Installation

Variable Refrigerant Flow (VRF) System

Mini Outdoor Unit Series

Models: **4TVH0036B100NB**
4TVH0048B100NB
4TVH0053B100NB

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

May 2013

VRF-SVN33A-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE recommended for the work being undertaken. ALWAYS refer to appropriate MSDS sheets and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS sheets and OSHA guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling recommendations.**
- **If there is a risk of arc or flash, technicians MUST put on all PPE in accordance with NFPA 70E or other country-specific requirements for arc flash protection, PRIOR to servicing the unit.**

Copyright

Trademarks

All trademarks referenced in this document are the trademarks of their respective owners.

Table of Contents

Preparing for Installation

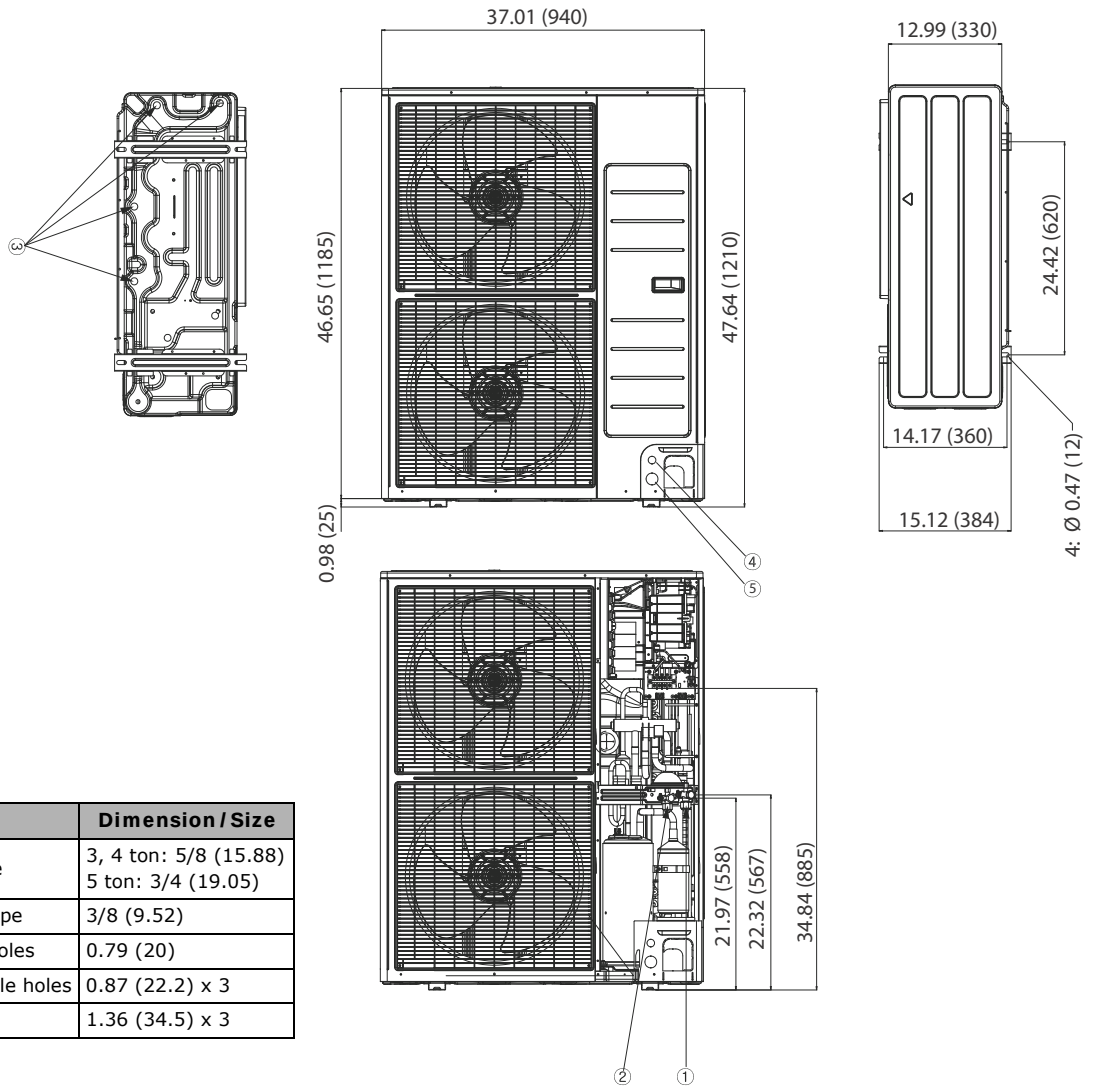
Unit Dimensions and Weights

Table 1. Unit dimensions and weights

Unit model number	Dimensions (WxHxD) in. (mm)	Weight lb (kg)	Shipping dimensions (WxHxD) in. (mm)	Shipping weight lb (kg)
4TVH0036B100NB	37 (940) x 47.6 (1210) x 13 (330)	220.5 (100.0)	39.2 (995) x 53.9 1368) x 16.8 (426)	231.5 (105.0)
4TVH0048B100NB				
4TVH0053B100NB		227.1 (103.0)		238.1 (108.0)

Dimensional Drawing

Unit : inch (mm)



No.	Item	Dimension / Size
1	Gas refrigerant pipe	3, 4 ton: 5/8 (15.88) 5 ton: 3/4 (19.05)
2	Liquid refrigerant pipe	3/8 (9.52)
3	Condensate drain holes	0.79 (20)
4	Communication cable holes	0.87 (22.2) x 3
5	Power cable holes	1.36 (34.5) x 3

Maximum Quantity of Indoor Units by Mini Outdoor Unit Capacity

To prevent reducing indoor unit capacity, the sum capacity of indoor units connected to a mini outdoor unit should be no greater than the capacity of the mini outdoor unit. Refer to Table 2.

Table 2. Maximum number of indoor units determined by mini outdoor unit capacity

Mini outdoor unit model number	Mini outdoor unit capacity (tons)	Maximum quantity of indoor units connected to a mini outdoor unit	Total capacity of connected indoor units (Btu/h)
4TVH0036B100NB	3	6	19000–49000
4TVH0048B100NB	4	8	24000–62000
4TVH0053B100NB	5	9	27000–69000

Service Clearances

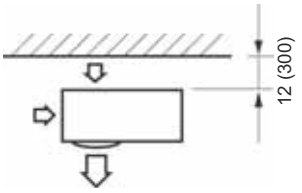
Install units as shown in the illustrations below (Figure 1, Figure 2, and Figure 3), observing ventilation and service requirements. Space requirements are based on cooling mode operation and an outdoor temperature of 95°F (35°C). More space is required if the outdoor temperature is higher than 95°F (35°C) or if the area is easily heated by solar radiation.

Note: The front of the unit is curved and has the name brand logo on it.

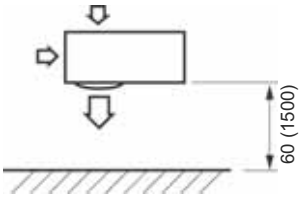
Figure 1. Air flow direction

Figure 2. Minimum service clearances for a single mini outdoor unit installation

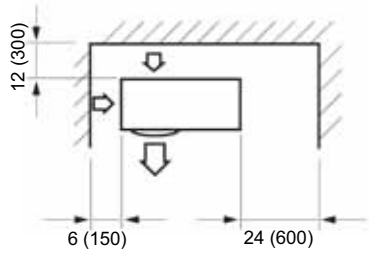
When the air outlet is opposite a wall



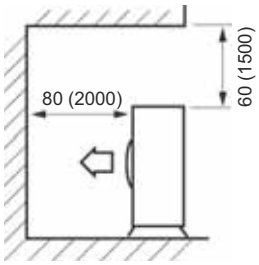
When air outlet is toward a wall



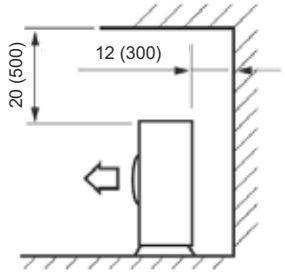
When three sides are blocked by a wall



Top of unit is blocked and the air outlet is toward a wall



When top of unit is blocked and the air outlet is opposite the wall



When from and back of unit are blocked by walls

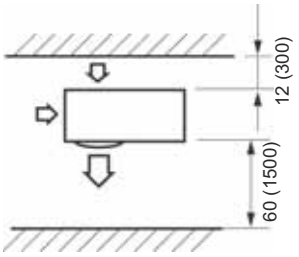
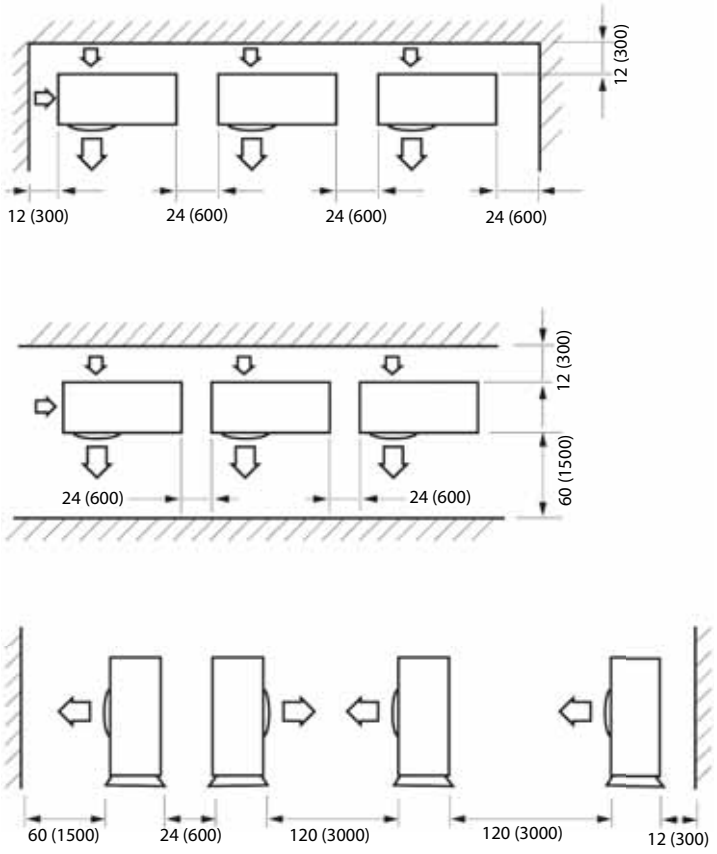


Figure 3. Minimum service clearances for multiple mini outdoor unit installations



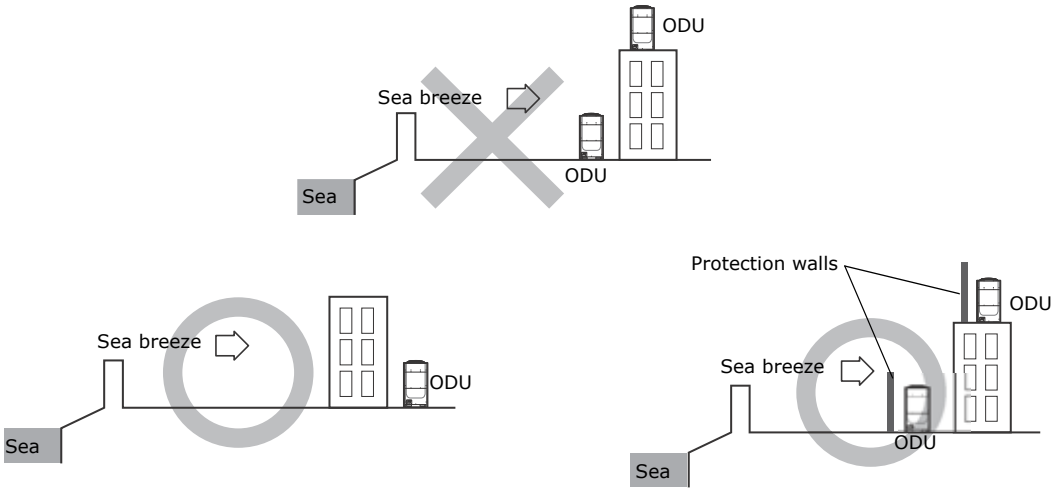
Location Considerations

Choose an installation location based on the following considerations.

- Install the outdoor unit:
  - On a supporting structure that can bear the weight of the outdoor unit.
  - With sufficient clearances around the unit for service and repairs.
  - Install the outdoor unit.
  - On a flat surface that does not collect rain water.
  - In a well ventilated location.
  - Away from strong wind.
  - Away from direct exposure to rain or snow.
  - Where there is no risk of flammable gas leakage
  - Where there is no exposure to salt, machine oil, sulfide gas, or corrosive environmental conditions.
  - Away from sea breeze.

  Note: For seacoast applications, block the unit from direct exposure to sea breeze by installing the unit behind a structure (such as a building) or a protective wall that is 1.5 times higher than the unit, leaving 28 in. (700 mm) of space between the wall and unit for air

circulation. Consult an installation expert about taking anti-corrosion measures, such as removing salinity on the heat exchanger and applying a rust inhibitor more frequently than once a year.



