LG
Life's Good

MULTI V™
SPACE II

INSTALLATION MANUAL

Variable Refrigerant Flow Outdoor Unit
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 below.

A summary list of safety precautions begins on page 3.

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

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TABLE OF SYMBOLS

⚠WARNING	*This symbol indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.*
Note	*This symbol indicates additional helpful information such as an explanation, a comment, or a clarification about the subject.*
✓	*This symbol indicates a recommendation or tip. Recommendations instruct the user to apply the suggested practice to ensure the best operating results in order to achieve the maximum benefit of the product. Tips contain practical information that may help the user solve a problem or describe actions that may save time.*

INSTALLATION

⚠WARNING

Do not install, remove, or re-install the unit by yourself (customer). Ask the dealer or an authorized technician to install the unit.
Improper installation by the user may result in water leakage, fire, explosion, electric shock, physical injury or death.

For replacement of an installed unit, always contact an authorized LG service provider.
There is risk of fire, electric shock, explosion, and physical injury or death.

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

The unit is shipped with refrigerant and the service valves closed. Do not open service valves on the unit until all non-condensables have been removed from the piping system and authorization to do so has been obtained from the commissioning agent.
There is a risk of equipment damage, refrigerant contamination, refrigerant loss, physical injury or death.

The unit is shipped with refrigerant and service valves closed. Do not run the compressor with the service valves closed.
There is a risk of equipment damage, explosion, physical injury, or death.

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.

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.

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

Install the unit in a safe location where nobody can step on or fall onto it.
There is risk of unit damage, physical injury or death.

Do not install the unit on a defective stand.
It may result in an accident that causes product damage or personal injury or death.

Do not change the settings of the protection devices.
If the pressure switch, thermal switch, or other protection device is shorted and forced to operate improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, and physical injury or death.

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

Don't install the unit where it's directly exposed to ocean winds.
Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.

Replace all control box and panel covers.
If cover panels are not installed securely, dust, water and animals may enter the water source unit, causing fire, electric shock, and physical injury or death.

Always check for system refrigerant leaks after the unit has been installed or serviced.
Low refrigerant levels may cause product failure, and exposure to high concentration levels of refrigerant gas may lead to illness or death.

INSTALLATION, CONTINUED

Note

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

When installing the unit in a low-lying area, or a location that is not level, use a raised concrete pad or concrete blocks to provide a solid, level foundation.
This may prevent water damage and reduce abnormal vibration.

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

When installing the unit in a hospital, mechanical room, or similar electromagnetic field (EMF) sensitive environment, provide sufficient protection against electrical noise.
Inverter equipment, power generators, high-frequency medical equipment, or radio communication equipment may cause the air conditioner to operate improperly. The unit may also affect such equipment by creating electrical noise that disturbs medical treatment or image broadcasting.

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

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

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

Do not install the 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.

WIRING

⚠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.

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

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

Properly size all circuit breakers or fuses.
There is risk of fire, electric shock, explosion, 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.

Properly tighten all power lugs.
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 pressure switch, thermal switch, or other protection devices are bypassed or forced to work improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, 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.

Do not supply power to the unit until all installation and pre-commissioning tasks are complete and the commissioning agent indicates it is safe to do so.

Note

Auto-addressing should be carried out with power applied to all indoor and outdoor units. Auto-addressing should also be performed any time an indoor unit PCB is changed.

OPERATION

⚠WARNING

Do not allow water, dirt, or animals to enter the unit.
There is risk of unit failure, fire, electric shock, physical injury or death.

Do not provide power to or operate the unit if it is flooded or submerged.
There is risk of fire, electric shock, physical injury or death.

Use a dedicated power source for this product.
There is risk of fire, electric shock, physical injury or death.

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 property damage, product failure, physical injury or death.

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

Do not operate the unit with the panel(s) or protective cover(s) removed; keep fingers and clothing away from moving parts.
The rotating, hot, cold, and high-voltage parts of the unit can cause physical injury or death.

If gas leaks out, ventilate the area before operating the unit.
Leaking gas may cause fire, electric shock, explosion, physical injury or death if the unit is mounted in an enclosed, low-lying, or poorly ventilated area and the system develops a refrigerant leak.

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

Do not turn off the main power switch after operation has been stopped.
Wait at least five (5) minutes before turning off the main power switch, otherwise it may result in product malfunction.

Do not use this equipment in mission critical or special-purpose applications such as preserving foods, works of art, wine coolers or refrigeration. The equipment is designed to provide comfort cooling and heating.
Oil, steam, sulfuric smoke, etc., can significantly reduce the performance of the unit, or damage its parts.

Provide power to the compressor crankcase heaters 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.

Do not open the inlet grille of the unit during operation. Do not operate the unit with the panels or guards removed. Do not insert hands or other objects through the inlet or outlet with the unit is plugged in. Do not touch the electrostatic filter, if the unit includes one.
The unit contains sharp, rotating, hot, and high voltage parts that can cause personal injury and / or electric shock.

Note

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

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

Unit Model Number		4.4 Ton ARUN053GF2
Cooling Performance		
Nominal Cooling Capacity (Btu/h)[1]		53,000
Rated Cooling Capacity (Btu/h)[2]		54,000
Heating Performance		
Nominal Heating Capacity (Btu/h)[1]		59,000
Rated Heating Capacity (Btu/h)[2]		60,000
Operating Range		
Cooling (°F DB)		23 - 118
Heating (°F WB)		(-4) - +60
Compressor		
Inverter Quantity		Inverter
Oil/Type		PVE/FVC68D
Fan (Rear Discharge)		
Type		Propeller (BLDC)
Motor Output (kW) x Qty.		0.90 x 1
Motor/Drive		Brushless Digitally Controlled/Direct
Operating Range (RPM)	**Cooling**	80-813
	Heating	80-813
Maximum Air Volume (CFM)		3,532
External Static Pressure Fan (inches WG)		0.12 - 0.20
Unit Data		
Refrigerant Type		R410A
Refrigerant Control/Location		EEV/Indoor Unit
Max. Number Indoor Units/System[3]		9
Sound Pressure dB(A) (Rear Fan Side/Front)[4]		53 / 68
Net Unit Weight (lbs.)		320
Shipping Weight (lbs.)		346
Communication Cables[5,6]		2 x 18
Heat Exchanger		
Material and Fin Coating		Copper Tube/Aluminum Fin and GoldFin™
Rows/Fins per inch		2/14
Piping[7]		
Liquid Line Connection (in., OD)		3/8 Braze
Vapor Line Connection (in., OD)		3/4 Braze
Factory Charge lbs. of R410A		7.7

[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 capacity is outside the scope of AHRI Standard 210/240.)
Nominal cooling capacity rating obtained with air entering the indoor unit at 80°F dry bulb (DB) and 67°F wet bulb (WB) and outdoor ambient conditions of 95°F dry bulb (DB) and 75°F wet bulb (WB).
Nominal heating capacity rating obtained with air entering the indoor unit at 70°F dry bulb (DB) and 59°F wet bulb (WB) and outdoor ambient conditions of 47°F dry bulb (DB) and 43°F wet bulb (WB).

[2]Rated capacity is certified under AHRI Standard 210/240. 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, 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: Multi V Space II Electrical Data

Nominal Tons	Unit Model No.	Compressor Qty.	Compressor Motor (A)	Fan Qty.	Condenser Fan Motor (A)	MCA	MOP
4.4	ARUN053GF2	1	21.7	1	4.0	31.2	50

Voltage tolerance is ±10%.

Maximum allowable voltage unbalance is 2%.

MCA = Minimum Circuit Ampacity.

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

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. Many countries have approved of and encouraged R410A for use as an environment friendly refrigerant.

⚠ WARNING

- *To prevent the refrigerant cylinder from exploding, do not place it in direct sunlight.*
- *Do not use any piping that has not been approved for use in high-pressure refrigerant systems.*
- *To prevent the piping from softening, do not heat it more than necessary during installation.*

Note:

- *Piping wall thickness must comply with the applicable local, state, and federal codes for the 551 psi design pressure of R410A.*
- *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.*

Location Selection

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

- Where the unit will not be subjected to direct thermal radiation from other heat sources.
- Where operating sound from the unit will not disturb inhabitants of surrounding buildings.
- Where the unit will not be exposed to direct, strong winds.
- Where there is enough strength to bear the weight of the unit.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in heating mode.
- Include enough space for air flow and for service access.
- To avoid the possibility of fire, do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak.
- Do not install the unit in a location where acidic solution and spray (sulfur) are often used.
- Do not use the unit in environments where oil, steam, or sulfuric gas are present.
- Install a fence to prevent vermin from crawling into the unit or unauthorized individuals from accessing it.

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

1. Prepare for severe winter wind chills and heavy snowfall, even in areas of the country where these are unusual phenomena.
2. Position the unit so that its airflow fans are not buried by direct, heavy snowfall. If snow piles up and blocks the airflow, the system may malfunction.
3. Install a snow protection hood.
4. To prevent snow and heavy rain from entering the unit, install the suction and discharge ducts facing away from direct winds.

Additionally, the following conditions should be taken into considerations when the unit operates in defrost mode:

- If the unit is installed in a highly humid environment (near an ocean, lake, etc.), ensure that the site is well-ventilated and has a lot of natural light. (Example: Install on a rooftop.)
- Sidewalks or parking lots near the Space II unit may accumulate moisture after unit operates in defrost mode that can turn to ice.

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

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

Ambient Air Conditions

⚠ WARNING

- *Avoid exposing the Space II unit to steam, combustible gases, or other corrosive elements.*
- *Avoid exposing the unit to discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperature, gases, or substances that may degrade performance or cause damage to the unit.*
- *When installing multiple Space II units, avoid placing the units where discharge of one Space II unit will blow into the inlet side of an adjacent unit.*

GENERAL INSTALLATION GUIDELINES

Oceanside Applications / Required Clearances

Oceanside Applications

⚠ WARNING

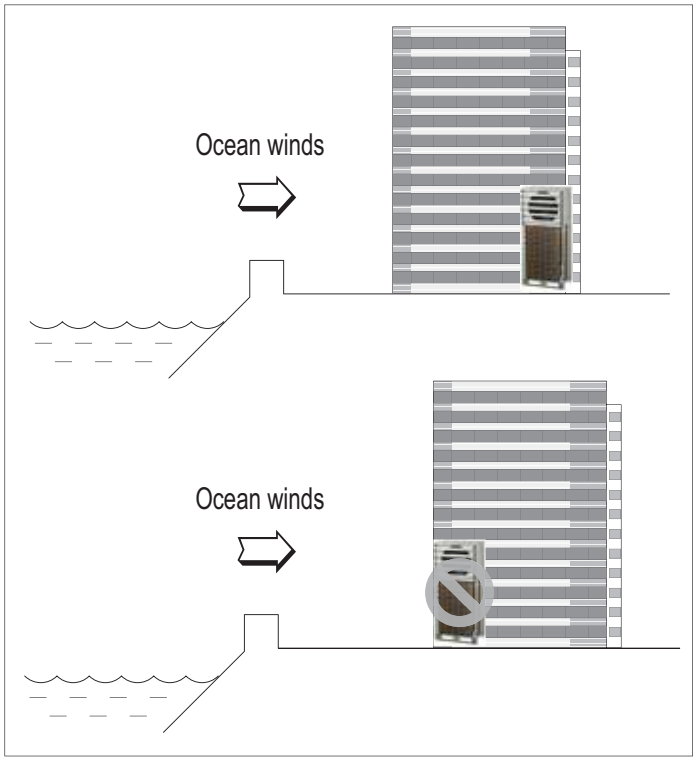
Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.

- Multi V Space II should be installed in a soundproofed mechanical room.
- Avoid installing the Space II unit where it would be directly exposed to ocean winds.
- Install the outdoor unit on the side of the building opposite from direct ocean winds.
- Select a location with good drainage.
- Periodically clean dust or salt particles off of the heat exchanger with water.
- If the Space II 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.

Note:

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

Figure 1: Oceanside Placement.



Required Clearances

- Allow adequate clearance for the system louvers (see figure at right).
- Automatic louver installation = 6 inches
- Manual louver installation = 6 inches
- Fixed louver installation = 4 inches (Basic space)
- Place the product so that the door of the Space II unit's enclosure can be opened completely for easier installation and service access.

Water Drain Outlet

- An outlet is required to allow water drainage from the bottom of the Space II unit enclosure (condensation could form during unit operation).

Figure 2: Required Clearances for Multi V Space II.

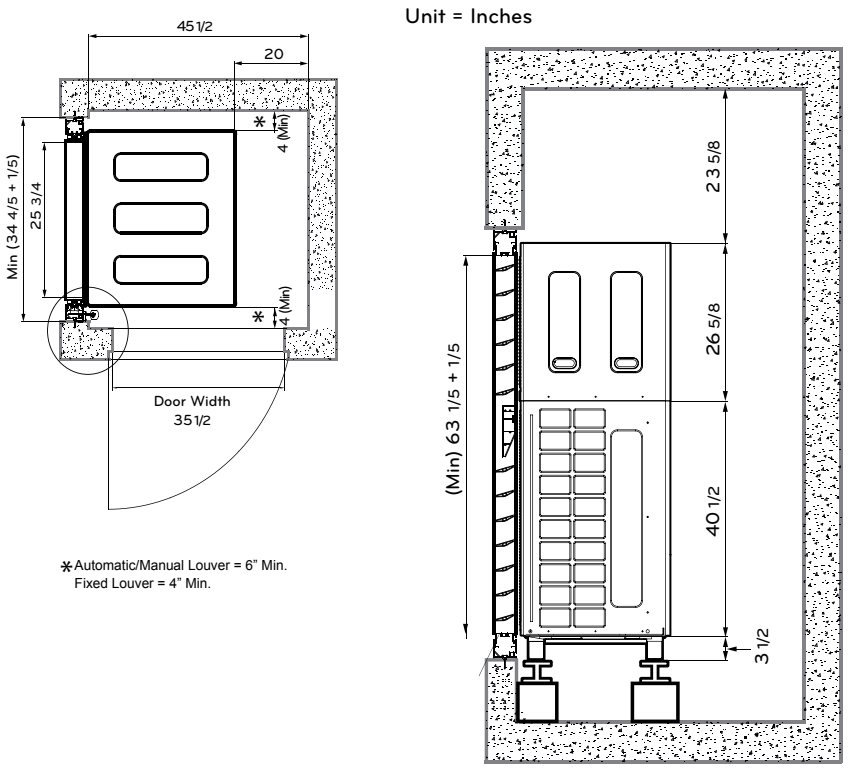
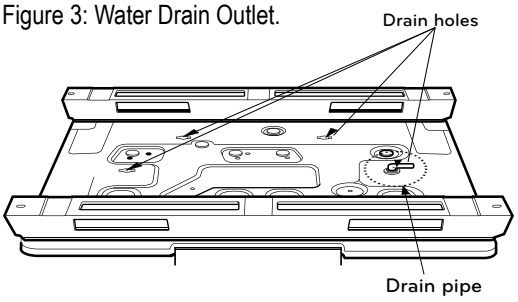


Figure 3: Water Drain Outlet.



Louver Specifications

Figure 4: Recommended Top and Side Clearance Spaces for the Multi V Space II Louver.

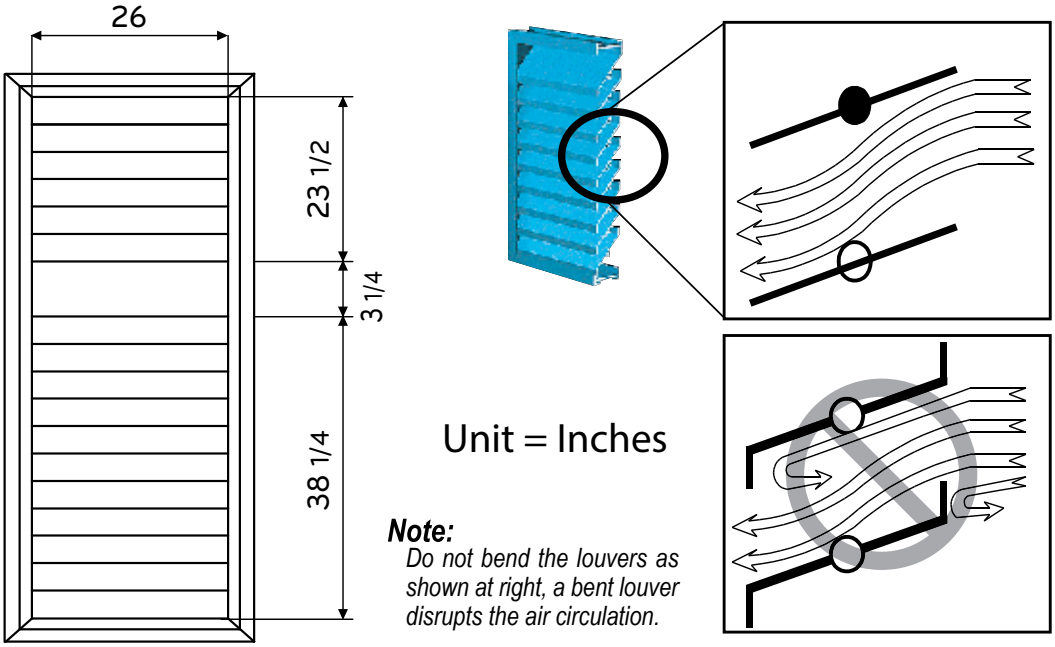
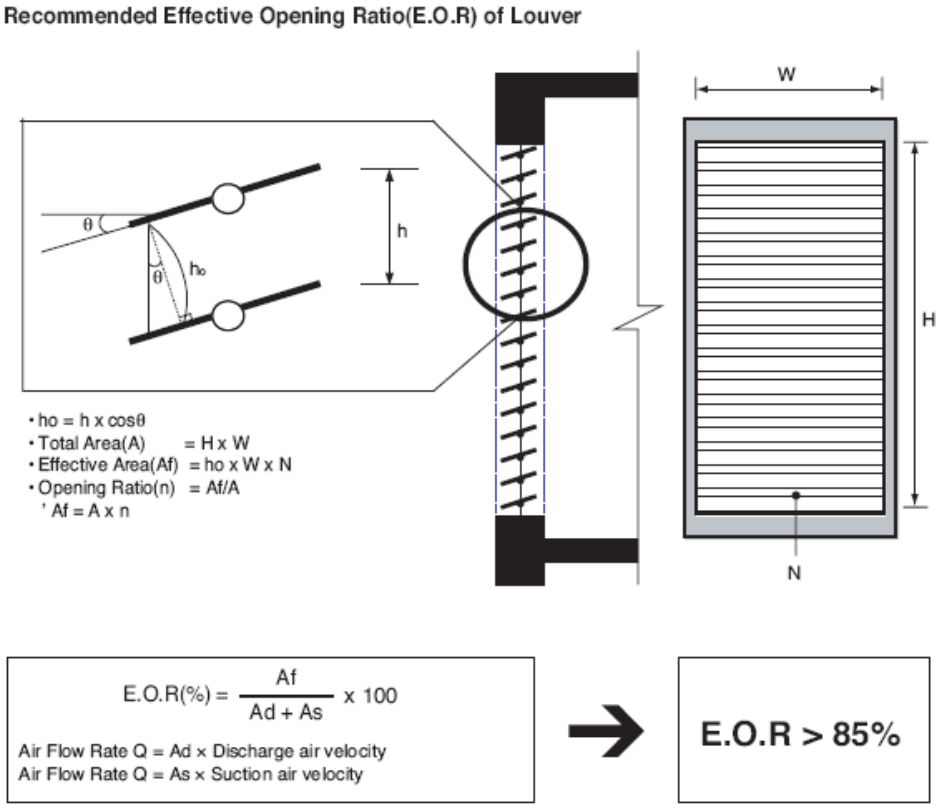


Figure 5: Recommended Effective Opening Ratio of Louver

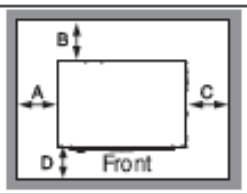
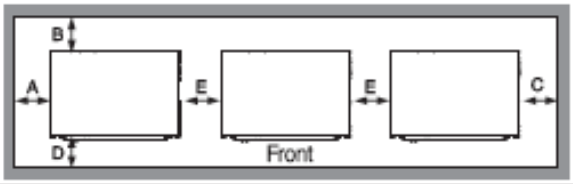
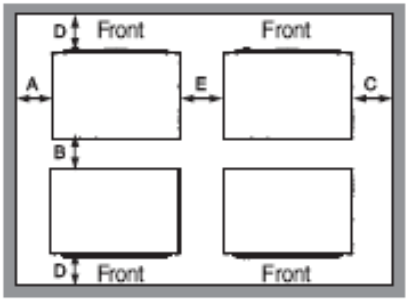
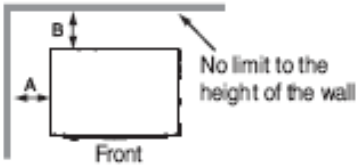
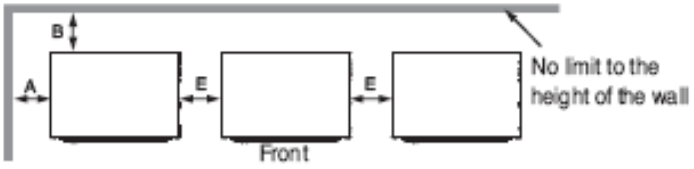
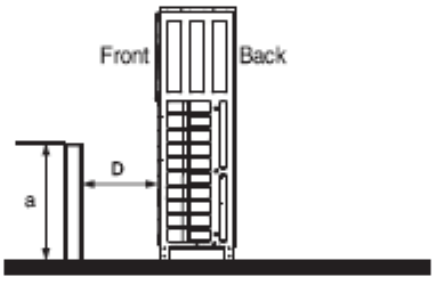


GENERAL INSTALLATION GUIDELINES

Required Clearances

Proper airflow through the Space II unit coil is critical for correct unit operation. When installing the multiple Space II units, consider service, inlet, and outlet, and minimum allowable space requirements as illustrated in the diagrams below.

