



# ***MULTI V***<sup>TM</sup> **S** **INSTALLATION MANUAL**

Variable Refrigerant Flow  
Heat Pump  
Outdoor Units  
2.0, 3.0, 4.0, 4.4, and 5.0 Tons

Variable Refrigerant Flow  
Heat Recovery  
Outdoor Unit  
5 Tons



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Content familiarity is required for proper installation.**

The instructions included in this manual must be followed to prevent product malfunction, property damage, injury, or death to the user or other people. Incorrect operation due to ignoring any instructions will cause harm or damage. The level of seriousness is classified by the symbols described by the summary list of safety precautions on page 4.

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# SAFETY PRECAUTIONS


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


## TABLE OF SYMBOLS

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


## INSTALLATION

### **DANGER**

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


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

### **WARNING**

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

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

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


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

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

**Always check for system refrigerant leaks after the unit has been installed or serviced.**  
*Exposure to high concentration levels of refrigerant gas may lead to illness or death.*

**Periodically check that the outdoor frame is not damaged.**  
*There is a risk of explosion, physical injury, or death.*  
**If the air conditioner is installed in a small space, take**


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

**The heat recovery unit must be installed indoors;  do not install the heat recovery unit in a highly humid environment.**  
*There is risk of physical injury or death due to electric shock.*

**Dispose the packing materials safely.**

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

**Install the unit considering the potential for strong winds or earthquakes.**  
*Improper installation may cause the unit to fall over, resulting in physical injury or death.*

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

## ⚠ WARNING

**Properly insulate all cold surfaces to prevent “sweating.”**

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

## ⚠ CAUTION

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

- Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed.
- Some products use polypropylene bands for packaging. Ⓢ Do not use polypropylene bands to lift the unit.
- Suspend the outdoor unit from the base at specified positions (at a minimum of six [6] points) to avoid slippage from rigging apparatus.

## Note:

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

Ⓢ Do not install the product where it is exposed directly to ocean winds.

*Sea salt in the air may cause the product to corrode. Corrosion, particularly on the condenser and evaporator fins, could cause product malfunction or inefficient operation.*

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

*This prevents water damage and abnormal vibration.*

**Properly insulate all cold surfaces to prevent “sweating.”**

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

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

*Low refrigerant levels may cause product failure.*

Ⓢ Do not make refrigerant substitutions. Use R410A only.

*If a different refrigerant is used, or air mixes with original refrigerant, the unit will malfunction and be damaged.*

Ⓢ Do not store or use flammable gas / combustibles near the unit.

*There is a risk of product failure.*

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

*There is risk of property damage.*

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

**When 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.*

**The heat recovery box must be installed indoors; Ⓢ do not install the heat recovery box in a highly humid environment.**  
*There is risk of product failure and property damage.*

**When connecting refrigerant piping, remember to allow for pipe expansion.**

*Improper piping may cause system malfunction.*

Ⓢ Do not install the outdoor unit or heat recovery unit in a noise-sensitive area.

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

**Periodically check that the outdoor frame is not damaged.**  
*There is a risk of equipment damage.*

**Install the unit in a safe location where nobody can step on or fall onto it. Ⓢ Do not install the unit on a defective stand.**  
*There is a risk of unit and property damage.*

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

# SAFETY PRECAUTIONS



## WIRING

### DANGER

**High voltage electricity is required to operate this system. Adhere to the U.S. National Electric Code NEC and these instructions when wiring.**

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

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

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

*Electrical shock can cause physical injury or death.*

**Properly size all circuit breakers or fuses.**

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

**Do not share the electrical circuit with other devices.**

*There is risk of fire, electric shock, and physical injury or death due to heat generation.*

**Do not use damaged or loose power wiring.** **Do not modify or extend the outdoor unit's power wiring randomly.**  
**Ensure that the power wiring will not be pulled nor weight be placed on the power wiring during operation.**

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

### WARNING

**The information contained in this manual is intended for use by an industry-qualified, experienced, certified electrician familiar with the 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 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 NEC, and the instructions given in this manual.**

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

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

*Wires that are too small may generate heat and cause a fire, and physical injury or death.*

**Secure all field wiring connections with appropriate wire strain relief.**

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

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

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

**Properly tighten all power connections.**

*Loose wiring may overheat at connection points, causing a fire, physical injury or death.*

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

*If the protection devices have been bypassed or is forced to operate improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, and physical injury or death.*

### Note:

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

*The system may malfunction.*

**The information contained in this manual is intended for use by an industry-qualified, experienced, certified electrician familiar with the 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 and property damage.*

## OPERATION

### ⚠ DANGER

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

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

**Use a dedicated breaker for this product.**

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

⊘ Do not operate the disconnect switch with wet hands.

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

**Periodically verify the equipment mounts have not deteriorated.**

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

**Use inert (nitrogen) gas when performing leak tests or air purges.** ⊘ Do not use compressed air, oxygen, or flammable gases.

*Using these substances may cause fire, explosion, and physical injury or death.*

**If refrigerant leaks out, ventilate the area before operating the unit.**

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

### ⚠ WARNING

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

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

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

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

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

*It can cause burns or frostbite.*

⊘ Do not open the inlet during operation.

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

### ⚠ CAUTION

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

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

### Note:

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

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

*There is risk of property damage.*

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

*There is risk of unit failure.*

⊘ Do not open the inlet during operation.

*There is risk of unit failure.*

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

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

**Periodically verify the equipment mounts have not deteriorated.**

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

**Use only a soft cloth to clean the air conditioner.** ⊘ Do not use wax, thinner, or strong detergents.

*Strong cleaning products may damage the surface of the air conditioner, or may cause its appearance to deteriorate.*

**Provide power to the outdoor unit to warm the compressor crankcase at least six (6) hours before operation begins.**

*Starting operation with a cold compressor sump(s) may result in severe bearing damage to the compressor(s). Keep the power switch on during the operational season.*

⊘ Do not 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 block the inlet or outlet.

*Unit may malfunction.*

**Auto-addressing must be performed after connecting the power of all indoor and outdoor units.**

*Auto-addressing must also be performed after servicing an indoor unit.*

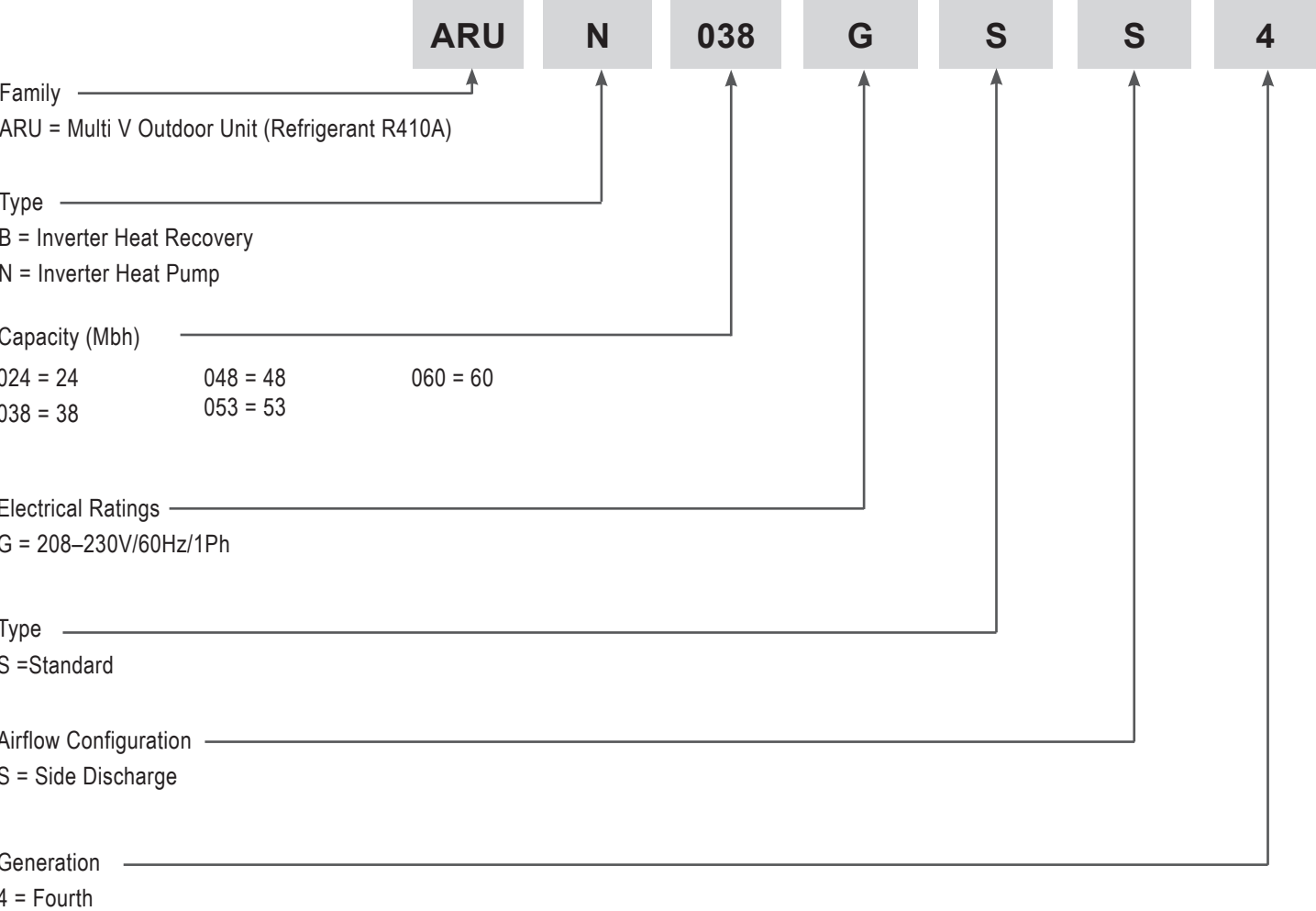


# UNIT NOMENCLATURE

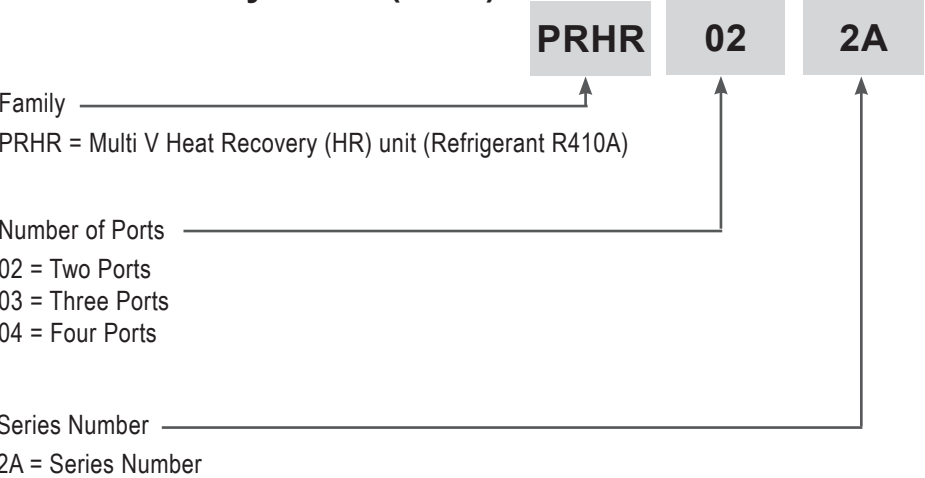


## Outdoor Units

### Outdoor Units (ODU)



### Heat Recovery Units (HRU)



## Heat Pump Outdoor Unit Specifications / Electrical Data

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

Model Numbers		2.0 Ton	3.0 Ton	4.0 Ton	4.4 Ton	5.0 Ton
		ARUN024GSS4	ARUN038GSS4	ARUN048GSS4	ARUN053GSS4	ARUN060GSS4
Cooling Performance						
Nominal Cooling Capacity (Btu/h) <sup>1</sup>		24,000	39,500	50,000	55,500	60,000
Rated Cooling Capacity (Btu/h) <sup>2</sup>		24,000	38,000	48,000	53,000	60,000
Heating Performance						
Nominal Heating Capacity (Btu/h) <sup>1</sup>		27,000	44,000	56,500	61,500	64,000
Rated Heating Capacity (Btu/h) <sup>2</sup>		27,000	42,000	54,000	59,000	64,000
Operating Range						
Cooling (°F DB) <sup>3</sup>		23 to 122				
Heating (°F WB)		-4 to +61				-13 to +61
Compressor						
Inverter Type / Quantity		DC Inverter Starting / 1				Hermetically Sealed Scroll / 1
Oil / Type		PVE / FVC68D				
Fan (Side Discharge)						
Type		Axial Flow Fan				
Motor Output (kW) x Qty.		0.124 x 1	0.124 x 2			
Motor / Drive		Brushless Digitally Controlled / Direct				
Operating Range (RPM)	Cooling	0 to 850				
	Heating	0 to 850				
Maximum Air Volume (CFM)		2,119	3,885			
Unit Data						
Refrigerant Type		R410A				
Refrigerant Control/Location		EEV / Indoor Unit				
Max. Number Indoor Units / System <sup>4</sup>		4	6	8	9	12
Sound Pressure dB(A) <sup>5</sup>		50		51	52	57
Net Unit Weight (lbs.)		159	207			260
Shipping Weight (lbs.)		176	218			291
Communication Cables <sup>6,7</sup>		2 x 18				
Heat Exchanger						
Material and Fin Coating		Copper Tube / Aluminum Fin and GoldFin™ / Hydrophilic				
Rows / Fins per inch		2 / 14				3 / 14
Piping <sup>8</sup>						
Liquid Line Connection (in., OD)		3/8 Flare	3/8 Braze	3/8 Braze	3/8 Braze	3/8 Braze
Vapor Line Connection (in., OD)		5/8 Flare	5/8 Braze	5/8 Braze	3/4 Braze	3/4 Braze
Factory Charge lbs. of R410A		4.0	6.6			7.7

<sup>1</sup>Nominal capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a Combination Ratio between 95–105%.

Nominal cooling capacity rating obtained with air entering the indoor unit at 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).

<sup>2</sup>Rated capacity is certified under AHRI Standard 210/240. See [www.ahrinet.org](http://www.ahrinet.org) for information.

<sup>3</sup>Cooling range with the Low Ambient Baffle Kit (sold separately) is -9.9°F to +122°F.

<sup>4</sup>The System Combination Ratio must be between 50–130%.

<sup>5</sup>Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745.

<sup>6</sup>Communication cable between ODU, IDU(s), and Central Controller must be a minimum of 18 AWG, 2-conductor, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only.

⚠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

<sup>7</sup>Power wiring is field provided, solid or stranded, and must comply with all local and national codes. See next page for detailed electrical data.

<sup>8</sup>LG requires that LATS software be used on all projects to ensure correct line sizing. Designer must verify the shop drawing design against the as-built design using LATS. Contractor must also use LG manufactured Y-Branch and Header Kits only.

# GENERAL DATA



## Heat Pump Outdoor Unit Specifications / Electrical Data

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

Nominal Tons	Unit Model No.	Compressor Motor		Condenser Fan Motor		MCA	MOCP
		Quantity	Motor Amps RLA (Ea.)	Fan Qty.	Amps FLA x Qty.		
2.0	ARUN024GSS4	1	15.3	1	0.5 x 1	19.6	30
3.0	ARUN038GSS4	1	19.5	2	0.5 x 2	25	40
4.0	ARUN048GSS4	1	23.1	2	0.5 x 2	30	50
4.4	ARUN053GSS4	1	25.2	2	0.5 x 2	33	50
5.0	ARUN060GSS4	1	19.5	2	0.5 x 2	25.4	40

Voltage tolerance is  $\pm 10\%$ .

Maximum allowable voltage unbalance is 2%.

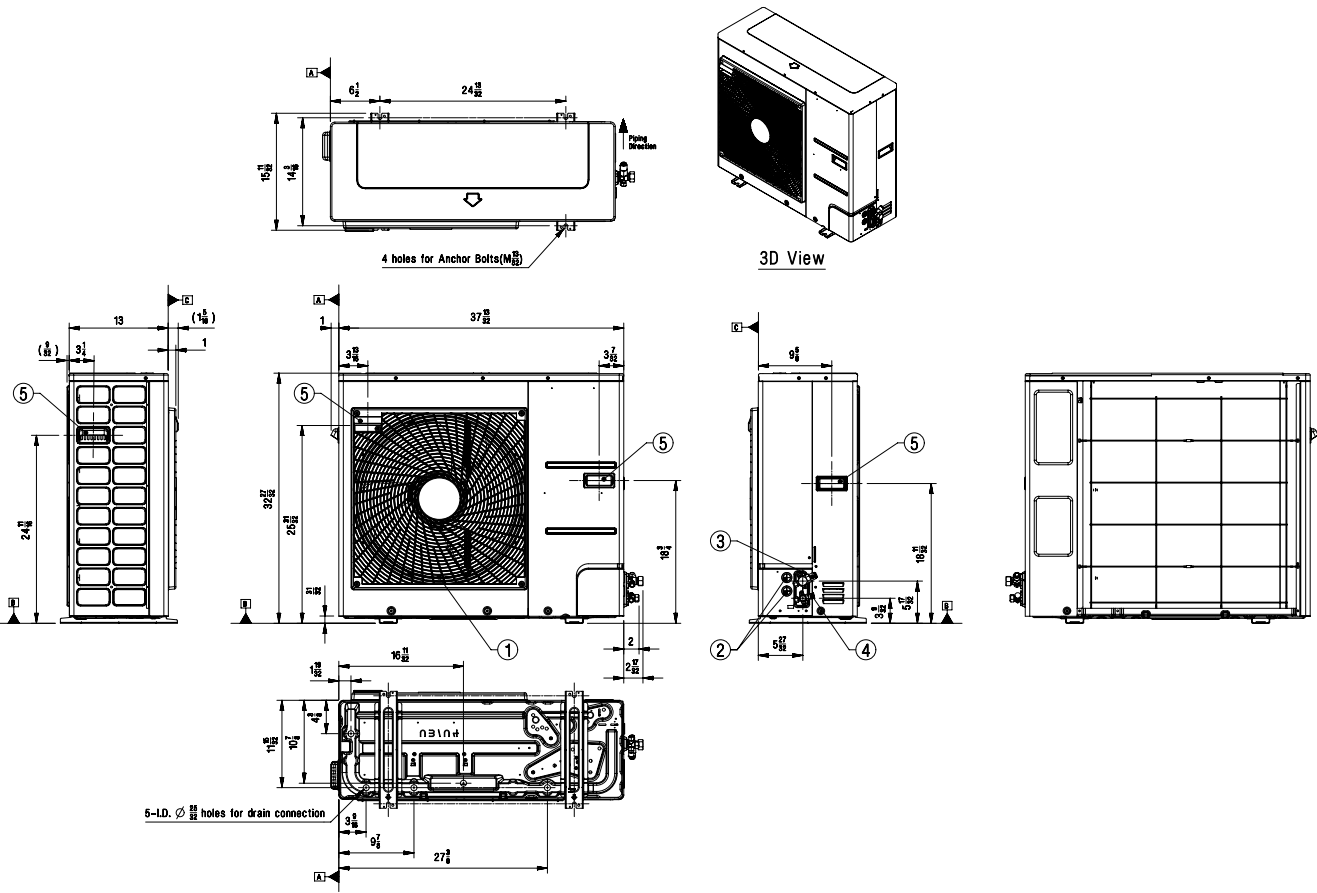
MCA = Minimum Circuit Ampacity.

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

\*SCCR rating: 5kA RMS Symmetrical.



ARUN024GSS4 Dimensions.



[Unit: inch]

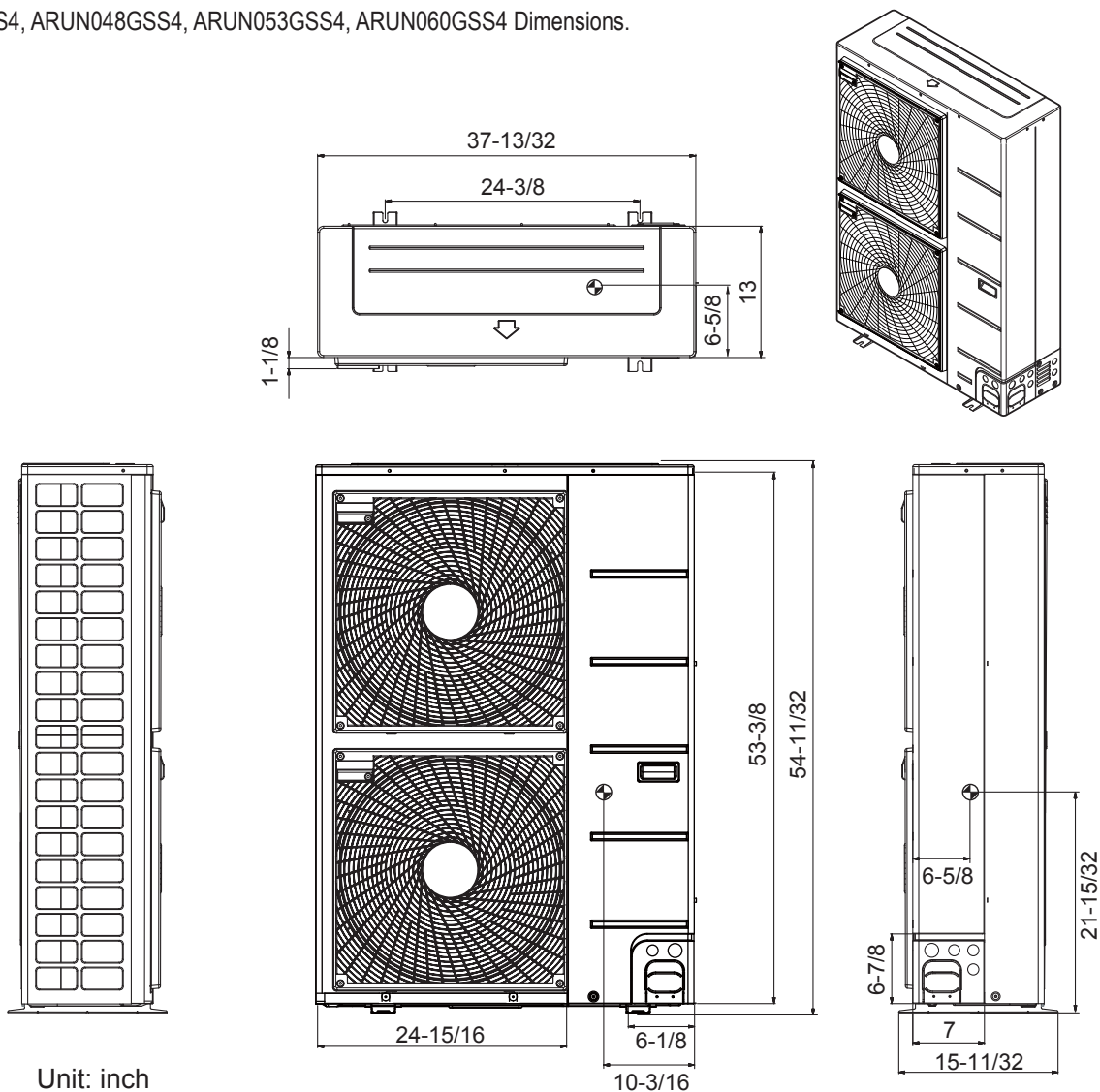
<div>Symbols</div> <div><div>→</div>Piping Direction</div> <div><div>▶</div><div>□</div>Datum line</div>	<div>Note</div> <div>1. Unit should be installed in compliance with the installation manual.</div> <div>2. Unit should be grounded in accordance with the local regulations or applicable national codes.</div> <div>3. All electrical components and materials to be supplied from the site must comply with the local regulations or international codes.</div> <div>4. Electric characteristics chapter should be considered for electrical work and design. Especially the power cable and circuit breaker should be selected in accordance with that.</div>	4	Liquid Pipe Connection	Flare joint
		3	Gas Pipe Connection	Flare joint
		2	Power and communication cable Hole	—
		1	Air Outlet	—
		No.	Part Name	Description

# HEAT PUMP OUTDOOR UNIT DIMENSIONS

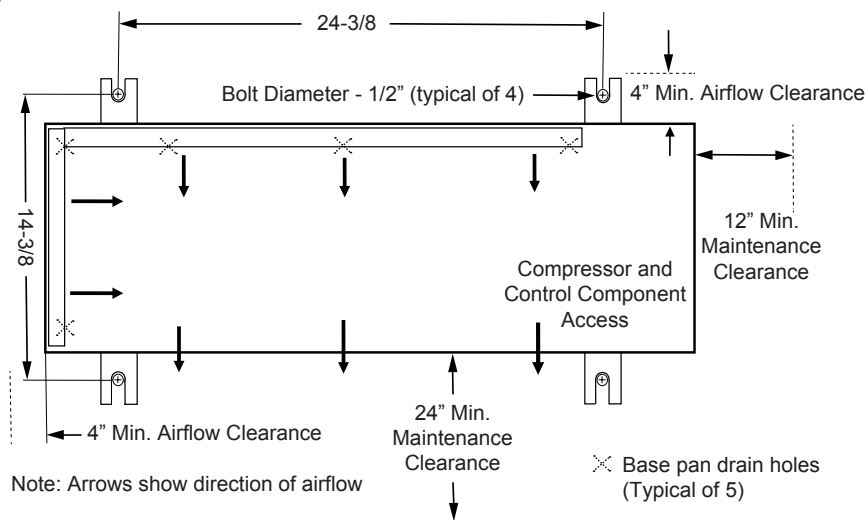
ARUN038GSS4, ARUN048GSS4, ARUN053GSS4, ARUN060GSS4



ARUN038GSS4, ARUN048GSS4, ARUN053GSS4, ARUN060GSS4 Dimensions.