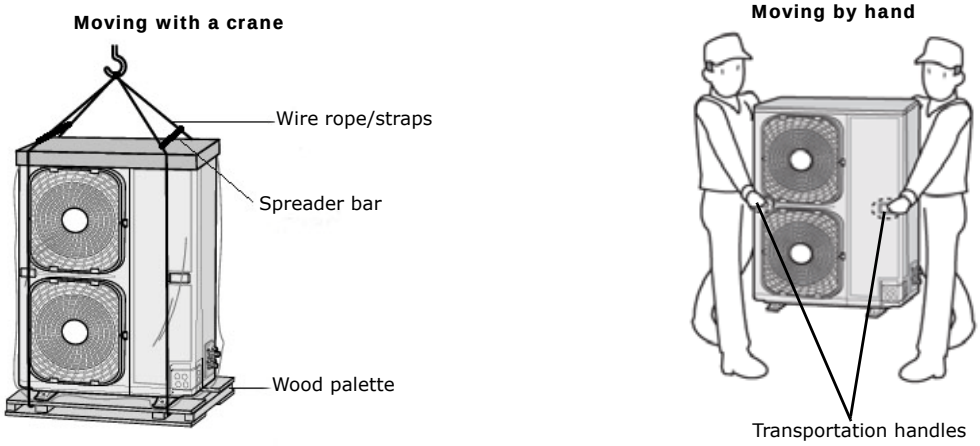
  - At least 9.84 ft (3 m) away from equipment that generates electromagnetic waves.
  - Away from interfering sources, such as radio, computer, and stereo equipment.
  - Far enough away from people living and working nearby so that hot discharge air or noise do not disturb them.
  - Away from inflammable materials.
- Ensure that condensate water generated by the outdoor unit can drain smoothly away from the unit.
- Install the power and communication cables in a separately installed enclosure.
- If installing on a high place such as a roof, with a fence or guard rail around it.
- If there is a potential for accumulated snow to block the air inlet or heat exchanger, install the unit on a higher base.
- R-410A refrigerant is a safe, nontoxic and nonflammable refrigerant. However, if there is a concern about a dangerous level of refrigerant concentration in the case of refrigerant leakage, add extra ventilation.
- Avoid installing the outdoor unit where corrosive gases, such as sulfur oxides, ammonia, and sulfurous gas, are produced. If unavoidable, consult with an installation specialist about using a corrosion-proof or anti-rust additive to protect the unit coils.

Moving the Mini Outdoor Unit

Follow these guidelines when moving the mini outdoor unit:

- Before moving the unit, determine a path that can support its weight.
- Do not lay the unit on its side and do not slant the unit more than 30 degrees.
- Take care to avoid injury while moving the unit; the surface of the heat exchanger is sharp.
  - If moving the unit with a crane, fasten the wire rope as shown in Figure 4. To protect damage or scratches to the unit, use a spreader bar.
  - If the unit is being moved a short distance by hand, two people should lift and carry it together using the transportation handles on the side of the unit, as shown in Figure 4.

Figure 4. Moving the mini outdoor unit



Unit Installation

Follow these guidelines for installing the mini outdoor unit.

Important: The manufacturer is not responsible for damage incurred for installations that have not followed these guidelines.

The unit must be installed:

- On a horizontally level surface.
- On a surface that is strong enough to support the unit and to minimize noise.

Base Recommendations

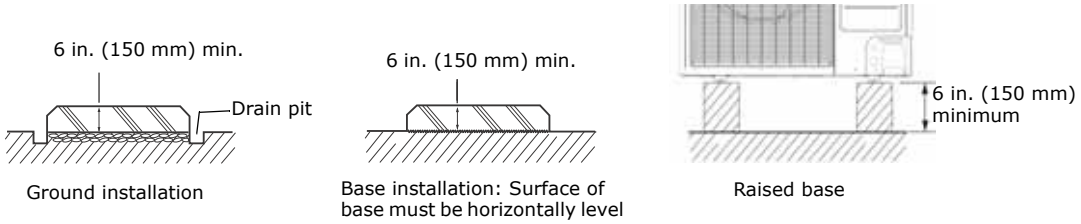
General guidelines

A supporting base for the mini outdoor unit:

- Is typically made of concrete.
- Should typically be 1.5 times larger than the bottom of the unit. However, for installations that are subject to snow accumulation, the base should be no larger than the bottom of the unit.
- Should be 6 in. (150 mm) or higher to protect the unit from rain water or other conditions that may cause damage to the unit.

  Note: The base height or, if the unit is installed on a frame (see "Minimizing Vibration" p. 11), the base height plus the frame height, should be greater than the highest expected snowfall.

- If necessary, has wire mesh or steel bars added to the concrete to prevent damages or cracks.

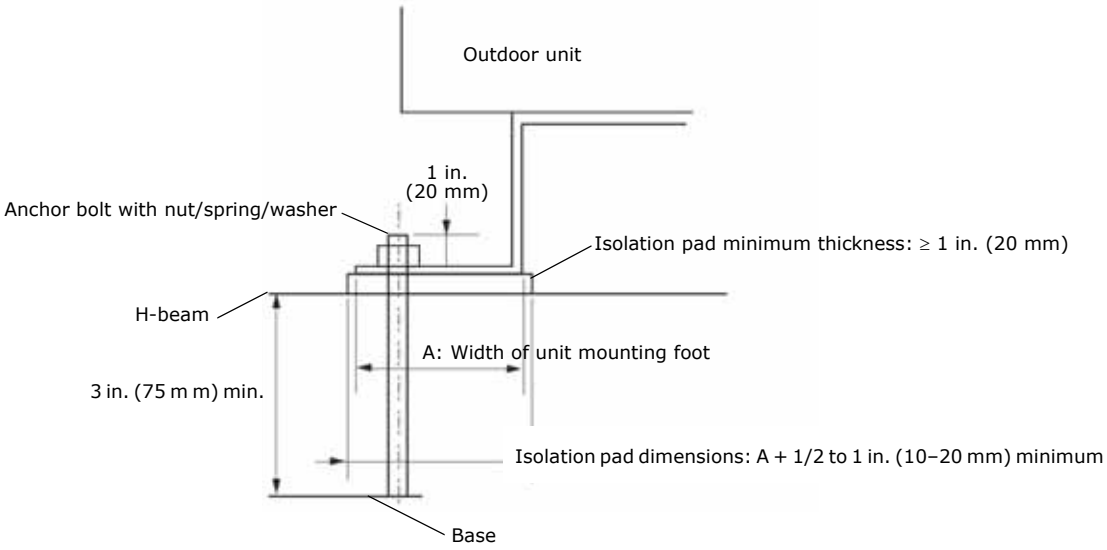


Minimizing Vibration

When installing multiple mini outdoor units side by side, or when there is a need to minimize unit vibrations, use a vibration-minimizing structure such as an H-beam frame or a vibration-isolation frame, and an isolation pad. Refer to the specifications in Figure 5.

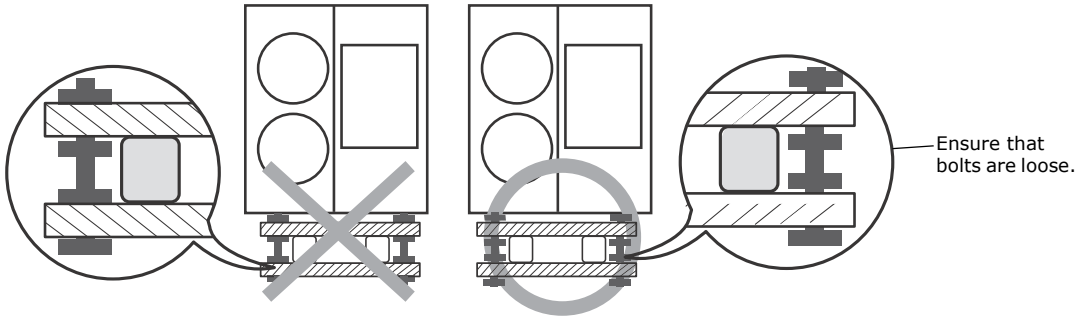
After installation, apply corrosion-protection to the frame.

Figure 5. Vibration-minimizing structure specifications



After installing a vibration-isolation frame, loosen the bolts so that the isolators are capable of absorbing vibrations (Figure 6).

Figure 6. Bolts on vibration-isolation frame



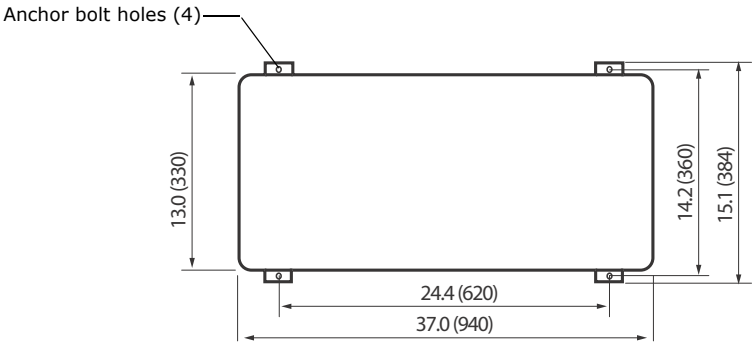
Securing the Mini Outdoor Unit

The mini outdoor unit must be secured so that it can withstand a wind speed of 67 mph (30 m/s).

Secure the unit firmly to the base with M10 anchor bolts (see Figure 7).

- Use zinc-plated or stainless steel nuts and bolts.
- Use a rubber washer between the bolt and the unit to prevent bimetallic corrosion.

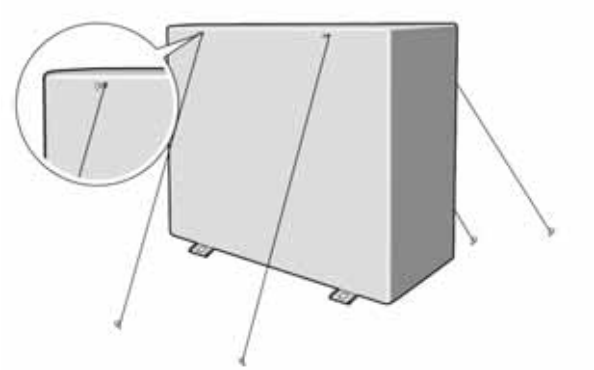
Figure 7. Anchor bolt positions



If you cannot attach the unit to the base or if the unit needs additional support, secure it with wires as follows:

1. Loosen the four screws at the top of the unit and wrap wire around each of them.
2. Tighten the screws.
3. Stake the wires to the ground (see Figure 8).

Figure 8. Securing the unit with wire



Condenser Air Discharge Duct (optional)

⚠CAUTION

Sharp Edges!

Working with galvanized sheet metal involves working with sharp edges. To avoid being cut, technicians MUST put on all necessary Personal Protective Equipment (PPE), including gloves and arm guards.

If you remove the fan guard to install the discharge duct, make sure to install a safety net on the duct outlet to prevent foreign substances from entering the unit and to prevent the risk of personal injury from sharp fan blades.

Refrigerant Piping

This section contains information on selecting, storing, and connecting refrigerant piping.

Selecting Refrigerant Piping

Refrigerant piping diameter, thickness, and temper is selected according to length, as specified in this section.

Notes:

- *Use insulated, unwelded, degreased, and deoxidized copper pipe (Cu-DHP type according to ISO 1337 or UNI EN 12735-1) suitable for an operating pressure of at least 609.15 psi (4200 kPa) and a burst pressure of at least 3002.28 psi (20,700 kPa). Copper pipe for hydro-sanitary applications is unsuitable.*
- *If there is a risk of decreased performance caused by pipe length, use piping that is one size larger than that specified in this section.*

Pipe Diameter

Table 3 specifies the diameter of the main pipe based on unit capacity.

Table 3. Mini outdoor unit main pipe size based on unit capacity

Mini outdoor unit capacity		Liquid pipe in. (mm)	Gas pipe[a] in. (mm)
Ton	MBH		
3	38	3/8 in. (9.52 mm)	5/8 in. (15.88 mm)
4	48		
5	53		3/4 in. (19.05 mm)

(a) Increase the gas pipe from the outdoor unit to the first branch joint by one size if the pipe length between the outdoor unit and the farthest indoor unit, including the elbow, exceeds 295 ft (90 m); or if the outdoor unit capacity declines due to pipe length.

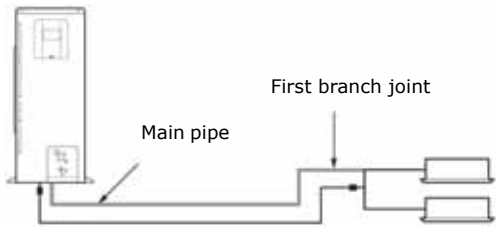


Table 4 specifies the pipe size between branch joints.

Table 4. Pipe size between branch joints

Indoor unit total capacity (MBH)	Pipe size (OD)	
	Liquid in. (mm)	Gas in. (mm)
Less than 51	3/8 (9.52)	5/8 (15.88)
51-79.2		3/4 (19.05)

Branch Joint Selection

Table 5 specifies the first branch joint according to mini outdoor unit capacity.

Table 5. First branch joint according to mini outdoor unit capacity

Mini outdoor unit total capacity (ton)	Branch joint model
3	4YDK1509B0051A
4	
5	4YDK2512B0138A

Table 6 specifies branch joints connected after the first branch, according to the total capacity of all indoor units connected after the first branch.

Table 6. Branch joints connected after the first branch, according to total indoor unit capacity

Total indoor unit capacity (MBH)	Branch joint model
Less than 51	4YDK1509B0051A
51–138.5	4YDK2512B0138A

Pipe Thickness and Temper Grade

Table 7 specifies pipe minimum thickness and temper grade based on pipe diameter.

⚠CAUTION

Risk of Pipes Breaking!

If pipes with a diameter larger than 3/4 in. (19.05 mm) are specified, use semi-hard (C1220T-1/2H) or hard (C1220T-H) copper piping. If a softer copper pipe (C1220T-O) is used, the pipe may break due to its low pressure resistance and cause personal injury.

Table 7. Refrigerant pipe minimum thickness and temper grade

Outer diameter in. (mm)	Minimum thickness in. (mm)	Temper grade
1/4 (6.35)	0.028 (0.70)	Annealed (C1220T-O)
3/8 (9.52)	0.028 (0.70)	
1/2 (12.70)	0.031 (0.80)	
5/8 (15.88)	0.039 (1.00)	
3/4 (19.05)	0.035 (0.9)	Drawn (C1220T-1/2H or C1220T-H)
7/8 (22.22)	0.035 (0.9)	

Refrigerant Piping Maximum Length and Height Differences

Table 8. Maximum refrigerant piping length and height differences for installations with Y-joints and EEV kits

	Piping location	Piping length and height difference (ft [m])	Y-joint connection (refer to Figure 9)	Y-joint and EEV kit connection (refer to Figure 10)
Maximum allowable piping length	Mini outdoor unit to indoor units	Actual length	The distance between the mini outdoor unit and the farthest indoor unit ≤ 492 ft (150 m)	
			Example: 8 indoor units a+b+c+d+e+f+g+p ≤ 492 ft (150 m)	Example: 6 indoor units a+b+c+d+j ≤ 492 ft (150 m)
		Equivalent length	The distance between a mini outdoor unit and the farthest indoor unit ≤ 574 ft (175 m)(a)	
		Main pipe length	The main pipe (a) from the mini outdoor unit to the first Y-joint should be less than 361 ft (110 m)	
		Total length	The sum of the total length of pipes should be less than 984 ft (300 m)	
Maximum allowable height difference	Mini outdoor unit to indoor units	Height	H1: Height difference between a mini outdoor unit and indoor unit < 164 ft (50 m)	
			H2: Height difference between indoor units ≤ 49 ft (15 m)	
Maximum allowable length after Y-joint		Actual length	The distance between the first Y-joint and the farthest indoor unit ≤ 131 ft (40 m) Example: 8 indoor units b+c+d+e+f+g+p ≤ 131 ft (40 m)	Allowable length between EEV kit and an indoor unit ≤ 65 ft (20 m) Example: h, l, j ≤ 65 ft (20 m)

(a) If the equivalent length between an outdoor unit and the farthest indoor unit exceeds 295 ft (90 m), increase the gas pipe by one size.

