LG
Life's Good

MULTI V™ S

INSTALLATION MANUAL

Variable Refrigerant Flow Outdoor Units

3.0, 4.0, and 4.4 Tons

PROPRIETARY DATA NOTICE

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 by the summary list of safety precautions on page 4.

For more materials such as submittals, catalogs, engineering, installation, owner's, and service manuals, visit www.lghvac.com.

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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 should not be completed.*

Installation

⚠DANGER

⃠ Do not store or use flammable gas or combustibles near the unit.
There is risk of fire, explosion, and physical injury or death.

⃠ Do not supply power to the unit until all wiring and piping are completed or reconnected and checked.
There is risk of physical injury or death due to electric shock.

⚠WARNING

⃠ Do not install, remove, or re-install the unit by yourself (end user). Ask the dealer or a trained technician to install the unit.
Improper installation by the user may result in 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.

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

⃠ Do not change the settings of the protection devices.
If the protection devices have been bypassed or is 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.

Replace all control box and panel covers.
If cover panels are not installed securely, dust, water and animals may enter the outdoor 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.

Periodically check that the outdoor frame is not damaged.
There is a risk of explosion, physical injury, or death.

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.

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.

Install the unit in a safe location where nobody can step, fall onto it, or place objects on it. ⃠ Do not install the unit on a defective stand.
It may result in an accident that causes physical injury or death.

Installation, continued

⚠WARNING
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. 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 a minimum of four points to avoid slippage from rigging apparatus.*

Note

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

⃠ **Do not install the product where it is exposed directly to ocean winds.**
Sea salt in the air may cause the product to corrode. Corrosion, particularly on the condenser and evaporator fins, could cause product malfunction or inefficient operation.

When installing the outdoor 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 prevents water damage and abnormal vibration.

Properly insulate all cold surfaces to prevent "sweating."
Cold surfaces such as uninsulated piping can generate condensate that may drip and cause water damage to walls.

Always check for system refrigerant leaks after the unit has been installed or serviced.
Low refrigerant levels may cause product failure.

⃠ **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.

⃠ **Do not store or use flammable gas / combustibles near the unit.**
There is a risk of product failure.

⃠ **Do not use the product for mission critical or special purpose applications such as preserving foods, works of art, or other precision air conditioning applications. The equipment is designed to provide comfort cooling and heating.**
There is risk of property damage.

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

When connecting refrigerant tubing, remember to allow for pipe expansion.
Improper piping may cause refrigerant leaks and system malfunction.

⃠ **Do not install the outdoor unit in a noise-sensitive area.**

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.

⃠ **Do not install the unit on a defective stand.**
There is a risk of unit and property damage.

Install the drain hose to ensure adequate drainage.
There is a risk of water leakage and property damage.

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Wiring

⚠DANGER

High voltage electricity is required to operate this system. Adhere to the NEC code and these instructions when wiring.
Improper connections and inadequate grounding can cause accidental injury or death.

Always ground the unit following local, state, and NEC codes.
There is risk of fire, electric shock, and physical injury or death.

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

⃠ Do not share the electrical circuit with other appliances.
There is risk of fire, electric shock, and physical injury or death due to heat generation.

⃠ Do not use damaged or loose power wiring. ⃠ Do not modify or extend the outdoor unit's power wiring randomly. Ensure that the power wiring will not be pulled nor weight be placed on the power wiring during operation.
There is risk of fire, electric shock, and 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.

Ensure the system is connected to a dedicated power source that provides adequate power.
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.

Properly tighten all power connections.
Loose wiring may overheat at connection points, causing a fire, physical injury or death.

⃠ Do not change the settings of the protection devices.
If the protection devices have been bypassed or is 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.

Note

⃠ Do not supply power to the unit until all electrical wiring, controls wiring, piping, installation, and refrigerant system evacuation are completed.
System may malfunction.

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 breaker for this product.
There is risk of fire, electric shock, physical injury or death.

⃠ Do not operate the disconnect switch with wet hands.
There is risk of fire, electric shock, 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.

Use inert (nitrogen) gas when performing leak tests or air purges. ⃠ Do not use compressed air, oxygen, or flammable gases.
Using these substances may cause fire, explosion, and physical injury or death.

If refrigerant 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 a fire, electric shock, explosion, 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.

⃠ 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.

⃠ Do not touch the refrigerant piping during or after operation.
It can cause burns or frostbite.

⃠ Do not open the inlet during operation.
There is risk of electric shock, physical injury or death.

⚠CAUTION

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

Note

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

⃠ Do not use the product for mission critical or special purpose applications such as preserving foods, works of art, or other precision air conditioning applications. 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 allow water, dirt, or animals to enter the unit.
There is risk of unit failure.

⃠ Do not open the inlet during operation.
There is risk of unit failure.

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

Use a only soft cloth to clean the air conditioner. ⃠ Do not use wax, thinner, or strong detergents.
Strong cleaning products may damage the surface of the air conditioner, or may cause its appearance to deteriorate.

Provide power to outdoor unit to warm the compressor crankcase at least six (6) hours before operation begins.
Starting operation with a cold compressor sump(s) may result in severe bearing damage to the compressor(s). Keep the power switch on during the operational season.

⃠ Do not block the inlet or outlet.
Unit may malfunction.

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GENERAL DATA

MULTI V S

Multi V S Outdoor Unit Specifications / Electrical Data

Table 1: 208-230V Heat Pump Unit Specifications.

Model Numbers		3.0 Ton	4.0 Ton	4.4 Ton
		ARUN038GSS4	ARUN048GSS4	ARUN053GSS4
Cooling Performance				
Nominal Cooling Capacity (Btu/h)[1]		39,500	50,000	55,500
Rated Cooling Capacity (Btu/h)[2]		38,000	48,000	53,000
Heating Performance				
Nominal Heating Capacity (Btu/h)[1]		44,000	56,500	61,500
Rated Heating Capacity (Btu/h)[2]		42,000	54,000	59,000
Operating Range				
Cooling (°F DB)		23 - 122	23 - 122	23 - 122
Heating (°F WB)		-4 - 61	-4 - 61	-4 - 61
Compressor				
Inverter Quantity		DC Inverter Starting	DC Inverter Starting	DC Inverter Starting
Oil / Type		PVE / FVC68D	PVE / FVC68D	PVE / FVC68D
Fan (Side Discharge)				
Type		Axial Flow Fan	Axial Flow Fan	Axial Flow Fan
Motor Output (kW) x Qty.		0.124 x 2	0.124 x 2	0.124 x 2
Motor / Drive		Brushless Digitally Controlled / Direct		
Operating Range (RPM)	Cooling	0 - 850	0 - 850	0 - 850
	Heating	0 - 850	0 - 850	0 - 850
Maximum Air Volume (CFM)		3,885	3,885	3,885
Unit Data				
Refrigerant Type		R410A	R410A	R410A
Refrigerant Control/Location		EEV / Indoor Unit	EEV / Indoor Unit	EEV / Indoor Unit
Max. Number Indoor Units/System[3]		6	8	9
Sound Pressure dB(A)[4]		50	51	52
Net Unit Weight (lbs.)		207	207	207
Shipping Weight (lbs.)		218	218	218
Communication Cables[5,6]		2 x 18	2 x 18	2 x 18
Heat Exchanger				
Material and Fin Coating		Copper Tube / Aluminum Fin and GoldFin™ / Hydrophilic		
Rows/Fins per inch		2 / 14	2 / 14	2 / 14
Piping[7]				
Liquid Line Connection (in., OD)		3/8 Braze	3/8 Braze	3/8 Braze
Vapor Line Connection (in., OD)		5/8 Braze	5/8 Braze	3/4 Braze
Factory Charge lbs. of R410A		6.6	6.6	6.6

[1]Nominal capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a Combination Ratio between 95–105%.
Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB) and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB).
Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB) and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

[2]Rated capacity is certified under AHRI Standard 1230. See www.ahrinet.org for information.

[3]The System Combination Ratio must be between 50–130%.

[4]Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745.

[5]All communication cable to be minimum 18 AWG, 2-conductor, stranded, shielded or unshielded (if shielded, must be grounded to chassis at ODU only), and must comply with applicable local and national codes.

[6]Power wiring cable is field provided and must comply with the applicable local and national codes. See below for detailed electrical data.

[7]Refer to the Refrigerant Piping section of this manual for correct line sizing. Contractor must use LG manufactured Y-Branch and Header Kits only. Designer must verify refrigerant piping design configuration using LG's computerized refrigerant piping (LATS Multi V) software to validate the pipe design.

Table 2: 208-230V Heat Pump Unit Electrical Data.

Nominal Tons	Unit Model No.	Compressor Motor		**Condenser Fan Motor**		MCA	MOCP
		Quantity	Motor Amps **RLA (Ea.)**	**Fan Qty.**	Amps **FLA (Ea.)**		
3.0	ARUN038GSS4	1	19.5	2	1.0	25	40
4.0	ARUN048GSS4	1	23.1	2	1.0	30	50
4.4	ARUN053GSS4	1	25.2	2	1.0	33	50

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R410A Refrigerant

R410A refrigerant has a higher operating pressure in comparison to R22 refrigerant and, therefore, all piping system materials installed must have a higher resisting pressure than the materials traditionally used in R22 systems.

R410A refrigerant is an azeotrope of R32 and R125, mixed at 50:50, so the ozone depletion potential (ODP) is 0.

⚠WARNING

⃠ *Do not place refrigerant cylinder in direct sunlight. Refrigerant cylinder may explode causing severe injury or death.*

Note:

- *Because R410A is a combination of R32 and R125, the required additional refrigerant must be charged in its liquid state. If the refrigerant is charged in its gaseous state, its composition changes and the system will not work properly.*
- ⃠ *Do not heat piping more than necessary during installation. Piping may become soft and fail when pressurized.*
- ⃠ *Do not use any piping that has not been approved for use in high-pressure refrigerant systems. Piping wall thickness must comply with the applicable local, state, and federal codes for the 551 psi design pressure of R410A. Inadequate piping may fail when pressurized.*

GENERAL INSTALLATION GUIDELINES

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Location for Outdoor Unit

Selecting the Best Location for the Outdoor Unit

⚠DANGER

To avoid the possibility of fire, do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak. Failure to do so will cause serious bodily injury or death.

⚠WARNING

⃠ *Do not install the unit in a location where acidic solution and spray (sulfur) are often used as this may cause serious bodily injury or death.*
⃠ *Do not use the unit in environments where oil, steam, or sulfuric gas are present as this may cause serious bodily injury or death.*

⚠CAUTION

When deciding on a location to place the outdoor unit, be sure to choose an area where run-off from defrost will not accumulate and freeze on sidewalks or driveways which may create unsafe conditions.

Note:

- Select a location for installing the outdoor unit that will meet the following general conditions:
- A location strong enough to bear the weight of the outdoor 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(s) 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.
- Install a fence to prevent animals and unauthorized personnel from accessing the outdoor unit.

⃠

- Where it will not be subjected to direct thermal radiation from other heat sources, nor an area that would not 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 not affect operation.
- Where operating sound from the unit will not disturb inhabitants of surrounding buildings.
- Where the unit will not be exposed to direct, strong winds.

Oceanside Installation Precautions

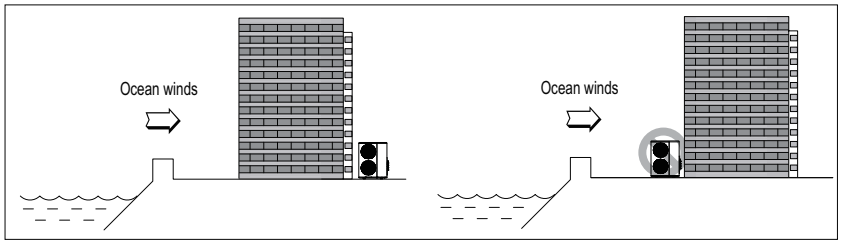
- Avoid installing the outdoor unit where it would be directly exposed to ocean winds.
- Install the outdoor unit on the side of the building opposite from direct ocean winds.
- Select a location with good drainage.
- Periodically clean dust or salt particles off of the heat exchanger with water.

Note:

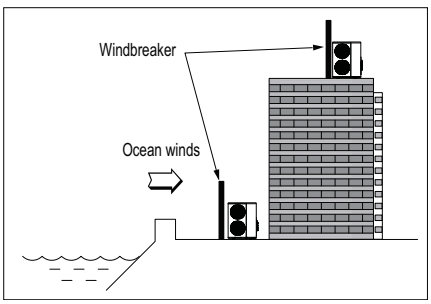
Additional anti-corrosion treatment may need to be applied to the outdoor unit at oceanside locations.

Note:

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



If the outdoor unit must be placed in a location where it would be subjected to direct ocean winds, install a concrete windbreaker strong enough to block any winds. Windbreaker height and width should be more than 150% of the outdoor unit, and be installed at least 27-1/2 inches away from the outdoor unit to allow for airflow.



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Rooftop Installations

If the outdoor unit is installed on a roof structure, be sure to level the unit. Ensure the roof structure and anchoring method are adequate for the unit location. Consult local codes regarding rooftop mounting.

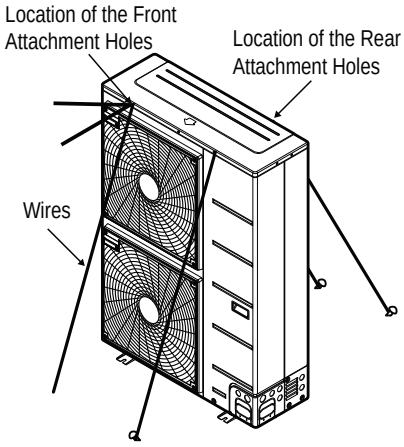
Dealing with Snow and Ice

In climates that experience snow buildup, place the unit on a raised platform to ensure proper condenser airflow. The raised support platform must be high enough to allow the unit to remain above possible snow drifts. Mount the unit on a field-provided stand that is higher than the maximum anticipated snowfall for the location. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit case. If necessary, provide a field fabricated hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces. Use inlet and discharge duct or hoods to prevent snow or rain from accumulating on the fan inlet and outlet guards. Best practice prevents snow from accumulating on top of the unit. Consider tie-down requirements in case of high winds or where required by local codes. In all cases, connected duct work and accessories must provide a combined air pressure drop rating that does not exceed 0.16" WG.

Note:

- *When deciding on a location to place the outdoor unit, be sure to choose an area where run-off from defrost mode will not accumulate and freeze on sidewalks or driveways.*
- *Snow throw mode does not prevent ice from forming on the fan blade or discharge grille.*

Figure 1: Lightning Protection Diagram.



Tie-Downs and Lightning Protection

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 (see diagram at right for example).
- Use four wires, deattach the top of the frame at the locations indicated, thread the screws through the wires, then reattach the screws to the outdoor unit frame.
- The overall tie-down configuration must be approved by a local professional engineer. Always refer to local code when using a wind restraint system.

Lightening Protection

- To protect the outdoor unit from lightning, it should be placed within the specified lightning safety zone.

Table 3: Safety Zone Specifications.

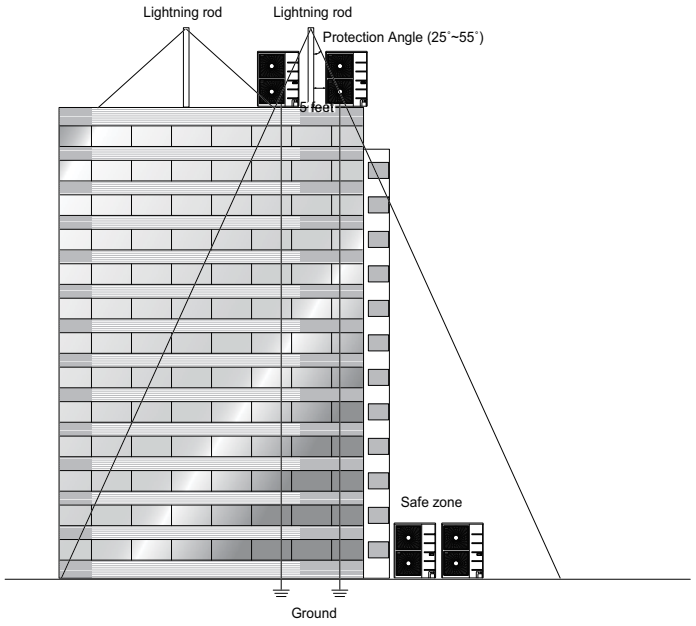
Building Height (feet)	66	98	148	197
Protection Angle (˚)	55	45	35	25

- Power cable and communication cable should be installed five (5) feet away from lightning rod.
- A high-resistance ground system should be included to protect against induced lightning or indirect strike.

Note:

If the building does not include lightning protection, the outdoor unit may be damaged from a lightening strike. Inform the customer of this possibility in advance.

Figure 2: Lightening Protection Diagram.



GENERAL INSTALLATION GUIDELINES

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Service Access and Allowable Clearances for Outdoor Unit

Outdoor Unit Service Access and Allowable Clearances

Proper airflow through the outdoor unit coil is critical for proper unit operation. Figures below and on the next page illustrate clearance requirements for various installation scenarios for the Multi V S outdoor unit. Use the hot isle / cold isle approach when placing multiple units in close proximity to each other. Outdoor unit fans draw air from the back of the unit and discharges out the front. Place units back to back and face to face.

Note:

- *Installation clearances must comply with local building codes.*
- *All figures not to scale.*
- *Never place multiple units facing back to front or front to back as shown immediately below here or high and low system pressure problems may occur.*

Legend

LR = Rear wall height

LF = Front wall height

H = Unit height

Figure 3: Improper Outdoor Unit Placement.

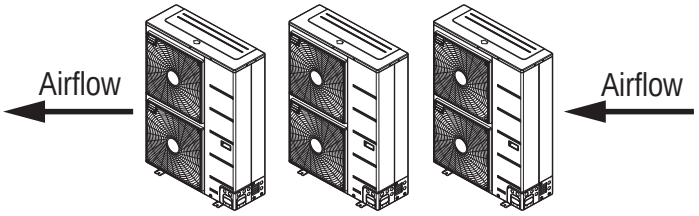
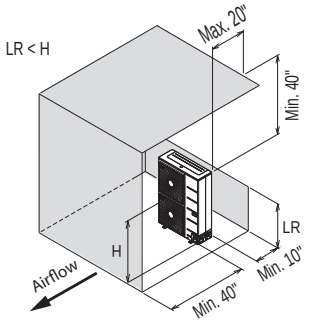


Figure 4: Proper Outdoor Unit Placement and Clearances.

Single Unit—High Front Wall with Building Overhang and No Side Walls



Single Unit—High Rear Wall and Low Front Wall with No Side Walls

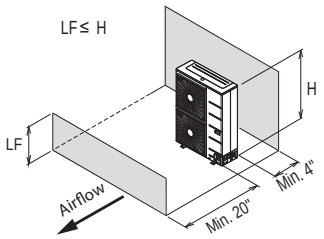
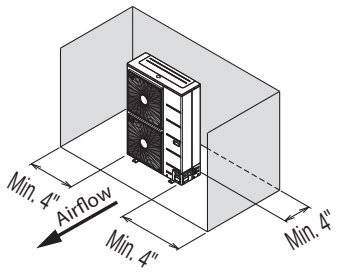
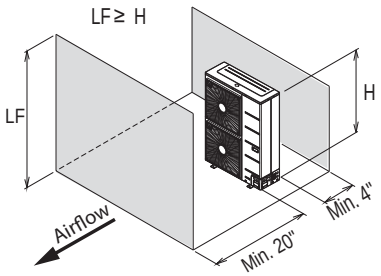


Figure 5: Proper Outdoor Unit Placement and Clearances, continued.

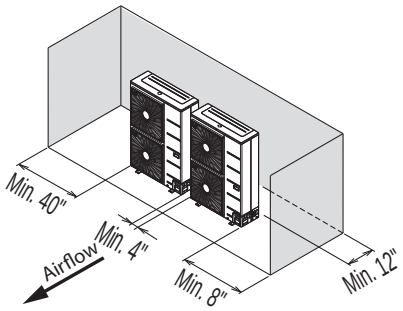
Single Unit—High Rear Wall with or without High Side Walls



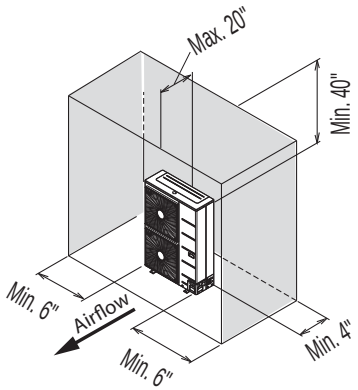
Single Unit—High Rear and Front Walls with No Side Walls



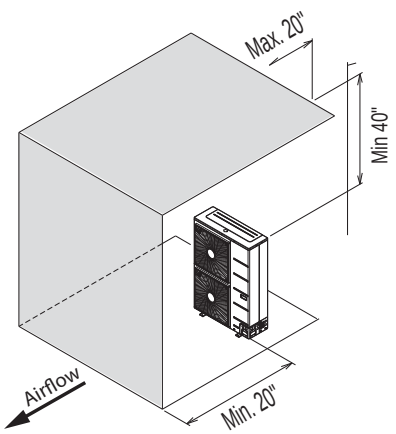
Side by Side—High Rear and Side Walls



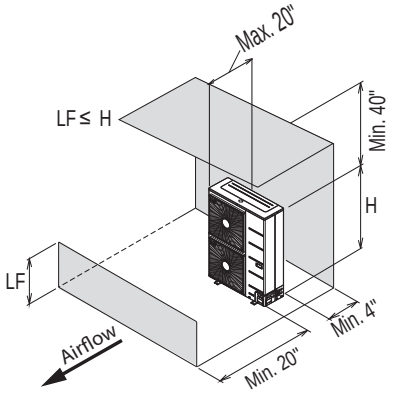
Single Unit—High Rear and Side Walls with Building Overhang



Single Unit—High Front and Rear Walls with Building Overhang and No Side Walls



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



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Note:

- *Installation clearances must comply with local building codes.*
- *All figures not to scale.*

Legend

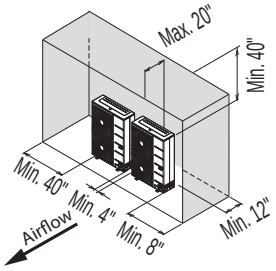
LR = Rear wall height

LF = Front wall height

H = Unit height

Figure 6: Proper Outdoor Unit Placement and Clearances, continued.

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



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

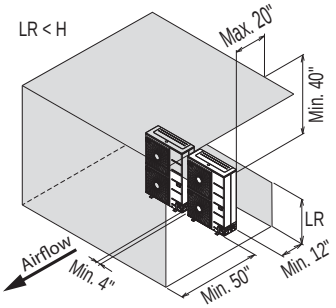
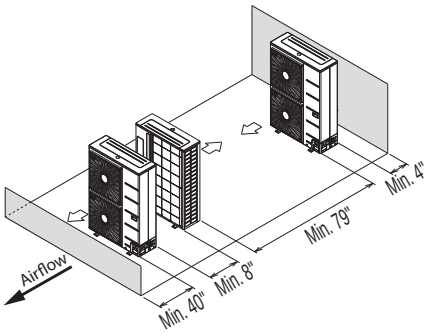
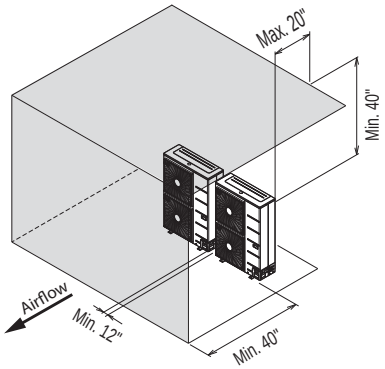


Figure 7: Proper Outdoor Unit Placement and Clearances, continued.

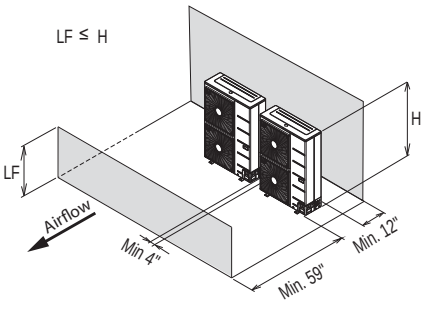
Single Row Units—High Rear Wall and Low Front Wall with No Side Walls or Overhang



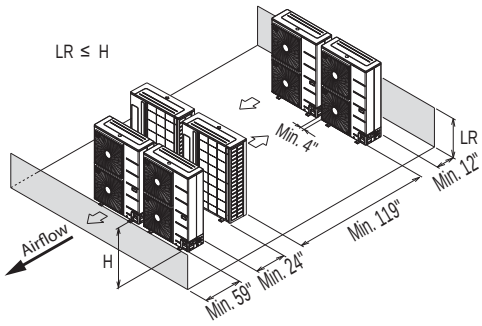
Side by Side —High Front Wall with Building Overhang and No Side or Rear Walls



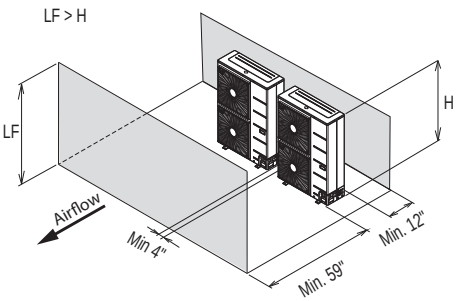
Side by Side—High Rear Wall and Low Front Wall with No Side Walls



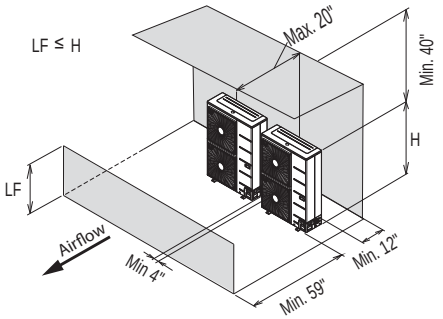
Double Row Units—Low Rear and Front Walls with No Side Walls or Overhang



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



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



GENERAL INSTALLATION GUIDELINES

MULTI V S

Rigging Instructions for Outdoor Unit

Rigging Multi V S Outdoor Units

- When lifting the unit, use lifting straps and place around the unit as shown.
- Always lift the unit using properly sized lifting straps rated to carry the unit weight.
- Ensure the straps are long enough to maintain a maximum of a 40° angle as shown.

Note:

When moving / adjusting the placement of the outdoor unit, always hold the unit by the corners. Moving the outdoor unit using the side intake holes on the frame may damage the frame.

Table 4: Multi V IV Shipping and Net Weights.

Capacity (ton)	Shipping Weight (lbs.)	Net Weight (lbs.)
3	218	207
4		
4.4		

Figure 8: Transporting the Outdoor Unit.

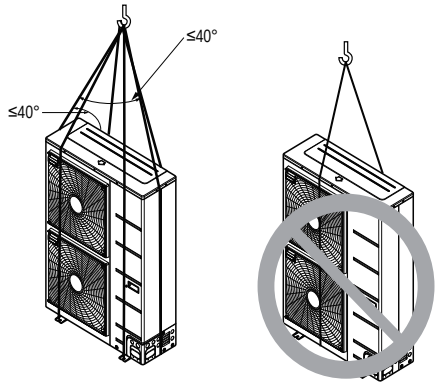
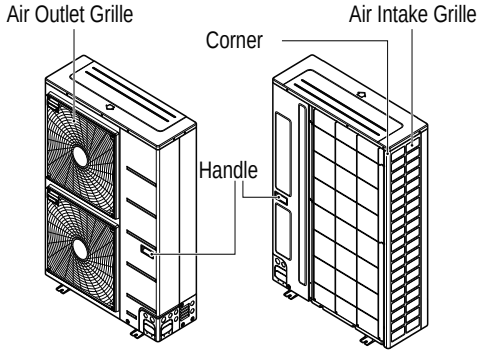


Figure 9: Transporting the Outdoor Unit.



⚠WARNING

- *Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed above. If unit is not moved correctly, it may result in an accident that causes physical injury or death.*
- *Wear protective gloves when handling equipment. Sharp edges may cause personal injury.*
- *Some products include polypropylene bands around the unit for packaging. ⃠ Do not use polypropylene bands to lift the unit. Bands may break, resulting in an accident that causes physical injury or death.*
- *Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.*
- *Lift the outdoor unit from the base at specified locations. Support the outdoor unit at a minimum of six (6) points to avoid slippage from the rigging apparatus. If unit is not supported correctly, it may result in an accident that causes physical injury or death.*
- *⃠ Do not drop the unit when carrying it with a forklift. It may result in an accident that causes physical injury or death.*
- *Use a minimum of three (3) lifting straps of at least 26-1/4 feet long. If unit is not supported correctly, it may result in an accident that causes physical injury or death.*
- *Always know where the unit's center of gravity is before lifting. Hoist the unit with the center of gravity centered among the lifting straps. If unit is not hoisted properly, it may result in an accident that causes physical injury or death.*

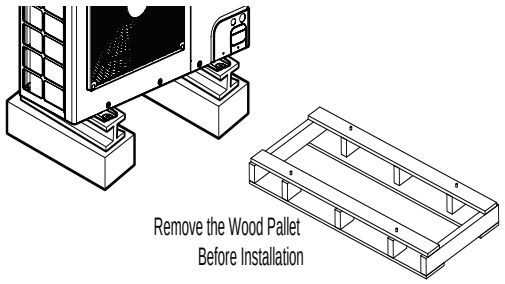
Note:

Place a protective cloth or other soft material at the locations where the casing comes in contact with the lifting straps to prevent damage to painted surfaces.