Unit: inch  
 ⊕ Center of Gravity



# HEAT RECOVERY GENERAL DATA

## Heat Recovery Outdoor Unit Specifications / Electrical Data

Table 3: 208-230V Heat Recovery Outdoor Unit Specifications.

Model Numbers		5.0 Ton ARUB060GSS4
<b>Cooling Performance</b>		
Nominal Cooling Capacity (Btu/h) <sup>1</sup>		60,000
Rated Cooling Capacity (Btu/h) <sup>2</sup>		60,000
<b>Heating Performance</b>		
Nominal Heating Capacity (Btu/h) <sup>1</sup>		64,000
Rated Heating Capacity (Btu/h) <sup>2</sup>		64,000
<b>Operating Range</b>		
Cooling (°F DB) <sup>3</sup>		23 to 122
Heating (°F WB)		-13 to +61
Synchronous — Cooling Based (°F DB)		14°F to 81°F
Synchronous — Heating Based (°F WB)		14°F to 61°F
<b>Compressor</b>		
Inverter Type / Quantity		Hermetically Sealed Scroll / 1
Oil / Type		PVE / FVC68D
<b>Fan (Side Discharge)</b>		
Type		Axial Flow Fan
Motor Output (kW) x Qty.		0.124 x 2
Motor / Drive		Brushless Digitally Controlled / Direct
Operating Range (RPM)	Cooling	0 to 850
	Heating	0 to 850
Maximum Air Volume (CFM)		3,885
<b>Unit Data</b>		
Refrigerant Type		R410A
Refrigerant Control/Location		EEV/Indoor Unit
Max. Number Indoor Units / System <sup>4</sup>		12
Sound Pressure dB(A) <sup>5</sup>		57
Net Unit Weight (lbs.)		260
Shipping Weight (lbs.)		291
Communication Cables <sup>6,7</sup>		2 x 18
<b>Heat Exchanger</b>		
Material and Fin Coating		Copper Tube / Aluminum Fin and GoldFin™ / Hydrophilic
Rows / Fins per inch		3 / 14
<b>Piping<sup>8</sup></b>		
Liquid Line Connection (in., OD)		3/8 Braze
High Pressure Vapor Line Connection (in., OD)		5/8 Braze
Low Pressure Vapor Line Connection (in., OD)		3/4 Braze
Factory Charge lbs. of R410A		7.7

<sup>1</sup>Nominal capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a Combination Ratio between 95–105%.

Nominal cooling capacity rating obtained with air entering the indoor unit at 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).

<sup>2</sup>Rated capacity is certified under AHRI Standard 210/240. See [www.ahrinet.org](http://www.ahrinet.org) for information.

<sup>3</sup>Cooling range with the Low Ambient Baffle Kit (sold separately) is -9.9°F to +122°F.

<sup>4</sup>The System Combination Ratio must be between 50–130%.

Table 4: 208-230V Heat Recovery Unit Electrical Data.

Nominal Tons	Unit Model No.	Compressor Motor		Condenser Fan Motor		MCA	MOCP
		Quantity	Motor Amps RLA (Ea.)	Fan Qty.	Amps FLA x Qty.		
5.0	ARUB060GSS4	1	19.5	2	0.5 x 2	25.4	40

Voltage tolerance is ±10%.

Maximum allowable voltage unbalance is 2%.

MCA = Minimum Circuit Ampacity.

<sup>5</sup>Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745.

<sup>6</sup>Communication cable between ODU, IDU(s), / Heat Recovery Unit(s), and Central Controller must be a minimum of 18 AWG, 2-conductor, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. ☹ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

<sup>7</sup>Power wiring is field provided, solid or stranded, and must comply with all local and national codes. See below for detailed electrical data.

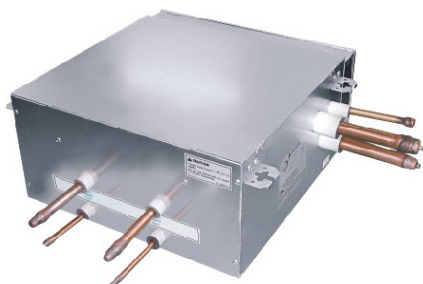
<sup>8</sup>LG requires that LATS software be used on all projects to ensure correct line sizing. Designer must verify the shop drawing design against the as-built design using LATS. Contractor must also use LG manufactured Y-Branch and Header Kits only.

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

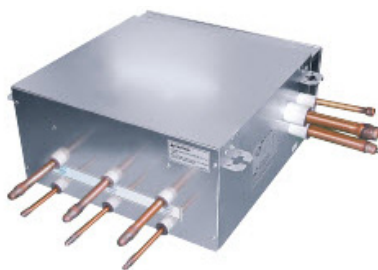
\*SCCR rating: 5kA RMS Symmetrical.

# HEAT RECOVERY GENERAL DATA

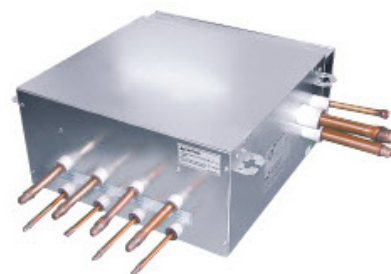
## Heat Recovery Unit Specifications / Electrical Data



Two-Port Heat Recovery Unit.



Three-Port Heat Recovery Unit.



Four-Port Heat Recovery Unit.

### Note:

Heat recovery units can only be used with LG heat recovery systems.

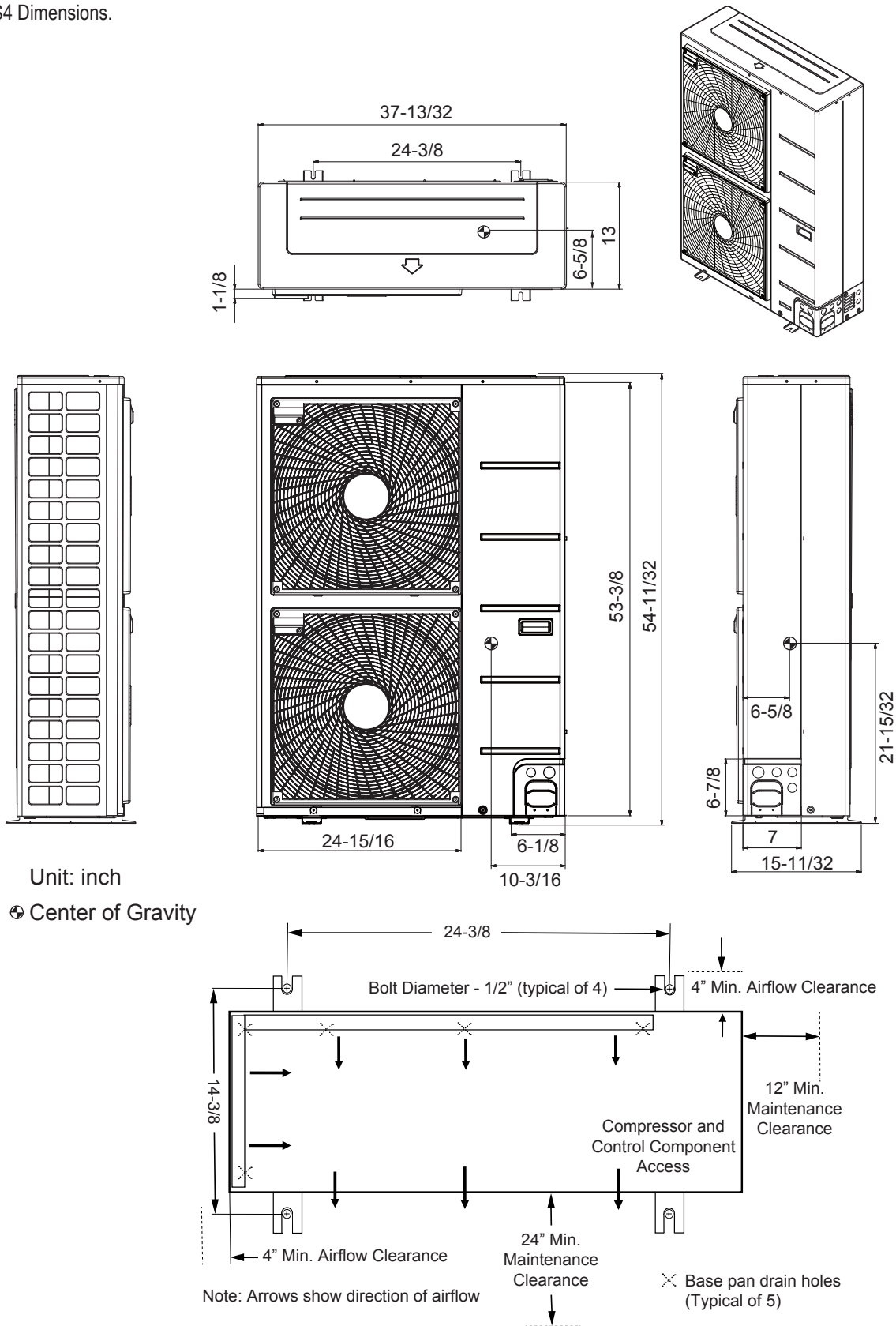
Table 5: Heat Recovery Unit Specifications.

Model			PRHR022A	PRHR032A	PRHR042A
Number of Ports			2	3	4
Max. Connectible No. of Indoor Units			16	24	32
Max. Connectible No. of Indoor Units on each port			8	8	8
Max. Port Capacity (each port)		Btu/h	54,000	54,000	54,000
Max. Unit Capacity (sum of ports)		Btu/h	192,000	192,000	192,000
Net Weight		lbs.	40	45	49
Dimensions (W x H x D)		inches	17-7/8 x 8-5/8 x 18-15/16		
Casing			Galvanized steel plate		
Connecting Pipes	To Indoor Units	Liquid Pipe (inches)	3/8		
		Vapor Pipe (inches)	5/8		
	To Outdoor Units	Liquid (inches)	3/8	1/2	5/8
		Low-pressure Vapor (inches)	7/8	1-1/8	1-1/8
		High-pressure Vapor (inches)	3/4	7/8	7/8
Insulation Material			Polyethylene		
Current	Minimum Circuit Amps (MCA)		0.1	0.15	0.2
	Maximum Fuse Amps (MFA)		15		
Power Supply			1Ø, 208-230V, 60Hz		

Table 6: Heat Recovery Unit Electrical Data.

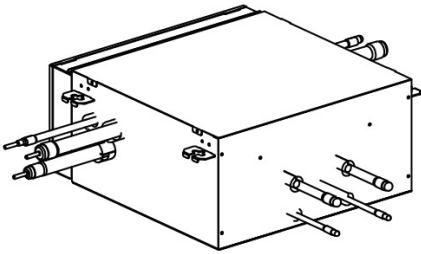
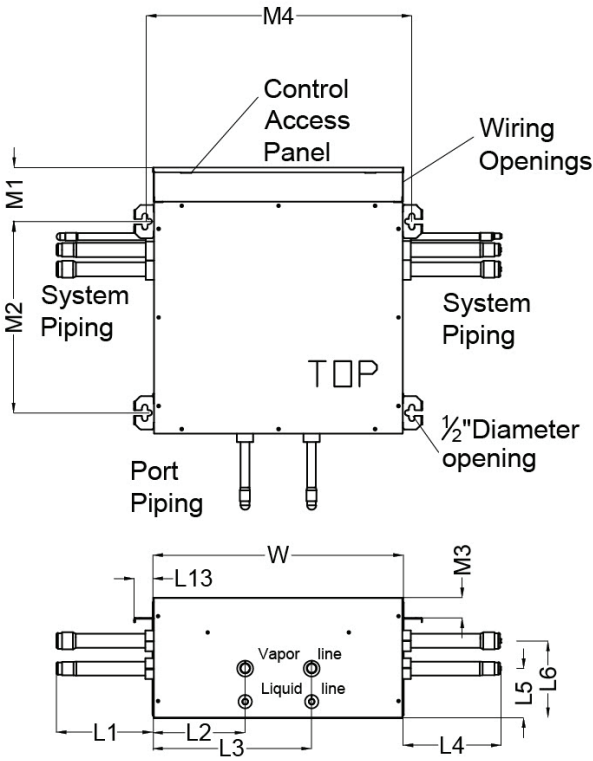
Unit Model No.	V / Hz / Ph	Input (kW)	
		Cooling	Heating
PRHR022A	208-230 / 60 / 1	0.026	0.026
PRHR032A	208-230 / 60 / 1	0.033	0.033
PRHR042A	208-230 / 60 / 1	0.040	0.040

ARUB060GSS4 Dimensions.

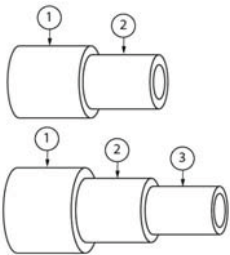


DIMENSIONS

Heat Recovery Unit — PRHR022A

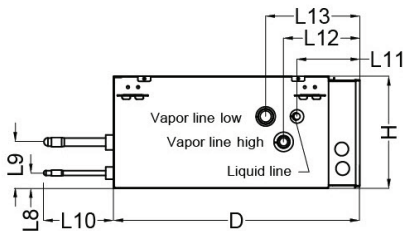
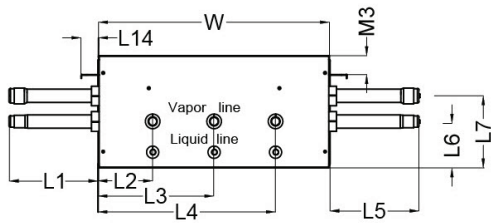
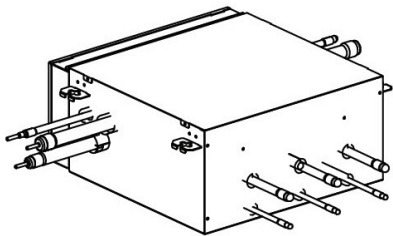
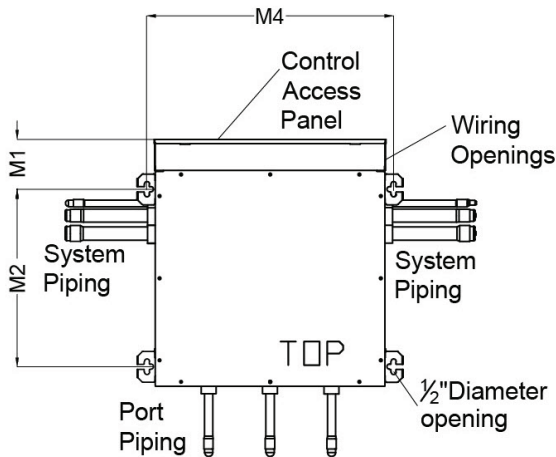


W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	6-5/8"
L3	11-3/8"
L4	6-7/8"
L5	3-1/2"
L6	5-1/2"
L7	1-3/16"
L8	3-9/16"
L9	5-7/16"
L10	4-3/4"
L11	5-3/4"
L12	7-1/4"
L13	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"

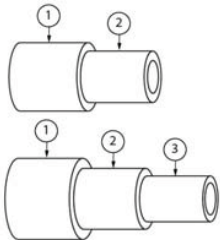


Reducer Dimensions (in)					
		1	2	3	Quantity
Indoor Unit	Liquid Line	3/8 OD	1/4 OD	-	2
	Vapor Line	5/8 OD	1/2 OD	-	2
HR Unit	Liquid Line	3/8 OD	1/4 OD	-	2
	Vapor Line Low	5/8 OD	1/2 OD	-	2
		7/8 OD	3/4 OD	5/8 OD	2
	Vapor Line High	1/2 OD	3/8 OD	-	2
		3/4 OD	5/8 OD	1/2 OD	2





W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	4-1/4"
L3	9"
L4	13-3/4"
L5	6-7/8"
L6	3-1/2"
L7	5-1/2"
L8	1-3/16"
L9	3-9/16"
L10	5-7/16"
L11	4-3/4"
L12	5-3/4"
L13	7-1/4"
L14	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"



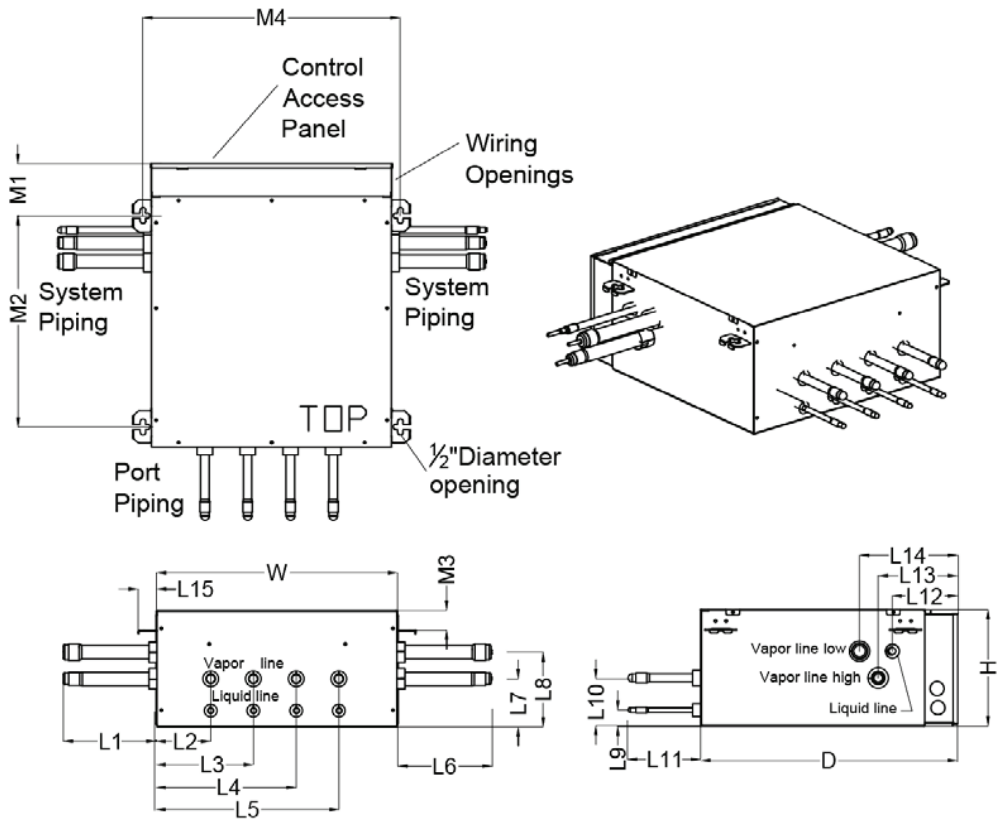
Reducer Dimensions (in)					
Indoor Unit		1	2	3	Quantity
	Liquid Line	3/8 OD	1/4 OD	-	3
HR Unit	Vapor Line	5/8 OD	1/2 OD	-	3
	Liquid Line	1/2 OD	3/8 OD	-	2
	Vapor Line Low	3/4 OD	5/8 OD	-	2
		1-1/8 OD	7/8 OD	3/4 OD	2
	Vapor Line High	5/8 OD	1/2 OD	-	2
		7/8 OD	3/4 OD	5/8 OD	2



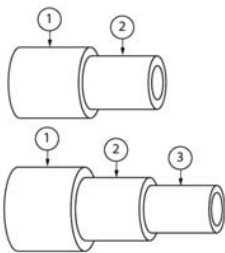
DIMENSIONS



Heat Recovery Unit — PRHR042A



W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	4-1/4"
L3	7-1/2"
L4	10-1/2"
L5	13-3/4"
L6	6-7/8"
L7	3-1/2"
L8	5-1/2"
L9	1-3/16"
L10	3-9/16"
L11	5-7/16"
L12	4-3/4"
L13	5-3/4"
L14	7-1/4"
L15	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"



Reducer Dimensions (in)					
		1	2	3	Quantity
Indoor Unit	Liquid Line	3/8 OD	1/4 OD	-	4
	Vapor Line	5/8 OD	1/2 OD	-	4
HR Unit	Liquid Line	1/2 OD	3/8 OD	-	2
	Vapor Line Low	3/4 OD	5/8 OD	-	2
	Vapor Line High	1-1/8 OD	7/8 OD	3/4 OD	2
		5/8 OD	1/2 OD	-	2
		7/8 OD	3/4 OD	5/8 OD	2





## Transporting / Lifting the Outdoor Unit

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

### Note:

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

Table 7: Multi V S Shipping and Net Weights.

Capacity (ton)	Shipping Weight (lbs.)	Net Weight (lbs.)
2	176	159
3	218	207
4		
4.4		
5	291	260

## ⚠ WARNING

- Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed above. If the equipment is not properly secured, it may result in an accident that causes physical injury or death.
- Wear protective gloves when handling equipment. Sharp edges may cause personal injury.
- Some products include polypropylene bands around the unit for packaging. ⓧ Do not use polypropylene bands to lift the unit. There is a risk of the product falling and causing physical injury.
- Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.
- Consider the unit's center of gravity before lifting. Hoist the unit with the center of gravity centered among the lifting straps. There is a risk of the product falling and causing physical injury.
- Lift the outdoor unit from the base at specified locations. Support the outdoor unit at a minimum of six (6) points to avoid slippage from the rigging apparatus, and use a minimum of three (3) lifting straps. There is a risk of the product falling and causing physical injury.
- Use caution when using a forklift to transport an unpackaged unit. ⓧ Do not drop the unit when carrying it with a forklift. There is a risk of the product falling and causing physical injury.

### Note:

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

Figure 1: Transporting / Lifting the Outdoor Unit.

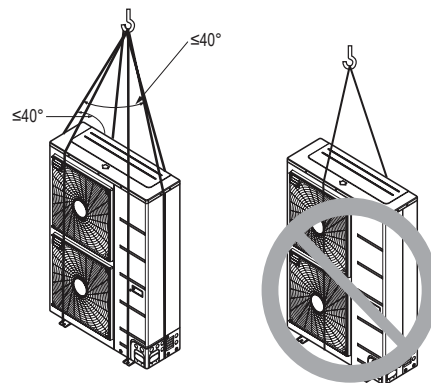
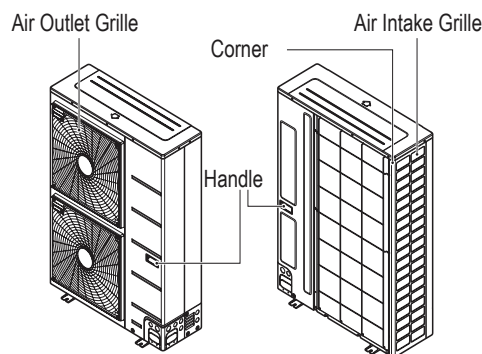


Figure 2: Transporting the Outdoor Unit.