Table 3: Minimum Space Requirements or Multiple Space II Units.

Category	Installation Space	Side Space
4 sides are walls		**A ≥ 3/8** **B ≥ 19**-3/4 **C ≥ 3/8** D:Waterproof wall installation condition
		**A ≥ 3/8** **B ≥ 19**-3/4 **C ≥ 3/8** D:Waterproof wall installation condition
		**A ≥ 3/8** **B ≥ 19**-3/4 **C ≥ 3/8** D:Waterproof wall installation condition **E ≥ 3/4**
2 sides or 1 side are walls		**A ≥ 3/8** **B ≥ 19**-3/4
		**A ≥ 3/8** **B ≥ 19**-3/4 **E ≥ 3/4**
In case of Waterproof wall installation		**If a ≤ 11-3/4 D ≥ 5**-7/8 If 11-**3/4 a ≤ 19**-3/4, **D ≥ 9**-3/4

Front side : outdoor unit discharge flow direction
Required side area for Louver vane operation should be considered separately.

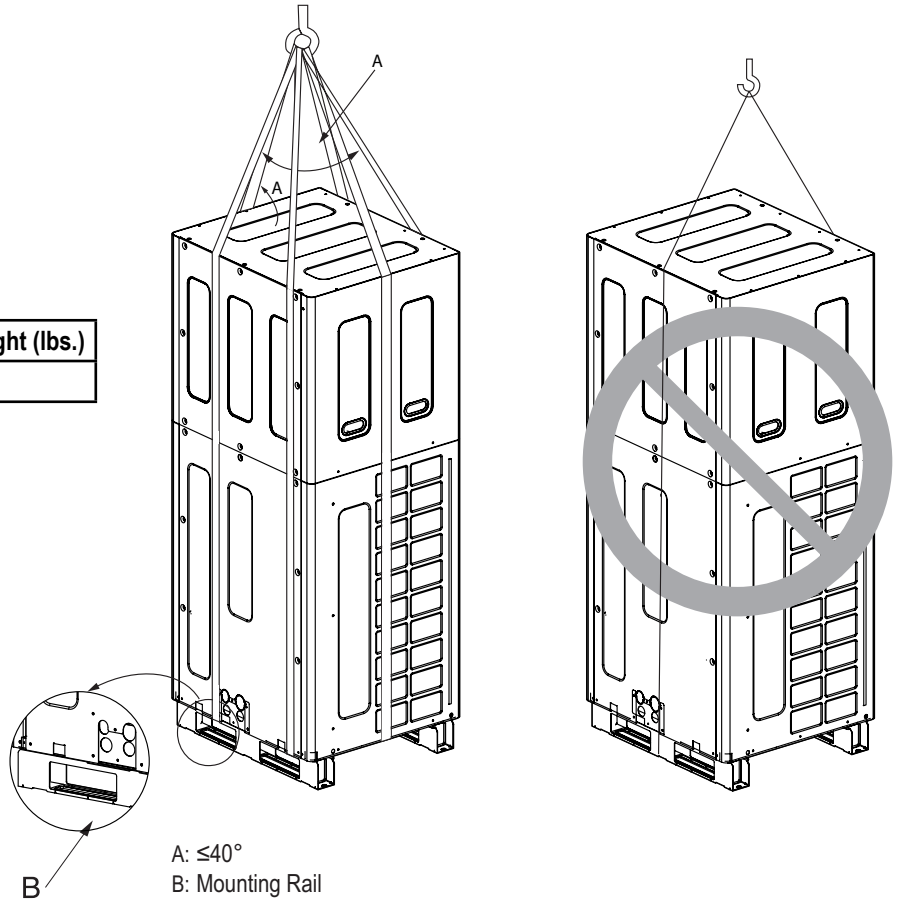
Rigging Instructions

- When lifting the unit, use lifting straps and place around the unit as shown below.
- 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 at “A”.

Table 4: Multi V Space II Net and Shipping Weights.

Capacity (ton)	Net Weight (lbs.)	Shipping Weight (lbs.)
4.4	320	346

Figure 6: Transporting the Space II Unit.



⚠ WARNING

- *Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed above.*
- *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.*
- *Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.*
- *Lift the unit from the base at specified locations. Support the unit at a minimum of six (6) points to avoid slippage from the rigging apparatus.*
- *Do not drop the unit when carrying it with a forklift.*
- *Use a minimum of three (3) lifting straps.*
- *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.*
- *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.*
- *Caution when using forklift to transport an unpackaged unit. Consider the unit’s center of gravity when lifting. Protect the painted surfaces as necessary to prevent damage to the unit finish.*

GENERAL INSTALLATION GUIDELINES

Mounting Bolt / Foundation for Installation

Mounting Bolt Location / Foundation for Installation

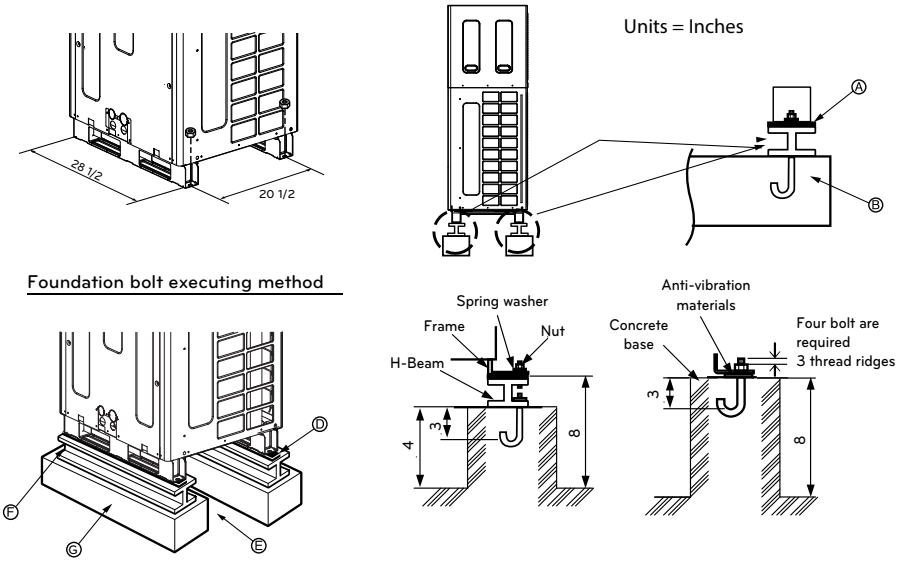
Securely attach the Space II unit as shown in Figure 12, using pad, base rails, or other mounting platform that is securely anchored to the ground or building structure. Refer to the dimensional drawing in the "Product Data" section, and follow the applicable local code for clearance, mounting, anchor, and vibration attenuation requirements.

The underlying structure or foundation must be designed to support the weight of the unit. Avoid placing the unit in a low lying area where water may accumulate.

⚠ WARNING

Any installation deficiency may cause unit to fall down, resulting in a personal injury.

Figure 7: Space II Unit—Mounting Methods[1].



[1]All referenced materials are to be field-supplied.
Images are not to scale. All dimensions ±0.25 inches.

A: Corners must be firmly attached, otherwise, the support will bend.

B: Use a 3/8 inch anchor bolt.

D: Insert cushion pad between Space II unit and base support to ensure sufficient anti-vibration coverage.

E: Pipe and wiring space.

F: H-beam support.

G: Concrete base support.

Note:

- *When deciding on a location to place the Space II unit, choose an area where run-off from defrost mode will not accumulate and freeze on sidewalks and driveways.*
- *Do not install a tube or pipe for the water in the base pan. Follow the drain path to properly remove condensation.*
- *Do not install the suction hole and the discharge hole of the unit so that either directly faces seasonal winds as this can cause freezing.*

Piping Preparation

⚠ WARNING

- *Do not allow the refrigerant to leak during brazing; if the refrigerant combusts, it generates a toxic gas.*
- *Do not braze in an enclosed location, and always test for gas leaks before / after brazing.*

Multi V Space II 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. Slide the flare nut onto the copper tube.

3. Flaring the pipe end.

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

4. Carefully inspect the flared pipe end.

- Compare the geometry with the figure to the right and dimensions as detailed in Figure 8.
- If the flare is defective, cut it off and re-do procedure.
- If flare looks good, blow clean the pipe with dry nitrogen.

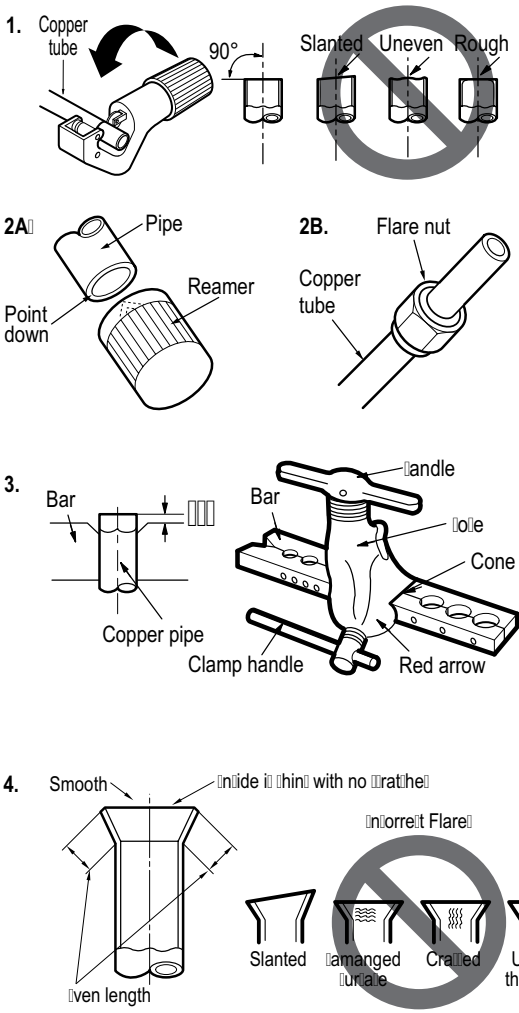


Figure 8: Dimensions of the Flare.

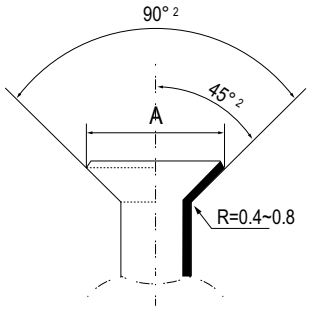


Table 5: Flared Connection Dimensions.

Indoor /unit (Btu/h)[1]	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

*[1]ARNU093-123-153TN*2, ARNU183-243TM*2, ARNU153-183-243BG*2 piping connections: 5/8 in. O.D. Vapor Piping, 3/8 in. O.D. Liquid Piping; Flare Size "A": 5/8 ~ 11/16 in. Vapor, 5/8 ~ 11/16 in. Liquid.*

Tightening the Flare Nuts

Figure 9: Tightening the Flare Nuts.

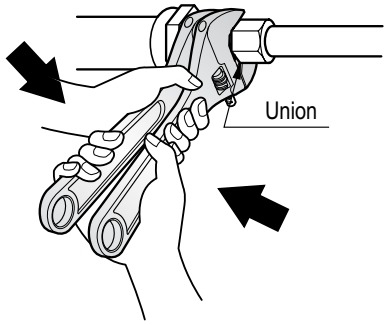


Table 6: Tightening Torque for Flare Nuts.

Pipe size (Inches O.D.)	Tightening torque (ft-lbs)	Width of the flare (A [inches])
3/8Ø	24.1 - 29.4	1/2
1/2Ø	36.5 - 44.5	5/8
5/8Ø	45.5 - 55.6	3/4

1. When connecting the flare nuts, coat the flare (inside and outside) 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.

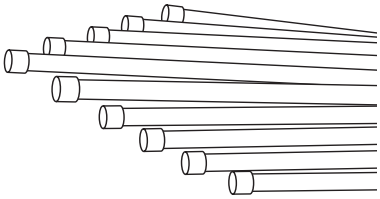
2. Initially hand tighten the flare nuts using three (3) or four (4) turns.
3. To finish tightening the flare nuts, use both a torque wrench and a backup wrench.
4. After all the piping has been connected and the caps have been tightened, check for refrigerant gas leaks.

Loosening the Flare Nuts

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

Piping Materials and Handling

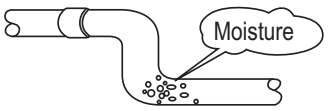
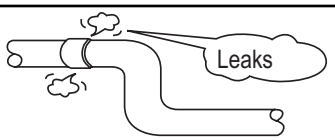
Figure 10: Keep Piping Capped While Storing.



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.

Table 7: 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 insure 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. - Insure that refrigerant lines are pressure tested to 550 psig.

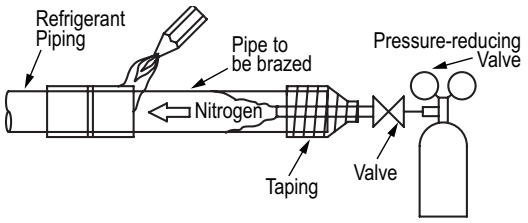
LG

Brazing Practices

Note:

It is imperative to keep the piping system free of contaminants and debris such as copper burrs, slag, or carbon dust during installation.

Figure 11: Refrigerant Pipe Brazing.



1. All joints are brazed in the field. Multi V Space II 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.

   • Store pipe stock in a dry place; keep stored pipe capped and clean.

   • Blow clean all pipe sections with dry nitrogen prior to assembly.

2. Proper system operation depends on the installer using best practices and the utmost care while assembling the piping system.
   • Use adapters to assemble different sizes of pipe.

   • Always use a non-oxidizing material for brazing. Do not use flux, soft solder, or anti-oxidant agents. If the proper material is not used, oxidized film may accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.

   • Use a tubing cutter, do not use a saw to cut pipe. De-bur and clean all cuts before assembly.

3. Brazing joints:
   • Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.

   • Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.

   • Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

GENERAL INSTALLATION GUIDELINES

Piping Materials and Handling

Selecting Field-Supplied Copper Tubing

Copper is the only approved refrigerant pipe material for use with LG Multi V commercial air conditioning products, and LG recommends seamless phosphorous deoxidized ACR type copper pipe, hard-drawn rigid type "K" or "L", or annealed-tempered, copper pipe.

- 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).

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 9: ACR Copper Tubing Material.

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

Table 10: 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 Type "K" or "L" and Soft ACR Acceptable			Rigid Type "K" or "L" Only					
Min. Bend Radius (in)	.563	.9375	1.5	2.25	3.0	3.0	3.5	4.0	4.5
Min. Wall Thickness (in)	.03	.03	.035	.040	.042	.045	.050	.050	.050

Table 8: 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.*

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.

No Substitutions

Only LG supplied Y-branch and Header fittings (as referenced below; sold separately) 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 Space II systems. The only field-provided fittings allowed in a Multi V Space II piping system are 45° and 90° elbows.

Table 11: Y-Branches and Headers.

Y-branches		Headers		
		4 branch	7 branch	10 branch
ARBLN01621	ARBLN07121	ARBL054	ARBL057	ARBL1010
ARBLN03321	ARBLN14521	ARBL104	ARBL107	ARBL2010

- *If the diameter of the branch pipe segments differ from that of the designated refrigerant piping, trim the 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.*

LG Y-branch kits consist of:

- Y-branches (liquid line, vapor lines).
- Reducer fittings as applicable.
- Molded clam-shell type insulation covers.

LG Header kits consist of:

- Two Headers (one liquid line, one vapor line).
- Reducer fittings as applicable.
- Molded clam-shell type insulation covers.

Y-branch Kits

LG supplied Y-branches must be used at each transition. Field-supplied "T" fittings or "Y" branches are not acceptable. Each LG supplied Y-branch kit comes with two (2) Y-branches for indoor units, step-down pipe reducers, and insulation covers.

Y-branches may be installed in horizontal or vertical configurations. When installed vertically, position the Y-branch so the straight-through leg is ±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 ±10° rotation.

There is no limitation on the number of Y-branches that can be installed, but there is a limitation on the number of indoor units connected to a single water source unit.

Y-branches should always be installed with the single port facing the water-source unit, the two-port end facing indoor units (Do not install Y-branches backwards as shown in Figure 15.) Refrigerant flow cannot make U-turns through Y-branches. The first Y-branch kit must be located at least three (3) feet from the outdoor unit.

Provide a minimum of 20 inches between a Y-branch and any other fittings or indoor unit piped in series. 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. The equivalent pipe length of each Y-branch (1.6') must be added to each pipe segment entered into LATS piping design software.

Figure 12: Y-branch Connections.

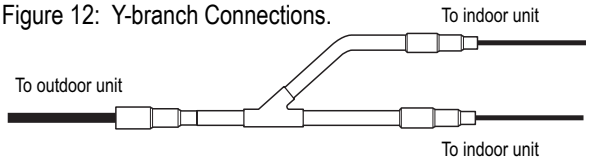


Figure 13: Y-branch Installation Alignment Specification.

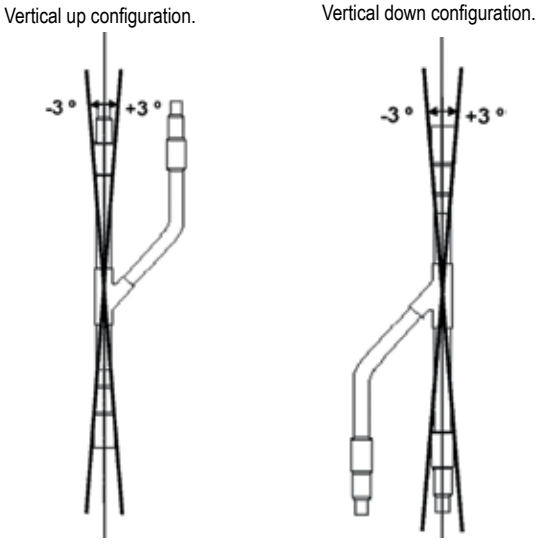


Figure 14: Horizontal Configuration End View.