⚠WARNING

- *Remove the wood pallet at the bottom of the outdoor unit base pan before attaching any bolts The wood pallet is not a permanent, stable support, and it may cause the outdoor unit to fall, resulting in physical injury.*
- *Remove the wood pallet before brazing. The pallet may catch fire, resulting in physical injury.*

Figure 10: Remove the Wood Pallet.



Note:

Use of the wood pallet as a support for the outdoor unit may cause the heat exchanger to freeze, resulting in operation malfunction.

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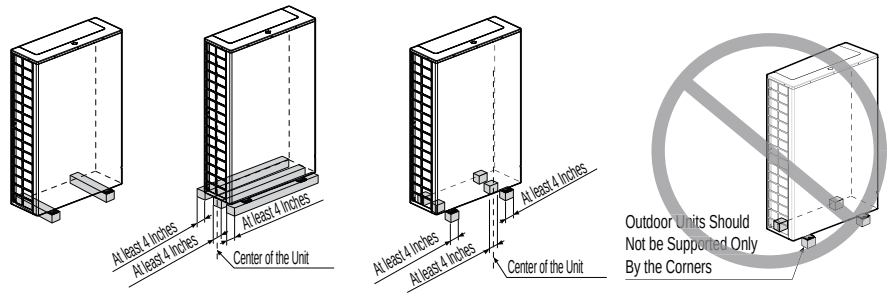
General Mounting

Securely attach the outdoor unit to a condenser pad, base rails, or other mounting platform that is securely anchored to the ground or building structure. See the figures below, and follow the applicable local codes for clearance, mounting, anchor, and vibration attenuation requirements.

- Location must be strong enough to bear the weight and vibration of the outdoor unit.
- The outdoor unit supports must have a minimum height of 7-7/8 inches, and a minimum width of four (4) inches under the unit's legs before being attached.
- Anchor bolts must be installed at least three (3) inches into the support.

Figure 11: Multi S Outdoor Unit Mounting Options.



Mounting Bolt Location / Foundation for Installation

- I-Beams can be used as a base support.
- Operation sound and vibration from the outdoor units may transfer to surrounding floors or walls; to reduce vibration and operation sound, add anti-vibration materials to the concrete base.
- Ensure there is enough room under the outdoor unit if installing the piping and wiring using the bottom access holes.

Figure 12: Mounting Bolt / Foundation Diagram.

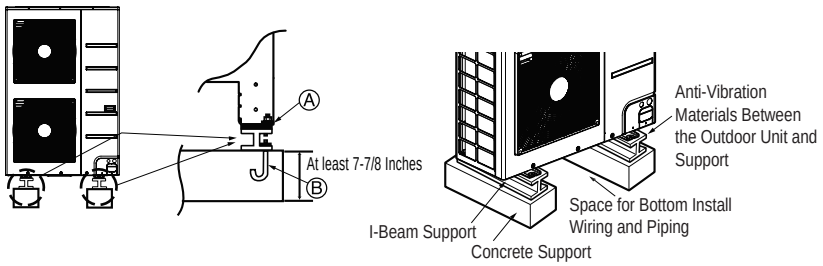
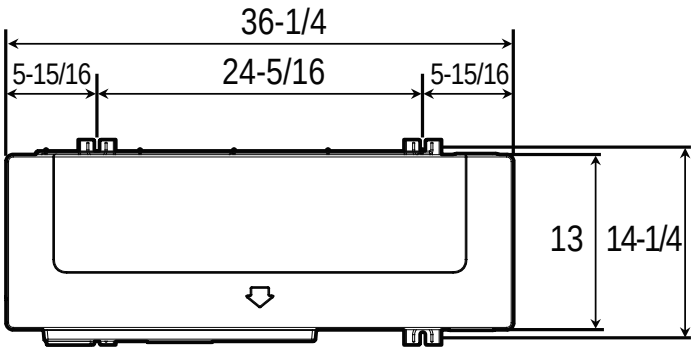


Figure 13: Locations for the Mounting Bolts.



⚠WARNING

- *The corners of the outdoor unit must be attached firmly to the support, otherwise, the bolts may bend, cause the outdoor unit to fall, which may result in physical injury or death.*
- *Attach the bolts tightly as shown to ensure the outdoor unit will not fall due to earthquakes or strong wind gusts, causing physical injury or death.*

Figure 14: Mounting Method No. 1.

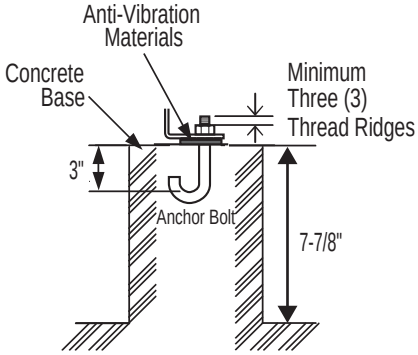
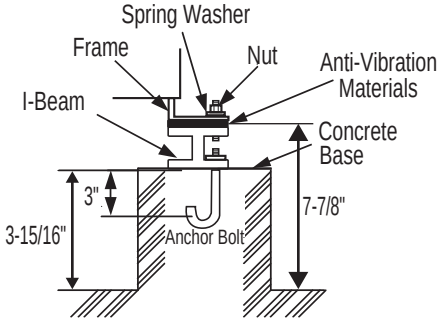


Figure 15: Mounting Method No. 2.



GENERAL INSTALLATION GUIDELINES

MULTI V S

Piping Preparation

⚠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.*

Outdoor Unit Pipe Connections

1. ⃠ Do not use kinked pipe caused by excessive bending in one specific area on its length.
2. Braze the pipes to the service valve pipe stub of the outdoor unit.
3. After brazing, check for refrigerant gas leaks.
4. 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.

Creating a Flare Fitting

One of the main causes of refrigerant leaks is defective flared connections. Create flared connections using the procedure below.

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. Remove the flare nuts attached to the indoor and outdoor units. 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.
- Firmly hold copper tube in a bar with a dimension as indicated in the table below.

4. Carefully inspect the flared pipe end.
- Compare the geometry with the figures and dimensions as detailed.
- If the flare is defective, cut it off and re-do procedure.
- If flare looks good, blow clean the pipe with dry nitrogen.

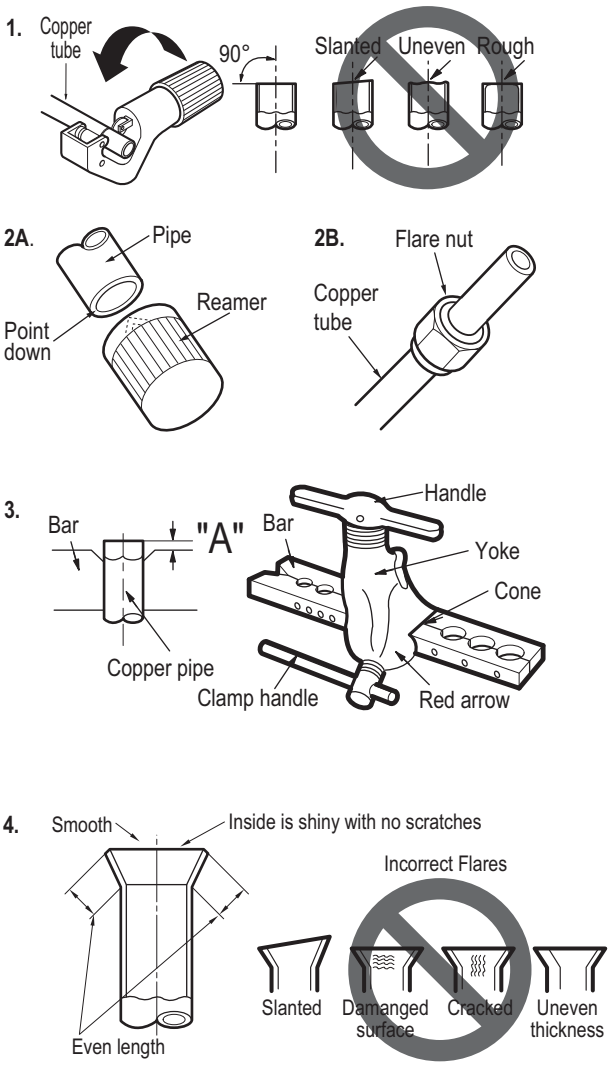


Figure 16: Dimensions of the Flare.

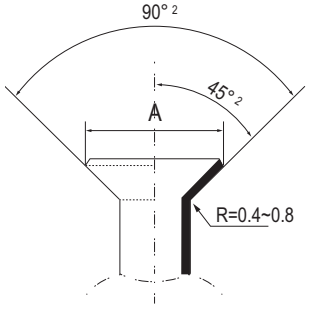


Table 5: Flared Connection Dimensions.

Indoor Unit (Btu/h)	Pipe		"A"	
	Vapor (in. O.D.)	Liquid (in. O.D.)	Vapor (in.)	Liquid (in.)
≤19,100	1/2	1/4	5/8 ~ 11/16	7/16 ~ 1/2
<54,600	5/8	3/8	5/8 ~ 11/16	5/8 ~ 11/16
≤76,400	3/4	3/8	3/4 ~ 13/16	5/8 ~ 11/16

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Tightening the Flare Connections

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

Note:

Do not use polyolyester (POE) or any other type of mineral oil as a thread lubricant. These lubricants are not compatible with PVE oil used in this system and create oil sludge leading to equipment damage and system malfunction.

Table 6: Tightening Torque for Flare Nuts.

Pipe size (Inches O.D.)	Tightening torque (ft-lbs)
1/4Ø	13.02 ~ 18.08
3/8Ø	24.59 ~ 30.38
1/2Ø	39.78 ~ 47.74
5/8Ø	45.57 ~ 59.31
3/4Ø	71.61 ~ 87.52

Multi V S Outdoor Unit Piping Installation Options

For Multi V S outdoor units, piping can be installed in one of four directions: front, rear, right, and bottom. Whatever direction is chosen, plug the access holes with field-provided putty or insulation to fill all gaps.

⚠WARNING

Insects or small animals entering the outdoor unit may cause a short circuit in the electrical box, which may lead to fire, electric shock, physical injury, or death.

Note:

Insects or small animals entering the outdoor unit may cause a short circuit in the electrical box, which may lead to unit failure.

Figure 18: Multi V S Outdoor Unit Piping Installation Options.

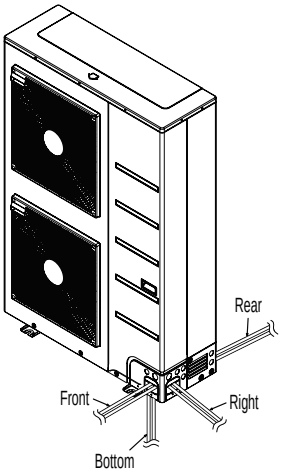


Figure 19: Front Access Hole for Multi V S Piping.

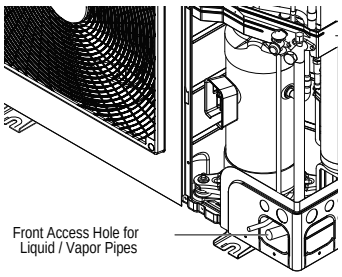
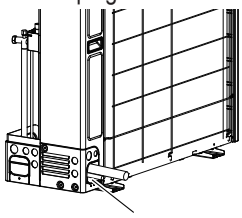


Figure 20: Rear Access Hole for Multi V S Piping.



Loosening the Flare Nuts

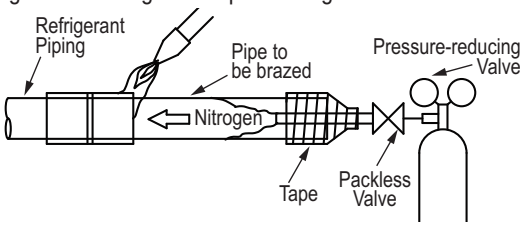
Always use two (2) wrenches to loosen the flare nuts.

Brazing Practices

Note:

Keep the piping system free of contaminants and debris such as copper burrs, slag, or carbon dust during installation. Contaminants can result in mechanical failure of the system.

Figure 17: Refrigerant Pipe Brazing.



All joints are brazed in the field. Multi V S 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.

- While brazing, use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
- Blow clean all pipe sections with dry nitrogen prior to assembly.
- Use a tubing cutter. De-burr and clean all cuts before assembly.
- Store pipe stock in a dry place. Keep pipe capped and clean.
- Use adapters to assemble different sizes of pipe. 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 a heat barrier spray product.

⃠

- Do not use flux, soft solder, or anti-oxidant agents.
- Do not use a saw to cut pipe.

GENERAL INSTALLATION GUIDELINES

MULTI V S

Piping Preparation

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. See Table 9 for care of piping.

Figure 21: Keep Piping Capped While Storing.

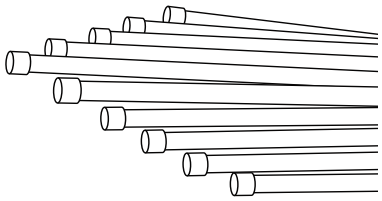
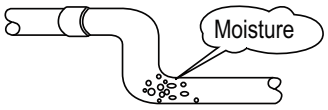
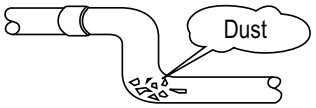
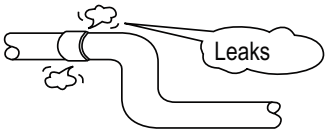


Table 9: Three Principles of Refrigerant Piping.

	Dry	Clean	Airtight
Principles	No moisture should be inside the piping.	No dust should be inside the piping.	No leaks should occur.
			
Problems Caused	- 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 ensure the vacuum holds at that level for 24 hours	- 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. - Perform flanging procedures that comply with all applicable standards. - Ensure that refrigerant lines are pressure tested to 550 psig.

Selecting Field-Supplied Copper Tubing

Type ACR copper is the only approved refrigerant pipe material for use with LG Multi V S air conditioning products. ACR rated tubing is the only type that ships with yellow caps. Approved tubing for use with Multi V products will be marked "R410 RATED" along the length of the tube.

- Drawn temper (rigid) ACR copper tubing is available in sizes 3/8 through 2-1/8 inches (ASTM B 280, clean, dry, and capped).
- Annealed temper (soft) ACR copper tubing is available in sizes 1/4 through 2-1/8 inches (ASTM B 280, clean, dry, and capped).

Note:

Tube wall thickness should meet local code requirements and be approved for an operating pressure of 551 psi. If local code does not specify wall thickness, LG suggests using tube thickness per table below. When bending tubing, try to keep the number of bends to a minimum, and use the largest radii possible to reduce the equivalent length of installed pipe; also, bending radii greater than ten (10) pipe diameters can minimize pressure drop. Be sure no traps or sags are present when rolling out soft copper tubing coils.

Table 7: ACR Rated Copper Tubing Material.

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

Table 8: ACR Rated 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)**	.563	.9375	1.5	2.25	3.0	3.0	3.5	4.0	4.5
Min. Wall **Thickness (in)**	.031	.031	.031	.039	.042	.045	.050	.050	.05

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Table 10: ACR Copper Tubing Dimensions and Physical Characteristics[1-4].

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	.00020
3/8	0.375	0.030	0.126	.00054	0.032	0.134	.00053
1/2	0.500	0.035	0.198	.00101	0.032	0.182	.00103
5/8	0.625	0.040	0.285	.00162	0.035	0.251	.00168
3/4	0.750	0.042	0.362	.00242	0.042	0.362	.00242
7/8	0.875	0.045	0.455	.00336	0.045	0.455	.00336
1-1/8	1.125	0.050	0.655	.00573	0.050	0.655	.00573

[1]All dimensions provided are in accordance with ASTM B280 – Standard.
[2]Design pressure = 551 psig.
[3]ACR Tubing is available as hard drawn or annealed (soft) and are suitable for use with R410A refrigerant.
[4]The 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 blow it clean with a dry inert gas.*
- *Prevent dust, water or other contaminants from entering the piping during installation. Contaminants can cause mechanical failure.*

LG Engineered Y-branch Kits and Header Kits

LG Y-branch and Header kits are highly engineered devices designed to evenly divide the flow of refrigerant, and are used to join one pipe segment to two or more segments.

Note:

No Substitutions

Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. Third-party or field-fabricated Tee's, Y-fittings, Headers, or other branch fittings are not qualified for use with LG Multi V S systems. The only field-provided fittings allowed in a Multi V S piping system are 45° and 90° elbows.

Install Correctly

- *Y-branches can be installed upstream between the Header and the outdoor unit, but a Y-branch cannot be installed between a header and an indoor unit.*
- *To avoid the potential of uneven refrigerant distribution through a header fitting, minimize the difference in equivalent pipe length between the header fitting and each connected indoor unit.*

Table 11: Y-Branches and Headers.

Y-branch Kit Model No	Headers	
	4 branch	7 branch
ARBLN01621	ARBL054	ARBL057
ARBLN03321	ARBL104	ARBL107

- *If the diameter of the branch pipe segments differ from that of the designated refrigerant piping, trim to the desired section using a pipe cutter, and then use an adapter to connect.*
- *Always follow manufacturer's guidelines on refrigerant piping restrictions such as maximum length, elevation difference, and diameters. Failure to do so can result in reduced heating / cooling performance or equipment malfunction.*

Y-Branch Kits

LG Y-branch and kits are highly engineered devices designed to evenly divide the flow of refrigerant, and are used to join one pipe segment to two or more segments. There is only one type of Y-branch used in LG Multi S systems: Y-branches used with the indoor units in the refrigerant piping system at each transition. Field-supplied "T" fittings or "Y" branches will not be accepted. ⃠ Do not install Y-branches backwards; refrigerant flow cannot make U-turns through Y-branches. The equivalent pipe length of each Y-branch (1.6') must be added to each pipe segment entered into LATS piping design software.

LG Y-Branch Kits Consist of:

- Y-branches: For heat pump systems - one liquid line and one vapor line (two [2] total).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers.

GENERAL INSTALLATION GUIDELINES

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Piping Preparation

Indoor Unit Y-Branches, continued.

Indoor unit Y-branches may be installed in horizontal or vertical configurations. When installed vertically, position the Y-branch so the straight-through leg is within ±3° of plumb. When installed horizontally, position the Y-branch so the take-off leg is level and shares the same horizontal plane as the straight-through leg within ±5° rotation.

Indoor unit Y-branches must always be installed with the single port end towards the outdoor unit, the two-port end towards the indoor units. The first indoor unit Y-branch kit must be located at least three (3) feet from the outdoor unit. Provide a minimum of twenty (20) inches between a Y-branch and any other fittings or indoor unit piped in series.

There is no limitation on the number of indoor unit Y-branches that can be installed, but there is a limitation on the number of indoor units connected to a single outdoor unit. It is recommended that when a Y-branch is located in a pipe chase or other concealed space, access doors should be provided for inspection access.

Figure 22: Y-branch Vertical Installation Alignment Specification.

Vertical UP Configuration - For Indoor Unit Y-Branches.

Vertical DOWN Configuration - For Indoor Unit Y-Branches.

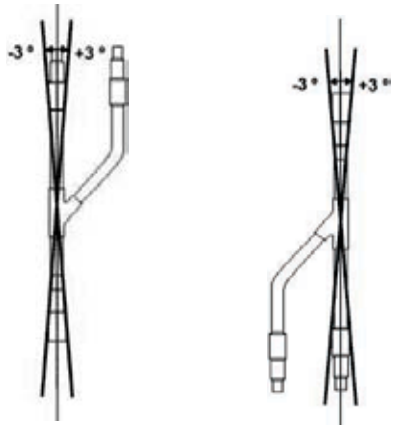


Figure 23: Horizontal Configuration.

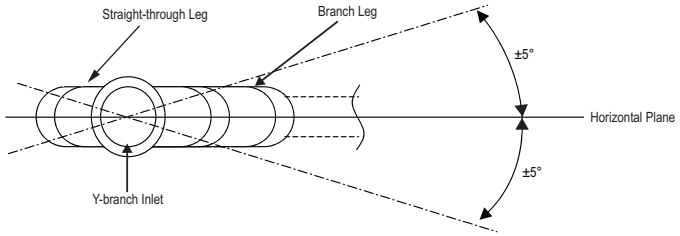
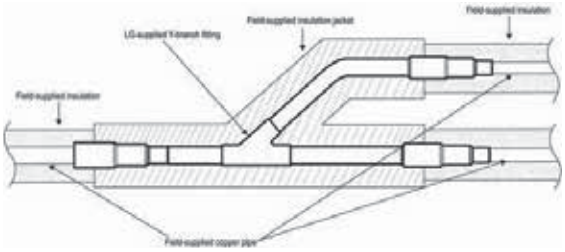


Figure 24: Y-branch Insulation and Pipe Detail.



Header Kits

LG Header kits are highly engineered devices designed to evenly divide the flow of refrigerant, and are used to join one pipe segment to two or more segments. Header kits are intended for use where multiple indoor units are in the same vicinity and it would be better to "home-run" the run-out pipes back to a centralized location. If connecting multiple indoor units that are far apart, Y-branches may be more economical.

LG Header Kits Consist of:

- Two headers (one liquid line, one vapor line).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers—one for the liquid line and one for the vapor line.

Y-branches can be installed upstream between the Header and the outdoor unit, but a Y-branch cannot be installed between a Header and an indoor unit. Headers must be installed in a horizontal and level position with the distribution ports of the fitting in the same horizontal plane as the straight-through branch.

When connecting indoor units to a Header, always connect the unit with the largest nominal capacity to the port closest to the outdoor unit. Then install the next largest indoor unit to the next port, working down to the smallest indoor unit. ⃠ Do not skip ports.

All indoor units connected to a single Header fitting should be located with an elevation difference between indoor units that does not exceed 49 feet.

Figure 25: Header Kit—Horizontal Rotation Limit (Must be Installed Level with No Rotation).

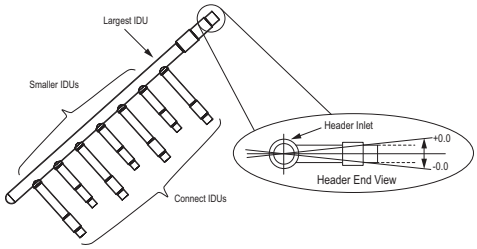
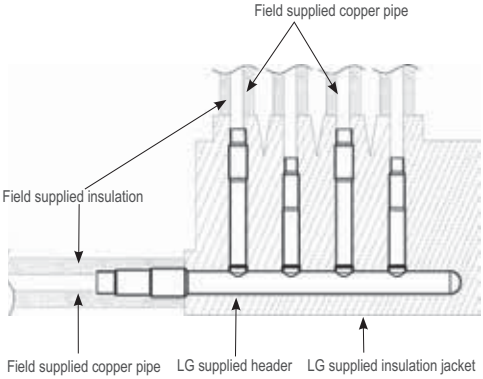


Figure 26: Header Insulation and Pipe Detail.



LG

Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of a Multi V S system can vary as much as 180°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 mounted in the horizontal plane. When expansion loops are placed in a vertical riser, the loop is to be formed in a horizontal fashion resulting in a torsional movement during expansion and contraction. 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 should 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. From Table 12, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe typical pipe temperature change range: High Pressure Vapor: ambient temperature to 215°F; Low Pressure Vapor: ambient to 35°F; Liquid pipe: ambient, 80°F, 110°F. Choose the two most extreme. 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.

Example:

A Multi V S heat pump system is installed and the design shows that there is a 260 feet straight segment of tubing between a Y-branch and an indoor unit. The system operates 24 hours per day. 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: 260 ft. pipe at 120°F = 3.64 in.
Transporting Suction Vapor: 260 ft. pipe at 40°F = 1.04 in.
Anticipated Change in Length: 3.64 in. – 1.04 in. = 2.60 in.

Liquid Line

The liquid temperature remains 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 depth should 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 13. 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.

Table 12: 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
200	0.80	0.80	1.00	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.16	2.30	2.60	2.80	2.90	3.00
220	0.88	0.88	1.10	1.32	1.43	1.54	1.65	1.76	1.87	1.98	2.09	2.20	2.31	2.42	2.38	2.53	2.86	3.08	3.19	3.30
240	0.96	0.96	1.20	1.44	1.56	1.68	1.80	1.92	2.04	2.16	2.28	2.40	2.52	2.64	2.59	2.76	3.12	3.36	3.48	3.60
260	1.04	1.04	1.30	1.56	1.69	1.82	1.95	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.81	2.99	3.38	3.64	3.77	3.90
280	1.12	1.12	1.40	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94	3.08	3.02	3.22	3.64	3.92	4.06	4.20
300	1.20	1.20	1.50	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00	3.15	3.30	3.24	3.45	3.90	4.20	4.35	4.50
320	1.28	1.28	1.60	1.92	2.08	2.24	2.40	2.56	2.72	2.88	3.04	3.20	3.36	3.52	3.46	3.68	4.16	4.48	4.64	4.80
340	1.36	1.36	1.70	2.04	2.21	2.38	2.55	2.72	2.89	3.06	3.23	3.40	3.57	3.74	3.67	3.91	4.42	4.76	4.93	5.10
360	1.44	1.44	1.80	2.16	2.34	2.52	2.70	2.88	3.06	3.24	3.42	3.60	3.78	3.96	3.89	4.14	4.68	5.04	5.22	5.40
380	1.52	1.52	1.90	2.28	2.47	2.66	2.85	3.04	3.23	3.42	3.61	3.80	3.99	4.18	4.10	4.37	4.94	5.32	5.51	5.70
400	1.60	1.60	2.00	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.32	4.60	5.20	5.60	5.80	6.00
420	1.68	1.68	2.10	2.52	2.73	2.94	3.15	3.36	3.57	3.78	3.99	4.20	4.41	4.62	4.54	4.83	5.46	5.88	6.09	6.30
440	1.76	1.76	2.20	2.64	2.86	3.08	3.30	3.52	3.74	3.96	4.18	4.40	4.62	4.84	4.75	5.06	5.72	6.16	6.38	6.60
460	1.84	1.84	2.30	2.76	2.99	3.22	3.45	3.68	3.91	4.14	4.37	4.60	4.83	5.06	4.97	5.29	5.98	6.44	6.67	6.90
480	1.92	1.92	2.40	2.88	3.12	3.36	3.60	3.84	4.08	4.32	4.56	4.80	5.04	5.28	5.18	5.52	6.24	6.72	6.96	7.20
500	2.00	2.00	2.50	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.40	5.75	6.50	7.00	7.25	7.50

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

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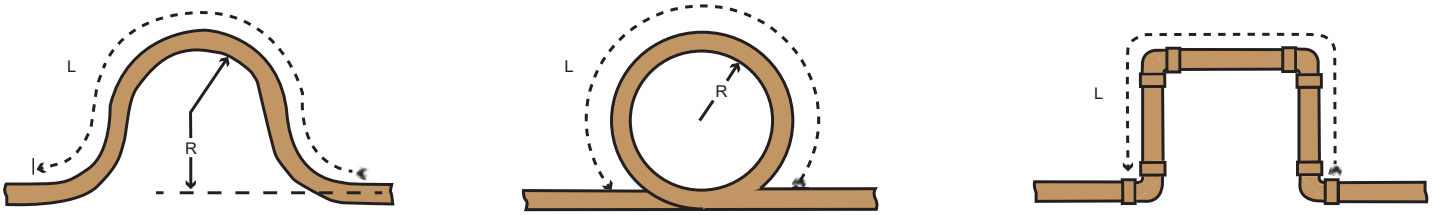
Figure 27: Coiled Expansion Loops and Offsets (Plan View).



Large Tubing U-bend (>3/4 in.) Loop Small Tubing U-bend (<3/4 in.)

Table 13: 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	1-1/4	1-1/2
1/2	R[1]	6	7	8	9	11	12	13
	L[2]	38	44	50	59	67	74	80
1	R[1]	9	10	11	13	15	17	18
	L[2]	54	63	70	83	94	104	113
1-1/2	R[1]	11	12	14	16	18	20	22
	L[2]	66	77	86	101	115	127	138
2	R[1]	12	14	16	19	21	23	25
	L[2]	77	89	99	117	133	147	160
2-1/2	R[1]	14	16	18	21	24	26	29
	L[2]	86	99	111	131	149	165	179
3	R[1]	15	17	19	23	26	29	31
	L[2]	94	109	122	143	163	180	196
3-1/2	R[1]	16	19	21	25	28	31	34
	L[2]	102	117	131	155	176	195	212
4	R[1]	17	20	22	26	30	33	36
	L[2]	109	126	140	166	188	208	226

[1]R = Centerline Length of Pipe. [2]L = Centerline Minimum Radius (inches).