# PLACEMENT CONSIDERATIONS



## Selecting the Best Location for the Outdoor Unit(s)

### Selecting the Best Location for the Outdoor Unit(s)

#### DANGER

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

#### WARNING

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

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

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

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

#### Don'ts

- Where it will be subjected to direct thermal radiation from other heat sources, or an area that would expose the outdoor unit to heat or steam like discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperatures.
- Where high-frequency electrical noise / electromagnetic waves will affect operation.
- Where operating sound from the unit will disturb inhabitants of surrounding buildings.
- Where the unit will be exposed to direct, strong winds.
- Where the discharge of one outdoor unit will blow into the inlet side of an adjacent unit (when installing multiple outdoor units).

#### Planning for Snow and Ice

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

1. Prepare for severe winter wind chills and heavy snowfall, even in areas of the country where these are unusual phenomena.
2. Position the outdoor unit so that its airflow fans are not buried by direct, heavy snowfall. If snow piles up and blocks the airflow, the system may malfunction.
3. Remove any snow that has accumulated four (4) inches or more on the top of the outdoor unit.
4. In climates that may experience significant snow buildup, mount the outdoor unit on a raised, field-provided platform or stand. The raised support platform must be high enough to allow the unit to remain above possible snow drifts, and must be higher than the maximum anticipated snowfall for the location.
5. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit frame.
6. Provide a field fabricated snow protection hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces.
7. Install a hail guard kit and air guide accessories (sold separately) to prevent snow or rain from accumulating on the fan inlet/outlet guards.
8. Consider tie-down requirements in case of high winds or where required by local codes. In all cases, connected duct work and accessories must provide a combined air pressure drop rating that does not exceed 0.16" WG.

### Planning for Snow and Ice, continued.

#### Note:

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

- Snow throw mode does not prevent ice from forming on the fan blade or discharge grille.

#### Note:

The system may take longer to provide heat, or heating performance will be reduced in winter if the outdoor 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.

### Wind Protection

If the outdoor unit is placed on a roof, position it with the compressor end (no coil surface) in the direction of the prevailing wind as shown in the figure at right. In cooler climates, it may be beneficial to position the unit in direct sunlight to assist with defrost operations.

If the outdoor unit is not placed on a roof, place it on the leeward side of the building or in a location where the unit will not be exposed to constant wind.

If placement exposes the unit to constant wind activity, construct a wind break in front of the unit. Follow the placement guidelines set forth in "Clearance Requirements".

### Tie-Downs and Wind Restraints

The strength of Multi V frames is adequate to be used with field-provided wind restraint tie-downs. The overall tie-down configuration must be approved by a local professional engineer. Always refer to local code when designing a wind restraint system.

### Mounting Platform

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.

Figure 3: Prevailing Wind Direction.

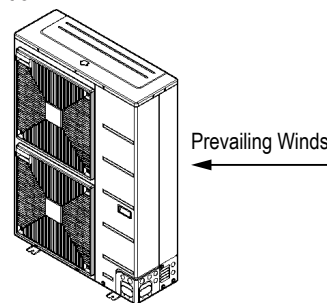
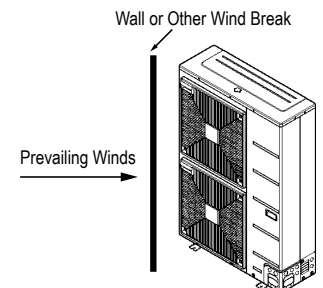


Figure 4: Leeward Side of the Building.



Figure 5: Wind Break.



# PLACEMENT CONSIDERATIONS



## Selecting the Best Location for the Outdoor Unit(s)

### Tie-Downs and Lightning Protection

#### Tie-Downs

- The strength of the roof must be checked before installing the outdoor units.
- If the installation site is prone to high winds or earthquakes, when installing on the wall or roof, securely anchor the mounting base using a field-provided tie-down configuration approved by a local professional engineer (see diagram at right for example).
- Use four wires, detach the top of the frame at the locations indicated, thread the screws through the wires, then reattach the screws to the outdoor unit frame.
- The overall tie-down configuration must be approved by a local professional engineer. Always refer to local code when using a wind restraint system.

#### Lightning Protection

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

Table 8: Safety Zone Specifications.

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

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

#### Note:

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

Figure 6: Lightning Protection Diagram.

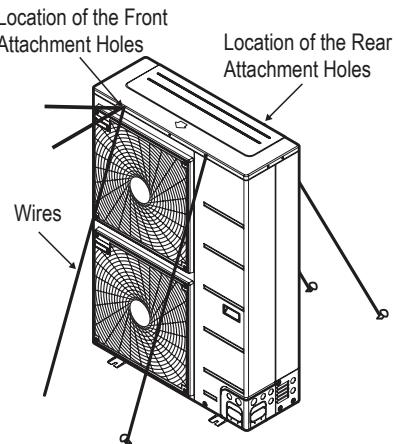
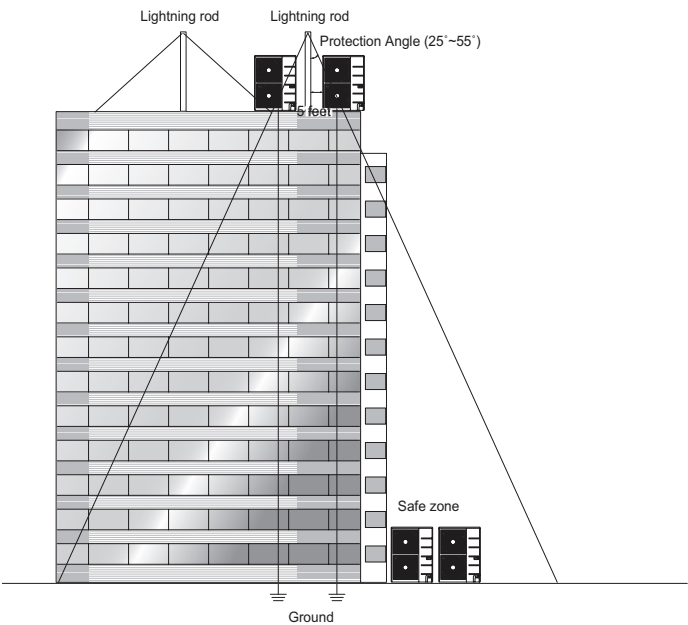


Figure 7: Lightning Protection Diagram.



### Oceanside Installation Precautions

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

### Note:

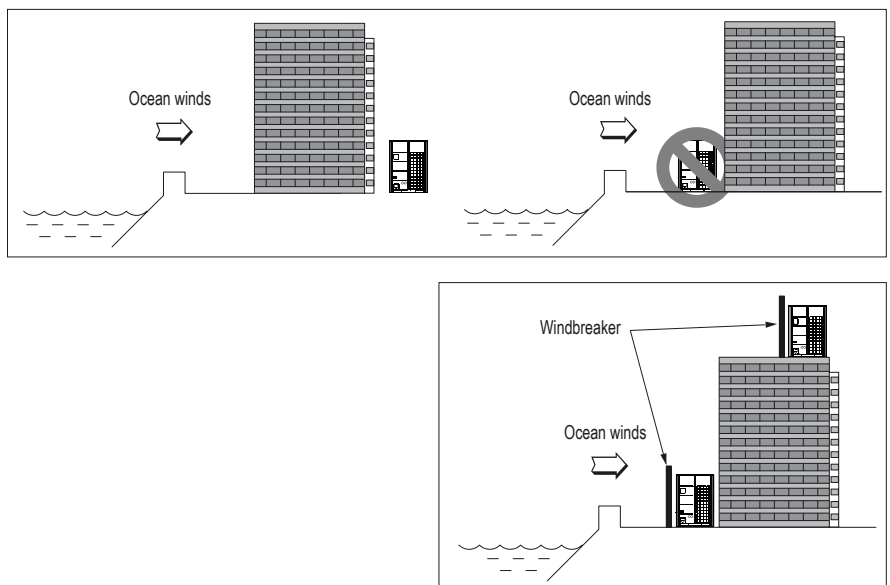
*Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.*

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

### Note:

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

Figure 8: Oceanside Installation Precautions.



# PLACEMENT CONSIDERATIONS

## Outdoor Unit Clearance Requirements

### Minimum Clearance Requirements for Multi V S Outdoor Units

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

#### Minimum Clearance Requirements for the Multi V S 24K Outdoor Unit

Specific clearance requirements in the diagram below are for Multi V S 24,000 Btu/h (ARUN024GSS4) systems. The figure below shows the overall minimum clearances that must be observed for safe operation and adequate airflow around the outdoor unit.

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

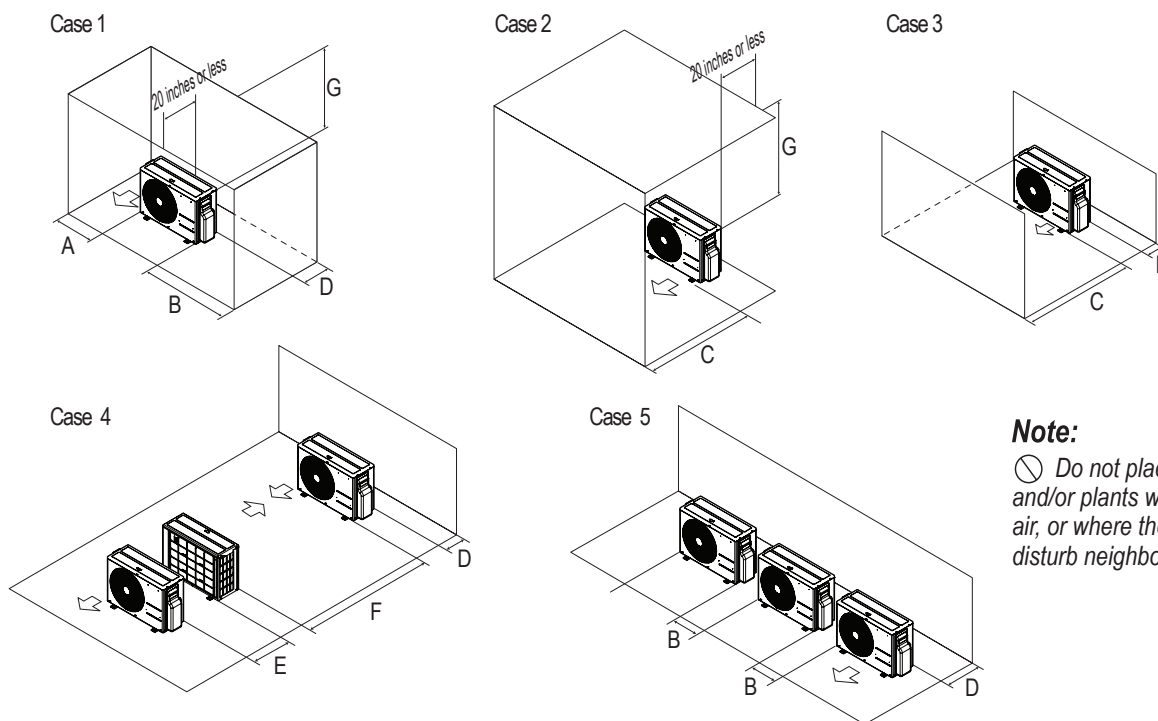
Adhere to all clearance requirements if installing the unit on a roof. Be sure to level the unit and ensure that the unit is adequately anchored. Consult local codes for rooftop mounting requirements.

To have successful service access to the outdoor unit, see the following figure for minimum spacing. When installing multiple outdoor units, see Cases 4 and 5 for correct spacing requirements.

#### Note:

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

Figure 9: Outdoor Unit Service Access and Allowable Clearances Diagram.



#### Note:

Do not place the unit where animals and/or plants will be in the path of the warm air, or where the warm air and / or noise will disturb neighbors.

Table 9: 24K Outdoor Unit Service Access and Allowable Clearances Diagram Legend.

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



### Minimum Clearance Requirements for Multi V S 38, 48, 53, and 60K Outdoor Units

Figures below and on the next page illustrate clearance requirements for various installation scenarios for Multi V S 38,000 Btu/h (ARUN038GSS4), 48,000 Btu/h (ARUN048GSS4), 53,000 Btu/h (ARUN053GSS4) and 60,000 Btu/h (ARUN060GSS4) Heat Pump outdoor units; and 60,000 Btu/h (ARUB060GSS4) Heat Recovery outdoor units. Use the hot isle / cold isle approach when placing multiple units in close proximity to each other. Outdoor unit fans draw air from the back of the unit and discharges out the front. Place units back to back and face to face.

**Note:**

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

**Legend**

LR = Rear wall height

LF = Front wall height

H = Unit height

Figure 10: Improper Outdoor Unit Placement.

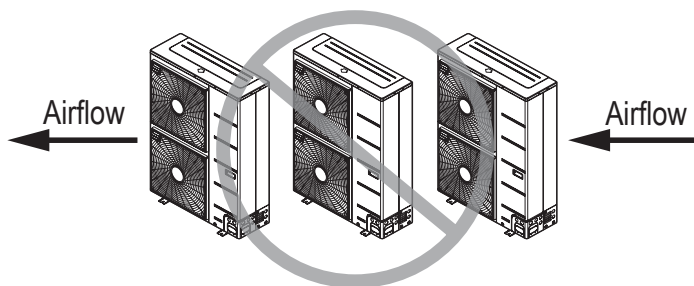
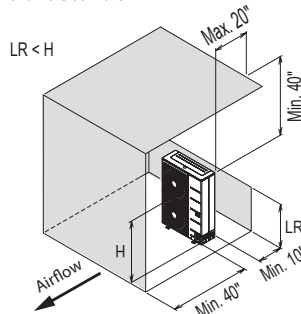


Figure 11: Proper Outdoor Unit Placement and Clearances.

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



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

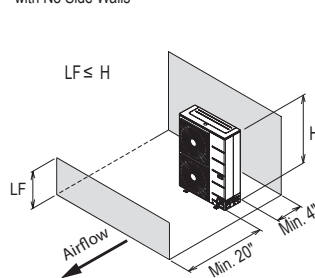
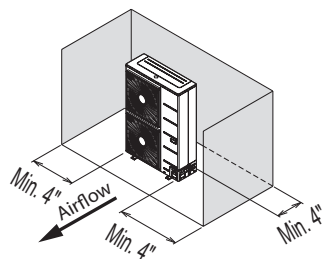
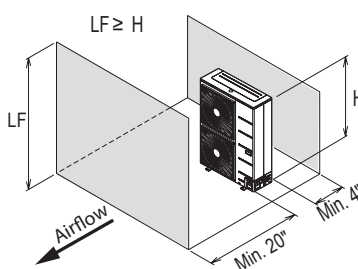


Figure 12: Proper Outdoor Unit Placement and Clearances, continued.

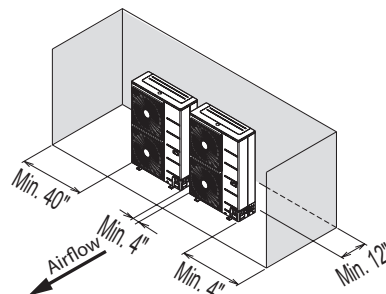
Single Unit—High Rear Wall with or without High Side Walls



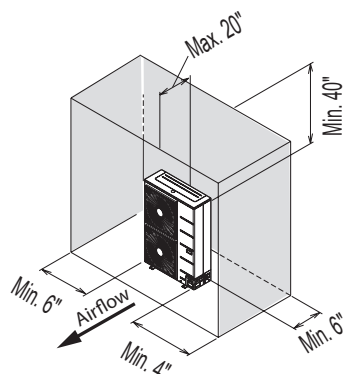
Single Unit—High Rear and Front Walls with No Side Walls



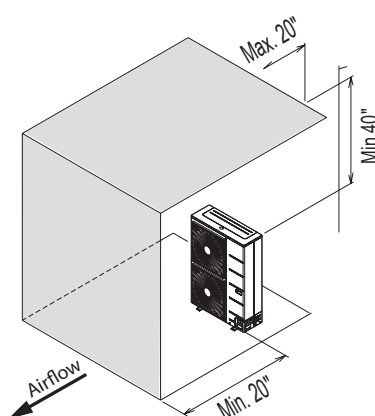
Side by Side—High Rear and Side Walls



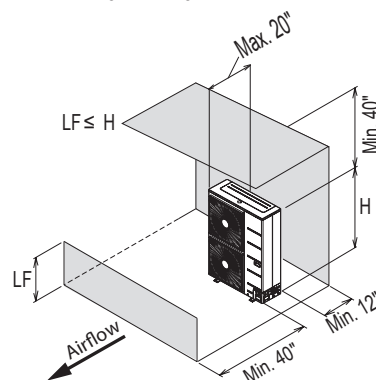
Single Unit—High Rear and Side Walls with Building Overhang



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



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



# PLACEMENT CONSIDERATIONS



## Outdoor Unit Clearance Requirements

### Note:

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

### Legend

LR = Rear wall height  
 LF = Front wall height  
 H = Unit height

Figure 13: Proper Outdoor Unit Placement and Clearances, continued.

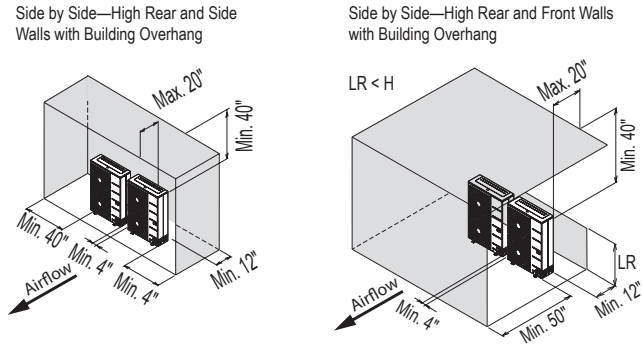
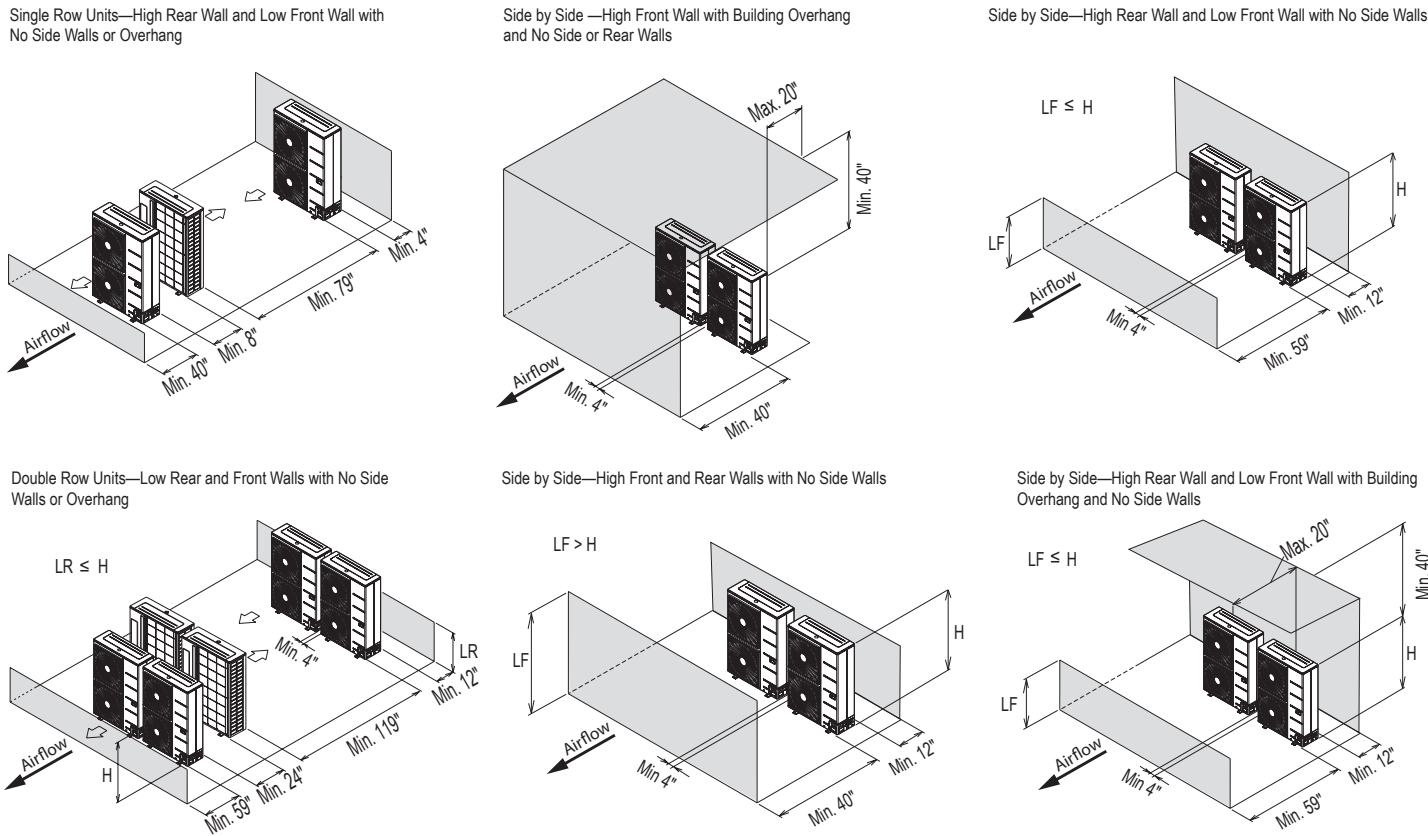


Figure 14: Proper Outdoor Unit Placement and Clearances, continued.





### Installing Outdoor Units Indoors

LG Multi V outdoor units are engineered to be mounted outdoors and include technology designed to minimize the negative effects of winter weather's freezing rain, sleet, and snow. Some building projects, however, necessitate placing the HVAC outdoor units indoors:

- Lack of ground space.
- Lack of an appropriate outdoor location that meets system design requirements.
- When mounting on the roof is not an option due to a lack of roof space.
- Roof warranty will be voided if mechanical equipment is placed on the membrane.
- On retrofit projects, a former chiller / boiler / air handler equipment room, mechanical area, or penthouse already exists.
- Where a project has vertical, self-contained VAV air handlers on each floor (in lieu of a centralized mechanical room).
- To curtail the potential need for redundant zone heating devices such as wall-fin radiators or duct heaters.
- In extremely cold environments where there is a significant amount of run-time at temperatures well below freezing outside the outdoor unit ambient air temperature range published in the Multi V S Engineering manual.

### Benefits of Installing Outdoor Units Indoors

- Shelters the outdoor unit from direct exposure to prevailing winds that decrease the heating capability of the outdoor unit.
- Protects equipment from freezing precipitation and / or potential ice build-up that could hinder unit operation.
- Maintains coil heat transfer efficiency by reducing the number of and shortening the cycle time for defrost operation.
- Easier maintenance and servicing during inclement weather.
- When mounted in a fully enclosed space, limiting the ambient air temperature may allow the Multi V system designer to eliminate oversizing the outdoor unit to compensate for loss of capacity at low ambient temperatures.
- May also curtail the need to provide inefficient redundant zone heating devices such as wall-fin radiators and second-stage ancillary heating devices.

### Design Considerations Include:

- Enclosure types and elements such as louvers, rain hoods, dampers and controls, heating methods and sizing of heating devices
- Heating strategies
- Duct design
- Condensate handling

### General Guidelines

- Follow ASHRAE 62.1 design guidelines.
- Depending on the project / application, a roof over the outdoor units in combination with a wind break may be all that is necessary.
- Consider the potential for snow accumulation near louvers / roof openings. Outside air intakes and discharge ducts/louvers must be engineered to clear anticipated snow accumulation levels by at least one (1) foot.
- In situations where operation is anticipated at temperatures of -13°F and lower, ancillary heat must be provided to heat the outdoor unit coils to assure continuous compressor operation and heating.