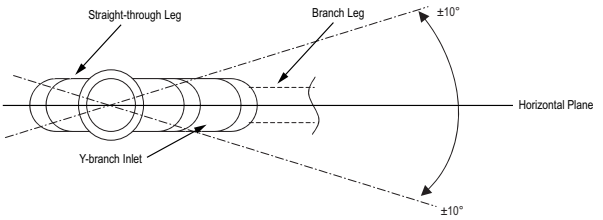
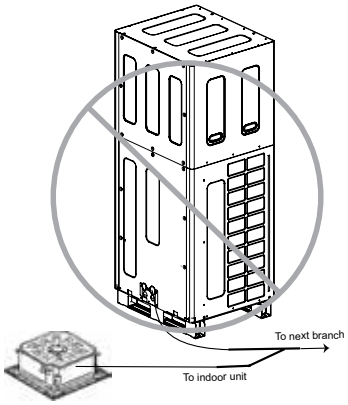


Figure 15: Diagram of an Incorrect Y-branch Installation.

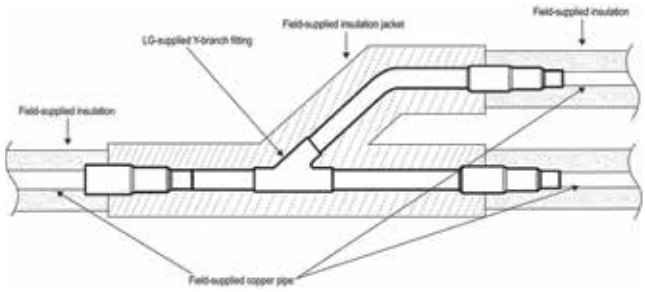


Y-branch Insulation

Each Y-branch kit comes with clam-shell type peel-and-stick insulation jackets molded to fit the Y-branch fittings—one for the liquid line, one for the vapor line.

- Check the fit of the Y-branch clam-shell insulation jacket after the Y-branch is installed.
- Mark the pipe where the insulation jacket ends.
- Remove the jacket.
- Install field-provided insulation on the three (3) pipes first.
- Peel the adhesive glue protector slip and install the clam-shell jacket over the fitting.

Figure 16: Y-branch Insulation and Pipe Detail.



Header Kits

Note:

Install Correctly

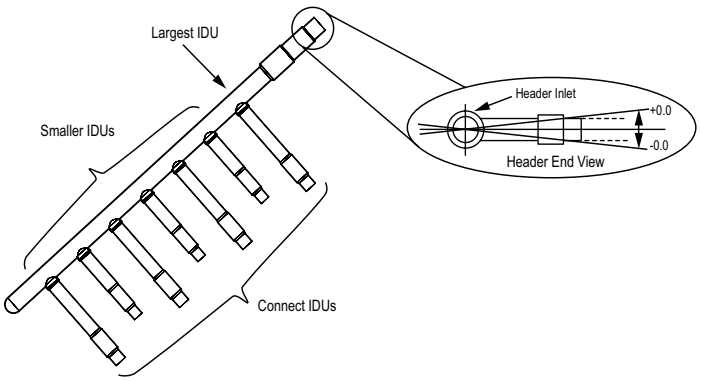
- *Y-branches can be installed upstream between the Header and the water-source unit, but a Y-branch cannot be installed between a header and an indoor unit.*
- *To avoid the potential of uneven refrigerant distribution through a header fitting, minimize the difference in equivalent pipe length between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

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. See page 34 for Header kit specifications and capacities.

Y-branches can be installed 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.

Figure 18: Header Kit—Horizontal Rotation Limit (Must be Installed Level with No Rotation).

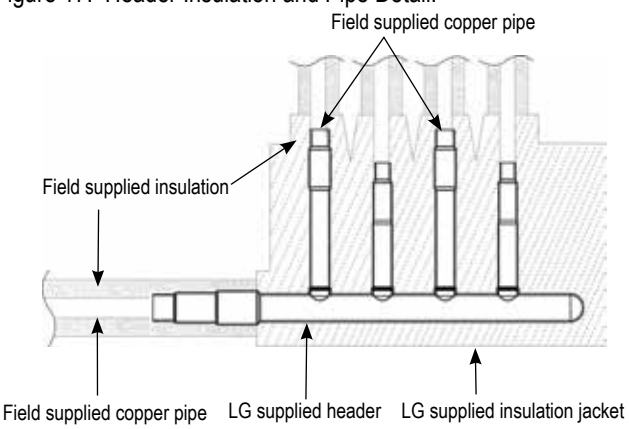


All indoor units must be mounted at an elevation below the Header fitting. All indoor units connected to a single Header fitting should be located with an elevation difference between indoor units that does not exceed 49 feet. If indoor units are located at an elevation the same as or above the Header fitting, do not use a Header. Instead, install a Y-branch fitting between the outdoor unit and the Header fitting, and connect the elevated indoor unit to the Y-branch.

Header Insulation

Each Header kit comes with clam-shell type peel and stick insulation jackets molded to fit the Header fittings—one for the liquid line and one for the vapor line.

Figure 17: Header Insulation and Pipe Detail.



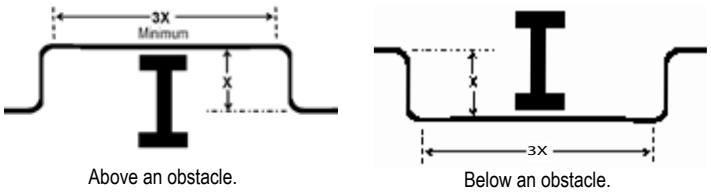
No Pipe Size Substitutions

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

Obstacles

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

Figure 19: Installing Piping Above and Below an Obstacle.



Above an obstacle. Below an obstacle.

Copper Expansion and Contraction

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

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

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

The refrigerant pipe support system must be engineered to allow free expansion to occur. When a segment of pipe is mounted between two fixed points, provisions must be provided to allow pipe expansion to naturally occur. The most common method is the inclusion of expansion Loop or U-bends. See Figure 20 on page 23. 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 10, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

General Example:

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

Vapor Line

Transporting Hot Vapor: 120 ft. pipe at 120°F = 1.68 in.
Transporting Suction Vapor: 120 ft. pipe at 40°F = 0.48 in.
Anticipated Change in Length: 1.68 in. – 0.48 in. = 1.20 in.

Liquid Line

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

When creating an expansion joint, the joint height 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 11. Use soft copper with long radius bends on longer runs or long radius elbows for shorter pipe segments. Using the anticipated linear expansion (LE) distance calculated, look up the Expansion Loop or U-bend minimum design dimensions. If other types of expansion joints are chosen, design per ASTM B-88 Standards.

GENERAL INSTALLATION GUIDELINES

Piping Materials and Handling

See table below for precalculated anticipated expansion for various pipe sizes and lengths of refrigerant tubing.

To find the anticipated expansion value:

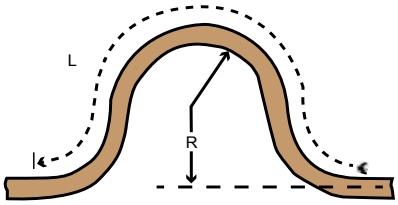
1. From the table below, find the row corresponding with the actual feet of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe.
3. In the column showing the minimum pipe temperature, look up the anticipated expansion distance corresponding to the segment length. Do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

Table 12: Linear Thermal Expansion of Copper Tubing in Inches.

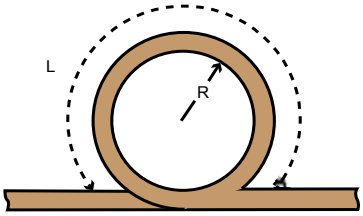
Pipe Length[1]	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	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

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

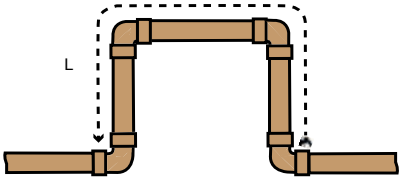
Figure 20: Coiled Expansion Loops and Offsets.



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) (in)		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).*

GENERAL INSTALLATION GUIDELINES

Piping Materials and Handling

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 V Space II 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 allows the installation of field-supplied ball valves with Schrader ports at each indoor unit. Full-port isolation ball valves with Schrader ports (positioned between valve and indoor unit) rated for use with R410A refrigerant should be used on both the liquid and vapor lines.

If valves are not installed and a single indoor unit needs to be removed or repaired, the entire system must be shut down and evacuated. If isolation ball valves are installed, and an indoor unit needs to be repaired, the unaffected indoor units can remain operational. Reclamation of refrigerant, then, can be restricted to a single indoor unit.

Position valves with a minimum distance of three (3) to six (6) inches of pipe on either side of the valve, and placed between six (6) and twelve (12) inches from the Y-branch or header connecting the run-out pipe to the upstream main or branch pipe. If ball valves are installed closer to the indoor unit, a section of pipe becomes a dead zone when the valves are closed where oil may accumulate.

Valves shall be accessible for service. If necessary, install drywall access doors or removable ceiling panels, and position the valves to face the access door or ceiling panel opening. Mount valves with adequate space between them to allow for placement of adequate pipe insulation around the valves. Recommended best practice is to clearly label and document locations of all service valves, Y-branches, and headers.

Using Elbows

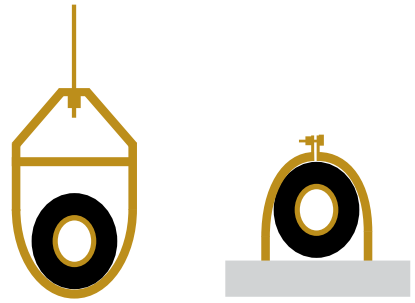
Field supplied elbows are allowed as long as they are designed for use with R410A refrigerant. The designer and installer, however, should be cautious with the quantity and size of fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment in the LATS program. See page 27 for equivalent lengths.

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 (see Figure 21). 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.

Figure 21: Pipe Hanger Details.



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 as shown in Figure 22. Support piping at indoor units as shown in Figure 25. Support Y-Branch and Header fittings as shown in Figures 23 and 24.

Figure 22: Typical Pipe Support Location—Change in Pipe Direction.

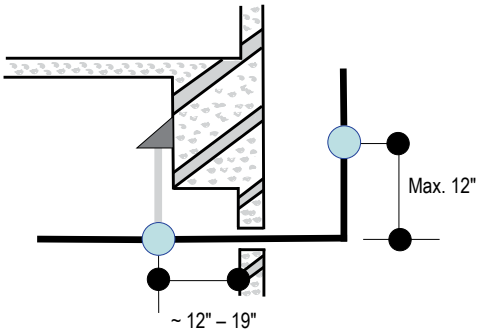


Figure 23: Pipe Support at Indoor Unit.

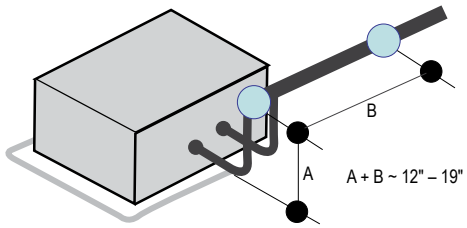


Figure 24: Pipe Support at Y-branch Fitting.

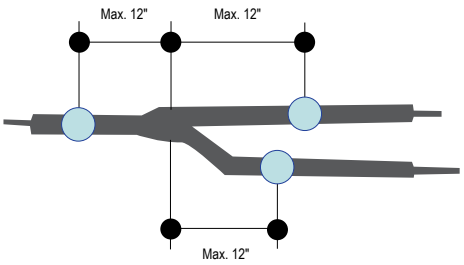
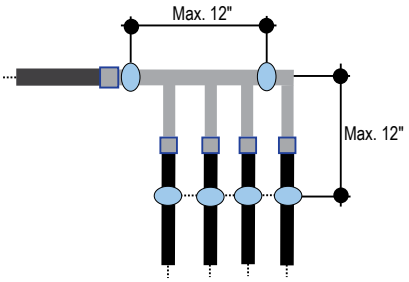


Figure 25: Pipe Support at Header Fitting.



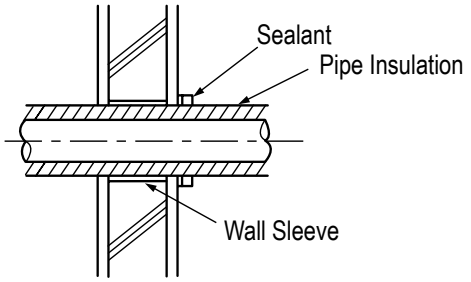
Pipe Slope

The horizontal pipe slope cannot exceed 10° up or down.

Pipe Sleeves and Wall Penetrations

LG requires that all pipe penetrations through walls, floors, and pipes buried underground be properly insulated and routed through an appropriate wall sleeve of sufficient size to prevent compression of refrigerant pipe insulation and free movement of the pipe within the sleeve. Underground refrigerant pipe shall be routed inside a protective sleeve to prevent insulation deterioration.

Figure 26: Typical Pipe Penetration.



REFRIGERANT PIPING CONNECTIONS

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

Note:

Avoid Pipe Damage

- *When routing field-provided piping inside the Space II unit frame, avoid causing vibration that will damage the components.*
- *Correctly route the piping so it does not make contact with the compressor casing, terminal cover, or mounting bolts. Allow room for field installation.*
- *Properly insulate all refrigerant pipes separately up to the service valve body inside the confines of the unit frame.*

Refrigerant piping can be connected through the access holes on the front panel of the Multi V Space II frame.

- Use nitrogen at 3 psi flow during welding.
- If nitrogen was not used during welding, oxidized contaminants may build inside the piping and effect valve and condenser operation.

Figure 27: Space II Refrigerant Piping (and Wiring) Direction.

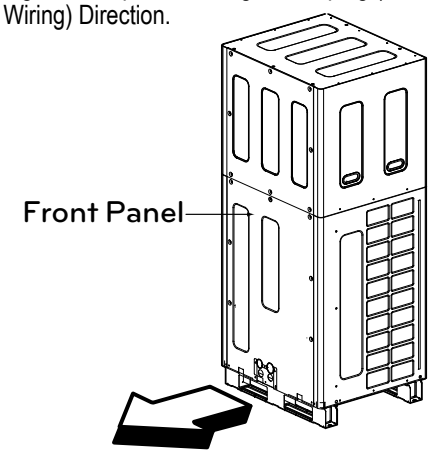
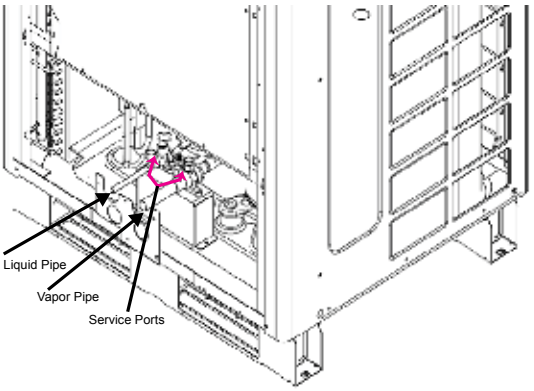


Table 14: Space II Unit Refrigerant Pipe Connections (All Brazed Type).

Model	Liquid Conn. (inches)	Vapor Conn. (inches)
ARUN053FG2	3/8	3/4

Figure 28: Space II Unit Pipe Connections.



Space II Unit Pipe Routing

1. Remove the leak-prevention cap.
2. Check if the liquid and vapor pipes are fully locked.
3. Vacuum out any remaining refrigerant or air through the service port.

Note:

The leak prevention cap attached to the outdoor unit must be removed before piping installation.

Device Connection Limitations

- The minimum number of connected and operating indoor units to Multi V Space II systems is one (1), taking into consideration the minimum combination ratio.
- The maximum number of indoor units on a Multi V Space II unit is nine (9).

One of the most critical elements of a Multi V Space II system is the refrigerant piping. The table below lists pipe length limits that must be followed in the design of a Multi V Space II refrigerant pipe system:

Table 15: Multi V Space II Refrigerant Piping System Limitations.

Pipe Length (ELF = Equivalent Length of pipe in Feet)	**Longest total equivalent piping length**	≤ 476 feet
	Longest distance from outdoor unit (ODU) to indoor unit (IDU)	230 feet (Actual) 296 feet (Equivalent)
	Distance between fittings and indoor units	≥ 20 inches
	Minimum distance between Indoor unit to any Y-branch	≤ 131 feet
	Minimum distance from indoor unit to Y-branch	3 feet
	Maximum distance between first Y-branch to farthest indoor unit	131 feet
Elevation (All Elevation Limitations are Measured in Actual Feet)	**If outdoor unit is above indoor unit**	98.4 feet
	If outdoor unit is below indoor unit	98.4 feet
	Between any two indoor units	49 feet

Table 16: Equivalent Piping Length for Y-branches, Headers, and Other Piping Components.

Component	Size (Inches)													
	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-5/8	1-3/4	2-1/8
Elbow (ft.)	0.5	0.6	0.7	0.8	1.2	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.5	2.8
Y-branch (ft.)[1]	1.6													
Header (ft.)	3.3													

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

Space II Unit.

IDU: Indoor Units.

A: Main Pipe from Space II Unit to Y-branch.

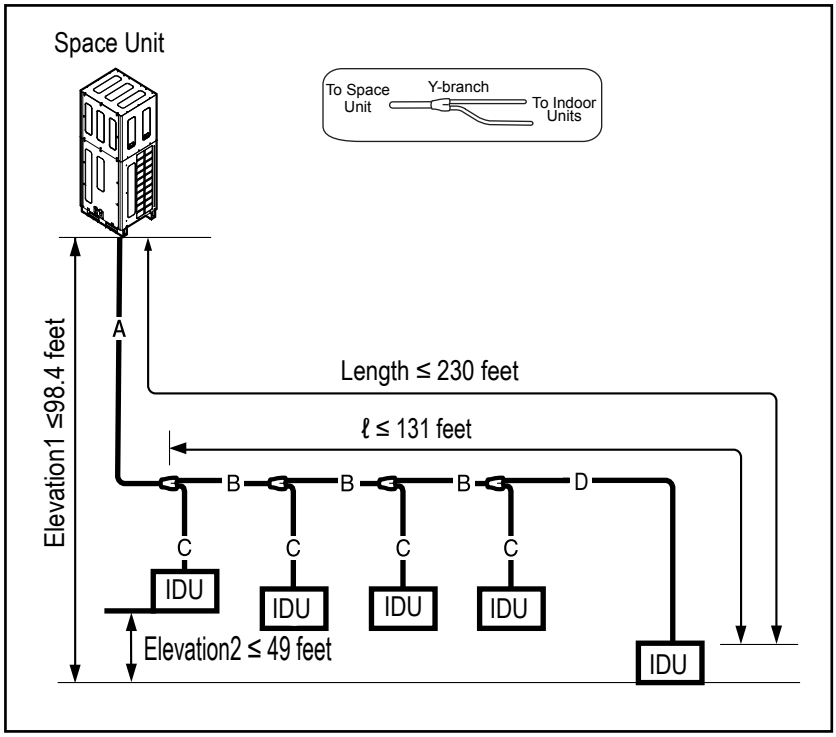
B: Y-branch to Y-branch.

C: Y-branch to Indoor Unit.

D: Y-branch to Farthest Indoor Unit.

Note:

- *Always reference the LATS Multi V software report.*
- *See pages 29-30 for refrigerant pipe diameter and pipe length tables.*



System Using a Header

Example: Six (6) indoor units connected

Space II Unit.

IDU: Indoor Units.

Header.