Note:

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

GENERAL INSTALLATION GUIDELINES

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Piping Preparation

Note:

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

No Pipe Size Substitutions

Use only the pipe size selected by the LATS Multi V S pipe system design software or as conveyed in the product installation instructions. Using a different size is prohibited and may result in a system malfunction or failure to work at all.

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, page 23.

In-line Refrigeration Components

Components such as oil traps, solenoid valves, filter-dryers, sight glasses, tee fittings, and other after-market accessories are not permitted on the refrigerant piping system between the outdoor units and the indoor units. Multi S systems are provided with redundant systems that assure oil is properly returned to the compressor. Sight-glasses and solenoid valves may cause vapor to form in the liquid stream. Over time, dryers may deteriorate and introduce debris into the system. The designer and installer should verify the refrigerant piping system is free of traps, sagging pipes, sight glasses, filter dryers, etc.

Using Elbows

Field-supplied elbows are allowed as long as they are long radius and designed for use with R410A refrigerant. The designer, however, should 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 in the LATS program.

Pipe Slope

The horizontal pipe slope cannot exceed 5° up or down.

In-line Refrigeration Components

Components such as oil traps, solenoid valves, filter-dryers, sight glasses, tee fittings, and other after-market accessories are not permitted on the refrigerant piping system between the outdoor units and the indoor / heat recovery units. Multi V S air-source systems are provided with redundant systems that assure oil is properly returned to the compressor. Sight-glasses and solenoid valves may cause vapor to form in the liquid stream. Over time, dryers may deteriorate and introduce debris into the system. The designer and installer should verify the refrigerant piping system is free of traps, sagging pipes, sight glasses, filter dryers, etc.

Field-Provided Isolation Ball Valves

LG maintains a neutral position on using isolation valves in VRF 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 should 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.

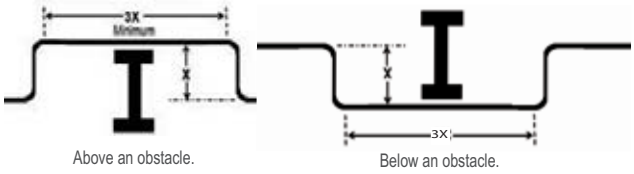
Failure to do so may cause significant performance degradation. Proper leak checks must be performed. Using isolation valves does not automatically void any LG product warranty; however, a limited warranty may be voided in whole or part should any field supplied accessory fail in any way that causes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

LG

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 horizontal section of pipe above or below the obstacle be a minimum of three (3) times greater than the longest vertical rise (or fall) distance.

Figure 33: Installing Piping Above and Below an Obstacle.



Pipe Supports

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

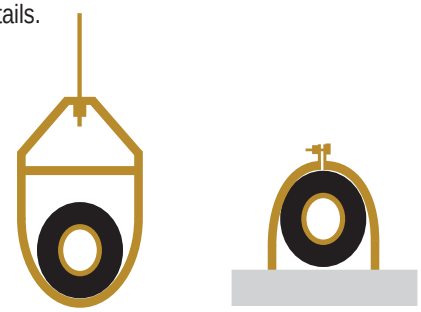
Pipe supports should never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket. Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers should be used with shields between the hangers and insulation. Field provided pipe supports should 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 will 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. If local codes do not specify pipe support spacing, pipe shall be supported:

- Maximum of five feet (5') on center for straight segments of pipe up to 3/4" outside diameter size.
- Maximum of six feet (6') on center for pipe up to one inch (1") outside diameter size.
- Maximum of eight feet (8') on center for pipe up to two inches (2") outside diameter size.

Wherever the pipe changes direction, place a hanger within twelve (12) inches on one side and within twelve to nineteen (12 to 19) inches of the bend on the other side. Support piping at indoor units as shown. Support Y-Branch and Header fittings as shown.

Figure 28: Pipe Hanger Details.



Note:

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

Figure 29: Typical Pipe Support Location—Change in Pipe Direction.

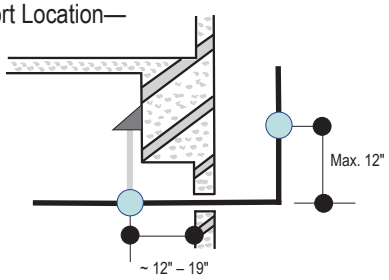


Figure 30: Pipe Support at Indoor Unit.

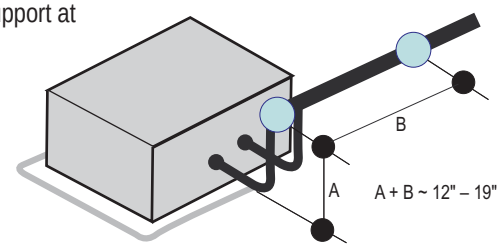


Figure 31: Pipe Support at Y-branch Fitting.

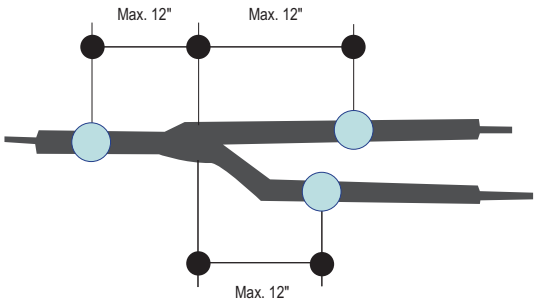
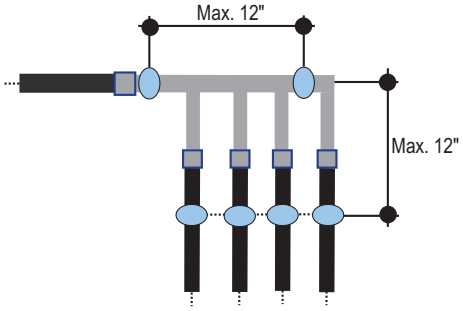


Figure 32: Pipe Support at Header Fitting.



Examples of Supports

Figure 34: U-Bolt Support with Insulation.

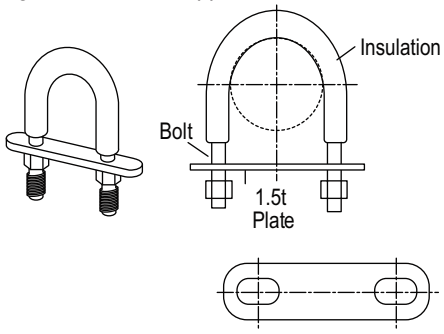


Figure 35: O-Ring Support with Insulation.

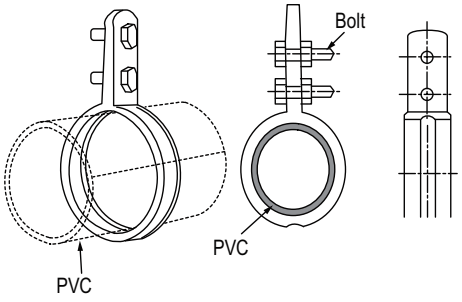
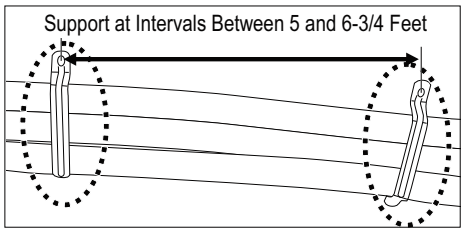


Figure 36: Saddle-Type Support.



Do not compress the insulation with the saddle-type support. If the insulation is compressed, it may tear open and allow condensation to generate during product operation.

Figure 37: U-Bolt Support with an Insulated Pipe.

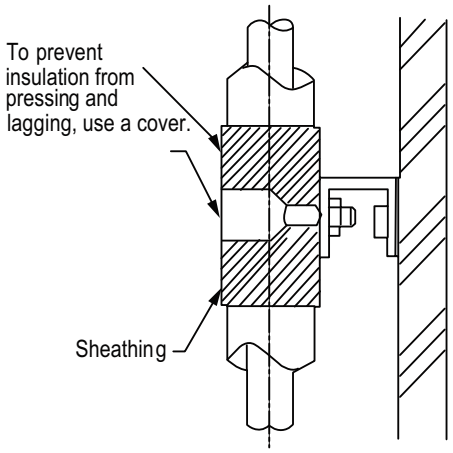


Figure 38: O-Ring Band Support with an Insulated Pipe.

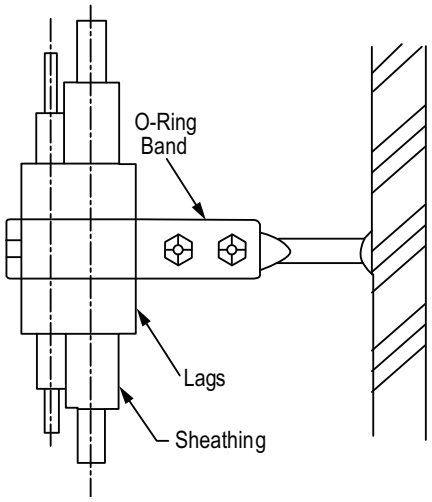


Figure 39: One-Point Down-Stop Support (>441 lbs.).

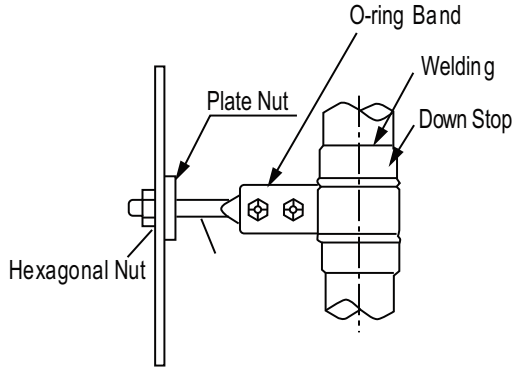
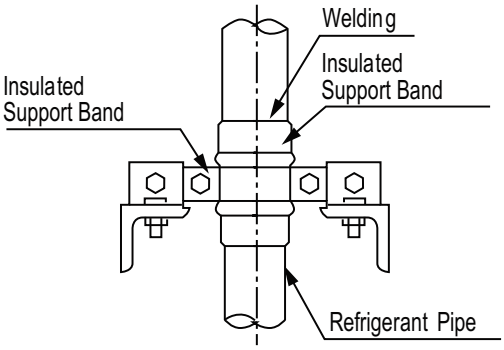


Figure 40: Two-Point Down-Stop Support.



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Refrigerant Piping Connections

- For Multi V S outdoor units, piping can be installed in one of four directions: front, rear, right, and bottom. Whatever direction is chosen, plug the access holes with field-provided putty or insulation to fill all gaps.

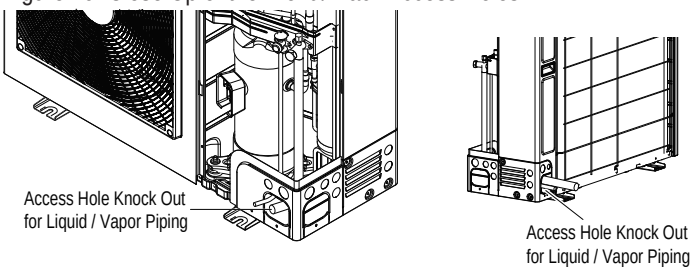
⚠WARNING

Insects or small animals entering the outdoor unit may cause a short circuit in the electrical box, which may lead to fire, electric shock, physical injury, or death.

Note:

Insects or small animals entering the outdoor unit may cause a short circuit in the electrical box, which may lead to unit failure.

Figure 29: Close Up of the Front / Back Access Holes.



- If piping from the left / right or bottom, use the access holes on the base pan. ⃠ Do not damage the piping / base while knocking out the holes.
- Remove any burrs that may have been generated while knocking out the access holes.
- Add a protection sleeve to prevent damage when passing the wiring through the access holes.
- After piping installation, block any holes in the front or side panels to prevent animals or foreign objects from entering the outdoor unit and damaging the wiring / components.
- Pipe system connection is done by connecting from the end of the pipe to the branching pipes, and the refrigerant pipe coming out of the outdoor unit is divided at the end to connect to each indoor unit.
- Flare connections are used to connect the piping on the indoor units, and braze connections are used to connect the piping on the outdoor unit (see piping dimensions below), Y-branches, and headers.

Table 14: Outdoor Unit Refrigerant Piping Connections.

Model	Liquid Conn. (in.)	Type	Vapor Conn. (in.)	Type
ARUN038GSS4	3/8	Brazed	5/8	Brazed
ARUN048GSS4	3/8	Brazed	5/8	Brazed
ARUN053GSS4	3/8	Brazed	3/4	Brazed

Figure 27: Outdoor Unit Refrigerant Piping Connection Options.

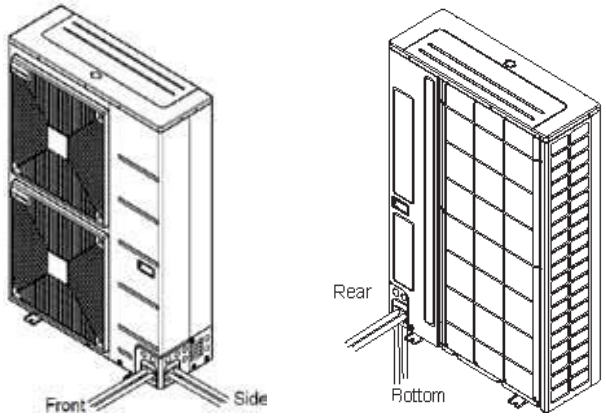


Figure 28: Bottom Access Hole.

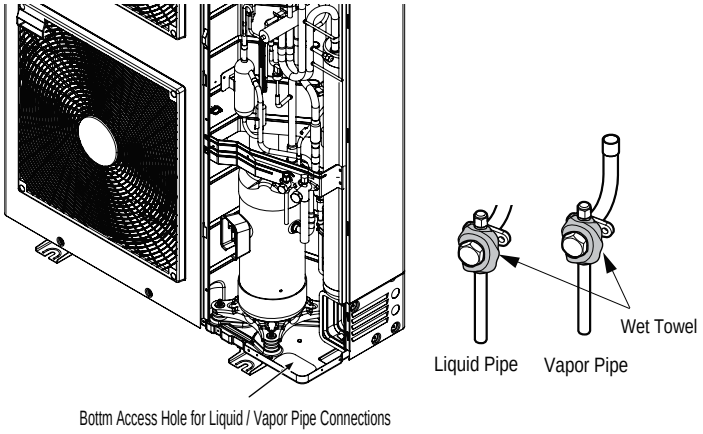
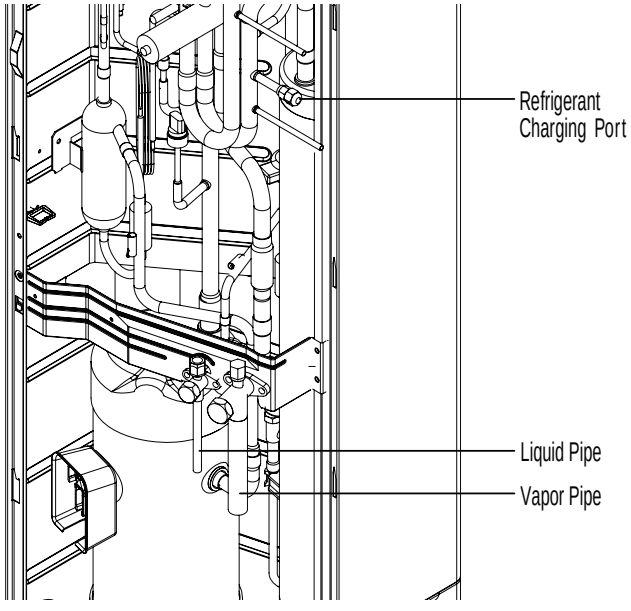


Figure 30: Location of the Refrigerant Charging Port and the Liquid / Vapor Piping.



REFRIGERANT PIPING CONNECTIONS

MULTI V S

Outdoor Unit Connections

Note:

Avoid Pipe Damage

- *When routing field-installed piping inside the outdoor unit frame, avoid causing damage to the piping from vibration. Mount the piping so it does not make contact with the compressor, unit frame, terminal cover, or mounting bolts. Allow room for field installation.*
- *Properly insulate the liquid and vapor lines separately inside the confines of the unit casing.*
- *Refer to the figure on previous page for unit pipe routing options and the table for outdoor unit connection types.*

When brazing the field-supplied piping to the outdoor unit piping connections:

- Protect the liquid and vapor piping / ports with a wet towel.
- Use 0.284 lbs. / in.^{2} nitrogen flow in the piping. If a nitrogen flow was not used during welding, oxidization may form inside the piping and cause the valves and condensers to malfunction.

⚠DANGER

- ⃠ *Do not permit the refrigerant to leak during brazing. Exposure to high concentration levels of refrigerant gas may lead to illness or death.*
- ⃠ *Do not perform brazing in a closed space. Combustible refrigerant generates a poisonous gas harmful to humans. There is also a risk of fire, explosion, and physical injury or death.*
- *After work is complete, close the service port cap to prevent refrigerant leaks. Exposure to high concentration levels of refrigerant gas may lead to illness or death.*

Opening the Shut Off Valve

1. Remove the shut off valve cap.
2. Turn the valve counterclockwise using a hexagon wrench until the shaft stops.

Note:

⃠ *Do not apply excessive force to the shut off valve. Doing so may break the valve body (the valve is not a backseat type*

3. Securely tighten the shut off valve cap.

Table 15: Tightening Torque.

Shut Off Valve Size (inch)	Tightening Torque (lbs. / ft.) (Turn Clockwise to Close)						
	Shaft (Valve Body)			Cap	Service Port	Flare Nut	Vapor Piping Connected to Unit
	Closed	Opened	Hexagonal				
Ø1/4	4.4 ± 0.4	3.7 ± 0.4	0.16 in.	13.0 ± 1.5	12.7 ± 2	12 ± 1.5	-
Ø3/8						28 ± 3.0	
Ø1/2	7.4 ± 0.7			14.8 ± 1.5		41 ± 4.4	
Ø5/8	8.9 ± 0.9		0.24 in.	18.4 ± 1.8		55 ± 5.1	
Ø3/4	10.3 ± 1.0					81.1 ± 7.4	
Ø7/8	22.1 ± 2.2		0.31 in.			-	18.5 ± 2.2
Ø1.0							

Closing the Shut Off Valve

1. Remove the shut off valve cap.
2. Turn the valve clockwise using a hexagon wrench until the shaft contacts the main body seal.

Note:

⃠ *Do not apply excessive force to the shut off valve. Doing so may break the valve body (the valve is not a backseat type).*

3. Securely tighten the shut off valve cap.

Insulating the Shut Off Valve

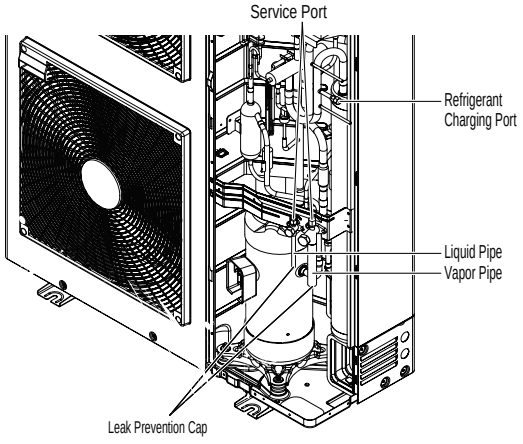
Shut off valves must be insulated correctly and completely using closed cell Ethylene Propylene Diene Methylene (EPDM) insulation. Insulation shall be a minimum 1/2" thick, and thickness may need to be increased based on ambient conditions, humidity levels, and local codes. See page 44 - 46 for information regarding Ethylene Propylene Diene Methylene (EPDM) insulation.

Remove Leak Prevention Cap

The leak prevention cap on the outdoor unit service valve must be removed before piping installation.

1. Verify if the liquid and vapor piping are locked.
2. Extract any remaining refrigerant or air inside through the service port.
3. Remove the leak prevention cap.

Figure 31: Removing the Leak Prevention Cap.



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Minimum number of connected and operating indoor units is 1.
Maximum number of indoor units on a system is:

- ARUN038 = 6
- ARUN048 = 8
- ARUN053 = 9

Table 17: Multi V S Liquid Piping Design Parameters.

Pipe Length	Longest total	984 ELF
	Longest distance from ODU to IDU	492 feet (Actual) 574 feet (Equivalent)
	Distance Between Fittings and IDUs	≥ 20" ELF
	Minimum distance between IDU to any Y-Branch	≤ 131 ELF
	Maximum distance between first Y-Branch to farthest IDU	131 feet
	Minimum distance from IDU to Y-Branch	3 feet
Elevation	If ODU is above IDU	164 feet
	If ODU is below IDU	131 feet
	Between any two IDUs	49 feet

IDU = Indoor Unit
ODU = Outdoor Unit
All elevation limitations are measured in actual feet
ELF = Equivalent length of pipe in feet

Figure 32: Multi V S Piping System Configuration Limitations.

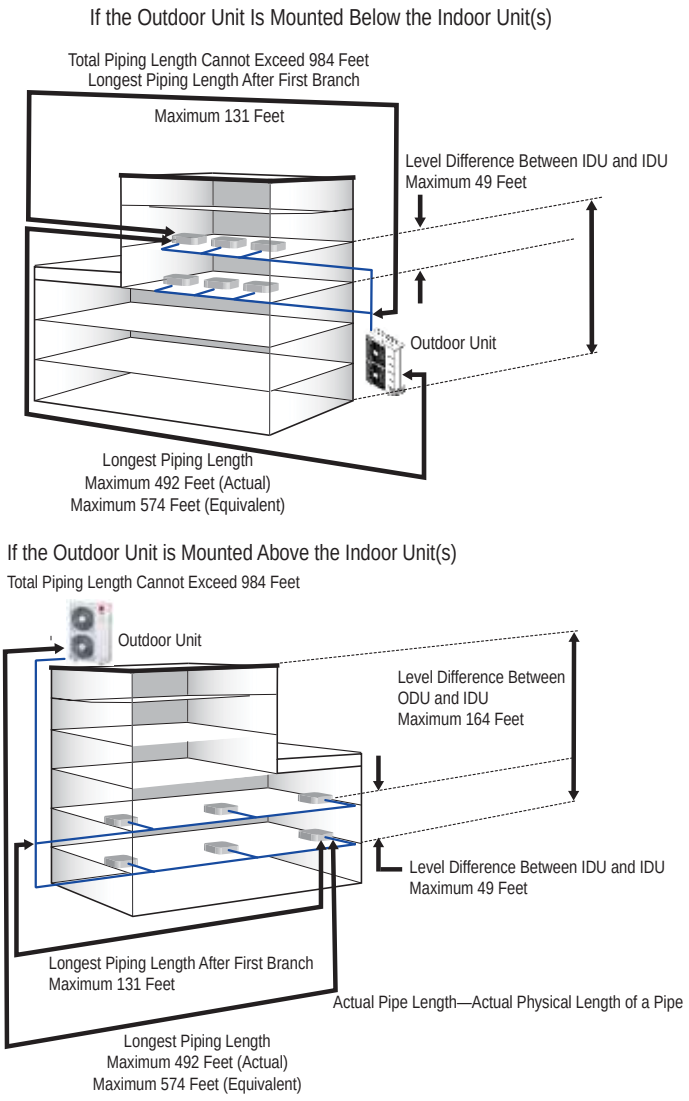


Table 16: Field-Supplied Refrigerant Fittings—Liquid Line Equivalent Pipe Length.

Copper Tubing Size (O.D.)	Equivalent Pipe Length*					
	3/8	**1/2**	**5/8**	**3/4**	**7/8**	**1-1/8**
Standard 90° Elbow	0.6	0.9	1.3	1.6	1.9	2.5
Long Radius 90° Elbow	0.4	0.6	0.8	1.0	1.3	1.7
Street 90° Elbow	1.0	1.6	2.1	2.6	3.1	4.2
Standard 45° Elbow	0.3	0.5	0.7	0.8	1.0	1.3
Street 45° Elbow	0.5	0.8	1.1	1.4	1.6	2.2
Y-Branch	1.6	1.6	1.6	1.6	1.6	1.6
Header	3.3	3.3	3.3	3.3	3.3	3.3
Ball Valve	The equivalent length of a FULL port ball valve is the physical length of the valve. In other words, treat as straight pipe. A full port ball has the same bore diameter as the connected pipe.					

*Equivalent pipe length–The sum of the actual pipe length plus allocations for pressure drop through elbows, valves, and other fittings in equivalent length.
Values calculated based on formula and factors from www.sporlanonline.com.
LG supplied Y-Branch and Header fittings must be used. Field-built Y-Branch and Header fittings are not permitted.

REFRIGERANT PIPING CONNECTIONS

Refrigerant Piping System Examples

The following is an example of manual pipe size calculations. Designers are highly encouraged to use LATS instead of manual calculations.

System Using Y-branches

Example: Five (5) indoor units connected

Multi V S Outdoor Unit.

IDU: Indoor Units.

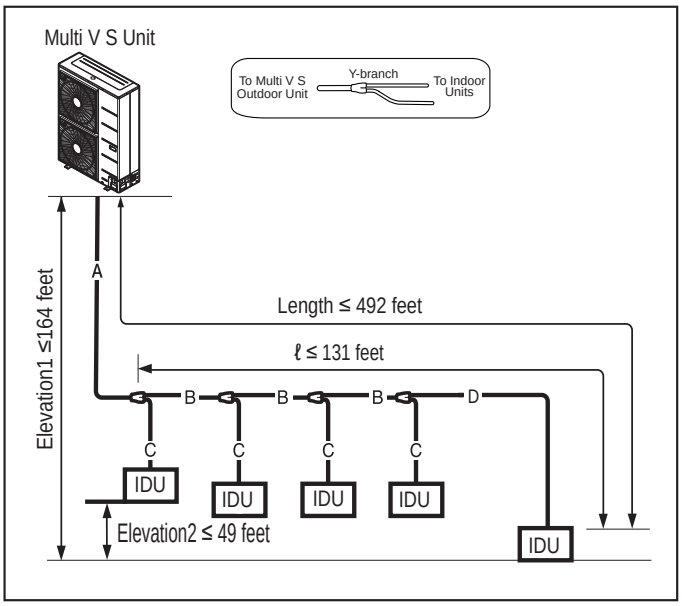
A: Main Pipe from Multi V S Outdoor Unit to Y-branch.

B: Y-branch to Y-branch.

C: Y-branch to Indoor Unit.

D: Y-branch to Farthest Indoor Unit.

- *Always reference the LATS Multi V software report.*
- *See pages 31 - 33 for refrigerant pipe diameter and pipe length tables.*



System Using a Header

Example: Six (6) indoor units connected

Multi V S Outdoor Unit.

IDU: Indoor Units.

Header.

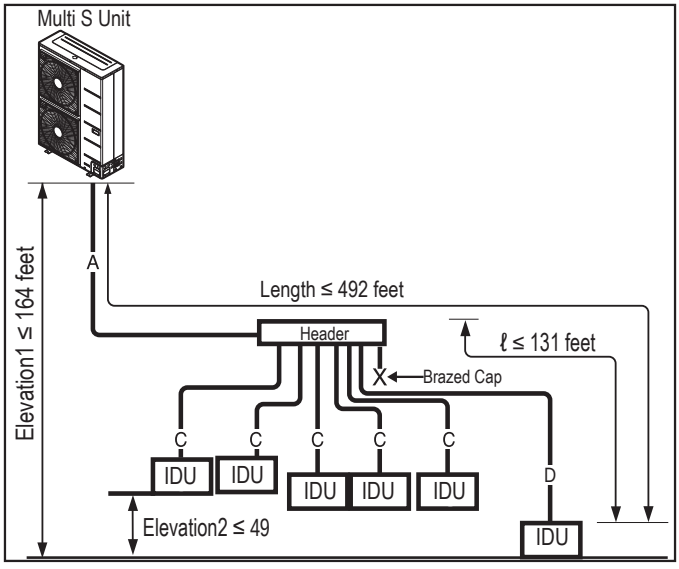
A: Main Pipe from Multi V S Outdoor Unit to Header.

C: Header to Indoor Unit.

D: To Farthest Indoor Unit.

Note:

- *Indoor units should be installed at a lower position than the Header.*
- *Y-branch pipes cannot be used after Headers.*
- *Install the Header so that the pipe distances between the connected indoor units are minimized. Large differences in pipe distances can cause indoor unit performances to fluctuate.*
- *Always reference the LATS Multi V software report.*
- *See pages 31 - 33 for refrigerant pipe diameter and pipe length tables.*



Refrigerant Piping System Examples

The following is an example of manual pipe size calculations. Designers are highly encouraged to use LATS instead of manual calculations.

System Using Y-branches and Header

Example: Five (5) indoor units connected

Multi V S Outdoor Unit.

IDU: Indoor Units.

Y-branches.

