged by condensation that may form if the humidity or the latent heat load is continuously high.
(for example:
 - using at kitchen or gymnasium; or
 - using at the room that has high population density or introduces outside air; or
 - using humidifier together; or
 - using combustion heater like gas heater together)
 7. 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.
 8. Operation in the outdoor temperature of 5 to -13°F WB (-15 to -25°C WB) is assumed to limited conditions such as start-up in early morning. Extended operation in this condition may shorten the life of the compressor.
 9. When the outdoor air temperature is 14°F (-10°C) or less, or under the high heating load conditions, the total indoor unit capacity should be less than 100% of the outdoor unit capacity, and the total piping length should be less than 984 ft (300m).
 10. There are some limitations of the height difference between Outdoor Units and Indoor Units.
Refer to Section 6.5 " and Multi-kit Selection" for details.
- 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.

Interchangeability between Generation 1 and 2 Change-Over Boxes

- Generation 2 change-over box is compatible with the generation 2 outdoor unit.
- Generation 1 change-over box is compatible with the generation 1 outdoor unit when there is no generation 2 change-over box in the same system.
- Generation 1 change-over box is compatible with the generation 2 outdoor unit with limitations of the operating temperature range and the connectable indoor unit capacity ratio.
See the following table "Limitations for Combination of Generation 1 Change-Over Box and Generation 2 Outdoor Unit" for details.
- Generation 1 and 2 change-over boxes cannot be used in the same system together.
- Production of generation 1 change-over box shall be discontinued. However, it will be supplied for servicing and maintenance until further notice. Regarding order requests for the generation 1 change-over box, contact Tech Support at: 1-844-873-4445 (option 2).

Determining Propriety of Connection between
Change-Over Box and VRF Outdoor Unit (Heat Recovery)

Model of Change-Over Box and VRF Outdoor Unit			Change-Over Box			
			Generation 1		Generation 2	
			Single Branch Type	Multiple Branch Type	Single Branch Type	Multiple Branch Type
			COBS048B21S/C COBS096B21S/C	-	COBS048B22S/C COBS096B22S/C	COB04M132B22S COB08M264B22S COB12M264B22S
VRF Outdoor Unit (Heat Recovery)	Generation 1	208/230V	(H,Y)VAHR072B31S (H,Y)VAHR096B31S (H,Y)VAHR120B31S	 Available	 Not Available	
		460V	(H,Y)VAHR072B41S (H,Y)VAHR096B41S (H,Y)VAHR120B41S			
	Generation 2 (This Manual)	208/230V	(H,Y)VAHR072B32S (H,Y)VAHR096B32S (H,Y)VAHR120B32S (H,Y)VAHR144B32S (H,Y)VAHR168B32S (H,Y)VAHR192B32S	 Available	 Available	
		460V	(H,Y)VAHR072B42S (H,Y)VAHR096B42S (H,Y)VAHR120B42S (H,Y)VAHR144B42S (H,Y)VAHR168B42S (H,Y)VAHR192B42S			
		575V	(H,Y)VAHR072B52S (H,Y)VAHR096B52S (H,Y)VAHR120B52S (H,Y)VAHR144B52S (H,Y)VAHR168B52S (H,Y)VAHR192B52S			

Limitations for Combination of Generation 1 Change-Over Box and Generation 2 Outdoor Unit

Temperature	Cooling Operation Range	Indoor	°F WB (°C WB)	59 (15) to 73 (23)
		Outdoor	°F DB (°C DB)	23 (-5) to 109 (43)
	Heating Operation Range	Indoor	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor	°F WB (°C WB)	-4 (-20) to 59 (15)
	Cooling & Heating Operation Range	Indoor (Cooling Side)	°F WB (°C WB)	59 (15) to 73 (23)
		Indoor (Heating Side)	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor	°F DB (°C DB)	23 (-5) to 75 (24)
			°F WB (°C WB)	22 (-6) to 59 (15)
Connectable Indoor Unit Capacity Ratio		Maximum	100%	
		Minimum	Depends on Outdoor Units (Refer to Table 3.2 for details.)	

DB: Dry Bulb, WB: Wet Bulb

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1. Introduction

This manual concentrates on the Outdoor Heat Recovery Unit. Read this manual carefully before installation. Read 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 related 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. Refer back to these safety instructions as needed.
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- This system should be installed by personnel certified by Johnson Controls, Inc. Personnel must be qualified according to local 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, if necessary, keep a gas mask nearby. Also use electrical protection equipment and tools suited for electrical operation purposes. Keep heat shields, fire blankets, 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 for following reasons.
 - It may create hazards which could result in death, serious injury, equipment damage, or property damage.
 - It will void product warranties.
 - It may invalidate product regulatory certifications.
 - It may violate OSHA standards.

NOTICE

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

- Make sure that moisture, dust, or any refrigerant compounds do 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 1m) 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 walls, floors, or property within the space.
 - Damp or uneven areas: Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the unit to prevent water damage and abnormal vibration.
 - An area with high winds: Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable wind baffle.
 - A snowy area: Install the outdoor unit on a raised platform that is higher than anticipated snow levels and drifting snow. Provide snow protection hood or low ambient kit.
- 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 tools, 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	<p>To reduce the risk of serious injury or death, the following refrigerant precautions must be followed.</p>
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- As originally manufactured, this unit contains refrigerant installed by Johnson Controls. Johnson Controls uses only refrigerants that have been approved for use in the unit's intended home country or market. Johnson Controls distributors similarly are only authorized to provide refrigerants that have been approved for use in the countries or markets they serve. The refrigerant used in this unit is identified on the unit's faceplate and/or in the associated manuals. Any additions of refrigerant into this unit must comply with the country's requirements with regard to refrigerant use and should be obtained from Johnson Controls distributors. Use of any non-approved refrigerant substitutes will void the warranty and will increase the potential risk of equipment damage, property damage, personal injury, or death.
- Take measures to ensure that the refrigerant limitations in ASHRAE Standard 15 (Canada: B52), or other local codes, are followed. 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 other non-condensables. 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 excessive force to the stop valve at the end of opening. Otherwise, the stop valve flies out due to refrigerant pressure. At the test run, fully open the gas and liquid valves, otherwise, these devices will be damaged. (It is closed before shipment.)
- If the arrangement for outdoor units is incorrect, it may cause flowback of the refrigerant and result in failure of the outdoor unit.
- The refrigerant system may be damaged if the slope of the piping connection kit exceeds $\pm 15^\circ$.

Electrical Precautions



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

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

External Equipment*: (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 cable 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 cable is applied, secure properly and terminate cable shield as required 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 supply 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 supply completely before attempting any maintenance for electrical parts. Check to ensure that no residual voltage is present after disconnecting the power supply.
- 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 supply before starting work on the unit.
- This equipment can be installed with a Ground Fault Circuit Breaker (GFCI), which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers/fuses/overcurrent protection switches, and wiring in accordance with local codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements.

3. Before Installation

3.1 Factory-Supplied Accessories

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

inch (mm)

Accessory		72 Model	96 Model	120 Model	144 Model	168 Model	192 Model	Remarks
Accessory Pipe	Connection for Refrigerant Gas (High/Low) Pipe	 x 1 ID 7/8 (22.2) → OD 3/4 (19.05)	 x 1 ID 7/8 (22.2) → OD 3/4 (19.05)	-	-	-	-	
	Connection for Refrigerant Gas (Low) Pipe	-	 x 1 ID 1 (25.4) → OD 7/8 (22.2)	 x 1 ID 1 (25.4) → OD 1-1/8 (28.6)	 x 1 ID 1 (25.4) → OD 1-1/8 (28.6)	-	-	
	Connection for Refrigerant Liquid Pipe	 x 1 OD 3/8 (9.52) → OD 1/2 (12.7)	-	-	 x 1 OD 1/2 (12.7) → OD 5/8 (15.88)	-	-	
	90° Elbow for Refrigerant Gas Pipe	-	 x 1 ID 1 (25.4) → OD 1 (25.4)	 x 1 ID 1 (25.4) → OD 1 (25.4)	 x 1 ID 1 (25.4) → OD 1 (25.4)	-	-	
Cable Clamp	For Fixing Power Supply Wiring	 x 1	 x 1	 x 1	 x 1	 x 1	 x 1	
Cable Band	For Fixing Power Supply Wiring	 x 2	 x 2	 x 2	 x 2	 x 2	 x 2	
	For Fixing PVC Tube	 x 5	 x 5	 x 5	 x 5	 x 5	 x 5	
Screw (One for Fixing Cable Clamp, Two for Spare)		 x 3	 x 3	 x 3	 x 3	 x 3	 x 3	
PVC Tube		 x 2	 x 2	 x 2	 x 2	 x 2	 x 2	ID 1/2 (12)
Rubber Bush	For Communication Cable	 x 2	 x 2	 x 2	 x 2	 x 2	 x 2	OD 1-1/2 (38)
Open/Close Indication for Stop Valve	For Indication of "Open"	 x 3	 x 3	 x 3	 x 3	 x 3	 x 3	
Seismic Plate		 x 4	 x 4	 x 4	 x 4	 x 4	 x 4	
Refrigerant Label								

OD: Outer Diameter

ID: Inner Diameter

NOTICE

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

3.2 Necessary Tools and Instrument List for Installation

No.	Tool	No.	Tool	No.	Tool
1	Handsaw	8	Pliers	16	Wire Cutters
2	Phillips Screwdriver, Slotted Screwdriver	9	Copper Tube Cutter	17	Gas Leak Detector
		10	Brazing Kit	18	Level
3	Vacuum Pump	11	Hexagon Wrench	19	Crimper for Solderless Terminals
4	Refrigerant Gas Hose	12	Wrench	20	Hoist (for Indoor Unit)
5	Megohmmeter	13	Scale	21	Ammeter
6	Copper Pipe Bender	14	Charging Cylinder	22	Voltage Meter
7	Manual Water Pump (for Indoor Unit)	15	Gauge Manifold	23	Ratchet Wrench

Use specially designated tools for handling R410A refrigerant.

◇: Interchangeable with current R22

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

×: Prohibited

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

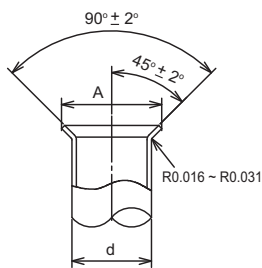
Measuring Instrument and Tool		Interchangeability with R22		Reason of Non-Interchangeability and Attention	Use
		R410A	R407C		
Refrigerant Pipe	Copper Tube Cutter, Chamfering Reamer	◇	◇	-	Cutting Pipe Removing Burrs
	Flaring Tool	◇ ●	◇	<ul style="list-style-type: none"> The flaring tools for R407C are applicable to R22. If using a flaring tube, make the dimension of the tube larger for R410A. For a hard temper pipe, flaring is not available. 	Flaring for Tubes
	Extrusion Adjustment Gauge	●	-		Dimensional Control for Extruded Portion of Tube after Flaring
	Pipe Bender	◇	◇		Bending
	Expanding Tool	◇	◇	For a hard temper pipe, expansion of the tube is not available. Use socket for connecting tube.	Expanding Tubes
	Torque Wrench	●	◇	For Φ 1/2 inch (12.7mm), Φ 5/8 inch (15.88mm), spanner size is up 1/16 inch (2mm).	Connection of Flare Nut
		◇	◇	For Φ 1/4 inch (6.35mm), Φ 3/8 inch (9.52mm), Φ 3/4 inch (19.05mm), spanner size is the same.	
	Brazing Tool	◇	◇	Perform correct brazing work.	Brazing for Tubes
	Nitrogen Gas	◇	◇	Strict Control against Contamination (Blow nitrogen during brazing.)	Prevention from Oxidation during Brazing
Vacuum Drying Refrigerant Charge	Lubrication Oil (for Flare Surface)	●	◆	<ul style="list-style-type: none"> 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
	Refrigerant Cylinder	●	◆	<ul style="list-style-type: none"> Check refrigerant cylinder color. NOTE: Liquid refrigerant charging is required for zeotropic refrigerant.	Refrigerant Charging
	Vacuum Pump	◇	◇	NOTE: The current ones are applicable. However, it is required to mount a vacuum pump adapter which can prevent reverse flow when a vacuum pump stops, resulting in no reverse oil flow.	Vacuum Pumping
	Adapter for Vacuum Pump	●*	◆		
	Manifold Valve	●	◆	<ul style="list-style-type: none"> No interchangeability is available due to higher pressures when compared with R22. NOTE: Use the same ones as for the current refrigerant. Otherwise, mineral oil will flow into the cycle and cause sludge resulting in clogging or compressor failure. Connection diameter is different; R410A: UNF1/2, R407C: UNF7/16.	Vacuum Pumping, Vacuum Holding, Refrigerant Charging and Check of Pressures
	Charging Hose	●	◆		
	Charging Cylinder	×	×	Use the weight scale to ensure proper charging of the unit.	-
	Weight Scale	◇	◇	-	Measuring Instrument for Refrigerant Charging
	Refrigerant Gas Leakage Detector	●*	◆	The current gas leakage detector (R22) is not applicable due to a different detecting method.	Gas Leakage Check

*Interchangeability with R407C.

3.3 Flaring and Joint

- Flaring Dimension

Perform the flaring work as shown below.



Diameter (d)	inch (mm) A ⁺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

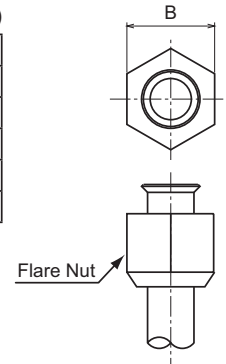
If hard temper pipe is used, the flaring work cannot be performed. In this case, use a joint selected from Table1. Do not use any other thin joint other than the ones shown in Table1.

Minimum Thickness of Joint

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

Flare Nut Dimension B

Diameter	inch (mm) R410A
1/4 (6.35)	11/16 (17)
3/8 (9.52)	7/8 (22)
1/2 (12.7)	1 (26)
5/8 (15.88)	1-1/8 (29)
3/4 (19.05)	1-7/16 (36)



- Piping Thickness and Material

Use the pipe as described below.

The thickness of refrigerant pipe differs depending on design pressure.

The thickness of copper pipe differs depending on its material.

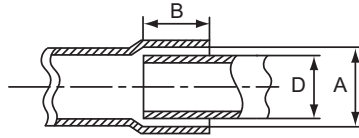
Outer Diameter	inch (mm) R410A	
	Thickness	Temper
1/4 (6.35)	0.03 (0.76)	Annealed
3/8 (9.52)	0.032 (0.81)	Annealed
1/2 (12.7)	0.032 (0.81)	Annealed
5/8 (15.88)	0.035 (0.89)	Annealed
3/4 (19.05)	0.035 (0.89)	Hard Temper (or Annealed)
7/8 (22.2)	0.045 (1.14)	Hard Temper
1-1/8 (28.58)	0.050 (1.27)	Hard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

NOTES:

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

- Processing at Brazing Connection

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



inch (mm)		
Diameter (D)	Min. Insertion Depth (B)	Gap (A - D)
$3/16 \leq D < 5/16$ (5 ≤ D < 8)	1/4 (6)	0.002 - 0.014 (0.05 - 0.35)
$5/16 \leq D < 1/2$ (8 ≤ D < 12)	9/32 (7)	
$1/2 \leq D < 5/8$ (12 ≤ D < 16)	5/16 (8)	0.002 - 0.018 (0.05 - 0.45)
$5/8 \leq D < 1$ (16 ≤ D < 25)	3/8 (10)	
$1 \leq D < 1-3/8$ (25 ≤ D < 35)	1/2 (12)	0.002 - 0.022 (0.05 - 0.55)
$1-3/8 \leq D < 1-3/4$ (35 ≤ D < 45)	9/16 (14)	

3.4 Line-Up of Outdoor Units

- (1) This outdoor unit series can build the capacity of 72 to 432 MBH by combining the outdoor units of 72 to 192 MBH.
- (2) The outdoor units of 216 to 432 MBH consist of the combination of two to three base units.
Use the combination of units in the following table. If the combinations are not listed, then they are not available.

208/230V

Base Unit

Capacity (MBH)	72	96	120
Model	(H,Y)VAHR072B32S	(H,Y)VAHR096B32S	(H,Y)VAHR120B32S
Capacity (MBH)	144	168	192
Model	(H,Y)VAHR144B32S	(H,Y)VAHR168B32S	(H,Y)VAHR192B32S

Combination of Base Units

Capacity (MBH)	216	240	264	288
Model	(H,Y)VAHR216B32S	(H,Y)VAHR240B32S	(H,Y)VAHR264B32S	(H,Y)VAHR288B32S
Combination	(H,Y)VAHR144B32S	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S	(H,Y)VAHR144B32S
	(H,Y)VAHR072B32S	(H,Y)VAHR120B32S	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S
Capacity (MBH)	312	336	360	
Model	(H,Y)VAHR312B32S	(H,Y)VAHR336B32S	(H,Y)VAHR360B32S	
Combination	(H,Y)VAHR168B32S	(H,Y)VAHR192B32S	(H,Y)VAHR192B32S	
	(H,Y)VAHR144B32S	(H,Y)VAHR144B32S	(H,Y)VAHR168B32S	
Capacity (MBH)	384	408	432	
Model	(H,Y)VAHR384B32S	(H,Y)VAHR408B32S	(H,Y)VAHR432B32S	
Combination	(H,Y)VAHR144B32S	(H,Y)VAHR144B32S	(H,Y)VAHR144B32S	
	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S	(H,Y)VAHR144B32S	
	(H,Y)VAHR120B32S	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S	
	(H,Y)VAHR120B32S	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S	

460V

Base Unit

Capacity (MBH)	72	96	120
Model	(H,Y)VAHR072B42S	(H,Y)VAHR096B42S	(H,Y)VAHR120B42S
Capacity (MBH)	144	168	192
Model	(H,Y)VAHR144B42S	(H,Y)VAHR168B42S	(H,Y)VAHR192B42S

Combination of Base Units

Capacity (MBH)	216	240	264	288
Model	(H,Y)VAHR216B42S	(H,Y)VAHR240B42S	(H,Y)VAHR264B42S	(H,Y)VAHR288B42S
Combination	(H,Y)VAHR144B42S	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S	(H,Y)VAHR144B42S
	(H,Y)VAHR072B42S	(H,Y)VAHR120B42S	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S
Capacity (MBH)	312	336	360	
Model	(H,Y)VAHR312B42S	(H,Y)VAHR336B42S	(H,Y)VAHR360B42S	
Combination	(H,Y)VAHR168B42S	(H,Y)VAHR192B42S	(H,Y)VAHR192B42S	
	(H,Y)VAHR144B42S	(H,Y)VAHR144B42S	(H,Y)VAHR168B42S	
Capacity (MBH)	384	408	432	
Model	(H,Y)VAHR384B42S	(H,Y)VAHR408B42S	(H,Y)VAHR432B42S	
Combination	(H,Y)VAHR144B42S	(H,Y)VAHR144B42S	(H,Y)VAHR144B42S	
	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S	(H,Y)VAHR144B42S	
	(H,Y)VAHR120B42S	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S	
	(H,Y)VAHR120B42S	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S	

575V

Base Unit

Capacity (MBH)	72	96	120
Model	(H,Y)VAHR072B52S	(H,Y)VAHR096B52S	(H,Y)VAHR120B52S

Capacity (MBH)	144	168	192
Model	(H,Y)VAHR144B52S	(H,Y)VAHR168B52S	(H,Y)VAHR192B52S

Combination of Base Units

Capacity (MBH)	216	240	264	288
Model	(H,Y)VAHR216B52S	(H,Y)VAHR240B52S	(H,Y)VAHR264B52S	(H,Y)VAHR288B52S
Combination	(H,Y)VAHR144B52S	(H,Y)VAHR120B52S	(H,Y)VAHR144B52S	(H,Y)VAHR144B52S
	(H,Y)VAHR072B52S	(H,Y)VAHR120B52S	(H,Y)VAHR120B52S	(H,Y)VAHR144B52S

Capacity (MBH)	312	336	360
Model	(H,Y)VAHR312B52S	(H,Y)VAHR336B52S	(H,Y)VAHR360B52S
Combination	(H,Y)VAHR168B52S	(H,Y)VAHR192B52S	(H,Y)VAHR192B52S
	(H,Y)VAHR144B52S	(H,Y)VAHR144B52S	(H,Y)VAHR168B52S

Capacity (MBH)	384	408	432
Model	(H,Y)VAHR384B52S	(H,Y)VAHR408B52S	(H,Y)VAHR432B52S
Combination	(H,Y)VAHR144B52S	(H,Y)VAHR144B52S	(H,Y)VAHR144B52S
	(H,Y)VAHR120B52S	(H,Y)VAHR144B52S	(H,Y)VAHR144B52S
	(H,Y)VAHR120B52S	(H,Y)VAHR120B52S	(H,Y)VAHR144B52S

3.5 Combinations of Indoor Units and Outdoor Units

Table 3.1 Indoor Unit Model List

Indoor Unit Model			Capacity (MBH)													
			6	8	12	15	18	24	27	30	36	48	54	60	72	96
Ducted	Ducted (High Static)	(H,Y)IDH_B21S					○	○		○	○	○			○	○
		(H,Y)IDH_B22S				○	○	○	○	○	○	○	○			
	Ducted (Medium Static)	(H,Y>IDM_B21S	○	○	○	○	○	○		○	○	○				
		(H,Y>IDM_B22S	○	○	○	○	○	○	○	○	○	○	○			
	Ducted (Slim)	(H,Y)IDS_B21S	○	○	○	○	○									
	Ducted (EconoFresh)	(H,Y>IDM_B21E								○	○	○				
	Air Handler with DX-Kit	(H,Y)MAHP_(B,C,D)21S					○	○		○	○	○		○		
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 Mount	TIWM_B21S	○	○	○	○	○	○		○						
		TIWM_B22S	○	○	○	○	○	○		○						
	Ceiling Suspended	(H,Y)ICS_B21S				○		○		○	○					
	Floor Exposed	(H,Y)IFE_B21S	○	○	○	○										
	Floor Concealed	(H,Y)IFC_B21S	○	○	○	○										

○ : Available

NOTICE:

For connection to a Ducted (EconoFresh), see below.

- Ducted (EconoFresh) only:
Total capacity of Ducted (EconoFresh) is 70% to 100% of the outdoor unit capacity.
- Ducted (EconoFresh) + Other Standard Indoor Unit:
Total capacity of Ducted (EconoFresh) is 30% or below the outdoor unit capacity.
and
Total capacity of indoor unit, including Ducted (EconoFresh) is 70% to 100% of the outdoor unit capacity.

The number of indoor units that can be connected to an outdoor unit is defined in Table 3.2.

Comply with the following conditions when installing the unit.

A maximum and minimum total capacity as opposed to the nominal outdoor unit capacity can be obtained through combination of indoor units.

Table 3.2 System Combination

Model: (H,Y)VAHR_B(3,4,5)2S

Outdoor Unit Capacity (MBH)	Minimum Capacity at Individual Operation (MBH)	Maximum Number of Connectable I.U.	Recommended Number of Connected I.U.	Connectable Indoor Unit Capacity Ratio	
				Maximum 2,3,4,5	Minimum
72	6 ¹	15	8	130%	70%
96		20	8	130%	65%
120		26	8	130%	60%
144		26	10	130%	55%
168		36	12	130%	55%
192		40	14	130%	55%
216		46	18	130%	60%
240		52	18	130%	60%
264		56	20	130%	55%
288		59	20	130%	55%
312		64	22	130%	55%
336		64	24	130%	55%
360		64	28	130%	55%
384		64	30	130%	55%
408		64	30	130%	55%
432		64	30	130%	55%

1. When the outdoor air temperature is 23°F (-5°C) or less during the outdoor unit cooling operation, the minimum connectable indoor unit capacity is 18 MBH. A snow protection hood or low ambient kit (optional part) should be installed.
2. When the outdoor air temperature is 109°F (43°C) or more during the outdoor unit cooling operation, the maximum connectable indoor unit capacity ratio is 100%.
3. When the outdoor air temperature is 14°F (-10°C) or less, or under the high heating load conditions, the total indoor unit capacity should be less than 100% of the outdoor unit capacity, and the total piping length should be less than 984 ft (300m).
4. When the number of connected indoor unit (I.U.) is within the recommended, the maximum connectable indoor unit capacity ratio is available up to 150%.
5. There are some limitations of the Height Difference between Outdoor Units and Indoor Units. Refer to Section 6.5 "Piping Size and Multi-kit Selection" for details.

NOTICE:

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

$$\text{Connectable Indoor Unit Capacity Ratio} = \text{Total Indoor Unit Capacity} / \text{Total Outdoor Unit Capacity}$$

In a system where 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.

In a system where all the indoor units do not operate simultaneously, the total indoor unit capacity is available up to 150% of the outdoor unit capacity.

The air flow 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 a cold draft may occur during heating operation.

If installing indoor units in such locations, refer to the recommended number of indoor units as shown in above table that can be connected.

3.6 Outdoor Unit Installation Precautions

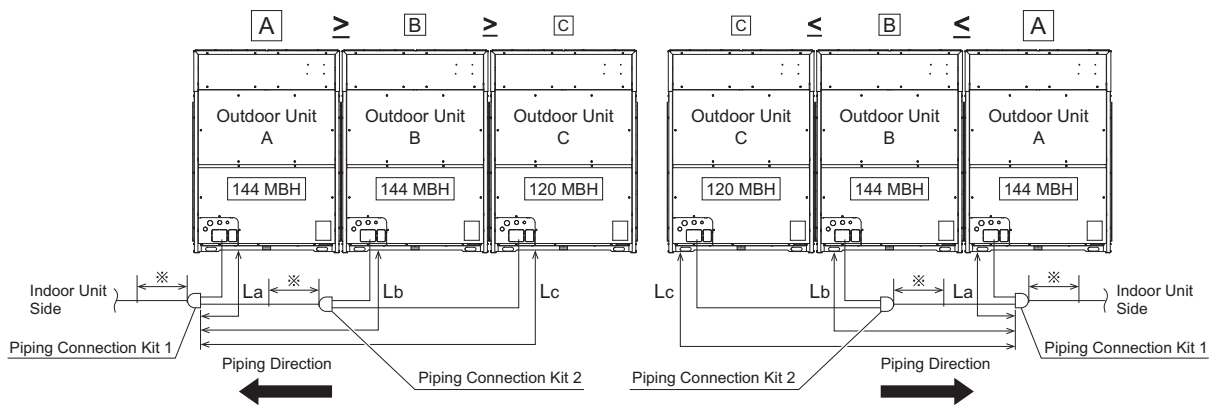
When the installation and piping work for the multiple outdoor units are performed, it is required that you determine the arrangement of the outdoor units and the piping length. Perform the installation work in strict accordance with the following requirements.

NOTICE

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

Requirements for Combining Two and Three Units

- (1) When using a combination of two and three outdoor units, align the outdoor units from largest capacity to smallest as $A \geq B \geq C$ and connect outdoor unit "A" is connected to the piping connection kit 1.
- (2) The piping length between the piping connection kit 1 and the outdoor unit should be $L_a \leq L_b \leq L_c \leq 32 \text{ ft (10m)}$.



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

3.7 Piping Work between Outdoor Units

When installing a combination unit, a piping connection kit is needed for each additional unit but not for the base unit (72, 96, 120, 144, 168, 192 Models). The piping connection kit (MC-NP**SX1) consists of branch pipes for low pressure gas, high/low pressure gas and liquid. Interconnecting pipe is not included in these kits (field-supplied).

Model: (H,Y)VAHR_B(3,4,5)2S

Operation	Applicable Outdoor Unit		Model	Piping Set	Remarks
	Outdoor Unit Capacity (MBH)	Outdoor Unit Number			
Heat Recovery	216 - 360	2	MC-NP21SX1*	1	3 Pipes Type • for Low Pressure Gas • for High/Low Pressure Gas • for Liquid
	384 - 432	3	MC-NP30SX1*	1	

*SX type is to be used in place of SX1 type.

The piping kits for SX model numbers MC-NP21SX and MC-NP30SX are to be used in place of the piping kits for the SX1 model numbers MC-NP21SX1 and MC-NP30SX1 as noted.

