

SINGLE ZONE VERTICAL AIR HANDLING UNIT INSTALLATION MANUAL



LV181HV4 (18,000 Btu/h)
LV241HV4 (24,000 Btu/h)



LV361HV4 (36,000 Btu/h)



LV420HV (42,000 Btu/h)
LV480HV (48,000 Btu/h)

**Single-Zone Vertical Air
Handling Unit System**
18,000 - 48,000 Btu/h

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⊗ Do not throw away, destroy, or lose this manual.

Please read carefully and store in a safe place for future reference.

Content familiarity required for proper installation.

The instructions included in this manual must be followed to prevent product malfunction, property damage, injury, or death to the user or other people. Incorrect operation due to ignoring any instructions will cause harm or damage. The level of seriousness is classified by the symbols described below.

A summary list of safety precautions begins on page 3.

For more technical materials such as submittals, engineering databooks, and catalogs, visit www.lghvac.com.

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SAFETY INSTRUCTIONS

The instructions below must be followed to prevent product malfunction, property damage, injury or death to the user or other people. Incorrect operation due to ignoring any instructions will cause harm or damage. The level of seriousness is classified by the symbols described below.

TABLE OF SYMBOLS

 DANGER	This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	This symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
Note:	This symbol indicates situations that may result in equipment or property damage accidents only.
	This symbol indicates an action that must not be completed.

INSTALLATION

DANGER

 **Don't store or use flammable gas / combustibles near the unit.**
There is risk of fire, explosion, and physical injury or death.

WARNING

 **Do not install or remove the unit by yourself (end user).**
Ask the dealer or an LG trained service provider to install the unit.

Improper installation by the user may result in water leakage, fire, explosion, electric shock, physical injury or death.

For replacement of an installed unit, always contact an LG trained service provider.

There is risk of fire, electric shock, explosion, and physical injury or death.

The unit is shipped with refrigerant and the service valves closed.  **Do not open service valves on the unit until all non-condensibles have been removed from the piping system and authorization to do so has been obtained from the commissioning agent.**

There is a risk of physical injury or death.

 **Do not operate the compressor with the service valves closed.**

There is a risk of explosion, physical injury, or death.

Periodically check that the outdoor frame is not damaged.

There is a risk of explosion, physical injury, or death.

Confirm all control box and panel covers are secure and intact.

If cover panels are not installed securely, dust, water and animals may enter the unit, causing fire, electric shock, and physical injury or death.

Always check for system refrigerant leaks after the unit has been installed or serviced.

Exposure to high concentration levels of refrigerant gas may lead to illness or death.

Wear protective gloves and safety goggles when handling equipment. Sharp edges may cause personal injury.

Dispose the packing materials safely.

- Packing materials, such as nails and other metal or wooden parts, may cause puncture wounds or other injuries.
- Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.

Install the unit considering the potential for strong winds or earthquakes.

Improper installation may cause the unit to fall over, resulting in physical injury or death.

 **Do not change the settings of the protection devices.**

If the pressure switch, thermal switch, or other protection device is shorted and forced to operate improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, and physical injury or death.

 **Do not install the unit on a defective stand.**

There is a risk of physical injury.

SAFETY INSTRUCTIONS

INSTALLATION - CONTINUED

⚠ WARNING

If the air conditioner is installed in a small space, take measures to prevent the refrigerant concentration from exceeding safety limits in the event of a refrigerant leak. Consult the latest edition of ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers) Standard 15. If the refrigerant leaks and safety limits are exceeded, it could result in personal injuries or death from oxygen depletion.

Install the unit in a safe location where nobody can step on or fall onto it.

There is risk of physical injury or death.

Properly insulate all cold surfaces to prevent “sweating.”

Cold surfaces such as uninsulated piping can generate condensate that could drip, causing a slippery surface that creates a risk of slipping, falling, and personal injury.

⚠ CAUTION

Be very careful when transporting the product.

- ⓧ Do not attempt to carry the product without assistance.
- Some products use polypropylene bands for packaging. ⓧ Do not use polypropylene bands to lift the unit.
- Suspend the unit from the base at specified positions.
- Support the unit a minimum of four points to avoid slippage from rigging apparatus.

Note:

ⓧ Don't install the unit where it's directly exposed to ocean winds.

Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.

When installing the unit in a low-lying area, or a location that is not level, use a raised concrete pad or concrete blocks to provide a solid, level foundation.

This may prevent water damage and reduce abnormal vibration.

Properly insulate all cold surfaces to prevent “sweating.”

Cold surfaces such as uninsulated piping can generate condensate that may drip and cause a slippery surface condition and/or water damage to walls.

When installing the unit in a hospital, mechanical room, or similar electromagnetic field (EMF) sensitive environment, provide sufficient protection against electrical noise.

Inverter equipment, power generators, high-frequency medical equipment, or radio communication equipment may cause the air conditioner to operate improperly. The unit may also affect such equipment by creating electrical noise that disturbs medical treatment or image broadcasting.

ⓧ Do not use the product for special purposes such as preserving foods, works of art, wine coolers, or other precision air conditioning applications. The equipment is designed to provide comfort cooling and heating.

There is risk of property damage.

ⓧ Do not make refrigerant substitutions. Use R410A only. If a different refrigerant is used, or air mixes with original refrigerant, the unit will malfunction and be damaged.

Keep the unit upright during installation to avoid vibration or water leakage.

ⓧ Do not install the unit in a noise sensitive area.

When connecting refrigerant tubing, remember to allow for pipe expansion.

Improper piping may cause refrigerant leaks and system malfunction.

Take appropriate actions at the end of HVAC equipment life to recover, recycle, reclaim or destroy R410A refrigerant according to applicable U.S. Environmental Protection Agency (EPA) rules.

Periodically check that the outdoor frame is not damaged.

There is a risk of equipment damage.

Install the unit in a safe location where nobody can step on or fall onto it. ⓧ Do not install the unit on a defective stand.

There is risk of unit and property damage.

Install the drain hose to ensure adequate drainage.

There is a risk of water leakage and property damage.

ⓧ Don't store or use flammable gas / combustibles near the unit.

There is risk of product failure.

Always check for system refrigerant leaks after the unit has been installed or serviced.

Low refrigerant levels may cause product failure

The unit is shipped with refrigerant and the service valves closed. ⓧ Do not open service valves on the unit until all non-condensibles have been removed from the piping system and authorization to do so has been obtained from the commissioning agent.

There is a risk of refrigerant contamination, refrigerant loss and equipment damage.

ⓧ Do not run the compressor with the service valves closed.

There is a risk of equipment damage.

SAFETY INSTRUCTIONS

WIRING

DANGER

High voltage electricity is required to operate this system. Adhere to the National Electrical Codes and these instructions when wiring.

Improper connections and inadequate grounding can cause accidental injury or death.

Always ground the unit following local, state, and National Electrical Codes.

Turn the power off at the nearest disconnect before servicing the equipment.

Electrical shock can cause physical injury or death.

Properly size all circuit breakers or fuses.

There is risk of fire, electric shock, explosion, physical injury or death.

WARNING

The information contained in this manual is intended for use by an industry-qualified, experienced, certified electrician familiar with the U.S. National Electric Code (NEC) who is equipped with the proper tools and test instruments.

Failure to carefully read and follow all instructions in this manual can result in equipment malfunction, property damage, personal injury or death.

All electric work must be performed by a licensed electrician and conform to local building codes or, in the absence of local codes, with the National Electrical Code, and the instructions given in this manual.

If the power source capacity is inadequate or the electric work is not performed properly, it may result in fire, electric shock, physical injury or death.

Refer to local, state, and federal codes, and use power wires of sufficient current capacity and rating.

Wires that are too small may generate heat and cause a fire.

Secure all field wiring connections with appropriate wire strain relief.

Improperly securing wires will create undue stress on equipment power lugs. Inadequate connections may generate heat, cause a fire and physical injury or death.

SAFETY INSTRUCTIONS

OPERATION

DANGER

- ⊘ Do not provide power to or operate the unit if it is flooded or submerged.

There is risk of fire, electric shock, physical injury or death.

Use a dedicated power source for this product.

There is risk of fire, electric shock, physical injury or death.

WARNING

- ⊘ Do not allow water, dirt, or animals to enter the unit.

There is risk of fire, electric shock, physical injury or death.

Avoid excessive cooling and periodically perform ventilation to the unit.

Inadequate ventilation is a health hazard.

- ⊘ Do not touch the refrigerant piping during or after operation.

It can cause burns or frostbite.

- ⊘ Do not operate the unit with the panel(s) or protective cover(s) removed; keep fingers and clothing away from moving parts.

The rotating, hot, cold, and high-voltage parts of the unit can cause physical injury or death.

Periodically verify the equipment mounts have not deteriorated.

If the base collapses, the unit could fall and cause physical injury or death.

CAUTION

To avoid physical injury, use caution when cleaning or servicing the air conditioner.

Note:

Clean up the site after installation is finished, and check that no metal scraps, screws, or bits of wiring have been left inside or surrounding the unit.

- ⊘ Do not use this equipment in mission critical or special-purpose applications such as preserving foods, works of art, wine coolers or refrigeration. The equipment is designed to provide comfort cooling and heating.

Oil, steam, sulfuric smoke, etc., can significantly reduce the performance of the unit, or damage its parts.

- ⊘ Do not block the inlet or outlet.

Unit may malfunction.

- ⊘ Do not operate the disconnect switch with wet hands.

There is risk of fire, electric shock, physical injury or death.

If gas leaks out, ventilate the area before operating the unit.

If the unit is mounted in an enclosed, low-lying, or poorly ventilated area, and the system develops a refrigerant leak, it may cause fire, electric shock, explosion, physical injury, or death.

Periodically check power wiring for damage.

Power wiring must be replaced by the manufacturer, its service agent, or similar qualified persons in order to avoid physical injury and/or electric shock.

- ⊘ Do not open the inlet grille of the unit during operation.
- ⊘ Do not operate the unit with the panels or guards removed.
- ⊘ Do not insert hands or other objects through the inlet or outlet when the unit has power applied to it.
- ⊘ Do not touch the electrostatic filter, if the unit includes one.

The unit contains sharp, rotating, hot, and high voltage parts that can cause personal injury and/or electric shock.

Securely attach the electrical part cover to the indoor unit and the service panel to the outdoor unit.

Non-secured covers can result in burns or electric shock due to dust or water in the service panel.

Securely attach the electrical part cover to the indoor unit and the service panel to the outdoor unit.

Non-secured covers can result in malfunction due to dust or water in the service panel.

Periodically verify the equipment mounts have not deteriorated.

If the base collapses, the unit could fall and cause property damage or product failure.

- ⊘ Do not allow water, dirt, or animals to enter the unit.

There is risk of unit failure.

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GENERAL DATA

Unit Nomenclature

Indoor Units and Outdoor Units

	L	V	N	181	H	V	4
L = LG	↑	↑	↑	↑	↑	↑	↑
Frame Type:							
A: Art Cool™							
S: Standard							
C: Four-Way Ceiling-Cassette							
D: Ceiling-Concealed Duct (Low Static)							
H: Ceiling-Concealed Duct (High Static)							
V: Vertical-Horizontal Air Handling							
N: Indoor Unit							
U: Outdoor Unit							
No N or U: System							
Nominal Capacity							
(Nominal cooling capacity in Btu/h):							
18 = 18,000							
42 = 42,000							
24 = 24,000							
48 = 48,000							
36 = 36,000							
System Type:							
H = Heat Pump							
Style:							
SV = High Efficiency Inverter							
VP = Gallery							
YV = Premier							
EV = Mega							
V = Standard Inverter							
T = Thermostat Compatible							
Generation:							

GENERAL DATA

Specifications

Table 1: Vertical Air Handling Unit General Data.

Type	Vertical Air Handling Unit				
System Model (Indoor Unit / Outdoor Unit)	LV181HV4 (LVN181HV4/ LUU189HV)	LV241HV4 (LVN241HV4/ LUU249HV)	LV361HV4 (LVN361HV4/ LUU369HV)	LV420HV (LVN420HV/ LUU428HV)	LV480HV (LVN480HV/ LUU488HV)
Cooling Capacity (Min/Rated/Max) (Btu/h)	7,200 ~ 18,000 ~ 24,000	9,600 ~ 24,000 ~ 30,000	14,400 ~ 36,000 ~ 39,000	17,000 ~ 42,000 ~ 48,000	18,000 ~ 48,000 ~ 53,000
Cooling Power Input¹ (kW)	0.45 ~ 1.35 ~ 3.25	0.58 ~ 2.00 ~3.26	1.00 ~ 3.27 ~ 3.60	1.35 ~ 3.80 ~ 5.30	1.40 ~ 4.80 ~ 6.00
EER	13.30	12.0	11.0	11.05	10.00
SEER	19.2	19.5	18.0	17.0	16.5
Heating Capacity (Min / Rated / Max) (Btu/h)	8,000 ~ 20,000 ~ 24,000	10,800 ~ 27,000 ~ 30,000	16,000 ~ 40,000 ~ 43,000	18,000 ~ 47,000 ~ 55,000	19,000 ~ 56,000 ~ 60,000
Heating Power Input¹ (kW)	0.50 ~ 1.73 ~ 2.37	0.65 ~ 2.25 ~ 3.04	1.02 ~ 3.57 ~4.40	1.45 ~ 4.00 ~ 5.65	1.50 ~ 5.10 ~ 6.20
COP	3.40	3.52	3.28	3.44	3.22
HSPF	10.4	11.0	10.0	10.0	9.5
Maximum Heating Capacity (Btu/h)					
Outdoor 17°F (DB) / Indoor 70°F (DB)	21,000	26,000	37,350	37,000	40,000
Outdoor 5°F (DB) / Indoor 70°F (DB)	20,500	23,600	35,000	32,000	34,000
Power Input [W] @ Outdoor 5°F (WB)	3,100	3,290	5,620	4,800	5,250
Outdoor -4 °F(DB) / Indoor 70°F (DB)	19,910	20,760	32,220	24,000	26,000
Power Supply V, Ø, Hz	208-230 / 1 / 60				
Outdoor Unit Operating Range					
Cooling (°F DB)	5 to 118				
Optional Wind Baffle Cooling (°F DB)	Yes (-4)				
Heating (°F WB)	-4 to 64				
Indoor Unit Operating Range					
Cooling (°F WB)	57 to 77				
Heating (°F DB)	59 to 81				
Indoor Temperature Setting Range					
Cooling (°F DB)	65 to 86				
Heating (°F WB)	61 to 86				

EEV: Electronic Expansion Valve, IDU: Indoor Unit, ODU: Outdoor Unit. This unit comes with a dry helium charge.

This data is rated 0 ft above sea level, with 24.6 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.

Cooling capacity rating obtained with air entering the indoor coil at 80°F dry bulb (DB) and 67°F wet bulb (WB); and outdoor ambient conditions of 95°F dry bulb (DB) and 75°F wet bulb (WB).

Heating capacity rating obtained with air entering the indoor unit at 70°F dry bulb (DB) and 60°F wet bulb (WB); and outdoor ambient conditions of 47°F dry bulb (DB) and 43°F wet bulb (WB).

¹ Power Input is rated at high speed. Cooling range can be extended from 5°F down to -4°F using the Low Ambient Wind Baffle Kit (sold separately).

² All communication / connection (power) cable from the outdoor unit to the indoor unit

are field supplied and is to be a minimum four-conductor, 14 AWG, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of ODU only), and must comply with applicable local and national codes.

³ Take appropriate actions at the end of HVAC equipment life to recover, recycle, reclaim or destroy R410A refrigerant according to applicable regulations (40 CFR Part 82, Subpart F) under section 608 of CAA.

⁴ Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745 and are the same in both cooling and heating mode. These values can increase due to ambient conditions during operation.

⁵ Piping lengths are equivalent.

GENERAL DATA

Table 2: Vertical Air Handling Unit General Data, continued.

Type	Vertical Air Handling Unit				
System (Model) (Indoor Unit / Outdoor Unit)	LV181HV4 (LVN181HV4/ LUU189HV)	LV241HV4 (LVN241HV4/ LUU249HV)	LV361HV4 (LVN361HV4/ LUU369HV)	LV420HV (LVN420HV/ LUU428HV)	LV480HV (LVN480HV/ LUU488HV)
Unit Data					
Refrigerant Type ³	R410A				
Additional Refrigerant Charge (oz./ft.)	0.43				
Refrigerant Control	EEV				
Indoor Unit Sound Pressure Level (dB(A)) (H/M/L) ⁴	35 / 33 / 30	36 / 34 / 30	44 / 41 / 39	48 / 45 / 44	49 / 48 / 44
Outdoor Unit Sound Pressure Level (dB(A)) (Cool/Heat) ⁴	48 / 52	48 / 52	52 / 54	52 / 54	52 / 54
Indoor Unit Net / Shipping Weight (lbs.)	123.5 / 135.1	123.5 / 135.1	129 / 140	165 / 188	165 / 188
Outdoor Unit Net / Shipping Weight (lbs.)	129 / 141	130.0 / 143.3	198.9 / 223.1	203 / 232	203 / 232
Power Wiring / Communications Cable (No. x AWG) ²	4 x 14				
Power Supply (No. x AWG)	3 x 12	3 x 12	3 x 10	3 x 10	3 x 10
Compressor (Type x Qty.)	Twin Rotary x 1	Twin Rotary x 1	Scroll x 1	Twin Rotary x 1	Twin Rotary x 1
Dehumidification Rate (pts./hr.)	3.1	4.0	5.1	4.3	5.2
Fan					
Indoor Unit Type x Qty.	Sirocco				
Outdoor Unit Type x Qty.	Propeller x 1	Propeller x 1	Propeller x 2	Propeller x 2	Propeller x 2
Motor / Drive	ECM (Electronically Commutated Motor)			Brushless Digitally Controller / Direct	
Airflow Rate					
Indoor Unit (H / M / L [CFM])	640 / 580 / 480	710 / 640 / 480	990 / 880 / 800	1,260 / 1,100 / 1,000	1,400 / 1,260 / 1,000
Outdoor Unit (CFM)	2,048	2,048	1,942 x 2	1,942 x 2	1,942 x 2
Factory Set (High) External Static Pressure (in.wg)	Constant CFM @ 0.1" ~ 1.0" ESP			0.3	0.3
Piping					
Liquid (in.)	3/8				
Vapor (in.)	5/8				
Indoor Unit Condensate Drain O.D. / I.D. (in.)	Primary & Secondary: 3/4 FPT				
Minimum / Maximum Pipe Length (ft.) ⁵	6.6 / 164	6.6 / 164	6.6 / 246	6.6 / 246	6.6 / 246
Piping Length (no additional refrigerant, ft.)	24.6				
Maximum Elevation Difference (ft.)	98.4				

EEV: Electronic Expansion Valve, IDU: Indoor Unit, ODU: Outdoor Unit. This unit comes with a dry helium charge.

This data is rated 0 ft above sea level, with 24.6 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units.

Cooling capacity rating obtained with air entering the indoor coil at 80°F dry bulb (DB) and 67°F wet bulb (WB); and outdoor ambient conditions of 95°F dry bulb (DB) and 75°F wet bulb (WB). Heating capacity rating obtained with air entering the indoor unit at 70°F dry bulb (DB) and 60°F wet bulb (WB); and outdoor ambient conditions of 47°F dry bulb (DB) and 43°F wet bulb (WB).

1 Power Input is rated at high speed. Cooling range can be extended from 5°F down to -4°F using the Low Ambient Wind Baffle Kit (sold separately)

2 All communication / connection (power) cable from the outdoor unit to the indoor unit

are field supplied and is to be a minimum four-conductor, 14 AWG, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of ODU only), and must comply with applicable local and national codes.

3 Take appropriate actions at the end of HVAC equipment life to recover, recycle, reclaim or destroy R410A refrigerant according to applicable regulations (40 CFR Part 82, Subpart F) under section 608 of CAA.

4 Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745 and are the same in both cooling and heating mode. These values can increase due to ambient conditions during operation.

5 Piping lengths are equivalent.

Electrical Data

Table 3: Vertical Air Handling Unit ODU Electrical Data.

Nominal Tons	Model Name	Unit			Power Supply		Compressor Quantity	Compressor Motor RLA (Cooling)	Condenser Fan Motor(s)	
		Hz	Volts	Voltage Range	MCA	MOP			Condenser Fan Quantity.	Condenser Fan Motor FLA
1.5	LUU189HV	60	208/230	Min.: 187 Max.: 253	20	30	1	13.5	1	1.6
2.0	LUU249HV				20	30	1	13.5	1	1.6
3.0	LUU369HV				32	40	1	22.0	2	1.6 x 2
3.5	LUU428HV				32	40	1	21.0	2	1.6 x 2
4.0	LUU488HV				32	40	1	21.0	2	1.6 x 2

Voltage tolerance is $\pm 10\%$.

Maximum allowable voltage unbalance is 2%.

RLA = Rated Load Amps.

MCA = Minimum Circuit Ampacity.

Maximum Overcurrent Protection (MOP) is calculated as follows:
(Largest motor FLA x 2.25) + (Sum of other motor FLA) rounded down to the nearest standard fuse size.

GENERAL INSTALLATION GUIDELINES

Location Selection

Selecting the Best Location

⚠ DANGER

-  Do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak. These conditions can cause a fire, resulting in bodily injury or death.
-  Do not install the unit in a location where acidic solution and spray (sulfur) are often used as it can cause bodily injury or death.
-  Do not use the unit in environments where oil, steam, or sulfuric gas are present as it can cause bodily injury or death.

⚠ WARNING

Install a fence to prevent vermin from crawling into the unit or unauthorized individuals from accessing it. Follow the placement guidelines set forth in "Clearance Requirements."

⚠ CAUTION

When deciding on a location to place the outdoor unit, be sure to choose an area where run-off water from defrost cycle will not accumulate and freeze on sidewalks or driveways, which may create unsafe conditions. Properly install and insulate any drain hoses to prevent the hose from freezing, cracking, leaking, and causing unsafe conditions from frozen condensate.

Note:

 Indoor units (IDUs) must not be placed in an environment where the IDUs may be exposed to harmful volatile organic compounds (VOCs) or in environments where there is improper air make up or supply or inadequate ventilation. If there are concerns about VOCs in the environment where the IDUs are installed, proper air make up or supply and/or adequate ventilation must be provided. Additionally, in buildings where IDUs will be exposed to VOCs consider a factory-applied epoxy coating to the fan coils for each IDU.

Select a location for installing the outdoor unit that will meet the following conditions:

- Where there is enough structural strength to bear the weight of the unit.
- A location that allows for optimum air flow and is easily accessible for inspection, maintenance, and service.
- Where piping between the outdoor unit and indoor unit is within allowable limits.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in heating mode. Avoid placing the outdoor unit in a low-lying area where water could accumulate.
- If the outdoor unit is installed in a highly humid environment (near an ocean, lake, etc.), ensure that the site is well-ventilated and has a lot of natural light (Example: Install on a rooftop).

Don't

- Where it will be subjected to direct thermal radiation from other heat sources, or an area that would expose the outdoor unit to heat or steam like discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperatures.
- Where high-frequency electrical noise / electromagnetic waves will affect operation.

Where operating sound from the unit will disturb inhabitants of surrounding buildings.

- Where the unit will be exposed to direct, strong winds.
- Where the discharge of one outdoor unit will blow into the inlet side of an adjacent unit (when installing multiple outdoor units).

Planning for Snow and Ice

To ensure the outdoor unit operates properly, certain measures are required in locations where there is a possibility of heavy snowfall or severe wind chill or cold:

1. Prepare for severe winter wind chills and heavy snowfall, even in areas of the country where these are unusual phenomena.
2. Position the outdoor unit so that its airflow fans are not buried by direct, heavy snowfall. If snow piles up and blocks the airflow, the system may malfunction.
3. Remove any snow that has accumulated four (4) inches or more on the top of the outdoor unit.
4. In climates that may experience significant snow buildup, mount the outdoor unit on a raised, field-provided platform or stand. The raised support platform must be high enough to allow the unit to remain above possible snow drifts, and must be higher than the maximum anticipated snowfall for the location.

GENERAL INSTALLATION GUIDELINES

Location Selection

Planning for Snow and Ice, continued.

5. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit frame.
6. Provide a field fabricated snow protection hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces.
7. To prevent snow and heavy rain from entering the outdoor unit, install the condenser air inlets and outlets facing away from direct winds.
8. Consider tie-down requirements in case of high winds or where required by local codes.

⚠ CAUTION

When deciding on a location to place the outdoor unit, be sure to choose an area where run-off water from defrost cycle will not accumulate and freeze on sidewalks or driveways, which may create unsafe conditions. Properly install and insulate any drain hoses to prevent the hose from freezing, cracking, leaking, and causing unsafe conditions from frozen condensate.

Note:

Choose an area where run-off water from defrost cycle will not accumulate and freeze on sidewalks or driveways. Properly install and insulate any drain hoses to prevent the hose from freezing, cracking, leaking, and damaging the outdoor unit.

Note:

The indoor unit may take longer to provide heat, or heating performance will be reduced in winter if the unit is installed:

- | | |
|---|--|
| 1. In a narrow, shady location. | 3. In a highly humid environment. |
| 2. Near a location that has a lot of ground moisture. | 4. In an area in which condensate does not drain properly. |

GENERAL INSTALLATION GUIDELINES

Oceanside Applications

Tie-Downs and Wind Restraints

- The strength of the Single Zone system frame is adequate to be used with field-provided wind restraint tie-downs.
- The strength of the roof must be checked before installing the outdoor units.
- If the installation site is prone to high winds or earthquakes, when installing on the wall or roof, securely anchor the mounting base using a field-provided tie-down configuration approved by a local professional engineer.
- The overall tie-down configuration must be approved by a local professional engineer. Always refer to local code when using a wind restraint system.

Oceanside Applications

Use of a Windbreak to Shield from Sea Wind

Note:

Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.

- Avoid installing the outdoor unit where it would be directly exposed to ocean winds.
- Install the outdoor unit on the side of the building opposite from direct ocean winds.
- Select a location with good drainage.
- Periodically clean dust or salt particles off of the heat exchanger with water.
- If the outdoor unit must be placed in a location where it would be subjected to direct ocean winds, install a concrete windbreak strong enough to block any winds.
- Windbreak must be more than 150% of the outdoor unit's height. There must be 2 to 3-1/2 inches of clearance between the outdoor unit and the windbreaker for purposes of air flow.

Note:

Additional anti-corrosion treatment may need to be applied to the outdoor unit at oceanside locations.

Use of a Building to Shield from Sea Wind

If a windbreak is not possible, a building or larger structure must be used to shield the outdoor unit from direct exposure to the sea wind. The unit must be placed on the side of the building directly opposite to the direction of the wind as shown at right.

Figure 1: Oceanside Placement Using Windbreak.

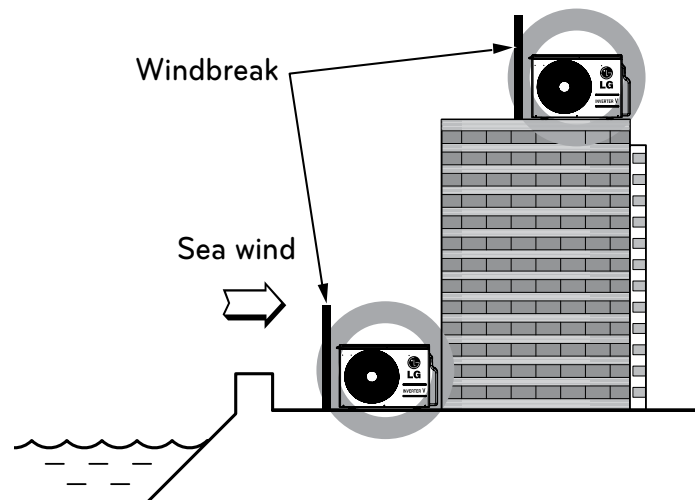
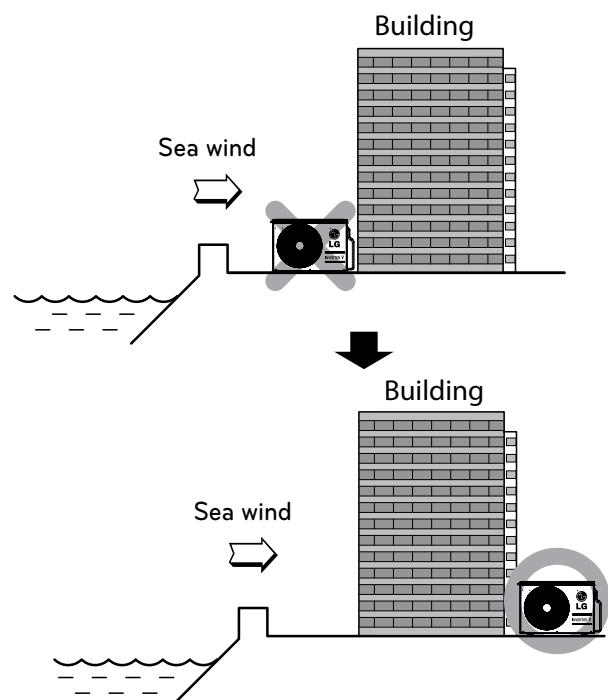


Figure 2: Placement Using Building as Shield.