Figure 9. Y-joint connection

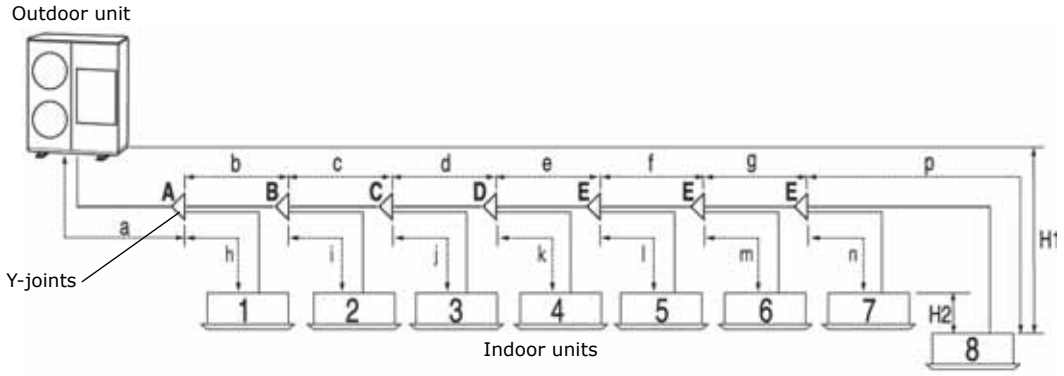


Figure 10. Y-joint and EEV kit connection

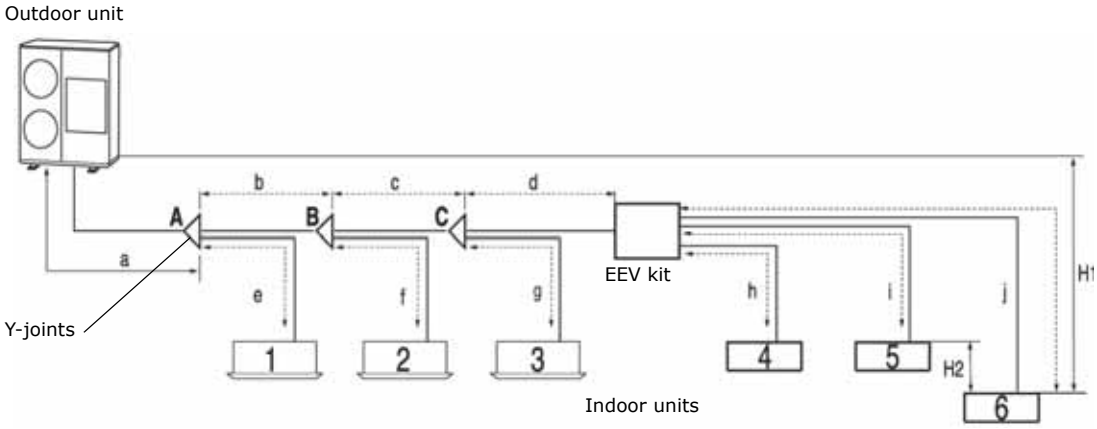


Table 9. Maximum refrigerant piping length and height differences for installations with Y-joints and EEV kits

	Piping location	Piping length and height difference (ft [m])	Distribution header connection (refer to Figure 11)	Y-joint and distribution header connection (refer to Figure 12)
Maximum allowable piping length	Mini outdoor unit to indoor units	Actual length	The distance between the mini outdoor unit and the farthest indoor unit ≤ 492 ft (150 m)	
			Example: 8 indoor units a+g ≤ 492 ft (150 m)	Example: 8 indoor units a+b+c ≤ 492 ft (150 m)
		Equivalent length	The distance between a mini outdoor unit and the farthest indoor unit ≤ 574 ft (175 m)[(a)]	
		Main pipe length	The main pipe (a) from the mini outdoor unit to the first Y-joint should be less than 361 ft (110 m)	
		Total length	The sum of the total length of pipes should be less than 984 ft (300 m)	
Maximum allowable height difference	Mini outdoor unit to indoor units	Height	H1: Height difference between a mini outdoor unit and indoor unit < 164 ft (50 m)	
			H2: Height difference between indoor units ≤ 49 ft (15 m)	
Maximum allowable length after Y-joint		Actual length	The distance between the first Y-joint and the farthest indoor unit ≤ 131 ft (40 m) Example: b+c–f+g ≤ 131 ft (40 m)	The distance between the first Y-joint and the farthest indoor unit ≤ 131 ft (40 m) Example: 8 indoor units b+c, d+g ≤ 131 ft (40 m)

(a) If the equivalent length between a mini outdoor unit and the farthest indoor unit exceeds 295 ft (90 m), increase the main gas pipe by one size.

Figure 11. Distribution header connection

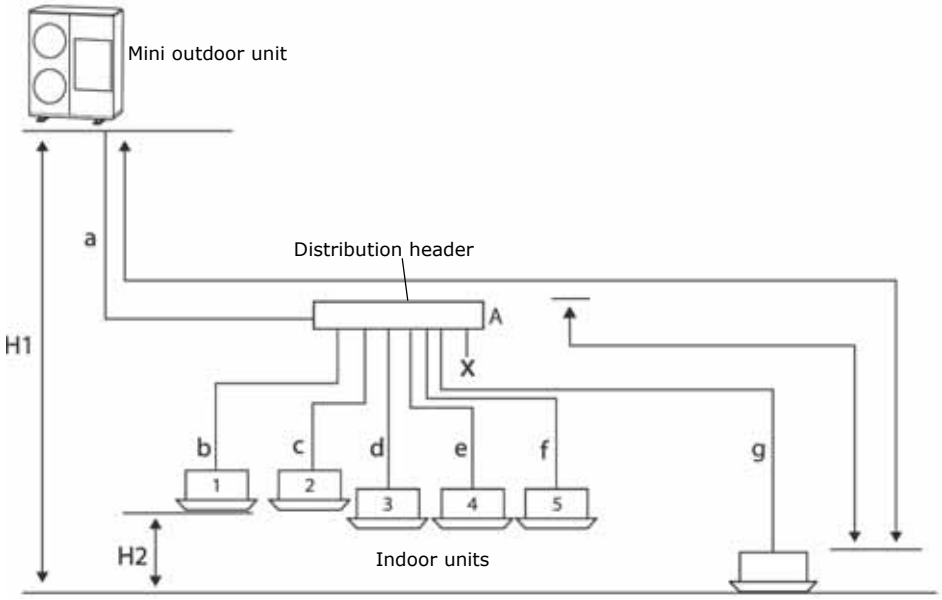
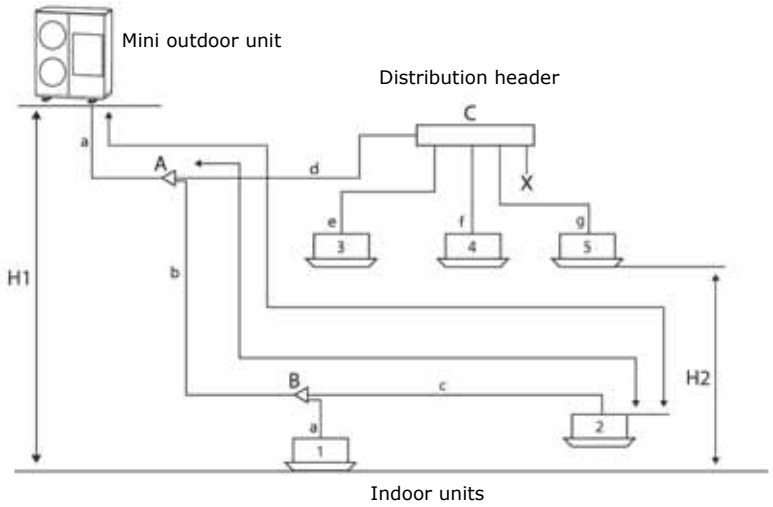


Figure 12. Y-joint and distribution header connection



Storing Refrigerant Piping

To prevent foreign materials or water from entering the pipe, storing method and sealing method (especially during installation) is very important. Apply correct sealing method depending on the environment (see Table 10).

Table 10. Refrigerant pipe storage factors

Storage location	Storage time	Sealing type
Outdoor	Longer than one month	Pipe pinch
	Shorter than one month	Taping
Indoor	—	Taping

Evacuating Refrigerant

The mini outdoor unit ships with the following amount of refrigerant. Evacuate the unit of all ship-with refrigerant before installing refrigerant piping.

Ship-with refrigerant amount by unit type		
3 ton unit	**4 ton unit**	**5 ton unit**
7.1 lbs	7.1 lbs	7.3 lbs

Installing Refrigerant Piping

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

NOTICE:

System Component Damage!

Do not remove the seal caps from refrigerant connections, or open the service valves until prepared to braze refrigerant lines to the connections. Excessive exposure to atmosphere (> 5 min.) may allow moisture or dirt to contaminate the system, damaging valve seals and causing ice formation in system components.

Overview

1. Cut or extend field-supplied piping as needed. To extend pipes, braze or using flared pipe connections (not supplied). Refer to “Pipe Cutting” p. 18, “Nitrogen Flushing While Brazing” p. 19, and “Flared Pipe Connections” p. 19.)
2. Make sure that pipes are free of dirt, debris, and moisture, and do not leak. (Refer to “Leak Testing Pipe Connections” p. 29).
3. Braze or use flared pipe connections to install piping. Refer to “Connecting Piping to the Mini Outdoor Unit” p. 21).

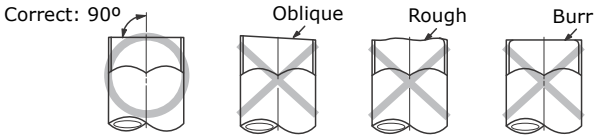
Pipe Cutting

Required tools:

- Pipe cutter
- Reamer
- Pipe holder

1. Using a pipe cutter, cut the pipe so that the cut edge is at 90° to the side of the pipe.
2. Use a reamer to remove all burrs at the cut edge.

   Examples of correctly and incorrectly cut pipes.



Nitrogen Flushing While Brazing

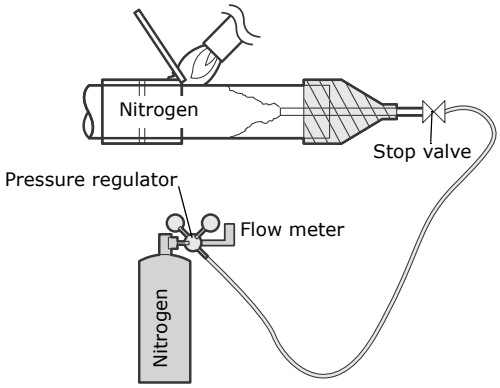
NOTICE

Avoid Unit Damage!

Never braze pipe connections without performing nitrogen flushing. Failure to perform this procedure will damage the unit, resulting in capacity loss and reduced long-term reliability.

While brazing refrigerant pipes, flush them with nitrogen gas. Use a pressure regulator to maintain a flow rate of 1.76 ft^3/h (0.05 m^3/h) or more.

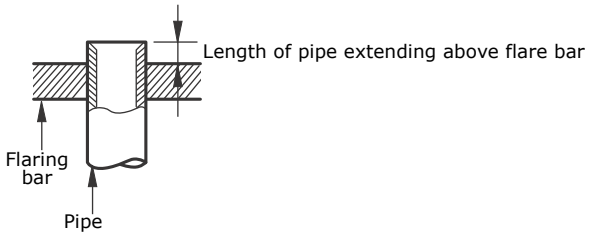
Figure 13. Nitrogen flushing while brazing refrigerant pipes

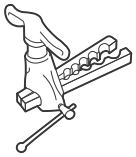


Flared Pipe Connections

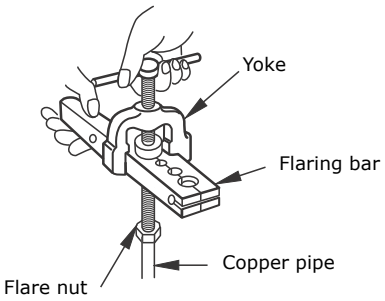
Clutch type and wing nut type flare tools are available for flared pipe connections.

1. Slide the flare nut over the pipe to be flared.
2. Slide the end of the pipe into the hole on the flaring bar that fits the pipe, leaving a length of pipe, determined by tool type (see table), extending above the flaring bar. Clamp it down.

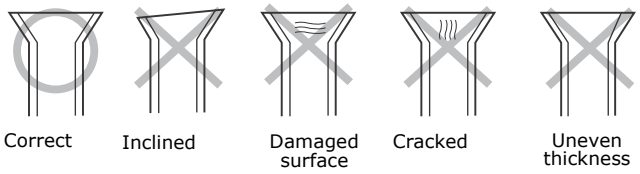


R-410A clutch type	Conventional flare tool	
	Clutch type	Wing nut type
0–0.020 in.	0.04–0.06 in.	0.06–0.08 in.
		

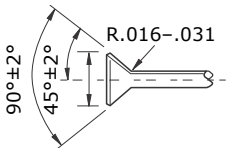
3. Attach the yoke to the flaring bar, centering the conical part over the end of the pipe that is extending above the flaring bar.
4. Tighten the yoke securely to flare the end of the pipe.