4. Outdoor Unit Installation

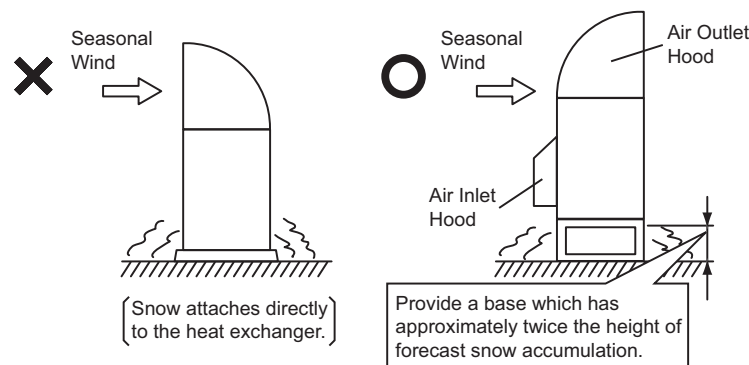
4.1 Installation Location and Precautions

WARNING

To reduce the risk of serious injury or death, follow the installation precautions below.

- 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 walls, floors, equipment, and property.
 - Damp or uneven areas: Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the unit to prevent water damage and abnormal vibration.
 - An area with high winds: Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable wind baffle (field-supplied).
 - A snowy area: Install the outdoor unit on a raised platform that is higher than the anticipated snow levels and drifting snow. Provide snow protection hood or low ambient kit (optional part).
- Do not install the unit in the following places. Doing so can result in an explosion, fire, deformation, corrosion, or product failure.
 - Explosive or flammable atmosphere
 - Where a fire, oil, steam or powder can directly enter the unit, such as nearby or above a kitchen stove.
 - Where oil (including machinery oil) may be present.
 - Where corrosive gases such as chlorine, bromine, or sulfide can accumulate, such as near a hot tub or hot spring.
 - Where dense, salt-laden airflow is heavy, such as in coastal regions.
 - Where the air quality is of high acidity.
 - Where harmful gases can be generated from decomposition.
- During heating or defrosting operation, drain water is discharged. Provide adequate drainage around the foundation. If installing the unit on a roof or a balcony, provide the additional drainage around the foundation to prevent water from dripping on walk ways, people, property, and preventing ice from forming during freezing temperatures creating slip hazards.
- 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 tools, metal scraps, or bits of wiring have been left behind inside the unit being installed.

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



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

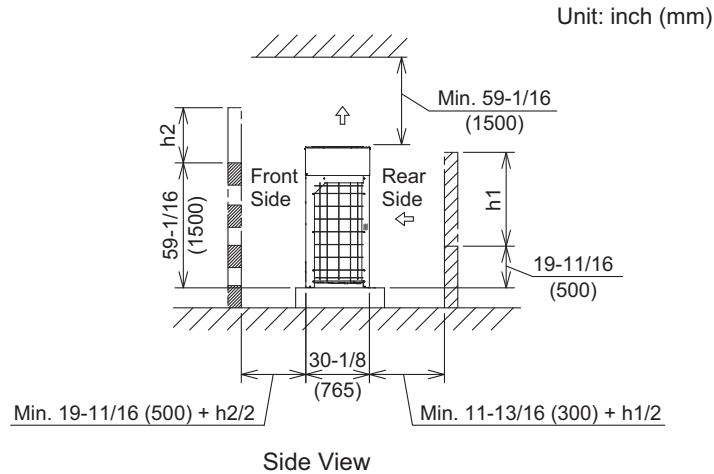
4.2 Service Space

NOTICE:

Refer to the Engineering Manual for the outdoor unit when installing the low ambient kit.

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

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

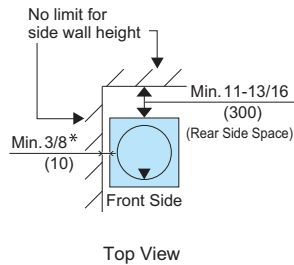


- If there are no walls on the front and rear sides, clearance for service access is required as follows:
 - * Front Side: Minimum 19-11/16 inches (500mm)
 - * Rear Side: Minimum 11-13/16 inches (300mm)
 - * Right and Left Sides: Minimum 3/8 inches (10mm)
(In an instance where the snow protection hood (optional part) or the air outlet duct (field-supplied) is mounted to the unit, a minimum gap of 1-15/16 inches (50mm) is required.)
- If the wall on the front side is over 59-1/16 inches (1,500mm) high, a clearance of (19-11/16 inches (500mm) + h2/2) is required for the front side.
- If the wall on the rear side is over 19-11/16 inches (500mm) high, a clearance of (11-13/16 inches (300mm) + h1/2) is required for the rear side.
- When the units are surrounded by walls on more than two sides. Refer to the following illustrations for the necessary clearance.
- For walls on more than two sides, secure adequate clearance for service access space as shown in the following illustrations.
- If the space between the unit and an obstacle above the unit is less than 59-1/16 inches (1,500mm) or the space above the unit is closed, set up the duct at the air outlet side in order to prevent a short circuit.
- Make sure there is enough space in case the unit needs to be serviced and any of the four sides would need to be opened or removed.

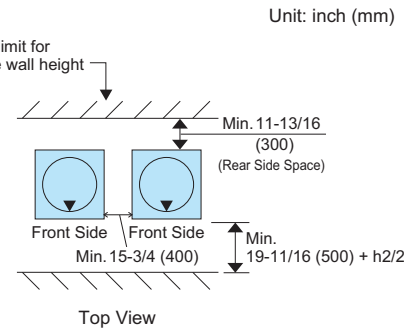
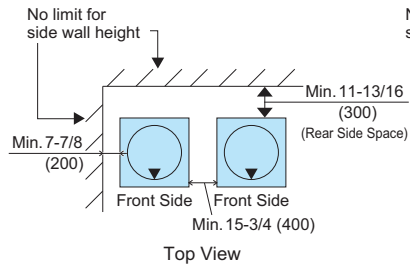
1) Walls on Two Sides

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

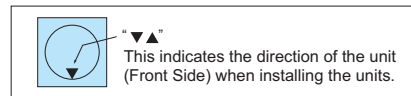
Single Installation



Multiple/Serial Installation

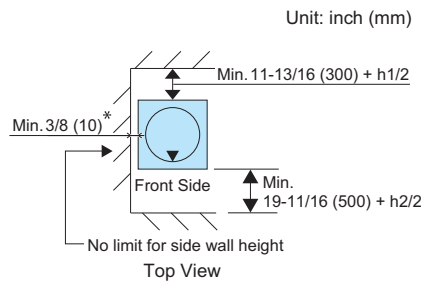


*If using the snow protection hood (optional part) or the air outlet duct (field supplied) is adopted, a minimum clearance of 2 inches (50mm) is required.



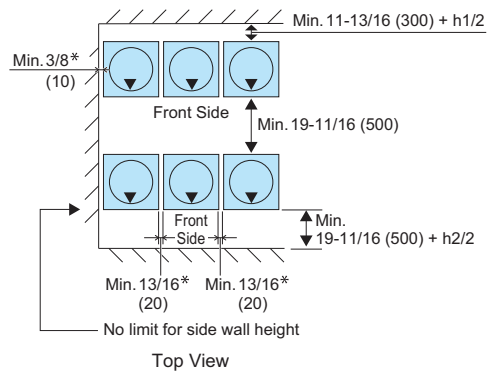
2) Walls on Three Sides

Single Installation

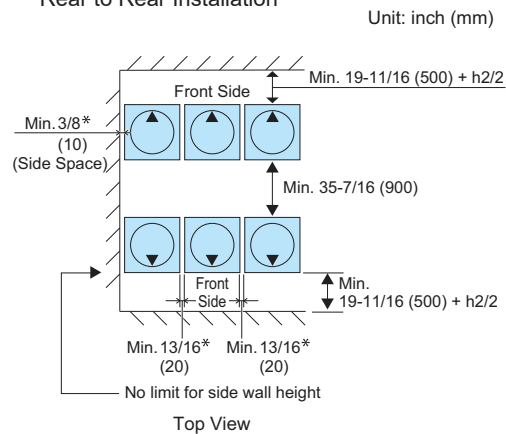


Multiple/Serial Installation

Installation in the Same Direction



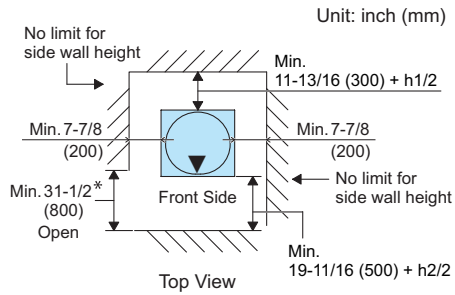
Rear to Rear Installation



* If the snow protection hood (optional part) or the air outlet duct (field supplied) is adopted, a minimum clearance of 2 inches (50mm) is required.

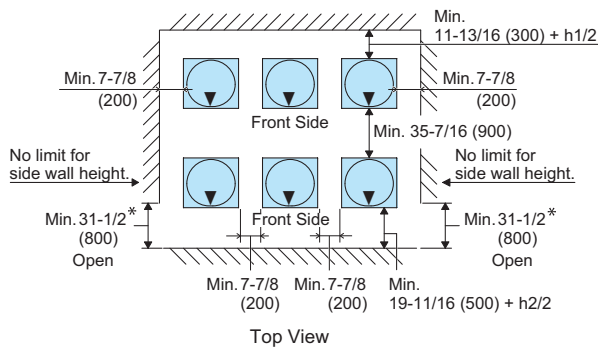
3) Walls on Four Sides

Single Installation

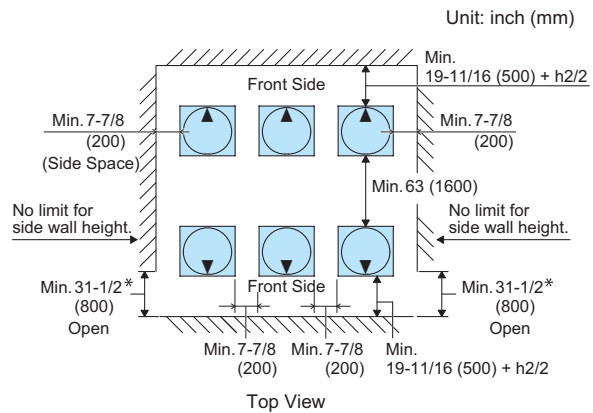


Multiple/Serial Installation

Installation in the Same Direction



Rear to Rear Installation



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

NOTICE:

Keep the upper side open to prevent mutual interference between the inlet and outlet air of each outdoor unit.

The figure indicates sufficient clearance around the outdoor units for operation and maintenance at typical installation conditions as follows.

[Operation Mode: Cooling Operation, Outside Temp.: 95°F (35°C)]

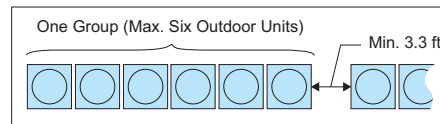
In the following situations when compared to the installation condition, an appropriate clearance dimension is required by calculating air flow current when

* the outdoor unit ambient temperature is higher

* a short circuit is likely to occur

For the multiple installation of units, one group will consist of a maximum of six outdoor units.

Keep 3.3 ft (1m) between each unit group.



5. Transportation and Installation Work

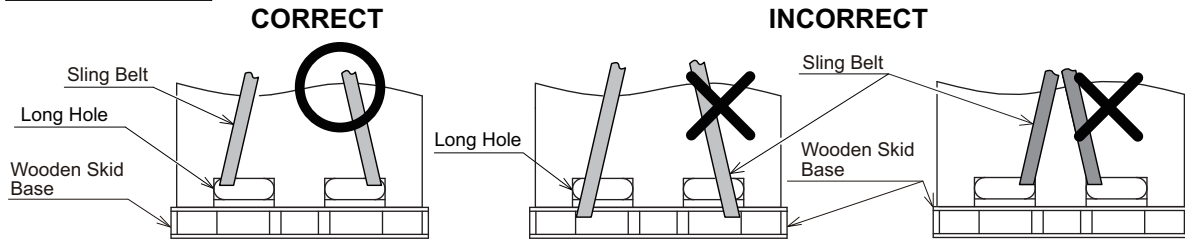
5.1 Transportation

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

⚠ WARNING

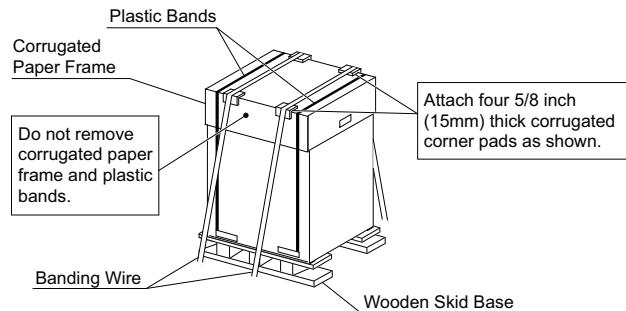
- Do not hang the unit with the sling belts at the wooden skid base.

Sling Belt Position



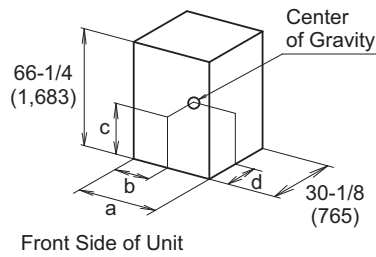
⚠ CAUTION

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



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

Center of Gravity



inch (mm)					
Voltage	Model	a	b	c	d
208/230V	72	38-3/8 (975)	21-1/4 (540)	24-5/8 (625)	12 (330)
	96	48-5/8 (1,235)	25-13/16 (655)	26-9/16 (675)	13-3/8 (340)
	120,144	48-5/8 (1,235)	27-3/8 (695)	25 (635)	12-13/16 (325)
	168,192	64 (1,625)	32-7/8 (835)	24-3/16 (615)	12-13/16 (325)
460V, 575V	72	38-3/8 (975)	21-7/16 (545)	25 (635)	12 (330)
	96	48-5/8 (1,235)	26 (660)	26-15/16 (685)	13-3/8 (340)
	120,144	48-5/8 (1,235)	27-3/8 (695)	25-3/8 (645)	12-13/16 (325)
	168,192	64 (1,625)	33-1/16 (840)	24-5/8 (625)	12-13/16 (325)

Hanging Method

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

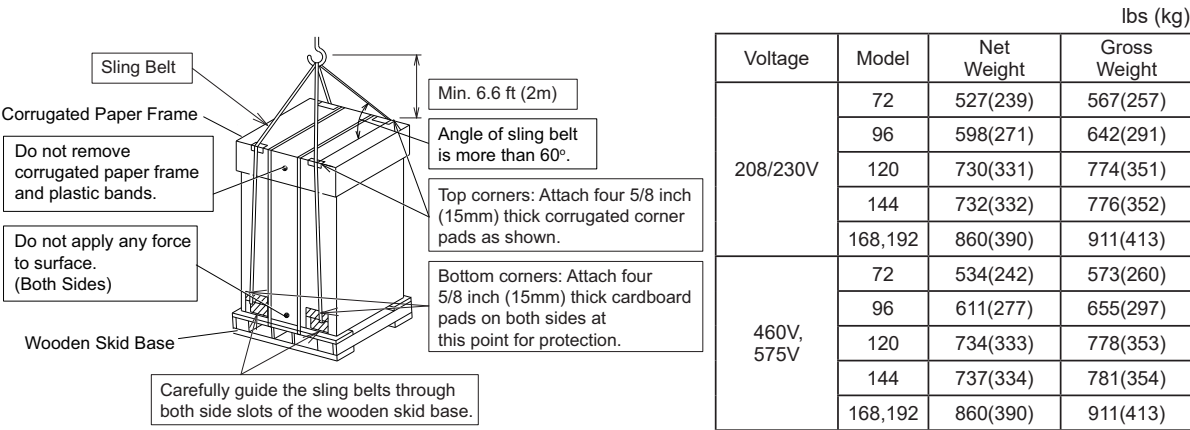


Figure 5.1 Hanging Unit on Wooden Skid Base for Transportation

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

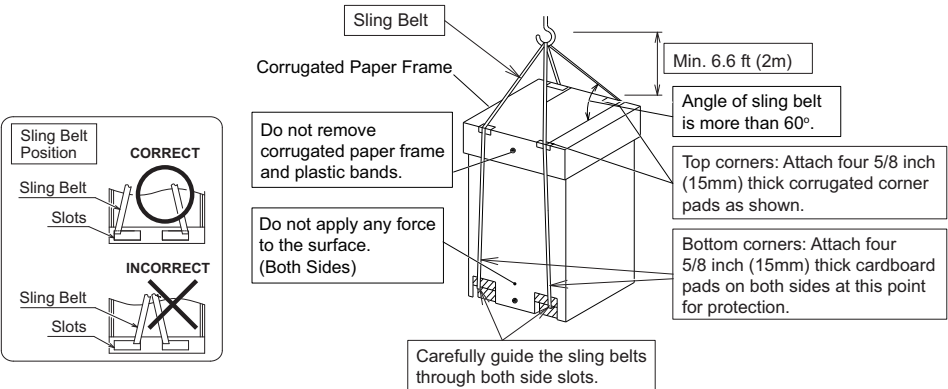
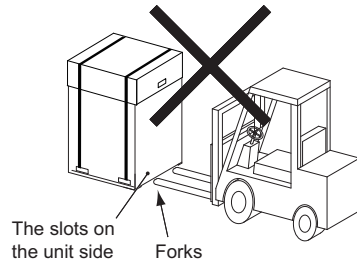


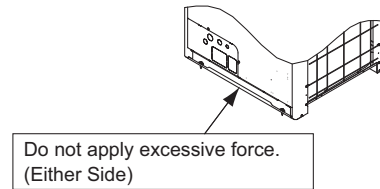
Figure 5.2 Hanging Unit without Wooden Skid Base

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



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

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



Wooden Skid Base Removal Method

- (1) Remove the hexagon head bolt using the ratchet wrench.
- (2) Suspend the unit from the wooden skid base in its packing with two sling belts.
- (3) Ensure safety while hoisting the unit gently to prevent the unit from tipping over as shown in Figure 5.3.

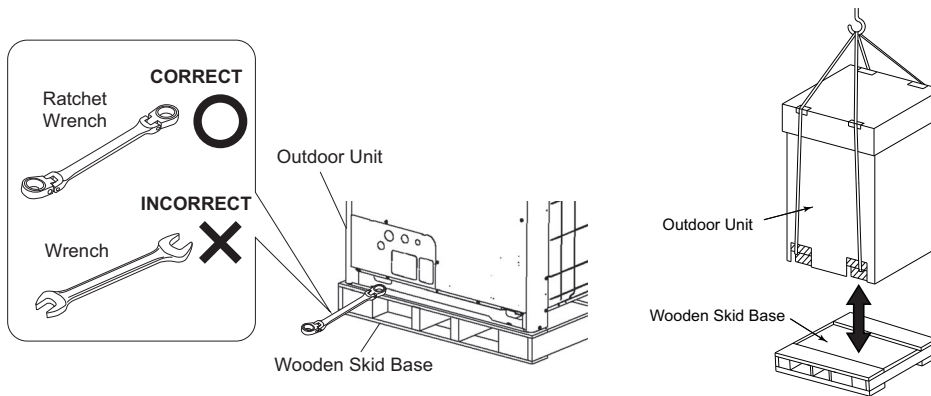
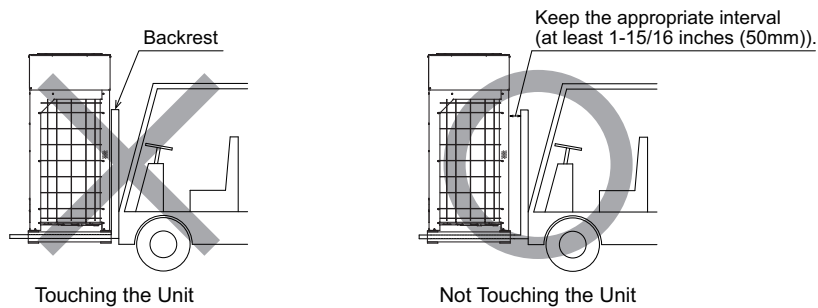


Figure 5.3 Wooden Skid Base Removal Method

CAUTION

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



NOTICE

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

5.2 Handling of Outdoor Unit

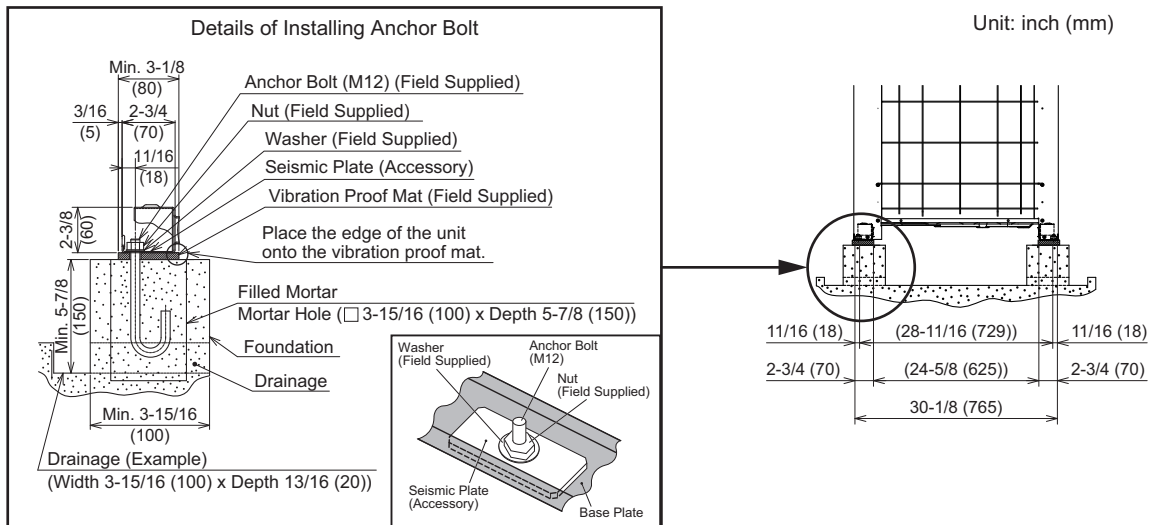
WARNING

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

5.3 Installation Work

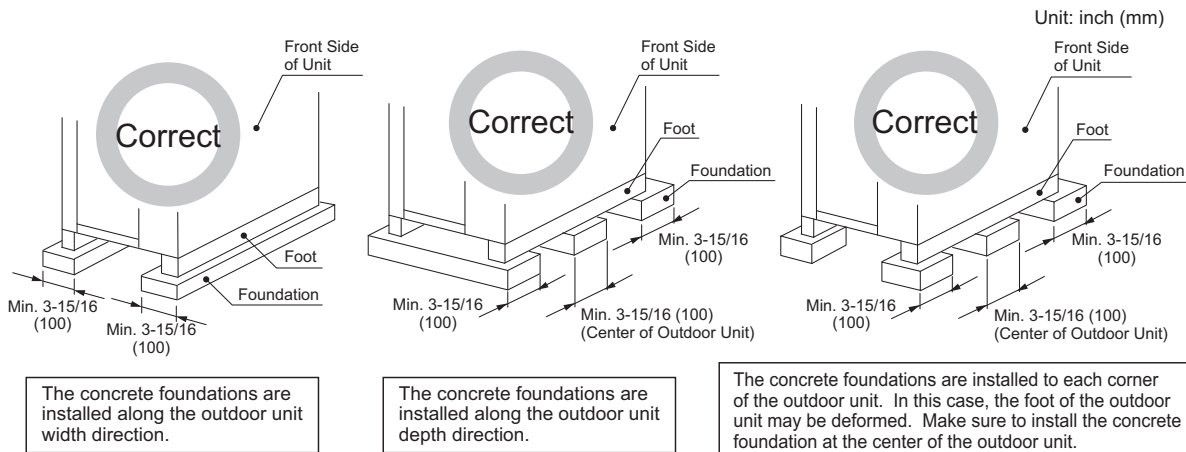
5.3.1 Concrete Foundations

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

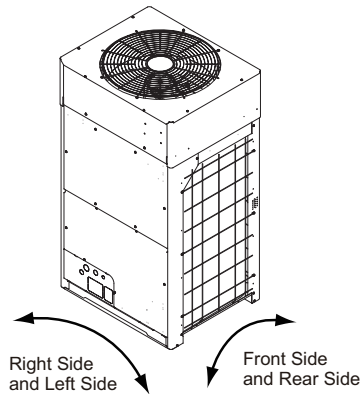


NOTES:

1. Provide a concrete foundation as shown below.
2. Do not use a concrete foundation such as seen here. The footing for the outdoor unit can become deformed.



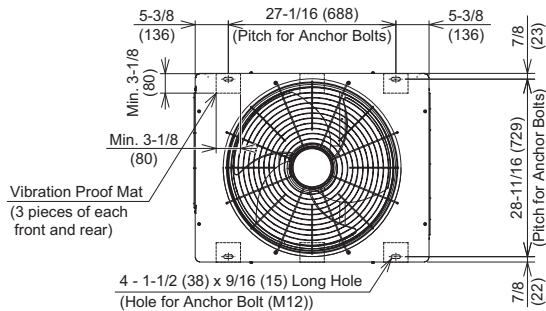
- (3) Install the outdoor unit in the front-rear and right-left direction horizontally. (Use a level.)
Verify that the gradient slope in all four directions (front, rear, right, and left) falls within 3/8 inch (10mm).



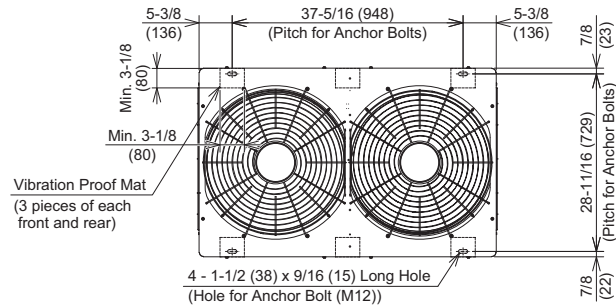
- (4) Provide a strong, level, and stable foundation so that:
- The outdoor unit does not lean to one side.
 - Sound from inside unit are inaudible.
 - The outdoor unit remains stable and upright in the face of strong winds and seismic events.
- (5) When installing the outdoor unit, secure the unit with anchor bolts and field-supplied vibration-proof mats. Refer to Figure 5.4 for the location of holes for anchor bolts.

Unit: inch (mm)

72 Model



96, 120 and 144 Model



168 and 192 Model

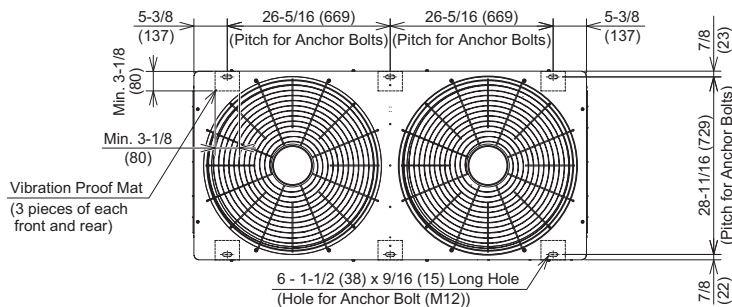


Figure 5.4 Positions of Anchor Bolts

5.3.2 Condensation Treatment

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

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

NOTICE:

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

Unit: inch (mm)

Model	Dimension
72	<p>Diagram of Model 72 unit showing dimensions and components. The unit is rectangular with a width of 28-3/8 (720) and a height of 15-1/16 (382). The top edge has three 'Not Used' labels. The right side has a 'Drain Hole (φ1 (26) x 2 Positions)' and a 'Drain Adaptor Position (Optional Part)'. The bottom edge has two 'Refrigerant Piping Outlet' labels: one for 'Low Pressure Gas (Knockout Square Hole)' and one for 'High/Low Pressure Gas and Liquid (Knockout Square Hole)'. Dimensions include 4-1/2 (115) for the top right corner, 3-1/8 (80) for the top right corner, 9-7/16 (239) for the bottom left corner, 14-3/4 (374) for the bottom left corner, 5 (127) for the bottom center, and 2-7/8 (73) for the bottom right corner.</p>
96, 120 and 144	<p>Diagram of Model 96, 120 and 144 unit showing dimensions and components. The unit is rectangular with a width of 20-1/2 (520) and a height of 19 (483). The top edge has three 'Not Used' labels. The right side has a 'Drain Hole (φ1 (26) x 4 Positions)' and a 'Drain Adaptor Position (Optional Part)'. The bottom edge has two 'Refrigerant Piping Outlet' labels: one for 'High/Low Pressure Gas and Liquid (Knockout Square Hole)' and one for 'Low Pressure Gas (Knockout Square Hole)'. Dimensions include 9-1/16 (230) for the top left corner, 20-1/2 (520) for the top center, 9-1/16 (230) for the top right corner, 4-1/2 (115) for the top right corner, 6 (152) for the top right corner, 3-1/8 (80) for the top right corner, 5-13/16 (147) for the bottom left corner, 11-1/8 (283) for the bottom left corner, 5 (127) for the bottom center, and 2-7/8 (73) for the bottom right corner.</p>
168 and 192	<p>Diagram of Model 168 and 192 unit showing dimensions and components. The unit is rectangular with a width of 18-3/16 (462) and a height of 25 (635). The top edge has three 'Not Used' labels. The right side has a 'Drain Hole (φ1 (26) x 4 Positions)' and a 'Drain Adaptor Position (Optional Part)'. The bottom edge has two 'Refrigerant Piping Outlet' labels: one for 'High/Low Pressure Gas and Liquid (Knockout Square Hole)' and one for 'Low Pressure Gas (Knockout Square Hole)'. Dimensions include 13-3/8 (339) for the top left corner, 18-3/16 (462) for the top center, 13-3/8 (339) for the top right corner, 9-3/8 (238) for the top right corner, 3-1/8 (80) for the top right corner, 5-13/16 (147) for the bottom left corner, 11-1/8 (283) for the bottom left corner, 5 (127) for the bottom center, and 2-7/8 (73) for the bottom right corner.</p>

- Drain Adaptor (Optional Parts)

Use a drain adaptor as a condensation pipe connection.