GENERAL INSTALLATION GUIDELINES

Required Outdoor Unit Clearances

Minimum Clearance Requirements for Single Fan Outdoor Units

Proper clearance for the outdoor unit coil is critical for proper unit operation. When installing the outdoor unit, consider service, inlet and outlet and minimum allowable space requirements as illustrated in the diagrams below.

Specific clearance requirements in the diagram below are for single fan outdoor units. Figure 3 shows the overall minimum clearances that must be observed for safe operation and adequate airflow around the outdoor unit.

When placing the outdoor unit under an overhang, awning, sunroof or other “roof-like structure”, observe the clearance requirements (as shown in Cases 1 and 2 in Figure 3) for height in relation to the unit. This clearance ensures that heat radiation from the condenser is not restricted around the unit.

Adhere to all clearance requirements if installing the unit on a roof. Be sure to level the unit and ensure that the unit is adequately anchored. Consult local codes for rooftop mounting requirements. To have successful service access to the outdoor unit, see Figure 3 for minimum spacing. When installing multiple outdoor units, see Cases 4 and 5 in Figure 3 for correct spacing requirements. Outdoor unit fans draw air from the back of the unit and discharge out the front. Place units back to back and front to front.

Note:

If the outdoor unit is installed between standard and minimum clearances, capacity decreases approximately 10%.

Figure 3: Single Fan Outdoor Unit Service Access and Allowable Clearances Diagram.

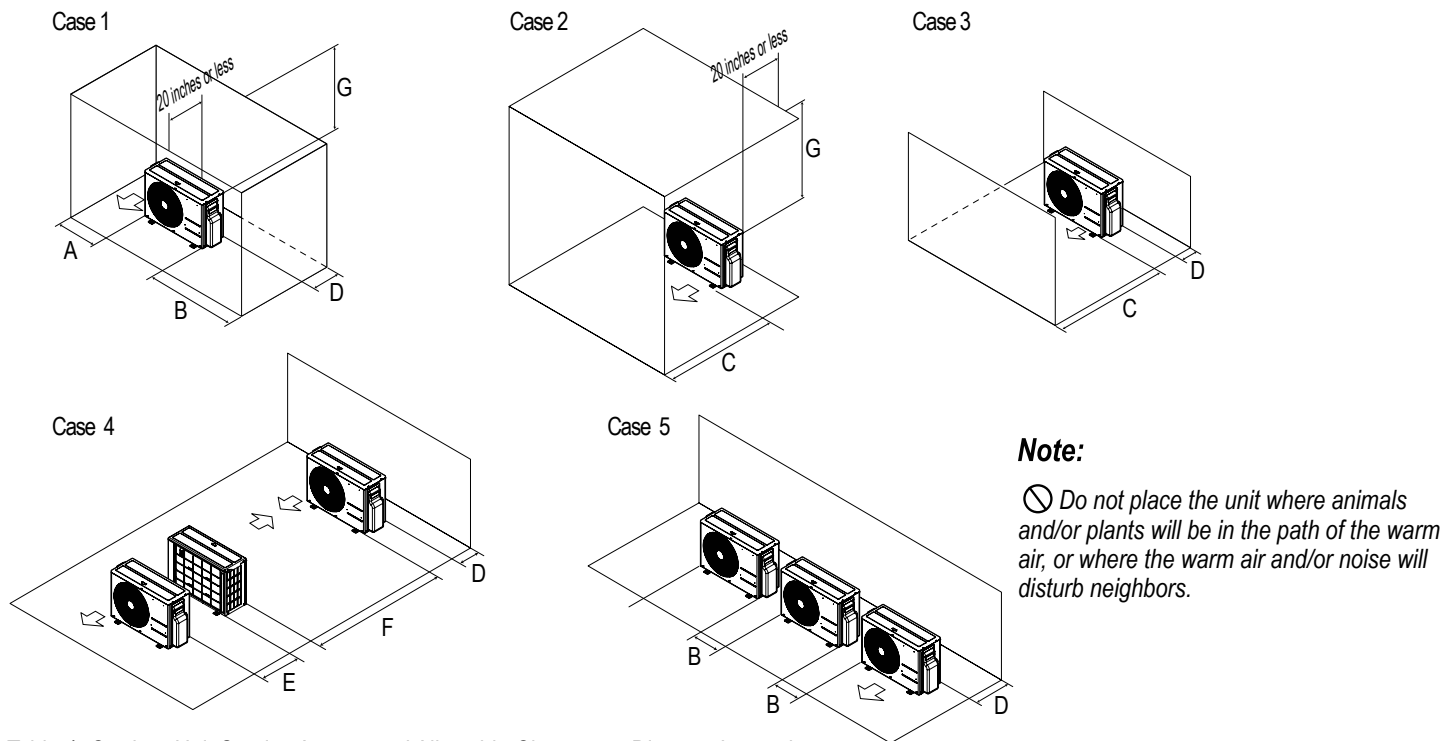


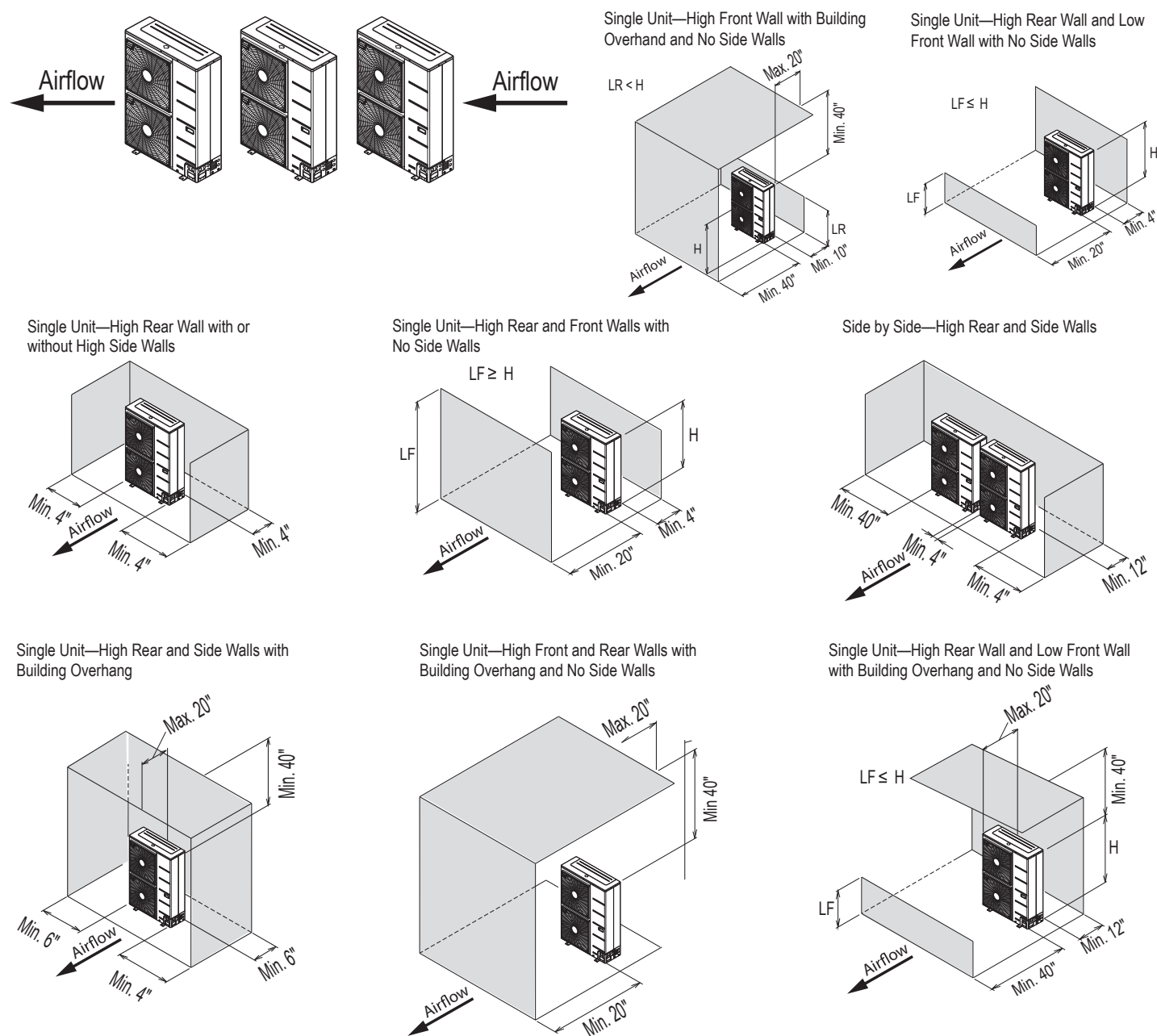
Table 4: Outdoor Unit Service Access and Allowable Clearances Diagram Legend.

Unit: Inch		A	B	C	D	E	F	G
Case 1	Standard	12	24	-	12	-	-	-
	Minimum	4	10	-	4	-	-	40
Case 2	Standard	-	-	20	-	-	-	-
	Minimum	-	-	14	-	-	-	40
Case 3	Standard	-	-	20	12	-	-	-
	Minimum	-	-	14	4	-	-	-
Case 4	Standard	-	-	-	12	24	-	-
	Minimum	-	-	-	4	8	79	-
Case 5	Standard	-	24	-	12	-	-	-
	Minimum	-	10	-	4	-	-	-

GENERAL INSTALLATION GUIDELINES

Required Outdoor Unit Clearances

Figure 3: Single Fan Outdoor Unit Service Access and Allowable Clearances Diagram - continued



GENERAL INSTALLATION GUIDELINES

Required Outdoor Unit Clearances

Minimum Clearance Requirements for Dual Fan Outdoor Units

Proper clearance for the outdoor unit coil is critical for proper unit operation. When installing the outdoor unit, consider service, inlet and outlet and minimum allowable space requirements as illustrated in the diagrams below.

Specific clearance requirements in the diagram below are for dual fan outdoor units. Figure 4 shows the overall minimum clearances that must be observed for safe operation and adequate airflow around the outdoor unit.

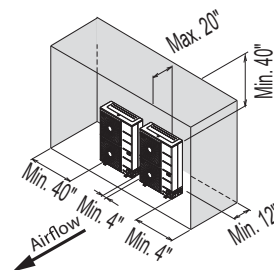
When placing the outdoor unit under an overhang, awning, sunroof or other “roof-like structure”, observe the specified clearance requirements for height in relation to the unit. This clearance ensures that heat radiation from the condenser is not restricted around the unit.

Adhere to all clearance requirements if installing the unit on a roof. Be sure to level the unit and ensure that the unit is adequately anchored. Consult local codes for rooftop mounting requirements.

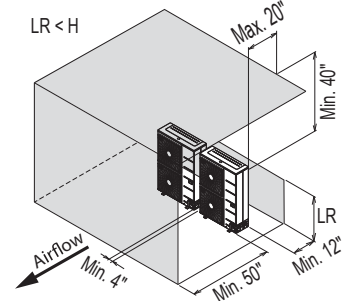
To have successful service access to the outdoor unit, see Figure 4 for minimum spacing. When installing multiple outdoor units, refer to the appropriate clearance diagram for your installation. Outdoor unit fans draw air from the back of the unit and discharge out the front. Place units back to back and front to front.

Figure 4: Dual Fan Outdoor Unit Service Access and Allowable Clearances Diagram.

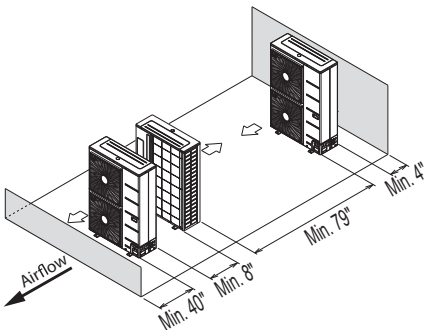
Side by Side—High Rear and Side Walls with Building Overhang



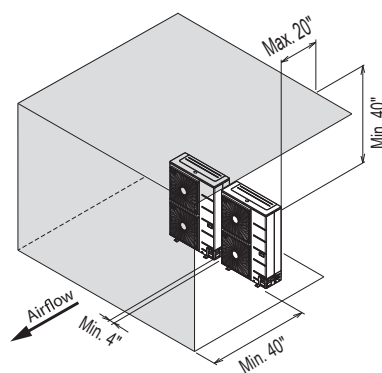
Side by Side—High Rear and Front Walls with Building Overhang



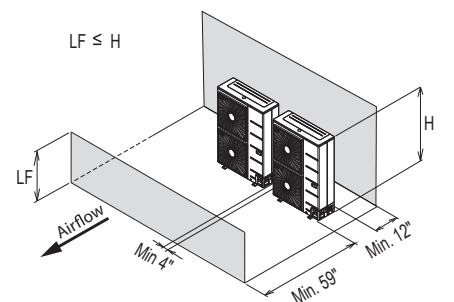
Single Row Units—High Rear Wall and Low Front Wall with No Side Walls or Overhang



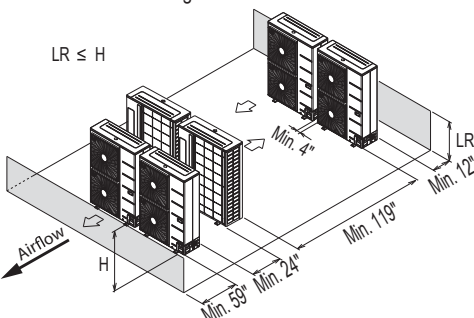
Side by Side—High Front Wall with Building Overhang and No Side or Rear Walls



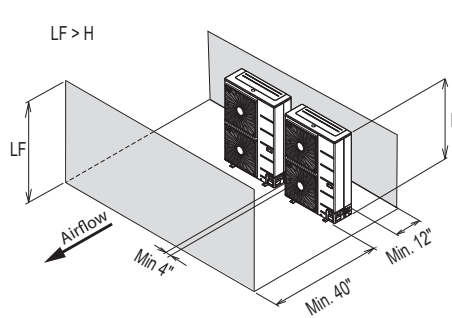
Side by Side—High Rear Wall and Low Front Wall with No Side Walls



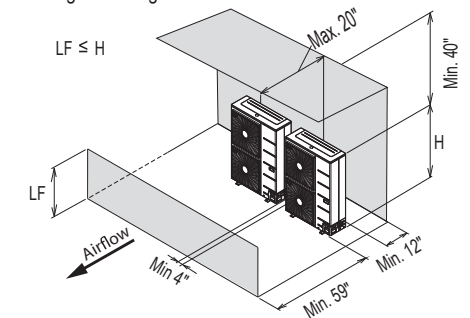
Double Row Units—Low Rear and Front Walls with No Side Walls or Overhang



Side by Side—High Front and Rear Walls with No Side Wall



Side by Side—High Rear Wall and Low Front Wall with Building Overhang and No Side Walls



GENERAL INSTALLATION GUIDELINES

Rigging and Lifting Instructions

⚠ WARNING

Wear protective gloves and safety goggles when handling equipment. Sharp edges may cause personal injury.

Dispose of the packing materials safely.

- Packing materials, such as nails and other metal or wooden parts, may cause puncture wounds or other injuries.
- Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.

⚠ CAUTIC

Be very careful when transporting the product. There is a risk of the product falling and causing physical injury.

- Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed.
- Some products use polypropylene bands for packaging. Ⓢ Do not use polypropylene bands to lift the unit.
- Support the outdoor unit at a minimum of four points to avoid slippage from rigging apparatus.

Note:

- Make sure the outdoor unit is in its original packaging to avoid damage during local transport.
- At the time of delivery, the package must be checked for any damage (exterior and interior). Report any damage to the carrier claims agent immediately.
- Handle the outdoor unit with care. Keep the outdoor unit upright to avoid damaging inside components.
- If a forklift is to transport the outdoor unit, the forklift arms must pass through the openings at the bottom.
- If a crane is to suspend the outdoor unit, it is recommended that two (2) ropes at least twenty-three (23) feet in length be used. Pass the ropes under the unit. Pass the rope through the two (2) forklift slots each at the front and rear of the outdoor unit.
- To prevent damage to the outdoor unit, always lift the unit with the ropes attached at four (4) points at an angle of $\leq 40^\circ$.
- Always include padding to protect the outdoor unit from rope damage, and take into consideration the outdoor unit's center of gravity.

Concrete Platform Specifications

- Concrete foundations must be made of one part cement, two parts sand, and four parts gravel.
- The surface of the foundation must be finished with mortar with rounded edges, and weather-proofed.

Anchoring the Outdoor Unit

- Tightly anchor the outdoor unit with a bolt and nut to a concrete or rigid platform.
- When installing on a wall (with field-supplied brackets), roof, or rooftop, securely anchor the mounting platform with nails, taking into consideration the possibility of strong winds or earthquakes.
- If there is a possibility of vibration from the outdoor unit transmitting to the building, add an anti-vibration material to the platform.

Figure 5: Example of Using an Insert for a Hole in a Reinforced Concrete Beam.

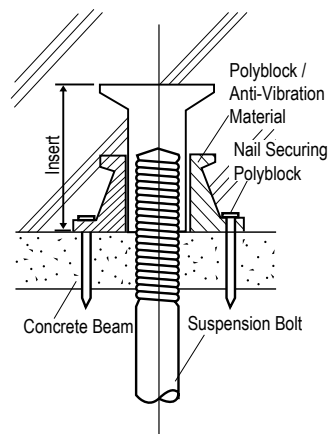
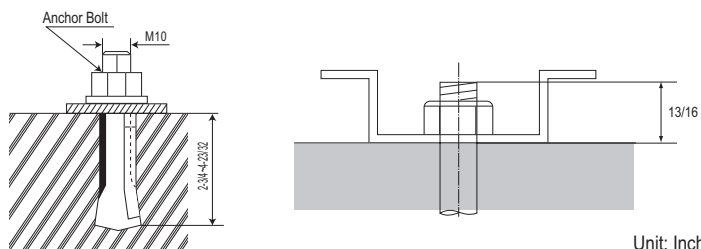


Figure 6: Close up of Bolt Attachment.



Unit: Inch

GENERAL INSTALLATION GUIDELINES

Outdoor Unit Platform Requirements

Outdoor Unit Foundation Requirements.

Figure 7: LUU189HV and LUU249HV Outdoor Units.

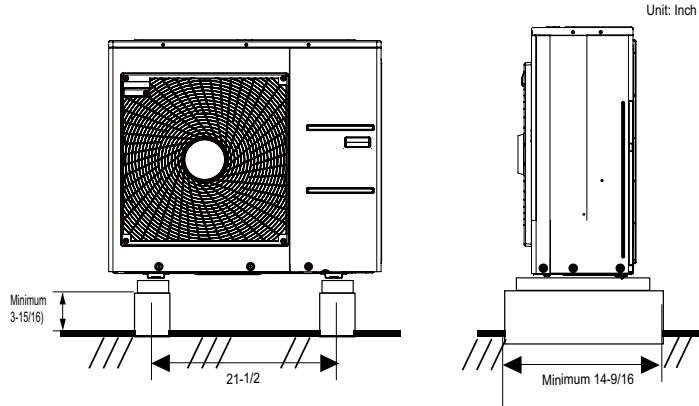


Figure 8: LUU369HV, LUU428HV, LUU488HV Outdoor Units.

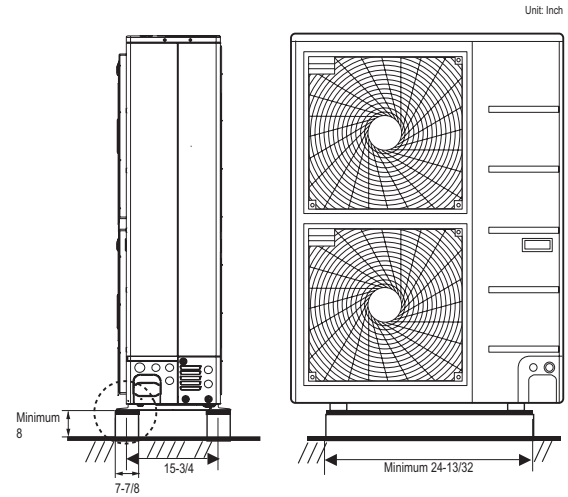


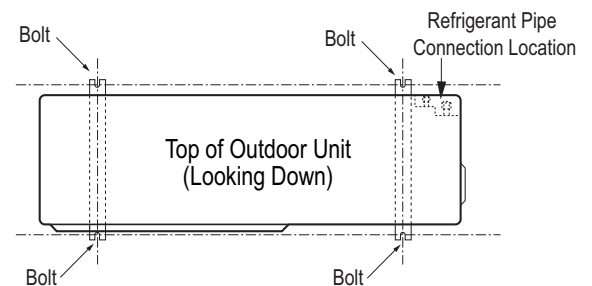
Table 5: Outdoor Unit Foundation Specifications.

Outdoor Unit Type	Bolt Type	Concrete Height	Bolt Depth
LUU189HV, LUU249HV	M10-J	Minimum 4 inches	Minimum 3 inches
LUU369HV, LUU428HV, LUU488HV	M10-J	Minimum 8 inches	Minimum 3 inches

Bolting the Outdoor Unit to the Platform

1. Ensure that the concrete platform will not degrade easily, and has enough strength to bear the weight of the unit.
2. Include an H-beam support. Firmly attach the corners, otherwise the support will bend.
3. Use a hexagon nut.
4. Use anti-vibration material.
5. Include enough space around the concrete foundation for condensate drainage.
6. Seal all wiring and piping access holes to prevent insects from entering the unit.

Figure 9: Bolting the Outdoor Unit to the Platform (Piping Location May Differ Depending on Outdoor Unit Model).



GENERAL INSTALLATION GUIDELINES

Required Indoor Unit Clearances

Indoor Unit Clearances

Follow recommended best practices when choosing an indoor location for the single zone indoor unit.

- Where there is enough structural strength to bear the weight of the unit.
- Operating sound from the unit will not disturb occupants.
- Include enough space for service access.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in cooling mode.
- Use a level indicator to ensure the unit is installed on a level plane.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in cooling mode

Note:

The unit may be damaged, may malfunction, and/or will not operate as designed if installed in any of these conditions:

- ⊘ Do not install the unit near a heat or steam source, or where considerable amounts of oil, iron powder, or flour are used. These materials may generate condensate, cause a reduction in heat exchanger efficiency, or malfunction of the condensate drain. If this is a potential problem, install a ventilation fan large enough to vent out these materials
- ⊘ Do not install the unit where it will be subjected to direct thermal radiation from other heat sources.
- ⊘ Do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak. There is the possibility of fire.
- ⊘ Do not install the unit in a location where acidic solution and spray (sulfur) are often used.

- ⊘ Do not use the unit in environments where oil, steam, or sulfuric gas are present.
- ⊘ Do not install additional ventilation products on the chassis of the unit.
- ⊘ Do not install the unit near high-frequency generator sources.

Installing in an Area Exposed to Unconditioned Air

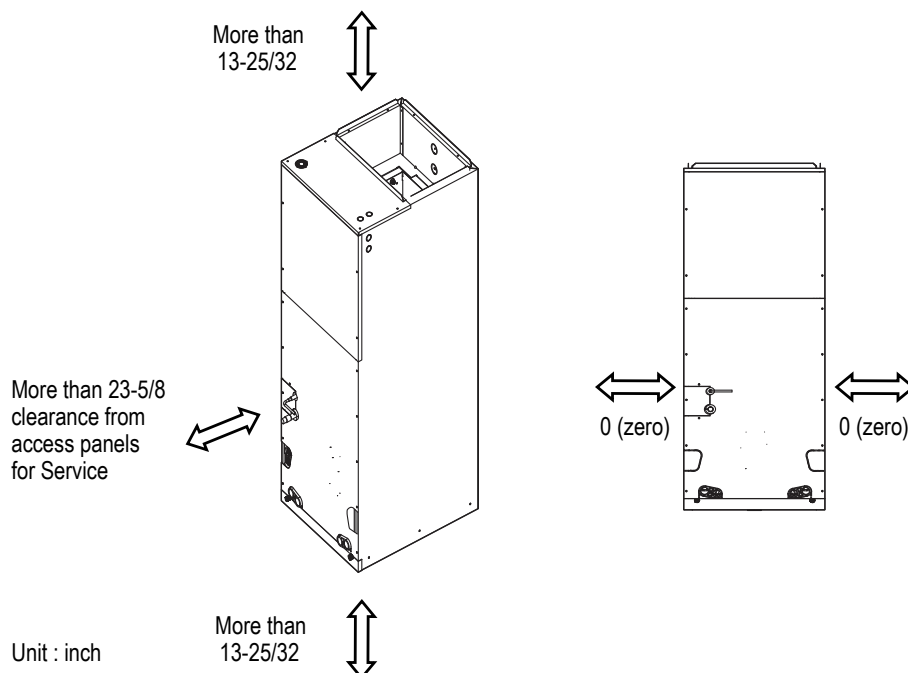
In some installation applications, areas (floors, walls) in some rooms may be exposed to unconditioned air. The room may be above or next to an unheated garage or storeroom. To counter this condition:

- Verify that carpet is or will be installed (carpet may increase the temperature by three (3) degrees.
- Install radiant heat or another type of heating system to the floor.
- Add insulation between the floor joists.

Volatile Organic Compounds

⊘ Indoor Units (IDUs) must not be placed in an environment where the IDUs may be exposed to harmful volatile organic compounds (VOCs) or in environments where there is improper air make up or supply or inadequate ventilation. If there are concerns about VOCs in the environment where the IDUs are installed, proper air make up or supply and/ or adequate ventilation must be provided. Additionally, in buildings where IDUs will be exposed to VOCs consider a factory-applied epoxy coating to the fan coils for each IDU.

Figure 10: VAHU Indoor Unit Installation Clearances.



GENERAL INSTALLATION GUIDELINES

Drilling the Piping Hole in the Wall

Follow all piping clearance recommendations.

1. Using a 2-5/8" hole core drill bit, drill a hole at the selected location. Avoid obstructions in the wall such as electrical wires or conduits and water or gas pipes.
 - The slant of the hole must be 3/16" to 5/16" from level with the slant being upward on the indoor unit side and downward on the outdoor unit side.
2. Finish off the newly drilled hole as shown with bushing and sleeve covering.
 - Sleeve and bushing prevents damage to the tubing/bundling of the piping.

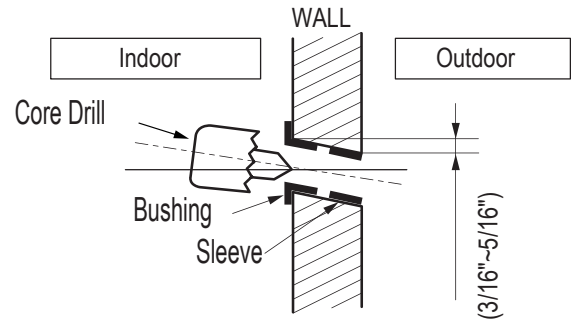
Note:

See *Refrigerant Piping Connections for Indoor Unit* for information on piping installation.

Note:

- Go to the *Refrigerant Piping Connections* section of this manual for information on indoor unit piping connection installation.
- Go to the *Electrical Connections* section of this manual for information on conduit / electrical wiring to the indoor unit.

Figure 11: Drilling Piping Hole.