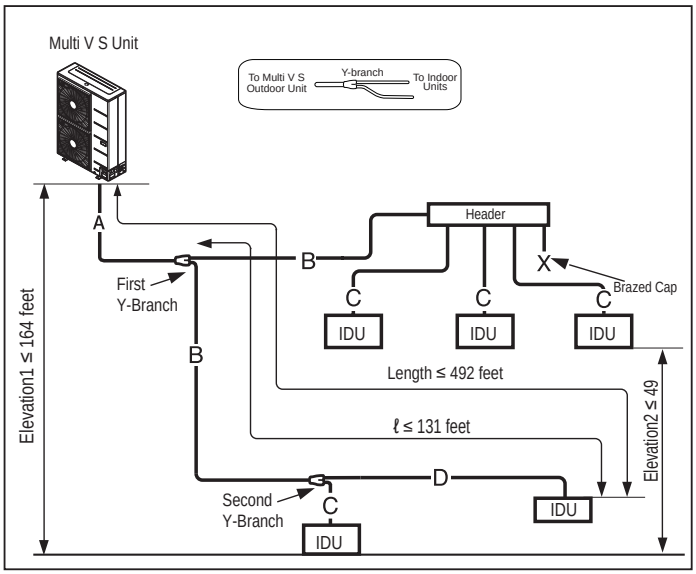
Header.

A: Main Pipe from First Y-branch.

B: Pipe from Y-branch to Y-branch or Header.

C: Pipe from Y-branch or Header to Indoor Unit.

D: Pipe to Farthest Indoor Unit.



Note:

- *Indoor units should be installed at a lower position than the Header.*
- *Y-branch pipes cannot be used after Headers.*
- *Install the Header so that the pipe distances between the between the connected indoor units are minimized. Large differences in pipe distances can cause indoor unit performances to fluctuate.*
- *Always reference the LATS Multi V software report.*

Table 19: Pipe Capabilities.

Length	Total pipe length	Longest actual pipe length	Equivalent pipe length[1]
	A + ΣB + ΣC + D ≤984 feet	A + B + D ≤492 feet	≤574 feet
ℓ	Longest pipe length after first branch		
	B + D ≤131 feet		
Elevation1	Elevation differential (Multi V S Outdoor unit ↔ Indoor unit)		
	When the Outdoor unit is Positioned Higher than the Indoor Units	When the Outdoor unit is Positioned Lower than the Indoor Units	
	≤164 feet	≤131 feet	
Elevation2	Elevation differential (Indoor unit ↔ Indoor unit)		
	≤49 feet		
Distance between fittings and indoor units	≥20 inches		
Distance between fittings and Y-Branches / Headers	≥20 inches		
Distance between two Y-Branches / Headers	≥20 inches		

[1]For calculation purposes, assume equivalent pipe length of Y-branch is 1.6 feet, and equivalent pipe length of header is 3.3 feet.

Table 18: Refrigerant Pipe Diameter (B) from Y-branch to Y-branch / Header.

Downstream Total Capacity of IDUs (Btu/h)	Liquid Pipe (Inches O.D.)	Vapor Pipe (Inches O.D.)
≤19,100	Ø1/4	Ø1/2
<54,600	Ø3/8	Ø5/8
≤76,400	Ø3/8	Ø3/4

- *Connection piping from branch to branch cannot exceed the main pipe diameter (A) used by the Multi V S outdoor unit.*
- *Y-branches and other header branches cannot be installed downstream of the initial header branch.*

REFRIGERANT PIPING CONNECTIONS

MULTI V S

Refrigerant Piping System Examples

Selecting the Refrigerant Piping

Example: Five (5) indoor units connected

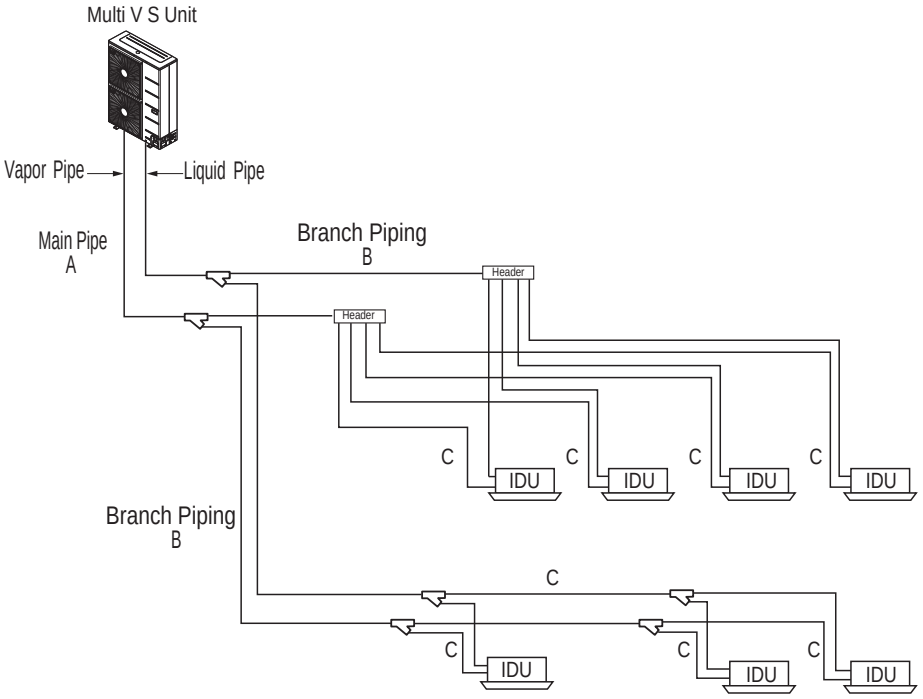
Multi V S Outdoor Unit.

IDU: Indoor Units.

A: Main Pipe from Multi V S Outdoor Unit to Y-branches.

B: Branch Piping.

C: Branch Piping to Indoor Unit (IDU).



Note:

- *Indoor units should be installed at a lower position than the Header.*
- *Y-branch pipes cannot be used after Headers.*
- *Install the Header so that the pipe distances between the between the connected indoor units are minimized. Large differences in pipe distances can cause indoor unit performances to fluctuate.*
- *Always reference the LATS Multi V software report.*

Table 20: Size of Main Pipe (A) (From Space II Unit to Y-branches).

Multi V S Outdoor Unit Capacity (ton)	Liquid pipe (inches OD)	Vapor pipe (inches OD)
3.0	Ø3/8	Ø5/8
4.0	Ø3/8	Ø5/8
4.4	Ø3/8	Ø3/4

Table 21: Size of Branch Piping (B) to Branch Piping (B).

Downstream Total Capacity of IDUs (Btu/h)[1]	Liquid pipe (inches OD)	Vapor pipe (inches OD)
≤19,100	Ø1/4	Ø1/2
≤54,600	Ø3/8	Ø5/8
≤76,400	Ø3/8	Ø3/4

[1]9,600-24,200 Btu/h 4-way 3 feet x 3 feet Cassette and 15,400-24,200 Btu/h High Static Ducted indoor units have Ø3/8 (liquid) and Ø5/8 (vapor).

Table 22: Size of Branch Piping to Indoor Unit (C).

Indoor Unit Capacity[1]	Liquid pipe (inches OD)	Vapor pipe (inches OD)
≤19,100	1/4Ø	1/2Ø
≤54,600	3/8Ø	5/8Ø
≤76,400	3/8Ø	3/4Ø

[1]9,600-24,200 Btu/h 4-way 3 feet x 3 feet Cassette and 15,400-24,200 Btu/h High Static Ducted indoor units have Ø3/8 (liquid) and Ø5/8 (vapor).

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Table 23: Pipe Segment Sizing— All Pipe Dimensions are Inches O.D.

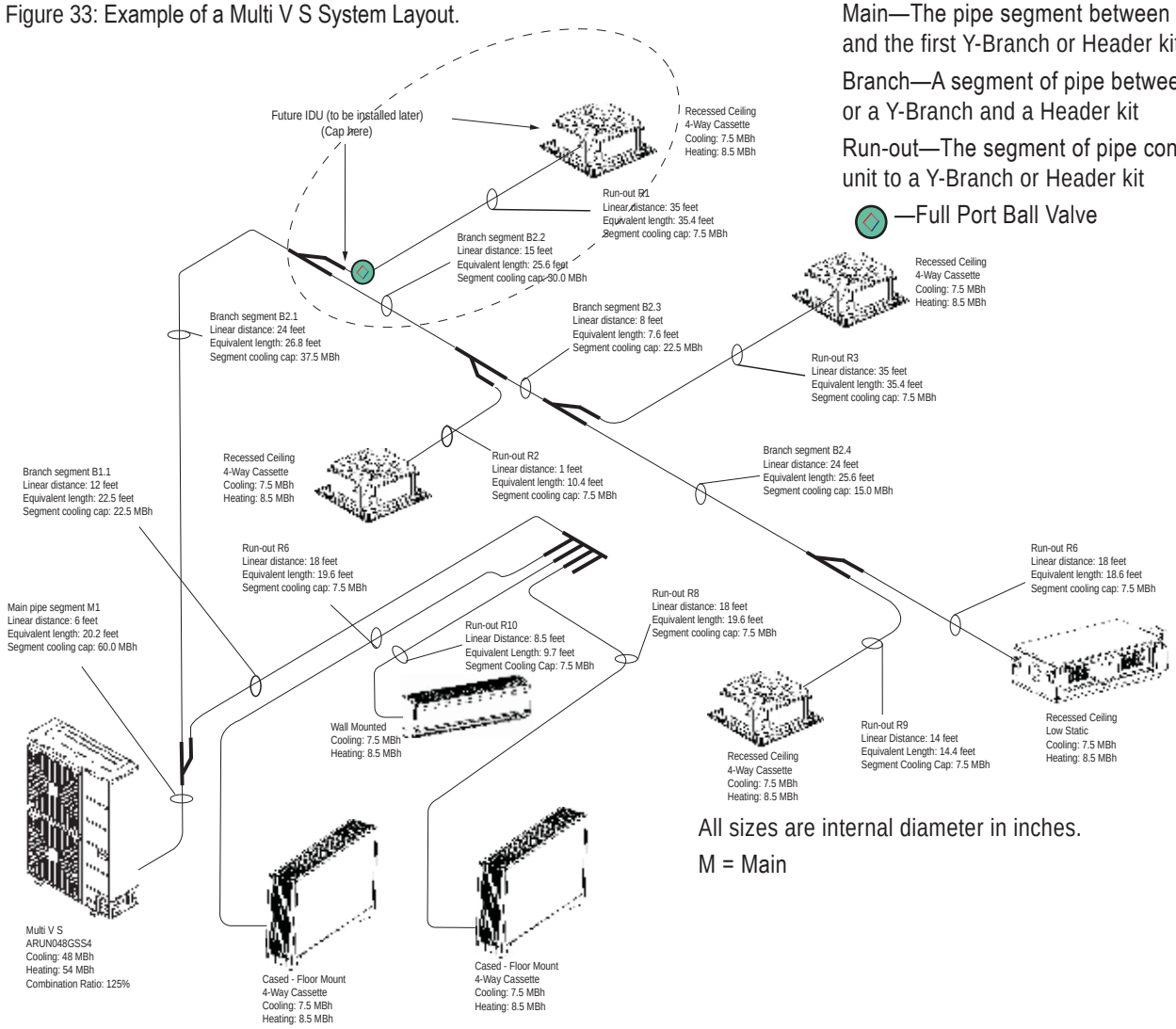
Model	Main Pipe Segment[1]				Branch and Run-Outs[2,3]					
	<295 feet equivalent		≥ 295 feet equivalent		≤19.1 MBh downstream capacity		>19.1 MBh <54.6 MBh downstream capacity		≥54.6 MBh <68.9 MBh downstream capacity	
	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
ARUN038GSS4	3/8	5/8	3/8	3/4	1/4	1/2	3/8	5/8	–	–
ARUN048GSS4	3/8	5/8	3/8	3/4	1/4	1/2	3/8	5/8	–	–
ARUN053GSS4	3/8	3/4	3/8	3/4	3/8	3/4	3/8	3/4	3/8	3/4

[1]Use the equivalent length of the longest pipe run between the outdoor unit and the furthest indoor unit.

[2]Capacity (MBh) = The sum of the nominal capacity of all connected indoor units served by the pipe segment.

[3]If the sum of the nominal cooling capacity of all connected indoor units served by a branch or run-out segment is greater than the capacity of the outdoor unit, size the pipe segment based on the outdoor unit nominal capacity.

Figure 33: Example of a Multi V S System Layout.



Main—The pipe segment between the outdoor unit and the first Y-Branch or Header kit

Branch—A segment of pipe between two Y-Branches or a Y-Branch and a Header kit

Run-out—The segment of pipe connecting an indoor unit to a Y-Branch or Header kit

—Full Port Ball Valve

All sizes are internal diameter in inches.

M = Main

Table 24: Example System Pipe Segment Sizes.

Segment Tag	M1	B1.1	B2.1	B2.2	B2.3	B2.4	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Liquid Line Dia. OD (in)	3/8	3/8	3/8	3/8	3/8	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Vapor Line Dia. OD (in)	3/4	5/8	5/8	5/8	5/8	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2

REFRIGERANT PIPING CONNECTIONS

MULTI V S

Required LATS Multi V Piping Design Software File

LATS Multi V Piping Design Software

The proper design and installation of the refrigerant piping system is a critical element of a Multi V system. Multi V S Heat Pump systems require two pipes between components – a liquid line and a vapor line. A properly designed refrigerant piping system ensures that refrigerant is delivered to the indoor unit coils for optimal system performance and capacity.

LG Air Conditioner Technical Solution (LATS) software is a total design solution for LG Multi V S air conditioning systems. This Windows®-based application assists the design engineer with specifying and sizing outdoor and indoor units (by calculating component capacity based on design conditions), laying out the refrigeration distribution pipe system, checking piping limitations, calculating refrigerant charge, and generating equipment schedules and piping diagrams in (.dxf) format for use on CAD building design drawings.*

* Windows® is a registered mark of Microsoft® Corporation.

To ensure that the refrigerant piping design meets LG's quality standards, a LATS refrigerant piping design must be provided with **every Multi V S order. Following the installation, if any changes or variations to the design are necessary, a new LATS file must be** created and provided to LG prior to system commissioning to ensure the proper pipe size has not changed.

Adjusting LATS Multi V S Output for Altitude

When a system is installed at elevations significantly above sea level, consider the impact air density has on the capacity of the indoor and air-source units. LATS does not de-rate indoor unit capacity for high altitude applications. Be sure to apply locally accepted correction factors when calculating actual indoor unit capacities at that altitude.

Design Choices

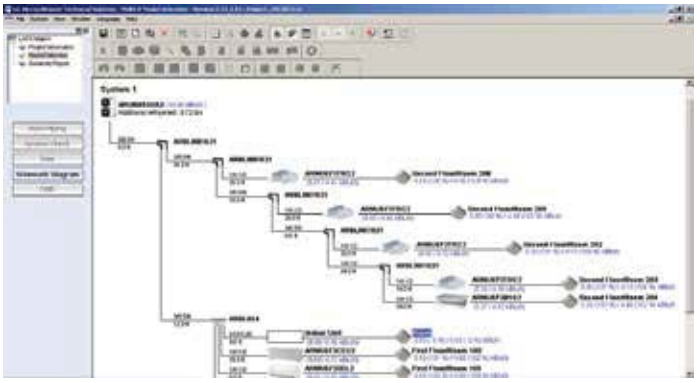
LATS Multi V software is flexible, offering the HVAC system engineer an easy to use Tree mode.

Tree Mode

Using the Tree mode, the engineer can quickly create a one-line schematic drawing of a Multi V system. Integration of the engineered pipe system into the building drawings is done at a later date by the draftsperson using standard drafting software tools.
Import building loads from an external file (.xls format).

- System components selected using an easy drag and drop process.
- Automatically analyzes and checks the design complies with most piping design limitations.
- Sizes refrigerant piping.
- Generates a system engineering report (.xls format).
- Generates an equipment schedule (.xls or .dxf format).
- Generates a system piping diagram (.dxf format).

Figure 34: Screenshot of LATS Pipe System Design Tool in Tree Mode.



LATS Report

LATS Multi V software generates a report file (.xls format) containing project design parameters, cooling and heating design day system component performance, and capacity data. The report calculates the system combination ratio, calculates the system refrigerant charge, and provides detailed bill of material information including a list of Multi V outdoor units, air handlers, control devices, accessories, refrigerant pipe sizes segregated by building, by system, by pipe size, and by pipe segments.

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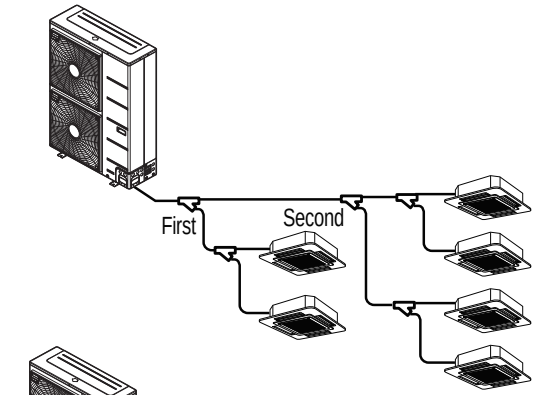
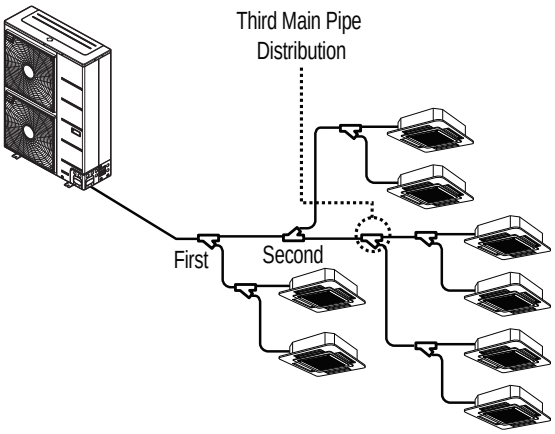
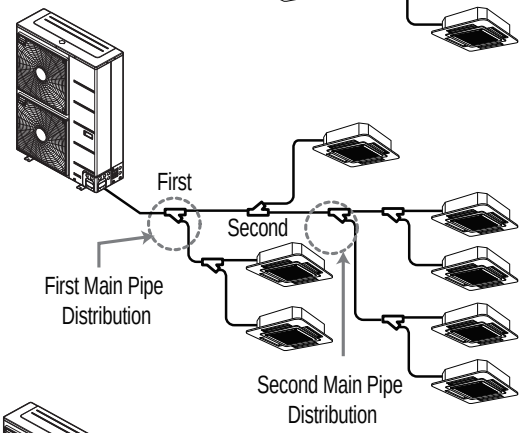
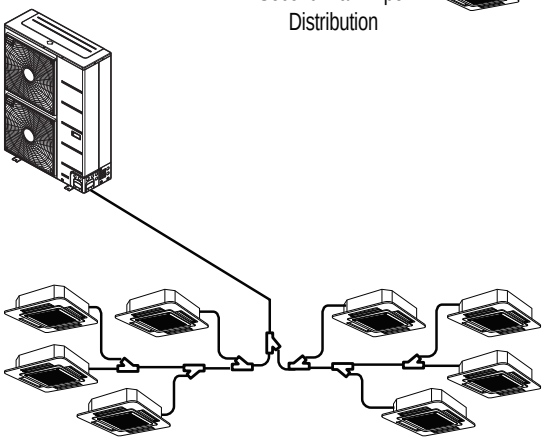
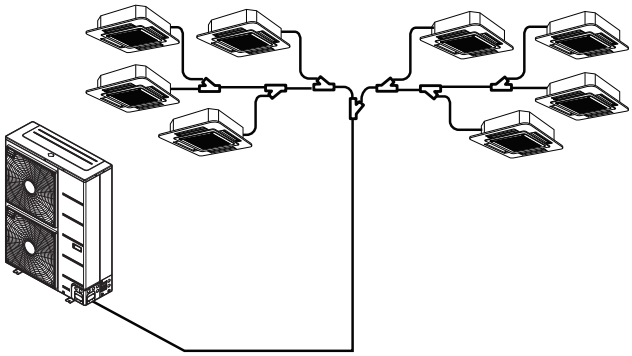
Various Acceptable Layouts

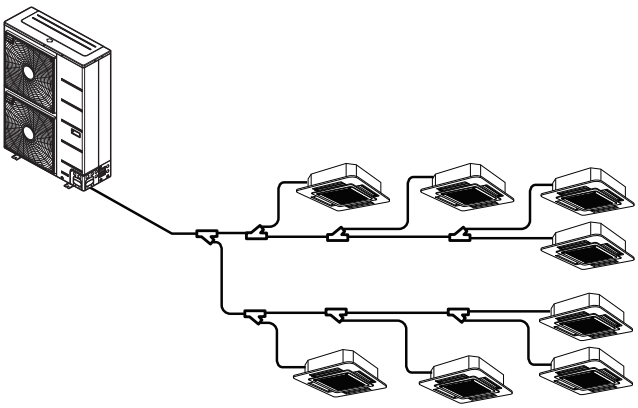


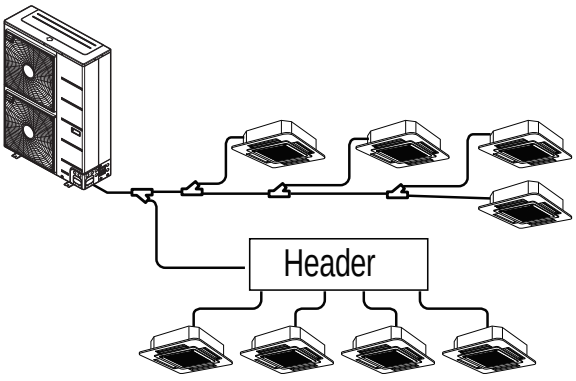








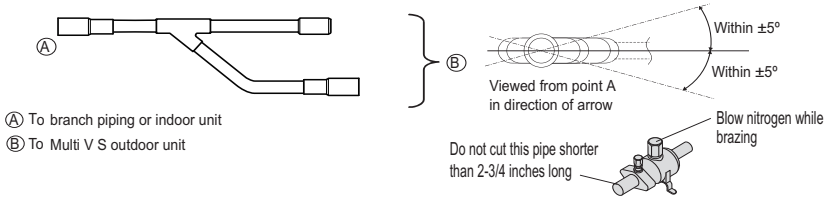




Y-branches

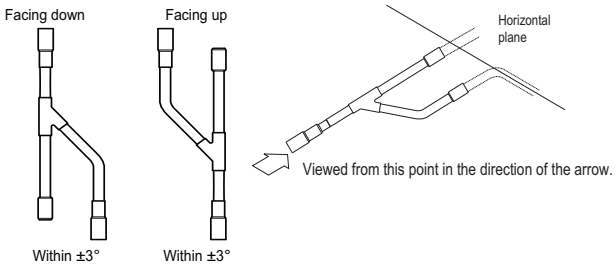
Figure 35: Y-Branch Installation Recommendations.

Install the branch pipe between the outdoor units so that the outlet pipe is parallel with the surface.



Ⓐ To branch piping or indoor unit
Ⓑ To Multi V S outdoor unit

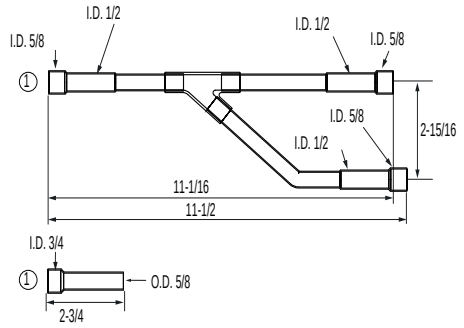
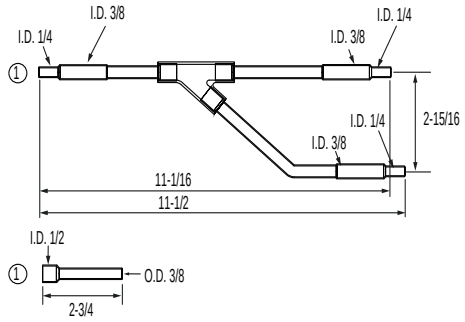
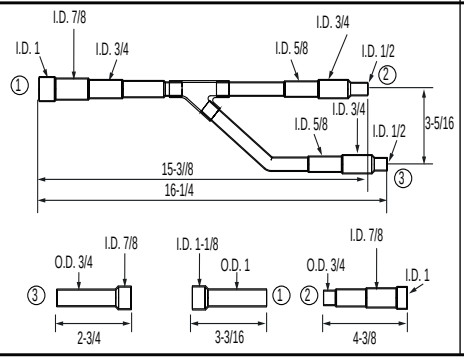
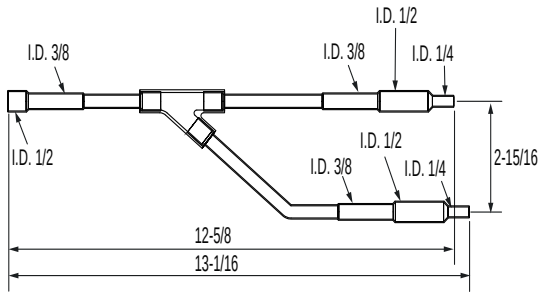
Figure 36: Y-Branch Horizontal Plane.



- Y-branches must be installed horizontally or vertically as shown in the diagrams above.
- Configuration can be any of the above, providing the horizontal 5 degree rule is followed.
- If the diameter of the refrigerant piping is different from the Y-branch port size, trim to the desired section using a pipe cutter.
- Y-branches should be insulated with the clam-shell jacket included in each kit.

Table 25: Multi V S Y-Branches.

Unit: Inch

Models	Vapor pipe	Liquid pipe
ARBLN01621		
ARBLN03321		

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Headers

- The largest-capacity indoor unit must be installed closest to the Multi V S outdoor unit.
- Install the Header in a horizontal plane.
- If the diameter of the refrigerant piping is different from the Header port size, trim to the desired section using a pipe cutter.
- When the number of pipes to be connected is less than the number of available header branches, install a cap to the unused ports.
- Headers should be insulated with the clam-shell jacket included in each kit.

Figure 37: Header Installation.

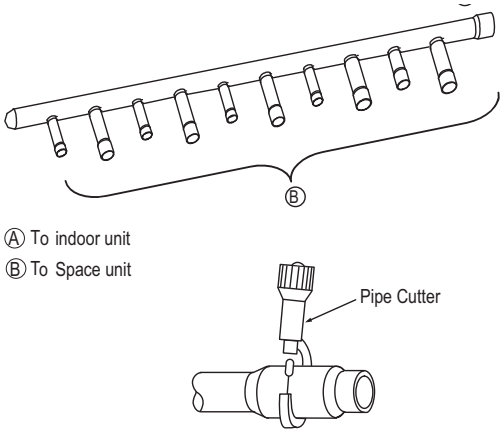


Figure 38: Capping Unused Ports and Horizontal Plane.

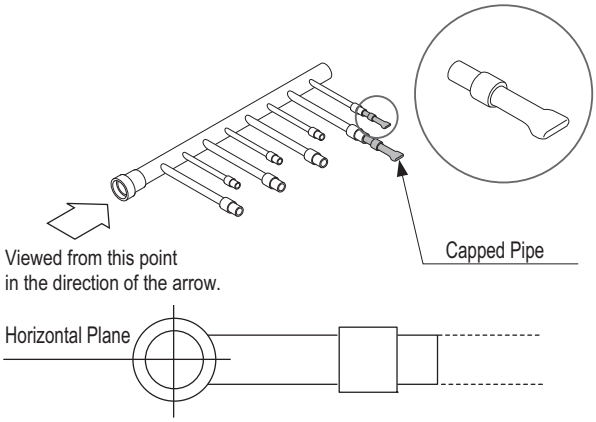
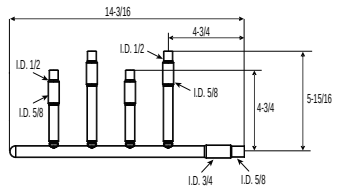
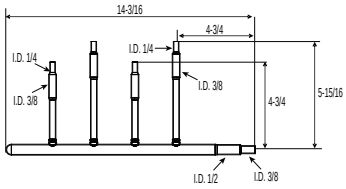
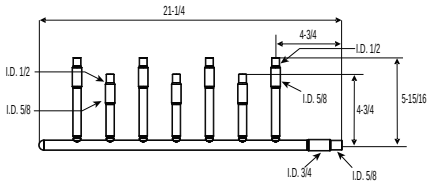
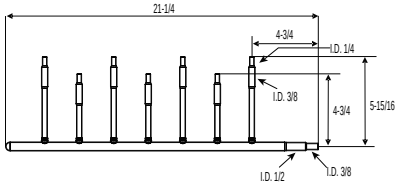
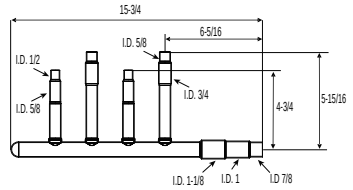
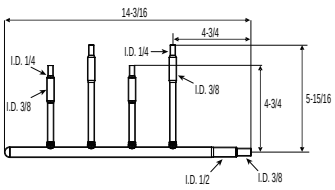
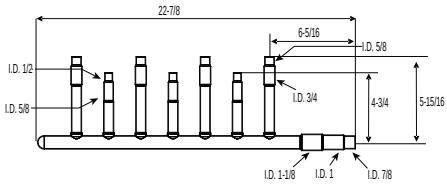
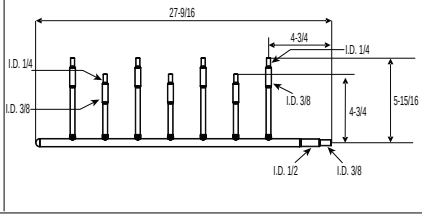


Table 26: Multi V S Headers.