Then use an outdoor unit bottom base as a condensation drainage pan.

Name	Model
Drain Adaptor	DBS-TP10A

Component Formation of Drain Adaptor

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

6. Refrigerant Piping Work

WARNING

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

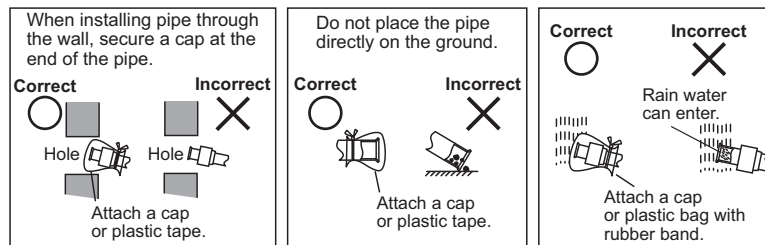
CAUTION

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

6.1 Piping Materials

- (1) Obtain locally-supplied copper pipes.
- (2) Use 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.
Do not use any tools which produce a lot of metal shavings such as a saw or a grinder.
- (5) Take special care to prevent contamination or moisture settling on interior pipe surfaces during piping work.
- (6) Avoid performing the piping connection work for outdoor unit in the rain.

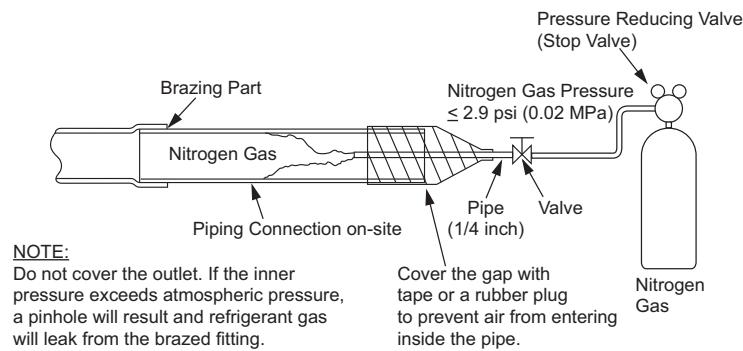
Cautions for Refrigerant Pipe Ends



Brazing Work

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

- Make sure to use nitrogen which gas pressure shall be 2.9 psi (0.02 MPa) or less.
- Make sure to use the pressure-reducing valve.
- Do not use field-supplied antioxidant.



NOTICE:

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

Cautions for Piping Connection Work

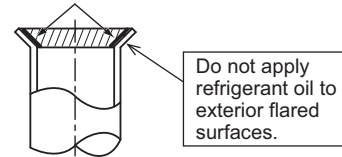
- (1) Verify that there are no scratches, metal shavings, gaps, or deformations at the flared end before connecting pipe to the system.
- (2) Before tightening the flare nut, apply a small amount of oil (field-supplied) to the outside of the flare. (Do not apply any oil to the flare face or the threads.)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

NOTE:

Refrigerant oil is field-supplied.

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

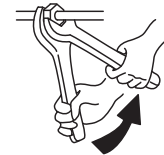
Apply Refrigerant Oil.



- (3) Be sure to use the accessory flare nuts for indoor unit connections.
To tighten the torque for liquid stop valve, refer to Section 6.2.1 "Stop Valve" of the tightening torque table.

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)



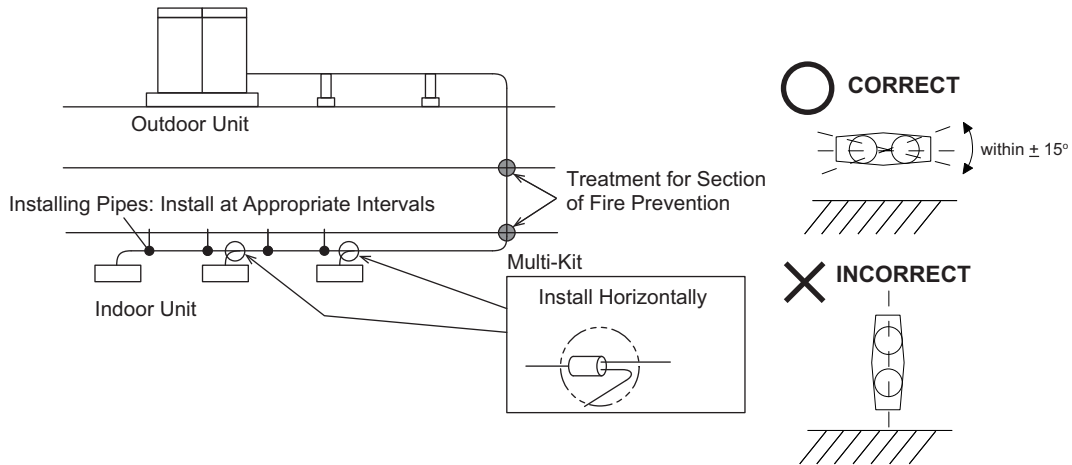
Use two wrenches as shown.

- (4) When the temperature and humidity inside the ceiling exceed 80°F (27°C)/RH80%, apply additional insulation of approximately 3/8 inch (10mm) in thickness to the accessory insulation. The insulation 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, apply insulation to all the refrigerant pipes.
- (7) Connect the indoor/outdoor units with refrigerant pipe. Secure the pipe to prevent it from coming into contact with weak structures such as a wall or ceiling. Otherwise, noise will occur due to vibration of the pipe.

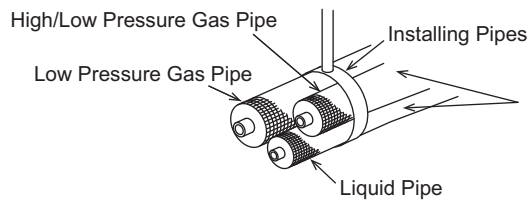
Precaution for Installing and Securing Piping

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

Example for Pipe Support



Secure Liquid Pipes, Low Pressure Gas Pipes and High/Low Pressure Gas Pipes



NOTICE:

Due to varying chemical properties, gas and liquid pipes will expand or contract at different rates due to changing refrigerant temperatures. Do not fasten gas and liquid pipes together with tape. Distortion and deformation of the pipes can occur.

Table 6.1 Pipe Sizes of Outdoor Unit

Model: (H,Y)VAHR_B(3,4,5)2S

inch (mm)

Outdoor Unit Capacity (MBH)	Gas		Liquid
	Low Pressure	High/Low Pressure	
72, 96	7/8 (22.2)	3/4 (19.05)	1/2 (12.7)
120	1-1/8 (28.58)	7/8 (22.2)	1/2 (12.7)
144 - 192	1-1/8 (28.58)	7/8 (22.2)	5/8 (15.88)
216	1-1/8 (28.58)	7/8 (22.2)	3/4 (19.05)
240 - 360	1-3/8 (34.93)	1-1/8 (28.58)	3/4 (19.05)
384 - 432	1-5/8 (41.28)	1-3/8 (34.93)	3/4 (19.05)

Table 6.2 Pipe Sizes of Indoor Unit

inch (mm)

Indoor Unit Capacity (MBH)	Gas	Liquid
6 - 15	1/2 (12.7)	1/4 (6.35)
18 - 54	5/8 (15.88)	3/8 (9.52)
60 - 72	3/4 (19.05)	3/8 (9.52)
96	7/8 (22.2)	3/8 (9.52)

6.2 Piping Connection Work

Comply with the restrictions for refrigerant piping (permissible length, height difference) in Sections 6.5 "Piping Work Conditions" and "Piping Branch Restriction." If not, the outdoor unit can become damaged or fail. The stop valves are closed completely (factory-setting) when refrigerant piping connections are performed. Do not open these stop valves until all the refrigerant pipes are connected, pressure tested, and vacuumed.

6.2.1 Stop Valve

Gas Valve

- (1) Make sure that all the stop valves are closed completely.
- (2) Connect the charging hose to the service port and release the gas inside the pipe.
- (3) Cut the end of the closing pipe and ensure that no residual gas or oil is inside the gas pipe.
- (4) Remove any combustible material such as stop valve cover (cardboard) from unit before using a torch. (Please see closing pipe drawing below.)
- (5) Remove the closing pipe from the brazing portion with a torch. Be careful that the flame doesn't damage the stop valve.

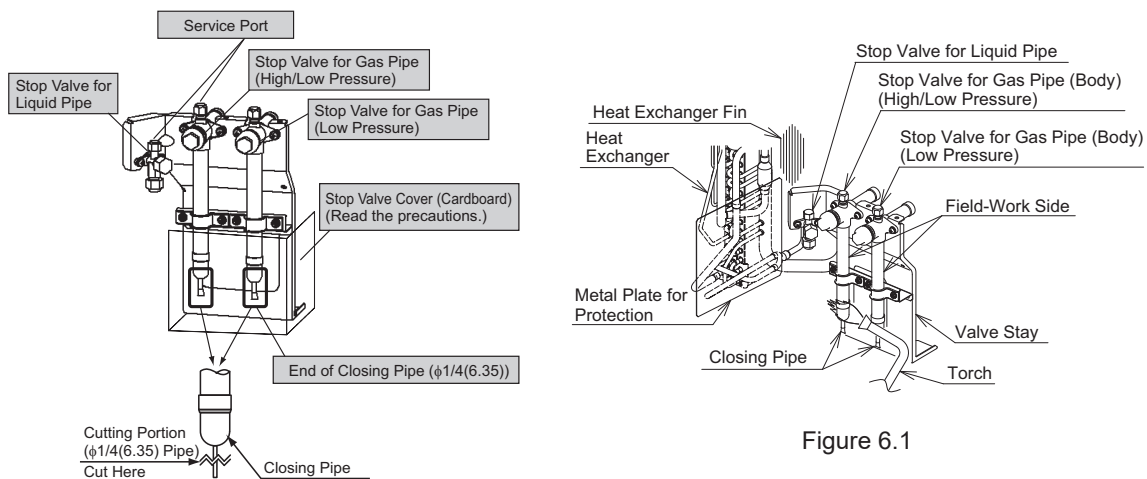


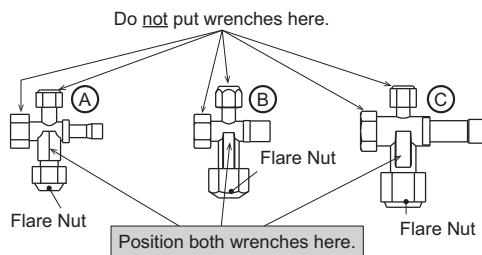
Figure 6.1

⚠ WARNING

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

Liquid Valve

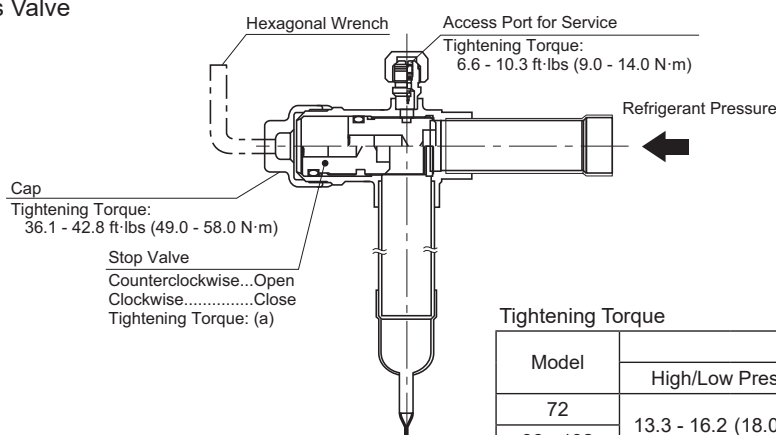
Tighten the flare nut for the liquid stop valve according to the following torque. If excessive force is applied to the flare nut, refrigerant leakage may occur from the stop valve. (To prevent leakage when removing and connecting pipe, place two wrenches at the positions indicated in the following diagram.



Model	Tightening Torque ft·lbs (N·m)	Valve
72	24.3 - 31.0 (33.0 - 42.0)	(A)
96 - 144	36.9 - 45.7 (50.0 - 62.0)	(B)
168, 192	50.2 - 62.0 (68.0 - 84.0)	(C)

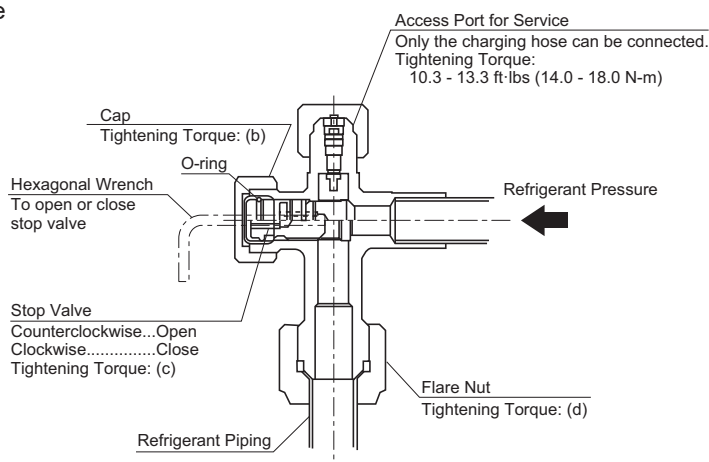
- The details of stop valves are as follows.

Gas Valve



Model	Tightening Torque ft·lbs (N·m)	
	Stop Valve (a)	
	High/Low Pressure	Low Pressure
72	13.3 - 16.2 (18.0 - 22.0)	13.3 - 16.2 (18.0 - 22.0)
96 - 192	13.3 - 16.2 (18.0 - 22.0)	18.4 - 22.9 (25.0 - 31.0)

Liquid Valve



Model	Tightening Torque ft·lbs (N·m)		
	Cap (b)	Stop Valve (c)	Flare Nut (d)
72	24.3 - 31.0 (33.0 - 42.0)	5.2 - 6.6 (7.0 - 9.0)	24.3 - 31.0 (33.0 - 42.0)
96 - 144	24.3 - 31.0 (33.0 - 42.0)	5.2 - 6.6 (7.0 - 9.0)	36.9 - 45.7 (50.0 - 62.0)
168, 192	36.9 - 45.7 (50.0 - 62.0)	6.6 - 8.1 (9.0 - 11.0)	50.2 - 62.0 (68.0 - 84.0)

CAUTION

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

6.2.2 Piping Connection Method

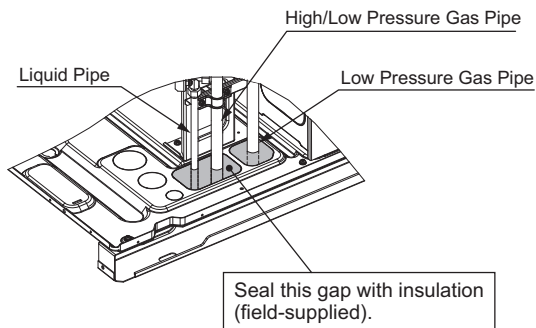
Perform the piping connection work for each outdoor unit.

NOTICE:

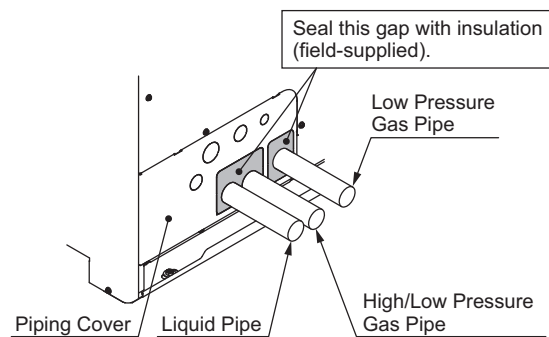
Ensure that the refrigerant pipe is connected to the same refrigerant system.

- Firmly secure the pipe in order to avoid vibration, excessive force on the valve, and noise.
- (1) Piping can be installed from the bottom base and the front piping cover.
For vibration protection, properly secure pipe connections and check that no excessive force is applied to the stop valve.
 - (2) Follow the installation procedures in Section 6.2.1.
 - (3) Connect the piping in accordance with Figures 6.1 and 6.2 on the following page.
 - (4) Seal the gap between the bottom base or front piping cover and pipes with the insulation.

For Pipes from Bottom Base

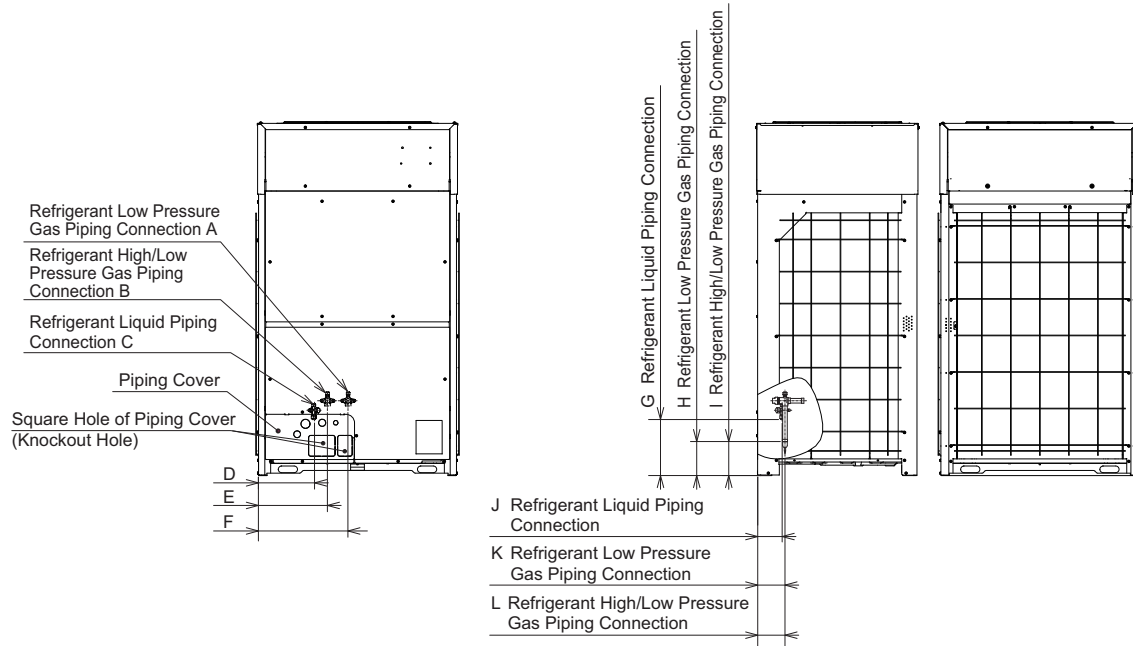


For Pipes from Front Side Piping Cover

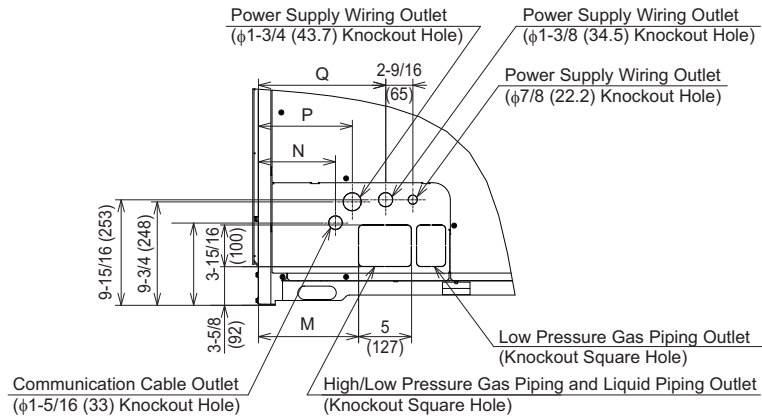


- Prepare refrigerant piping for assembly. The following examples illustrate a small cabinet.
Refer to Figure 6.2 for the position for piping connections.

Unit: inch (mm)



Detail of Piping Cover

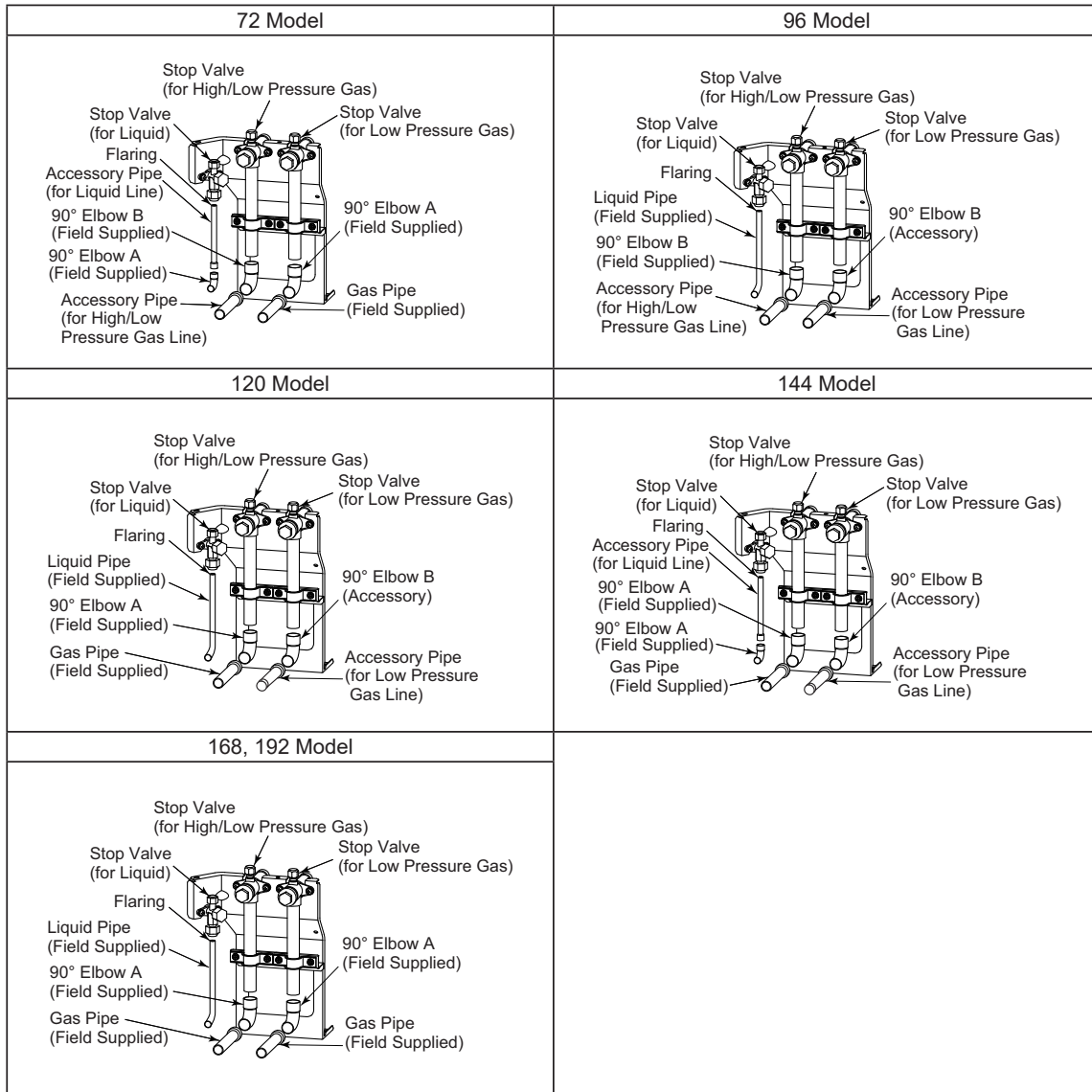


Model	Gas		Liquid	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q
	Low Pressure	High/Low Pressure																	
72	φ7/8 (22.2)	φ3/4 (19.05)	φ1/2 (12.7)	φ7/8 (22.2)	φ7/8 (22.2)	φ3/8 (9.52)	10-3/8 (264)	13-1/16 (331)	16-5/16 (414)	10-9/16 (268)	6-7/16 (163)	6-7/16 (163)	4-5/8 (117)	5-3/16 (131)	5-3/16 (131)	9-7/16 (240)	7-5/16 (185)	8-7/8 (225)	12 (305)
96	φ7/8 (22.2)	φ3/4 (19.05)	φ1/2 (12.7)																
120	φ1-1/8 (28.58)	φ7/8 (22.2)	φ1/2 (12.7)	φ1 (25.4)	φ7/8 (22.2)	φ1/2 (12.7)	6-7/8 (174)	9-7/16 (239)	12-11/16 (322)	10-3/8 (263)	6-5/16 (160)	6-7/16 (163)	4-7/16 (112)	5-1/8 (130)	5-3/16 (131)	5-13/16 (147)	3-5/8 (92)	5-3/16 (132)	8-3/8 (212)
144	φ1-1/8 (28.58)	φ7/8 (22.2)	φ5/8 (15.88)																
168	φ1-1/8 (28.58)	φ7/8 (22.2)	φ5/8 (15.88)	φ1-1/8 (28.58)	φ7/8 (22.2)	φ5/8 (15.88)	6-15/16 (177)	9-7/16 (239)	12-11/16 (322)	10-3/16 (259)	6-5/16 (160)	6-7/16 (163)	5-3/16 (132)	6 (152)	6 (153)	5-13/16 (147)	3-5/8 (92)	5-3/16 (132)	8-3/8 (212)
192	φ1-1/8 (28.58)	φ7/8 (22.2)	φ5/8 (15.88)																

Figure 6.2 Refrigerant Piping Connection and Wiring Outlet

- Details of Stop Valve Piping Connections

Be sure to remove first the closing pipe of the gas stop valve. Refer to Figure 6.1 for the flaring work. Refer to Section 3.1 “Factory-Supplied Accessories” for the details of the accessory pipes.



6.3 Piping Work between Outdoor Units

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

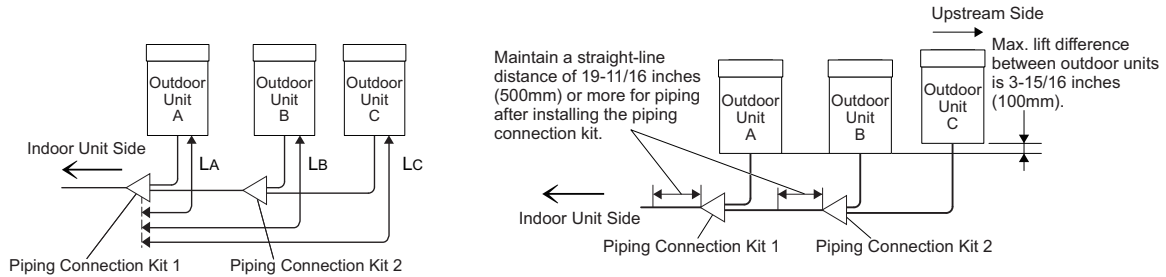
For refrigerant piping between multiple outdoor units, use the optional piping connection kit.