GENERAL INSTALLATION GUIDELINES

Horizontal Right Installation

Configuring the VAHU for Horizontal Right Installation

The 4-way Vertical Air Handling Unit is factory ready for vertical up or horizontal left installation. Horizontal right installation requires field reconfiguration of the indoor unit. The internal drain pan must be removed from the left side of the unit and reinstalled on the right side. For horizontal right, no additional parts are necessary.

This procedure describes how to convert the VAHU to horizontal right configuration.

1. Remove the upper and lower front panels.
2. Remove the two panel supports and the refrigerant pipe support.
3. Remove the thermistor from the coil assembly.
4. Carefully remove the coil assembly and the drain pan.
5. Move the drain pan to the right (opposite) side of the coil assembly. Be sure the drain connections are in the correct location to allow drain pipe connection.
6. Carefully reinstall the coil assembly and drain pan.
7. Reinstall the coil assembly thermistor.
8. Reinstall the two panel supports and the refrigerant pipe support.
9. Reinstall the upper and lower front panels.

Figure 12: Remove Front Panel.

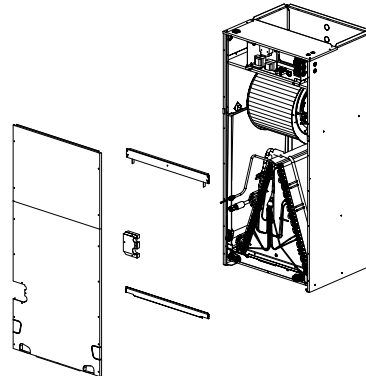


Figure 13: Remove Coil and Drain Pan.

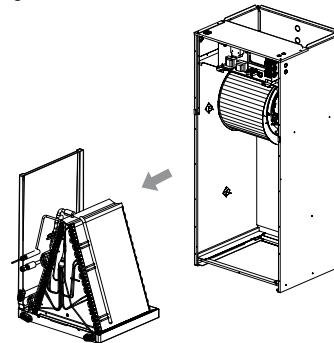


Figure 14: Install Pan on Right.

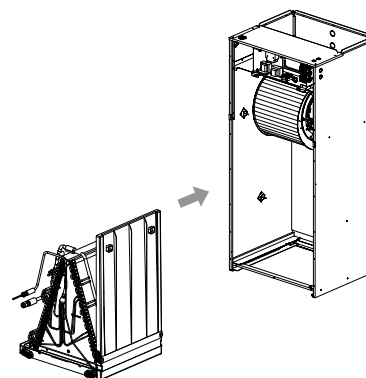
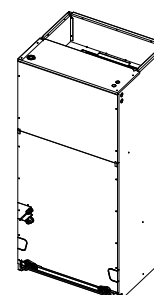


Figure 15: Replace Panels.



GENERAL INSTALLATION GUIDELINES

Vertical Downflow Installation

Configuring the VAHU for Vertical Downflow Installation

The 4-way Vertical Air Handling Unit is factory ready for vertical up or horizontal left installation. Vertical down installation requires field reconfiguration of the indoor unit. For vertical down, the downflow conversion kit is required.

Downflow kit PNDFJ0 is required for 18-24MBH NJ chassis units and downflow kit PNDFK0 is required for 36-48MBH NK chassis units.

1. Remove front panels and supports. Retain all except bottom front panel. Bottom front panel is replaced by a panel in the kit (Figure 16).
2. Remove pipe in and out sensors and temporarily store in the blower section (Figure 17).
3. Carefully slide the evaporator coil/drain pan assembly out of the cabinet (Figure 18). ⚠ Do not apply excessive force on the piping as it may result in refrigerant leaks.
4. Remove the horizontal drain pan from the assembly. Field scrap the drain pan.
5. Rotate the VAHU cabinet 180° (Figure 19).

Figure 16: Remove Front Panels and Supports.

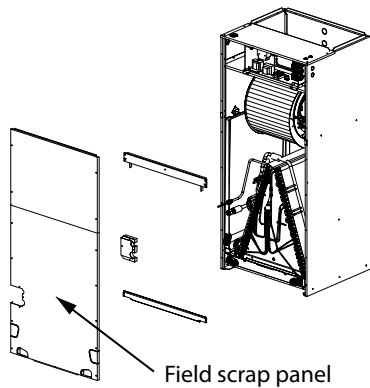


Figure 17: Sensors and Wiring.

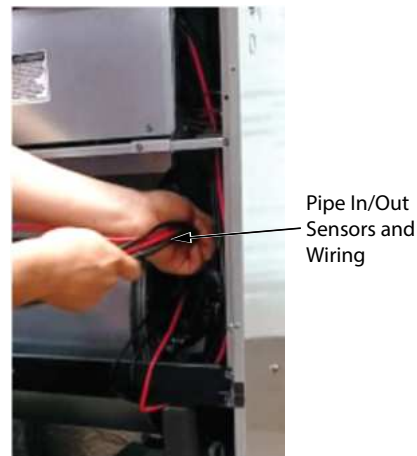
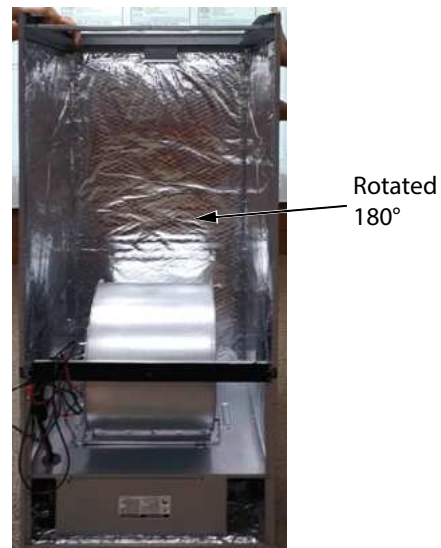


Figure 18: Evaporator Coil/ Drain Pan Assembly.



Figure 19: Rotate Cabinet.



GENERAL INSTALLATION GUIDELINES

Vertical Downflow Installation

Vertical Downflow Installation - continued

6. Install the conversion kit left and right rear vertical brackets in the rear corners of the cabinet (Figure 20).
7. Position the rear horizontal bracket on the two vertical brackets and secure with screws (Figure 21).
8. Position the left and right horizontal side brackets and secure with screws (Figure 21). The brackets are not left/right hand dependent.
9. Position the front horizontal bracket and secure with screws (Figure 21).
10. Confirm all bracket screws are secure and the bracket assembly is correctly positioned to support the evaporator coil/drain pan assembly.
11. Route the wiring for the pipe in and pipe out sensors (Figure 22).
12. Carefully slide the evaporator coil/drain pan assembly back into the cabinet (Figure 23). Confirm the assembly is against the rear panel of the cabinet.

Figure 20: Vertical Brackets.

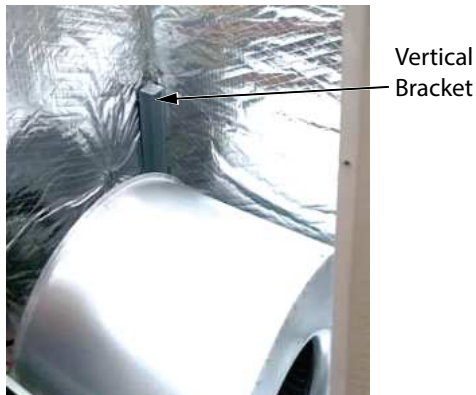


Figure 21: Horizontal Brackets.

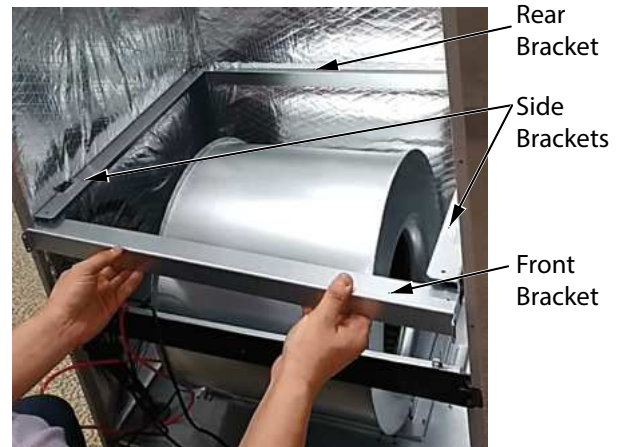


Figure 22: Route Wiring.

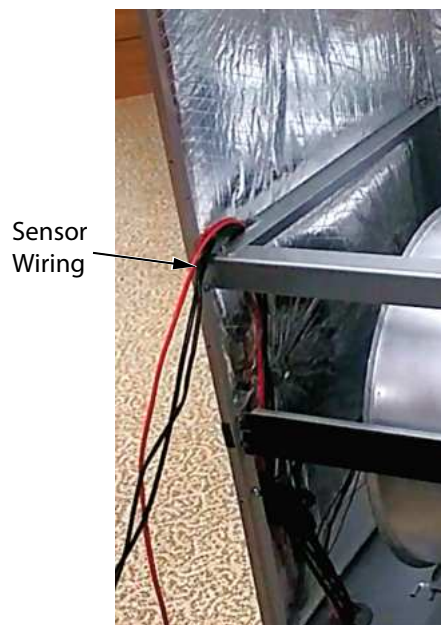
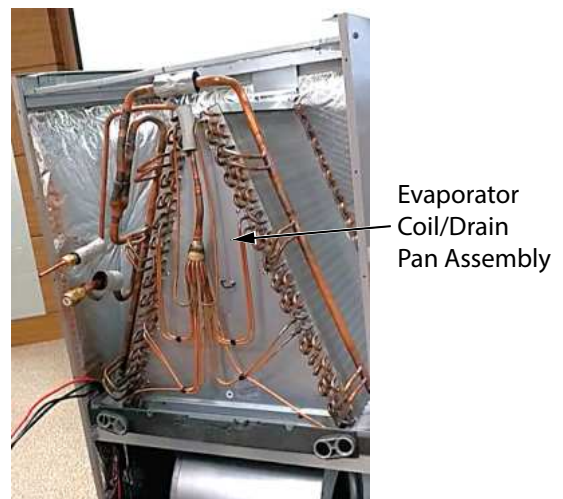


Figure 23: Reinstall Coil Assembly.



GENERAL INSTALLATION GUIDELINES

Vertical Downflow Installation

Vertical Downflow Installation - continued

13. Reinstall the cabinet support bracket (Figure 24).
14. Reinstall the plastic wiring ring and route the sensor wires through the ring (Figure 25).
15. Reinstall the refrigerant pipe support bracket (Figure 26).
16. Reinstall the pipe in and pipe out sensors (Figure 27).
17. Reinstall all front panels. Be sure to use the front panel included in the downflow kit (Figure 28).

Figure 24: Reinstall Support Bracket.



Figure 25: Wiring Ring.



Figure 26: Pipe Support Bracket.

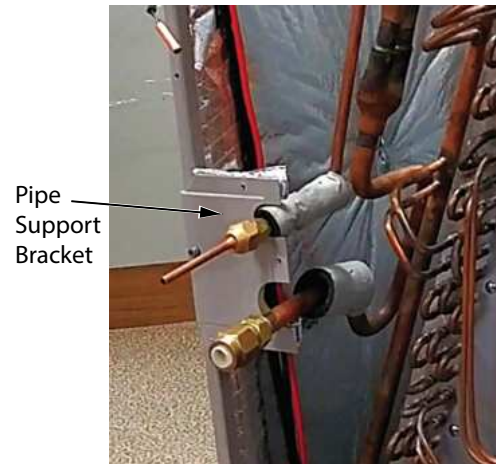


Figure 27: Reinstall Sensors.

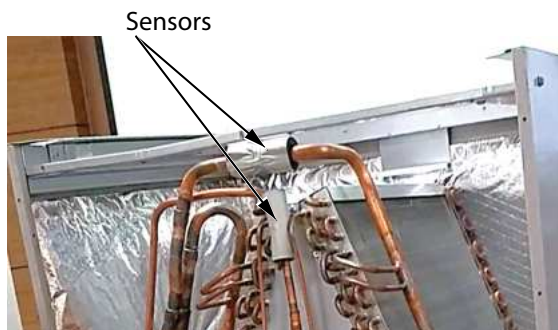
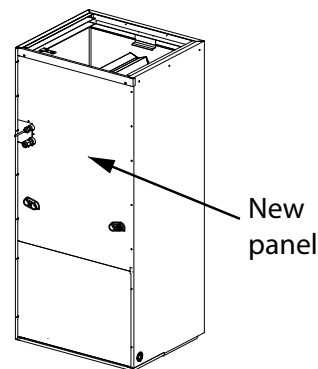


Figure 28: Reinstall Panels.



GENERAL INSTALLATION GUIDELINES

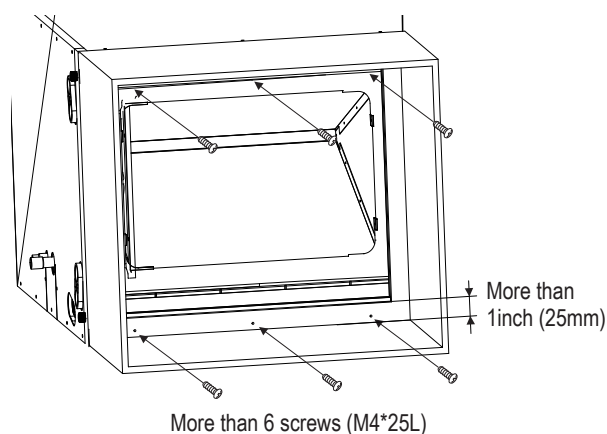
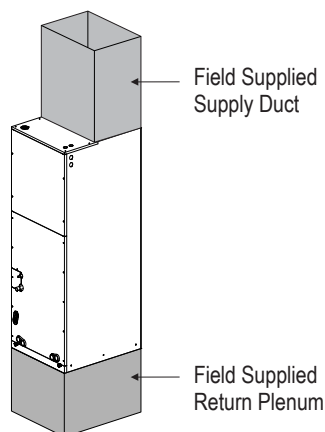
Installing Ductwork

Installing Ductwork

Install ductwork to the 4-way Vertical Air Handling Unit as required for your system. Some general guidelines are:

- Use more than 10 screws to join the supply duct to the VAHU.
- Seal all duct work according to local codes to prevent air leakage. Ensure that filter access is unobstructed.
- The VAHU support platform must be sturdy enough to support the cabinet plus any accessory components including filter box.
- The minimum height clearance is 14 inches to maintain proper air flow.
- Vibration isolators (field supplied) must be placed between the unit and the pedestal.
- To prevent vibration transmission, use flexible connectors between duct and the unit. If the optional electric heater is installed, it is mandatory that the flexible connector between unit and duct at discharge connection is made of heat resistant material.
- Duct work must be insulated and covered with vapor barrier when routed through unconditioned space.
- To prevent the formation of condensation, insulate the duct well.
- Internal acoustical insulation lining may be necessary for the metal duct system if it does not have a 90° elbow and 10ft. of main duct to the first branch takeoff.
- It is advised that a fibrous duct work could be used as a substitute if built and installed in accordance with the most recent edition of SMACNA construction standard on fibrous glass ducts.
- Collectively, fibrous duct work and acoustical lining must follow National Fire Protection Association standards 90A or B as tested by UL standard 181 for class 1 air ducts.
- Seal around the duct after it is secured to prevent air leaks.

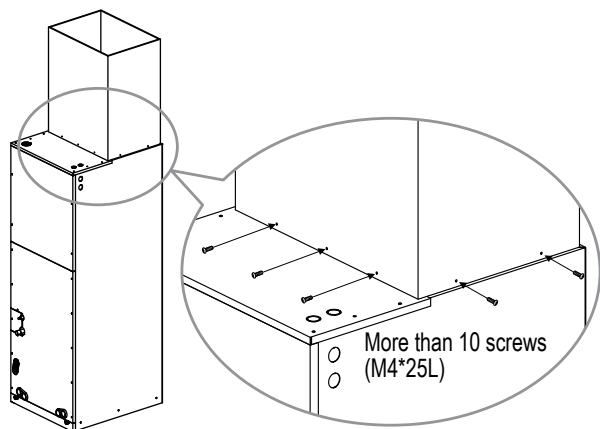
Figure 29: Installing Ductwork.



Note:

- ⊘ Do not connect screws on front and rear side; they may interfere with filter installation.

Figure 30: Securely Fasten Supply Duct.



REFRIGERANT SAFETY STANDARDS / DEVICE CONNECTION LIMITATIONS

Refrigerant Safety Standards

ASHRAE Standards 15-2010 and 34-2010 address refrigerant safety and the maximum allowable concentration of refrigerant in an occupied space. Refrigerant will dissipate into the atmosphere, but a certain volume of air is required to safely dissipate the refrigerant. For R410A refrigerant, the maximum allowable concentration of refrigerant is 26 lbs./1,000 cubic feet (Addendum L modified the RCL to 26) of occupied spaces. Buildings with 24-hour occupancy are allowed half of that concentration.

If the system develops a refrigerant leak, the entire refrigerant charge of the system will dump into the area where the leak occurs. To meet ASHRAE Standards 15 and 34, the smallest room volume on the system must be calculated and compared to the maximum allowable concentration. Also consult state and local codes in regards to refrigerant safety.

Connection Limitations

Single zone systems consist of one outdoor unit and one indoor unit. One of the most critical elements of a single zone system is the refrigerant piping. Table 6 lists the pipe length limits that must be followed in the design of a Single Zone VAHU refrigerant pipe system.

Figure 31: LV181HV4, LV241HV4 System Layout

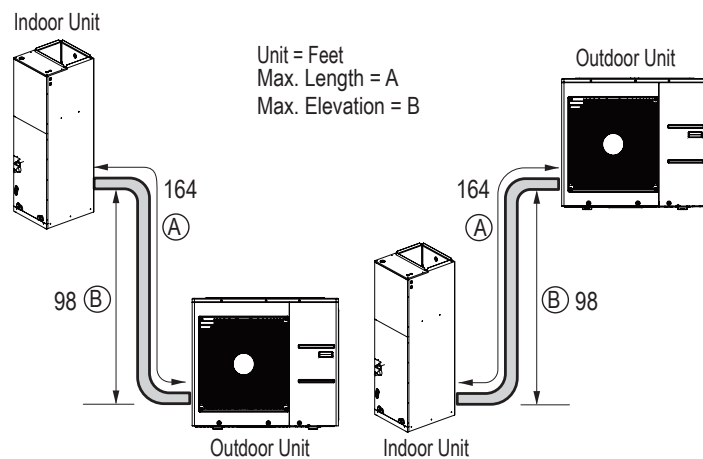


Figure 32: LV361HV4, LV420HV, LV480HV System Layout

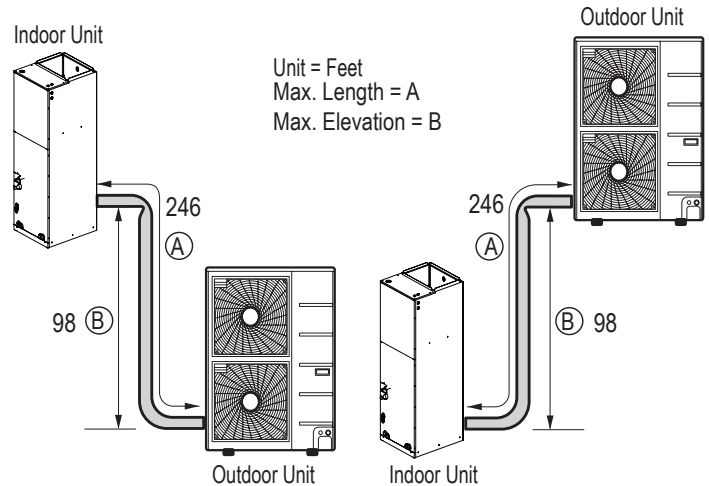


Table 6: Single Zone VAHU Refrigerant Piping System Limitations

System Model Name		LV181HV4, LV241HV4	LV361HV4, LV420HV, LV480HV
Pipe Length (ELF = Equivalent Length of pipe in Feet)	Longest total equivalent piping length	164 feet	246 feet
	Shortest total equivalent piping length	6.6 feet	6.6 feet
	Distance between fittings and indoor or outdoor unit	≥20 inches	≥20 inches
	No additional refrigerant	24.6 feet	24.6 feet
Elevation (All Elevation Limitations are Measured in Actual Feet)	If outdoor unit is above indoor unit	98 feet	98 feet
	If outdoor unit is below indoor unit	98 feet	98 feet
Additional Refrigerant Needed (oz/ft)		0.43	0.43

SELECTING FIELD SUPPLIED PIPING

Selecting Field-Supplied Copper Piping

Note:

Always follow local codes when selecting and installing copper pipe and piping system components.

Approved piping for use with LG Single Zone products will be marked "R410 RATED" along the length of the pipe. Piping wall thickness must meet local code requirements and be approved for a maximum operating pressure of 551 psi. When bending piping, try to keep the number of bends to a minimum, and use the largest radii possible to reduce the equivalent length of installed piping; also, bending radii greater than ten (10) piping diameters can minimize pressure drop. Be sure no traps or sags are present.

For Single Zone Systems

LG prefers the use of ACR copper piping rated at the system working pressure was used.

Note:

Always properly support the piping as per the instructions on page 33.

Table 7: ACR Rated Copper Tubing Material.

Type	Seamless Phosphorous Deoxidized
Class	UNS C12200 DHP
Straight Lengths	H58 Temper
Coils	O60 Temper

Table 8: Piping Tube Thicknesses.

OD (in)	1/4	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8	1-5/8
Material	Rigid or Soft ACR Rated for R410A				Rigid or Solid ACR Rated for R410A				
Min. Bend Radius (in)	0.563	0.9375	1.5	2.25	3.0	3.0	3.5	4.0	4.5
Min. Wall Thickness (in)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.050

Table 9: ACR Copper Tubing Dimensions and Physical Characteristics¹⁻³.

Nominal Pipe Outside Diameter (in)	Actual Outside Diameter (in)	Drawn Temper			Annealed Temper		
		Nominal Wall Thickness (in)	Weight (lb/ft)	Cubic ft per Linear ft	Nominal Wall Thickness (in)	Weight (lb/ft)	Cubic ft per Linear ft
1/4	0.250	--	--	--	0.030	0.081	0.00020
3/8	0.375	0.030	0.126	0.00054	0.032	0.134	0.00053
1/2	0.500	0.035	0.198	0.00101	0.032	0.182	0.00103
5/8	0.625	0.040	0.285	0.00162	0.035	0.251	0.00168
3/4	0.750	0.042	0.362	0.00242	0.042	0.362	0.00242
7/8	0.875	0.045	0.455	0.00336	0.045	0.455	0.00336
1-1/8	1.125	0.050	0.655	0.00573	0.050	0.655	0.00573

¹All dimensions provided are in accordance with ASTM B280 – Standard..

²Design pressure = 551 psig.

³The Copper Tube Handbook, 2010, Copper Development Association Inc., 260 Madison Avenue, New York, NY 10016.

Note:

- Commercially available piping often contains dust and other materials. Always purge it clean with a dry nitrogen.
- Prevent dust, water or other contaminants from entering the piping during installation.

COPPER EXPANSION AND CONTRACTION

Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of a Duct Free System can vary as much as 280°F. With this large variance in pipe temperature, the designer must consider pipe expansion and contraction to avoid pipe and fitting fatigue failures.

Refrigerant pipe along with the insulation jacket form a cohesive unit that expands and contracts together. During system operation, thermal heat transfer occurs between the pipe and the surrounding insulation.

If the pipe is mounted in free air space, no natural restriction to movement is present if mounting clamps are properly spaced and installed. When the refrigerant pipe is mounted underground in a utility duct stacked among other pipes, natural restriction to linear movement is present. In extreme cases, the restrictive force of surface friction between insulating jackets could become so great that natural expansion ceases and the pipe is "fixed" in place. In this situation, opposing force caused by change in refrigerant fluid/vapor temperature can lead to pipe/fitting stress failure.

The refrigerant pipe support system must be engineered to allow free expansion to occur. When a segment of pipe is mounted between two fixed points, provisions must be provided to allow pipe expansion to naturally occur. The most common method is the inclusion of expansion Loop or U-bends. Each segment of pipe has a natural fixed point where no movement occurs. This fixed point is located at the center point of the segment assuming the entire pipe is insulated in a similar fashion. The natural fixed point of the pipe segment is typically where the expansion Loop or U-bend must be.

Linear pipe expansion can be calculated using the following formula:

$$LE = C \times L \times (T_r - T_a) \times 12$$

LE	=	Anticipated linear tubing expansion (in.)
C	=	Constant (For copper = 9.2×10^{-6} in./in.°F)
L	=	Length of pipe (ft.)
T_r	=	Refrigerant pipe temperature (°F)
T_a	=	Ambient air temperature (°F)
12	=	Inches to feet conversion (12 in./ft.)

1. In Table 10 find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

General Example:

A system is installed and the design shows that there is a 100 foot straight segment of tubing between an indoor unit and the outdoor unit. In heating, this pipe transports hot gas vapor to the indoor units at 120 °F. In cooling, the same tube is a suction line returning refrigerant vapor to the outdoor unit at 40 °F. Look up the copper tubing expansion at each temperature and calculate the difference.

Vapor Line

Transporting Hot Vapor: 100 ft. pipe at 120 °F = 1.40 in.
Transporting Suction Vapor: 100 ft. pipe at 40 °F = 0.40 in.
Anticipated Change in Length: 1.40 in. – 0.40 in. = 1.00 in.

Liquid Line

The liquid temperature remains relatively the same temperature; only the direction of flow will reverse. Therefore, no significant change in length of the liquid line is anticipated.

When creating an expansion joint, the joint height must be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an Expansion Loop is provided in Table 11. Use soft copper with long radius bends on longer runs or long radius elbows for shorter pipe segments. Using the anticipated linear expansion (LE) distance calculated, look up the Expansion Loop or U-bend minimum design dimensions. If other types of expansion joints are chosen, design per ASTM B-88 Standards.

See table on next page for precalculated anticipated expansion for various pipe sizes and lengths of refrigerant tubing.

To find the anticipated expansion value:

1. From the table below, find the row corresponding with the actual feet of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe.
3. In the column showing the minimum pipe temperature, look up the anticipated expansion distance corresponding to the segment length. Do the same for the maximum pipe temperature.
4. Calculate the difference in the two expansion distance values. The result will be the change in pipe length.

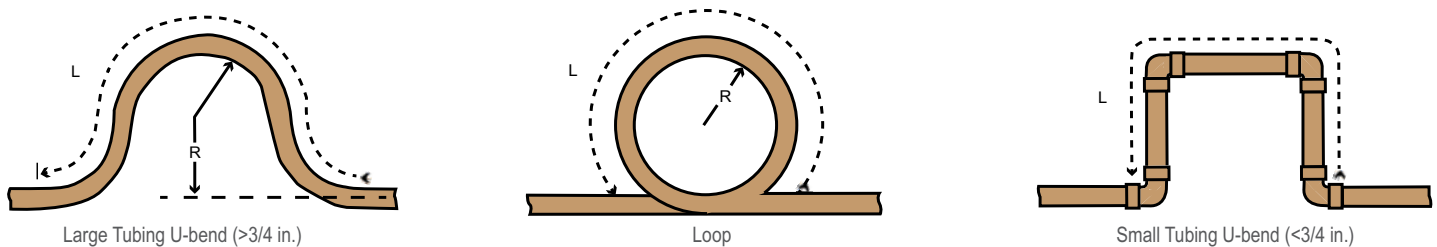
COPPER EXPANSION AND CONTRACTION

Table 10: Linear Thermal Expansion of Copper Tubing in Inches.