Unit: Inch

Models	Vapor pipe	Liquid pipe
4 branch ARBL054		
7 branch ARBL057		
4 branch ARBL104		
7 branch ARBL107		

Vacuum Mode

Vacuum mode is used for creating vacuum in the system after the compressor or other outdoor unit parts have been replaced, or if an indoor unit has been added to or replaced.

Vacuum Mode On

Turn No. 5 on Outdoor Unit DIP Switch to ON.

↓

Select the mode using the ▶ and ◀ buttons.
Choose “SVC” by pushing the ● button.

↓

Select the function using the ▶ and ◀ buttons.
Choose “Se3” by pushing the ● button.

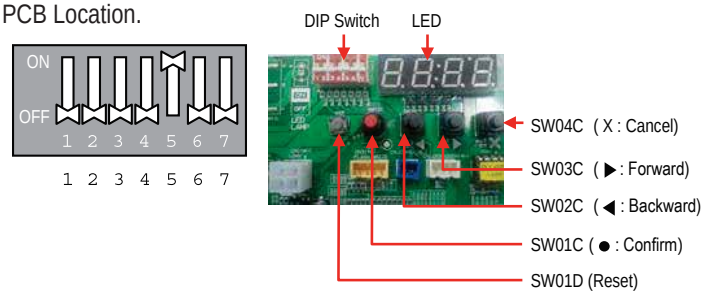
↓

Start the vacuum mode “VACC”. Outdoor Unit valves and EEV should be open. Indoor Units EEVs should be open.

Vacuum Mode Off

Set DIP Switch No. 5 to Off, and push the reset button on the Outdoor Unit PCB.

Figure 39: Multi V S Outdoor Unit DIP Switch Vacuum Mode Setting and PCB Location.



Note:

- *All valves in the indoor and outdoor units will be opened when the Vacuum Mode is set.*
- *Outdoor unit operation mode stops during Vacuum Mode; compressor can’t operate.*
- *After moving and installing the system to another site, recharge the refrigerant after perfect vacuum. If a different refrigerant or air is mixed with the original refrigerant, the refrigerant cycle may malfunction and damage the unit.*
- *Always add the appropriate amount of refrigerant when adding an additional refrigerant charge. Too much or too little refrigerant will cause system malfunction.*

LG

Vacuum Procedure

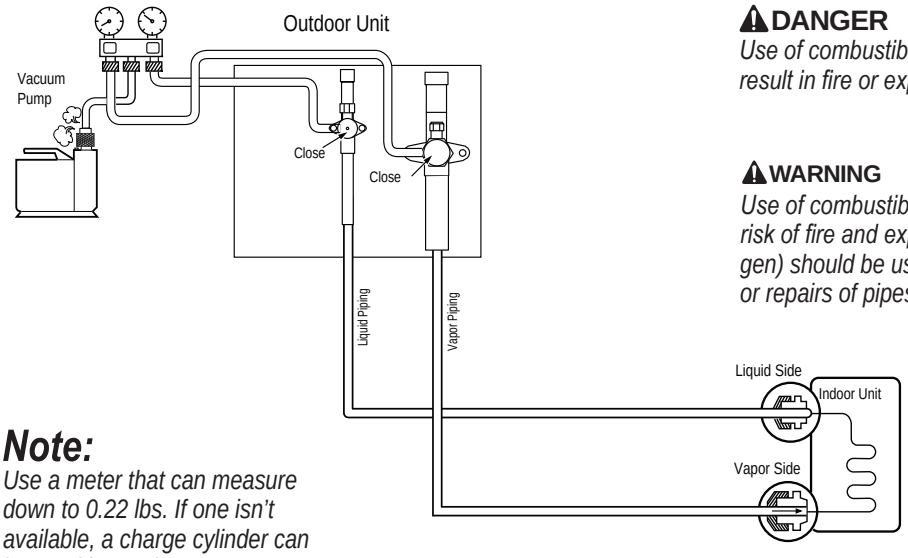
Vacuum drying should be performed from the service port provided on the outdoor unit's service valve to the vacuum pump commonly used for liquid pipe and the vapor pipe. Vacuum of the pipe and the indoor units should be made from the port of the outdoor unit's service valve with the service valve closed.

Note:

- *Never perform air purging using refrigerant; it will damage the outdoor unit.*
- *Use a vacuum pump that can evacuate to 500 microns.*

1. Evacuate the system from the liquid and vapor pipes with a vacuum pump for over two (2) hours and bring the system to 500 microns.
2. Maintain system under that condition for over one (1) hour; if the vacuum gauge rises, the system may contain moisture or a leak.
3. If there is a possibility of moisture in the piping (rainwater may have entered the piping if work was performed during a rainy season or over an extended period), then:
   - Evacuate the system for two (2) hours to 7.3 psi (vacuum break) with nitrogen gas.
   - Evacuate it again with the vacuum pump for one (1) hour to 500 microns (vacuum drying).
4. If the system cannot be evacuated to 500 microns, repeat the steps of vacuum break and drying.
5. Finally, after maintaining the system in vacuum for one (1) hour, check if the vacuum gauge rises or not.

Figure 40: Vacuum Procedure Diagram.



⚠DANGER

Use of combustible gases including compressed air or oxygen, may result in fire or explosion and physical injury or death.

⚠WARNING

Use of combustible gases including compressed air or oxygen runs the risk of fire and explosion and physical injury or death. Inert gas (nitrogen) should be used when performing vacuum, checking leaks, cleaning or repairs of pipes, etc.

Note:

Use a meter that can measure down to 0.22 lbs. If one isn't available, a charge cylinder can be used instead.

Note:

- *If the primary refrigerant charge is not performed in a reasonable time after the vacuum procedure is complete, wet air may infiltrate the outdoor unit. If wet air is mixed with refrigerant, the refrigerant cycle may malfunction and the unit may be damaged.*
- ⃠ *Do not perform refrigerant charge while the compressor is operating, otherwise, liquid may leak and subsequently damage the compressor.*
- *Use a micron gauge to measure vacuum.*
- *Obtain the precise amount of refrigerant needed using calculations outlined in the following pages. Too much or too little refrigerant may cause the system to malfunction.*
- *If other refrigerants are mixed in the original refrigerant, the refrigerant piping system may be damaged or malfunction.*
- *Because R410A is a mixed refrigerant, the required additional refrigerant must be charged in its liquid state. If the refrigerant is charged in its gaseous state, its composition changes and the system will not work properly.*

Leak Test

Note:

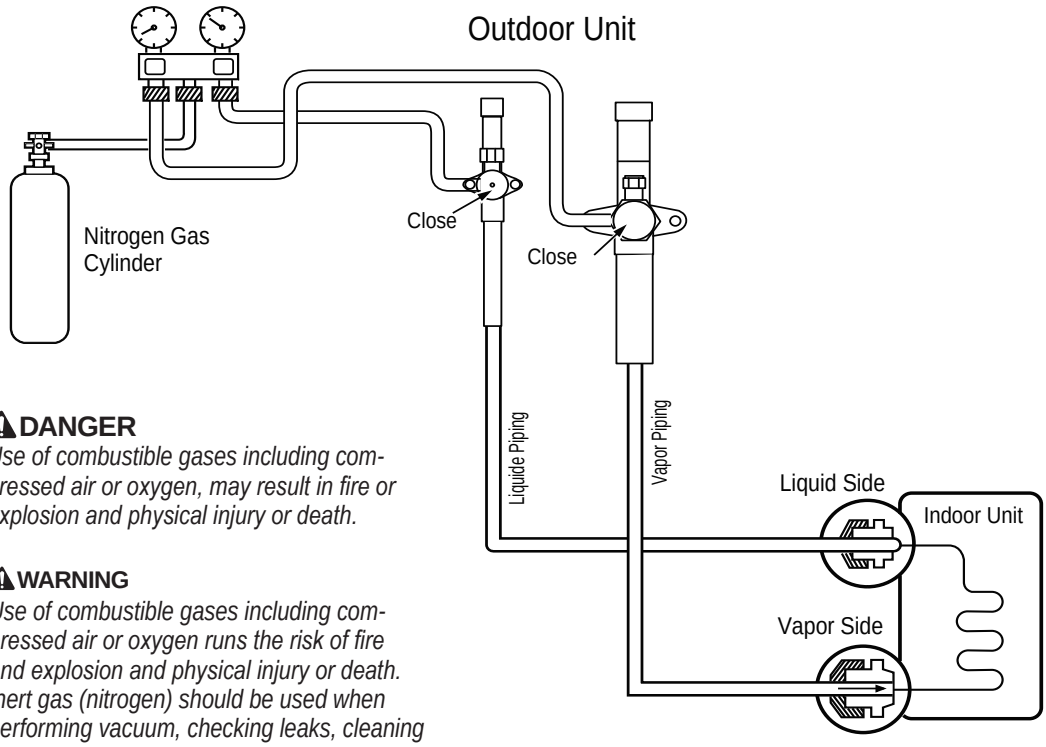
The indoor units must be OFF, and the DIP switches can be set to Vacuum Mode (see page 38) before initializing the leak test. The use of vacuum mode is not required and may not always apply to pressure test procedure during initial equipment installation.

First set the DIP Switch to Vacuum Mode. Test for leaks by pressurizing the system with nitrogen gas to 550 psi for twenty-four (24) hours with the service valves closed. Pressurize both the liquid and the vapor piping. If the pressure does not drop for twenty-four (24) hours, the system passes the test and no leaks are present. If the pressure drops, there is a nitrogen leak in the system. Find the leak, repair, and then test again.

Note:

- *To avoid nitrogen entering the refrigerant system in a liquid state, the top of the cylinder must be higher than its bottom when the system is pressurized.*
- *The cylinder should be used in a vertical standing position.*

Figure 41: Leak Test Diagram.



⚠DANGER

Use of combustible gases including compressed air or oxygen, may result in fire or explosion and physical injury or death.

⚠WARNING

Use of combustible gases including compressed air or oxygen runs the risk of fire and explosion and physical injury or death. Inert gas (nitrogen) should be used when performing vacuum, checking leaks, cleaning or repairs of pipes, etc.

Leak Test Ambient Temperature Correction

If the ambient temperature changed between the time when pressure was applied and when the pressure drop was checked, adjust results by factoring in approximately 1.5 psi for each 2°F of temperature difference.

Correction formula = (Ambient temperature when pressure was applied - Ambient temperature when pressure drop was checked) x 0.01.

Example:

When pressure (550 psig) was applied, the ambient temperature was 80.6°F; 24 hours later when pressure drop (540 psi) was checked, ambient temperature was 68°F.

Thus, 80.6 - 68 x 0.01 = 0.126. In this case, the pressure drop of 0.126 was due to temperature difference, therefore, there is no leak in the refrigerant piping system.

REFRIGERANT PIPING CONNECTIONS

Refrigerant Charge

Note:

The system will stop operation due to excessive or insufficient refrigerant, therefore, always charge the unit properly. When servicing, always refer to any notes about system piping length and additional refrigerant amounts.

System Tag or ID_____ —	Job Name_____ Project Manager_____ Date_____

Line #	Description	Chassis I.D.	Size	Quantity	CF (Ref.)[1]	Total (lbs.)
1	Linear feet of 1/4" liquid line tubing[2]	—	—		0.015	
2	Linear feet of 3/8" liquid line tubing[2]	—	—		0.041	
3	Linear feet of 1/2" liquid line tubing[2]	—	—		0.079	
4	Linear feet of 5/8" liquid line tubing[2]	—	—		0.116	
5	Linear feet of 3/4" liquid line tubing[2]	—	—		0.179	
6	Linear feet of 7/8" liquid line tubing[2]	—	—		0.238	
7	Linear feet of 1" liquid line tubing[2]	—	—		0.323	
8	Art Cool Gallery	SF	9k to 12k		0.22	
9	Wall Mounted + Art Cool Mirror	SB, SE	5k to 15k		0.53	
10	Wall Mounted + Art Cool Mirror	SC	18k to 24k		0.62	
11	Wall Mounted	SV	30k to 36k		1.01	
12	1-Way Cassette	TU	7k to 12k		0.44	
13	1-Way Cassette	TT	18k to 24k		0.64	
14	2-Way Cassette	TL	18k to 24k		0.35	
15	4-Way 2' x 2' Cassette	TR	5k to 7k		0.40	
16	4-Way 2' x 2' Cassette	TR	9k to 12k		0.55	
17	4-Way 2' x 2' Cassette	TQ	15k to 18k		0.71	
18	4-Way 3' x 3' Cassette	TNA	7k to 24k		0.89	
19	4-Way 3' x 3' Cassette	TPC	24k to 28k		1.06	
20	4-Way 3' x 3' Cassette	TMA	24k to 36k		1.08	
21	4-Way 3' x 3' Cassette	TNC	36k		1.41	
22	4-Way 3' x 3' Cassette	TMC	42k to 48k		1.41	
23	High Static Ducted	BH	7k to 24k		0.57	
24	High Static Ducted	BG	7k to 42k		0.97	
25	High Static Ducted	BR	28k to 54k		1.37	
26	High Static Ducted	B8	36k to 96k		2.2	
27	Low Static Ducted	L1	7k to 9k		0.31	
28	Low Static Ducted	L2	12k to 18k		0.42	
29	Low Static Ducted	L3	24k		0.55	
30	Low Static Ducted Bottom Return	B3	7k to 15k		0.37	
31	Low Static Ducted Bottom Return	B4	18k to 24k		0.82	
32	Vertical / Horizontal Air Handling Unit	NJ	12k to 30k		1.04	
33	Vertical / Horizontal Air Handling Unit	NJ	36k		1.57	
34	Vertical / Horizontal Air Handling Unit	NK	42k to 54k		2.00	
35	Ceiling Suspended	VJ	18k to 24k		0.77	
36	Convertible Surface Mount—Ceiling / Wall	VE	9k to 12k		0.22	
37	Floor Standing	CE (U)	7k to 15k		0.37	
38	Floor Standing	CF (U)	18k to 24k		0.82	
39	Additional Refrigerant Charge Required					
40	ARUN038GSS4 Outdoor Unit Factory Refrigerant Charge[3]		38k		6.6	
41	ARUN048GSS4 Outdoor Unit Factory Refrigerant Charge[3]		48k		6.6	
42	ARUN053GSS4 Outdoor Unit Factory Refrigerant Charge[3]		53k		6.6	
43	**Total System Charge: Sum of Additional Refrigerant Charge Required and Total Factory Refrigerant Charge[4]**					

[1]CF (Ref.) = Correction Factor for Refrigerant Charge.
[2]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).
[3]Maximum quantity of indoor units allowed: ARUN038 = 6, ARUN048 = 8, ARUN053 = 9.
[4]If trim charge is negative, remove refrigerant. If trim charge is positive, add refrigerant.

REFRIGERANT PIPING CONNECTIONS

MULTI V S

Refrigerant Charge

Table 27: Total Multi V S Outdoor Unit Refrigerant Charge.

Nominal Tons	Model Number	Refrigerant Charge (lbs.)
3.0	ARUN038GSS4	6.6
4.0	ARUN048GSS4	6.6
4.4	ARUN053GSS4	6.6

⚠ WARNING

See the Cautions for Refrigerant Leaks section on pages 71 - 72.

Calculating the additional refrigerant charge must also take into account piping length.

Additional Refrigerant Charge Formula:

Multi V S Outdoor Unit Factory Refrigerant Charge (lbs.) + Additional Charge (lbs.) + Total Additional Refrigerant Amount (lbs.)

Where Additional Charge (lbs.) =

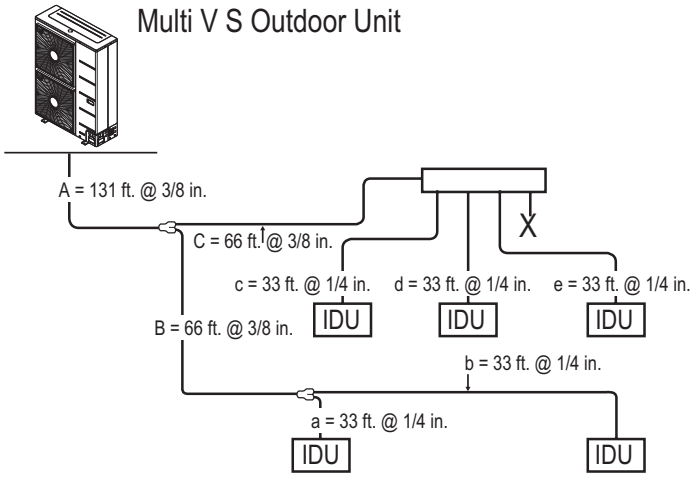
+ Total liquid piping length (feet) @ 7/8 inches x 0.238 lbs./ft.
+ Total liquid piping length (feet) @ 3/4 inches x 0.179 lbs./ft.
+ Total liquid piping length (feet) @ 5/8 inches x 0.116 lbs./ft.
+ Total liquid piping length (feet) @ 1/2 inches x 0.079 lbs./ft.
+ Total liquid piping length (feet) @ 3/8 inches x 0.041 lbs./ft.
+ Total liquid piping length (feet) @ 1/4 inches x 0.015 lbs./ft.
+ Correction Factor (CF) (lbs.)

Example:

Additional Charge =

A (131 ft.) x 0.041 lbs./ft. (for 3/8 in. piping)
+ B (66 ft.) x 0.041 lbs./ft. (for 3/8 in. piping)
+ C (66 ft.) x 0.041 lbs./ft. (for 3/8 in. piping)
+ a+b+c+d+e (33 ft.+33 ft.+33 ft.+33 ft.+33 ft.) x 0.015 lbs./ft. (for 1/4 in. piping)
+ CF
= 5.37 (A) + 2.71 (B) + 2.71 (C) + 2.46 ([a+b+c+d+e] x 0.015) + 0 (CF) = 13.3

Figure 42: Example of Additional Refrigerant Charge Calculation.



Note:

If the calculation results in a negative number, refrigerant does not need to be added.

Refrigerant Charge

- *Both vapor and liquid piping to be vacuumed.*
- *Always add the appropriate amount of refrigerant when adding an additional refrigerant charge. Too much or too little refrigerant will cause system malfunction.*

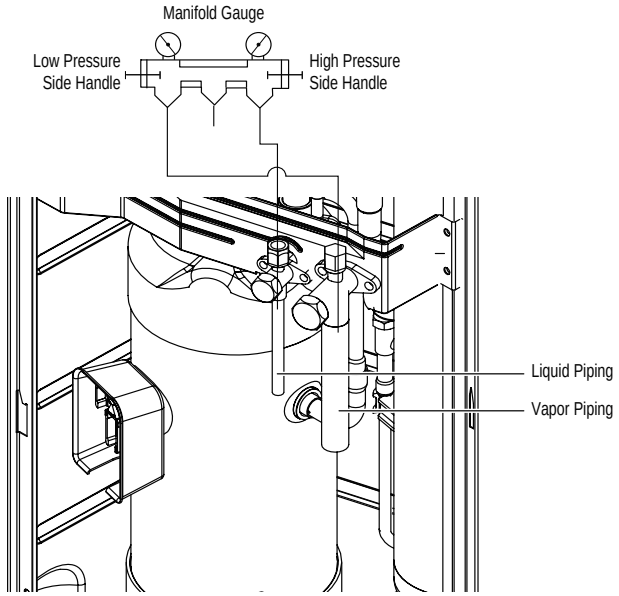
⚠ DANGER

If the added refrigerant charge is more than 10% over the necessary amount, the condenser will rupture, which may cause physical injury or death.

Note:

If the added refrigerant charge is more than 10% over the necessary amount, indoor unit operation may malfunction.

Figure 43: Charging the Refrigerant.



Refrigerant Piping System Insulation

All refrigerant piping from the outdoor unit to the indoor units must be insulated correctly for safety and usage. Y-branch connections, Headers, 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" thick, and thickness may need to be increased based on ambient conditions and local codes. Table on the 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

Note:

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.

Figure 44: Typical Pipe Insulation, Power Wire and Communications Cable Arrangement

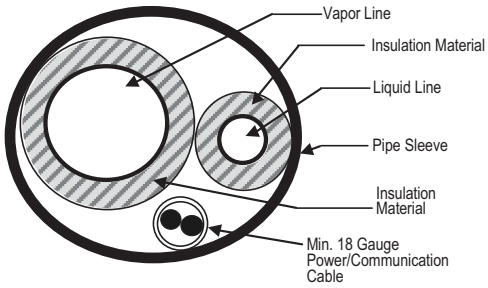


Figure 45: Typical Insulation Butt-Joint at Indoor Unit Casing

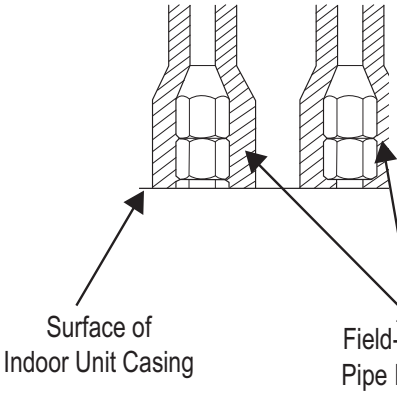
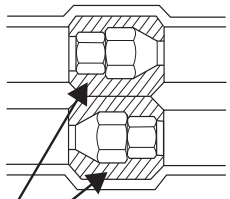


Figure 46: Typical Refrigerant Flare Fitting Insulation Detail



Note:

- *Do not insulate gas and liquid pipes together as this can result in pipe leakage and malfunction due to extreme temperature fluctuations.*
- *Be sure to fully insulate the piping connections.*

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

Note:

Follow locals codes and the designer's instructions when selecting EPDM insulation wall thickness.

Table 28: Minimum Refrigerant Pipe EPDM Insulation Wall Thickness Requirements.[1]

<table>
<tr><th colspan="2" rowspan="2">Classification / Piping O.D.</th><th colspan="2">Air-conditioned location</th><th colspan="2">Non-air conditioned location</th></tr>
<tr><th>1. Typical Conditioned Location</th><th>2. Special Conditioned Location</th><th>3. Typical Unconditioned Location</th><th>4. Special Unconditioned Location</th></tr>
<tr><td rowspan="2">Liquid pipe</td><td>ø1/4 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td></tr>
<tr><td>ø3/8 inches</td></tr>
<tr><td colspan="2">≥ø1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td></tr>
<tr><td rowspan="13">Vapor pipe</td><td>ø3/8 inches</td><td rowspan="7">>1/2 inches</td><td rowspan="8">>3/4 inches</td><td rowspan="8">>3/4 inches</td><td rowspan="13">>1 inch</td></tr>
<tr><td>ø1/2 inches</td></tr>
<tr><td>ø5/8 inches</td></tr>
<tr><td>ø3/4 inches</td></tr>
<tr><td>ø7/8 inches</td></tr>
<tr><td>ø1 inch</td></tr>
<tr><td>ø1-1/8 inches</td><td rowspan="6">>3/4 inches</td></tr>
<tr><td>ø1-1/4 inches</td><td rowspan="5">>1 inch</td><td rowspan="5">>1 inch</td></tr>
<tr><td>ø1-3/8 inches</td></tr>
<tr><td>ø1-1/2 inches</td></tr>
<tr><td>ø1-3/4 inches</td></tr>
</table>

[1]The 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.

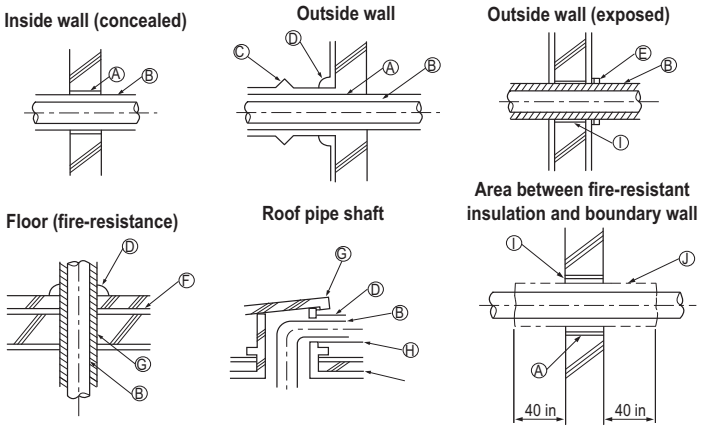
The air conditioner factory insulation has been tested according to "ISO Conditions with Mist," and it satisfies the requirements. If the system has been operating for a long time in a high humidity environment (dew point temperature: more than 73°F), condensate is likely to form. If this happens, install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

LG

Pipe Sleeves at Penetrations

LG requires that all pipe penetrations through walls, floors, and pipes buried underground be routed through a properly insulated sleeve that is sufficiently sized to provide free movement of the pipe and does not compress the insulation. Underground refrigerant pipe shall be routed inside a protective sleeve to prevent insulation deterioration. Also follow federal, state, and local regulations and codes when choosing a sleeve type.

Figure 49: Pipe Sleeve Options.



Ⓐ Sleeve
Ⓑ Insulation
Ⓒ Lagging
Ⓓ Caulk
Ⓔ Band
Ⓕ Water-resistant layer
Ⓖ Sleeve with edge
Ⓗ Lagging
Ⓘ Mortar or other fire-resistant caulk
Ⓙ Fire-resistant insulation

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.

For example:

Diameter of Gas Piping:	1/2"
Diameter of Liquid Piping:	1/4"
Thickness of Gas Piping Insulation:	0.4" x 2
Thickness of Liquid Piping Insulation:	0.4" x 2
Surplus:	0.8"
Sleeve diameter (total):	3.1" minimum

Note:

All floor and wall penetrations should be properly sized and large enough to accommodate pipe diameter plus insulation thickness.

Underground Refrigerant Piping

Refrigerant pipe installed underground should 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 29: 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

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

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

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

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

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

Figure 47: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.

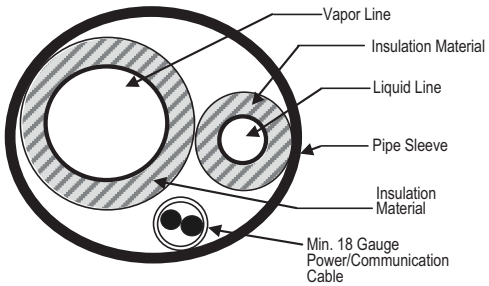


Figure 48: Underground Refrigerant Piping.

Applying Insulation to Y-Branch and Header Fittings

Check the fit of the insulation jacket provided with the LG Y-branch and Header kits after all pipes are brazed to fittings. Mark all pipes at the point where the insulation jacket ends. Remove the jacket. Install field-supplied insulation on the pipe segments first, and then install the LG provided insulation plugs on the ends of all unused Header ports. Apply the clam-shell insulation on jackets to Y-branch and Header fittings last. Peel the adhesive glue protector slip from the insulation jacket and install the clam-shell jacket over the fitting.

Figure 50: Y-branch Insulation.

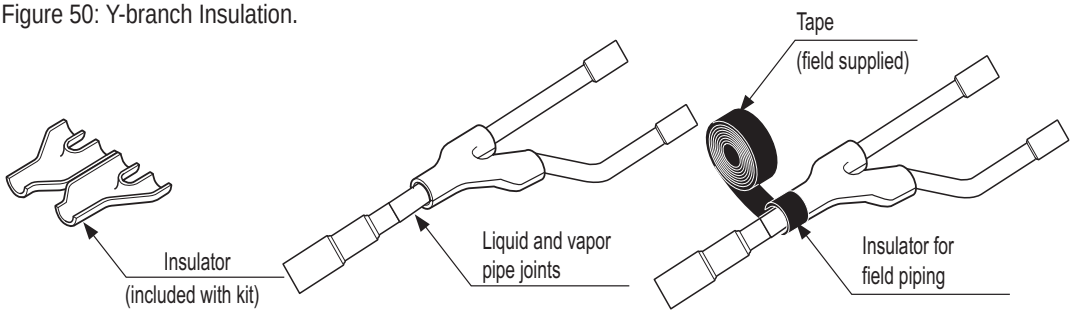


Figure 51: Header Insulation.

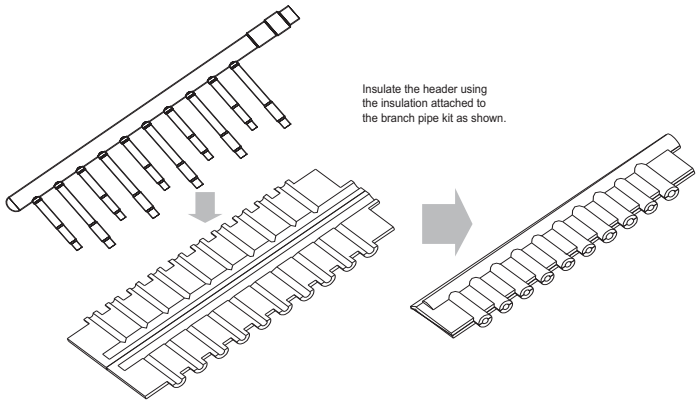


Figure 52: Joints between branch and pipe should be sealed with tape included in each kit.