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

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

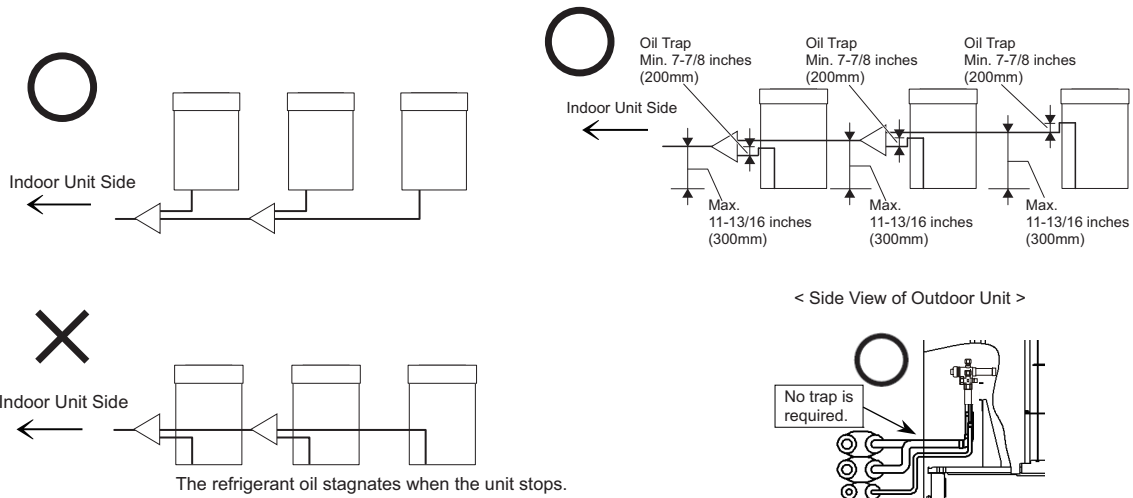
$$L_A \leq L_B \leq L_C \leq 32 \text{ ft (10m)}.$$

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



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

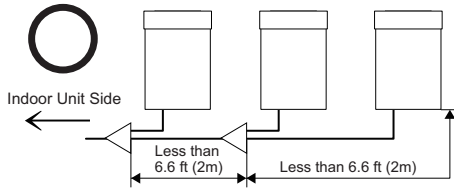
When the piping connection kit is installed higher than the outdoor unit piping connection, maintain a maximum clearance of 11-13/16 inches (300mm) between the piping connection kit and the bottom of the outdoor unit. Also, install an oil trap (minimum 7-7/8 inches (200mm)) for the gas piping between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



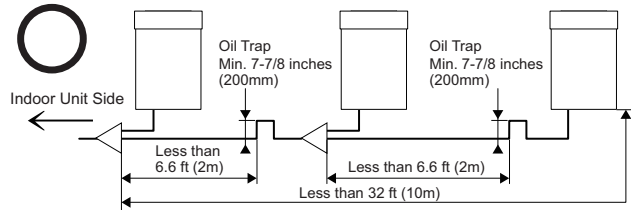
The refrigerant oil stagnates in the stopped outdoor unit during system operation.

- (3) Install an oil trap for the gas piping when the piping length between the piping connection kits, or the outdoor unit and the piping connection kit is 6.6 ft (2m) or more to prevent any accumulation of refrigerant oil.

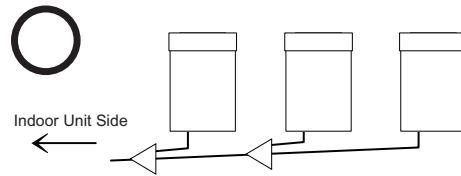
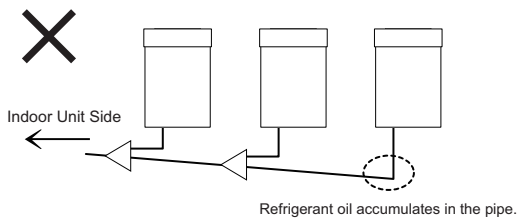
• Less than 6.6 ft (2m)



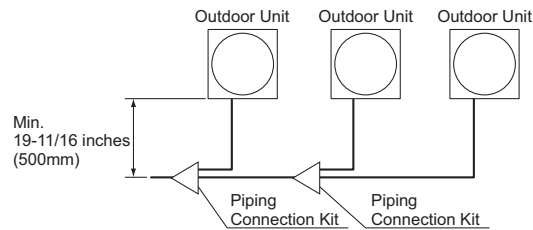
• 6.6 ft (2m) or More



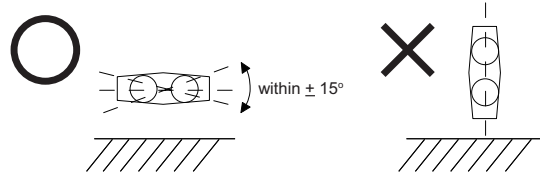
- (4) Place the outdoor unit pipe horizontally or with the pipe slanted downward towards the indoor unit side so that accumulation of refrigerant oil does not occur in the pipe.



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



- (6) Direction of Piping Connection Kit
Place the piping connection kit so it is parallel to the ground (the slope must be within $\pm 15^\circ$) as shown in the figure.

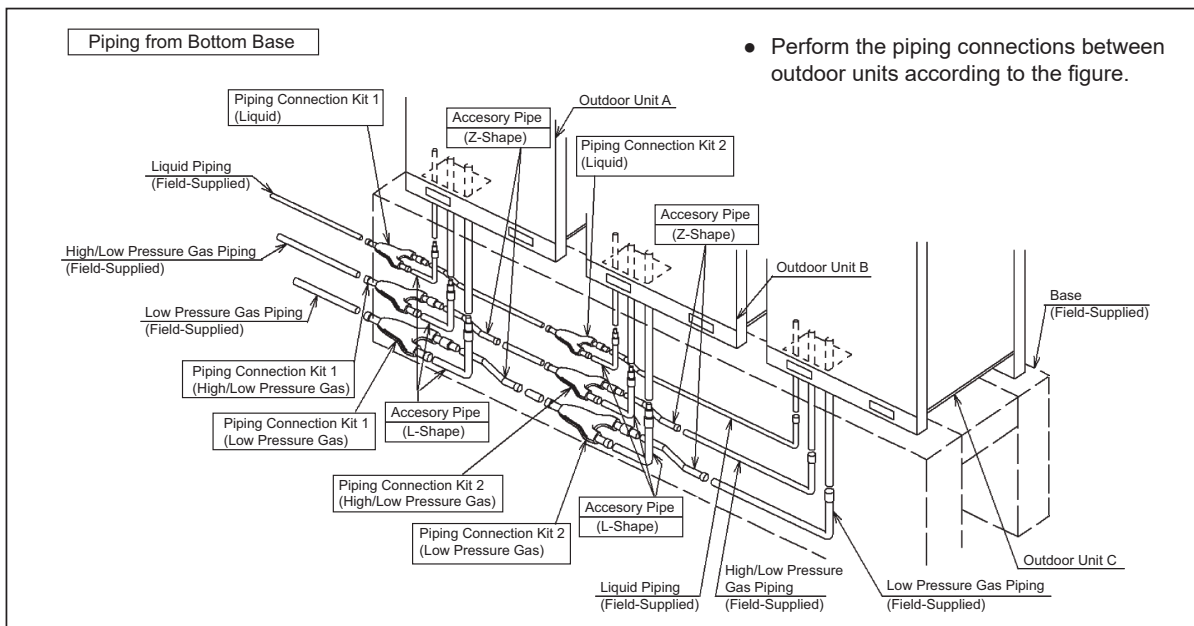
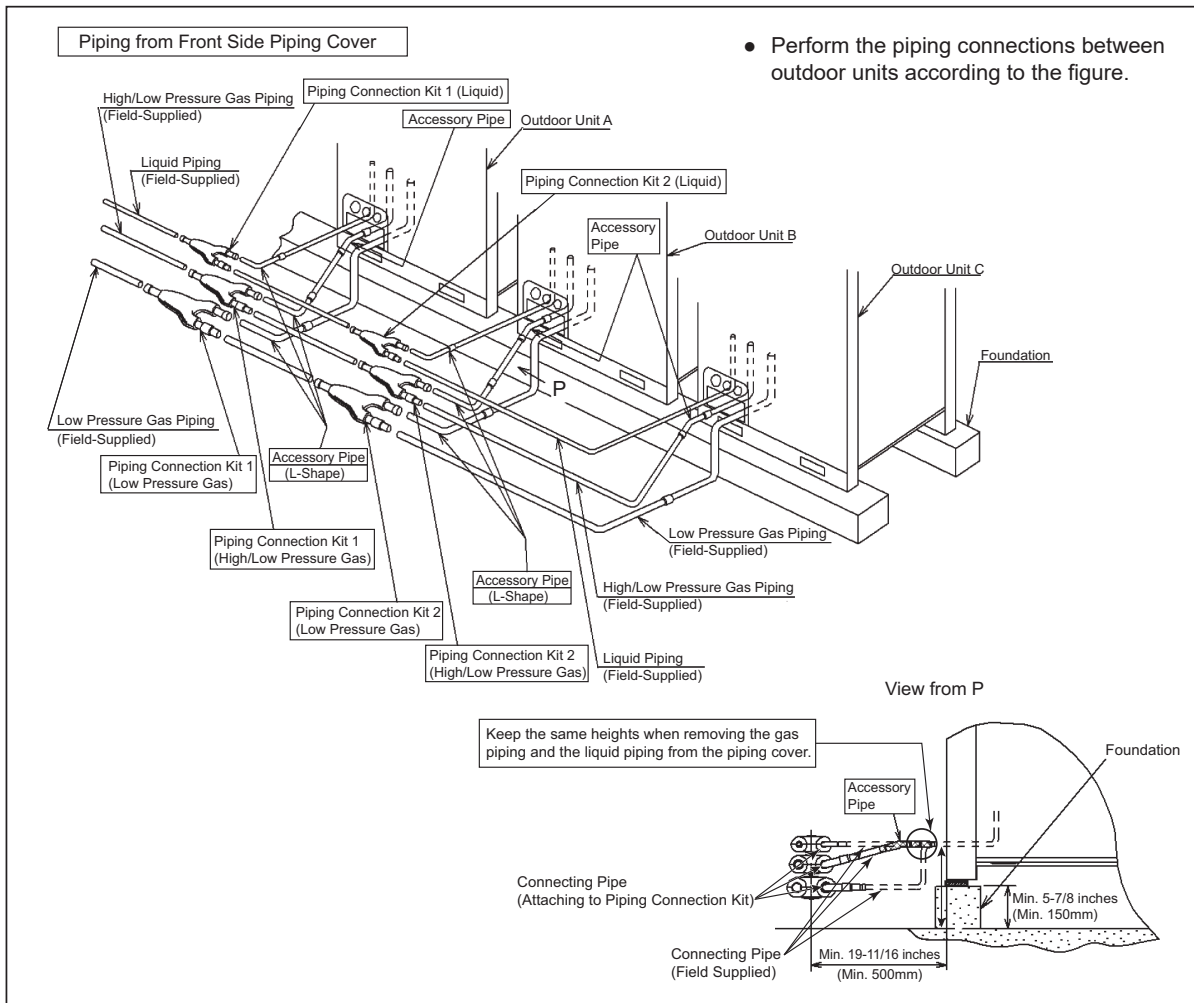


NOTICE

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

- Construction Example

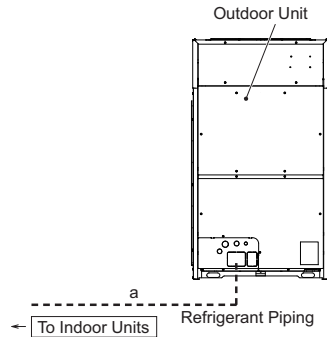
The following figures show examples of a heat recovery system (three units in combination). Regarding the piping work for combining the units, refer to the "Installation and Maintenance Manual" enclosed in the piping connection kit package. Refer to the following figure to perform the piping connections between the outdoor units.



6.4 Piping Sizes between Outdoor Units

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

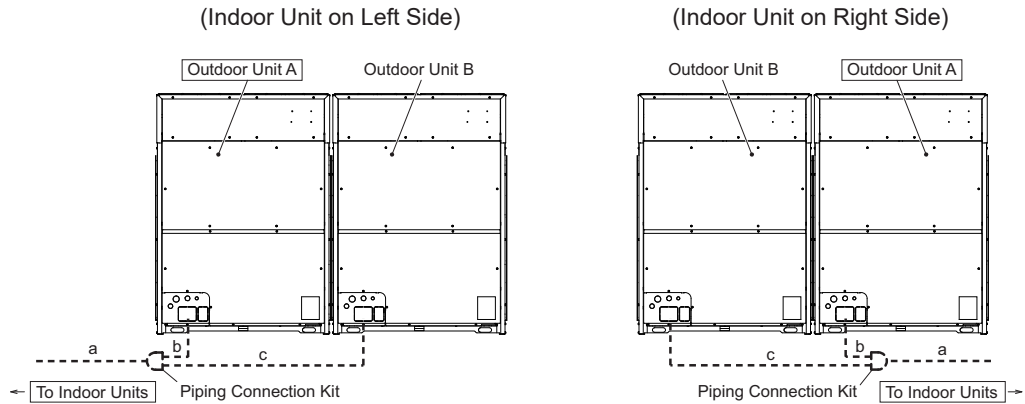
Base Unit



		inch (mm)					
Model		72	96	120	144	168	192
Piping Size	a	Low Pressure Gas	7/8 (22.2)	7/8 (22.2)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	3/4 (19.05)	3/4 (19.05)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)
		Liquid	1/2 (12.7)	1/2 (12.7)	1/2 (12.7)	5/8 (15.88)	5/8 (15.88)

Two Unit Combination

The following drawing is for a 288 model combination.



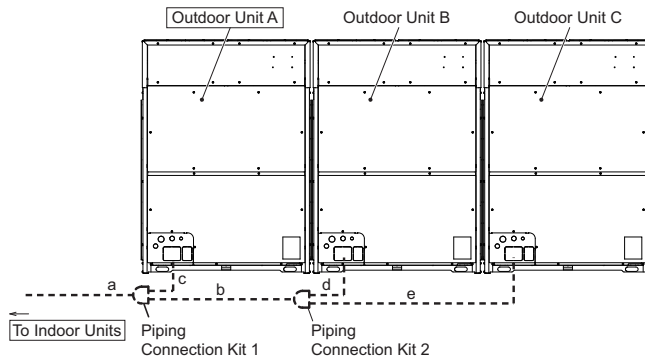
			inch (mm)						
Model		216	240	264	288	312	336	360	
Combination Unit	Outdoor Unit A	144	120	144	144	168	192	192	
	Outdoor Unit B	72	120	120	144	144	144	168	
Piping Connection Kit		MC-NP21SX1							
Piping Size	a	Low Pressure Gas	1-1/8 (28.58)	1-3/8 (34.93)	1-3/8 (34.93)	1-3/8 (34.93)	1-3/8 (34.93)	1-3/8 (34.93)	1-3/8 (34.93)
		High/Low Pressure Gas	7/8 (22.2)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)
		Liquid	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)	3/4 (19.05)
	b	Low Pressure Gas	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)
		Liquid	5/8 (15.88)	1/2 (12.7)	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)
	c	Low Pressure Gas	7/8 (22.2)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	3/4 (19.05)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)	7/8 (22.2)
		Liquid	1/2 (12.7)	1/2 (12.7)	1/2 (12.7)	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)	5/8 (15.88)

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

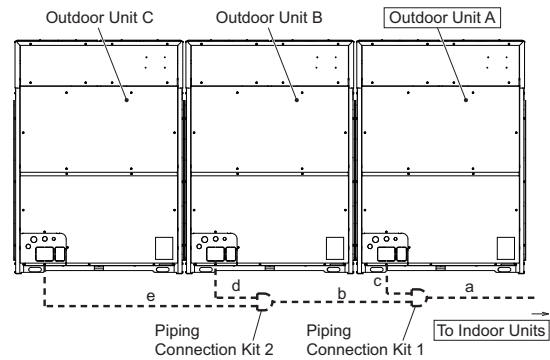
Three Unit Combination

The following drawing is for a 432 model combination.

(Indoor Unit on Left Side)



(Indoor Unit on Right Side)

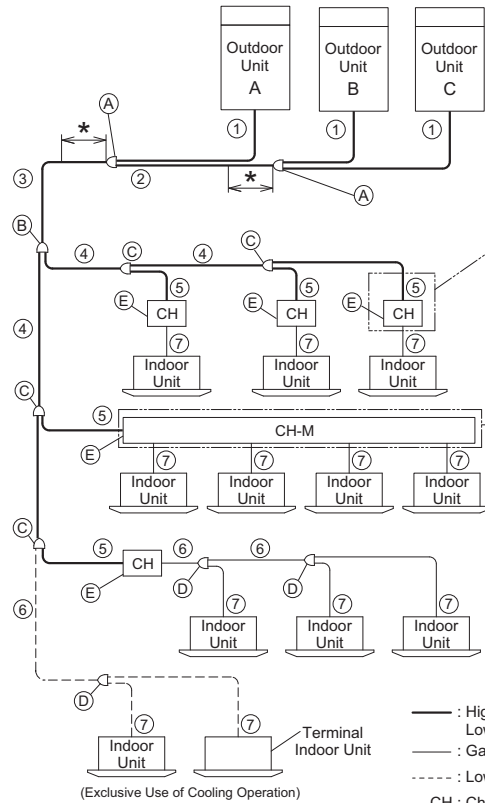


		inch (mm)		
Model		384	408	432
Combination Unit	Outdoor Unit A	144	144	144
	Outdoor Unit B	120	144	144
	Outdoor Unit C	120	120	144
Piping Connection Kit		MC-NP30SX1		
Piping Size	a	Low Pressure Gas	1-5/8 (41.28)	1-5/8 (41.28)
		High/Low Pressure Gas	1-3/8 (34.93)	1-3/8 (34.93)
		Liquid	3/4 (19.05)	3/4 (19.05)
	b	Low Pressure Gas	1-3/8 (34.93)	1-3/8 (34.93)
		High/Low Pressure Gas	1-1/8 (28.58)	1-1/8 (28.58)
		Liquid	3/4 (19.05)	3/4 (19.05)
	c	Low Pressure Gas	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	7/8 (22.2)	7/8 (22.2)
		Liquid	5/8 (15.88)	5/8 (15.88)
	d	Low Pressure Gas	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	7/8 (22.2)	7/8 (22.2)
		Liquid	1/2 (12.7)	5/8 (15.88)
	e	Low Pressure Gas	1-1/8 (28.58)	1-1/8 (28.58)
		High/Low Pressure Gas	7/8 (22.2)	7/8 (22.2)
		Liquid	1/2 (12.7)	5/8 (15.88)

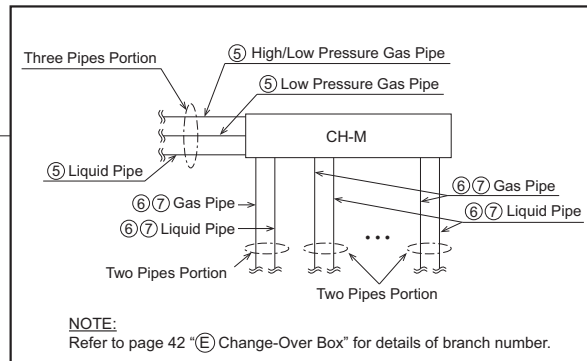
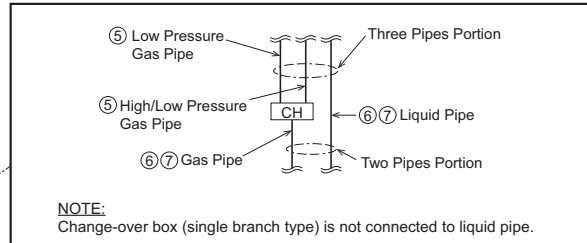
6.5 Piping Size and Multi-Kit Selection

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

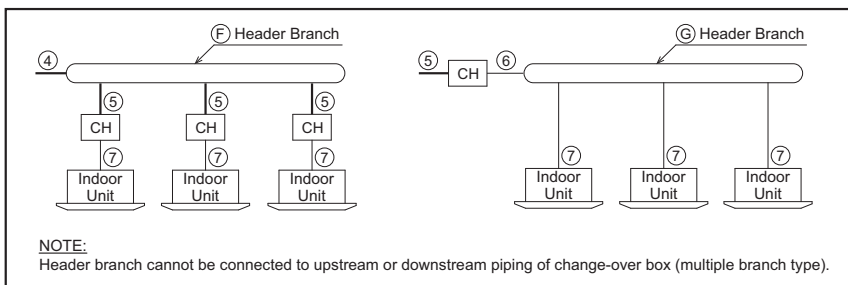
★ Maintain a straight-line distance of 19-11/16 inches (500mm) or more for piping after the piping connection kit.



— : High/Low Pressure Gas Pipe,
Low Pressure Gas Pipe, Liquid Pipe
— : Gas Pipe, Liquid Pipe
- - - : Low Pressure Gas Pipe, Liquid Pipe
CH : Change-Over Box (Single Branch Type)
CH-M : Change-Over Box (Multiple Branch Type)



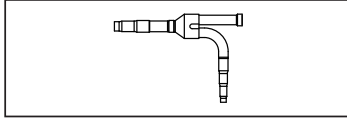
If header branch is used instead of (C) (D) multi-kit.



Multi-Kit (Optional Parts)

Line Branch

Branch using Multi-Kit (MW Model)



If ③ “Multi-Kit after First Branch” is larger than ② “Multi-Kit for First Branch”, use the same model as ② “Multi-Kit for First Branch”.

② Multi-Kit for First Branch

Outdoor Unit Capacity (MBH)	Model
72 - 120	MW-NP452X3 *1
144 - 192	MW-NP562X3 *1
216 - 432	MW-NP902X3 *1

NOTE:

The change-over box (multiple branch type) or header branch can also be used instead of the multi-kit as first branch.

③ Multi-Kit after First Branch (Three Pipes Portion)

Total Indoor Unit Capacity (MBH)	Model
≤ 47	MW-NP142X3 *1
48 - 95	MW-NP282X3 *1
96 - 143	MW-NP452X3 *1
144 - 215	MW-NP562X3 *1
≥ 216	MW-NP902X3 *1

*1 X2 type is to be used in place of X3 type:
The piping kits for X2 model number MW-NP142X2, MW-NP282X2, MW-NP452X2, MW-NP562X2 and MW-NP902X2 are to be used in place of the piping kits for the X3 model numbers, MW-NP142X3, MW-NP282X3, MW-NP452X3, MW-NP562X3 and MW-NP902X3, as noted.

④ Multi-Kit after First Branch (Two Pipes Portion)

Total Indoor Unit Capacity (MBH)	Model
≤ 95	MW-NP282A3 *2
96 - 143	MW-NP452A3 *2
144 - 215	MW-NP692A3 *2
≥ 216	MW-NP902A3 *2

*2 A2 type is to be used in place of A3 type

The piping kits for A2 model number MW-NP282A2, MW-NP452A2, MW-NP692A2 and MW-NP902A2 are to be used in place of the piping kits for the A3 model numbers, MW-NP282A3, MW-NP452A3, MW-NP692A3 and MW-NP902A3, as noted.

Ⓔ Change-Over Box

• Single Unit for 1 Branch

Model	Indoor Unit Side Branch Number	Indoor Unit Maximum Connection Capacity	Indoor Unit Maximum Connection Capacity for 1 Branch
COBS048B21S	1	≤ 54	≤ 54
COBS048B22S	1	≤ 54	≤ 54
COBS096B21S	1	≤ 96	≤ 96
COBS096B22S	1	≤ 96	≤ 96
COB04M132B22S	4	≤ 132	≤ 96 ^{*3}
COB08M264B22S	8	≤ 264	≤ 96 ^{*3}
COB12M264B22S	12	≤ 264	≤ 96 ^{*3}

^{*3} Upto two 60, 72 or 96 type indoor units can be connected to the change-over box within the “Indoor Unit Maximum Connection Capacity” shown in above table.

Make sure to increase the pipe connection size by using the appropriate accessory pipe.

• Multiple Units for 1 Branch

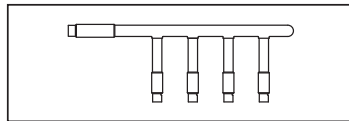
Model	Indoor Unit Side Branch Number	Maximum Number of Connected Indoor Units for 1 Branch	Indoor Unit Maximum Connection Capacity	Indoor Unit Maximum Connection Capacity for 1 Branch
COBS048B21S ^{*4}	1	7	≤ 41	≤ 41
COBS048B22S	1	7	≤ 41	≤ 41
COBS096B21S ^{*4}	1	8	≤ 71	≤ 71
COBS096B22S	1	8	≤ 71	≤ 71
COB04M132B22S	4	6	≤ 114	≤ 41
COB08M264B22S	8	6	≤ 216	≤ 41
COB12M264B22S	12	6	≤ 216	≤ 41

^{*4} If the number of connected indoor unit exceeds four, the upstream or downstream piping of change-over box (Piping Size ⑤⑥⑦) need to change the size respectively. Refer to page 44 ⑤ “Diameter of Pipe between Change-Over Box and Multi-kit” for details.

Only single unit per branch is allowed to be connected.

Header Branch

Branch using Multi-Kit (MH Model)



Ⓕ for Three Pipes Portion

Total Indoor Unit Capacity (MBH)	No. of Header Branches	Model
36 - 72	8	MH-NP288X

Ⓖ for Two Pipes Portion

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

Refer to the figure at the beginning of section 6.5.

Unit: inch (mm)

③ Main Pipe Diameter

(Base Unit or Piping Connection Kit 1 to First Branch)

Model: (H,Y)VAHR_B(3,4,5)2S

inch (mm)

Outdoor Unit Capacity (MBH)	Low Pressure Gas	High/Low Pressure Gas	Liquid	
			Maximum Equivalent Piping Length	
			< 328 ft (100m)	≥ 328 ft (100m) * ⁵
72, 96	7/8 (22.2)	3/4 (19.05)	1/2 (12.7)	5/8 (15.88)
120	1-1/8 (28.58)	7/8 (22.2)	1/2 (12.7)	5/8 (15.88)
144 - 192	1-1/8 (28.58)	7/8 (22.2)	5/8 (15.88)	3/4 (19.05)
216	1-1/8 (28.58)	7/8 (22.2)	3/4 (19.05)	3/4 (19.05)
240, 264	1-3/8 (34.93)	1-1/8 (28.58)	3/4 (19.05)	3/4 (19.05)
288 - 360	1-3/8 (34.93)	1-1/8 (28.58)	3/4 (19.05)	7/8 (22.2)
384 - 432	1-5/8 (41.28)	1-3/8 (34.93)	3/4 (19.05)	7/8 (22.2)

*⁵ In some cases, it is required to prepare the reducer (field-supplied).

④ Diameter of Pipe after First Branch *⁶

inch (mm)

Total Indoor Unit Capacity (MBH)	Low Pressure Gas	High/Low Pressure Gas	Liquid
≤ 47	5/8 (15.88)	1/2 (12.7)	3/8 (9.52)
48 - 71	3/4 (19.05)	5/8 (15.88)	3/8 (9.52)
72 - 95	7/8 (22.2)	3/4 (19.05)	3/8 (9.52)
96 - 119	7/8 (22.2)	3/4 (19.05)	1/2 (12.7)
120 - 143	1-1/8 (28.58)	7/8 (22.2)	1/2 (12.7)
144 - 215	1-1/8 (28.58)	7/8 (22.2)	5/8 (15.88)
216 - 299	1-3/8 (34.93)	1-1/8 (28.58)	3/4 (19.05)
≥ 300	1-5/8 (41.28)	1-3/8 (34.93)	3/4 (19.05)

*⁶ If the size of ④ "Diameter of Pipe after First Branch" is larger than the size of ③ "Main Pipe Diameter", adjust the size of ④ "Diameter of Pipe after First Branch" to the same size as ③ "Main Pipe Diameter".