Pipe Length ¹	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.26	0.28	0.29	0.30
30	0.12	0.12	0.15	0.18	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.32	0.35	0.39	0.42	0.44	0.45
40	0.16	0.16	0.20	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.43	0.46	0.52	0.56	0.58	0.60
50	0.20	0.20	0.25	0.30	0.33	0.35	0.38	0.40	0.43	0.45	0.48	0.50	0.53	0.55	0.54	0.58	0.65	0.70	0.73	0.75
60	0.24	0.24	0.30	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.65	0.69	0.78	0.84	0.87	0.90
70	0.28	0.28	0.35	0.42	0.46	0.49	0.53	0.56	0.60	0.63	0.67	0.70	0.74	0.77	0.76	0.81	0.91	0.98	1.02	1.05
80	0.32	0.32	0.40	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.86	0.92	1.04	1.12	1.16	1.20
90	0.36	0.36	0.45	0.54	0.59	0.63	0.68	0.72	0.77	0.81	0.86	0.90	0.95	0.99	0.97	1.04	1.17	1.26	1.31	1.35
100	0.40	0.40	0.50	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.08	1.15	1.30	1.40	1.45	1.50
120	0.48	0.48	0.60	0.72	0.78	0.84	0.90	0.96	1.02	1.08	1.14	1.20	1.26	1.32	1.30	1.38	1.56	1.68	1.74	1.80
140	0.56	0.56	0.70	0.84	0.91	0.98	1.05	1.12	1.19	1.26	1.33	1.40	1.47	1.54	1.51	1.61	1.82	1.96	2.03	2.10
160	0.64	0.64	0.80	0.96	1.04	1.12	1.20	1.28	1.36	1.44	1.52	1.60	1.68	1.76	1.73	1.84	2.08	2.24	2.32	2.40
180	0.72	0.72	0.90	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	1.94	2.07	2.34	2.52	2.61	2.70

¹Pipe length baseline temperature = 0°F. "Expansion of Carbon, Copper and Stainless Steel Pipe," *The Engineers' Toolbox*, www.engineeringtoolbox.com.

Figure 33: Coiled Expansion Loops and Offsets (Plan View).



Note:

All expansion loops and offsets must be installed in the horizontal plane to prevent the possibility of trapping oil. Loops and offsets in vertical risers must also be installed in a horizontal plane.

Table 11: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets.

Anticipated Linear Expansion (LE) (inches)		Nominal Tube Size (OD) inches			
		1/4	3/8	1/2	3/4
1/2	R ¹	6	7	8	9
	L ²	38	44	50	59
1	R ¹	9	10	11	13
	L ²	54	63	70	83
1-1/2	R ¹	11	12	14	16
	L ²	66	77	86	101
2	R ¹	12	14	16	19
	L ²	77	89	99	117
2-1/2	R ¹	14	16	18	21
	L ²	86	99	111	131
3	R ¹	15	17	19	23
	L ²	94	109	122	143
3-1/2	R ¹	16	19	21	25
	L ²	102	117	131	155
4	R ¹	17	20	22	26
	L ²	109	126	140	166

¹R = Centerline Length of Pipe.

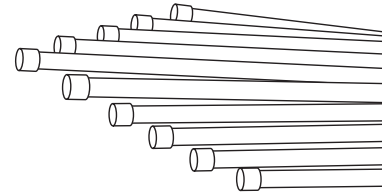
²L = Centerline Minimum Radius (inches).

Piping Materials and Handling

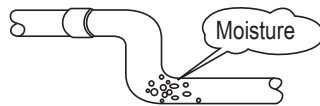
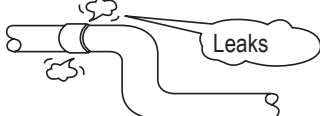
Pipes used for the refrigerant piping system must include the specified thickness, and the interior must be clean.

While handling and storing,  do not bend or damage the pipes, and take care not to contaminate the interior with dust, moisture, etc.

Keep Pipes Capped While Storing.



Keep refrigerant pipe dry, clean, and airtight.

	Dry	Clean	Airtight
	No moisture should be inside the piping. 	No dust should be inside the piping. 	No leaks should occur. 
Possible Problems	- Significant hydrolysis of refrigerant oil. - Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly. - EEVs, capillary tubes are clogged.	- Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly. - EEVs and capillary tubes become clogged.	- Refrigerant gas leaks / shortages. - Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly.
Solutions	- Remove moisture from the piping. - Piping ends should remain capped until connections are complete. -  Do not install piping on a rainy day. - Connect piping properly at the unit's side. - Remove caps only after the piping is cut, the burrs are removed, and after passing the piping through the walls. - Evacuate system to a minimum of 500 microns and insure the vacuum holds at that level for 1 hour	- Remove dust from the piping. - Piping ends should remain capped until connections are complete. - Connect piping properly at the side of the unit. - Remove caps only after the piping is cut and burrs are removed. - Retain the cap on the piping when passing it through walls, etc.	- Test system for air tightness. - Perform brazing procedures that comply with all applicable standards. - Perform flaring procedures that comply with all applicable standards. - Ensure that refrigerant lines are pressure tested to 550 psig and hold for 1 hour.

REFRIGERANT SYSTEM ENGINEERING

Proper system operation depends on the installer using utmost care while assembling the piping system. The following pages are an overview of best practices when installing the refrigerant piping system.

Note:

LG Electronics U.S.A., Inc., is not responsible for any piping calculations, refrigerant leaks, degradation of performance, any other potential problems or damages caused by the interconnecting piping, their joint connections, isolation valves, or introduced debris inside the piping system.

⊘ No Pipe Size Substitutions

Use only the pipe size selected by the information in this manual. Using a different size is prohibited and may result in a system malfunction or failure to work at all.

⊘ No In-line Refrigeration Components

Components such as oil traps, solenoid valves, filter-driers, sight glasses, tee fittings, and other after-market accessories are not permitted on the refrigerant piping system between the outdoor unit and the indoor unit. Sight-glasses and solenoid valves may cause vapor to form in the liquid stream. Over time, driers may deteriorate and introduce debris into the system. The designer and installer must verify the refrigerant piping system is free of traps, sagging pipes, sight glasses, filter driers, etc.

Field-Provided Isolation Ball Valves

LG maintains a neutral position on using isolation valves in refrigerant piping systems. LG does not endorse any manufacturer of isolation valves. It is recognized that installing isolation valves may simplify future maintenance requirements, and, if used, considerations must be taken including, but not limited to, the following:

- Pressure drops for any component used, including isolation valves, must be known in equivalent pipe length and calculated into the total and segment equivalent piping lengths and compared to product design limitations.
- In all cases, materials must be suitable for the application and any applicable codes, including, but not limited to, diameter and wall thickness continuity per ACR standards.

Failure to do so may cause significant performance degradation. Proper leak checks must be performed. Using isolation valves does not automatically void any LG product warranty, however, a limited warranty may be voided in whole or part must any field supplied accessory fail in any way that causes product failure.

Using Elbows

Field-supplied elbows are allowed if they are long radius and designed for use with R410A refrigerant. The designer and installer, however, must be cautious with the quantity and size of fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment manually (Table 12).

Table 12: Equivalent Piping Length for Elbows.

Component	Size (Inches)				
Elbow (ft.)	1/4	3/8	1/2	5/8	3/4
	0.5	0.6	0.7	0.8	1.2

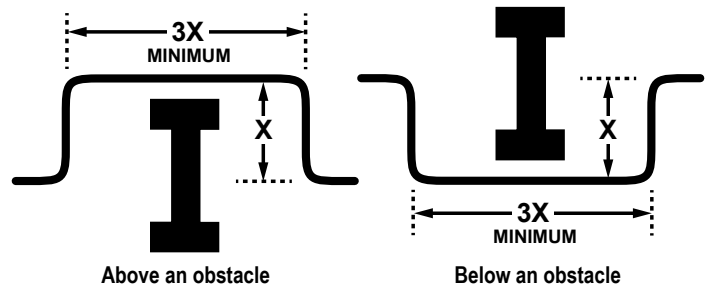
Pipe Bends

When bending soft copper, use long radius bends. Refer to the "Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets" table for minimum radius specifications.

Obstacles

When an obstacle, such as an I-beam or concrete T, is in the path of the planned refrigerant pipe run, it is best practice to route the pipe over the obstacle. If adequate space is not available to route the insulated pipe over the obstacle, then route the pipe under the obstacle. In either case, it is imperative the length of the horizontal section of pipe above or below the obstacle be a minimum of three (3) times the longest vertical rise (or fall) at either end of the segment.

Figure 34: Installing Piping Above and Below an Obstacle.



Pipe Supports

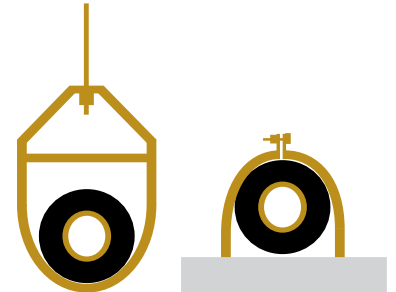
A properly installed pipe system must be adequately supported to avoid pipe sagging. Sagging pipes become oil traps that lead to equipment malfunction.

Pipe supports must never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket. Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers must be used with shields between the hangers and insulation. Field provided pipe supports must be designed to meet local codes. If allowed by code, use fiber straps or split-ring hangers suspended from the ceiling on all-thread rods (fiber straps or split ring hangers can be used as long as they do not compress the pipe insulation). Place a second layer of insulation over the pipe insulation jacket to prevent chafing and compression of the primary insulation within the confines of the support pipe clamp.

A properly installed pipe system must have sufficient supports to avoid pipes from sagging during the life of the system. As necessary, place supports closer for segments where potential sagging could occur. Maximum spacing of pipe supports shall meet local codes.

Wherever the pipe changes direction, place a hanger within twelve (12) inches on one side and within twelve (12) to nineteen (19) inches of the bend on the other side.

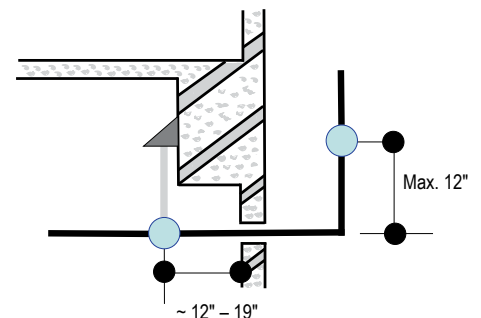
Figure 35: Pipe Hanger Details.



Note:

Use a 4" + long sheet curved sheet metal saddles between hanger bracket and insulation to promote linear expansion/contraction.

Figure 36: Typical Pipe Support Location—Change in Pipe Direction.

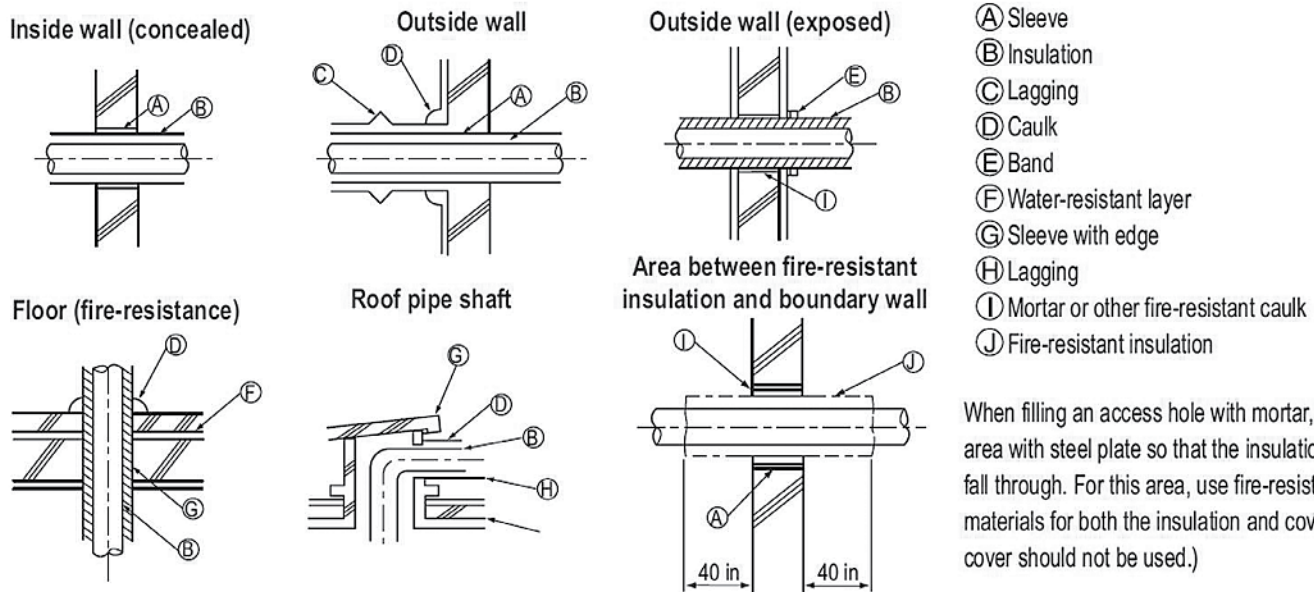


REFRIGERANT SYSTEM ENGINEERING

Pipe Sleeves at Penetrations

LG requires that all pipe penetrations through walls, floors, and pipes buried underground be properly insulated and routed through an appropriate wall sleeve of sufficient size to prevent compression of refrigerant pipe insulation and free movement of the pipe within the sleeve. Use 4" + curved sheet metal saddles between the bottom surface of the pipe and the bottom surface of the penetration.

Figure 37: Pipe Sleeve Options.



When filling an access hole with mortar, cover the area with steel plate so that the insulation will not fall through. For this area, use fire-resistant materials for both the insulation and cover. (Vinyl cover should not be used.)

Note:

Diameter of penetrations shall be determined by pipe diameter plus the thickness of the insulation.

Underground Refrigerant Piping

Refrigerant pipe installed underground must be routed inside a vapor tight protective sleeve to prevent insulation deterioration and water infiltration. Refrigerant pipe installed inside underground casing must be continuous without any joints. Underground refrigerant pipe must be located at a level **below the frost line**.

Table 13: Utility Conduit Sizes.

Liquid Pipe ¹	Vapor Pipe ¹		
	1/2 (2.0 ^{2,5})	5/8 (2-1/8 ^{2,5})	3/4 (2-1/4 ^{2,5})
1/4 (1.0) ³	4	4	4
3/8 (1-1/8) ³	4	4	5
1/2 (1-1/2) ⁴	5	5	5
5/8 (1-5/8) ⁴	5	5	5
3/4 (1-3/4) ⁴	5	5	5

¹OD pipe diameter in inches; Values in parenthesis () indicate OD of pipe with insulation jacket.

²Diameter of pipe with insulation. Thickness of pipe insulation is typical. Actual required thickness may vary based on surrounding ambient conditions and must be calculated and specified by the design engineer.

³Insulation thickness (value in parenthesis) = 3/8 inch.

⁴Insulation thickness (value in parenthesis) = 1 inch.

⁵Insulation thickness (value in parenthesis) = 3/4 inch.

Figure 38: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.

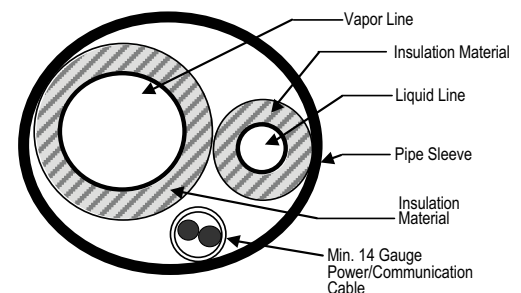


Table 14: Heat Pump Unit Refrigerant Pipe Connections (All Brazed).

Model	Liquid Conn. (inches)	Vapor Conn. (inches)
LUU189HV, LUU249HV, LUU369HV, LUU428HV, LUU488HV	3/8	5/8

Note:

Provide expansion joints in long pipe segments and place in an accessible conduit box for inspection. Use galvanized curved sheet metal saddles at all mounting points. Pipe must be allowed to move freely linearly.

FLARING AND BRAZING PROCEDURES

Flaring and Brazing Procedures

One of the main causes of refrigerant leaks is a defective connection. The installer needs to know how perform both flared and brazed connections successfully.

Note:

- During installation, it is imperative to keep the piping system free of contaminants and debris such as copper burrs, slag, or carbon dust.
- ⚠ Do not use kinked pipe caused by excessive bending in one specific area on its length.

Flaring Procedure

Note:

When selecting flare fittings, always use a 45° fitting rated for use with high pressure refrigerant R410A. Selected fittings must also comply with local, state, or federal standards.

1. Cut the pipe to length.

- Measure the distance between the indoor unit and the outdoor unit.
- Cut the pipes a little longer than measured distance.

2A. Remove the burrs.

- Completely remove all burrs from pipe ends.
- When removing burrs, point the end of the copper pipe down to avoid introducing foreign materials in the pipe.

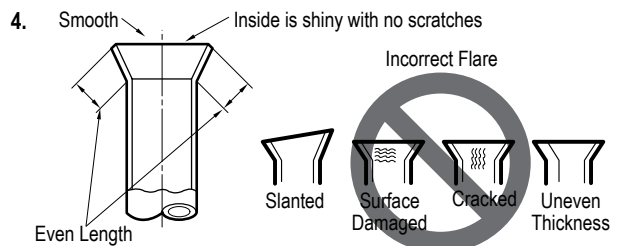
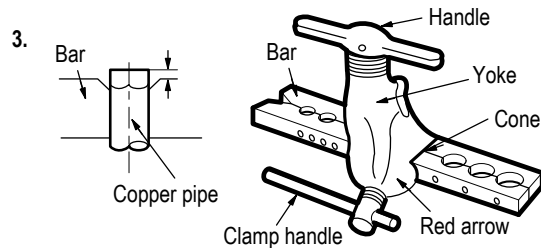
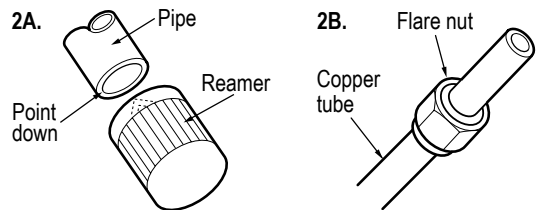
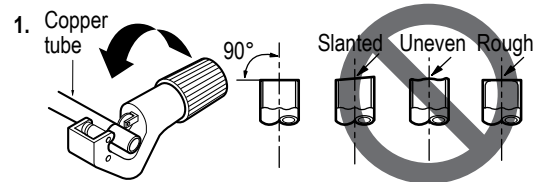
2B. Slide the flare nut onto the copper tube.

3. Flaring the pipe end.

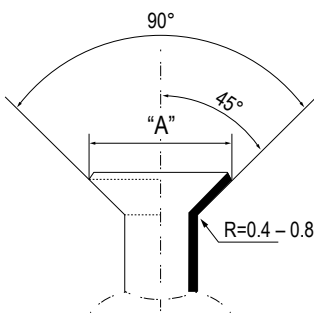
- Use the proper size flaring tool to finish flared connections as shown.
- ALWAYS create a 45° flare when working with R410A.

4. Carefully inspect the flared pipe end.

- Compare the geometry with the figure to the right
- If the flare is defective, cut it off and re-do procedure.
- If flare looks good, blow the pipe clean with dry nitrogen.



Dimensions of the Flare.



Flared Connection Dimensions / Tightening Torque.

Pipe Size (in. O.D.)	Outside Diameter (mm)	"A" Dimension (mm [in.])
1/4	6.35	~ 9.1 (11/32 - 23/64)
3/8	9.52	~ 13.2 (1/2 - 33/64)
1/2	12.7	~ 16.6 (41/64 - 21/32)
5/8	15.88	~ 19.7 (49/64 - 25/32)
3/4	19.05	-

FLARING AND BRAZING PROCEDURES

Tightening the Flare Nuts

Tightening Torque for Flare Nuts.

Pipe Size (in. O.D.)	Outside Diameter (mm)	Tightening Torque (ft-lbs.)
1/4	6.35	13.0 - 18.0
3/8	9.52	24.6 - 30.4
1/2	12.7	39.8 - 47.7
5/8	15.88	45.4 - 59.3
3/4	19.05	71.5 - 87.5

- When connecting the flare nuts, coat the flare (outside only) with polyvinyl ether (PVE) refrigeration oil only.

Note:

- ⊘ Do not use polyolylester (POE) or any other type of mineral oil as a thread lubricant. These lubricants are not compatible with the PVE oil used in this system and create oil sludge leading to equipment damage and system malfunction.
 - ⊘ Do not add any contaminants inside the refrigerant piping.
- Initially hand tighten the flare nuts using three (3) or four (4) turns.
 - To finish tightening the flare nuts, use both a torque wrench and a backup wrench.
 - After all the piping has been connected and the caps have been tightened, check for refrigerant gas leaks.

Loosening the Flare Nuts

Always use two (2) wrenches to loosen the flare nuts.

Brazing Practices

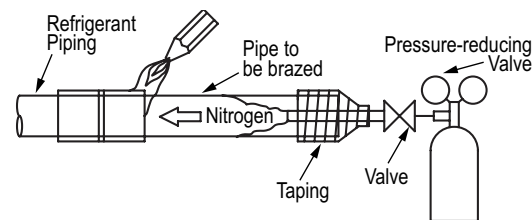
⚠ WARNING

- ⊘ Do not braze in an enclosed location. ⊘ Do not allow the refrigerant to leak during brazing. Always test for gas leaks before and after brazing.

If the refrigerant combusts, it generates a toxic gas that may cause physical injury or death.

1. Joints are brazed in the field. Single Zone refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, and heat exchangers that can easily become blocked. Proper system operation depends on the installer using best practices and utmost care while assembling the piping system.
2. Store pipe stock in a dry place; keep stored pipe capped and clean.
3. Flush clean all pipe sections with dry nitrogen prior to assembly.
4. Always use a non-oxidizing material for brazing. ⊘ Do not use flux, soft solder, or anti-oxidant agents. If the proper material is not used, oxidized film may accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.
5. Use a tubing cutter, ⊘ do not use a saw to cut pipe. De-bur and clean all cuts before assembly.
6. Brazing joints:
 - Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
 - Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
 - Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

Figure 39: Refrigerant Pipe Brazing.



⚠ WARNING

- ⊘ Do not allow the refrigerant to leak during brazing; if the refrigerant combusts, it generates a toxic gas. There is risk of fire, explosion, and physical injury or death.
- ⊘ Do not braze in an enclosed location, and always test for gas leaks before / after brazing. There is risk of fire, explosion, and physical injury or death.

REFRIGERANT PIPING CONNECTIONS

Installation Overview

Installation

Single Zone Vertical Air Handling Unit systems are one-to-one systems. There is a direct piping connection between the outdoor unit and the indoor unit.

Refer back to the tables within the “Connection Limitations” section for specific length limitations in conjunction with outdoor unit and indoor unit positioning.

Note:

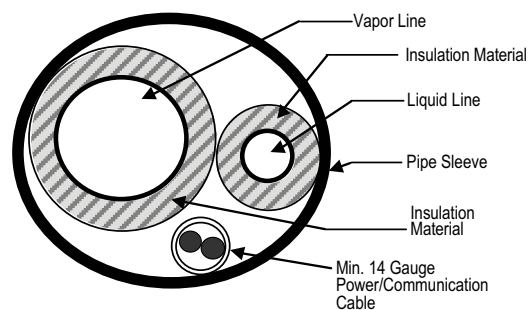
- When proceeding with piping connections, be sure to adhere to pipe support spacing lengths as shown in the figure below. Refer back to “Pipe Supports” section for in-depth information regarding using elbows, clamps and pipe supporting materials.
- Always adhere to local codes regarding piping and accurate support spacing along the outdoor pipe line.
- Always include plenty of insulation on all refrigerant and drain piping to ensure condensate does not form and cause damage to walls, floors, etc.

Pipe Bundling

See the figure at right for proper pipe and cable bundling. Note the placement of the piping along with the necessary insulation material.

1. Wrap each pipe with plenty of the proper insulation material.
2. Secure the piping by wrapping vinyl tape around the pipe.
 - Use the narrow size tape for wrapping the actual pipe.
3. Include the drain hose within the bundled piping, and wrap all of them together using the wider vinyl tape as shown in the figure.
 - The end of the drain hose outlet must be routed above the ground.

Figure 40: Cutaway of Proper Pipe and Cable Bundling.



Note:

Always include plenty of insulation on all refrigerant and drain piping to ensure condensate does not form and cause damage to walls, floors, etc.

REFRIGERANT PIPING CONNECTIONS

Directional Pipe Formation

Special Applications

If an additional drain hose is necessary, the end of drain outlet must be routed above the ground. Secure and the drain hose appropriately.

When the Outdoor Unit is Installed Below the Indoor Unit:

1. Use a conduit, piping set cover, or bundle the (separately) insulated refrigerant piping, the drain hose, and the communications / connection (power) cable together.
2. Make sure to include some slack in the wiring. Wiring must be installed in upwards direction to prevent water from entering the control box.
3. Secure the conduit, piping set cover, or bundle along the outside wall using saddles or a similar type of piping support.
4. Seal any openings in the wall that are around the piping.

When the Outdoor Unit is Installed Above the Indoor Unit:

1. Use a conduit, piping set cover, or bundle the (separately) insulated refrigerant piping and the communications / connection (power) cable together up to the outdoor unit service valves.
2. Make sure to include some slack in the wiring. Wiring must be installed in upwards direction to prevent water from traveling into the control box.
3. If necessary, secure the conduit, piping set cover, or bundle along the outside wall using saddles or a similar type of piping support.
4. Ensure the insulated drain hose from the indoor unit is installed away from the outdoor unit, and in a downwards direction. If necessary, secure along the outside wall using saddles or a similar type of support.
5. Seal any openings in the wall that are around the piping.

Note:

Always include plenty of insulation on all refrigerant and drain piping to ensure condensate does not form and cause damage to walls, floors, etc.

Figure 41: Bundling and Taping.

Bundling Piping

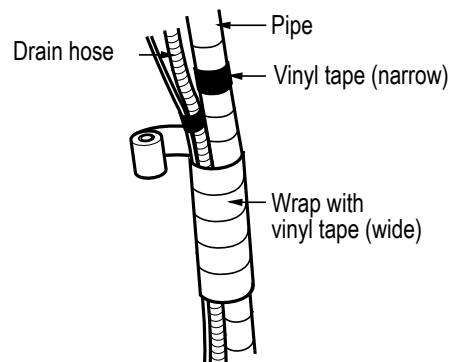
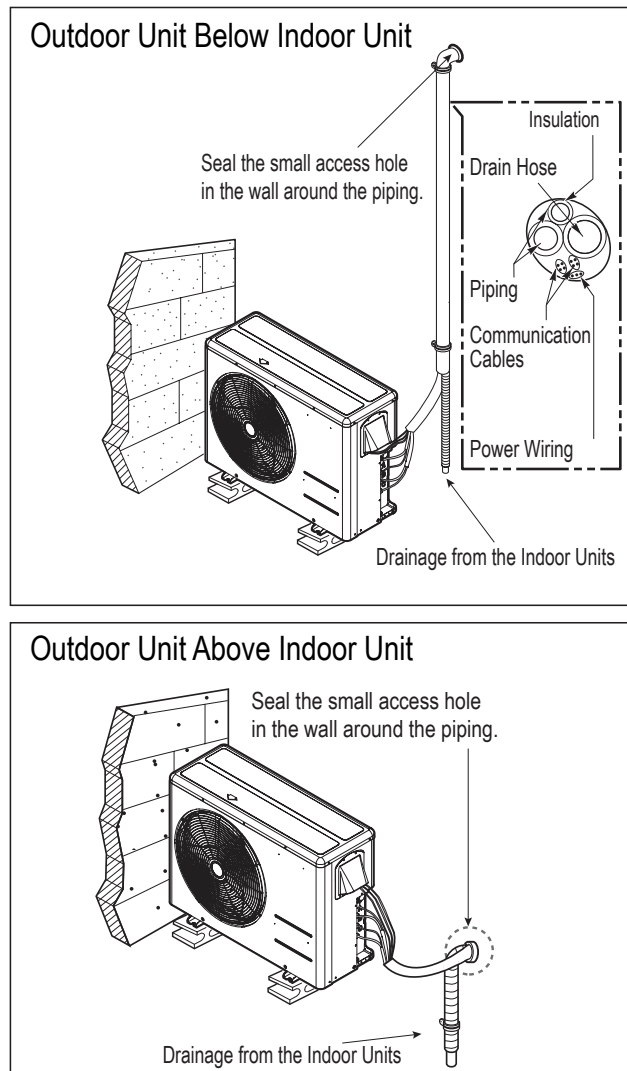


Figure 42: Special Applications.