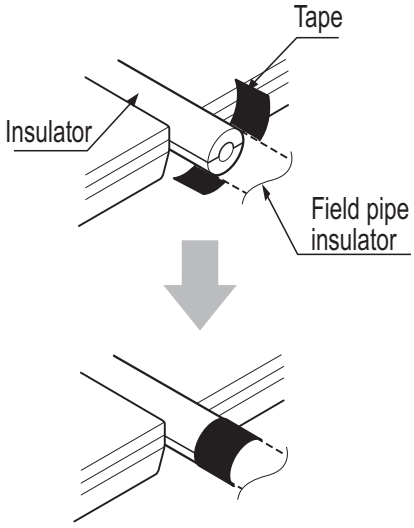
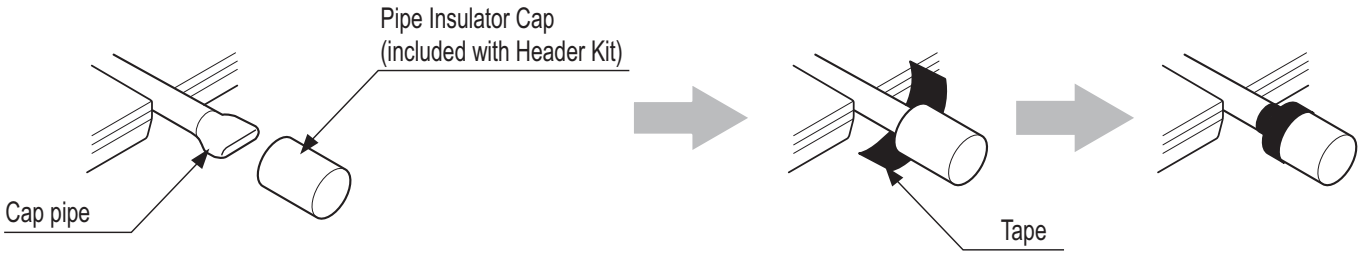


Figure 53: Capped pipes should be insulated using the cap included in each kit, and then taped as shown.



Note:

Additional Insulation for Y-Branches and Headers May be Required in Humid Environments.

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 ethylene propylene diene methylene (EPDM) insulation that is plenum-rated with a heat-resistance factor of more than 248°F.

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⚠ 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.*
- *Be sure 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 cause electric shock and bodily injury.*
- *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 unit malfunction and be a fire hazard.*
- *Properly ground the outdoor 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 outdoor units. Improperly ground wire can cause communication problems from electrical noise, and motor current leakage. Ground wiring must always be installed by a qualified technician.*
- *If the system operates in reversed phase, it may damage the compressors and other components.*
- *If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit.*
- *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.*
- *If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit. If the system operates in reversed phase, it may damage the compressors and other components.*

Separating Power Wires and Communication Cables

- Position the power wiring a minimum of two (2) inches away from the communication cables to avoid operation problems caused by electrical interference. ⃠ Do not run both in the same conduit.
- If it is necessary to run the power wiring and communication cable alongside each other and cannot be avoided, see the table below for minimum recommended distances.

Table 30: Power Wire and Communications Cable Minimum Required Separation Minimum Allowable Distances.

Capacity of Power Supply Wiring (current)		Recommended Minimum Distance[1,2]
100V or more	10A	12 inches
	50A	20 inches
	100A	40 inches
	Exceed 100A	60 inches

[1]The figures above are based on parallel lengths up to 328 feet long. For lengths in excess of 328 feet, the distances will have to be recalculated in direct proportion to the additional line lengths involved.
[2]If the power supply waveform continues to exhibit some distortion, the space between the power wiring and communication cable should be increased.

Note:

- ⃠ *Do not secure the power wiring and communication cables together.*
- ⃠ *Do not run the power wiring and the communication cable in the same conduit.*

Accessing the Power Wiring and Communications Cable Connections

1. Remove all of the screws that hold the side panel to the outdoor unit frame.
2. Detach panel from outdoor unit chassis by pulling the panel forward.
3. Locate the control box on the right side of the outdoor unit frame. Remove the control box cover to access the Main PCB, the Indoor Communications PCB, and the PI-485 PCB. Outdoor unit terminal block is located immediately below the control box.
4. Connect the indoor unit to outdoor unit communication cables to the correct terminals on the outdoor unit terminal block.
5. When connecting the indoor unit to outdoor unit communication cable with a shielded cable, connect the ground wire to the outdoor unit ground terminal only.

Note:

Multi V S Outdoor Unit contains a temperature sensor that should not be exposed to direct sunlight. When the panel is off, cover the temperature sensor to protect it from any direct sunlight.

Figure 54: Removing the Multi V S Outdoor Unit Access Panel.

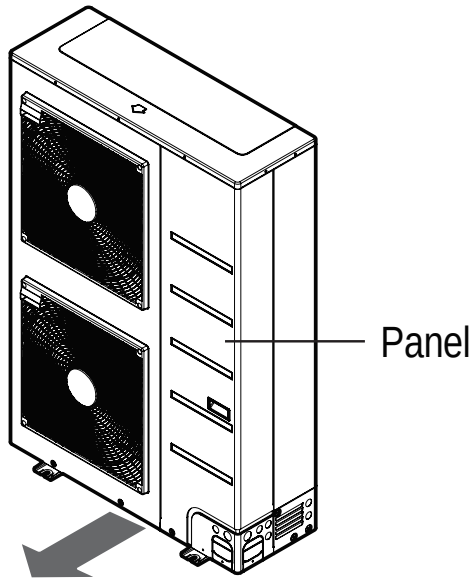


Figure 55: Power Wiring / Communications Cable Paths and Terminations Inside the Multi V S Outdoor Unit.

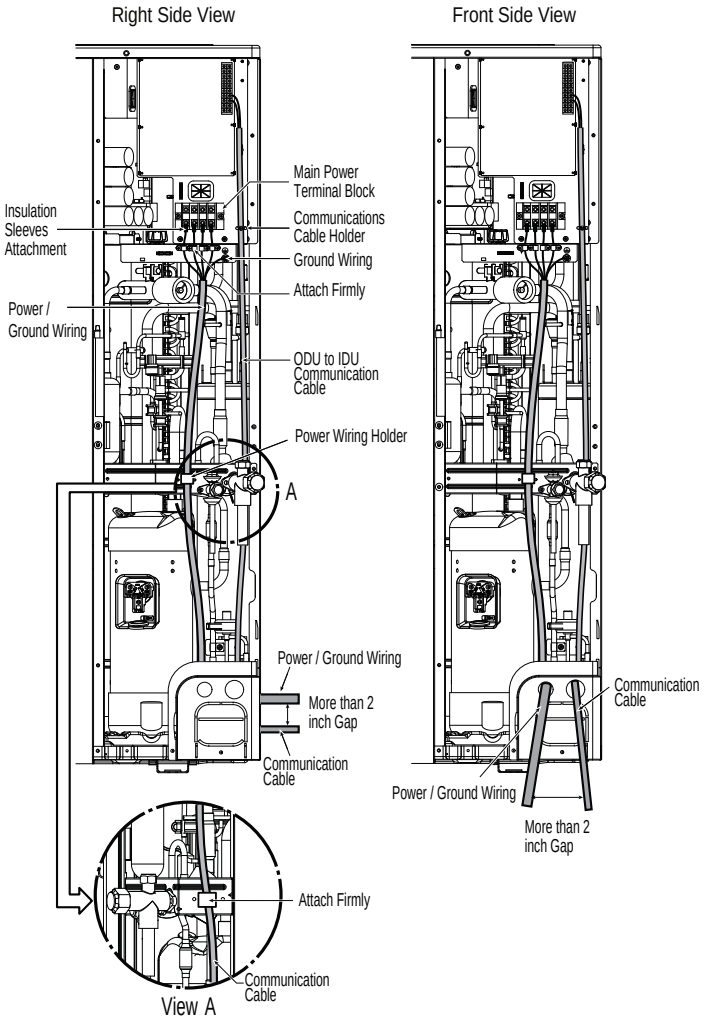
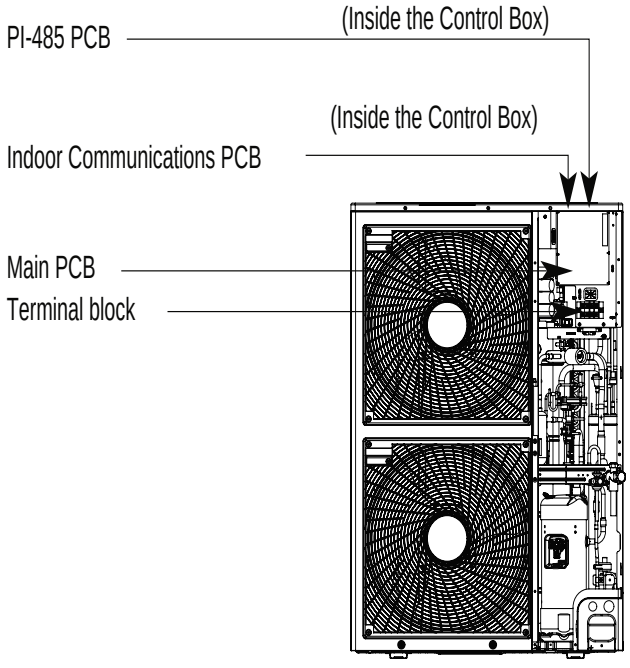


Figure 56: Locations of the Different Outdoor Unit PCBs.



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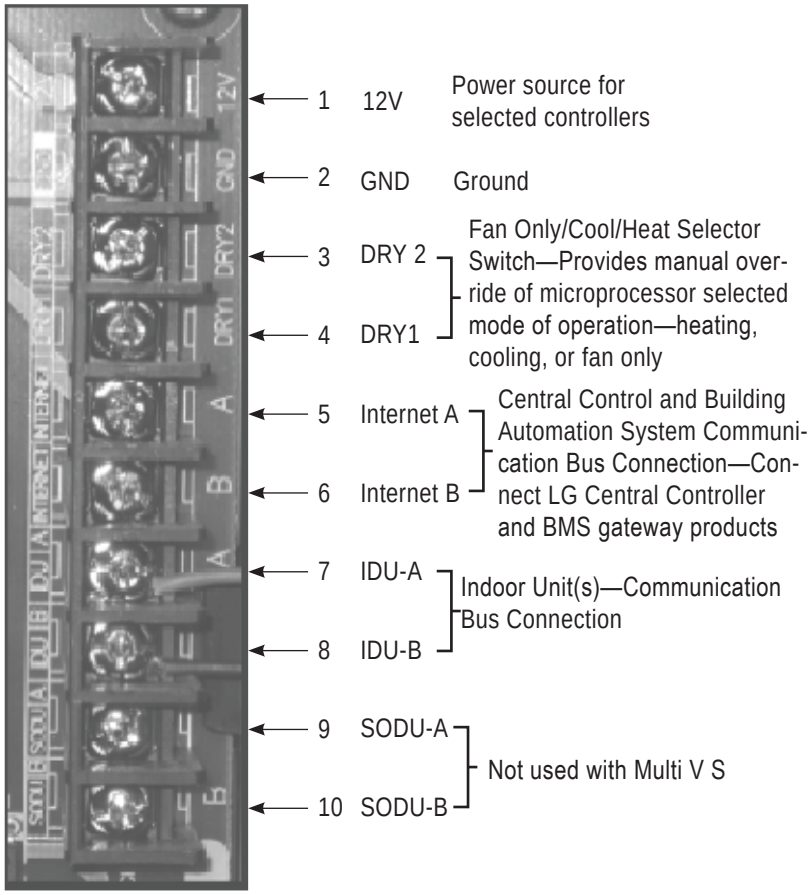
Detail of the Power Wiring and Communications Cable Connections

- For power wiring, use solid or stranded that must comply with all local and national electrical codes.
- Connect the communications cable between indoor units using a daisy chain configuration only. “Star” or “home run” control wiring connections involving soldering or wire caps are not permitted.
- For communications cable, use 18 AWG, two-conductor, stranded, shielded or unshielded. If shielded, must be grounded to the chassis at the outdoor unit only.
- Provide separate conduits for control wiring and power wiring.
- Power and communications cables must not be routed in the same conduit and must be routed in a manner that keeps them a minimum of two (2) inches apart.
- Connect outdoor unit terminal IDU-A to the odd numbered indoor unit terminal. Terminal “A” on the indoor units may be tagged 3(A) or 5(A).
- Connect outdoor unit terminal IDU-B to indoor unit terminal “B”. Terminal “B” on the indoor units may be tagged 3(B) or 5(B).
- Maximum allowed length of indoor unit communication cable is 984 feet.

Figure 57: Communications Wiring Terminals.

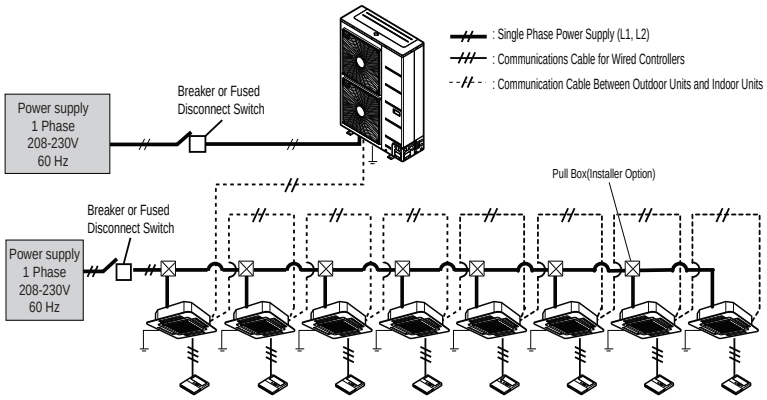


Power Supply / Power Wiring Specifications

Note:

- *Multi V S outdoor unit and the indoor units must obtain power from separate breakers:*
  - *Multi V S systems operate at 1Ø, 208-230V, 60Hz*
  - *Multi V indoor units operate at 1Ø, 208-230V, 60Hz. (Indoor units draw minimal power. Where permitted by National Electrical Code and local codes, it may be prudent to connect multiple indoor units to a properly sized breaker.)*
- *Power supplies, wire types and sizes should be selected based on National Electrical Code and local codes. Maximum allowable voltage fluctuation ±10% or nameplate rated value.*
- *Properly ground the outdoor unit and indoor units per National Electrical Code and local codes.*
- *For power to the outdoor units, use copper wiring that is solid or stranded, and shielded with the wires separately insulated.*
- *Ground wire should 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 for circuit and terminal block diagrams for your model unit.*
- *Always match color codes of each wire and follow wiring diagram.*
- *Outdoor unit wiring can be found on the inside of the outdoor unit control cover.*

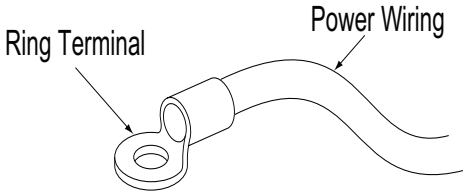
Figure 59: Schematic of Suggested Power Wiring / Communication Cable System.



Power Wiring Connection Guidelines

Best practice dictates using ring or spade terminals to terminate power wiring at the power terminal block

Figure 58: Close up of a Typical Ring Terminal



To Install a Ring Terminal:

1. Trim the strand wiring with wire cutters or pliers, then strip the insulation to expose the strand wiring to about 3/8 inch.
2. Using a ring terminal fastener or pliers, securely clamp a ring terminal to each stripped wire end.

If ring terminals or spade clips are not available, then:

Note:

- *When terminating wires of the same thickness, follow the instructions demonstrated in the illustrations.*
- *Firmly attach the wire; secure in a way to prevent external forces from being imparted on the terminal block.*
- *Use an appropriately sized screwdriver for tightening the terminals.*
- ⃠ *Do not over tighten the connections; over-tightening may damage the terminals.*

⚠WARNING

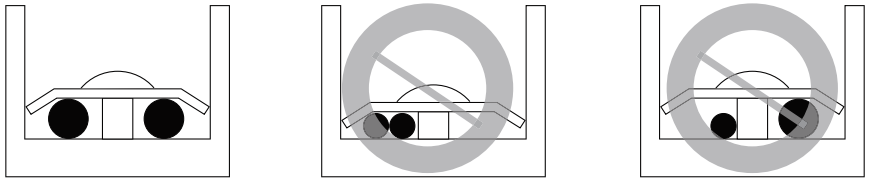
⃠ *Do not terminate different gauge wires to the power terminal block. Slack in the wiring may generate heat and fire, which may result in physical injury or death.*

⚠WARNING

- *If power wires are not properly terminated and firmly attached, there is risk of fire, electric shock, and physical injury or death.*
- ⃠ *Never ground the shield of the communications cable to the indoor unit frame or other grounded entities of the building. Failure to properly provide a National Electrical Code-approved earth ground can result in electric shock, physical injury or death.*

Figure 60: Proper and Improper Power Wiring Connections

● :Copper Wire



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.

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. Provide some slack to facilitate removing the electrical panels while servicing.*

Communication Cable Specifications

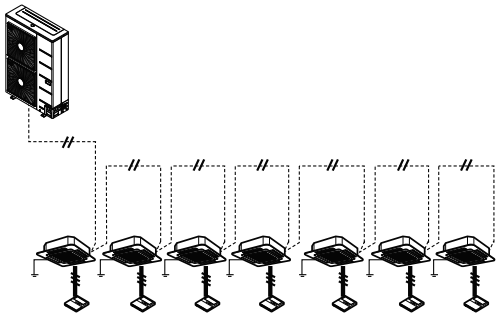
Between Outdoor Unit and Indoor Units

Note:

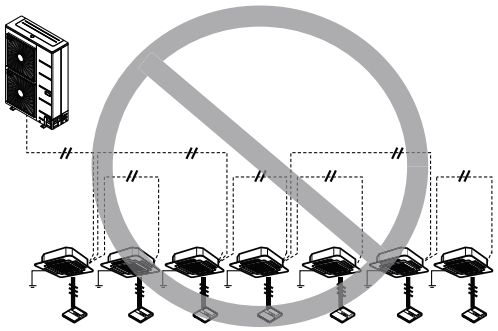
- *Use a two-core, stranded, shielded or unshielded cable minimum 18 gauge between the Multi V S outdoor unit and the indoor units. If shielded, cable must be grounded to the chassis at the outdoor unit only.*
- *Insulation material as required by local code.*
- *Rated for continuous exposure of temperatures up to 140°F.*
- *Maximum allowable cable length: 984 feet.*
- *Ring and spade terminals used to connect communications cables MUST be copper bearing.* ⃠ *Do NOT use terminals that are galvanized or nickel plate over steel.*
- *Firmly attach the cable; provide slack but secure in a way to prevent external forces from being imparted on the terminal block.*
- *Communications cable connecting the Multi V S outdoor unit and indoor unit(s) should be installed and terminated in a daisy chain (BUS) configuration starting at the Multi V S outdoor unit.*
- *Wiring should be completed without splices.*
- *Always verify the communication cable is connected to a communications terminal on the Multi V S unit. Never apply line voltage power to the communication cable connection. If contact is made, the PCBs may be damaged.*
- *Position the Multi V S outdoor unit communications cables away from the power wiring. Refer to minimum spacing requirements provided in Table 30.*
- ⃠ *Never use a common multiple-core communications cable. Each communications bus shall be provided a separate cable (i.e., between Multi V S outdoor unit and indoor units, Multi V S outdoor units and central controller(s). If communications cables of separate systems are wired using a common multiple-core cable, it will result in a poor communications signal and unacceptable system operation.*

Figure 61: Multi V S System Communications Labeling Schematic

Recommended—Two-Core Stranded, Shielded or Unshielded Cable in a Daisy Chain Configuration.



Improperly Terminated Communications Cable—Multiple Core Cable in a Starburst Configuration.



Communication Cables Between the Outdoor Unit(s) and the Central Controllers

- AC EZ Simple Central Controllers: Field-Provided, 18 Gauge, Stranded Four-Core Communication Cable (shielded).
- All Other Central Controllers: Field-Provided 18 Gauge, Stranded Two-Core Communications Cable (Shielded).
- Insulation material as recommended by local code.
- Separate communications cables and power wiring. See Table 30 for appropriate distances.

Connect all central control devices such as AC products, ACPs, BACnet and LonWorks gateways, and energy recovery ventilators all on the same cable. Order does not matter. Polarity does. Keep “A” terminals with “A” terminals, and “B” terminals with “B” terminals. Starting at the outdoor unit, terminate the cable on terminals Internet A and Internet B. Route the cable as needed between each device.

Note:

Connect the shield to ground ONLY at the outdoor unit. Tie shields together at each termination point.

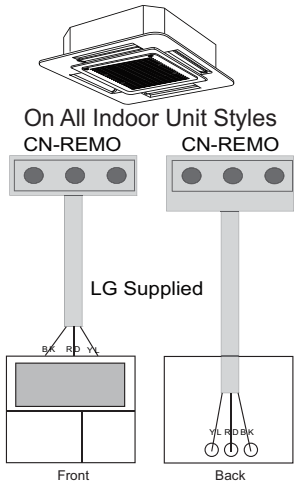
Communication Cables Between the Indoor Units and the Wall-Mounted Zone Controller

- Only use LG provided three-core communications cable between the indoor unit and the wall-mounted zone controller.
- ⃠ NEVER splice, cut, or extend cable length with field provided cable. If the length needs to be extended, the LG Extension Kit (sold separately) must be used. A maximum of four (4) kits (up to 165 feet) can be used.
- Set the indoor unit operating parameters using DIP switches or by setting up the zone controller. Refer to the indoor unit installation manuals for more details.

Note:

Cable connected to Zone Controller is the factory default connection.

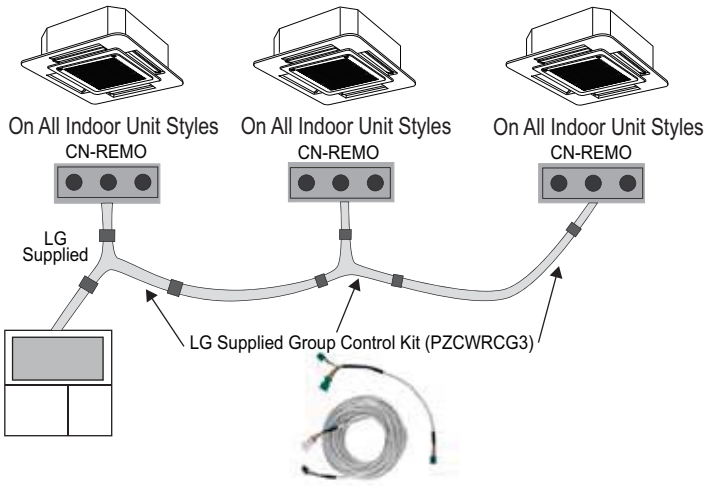
Figure 62: Indoor Unit to Zone Controller Connection.



Communication Cables Between Multiple Indoor Units Operating as a Group (Group Control)

- If any indoor units were specified to operate in unison, use one (or multiple) three-core Group Control Kit (sold separately) containing extension and Y-splitter cables. One (1) group control cable kit for each indoor unit in the group except for the last indoor unit.
- Always use an LG provided group control communications cable (Group Control Kit; sold separately) between the indoor unit and the wall-mounted zone controller.
- ⃠ NEVER splice, cut, or extend cable length with field provided cable.
- Before running cable, decide which indoor unit will be the “Master.” The zone controller will be connected to the “Master.”
- Identify each indoor unit operating as a group as “Master” or “Slave”. Adjust the pertinent DIP switch at each indoor unit. On wall mounted indoor unit models, set the assignment using the handheld remote controller.
- Use a daisy chain configuration and connect all of the group’s indoor units together starting at the “Master” unit.

Figure 63: Indoor Unit Group to Zone Controller Connections.



Note:

Cable connected to Zone Controller is the factory default connection.

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Run Self Diagnostics Check

Using the DIP Switches

- Outdoor unit settings can be checked from the LED.
- DIP switch settings only should be changed when the power to the outdoor unit is OFF.

⚠ WARNING

Power to the outdoor unit must be turned off before checking the DIP switch settings. If not, there is risk of electric shock and physical injury or death.

Using the Initial Display

1. Power all indoor units.
2. Verify the outdoor units to indoor units communications cable is installed and terminated correctly. Inspect terminals on the outdoor unit.
3. Verify that DIP switches were properly adjusted for the jobsite configuration.
4. Power the outdoor unit.
5. After power is provided to the main printed circuit board (PCB) on the outdoor unit for five (5) seconds, observe the LED.
   - Wait. The perimeter segments will flash in sequence for 45 seconds.
   - Verify the microprocessor's outdoor unit configuration agrees with the submittal information approved the design engineer (see below).
   - Confirm that this step has been completed by checking the box provided on the Record following the information as it is provided. The date is provided in sequence, and segment of the sequence will remain lit for two (2) seconds.

Table 32: Display Code Definitions—Outdoor Unit Nominal Capacity.

Display Code	4	6	8	10	12
Nominal Mb/h	2	4	6	8	10

Table 33: Display Code Definitions—Voltage.

Outdoor Unit Code	22
Electrical Requirements	208-230V / 60Hz / 1Ø

Table 34: Segment Display Sequence (Two [2] seconds per segment following a forty-five [45] second wait).

Sequence	**Description**		**Code(s)**
1	Nominal Capacity		4 - 12*
2	Unit Type	Heat Pump	2
3	Unit Voltage	208-230V / 60Hz / 1Ø	22
4	Efficiency Level		1 or 5

**See tables above for code definitions.*

Indoor Unit Auto Addressing

⚠ WARNING

Disconnects should only be operated by a properly licensed electrician at this time. Never look at a disconnect switch when closing. Turn away from the switch when closing. Incorrect wiring could cause the disconnect to explode, physical injury, and / or death.

Note:

⃠ *Do not change any DIP switch settings during the pre-commissioning process. All DIP switches should be left in the OFF position.*

Initiate the Auto Addressing Procedure

Note:

- *If the Auto Address Procedure has never been successfully completed for the system, the compressor(s) will not start when power is applied to the unit.*
- *Auto addressing is only possible on the main PCB of the outdoor unit.*

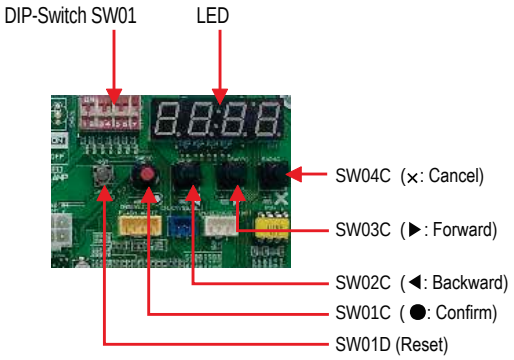
1. Verify all that all indoor units connected to the system have power to the PCB board AND all zone controller system start buttons are OFF.
2. Remove the maintenance access panel and unit control box cover from the outdoor unit. Place panels and screws in a secure area.
3. Verify that the communications cable between the indoor units and the outdoor unit is terminated at the outdoor unit terminals IDU(A) and IDU (B).
4. Verify the shield on the communications cable is grounded at the outdoor unit.
5. Check if all DIP switches are set to OFF.
6. Cycle power on the outdoor unit and wait for three (3) minutes. Leave disconnect in the "ON" position.
7. Check the outdoor unit(s) current configuration code(s). Observe the unit setup codes using the LED display found on the outdoor units PCB. Each code will display for two (2) seconds.
8. Know how many indoor units are connected to the system.

Note:

While this routine runs, the unit runs a self-diagnostics check. At completion, the LED should be clear and nothing displayed. Diagnostic process should take from two (2) to seven (7) minutes.

9. Press and hold the red SW01C button for about five (5) seconds. Release when “88” appears on the LED. After two (2) to seven (7) minutes, the display will flash a number for about ten (10) to thirty (30) seconds indicating how many indoor units the system successfully communicated with.
10. This number should match the known installed number of indoor units if the auto addressing procedure was successful. Using LGMV, read the address of each indoor unit.
11. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.

Figure 64: Auto Address Button Location.



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Initiate the Auto Addressing Procedure, continued.

12. Upon successful completion of the auto address procedure, record the system address assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.

13. After recording the system addresses assigned to each device, open the outdoor unit disconnect. Remove the outdoor unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends.

14. Close the disconnect to reapply power to the outdoor unit and energize the compressor crankcase heater. Once again, verify that the outdoor unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the outdoor unit.