⑤ Diameter of Pipe between Change-Over Box and Multi-Kit

For Change-Over Box (Generation 1)

inch (mm)

Change-Over Box Model	Total Indoor Unit Capacity (MBH)	Low Pressure Gas ^{*7}	High/Low Pressure Gas ^{*7}
COB048/096B21S (Generation 1)	≤ 29	5/8 (15.88) [5/8 (15.88)]	1/2 (12.7) [1/2 (12.7)]
	30 - 59	3/4 (19.05) [7/8 (22.2)]	5/8 (15.88) [3/4 (19.05)]
	60 - 96	7/8 (22.2) [1-1/8 (28.58)]	3/4 (19.05) [7/8 (22.2)]

For Change-Over Box (Generation 2) ^{*8}

inch (mm)

Change-Over Box Model	Total Indoor Unit Capacity (MBH)	Low Pressure Gas	High/Low Pressure Gas	Liquid ^{*9}
COBS048/096B22S COB04M132B22S COB08/12M264B22S (Generation 2)	≤ 47	5/8 (15.88)	1/2 (12.7)	3/8 (9.52)
	48 - 71	3/4 (19.05)	5/8 (15.88)	3/8 (9.52)
	72 - 95	7/8 (22.2)	3/4 (19.05)	3/8 (9.52)
	96 - 119	7/8 (22.2)	3/4 (19.05)	1/2 (12.7)
	120 - 143	1-1/8 (28.58)	7/8 (22.2)	1/2 (12.7)
	144 - 215	1-1/8 (28.58)	7/8 (22.2)	5/8 (15.88)
	216 - 264	1-3/8 (34.93)	1-1/8 (28.58)	3/4 (19.05)

^{*7} If the number of connected indoor unit exceeds four, the low pressure gas and high/low pressure gas pipes need to change size in square bracket. In addition, the gas and liquid pipes of ⑥ “Diameter of Pipe (Two Pipes Portion)” and ⑦ “Diameter of Pipe Connected to Indoor Unit (Two Pipes Portion)” need to increase one size respectively. In this case, prepare a field-supplied reducer.

^{*8} If the size of ⑤ “Diameter of Pipe between Change-Over Box and Multi-Kit” is larger than the size of ③ “Main Pipe Diameter”, adjust the size of ⑤ “Diameter of Pipe between Change-Over Box and Multi-Kit” to the same size as ③ “Main Pipe Diameter”

^{*9} Change-Over Box (COBS048/096B22S) is not connected to liquid pipe.

⑥ Diameter of Pipe (Two Pipes Portion)

inch (mm)

Total Indoor Unit Capacity (MBH)	Gas ^{*10}	Liquid
≤ 47	5/8 (15.88)	3/8 (9.52)
48 - 71	3/4 (19.05)	3/8 (9.52)
72 - 95	7/8 (22.2)	3/8 (9.52)
96 - 119	7/8 (22.2)	1/2 (12.7)
120 - 143	1-1/8 (28.58)	1/2 (12.7)
144 - 215	1-1/8 (28.58)	5/8 (15.88)
216 - 299	1-3/8 (34.93)	3/4 (19.05)
≥ 300	1-5/8 (41.28)	3/4 (19.05)

^{*10} For the exclusive use of cooling operation, connect the low pressure gas pipe to the gas pipe of line branch or header branch for two pipes portion.

⑦ Diameter of Pipe Connected to Indoor Unit (Two Pipes Portion)

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

inch (mm)

Indoor Unit Capacity (MBH)	Gas ^{*11}	Liquid
6 - 15	1/2 (12.7)	1/4 (6.35) ^{*12}
18 - 54	5/8 (15.88)	3/8 (9.52)
60 - 72	3/4 (19.05)	3/8 (9.52)
96	7/8 (22.2)	3/8 (9.52)

^{*11} For the exclusive use of cooling operation, connect the low pressure gas pipe to the gas pipe of the indoor unit.

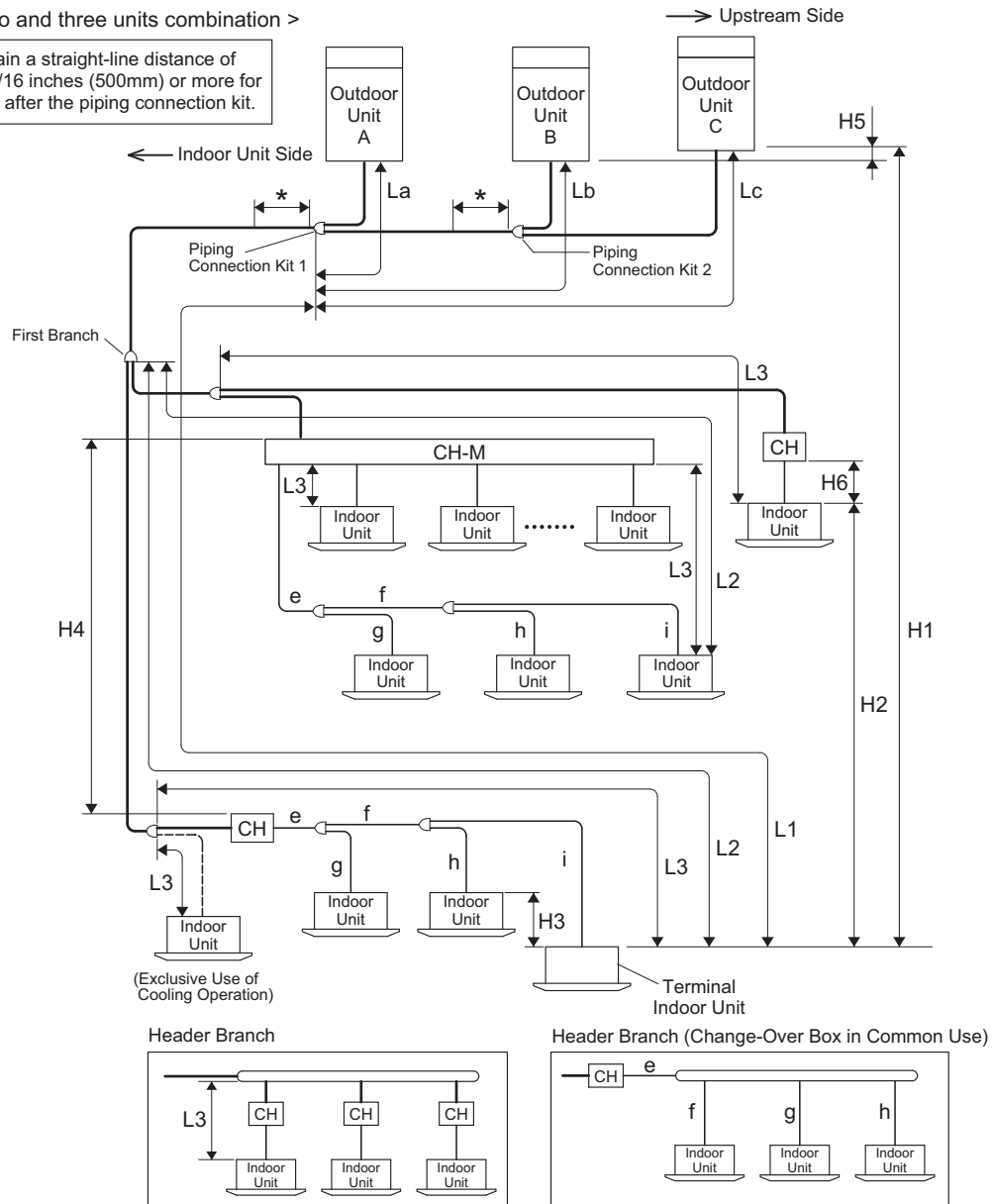
^{*12} When liquid piping length is longer than 49ft (15m), use 3/8inch (9.52mm) diameter pipe to connect to the indoor unit (two pipes portion).

- Piping Work Conditions

Comply with the following when installing the unit.

< For two and three units combination >

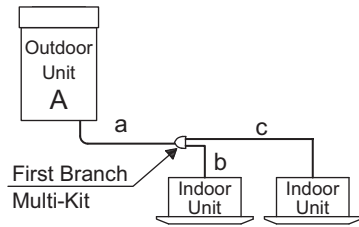
* Maintain a straight-line distance of 19-11/16 inches (500mm) or more for piping after the piping connection kit.



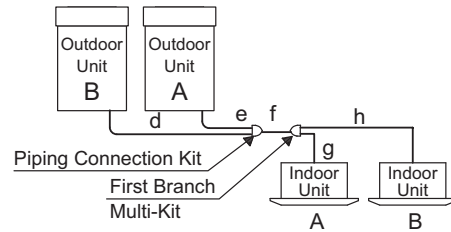
— : High/Low Pressure Gas Pipe, Low Pressure Gas Pipe, Liquid Pipe
 — : Gas Pipe, Liquid Pipe
 - - - - : Low Pressure Gas Pipe, Liquid Pipe
 CH : Change-Over Box (Single Branch Type)
 CH-M : Change-Over Box (Multiple Branch Type)

Item	Mark		Details
Total Piping Length	Ex1	a+b+c	The total amount of all piping actual length.
	Ex2	d+e+f+g+h	
Maximum Piping Length	Ex1	a+c	The actual pipe length between the stop valve of the outdoor unit or the piping connection kit 1 and the terminal indoor unit.
	Ex2	f+h	
Piping Length	-		The actual length of pipe that takes no account for equivalent lengths for pressure drops of elbows.
Equivalent Piping Length	-		The combination of the straight pipe length plus the equivalent length of elbows and other pressure drop calculations.

Example1) Line Branch Includes Main Branch



Example 2) Utilizing a Piping Connection Kit



● Piping Work Conditions

Item		Mark	Allowable Piping Length	
			≤ the recommended number of connected indoor units	> the recommended number of connected indoor units
Total Piping Length		-	≤ 3,281 ft (1,000m)	≤ 984 ft (300m)
Maximum Piping Length	Actual Length	L1	≤ 541 ft (165m)	≤ 541 ft (165m)
	Equivalent Length		≤ 623 ft (190m)	≤ 623 ft (190m)
Maximum Piping Length between Multi-kit of 1st Branch and Each Indoor Unit		L2	≤ 295 ft (90m)	≤ 131 ft (40m)
Maximum Piping Length between Each Multi-kit/Change-Over Box (Multiple Branch Type) and Each Indoor Unit		L3 ¹³	≤ 131 ft (40m)	≤ 98 ft (30m)
Total Piping Length between Change-Over Box and Each Indoor Unit per Branch		e+f+g+h+i	≤ 131 ft (40m)	≤ 98 ft (30m)
Piping Length between Piping Connection Kit 1 and Each Outdoor Unit		La, Lb, Lc	≤ 32 ft (10m)	≤ 32 ft (10m)
Height Difference between Outdoor Units and Indoor Units	O.U. is Higher	H1	≤ 164 ft (50m) (360 ft (110m)) ¹⁰	≤ 164 ft (50m) (360 ft (110m)) ¹⁰
	O.U. is Lower		≤ 131 ft (40m) (360 ft (110m)) ¹¹	≤ 131 ft (40m) (360 ft (110m)) ¹¹
Height Difference between Indoor Units		H2	≤ 49 ft (15m)	≤ 49 ft (15m)
Height Difference between Indoor Units Connected to Same Branch of Change-Over Box		H3	≤ 13 ft (4m)	≤ 13 ft (4m)
Height Difference between Change-Over Box		H4	≤ 49 ft (15m)	≤ 49 ft (15m)
Height Difference between Outdoor Units		H5	≤ 0.3 ft (0.1m)	≤ 0.3 ft (0.1m)
Height Difference between Change-Over Box and Indoor Unit		H6	See Notice 12 below	See Notice 12 below

NOTICE

Comply with the following conditions when installing the unit.

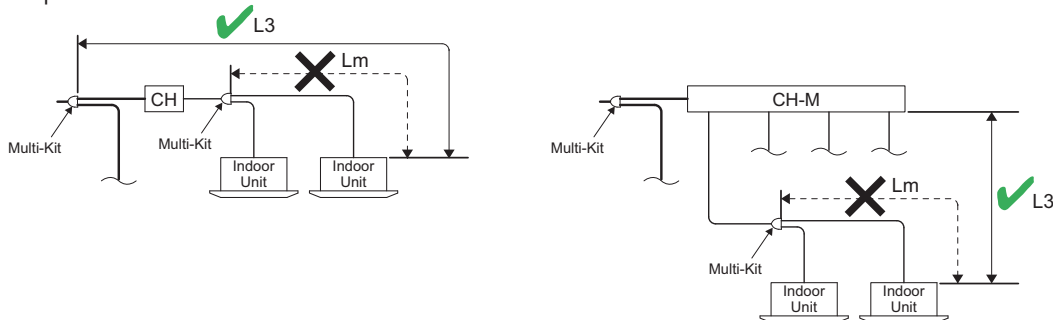
1. For a combination of two or three outdoor units, the outdoor unit "A" should be connected to the piping connection of Kit 1. (Refer to Section 6.4 for outdoor unit models.) Refer to the Piping Kit Installation Manual for piping details.
2. The piping length between outdoor units should be $L_a \leq L_b \leq L_c \leq 32 \text{ ft (10m)}$.
(If the piping length is incorrect, there may be a failure of outdoor units caused by returned refrigerant.)
3. Maintain a straight-line distance of 19-11/16 inches (500mm) or more for pipe after installing the piping connection kit.
4. For the exclusive use of cooling operation only, connect indoor units with low pressure gas pipe and liquid pipe (without Change-Over Box). The total capacity of the exclusive cooling operation should be smaller than 50% of the total indoor unit capacity.
5. The condition of refrigerant piping installation is different depending on the number of indoor units that are connected. Refer to Table 3.2 "System Combination" above for details.
6. Allowable total piping length may not exceed 3,281 ft (1,000m) because of the limitation of maximum additional refrigerant amount as described in the following table. Make sure that the additional refrigerant volume does not exceed the maximum additional refrigerant amount as shown below.

Outdoor Unit Capacity (MBH)	72	96 - 144	168	192	216 - 432
Max. Additional Refrigerant Charge: lbs (kg)	79.4 (36)	88.2 (40)	112.5 (51)	114.7 (52)	138.9 (63)

When the outdoor air temperature is 14°F (-10°C) or less, or under the high heating load conditions, the total indoor unit capacity should be less than 100% of the outdoor unit capacity, and the total piping length should be less than 984 ft (300m).

7. If the piping length (L3) between each multi-kit and indoor unit is considerably longer than other indoor unit, refrigerant may not flow well, and may lessen the unit's performance compared to other models.
(Recommended Piping Length: Within 49 ft (15m))
8. When the piping length from the multi-kit to the first branch and to the terminal indoor unit exceeds 131 ft (40m), refer to "Piping Branch Restrictions," Section 6.5.
9. When completing on-site piping, install bent piping or horizontal loop piping to absorb any expansion or contraction due to changing temperatures.
10. When the height difference is longer than 164 ft (50m) and up to 360 ft (110m) (in case the outdoor unit is higher, "O.U. is Higher"), there are following restrictions.
 - a) Maximum outdoor temperature for cooling operation should be within 109°F DB (43°C DB).
 - b) When operating the outdoor unit in the outdoor air temperature approx. 14°F (-10°C) or less, the height difference should be below 164ft (50m).
 - c) Maximum connectable indoor units capacity ratio must be within 100%.
 - d) When operating the outdoor unit under the high cooling load conditions or in the high outdoor air temperature (approx. 100°F (38°C) or more), the capacity may decrease significantly compared to the installation condition of height difference below 164 ft (50m) due to the compressor protection controls. When the outdoor air temperature is 100°F DB (38°C DB) or more, the outdoor unit will function as Thermo-OFF to protect the compressor from failure.
 - e) Use of outdoor unit function setting item "nU" (Priority Capacity Mode) may be invalid.
 - f) Contact your distributor or contractor for details of setting.
11. When the height difference is longer than 131 ft (40m) and up to 360 ft (110m) (in case the outdoor unit is lower, "O.U. is Lower"), there are following restrictions.
 - a) Maximum outdoor temperature for cooling operation should be 109°F DB (43°C DB) or less.
 - b) Minimum outdoor temperature for cooling operation should be 50°F DB (10°C DB) or more.
 - c) Minimum outdoor temperature for simultaneous operation should be 50°F DB (10°C DB) or more.
 - d) Contact your distributor or contractor for details of setting.
12. When the piping height difference between change-over box and indoor unit over 49 ft (15m), the performance may decrease. (Recommended Height Difference: Within 49 ft (15m))
13. The piping length calculation is not included in the multi-kit between change-over box and indoor unit(s).
(Lm in following examples are NOT L3.)

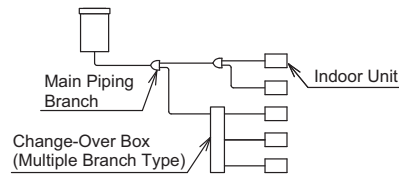
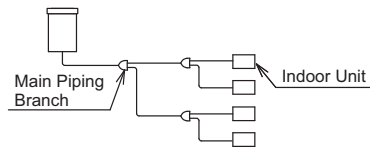
Example



- Piping Branch Restriction

- * Main Piping Branch:

Both branches of piping from a multi-kit are connected to the next multi-kits.
(including change-over box (multiple branch type).)



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

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

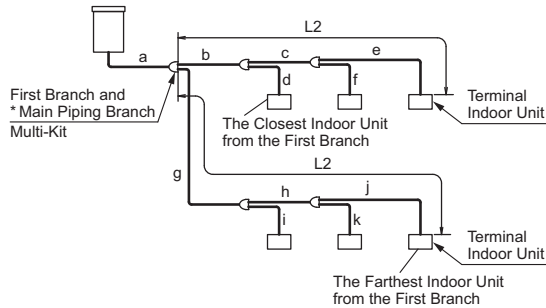
If the installation contains a main piping branch

And, any piping length between the first branch to each indoor units (L2) is over 131.2 ft (40m).

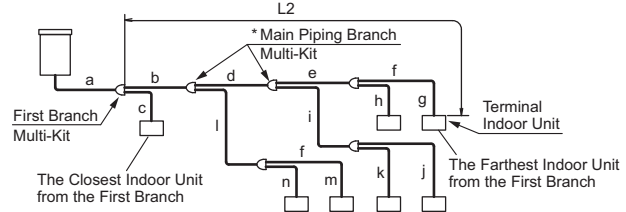
Then the difference between closest L2 and the farthest L2 (terminal unit) cannot be greater than 131.2 ft (40m).

Piping Length from the Multi-Kit at the first branch to the terminal Indoor Unit is within 131.2 - 295.3 ft (40 - 90m)

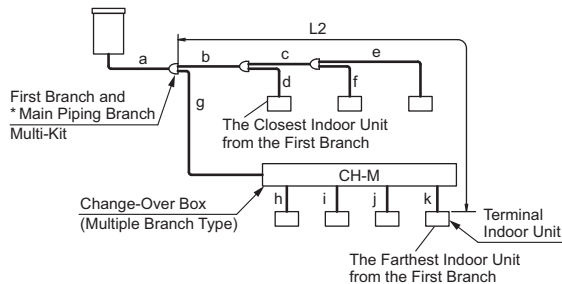
$$(g+h+j)-(b+d) \leq 131.2 \text{ ft (40m)}$$



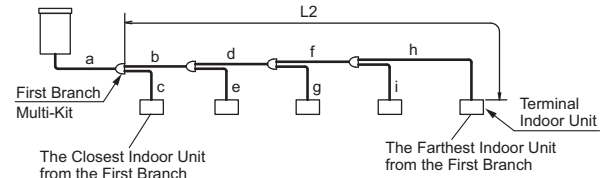
$$(b+d+e+f+g) - c \leq 131.2 \text{ ft (40m)}$$



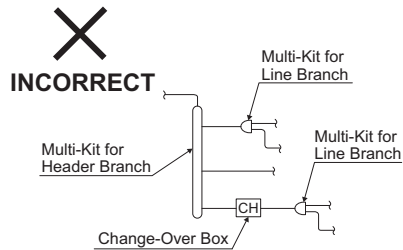
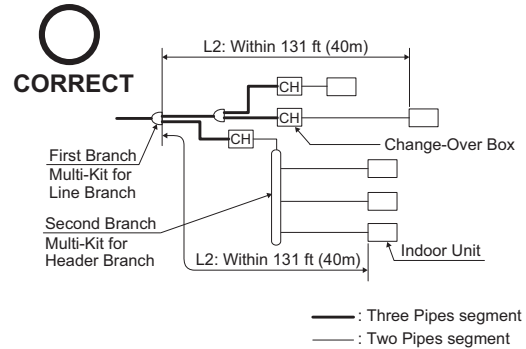
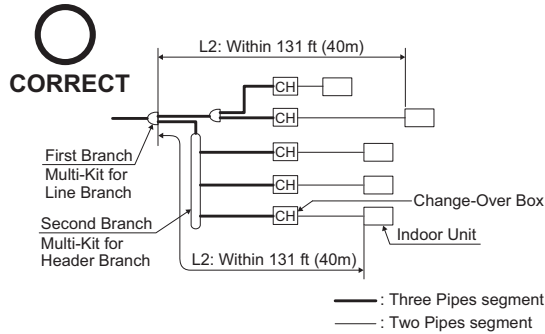
$$(g+k) - (b+d) \leq 131.2 \text{ ft (40m)}$$



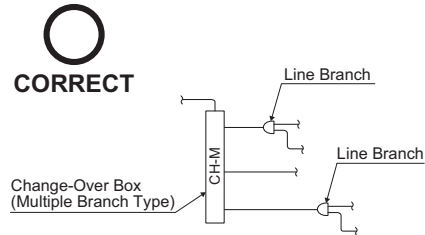
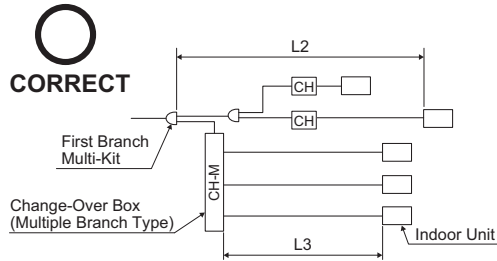
Installation without Main Piping Branch: Unrestricted



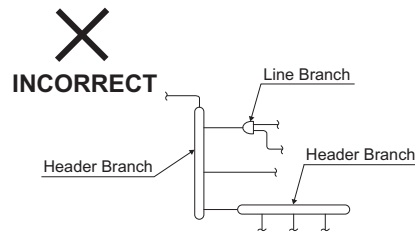
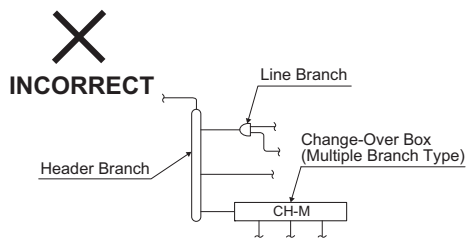
Header branch can be used with a line branch at the three pipes segment and two pipes segment. Header branch can also be used after the second branch. Do not connect a line branch to a header branch. When using a header branch, make sure that the piping length L2 from the multi-kit at the first branch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



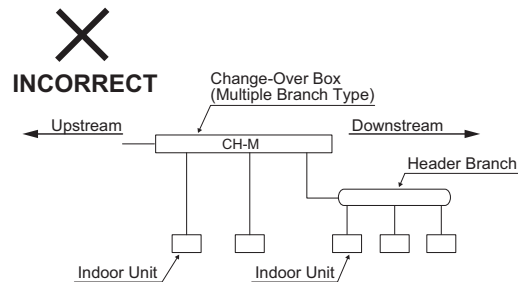
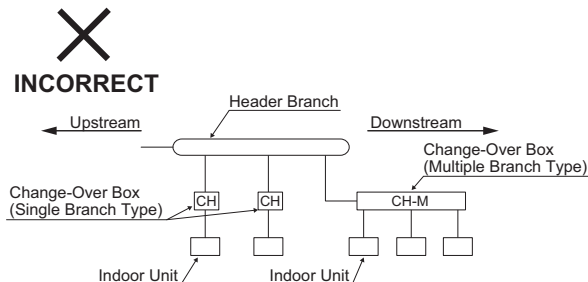
In case of the change-over box (multiple branch type) is connected, the following restrictions apply.



Header branch cannot be connected before and after change-over box (multiple branch type). Also, header branch cannot connect to another header branch.



Header branch cannot be connected to upstream or downstream piping of change-over box (multiple branch type).



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

Outdoor Unit Capacity (MBH)	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432
Maximum Number of Connectable I.U	15	20	26	26	36	40	46	52	56	59	64	64	64	64	64	64
Recommended Number of Connectable I.U	8	8	8	10	12	14	18	18	20	20	22	24	28	30	30	30

NOTES:

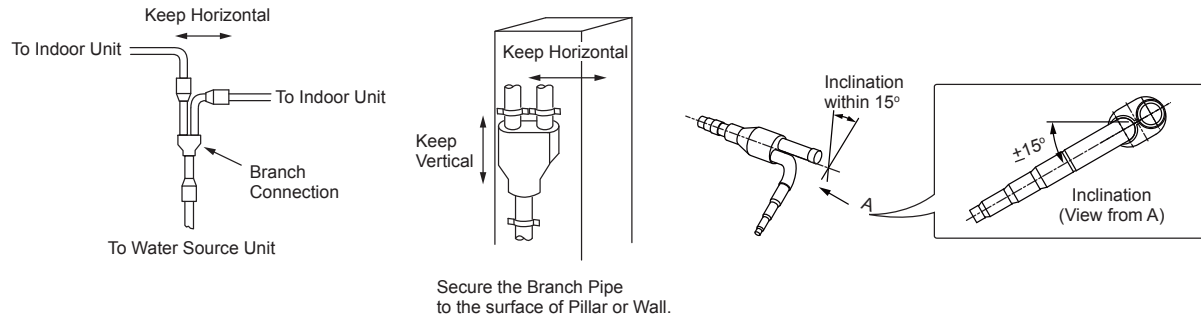
1. For a system under which all the indoor units are supposed to operate simultaneously, the total indoor unit capacity should be less than outdoor unit capacity. Otherwise, it may cause a decrease of operating performance and operating limit in overload operation.
2. For the system under which all the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

6.6 Multi-Kit Connection

Use the branch piping kit to ensure proper piping.

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

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 Position of Branch Piping

Upper Side	Upper Side	Upper Side	Upper Side
CORRECT	CORRECT	CORRECT	INCORRECT

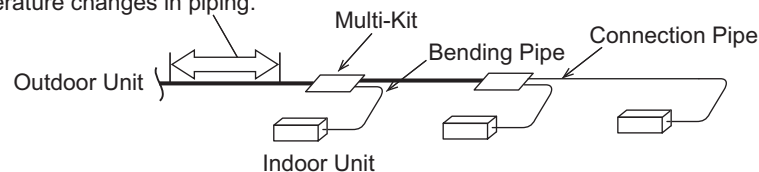
Piping Form from Multi-Kit to Indoor Unit

When on-site piping is installed using soft or hard copper, make sure that the piping is installed to allow for movement of the piping. Temperature changes cause contraction and expansion of the pipe.

Example: Recommended

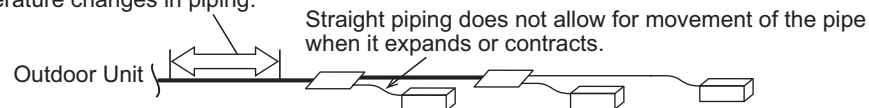
From each Indoor Unit to Multi-Kit, use hard copper pipes that bend to prevent kinking.

Hard copper pipe will expand and contract due to temperature changes in piping.



Example: Not Recommended





Hard copper pipe will expand and contract due to temperature changes in piping.



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 deteriorate system performance with time.
- Electrical cables should not come into contact with refrigerant piping, plate edges, and electrical components inside the unit.
- GFCI may be recommended depending on the application; 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.
 - M3.5: 0.5 to 0.7 ft·lbs (0.7 to 0.9 N·m)
 - M5: 1.5 to 1.8 ft·lbs (2.0 to 2.5 N·m)
 - M6: 3.0 to 3.7 ft·lbs (4.0 to 5.0 N·m)
 - M8: 6.6 to 8.1 ft·lbs (9.0 to 11.0 N·m)
 - M10: 13.3 to 17.0 ft·lbs (18.0 to 23.0 N·m)
- Set DSW7 on the PCB1 according to each power supply shown in the figure below.