5. Remove the pipe. The end of the pipe that you flared should look like the end of a trumpet. See examples of correctly and incorrectly flared pipes.



6. Align the pipes and tighten the flare nuts manually and then with a spanner torque wrench, applying the torque according to pipe dimensions:

Outer diameter in. (mm)	Connection torque (ft·lb)	Flare dimension (in.)	Flare shape (in.)
1/4 (6.35)	10.3–13.3 ft·lb	0.34–0.36	
3/8 (9.52)	25.1–31.0 ft·lb	0.50–0.52	
1/2 (12.70)	36.1–45.0 ft·lb	0.64–0.65	
5/8 (15.88)	50.2–60.5 ft·lb	0.76–0.78	

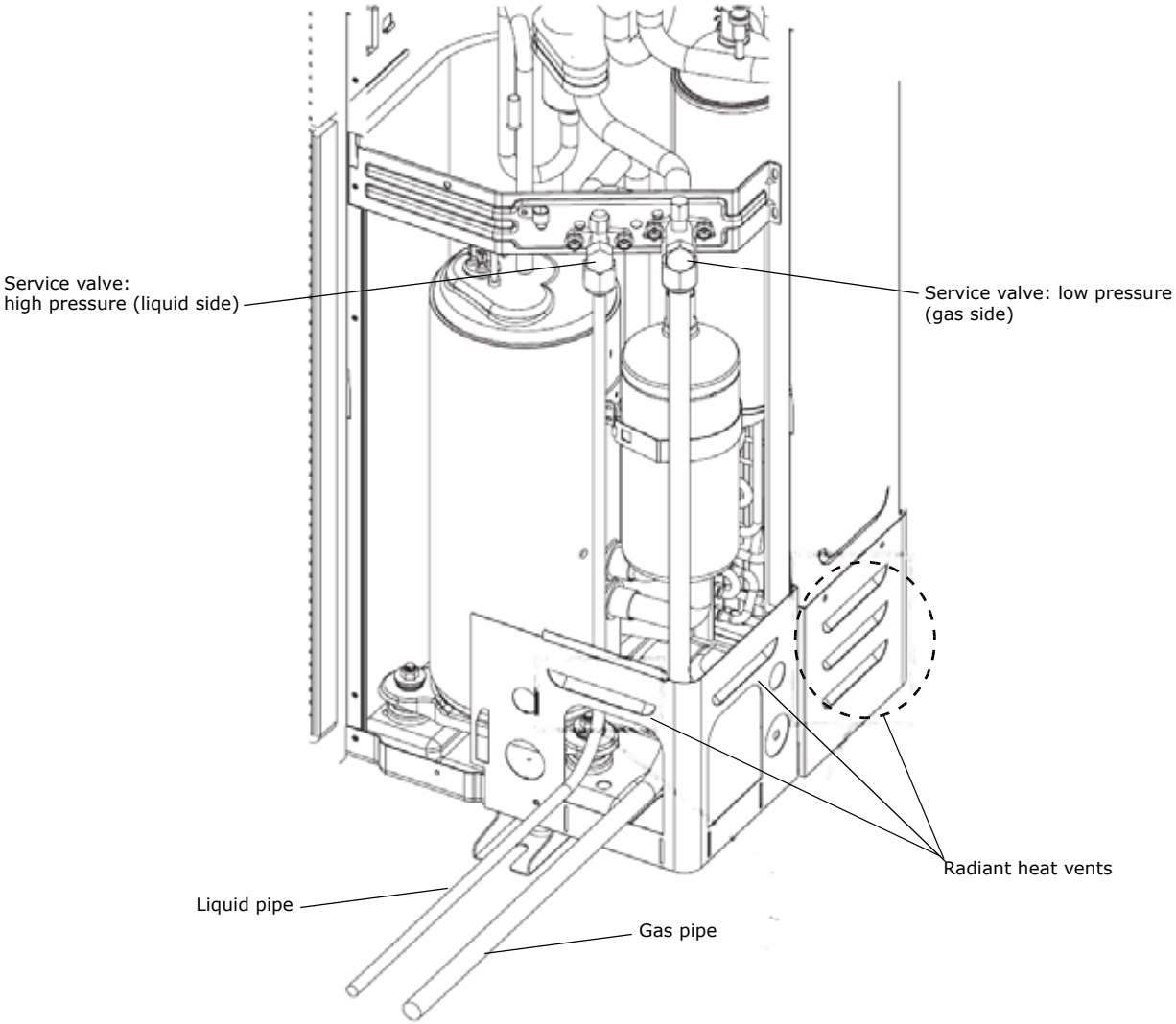
Connecting Piping to the Mini Outdoor Unit

Important: Ensure that all pipe connections are accessible for servicing and maintenance.

Pipes can be connected to the mini outdoor unit at the front, back, bottom, left, or right of the unit:

1. Remove the pipe cover from the unit. See Figure 14.

Figure 14. Pipe connections on unit

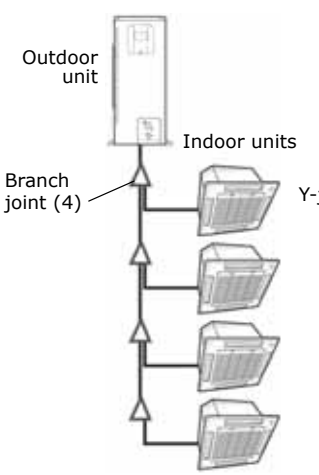


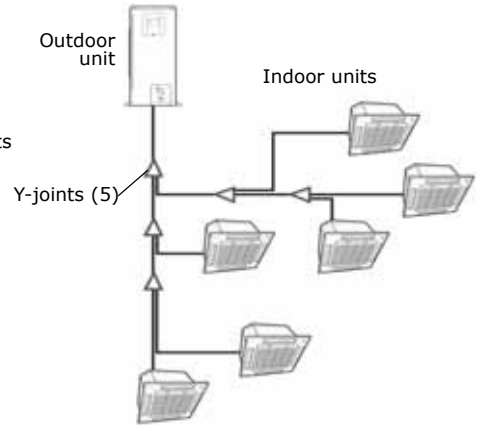
2. Remove the knock-out that you are going to use. Unused knock-outs should remain closed to prevent damage to the unit.
   - Take care to prevent damage to the exterior of the unit.
   - Remove burrs from knock-out hole edges and apply rust inhibitor.
3. Connect the pipes to the unit using flared connections or by brazing. If brazing the pipe connection, avoid damaging the service valves by wrapping them with a wet cloth.
   - Avoid damaging the temperature sensor.
   - Ensure that the connected pipes do not touch each other or make contact with the unit.

4. After making electrical connections (see “Electrical Wiring” p. 23) and insulating the pipes (see “Insulating Refrigerant Pipes” p. 32), replace the pipe cover and close the remaining gap. Make sure the radiant heat vents (Figure 14, p. 21) are not blocked.

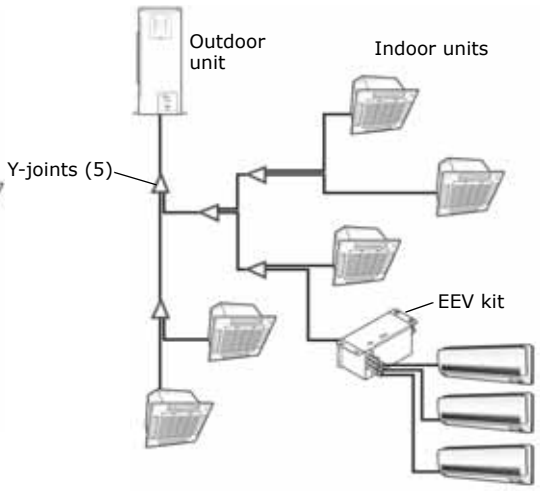
Refrigerant Piping Installation Examples

Example with Y-Joints

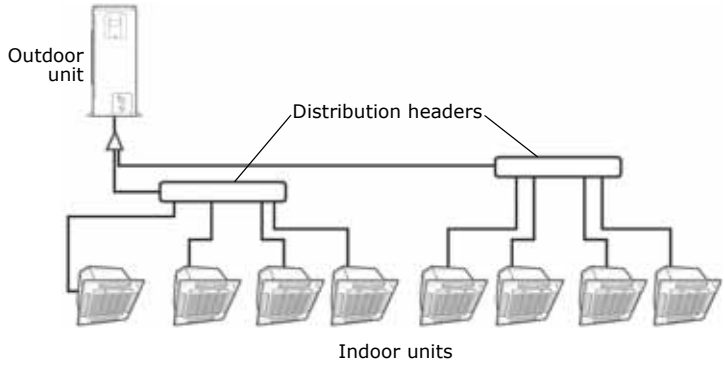




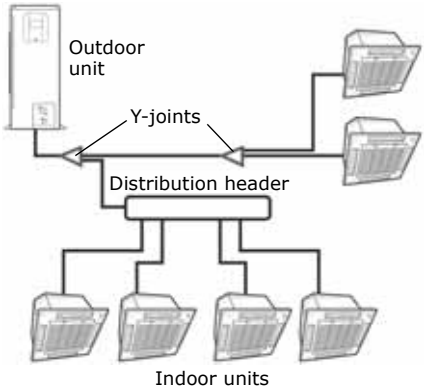
Example with Y-Joints and EEV Kit



Example with distribution headers



Example with Y-joints and distribution header



Electrical Wiring

Observe the following precautions when making electrical connections. Refer to wiring diagrams (Figure 15 and Figure 16).

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

NOTICE

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

- Make all electrical connections in accordance with electrical codes and ordinances.
- All wiring must be protected from weather and damage.
- Do not disconnect or change the factory wiring inside the unit.

Figure 15. Typical system installation wiring with internal EEV

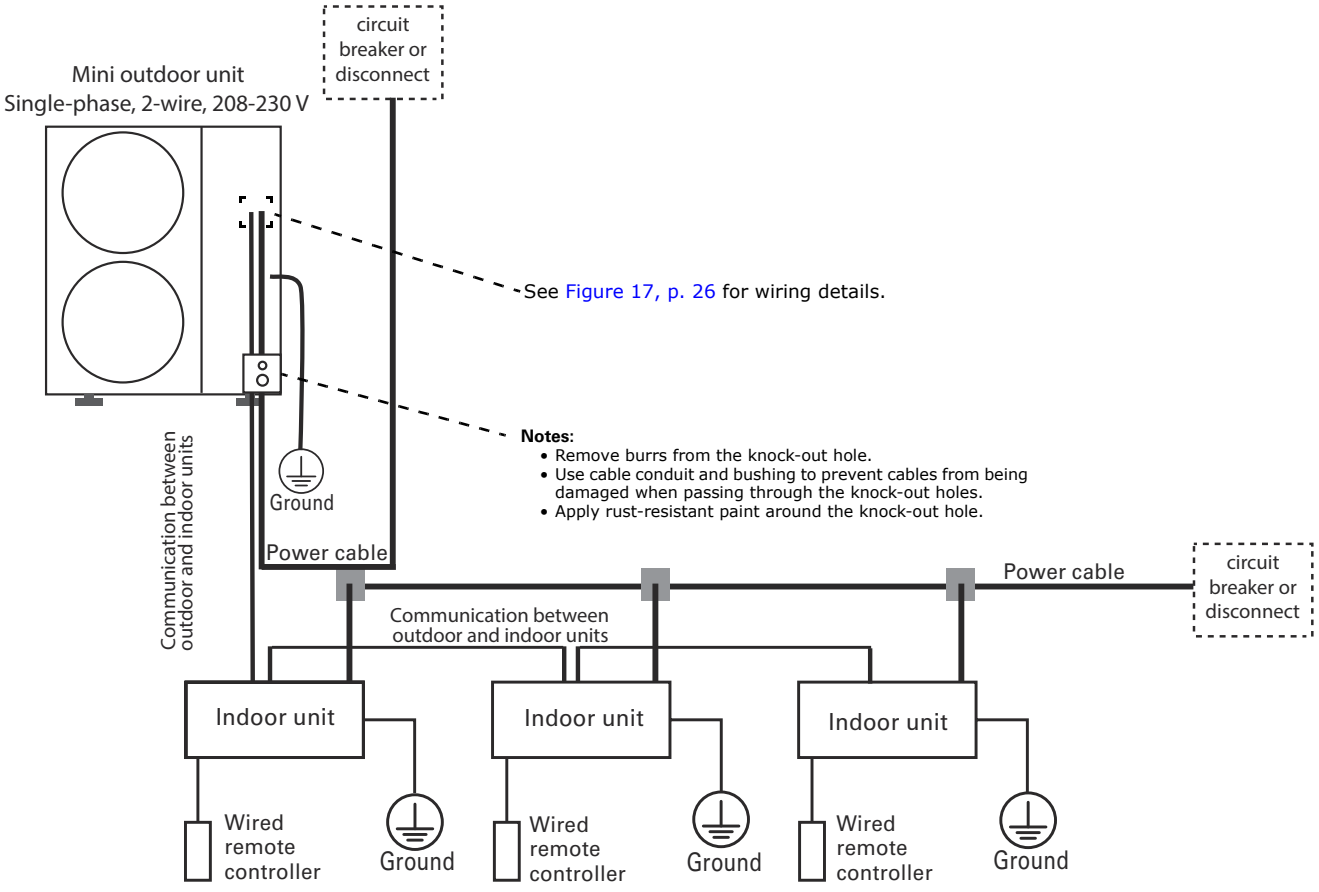
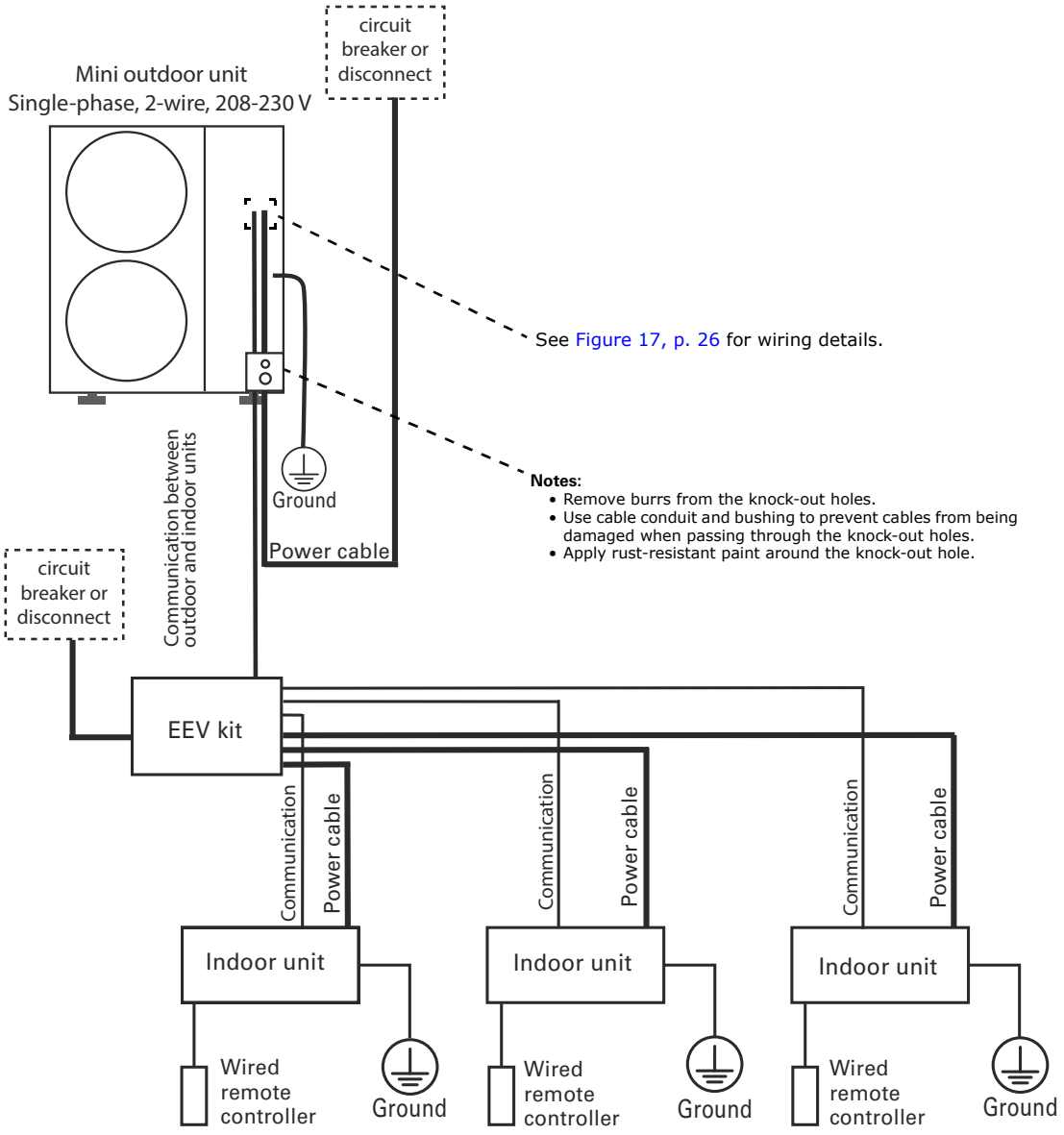