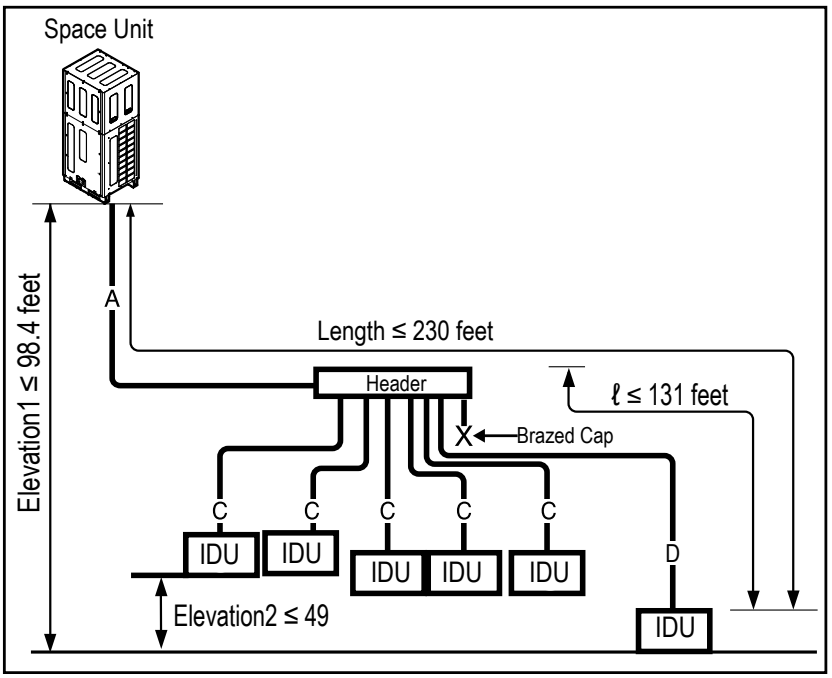
A: Main Pipe from Space II Unit to Header.

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 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 29-30 for refrigerant pipe diameter and pipe length tables.*



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

Space II Unit.

IDU: Indoor Units.

Y-branches.

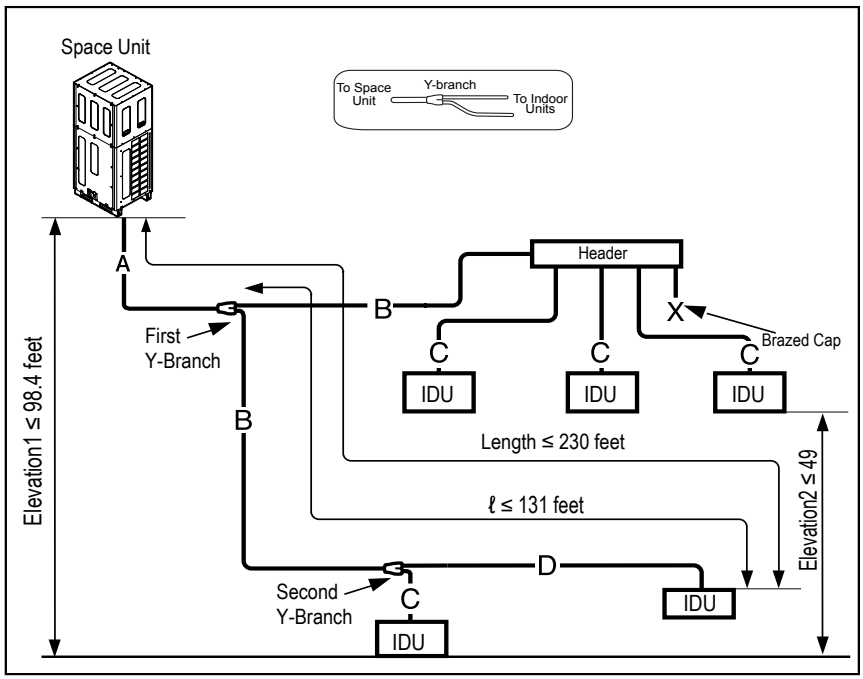
Header.

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 18: Pipe Capabilities.

Length	Total pipe length	Longest actual pipe length	Equivalent pipe length[1]
	A + ΣB + ΣC + D ≤475.7 feet	A + B + D ≤230 feet	≤295 feet
ℓ	Longest pipe length after first branch		
	B + D ≤ 131 feet		
Elevation1	Elevation differential (Space II unit ↔ Indoor unit)		
	≤ 98.4 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 17: 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 Space II unit.*
- *Y-branches and other header branches cannot be installed downstream of the initial header branch.*

REFRIGERANT PIPING CONNECTIONS

Selecting the Refrigerant Piping

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

Selecting the Refrigerant Piping

Example: Five (5) indoor units connected

Space II Unit.

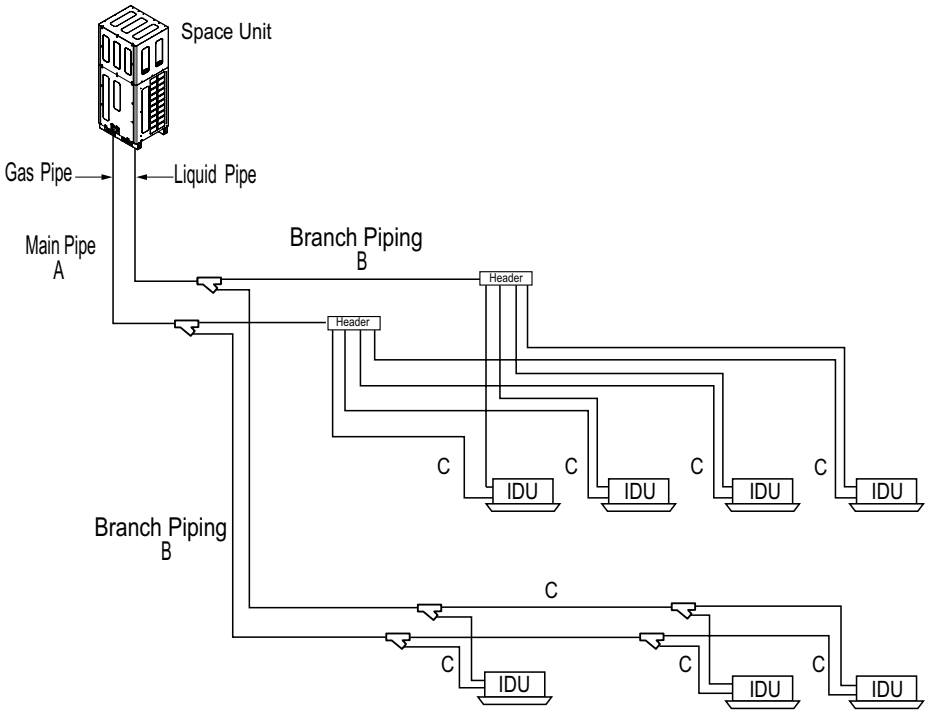
IDU: Indoor Units.

A: Main Pipe from Space II Unit to Y-branches.

B: Branch Piping.

C: Branch Piping to Indoor Unit (IDU).

Figure 29: Selecting Refrigerant Piping.



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

Space II Unit Capacity (ton)	Liquid pipe (inches OD)	Vapor pipe (inches OD)
4.4	Ø3/8	Ø3/4

Table 20: 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 21: 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).

REFRIGERANT PIPING CONNECTIONS

Required LATS Multi V Piping Design Software File

The proper design and installation of the refrigerant piping system is a critical element of the Multi V Space II system. Multi V Space II requires two pipes between system components – a liquid line and a vapor line. A properly designed refrigerant piping system ensures that refrigerant is delivered to the evaporator coils electronic expansion valve (EEV) in a pure liquid state free of gas bubbles. A proper design also ensures a sufficient refrigerant gas flow rate in the vapor line that eliminates the possibility of refrigeration oil from collecting in the vapor lines.

Refrigerant Piping Quality Assurance

LG's LATS Multi V software makes designing the refrigerant system easy. LATS Multi V is a Windows®-based application that assists the engineer in the design of the refrigeration distribution pipe system, verifies the design complies with pipe design limitations, applies capacity correction factors, and calculates the system refrigerant charge. The piping system can be entered manually into LATS from a one-line pipe diagram.

To ensure that the refrigerant piping design meets LG's quality standards, a LATS refrigerant piping design must be provided with every Multi V Space II 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 Output for Altitude

When a system is installed at elevations significantly above sea level, the designer must also consider the impact air density has on the capacity of the indoor and Space II units. LATS does not de-rate indoor unit capacity for high altitude applications. Locally accepted altitude correction factors must be applied to indoor unit capacities.

Design Choices

LATS Multi V software is flexible, offering the HVAC system engineer a choice of two design methods: CAD mode and Tree mode.

CAD Mode

Using the CAD mode, the refrigerant pipe design and layout work is performed concurrently. Simply import a copy of a plan view drawing (.dwg format) for floor of the structure into LATS Multi V software. Multi V air-source units, heat recovery units, and indoor units can be selected from drag and drop lists and placed on the floor plan drawing(s), and interconnecting pipes between system components will be drafted directly on the drawing set. LATS will size the refrigerant piping, certify the design, and provide a detailed materials report and system schematic. Use the export feature to create a CAD file (.dxf format) that can subsequently be imported into the building design drawings.

- Import the building's architectural CAD (.dwg and .dxf format).
- Import building loads from an external file (.xls and .xlsx format).
- Layout refrigerant piping directly onto an overlay of the building drawing.
- Automatically calculates pipe segment lengths based on drawing layout.
- Creates an export image file for import to the building drawing set (.dxf format).
- Generates a system engineering report (.xls or .xlsx format).

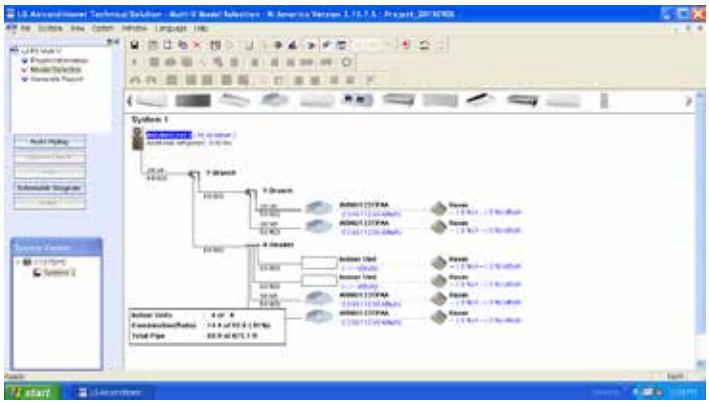
Tree Mode

Using the TREE mode, the engineer can quickly create a one-line schematic drawing of the 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).

In either case, 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.

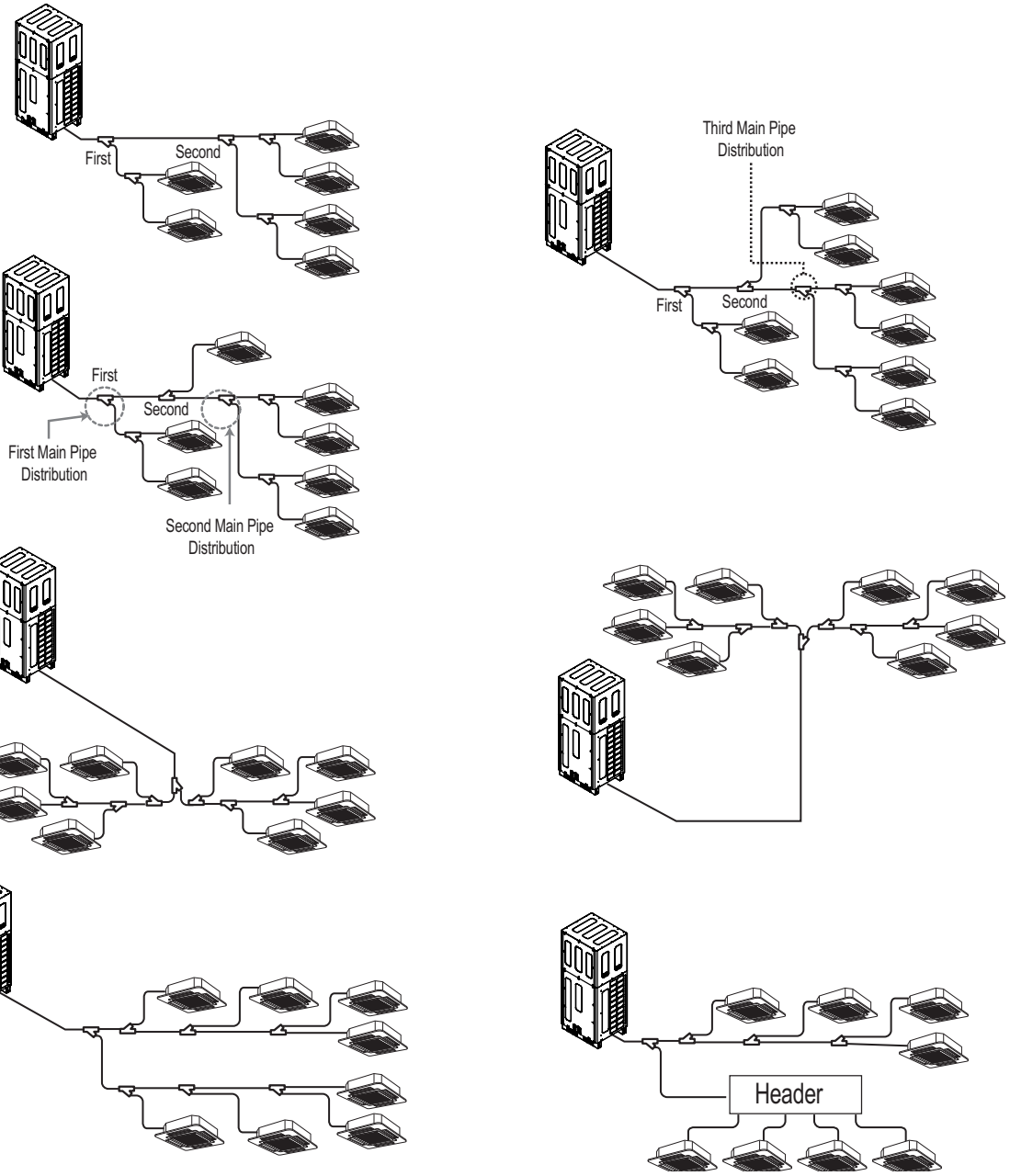
Figure 30: Screenshot of LATS Pipe System Design Tool in Tree Mode.



REFRIGERANT PIPING CONNECTIONS

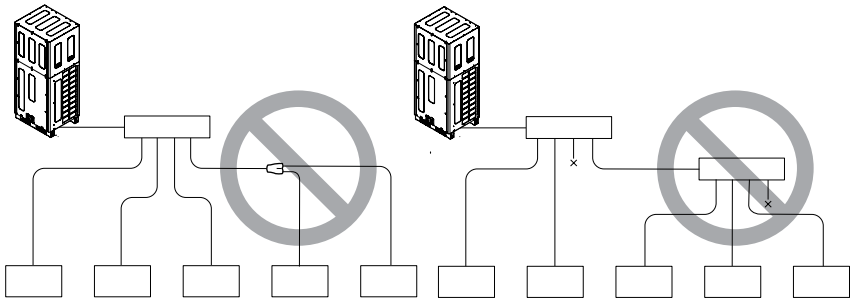
Acceptable Piping Layouts

Various Acceptable Layouts



Unacceptable Piping System Layouts

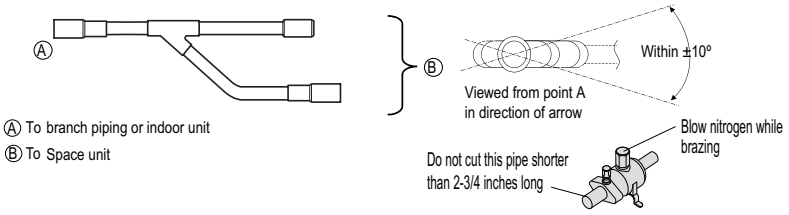
A second branch cannot be installed after a header.



Y-branches

Figure 31: Y-Branch Installation Recommendations.

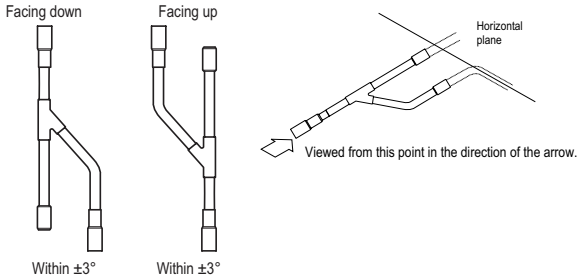
Install the branch pipe between the outdoor units so that the outlet pipe is parallel with the surface.



Ⓐ To branch piping or indoor unit

Ⓑ To Space unit

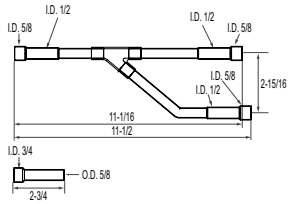
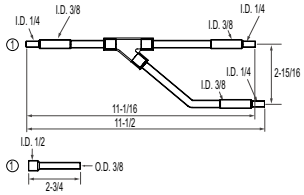
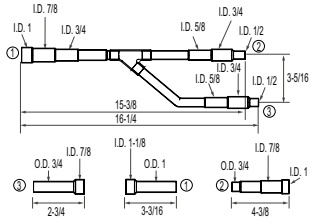
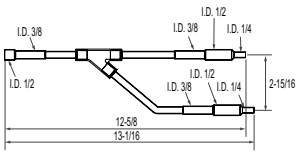
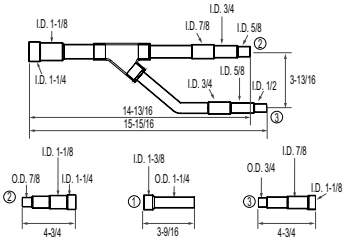
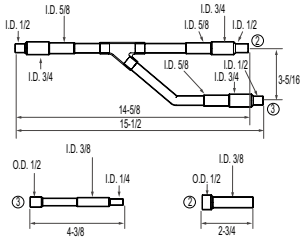
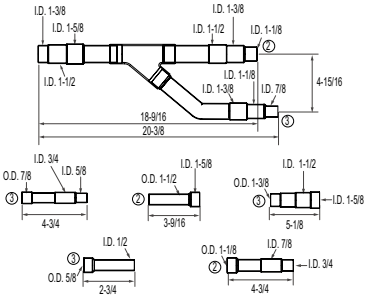
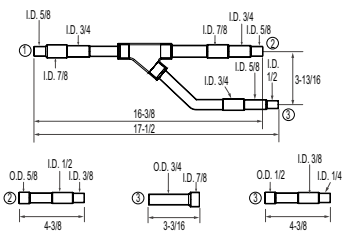
Figure 32: Y-Branch Horizontal Plane.



- Y-branches must be installed horizontally or vertically as shown in the diagrams above.
- Configuration can be any of the above, providing the horizontal 10 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 22: Y-Branch Table.

Unit: Inch

Models	Vapor pipe	Liquid pipe
ARBLN01621		
ARBLN03321		
ARBLN07121		
ARBLN14521		

REFRIGERANT PIPING CONNECTIONS

Branch Pipe Fittings

Headers

- The largest-capacity indoor unit must be installed closest to the Space II 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 33: Header Installation.

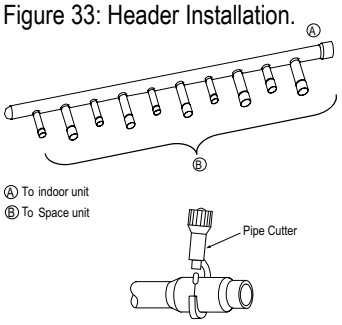


Figure 34: Capping Unused Ports and Horizontal Plane.