DSW7	Power Supply Setting
208V Unit:	<input type="checkbox"/> Setting is required.
230V, 460V, 575V Unit:	<input type="checkbox"/> No setting is required.
208V, 230V Unit: 230V Setting Before Shipment	
460V Unit: 460V Setting Before Shipment	
575V Unit: 575V Setting Before Shipment	
208V	230V
	
460V	575V
	

- 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 cable 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 cable is applied, secure properly and terminate cable shield as required 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) are properly selected according to the electrical characteristics indicated in Table 7.1. Make sure that the components comply with local codes.
 - Supply electrical power to each outdoor unit. This equipment can be installed with a GFCI, which is a recognized measure for added protection to a properly grounded unit. Install appropriate sized breakers/fuses/overcurrent protection switches and wiring in accordance with local codes. The equipment installer is responsible for understanding and abiding by applicable codes and requirements.
 - Supply power supplies for the indoor unit and outdoor unit respectively. Connect the power supply wiring to each indoor unit group and its respective outdoor unit. This equipment can be installed with a 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 codes. The equipment installer is responsible for understanding and abiding by applicable codes.
 - The power supply for the Change-Over Box and Indoor Unit in the same refrigerant system can be supplied with one main switch.
- (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 cable must be a minimum of AWG18 (0.82mm^2), 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 cable is applied, secure properly and terminate cable shield as required per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local codes where:
 - The power supply for the packaged air conditioner is supplied from the same power transformer as the device with high electricity consumption*
 - The power supply wiring for the device* and for the packaged air conditioner are 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 local codes before performing electrical work in order to protect the power supply wiring of the packaged air conditioner.
- (5) Check to ensure that the ground wiring for the outdoor unit and indoor unit are connected.

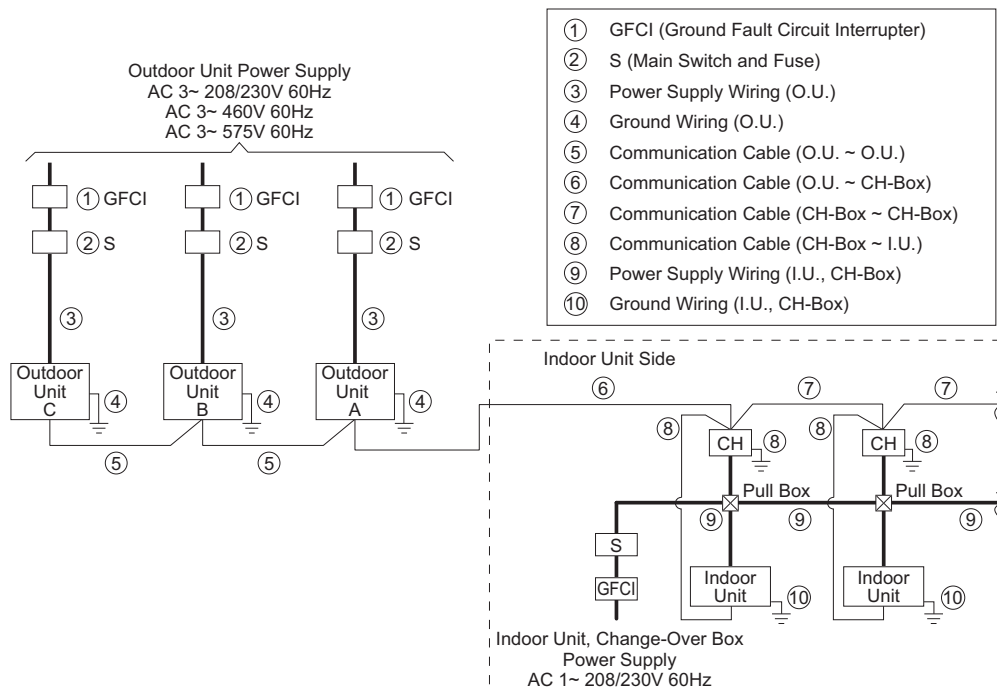
7.2 Electrical Wiring Connection

⚠ WARNING

- This equipment can be installed with a 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 codes and requirements. The equipment installer is responsible for understanding and abiding by applicable codes and requirements.
- Perform the electrical work according to the regulations of each region and this manual. A separate, dedicated electrical circuit must be used. If the electrical wiring work is performed incorrectly or there is a capacity shortage of the power circuit, it will cause an electric shock or a fire.
- Check that the ground wire is securely connected. If the unit is not correctly grounded, it may lead to an electrical shock. Do not connect the ground wiring to gas piping, water piping, lighting conductor, or telephone ground cables.

(1) Power Supply Wiring

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



(2) Electrical Characteristics

Note the following when selecting wiring:

- Use the charts below to select appropriate sized breakers/fuses/overcurrent protection switches and wiring in accordance with local codes.
- Ensure communication cable 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 cable is applied, secure properly and terminate cable shield as required per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code requirements.

Table 7.1 Electrical Characteristics and Recommended Wiring Size

208/230V

Model	Outdoor Unit							Inverter 1	Inverter 2	INV Comp. 1	INV Comp. 2
	Hz (Hz)	Voltage (V)	Max. (V)	Min. (V)	MCA (A)	MOP (A)	Max. Fuse (A)	MOC (A)	MOC (A)	LRA (A)	LRA (A)
(H,Y)VAHR072B32S	60	208/230	253	188	29/26	40/40	40/40	22.6	-	50	-
(H,Y)VAHR096B32S	60	208/230	253	188	39/35	50/50	50/50	30.7	-	50	-
(H,Y)VAHR120B32S	60	208/230	253	188	46/42	60/50	60/50	20.2	20.2	54	54
(H,Y)VAHR144B32S	60	208/230	253	188	58/52	70/70	70/70	25.5	25.5	54	54
(H,Y)VAHR168B32S	60	208/230	253	188	65/59	80/80	80/80	28.6	28.6	50	50
(H,Y)VAHR192B32S	60	208/230	253	188	76/68	90/90	90/90	33.4	33.4	50	50

Model	Fan Motor 1	Fan Motor 2	Wiring Size		
	Output (kW)	Output (kW)	Power Supply Wiring (AWG)	Ground Wiring (AWG)	Communication Cable (AWG)
(H,Y)VAHR072B32S	0.75	-	10/10	10/10	18
(H,Y)VAHR096B32S	0.75	0.75	8/8	8/8	18
(H,Y)VAHR120B32S	0.75	0.75	6/6	6/6	18
(H,Y)VAHR144B32S	0.75	0.75	4/4	4/4	18
(H,Y)VAHR168B32S	0.75	0.75	4/4	4/4	18
(H,Y)VAHR192B32S	0.75	0.75	2/4	2/4	18

460V

Model	Outdoor Unit							Inverter 1	Inverter 2	INV Comp. 1	INV Comp. 2
	Hz (Hz)	Voltage (V)	Max. (V)	Min. (V)	MCA (A)	MOP (A)	Max. Fuse (A)	MOC (A)	MOC (A)	LRA (A)	LRA (A)
(H,Y)VAHR072B42S	60	460	506	414	15	20	20	11.5	-	47	-
(H,Y)VAHR096B42S	60	460	506	414	22	30	30	17.1	-	47	-
(H,Y)VAHR120B42S	60	460	506	414	24	30	30	10.4	10.4	32	32
(H,Y)VAHR144B42S	60	460	506	414	30	35	35	13.2	13.2	32	32
(H,Y)VAHR168B42S	60	460	506	414	34	40	40	14.8	14.8	47	47
(H,Y)VAHR192B42S	60	460	506	414	39	50	50	17.3	17.3	47	47

Model	Fan Motor 1	Fan Motor 2	Wiring Size		
	Output (kW)	Output (kW)	Power Supply Wiring (AWG)	Ground Wiring (AWG)	Communication Cable (AWG)
(H,Y)VAHR072B42S	0.75	-	14	14	18
(H,Y)VAHR096B42S	0.75	0.75	12	12	18
(H,Y)VAHR120B42S	0.75	0.75	12	12	18
(H,Y)VAHR144B42S	0.75	0.75	10	10	18
(H,Y)VAHR168B42S	0.75	0.75	8	8	18
(H,Y)VAHR192B42S	0.75	0.75	8	8	18

MCA: Minimum Circuit Ampacity (A)

MOP: Maximum Overcurrent Protective Device (A)

MOC: Maximum Operating Current (A)

LRA: Locked Rotor Ampacity (A)

575V

Model	Outdoor Unit							Inverter 1	Inverter 2	INV Comp. 1	INV Comp. 2
	Hz (Hz)	Voltage (V)	Max. (V)	Min. (V)	MCA (A)	MOP (A)	Max. Fuse (A)	MOC (A)	MOC (A)	LRA (A)	LRA (A)
(H,Y)VAHR072B52S	60	575	660	518	12	15	15	9.1	-	24	-
(H,Y)VAHR096B52S	60	575	660	518	16	25	25	12.5	-	24	-
(H,Y)VAHR120B52S	60	575	660	518	19	25	25	8.3	8.3	19.5	19.5
(H,Y)VAHR144B52S	60	575	660	518	24	30	30	10.5	10.5	19.5	19.5
(H,Y)VAHR168B52S	60	575	660	518	27	35	35	11.8	11.8	24	24
(H,Y)VAHR192B52S	60	575	660	518	32	40	40	13.8	13.8	24	24

Model	Fan Motor 1	Fan Motor 2	Wiring Size		
	Output (kW)	Output (kW)	Power Supply Wiring (AWG)	Ground Wiring (AWG)	Communication Cable (AWG)
(H,Y)VAHR072B52S	0.75	-	16	16	18
(H,Y)VAHR096B52S	0.75	0.75	14	14	18
(H,Y)VAHR120B52S	0.75	0.75	12	12	18
(H,Y)VAHR144B52S	0.75	0.75	12	12	18
(H,Y)VAHR168B52S	0.75	0.75	10	10	18
(H,Y)VAHR192B52S	0.75	0.75	8	8	18

MCA: Minimum Circuit Ampacity (A)

MOP: Maximum Overcurrent Protective Device (A)

MOC: Maximum Operating Current (A)

LRA: Locked Rotor Ampacity (A)

⚠ CAUTION

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

ATTENTION:

- When the power supply wiring is longer, select the minimum wiring size that has a voltage drop within 2%.
- Power supply voltage should be satisfied with the followings.
 - Supply Voltage: Rated Voltage within $\pm 10\%$ (208/230V, 460V)
575V -10% , 600V $+10\%$ (575V)
 - Starting Voltage: Rated Voltage within -15%
 - Operating Voltage: Rated Voltage within $\pm 10\%$
 - Imbalance between Phases: within 3%
- Do not connect the ground wiring to gas piping, water piping, or a lightening conductor.
 - Gas Piping: An explosion and ignition may occur if there is escaping gas.
 - Water Piping: There is no effective electrical ground provided when hard vinyl piping is used.
 - Lightening Conductor: The electrical potential of the earth increases when a lightening conductor is used.

7.3 Electrical Wiring for Outdoor Unit

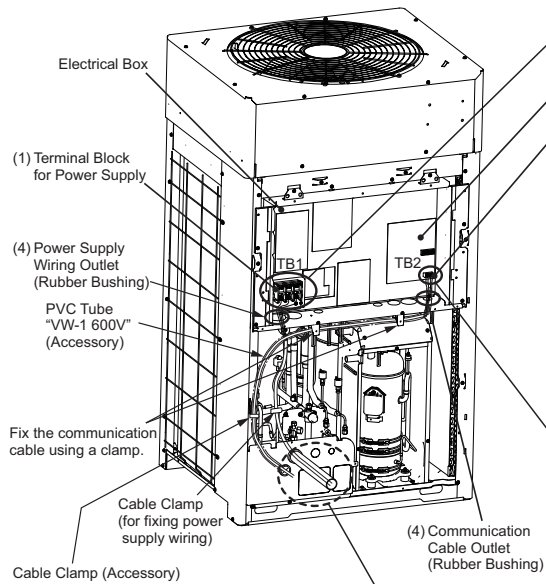
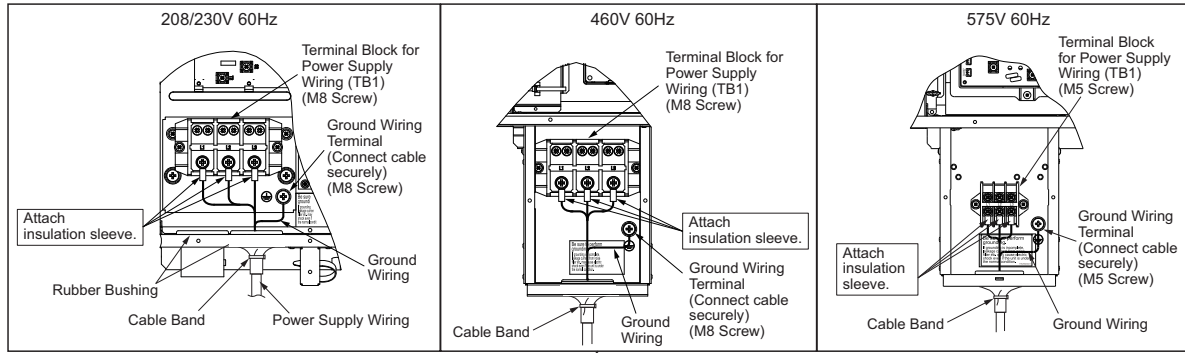
Connect the electrical wiring according to the following figure:

- (1) Connect the power supply wires to L1, L2, and L3 for the three-phase power supply on the terminal block TB1 and ground wiring to the terminal in the electrical control box.
- (2) Connect the communication cables between the outdoor and indoor units to the TB2 terminals 1 and 2 on the PCB1. As for the communication cables between outdoor units in the same refrigerant system, connect them to the TB2 terminals 3 and 4 on the PCB1. When shielded cable is applied (M4), secure properly and terminate cable shield as required per Johnson Controls guidelines. Plenum and riser ratings for communication cables must be considered per application and local code. Communication cable must 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. Local codes need to be followed.
Then, tighten both ends of the PVC tubing with the cable bands (accessory) in order to secure the PVC tubing to the communication cables.
- (4) Tighten screws for the terminal block according to the following table.

Required Tightening Torque

Size	Tightening Torque
M3.5	0.5 to 0.7 ft·lbs (0.7 to 0.9 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)

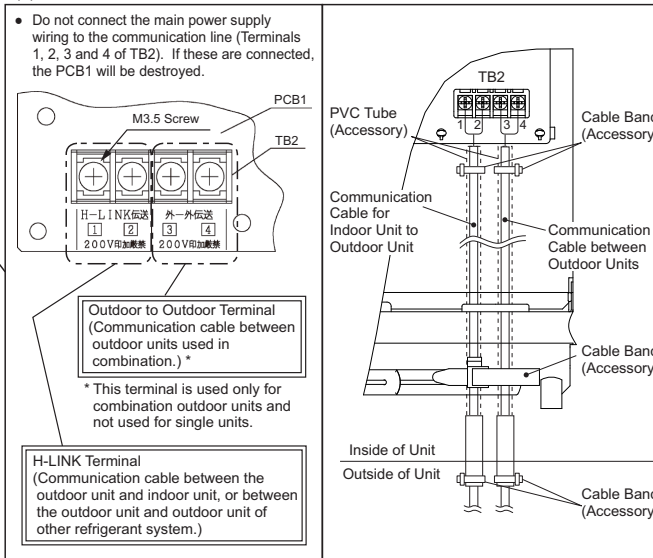
(1) Detail of Electrical Box Terminal



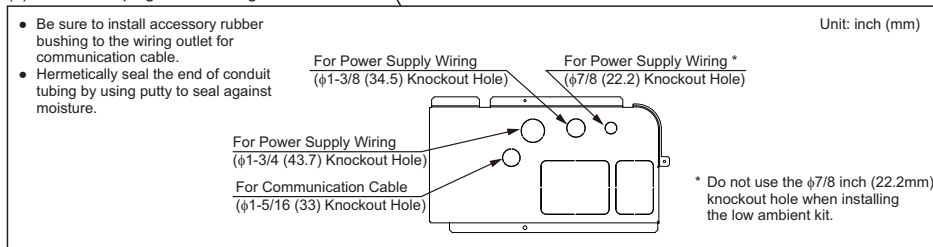
NOTE:
Fix by accessory screw
(for fixing communication cable).

Above figure illustrate the example of
a small cabinet (208/230V).

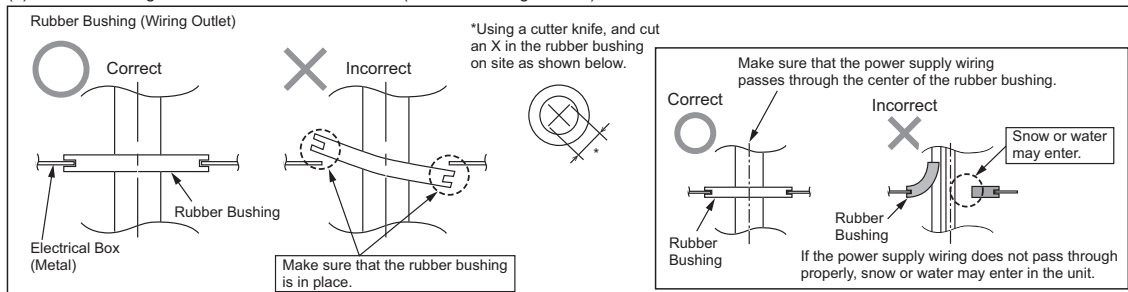
(2) Detail of Terminal Block for Communication Cable



(3) Details of Piping Cover Wiring Outlet



(4) Details of Wiring Outlets inside the Electrical Box (Rubber Bushing Section)

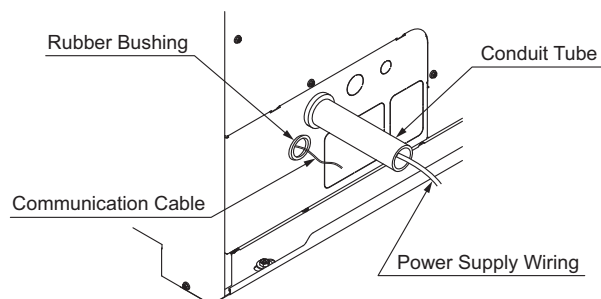


CAUTION

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

NOTICE:

- When installing the power supply wiring, use the field-supplied conduit tube as shown below. Remove the rubber bushing from the unit for the conduit tubing installation.
- When installing the communication cables, run them through the rubber grommet attached to the unit.
- Maintain at least 5 inches (127mm) between the power supply wiring and communication cables.
- Prevent cables from touching or rubbing up against refrigerant piping, plate edges, and electrical components inside the unit.



CAUTION

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

7.4 Electrical Wiring Connections of Indoor Unit, Outdoor Unit, and Change-Over Box

- (1) Connect a power supply wiring to each outdoor unit. Connect an optional Ground Fault Circuit Interrupter (GFCI), fuse, and main switch (S) to each outdoor unit.
- (2) Connect a power supply wiring to each indoor unit group and change-over box group connected to the same outdoor unit. (Total operating current be less than 12A.)
Connect an optional Ground Fault Circuit Interrupter (GFCI), fuse, and main switch (S) to each indoor unit group.
- (3) Connect the communication cable between indoor units, change-over boxes and outdoor units, as shown in Figure 7.1.
- (4) Connect the communication cables in the same refrigerant system unit. (If the refrigerant piping of indoor unit is connected to the outdoor unit, also connect the communication cables to the same indoor unit.) Connecting the refrigerant piping and communication cables to the different refrigerant systems may lead to malfunction.
- (5) Use communication cabling that is a minimum of AWG18 (0.82mm²), 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, secure properly and terminate cable shield as required 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.)

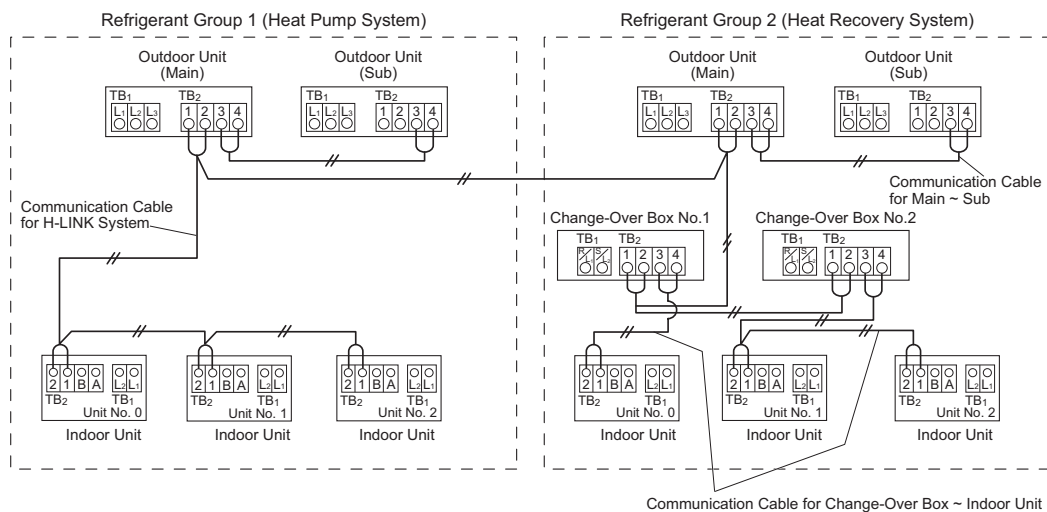
- (6) Use the same kind of cables in the same H-LINK system.
- (7) Maintain at least 5 inches (127mm) between the communication cables and the power supply wiring, and also min. 5 ft (1.5m) between the communication cables and power supply wiring for other electrical device. If these cables are not secured,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

Communication Cable

Install communication cable while paying attention to the following.

For the combination units, DSW settings of Main and Sub.

- An alarm occurs if the communication cables between main outdoor unit and sub outdoor units are connected to the terminals 1 and 2 for H-LINK system.
- If an alarm is triggered on the LCD of Main outdoor unit, follow the "7-segment" display at the Main outdoor unit for verification purposes.
- Perform a function setting at the Main outdoor unit.
- 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).



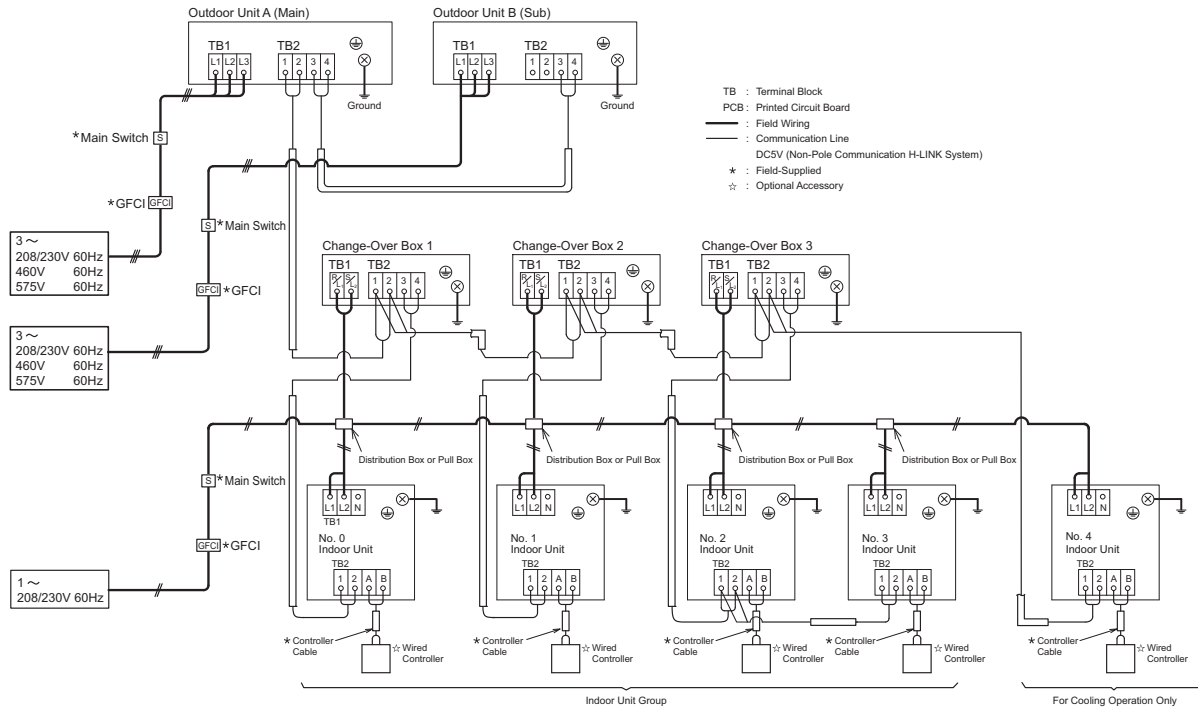


Figure 7.1 Layout for Electrical Wiring Connection (Heat Recovery System)

7.5 DIP Switch Setting of Outdoor Unit

Before performing settings:

- Turn OFF all power supplies before performing settings. DIP switch settings cannot be set without first disconnecting them from the power supply. (However, DSW4, 5, 8 and push switches can be operated when power supply is ON.)

The darkened square “■” indicates the position of DIP switches.