Figure 16. Typical system installation wiring with external EEV kit



Power Wiring

- Multi-pole circuit breaker or disconnect is required to fully isolate the unit from all power.
- Install circuit breakers/disconnects in accordance with local and national codes.
- Select the power cable in accordance with relevant local and national regulations.
- Power cable specifications are based on an underground/ambient temperature of 86ºF (30ºC) and single multi-conductor cables. If conditions are different from these, consult an electrical installation expert and re-select the power cable. If the length of power cable exceeds 164.04 ft (50 m), re-select the power cable considering the voltage drop.
- Do not use power cable that has exposed wire.
- Unbalanced power must be maintained within 10% of supply rating among all indoor units or the unit will stop and an error code will be generated. (Significantly unbalanced power may shorten the life of the system.)
- Use a power cable made out of incombustible material for the insulator (inner cover) and the sheath (outer cover).
- Provide strain relief for power cables.

⚠WARNING

Avoid Risk of Fire or Explosion!

Do not let the power cable come into contact with the pipes inside the outdoor unit. If the power supply cable touches the pipes, the vibration of the compressor will be transferred to the pipes and can damage the power supply cables or pipes. The damage could result in fire or explosion, causing death or serious injury.

Follow this procedure:

1. Refer to Table 11 for power cable and circuit breaker specifications, and Table 12 for conduit specifications.

Table 11. Circuit breaker and power cable specifications

	Power		RLA	FLA			
Model	Hz	V		Fan1	Fan2	MCA	MOP
4TVH0036B100NB	60	208/230	16.9	0.6	0.6	23	40
4TVH0048B100NB			22.1	0.6	0.6	29	50
4TVH0053B100NB			26.0	0.6	0.6	34	55

Notes:
- RLA is based on AHRI 210/240 cooling standard condition (indoor temperature: 80°F (26.7°C) DB/67°F (19.46°C) WB; outdoor temperature: 95°F (35°C) DB.
- Voltage tolerance is ± 10%.
- Maximum allowable voltage between phases is 2%.
- Abbreviations: RLA: Rated load ampere; FLA: Full load ampere; MCA: Minimum circuit amperes ; MOP: Maximum overcurrent protective device (amperes).

Table 12. Cable conduit specifications

Name	Temper grade	Application conditions
Flexible PVC conduit	PVC	If conduit is installed indoors and not exposed to outside elements (embedded in concrete)
Class 1 flexible conduit	Galvanized steel sheet	If conduit is installed indoors but exposed to outside elements
Class 1 PVC-coated flexible conduit	Galvanized steel sheet and soft PVC compound	If conduit is installed outdoors and requires waterproofing

2. Cut the power cable to an appropriate length and connect it to terminals L and N in the power supply box with a solderless ring terminal (see Figure 17).

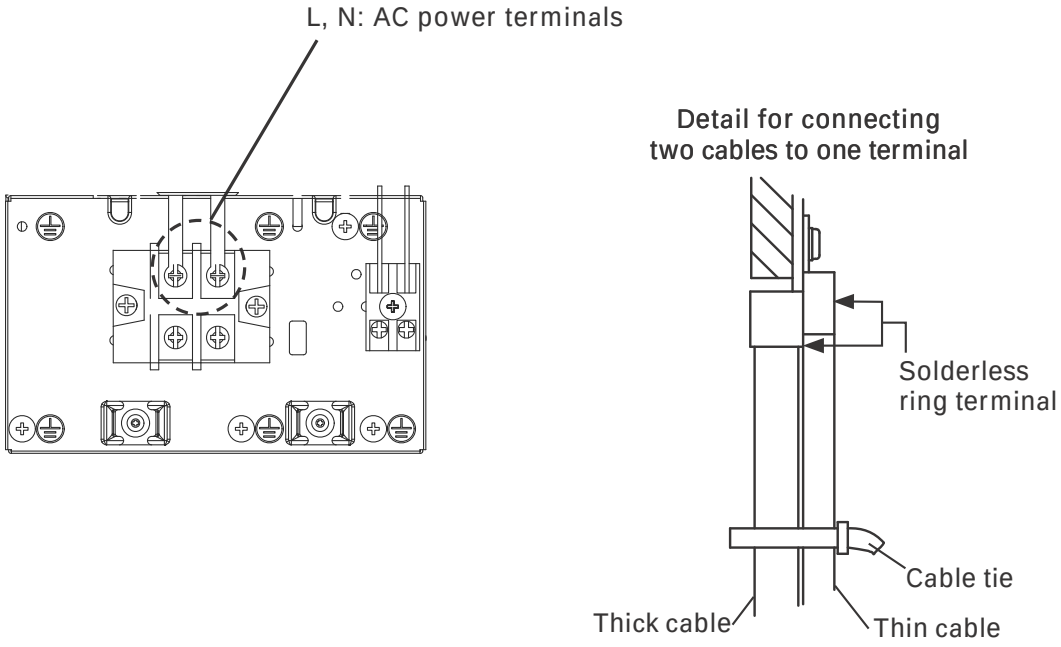
Screw	Tightening torque for terminal	Terminals
M4	0.9–1.1 lbf/ft (1.2–1.5 N·m)	Communication: F1, F2
M5	1.5–1.8 lbf/ft (2.0–2.5 N·m)	Single-phase AC power: L1, L2

3. If two cables are connected to one terminal, place the cables back to back with the thin cable upward and the thick cable downward, as shown in the detail in Figure 17.
4. Secure the cable(s) with a cable tie and provide strain relief.
5. Replace the cover on the terminal board.

   Note: Make sure that the section of the power supply cable that has the sheath removed is inside the power supply box. If this is not possible, connect the power cable conduit to the power supply box.

6. Pull the power cable through the designated knock-out at the bottom right of the mini outdoor unit (refer to Figure 15, p. 23/Figure 16, p. 24).

Figure 17. Power wiring connections

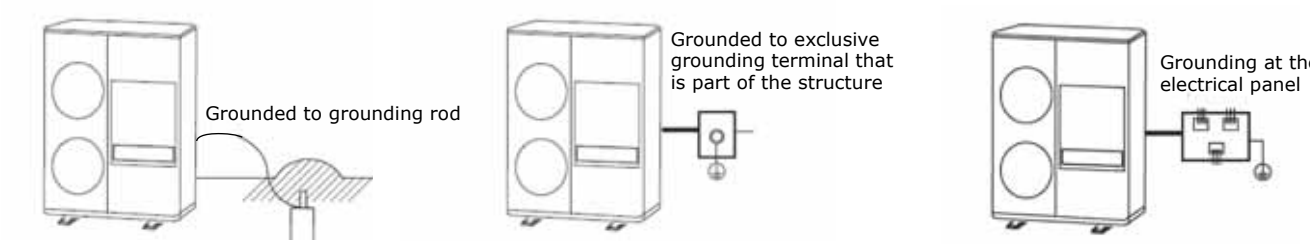


Grounding

Important: Grounding must be done by a qualified electrician. The unit cannot be ground by a gas or water pipe, a lightning rod, or a telephone line grounding wire.

Ground the unit at an exclusive grounding terminal, at the electrical panel (see Figure 18), or—if the power distribution circuit is not grounded or its grounding does not comply with electrical codes and specifications—to a grounding rod.

Figure 18. Mini outdoor unit grounding examples



Installing a Grounding Rod

If the installation requires a grounding rod is required, follow this procedure:

1. Select a grounding rod that complies with national and local codes.
2. Select a location for the grounding rod that:
   - Contains hard damp soil rather than loose sand or gravel.
   - Is located away from underground structures such as gas and water pipes, telephone lines, and underground cables.
   - Is at least 6.6 ft (2 m) away from a lightning conductor.
3. Install the grounding rod in accordance with national and local codes.
4. Proceed with "Installing the Grounding Cable."

Installing the Grounding Cable

1. Select rated grounding cable by referring to the mini outdoor unit power cable specifications (Table 11, p. 25).
2. Connect the grounding cable to the grounding hole inside the power supply box and pull it through the designated grounding knock-out.

   Note: If the grounding cable length needs to be extended, make the cable connection in accordance with national and local codes.
3. If a grounding rod was installed to ground the unit, measure the resistance with a ground resistance tester. Refer to Table 13 for resistance requirements.
   - If the resistance is above the requirements, drive the grounding rod deeper into the ground or increase the number of grounding rods until the resistance requirement is achieved.

- If you have grounded the unit to a grounding terminal or electrical panel, ensure that the resistance meets the requirements.

Table 13. Grounding resistance requirements

Power condition at installation site	High or average humidity	Low humidity
Voltage to ground is ≤ 150 V	• Ensure that the grounding resistance is <100 Ω. • If a circuit breaker is installed that disconnects the circuit within 0.5 seconds, the allowable grounding resistance is 30–500 Ω.	• Ideally, grounding resistance should be <100 Ω, and should not exceed 250 Ω.
Voltage to ground is > 150 V		• Ensure that the grounding resistance is <100 Ω. • If a circuit breaker is installed that disconnects the circuit within 0.5 seconds, the allowable grounding resistance is 30–500 Ω.

Communications Wiring

- Refer to BAS-SVX51 for communications wiring specifications and best practices.
- Refer to Table 12, p. 25 for cable conduit specifications.

⚠WARNING

Hazardous Voltage!

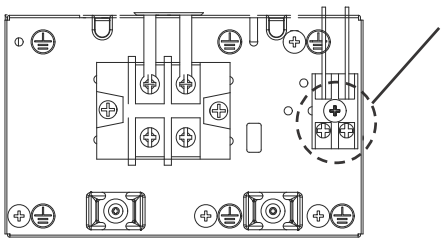
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Connect the communications cable wires to the terminals, as shown in Figure 19.

Notes:

- *Ensure that more than 1 in. (20 mm) of the outer sheath of the power and communication cable conduit are inside the electrical component box.*
- *To reduce interference, ensure that power and communication cables run in parallel with a minimum space of 2 in. (50 mm) between the cables or, if crossing is necessary, cross at 90 degrees.*
- *The communication cable between mini outdoor units and between indoor and outdoor units has no polarity.*

Figure 19. Communications board and wiring terminals



2. Provide strain relief for the communications cable.
3. Pull the communications cable through the designated knock-out at the bottom right of the mini outdoor unit (refer to Figure 15, p. 23/Figure 16, p. 24).

Leak Testing Pipe Connections

Before leak testing pipe connections, read all safety precautions and notes.

⚠WARNING

Confined Space Hazards!

Do not work in confined spaces where refrigerant or other hazardous, toxic or flammable gas may be leaking. Refrigerant or other gases could displace available oxygen to breathe, causing possible asphyxiation or other serious health risks. Some gases may be flammable and or explosive. If a leak in such spaces is detected, evacuate the area immediately and contact the proper rescue or response authority. Failure to take appropriate precautions or to react properly to such potential hazards could result in death or serious injury.

⚠WARNING

Explosion Hazard!

Never use an open flame to detect gas leaks. It could result in an explosion. Use a leak test solution for leak testing. Failure to follow recommended safe leak test procedures could result in death or serious injury or equipment or property-only-damage.