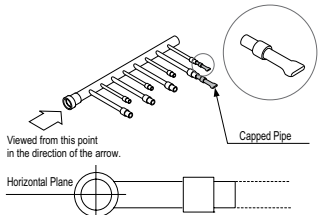
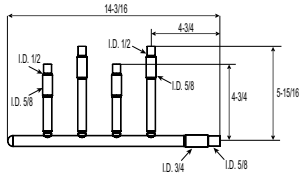
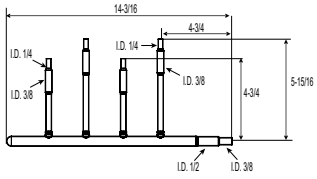
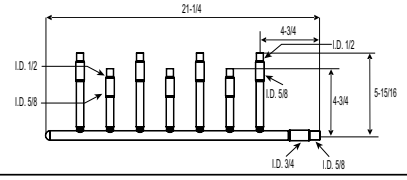
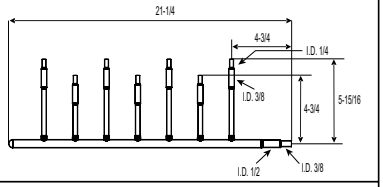
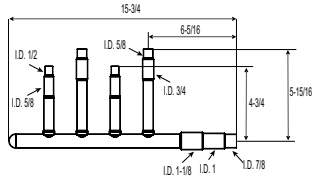
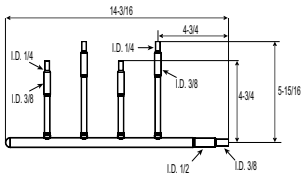
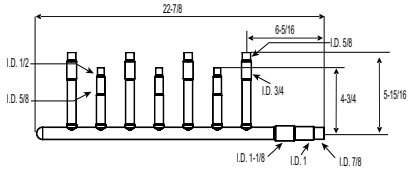
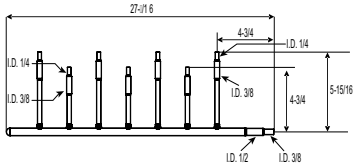
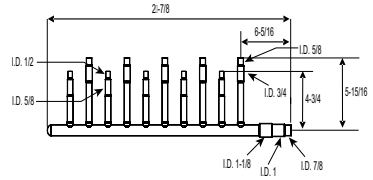
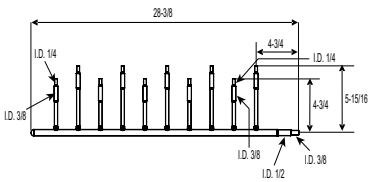
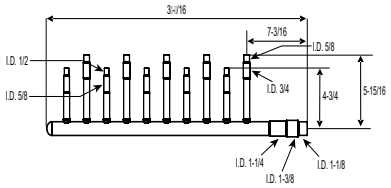
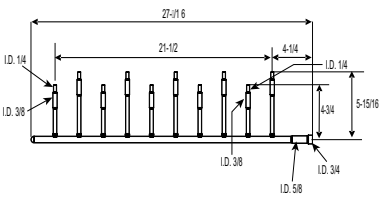


Table 23: Header Table.

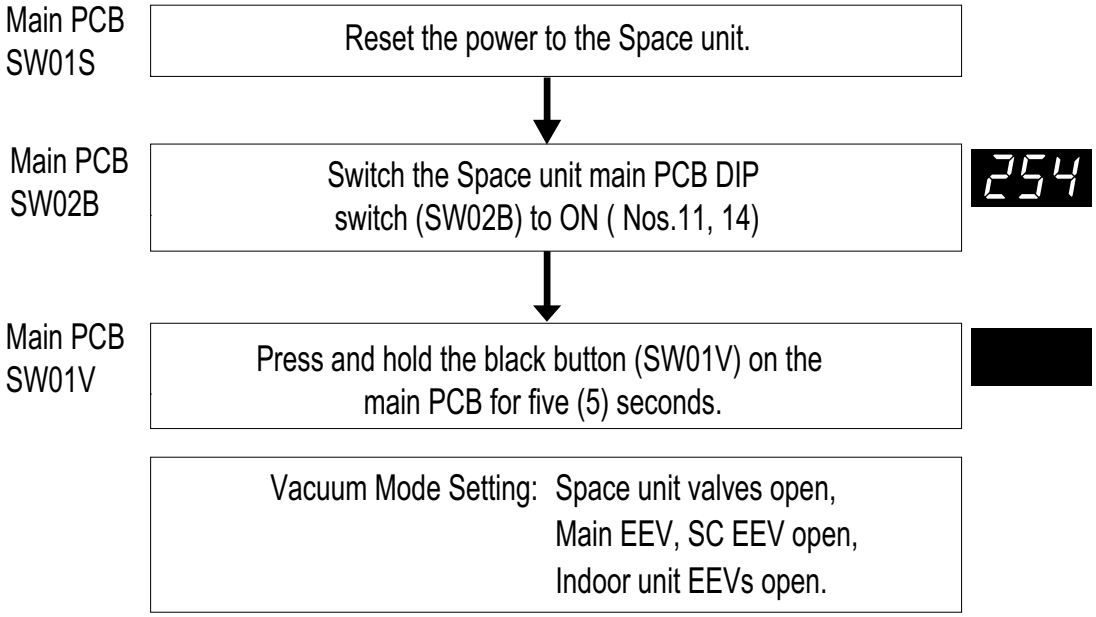
Unit: inch

Models	Vapor pipe	Liquid pipe
4 branch ARBL054		
7 branch ARBL057		
4 branch ARBL104		
7 branch ARBL107		
10 branch ARBL1010		
10 branch ARBL2010		

Vacuum Mode

Vacuum mode is used for creating a vacuum in the system after the compressor or other Space II unit components have been replaced, or if an indoor unit has been replaced or added.

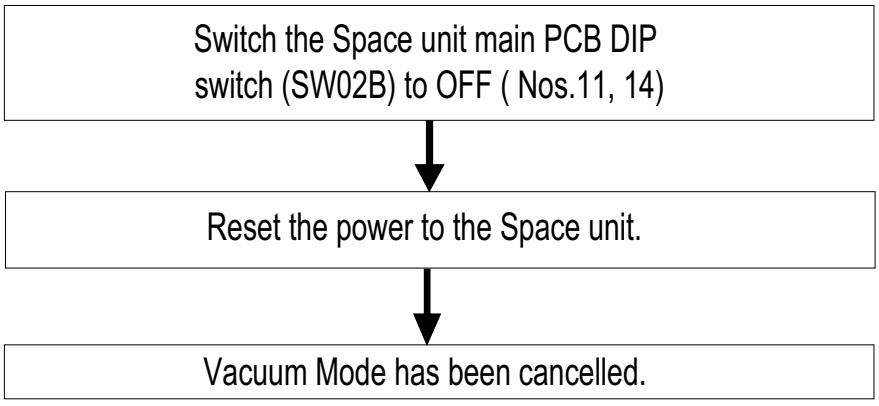
Figure 35: Setting the Vacuum Mode.



Note:

The Space II unit does not operate during vacuum mode; Space II unit compressor will not operate.

Figure 36: Canceling the Vacuum Mode.



Leak Test

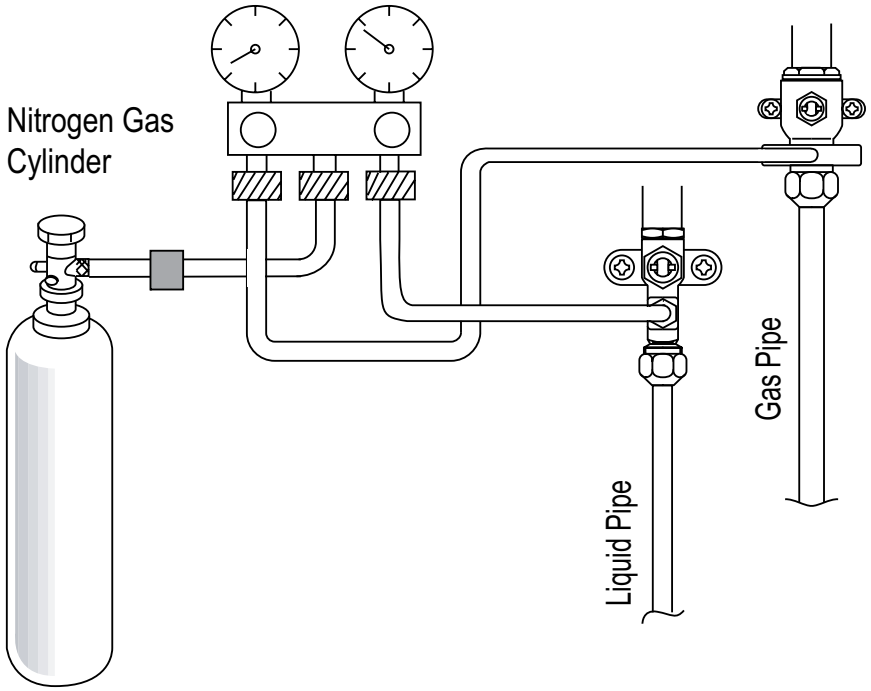
Note:

The indoor units must be OFF, and the DIP switches must be set to Vacuum Mode (see page 35) before initializing the leak test.

First set the DIP switches to Vacuum Mode (see page 35). Then, perform the leak test by pressurizing nitrogen gas to 550 psi on both the liquid and gas pipes. Test with the piping service valves closed. If the pressure does not drop for twenty-four (24) hours, the system passes the test. If the pressure drops, there is a nitrogen leak in the system. Find the leak, repair, and then test again.

To prevent the nitrogen from entering the refrigeration system in the liquid state, the cylinder must be used in a standing vertical position.

Figure 37: Leak Test Diagram.



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 1.45 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

Evacuation

Evacuate the system from the Space II unit's liquid and gas piping service ports (vacuum with both service valves closed).

- *Use a vacuum pump that can evacuate down to 500 microns.*
- *Never air purge with refrigerant.*

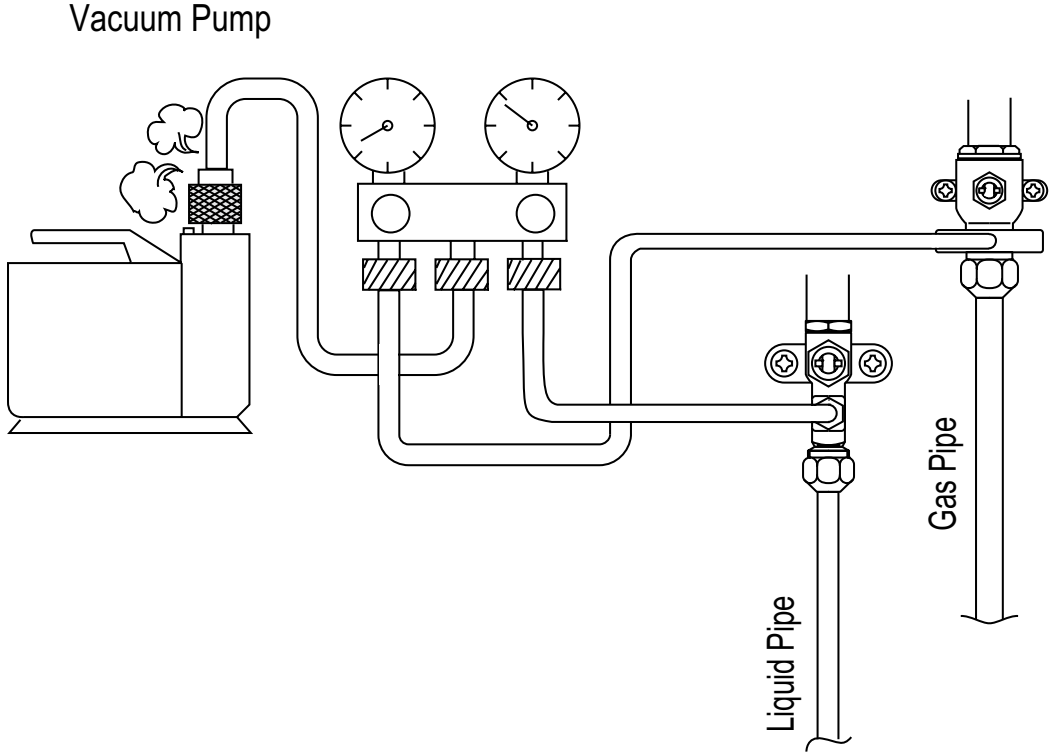
1. Evacuate for more than two (2) hours; bring the system to 500 microns. Maintain the system under 500 microns for one (1) hour, and watch if the vacuum gauge rises. If the gauge rises, the system may contain moisture or may have a leak somewhere (water may have entered the piping during a rainy period or if the installation took a long time to complete).

2. If moisture remains in the piping after the system is evacuated for two (2) hours, break the vacuum (down to 7.5 psi with nitrogen gas. Then evacuate the system again with the vacuum pump for at least one (1) hour to 500 microns If the system does not reach 500 microns within two (2) hours, repeat the vacuum break and evacuation procedure until the gauge does not rise.

⚠ WARNING

- *If system refrigerant charge is not performed soon after the evacuation procedure is complete, humid air may access the Space II unit and mix with the refrigerant, causing the refrigerant cycle to malfunction and damage the Space II unit.*
- *Do not charge the refrigerant when the compressor is operating. Liquid may infiltrate, causing the compressor to malfunction.*
- *The refrigerant cycle may malfunction or become damaged if unspecified refrigerants are mixed with the required refrigerant.*
- *Add an accurate amount of refrigerant charge; too much or too little refrigerant may cause the system to malfunction.*
- *The indoor unit EEVs may become damaged if the indoor units are turned off and on repeatedly without refrigerant in the lines.*
- *R410A is a mixed refrigerant, therefore, any 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.*

Figure 38: Space II Unit Evacuation Procedure.



REFRIGERANT PIPING CONNECTIONS

Additional 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 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	Wall Mounted + Art Cool Mirror	SE	7k to 15k		0.53	
9	Wall Mounted + Art Cool Mirror	S8, S5	18k to 24k		0.62	
10	1-Way Cassette	TJ	7k to 12k		0.44	
11	2-Way Cassette	TL	18k to 24k		0.35	
12	4-Way 2' x 2' Cassette	TR	5k to 7k		0.40	
13	4-Way 2' x 2' Cassette	TR	9k to 12k		0.55	
14	4-Way 2' x 2' Cassette	TQ	15k to 18k		0.71	
15	4-Way 3' x 3' Cassette	TN	9k to 15k		1.06	
16	4-Way 3' x 3' Cassette	TM	18k to 24k		1.41	
17	4-Way 3' x 3' Cassette	TP	24k to 28k		1.06	
18	4-Way 3' x 3' Cassette	TN	36k		1.41	
19	4-Way 3' x 3' Cassette	TM	42k to 48k		1.41	
20	High Static Ducted	BH	7k to 24k		0.57	
21	High Static Ducted	BG	15k to 42k		0.97	
22	High Static Ducted	BR	48k to 54k		1.37	
23	High Static Ducted	B8	76k to 95k		2.20	
24	Low Static Ducted, Low Static Ducted Bottom Return	B1, B3	7k to 15k		0.37	
25	Low Static Ducted, Low Static Ducted Bottom Return	B2, B4	18k to 24k		0.82	
26	Vertical / Horizontal Air Handling Unit	NJ	12k to 24k		1.04	
27	Vertical / Horizontal Air Handling Unit	NJ	30k		1.04	
28	Vertical / Horizontal Air Handling Unit	NJ	36k		1.57	
29	Vertical / Horizontal Air Handling Unit	NK	42k to 54k		2.00	
30	Ceiling Suspended	VJ	18k to 24k		0.77	
31	Convertible Surface Mount—Ceiling/Wall	VE	9k to 12k		0.22	
32	Floor Standing	CE (U)	7k to 15k		0.37	
33	Floor Standing	CF (U)	18k to 24k		0.82	
34	**Additional Refrigerant Charge Required**					
35	Space II Unit Factory Refrigerant Charge	ARUN053GF2	53K		7.7	
36	**Total System Charge: Sum of Additional Refrigerant Charge Required and Space II Unit Factory Refrigerant Charge**					

[1]CF (Ref.) = Correction Factor for Refrigerant Charge.
[2]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).

Table 24: Total Space II Unit Refrigerant Charge.

Nominal Tons	Model Number	Refrigerant Charge (lbs.)
4.4	ARUN053GF2	7.7

⚠ WARNING

See cautions for refrigerant leakage on pages 63-64

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

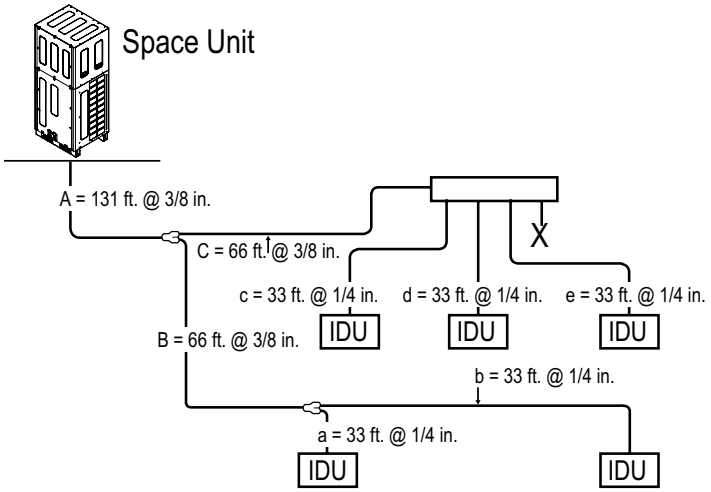
Additional Refrigerant Charge Formula:

Space II 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 0.237 lbs./ft.
+ Total liquid piping length (feet) @ 3/4 inches x 0.178 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)

Figure 39: Example of Additional Refrigerant Charge Calculation.



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

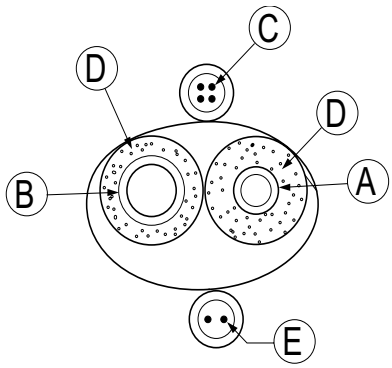
= 5.37 (A) + 2.71 (B) + 2.71 (C) + 2.46 ([a+b+c+d+e] x 0.015) + 0 (CF) = 13.3

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

Refrigerant Piping Insulation

To prevent heat loss/heat gain through the refrigerant piping, all refrigerant piping including liquid lines and vapor lines must be insulated separately. Insulation must be a minimum 1/2" thick, and thickness may need to be increased based on ambient conditions and local codes. All refrigerant piping including Y-branch and Header connections, field-provided isolation ball valves, service valves, and elbows must be completely insulated using closed-cell pipe insulation. All insulation joints must be glued with no air gaps. Insulation material must fit snugly against the refrigeration pipe with no air space between it and the pipe. Insulation passing through pipe hangers, inside conduit, and/or sleeves must not be compressed. Protect insulation inside hangers and supports with a second layer. All pipe insulation exposed to direct sunlight and deterioration-producing elements must be properly protected with a PVC-aluminum vapor barrier jacket, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover. The design engineer should perform calculations to determine if the factory-supplied insulation jackets have sufficient thickness to meet local codes and to avoid sweating at jobsite conditions. Maximum refrigerant pipe temperature is 227°F; minimum refrigerant pipe temperature is -4°F. Add additional insulation if necessary.

Figure 40: Typical Pipe Insulation, Power Wire and Communications Cable Arrangement.



Ⓐ Liquid Pipe
Ⓑ Gas Pipe
Ⓒ Power Wiring
Ⓓ Insulation
Ⓔ Communication Cables

Figure 41: Typical Insulation Butt-Joint at Indoor Unit Casing.