REFRIGERANT PIPING CONNECTIONS

Outdoor Unit Connections

Outdoor Unit Connections

1. Remove the ODU front panel by loosening the fastening screws.
2. Align the center of the refrigerant piping and corresponding connection as shown.
3. Refer to the figures at right for liquid and gas piping attachments onto the outdoor unit.
4. Place a couple of drops of PVE refrigerant oil on outside of the flare before assembling. ⚠ Do not add any contaminants. Tighten the flare nut initially by hand.
5. Finish tightening the flare nut with a torque wrench until the wrench clicks. Follow torque guidelines in the table below. See figures for correct connection points.

Note:

When tightening the flare nut with a torque wrench, ensure the direction for tightening follows the arrow on the wrench.

Figure 45: Pipe Attachment.

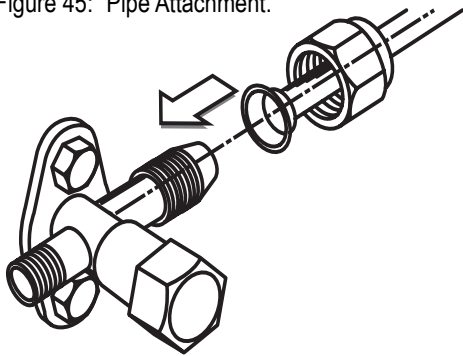


Table 15: Torque Wrench Tightening.

Pipe Size (in. OD)	Outside Diameter (mm)	Torque (lbs-ft)
1/4	6.35	13.0 - 18.0
3/8	9.52	24.6 - 30.4
1/2	12.7	39.8 - 47.7
5/8	15.88	45.4 - 59.3
3/4	19.05	71.5 - 87.5

Figure 43: LUU369HV, LUU428HV, LUU488HV Outdoor Unit Piping Connection

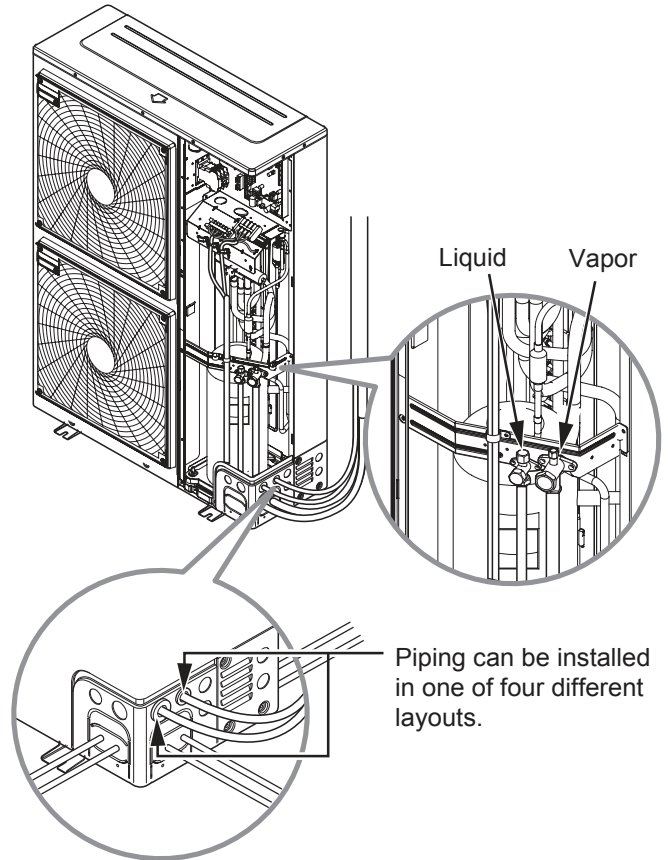
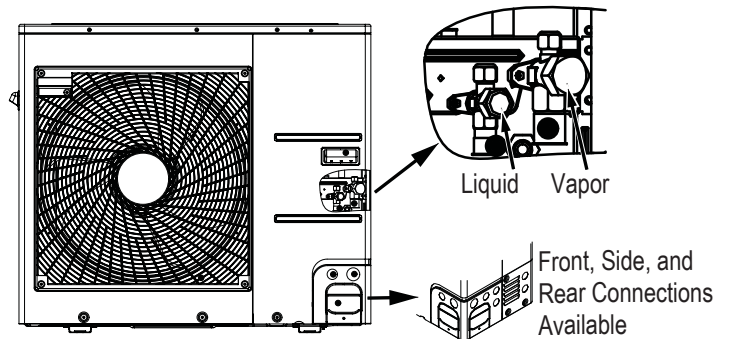


Figure 44: LUU189HV, LUU249HV Outdoor Unit Piping Connection



REFRIGERANT PIPING CONNECTIONS

Indoor Unit Connections

Piping to Indoor Unit

Follow the steps below and refer to the illustrations on this page to connect piping to the Single Zone indoor unit. To see specific bundling of piping and drain hose, see the Bundling and Cutting Line section. Also, refer to the Drain Hose Guidelines section on the next page for proper drainage slope during piping procedure. Also refer to the General Piping information in Section 3.

⚠ WARNING

⊘ **Do not braze in an enclosed location.** ⊘ **Do not allow the refrigerant to leak during brazing. Always test for gas leaks before and after brazing.**

If the refrigerant combusts, it generates a toxic gas that may cause physical injury or death.

1. Joints are brazed in the field. Single Zone refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, and heat exchangers that can easily become blocked. Proper system operation depends on the installer using best practices and utmost care while assembling the piping system.
2. Store pipe stock in a dry place; keep stored pipe capped and clean.
3. Purge clean all pipe sections with dry nitrogen prior to assembly.
4. Always use a non-oxidizing material for brazing. ⊘ Do not use flux, soft solder, or anti-oxidant agents. If the proper material is not used, oxidized film may accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.
5. Use a tubing cutter, ⊘ do not use a saw to cut pipe. De-bur and clean all cuts before assembly.
6. Brazing joints:
 - Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
 - Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
 - Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

Figure 46: VAHU Refrigerant Pipe Brazed Connections.

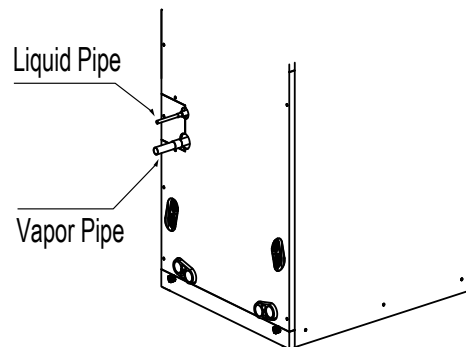
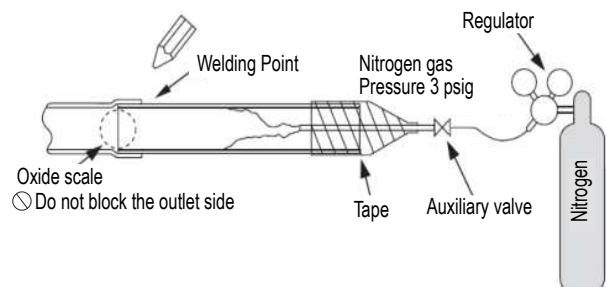


Figure 47: Refrigerant Pipe Brazing.



REFRIGERANT PIPING CONNECTIONS

Drain Hose

Indoor Unit Drain Hose Guidelines

Note:

Refer to the diagrams below and follow proper installation and the running of the drain hose along the pipe installation line to avoid leakage. Once drain hose is set in place, always follow with evacuation and leakage testing of all piping to be sure all piping is properly sealed. Re-check and retest as necessary.

Drain hose is routed from the indoor unit through the structure (wall) to the outdoors. It must slope at an angle where it is higher at the indoor unit and lower toward the outdoor area, thereby letting gravity push any condensation down and out. Avoid piping the drain hose as shown in Figure 50. These methods are incorrect and can cause leaks at the indoor unit site.

The drain hose may need to be extended so that condensate can be properly routed away. The drain hose extension must be correctly insulated to ensure any condensation will not damage walls, floors, etc. Foamed polyethylene or equivalent at least 5/16 inches thick is recommended.

Figure 49: Correct Slope Angle for the Drain Hose.

Correct Drainage Slope

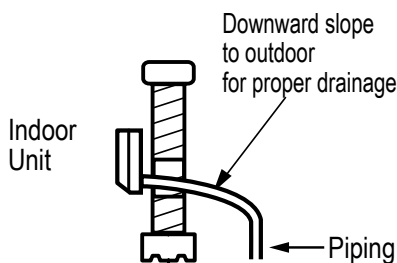


Figure 48: Drain Piping

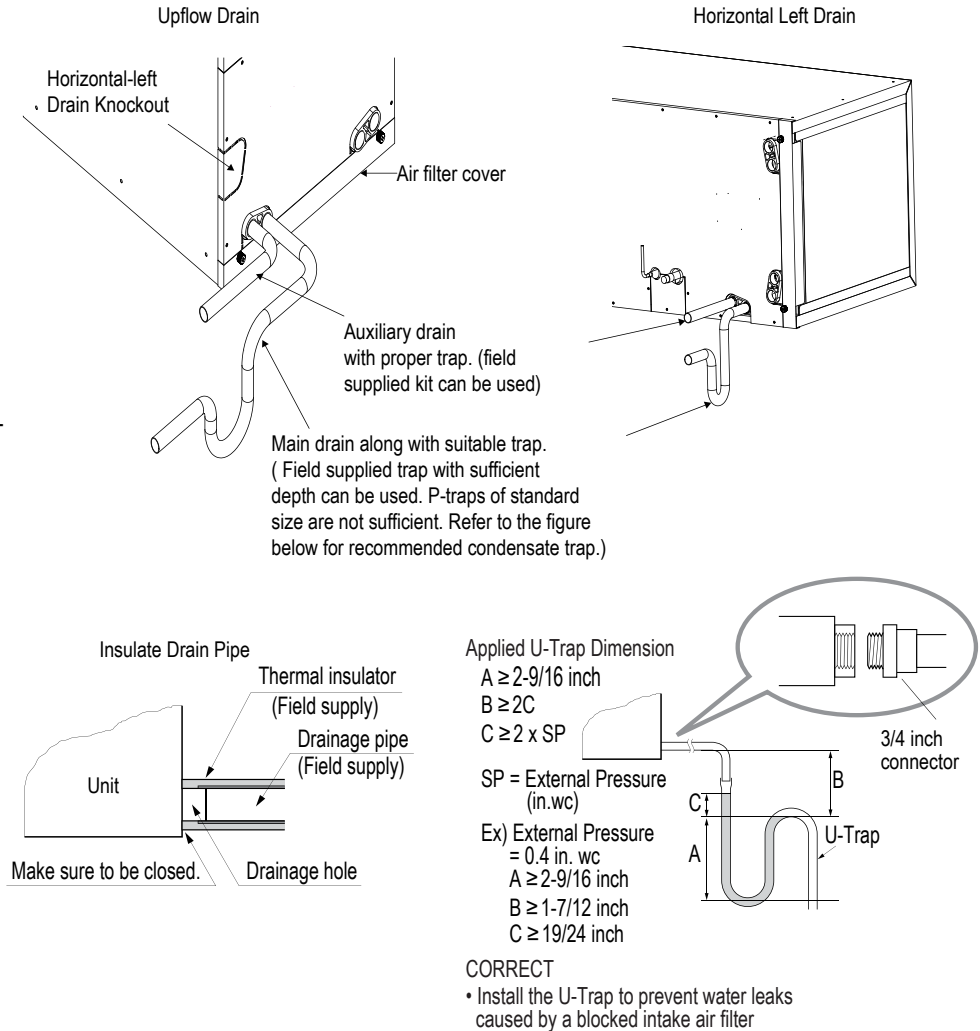
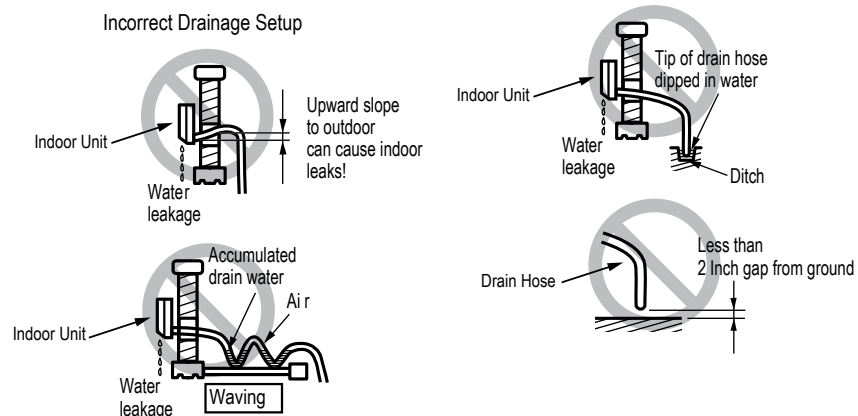


Figure 50: Incorrect Slope Angles for the Drain Hose.



REFRIGERANT PIPING CONNECTIONS

Bundling and Cutting Line

Indoor Unit Drain Pan

1. Install a drain pan if required by local code.
2. Figure 51 shows typical drain pan installation.

Checking the Indoor Unit Drain Hose for Leaks

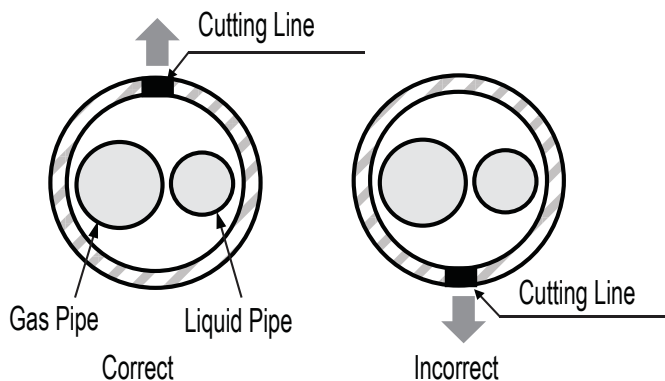
1. Pour a glass of water on the evaporator.
2. Verify that the water flows appropriately through and out of the drain hose of the indoor unit without any leaks.

Bundling and Cutting Line

Piping and cabling must be insulated and bundled together correctly for safety and usage. Follow proper methods and procedures as outlined here and on the next pages to ensure installation and piping are correctly installed.

1. Piping must be fully encased in insulation material: Overlap the field installation piping insulation material and the indoor unit piping insulation material.
2. Bind together the two pipes, using vinyl tape. Make sure there are no gaps during the binding.
3. Be sure the cutting line is placed upward (see figure below).
4. Wrap the rear piping house section with narrow vinyl tape.
5. Continue to wrap the indoor unit pipe as connected to the outdoor connection pipe.

Figure 53: Correct Cutting Line Placement



6. Using a wider vinyl tape, bundle the piping and drain hose together.
 - Tape must be sufficient to cover the piping in order to fit into the rear piping housing area at the back of the indoor unit.

Note:

Always include plenty of insulation on all refrigerant and drain piping to ensure condensate does not form and cause damage to walls, floors, etc.

Figure 51: Typical Drain Pan Installation.

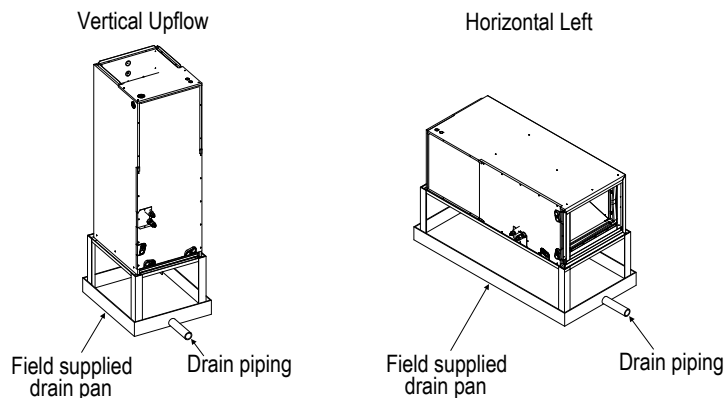


Figure 52: Piping with Insulation Material.

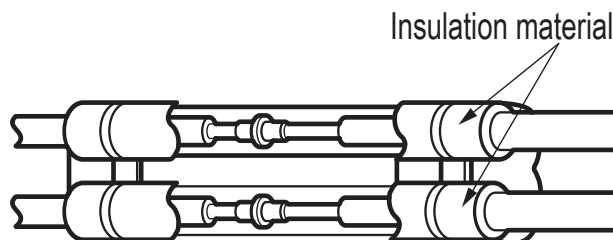


Figure 54: Wrapping Connection Pipe to Indoor Unit's Pipe.

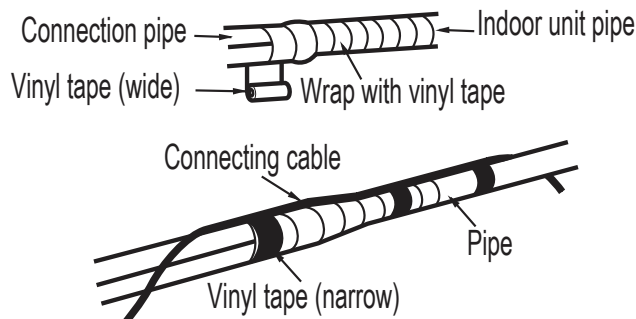
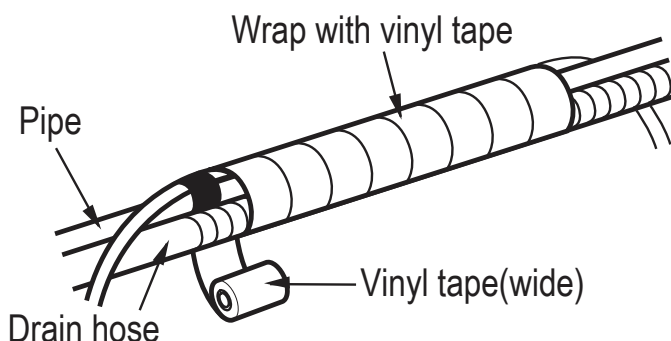


Figure 55: Bundling Pipe and Drain Hose



Refrigerant Piping System Insulation

Note:

For information regarding insulation for underground or penetration situations, see the "General Refrigerant Piping System Information" section.

All refrigerant piping from the outdoor unit to the indoor units must be insulated correctly for safety and usage. Refrigerant piping, field-provided isolation ball valves (if present), service valves, and elbows must be properly and completely insulated using closed cell pipe insulation (up to the indoor unit piping connections). To prevent heat loss / heat gain through the refrigerant piping, all refrigerant piping including liquid lines and vapor lines shall be insulated separately. Insulation shall be a minimum 1/2 inches thick, and thickness may need to be increased based on ambient conditions and local codes. Table on next page lists minimum wall thickness requirements for Ethylene Propylene Diene Methylene (EPDM) insulation.

Inside the outdoor unit, maximum pipe temperature is 248°F and minimum pipe temperature is -40°F. For field insulation of refrigerant piping between outdoor units and indoor units, consider the following pipe temperature ranges for an operating heat pump system:

- Heating mode refrigerant temperature ranges: Liquid = 75-118°F; High Pressure Vapor = 95-220°F
- Cooling mode refrigerant temperature ranges: Liquid = 75-118°F; Low Pressure Vapor = 40-90°F

All insulation joints shall be glued with no air gaps. Insulation material shall fit snugly against the refrigeration pipe with no air space between it and the pipe. ⚠ Do not allow insulation passing through pipe hangers, inside conduit, and/or sleeves to be compressed. Protect insulation inside hangers and supports with a second layer. All pipe insulation exposed to the sun and outdoor elements shall be properly protected with PVC, aluminum vapor barrier, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover; and meet local codes.

Figure 56: Typical Pipe Insulation, Power Wire and Communications Cable Arrangement.

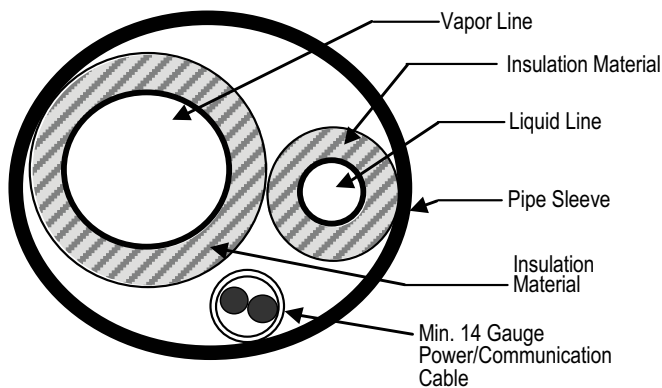


Figure 58: Insulating the Shut Off / Insulation Ball Valve (If Present).

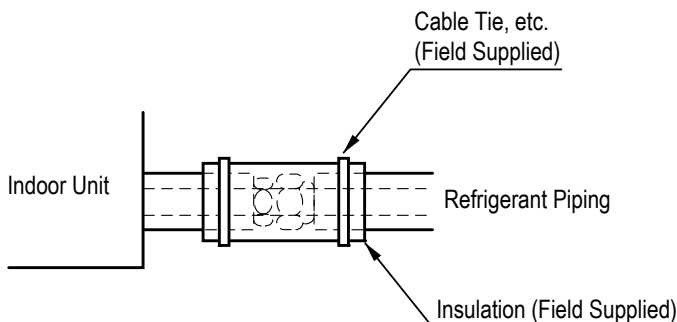
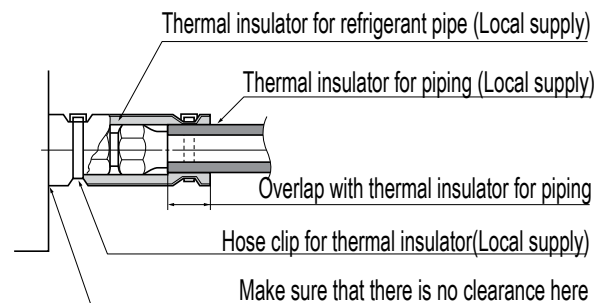
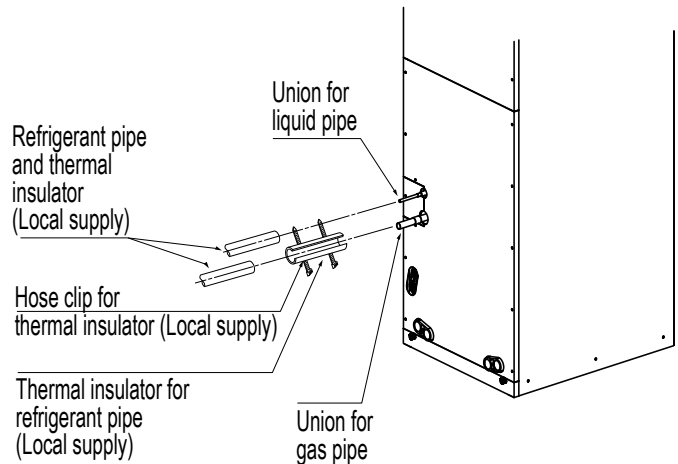


Figure 57: Typical Refrigerant Pipe Insulation at Indoor Unit



Note:

Always include plenty of insulation on all refrigerant and drain piping to ensure condensate does not form and cause damage to walls, floors, etc.

INSULATION

Minimum Refrigerant Pipe Ethylene Propylene Diene Methylene (EPDM) Insulation Wall Thickness Requirements

Note:

- Do not insulate gas and liquid pipes together as this can result in pipe leakage and malfunction due to extreme temperature fluctuations.
- Always properly insulate the piping. Insufficient insulation will result in condensation, reduced heating/cooling performance, etc. Also, if the pipes aren't insulated properly, condensation could potentially cause damage to building finishes. Pay special attention to insulating the pipes installed in the ceiling plenum.
- Fully insulate the piping connections.
- Follow locals codes and the designer's instructions when selecting ethylene propylene diene methylene (EPDM) insulation wall thickness.

Table 16: Minimum Refrigerant Pipe EPDM Insulation Wall Thickness Requirements.¹

Classification / Piping O.D.		Air-conditioned location		Non-air conditioned location	
		1. Typical Conditioned Location	2. Special Conditioned Location	3. Typical Unconditioned Location	4. Special Unconditioned Location
Liquid pipe	ø1/4 inch	>1/2 inches	>1/2 inches	>1/2 inches	>1/2 inches
	ø3/8 inch				
	≥ø1/2 inch				
Vapor pipe	ø3/8 inch	>1/2 inches	>3/4 inches	>3/4 inches	>1 inch
	ø1/2 inch				
	ø5/8 inch				
	ø3/4 inch				
	ø7/8 inch				
	ø1 inch				
	ø1-1/8 inches	>3/4 inches	>1 inch	>1 inch	
	ø1-1/4 inches				
	ø1-3/8 inches				
	ø1-1/2 inches				
	ø1-3/4 inches				

¹The thickness of the above insulation material is based on heat conductivity of 0.61 Btu/in/h/ft²/°F.

1. Typical Conditioned Location

A building plenum or space that contains conditioned air that does not exceed 80°F DB.

2. Special Conditioned Location

1. When the location is air conditioned, but there is severe temperature/humidity difference due to high ceilings.
 - Church, auditorium, theater, lobby, etc.
2. When the location is air conditioned, but internal temperature/humidity are high.
 - Bathroom, swimming pool, locker room, etc.

3. Typical Unconditioned Location

An unconditioned space inside a building.

4. Special Unconditioned Location: If conditions 1 and 2 below are present.

1. An unconditioned space or plenum of a building.
2. An area where there is an elevated humidity level.

5. Additional Insulation for Indoor Units May be Required in Humid Environments.

The air conditioner factory insulation has been tested according to "ISO Conditions with Mist," and it satisfies the requirements. If the system has been operating for a long time in a high humidity environment (dew point temperature: more than 73°F), condensate is likely to form. If this happens, install 3/8 inch thick EPDM insulation that is plenum-rated with a heat-resistance factor of more than 248°F.

ELECTRICAL SYSTEM INSTALLATION

General Information and Safety Guidelines

WARNING

- All power wiring and communication cable installation must be performed by authorized service providers working in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Failure to do so may lead to electric shock and bodily injury or death.
- Verify that main power to the unit is completely off before proceeding. Follow all safety and warning information outlined at the beginning of this manual. Failure to do so may lead to electric shock and bodily injury or death.
- Familiarize yourself with the location of the circuit breaker. Be sure that a circuit breaker or some other emergency power cutoff device is in place before any power wiring is done to the system. Failure to do so may cause bodily injury or death.
- ⚠ Never touch any power lines or live cables before all power is cutoff to the system. To do so may cause bodily injury or death.
- Undersized wiring may lead to unacceptable voltage at the unit and may cause a fire, which may cause bodily injury or death.
- Properly ground the Single Zone outdoor and indoor units. Ground wiring is required to prevent accidental electrical shock during current leakage.
- Ground wiring must always be installed by a qualified technician.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Using an oversized breaker or fuse may result in electric shock, physical injury or death.
- ⚠ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods, to telephone ground wiring, or to the building plumbing system. Failure to properly provide a National Electrical Code-approved earth ground can result in electric shock, physical injury or death.

Note:

- Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.
- Properly ground the Single Zone outdoor and indoor unit. Improperly connected ground wire can cause communication problems from electrical noise and motor current leakage. Ground wiring must always be installed by a qualified technician.
- If there is a possibility of electric surge, make sure the outdoor unit is properly grounded. Improperly ground wire can cause communication problems.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Using an oversized breaker or fuse may result in equipment malfunction and property damage.
- ⚠ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a National Electrical Code-approved earth ground can result in property damage and equipment malfunction.

ELECTRICAL SYSTEM INSTALLATION

Power Wiring Specifications and Best Practices

Power Wiring / Communication Cable Connections

Best practice dictates using solderless ring or fork terminals at all power wiring and communication cable terminations. Use copper bearing ring or fork terminals; **do not** use galvanized or nickel plate over steel. Use appropriate crimping tool to attach the ring or fork terminals at all power wiring and control cable terminations. To install:

- Firmly attach the wire; secure in a way to prevent external forces from being imparted on the terminal block.
 - Use an appropriately sized JIS screwdriver for tightening the terminals.
 - Do not** overtighten the connections; overtightening may damage the terminals.
- Allow at least 1/4 inches between the terminal connections.

If ring terminals or fork terminals are not available, then:

- Do not** terminate different gauge wires to the power terminal block. (Slack in the wiring may generate heat.)
- When terminating wires of the same thickness, follow the instructions demonstrated in the figures below.