Use only dry nitrogen with a pressure regulator for pressurizing unit. Do not use acetylene, oxygen or compressed air or mixtures containing them for pressure testing. Do not use mixtures of a hydrogen containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units. Failure to follow these recommendations could result in death or serious injury or equipment or property-only damage.

Do not exceed unit nameplate design pressures when performing a leak test. Failure to follow these instructions could result in an explosion causing death or serious injury.

Notes:

- *All required piping pressure tests must be completed in accordance with national and/or local codes.*
- *When leak-testing refrigerant systems, observe all safety precautions.*
- *Leak test only one circuit at a time to minimize system exposure to potentially harmful moisture in the air.*
- *Use R-410A refrigerant gas as a tracer for leak detection and use oil-pumped dry nitrogen to develop required test pressures.*
- *Use tools rated for R-410A.*
- *Do not remove the valve core of the charging port.*
- *Perform the leak test with the outdoor unit service valves closed.*

Leak Testing Pipe Connections

Use the following procedure for leak testing pipe connections.

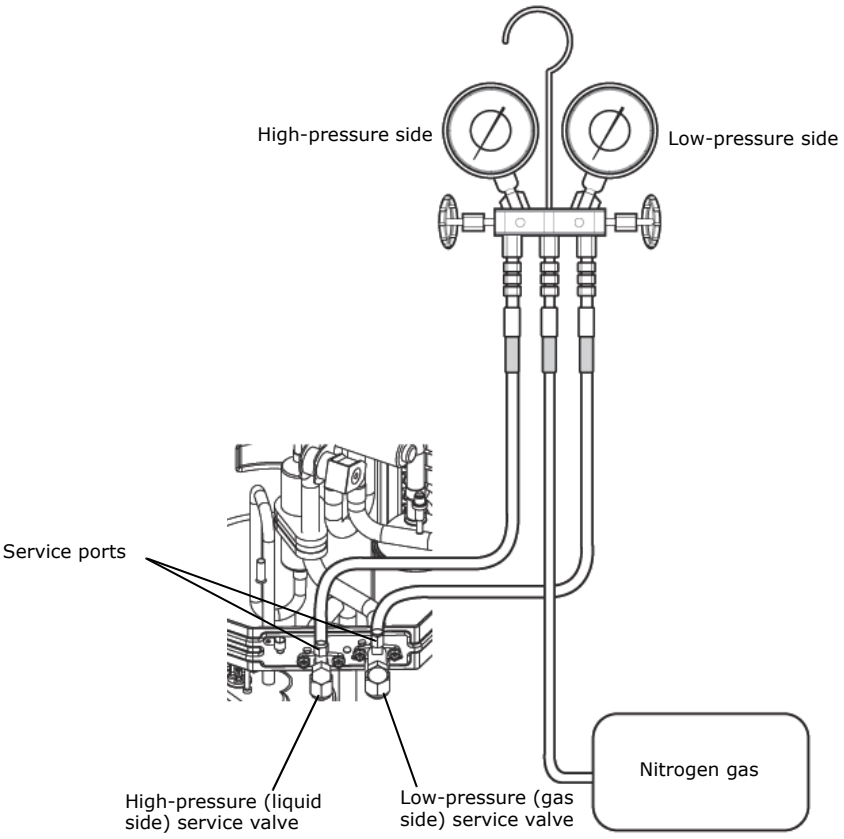
NOTICE

Refrigerant Pipe Damage!

When performing a leak test, use a pressure regulator to prevent an excess amount of nitrogen (over 594.6 psi [4.1 MPa]) from entering the pipes. If the pipe is filled with more than the specified amount of nitrogen in a short period of time, pipe damage may occur.

1. Connect the refrigerant manifold gauge hoses to the liquid side and gas side service ports on the unit, and connect the center hose to a nitrogen gas tank fitted with a pressure regulator (see Figure 20).

Figure 20. Leak testing pipe connections with a manifold gauge



2. Fill the lines with nitrogen to no more than 594.6 psi (4.1 MPa).
3. Monitor the pressure periodically for a minimum of 24 hours. If the pressure drops, use soapy water to check for leaks. Bubbles will occur if joints are not tight.
4. Release pressure in pipelines gradually.
5. Repair leaks.
6. Repeat the previous steps until the pressure remains constant.
7. Maintain 145 psi (1.0 MPa) of pressure for 15 minutes and check for further leakage. If the pressure drops, check for leaks and repair them. Repeat this step as necessary until 145 psi (1.0 MPa) of pressure is maintained for 15 minutes.
8. Remove hoses from service ports.

Vacuum Drying Procedure

After performing a successful leak test, follow this vacuum drying procedure:

Notes:

- *Use tools rated for R-410A.*
- *Use a vacuum pump that allows vacuuming under 29.7 inH_2O.*
- *Use a vacuum pump with an installed check valve so that pump oil is prevented from flowing into the pipes when the vacuum pump is stopped.*

1. Completely close both the liquid and the gas side service valves.
2. Connect the refrigerant manifold gauge hoses to the liquid side and gas side pipe service ports and connect the center hose to the vacuum pump.
3. Open both manifold gauge valves and turn on the vacuum pump. With vacuum pressure less than 29.7 inH_2O, allow the vacuum drying to continue for at least 2.5 hours.

   Note: More time may be needed depending on pipe length or outdoor temperature.
4. Close both manifold gauge valves to isolate the system. Then quickly shut off the vacuum pump.
5. Wait 1 hour. Then use the vacuum gauge to verify that the pressure remains at 29.7 inH_2O. If it has, proceed to Step 7.
6. If the pressure increases to over 29.7 inH_2O in an hour, either leaks or moisture remain in the pipes. Repair as necessary using the following procedure:
   a. Using a nitrogen gas tank fitted with a pressure regulator, attach hoses from the tank to the liquid side and gas side service ports on the unit (see location in Figure 20, p. 30).
   b. Apply nitrogen at 7.25 psi (0.05 MPa) to help remove moisture in the lines.
   c. Perform the vacuum drying procedure again (steps 1–3) for a minimum of 2 hours.
   d. Repeat the leak test and the vacuum drying procedure as necessary until the pressure remains at 29.7 inH_2O for 1 hour.
7. Proceed with insulating the pipes (p. 32) and charging the refrigerant (p. 34).

Insulating Refrigerant Pipes

After determining that there are no leaks in the refrigerant pipes, insulate them as described:

1. Use Table 14 to select the insulation thickness according to pipe size and humidity conditions.

Table 14. Pipe insulation selector

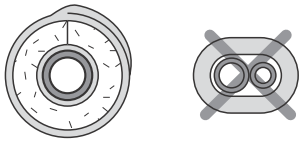
Pipe	Pipe size in. (mm)	Insulation Type	
		Standard conditions 86°F (30°C), < 85%	High humidity conditions[a] 86°F (30°C), ≥ 85%
		EPDM or NBR (in. (mm))	
Liquid pipe	1/4 (6.35) – 3/8 (9.52)	3/8 (9)	3/8 (9)
	1/2 (12.70) – 2 (50.80)	1/2 (13)	1/2 (13)
Gas pipe[b]	1/4 (6.35)	1/2 (13)	3/4 (19)
	3/8 (9.52)	3/4 (19)	1.0 (25)
	1/2 (12.70)		
	5/8 (15.88)		
	3/4 (19.05)		
	7/8 (22.23)		

(a) When installing insulation in any of the following environments, use insulation required for high humidity conditions: Buildings with close proximity to bodies of water or hot springs or on the side of a hill in which the building is partly covered by earth; ceilings frequently exposed to moisture such as in restaurants, saunas, swimming pools, and corridors of dormitories or studios near a frequently-used outdoor exit; buildings with no ventilation system.
(b) Internal temperature of gas pipe is higher than 248°F (120°C).

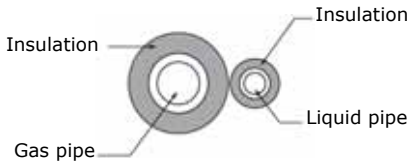
2. Wrap insulation around the entire surface of each pipe, including the refrigerant pipes from the indoor unit to the service valves inside the outdoor unit, the branch joints, distribution header, and connection points on each pipe.

   Note: For details on insulating branch joints, refer to the branch joint installation manual (VRF-SVN41).

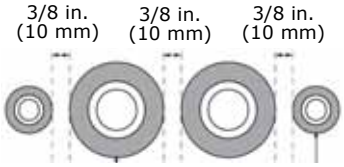
   - Do not wrap the gas and liquid refrigerant pipes together.



   - If gas and liquid pipes are in contact with one another, use thicker insulation and make sure the pipes are not pressing tightly against one another.

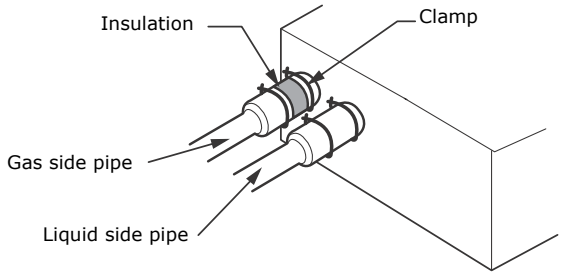


   - Pipe connections between the indoor unit and EEV kit: Leave 3/8 in. (10 mm) of space between gas and liquid side pipes.



- Overlap insulation to avoid gaps.
- Avoid compressing the insulation as much as possible.
- Be sure there are no cracks or deformities in the insulation at bends in pipes or where hangers are attached to pipes.
- If necessary, double the insulation to prevent condensation from forming in warm or humid areas.

3. Clamp insulation tightly to pipes.



4. Cut off excess insulation.

Refrigerant

After successful leak testing and vacuum drying, calculate the amount of refrigerant needed and then charge the system, as explained in this section.

Calculating the Refrigerant

The initial refrigerant quantity (given in Table 15) is charged into the unit at the factory.

Calculate the total amount of additional refrigerant to add to the system as follows:

Total additional refrigerant = [total length of 3/8 in. (0.52 mm) liquid piping x 2.12 oz (60 g)] + [total length of 1/4 in. (6.35 mm) liquid piping x 0.71 oz (20 g)] + [total refrigerant quantity for all connected indoor units (refer to Table 16)].

Table 15. Initial refrigerant quantity for each mini outdoor unit model

Model	4TVH0036B100NB (3 ton)	4TVH0048B100NB (4 ton)	4TVH0053B100NB (5 ton)
Initial refrigerant quantity: lb (kg)	7.1 (3.2)	7.1 (3.2)	7.3 (3.3)

Table 16. Refrigerant quantity for each indoor unit

	Capacity (MBH)											
	7.5	9	9.5	12	18	20	24	30	36	48	76.8	96
Model	Refrigerant quantity: lb (kg)											
1-way cassette (4TVE00**B100NB)	0.55 (0.25)		0.55 (0.25)	0.55 (0.25)								
Mini 4-way cassette (4TVB00**B100NB)			0.82 (0.37)	0.82 (0.37)	0.82 (0.37)	0.82 (0.37)						
4-way cassette (4TVC00**B100NB)		0.99 (0.45)			0.99 (0.45)		0.99 (0.45)	1.52 (0.69)	1.52 (0.69)	1.52 (0.69)		
Slim duct (4TVL00**B100NB)	0.53 (0.24)		0.53 (0.24)	0.53 (0.24)	0.99 (0.45)		0.99 (0.45)	0.93 (0.42)	0.93 (0.42)	1.37 (0.62)		
MSP duct (4TVD00**B100NB)					0.62 (0.28)		0.62 (0.28)	1.19 (0.54)	1.19 (0.54)	1.50 (0.68)		
HSP duct (4TVA00**B100NB)									1.50 (0.68)	1.50 (0.68)	2.60 (1.18)	2.60 (1.18)
High-wall (4TVW00**B100NB)	0.53 (0.24)		0.53 (0.24)	0.53 (0.24)	0.79 (0.36)	0.79 (0.36)	0.79 (0.36)					
Convertible ceiling/floor (4TVX00**B100NB)					0.86 (0.39)		0.86 (0.39)					

Charging the Refrigerant

After calculating the correct amount of refrigerant needed by the system (see “Calculating the Refrigerant” p. 34), charge the system as described in the following procedure:

⚠WARNING

Hazard of Explosion and Deadly Gases!

Do not heat the refrigerant container to speed up the charging process. An explosion could result, resulting in death or serious injury.

NOTICE

Risk of Unit Malfunction!

Do not leave the front panel open while charging refrigerant. If the front panel is open, the amount charged into the unit will be incorrect.

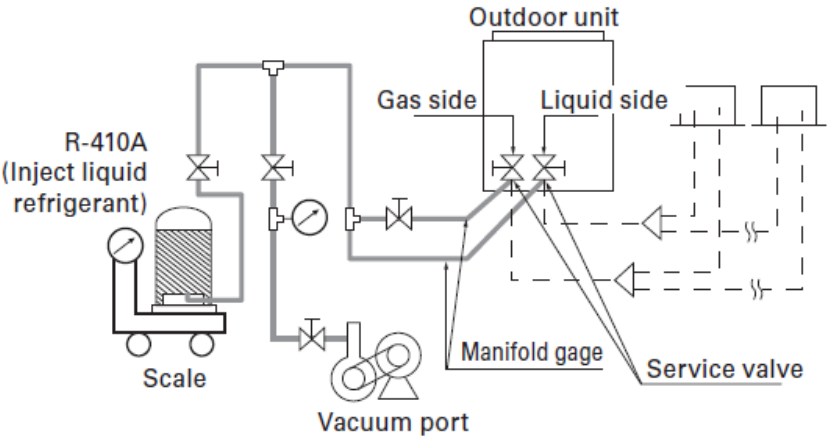
NOTICE

Unit Component Damage!

Open the gas side and liquid side service valves completely after charging the refrigerant. If you operate the unit with the service valves closed, the unit may be damaged.

1. Attach the liquid manifold hose to the liquid side service port and open the manifold gauge valve.
2. Add the liquid refrigerant, making sure the refrigerant bottle is held in an upright position. Use a scale to determine that the correct amount has been added.
3. Close the refrigerant container immediately after adding the refrigerant.
4. If you are unable to add all of the refrigerant needed into the liquid side, close the liquid side service port and remove the liquid manifold hose.
5. Attach the gas manifold hose to the gas side service port and open the manifold gauge valve.