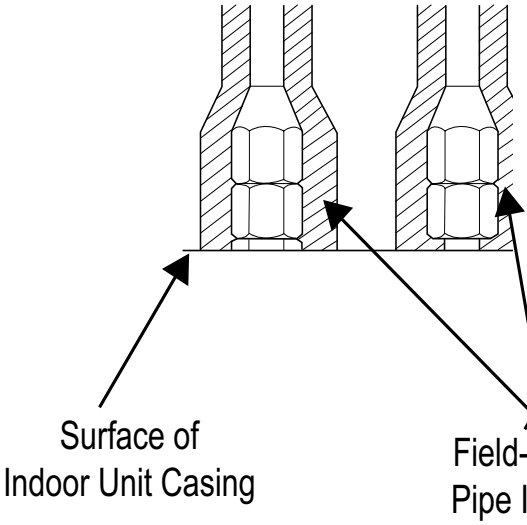
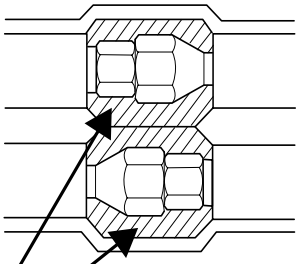


Figure 42: Typical Refrigerant Flare Fitting Insulation Detail.



- *Do not insulate gas and liquid pipes together.*
- *Be sure to fully insulate the piping connections.*

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

Note:

Follow locals codes when selecting EPDM insulation wall thickness.

Table 25: Insulation Guidelines for Typical and Special Circumstances.

Classification		Air-conditioned location		Non-air conditioned location	
		1. Typical location	2. Special location	3. Typical location	4. Special location
Liquid pipe	ø1/4 inches	1/2 inches	1/2 inches	1/2 inches	1/2 inches
	ø3/8 inches				
	≥ø1/2 inches	1/2 inches	1/2 inches	1/2 inches	1/2 inches
Vapor pipe	ø3/8 inches	1/2 inches	3/4 inches	3/4 inches	1 inch
	ø1/2 inches				
	ø5/8 inches				
	ø3/4 inches				
	ø7/8 inches				
	ø1 inch				
	ø1-1/8 inches	3/4 inches	1 inches	1 inch	
	ø1-1/4 inches				
	ø1-3/8 inches				
	ø1-1/2 inches				
	ø1-3/4 inches				

1. Typical location (Air-conditioned location): When the piping passes through an indoor area where the indoor unit operates.

• Apartment, classroom, office, mall, hospital, etc.

2. Special location (Air-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 location (Non-Air conditioned location): When the piping passes through an indoor area where the indoor unit does not operate.

• Hallway or a dormitory or school, etc.

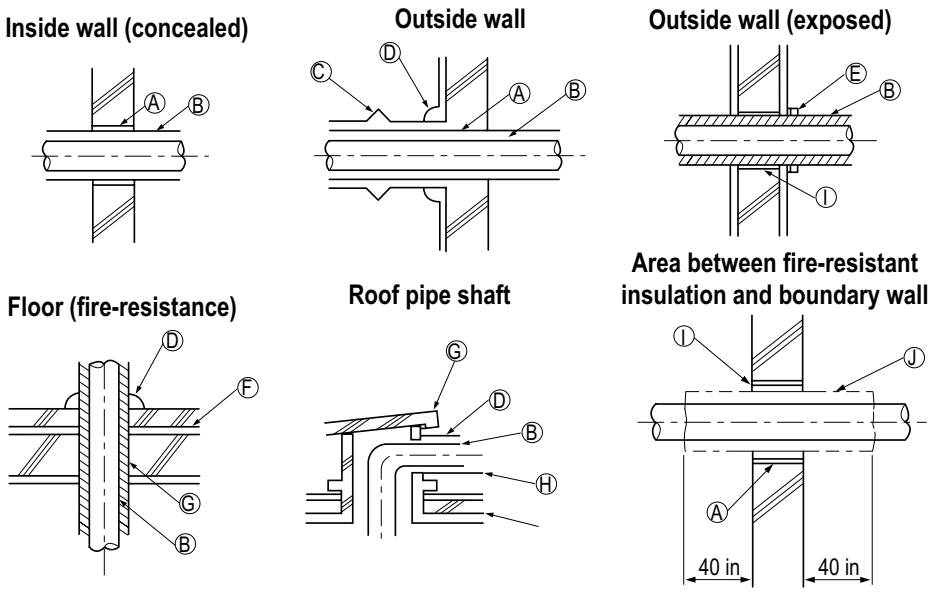
4. Special location (Non-Air conditioned location): If conditions 1 and 2 below are present.

1. When the piping passes through an indoor area where the indoor unit does not operate.
2. When the humidity is high and there is no air flow in the location where the piping is installed.
   • The thickness of the above insulation material is based on heat conductivity of 0.61 Btu/in/h/ft^2/°F.

Pipe Sleeves at Penetrations

LG requires that all pipe penetrations through walls, floors, and pipes buried underground be properly insulated and routed through an appropriate wall sleeve of sufficient size to prevent compression of refrigerant pipe insulation and free movement of the pipe within the sleeve. Underground refrigerant pipe shall be routed inside a protective sleeve to prevent insulation deterioration.

Figure 43: Pipe Sleeves at Penetrations.



Ⓐ 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:

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

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 45: Y-Branch Insulation.

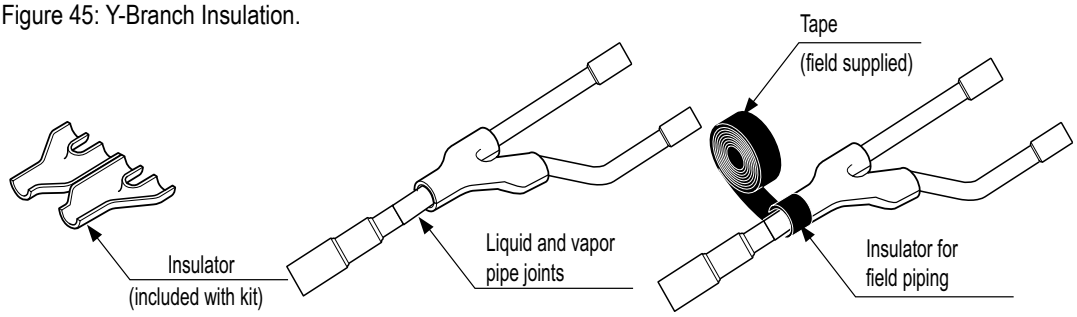


Figure 46: Header Insulation.

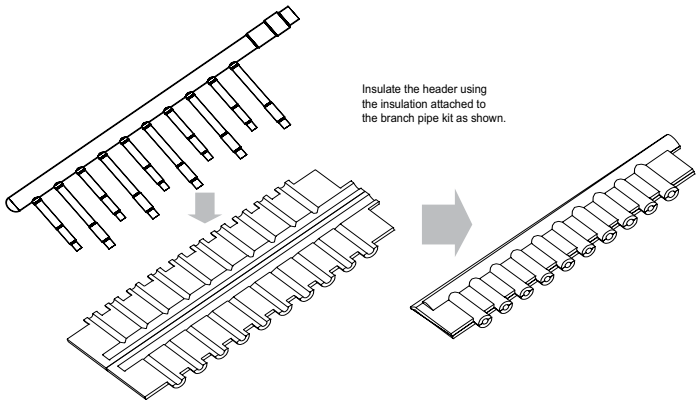


Figure 44: Joints between branch and pipe should be sealed with tape included in each kit.

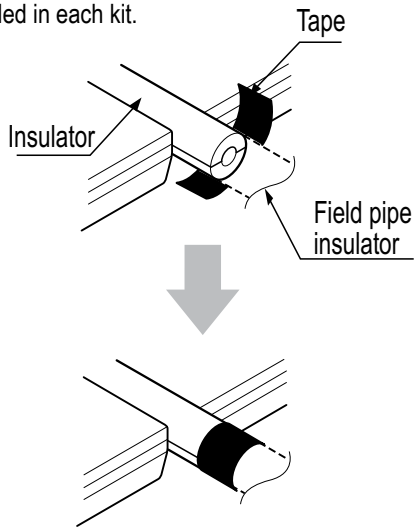
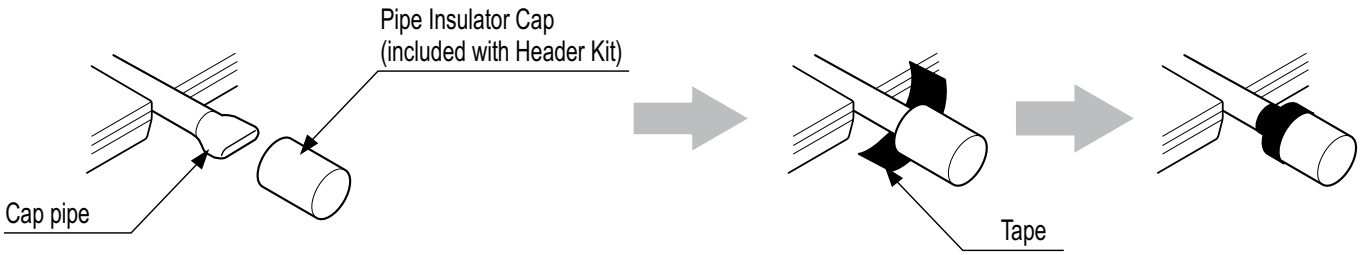


Figure 47: Capped pipes should be insulated using the cap included in each kit, and then taped as shown.



Note:

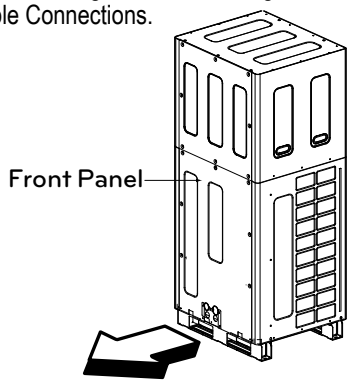
Additional Insulation for Y-Branches and Headers May be Required in Humid Environments.

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.

⚠ 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.*
- *Undersized wiring may lead to unacceptable voltage at the unit and may cause unit malfunction and be a fire hazard.*
- *Properly ground the Space II unit and indoor units. Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Ground wiring must always be installed by a qualified technician. 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 an National Electrical Code-approved earth ground can result in equipment malfunction, property damage, electric shock, physical injury or death.*

Figure 48: Accessing the Power Wiring and Communication Cable Connections.



To access the power wiring / communications cable connections, remove all of the screws on the front panel and pull it forward.

- *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, property damage, electric shock, physical injury or death.*
- *Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.*
- *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.*

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 26: 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.*

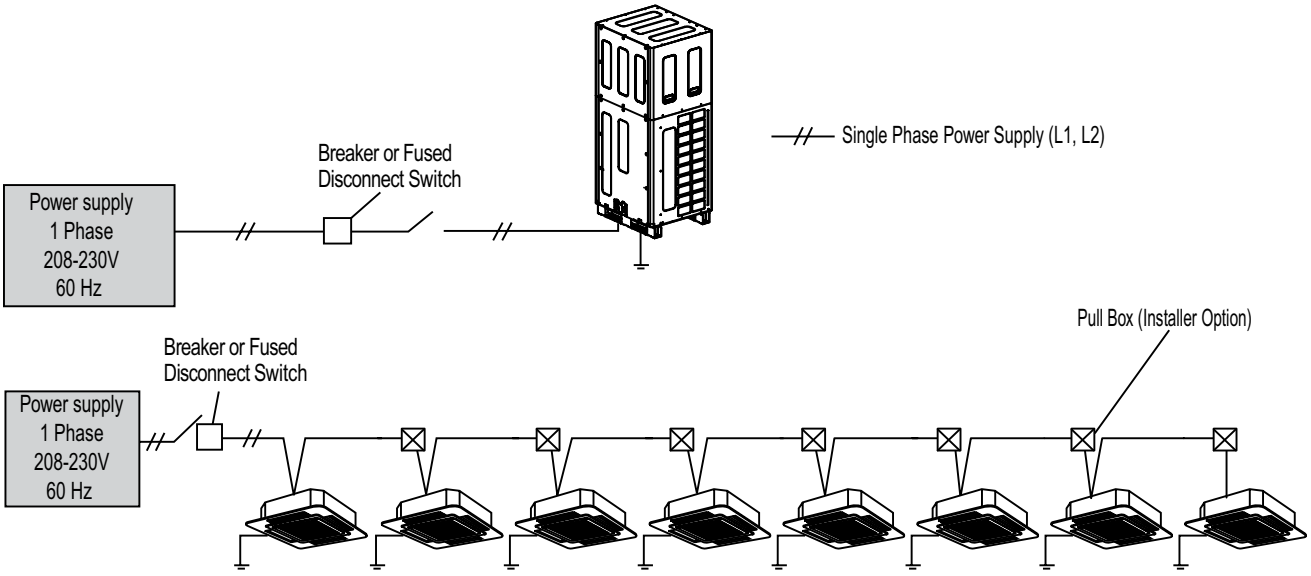
ELECTRICAL WIRING

Power Wiring

Power Supply / Power Wiring Specifications

1. Space II unit and indoor units must obtain power from separate breakers:
   - Space II unit: 1Ø, 208-230V, 60Hz
   - Indoor units: 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.)
2. Power supply wire type and size should be selected based on National Electrical Code and local codes. Maximum allowable voltage fluctuation ±10% or nameplate rated value.
3. Properly ground the Space II unit and indoor units per National Electrical Code and local codes.

Figure 49: Schematic of Suggested Power Wiring.



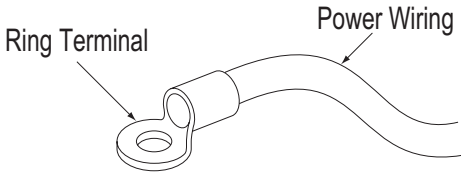
Connecting the Power Wiring

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

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

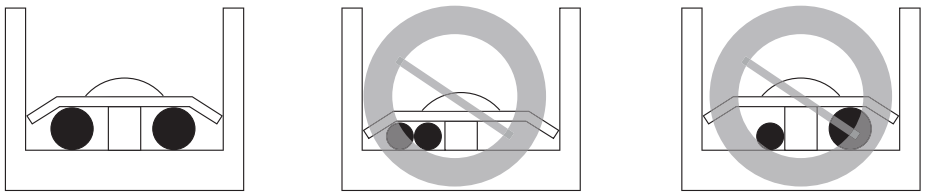
- Do not terminate different gauge wires to the power terminal block. (Slack in the wiring may generate heat.)
- When terminating wires of the same thickness, follow the instructions demonstrated in the figures below.

Figure 50: Close up of a Typical Ring Terminal.



- 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 overtighten the connections; overtightening may damage the terminals.

Figure 51: Proper and Improper Power Wiring Connections.



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

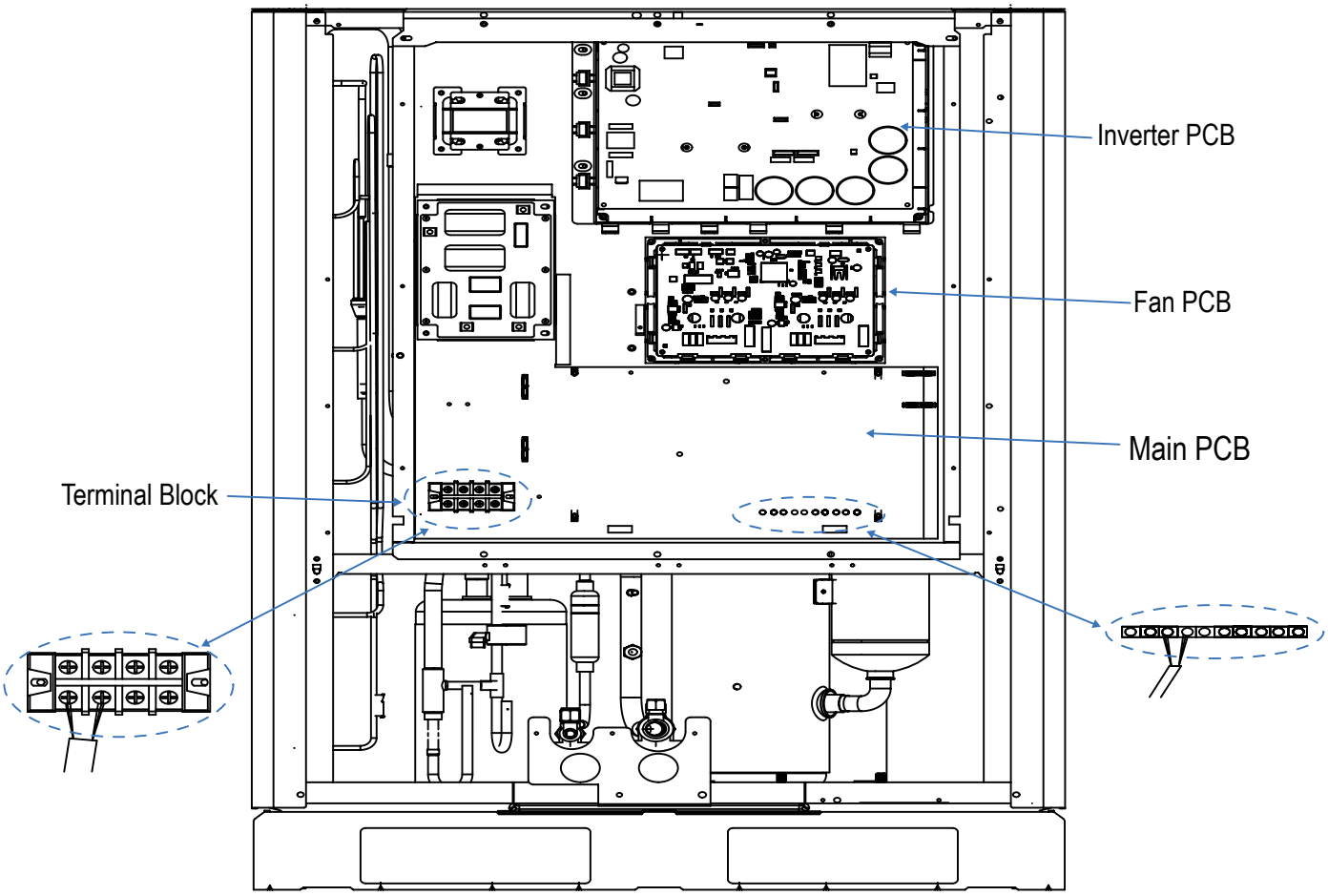
Do not terminate two wires on one side.

Do not terminate different gauge wires to a terminal block.

⚠ WARNING

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

Figure 52: Space II Unit Power Wiring and Communication Cable Connections.



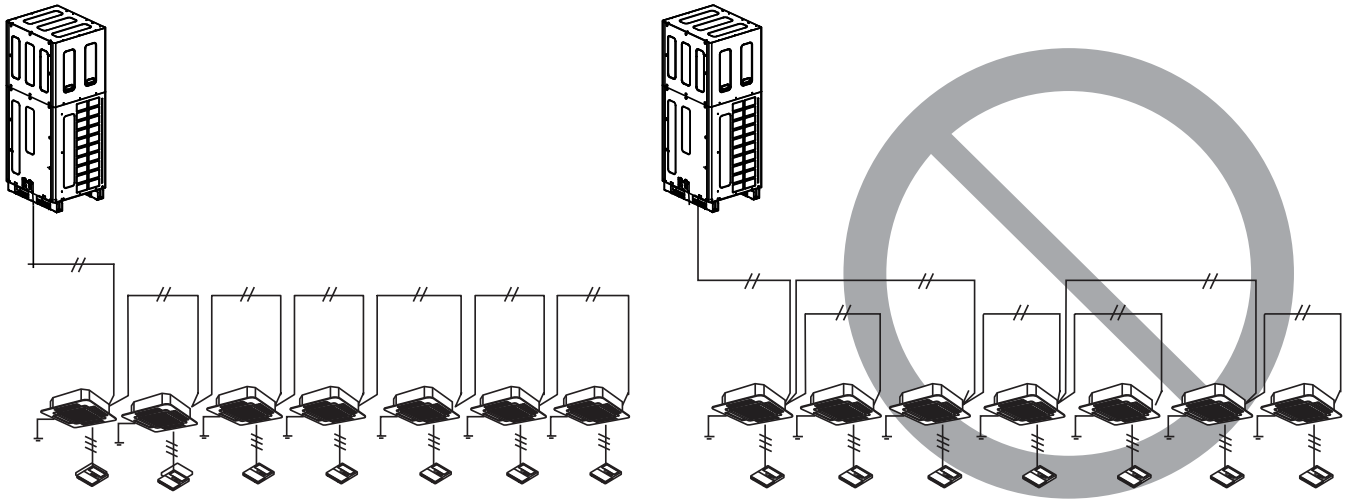
⚠ WARNING

- *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.*

General Communication Cable Specifications

- Use a two-core, shielded, stranded cable between the Space II unit and the indoor units.
  - Minimum 18 gauge shielded CVVS or CPEVS cable.
  - Insulation material as required by local code.
  - Rated for continuous exposure of temperatures up to 140°F.
  - Maximum allowable cable length: 984 feet.
- Use copper-bearing ring or spade terminals to terminate communication cables.
- 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 Space II unit and indoor unit(s) should be installed and terminated in a daisy chain (BUS) configuration starting at the Space II unit.
- Wiring should be completed without splices.
- Terminate the cable shield to a grounded surface at the Space II unit only. Cable shields between connected devices shall be tied together and continuous from the Space II unit to the last device connected.