NOTICE

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



Arrangement of DIP Switches (PCB1)		DSW1 (PCB1) Ref. Cycle No. Setting	DSW3 (PCB1) Function Setting																														
		<p>Setting is required.</p> <p>Setting Before Shipment</p> <p>Setting Position</p> <p>DSW1</p> <p>Tens Digit</p> <p>Last Digit</p> <p>Set the unit number of outdoor unit at each refrigerant cycle. (Setting before shipment is unit 0.)</p>	<p>No setting is required.</p> <p>Setting Before Shipment</p> <p>ON</p> <p>1 2 3 4</p> <p>IMPORTANT NOTICE</p> <p>Do not change DSW3 setting. Otherwise, it may cause abnormal operation.</p>																														
<p>DSW2 (PCB1) Capacity Setting</p> <p>No setting is required.</p> <table border="1"> <thead> <tr> <th>Capacity</th> <th>72 MBH</th> <th>96 MBH</th> <th>120 MBH</th> </tr> </thead> <tbody> <tr> <td>DSW2 Setting</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>Capacity</td> <td>144 MBH</td> <td>168 MBH</td> <td>192 MBH</td> </tr> <tr> <td>DSW2 Setting</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table>		Capacity	72 MBH	96 MBH	120 MBH	DSW2 Setting	ON	ON	ON	Capacity	144 MBH	168 MBH	192 MBH	DSW2 Setting	ON	ON	ON	<p>DSW4 (PCB1) Test Run and Service Setting</p> <p>Setting is required.</p> <p>Setting Before Shipment</p> <table border="1"> <thead> <tr> <th>Setting Item</th> <th>Pin No.</th> </tr> </thead> <tbody> <tr> <td>Test Cooling Operation</td> <td>1</td> </tr> <tr> <td>Test Heating Operation</td> <td>1, 2</td> </tr> <tr> <td>Compressor Forced Stop</td> <td>4</td> </tr> <tr> <td>Function Setting</td> <td>4, 5</td> </tr> <tr> <td>External Input/Output Setting</td> <td>4, 6</td> </tr> <tr> <td>Refrigerant Recovery/ Vacuum Mode</td> <td>4 (* PSW4 for 3sec.)</td> </tr> </tbody> </table>		Setting Item	Pin No.	Test Cooling Operation	1	Test Heating Operation	1, 2	Compressor Forced Stop	4	Function Setting	4, 5	External Input/Output Setting	4, 6	Refrigerant Recovery/ Vacuum Mode	4 (* PSW4 for 3sec.)
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<p>DSW5 (PCB1) Emergency Operation</p> <p>No setting is required.</p> <p>Turn ON the DIP switch when using the below functions.</p> <p>Setting Before Shipment</p> <table border="1"> <thead> <tr> <th>Setting Item</th> <th>Pin No.</th> </tr> </thead> <tbody> <tr> <td>Except No.1 Comp. (MC1) Operation</td> <td>1</td> </tr> <tr> <td>Except No.2 Comp. (MC2) Operation</td> <td>2</td> </tr> </tbody> </table>		Setting Item	Pin No.	Except No.1 Comp. (MC1) Operation	1	Except No.2 Comp. (MC2) Operation	2	<p>DSW7 (PCB1) Power Supply Setting</p> <p>208V Unit: Setting is required. 230V Setting Before Shipment</p> <p>230V, 460V, 575V Unit: No setting is required.</p> <p>Power Supply Voltage and System Setting</p> <table border="1"> <thead> <tr> <th>208V</th> <th>230V</th> <th>460V</th> <th>575V</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>1 2 3 4</td> <td>1 2 3 4</td> <td>1 2 3 4</td> <td>1 2 3 4</td> </tr> </tbody> </table>		208V	230V	460V	575V	ON	ON	ON	ON	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4												
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ON	ON	ON	ON																														
1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4																														
<p>DSW6 (PCB1) Outdoor Unit No. Setting</p> <p>Setting is required.</p> <p>Single Setting (Setting Before Shipment)</p> <p>ON</p> <p>1 2 3 4</p> <p>IMPORTANT NOTICE</p> <p>The outdoor unit is not single, the combination setting is necessary. Be sure to do this setting.</p> <p>Combination Setting</p> <table border="1"> <thead> <tr> <th>Unit A (No.0 Unit)</th> <th>Unit B (No.1 Unit)</th> <th>Unit C (No.2 Unit)</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>1 2 3 4</td> <td>1 2 3 4</td> <td>1 2 3 4</td> </tr> </tbody> </table> <p>NOTE:</p> <p>No.4 pin is for optional setting. Refer to Service Manual for detail.</p>		Unit A (No.0 Unit)	Unit B (No.1 Unit)	Unit C (No.2 Unit)	ON	ON	ON	1 2 3 4	1 2 3 4	1 2 3 4	<p>DSW8 (PCB1) High Static Pressure Mode Setting</p> <p>Setting is required.</p> <p>Turn ON the DIP switch when using the below functions.</p> <p>Setting Before Shipment</p> <table border="1"> <thead> <tr> <th>Setting Item</th> <th>Pin No.</th> </tr> </thead> <tbody> <tr> <td>HSP Setting: 0.12 in. W.G. (30Pa)</td> <td>1</td> </tr> <tr> <td>HSP Setting: 0.24 in. W.G. (60Pa)</td> <td>2</td> </tr> <tr> <td>HSP Setting: 0.32 in. W.G. (80Pa)</td> <td>1, 2</td> </tr> </tbody> </table> <p>IMPORTANT NOTICE</p> <p>When adopting the air outlet duct (field supplied), make sure to set DSW8.</p>		Setting Item	Pin No.	HSP Setting: 0.12 in. W.G. (30Pa)	1	HSP Setting: 0.24 in. W.G. (60Pa)	2	HSP Setting: 0.32 in. W.G. (80Pa)	1, 2													
Unit A (No.0 Unit)	Unit B (No.1 Unit)	Unit C (No.2 Unit)																															
ON	ON	ON																															
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<p>DSW10 (PCB1) Transmission Setting</p> <p>Setting is required.</p> <p>Set DSW10-1 correctly for end resistance cancellation.</p> <p>Setting Before Shipment</p> <p>ON</p> <p>1 2</p> <table border="1"> <thead> <tr> <th>Setting Item</th> <th>Pin No.</th> </tr> </thead> <tbody> <tr> <td>End Resistance Setting *1</td> <td>1</td> </tr> <tr> <td>Fuse Recovery *2</td> <td>2</td> </tr> </tbody> </table> <p>*1: Turn OFF No.1 pin for all of the outdoor units in the same H-LINK system except one outdoor unit.</p> <p>*2: If the fuse (EF1) is melted, set No.2 pin to ON for recovery.</p>		Setting Item	Pin No.	End Resistance Setting *1	1	Fuse Recovery *2	2	<p>DSW101 (INV1, 2) INV No. Setting/Service Setting</p> <p>No setting is required.</p> <table border="1"> <thead> <tr> <th>INV1</th> <th>INV2</th> </tr> </thead> <tbody> <tr> <td>Setting Before Shipment</td> <td>Setting Before Shipment</td> </tr> <tr> <td>ON</td> <td>ON</td> </tr> <tr> <td>1 2 3 4 5 6</td> <td>1 2 3 4 5 6</td> </tr> </tbody> </table> <p>Turn ON the DIP switch when using the below functions.</p> <table border="1"> <thead> <tr> <th>Setting Item</th> <th>Pin No.</th> </tr> </thead> <tbody> <tr> <td>Cancellation of Current Detection</td> <td>1</td> </tr> </tbody> </table> <p>IMPORTANT NOTICE</p> <p>If Cancellation of Current Detection is set, make sure to return the setting, after service works.</p>		INV1	INV2	Setting Before Shipment	Setting Before Shipment	ON	ON	1 2 3 4 5 6	1 2 3 4 5 6	Setting Item	Pin No.	Cancellation of Current Detection	1												
Setting Item	Pin No.																																
End Resistance Setting *1	1																																
Fuse Recovery *2	2																																
INV1	INV2																																
Setting Before Shipment	Setting Before Shipment																																
ON	ON																																
1 2 3 4 5 6	1 2 3 4 5 6																																
Setting Item	Pin No.																																
Cancellation of Current Detection	1																																

Figure 7.2 DSW Setting

- **Setting for Transmitting**

Use the following settings for the outdoor unit numbers, refrigerant system numbers and end terminal resistance for this H-LINK system.

- **Setting of Outdoor Unit Number (No.)**

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

Base Unit (Before Shipment)	Combination of Base Unit		
	Unit A (No.0)	Unit B (No.1)	Unit C (No.2)
ON OFF 1 2 3 4	ON OFF 1 2 3 4	ON OFF 1 2 3 4	ON OFF 1 2 3 4

NOTE:

Be sure to set DIP switch DSW6-No.4 for the use of the low ambient kit.

Refer to the "Installation Manual" for LAK or "Service Manual" for the outdoor unit.

- **Setting of Refrigerant System Number**

In the same refrigerant system, set the same refrigerant system number for the outdoor unit and the indoor units as shown below.

Setting outdoor unit refrigerant system number is required only for the main unit.

The sub unit settings are not required.

As for setting indoor unit refrigerant system number, set RSW2 and DSW5 on the indoor unit PCB.

	Setting Switch	
	10 digit	1 digit
	ON OFF 1 2 3 4 5 6	Setting Position Set by inserting slotted screwdriver into the groove.
Outdoor Unit	DSW1	RSW1
Indoor Unit (H-LINK II)	DSW5	RSW2

Example: When Setting Refrigerant System No. 25



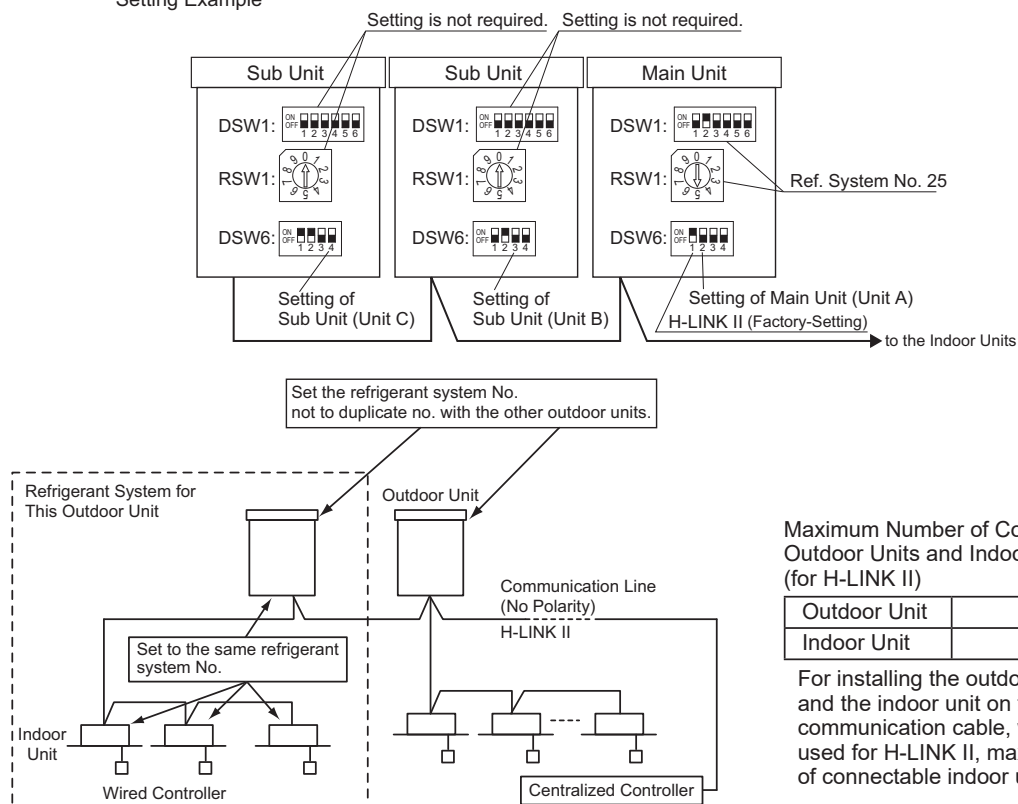
Turn ON No. 2 pin.



Set Dial No.5.

DSW and RSW setting before shipment is 0.
Maximum in setting refrigerant system number is 63.

Setting Example



• DSW7 Setting for Rated Voltage

DSW7 is used for setting the rated voltage for the outdoor unit as shown in the right figure.
When the site power supply voltage is different from factory setting, a DSW7 setting is required.

CAUTION:

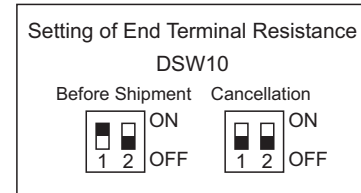
The same voltage setting is required to the main unit and sub unit(s).

Voltage	DSW7 Setting
208V	ON OFF <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4
230V	ON OFF <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4
460V	ON OFF <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4
575V	ON OFF <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4

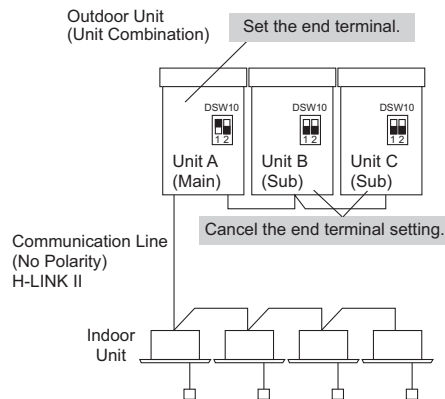
• Setting of End Terminal Resistance

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

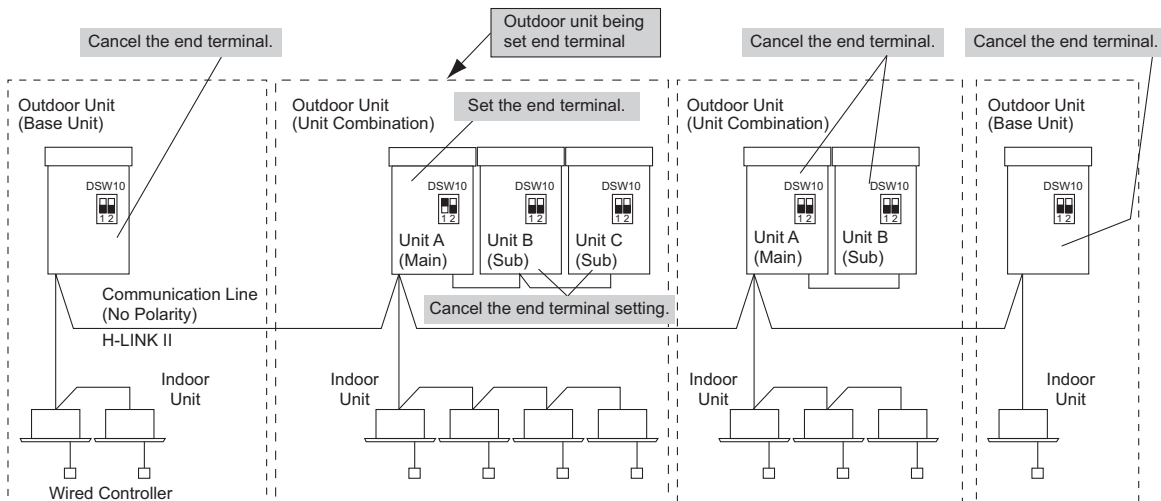
In the case of one refrigerant system in the same H-LINK II, set all DSW10 No.1 pins to the "OFF" position except in the main outdoor unit A.



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



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



• 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 in check mode.

External Input/Output Setting

■ Start of Setting

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

For the setting mode, refer to ① below.

■ Exit Setting Mode

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

Function Setting

■ Start of Setting

Turn ON DSW4-No.4.
Turn ON DSW4-No.5.

For the setting mode, refer to ② below.

■ Exit Setting Mode

Turn OFF DSW4-No.5 during indicated
Function Setting Mode.
Turn OFF DSW4-No.4.

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

After setting, confirm DSW4 setting is same as setting before shipment.

② Function Setting

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

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

Example

1

① External Input/Output Setting

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

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

Example

1

Item	SEG2	SEG1	SET
1 Input Setting 1 CN17 [1-2 pin]	11	1	
2 Input Setting 2 CN17 [2-3 pin]	12	2	
3 Input Setting 3 CN18 [1-2 pin]	13	3	
4 Output Setting 1 CN16 [1-2 pin]	01	1	
5 Output Setting 2 CN16 [1-3 pin]	02	2	

(Setting Before Shipment)

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

Setting of External Input and Output Function

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

The same input/output function setting cannot be set to different
input/output terminals.
If set, a setting of larger function number becomes invalid.
Example: When setting of input 1 and input 2 are same,
input 2 will be invalid.

Function No.14 is valid only when applied to Input Setting 3.

Item	SEG2	SEG1	SET
1 Circulator Function at Heating Thermo-OFF	FA	0	
2 Night-Shift (Low Noise)	n1	0	
3 Cancellation of Outdoor Ambient Temperature Limit	05	0	
4 Defrost for Cold Area (Change of Defrost Condition)	Jo	0	
5 SLo (Fan Speed) Defrost Setting	bJ	0	
6 Cancellation of Outdoor Unit Hot Start	Hr	0	
7 Priority Capacity Mode	nU	0	
8 Minimum Evaporating Temperature Setting for Cooling	Hc	0	
9 Compressor Frequency Control Target Value for Heating	Hh	0	
10 Indoor Expansion Valve Control Target Value for Cooling	Sc	0	
11 Indoor Expansion Valve Control Target Value for Heating	SH	0	
12 Indoor Expansion Valve Opening during Heating Operation Stoppage	Si	0	
13 Indoor Expansion Valve Opening during Heating Thermo-OFF	So	0	
14 Indoor Expansion Valve Initial Opening during Heating Thermo-ON	ci	0	
15 Indoor Expansion Valve Initial Opening for Cooling	cb	0	
16 Outdoor Expansion Valve Initial Opening for Heating	ch	0	
17 Low Noise Setting	db	0	
18 Demand Function Setting	dE	0	
19 Wave Function Setting	UE	0	
20 Protection of Decrease in Outlet Temperature for Cooling	Fb	0	
21 Outlet Temperature Control (DOAS)	Ff	0	
22 Adjustment of Fan Rotation (for multiple installation)	fo	0	
23 Not Prepared	Lr	0	
24 Thermo-OFF Setting for Outdoor Unit After Defrosting Operation	dS	0	

Item	SEG2	SEG1	SET
25 Not Prepared	F1	0	
26 Crankcase Heater Control during Stoppage	F2	0	
27 Indoor Fan Hot Start Period Setting	F3	0	
28 Intermittent Operation of Outdoor Fan Motor	F4	0	
29 Indoor Expansion Valve Control Target Value for Cooling (Only for 4-Way Cassette Model)	F5	0	
30 Indoor Expansion Valve Opening Lower Limit during Heating SW-OFF	F6	0	
31 Not Prepared	F7	0	
32 Forced Defrosting after Enforced Stoppage during Defrosting Cycle	F8	0	
33 Not Prepared	F9	0	
34 Not Prepared	FC	0	
35 Convert Unit in Checking Mode	Fd	0	
36 Permit Indoor Fan Operation during Forced Stoppage	FE	0	
37 Not Prepared	FF	0	
38 Not Prepared	FG	0	
39 Not Prepared	FH	0	
40 Not Prepared	Fi	0	
41 Not Prepared	FJ	0	
42 Not Prepared	FL	0	
43 Not Prepared	Fn	0	
44 Not Prepared	FP	0	
45 Not Prepared	Fr	0	
46 Not Prepared	FU	0	
47 Not Prepared	FY	0	

8. Additional Refrigerant Charge

8.1 Airtight Test

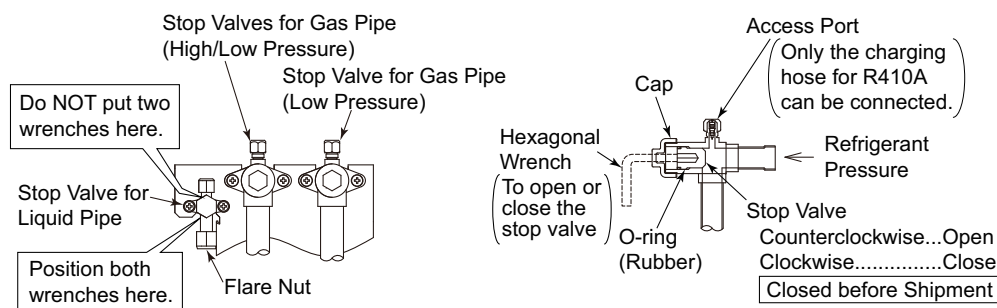
- (1) Make sure that the stop valves for high/low pressure gas, low pressure gas and liquid pipes are closed completely before airtight test.
- (2) The refrigerant used for this outdoor unit is R410A. Use the manifold gauge and the charging hose for exclusive use of R410A.

Tightening Check of Stop Valves

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

Operation of Stop Valves Caution

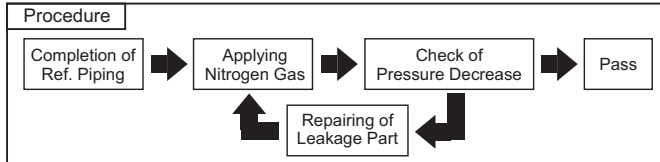
- (a) Remove the stop valve caps before performing the airtight test after connecting the refrigerant piping. Tighten the stop valve in clockwise direction.
- (b) Perform the work after warming the stop valve with a hair dryer etc. when controlling the stop valve in a cold area. (The stop valve O-ring 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 stop valve (Tightening Torque: < 3.7 ft·lbs (5.0 N·m)). (A back seat (hard stop), is not provided, allowing complete removal of the valve stem.)
- (d) Tighten caps securely according to the following torque specifications after each stop valve is opened.



Model	Tightening Torque [ft·lbs (N·m)]								Hexagonal Wrench Size inch (mm)	
	Stop Valve			Flare Nut	Cap		Access Port			
	High/Low Pressure Gas Valve	Low Pressure Gas Valve	Liquid Valve	Liquid Valve	Gas Valve	Liquid Valve	Gas Valve	Liquid Valve	Gas Valve	Liquid Valve
72	13.3 - 16.2 (18.0 - 22.0)	13.3 - 16.2 (18.0 - 22.0)	5.2 - 6.6 (7.0 - 9.0)	24.3 - 31.0 (33.0 - 42.0)	36.1 - 42.8 (49.0 - 58.0)	24.3 - 31.0 (33.0 - 42.0)	6.6 - 10.3 (9.0 - 14.0)	10.3 - 13.3 (14.0 - 18.0)	3/8 (10)	3/16 (4)
96 - 144		18.4 - 22.9 (25.0 - 31.0)		36.9 - 45.7 (50.0 - 62.0)		36.9 - 45.7 (50.0 - 62.0)				3/16 (5)
168, 192			6.6 - 8.1 (9.0 - 11.0)	50.2 - 62.0 (68.0 - 84.0)						

Airtight Test Method

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



Recommended Foaming Agent	Manufacturer
Güproflex	Yokogawa & CO.,Ltd

CAUTION:

Nitrogen Gas should be sufficiently charged for each access ports (high/low pressure gas line side, low pressure gas line side (for heat recovery system only), and for liquid line side). If not performed in this manner, the expansion valve for the outdoor unit, indoor unit, or change-over box 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.

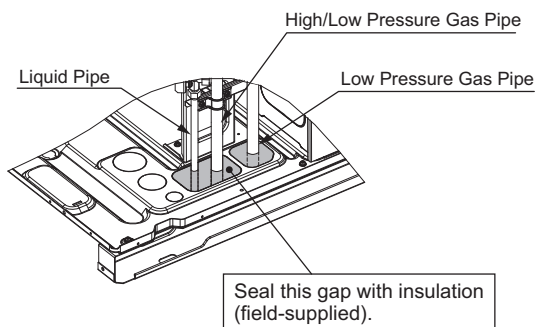
Insulation Work

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

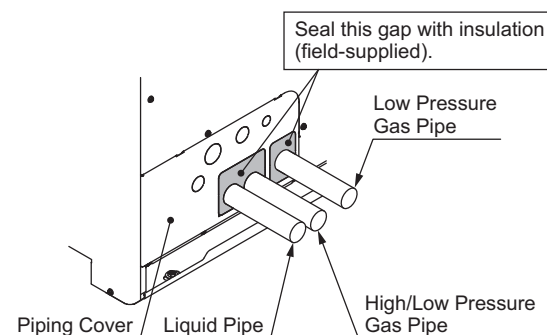
CAUTION:

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

For Pipes from Bottom Base



For Pipes from Front Side Piping Cover



8.2 Vacuuming

Connecting

Connect a manifold gauge, vacuum gauge and vacuum pump to the access ports (High/Low Pressure Gas Stop Valve, Low Pressure Gas Stop Valve and Liquid Stop Valve).

Triple Evacuation Method

According to the following < Step 1 > < Step 2 > < Step 3 > in order, conduct vacuum drying work.

< Step 1 >

- (1) Vacuum until the pressure reaches 2000 microns (2 mmHg).
- (2) Pressurize with nitrogen up to 50 PSIG (0.3 MPaG) for 15 minutes.
- (3) Release pressure to atmosphere level as less than 5 PSIG (0.03 MPaG).

< Step 2 >

- (1) Vacuum until the pressure reaches 1000 microns (1 mmHg).
- (2) Pressurize with nitrogen up to 50 PSIG (0.3 MPaG) for 15 minutes.
- (3) Release pressure to atmosphere level as less than 5 PSIG (0.03 MPaG).

< Step 3 >

- (1) Vacuum until the pressure reaches 500 microns (0.5 mmHg).
- (2) Stop vacuum pump.
- (3) Check that the vacuum 500 microns (0.5 mmHg) can maintain for one hour.

NOTICE

1. If tool or measuring instruments come into contact with the refrigerant, use the tools or the measuring instruments exclusively for R410A.
 2. Do not perform vacuum pumping work with valves of the outdoor units open.
Otherwise, the refrigerant charged before shipment may leak and it may result in failure.
If moisture remains inside the pipes, the compressor may be damaged.
-

8.3 Charging Work

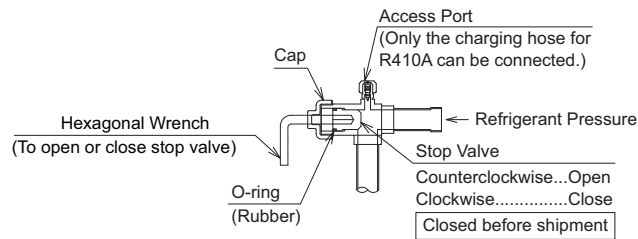
- (1) An additional refrigerant charge is required according to total piping length. Refer to Table 8.1.
- (2) After vacuum pumping work, check that the high/low pressure gas valve, and liquid stop valve are fully closed.
Charge the additional refrigerant from the access port of liquid stop valve (acceptable 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.
Gas remaining at the O-ring or screw component may emit a hissing sound when removing the stop valve 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 (both stop valves of high/low pressure and low pressure side).

NOTICE

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

Caution for Opening Stop Valve

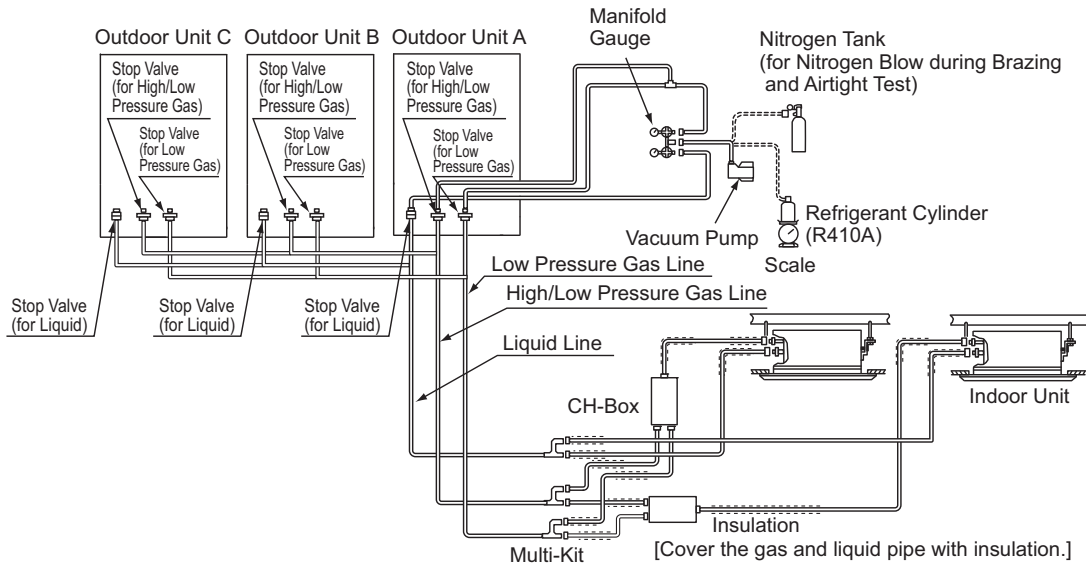
1. Do not apply an excessive force after the stop valve is fully opened (Tightening Torque: < 3.7 ft·lbs (5.0 N·m)). (This valve does not have a hard stop when opening, and allows for the complete removal of the valve stem.)
2. Securely tighten the caps according to the torque specs (Section 8.1-(2)-(d)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



Hexagonal Wrench Size [inch (mm)]

Model	Gas Valve	Liquid Valve
72 - 144	3/8 (10)	3/16 (4)
168, 192		3/16 (5)

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



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

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

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

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

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

8.4 Additional Refrigerant Charge Calculation

Table 8.1 Additional Refrigerant Charge Calculation

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

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

(1) Calculating Method of Additional Refrigerant Charge [WT lbs (kg)]