Figure 21. Charging additional refrigerant



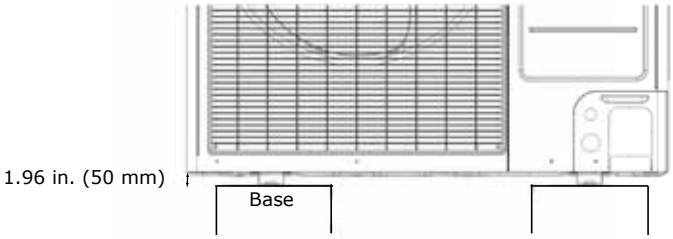
6. Press K2 once to initiate refrigerant charging in cooling mode.
7. To determine if the amount of refrigerant added is correct, use the automatic refrigerant function (see “Refrigerant detection operation” p. 46).
8. After charging the refrigerant, close the service valves and replace caps.

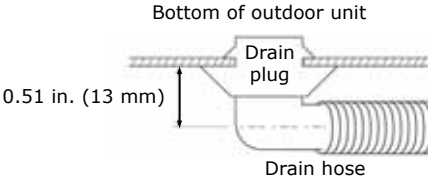
Connecting the Drain Hose

When using the air conditioner in the heating mode, ice may accumulate. When the unit is in defrost mode, condensed water must be safely drained away from the unit through a drain hose.

To install the drain hose:

Note: A minimum space of 1.96 in. (50 mm) must be allowed between the bottom of the mini outdoor unit and the supporting base to facilitate drain hose installation.





1. Insert the drain connector into the drain hole on the underside of the mini outdoor unit.
2. Connect the drain hose to the drain connector.
3. Plug the unused drain holes with drain plugs.

Control System

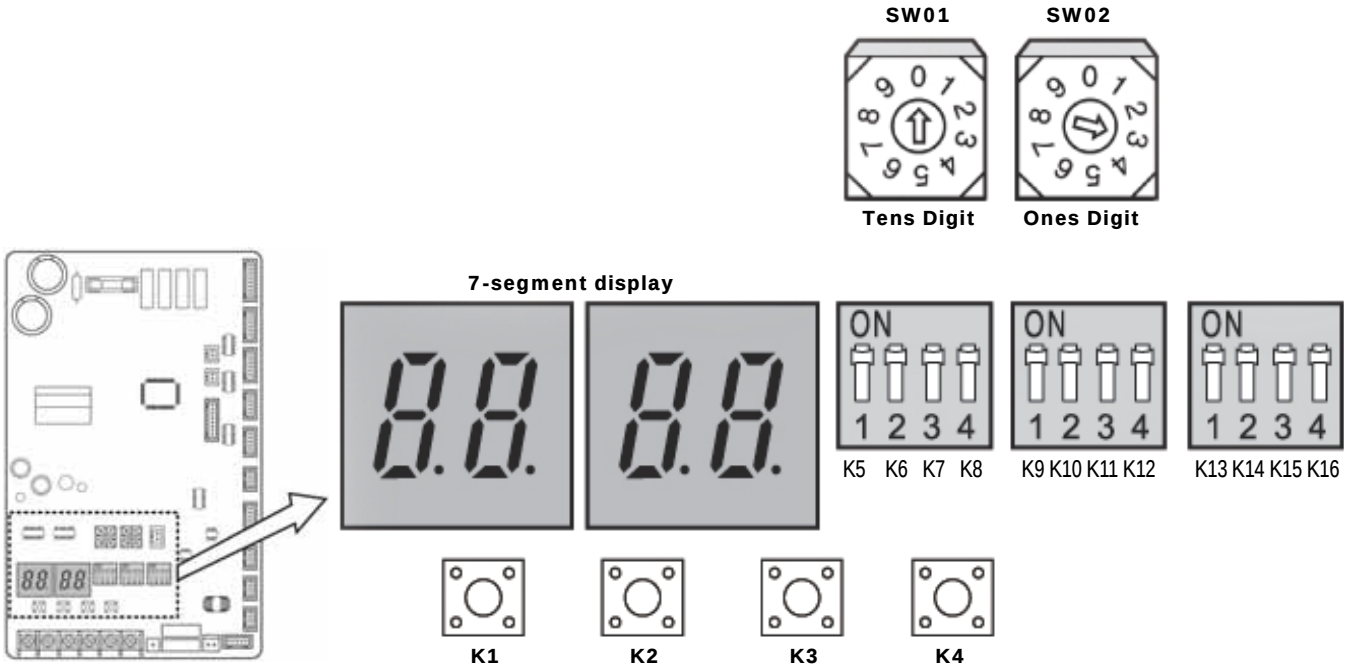
The control board contains a 7-segment display, three DIP switches, two rotary switches, and four buttons, as shown in Figure 22. Their functions are explained in this section.

⚠WARNING

Hazardous Voltage!

Before making contact with the inverter circuit board, wait for at least 15 minutes after powering down the mini outdoor unit to allow the unit to fully discharge high DC voltage. Failure to allow the high DC voltage to discharge completely could result in death or serious injury.

Figure 22. Control board



System Monitoring

The 7-segment display indicates system power and communication status.

Table 17. 7-segment display

Event	Digit 1	Digit 2	Digit 3	Digit 4
Power up[a]	"8"	"8"	"8"	"8"
Establishing communication between outdoor and indoor units	"A"	"d"	Number of connected indoor units	
Transmit/receive (normal operation)	Indoor unit: "A"	Indoor unit: "0"	Unit address (decimal number)	

(a) 7-segment display example showing power-up is shown in Figure 22.

Configuring the System

The control board contains two rotary switches and three DIP switches (shown in Figure 22). The following tables explain their functions.

Table 18. Configuration using rotary switches SW01 and SW02

SW01/SW02	Total number of installed indoor units
Tens digit/Ones digit	Use to set total number of installed indoor units. **Notes:** **1.** For example, if 3 indoor units are installed: Set SW01 to "0"; set SW02 to "3". **2.** Set at mini outdoor unit only.

Table 19. Configuration using DIP switches K5–K8

DIP switch	Setting	Function description
K5	Not used	Not used. Default is 0.
Snow prevention control		
K6	On	Disables snow prevention control (default).
	Off	Enables snow prevention control.[a]
Cooling capacity correction[b]		
K7	On	44.6–48.2°F (7–9°C) (default)
K8	On	
K7	On	41.0–44.6°F (5–7°C)
K8	Off	
K7	Off	48.2–51.8°F (9–11°C)
K8	On	
K7	Off	50.0–53.6°F (10–12°C)
K8	Off	

(a) If enabled, the mini outdoor unit fan will operate for 1 minute every 30 minutes to prevent snow build-up.
(b) Maintain optimal evaporating temperature in the cooling mode if long line lengths exist. Refer to cooling long pipe performance data in the technical data book. If you upgrade the performance at your discretion, low discharge air temperature of an indoor unit might cause discomfort.

Table 20. Configuration using DIP switches K9–K12

DIP switch	Setting	Function description
Night-time silent mode[a]		
K9	On	Disable
K10	On	
K9	On	Mode 1 3 ton: 600 rpm 4 ton: 600 rpm 5 ton: 620 rpm
K10	Off	
K9	Off	Mode 2 3 ton: 540 rpm 4 ton: 540 rpm 5 ton: 560 rpm
K10	On	
K9	Off	Mode 3 3 ton: 480 rpm 4 ton: 480 rpm 5 ton: 500 rpm
K10	Off	
Heating capacity correction[b],[c],[d],[e]		
K11	On	Default: 426.7 psi
K12	On	
K11	On	Default – 28.4 psi
K12	Off	
K11	Off	Default – 14.2 psi
K12	On	
K11	Off	Default + 14.2 psi
K12	Off	

(a) Reduces fan speed for quiet operation.
(b) Maintaining factory default status is recommended. However, if the desire is to reduce energy consumption or improve heating performance, control the operation according to the surrounding environment.
(c) As the target high pressure is decreased, energy consumption and noise may decrease but the indoor air discharge temperature will also decrease.
(d) Heating operation increases frequency when the current high pressure is higher than the target high pressure; and vice versa.
(e) If the target high pressure is high, the discharge air temperature of an indoor unit will increase, but energy consumption will also increase.

Table 21. System configuration using DIP switches K13–K16

DIP switch		Maximum current per unit model		
		4TVH0036B100NB 3 ton	4TVH0048B100NB 4 ton	4TVH0053B100NB 5 ton
		Current limit option		
K13	On	Maximum current default: 22 A	Maximum current default: 24 A	Maximum current default: 32 A
K14	On			
K13	On	Default – 4 A	Default – 2 A	Default – 2 A
K14	Off			
K13	Off	Default – 6 A	Default – 4 A	Default – 4 A
K14	On			
K13	Off	Default – 8 A	Default – 6 A	Default – 6 A
K14	Off			
Defrost optimization[a],[b],[c]				
K15	On	Default: Mid		
K16	On			
K15	On	Default: Mid		
K16	Off			
K15	Off	Low1		
K16	On			
K15	Off	Low2		
K16	Off			

(a) This option is used in locations where humidity is high and, as a result, defrost mode occurs frequently.
(b) Maintaining factory default status is recommended. If set to Low, the temperature at which it enters defrost mode will decrease. If the temperature at which it enters defrost mode decreases, the duration of defrost operation will increase. As a result, the overall heating capacity will be reduced.
(c) Defrost mode will start when the difference between the outdoor temperature and the outdoor coil temperature has exceeded its Δt.

Initiating System Operations

Buttons K1, K2, and K3 are used to initiate system operations. The first two digits of the 7-segment display respond as shown in the last column of the following tables.

Table 22. Button K1

Number of times K1 is pressed	Operation	7-segment display: Digits 1 and 2
1 (hold for 5 seconds)	Test operation	
1	Refrigerant charging in heating mode	
2	Test operation in heating mode	
3	Pump down in heating mode	
4	Vacuum	
5	Completion	Blank

Table 23. Button K2

Number of times button K2 is pressed	Operation	7-segment display: Digits 1 and 2
1	Refrigerant charging in cooling mode	
2	Test operation in cooling mode	
3	Pump down in cooling mode	
4	Refrigerant detection operation	
5	Completion	Blank

Table 24. Button K3

Number of times button K3 is pressed	Operation	7-segment display
1	Initialize (reset) operation	Same as power up: "8888"

Monitoring System Settings

Buttons K4 is used to monitor system settings and software versions.

Table 25. Button K4

Number of times button K4 is pressed	Setting	Description	7-segment display
			Digits 1, 2, 3, 4
1	Current frequency	15 Hz	1,0,1,5
2	Low pressure	37.0 psi (2.6 kg/cm^2)[(a)]	2,0,2,6
3	Outdoor temperature	74.3°F (23.5°C)	3,2,3,5
4	Discharge temperature	177.3°F (80.7°C)	4,8,0,7
5	OLP temperature	203°F (95°C)	5,9,5,0
6	COND Out temperature	79.3°F (26.3°C)	6,2,6,3
7	Double pipe out tube temperature	113°F (45°C)	7,4,5,0
8	High pressure value	221.9 psi (15.6 kg/cm^2)[(a)]	8,1,5,6
9	Fan speed	700 rpm	9,7,0,0
10	ESC(EVI)EEV	180 step	A,1,8,0
11	MAIN EEV	1500 step	B,1,5,0
12	Present running current	15 A	C,1,5,0
13	Number of connected indoor units	10	D,0,1,0
14	Number of operating mini outdoor units	8	E,0,0,8
15	Sum of indoor unit capacity	47,640 Btu/h (12,000 kcal/h)	F,1,2,0

(a) Gauge pressure

Table 26. Button K4 (press and hold for 3 seconds)

Number of times button K4 is pressed and held 3 seconds	Software version / Unit address	7-segment display		
		Version examples Digits 1, 2, 3, 4		
0	Main circuit board version	0,9,1,2		
1	Inverter board version	0,9,1,2		
2	EEPROM version	0,9,1,2		
		Digit 1	Digit 2	Digit 3, 4
		Address examples		
3	Automatically assigned unit addresses	A	0	0, 5
4	Manually assigned unit addresses	A	0	0, 1

Pre-Start Checks

After installation and before the test operation is conducted, perform the following pre-start checks:

NOTICE

Avoid Damage to the Communication Circuit!

Do not measure the communication terminal with an insulation tester. Doing so will damage the communication circuit.

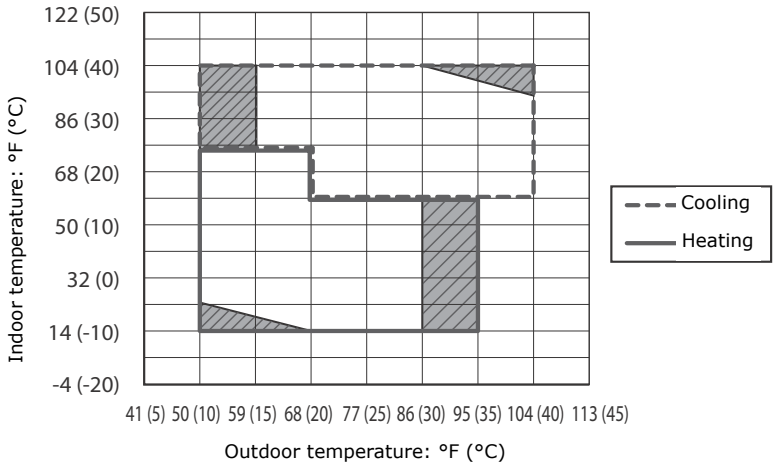
1. Ensure that the power and communication cables of the indoor and mini outdoor units are properly connected.
2. Before supplying power, use a resistance tester to verify that resistance to ground is greater than 30 MΩ .
3. Ensure that the indoor units are connected.
4. Check for a short-circuit between the communication terminal and ground.
5. Ensure that the pre-start checklist (Table 27) has been completed.