It may be necessary to use an air guide accessory to prevent discharge air from short-cycling back to the coil inlet.

- Another option is to field manufacture ductwork and mount on top of the unit to encompass the outdoor unit fan discharge and connect to the exterior discharge grille on the building.
- Avoid using a single duct on multi-fan units to prevent short cycling. Provide a dedicated duct for each outdoor unit fan discharge.
- Consider the direction of prevailing winds and opening placement. If possible, locate inlet openings upwind of discharge openings and other exhaust outlets.
- When inlet and outlet openings are placed on the same wall, minimum distance between the two openings must be approximately three (3) feet (minimum distance varies significantly with variations in outlet opening face velocity).
- If roof-mounted ventilation openings are used, strategically locate the inlet ventilation opening(s) upwind of the outlet opening(s).
- Discharge and supply ductwork must be designed to avoid weather related long periods of water entrainment and the potential for microbial growth.

# PLACEMENT CONSIDERATIONS



## Installing Outdoor Units Indoors

Provide a means to drain the condensate generated during heating mode and defrost cycle in addition to rainwater that infiltrates the inlet louver enclosed area.

- Install a field-provided drain pan under the outdoor units and provide a path to a nearby floor drain.
- If the ambient air temperature is expected to drop below 32°F in the enclosure, heat the bottom surface of the pan, drain line, and floor drain so that the condensate does not freeze before reaching the drain.

Allow for ventilation intake and exhaust air based on maximum outdoor unit fan capacity.

- Select the size, type and orientation of architectural louvers with adequate "net free area" face velocity to ensure the total external static pressure from the outdoor unit fan does not exceed design limitations (see specification data tables).
- ⦿ No obstructions must be placed in front of the louver that could hamper the free flow (throw) of air.
- Roof top openings and / or discharge and supply louvers must be equipped with screens to prevent bird and insect infiltration.

As always, the best solution for each project balances acceptable heating performance (considering local weather conditions), capital costs, life cycle energy consumption, and limitations set forth by local building codes. For more detailed information on how to design indoor spaces for LG Multi V outdoor units, see the white paper "Air-Source VRF Mechanical Room Design Considerations for Outdoor Unit Placement in Enclosures" on [www.lg-vrf.com](http://www.lg-vrf.com).


### **Note:**

**For detailed placement considerations and installation requirements for indoor units, refer to its Indoor Unit Engineering and / or Installation Manuals.**

## Louver Recommendations for Outdoor Unit Enclosure

1. Outdoor Unit Enclosure: Manual Door Open Type.
2. Louver Angle: No More Than 15° Horizontally.
3. Space Between Louvers: More than 4 inches (Recommend).
4. Louver Shape: Wing or Plane Type.

### Note:

- Open Rate and Inlet must be taken into consideration when designing the louvered outdoor unit enclosure.
-  Do not use "S" type louvers.

### Note:

#### If the Louver Open Rate is Too Small

1. Noise can occur because of the increased air velocity passing through the louver blade.
2. Noise can occur from louver blade vibrations.
3. A drop in outdoor unit fan performance (excess static pressure can cause a drop in outdoor unit performance and heat exchanger efficiency).
4. If the louver open rate is too small or there is insufficient air flow exchange, the air conditioner might stop operating.

Figure 15: Louver Recommendations.

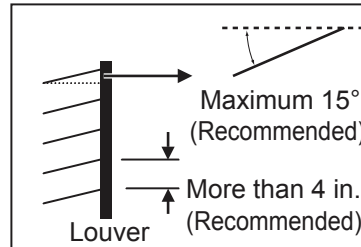
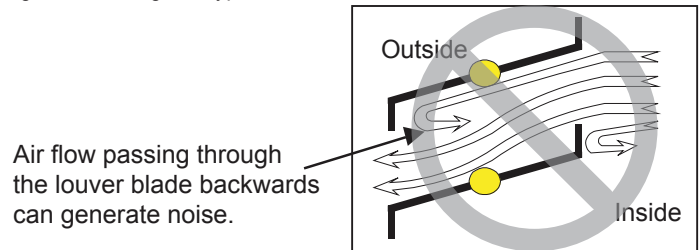
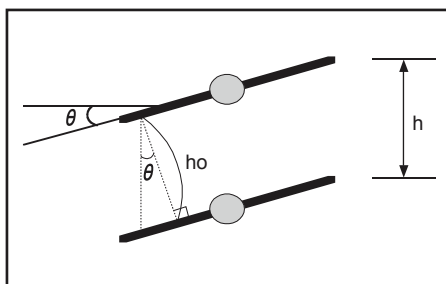


Figure 16: Using "S" Type Louvers.



## Open Rate by Louver Radian

Figure 17: Open Rate by Louver Radian Formula.



$$\theta \leq 15$$

$$h_o = h \cdot \cos \theta$$

$$\text{Total Area (A)} = H \cdot W$$

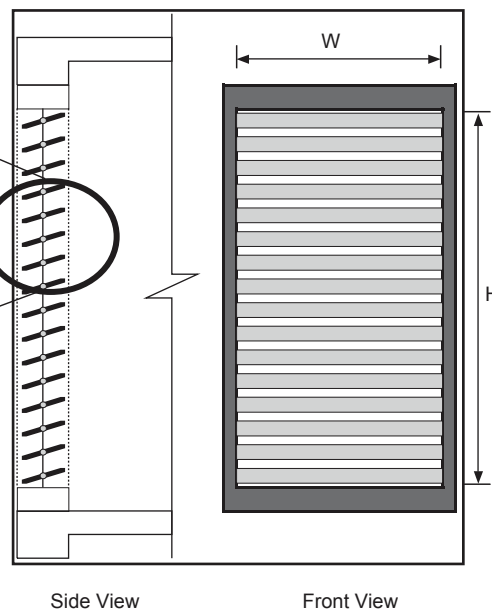
$$\text{Number of Open Spaces (N)} = (\text{Number of Louvers} - 1)$$

$$\text{Effective Area (Af)} = h_o \cdot W \cdot N$$

$$\text{Louver Open Rate (n)} = A_f / A$$

$$\therefore A_f = A \cdot n$$

Effective Cross Section Area



Side View

Front View

## Confirming Air Flow Rate / Total Opening Rate Figure 18: Example of Installing Outdoor Unit Indoors.

- Airflow Rate: 2,119 ft.<sup>3</sup>/min.

- Velocity of Outlet Air: 16.4 ft./s

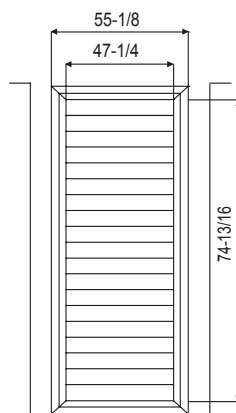
- Velocity of Inlet Air: 8.2 ft./s

- Open Rate = 80% or More

$$\text{Open Rate} = \frac{\text{Effective Face Area (Af)}}{\text{Total Face Area (A)}}$$

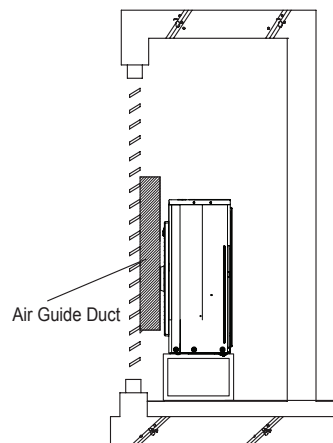
- Discharge Air Guide must be installed.

Louver Dimensions

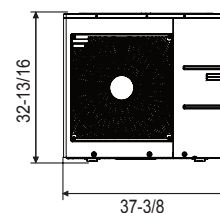


Unit: Inch

Air Guide Duct on Outdoor Unit



Outdoor Unit Dimensions



### Formula

- Total Louver Dimension (Excluding Frame) (A) = 3.9 feet x 6.2 feet = 24.2 ft.<sup>2</sup>
- Louver Shield Dimension by Product (B) = 3.12 feet x 2.74 feet = 8.55 ft.<sup>2</sup>
- Inlet Louver Dimension (A - B) = 15.7 ft.<sup>2</sup>
- Equivalent Inlet Dimension (Open Rate 80%) = 15.7 ft.<sup>2</sup> x 0.8 = 12.56 ft.<sup>2</sup>
- Equivalent Inlet Air Volume = 12.56 ft.<sup>2</sup> x 8.2 ft./s x 60 sec./min. = 6,179.5 ft.<sup>3</sup>/min.
- Required Air Volume / Equivalent Volume = 6,179.5 ft.<sup>3</sup>/min. / 2,119 ft.<sup>3</sup>/min. = 291% (Within Allowable Limits)

### Note:

Heat recovery units are for use with systems designed for heat recovery operation only (ARUB060GSS4).

Select an installation space for the heat recovery unit that meets the following conditions:

- Install the heat recovery unit indoors in a level and upright position.
- Ensure there is enough space in the installation area for service access.
- Install the heat recovery unit in a location where any sound it may generate will not disturb occupants in the surrounding rooms.
- Install the refrigerant piping and electrical wiring system in an easily accessible location.



### Don't's

- Refrigerant pipes must not exceed lengths specified by LG Electronics.
- Do not install the heat recovery unit in a location where it would be subjected to strong radiation heat from heat sources.
- Avoid an installation environment where oil splattering or vapor spray may occur.
- Avoid an installation environment where high-frequency electric noise could occur.
- Condensate drain piping is not required.

Figure 19: Dimensions for Heat Recovery Units.

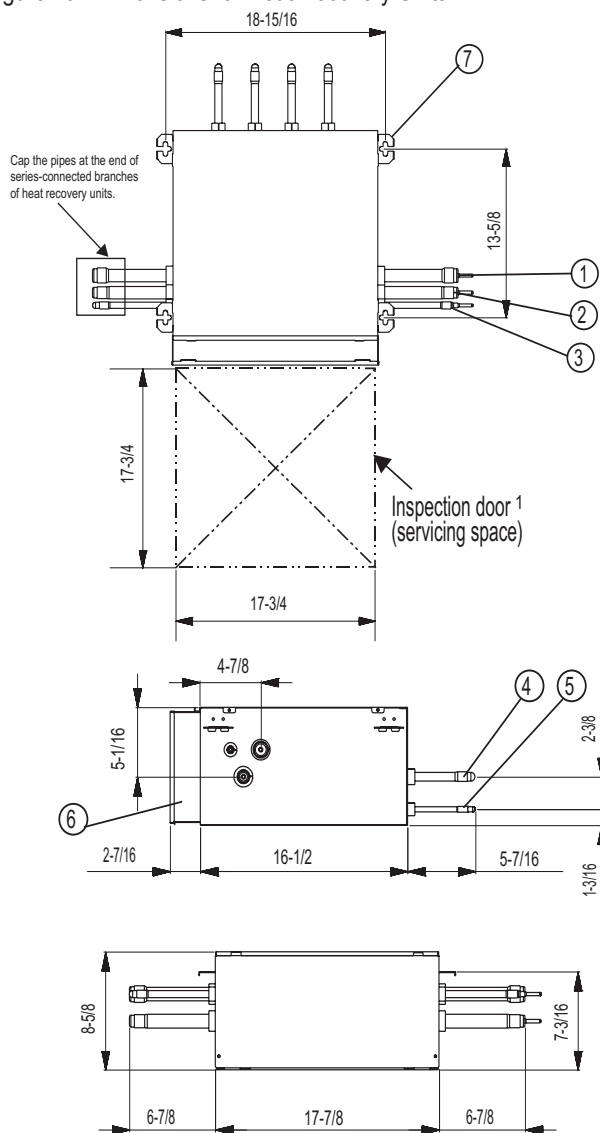


Figure 20: Minimum Service Clearances for Heat Recovery Units.

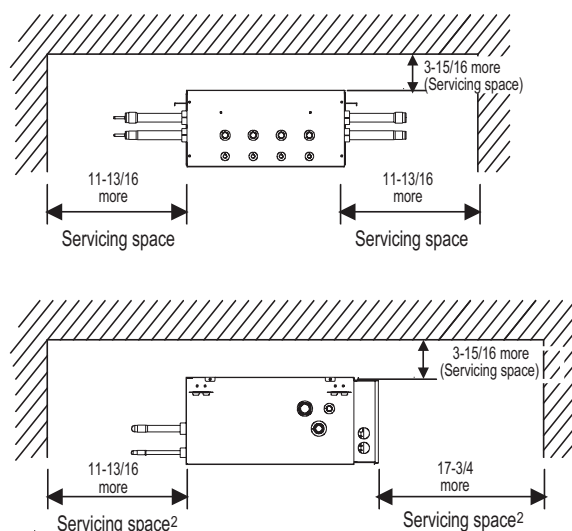


Table 10: Heat Recovery Unit Parts.

Tag No.	Part Name	Connection Size(in.)/Type		
		PRHR022A	PRHR032A	PRHR042A
1	Low pressure vapor pipe connection port	7/8 Braze	1-1/8 Braze	1-1/8 Braze
2	High pressure vapor pipe connection port	3/4 Braze	7/8 Braze	7/8 Braze
3	Liquid pipe connection port	3/8 Braze	1/2 Braze	5/8 Braze
4	Indoor unit vapor pipe connection port	5/8 Braze	5/8 Braze	5/8 Braze
5	Indoor unit liquid pipe connection port	3/8 Braze	3/8 Braze	3/8 Braze
6	Control box	—	—	—
7	Hanger bracket	3/8 or 5/16	3/8 or 5/16	3/8 or 5/16

<sup>1</sup>Locate the inspection door at the control box side of the heat recovery unit.

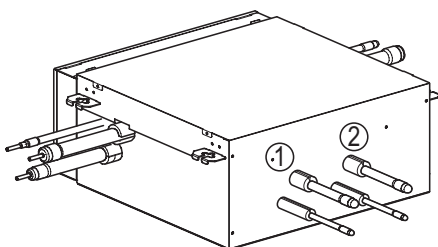
<sup>2</sup>If reducers are used, space for service access must be increased to match the dimensions of the reducer.

# PLACEMENT CONSIDERATIONS

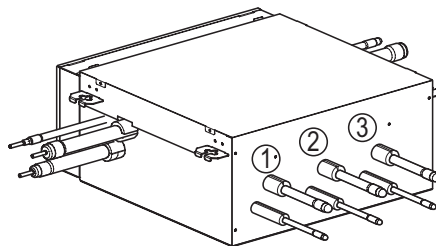
**MULTI V<sup>S</sup>**

Selecting the Best Location / Clearance Requirements for the Heat Recovery Unit(s)

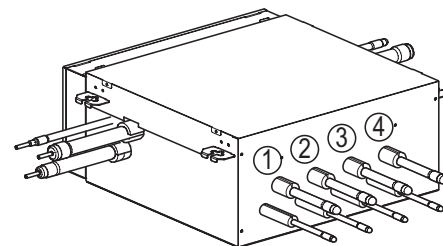
Figure 21: Heat Recovery Unit Types.



PRHR022A (Two [2] ports)



PRHR032A (Three [3] ports)



PRHR042A (Four [4] ports)

1. Each heat recovery unit has a capacity up to 192,000 Btu/h.
2. Heat recovery units connected in series have a total capacity up to 192,000 Btu/h per series string. Series string is defined as heat recovery units piped in series.
3. Elevation difference between heat recovery units connected in series is permitted, but must not exceed 16 feet.
4. Each port on the heat recovery unit has a capacity up to 54,000 Btu/h.
5. Each port can be connected to a maximum of eight (8) indoor units. When multiple indoor units are connected to one port, all indoor units on that port must operate in the same mode (cooling or heating).
6. If an indoor unit larger than 54,000 Btu/h is to be used, two (2) ports must be twinned using a reverse Y-branch.
7. Connect largest indoor unit to first port of the heat recovery unit.
8. Elevation difference between the heat recovery unit and the indoor unit(s) must not exceed 49 feet.

## **Note:**

Multi V S heat recovery unit has a maximum allowable system combination ratio of 130%. The maximum total combined capacity of indoor units is 78,000 Btu/h.

## ⚠ WARNING

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

## Note:

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

## ⚠ WARNING

- Ensure that the floor / chosen location has enough strength to support the weight of the unit(s) and the base. If it does not have sufficient strength, the unit(s) and base may fall and cause physical injury or death.
- Install the outdoor unit to protect against extremely high winds and earthquakes. Any deficiency in installation may cause unit to fall, resulting in physical injury or death.

## ⚠ CAUTION

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

## General Mounting

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

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

Figure 22: Remove the Wood Pallet.

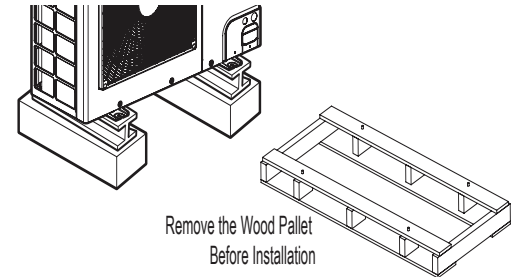
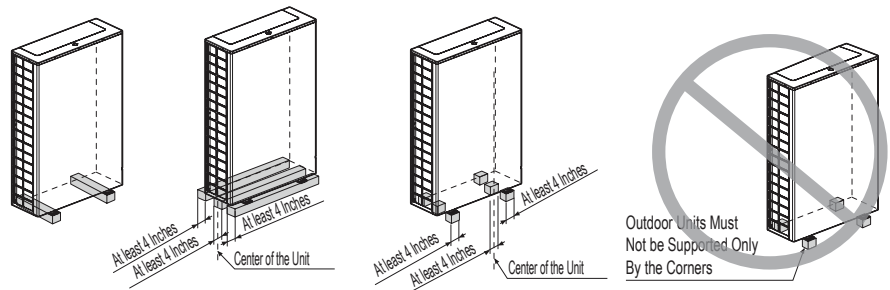


Figure 23: Multi S Outdoor Unit Mounting Options.

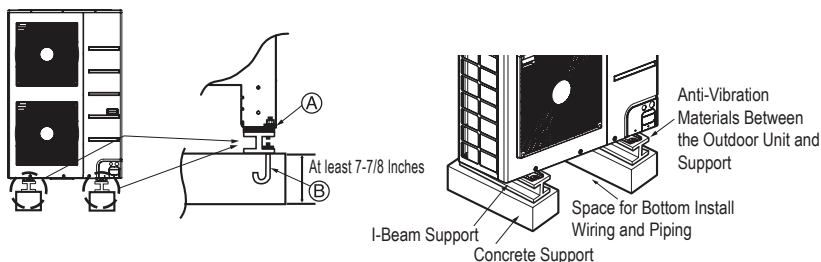


# MOUNTING / ANCHORING THE OUTDOOR UNIT(S)

## Mounting Bolt Location / Foundation for Installation

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

Figure 24: Mounting Bolt / Foundation Diagram.



### ⚠ WARNING

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

Figure 25: Mounting Method No. 1

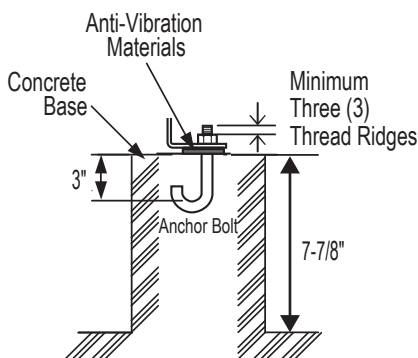


Figure 26: Mounting Method No. 2.

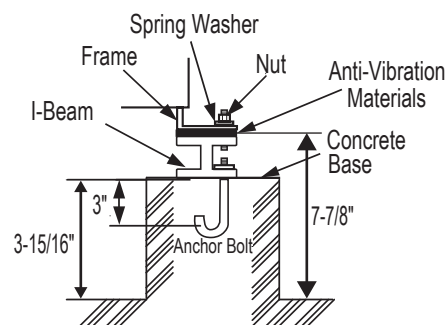
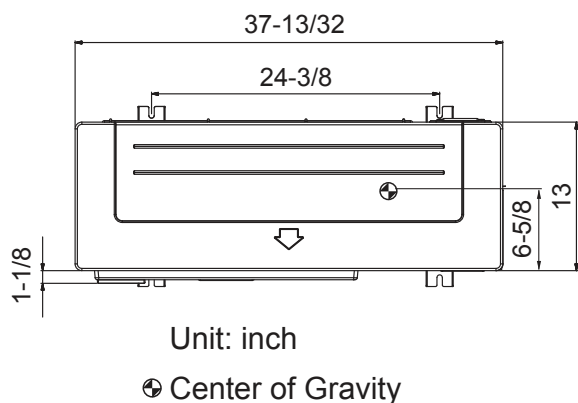


Figure 27: Locations for the Mounting Bolts.





## Mounting / Anchoring the Heat Recovery Unit(s)

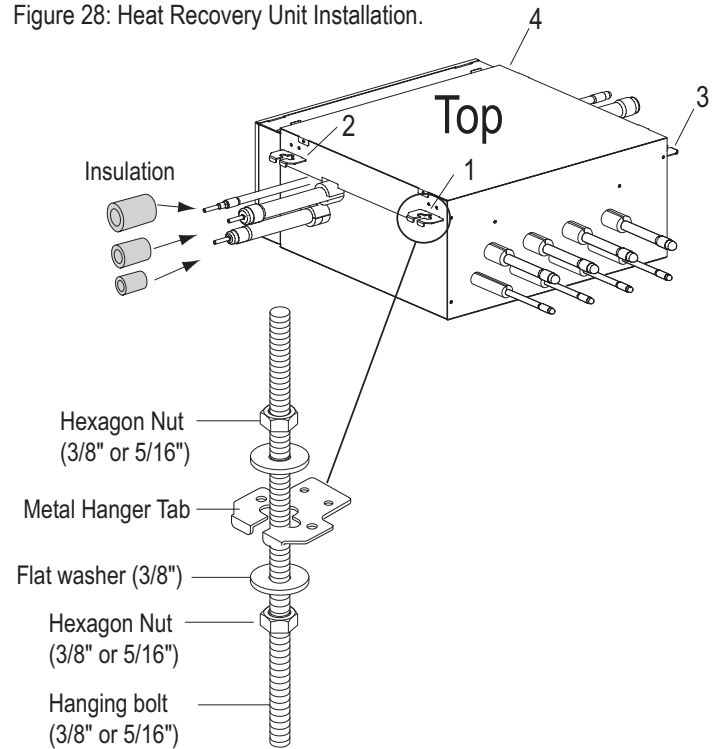
Install the heat recovery unit by suspending it from the ceiling with the top (see diagram) always facing up.

Figure 28: Heat Recovery Unit Installation.

1. Using a drop-in anchor, install the hanging bolt.
2. Thread 3/8 or 5/16 inch hexagon nuts (field-supplied), the metal hanger tabs, and flat washers (field-supplied) onto the hanging bolts as shown in the diagram.
3. After verifying that the heat recovery unit is level, tighten the hexagon nuts.

### Note:

- The heat recovery unit must be positioned no more than  $\pm 5^\circ$  from level front to back and left to right.
- Removing the factory process stubs is recommended. Replace with refrigerant-grade caps.
- Insulate unused ports completely as shown in the figure.



# LG AIR CONDITIONER TECHNICAL SOLUTION (LATS)



## LG Air Conditioner Technical Solution (LATS) Software

A properly designed and installed refrigerant piping system is critical to the optimal performance of LG air-conditioning systems. To assist engineers, LG offers, free of charge, LG Air Conditioner Technical Solution (LATS) software—a total design solution for LG air conditioning systems.

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

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

### Note:

To reduce the risk of designing an improper applied system or one that will not operate correctly, LG requires that LATS software be used on all projects.

### Formats

LATS is available to LG customers in three user interfaces: LATS HVAC, LATS CAD2, and LATS REVIT. All three LATS formats are available through [www.myLGHVAC.com](http://www.myLGHVAC.com), or contact an LG Sales Representative.

**LATS HVAC** is a Windows®-based application that aids engineers in designing LG Variable Refrigerant Flow (VRF), Multi F / Multi F MAX, Single-Zone, and Energy Recovery Ventilator (ERV) systems.