No.	Symbol	Step	Additional Charge																																
1	W1	Additional Refrigerant Charge Calculation for Liquid Piping [W1 lbs (kg)]																																	
		<table><tr><th>Pipe Diameter [inch (mm)]</th><th>Total Piping Length [ft (m)]</th><th>Refrigerant Charge for 1 ft Pipe [lbs/ft (kg/m)]</th><th>Additional Charge [lbs (kg)]</th></tr><tr><td>7/8 (22.2)</td><td></td><td>× 0.24 (0.36) =</td><td></td></tr><tr><td>3/4 (19.05)</td><td></td><td>× 0.17 (0.26) =</td><td></td></tr><tr><td>5/8 (15.88)</td><td></td><td>× 0.11 (0.17) =</td><td></td></tr><tr><td>1/2 (12.7)</td><td></td><td>× 0.074 (0.11) =</td><td></td></tr><tr><td>3/8 (9.52)</td><td></td><td>× 0.038 (0.056) =</td><td></td></tr><tr><td>1/4 (6.35)</td><td></td><td>× 0.016 (0.024) =</td><td></td></tr><tr><td colspan="4">Total Additional Charge For Liquid Piping =</td></tr></table>	Pipe Diameter [inch (mm)]	Total Piping Length [ft (m)]	Refrigerant Charge for 1 ft Pipe [lbs/ft (kg/m)]	Additional Charge [lbs (kg)]	7/8 (22.2)		× 0.24 (0.36) =		3/4 (19.05)		× 0.17 (0.26) =		5/8 (15.88)		× 0.11 (0.17) =		1/2 (12.7)		× 0.074 (0.11) =		3/8 (9.52)		× 0.038 (0.056) =		1/4 (6.35)		× 0.016 (0.024) =		Total Additional Charge For Liquid Piping =				
		Pipe Diameter [inch (mm)]	Total Piping Length [ft (m)]	Refrigerant Charge for 1 ft Pipe [lbs/ft (kg/m)]	Additional Charge [lbs (kg)]																														
		7/8 (22.2)		× 0.24 (0.36) =																															
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		5/8 (15.88)		× 0.11 (0.17) =																															
		1/2 (12.7)		× 0.074 (0.11) =																															
		3/8 (9.52)		× 0.038 (0.056) =																															
		1/4 (6.35)		× 0.016 (0.024) =																															
		Total Additional Charge For Liquid Piping =																																	
If the calculated charge above is less than the charge shown in the table below, then add W1 as the additional refrigerant charge shown below.																																			
<table><tr><th>Outdoor Unit Capacity (MBH)</th><td>072-144</td><td>168, 192</td><td>216-288</td><td>312, 336</td><td>360</td><td>384-432</td></tr><tr><th>Minimum Additional Ref. Charge [lbs (kg)]</th><td>6.6 (3.0)</td><td>8.8 (4.0)</td><td>13.2 (6.0)</td><td>15.4 (7.0)</td><td>17.6 (8.0)</td><td>19.8 (9.0)</td></tr></table>	Outdoor Unit Capacity (MBH)	072-144	168, 192	216-288	312, 336	360	384-432	Minimum Additional Ref. Charge [lbs (kg)]	6.6 (3.0)	8.8 (4.0)	13.2 (6.0)	15.4 (7.0)	17.6 (8.0)	19.8 (9.0)																					
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		lbs (kg)																																	
2	W2	Depending on connection of indoor unit capacity, additional refrigerant charge is required. Select appropriate refrigerant charge from the table below.																																	
		Additional Refrigerant Charge for Each Indoor Unit Connected [W2 lbs (kg)]																																	
		<table><tr><th>Indoor Unit Capacity (MBH)</th><td>006, 008</td><td>012-054</td></tr><tr><th>Additional Ref. Charge [lbs (kg)/unit]</th><td>0.7 (0.3)</td><td>1.1 (0.5)</td></tr></table>	Indoor Unit Capacity (MBH)	006, 008	012-054	Additional Ref. Charge [lbs (kg)/unit]	0.7 (0.3)	1.1 (0.5)																											
		Indoor Unit Capacity (MBH)	006, 008	012-054																															
Additional Ref. Charge [lbs (kg)/unit]	0.7 (0.3)	1.1 (0.5)																																	
Maximum additional refrigerant charge must not exceed 13.2 lbs (6.0kg).																																			
		lbs (kg)																																	
3	W3	Calculation Method for Additional Refrigerant Charge [W3 lbs (kg)]																																	
		The additional refrigerant charge must be 2.2 lbs (1.0kg) per indoor unit which is 060 MBH or more.																																	
		<div></div> unit × 2.2 lbs (1.0kg)/unit = <div></div>	lbs (kg)																																
4	W4	The Ratio of Indoor Unit Connection Capacity (Indoor Unit Total Capacity/Outdoor Unit Capacity) Additional Charge [W4 lbs (kg)]																																	
		Determine the ratio of indoor unit connection capacity.																																	
		<table><tr><th>Condition</th><th>Additional Charge [lbs (kg)]</th></tr><tr><td>I.U. Capacity Ratio is less than 100%</td><td>0.0 (0.0)</td></tr><tr><td>I.U. Capacity Ratio is 100% or more</td><td>1.1 (0.5)</td></tr></table>	Condition	Additional Charge [lbs (kg)]	I.U. Capacity Ratio is less than 100%	0.0 (0.0)	I.U. Capacity Ratio is 100% or more	1.1 (0.5)																											
		Condition	Additional Charge [lbs (kg)]																																
I.U. Capacity Ratio is less than 100%	0.0 (0.0)																																		
I.U. Capacity Ratio is 100% or more	1.1 (0.5)																																		
		lbs (kg)																																	
5	W5	Depending on connection of outdoor unit model, additional refrigerant charge is required. Select adequate refrigerant charge from the table below. [W5 lbs (kg)]																																	
		<table><tr><th>Outdoor Unit Model</th><th>Additional Charge [lbs (kg)]</th></tr><tr><td>(H,Y)VAHR192B(3,4,5)2S</td><td rowspan="3">2.2 (1.0)</td></tr><tr><td>(H,Y)VAHR336B(3,4,5)2S</td></tr><tr><td>(H,Y)VAHR360B(3,4,5)2S</td></tr></table>	Outdoor Unit Model	Additional Charge [lbs (kg)]	(H,Y)VAHR192B(3,4,5)2S	2.2 (1.0)	(H,Y)VAHR336B(3,4,5)2S	(H,Y)VAHR360B(3,4,5)2S																											
		Outdoor Unit Model	Additional Charge [lbs (kg)]																																
		(H,Y)VAHR192B(3,4,5)2S	2.2 (1.0)																																
		(H,Y)VAHR336B(3,4,5)2S																																	
(H,Y)VAHR360B(3,4,5)2S																																			
		lbs (kg)																																	
6	W6	If Change-Over Boxes Multiple Branch type are connected, additional refrigerant charge is required.																																	
		Select adequate refrigerant charge from the table below. [W6 lbs (kg)]																																	
		<table><tr><th>Change-Over Box Model</th><th>Additional Charge [lbs (kg)/unit]</th></tr><tr><td>COB04M132B22S</td><td>0.3 (0.1)</td></tr><tr><td>COB08M264B22S</td><td>0.5 (0.2)</td></tr><tr><td>COB12M264B22S</td><td>0.7 (0.3)</td></tr></table>	Change-Over Box Model	Additional Charge [lbs (kg)/unit]	COB04M132B22S	0.3 (0.1)	COB08M264B22S	0.5 (0.2)	COB12M264B22S	0.7 (0.3)																									
		Change-Over Box Model	Additional Charge [lbs (kg)/unit]																																
		COB04M132B22S	0.3 (0.1)																																
		COB08M264B22S	0.5 (0.2)																																
COB12M264B22S	0.7 (0.3)																																		
		lbs (kg)																																	
7	WT	Calculation of Additional Charge [WT lbs (kg)] = W1 + W2 + W3 + W4 + W5 + W6 =																																	
		lbs (kg)																																	

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

Max. Additional Refrigerant Charge Quantity Allowed

Outdoor Unit Capacity (MBH)	072	096 - 144	168	192	216 - 432
Max. Additional Ref. Charge [lbs (kg)]	79.4 (36.0)	88.2 (40.0)	112.5 (51.0)	114.7 (52.0)	138.9 (63.0)

Initial Ref. Charge Amount of O.U. (Before Shipment) [W0 lbs (kg)]

Outdoor Unit Capacity (MBH)	072	096	120	144	168	192
W0 Outdoor Unit Ref. Charge [lbs (kg)]	15.9 (7.2)	19.6 (8.9)	21.8 (9.9)	23.6 (10.7)	24.9 (11.3)	25.6 (11.6)

W0 is the outdoor unit refrigerant charge prior to shipment.

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

(2) Record of Additional Charge

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

$$\text{Total Ref. Charge} = \text{WT lbs (kg)} + \text{W0 lbs (kg)} = \boxed{} \text{ lbs (} \boxed{} \text{ kg)}$$

When refrigerant is recovered or charged due to repairs, operations or adjustments of the unit, record the refrigerant quantity again.

NOTICE

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

- 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 provides safeguards for life, limb, health, and 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 for the room.

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

NOTICE

Do not activate the system until all issues have been examined and cleared.
Test Run of indoor unit: refer to the installation and maintenance manual which is attached to the indoor unit and change-over box.

9.1 Before Test Run

- (1) Check to ensure that the refrigerant piping and communication lines between indoor and outdoor units are connected into the same refrigerant system. If not, the result will be abnormal operation with a potentially serious accident.
Verify that all DIP switch settings for the refrigerant system numbers: (DSW1 and RSW1 for outdoor unit, DSW5 and RSW2 for indoor unit) and the unit number (DSW6 and RSW1) for indoor units are applicable to the system.
Depending on the indoor unit type, RSW is different. Refer to the installation manual attached to each indoor unit.
Confirm that all DIP switch settings on the printed circuit board for indoor and outdoor units are correct. Pay special attention to the setting for outdoor unit number, the refrigerant system number, and end terminal resistance. Refer to Section 7, "Electrical Wiring."
- (2) Verify that electrical resistance is more than 1 megaohm, by measuring the resistance between ground and the terminal for electrical components. If the electrical resistance is less than 1 megaohm, do not operate the system until the source of electrical current outflow is found and fixed. (Refer to "Caution for Insulation Resistance" for details.)
Do not impress the voltage on the terminals for communication lines (Outdoor Unit: TB2 1, 2, 3, 4/ Indoor Unit: TB2 A, B, 1, 2/Change-Over Box: TB2 1, 2, 3, 4). Otherwise, failure can result.
- (3) Verify that each wire, L1, L2, and L3, is correctly connected to the power supply.
If any one of those is incorrectly connected, the unit will not operate and the wired controller will display the alarm code "05." In this case, check and change the phase of the power supply according to the spec sheet attached to the service cover.
- (4) Apply power to outdoor unit(s) at least 12 hours prior to operation of the system to allow for adequate pre-heating of the compressor oil.
The outdoor unit does not operate for at most four hours after power supply (Stoppage Code d1-22). If operation resumes within four hours, release the protection control as follows:
 1. Supply power to the outdoor unit.
 2. Wait for 30 seconds.
 3. Push PSW5 on the outdoor PCB for more than three seconds in order to release the d1-22.If using a wired controller for release:
 - * Press and hold "Menu" and "Back/Help" simultaneously for at least 3 seconds. The test run menu is displayed.
 - * Press "△" or "▽" to select "Cancel Preheating Control". Press "OK" and cancel the pre-heating control.For other controllers, refer to the manual attached to each controller.
- (5) Be sure to close the service cover at the front lower side when the test run is performed.

! CAUTION

Caution for Insulation Resistance

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

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

If the GFCI is activated, check the recommended size shown in Table 7.1.

NOTICE

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

9.2 Test Run

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

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

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

Test Run by Wired Controller

- (a) Press and hold "Menu" and "Back/Help" simultaneously for at least 3 seconds. The test run menu will be displayed.
- (b) Select "Test Run" by pressing " Δ " and press "OK".
The test run screen will be displayed.

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




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.)

Test Run Screen

Test Run Setting: 2 units	
MODE	: ◀ COOL ▶
SPEED	: AUTO
<div style="display: flex; justify-content: space-between; align-items: center;"> ◀ Sel. ◀ Adj. ⏻ ON Back Rtm </div>	

(c) Start the Test Run.

- Press “ On/Off” to start The Test Run operation. 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 “” 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 the working range.









Example

The cooling operation is not performed if the outdoor temperature is below -4°F DB (-20°C DB).

Temperature

Cooling Operation Range		Indoor	°F WB (°C WB)	59 (15) to 73 (23)
		Outdoor	°F DB (°C DB)	23 (-5) to 122 (50)
		with Snow Protection Hood	°F DB (°C DB)	14 (-10) to 109 (43)
		with Low Ambient Kit	°F DB (°C DB)	-10 (-23) to 109 (43)
Heating Operation Range		Indoor	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor	°F WB (°C WB)	-13 (-25) to 59 (15)
Cooling & Heating Operation Range	Cooling	Indoor	°F WB (°C WB)	59 (15) to 73 (23)
		Outdoor	°F DB (°C DB)	23 (-5) to 75 (24)
		with Snow Protection Hood	°F DB (°C DB)	14 (-10) to 75 (24)
		with Low Ambient Kit	°F DB (°C DB)	-10 (-23) to 75 (24)
	Heating	Indoor	°F DB (°C DB)	59 (15) to 80 (27)
		Outdoor	°F WB (°C WB)	22 (-6) to 59 (15)
		with Snow Protection Hood	°F WB (°C WB)	12 (-11) to 59 (15)
		with Low Ambient Kit	°F WB (°C WB)	-11 (-24) to 59 (15)

DB: Dry Bulb, WB: Wet Bulb

- (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 is heard 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 abnormal sounds are generated, press “” or “” again to halt the auto-swing operation.
- (e) Though the temperature detections by the thermistors are invalid, the protection devices are valid during the Test Run. If an alarm is triggered, refer to Table 9.2, Alarm Code and perform troubleshooting. Then perform the Test Run again
- (f) According to the label “Checking Method by Seven-Segment Display” attached to the back side of the service cover of the outdoor unit, check the temperature, the pressure and the operation frequency of the specified portions, and check the number of the connected indoor units on 7-segment displays.
- (g) To finish the Test Run, wait two hours (as a default setting) or press “ On/Off” switch again.
- With the operation LED flashing two seconds ON and two seconds OFF, this is an indication that the system is searching for irregularities in communication between indoor units and the wired controller. This could result in loose or disconnected wires, components, and incorrect wiring.
 - A small sound may be heard from the outdoor unit after turning ON at the power supply because the electrical expansion valve is activated to adjust the opening. Therefore, there is no mechanical fault with the unit.
 - Sound may be emitted from the outdoor unit for a few seconds after running or stopping the compressor, starting or finishing the defrosting, and so on. It generates because of the pressure difference inside the compressor piping. Therefore, there is no problem with the unit.

⚠ WARNING


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

Test Run from Outdoor Unit Side

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

Setting of DIP Switch (Factory Setting)

Note that the darkened squares here indicates that the switch is in the "OFF" position.

DSW4					
Switch for Setting of Service Operation and Function					
					
1	2	3	4	5	6
<div>1. Test Run</div> <div>2. COOL/HEAT Setting (ON: Heating Operation)</div> <div>3. Not Used</div> <div>4. Manual Compressor OFF</div> <div>5. Function Setting</div> <div>6. External Input/Output Setting</div>					

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 supply for the outdoor unit is supplied and the outdoor unit is operated.
- Turn all DIP switches of No.1 to 4 pins of DSW4 OFF when the test run operation is completed.




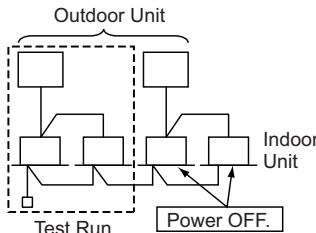


	DIP Switch Setting	Operation	Remarks
Test Run	<p>1. Setting of Operation Mode</p> <p>Cooling: Set No.2 pin of DSW4 OFF.</p>  <p>1 2 3 4 5 6 ON OFF</p> <p>Heating: Set No.2 pin of DSW4 ON.</p>  <p>1 2 3 4 5 6 ON OFF</p> <p>2. Starting Test Run</p> <p>Set No.1 pin of DSW4 ON and the operation will started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

Table 9.1 Test Run and Maintenance Record

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

1. Is the rotation direction of the indoor fan correct?
2. Is the rotation direction of the outdoor fan correct? (Correct direction is counter clockwise.)
3. Are there any abnormal compressor sounds?
4. Has the unit been operated at least twenty (20) minutes?
5. Check Room Temperature

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

Inlet:	DB	°F,	WB	°F
Outlet:	DB	°F,	WB	°F
7. Check Refrigerant Temperature

Liquid Temperature:	°F
Discharge Gas Temperature:	°F
8. Check Pressure

Discharge Pressure:	Psi
Suction Pressure:	Psi
9. Check Voltage

Rated Voltage:	V
Operating Voltage:	L ₁ -L ₂ V, L ₁ -L ₃ V, L ₂ -L ₃ V
Starting Voltage:	V
Phase Imbalance:	$1 - \frac{V}{V_m} =$
10. Check Compressor Input Running Current

Input:	kW
Running Current:	Comp. No.1 A Comp. No.2 A
11. Is the refrigerant charge adequate?
12. Do the operation control devices operate correctly?
13. Do the safety devices operate correctly?
14. Has the unit been checked for refrigerant leakage?
15. Is the unit clean inside and outside?
16. Are all cabinet panels securely closed?
17. Are all cabinet panels free from rattles?
18. Is the filter clean?
19. Is the heat exchanger clean?
20. Are the stop valves open?
21. Does the drain water flow smoothly from the drain pipe?

Table 9.2 Alarm Code

Code	Category	Content of Abnormality	Leading Cause
01	Indoor Unit	Activation of Protection Device (Float Switch)	Activation of Float Switch (High Water Level in Drain Pan, Abnormality of Drain Pipe, Float Switch, or Drain Pan)
02	Outdoor Unit	Activation of Protection Device (High Pressure Cut)	Activation of PSH (Pipe Clogging, Excessive Refrigerant, Inert Gas Mixing)
03	Communication	Abnormal Communication between Indoor Units and Outdoor Units	Incorrect Wiring, Loose Terminals, Disconnected Communication Cable, Blowout of Fuse, Indoor Unit Power OFF
04		Abnormal Communication between Inverter PCB and Outdoor PCB	Inverter PCB -Outdoor PCB Communication Failure (Loose Connector, Wire Breaking, Blowout of Fuse)
05	Supply Phase	Abnormality of Power Supply Phases	Incorrect Power Supply, Connection to Reversed Phase, Open-Phase
06	Voltage	Abnormal Inverter Voltage	Outdoor Voltage Decrease, Insufficient Power Capacity
07	Cycle	Decrease in Discharge Gas Superheat	Excessive Refrigerant Charge, Failure of Thermistor, Incorrect Wiring, Incorrect Piping Connection, Expansion Valve Locking at Opened Position (Disconnect Connector)
08		Increase in Discharge Gas Temperature	Insufficient Refrigerant Charge, Pipe Clogging, Failure of Thermistor, Incorrect Wiring, Incorrect Piping Connection, Expansion Valve Locking at Closed Position (Disconnect Connector)
0A	Communication	Abnormal Communication between Outdoor Units	Incorrect Wiring, Breaking Wire, Loose Terminals
0b	Outdoor Unit	Incorrect Outdoor Unit Address Setting	Duplication of Address Setting for Outdoor Units (Sub Units) in Same Refrigerant Cycle Number
0C		Incorrect Outdoor Unit Main Unit Setting	Two (or more) Outdoor Units Set as "Main Unit" Exist in Same Refrigerant Cycle Number
11	Sensor on Indoor Unit	Abnormality of Inlet Air Thermistor	Incorrect Wiring, Disconnecting Wiring, Breaking Wire, Short Circuit
12		Abnormality of Outlet Air Thermistor	
13		Abnormality of Freeze Protection Thermistor	
14		Abnormality of Gas Piping Thermistor	
15		Abnormality of Outdoor Air Thermistor (EconoFresh)	
16		Abnormality of Remote Sensor (DOAS)	
17		Abnormality of Thermistor Built-in Remote Controller (DOAS)	
18	Indoor Fan Motor	Abnormality of Indoor Fan System	Abnormality of Indoor Fan Motor (Step-Out), Indoor Fan Controller Failure
19		Activation of Protection Device for Indoor Fan	Fan Motor Overheat, Lockup
1A	Indoor Fan Controller	Abnormality of Fan Controller Fin Temperature	Abnormality of Fin Thermistor or Fan Controller, Heat Exchanger Clogging, Abnormality of Fan Motor
1b		Activation of Overcurrent Protection	Abnormality of Fan Motor
1C		Problem with Current Sensor	Abnormality of Fan Controller Current Sensor
1d		Activation Fan Controller Protection	Driver IC Error Signal Detection, Instantaneous Overcurrent
1E		Abnormality of Indoor Fan Controller Voltage	Indoor Voltage Decrease, Insufficient Capacity of Power Supply Wiring
21	Sensor on Outdoor Unit	Abnormality of High Pressure Sensor	Incorrect Wiring, Disconnecting Wiring, Breaking Wire, Short Circuit
22		Abnormality of Outdoor Air Thermistor	
23		Abnormality of Discharge Gas Thermistor on Top of Compressor	
24		Abnormality of Heat Exchanger Liquid Pipe Thermistor	
25		Abnormality of Heat Exchanger Gas Pipe Thermistor	
29		Abnormality of Low Pressure Sensor	

Code	Category	Content of Abnormality	Leading Cause
30	System	Incorrect Connection of Change-Over Box	Connection of Change-Over Box to Heat Pump System, Disconnection of Change-Over Box to Heat Recovery System, Generation1 and 2 Change-Over Boxes are used in the same system
31		Incorrect Capacity Setting of Outdoor Unit and Indoor Unit	Incorrect Capacity Setting of Outdoor Unit and Indoor Unit, Excessive or Insufficient Indoor Unit Total Capacity Code
35		Incorrect Setting of Indoor Unit No.	Duplication of Indoor Unit No. In same Refrigerant Cycle Number
36		Incorrect of Indoor Unit Combination	Indoor Unit is Designed for R22
38		Abnormality of Picking up Circuit for Protection in Outdoor Unit	Failure of Protection Detecting Device (Incorrect Wiring of Outdoor PCB)
3A	Outdoor Unit	Abnormality of Outdoor Unit Capacity	Outdoor Unit Capacity > 432MBH
3b		Incorrect Setting of Outdoor Unit Models Combination or Voltage	Incorrect Setting of Main and Sub Units(s) Combination or Voltage
3d		Abnormal Communication between Main Unit and Sub Unit(s)	Incorrect Wiring, Disconnect Wire, Breaking Wire, PCB Failure
3E		Abnormal Combination between Inverter PCB and Outdoor PCB	Incorrect Combination between Inverter PCB and Outdoor PCB
43	Protection Device	Activation of Pressure Ratio Decrease Protection	Defective Compression (Failure of Compressor or Inverter, Loose Power Supply Connection)
44		Activation of Low Pressure Increase Protection	Overload at Cooling, High Temperature at Heating, Expansion Valve Locking at Open Position (Loose Connector)
45		Activation of High Pressure Increase Protection	Overload Operation (Heat Exchanger Clogging, Short Circuit of Airflow), Pipe Clogging, Excessive Refrigerant, Inert Gas Mixing
47		Activation of Low Pressure Decrease Protection	Insufficient Refrigerant, Piping Clogging, Expansion Valve Locking at Close Position (Loosen Connector)
48		Activation of Inverter Overcurrent Protection	Overload Operation, Compressor Failure
51	Sensor	Abnormal Inverter Current Sensor	Current Sensor Failure
53	Inverter	Inverter Error Signal Detection	Driver IC Error Signal Detection (Protection for Overcurrent, Voltage Decrease, Short Circuit), Instantaneous Overcurrent
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, Voltage Decrease, Short Circuit), Instantaneous Overcurrent
5A		Abnormality of Fan Controller Fin Temperature	Fin Thermistor Failure, Heat Exchanger Clogging, Fan Motor Failure
5b		Activation of Overcurrent Protection	Fan Motor Failure
5C		Abnormality of Fan Controller Sensor	Failure of Current Sensor (Instantaneous Overcurrent, Increase of Fin Temperature, Voltage Decrease, Grand Fault, Step-Out)
A1	External Input	Detection of External Abnormality	Input Signal by External Abnormality Detection Setting
b0	Indoor Unit	Incorrect Setting of Unit Model Code	Incorrect Setting of Indoor Unit Model
b1		Incorrect Setting of Unit and Refrigerant Cycle Number	64 or More Number is Set for Address or Refrigerant Cycle
b2		Abnormality of EEPROM	EEPROM failure, Incorrect Data of EEPROM
b5		Incorrect Indoor Unit No. Setting	There are 17 or More Non-Corresponding to H-LINK II Units are Connected to One System.
b6		Abnormal Communication between Indoor PCB and Indoor Fan Controller	Communication Failure, Disconnected Communication Cable, Abnormal Connection
C1	Change-Over Box	Incorrect Change-Over Box Connection	2 or More Change-Over Boxes are Connected between Outdoor Unit and Indoor Unit
C2		Incorrect Indoor Unit Connection Number	9 or More I.U. Connected to Single Branch Type Change-Over Box, 7 or More I.U. Connected per a branch of Multiple Branch Type Change-Over Box
C3		Incorrect Indoor Unit Refrigerant Number Setting	Indoor Units of Different Refrigerant Cycle Number are Connected to Change-Over Box
C5		Incorrect Connection Port Setting	Indoor Unit is connected to a port that is set to not used for Multiple Branch Type Change-Over Box
EE	Compressor	Compressor Protection Alarm (It cannot 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

10. Safety and Control Device Setting

Compressor Protection

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

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

208/230V 60Hz

Model		(H,Y)VAHR072B32S	(H,Y)VAHR096B32S	(H,Y)VAHR120B32S	(H,Y)VAHR144B32S	(H,Y)VAHR168B32S	(H,Y)VAHR192B32S
High Pressure Increase Protection		Automatic Reset, Non-Adjustable					
High Pressure Increase Protection Control	psi (MPa)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)
Pressure Switch		(for each compressor)					
Cut-Out	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)	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)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
For Inverter Compressor		Automatic Reset, Non-Adjustable					
Over Current							
Inverter Current Protection Control	A	48	48	38	38	48	48
Fuse	A	50	50	40	40	50	50
Over Heat		Automatic Reset, Non-Adjustable					
Discharge Temperature							
Increase Protection Control							
for 5sec	°F (°C)	284 (140)	284 (140)	284 (140)	284 (140)	284 (140)	284 (140)
for 10min	°F (°C)	270 (132)	270 (132)	270 (132)	270 (132)	270 (132)	270 (132)
For Fan Motor		Automatic Reset, Non-Adjustable					
Over Current Protection Control	A	7	7	7	7	7	7
Fuse	A	10	10	10	10	10	10

460V 60Hz

Model		(H,Y)VAHR072B42S	(H,Y)VAHR096B42S	(H,Y)VAHR120B42S	(H,Y)VAHR144B42S	(H,Y)VAHR168B42S	(H,Y)VAHR192B42S
High Pressure Increase Protection		Automatic Reset, Non-Adjustable					
High Pressure Increase Protection Control	psi (MPa)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)
Pressure Switch		(for each compressor)					
Cut-Out	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)	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)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
For Inverter Compressor		Automatic Reset, Non-Adjustable					
Over Current							
Inverter Current Protection Control	A	26	26	19.5	19.5	26	26
Fuse	A	25	25	25	25	25	25
Over Heat		Automatic Reset, Non-Adjustable					
Discharge Temperature							
Increase Protection Control							
for 5sec	°F (°C)	284 (140)	284 (140)	284 (140)	284 (140)	284 (140)	284 (140)
for 10min	°F (°C)	270 (132)	270 (132)	270 (132)	270 (132)	270 (132)	270 (132)
For Fan Motor		Automatic Reset, Non-Adjustable					
Over Current Protection Control	A	3.5	3.5	3.5	3.5	3.5	3.5
Fuse	A	5	10	5	5	5	5

575V 60Hz

Model		(H,Y)VAHP072B52S	(H,Y)VAHP096B52S	(H,Y)VAHP120B52S	(H,Y)VAHP144B52S	(H,Y)VAHP168B52S	(H,Y)VAHP192B52S
High Pressure Increase Protection		Automatic Reset, Non-Adjustable					
High Pressure Increase Protection Control	psi (MPa)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)	551 (3.80)
Pressure Switch		(for each compressor)					
Cut-Out	psi	601 -7	601 -7	601 -7	601 -7	601 -7	601 -7
	(MPa)	(4.15 -0.05) -0.15)	(4.15 -0.05) -0.15)	(4.15 -0.05) -0.15)	(4.15 -0.05) -0.15)	(4.15 -0.05) -0.15)	(4.15 -0.05) -0.15)
Cut-In	psi (MPa)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)	464 ±21 (3.20 ±0.15)
For Inverter Compressor		Automatic Reset, Non-Adjustable					
Over Current							
Inverter Current Protection Control	A	24.0	24.0	19.0	19.0	24.0	24.0
Fuse	A	25	25	25	25	25	25
Over Heat		Automatic Reset, Non-Adjustable					
Discharge Temperature							
Increase Protection Control	°F	284	284	284	284	284	284
	(°C)	(140)	(140)	(140)	(140)	(140)	(140)
for 5sec	°F	270	270	270	270	270	270
	(°C)	(132)	(132)	(132)	(132)	(132)	(132)
for 10min							
For Fan Motor		Automatic Reset, Non-Adjustable					
Over Current Protection Control		A	3.5	3.5	3.5	3.5	3.5
Fuse	A	5	10	5	5	5	5