Table 27. Pre-start checklist

Installation	**Mini outdoor unit**	• Have you checked the external surface and the inside of the unit for damage? • Is there any possibility of short circuit due to the heat produced by the outdoor unit? • Is the place well-ventilated and meets recommended requirements for clearances and service? • Is the outdoor unit installed securely to withstand external forces?
	Indoor unit	• Have you checked the external surface and the inside of the indoor unit? • Is there enough space for service? • Have you ensured that the center of the indoor unit is installed horizontally and is level?
Refrigerant pipe		• Have you selected the correct pipes? • Are the liquid and gas valve open? • Is the total number of connected indoor units within the allowable range? • Are the length and the height difference between the refrigerant pipes within the allowable range? • Are the branch joints properly installed? • Has the connection of liquid and gas pipes been correctly performed? • Have you selected correct insulator for pipes and insulated them correctly? • Is the pipe or connection part properly insulated? • Is the quantity of the additional refrigerant correctly weighed in? (You must record the amount of additional refrigerant charging on the service record paper placed outside the outdoor unit.)
Drain pipe		• Have you checked whether the drain pipes of the indoor unit and outdoor unit are connected together? • Have you completed the drain test? • Is the drain pipe properly insulated?
Electrical		• Are the power cable and communication cable tightened firmly on the terminal board within the rated torque recommendations? • Have you checked for cross connection of the power and communication cables? • Have the outdoor unit been properly grounded? • Is the communication cable shielded? • Is the wire length within the recommended limit? • Is the wiring route correct?
Setting address		• Are the address of the indoor and outdoor units properly set? • Are the address of the indoor and outdoor units properly set, if multiple remote controllers are to be used?
Option		• Ensure that the vibration-isolation structure is correctly installed or if one needs to be installed.

Test Operation

After all pre-start checks (refer to “Pre-Start Checks” p. 43) have been have been completed, run the test operation under the following temperature conditions:



Notes:

- During the test operation, cooling/heating modes are selected automatically.
- Within the temperature range marked with hashed lines, system protection control may trigger during the test operation. If this occurs, test results may be inaccurate.
- When the temperature is outside of the guaranteed range, test accuracy may decrease to the borderline area shown in the graph.

⚠WARNING

Hazardous Voltage, Rotating Components!

Do not operate the product with the panel or duct outlet protection net off. There is risk of personal injury from parts that rotate or contain high voltage.

⚠CAUTION

Risk of Burn or Frostbit!

Refrigerant pipe may be hot or cold during or right after the operation depending on the status of the refrigerant which flows through the refrigerant pipe, compressor, and other parts of the refrigerant cycle. Do not touch the refrigerant pipe during or right after the operation to avoid getting burned our frostbit.

NOTICE

Avoid Unit Damage!

Wait at least 5 minutes before turning off the main power after the test operation is finished. If you do not, water leakage or other problems may occur.

Wait at least 3 hours after power is supplied to the outdoor unit before operating it to allow time for the crank case heater to pre-heat. If the crank case heater is not pre-heated before operation, unit parts are at risk of being seriously damaged.

1. Before powering the unit, heed the precautions given above for the test operation.

Note: When power is supplied to the outdoor unit, it will check for and verify communications with the indoor units.

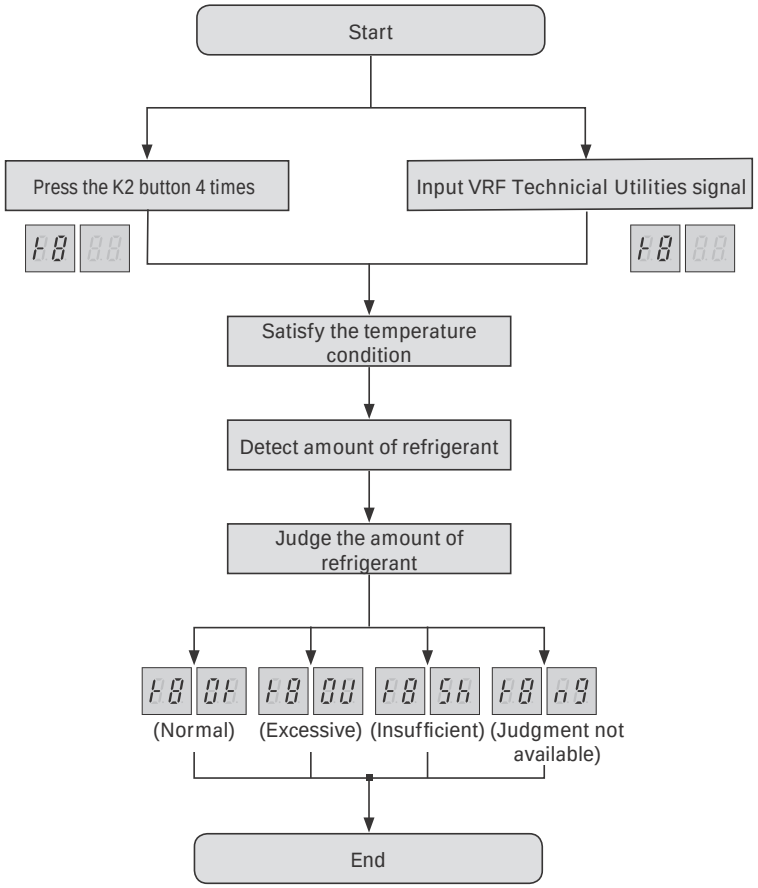
2. Ensure that the front of the outdoor unit is closed.
3. Press and hold button K1 for 5 seconds to run the test operation (see Table 22, p. 41.)
   - During the test operation, the compressor is restricted from operating.
   - **UP** (for "unprepared") will appear on the digital display. When the test operation has completed, the display will clear.
   - The test operation may continue from 30–50 minutes, depending on the operating status.
   - During the test operation, noise may occur due to valve inspection. (Examine the unit if abnormal noises continue to occur.)
4. When the test operation ends, use VRF Enterprise Management Software or VRF Auto-Commissioning Tool to issue a test results report. If any items in the report are marked with an "inspection required" sign, refer to the service manual for information on correcting the items and run the test operation again.
5. Ensure the following:
   - The system has the correct refrigerant amount (see "Refrigerant detection operation" p. 46) after the unit has been operating in cooling mode for at least 30 minutes
   - Cooling/heating operation runs normally.
   - Air flow direction and fan speed of indoor units runs normally.
   - There are no abnormal operating noises from indoor or outdoor units.
   - During cooling operation, the indoor units drain properly.
6. Use VRF Enterprise Management Software to check operating status details.
7. Explain to the user how to use the indoor unit and leave them with the indoor unit manual for their reference.

Refrigerant detection operation

Perform the refrigerant detection operation only under the following conditions:

- After the unit has been operating in cooling mode for at least 30 minutes.
- Within the following operating envelope:
  - Indoor: 68–86°F (20–30°C)
  - Outdoor: 41–109.4°F (5–43°C)

Failure to comply may result in the operation ending before completion or in inaccurate results. If the unit triggers protection control, the results may be inaccurate.



After the refrigerant detection operation is complete, take the following actions:

- If the amount of refrigerant is excessive, discharge 5% of the detected amount and restart the refrigerant amount detection operation.
- If the amount of refrigerant is insufficient, add 5% of the detected amount and restart the refrigerant amount detection operation.
- If the degree of supercooling is insufficient, add 10% of the detected amount of refrigerant and restart the refrigerant detection operation.
- If the result is unavailable, check that the refrigerant detection operation was conducted within the operating envelope stated above. Perform a test operation to determine if there are any other problems with the system.

Service: Pump Down Process

The pump down process pulls all of the refrigerant in the system into the outdoor unit condenser so that repairs can be made to the system.

Collecting Refrigerant into a Refrigerant Container

⚠WARNING

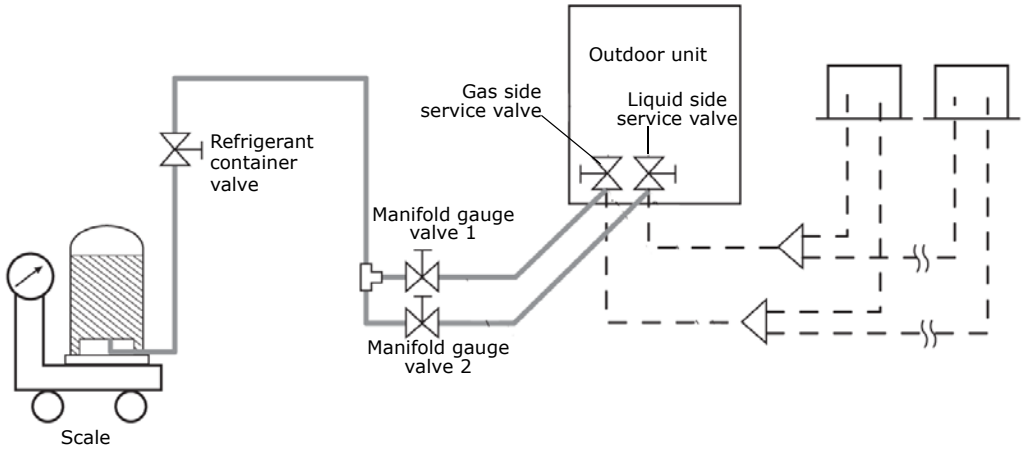
Refrigerant under High Pressure!

Failure to follow code concerning could result in an explosion which could result in death or serious injury or equipment damage. The refrigerant container used to collect refrigerant from the system must be one that is exclusively designed for that purpose.

The maximum amount of refrigerant that can be put into a mini outdoor unit is 176.4 oz. Because of this limitation, some of the refrigerant should be removed from the system to a refrigerant container before performing the pump down process.

1. Have ready an empty refrigerant container, a weighing scale, and a manifold gauge.
2. Determine through calculation the current amount of refrigerant in the system.
3. Connect the refrigerant container to the mini outdoor unit and operate 50% of all indoor units in cooling mode.

Figure 23. Removing refrigerant from the system to a refrigerant container



4. After 10 minutes of operation, use the manifold gauge to check the liquid side pressure. When the pressure is higher than 420.61 psig (2.9 MPa), decrease the number of operating indoor units.
5. Check the pressure again. When it has decreased to less than 420.61 psig (2.9 MPa), open the liquid side service valve and the manifold gauge valve that is connected to the liquid pipe to let the refrigerant run into the refrigerant container.

   Important: The amount of refrigerant that can be put into the refrigerant container should be approximately 50% of the total refrigerant in the system. Do not fill the refrigerant container more than 85% of its capacity (average temperature 77°F).
6. Use the scale to determine how much refrigerant that has been collected.
7. After the proper amount of refrigerant has been collected, turn off the manifold gauge valve and the liquid side service valve.

Pump Down Process

NOTICE

Equipment Damage!

Do not allow the amount of system refrigerant that is pulled into the outdoor unit during the pump down process to exceed the capacity of the outdoor unit or equipment damage may occur.

1. Follow the procedure for *"Collecting Refrigerant into a Refrigerant Container" p. 47*.
2. Press the K2 button on the outdoor unit control board three times to initiate the pump down process (Table 23, p. 41.)
3. Using a manifold gauge, observe the pressure drop when the compressor starts operating.
4. When the pressure reaches lower than 0 psig (0 MPa), turn off the gas side service valve.
5. Press the K3 button once.
6. Remove manifold gauge.

Warranty For Trane Advantage™ VRF Systems and Related Accessories

Products Covered. This warranty is extended by Trane, and applies to all Trane Advantage™ VRF systems and accessories for these products which are sold by Trane and applied in accordance with Trane specifications.

Basic Warranty

The warrantor warrants for a period of 12 months from the initial start-up or 18 months from date of shipment, whichever is less, against failure due to defects in material and manufacture and that it has the capacities and ratings set forth in Company's catalogs and bulletins ("Warranty").

If the following conditions are met, the warrantor extends this basic warranty period to five (5) years from date of start-up:

- The system is designed using an approved application tool (VRF Select).
- The system is installed by a contractor who has successfully completed a Trane factory training class.
- A verified commissioning report from the Trane VRF Commissioning Tool is submitted.

Exclusions and Limitations

Exclusions from this Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; modifications made by others to the Equipment; repairs or alterations by a party other than Company that adversely affects the stability or reliability of the Equipment; vandalism; neglect; accident; adverse weather or environmental conditions; abuse or improper use; improper installation; commissioning by a party other than Company; unusual physical or electrical or mechanical stress; operation with any accessory, equipment or part not specifically approved by Company; refrigerant not supplied by Company; and/or lack of proper maintenance as recommended by Company. Company shall not be obligated to pay for the cost of lost refrigerant or lost product. Company's obligations and liabilities under this Warranty are limited to furnishing replacement equipment or parts, at its option, FCA (Incoterms 2000) factory or warehouse (f.o.b. factory or warehouse for US domestic purposes) at Company-designated shipping point, freight-allowed to Company's warranty agent's stock location, for all non-conforming Company-manufactured Equipment (which have been returned by Customer to Company. Returns must have prior written approval by Company and are subject to restocking charge where applicable. Equipment, material and/or parts that are not manufactured by Company are not warranted by Company and have such warranties as may be extended by the respective manufacturer. **COMPANY MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, REGARDING PREVENTION OF MOLD/MOULD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES.** No warranty liability whatsoever shall attach to Company until Customer's complete order has been paid for in full and Company's liability under this Warranty shall be limited to the purchase price of the Equipment shown to be defective. EXCEPT FOR COMPANY'S WARRANTY EXPRESSLY SET FORTH HEREIN, COMPANY DOES NOT MAKE, AND HEREBY EXPRESSLY DISCLAIMS, ANY WARRANTIES, EXPRESS OR IMPLIED CONCERNING ITS PRODUCTS, EQUIPMENT OR SERVICES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF DESIGN, MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR OTHERS THAT ARE ALLEGED TO ARISE FROM COURSE OF DEALING OR TRADE.

Additional warranty protection is available on an extra-cost basis and must be in writing and agreed to by an authorized signatory of the Company. Additional terms and conditions of warranty coverage are applicable for refrigeration equipment. If you wish further help or information concerning this warranty, contact: Trane—Warrantor, 2701 Wilma Rudolph Blvd., Clarksville, TN 37040.

Warranty For Trane Advantage™ VRF Systems and Related Accessories

Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.

VRF-SVN33A-EN 31 May 2013
NEW

We are committed to using environmentally conscious print practices that reduce waste.