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

**LATS CAD2** combines the LG LATS program with AutoCAD® software\*\*. It permits engineers to layout and validate LG Multi V Variable Refrigerant Flow (VRF), Multi F / Multi F MAX, Single-Zone, and Energy Recovery Ventilator (ERV) systems directly into CAD drawings.

**LATS Revit** (due for release end of 2016) integrates the LG LATS program with Revit® software\*\*. It permits engineers to layout and validate Multi V VRF systems directly into Revit drawings.

\*\*AutoCAD® and Revit® are both registered marks of Autodesk, Inc.

### Features

All LG product design criteria have been loaded into the program, making LATS simple to use: double click or drag and drop the component choices. Build systems in Tree Mode where the refrigerant system can be viewed. Switch to a Schematic diagram to see the electrical and communications wiring.

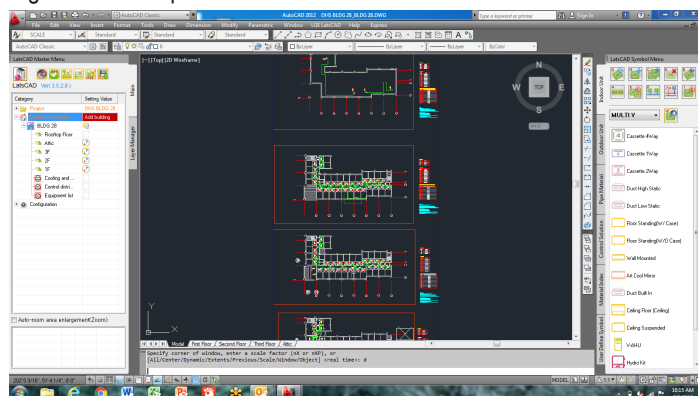
LATS software permits the user to input region data, indoor and outdoor design temperatures, modify humidity default values, zoning, specify type and size of outdoor units and indoor units, and input air flow and external static pressure (ESP) for ducted indoor units. The program can also:

- Import building loads from a separate Excel file.
- Present options for outdoor unit auto selection.
- Automatically calculate component capacity based on design conditions for the chosen region.
- Verify if the height differences between the various system components are within system limits.
- Provide the correct size of each refrigerant piping segment and LG Y-Branches and Headers.
- Adjust overall piping system length when elbows are added.
- Check for component piping limitations and flag if any parameters are broken.
- Factor operation and capacity for defrost operation.
- Calculate refrigerant charge, noting any additional trim charge.
- Suggest accessories for indoor units and outdoor units.
- Run system simulation.

### Note:

Features depend on which LATS program is being used, and the type of system being designed.

Figure 29: Example of LATS CAD2.



## LATS Generates a Complete Project Report

LATS software also generates a report containing project design parameters, cooling and heating design data, system component performance, and capacity data. The report includes system combination ratio and refrigerant charge calculations; and provides detailed bill of material, including outdoor units, indoor units, control devices, accessories, refrigerant pipe sizes segregated by building, by system, by pipe size, and by pipe segments. LATS can generate an Excel GERP report that can imported into the LG SOPS pricing and ordering system.

## Proper Design to Install Procedure

LG encourages a two report design-to-install-procedure. After the design engineer determines building / zone loads and other details, the engineer opens the LATS program and inputs the project's information. When the design is complete, the "Auto Piping" and "System Check" functions must be used to verify piping sizes, limitations, and if any design errors are present. If errors are found, engineers must adjust the design, and run Auto Piping and System Check again. When the design passes the checks, then the engineer prints out a project "Shop Drawing" (LATS Tree Diagram) and provides it to the installing contractor. The contractor must follow the LATS Tree Diagram when building the piping system, but oftentimes the design changes on the building site:

- Architect has changed location and/or purpose of room(s).
- Outdoor unit cannot be placed where originally intended.
- Structural elements prevent routing the piping as planned.
- Air conditioning system conflicts with other building systems (plumbing, gas lines, etc.).

The contractor must mark any deviation from the design on the Shop Drawing, including as-built straight lines and elbows. This "Mark Up" drawing must be returned to the design engineer or Rep, who must input contractor changes into the LATS file. (Copy the original LATS software file, save and rename as a separate file, and modify all piping lengths by double-clicking on each length and editing information.) Like the shop drawing, the Auto Piping and System Check must also be run on this new "As Built" drawing. The design engineer or Rep must then provide the final As Built file to the contractor.

The Mark Up version must be compared to the As Built version for the following

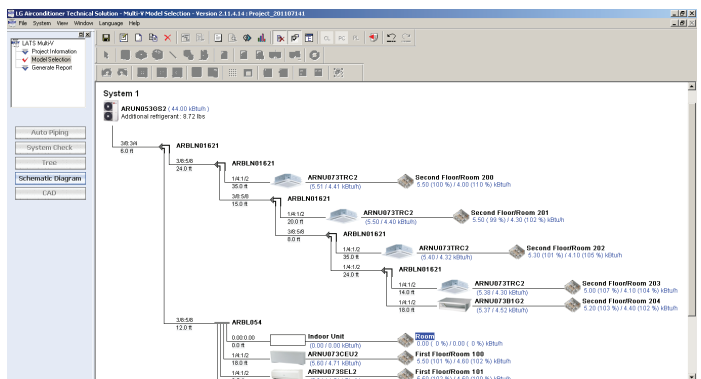
- Differences in pipe diameter(s). If incorrect diameters have been installed, the piping must be changed out. If pipe diameters have changed, check to see if Y-Branches will also need to be changed.
- Changes to outdoor unit and indoor unit capacities. Capacities changes may impact line length changes.
- Additional refrigerant charge quantity ("Trim Charge"). Trim charge will change if piping lengths and diameters change. The As Built version must reflect installed piping lengths to ensure correct trim charge.

All documents submitted by the contractor, as well as the Shop Drawing and the As Built Drawing files must be provided for commissioning purposes. Model and serial numbers for all system components must also be submitted. If the steps previously detailed are not followed, and all documents are not provided to the LG trained commissioner, the project runs the risk of not being commissioned and any warranty LG offers on the equipment not being activated.

## Note:

Any field changes, such as re-routing, shortening or lengthening a pipe segment, adding or eliminating elbows and/or fittings, re-sizing, adding, or eliminating indoor units, changing the mounting height, or moving the location of a device or fitting during installation must be done with caution and ALWAYS VERIFIED in LATS MULTI V SOFTWARE BEFORE supplies are purchased or installed. Doing so may lead to a more profitable installation, reduce the potential for rework, and will reduce the potential for multiple visits to the job site to complete the system commissioning.

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



# REFRIGERANT SAFETY STANDARDS / DEVICE CONNECTION LIMITATIONS



## Refrigerant Safety Standards

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

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

## Device Connection Limitations

When designing a system, the engineer must take into consideration the minimum combination ratio. The minimum number of connected and operating indoor units is 1. The maximum number of indoor units on a system is:

- ARUN024GSS4 = 4
- ARUN038GSS4 = 6
- ARUN048GSS4 = 8
- ARUN053GSS4 = 9
- ARUN060GSS4 = 12
- ARUB060GSS4 = 12

Table 11: Field-Supplied Refrigerant Fittings—Liquid Line Equivalent Pipe Length.

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

\*Equivalent pipe length—The sum of the actual pipe length plus allocations for pressure drop through elbows, valves, and other fittings in equivalent length.

Values calculated based on formula and factors from [www.sporlanonline.com](http://www.sporlanonline.com).

LG supplied Y-Branch and Header fittings must be used. Field-built Y-Branch and Header fittings are not permitted.

Table 12: Multi V S Liquid Piping Design Parameters.

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

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

## Selecting Field-Supplied Copper Piping

### Note:

Always follow local codes when selecting and installing copper pipe and piping system components. Always properly support the piping as per the instructions in "Pipe Supports" on page 45.

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

### For Heat Recovery Systems

LG prefers the use of ACR hard drawn copper on pipe segments located between heat recovery units and outdoor units, between heat recovery units piped in series, and between heat recovery units and multiple indoor units sharing an heat recovery unit port.

### For Heat Pump Systems

LG prefers the use of ACR hard drawn copper for all pipe segments in the piping system except segments located between Y-branch fittings (or header fittings) and indoor units.

### For DOAS Units

LG prefers the use of hard drawn copper in pipe segments connecting a DOAS product and an outdoor unit.

Table 13: ACR Rated Copper Tubing Material.

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

Table 14: ACR Rated Piping Wall Thicknesses.

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

Table 15: ACR Copper Tubing Dimensions and Physical Characteristics<sup>1-3</sup>

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

<sup>1</sup>All dimensions provided are in accordance with ASTM B280 – Standard.

<sup>2</sup>Design pressure = 551 psig.

<sup>3</sup>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.

# COPPER EXPANSION AND CONTRACTION

## Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of a Multi V system can vary as much as 180°F. With this large variance in pipe temperature, the designer must consider pipe expansion and contraction to avoid pipe and fitting fatigue failures.

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

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

The refrigerant pipe support system must be engineered to allow free expansion to occur. When a segment of pipe is mounted between two fixed points, provisions must be provided to allow pipe expansion to naturally occur. The most common method is the inclusion of expansion Loop or U-bends mounted in the horizontal plane. When expansion loops are placed in a vertical riser, the loop is to be formed in a horizontal fashion resulting in a torsional movement during expansion and contraction. Each segment of pipe has a natural fixed point where no movement occurs. This fixed point is located at the center point of the segment assuming the entire pipe is insulated in a similar fashion. The natural fixed point of the pipe segment is typically where the expansion Loop or U-bend must be. Linear pipe expansion can be calculated using the following formula:

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

LE	=	Anticipated linear tubing expansion (in.)
C	=	Constant (For copper = $9.2 \times 10^{-6}$ 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 the table "Linear Thermal Expansion of Copper Piping in Inches," find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. Typical pipe temperature change ranges: High Pressure Vapor: ambient temperature to 215°F; Low Pressure Vapor: ambient to 35°F; Liquid pipe: ambient, 80°F, 110°F. Choose the two most extreme. In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

### General Example:

A Multi V system is installed and the design shows that there is a 260 feet straight segment of piping between a Y-branch and an indoor unit. The system operates 24 hours per day. In heating, this pipe transports hot gas vapor to the indoor units at 120°F. In cooling, the same pipe is a suction line returning refrigerant vapor to the outdoor unit at 40°F. Look up the copper piping expansion at each temperature using the table "Linear Thermal Expansion of Copper Tubing in Inches," and calculate the difference.

### Vapor Line

Transporting Hot Vapor: 260 ft. pipe at 120°F = 3.64 in.  
 Transporting Suction Vapor: 260 ft. pipe at 40°F = 1.04 in.  
 Anticipated Change in Length: 3.64 in. – 1.04 in. = 2.60 in.

### Liquid Line

The liquid temperature remains 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 depth must be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an expansion loop is provided in the table "Coiled Expansion Loops and Offsets (Plan View)." Use soft copper with long radius bends on longer runs or long radius elbows for shorter pipe segments. Using the anticipated linear expansion (LE) distance calculated, look up the Expansion Loop or U-bend minimum design dimensions. If other types of expansion joints are chosen, design per ASTM B-88 Standards.



See table below for pre-calculated anticipated expansion for various pipe sizes and lengths of refrigerant piping.

## 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 16: Linear Thermal Expansion of Copper Piping in Inches.

Pipe Length <sup>1</sup>	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.26	0.28	0.29	0.30
30	0.12	0.12	0.15	0.18	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.32	0.35	0.39	0.42	0.44	0.45
40	0.16	0.16	0.20	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.43	0.46	0.52	0.56	0.58	0.60
50	0.20	0.20	0.25	0.30	0.33	0.35	0.38	0.40	0.43	0.45	0.48	0.50	0.53	0.55	0.54	0.58	0.65	0.70	0.73	0.75
60	0.24	0.24	0.30	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.65	0.69	0.78	0.84	0.87	0.90
70	0.28	0.28	0.35	0.42	0.46	0.49	0.53	0.56	0.60	0.63	0.67	0.70	0.74	0.77	0.76	0.81	0.91	0.98	1.02	1.05
80	0.32	0.32	0.40	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.86	0.92	1.04	1.12	1.16	1.20
90	0.36	0.36	0.45	0.54	0.59	0.63	0.68	0.72	0.77	0.81	0.86	0.90	0.95	0.99	0.97	1.04	1.17	1.26	1.31	1.35
100	0.40	0.40	0.50	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.08	1.15	1.30	1.40	1.45	1.50
120	0.48	0.48	0.60	0.72	0.78	0.84	0.90	0.96	1.02	1.08	1.14	1.20	1.26	1.32	1.30	1.38	1.56	1.68	1.74	1.80
140	0.56	0.56	0.70	0.84	0.91	0.98	1.05	1.12	1.19	1.26	1.33	1.40	1.47	1.54	1.51	1.61	1.82	1.96	2.03	2.10
160	0.64	0.64	0.80	0.96	1.04	1.12	1.20	1.28	1.36	1.44	1.52	1.60	1.68	1.76	1.73	1.84	2.08	2.24	2.32	2.40
180	0.72	0.72	0.90	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	1.94	2.07	2.34	2.52	2.61	2.70
200	0.80	0.80	1.00	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.16	2.30	2.60	2.80	2.90	3.00
220	0.88	0.88	1.10	1.32	1.43	1.54	1.65	1.76	1.87	1.98	2.09	2.20	2.31	2.42	2.38	2.53	2.86	3.08	3.19	3.30
240	0.96	0.96	1.20	1.44	1.56	1.68	1.80	1.92	2.04	2.16	2.28	2.40	2.52	2.64	2.59	2.76	3.12	3.36	3.48	3.60
260	1.04	1.04	1.30	1.56	1.69	1.82	1.95	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.81	2.99	3.38	3.64	3.77	3.90
280	1.12	1.12	1.40	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94	3.08	3.02	3.22	3.64	3.92	4.06	4.20
300	1.20	1.20	1.50	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00	3.15	3.30	3.24	3.45	3.90	4.20	4.35	4.50
320	1.28	1.28	1.60	1.92	2.08	2.24	2.40	2.56	2.72	2.88	3.04	3.20	3.36	3.52	3.46	3.68	4.16	4.48	4.64	4.80
340	1.36	1.36	1.70	2.04	2.21	2.38	2.55	2.72	2.89	3.06	3.23	3.40	3.57	3.74	3.67	3.91	4.42	4.76	4.93	5.10
360	1.44	1.44	1.80	2.16	2.34	2.52	2.70	2.88	3.06	3.24	3.42	3.60	3.78	3.96	3.89	4.14	4.68	5.04	5.22	5.40
380	1.52	1.52	1.90	2.28	2.47	2.66	2.85	3.04	3.23	3.42	3.61	3.80	3.99	4.18	4.10	4.37	4.94	5.32	5.51	5.70
400	1.60	1.60	2.00	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.32	4.60	5.20	5.60	5.80	6.00
420	1.68	1.68	2.10	2.52	2.73	2.94	3.15	3.36	3.57	3.78	3.99	4.20	4.41	4.62	4.54	4.83	5.46	5.88	6.09	6.30
440	1.76	1.76	2.20	2.64	2.86	3.08	3.30	3.52	3.74	3.96	4.18	4.40	4.62	4.84	4.75	5.06	5.72	6.16	6.38	6.60
460	1.84	1.84	2.30	2.76	2.99	3.22	3.45	3.68	3.91	4.14	4.37	4.60	4.83	5.06	4.97	5.29	5.98	6.44	6.67	6.90
480	1.92	1.92	2.40	2.88	3.12	3.36	3.60	3.84	4.08	4.32	4.56	4.80	5.04	5.28	5.18	5.52	6.24	6.72	6.96	7.20
500	2.00	2.00	2.50	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.40	5.75	6.50	7.00	7.25	7.50

<sup>1</sup>Pipe length baseline temperature = 0°F. "Expansion of Carbon, Copper and Stainless Steel Pipe," The Engineers' Toolbox, [www.engineeringtoolbox.com](http://www.engineeringtoolbox.com).

# COPPER EXPANSION AND CONTRACTION

Figure 31: Coiled Expansion Loops and Offsets (Plan View).

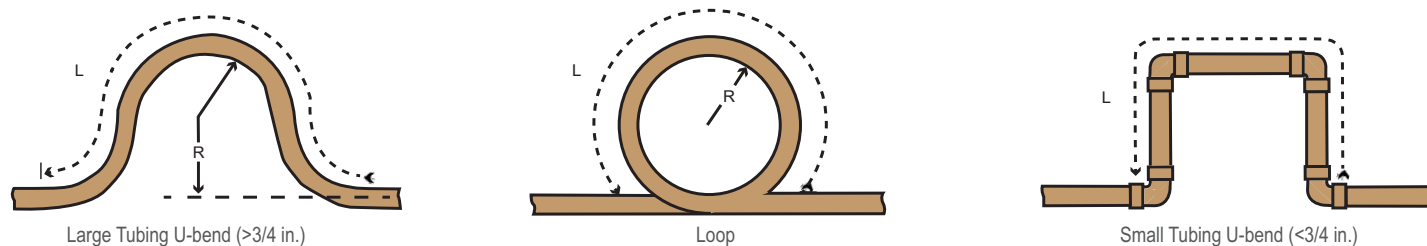


Table 17: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets.

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

<sup>1</sup>R = Centerline Length of Pipe.

<sup>2</sup>L = Centerline Minimum Radius (inches).

## Note:

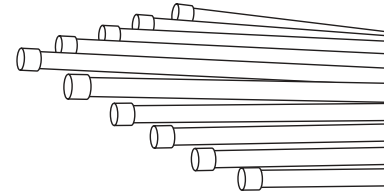
All expansion Loops and Offsets must be installed in the horizontal plane to prevent the possibility of trapping oil. Loops and Offsets in vertical risers must also be installed in a horizontal plane.

## Piping Handling

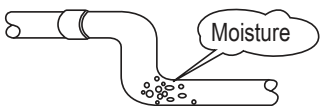


Pipes used for the refrigerant piping system must include the specified thickness, and the interior must be clean.

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

Keep Pipes Capped While Storing.



Keep refrigerant pipe dry, clean, and airtight.

	Dry	Clean	Airtight
	No moisture must be inside the piping. 	No dust must be inside the piping. 	No leaks must occur. 
<b>Possible Problems</b>	<ul style="list-style-type: none"> <li>- Significant hydrolysis of refrigerant oil.</li> <li>- Refrigerant oil degradation.</li> <li>- Poor insulation of the compressor.</li> <li>- System does not operate properly.</li> <li>- EEVs, capillary tubes are clogged.</li> </ul>	<ul style="list-style-type: none"> <li>- Refrigerant oil degradation.</li> <li>- Poor insulation of the compressor.</li> <li>- System does not operate properly.</li> <li>- EEVs and capillary tubes become clogged.</li> </ul>	<ul style="list-style-type: none"> <li>- Refrigerant gas leaks / shortages.</li> <li>- Refrigerant oil degradation.</li> <li>- Poor insulation of the compressor.</li> <li>- System does not operate properly.</li> </ul>
<b>Solutions</b>	<ul style="list-style-type: none"> <li>- Remove moisture from the piping.</li> <li>- Piping ends must remain capped until connections are complete.</li> <li>- ⚠ Do not install piping on a rainy day.</li> <li>- Connect piping properly at the unit's side.</li> <li>- Remove caps only after the piping is cut, the burrs are removed, and after passing the piping through the walls.</li> <li>- Evacuate system to a minimum of 500 microns and insure the vacuum holds at that level for 24 hours</li> </ul>	<ul style="list-style-type: none"> <li>- Remove dust from the piping.</li> <li>- Piping ends must remain capped until connections are complete.</li> <li>- Connect piping properly at the side of the unit.</li> <li>- Remove caps only after the piping is cut and burrs are removed.</li> <li>- Retain the cap on the piping when passing it through walls, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Test system for air tightness.</li> <li>- Perform brazing procedures that comply with all applicable standards.</li> <li>- Perform flaring procedures that comply with all applicable standards.</li> <li>- Perform flanging procedures that comply with all applicable standards.</li> <li>- Ensure that refrigerant lines are pressure tested to 550 psig and hold for 24 hours.</li> </ul>

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

## Note:

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

## ⊘ No Pipe Size Substitutions

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

## ⊘ No In-line Refrigeration Components

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

## Field-Provided Isolation Ball Valves

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

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

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

## Using Elbows

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

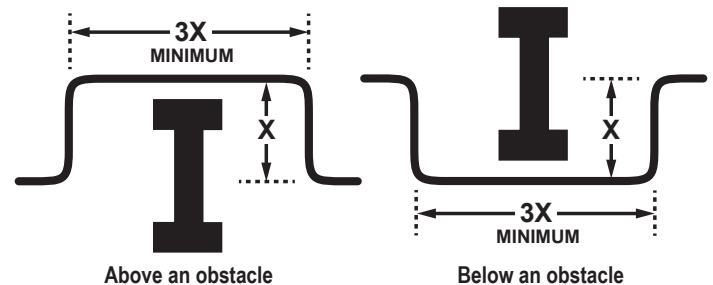
## Pipe Bends

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

## Obstacles

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

Figure 32: Installing Piping Above and Below an Obstacle.



## Pipe Supports

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

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

A properly installed pipe system will have sufficient supports to avoid pipes from sagging during the life of the system. As necessary, place supports closer for segments where potential sagging could occur. Maximum spacing of pipe supports must meet local codes. If local codes do not specify pipe support spacing, pipe must be supported:

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

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

Figure 35: Pipe Support at Indoor Unit.

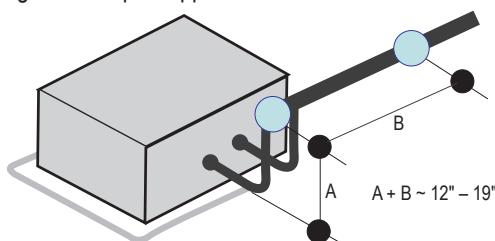


Figure 36: Pipe Support at Y-branch Fitting.

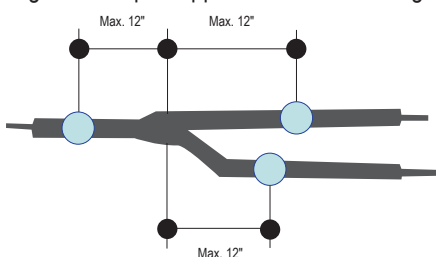
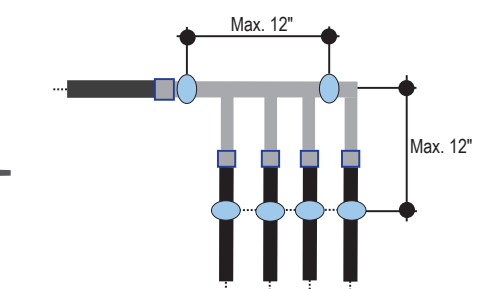


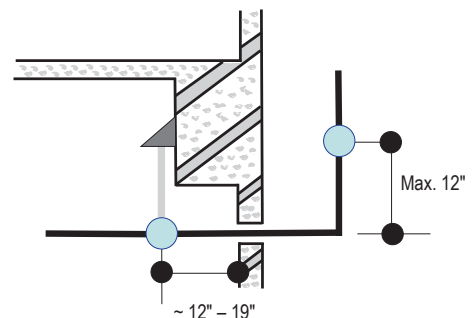
Figure 37: Pipe Support at Header Fitting.



**Note:**

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

Figure 34: Typical Pipe Support Location—  
Change in Pipe Direction.



## Examples of Supports

Figure 38: U-Bolt Support with Insulation.

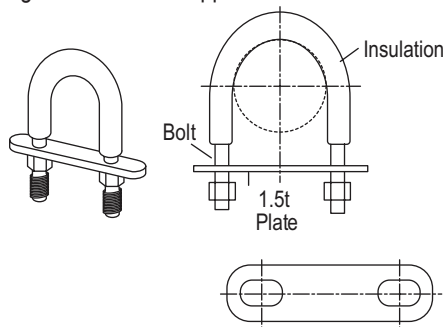


Figure 39: O-Ring Support with Insulation.