Figure 59: Close up of a Typical Ring Terminal.

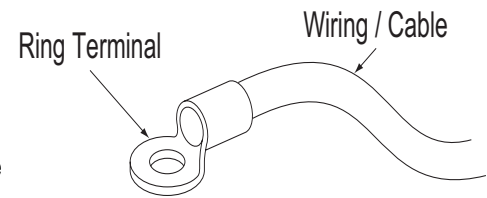


Figure 60: Distance Between the Terminal Connections.

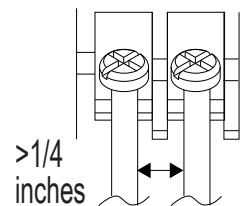
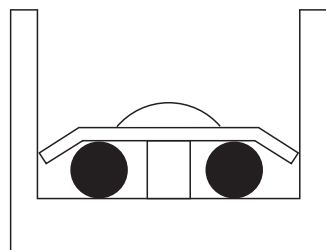
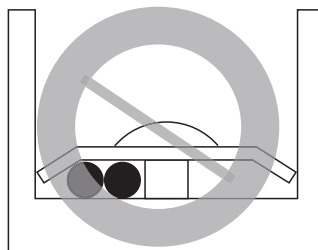


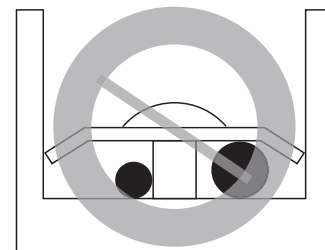
Figure 61: Proper and Improper Power Wiring Connections.



Terminate multiple power wires of the same gauge to both sides.



Do not terminate two wires on one side.



Do not terminate different gauge wires to a terminal block.

● :Copper Wire

⚠ WARNING

If power wires are not properly terminated and firmly attached, there is risk of fire, electric shock, and physical injury or death.

Note:

- Never** apply line voltage power to the communications cable terminal block. If contact is made, the PCBs may be damaged.
- Always include some allowance in the wiring length when terminating. Firmly attach the wiring or cable, but provide some slack to facilitate removing the electrical panels while servicing, and to prevent external forces from damaging the terminal block.

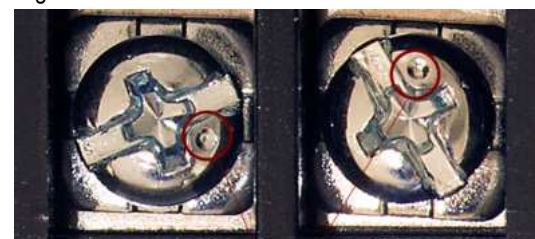
Terminal Connections

LG uses a "JIS" type of screw for all terminals; use a JIS screwdriver to tighten and loosen these screws and avoid damaging the terminal. **Do not** overtighten the connections — overtightening may damage the terminals — but firmly and securely attach the wiring in a way to prevent external forces from being imparted to the terminal block.

Note:

- The terminals labeled "GND" are **NOT** ground terminals. The terminals labeled  ARE ground terminals.
- Always create a wiring diagram that contains the exact sequence in which all the indoor unit is wired in relation to the outdoor unit.
- Do not** include splices or wire nuts in the communication cable.

Figure 62: JIS Screws.



JIS DIMPLES

ELECTRICAL SYSTEM INSTALLATION

Power Supply / Power Wiring Specifications

- LG Single Zone VAHU systems operate at 1Ø, 208-230V, 60Hz.
- Power wiring / power wiring gauge to the outdoor unit(s) must be solid or stranded, and must comply with all National Electrical Code (NEC), UL, and local electrical codes.
- The indoor unit is powered by the outdoor unit.
- Power supply, wire types and sizes, and circuit breaker must be selected based on NEC, UL, and local codes. Maximum allowable voltage fluctuation $\pm 10\%$ or nameplate rated value.
- Properly ground the outdoor unit and indoor unit per NEC, UL, and local codes.
- Ground wire must be longer than the common power / communication wires.
- Connect the wiring firmly so the wires cannot be easily pulled out.
- Refer to the inside of the chassis cover or control cover for circuit and terminal block diagrams.
- Always match color codes of each wire and follow wiring diagram.
- ⚠ Do not install power wiring to the outdoor unit and the communication / connection (power) cable to the indoor unit in the same conduit. Use separate conduits.

Figure 63: Single Zone Outdoor Unit Power Wiring Diagram.

Power Wiring, Ground to Outdoor Unit

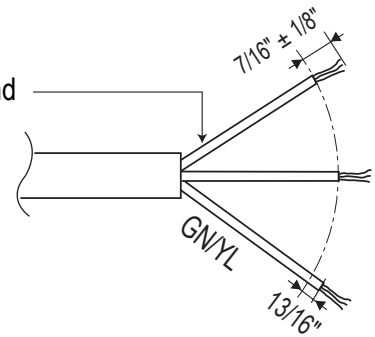


Figure 64: Power Wiring Conduit.



⚠ DANGER

Refer to *Electrical Data* table for ampere ratings. Properly size all circuit breakers / fuses, wiring and field provided components per local codes. There is risk of fire, electric shock, explosion, physical injury or death.

⚠ WARNING

- All power wiring installation must be performed by authorized service providers working in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Failure to do so may lead to electric shock and bodily injury or death.
- Use specified wiring for connections, and ensure that external force is not imparted to terminal connections. It may generate heat and / or cause a fire, resulting in physical injury or death.
- Use heat-proof electrical wire capable of withstanding temperatures up to 167°F to avoid wiring malfunction and electrical shock, which may cause physical injury or death.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulation related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in electric shock, physical injury or death.
- Use the appropriate type of overcurrent protection. Generated overcurrent may include some amount of direct current, and if the appropriate type of overcurrent protection is not installed, there is a risk of fire, electric shock, and physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. ⚠ Do not connect the ground line to the pipes. There is risk of fire, electric shock, explosion, physical injury or death.
- Per code, install a main indoor breaker and an outdoor service disconnect that interrupts all power sources simultaneously. There is risk of fire, electric shock, explosion, physical injury or death.

Note:

- If there is a possibility of momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit. If not, the compressor and other components may be damaged.
- Use heat-proof electrical wire capable of withstanding temperatures up to 167°F to avoid damage to unit.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in equipment malfunction and property damage.
- ⚠ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a NEC approved earth ground can result in property damage and equipment malfunction.

ELECTRICAL SYSTEM INSTALLATION

Communication / Connection (Power) Cable Specifications from Outdoor Unit to Indoor Unit

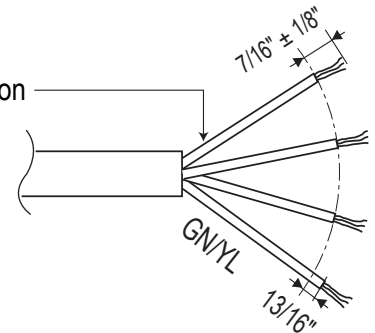
- For communication / connection (power) wires between the Single Zone outdoor unit and the indoor unit, use a minimum 18 gauge, four (4) conductor, stranded, shielded or unshielded wire. If shielded, the wire must be grounded to the chassis at the outdoor unit only.
- Install insulation material as required by local code.
- Firmly attach the cable; provide slack but secure in a way to prevent external forces from being imparted on the terminal block.
- Wiring must be completed without splices.

Note:

- Always verify the communication cable is connected to a communications terminal on the Single Zone unit. ⚠ Never apply line voltage power to the communication cable connection. If contact is made, the PCBs may be damaged.
- The shield of the communications cable connecting the outdoor unit to the indoor unit must be grounded only to the outdoor unit frame.
- Tie the shield of each cable segment together using a wire nut at the indoor unit. Maintain polarity throughout the communication network.
- Position the incoming power to the outdoor unit away from the power / communications cables from the outdoor unit to the indoor unit.
- ⚠ Never use a common multiple-core communications cable.

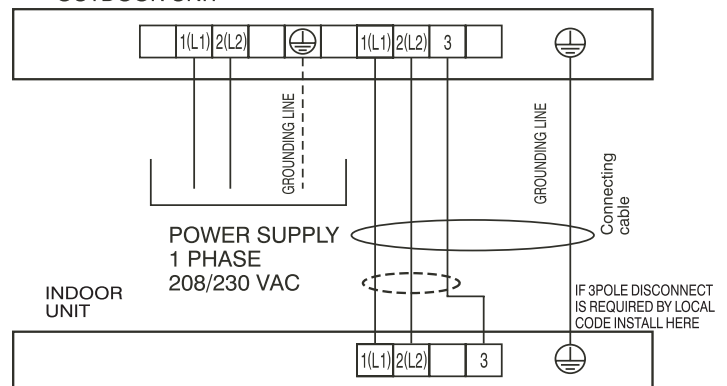
Figure 65: Single Zone Outdoor Unit to Indoor Unit Wiring and Communications Cable Diagrams.

Communication / Connection (Power), Ground Cable From Outdoor Unit To Indoor Unit



GN/YL = (Ground, Yellow)

Figure 66: General VAHU Power / Communication System Diagram.



ELECTRICAL SYSTEM INSTALLATION

Wall Controller Installation

Controller Options

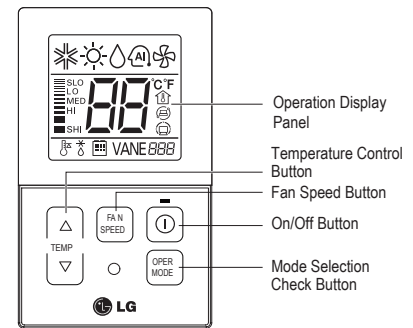
Vertical Air Handling indoor units do not include a wired controller. Optional LG-supplied wired controllers are available. The wireless handheld controller (Model No. PQWRHQ0FDB) is also an optional accessory with use of the wired controller.

- Operation Display Panel: Displays operation conditions.
- Temperature Control Button: Sets desired temperature.
- Fan Speed Button: Sets desired fan speed.
- On / Off Button: Turns system operation on and off.
- Mode Selection Check Button: Selects the operation mode: Cooling, Heating, Auto, Dry (Dehumidification), or Fan.

Note:

Each function displays on the LED for about three (3) seconds when the power is first cycled on.

Figure 67: PQRCVCL0QW Wired Controller.

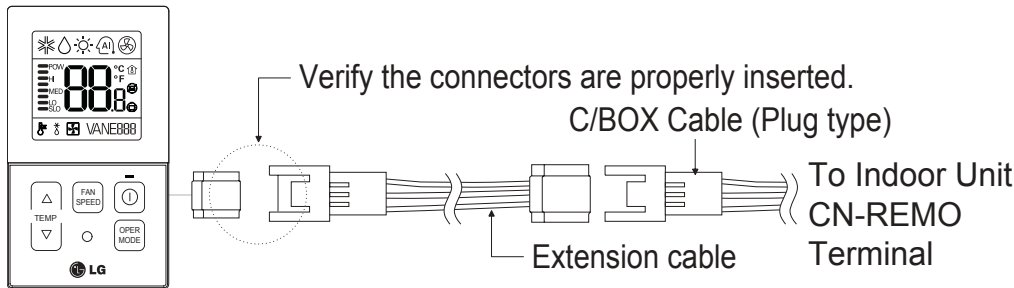


Wired Controller Connections

Controllers can connect to the indoor unit in one of two different ways.

1. LG Wired Remote Extension Cable with Molex plug (PZCWRC1; sold separately) that connects to the CN-REMO terminal on the indoor unit PCB.
2. Field-supplied controller cable that connects to the indoor unit terminal block (must be at least UL2547 or UL1007, and at least FT-6 rated if local electric and building codes require plenum cable usage). Communication cable from indoor unit to remote controller(s) is to be 22 AWG, 3-conductor, twisted, stranded, unshielded. Wiring must comply with all applicable local and national codes.

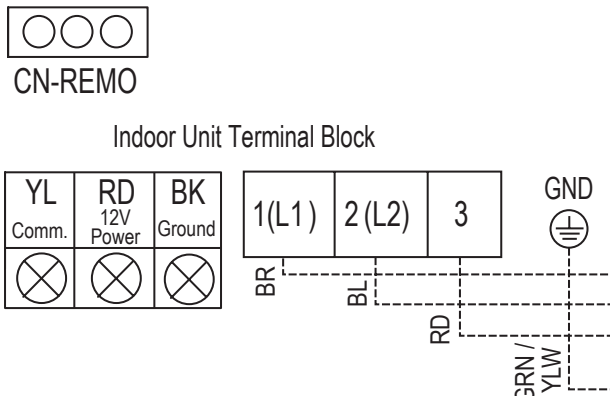
Figure 68: PZCWRC1 LG Wired Remote Extension Cable.



Note:

When using field-supplied controller cable, be sure to connect the yellow to yellow (communications wire), red to red (12V power wire), and black to black (ground wire) terminals from the remote controller to the indoor unit terminal blocks.

Figure 69: Wired Controller Connection on the Indoor Unit Terminal Block.



ELECTRICAL SYSTEM INSTALLATION

External Static Pressure Setting Values

External Static Pressure (ESP) Default Settings (NJ frame)

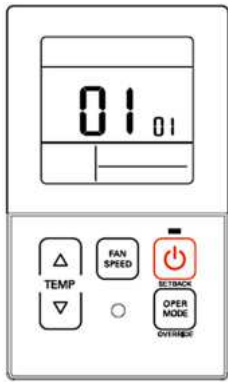
Table 17: ESP Setting Values (NJ frame).

Model Number	Air Volume*		
	High	Medium	Low
LVN181HV4	640	580	480
LVN241HV4	710	640	480
LVN361HV4	990	880	800

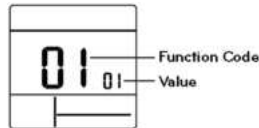
*Installer settings available to change the CFM to 10% above or 10% below the values mentioned in the above table.

How to Enter Installer Setting Mode

Follow this procedure to enter installer setting mode and set the target air volume as desired.



1. Press  button and  button simultaneously for 3 seconds to enter the installer setting mode.
2. When entering installer setting mode, function code is displayed on the LCD screen.



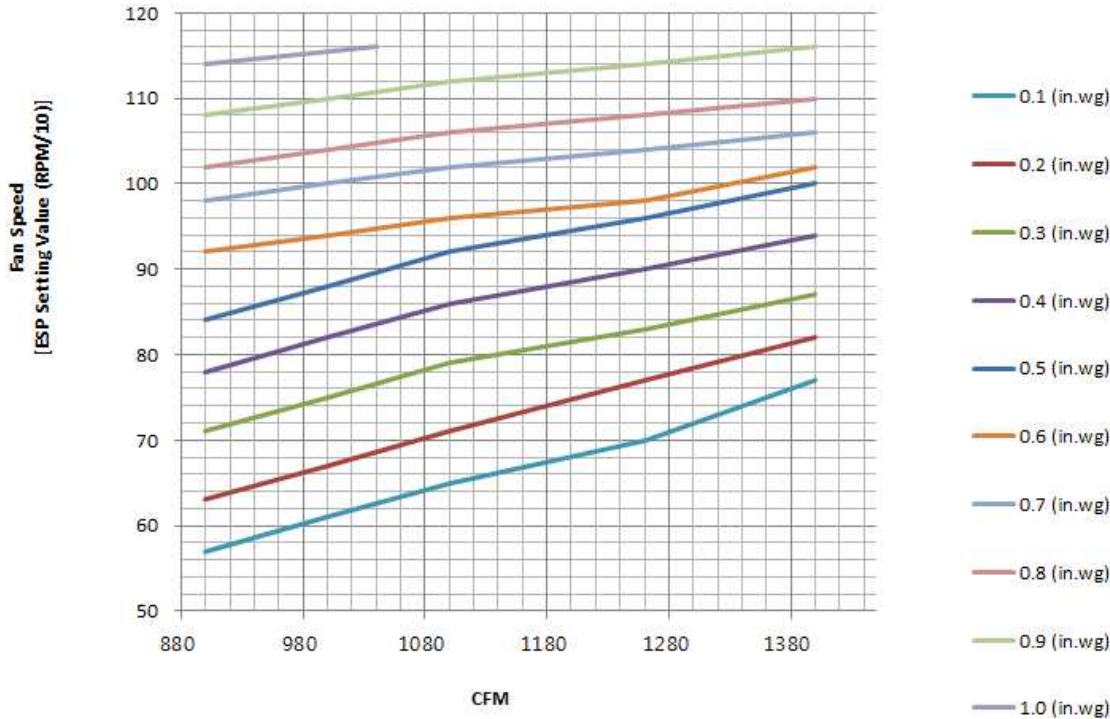
3. Press  button to select function code 64 (target air volume).
4. Press  buttons to change value as desired (00 = Default; 01 = +10%; 02 = -10%).
5. Press  button to set value.
6. Press  button and  button simultaneously for 3 seconds to exit installer setting mode.

ELECTRICAL SYSTEM INSTALLATION

External Static Pressure Setting Values

External Static Pressure Setting Values (NK frame)

Figure 70: ESP Setting Values (NK frame).



IDU External Static Pressure Setting Values

Table 18: Vertical Air Handling Unit Indoor Unit External Static Pressure and Air Flow Tables.

Static Pressure (in. wg)			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Model No. / Nominal Capacity of System (Btu/h)	Airflow Rate / CFM		Setting Value (in. WG) ¹									
LVN420HV / 42,000	High	1,260	70	77	83	90	96	98	104	108	116*	—
	Mid	1,100	65	71	79	86	92	96	102	106	114	—
	Low	1,000	61	67	75	82	88	94	100	104	112	116*
LVN480HV / 48,000	High	1,400	77	82	87	94	100	102	106	110	116*	—
	Mid	1,260	70	77	83	90	96	98	104	108	114	116*
	Low	1,000	61	67	75	82	88	94	100	104	112	116*

¹ Unless otherwise noted, vertical air handling units are UL listed up to 0.5 in. wg total static pressure, including coil, case, duct work pressure drop, air filter, and largest kW size heater. Internal static pressure includes coil and case only.

* Airflow rate (CFM) decreases by 3% per 0.1 in. wg.

Factory default status is 0.3 in wg.

Factory default is high static pressure.

Note:

- If the ESP is set incorrectly, the air conditioning may malfunction.
- To get the desired air flow and external static pressure combination, use the setting value from the table. Using a setting value other than the values listed in the table will not provide the desired combination.

ELECTRICAL SYSTEM INSTALLATION

Indoor Unit Electrical Connections

Connecting Indoor Unit Electrical Wiring

⚠ WARNING

- Verify that main power to the unit is completely off before proceeding with these steps as there is a risk of electrical shock and bodily injury.
- Follow all safety and warning information outlined at the beginning and throughout this manual. Failure to do so may cause bodily injury.

Note:

- Follow all safety and warning information outlined at the beginning and throughout this manual. Failure to do so may cause unit failure.
- Some units might require removal of the control cover from the terminal block area.
- Connect the communication / connection (power) cable to the indoor unit by matching the terminals on the outdoor unit control board. Verify the color of the wires at the outdoor unit, along with the terminal numbers, match those for the indoor unit.
- Images are representative; actual appearance may vary.
- Refer to the circuit diagram on the indoor unit chassis cover.

1. Using a JIS screwdriver, remove the screws from the upper front panel of the indoor unit and set aside.
 2. Using a JIS screwdriver, remove the control box cover.
 3. Route the power and communication wiring into the indoor unit. The wiring is usually routed through the wiring knockouts.
 4. Using a JIS screwdriver, connect the cable to the terminals..
 - The communication / connection (power): Each wire must be securely attached to the terminal block.
 - Connect the cables to the corresponding terminals.
 - Pay attention to the location/connection of the green/yellow ground cable. Ground cable must be longer than the other wires.
 - Secure the cable onto the control board using the cable tie.
 5. Reinstall the control box cover.
 6. Reinstall the indoor unit upper front panel.
 7. If all other piping and electrical wiring to the outside unit has been completed at this stage, the system can be turned on to test.
- If the piping connections have not been completed, ⓧ do not turn power on at this time. Proceed to complete all other piping, (along with drain hose) and wiring to the system.

Figure 71: Removing Panels

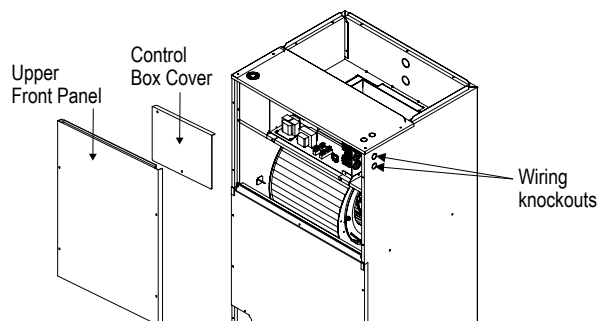


Figure 72: Routing Wiring Through Knockouts

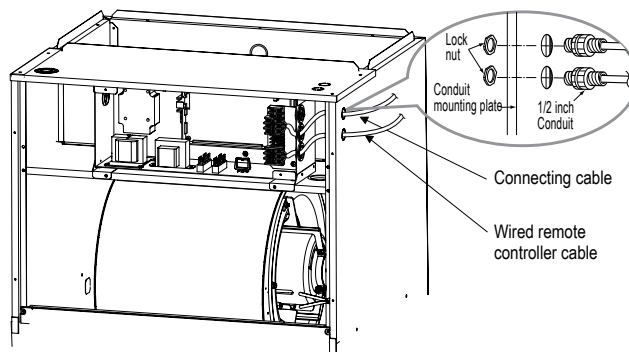


Figure 73: Typical Indoor Unit Terminal Block with Grounding Cable (Example Only).



ELECTRICAL SYSTEM INSTALLATION

Outdoor Unit Electrical Connections

Connecting Outdoor Unit Wiring

⚠ WARNING

- Verify that main power is completely off and that no power is going through the Single Zone system before proceeding with these steps. Follow all safety and warning information outlined at the beginning of this manual. Failure to do so may cause electric shock, bodily injury and / or death.
- Per code, install a main indoor breaker, and an outdoor service disconnect that interrupts all power sources simultaneously. There is risk of fire, electric shock, explosion, physical injury or death.
- Verify that the circuit breaker or some other emergency power cutoff device is in place before any power wiring is done to the system. Failure to do so may cause electric shock, bodily injury and / or death.
- ⚡ Never touch any power lines or live cables before all power is removed from the system. To do so may cause bodily injury or death.

1. Remove the front panel and / or control cover from the outdoor unit.
2. Before proceeding, inspect all wiring inside the casing to be sure they are secure and have not come loose during transportation and installation of the outdoor unit.
 - Loose wires can cause the wiring to burn out quickly.
 - Inspect wires for any damage or cracks.
3. Confirm that electrical power supply capacity will be sufficient to run the unit. See specifications sheets at the beginning of this installation manual for details on power.
4. Confirm that the right gauge is being used for wiring to proceed.
5. Using a JIS screwdriver, connect all wires as shown at right.
 - Each wire must be individually and securely attached to each terminal.
 - Secure the cable with the cable tie.
 - Pay attention to the location/connection of the green/yellow ground cable.
 - Maintain a minimum of 1/4 inches of wire length from terminal block to cable bundle.
6. When finished, reattach the control cover and front panel to the outdoor unit with the screws.

Figure 74: Circuit Breaker.

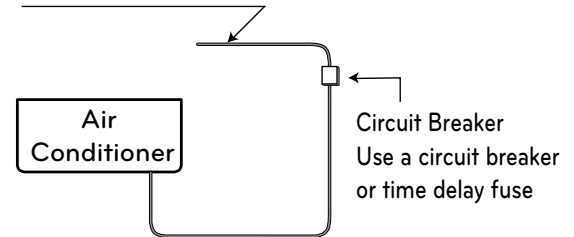
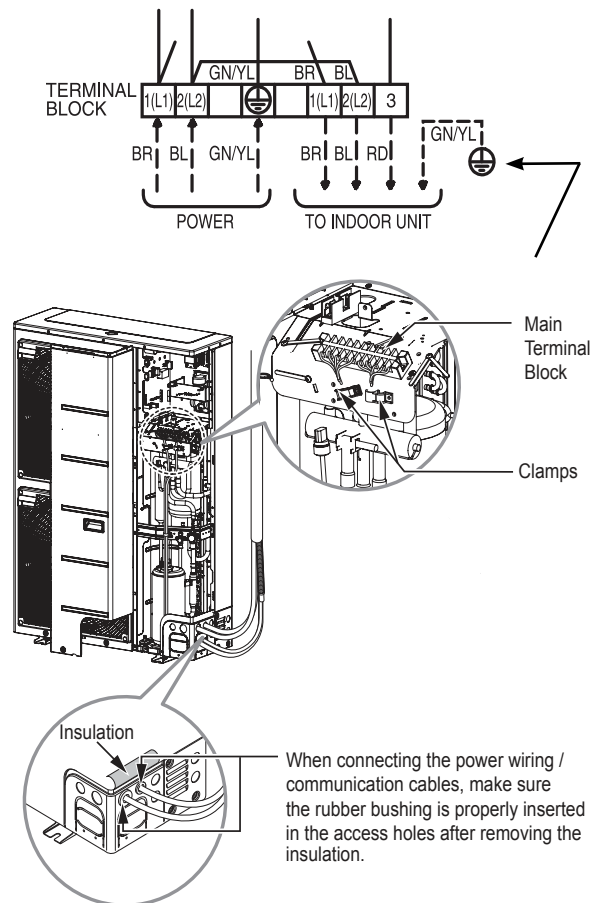


Figure 75: Outdoor Unit Electrical Connections.

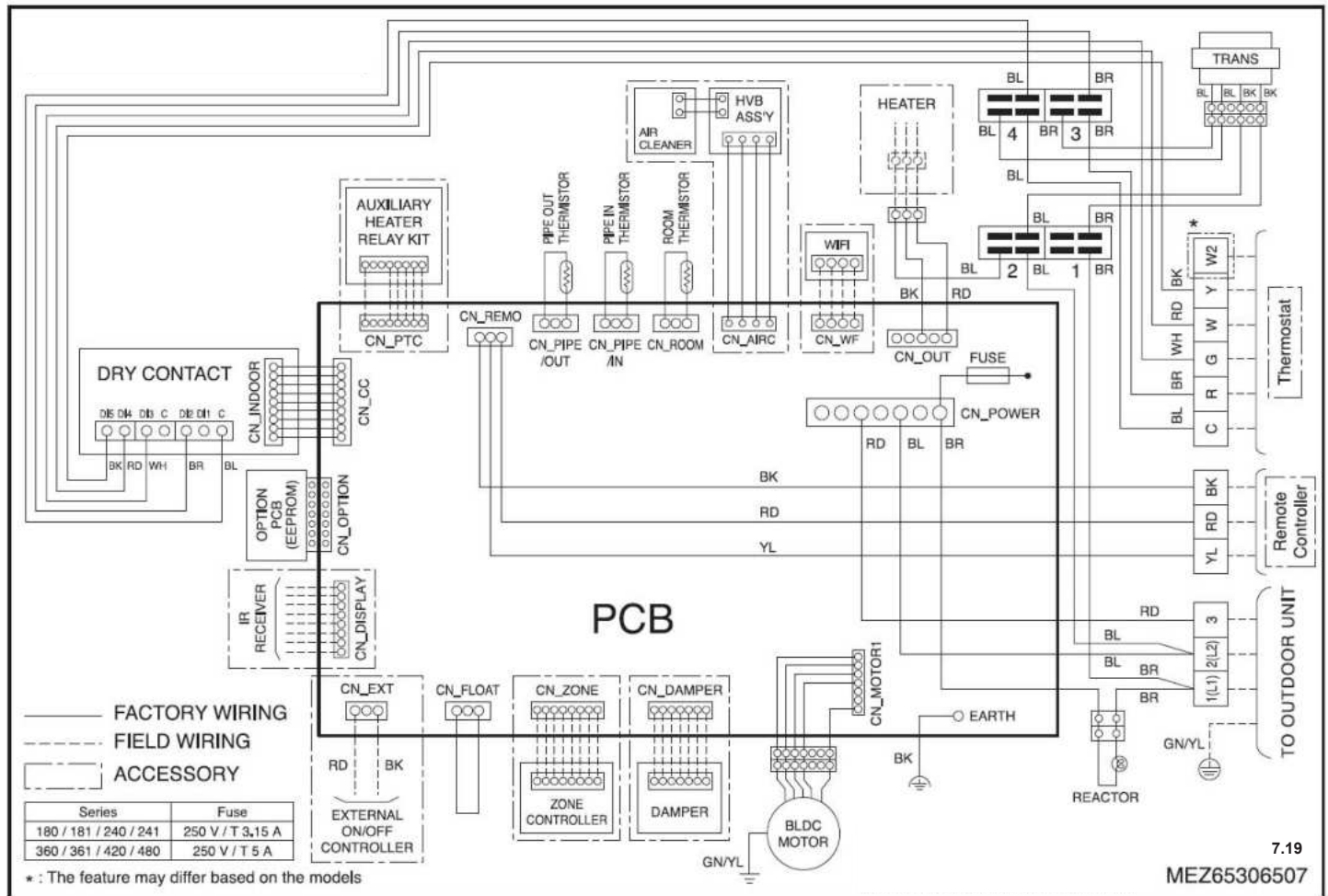


ELECTRICAL SYSTEM INSTALLATION

Indoor Unit Wiring Diagram LVN181HV4, LVN241HV4, LVN361HV4

Wiring Diagram for LVN181HV4, LVN241HV4, LVN361HV4

Figure 76: Indoor Unit Wiring Diagram.