Figure 53: Space II Unit Communications Labeling Schematic.



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

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

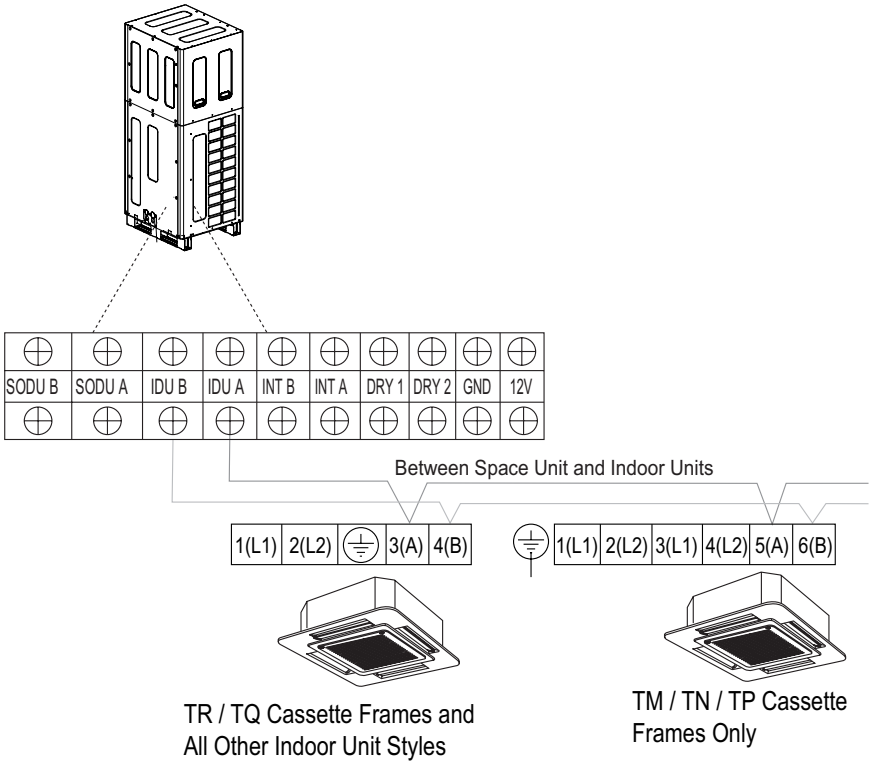
⚠ WARNING

- *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.*
- *Always verify the communication cable is connected to a communications terminal on the Space II unit. Never apply line voltage power to the communication cable connection. If contact is made, the PCBs may be damaged.*
- *The shield of the communications cable connecting the Space II unit to the indoor units should be grounded only to the Space II unit frame. Tie the shield of each cable segment together using a wire nut at each indoor unit. Maintain polarity throughout the communication network.*
- *Never ground the shield of the communications cable to the indoor unit frame or other grounded entities of the building.*
- *Position the Space unit communications cables away from the power wiring. Refer to minimum spacing requirements provided in Table 26.*
- *Never use a common multiple-core communications cable. Each communications bus shall be provided a separate cable (i.e., between Space II units and indoor units, Space II 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.*

Communication Cables Between the Space II Unit and the Indoor Units

- Field Provided 18 Gauge Stranded Two-core Cable (Shielded)
- Insulation material as recommended by local code.

Figure 54: Space II Unit to Indoor Unit Communications Cable Termination Detail.



Note:

The terminal tagged "GND" on the Space II unit PCB is not an earth ground terminal. It is a neutral (-) terminal provided to connect the Space II unit to central control devices.

Communication Cables Between the Space II Unit and the Controllers

- AC Ez or Simple Central Controller: field-provided, 18 gauge, stranded four-conductor communication cable (shielded).
- All other Central Controllers: field-provided, 18 gauge, stranded two-conductor communication cable (shielded).
- Insulation material as recommended by local code.

Connect all central control devices such as AC Smart II, AC Smart Premium, ACP, 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 Space II 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 Space II unit. Tie shields together at each termination point.

ELECTRICAL WIRING

Communications Cables

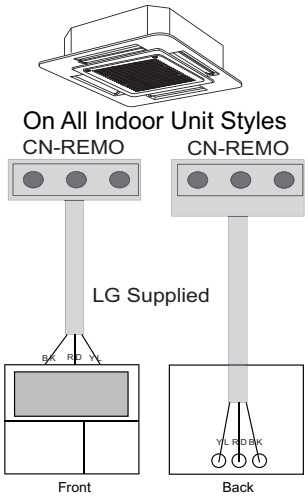
Communication Cables Between the Indoor Units and the Wall-Mounted Zone Controller

- 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.

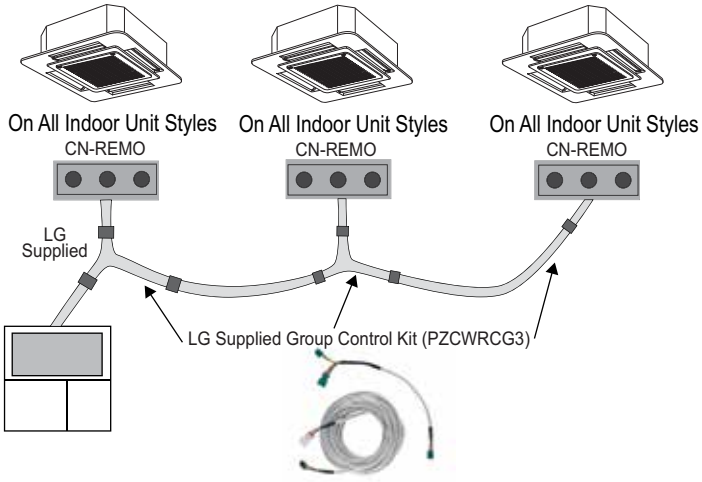
Figure 55: Indoor Unit to Zone Controller Connection.



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.”
- Identity 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.

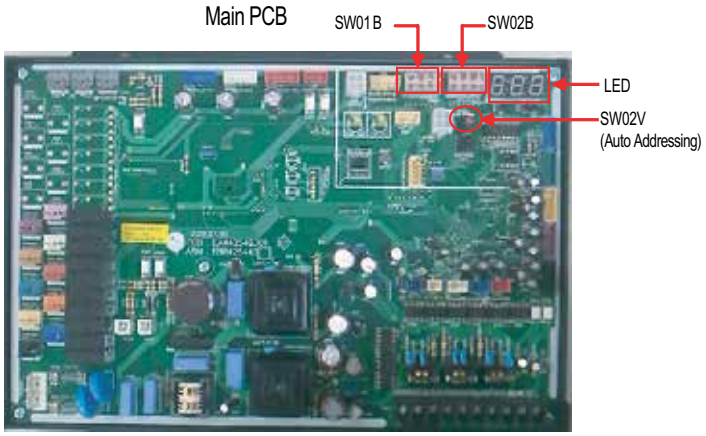
Figure 56: Indoor Unit Group to Zone Controller Connections.



Note:

Cable connected to Zone Controller is the factory default connection.

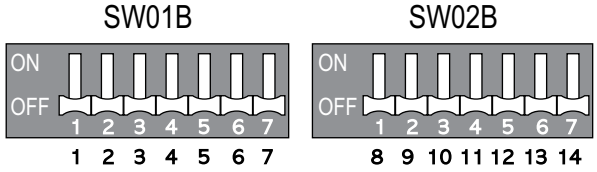
Figure 57: Space II Unit Main PCB - DIP Switch Locations.



Setting the DIP Switches

- If the DIP switches are set when the power is still ON, the new setting will not be enabled immediately. The change only is enabled when the power is cycled, or if the Reset button is pressed.
- When executing the test operation, check the operating condition of the indoor unit and only execute the test when all indoor units have stopped operation.
- Auto test operation will not work where only one indoor unit is connected to the Space II unit.
- Heat Pump model functions do not work on Cooling Only models.

Figure 58: Space II Unit DIP Switches.



Check the Space II Unit Settings

It is possible to check the set values of the Space II unit at the LED. (DIP switch settings should be changed when the power is OFF.)

1. LED will display whether the DIP switch is properly set.

Checking the Space II Unit Settings

Codes are displayed at the LED within five (5) seconds after power is applied. The code represents the set condition and model of the Space II unit.

Model Code → Total Capacity → Model Type → Normal → Model Name

1 ~ 255: Model Code

6 ~ 10 Horse Power: Total Capacity

2: Heat Pump Model

25: Normal

99: ARUN053GF2 Model

Example: ARUN053GF2

187 → 6 → 2 → 25 → 99

Note:

If the applicable DIP switch is not set properly, the system may not operate properly.

Table 27: DIP Switch Settings Per Function.

Function	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Increase Heating Capacity	●	X												
IDU EEV Cool	●	●					●						●	X
IDU EEV Heat	●	●											●	●
SEER Mode (Ducted)			●	X										
SEER Mode (Nonducted)			X	●										
PCB Check	●					●								
Control Box Check		●				●								
IDU EEV Closing	X	X			●	X	X							
IDU SC / SH Change	X	X			X	●	X							
IDU Minimum EEV	X	●			●	X	X							
Dry Contact					●	●	X							
Snow Removal								●	X					
Forced Defrost								X	●					
Snow Removal + Forced Defrost								●	●					
Forced Overall Defrost							●							●
Static Pressure Compensation Mode 1						●	●							
Static Pressure Compensation Mode 2						●	●	●						
Static Pressure Mode 1	X	X				●	●					X		X
Static Pressure Mode 2					●	●	●					●	●	
Low Sound Operation												X	●	●
Night Low Sound Operation (Cooling Only)												●	X	●
Night Low Sound Operation (Cooling / Heating)												●	●	●
Static Pressure Change Mode												X	●	●
Pump Down										●				X
Pump Out										●				●
Forced Oil Return Operation	X	X					●							X
Vacuum Mode											●	X	X	●
Only Overall Defrost											●			
Selector Fan / All Off	X	X									●	●	X	X
Space II Unit Address Setting												●	X	X
Low Ambient											●	●	●	

● = DIP Switch Set to ON X = DIP Switch Set to OFF

ELECTRICAL WIRING

Auto Addressing the Indoor Units

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. Verify the number of indoor units connected to the system.

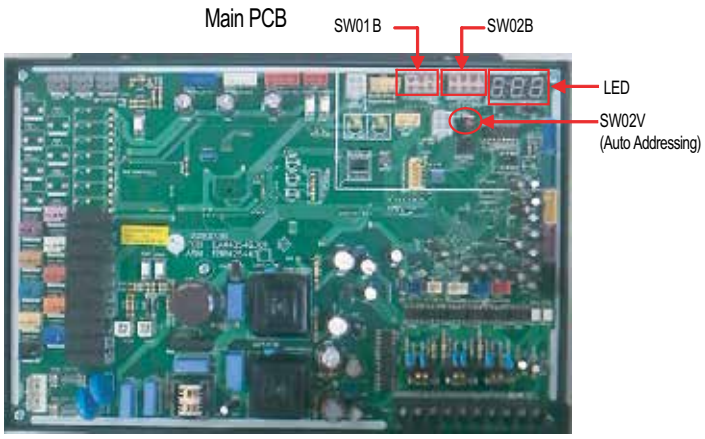
2. Verify the communications cable between the indoor units and the Space II unit is terminated at the Space II unit terminals IDU(A) and IDU(B).

3. Verify the shield on the communications cable is grounded at the Space II unit.

4. At the Space II unit PCB, verify all DIP switches are “OFF” on DIP switches SW01B and SW02B.

5. Cycle power on the Space II unit and indoor units. Wait for three (3) minutes.

Figure 59: Space II Unit Main PCB - Auto Addressing.



6. Press and hold red Auto Address Button (SW02V) for about five (5) seconds. Release when “88” appears on the LED. After three (3) to seven (7) minutes, the display will flash a number for about thirty (30) seconds indicating how many indoor units the system successfully communicated with.

7. If the auto addressing procedure was successful, this number should match the known installed number of indoor units.

8. Upon completion of the auto addressing routine, the address of each indoor unit is indicated on the wired remote control display window (CH01, CH02, CH03...CH06 indicates number of connected indoor units).

9. 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.

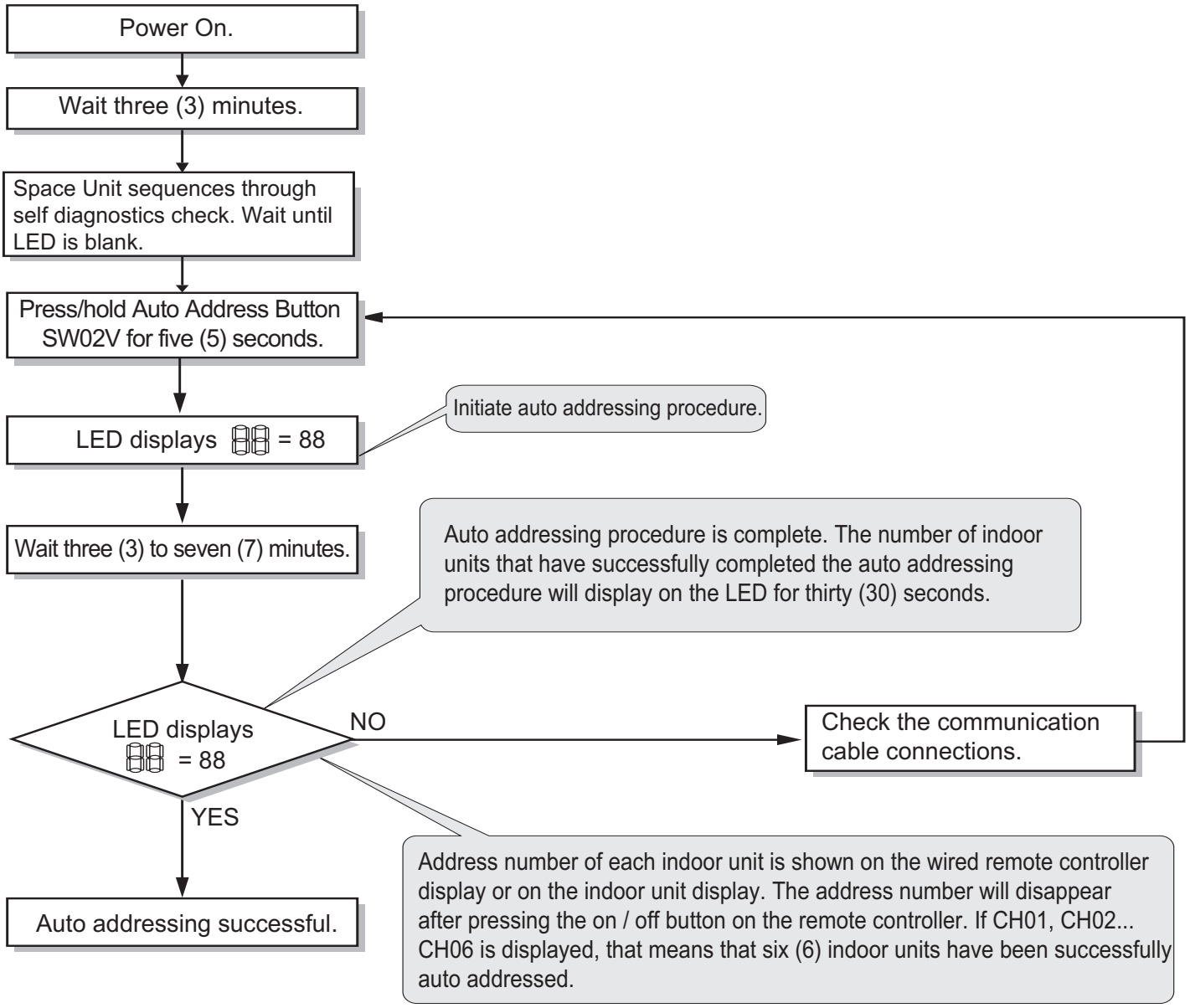
Note:

- *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 three (3) to seven (7) minutes.*
- *The auto addressing procedure must be performed again after an indoor unit PCB is replaced.*
- *If power is not applied to the indoor unit, an auto addressing error occurs.*
- *Auto addressing is only possible on the main PCB of the Space II unit.*
- *To improve communication, wait three (3) minutes after the power has been cycled on, then perform the auto addressing procedure.*

⚠ 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 Space II unit terminals IDU(A) and IDU(B). Do NOT open the service valves or attempt to start water source unit compressors or until directed by the Commissioning Agent. Major damage to the unit piping and compressors will occur, and there is a risk of explosion, suffocation, physical injury, and / or death.

Figure 60: 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 Space II unit and the indoor units. Verify the indoor unit to Space II unit communications cable is wired correctly.
   - Verify the conductor connected to the “3 (or “5” in the case of cassette frame codes TP, TN, TM) terminals on all indoor units and is terminated on the Space II unit terminal tagged IDU(A).
   - In a similar fashion, verify the conductor connected to all indoor units on the “4” (or “6” in the case of cassette chassis codes TP, TN, TM) terminals and is terminated on the Space II unit terminal tagged IDU(B).

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

4. After repairing the communications cable, repeat the auto addressing process until successful: Press and hold red Auto Address Button for about five (5) seconds. Release when “88” appears on the LED. After three (3) to seven (7) minutes, the display will flash a number for about ten (10) 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 Space II unit assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.

Group Addressing Procedure

1. Verify that the power is OFF to both the indoor units and the Space II units. If power is still on, shut it off.

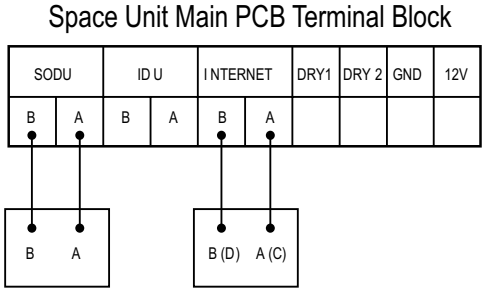
2. Communication cables should be connected to B and A terminals on the central controller and to INTERNET terminals B and A on the Space II unit, matching polarities (A → A, B → B).

3. Apply power to the entire system.

4. Set the group numbers and indoor unit numbers using a wireless handheld or wired zone controller, see subsections below and on the next page.

5. To designate several indoor units into one group, see subsections below and on the next page.

Figure 61: Connections for Group Addressing.



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 affected.
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 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 Address Assignments

Obtain job specifications / preferences; 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.[1]
- All members of a Hex Group are not required to be on the same Multi V system.
- Addresses can be assigned at random, not in any particular order, and can be skipped.[1]

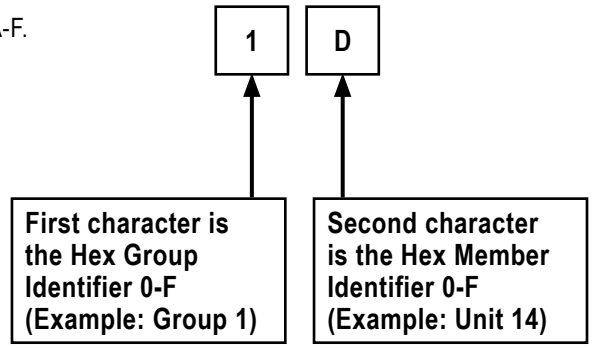
[1]On AC EZ, do not skip addresses. Start with Hex address 0. Buttons have pre-assigned Hex addresses. If an address is skipped, the associated button will do nothing.