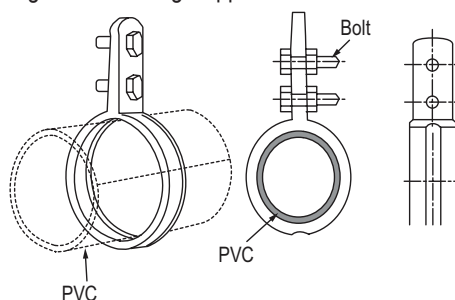
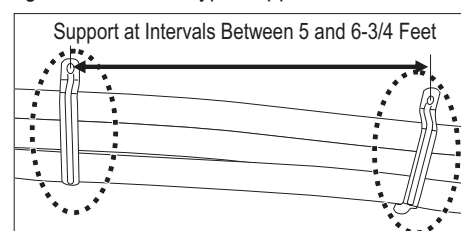


Figure 40: Saddle-Type Support.



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

Figure 41: U-Bolt Support with an Insulated Pipe.

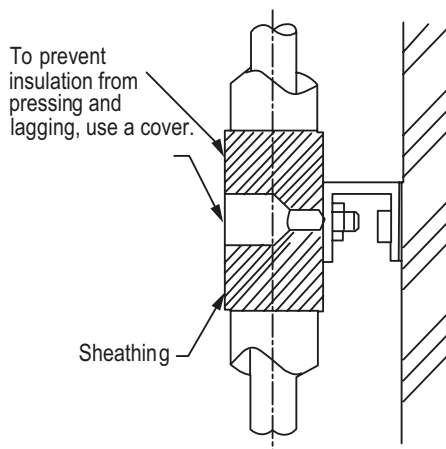


Figure 42: O-Ring Band Support with an Insulated Pipe.

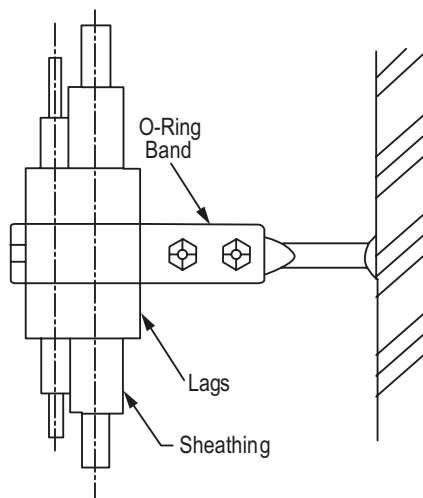


Figure 43: One-Point Down-Stop Support (>441 lbs.).

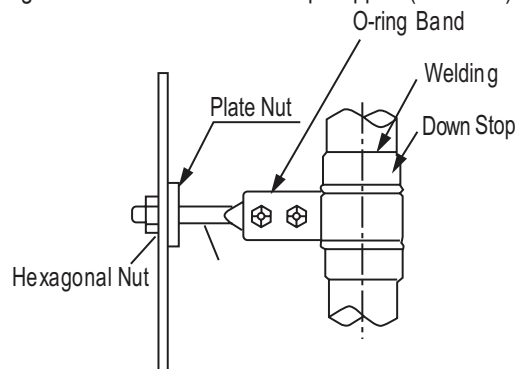
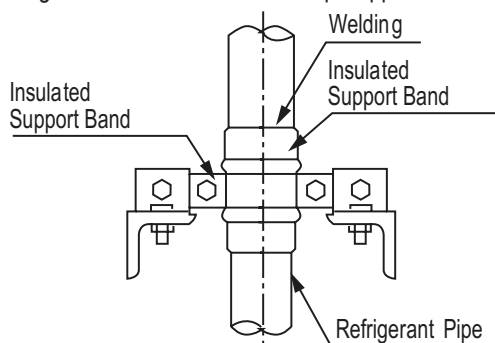


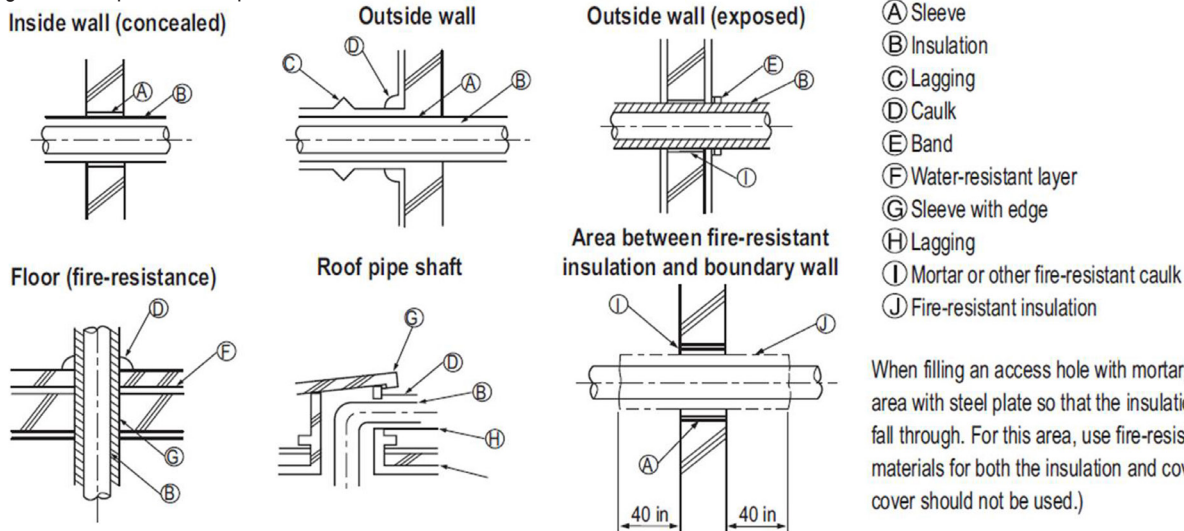
Figure 44: Two-Point Down-Stop Support.



## 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 promote free movement of the pipe within the sleeve. Use 4"+ curved sheet metal saddles between the bottom surface of the pipe and the bottom surface of the penetration.

Figure 45: Pipe Sleeve Options.



### Note:

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

## Underground Refrigerant Piping

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

Table 18: Utility Conduit Sizes.

Liquid Pipe <sup>1</sup>	Vapor Pipe <sup>1</sup>		
	1/2 (2.0 <sup>2,5</sup> )	5/8 (2-1/8 <sup>2,5</sup> )	3/4 (2-1/4 <sup>2,5</sup> )
1/4 (1.0) <sup>3</sup>	4	4	4
3/8 (1-1/8) <sup>3</sup>	4	4	5
1/2 (1-1/2) <sup>4</sup>	5	5	5
5/8 (1-5/8) <sup>4</sup>	5	5	5
3/4 (1-3/4) <sup>4</sup>	5	5	5

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

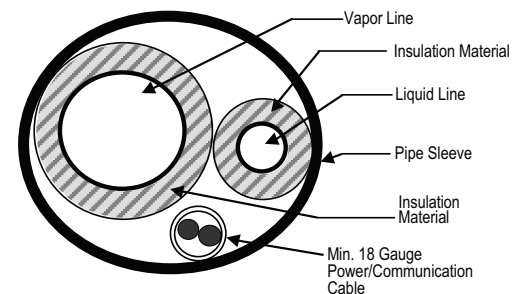
<sup>2</sup>Diameter of pipe with insulation. Thickness of pipe insulation is typical. Actual required thickness may vary based on surrounding ambient conditions and must be calculated and specified by the design engineer.

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

<sup>4</sup>Insulation thickness (value in parenthesis) = 1 inch.

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

Figure 46: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.



### Note:

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



## Flaring and Brazing Procedures

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

### Note:

- During installation, it is imperative to keep the piping system free of contaminants and debris such as copper burrs, slag, or carbon dust.
- ⚠ Do not use kinked pipe.

## Flaring Procedure

### Note:

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

1. Cut the pipe to length.

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

2A. Remove the burrs

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

2B. Remove the flare nuts attached to the indoor and outdoor units. Slide the flare nut onto the copper tube.

3. Flaring the pipe end.

- Use the proper size flaring tool to finish flared connections as shown.
- ALWAYS create a 45° flare when working with R410A.
- Firmly hold copper tube in a bar with a dimension as indicated in the table below.

4. Carefully inspect the flared pipe end.

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

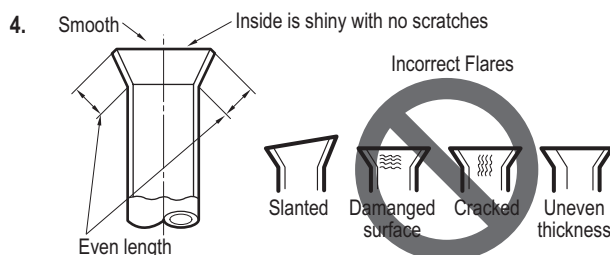
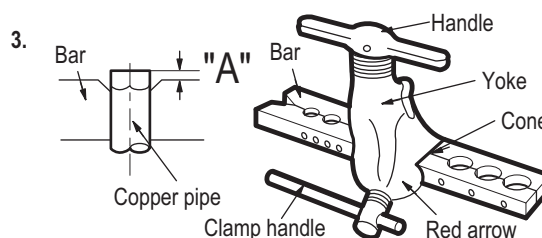
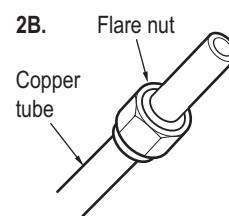
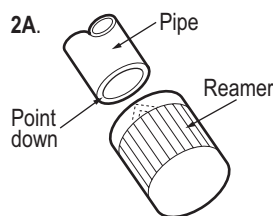
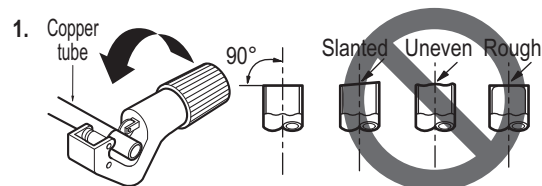


Table 19: Flared Connection Dimensions.

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

## Tightening the Flare Connections

Table 20: Tightening Torque for Flare Nuts.

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

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

### Note:

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

⊘ Do not add any contaminants inside the refrigerant piping.

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.

## Brazing Procedure

### ⚠ WARNING

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

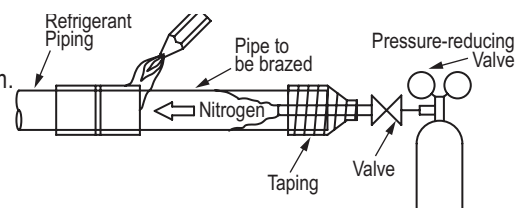
If the refrigerant combusts, it generates a toxic gas that may cause physical injury or death.

### Note:

Braze the pipes to the service valve pipe stub of the outdoor unit.

1. All joints are brazed in the field. Multi V refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, and heat exchangers that can easily become blocked. Proper system operation depends on the installer using best practices and utmost care while assembling the piping system.
2. Store pipe stock in a dry place; keep stored pipe capped and clean.
3. Blow clean all pipe sections with dry nitrogen prior to assembly.
4. Use adapters to assemble different sizes of pipe.
5. 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.
6. Use a tubing cutter, ⊘ do not use a saw to cut pipe. De-bur and clean all cuts before assembly.
7. Brazing joints:
  - Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
  - Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
  - Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

Figure 47: Refrigerant Pipe Brazing.



### ⚠ WARNING

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

# INSTALLING FOR HEAT PUMP OPERATION

## Indoor Unit Y-Branch Kits

### ⊗ No Substitutions on Piping Components

Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. ⊗ Third-party or field-fabricated components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).

### Install Correctly

- Y-branches can be installed upstream between the Header and the outdoor unit. ⊗ 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.

## Y-Branch Kits

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

### LG Y-Branch Kits for Heat Pump Operation Consist of:

- One liquid line and one vapor line (two [2] total).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers.

### Indoor Unit Y-Branched

Indoor unit Y-branches may be installed in horizontal or vertical configurations. When installed vertically, the straight-through leg must be within  $\pm 3^\circ$  of plumb. When installed horizontally, the straight-through leg must be level and the branch leg must be within  $\pm 5^\circ$  of horizontal rotation.

Figure 48: Indoor Unit Y-Branch Horizontal Configuration.

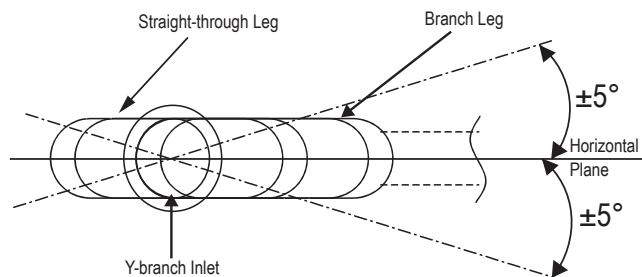


Figure 50: Y-Branch Insulation and Piping Detail.

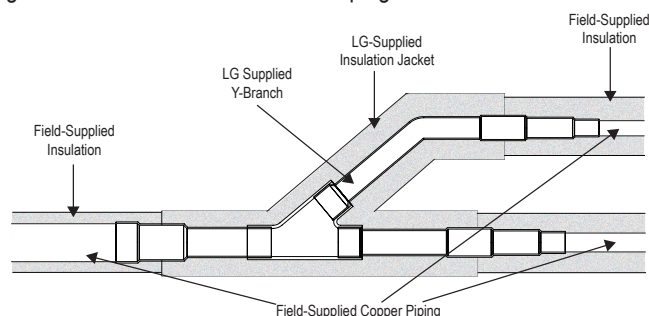
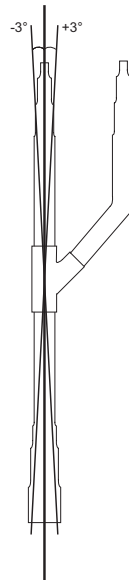
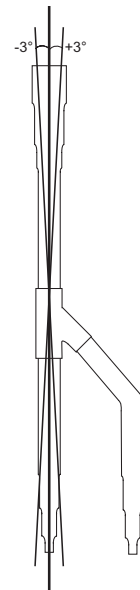


Figure 49: Indoor Unit Y-branch Vertical Installation Alignment Specifications.

Vertical UP Configuration for Indoor Unit Y-Branched.



Vertical DOWN Configuration for Indoor Unit Y-Branched.



### Indoor Unit Y-Branched for Heat Pump Systems

Indoor unit Y-branches must always be installed with the single port end towards the outdoor unit, and the two-port end towards the indoor units. The first indoor unit Y-branch kit must be located no closer than at least three (3) feet from the outdoor unit. Provide a minimum of twenty (20) inches between a Y-branch and any other fittings or indoor units.

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

**Note:**

- ⊘ Multi V S outdoor units cannot be combined.

Unit: Inch

Models	Vapor pipe	Liquid pipe
ARBLN01621		
ARBLN03321		

# INSTALLING FOR HEAT PUMP OPERATION



## Header Kits

- ⊗ **No Substitutions on Piping Components**  
Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. ⊗ Third-party or field-fabricated components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).
- Install Correctly**
  - Y-branches can be installed upstream between the Header and the outdoor unit. ⊗ 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

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

### LG Header Kits Consist of:

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

Headers must be installed with the main pipe level in the horizontal plane. Distribution ports must be either level in the horizontal plane (Figure 53) or within  $\pm 3^\circ$  of plumb in the vertical plane (Figure 50).

When connecting indoor units to a header, always connect the unit with the largest nominal capacity to the port closest to the outdoor unit. Then install the next largest indoor unit to the next port, working down to the smallest indoor unit.

- ⊗ Do not skip ports. All indoor units connected to a single header fitting must be located with an elevation difference between indoor units that does not exceed 49 feet.

Figure 51: Vertical Header Insulation and Piping Detail (Ports must point to an upright direction).

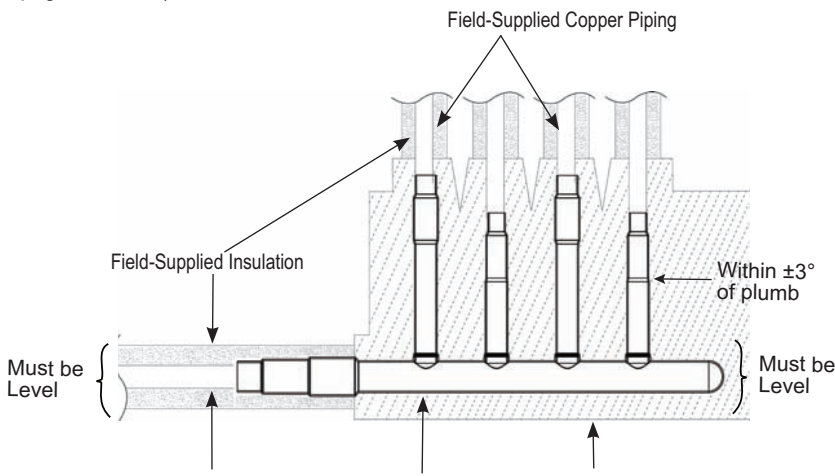


Figure 52: Incorrect Header Configuration.

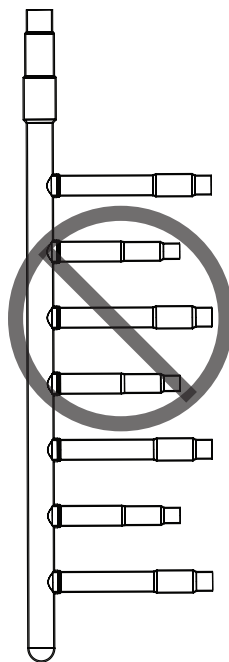


Figure 53: Incorrect Header Configuration (Ports pointing downwards).

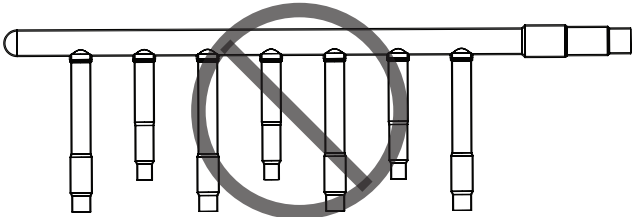
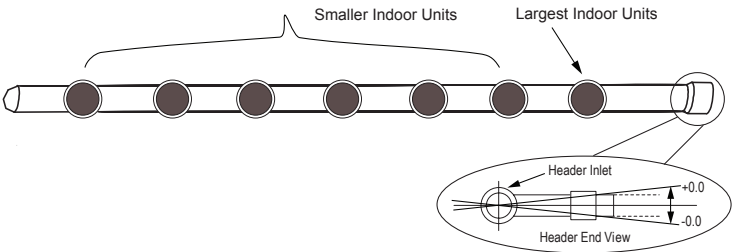


Figure 54: Header Kit—Horizontal Rotation Limit (Ports must point to a horizontal direction).



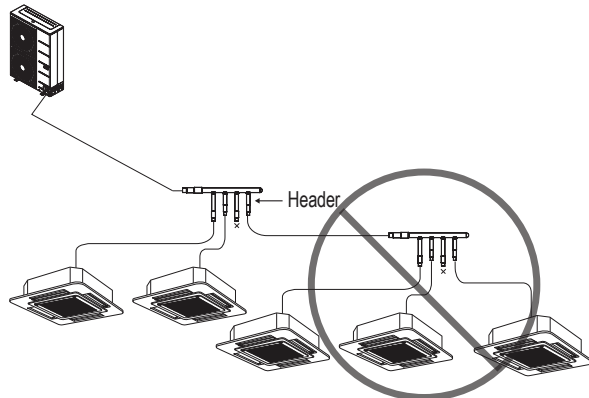
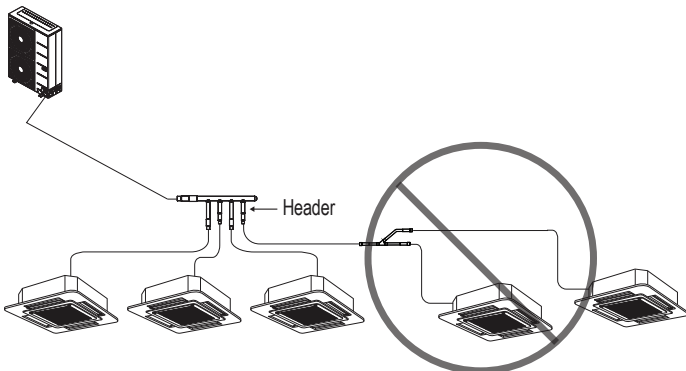
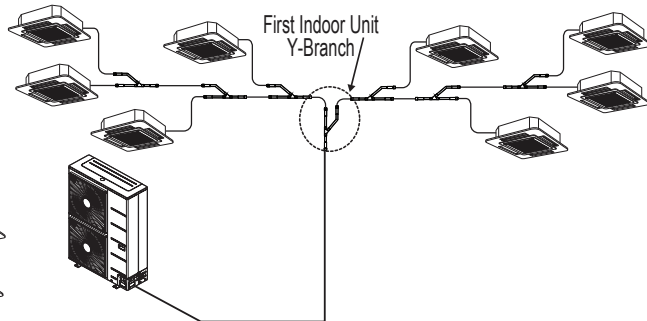
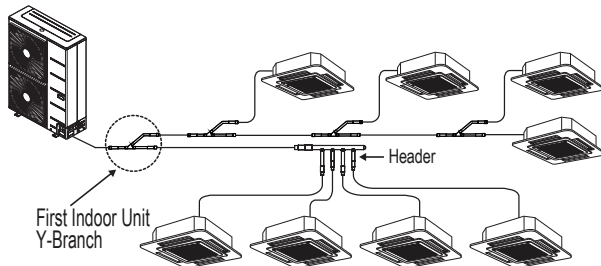
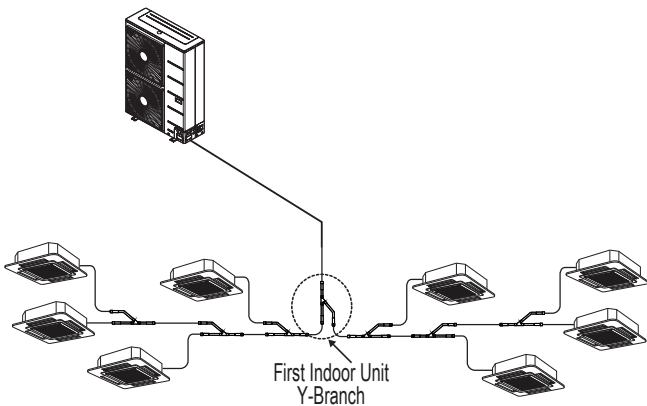
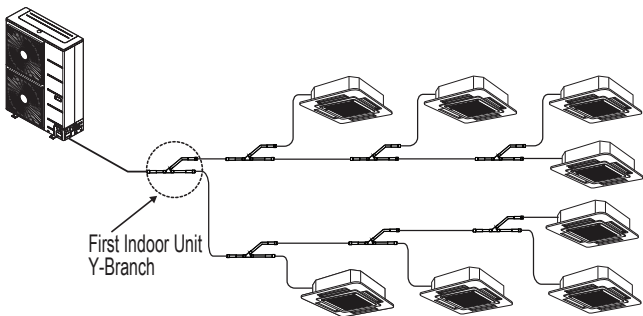
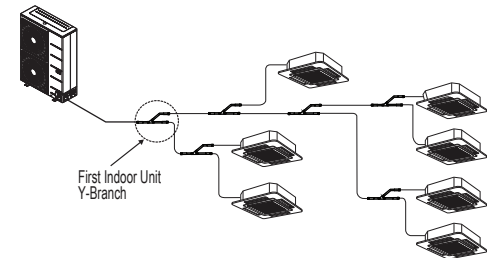
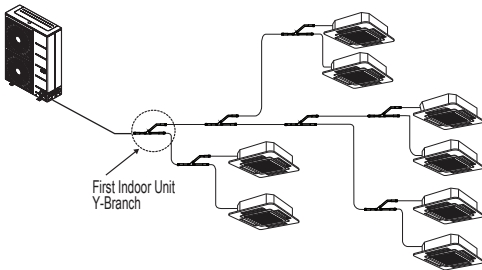
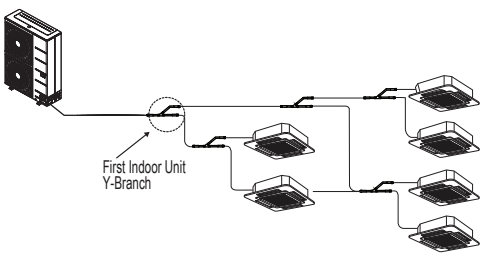
Unit: Inch.