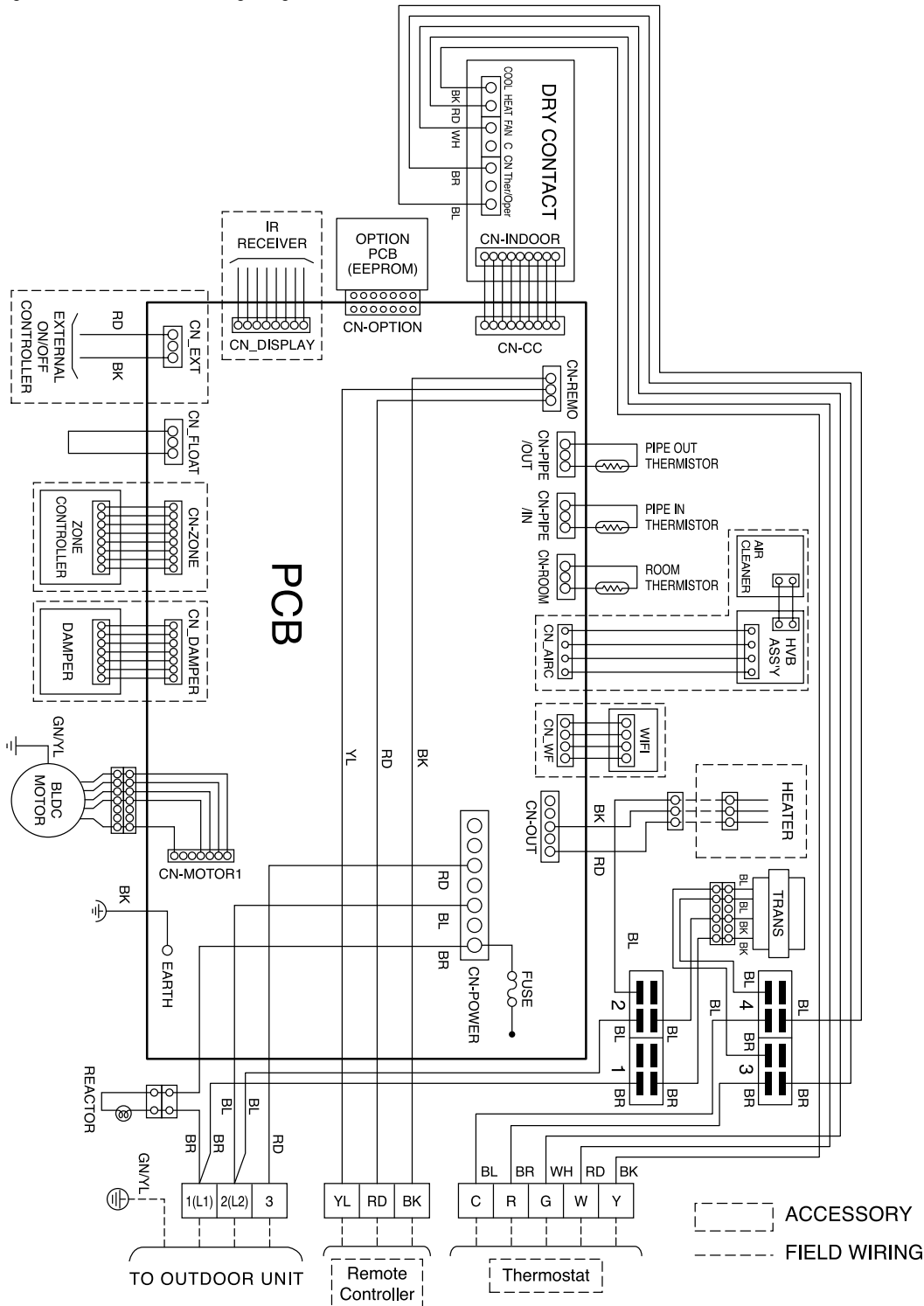
7.19
MEZ65306507

ELECTRICAL SYSTEM INSTALLATION

Indoor Unit Wiring Diagram LVN420HV, LVN480HV

Wiring Diagram for LVN420HV, LVN480HV

Figure 77: Indoor Unit Wiring Diagram.



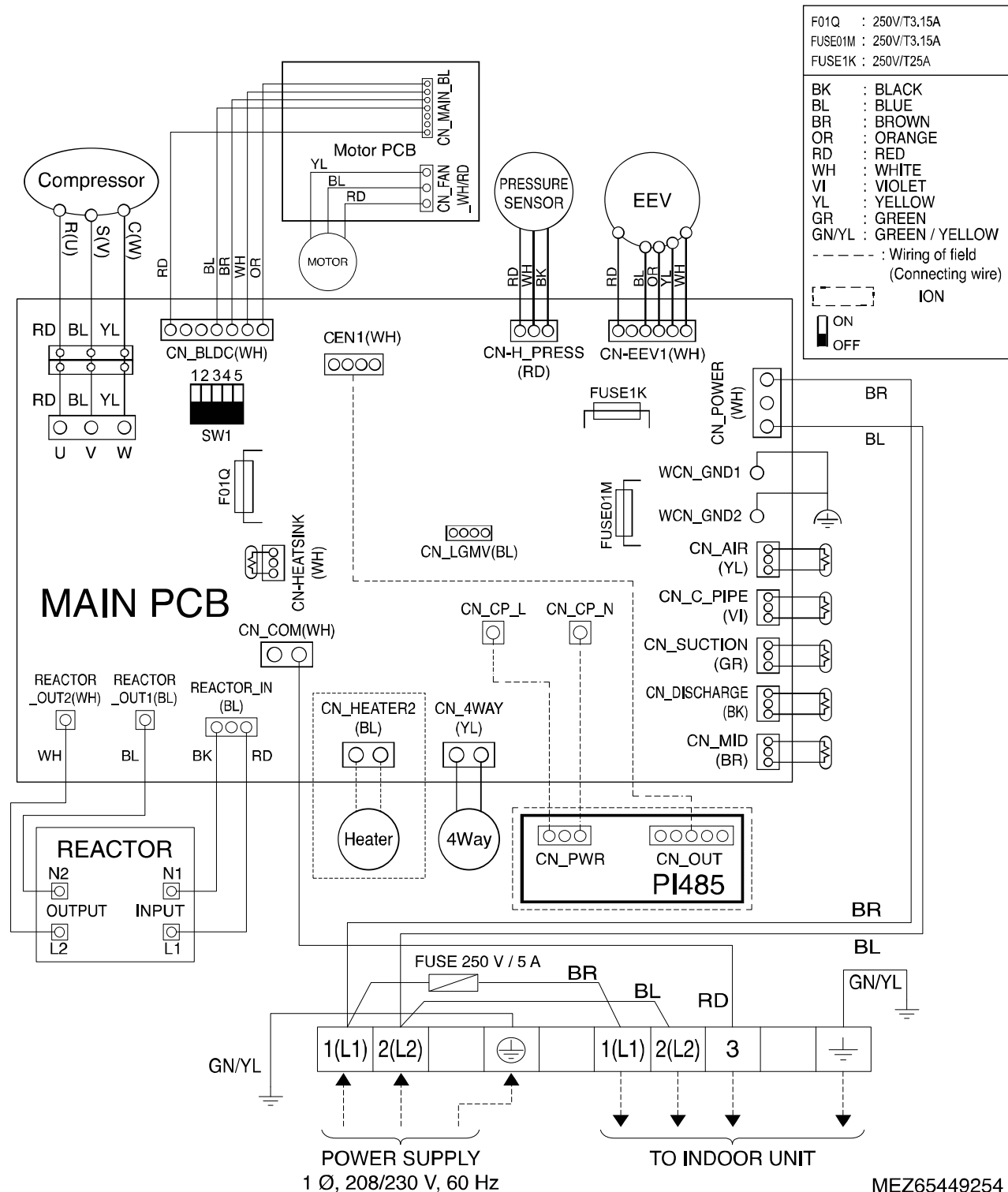
MODEL	Fuse
180 / 240 / 360	250 V / T 3.15 A
420 / 480	250 V / T 5 A

ELECTRICAL SYSTEM INSTALLATION

Outdoor Unit Wiring Diagram LUU189HV

Wiring Diagram for LUU189HV

Figure 78: Outdoor Unit Wiring Diagram.



MEZ65449254

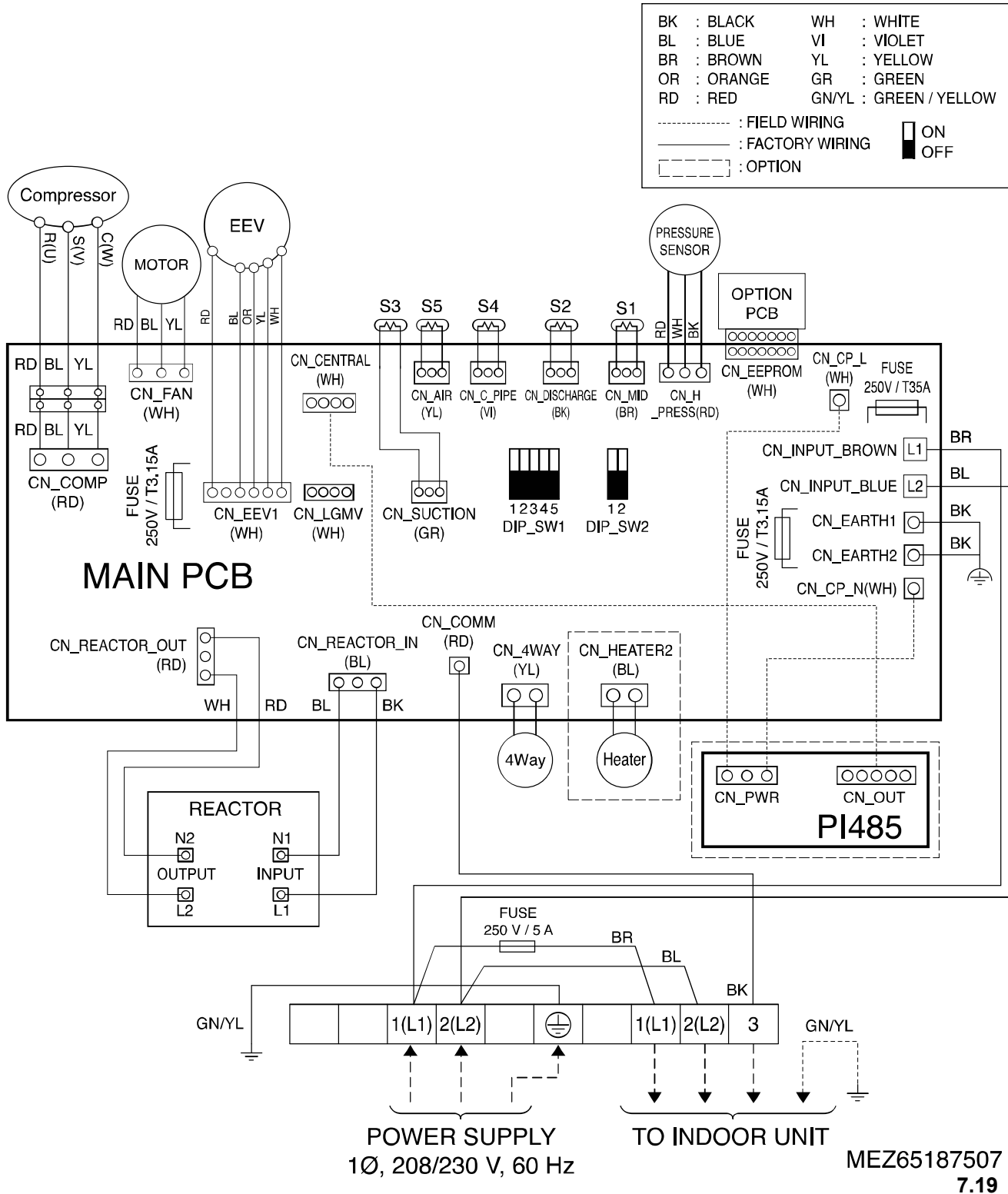
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ELECTRICAL SYSTEM INSTALLATION

Outdoor Unit Wiring Diagram LUU249HV

Wiring Diagram for LUU249HV

Figure 79: Outdoor Unit Wiring Diagram.



Single Zone Vertical Air Handling Unit Installation Manual

Wiring Diagram for LUU369HV

Wiring Diagram for Outdoor Unit

Power Supply: 10, 208/230 V, 60 Hz

TO INDOOR UNIT

Legend:

- : FIELD WIRING
- : FACTORY WIRING
- - - - - : OPTION

Note:

- T/B : Main Terminal block
- F1 : Fuse 250 V, 35 A
- F2 : Fuse 250 V, 5 A
- F3 : Fuse 250 V, 3.15 A
- F4 : Fuse 250 V, 1 A
- S1 : Pressure Sensor
- S2 : Thermistor (Pipe_Middle)
- S3 : Thermistor (Discharge)
- S4 : Thermistor (Suction)
- S5 : Thermistor (Pipe_Out)
- S6 : Thermistor (Air)
- EEV : Electronic Expansion Valve
- 4Way : 4way valve
- Motor 1 : Fan motor (up)
- Motor 2 : Fan motor (down)

Color Code:

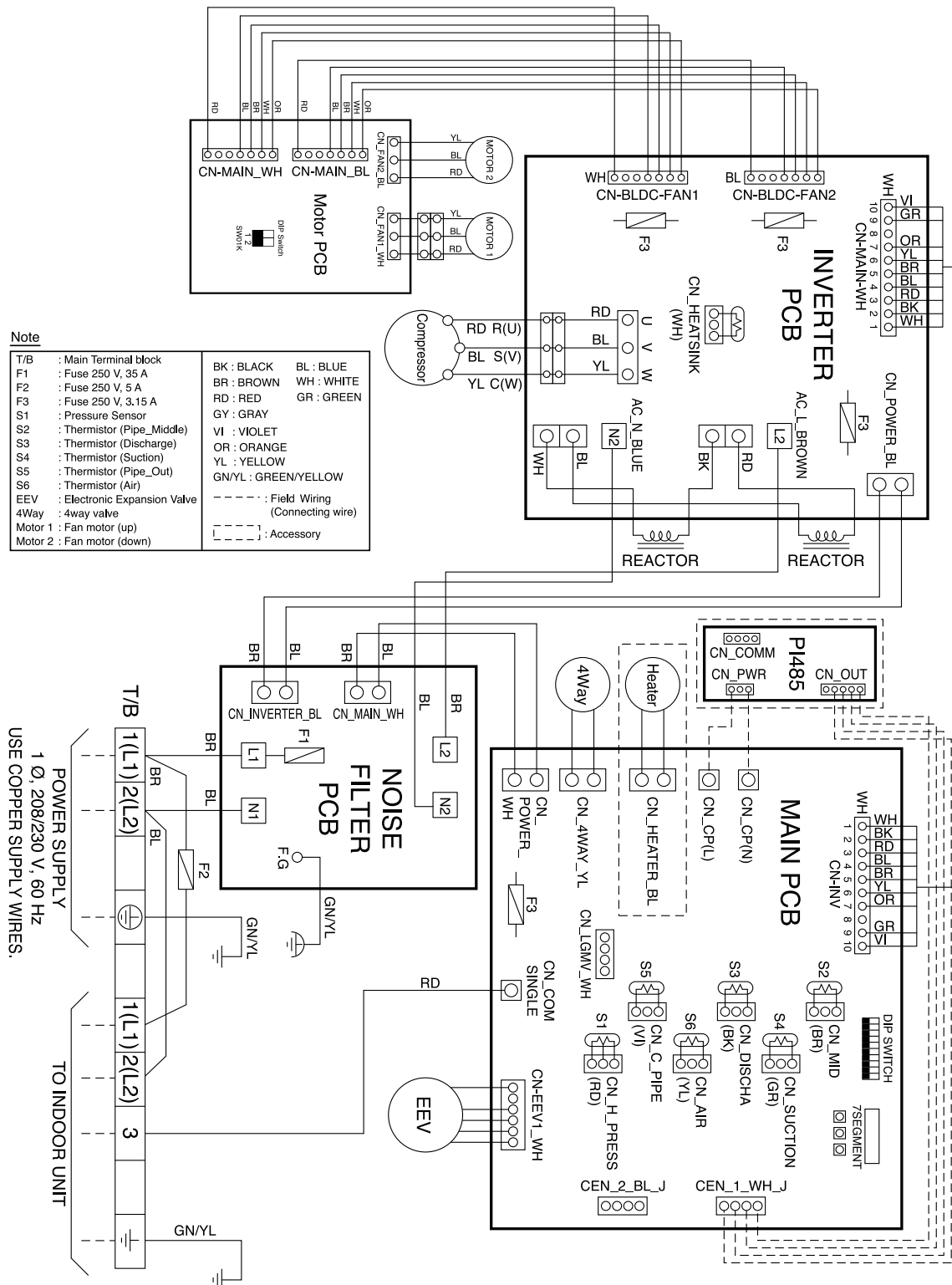
- BR : BROWN
- BL : BLUE
- Y : YELLOW
- RD : RED
- WH : WHITE
- GY : GRAY
- GR : GREEN
- V : VIOLET
- OR : ORANGE
- GN/YL : GREEN/YELLOW

ELECTRICAL SYSTEM INSTALLATION

Outdoor Unit Wiring Diagram LUU428HV, LUU488HV

Wiring Diagram for LUU428HV, LUU488HV

Figure 81: Outdoor Unit Wiring Diagram.



ELECTRICAL SYSTEM INSTALLATION

NJ, NK Wiring Diagrams Legend

Table 19: NJ/NK Frame Wiring Diagram Legend.

Terminal	Purpose	Function
CN-POWER	AC Power supply	AC Power line
CN-MOTOR1	Fan motor output	Motor output of BLDC
CN_OUT	Heater	Connection for heater
CN-D/PUMP	Drain pump output	AC output for drain pump
CN-FLOAT	Float switch input	Float switch sensing
CN-ZONE	Zone controller	Zone controller connection
CN-OPTION	Optional PCB EPROM	Option PCB connection
CN-EXT	External ON / OFF controller	External ON / OFF controller connection
CN-DISPLAY	Display	Display of indoor status
CN-CC	Dry contact	Dry Contact connection
CN-PIPE/OUT (RD)	Discharge pipe sensor	Pipe out thermistor
CN-LEAK (VI)	Refrigerant leak detector	Refrigerant leak detector connection
CN-PIPE/IN (WH)	Suction pipe sensor	Pipe in thermistor
CN-REMO (GN)	Wired remote controller	Wired remote control connection
CN-ROOM (YL)	Room sensor	Room air thermistor
CN-DAMPER	Damper Controller	Damper connection
CN-AIRC	Air Cleaner	Air Cleaner connection
CN-WF	Wifi	Wifi Module connection
CN-PTC	Auxiliary Heater Relay Kit	Auxiliary Heater Relay Kit Second stage heat

ELECTRICAL SYSTEM INSTALLATION

NJ/NK Chassis DIP Switch Settings

DIP Switch Settings for Indoor Unit PCB

Table 20: NJ/NK Frame DIP Switch Settings.

Dip Switch	Function	Off	On	Description
SW1	COMMUNICATION	Off (default)	–	–
SW2	CYCLE	Off (default)	–	–
SW3	GROUP CONTROL	Master	Slave	Group control setting using 7-Day Programmable Controller; selects Master/ Slave on each indoor unit.
SW4	DRY CONTACT MODE	Variable	Auto	Sets operation mode for optional Dry Contact accessory. 1. Variable: Auto or Manual Mode can be set through 7-Day Programmable Controller or Wireless Remote Controller (factory default setting is Auto if there is no setting). 2. Auto: For Dry Contact, it is always Auto mode.
SW5	CONTINUOUS FAN	Off	On	Selects continuous fan for ducted indoor units. 1. On: Indoor unit fan will always operate at a set fan speed, except when the system is off, or the outdoor unit is in defrost mode (when the outdoor unit is in defrost mode, the fan will operate at super low fan speed). 2. Off: Indoor unit fan speed can be changed by on / off.
SW6	HEATER INTERLOCK	Off	On	Selects heater interlock function for Vertical Air Handling units. 1. On: Automatic (heater will automatically operate during heating mode). 2. Off: Manual (heater needs to be manually turned on during heating mode).
SW7	Off			
SW8	Off			

Note:

To operate the indoor unit without Internal Electric Heater, Dip switch 1, 2, 6, 8 must be set OFF.

To operate the indoor unit with Internal Electric heater, Dip switch 6 must be set ON.

- SW6 ON: Automatic Heater operation: Heater operates automatically.
- SW6 OFF: Manual Heater operation: Owner's involvement is required for on/off operation.

If you operate the indoor unit with Internal Electric heater with Dip switch 5, note the following:

- SW5 ON: Fan operates continuously. During defrosting or oil return operation, uninterrupted heating can be attained, as a result of continuous heater and fan operation.
- SW5 OFF: Fan discontinuous operation. There would be reduction in heating capacity while defrosting or oil return operation.

FINAL INSTALLATION PROCEDURES

Triple Leak / Pressure Check

Triple Leak / Pressure Check

After the refrigerant piping installation is complete, perform a triple leak / pressure test. Triple leak / pressure test is performed between the indoor and outdoor unit to verify that refrigerant can flow through the system without danger of leaks or pressure losses. Air and moisture that is left in the piping can lead to undesirable results and can cause damage to the system. It is important to go through a complete leak / pressure cycle to make sure the refrigerant piping is cleared out. This process may need to be repeated if any air or moisture is found to remain in the piping.

Note:

Insufficient or incorrectly done air purging may lead to the following:

- Pressure in the system can rise.
- Operating current can rise.
- Insufficient cooling or heating capability.
- Moisture in the refrigerant circuit may freeze and block capillary tubing.
- Water can lead to corrosion of parts in the system.

⚠ DANGER

Using combustible gases, including oxygen may result in fire or explosion, resulting in personal injury or death. Use inert gas (medical-grade dry nitrogen) when checking leaks, cleaning, installing/repairing pipes, etc. The use of a 600 psig nitrogen regulator is required for safety.

Note:

- ⚠ Do not apply power to the single zone system before performing a system leak test. There is a possibility that the EEV valve may close and isolate sections of the piping system, making the leak test inconclusive.
- ⚠ Never perform the leak test using refrigerant.
- To avoid nitrogen entering the refrigerant system in a liquid state, the top of the cylinder must be higher than its bottom (used in a vertical standing position) when the system is pressurized.
- Use only a leak-free gauge manifold set.
- Piping system must not be pressured to more than 550 psi. Pressures greater than 550 psi may damage the piping system and cause unit malfunction.

Triple Leak / Pressure Check Procedure

1. After the refrigerant piping installation is complete, open the isolation ball valves, if any, that may have been included in the piping system.
2. Verify that both the liquid and gas (vapor) suction line outdoor unit service ports are closed, and the stem head access caps are tight. The leak / pressure check is to be performed to only the refrigerant piping system and connected indoor unit.
3. Remove the cap on the gas (vapor) line Schrader port. Connect the (medical-grade dry) nitrogen cylinder regulator to a gauge manifold, then connect the gauge manifold to the gas (vapor) suction Schrader port on the service port.
4. Perform the leak / pressure check at 150 psig for fifteen (15) minutes (standing pressure check).
5. Perform the leak / pressure check at 300 psig for thirty (30) minutes (standing pressure check).
6. Perform the leak / pressure check at 550 psig for one (1) hour to make sure the piping system is leak-free. After the gauge reading reaches 550 psig, isolate the system by first closing the gauge manifold, then close the nitrogen cylinder valve. Check the flared (and any brazed connections) for leaks by applying a bubble solution to all joints.

Note:

The bubble solution must be a solution designed for refrigerant leak testing. ⚠ Do not use common soap solution on refrigerant piping as those contain chemicals that could corrode copper and brass, and cause product malfunction.

Figure 82: Outdoor Unit Service Valves.

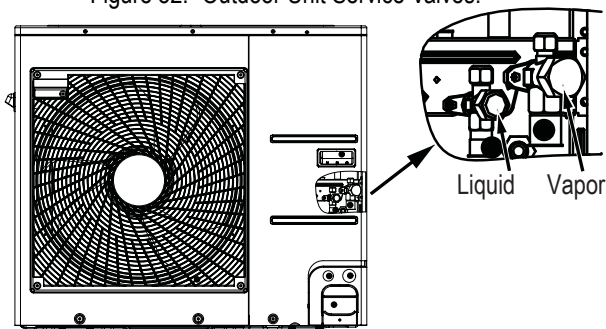
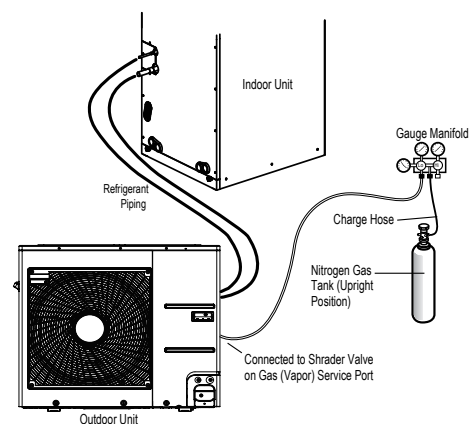


Figure 83: Leak Test Diagram.



FINAL INSTALLATION PROCEDURES

Triple Leak / Pressure and Evacuation Procedures

Triple Leak / Evacuation Procedure, continued.

7. If the pressure does NOT drop for one (1) hour, the system passes the test.
8. If the pressure drops, there is a leak and it must be found. Remove the bubble solution with a clean cloth, repair the leak(s), and perform the leak / pressure check again.
9. After the system has been thoroughly tested and no leaks are found, depressurize by loosening the charging hose connector at the nitrogen cylinder regulator. When system pressure returns to normal, completely disconnect the charging hose from the cylinder, and release the nitrogen charge from all refrigerant piping. Wipe off any remaining bubble solution with a clean cloth.

Triple Evacuation Procedure

After the leak / pressure check is complete, perform a Triple Evacuation to the refrigerant piping system and connected indoor unit. Evacuation must be performed through the Schrader ports on the outdoor unit service port.

Note:

For faster evacuation, the Schrader core can be removed, and an auxiliary service port can be used. Make sure to re-install the original Schrader core before operating the system.

- Deep evacuate through both the liquid and gas (vapor) suction Schrader ports on the outdoor unit service ports.
- The outdoor unit service valves must remain closed and the stem head access caps tight. ⚠ Do not open the outdoor unit service valves and release the factory refrigerant charge until trim charge is complete, and the system is ready to operate.
- Any field-installed ball valves (if used) in the refrigerant system must be open to ensure all piping is free and clear for evacuation on all piping and connected indoor unit.