15. Replace the control panel door.

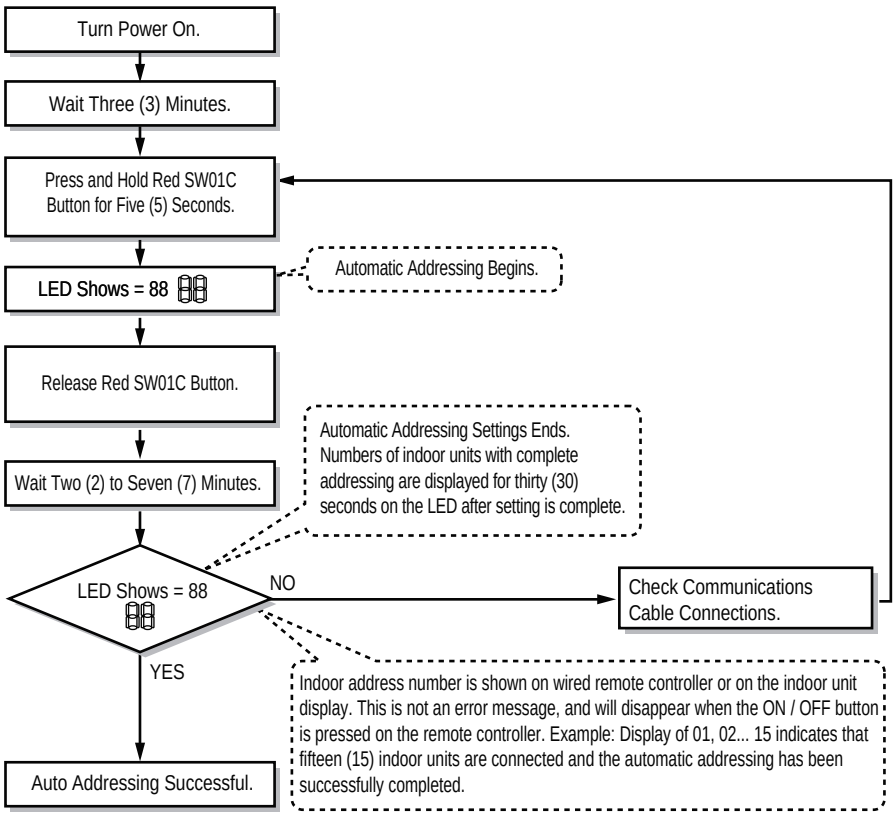
⚠ WARNING

Upon successful completion of the auto addressing function, an unintentional compressor start can occur unless the communications cable to the indoor units is removed from the outdoor unit terminals IDU(A) and IDU(B). ⃠ Do NOT open the service valves or attempt to start outdoor unit compressors or until directed by the Commissioning Agent. There is a risk of explosion, suffocation, physical injury, and / or death.

Note:

- ⃠ *Do NOT open the service valves or attempt to start outdoor unit compressors or until directed by the Commissioning Agent. Major damage to the unit piping and compressors will occur.*
- *Always perform auto addressing again when an indoor unit PCB is replaced.*
- *If power is not applied to the indoor units before auto addressing is performed, an operation error will occur.*
- *Auto addressing has to be performed after three (3) minutes to improve communication.*

Figure 65: Indoor Unit Auto Addressing Procedure Flowchart.



Troubleshooting a Failed Indoor Unit Auto Addressing Procedure

If the quantity of indoor units the auto addressing procedure found is incorrect, or the “88” never disappears from the display for the seven (7) minutes, the auto address routine has failed and a communications problem exists. If the Auto Address Procedure failed:

1. Verify ALL indoor unit ON / OFF buttons are in the OFF position (i.e., ON / OFF button NOT illuminated).

2. Check the terminations, polarity, and continuity of each conductor on the communications cable between the outdoor unit and the indoor units. Verify the indoor unit to outdoor unit communications cable is wired correctly.

3. Verify the shield of the communications cable is grounded at the outdoor unit only. All segment shields should be spliced together at each indoor unit and NOT grounded.

4. After repairing the communications cable, go to Step 9 of the Initiate the Auto Addressing Procedure and repeat the process until successful: Press and hold the red SW01C button for about five (5) seconds. Release when “88” appears on the LED. After two (2) to seven (7) minutes, the display will flash a number for ten (10) to thirty (30) seconds indicating how many indoor units the system successfully communicated with.

5. This number should match the known installed number of indoor units if the auto addressing procedure was successful.

6. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.

7. Record the system address the outdoor unit assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.

8. After recording the system addresses assigned to each device, open the outdoor unit disconnect. Remove the outdoor unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends to prevent an accidental compressor start from occurring before the Commissioning Agent arrives.

9. Close the disconnect to reapply power to the outdoor unit and energize the compressor crankcase heater. Once again, verify the outdoor unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the outdoor unit.

10. Replace the control panel cover.

Group Addressing Procedure

1. Verify that the power is OFF to both the indoor units and the Multi V S outdoor unit. If power is still on, shut it off.

2. Communication cables should be connected to B and A terminals on the central controller, and to central controller terminals B and A on the Multi V S outdoor unit, matching polarities (A → A, B → B).

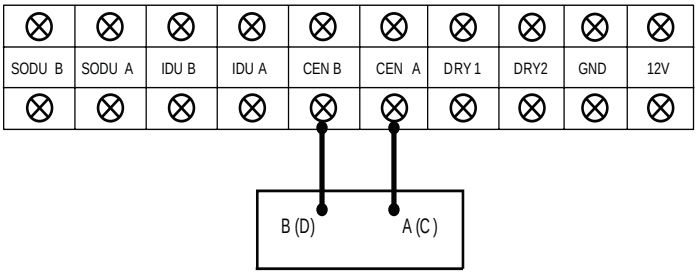
3. Apply power to the entire system.

4. Set the group numbers and indoor unit numbers using a wireless handheld or wired controller (see below and next few pages).

5. To designate several indoor units into one group, set the group ID from 0 to F (see next page).

Table 35: Controller Connections on the Multi V S Outdoor Unit PCB for Group Addressing.

Multi V S Outdoor Unit



Terminating Group Controlled Indoor Units

If any of the indoor units were specified to operate in unison, create a group control communications circuit between the indoor units using a group control cable kit consisting of three (3) cables:

- One pigtail cable.
- One Y-cable.
- One extension cable segment.

1. Before proceeding with group control cable terminations, verify power is off at all indoor units effected.
2. Identify which indoor unit will be the “Master” unit of the group. If not already recorded, record the "Master" and the "Slave" identity assignment to each indoor unit in the group on the Pre-commissioning Device Configuration Worksheet.
3. Termination Procedure:
   - Starting with the Master indoor unit, plug in the male end of the pigtail cable into the CN-REMO socket. At the last Slave indoor unit in the group, a pigtail cable is not required. Plug the male end of the extension cable coming from the previous indoor unit into the CN-REMO socket.
   - Plug the Y-cable into the pigtail at each indoor unit except for the last Slave indoor unit in the group where no Y-cable cable will be needed.
   - Connect two extension cable segments to each “Y” cable except for the “Y” cable connected to the Master indoor unit. At the Master indoor unit, connect one extension cable and the communications cable from the zone controller to the Y-cable.

Plan the Central Control Addresses Assignments

Check with the building’s Chief Engineer and gather any preferences the project may have. If there are no preferences:

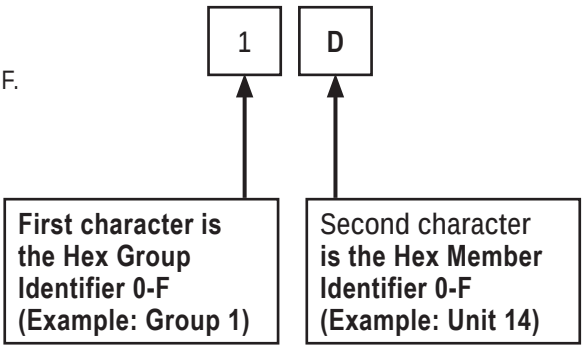
- Hex assignments do not have to be assigned in any particular order, or an order defined by the routing of the communications cable between the indoor units. In most cases, Hex addresses can be skipped.
- All members of a Hex Group are not required to be on the same Multi V S system.
- Addresses can be assigned at random, not in any particular order, and can be skipped.

Indoor Unit Central Control Address Assignments

A central control address is made up of two hexadecimal characters.

- The first character in the central control address is the Hex Group Identifier. Possible Hex Group Identifiers (in order of lowest to highest) are 0-9 followed by A-F.
- The second character in the address is the Hex Member Identifier in a Hex Group. Hex Member Identifiers (in order from lowest to highest) are 0-9 followed by A-F.

Figure 66: Central Control Address Nomenclature.



Hex Address Assignment Limitations

- There is a limit of 16 Members per Hex Group
- There is a limit of 16 Hex Groups per VRF system.
- There is a limit of 256 possible Member Identifiers per Central Control (See Central Controller Communications Limitations).

Table 36: Central Controller Identifier Table.

Hex Group Identifier No.	Hex Member Identifier No.	Identifier Range
0	0	00~0F
1	1	10~1F
2	2	20~2F
3	3	30~3F
4	4	40~4F
5	5	50~5F
6	6	60~6F
7	7	70~7F
8	8	80~8F
9	9	90~9F
A	A	A0~AF
B	B	B0~BF
C	C	C0~CF
D	D	D0~DF
E	E	E0~EF
F	F	F0~FF

Central Controller Communications Limitations

Each type of Central Controller device is designed to communicate with a limited quantity of indoor units. The quantity of indoor units that can be connected to a single central control communications cable, therefore, will be defined by the central control device on that cable with the smallest Maximum Indoor Unit Quantity as shown.

Table 37: Central Controller Indoor Unit Connection Limitations.

Central Control Device	Maximum Indoor Unit Quantity
AC Smart IV	128
AC Smart BACnet® Gateway*	128
ACP IV BACnet™ Gateway*	256
LonWorks™ Gateway*	64
Advanced Control Platform IV	256

* BACnet™ is a trademark of ASHRAE; LonWorks™ is a trademark of Echlelon Corporation.

Group Number

If the building operator wants to know which indoor units are on each Multi V S unit, and multiple systems serve a building:

- Assign a Group Number to each system. If there are more than 16 indoor units on a system, multiple Group Numbers may be necessary.

If the building owner wants to know which indoor units are on each floor:

- Assign a different group number for each floor. If there are more than 16 indoor units on a floor, multiple Group Numbers may be necessary.

Member Number

Can be assigned at will or for example, can follow the room layout on each floor.

For each LG Central Controller product provided on the project, devise a central control address schedule and assign a central control address to each indoor unit(s) Hydro Kit(s), and ERV(s) units. Record this central control address for each component in the column provided on the Pre-commissioning Device Configuration Worksheet.

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Upload Central Control Address to the Indoor Units

For all ducted, vertical and floor standing indoor units, the central control address must be assigned using a wired zone controller. Wall-mount, ceiling cassette, ceiling suspended, and the wall / ceiling convertible indoor units, the central control address can be assigned using a wireless handheld controller or a wired zone controller.

Power Up All Indoor Unit PCBs

Turn the disconnect for each indoor unit to the "ON" position. ⃠ **DO NOT** turn the unit ON (on / off button remains off).

Note:

During the following procedure, ⃠ NEVER PUSH the ON/OFF (Enable operation) Button on the zone controller.

For Indoor Units That Are NOT Being Controlled as a Group

1. Verify the zone controller cable is plugged into CN-REMO socket on the indoor unit PCB.
2. Using the controller, go to the setup function 02 (Icons are different for each controller. Refer to the controller user's manual for more information.)
3. Type in the Hex Central Control address that has been designated to the unit.
4. Repeat Steps 1 through 3 for each indoor unit in the building.

For Indoor Units That Are Being Controlled as a Group

1. Before attempting to assign a central control address to an indoor unit controlled as a group, identify which unit in the group will be identified as the Master indoor unit and which indoor units are going to be identified as Slave units.
2. Go to the Master indoor unit, and access the PCB.
3. Verify a group control pigtail cable is plugged into the CN-REMO socket on the indoor unit PCB. If it is not, do so now by plugging the communications cable pigtail into the CN-REMO socket.
4. If the group control extension cable between the indoor units is plugged into the Y-cable, unplug the extension cable from the Y-cable.
5. If not already present, plug the zone controller communications cable into the pigtail cable.
6. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for more information.) Type in the Central Control address designated for the Master indoor unit.
7. Disable power to the Master indoor unit. Do not restore Power to the Master indoor unit at this time. It shall be restored in step 18.
8. If the zone controller and associated communications cable has already been permanently mounted in place, plug the Y-cable back into the pigtail and obtain a loose zone controller with a communications cable to continue programming the Slave indoor units.
9. Go to the first Slave indoor unit and disconnect the Y-cable from the pigtail.
10. Plug the zone controller communications cable into the socket on the pigtail cable. ⃠ Do not push the ON / OFF button or enable indoor unit operation.
11. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for more information.) Type in the Hex address assigned to the unit.
12. Change DIP switch No. 3 on the indoor unit PCB to the "ON" position.
13. Disable power to the indoor unit using the disconnect switch. Wait one (1) minute.
14. While power is off, unplug the zone controller cable from the pigtail socket.
15. Plug the group control Y-cable back into the pigtail.
16. Restore power to that Slave indoor unit, and go to the next Slave indoor unit.
17. Repeat Steps 9 to 16 for each Slave indoor unit except the last one in the group. At the last Slave indoor unit, the process is the same except unplug the group control cable from socket CN-REMO on the indoor unit PCB board and plug the zone controller cable into the same socket.
18. After all Slave indoor unit have addresses assigned, go back to the Master indoor unit and restore power.

Setting the Functions

After No. 5 on DIP Switch SW01 is set to ON, select the functions (mode, option, value, etc.) by using the ▶ and ◀ buttons. Choose the particular function by pushing the ● button.

Figure 67: Outdoor Unit DIP Switch SW01 Function Setting.

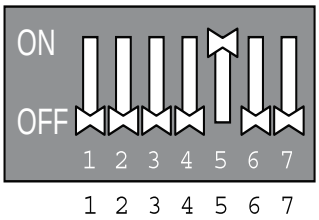

Figure 68: DIP Switch SW01 PCB Location.

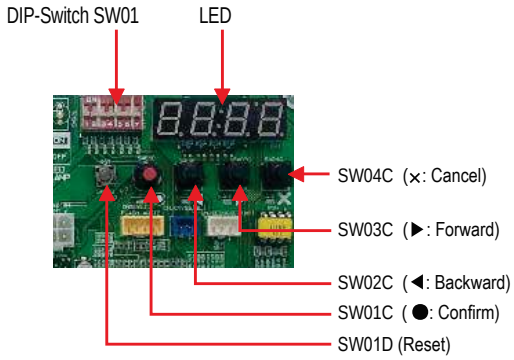

Table 38: Setting the Functions.

Mode		Function		Option			Value		Action		Notes
Content	Display 1	Content	Display 2	Content		Display 3	Content	Display 4	Implement	Display 5	
Installation	Func	Cool / Heat Selector	Fn1	oFF	op1 ~ op2	Selected the Option	-	-	Change the Set Value	Blank	Saved in EPROM
		Static Pressure Compensation	Fn2	oFF	op1 ~ op3	Selected the Option	-	-	Change the Set Value	Blank	Saved in EPROM
		Night Low Sound	Fn3	oFF	op1 ~ op12	Selected the Option	-	-	Change the Set Value	Blank	Saved in EPROM
		Outdoor Unit Address	Fn5	-		-	0 ~ 255	Set the Value	Change the Set Value	Blank	Saved in EPROM
		Snow Removal and Rapid Defrost	Fn6	oFF	op1 ~ op3	Selected the Option	-	-	Change the Set Value	Blank	Saved in EPROM
		Adjusting Target Pressure	Fn8	oFF	op1 ~ op3	Selected the Option	-	-	Change the Set Value	Blank	Saved in EPROM

Note:

- *Function sets are saved in the EPROM even if system power is reset.*
- *No. 3 on DIP Switch SW01 can be OFF except when installing a system that has all Generation 4 series indoor units (ARNU***4).*

Setting the Cool / Heat Selection Function

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ▶ and ◀ buttons. Choose “Func” by pushing the ● button.

↓

Select the function using the ▶ and ◀ buttons. Choose “Fn1” by pushing the ● button.

↓

Select the option using the ▶ and ◀ buttons. Choose “oFF,” “op1,” and “op2” by pushing the ● button.

↓

Cool / Heat Selection mode is set.

Figure 69: Cool / Heat Selector.

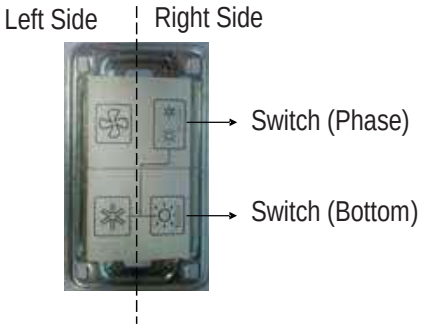

Table 39: Definition of Cool / Heat Selection Function Settings.

Switches		Function		
Switch (Phase)	Switch (Bottom)	oFF	op1 (Mode)	op2 (Mode)
Right	Left	Not Operating	Cooling	Cooling
Right	Right	Not Operating	Heating	Heating
Left	-	Not Operating	Fan Mode	Off

Note:

- *A trained technician must set the functions.*
- *If a function is not used, set it to off.*
- *Install the Cool / Heat Selector first if the other functions are to be used.*

Setting the Static Pressure Compensation Function

The Static Pressure Compensation function secures the air flow rate of the outdoor unit for installations where static pressure has been applied (Example: When a duct has been added to the outdoor unit fan discharge.)

Table 40: Maximum Fan RPM For Each Step.

Model	ARUN053GSS4, ARUN048GSS4, ARUN038GSS4	
Maximum RPM	Standard	800
	op1	850
	op2	850

Note:

- *A trained technician must set the functions.*
- *Cooling capacity may be reduced if the outdoor unit RPM is lowered.*

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ► and ◄ buttons.
Choose “Func” by pushing the ● button.

↓

Select the function using the ► and ◄ buttons.
Choose “Fn2” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “op1~op2” by pushing the ● button.

↓

Start the Static Pressure Compensation mode, and save the selected option in the EPROM.

Night Low Sound Function

In cooling mode at night when the cooling load is reduced, Night Low Sound function is used to adjust outdoor unit fan operation to a lower RPM (reduces sound).

Table 41: Night Low Sound Function Time Settings.

Step	Judgment Time **(Hour)**	Operation Time **(Hour)**
op1	8	9
op2	6.5	10.5
op3	5	12
op4	8	9
op5	6.5	10.5
op6	5	12
op7	8	9
op8	6.5	10.5
op9	5	12
op10	Continuous Operation	
op11	Continuous Operation	
op12	Continuous Operation	
op13	6.5	10.5
op14	6.5	10.5
op15	6.5	10.5

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ► and ◄ buttons.
Choose “Func” by pushing the ● button.

↓

Select the function using the ► and ◄ buttons.
Choose “Fn3” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “op1~op15” by pushing the ● button.

↓

Start the Night Low Sound function, and save the selected option in the EPROM.

Note:

- *A trained technician must set the functions.*
- *Cooling capacity may be reduced if the outdoor unit RPM is lowered.*

Setting the Outdoor Unit Address

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ► and ◄ buttons.
Choose “Func” by pushing the ● button.

↓

Select the function using the ► and ◄ buttons.
Choose “Fn5” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “0 ~ 255” by pushing the ● button.

↓

Outdoor Unit address is set.

Note:

- *A trained technician must set the functions.*
- *A central controller must first be installed before the outdoor unit address can be set.*

Snow Removal and Rapid Defrost Functions

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ► and ◄ buttons.
Choose “Func” by pushing the ● button.

↓

Select the function using the ► and ◄ buttons.
Choose “Fn6” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “oFF” ,“op1” ~ “op3” by pushing the ● button.

↓

Mode is set.

Table 42: Snow Removal and Rapid Defrost Functions Settings.

Setting	Mode
oFF	Not Set
op1	Snow Removal Function
op2	Rapid Defrost Function
op3	Snow Removal Function and Rapid Defrost Function

Note:

- *A trained technician must set the functions.*
- *If a function is not used, set it to OFF.*

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Adjusting Target Pressure Function

Set Outdoor Unit PCB DIP Switch No. 5 to ON.

↓

Select the mode using the ► and ◄ buttons.
Choose “Func” by pushing the ● button.

↓

Select the function using the ► and ◄ buttons.
Choose “Fn8” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “Heat” or “Cool” by pushing the ● button.

↓

Select the option using the ► and ◄ buttons.
Choose “op1” ~ “op4” by pushing the ● button.

↓

Target pressure is set.

Table 43: Adjusting Target Pressure Function Settings.

Mode	Purpose		Condensing Temperature **Variation**	Evaporating Temperature **Variation**
	Heat	Cool		
op1	Increase Capacity	Increase Capacity	+3.6°F (+2°C)	-5.4°F (-3°C)
op2	Decrease Power Consumption	Increase Capacity	-3.6°F (-2°C)	-2.7°F (-1.5°C)
op3	Decrease Power Consumption	Decrease Power Consumption	-7.2°F (-4°C)	+4.5°F (+2.5°C)
op4	Decrease Power Consumption	Decrease Power Consumption	-10.8°F (-6°C)	-8.1°F (-4.5°C)

Note:

- *A trained technician must set the functions.*
- *If a function is not used, set it to OFF.*
- *Change power consumption or capacity.*

DIP SWITCH SETTINGS FOR GEN4 EQUIPMENT

Generation 4 Equipment

The latest versions of LG's indoor units and outdoor (air / water source) units are designated Generation 4 (Gen 4). For Gen 4 units to operate with Gen 4 features, the air conditioning system must meet the following requirements:

- All indoor units, heat recovery units, and air / water source units must be Gen 4.
- All air / water source units must have Gen 4 software installed.
- Air / water source units DIP switch 3 must be set to ON (factory default setting is OFF).
- All controllers must support Gen 4 features.

The figure at right shows the ODU DIP switch. The "System Component Combinations and Operation Status" table lists how combining different components will affect system operation. The "Serial Numbers or Air / Water Source Units with Gen 4 Software" table lists the serial numbers of air and water source units that have Gen 4 software. All air and water source units, indoor units, heat recovery units, and controllers in a system must be Gen 4 compatible or the system will not operate with Gen 4 features.

Figure 70: Location and Setting of ODU DIP Switch 3.

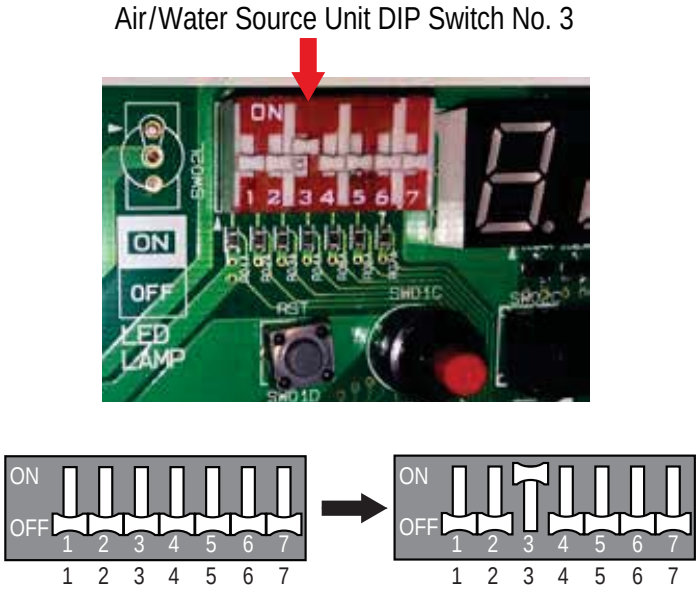


Table 44: System Component Combinations and Operation Status.

Air / Water Source Units*	**Indoor Unit(s)****	Heat Recovery **Unit(s)**	**Outdoor Unit DIP** Switch No. 3	Operation Status
Gen 4	Gen 4 ONLY	Model 2A ONLY	Must be ON	System will operate WITH Gen. 4 features.
Gen 4	Gen 4 ONLY	Model 2A ONLY	OFF	System will operate but WITHOUT Gen. 4 features.
Gen 4	Gen 4 ONLY	Any combination of Models 1A, 2A	Must be OFF (factory default)	Does NOT include Gen. 4 features. System will not operate if DIP Switch No. 3 is ON, and an error code will be generated.
Gen 4	Any combination of Gen 2 and Gen 4	Model 2A ONLY	Must be OFF (factory default)	
Gen 4	Any combination of Gen 2 and Gen 4	Any combination of Models 1A, 2A	Must be OFF (factory default)	
Gen 2	Any combination of Gen 2 and Gen 4	Any combination of Models 0A****, 1A, 2A	N/A***	Does not include Gen. 4 features.

*Gen 4 Air / Water Source Units = Multi V IV or Multi V Water IV with Gen 4 software (see table below for Gen 4 serial numbers) or Multi V S. Gen 2 Air / Water Source Units = Multi V II, Multi V III, Multi V IV without Gen. 4 software, Multi V Water II, Multi V Water IV without Gen. 4 software, Multi V Mini, Multi V Water Mini, or Multi V Space II.

**Gen 4 Indoor Units model numbers end in "4"; Gen 2 Indoor Units model numbers end in "2" or an "A", including Hydro Kit.

***DIP Switch No. 3 on Gen 2 air/water source units is not related to Gen 4 features as it is with Gen 4 air/water source units.

****0A Model Heat Recovery units are not for use with Multi V IV, Multi V Water IV, or Multi V III heat recovery systems.

Table 45: Serial Numbers of Air / Water Source Units with Gen 4 Software.

Air / Water Source Unit Model Type	**Multi V IV Air Source** Heat Pump	**Multi V Air Source** Heat Recovery	**Multi V IV Water Source** Heat Pump	**Multi V IV Water Source** Heat Recovery
Serial Number of Air / Water Source Units with Gen 4 Software	502********* and Higher	503********* and Higher	504********* and Higher	

LG Monitoring View (LGMV) Diagnostic Software

LGMV software (PRCTSL1 and PRCTFE1) allows the service technician or commissioning agent to connect a computer USB port to the Multi V S system's main printed circuit board (PCB) using an accessory cable without the need for a separate interface device. The monitoring screen for LGMV allows the user to view the following real time data on one screen (Figure 71):

- Actual inverter compressor speed
- Target inverter compressor speed
- Actual outdoor fan speed
- Target outdoor unit fan speed
- Actual superheat
- Target superheat
- Actual subcooler circuit superheat
- Target subcooler circuit superheat
- Main EEV position
- Subcooling EEV position
- Inverter compressor current transducer value
- Outdoor air temperature
- Actual high pressure/saturation temperature
- Actual low pressure/saturation temperature
- Suction temperature
- Inverter compressor discharge temperature
- Front outdoor coil pipe temperature
- Back outdoor coil pipe temperature
- Liquid line pipe temperature
- Subcooler inlet temperature
- Subcooler outlet temperature
- Average indoor unit (IDU) pipe temperature
- Inverter compressor operation indicator light
- Liquid injection valves' operation indicator lights
- Hot gas bypass valve operation indicator light
- Four-way reversing valve operation indicator light
- Pressure graph showing actual low pressure and high pressure levels
- Error code display
- Operating mode indicator
- Target high pressure
- Target low pressure
- PCB (printed circuit board) version
- Software version
- Installer name
- Model number of IDUs
- Site name
- Total number of connected IDUs

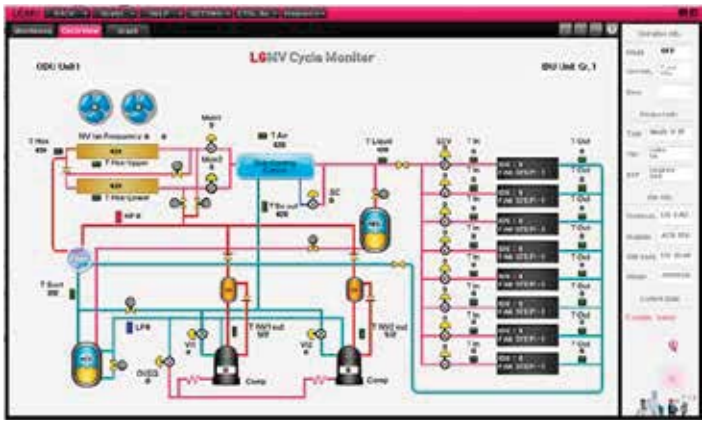
Figure 71: MV Real-time Data Screen

- Communication indicators
- IDU capacity
- IDU operating mode
- IDU fan speed
- IDU EEV position
- IDU room temperature
- IDU inlet pipe temperature
- IDU outlet pipe temperature
- IDU error code

Additional screens can be accessed by tabs on the main screen. Additional screens include the following:

1. Cycleview (Figure 72): Graphic of internal components including:
   - Compressors showing actual speeds
   - EEVs
   - IDUs
   - Temperature and pressure sensors
   - Four-way reversing valve
2. Graph: Full screen graph of actual high and low pressures and high and low pressure limits. A sliding bar enables user to go back in time and view data.
3. Control FTN: Enables user to turn on IDUs in 1.8 °F increments.
4. Useful Tab
   - Unit Conversion: Converts metric values to imperial values.

Figure 72: MV Cycleview



Note:
Images on these pages are examples of LGMV screenshots. Actual images may differ depending on the version of the software and the unit installed.

LG Monitoring View (LGMV) Diagnostic Software and Cable - Continued

1. Data (Figure 72)
   - Data Saving Start: Recording of real time data to a separate file created to be stored on the user's computer.
   - Data Loading Start: Recorded data from a saved ".CSV" file can be loaded to create an LGMV session.

2. Monitoring
   - Electrical: The lower half of main screen is changed to show Inverter Compressor Amps, Volts, Power Hz, Inverter control board fan Hz.