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

# INSTALLING FOR HEAT PUMP OPERATION



## Sample Layouts and Incorrect Layouts



### Note:

Images are for illustrative purposes only and are not accurate representations. For specific details on piping limitations and other refrigerant system rules, review the information in this entire piping section, see the Multi V S Engineering Manual, and follow the LATS diagram.





### Refrigerant Piping Connections

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

#### ⚠ WARNING

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

#### Note:

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

#### ⚠ WARNING

*It is imperative that the correct outdoor unit connections be used for the intended system operation (heat pump versus heat recovery). If the wrong connections are used, it may result in refrigerant leaks, which may lead to illness or death.*

#### Note:

*It is imperative that the correct outdoor unit connections be used for the intended system operation (heat pump versus heat recovery). If the wrong connections are used, it may result in refrigerant leaks, which may lead to system malfunction or even failure to work at all.*

### Pipe Routes

The pipe route chosen depends on the installation area, and is at the discretion of the installer. After the pipe route is chosen, the appropriate outdoor unit access holes must be knocked out (see next page for knock out information).

Table 21: Outdoor Unit Refrigerant Piping Connections.

Model	Liquid Conn. (in.)	Type	Vapor Conn. (in.)	Type
ARUN024GSS4	3/8	Flare	5/8	Flare
ARUN038GSS4	3/8	Brazed	5/8	Brazed
ARUN048GSS4	3/8	Brazed	5/8	Brazed
ARUN053GSS4	3/8	Brazed	3/4	Brazed
ARUN060GSS4	3/8	Brazed	3/4	Brazed

Figure 55: Outdoor Unit Refrigerant Piping Connection Options.

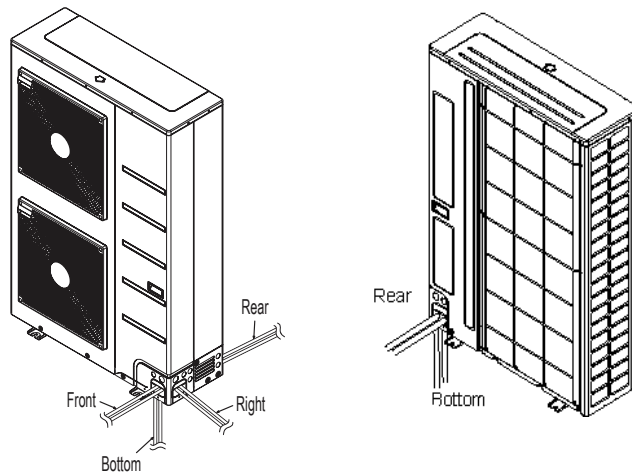


Figure 57: Close Up of the Front / Back Access Holes.

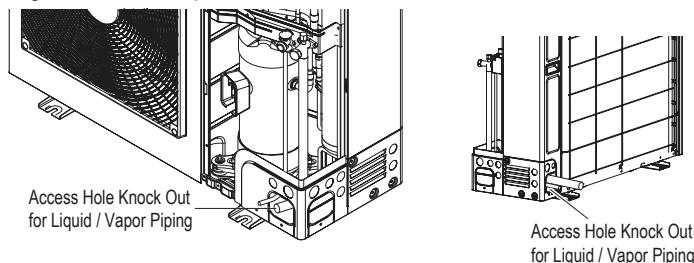
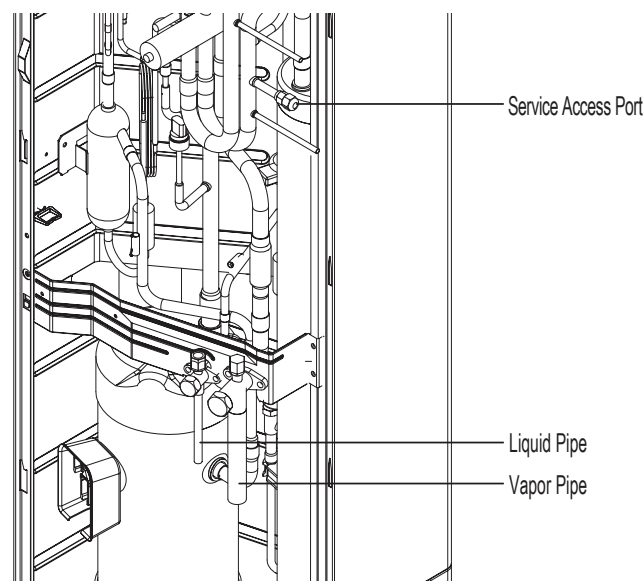


Figure 56: Location of the Refrigerant Charging Port and the Liquid / Vapor Piping.



# INSTALLING FOR HEAT PUMP OPERATION



## Knock Outs /Removing the Leak Prevention Caps

### Knock Outs

- If piping from the left / right or bottom, use the access holes on the base pan. Ⓢ Do not damage the piping / base while knocking out the holes.
- Add a protection sleeve to prevent damage when passing the wiring through the access holes.
- Pipe system connection is done by connecting from the end of the pipe to the branching pipes, and the refrigerant pipe coming out of the outdoor unit is divided at the end to connect to each indoor unit.
- Flare connections are used to connect the piping on the indoor units, and braze connections are used to connect the piping on the outdoor unit (see piping dimensions below), Y-branches, and headers.

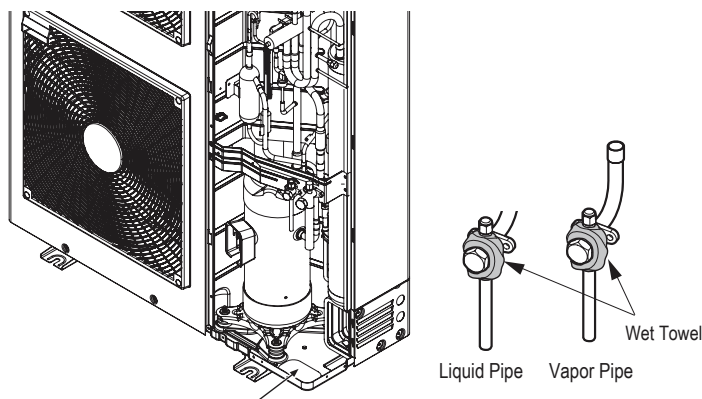
### Note:

- To avoid damaging the piping and power wiring / communication cables, remove any burrs that may have formed during the knock out procedure. Make sure the access holes have smooth edges.
- To avoid damaging the power wiring / communication cables, install sleeves.
- After piping installation is complete, to prevent animals or foreign materials from damaging the outdoor unit cables / wiring, seal any holes in with sealant, plugs, foam, caulk, putty, etc.

### Avoid Pipe Damage

- When routing field-provided piping inside the outdoor 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 install and insulate refrigerant pipes separately up to the service valve body inside the confines of the unit frame.

Figure 58: Bottom Access Hole.



Bottom Access Hole for Liquid / Vapor Pipe Connections

### Opening the Shut Off Valve

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

#### Note:

⊗ Do not apply excessive force to the shut off valve.

3. Securely tighten the shut off valve cap.

### Closing the Shut Off Valve

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

#### Note:

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

3. Securely tighten the shut off valve cap.

### Insulating the Shut Off Valve

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

### Remove Leak Prevention Cap

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

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

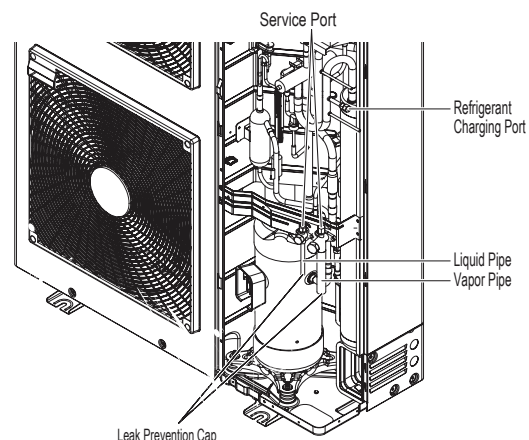
#### ⚠ WARNING

- Outdoor units ship with a factory charge of refrigerant. Always take extreme caution to prevent refrigerant gas (R410A) from leaking during use, around fire or flame, and during brazing. If the refrigerant gas comes in contact with a flame from any source, it may break down and generate a poisonous gas. ⊗ Do not braze in a small room, or a room that is not ventilated.
- After refrigerant piping work is complete, verify that the Schrader port and service port caps are securely tightened to help prevent refrigerant gas from leaking. Verify the system is free of leaks after refrigerant piping installation is complete. Exposure to high concentration levels of refrigerant gas may lead to illness or death.
- ⊗ Do not attempt to remove the service valve stem. Physical injury or death may occur from the uncontrolled rapid release of refrigerant.

#### Note:

- Before connecting the refrigerant piping, make sure the service port valves of the outdoor unit are completely closed (factory setting). ⊗ Do not open the service port valves or attempt to operate the system until the refrigerant pipe system installation has been completed. Never open the valves before a pressure test is performed, a leak test performed, the system is evacuated, and the Commissioning Agent provides authorization to do so. ⊗ Do not use polyolester (POE) or any other type of mineral oil as a thread lubricant. If introduced to the refrigerant circuit, it will create oil sludge leading to system malfunction. Use PVE (polyvinyl ether) type refrigeration oil only.
- Protect the liquid and vapor piping / ports with a wet towel during brazing.
- Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow. ⊗ 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.
- When brazing the field-supplied refrigerant piping to the outdoor unit connections, flow 3 psig nitrogen into the piping. If nitrogen was not flowed during brazing, the piping may oxidize and cause membranes to form, which may negatively impact valve and condenser operation.

Figure 59: Removing the Leak Prevention Cap.



# INSTALLING FOR HEAT RECOVERY OPERATION

## Indoor Unit Y-Branch Kits

### ⊘ No Substitutions on Piping Components

Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. ⊘ Third-party or field-fabricated components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).

### Install Correctly

- Y-branches can be installed upstream between the Header and the outdoor unit. ⊘ 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.

## Y-Branch Kits

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

### LG Y-Branch Kits for Heat Recovery Operation Consist of:

- One liquid line, one low pressure vapor line, and one high pressure vapor line (three [3] total).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers.

### Indoor Unit Y-Branched

Indoor unit Y-branches may be installed in horizontal or vertical configurations. When installed vertically, the straight-through leg must be within  $\pm 3^\circ$  of plumb. When installed horizontally, the straight-through leg must be level and the branch leg must be within  $\pm 5^\circ$  of horizontal rotation.

Indoor unit Y-branches must always be installed with the single port end towards the outdoor unit, and the two-port end towards the indoor units. The first indoor unit Y-branch kit must be located no closer than at least three (3) feet from the outdoor unit. Provide a minimum of twenty (20) inches between a Y-branch and any other fittings or indoor units.

Figure 60: Indoor Unit Y-Branch Horizontal Configuration.

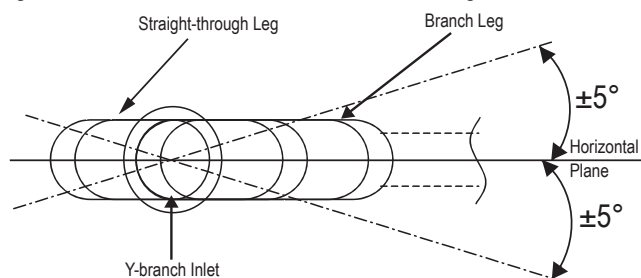


Figure 62: Y-Branch Insulation and Piping Detail.

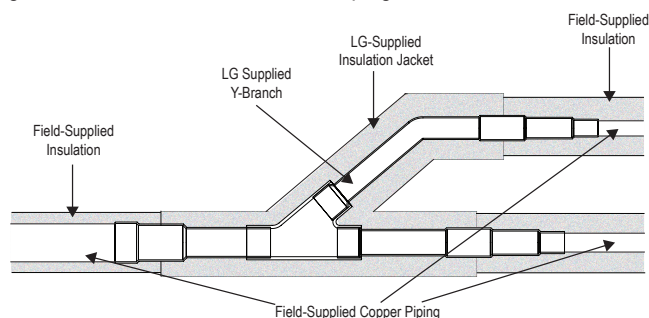
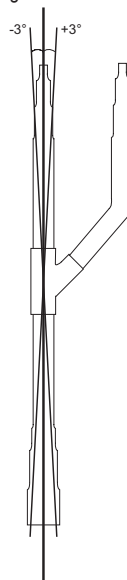
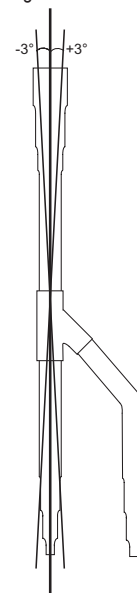


Figure 61: Indoor Unit Y-branch Vertical Installation Alignment Specifications.

Vertical UP Configuration for Indoor Unit Y-Branched.



Vertical DOWN Configuration for Indoor Unit Y-Branched.



### Indoor Unit Y-Branched for Heat Recovery Systems

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

#### Y-branch for Outdoor Unit to Heat Recovery Unit Connection

Unit: Inch

Models	Low-Pressure Vapor Pipe	Liquid pipe	High-Pressure Vapor Pipe
ARBLB03321			

#### Note:

- ⊘ Multi V S outdoor units cannot be combined.

#### Y-Branched from Heat Recovery Units to Indoor Units

Unit: Inch

Models	Vapor pipe	Liquid pipe
ARBLN01621		
ARBLN03321		

# INSTALLING FOR HEAT RECOVERY OPERATION

## Header Kits

### ⊘ No Substitutions on Piping Components

Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. ⊘ Third-party or field-fabricated components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).

### Install Correctly

- Y-branches can be installed upstream between the Header and the outdoor unit. ⊘ 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

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

### LG Header Kits Consist of:

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

Headers must be installed with the main pipe level in the horizontal plane. Distribution ports must be either level in the horizontal plane (Figure 65) or within  $\pm 3^\circ$  of plumb in the vertical plane (Figure 62).

When connecting indoor units to a header, always connect the unit with the largest nominal capacity to the port closest to the outdoor unit. Then install the next largest indoor unit to the next port, working down to the smallest indoor unit.

- ⊘ Do not skip ports. All indoor units connected to a single header fitting must be located with an elevation difference between indoor units that does not exceed 49 feet.

Figure 63: Vertical Header Insulation and Piping Detail (Ports must point to an upright direction).

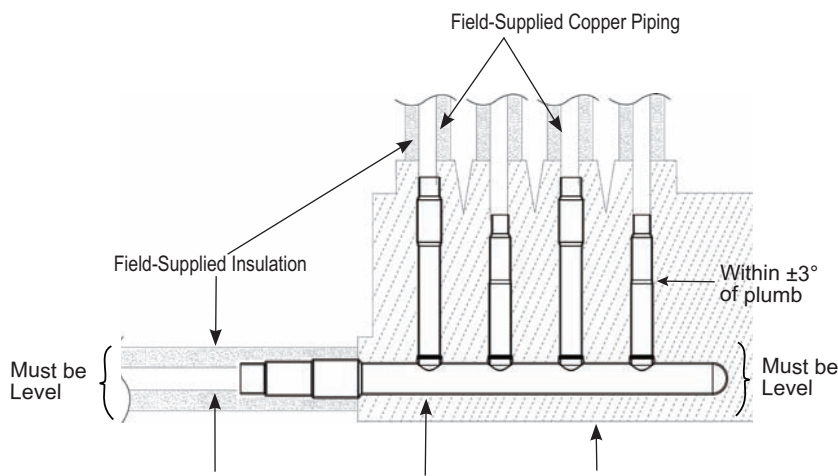
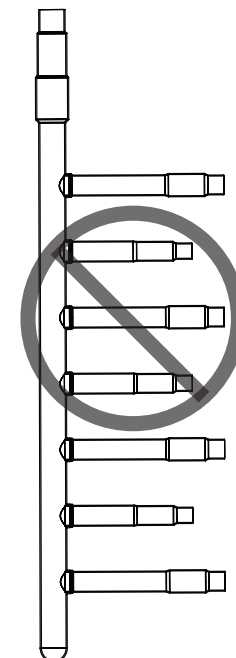


Figure 64: Incorrect Header Configuration.





# INSTALLING FOR HEAT RECOVERY OPERATION

## Header Kits

Figure 65: Incorrect Header Configuration (Ports pointing downwards).

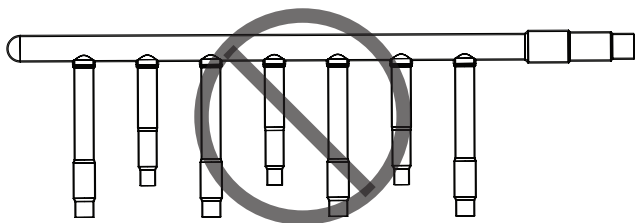
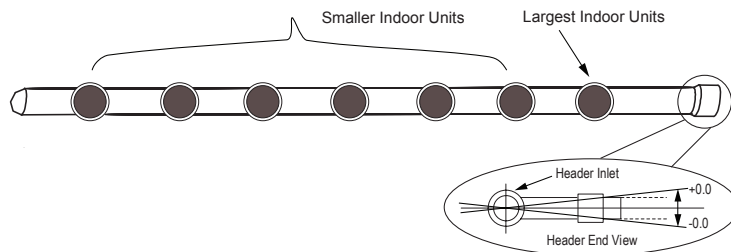


Figure 66: Header Kit—Horizontal Rotation Limit (Ports must point to a horizontal direction).



Unit: Inch.

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



# INSTALLING FOR HEAT RECOVERY OPERATION

## Heat Recovery Units

### Note:

Heat recovery units are **REQUIRED** for systems that are designed for heat recovery operation. Heat recovery units can **ONLY** be used with LG systems designed for heat recovery operation that include liquid, low pressure vapor, and high pressure vapor refrigerant pipes.

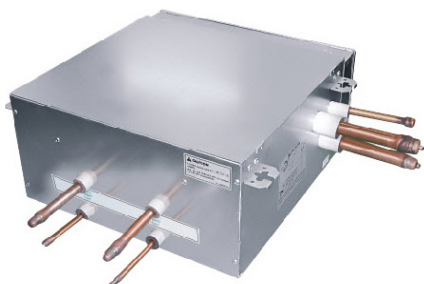


Figure 67: Two-Port Heat Recovery Unit.

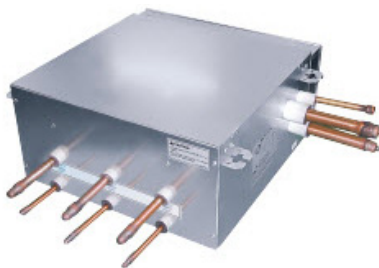


Figure 68: Three-Port Heat Recovery Unit.

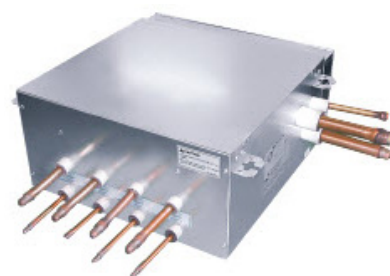


Figure 69: Four-Port Heat Recovery Unit.

Table 22: Heat Recovery Unit Specifications.

Model			PRHR022A	PRHR032A	PRHR042A
Number of Ports			2	3	4
Max. Connectable No. of Indoor Units			16	24	32
Max. Connectable No. of Indoor Units on each port			8	8	8
Max. Port Capacity (each port)	Btu/h		54,000	54,000	54,000
Max. Unit Capacity (sum of ports)	Btu/h		192,000	192,000	192,000
Net Weight	lbs.		40	45	49
Dimensions (W x H x D)	inches		17-7/8 x 8-5/8 x 18-15/16		
Casing			Galvanized steel plate		
Connecting Pipes	To Indoor Units	Liquid Pipe (inches)	3/8		
		Vapor Pipe (inches)	5/8		
	To Outdoor Units	Liquid (inches)	3/8	1/2	5/8
		Low-pressure Vapor (inches)	7/8	1-1/8	1-1/8
		High-pressure Vapor (inches)	3/4	7/8	7/8
Insulation Material			Polyethylene		
Current	Minimum Circuit Amps (MCA)		0.1	0.15	0.2
	Maximum Fuse Amps (MFA)		15		
Power Supply			1Ø, 208-230V, 60Hz		

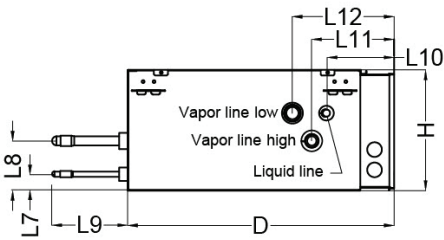
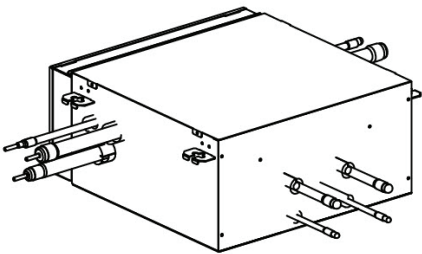
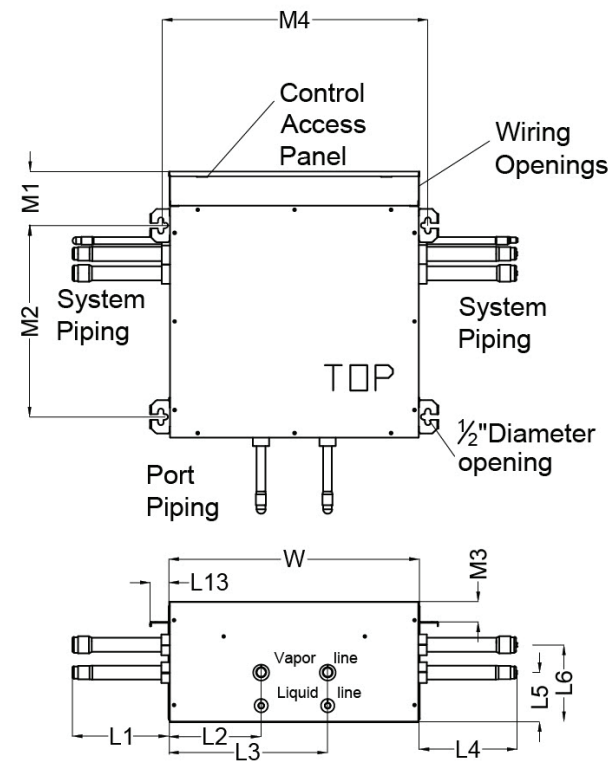
Table 23: Heat Recovery Unit Electrical Data.