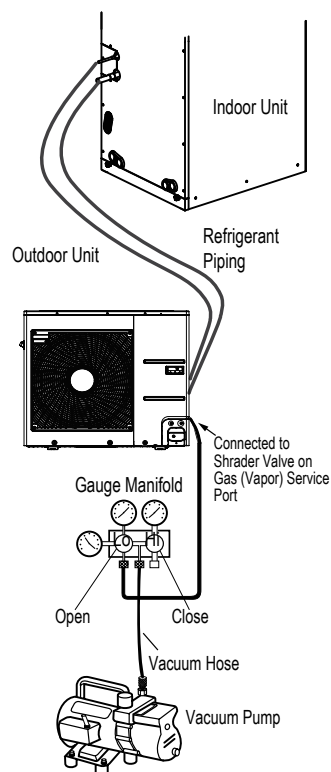
Note:

- ⚠ Do not apply power to the single zone system before performing the evacuation procedure. There is a possibility that the EEV valve may close and isolate sections of the piping system, making the evacuation procedure inconclusive.
- ⚠ Never perform evacuation using refrigerant.
- Use only a vacuum pump that can reach 500 microns, vacuum rated hoses or copper tubing, and a leak-free gauge manifold set.
- Use only new vacuum pump oil from a properly sealed (unopened) container, and change oil in pump before EVERY use.
- Subsequent oil changes will be necessary after several hours of continuous operation; have extra oil on hand.
- Use a quality micron gauge in good operating order and install as far away from pump as possible.

Triple Evacuation Procedure Steps

1. If this procedure is performed shortly after the leak / pressure test, the cap and core on the liquid and gas (vapor) suction Schrader ports must have already been removed, and the manifold must already be connected. If the procedure was not performed shortly after the leak / pressure test, make sure to remove the cap and core on the liquid and gas (vapor) suction Schrader ports. Verify that the service valves on the outdoor unit are closed, and the stem head access caps are tight.
2. Connect the gauge manifold along with the vacuum pump to the liquid and gas (vapor) suction Schrader ports (with core removed) using a vacuum hose. Open the gauge manifold and the vacuum pump valves.

Figure 84: Evacuation Setup



FINAL INSTALLATION PROCEDURES

Triple Evacuation Procedure

Triple Evacuation Procedure Steps, continued.

Note:

After the vacuum pump is first operated, if hoses, manifold, and vacuum valves are leak free (and oil is not moisture laden), the gauge must read <100 microns within one (1) minute. ⚠ Do not proceed if the gauge does not read <100 microns within one (1) minute. There is a leak in the hose, gauge manifold, or vacuum valve, and the equipment must be replaced.

3. Operate the vacuum pump and evacuate the system to the 2,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level may rise a bit, but MUST eventually stop rising for fifteen (15) minutes.
 - If the micron level DOES NOT stop rising, there is a leak, and the leak test must be performed again.
 - If the micron level DOES rise above 2,000 micron, re-open the manifold gauges and the vacuum pump valve and continue evacuation back down to 2,000 micron level.
 - If the micron level holds at 2,000 micron, continue to step 4.
4. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time (this is to “sweep” moisture from piping).
5. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
6. Evacuate to 1,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level may rise a bit, but MUST eventually stop rising for fifteen (15) minutes.
 - If the micron level DOES NOT stop rising, there is a leak, and the leak test must be performed again.
 - If the micron level DOES rise above 1,000 micron, re-open the manifold gauges and the vacuum pump valve, and continue evacuation back down to 1,000 micron level.
 - If the micron level holds at 1,000 microns, continue to step 7.
7. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time.
8. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
9. Evacuate to static micron level ≤ 500 for at least one (1) hour.
10. Micron level must remain ≤ 500 for two (2) hours. If the vacuum gauge rises and stops, the system may contain moisture, therefore, it will be necessary to repeat the steps of vacuum break and drying.
11. After maintaining the system in vacuum for two (2) hours, check if the vacuum gauge rises or not. If it doesn't rise, then the system is properly evacuated.
12. Close manifold gauges.
13. Shut the valve before turning off and disconnecting the vacuum pump.

FINAL INSTALLATION PROCEDURES

Trim Charge, Test Run

Refrigerant Trim Charge

The single zone system may need an additional refrigerant charge if the installed piping lengths are greater than the “piping length (no additional refrigerant, ft.) specification” listed in the product tables. See the product sections in the engineering and installation manuals. The additional refrigerant charge can be calculated manually using the information in the engineering and /or installation manuals, or by LATS.

1. Keep the outdoor unit service valves closed while adding the trim charge to the system. See the specification tables in the front of this installation manual for base charge, and the correct additional refrigerant trim charge amounts for each system.
2. Charge through just the gas (vapor) suction Schrader port.

⚠ WARNING

- Follow all guidelines when handling refrigerant. Not doing so may cause bodily injury.
- Never inhale or handle refrigerant directly. Doing so may cause bodily injury.

Finishing the Job

After the Triple Leak and Evacuation (and refrigerant trim charge, if any) procedures have been performed, follow the steps below to open the refrigerant lines.

1. Verify that the auxiliary service port is removed (if used in the Evacuation procedure) and the original Schrader core was re-installed on the gas (vapor) suction service port.
2. The service ports are a back-seated type with a right hand thread. Remove the service valve caps on both the gas (vapor) suction and the liquid service ports.
3. Use an Allen wrench to fully open the valves on both the gas (vapor) suction and the liquid service ports by turning the valve stem counterclockwise.
4. Turn until the valve stem is out, stops, and the valve is completely backseated. ⚠ Do not apply excessive force.
5. Securely replace service port caps on both the gas (vapor) suction and the liquid using an adjustable wrench.

Test Run

After all installation and testing procedures are complete, the system must be ready for a test run. Follow the guidelines below.

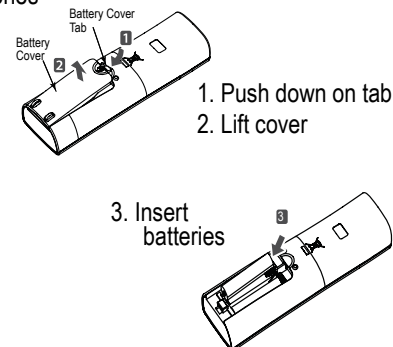
1. Check that all drain piping, refrigerant piping, and wiring are properly connected.
2. Install the batteries into the (optional) handheld remote controller (see below).
3. Turn on the power to the outdoor unit, and test system operation.
4. As the system is operating, make notes as needed to troubleshoot any issues that might appear.

Installing Batteries into the Optional Handheld Remote Controller

For information on using the optional handheld remote controller, refer to its owner's manual. To use a handheld controller with the VAHU, a wall controller with an infrared receiver is required.

1. The remote controller needs two AAA (1.5V) batteries for operation. Remove the battery cover from the back of the remote controller.
 - Push downward on the tab at the top of the battery cover and then lift up to remove.
2. Insert the two new batteries.
 - Align batteries by the (+) and (-) sides.
 - The interior battery compartment of the remote controller will have clear markings for the (+) and (-) placement.
3. Verify that the batteries have clicked into the compartment and are firmly engaged with the contacts on either side of them.
4. Reattach the back cover of the remote controller.
5. Proceed with powering on the remote controller and use as needed. Remove the batteries if system won't be used for an extended period.

Figure 85: Optional Remote Controller - Installing Batteries



FINAL INSTALLATION PROCEDURES

Pump Down, Cooling Only Mode

Pump Down Procedure

This procedure is performed when the refrigerant piping system is serviced. Pumping down pushes all the refrigerant into the outdoor unit without losing any charge. Always adhere to and be familiar with local codes regarding the handling of refrigerant.

The system must operate in cooling only mode to proceed with the pump down procedure. If needed, refer to the sections below for proper steps to place the unit into cooling only mode.

1. Connect a low-pressure gauge with manifold hose to the charge port on the gas line service valve.
2. Open the gas line service valve halfway.
3. Purge the air in the manifold hose using the refrigerant.
4. Close the liquid line service valve all the way.
5. Turn on the unit's power switch and start the cooling mode operation.
6. Observe the pressure gauge reading. When it changes 1 to 0.5 kg/cm² (14.2 to 7.1 psig), fully close the gas line valve and then immediately turn the unit off. Pump down procedure is complete and all refrigerant must be collected into the outdoor unit.

WARNING

Never inhale or handle refrigerant directly. Doing so may cause bodily harm and injury.

Note:

Perform Pump Down procedure in the cooling only mode.

Enabling Cooling Only Mode

Before running the Pump Down procedure, you must place the unit into Cooling Only Mode. In order to be able to run Cooling Only Mode, you must enter the unit into the Installer Mode by pressing the Reset button and the JET MODE button simultaneously.

1. Shut down power to system completely.
2. Enter the Installer Mode as stated in the paragraph above.
3. Set code to 45.
4. Press Power-ON button and select the code number 45.
 - Unit must beep to acknowledge that code has been received.
5. Turn off power.
 - Let unit cycle off for a minimum of 30 seconds.
6. Turn power back on to system.

Note:

- After the system is in Installer Mode (with Cooling Only Mode initiated), automatic operation is suspended.
- After Cooling Only Mode is disabled, the unit will return to normal operation.
- Installer Code cannot be entered if the unit is running. The system must be completely powered off.
- All Installer Code numbers must be entered into the system during Power Off state. (Complete shutdown of the system.)
- WLAN Module's communication time will lag by about 1 minute after unit is turned back on, and in normal operating mode.
- Entire lock or Mode lock cannot be set if you set heating or automatic operation through the central controller.

Disabling Cooling Only Mode

After Pump Down procedure has been performed, you will need to disable Cooling Only Mode, and place the unit back into normal operating mode. Follow the procedure below.

1. Shut down power to system completely.
2. Enter the Installer Mode.
3. Set code to 46.
4. Press Power-ON button and select the code number 46.
 - Unit must beep to acknowledge that code has been received.
5. Turn off power.
 - Let unit cycle off for a minimum of 30 seconds.
6. Turn power back on to system.

TROUBLESHOOTING

LG SIMS - Self Diagnosis Functions

The SIMS WLAN module and the smart phone app together provide monitoring and troubleshooting capability for LG Duct Free Systems. SIMS functions only with LG Duct Free products. LG SIMS can also be used with Single Zone one-to-one configurations such as the Single Zone VAHU systems.

SIMS can display and graph operational data for the air conditioner system including the indoor unit and the outdoor unit. SIMS also displays error codes and a troubleshooting guide. A full copy of the LG SIMS Smart Inverter Monitoring System User's Manual is available on the www.lghvac.com website.

To use SIMS, you must be a trained HVAC service technician familiar with variable refrigerant flow (VRF) systems in general, and with LG's Duct Free System products. You must understand the inverter air conditioning operation cycle, the meaning of the data displayed by SIMS, and how to use the data to troubleshoot the system.

⚠ WARNING

High voltages capable of causing death are used in this equipment. Outdoor unit power remains connected during this procedure. Take extreme caution not to touch electrical components or connections. Failure to observe this warning can result in death or severe injury.

Note:

- The air conditioning system must run for at least 15–20 minutes before data collected by SIMS 2.0 is valid for troubleshooting.
- The free SIMS app must be correctly installed on the smart phone before using SIMS.
- Some outdoor units have an LGMV extension cable accessed by removing the side handle cover. If the outdoor unit does not have this extension cable, access the LGMV connector by removing the top cover of the outdoor unit.

SIMS App Main Info Screen

The main screen is the first screen displayed after wireless connection is established. Tap the Main Info tab to display current readings regarding the indoor and outdoor unit(s). The Operational Info area of the screen will show active functions or modes by illuminating the light to the right of the function.

Additional Help information can be accessed by tapping the Help Menu buttons at the bottom of this screen.

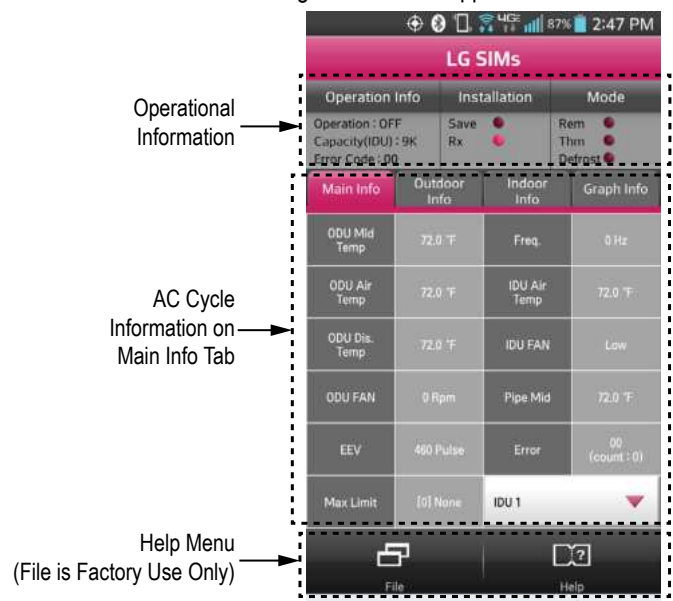
Figure 86: LG SIMS App and WLAN Module.



Figure 87: SIMS WLAN Module to DFS System Example.



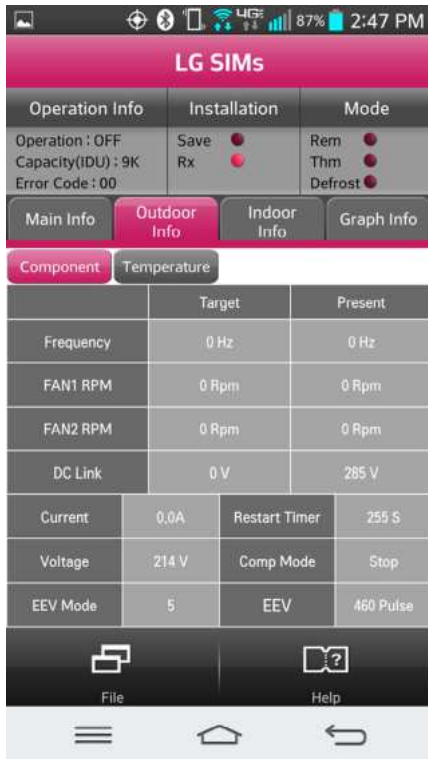
Figure 88: SIMS App Main Info Screen



TROUBLESHOOTING

LG SIMS - Self Diagnosis Functions

SIMs App Screens



Outdoor Info/Component Screen

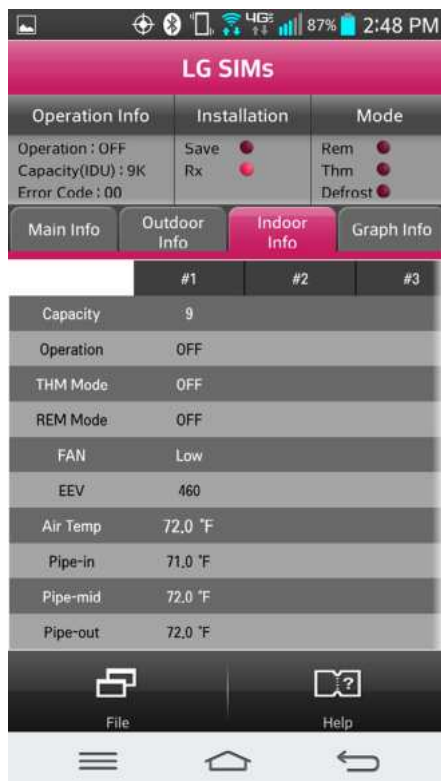
Displays the following information:

- Frequency
- FAN1 RPM
- FAN2 RPM
- DC Link
- Current
- Voltage
- EEV Mode
- Restart Timer
- Comp Mode
- EEV

Outdoor Info/Temperature Screen

Displays the following information:

- Inv TD
- Suction
- Discharge
- Cond Mid
- Cond Out
- Heatsink
- Air Temp



Indoor Info Tab

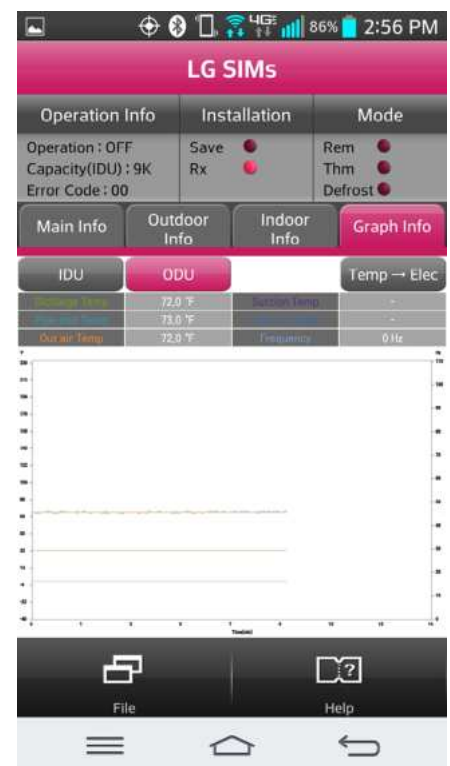
Displays the following information:

- Frequency
- Operation
- THM Mode
- REM Mode
- FAN
- EEV
- Air Temp
- Pipe-in
- Pipe-mid
- Pipe-out

Graph Info Tab

This tab, has three sub sections:

- IDU - Indoor Unit Temperature graph. Displays IDU information in graph format. Information displayed is for the IDU # selected on the Main screen.
- ODU - Outdoor Unit Temperature and Frequency graph. Displays ODU information in graph format.
- ODU Electric - Outdoor Unit Electric data graph is displayed.



Troubleshooting Using Error Codes

Refer to the table below and on the next two pages for error codes that are generated from the indoor and outdoor units. These codes are the most common. Your particular system might generate additional codes not listed here. Please contact LG Support if you see these types of errors and a simple power cycle has not corrected the issue.

Error Codes

- Refer to the figure below for your particular indoor unit's LED configuration.
- Indicate different types of unit failures, assists in self-diagnosis and to track the frequency of occurrence.
- Check the wired remote controller display first for error codes. Error codes are also shown on the control board LEDs of indoor and outdoor units and the SIMs app.
- If two or more errors occur simultaneously, the lower error code number is displayed first.
- After error is resolved, the error code does not display.

Decoding the Error Display

The first and second number on the LED indicates error number. Example: 21 = LED1 (Green light) 2x blink, LED2 (Red light) 1x blink.

Error Code Nomenclature Definitions

- MICOM: Non-volatile memory chip where unit setup information is stored.
- EPROM: Non-volatile memory chip where device identification, size, and factory defined default component operating parameters are stored.

Table 21: Indoor Unit Error Codes.

Error Code	Description	No. of Times Indoor Unit LEDs Blink	
		LED1	LED2
1	Indoor unit room temperature sensor error	1X	-
2	Indoor unit inlet pipe sensor error	2X	-
3	Wired remote control error	3X	-
4	Float switch error (optional)	4X	-
5	Communication error between indoor unit and outdoor units	-	5X
6	Indoor unit outlet pipe sensor error	6X	-
9	Indoor unit EPROM error	9X	-
10	Indoor unit BLDC motor fan lock	-	1X
12	Indoor unit middle pipe sensor error	2X	1X
67	Outdoor brushless direct current (BLDC) fan motor lock error	6X	7X

TROUBLESHOOTING

Error Codes

Single Zone Outdoor Unit Error Codes

The Single Zone Wall Mounted outdoor unit error codes are visible on the outdoor unit, as well as from the indoor unit. However, the indoor unit error codes are only visible from the indoor unit and will not display at the outdoor unit. When troubleshooting the system, be sure to verify if the error codes that are being displayed are specific for indoor or outdoor units.

Table 22: Outdoor Unit Error Codes.

Error Code	Description	No. of Times Outdoor Unit LEDs Blink	
		LED1	LED2
21	DC Peak (IPM Fault); Compressor DC voltage was too high	2X	1X
22	Current Transformer2 (CT2) error; Alternating current (AC) input too high	2X	2X
23	DC Link Low Volt	2X	3X
25	AC Low/High Volt	2X	5X
26	DC Comp Position Error (not providing rotation), Locking	2X	6X
27	PSC Fault; Current to inverter compressor between AC and DC converter circuit too high	2X	7X
28	Inverter compressor DC voltage is too high	2X	8X
29	Inverter compressor amperage is too high	2X	9X
31	Current-to-current transformer (CT) thermistor is too low	3X	1X
32	Inverter Compressor Discharge Pipe (D-Pipe) Overheat	3X	2X
40	CT Sensor Error; Thermistor is disconnected or is shorted out	4X	-
41	D-Pipe Sensor INV is disconnected or shorted out	4X	1X
44	Outdoor Air Sensor is disconnected or shorted out	4X	4X
45	Middle thermistor of outdoor unit condenser coil is disconnected or shorted out	4X	5X
46	Outdoor unit suction line thermistor is disconnected or shorted out	4X	6X
48	Outdoor unit coil outlet (liquid line) thermistor is disconnected or shorted out	4X	8X
53	Communication failure from outdoor unit to indoor unit	5X	3X
60	Outdoor unit printed circuit board (PCB) EPROM check sum error	6X	-
61	Outdoor unit condenser coil temperature is too high	6X	1X
62	Outdoor unit inverter compressor PCB heat sink temperature is too high	6X	2X
63	Condenser coil pipe thermistor temperature is too low	6X	3X
65	Heat sink thermistor has disconnected or has shorted out	6X	5X
67	Outdoor brushless direct current (BLDC) fan motor lock error	6X	7X

CAUTIONS FOR REFRIGERANT LEAKS

Refrigerant Leaks

Cautions for Refrigerant Leaks / Introduction

ASHRAE Standards 15-2010 and 34-2010 offer guidelines that address refrigerant safety and the maximum allowable concentration of refrigerant in an occupied space. Refrigerant will dissipate into the atmosphere, but a certain volume of air is required for this to occur safely. For R410A refrigerant, the maximum allowable concentration is 0.026 lbs./ft³ per 1,000 ft³ of air in an occupied space. Buildings with twenty-four (24) hour occupancy allow half of that concentration.¹

ASHRAE Standards 15 and 34 assume that if a system develops a leak, its entire refrigerant charge will dump into the area where the leak occurs. To meet ASHRAE Standards 15 and 34, calculate the refrigerant concentration that may occur in the smallest room volume on the system, and compare the results to the maximum allowable concentration number (see below for information on how to calculate the refrigerant concentration).¹ Also consult state and local codes in regards to refrigerant safety.

WARNING

Verify the maximum refrigerant concentration level in the space where the indoor unit will be mounted meets the concentration limit for the application. If the refrigerant leaks and safety limits are exceeded, it could result in personal injuries or death from oxygen depletion.

Note:

Take appropriate actions at the end of HVAC equipment life to recover, recycle, reclaim or destroy R410A refrigerant according to applicable US EPA rules.

To calculate the potential refrigerant concentration level (RCL):

1. Measure the occupied space dimensions (in feet).
2. Calculate the cubic foot volume of air in the smallest occupied space. (To obtain a detailed overview of the RCL, perform the same calculations to the second smallest zone, the third smallest zone until the RCL is obtained for all zones. Also, pay special attention to areas such as basements, etc., where refrigerant cannot dissipate easily.)
3. Divide the refrigerant charge of the Single Zone system serving the area in pounds by the results of step 1.
4. If the calculation indicates that the potential refrigerant concentration level is higher than the allowed RCL, increase the cubic volume of the smallest occupied space or modify the piping system design.
5. The allowable RCL limit for most applications must be equal to or less than 0.026 lbs./ft³. However, in special occupied spaces, such as hospitals and nursing homes, where occupants may have limited mobility, the allowable RCL limit is cut in half. See ASHRAE Standard 34-2007 and local codes for detailed information.¹

Refrigerant Concentration Limit (RCL) Calculations

To calculate total refrigerant amount per system:

Amount of Factory-Charged Refrigerant per Outdoor Unit	+	Amount of Additional Refrigerant Trim Charge	=	Total System Refrigerant Charge
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$$\text{RCL (lbs./ft}^3\text{)} = \frac{\text{Total System Refrigerant Charge (lbs.)}}{\text{Volume of Smallest Occupied Space (ft}^3\text{)}}$$

¹American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE). Atlanta, GA. ASHRAE, Inc. Information about ASHRAE Standard 15-2010 / 34-2010 and addenda current as of the date of this publication.

INSTALLATION CHECKLIST

Major Component Rough-In

Description	Check
Single Zone outdoor unit was connected properly per local code and the product installation procedures.	
All literature and bagged accessories have been removed from the fan discharge.	
Indoor unit was installed, properly supported, and located indoors in a non-corrosive environment.	
Single Zone unit's gravity condensate drain line was connected and routed where it properly drains away or, if installed in a mechanical room, was connected and properly routed to a drain terminal.	

Piping and Insulation

Description	Check
Single-zone and multi-zone duct-free split systems: ACR copper piping rated at the system working pressure for R410A was used.	
All refrigerant pipes and valves were insulated separately. Insulation is positioned up against the walls of the indoor unit. No gaps shown. Insulation was not compressed at clamps and hangers.	

Brazing Practices

Description	Check
Medical grade (there are 4 available) dry nitrogen for purging during brazing was used (constant 3 psi while brazing).	
15% silver brazing material only.	

Refrigerant Piping

Description	Check
All pipe materials were properly stored, capped, and clean. All burrs were removed after cutting and pipe ends were reamed before brazing.	
During refrigerant pipe installation, for each segment of pipe, a record was made of the pipe length (including expansion loops, offsets, double-back sections), and sizes, as well as the quantity and type of elbows used.	
Expansion loops, coils or other acceptable measures are provided where necessary to absorb temperature-change based pipe movement.	
A torque wrench and backup wrench were used to tighten all flare connections.	
The back side of all flares were lubricated with a small drop of PVE refrigeration oil before tightening flare fittings.	
Ensure all field made flares are 45°. Use factory-supplied flare nuts only.	
Pipe segments were secured to the structure using a combination of fixed and floating clamps, and all wall penetrations were sleeved.	
Pipe insulation was not compressed at any point.	
No oil traps, solenoid valves, sight glasses, filter driers, or any other unauthorized refrigerant specialties were present.	
(Optional) High quality R-410A rated full port ball valves (Schrader between the valve body and the indoor units) used at the indoor unit and at will in the refrigerant piping.	

Condensate Pump / Drain Installation

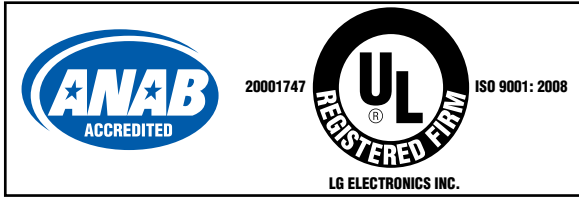
Description	Check
3/4" condensate drain installed on indoor units. Extended condensate piping material used is acceptable under local code. Insulated to prevent condensation.	
Indoor unit condensate drain pipes were installed correctly.	
Indoor unit with a gravity drain is level or slightly canted toward the drain connection and is supported properly.	
Drain lines are properly insulated to prevent condensation.	

Power Wire and Communication Cables

Description	Check
Power wiring to the Single Zone outdoor unit is solid or stranded, and complies with all local and national electrical codes.	
Power wiring was connected to a single phase 208-230V source.	
Ground wire was installed and properly terminated at the unit.	
The power supplied was clean with voltage fluctuations within specifications. ($\pm 10\%$ of nameplate).	
Power wiring to the Single Zone outdoor unit was installed per all local electrical code requirements.	
Communication / connection (power) wiring from the outdoor unit to the indoor unit is minimum 14 gauge, four-conductor, stranded, shielded or unshielded. If shielded, must be grounded to chassis at the outdoor unit only.	
Wiring to the indoor unit was installed per all local electrical code requirements.	
Communication / connection (power) wiring from the outdoor unit to the indoor unit can be run in the same conduit.	
Communication type RS-485-BUS type.	
22-3 AWG, twisted, stranded, unshielded cable (minimum) was used between the indoor unit and its zone controller. No cables were spliced and no wire caps are present.	
Appropriate crimping tool was used to attach ring or spade terminals at all power wiring and control cable terminations.	
Power and control wires were run in the same conduit (outdoor unit to indoor only) as provided in the product installation manual.	
Power to outdoor unit and power/communications to indoor unit CANNOT be run in the same conduit.	

NOTES

Inverter



For further technical materials such as submittals, engineering manuals, service manuals, and catalogs, visit www.lghvac.com.



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IM_SZ_VAHU_12_19
Supersedes: IM_SZ_VAHU_12_17