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 62: 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 below).

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 at right.

Table 28: Central Controller Indoor Unit Connection Limitations.

Central Control Device	Maximum Indoor Unit Quantity
AC EZ	32
AC Smart II	64
AC Smart II with Expansion Kit	128
AC SMART Premium	128
LonWorks Gateway	64
BACnet Gateway	256
Advanced Control Platform	256

Group Number

If the building operator wants to know which indoor units are on each Space II 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.

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.

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 Space II unit 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:

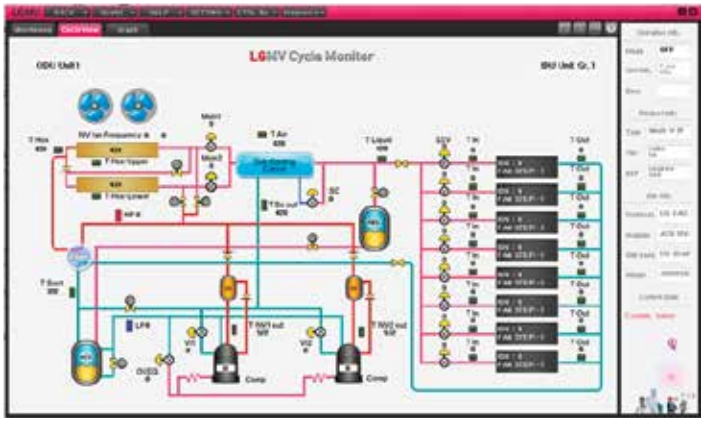
- Actual inverter compressor speed
- Target inverter compressor speed
- Actual outdoor fan speed
- Target outdoor unit fan speed
- Actual superheat
- Target superheat
- Actual subcooler circuit superheat
- Target subcooler circuit superheat
- Main EEV position
- Subcooling EEV position
- Inverter compressor 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
- 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

Figure 63: MV Real-time Data Screen.

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

1. Cycleview: 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 64: 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 units installed.

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

5. Data
   - 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.

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

Figure 65: 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. These error codes can be seen on the main screen of the LGMV software program. For an overview of Space II unit error codes, see pages 60-62. For detailed information on how to trouble-shoot individual error codes, see the Space II Unit Service Manual.

Figure 66: 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 WSU, 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.

ELECTRICAL WIRING

Self Diagnosis Functions

Error Codes

- Indicate different types of unit failures, assists in self-diagnosis and to track the frequency of occurrence.
- Error codes are shown on the LEDs of indoor units, wired remote controller, the Space II unit control board, and 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.

Error Display

The first and second number on the LED indicates error number; the third number on LED indicates Space II unit number.

Example: 01 = Error No. 1 on water source unit 1

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 29: 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 Space II unit and indoor unit.	• Indoor unit has not received communications signal from Space II unit. Check indoor unit to Space II unit communication cable for issues (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.
	0	6	-	Indoor unit outlet pipe temperature sensor error.	Indoor unit outlet pipe temperature sensor has disconnected or short circuited. (Check the connection 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 the connection between the two.) • Communication error between EPROM chips on the 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. • The system has detected the fan motor is not spinning. • On new installs, verify the installation manual and paperwork were removed from the fan discharge shroud before the unit was installed. • Check the wiring plug and connection at sockets (if used).
Space II Unit	2	1	1	Space II unit inverter compressor PCB error.	• Space II unit inverter compressor PCB error. • Under voltage • Refrigerant flow restriction from defective LEV or clogged strainer. • Refrigerant charge is too high (overcharge).
	2	2	1	Space II unit inverter board input overcurrent (RMS) error.	• Overcurrent of Space II unit inverter board PCB. • Under voltage • Refrigerant flow restriction from defective LEV or clogged strainer. • Refrigerant charge is too high (overcharged).
	2	3	1	Low DC voltage sensed at the Space II unit inverter compressor DC link.	DC voltage failed to charge on power up. (Start diagnosis at the CN inverter socket on the Space II unit noise filter PCB.)

For detailed information on how to troubleshoot each error, see the Space II Unit Service Manual on www.lg-vrf.com.

Table 30: Error Codes, continued.

	Error Code			Description	Details
Space II Unit	2	4	1	Space II unit high pressure switch error.	System was turned off by the Space II unit high pressure switch.
	2	6	1	Space II unit inverter compressor operation error.	Initial operation failure due to Space II unit inverter compressor problem.
	2	9	1	Space II unit inverter compressor overcurrent error.	Space II unit inverter compressor current draw is too high.
	3	2	1	Excessive increase in Space II unit inverter compressor gas discharge temperature.	• Shutdown due to excessive discharge gas pressure. • Check flow switch, clean the strainer, and verify pump is working properly.
	3	4	1	Compressor high pressure safety tripped.	Shutdown due to excessive discharge gas pressure.
	3	5	1	Low side pressure transducer senses pressure below allowable limits.	Shutdown due to low suction pressure.
	3	6	1	Space II unit low condensing ratio error.	Space II unit operating under the low condensing limit for 3 minutes.
	3	9	1	Communication error between Space II unit PFC and inverter board.	Space II unit inverter compressor current detection (CT) sensor has disconnected or short circuited.
	4	0	1	Space II unit inverter compressor current transducer (CT) sensor error.	Space II unit inverter compressor current transducer (CT)detection sensor has disconnected or short circuited.
	4	1	1	Space II unit inverter compressor discharge pipe temperature sensor error.	• Check the connection on the Space II unit PCB. • Thermistor has disconnected or short circuited.
	4	2	1	Space II unit low pressure transducer error.	• Check the connection on the Space II unit PCB. • Transducer has disconnected or short circuited.
	4	3	1	Space II unit high pressure transducer error.	• Check the connection on the Space unit PCB. • Transducer has disconnected or short circuited.
	4	4	1	Space II unit ambient temperature sensor error.	• Check the connection on the Space II unit PCB. • Thermistor has disconnected or short circuited.
	4	6	1	Space II unit compressor suction pipe temperature sensor error.	• Check the connection on the Space II unit PCB. • Thermistor has disconnected or short circuited.
	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 Space II unit capacity.
	5	2	1	Communication error between Space II 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 Space II unit main PCB and indoor unit(s) PCB.	• Check if Space II 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.
	6	0	1	Space II 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 Space II unit inverter heatsink.	System shut off because of high temperatures at the Space II unit inverter heatsink.
	6	7	1	Space II unit fan has locked up.	Space II unit air flow is restricted.
	7	1	1	Space II unit PFC current transducer (CT) sensor error.	Space II unit PFC current transducer (CT) sensor has disconnected or short circuited.
	7	3	1	Space II unit PFC instant overcurrent (peak) error.	Instant overcurrent (peak) of Space II unit PFC.
	7	5	1	Space II unit fan CT sensor error.	Disconnection or short circuit of Space II unit fan current transducer (CT) sensor.
	7	6	1	Space II unit fan DC link high voltage error.	Space II unit fan DC link high voltage error.
	7	7	1	Space II unit fan overcurrent error.	Space II unit fan current is >10A (for 208-230V units).
	7	8	1	Space II unit fan hall sensor error.	Space II unit fan hall sensor has disconnected or short circuited.
	7	9	1	Space II unit fan operation failure error.	Space II unit fan is experiencing first position sensor failure.

For detailed information on how to troubleshoot each error, see the Space II Unit Service Manual on www.lg-vrf.com.

Table 31: Error Codes, continued.

	Error Code				Description	Details
Space II Unit	8	6	1		Space II 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		Space II unit fan PCB EPROM error.	• Communication error between Space II unit fan MICOM and EPROM. • EPROM is missing.
	8	8	1		PFC PCB EPROM Error	• Communication error between Space II unit PFC MICOM and EPROM. • EPROM is missing.
	1	0	5	1	Space II unit fan PCB communication error.	Space II unit main PCB is not receiving a signal from the fan.
	1	0	6	1	Space II unit fan IPM error.	Instant overcurrent (peak) of Space II unit fan IPM.
	1	0	7	1	Space II unit fan DC link low voltage error.	Space II unit fan DC link voltage is <140V (for 208-230V units).
	1	1	3	1	Space II unit liquid pipe temperature sensor error.	• Check the connection on the Space II unit PCB. • Thermistor has disconnected or short circuited.
	1	1	4	1	Space II unit subcooling outlet temperature sensor error.	
	1	1	5	1	Space II unit subcooling inlet temperature sensor error.	
	1	5	1	1	Space II unit operation mode conversion error.	Space II unit is experiencing a pressure imbalance.
	1	8	2	1	Communication error between Space II unit external board main and sub MICOMs.	Space II unit external board main to sub MICOMs communication failure.
	1	9	1	1	Space II unit inverter PCB heatsink temperature sensor error.	Space II unit inverter PCB heatsink temperature sensor has disconnected or short circuited.
	1	9	3	1	Space II unit fan PCB heatsink temperature error.	System has shut off because Space II unit fan PCB heatsink temperature is >203°F.
	1	9	4	1	Space II unit fan PCB heatsink temperature sensor error.	Space II unit fan PCB heatsink temperature sensor has disconnected or short circuited.

For detailed information on how to troubleshoot each error, see the Space II Unit Service Manual on www.lg-vrf.com.

Cautions for Refrigerant Leaks / Introduction

ASHRAE Standards 15-2010 and 34-2010 offer guidelines that address refrigerant safety and the maximum allowable concentration of refrigerant in an occupied space. Refrigerant will dissipate into the atmosphere, but a certain volume of air is required for this to occur safely. For R410A refrigerant, the maximum allowable concentration is 0.026 lbs./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 following pages for information on how to calculate the refrigerant concentration).[1] Also consult state and local codes in regards to refrigerant safety.

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.

⚠ WARNING

Verify the maximum refrigerant concentration level in the space where the indoor unit will be mounted meets the concentration limit for the application.

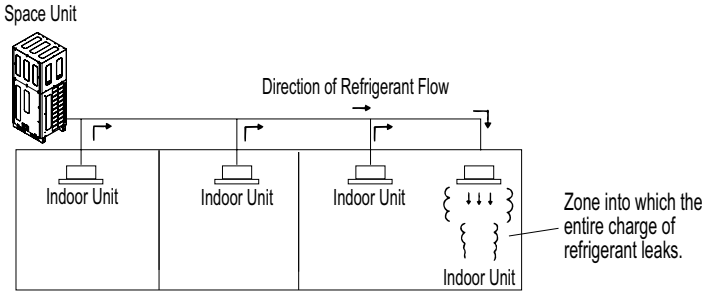
Refrigerant Concentration Limit (RCL) Calculations

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**

✓ *If a structure includes two or more independent outdoor units, the total refrigerant amount must be calculated for each system.*

Figure 67: Example of Where R410A Refrigerant Might Leak.



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 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 34-2007 and local codes for detailed information.[1]

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

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

CAUTIONS FOR REFRIGERANT LEAKS

To determine the volume of an occupied space, the designer must also determine which ones are connected, not connected, or ventilated (refer to Standard 34-2007).

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 supply 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 68: Examples of Zones.

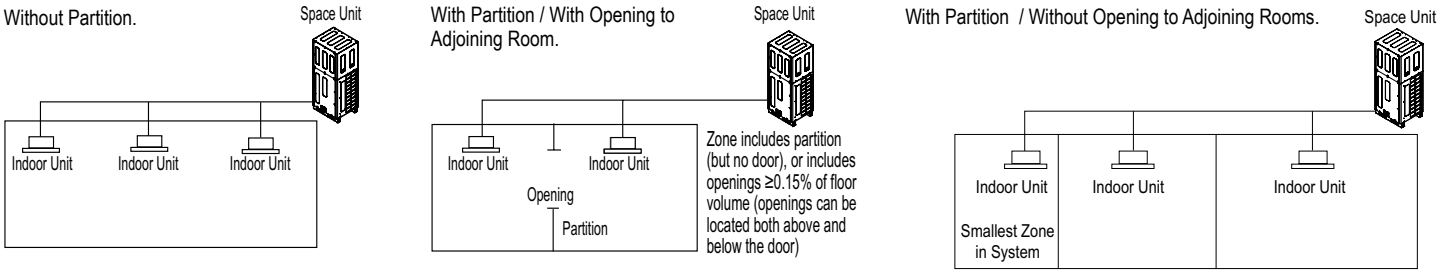
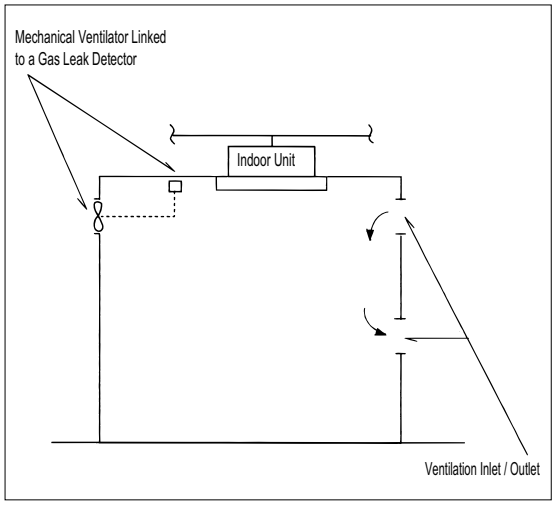


Figure 69: Examples of Acceptable Ventilation Methods.



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)

INSTALLATION CHECKLIST

Major Component Rough-In

Description	Check
All Multi V Space II units are connected properly per local code and the product installation procedures.	
All literature and bagged accessories have been removed from the fan discharge (ducted and cassette model indoor units).	
Indoor units are installed, properly supported, and located indoors in a non-corrosive environment.	
Duct work installation completed (ducted indoor units only).	
Space II unit's gravity condensate drain line is connected and routed where it properly drained away or, if installed in a mechanical room, is 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 are 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-branch fittings or headers were used as per LATS Multi V report.	
(Optional) Full port ball valves for all indoor units. (Schrader between the valve body and the indoor units.)	

Brazing Practices

Description	Check
Use medical grade (there are 4 available) dry nitrogen for purging during brazing (constant 3 psi while brazing).	
Minimum 3/4", maximum 1" condensate piping installed on indoor units–material used is acceptable under local code. Insulated as necessary to prevent condensation.	

Installation

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

Refrigerant Piping

Description	Check
You must have in your possession a copy of the "As-Designed" LATS Multi V 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 MULTI V 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.	
Insure Y-branch fittings are installed with no more than ±10° of horizontal.	
Insure Y-branch fittings are installed with no more than ±3° of vertical.	
Insure all Header fittings are installed horizontal at an elevation above all connected indoor units.	
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.	
Insure all field made flares are 45°. Use factory-supplied flare nuts only.	
All pipe segments were properly supported and all wall penetrations were sleeved.	
All pipe insulation is not compressed at any point.	
Y-branch and headers fittings were properly supported per details provided in the Multi V Space II Unit Installation Manual.	
Insure Y-branch fittings 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 are present.	
(Optional) High quality R410A rated full port ball valves with a Schrader port were used at all indoor units and at will in the refrigerant piping network. (Recommended for serviceability.)	
Best practice includes a minimum of 20" of straight pipe was installed between each elbow, and Y-branch or header fitting, and between two Y-branch fittings.	

INSTALLATION CHECKLIST

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 Space II unit.	
The power supplied was clean with voltage fluctuations within specifications. (±10% of nameplate).	
Power wiring to the Space II unit was installed per all local electrical code requirements.	
Power wiring to each indoor unit was installed per all local electrical code requirements.	
Communications cable between the Space II unit 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.	
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.	
All communications cables are a minimum of 18-Gauge, two conductor, stranded, with insulation material per local code. Cable segment shields were tied together. Cable shield is grounded at the water source unit only.	
Use 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.	
All power and control wires were properly separated using the recommended distance provided in the product installation manual.	
Only LG-supplied Y-cables and extension cables were used between indoor units.	

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 Space II unit'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.	
Insure all field-installed full-port ball valves are open.	
The piping system held a constant 550 psig pressure for a minimum of 24 hours with all isolation valves open.	
A triple system evacuation has been performed. Micron gauge reading held at a minimum of 500 for 24 hours with all isolation valves open and without the vacuum pump connected.	
Power was energized to the Space II unit at _____(time) on _____day to power the compressor crankcase heater(s). (Must be at least 6 hours before commissioning.)	
The communications cable to the indoor units has been disconnected from the IDU (B) and IDU (A) terminals at the Space II unit.	
None of the Space II unit 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 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 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 Space II unit, indoor units, ERVs, Air Cleaners, 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 II, AC Smart Premium 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.

PRE-COMMISSIONING CHECKLIST

Notes for the Commissioning Agent

PRE-COMMISSIONING CHECKLIST

Notes for the Commissioning Agent

PRE-COMMISSIONING CHECKLIST

Notes for the Commissioning Agent

REFRIGERANT CHARGE WORKSHEET

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_____

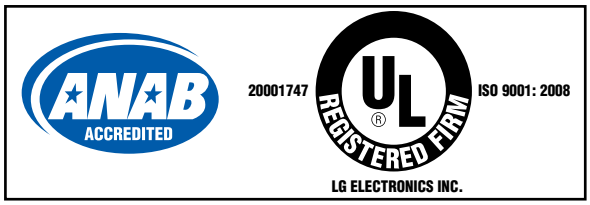
Project Manager_____

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	Wall Mounted + Art Cool Mirror	SE	7k to 15k		0.53	
9	Wall Mounted + Art Cool Mirror	S8, S5	18k to 24k		0.62	
10	1-Way Cassette	TJ	7k to 12k		0.44	
11	2-Way Cassette	TL	18k to 24k		0.35	
12	4-Way 2' x 2' Cassette	TR	5k to 7k		0.40	
13	4-Way 2' x 2' Cassette	TR	9k to 12k		0.55	
14	4-Way 2' x 2' Cassette	TQ	15k to 18k		0.71	
15	4-Way 3' x 3' Cassette	TN	9k to 15k		1.06	
16	4-Way 3' x 3' Cassette	TM	18k to 24k		1.41	
17	4-Way 3' x 3' Cassette	TP	24k to 28k		1.06	
18	4-Way 3' x 3' Cassette	TN	36k		1.41	
19	4-Way 3' x 3' Cassette	TM	42k to 48k		1.41	
20	High Static Ducted	BH	7k to 24k		0.57	
21	High Static Ducted	BG	15k to 42k		0.97	
22	High Static Ducted	BR	48k to 54k		1.37	
23	High Static Ducted	B8	76k to 95k		2.20	
24	Low Static Ducted, Low Static Ducted Bottom Return	B1, B3	7k to 15k		0.37	
25	Low Static Ducted, Low Static Ducted Bottom Return	B2, B4	18k to 24k		0.82	
26	Vertical / Horizontal Air Handling Unit	NJ	12k to 24k		1.04	
27	Vertical / Horizontal Air Handling Unit	NJ	30k		1.04	
28	Vertical / Horizontal Air Handling Unit	NJ	36k		1.57	
29	Vertical / Horizontal Air Handling Unit	NK	42k to 54k		2.00	
30	Ceiling Suspended	VJ	18k to 24k		0.77	
31	Convertible Surface Mount—Ceiling/Wall	VE	9k to 12k		0.22	
32	Floor Standing	CE (U)	7k to 15k		0.37	
33	Floor Standing	CF (U)	18k to 24k		0.82	
34	**Additional Refrigerant Charge Required**					
35	Space II Unit Factory Refrigerant Charge	ARUN053GF2	53K		7.7	
36	**Total System Charge: Sum of Additional Refrigerant Charge Required and Space II Unit Factory Refrigerant Charge**					

[1]CF (Ref.) = Correction Factor for Refrigerant Charge.
[2]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).

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



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