Figure 73: MV Control Indoor Units Screen

Error Codes

LGMV software helps the service technician or commissioning agent to troubleshoot system operation issues by displaying malfunction codes (Figure 73). These error codes can be seen on the main screen of the LGMV software program. For an overview of Multi V S system error codes, see Error Codes section. For detailed information on how to troubleshoot individual error codes, see the Multi V S Service Manual.

Figure 74: Error Code Screen

The software is available in a high version with all of the features listed above. The low version has all features as the high version without Target High Pressure and Target Low Pressure values shown on main screen.

In lieu of connecting to the outdoor unit, user has the option to connect to IDU with the use of a USB to RS-485 connector kit. When connected through IDU, user will not be able to record data.

This software can be used to both commission new systems and troubleshoot existing systems. LGMV data can be recorded to a ".CSV" file and emailed to an LG representative to assist with diagnostic evaluations.

Recommended Minimum PC Configuration:

- CPU: Pentium® IV 1.6 GHz
- Main Memory: 1G
- Operating System: Windows® XP/Vista/7 32 bit (recommended), 64 bit
- Hard Disk: 600 MB when operating
- MS Office 2003, 2007 (recommended) for select reporting functions

Note:

Images on these pages are examples of LGMV screenshots. Actual images may differ depending on the version of the software and the units installed.

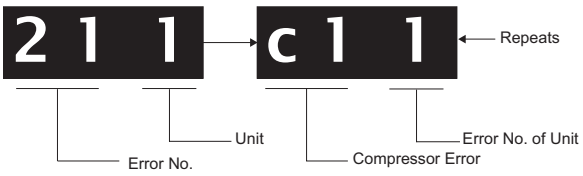
ERROR CODE TABLES

⚠WARNING *Please refer to the Safety Precautions on pages 4-7 for more detail to prevent injury or death regarding the operation and service troubleshooting of the Multi V S product.*

Error Codes

- Indicate different types of unit failures, assist in self-diagnosis and to track the frequency of occurrence.
- Error codes are shown on the LED of indoor units, wired remote controller, the outdoor unit control board, and on the main screen of the LG Monitoring View (LGMV) Diagnostic Software.
- 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.

Example



Error Display

The first, second, and third number on the LED indicates error number; the fourth number on LED indicates outdoor unit number.

Examples: 211 = Error No. 21 on master unit, 213 = Error No. 21 on slave2 unit, 21051 = Error No. 105 on master unit.

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 46: Indoor Unit Error Codes.

	Error Code			Description	Details
Indoor Unit	0	1	-	Indoor unit return air or optional remote wall temperature sensor communications error.	Indoor unit air temperature sensor has disconnected or short circuited. (Check the wiring, connection at the CN Room socket on the indoor unit PCB, then check the thermistor.)
	0	2	-	Indoor unit inlet pipe temperature sensor communication error.	Indoor unit inlet pipe temperature sensor has disconnected or short circuited. (Check the connection at the CN-PIPE/IN socket on the indoor unit PCB, then check the thermistor.)
	0	3	-	Communication error between zone controller and indoor unit.	Indoor unit PCB has not received communications signal from zone controller.
	0	4	-	Indoor unit drain pump error.	Drain pump and/or flow switch is/are malfunctioning. Also check drain line for obstructions.
	0	5	-	Communication error between outdoor unit and indoor unit.	• Indoor unit has not received communications signal from outdoor unit. • Check indoor unit to outdoor unit communication cable connections for issues.
	0	6	-	Indoor unit outlet pipe temperature sensor error.	Indoor unit outlet pipe temperature sensor has disconnected or short circuited. (Check the connection at the CN-PIPE/OUT socket on the indoor unit PCB, then check the thermistor.)
	0	9	-	Indoor unit EPROM error.	• Communication error between the indoor unit PCB board and its option card. (The option card is about 1' x 1' and is plugged into the indoor unit PCB board. Check connection between the two.) • Communication error between EPROM chips on indoor unit main PCB. • Indoor unit EPROM data is not available.
	1	0	-	Indoor unit BLDC fan motor communications error.	• Fan motor has been removed or is defective. Use the OHM and voltage check charts in the product service manual. • The system has detected the fan motor is not spinning. • On new installs, verify installation manual and paperwork were removed from fan discharge shroud before unit was installed. • Check the wiring plug and connection at sockets CN-MOTOR1 and CN-MOTOR2 (if used).
Outdoor Unit	2	1	1	Master outdoor unit inverter compressor PCB error.	• Outdoor unit inverter compressor PCB error. • Under voltage • Refrigerant flow restriction from defective LEV. • Refrigerant charge is too high (overcharge).

For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on www.lg-vrf.com.

Table 47: Outdoor Unit Error Codes.

	Error Code			Description	Details
Outdoor Unit	2	1	1	Outdoor unit inverter compressor PCB error.	• Outdoor unit inverter compressor PCB error. • Under voltage • Refrigerant flow restriction from defective LEV. • Refrigerant charge is too high (overcharge).
	2	2	1	Outdoor unit inverter board input overcurrent (RMS) error.	• Overcurrent of outdoor unit inverter board PCB. • Under voltage • Refrigerant flow restriction from defective LEV. • Refrigerant charge is too high (overcharged).
	2	3	1	Low DC voltage sensed at the outdoor unit inverter compressor DC link.	DC voltage failed to charge on power up. (Start diagnosis at the CN inverter socket on the outdoor unit noise filter PCB.)
	2	4	1	Outdoor unit high pressure switch error.	System has been turned off by the outdoor unit high pressure switch.
	2	5	1	Input voltage to the outdoor unit is too high or too low.	Outdoor unit has an input voltage of ≤140V or ≥300V (for 208-230V units).
	2	6	1	Outdoor unit inverter compressor operation error.	Initial operation failure due to outdoor unit inverter compressor problem.
	2	8	1	Outdoor unit inverter DC link high voltage error.	Compressor shut off because outdoor unit inverter PCB DC link voltage is too high.
	2	9	1	Outdoor unit inverter compressor overcurrent error.	Outdoor unit inverter compressor current draw is too high.
	3	2	1	Excessive increase in outdoor unit inverter compressor gas discharge temperature.	• Shutdown due to excessive discharge gas temperature. • Check the fan and coils.
	3	4	1	Outdoor unit compressor high pressure safety tripped.	• Shutdown due to excessive discharge gas temperature. • Check the fan and coils.
	3	5	1	Outdoor unit low side pressure transducer senses pressure below allowable limits.	• Shutdown due to low suction pressure.
	3	6	1	Outdoor unit fell below low condenser (compression) ratio limit.	Outdoor unit remained below the low condenser ratio limit for three (3) minutes.
	4	0	1	Outdoor unit inverter compressor current transducer (CT) sensor error.	Outdoor unit inverter compressor current transducer (CT) detection sensor has disconnected or short circuited.
	4	1	1	Outdoor unit inverter compressor discharge pipe temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	4	2	1	Outdoor unit low pressure transducer error.	• Check the connection at the socket on the outdoor unit PCB. • Transducer has disconnected or short circuited.
	4	3	1	Outdoor unit high pressure transducer error.	• Check the connection at the socket on the outdoor unit PCB. • Transducer has disconnected or short circuited.
	4	4	1	Outdoor unit ambient temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	4	5	1	Outdoor unit heat exchanger pipe temperature sensor (front side) error.	• Check suction sensor in cooling mode; check hot gas sensor located near the heat exchanger in heating mode. • Check the connection at the socket on the outdoor unit PCB, then check if thermistor is open or shorted. • Thermistor has disconnected or short circuited.
	4	6	1	Outdoor unit suction pipe temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	4	9	1	Outdoor unit IPM temperature sensor error.	Disconnection or short circuit of outdoor unit IPM temperature sensor.
	5	1	1	Combination ratio is out of range.	The total of the nominal indoor unit capacity is less than 50% or more than 130% of the nominal outdoor unit capacity.

For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on www.lg-vrf.com.

Table 48: Outdoor Unit Error Codes, continued.

	Error Code				Description	Details
Outdoor Unit	5	2	1		Communication error between outdoor unit main PCB and inverter PCB.	• Communication error between main PCB and inverter PCB. • Check connections at both sockets. • Inspect interconnecting cable for wear.
	5	3	1		Communication error between outdoor unit main PCB and indoor unit(s) PCB.	• Check if outdoor unit to indoor unit(s) communications cable has disconnected or short circuited. • Check A terminals are connected to indoor unit A and 3 (5 on 3 x 3 cassette) terminals; B connect to B or 4 (6 on 3 x 3 cassette) terminals.
	5	7	1		Outdoor unit main PCB and inverter PCB communication error.	Outdoor unit inverter PCB is not receiving signal from main PCB.
	5	9	1		Outdoor unit series installation error.	A smaller outdoor unit is set as the master outdoor unit.
	6	0	1		Outdoor unit inverter PCB EPROM error.	• Verify the EPROM is present and in the socket correctly. • Check if all pins are in and are not bent. • Check if notch in the chip lines up with the arrow on the socket.
	6	2	1		High temperature at the outdoor unit inverter heatsink.	System shut off because of high temperatures at the outdoor unit inverter heatsink.
	6	5	1		Outdoor unit inverter heatsink temperature sensor error.	Disconnection or short circuit of outdoor unit inverter heatsink temperature sensor.
	6	7	1		Outdoor unit fan has locked up.	Outdoor unit air flow is restricted.
	7	1	1		Outdoor unit converter CT sensor error.	Master outdoor unit is restricted.
	7	5	1		Master outdoor unit fan CT sensor error.	Disconnection or short circuit of outdoor unit fan current detection (CT) sensor.
	7	6	1		Outdoor unit fan DC link high voltage error.	Outdoor unit fan DC link high voltage error.
	7	7	1		Outdoor unit fan overcurrent error.	Outdoor unit fan current is >10A (for 208-230V units).
	7	9	1		Outdoor unit fan operation failure error.	Outdoor unit fan is experiencing first position sensor failure.
	8	6	1		Outdoor unit main PCB onboard EPROM error.	• Verify the EPROM is present and in the socket correctly. • Check if all pins are in and are not bent. • Check if notch in the chip lines up with the arrow on the socket.
	8	7	1		Outdoor unit fan PCB EPROM error.	• Communication error between outdoor unit fan MICOM and EPROM. • EPROM is missing.
	1	0	5	*	Outdoor unit fan PCB communication error.	Outdoor unit main PCB is not receiving a signal from the fan.
	1	0	6	*	Outdoor unit fan IPM error.	Instant overcurrent (peak) of outdoor unit fan IPM.
	1	0	7	*	Outdoor unit fan DC link low voltage error.	Outdoor unit fan DC link voltage is <140V (for 208-230V units).
	1	1	3	*	Outdoor unit liquid pipe temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	1	1	4	*	Outdoor unit subcooling inlet temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	1	1	5	*	Outdoor unit subcooling outlet temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	1	1	6	*	Outdoor unit oil level sensor error.	Disconnection or short circuit of outdoor unit oil level sensor.

For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on www.lg-vrf.com.

Table 49: Outdoor Unit Error Codes, continued.

Error Code					Description	Details
Outdoor Unit	1	4	5	*	Communication error between outdoor unit main board and external board.	Outdoor unit main board to external board communication failure.
	1	5	1	*	Outdoor unit operation mode conversion error.	Failure of operation mode conversion at outdoor unit.
	1	5	3	*	Outdoor unit upper heat exchanger temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	1	5	4	*	Outdoor unit lower heat exchanger temperature sensor error.	• Check the connection at the socket on the outdoor unit PCB. • Thermistor has disconnected or short circuited.
	1	8	2	*	Communication error between outdoor unit external board main and sub MICOMs.	Outdoor unit external board main to sub MICOMs communication failure.
	1	9	3	*	Excessive increase in outdoor unit fan heatsink temperature.	System has shut off because outdoor unit fan heatsink temperature is >203°F.
	1	9	4	*	Master outdoor unit fan heatsink temperature sensor error.	Disconnection or short circuit of master outdoor unit fan heatsink temperature sensor.

For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on www.lg-vrf.com.

LG

Cautions for Refrigerant Leaks / Introduction

ASHRAE Standards 15 and 34 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./ft^3 per 1,000 ft^3 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.

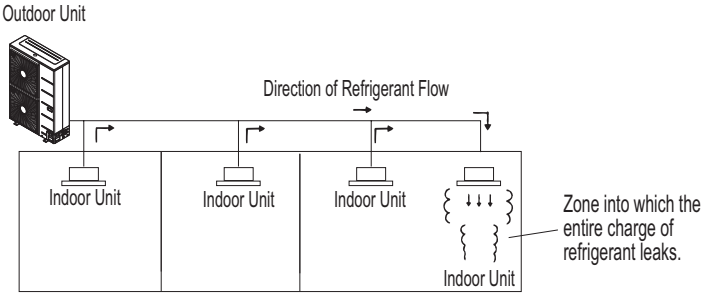
Note:

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 Multi V S 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./ft^3. 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 and local codes for detailed information.[1]

Figure 75: Example of R410A Refrigerant Leak Location.



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

$$\text{RCL (lbs./ft}^3\text{)} = \frac{\text{Total System Refrigerant Charge (lbs.)}}{\text{Volume of Smallest Occupied Space (ft}^3\text{)}}$$

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

To determine the volume of an occupied space, the designer must also determine which ones are connected, not connected, or ventilated (refer to Standard 34).

If the calculated RCL is above the allowable limit, there are two primary methods used to lower the RCL:

1. Increase the volume of the occupied space.
2. Decrease the size of the refrigerant charge.

Per Standard 34-2007, acceptable methods used to increase the volume of an occupied space include:

- Install transfer ducts between rooms.
- Undercut and overcut doors (partitions ≤0.15% of cubic volume of space within a zone).
- Add an opening without a door (partitions ≤0.15% of cubic volume of space within a zone).
- Include ventilation grilles in doors; include ventilation inlets / outlets (partitions ≤0.15% of cubic volume of space within a zone).
- Include the area above the ceiling as part of the return or sup ply air path (partitions ≤0.15% of cubic volume of space within a zone).
- Install a mechanical ventilator linked to a gas leak detector.
- Change the indoor unit type (wall mounted to ceiling cassette) / position.

Figure 76: Examples of Zones.

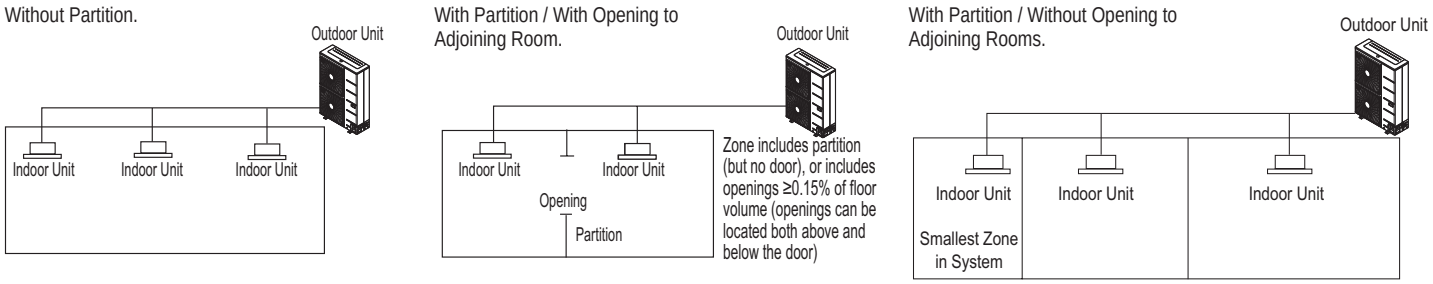
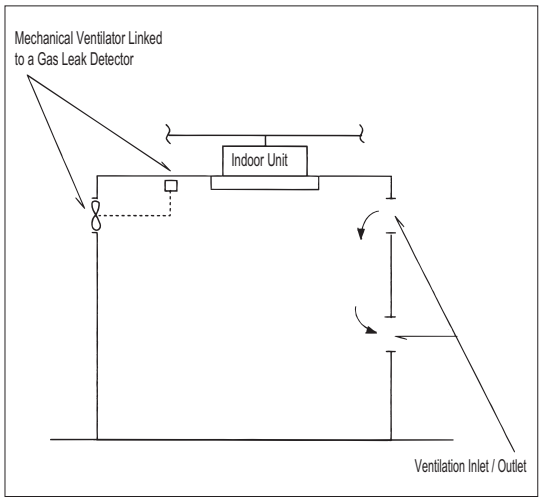


Figure 77: Examples of Acceptable Ventilation Methods.



LG Multi V Pre-Commissioning Device Configuration Worksheet

Project Name:	**Building ID**
Date: AC Smart Static IP address:	**System ID** **Page #**
Mech Contractor Company Name	MEP Project Mngr Name
Pre-Com Tech Name/Ph#/email	Ph# / Email

IDU's

Unit Tag	Building Floor	Room ID	Type	Model	Serial #	Adjusted Fan Setting Value . Low | Medium | High			System Address	Central Control Address	Group member ID or N/A if not in a group	Group Function M=Master S=Slave	Sensor Strategy (RA/ZC/Both)

MULTI V S

INSTALLATION CHECKLIST

LG

Major Component Rough-In

Description	Check
All Multi V S outdoor units were connected properly per local code and the product installation procedures.	
All literature and bagged accessories have been removed from the fan discharge.	
Indoor units are installed, properly supported, and located indoors in a non-corrosive environment.	
Multi V 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
Copper	
Over 5/8 inches—Rigid ACR only.	
5/8 inches and under—Can use soft ACR.	
15% silver brazing material only.	
All refrigerant pipes and valves were insulated separately. Insulation butts up against the walls of the indoor units. No gaps or cracks. Insulation was not compressed at clamps and hangers.	
LG Y-branches and headers were used per manufacturer's recommendations.	
(Optional) Full port ball valves for all indoor units. (Schrader between the valve body and the indoor units.)	
Condensate piping installed on indoor units–material used is acceptable under local code. Insulated as necessary to prevent condensation.	

Brazing Practices

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

Installation

(For more information on any procedure, refer to the detail provided in the Indoor Unit Installation Manuals.)

Refrigerant Piping

Description	Check
Have in possession a copy of the "As-Designed" LATS Multi V S piping tree diagram. BEFORE ANY FIELD PIPE SIZE OR LENGTH CHANGES ARE MADE, PROPOSED CHANGES MUST BE FORWARDED TO THE DESIGN ENGINEER SO THAT THEY CAN INPUT THE CHANGES INTO LATS and RE-ISSUE A NEW LATS PIPING TREE DIAGRAM. Installer must receive change authorization from the design engineer, because any change made requires the review of the entire tree diagram and verification that the change did not impact the size of piping segments in other parts of the system.	
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.	
All long runs of straight pipe were provided with expansion loops.	
Ensure Y-branches are installed with no more than ±5° of horizontal.	
Ensure Y-branches are installed with no more than ±3° of vertical.	
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 properly supported and all wall penetrations were sleeved.	
Pipe insulation was not compressed at any point.	
Y-branches were properly supported per details provided in the installation manual.	
Ensure Y-branches are installed in the correct direction. Flow is always from the single end to the double end.	
No oil traps, solenoid valves, sight glasses, filter driers, or any other unauthorized refrigerant specialties were present.	
(Optional) R410A rated full port ball valves were used at all indoor units and at will in the refrigerant piping network.	
Best practice including a minimum of 20" of straight pipe was installed between each elbow.	

Condensate Pump / Drain Installation

Description	Check
Indoor unit condensate drain pipes were installed correctly.	
All condensate vertical risers are equal to or less than 27-1/2" from the bottom of the indoor unit.	
Indoor units with condensate pumps were level. Units with gravity drains were level or slightly canted toward the drain connection and are supported properly.	
Pumped condensate drain lines were properly connected (do not have traps, and connect to the top surface of the main drain line).	

Power Wire and Communications Cables

Description	Check
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. (±10% of nameplate).	
Power wiring to the Multi V S outdoor unit was installed per all local electrical code requirements.	
Power wiring to the indoor units was installed per all local electrical code requirements.	
Communications cable between the outdoor unit(s) and indoor units was connected in a daisy chain configuration (i.e., single parallel chain). No “Star” or multiple parallel circuits. No cable splices or wire caps were used to connect communications cables.	
Record Communication Voltage Range High _____ VDC Low _____ VDC	
LG-supplied cable was used between each indoor unit and its zone controller. No cables were spliced and no wire caps are present.	
Communication type RS-485–BUS type.	
Power wiring to the outdoor unit must be solid or stranded, and must comply with all local and national electrical codes.	
All communications cables from the outdoor unit to the indoor units are a minimum of 18-gauge, two conductor, stranded, shielded or unshielded. If shielded, must be grounded to the outdoor unit only.	
Used appropriate crimping tool to attach ring or spade terminals at all power wiring and control cable terminations.	
Verify all ring and spade terminals are copper bearing in all communications daisy chains. Galvanized or nickel plated steel connectors were not used.	
Power wiring and communications cable from the ODU to IDU cannot be run in the same conduit and must be separated per manufacturer’s guidelines.	
Only LG-supplied Y-cables and extension cables were used between indoor units.	

INSTALLATION CHECKLIST

Major Component Rough-In

Piping and Insulation

Brazing Practices

INSTALLATION CHECKLIST

Installation—Refrigerant Piping

Installation—Condensate Pump / Drain Installation

Installation—Power Wire and Communications Cables

MULTI V S PRE-COMMISSIONING CHECKLIST

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Description	Check
Using a copy of the LATS Multi V pipe design diagram, verify the sum of the indoor unit nominal capacity connected to the piping system is between 50% and 130% of the outdoor unit's(s') nominal capacity. If this rule is violated, the system will not start.	
Check all indoor units for power at the unit disconnect and power is present at the indoor unit PCB board. (LED is lit.) ⃠ DO NOT TURN ON THE UNIT using the ON/OFF button.	
Successful auto address routine is complete. All device addresses have been recorded on the Indoor Unit Device Configuration Worksheet.	
Ensure all field-installed full-port ball valves are open.	
The piping system must hold a constant 550 psig pressure for a minimum of 24 hours with all isolation valves open. **Pressure Measurement Data** Initial Pressure _____ End Pressure _____ Start Date _____ End Date _____ Start Time _____ End Time _____ Initial Ambient Temperature _____ End Ambient Temperature _____	
A triple system evacuation has been performed. Micron gauge reading held at a minimum of 500 for 1 hour with all isolation valves open and without the vacuum pump connected. Evacuation Initial Micron Level _____ End Micron Level _____ Start Date _____ End Date _____ Start Time _____ End Time _____ Rise _____	
Power was energized to the outdoor unit(s) at _____(time) on _____day to warm the compressor crankcase. (Must be at least six [6] hours before commissioning.)	
The communications cable to the indoor units has been disconnected from the IDU (B) and IDU (A) terminals at the outdoor unit(s).	
None of the outdoor unit(s) service valves have been opened during the installation and preparation of the system for commissioning. (If the valves were opened, the factory refrigerant charge has been released.)	

Prepare Pre-commissioning Package Documents

Include	Check
1. A copy of the refrigerant piping system(s) shop drawing(s) generated by LATS Multi V S pipe design software.	
2. A copy of the pipe fitter's pipe changes and field notes.	
3. A verified copy of the "As-Built" LATS Multi V S Project file (*.mtv) that includes all changes noted by the pipe fitter(s) in Number 2. The tree diagram notes should include changes to the line lengths used for each liquid line segment.	
4. A copy of a completed and verified Installation Checklist for the outdoor unit(s), indoor units, and Control Devices. Correct any procedures needing attention before initiating a request for commissioning.	
5. A copy of the air balance report showing proper airflow at all indoor units.	
6. A completed Pre-commissioning Device Configuration Worksheet.	
7. A completed copy of the Pre-commissioning Checklist.	
8. If available, a list of IP addresses obtained from the building owners IT department for each ACP, BacNet, LonWorks, AC Smart devices.	

Initiate a Commissioning Request

Description	Check
Verify this checklist and requirements herein have been met. Complete this checklist in its entirety BEFORE initiating a request for Commissioning.	
Send all Pre-commissioning Package Documents to your LG Applied Representative.	

Contractor Name: _____ _____

(Authorized Signature)

Address: _____

_____

Phone: _____ Date: _____

**This form must be completed and submitted to LG a minimum of three (3) weeks prior to final scheduling of any startup.*
Note: If any of the above items are not complete at time of start-up, back charges will be assessed for additional costs.

Notes for the Commissioning Agent

Notes for the Commissioning Agent

COMMISSIONING NOTES

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Prepare Pre-commissioning Package Documents

Initiate a Commissioning Request

MULTI V S

COMMISSIONING CHECKLIST EXCEPTION REPORT

LG

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Prepare Pre-commissioning Package Documents

Initiate a Commissioning Request

Date of Commissioning Report: _____

Commissioning Agent Name: _____

Commissioning Agent Signature: _____

MULTI V S

MULTI V S REFRIGERANT CHARGE WORKSHEET

LG

Note:

The system will stop operation due to excessive or insufficient refrigerant, therefore, always charge the unit properly. When servicing, always refer to any notes about system piping length and additional refrigerant amounts.

System Refrigerant Charge Calculator (lbs.).

System Tag or ID_____ —	**Job Name**_____ **Project Manager**_____ **Date**_____

Line #	Description	Chassis I.D.	Size	Quantity	CF (Ref.)[1]	Total (lbs.)
1	Linear feet of 1/4" liquid line tubing[2]	—	—		0.015	
2	Linear feet of 3/8" liquid line tubing[2]	—	—		0.041	
3	Linear feet of 1/2" liquid line tubing[2]	—	—		0.079	
4	Linear feet of 5/8" liquid line tubing[2]	—	—		0.116	
5	Linear feet of 3/4" liquid line tubing[2]	—	—		0.179	
6	Linear feet of 7/8" liquid line tubing[2]	—	—		0.238	
7	Linear feet of 1" liquid line tubing[2]	—	—		0.323	
8	Art Cool Gallery	SF	9k to 12k		0.22	
9	Wall Mounted + Art Cool Mirror	SB, SE	5k to 15k		0.53	
10	Wall Mounted + Art Cool Mirror	SC	18k to 24k		0.62	
11	Wall Mounted	SV	30k to 36k		1.01	
12	1-Way Cassette	TU	7k to 12k		0.44	
13	1-Way Cassette	TT	18k to 24k		0.64	
14	2-Way Cassette	TL	18k to 24k		0.35	
15	4-Way 2' x 2' Cassette	TR	5k to 7k		0.40	
16	4-Way 2' x 2' Cassette	TR	9k to 12k		0.55	
17	4-Way 2' x 2' Cassette	TQ	15k to 18k		0.71	
18	4-Way 3' x 3' Cassette	TNA	7k to 24k		0.89	
19	4-Way 3' x 3' Cassette	TPC	24k to 28k		1.06	
20	4-Way 3' x 3' Cassette	TMA	24k to 36k		1.08	
21	4-Way 3' x 3' Cassette	TNC	36k		1.41	
22	4-Way 3' x 3' Cassette	TMC	42k to 48k		1.41	
23	High Static Ducted	BH	7k to 24k		0.57	
24	High Static Ducted	BG	7k to 42k		0.97	
25	High Static Ducted	BR	28k to 54k		1.37	
26	High Static Ducted	B8	36k to 96k		2.2	
27	Low Static Ducted	L1	7k to 9k		0.31	
28	Low Static Ducted	L2	12k to 18k		0.42	
29	Low Static Ducted	L3	24k		0.55	
30	Low Static Ducted Bottom Return	B3	7k to 15k		0.37	
31	Low Static Ducted Bottom Return	B4	18k to 24k		0.82	
32	Vertical / Horizontal Air Handling Unit	NJ	12k to 30k		1.04	
33	Vertical / Horizontal Air Handling Unit	NJ	36k		1.57	
34	Vertical / Horizontal Air Handling Unit	NK	42k to 54k		2.00	
35	Ceiling Suspended	VJ	18k to 24k		0.77	
36	Convertible Surface Mount—Ceiling / Wall	VE	9k to 12k		0.22	
37	Floor Standing	CE (U)	7k to 15k		0.37	
38	Floor Standing	CF (U)	18k to 24k		0.82	
39	Additional Refrigerant Charge Required					
40	ARUN038GSS4 Outdoor Unit Factory Refrigerant Charge[3]		38k		6.6	
41	ARUN048GSS4 Outdoor Unit Factory Refrigerant Charge[3]		48k		6.6	
42	ARUN053GSS4 Outdoor Unit Factory Refrigerant Charge[3]		53k		6.6	
43	**Total System Charge: Sum of Additional Refrigerant Charge Required and Total Factory Refrigerant Charge[4]**					

[1]CF (Ref.) = Correction Factor for Refrigerant Charge.
[2]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).
[3]Maximum quantity of indoor units allowed: ARUN038 = 6, ARUN048 = 8, ARUN053 = 9.
[4]If trim charge is negative, remove refrigerant. If trim charge is positive, add refrigerant.

Refer to Service Manuals posted on www.lghvac.com for a full description of all error codes and work-arounds.

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Follow the prompts for HVAC products.

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