Unit Model No.	V / Hz / Ph	Input (kW)	
		Cooling	Heating
PRHR022A	208-230 / 60 / 1	0.026	0.026
PRHR032A	208-230 / 60 / 1	0.033	0.033
PRHR042A	208-230 / 60 / 1	0.040	0.040

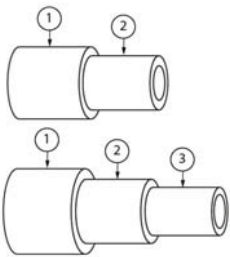
INSTALLING FOR HEAT RECOVERY  
OPERATION

Heat Recovery Units

PRHR022A



W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	6-5/8"
L3	11-3/8"
L4	6-7/8"
L5	3-1/2"
L6	5-1/2"
L7	1-3/16"
L8	3-9/16"
L9	5-7/16"
L10	4-3/4"
L11	5-3/4"
L12	7-1/4"
L13	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"



Reducer Dimensions (in)					
		1	2	3	Quantity
Indoor Unit	Liquid Line	3/8 OD	1/4 OD	-	2
	Vapor Line	5/8 OD	1/2 OD	-	2
HR Unit	Liquid Line	3/8 OD	1/4 OD	-	2
	Vapor Line Low	5/8 OD	1/2 OD	-	2
	Vapor Line High	7/8 OD	3/4 OD	5/8 OD	2
		1/2 OD	3/8 OD	-	2
		3/4 OD	5/8 OD	1/2 OD	2

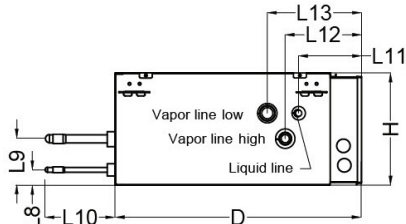
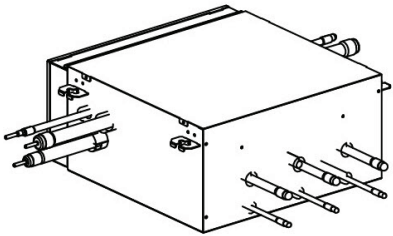
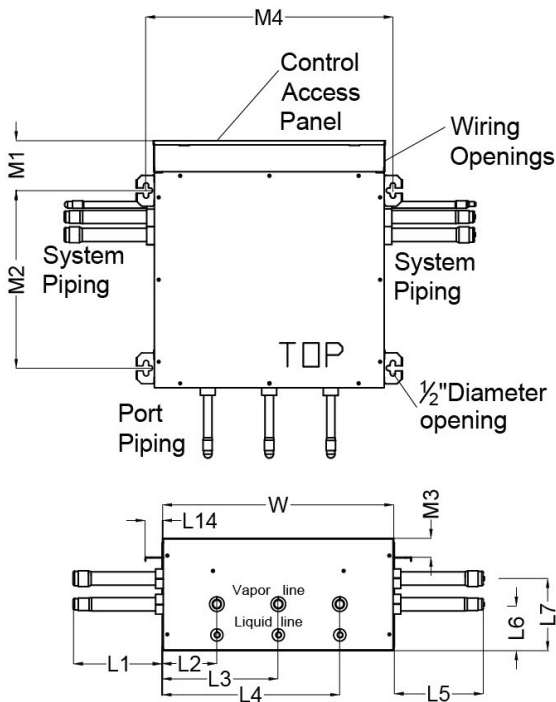
Refrigerant Piping System Installation for Heat Recovery Operation

# INSTALLING FOR HEAT RECOVERY OPERATION

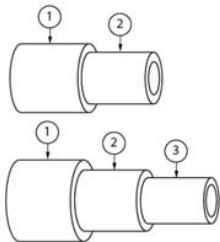


## Heat Recovery Units

### PRHR032A



W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	4-1/4"
L3	9"
L4	13-3/4"
L5	6-7/8"
L6	3-1/2"
L7	5-1/2"
L8	1-3/16"
L9	3-9/16"
L10	5-7/16"
L11	4-3/4"
L12	5-3/4"
L13	7-1/4"
L14	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"



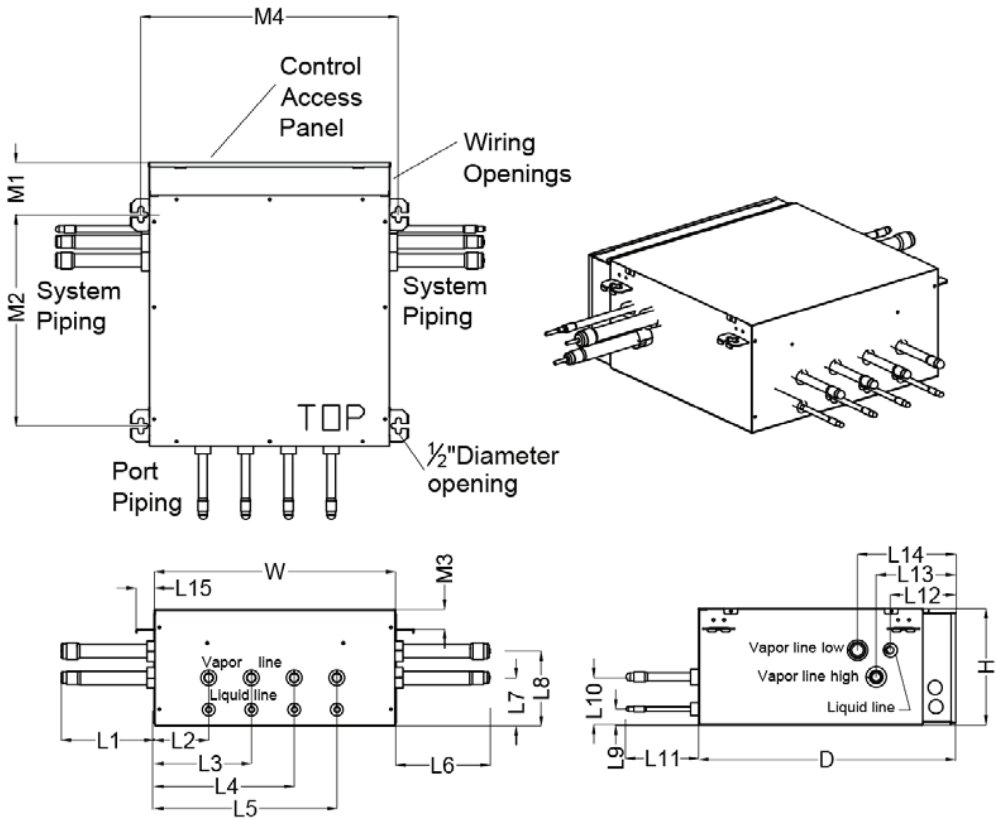
Reducer Dimensions (in)					
		1	2	3	Quantity
Indoor Unit	Liquid Line	3/8 OD	1/4 OD	-	3
	Vapor Line	5/8 OD	1/2 OD	-	3
HR Unit	Liquid Line	1/2 OD	3/8 OD	-	2
	Vapor Line Low	3/4 OD	5/8 OD	-	2
		1-1/8 OD	7/8 OD	3/4 OD	2
	Vapor Line High	5/8 OD	1/2 OD	-	2
		7/8 OD	3/4 OD	5/8 OD	2



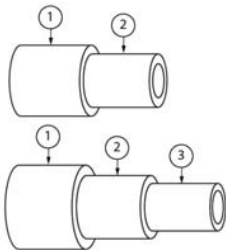
# INSTALLING FOR HEAT RECOVERY OPERATION

Heat Recovery Units

## PRHR042A



W	17-7/8"
H	8-5/8"
D	18-15/16"
L1	6-7/8"
L2	4-1/4"
L3	7-1/2"
L4	10-1/2"
L5	13-3/4"
L6	6-7/8"
L7	3-1/2"
L8	5-1/2"
L9	1-3/16"
L10	3-9/16"
L11	5-7/16"
L12	4-3/4"
L13	5-3/4"
L14	7-1/4"
L15	1-1/4"
M1	3-3/4"
M2	13-5/8"
M3	1-1/2"
M4	18-15/16"



Reducer Dimensions (in)					
		1	2	3	Quantity
Indoor Unit	Liquid Line	3/8 OD	1/4 OD	-	4
	Vapor Line	5/8 OD	1/2 OD	-	4
HR Unit	Liquid Line	1/2 OD	3/8 OD	-	2
	Vapor Line Low	3/4 OD	5/8 OD	-	2
		1-1/8 OD	7/8 OD	3/4 OD	2
	Vapor Line High	5/8 OD	1/2 OD	-	2
		7/8 OD	3/4 OD	5/8 OD	2

# INSTALLING FOR HEAT RECOVERY OPERATION



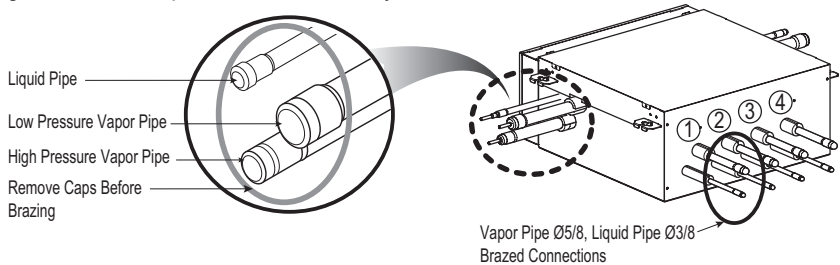
## Heat Recovery Units

### Heat Recovery Unit Connections and Limitations

#### Note:

1. Refer to the heat recovery unit PCB for valve group control setting.
2. Maximum capacity of each port is 54,000 Btu/h and eight (8) indoor units.
3. Do not skip ports when connecting indoor units. Start at port 1, then use 2, then use 3, then use 4 (the numbers are displayed on the heat recovery ports).

Figure 70: Close Up of the Heat Recovery Unit Connections.



### Removing the Caps

Before brazing the field-supplied refrigerant piping to the heat recovery unit connections, the caps **MUST** be removed from the liquid, high pressure vapor, and low pressure vapor pipe connections.

#### ⚠ WARNING

Removing the caps releases any gas present in the heat recovery unit. If the gas isn't released, physical injury or death may occur from the uncontrolled rapid release of gas, or if the gas comes in contact with a flare during brazing and generates a poisonous gas.

#### Note:

On whichever port or pipe not used, the factory-provided cap must be removed, and that port / pipe must be recapped and insulated.

Table 24: Heat Recovery Unit Piping Connection Sizes.

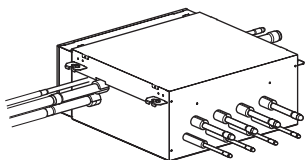
Model			PRHR022A	PRHR032A	PRHR042A
Number of Ports			2	3	4
Connecting Pipes	To Indoor Units	Liquid Pipe (inches)	3/8		
		Vapor Pipe (inches)	5/8		
	To Outdoor Units	Liquid (inches)	3/8	1/2	5/8
		Low-pressure Vapor (inches)	7/8	1-1/8	1-1/8
		High-pressure Vapor (inches)	3/4	7/8	7/8

### Piping Connection Options

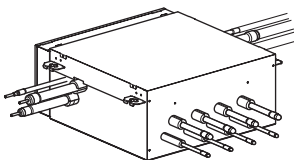
Heat recovery units can connect to the field-supplied refrigerant piping on the left side or on the right side. Heat recovery units can also be installed in series / in parallel using these side connections.

Figure 71: Heat Recovery Unit Piping Connection Options.

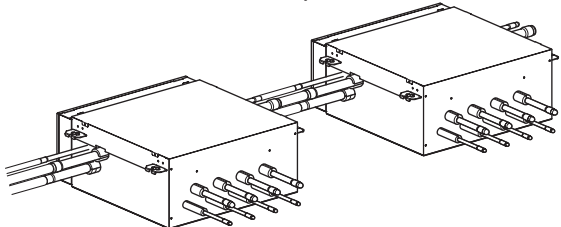
Pipe Connection from Left Side



Pipe Connection from Right Side



Series / Parallel Pipe Connection



# INSTALLING FOR HEAT RECOVERY OPERATION

## Heat Recovery System Piping

### Combining Heat Recovery Ports for Large Indoor Units

It is necessary to combine two ports on a heat recovery unit when installing a single indoor unit with a capacity exceeding 54,000 Btu/h. Two neighboring heat recovery ports are combined using a reverse Y-branch that is then connected to the one large indoor unit.

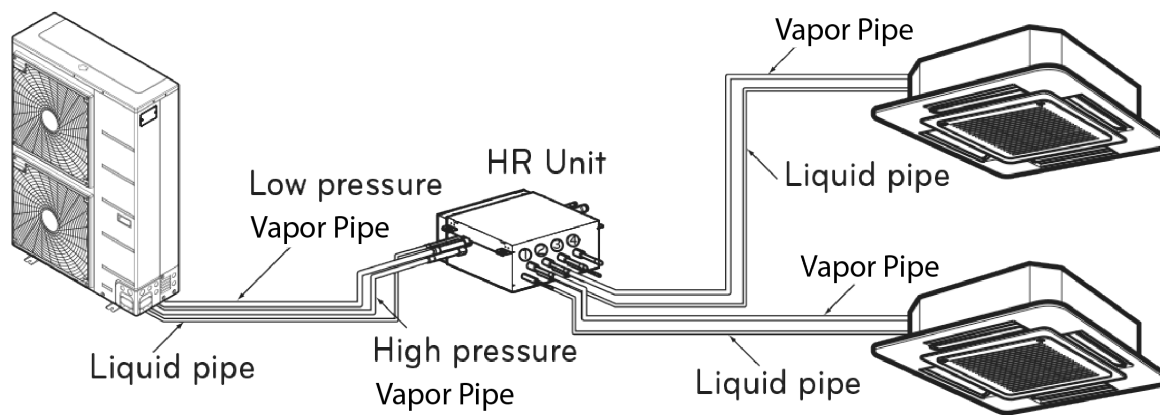
Unit: Inch

Kit Model No.	Vapor Pipe Dimensions	Vapor Pipe Model No.	Liquid Pipe Dimensions	Liquid Pipe Model No.
ARBLN03321		AJR54072906		AJR54072902

### Heat Recovery System Piping

Heat recovery systems have three pipes (liquid, high pressure vapor, low pressure vapor) running from the outdoor unit to the heat recovery unit, then two pipes (liquid, vapor) running from the heat recovery unit to the connected indoor units.

Figure 72: Simplified Diagram of Heat Recovery System Piping.



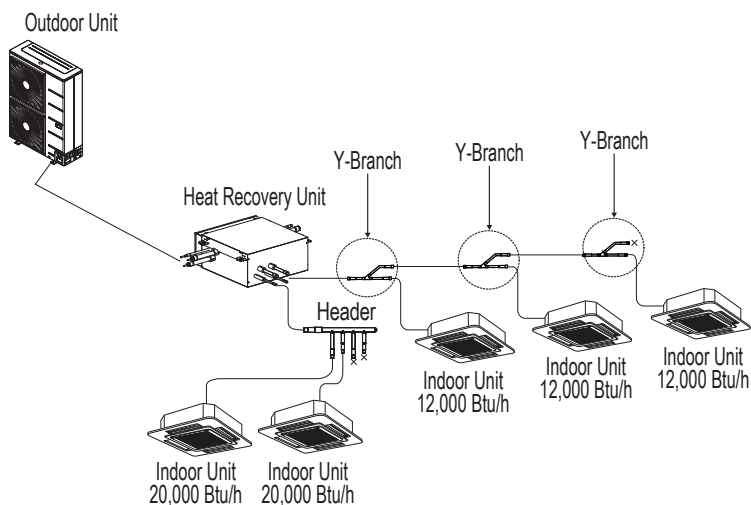
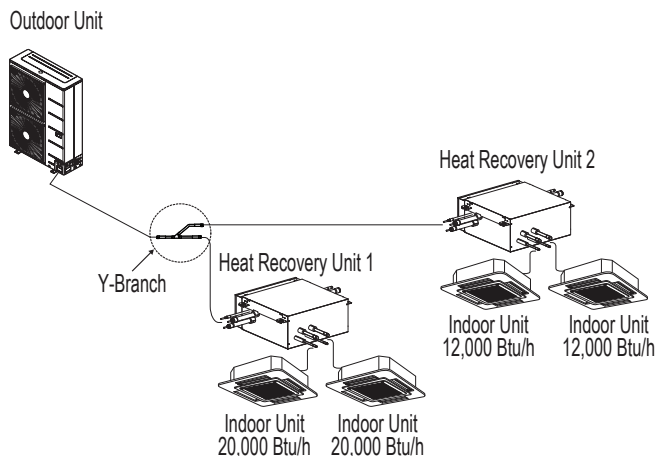
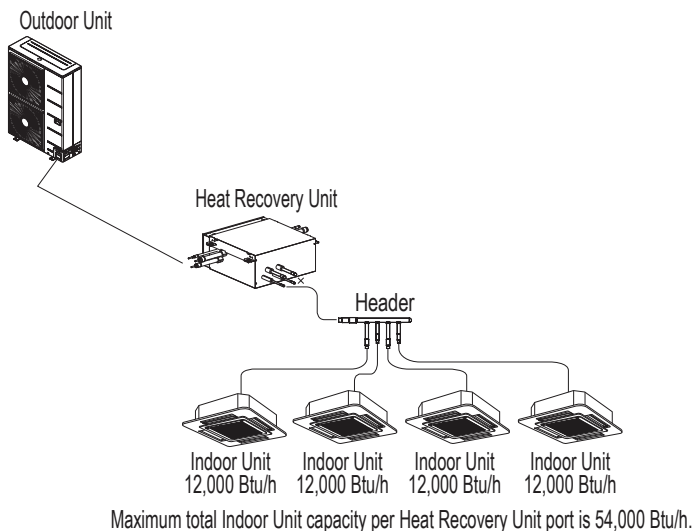
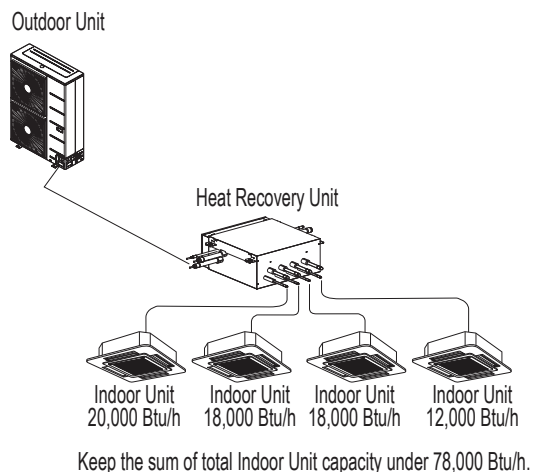
# INSTALLING FOR HEAT RECOVERY OPERATION

**MULTI V<sup>™</sup> S**

## Sample Layouts

### Sample Layouts

Systems designed for heat recovery operation can use also Y-branches and Headers in combination with heat recovery units.

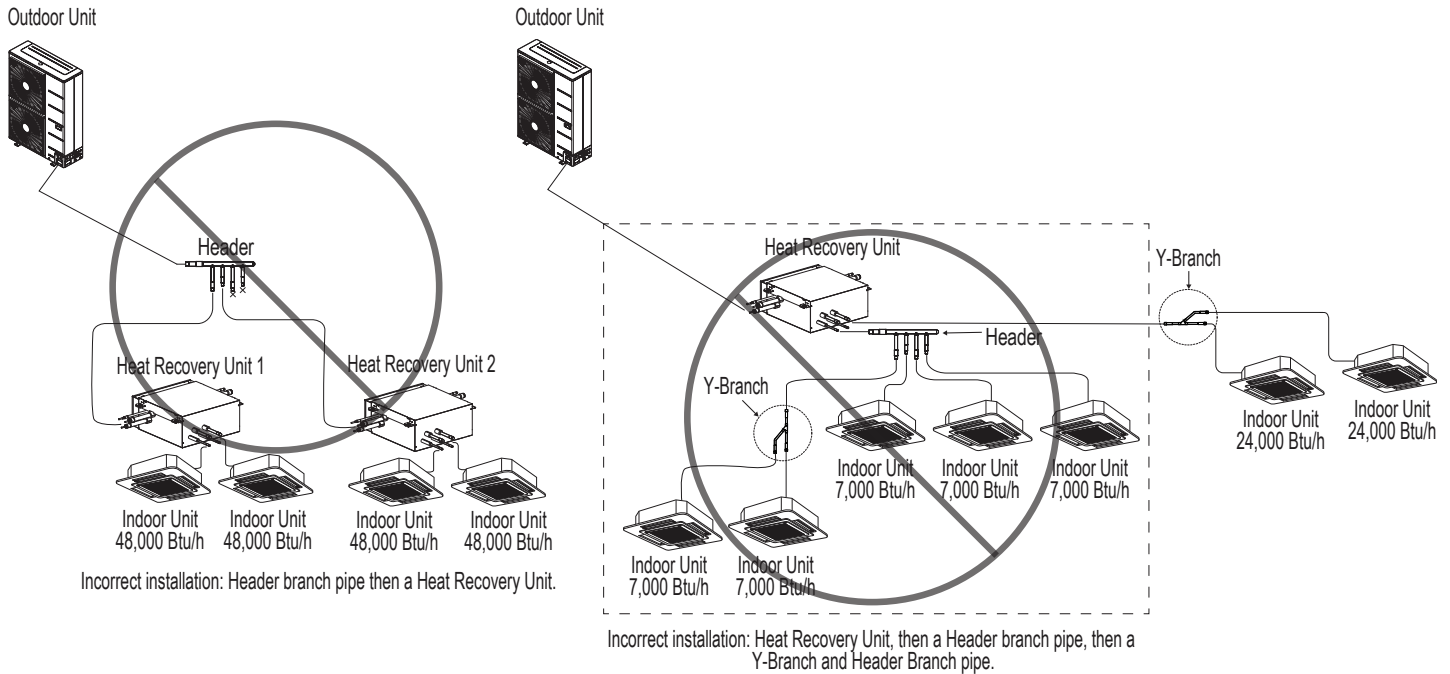


### Note:

Images are for illustrative purposes only and are not accurate representations. For specific details on piping limitations and other refrigerant system rules, review the information in this entire piping section, see the Multi V S Engineering Manual, and follow the LATS diagram.



### Incorrect Layouts



### Note:

Images are for illustrative purposes only and are not accurate representations. For specific details on piping limitations and other refrigerant system rules, review the information in this entire piping section, see the Multi V S Engineering Manual, and follow the LATS diagram.

# INSTALLING FOR HEAT RECOVERY OPERATION

## Piping Connections / Pipe Routes

### Refrigerant Piping Connections

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

#### ⚠ WARNING

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

#### Note:

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

#### ⚠ WARNING

*It is imperative that the correct outdoor unit connections be used for the intended system operation (heat pump versus heat recovery). If the wrong connections are used, it may result in refrigerant leaks, which may lead to illness or death.*

#### Note:

*It is imperative that the correct outdoor unit connections be used for the intended system operation (heat pump versus heat recovery). If the wrong connections are used, it may result in refrigerant leaks, which may lead to system malfunction or even failure to work at all.*

### Pipe Routes

The pipe route chosen depends on the installation area, and is at the discretion of the installer. After the pipe route is chosen, the appropriate outdoor unit access holes must be knocked out (see next page for knock out information).

Figure 73: Multi V S Outdoor Unit Piping Installation Options.

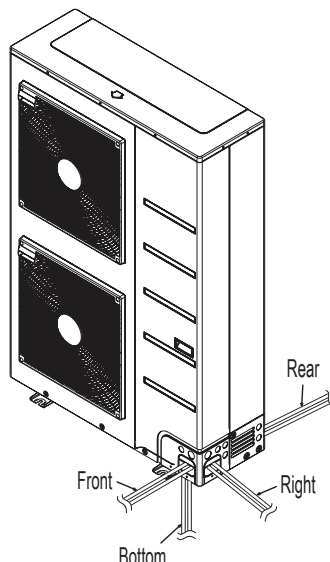


Figure 74: Piping Connections for Heat Recovery Operation.

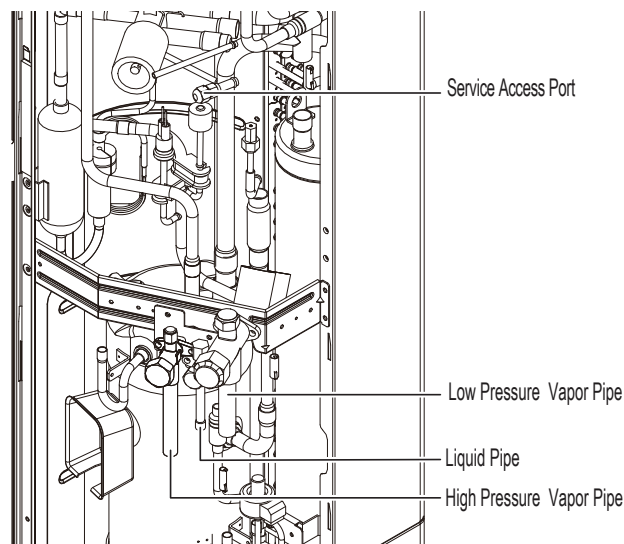
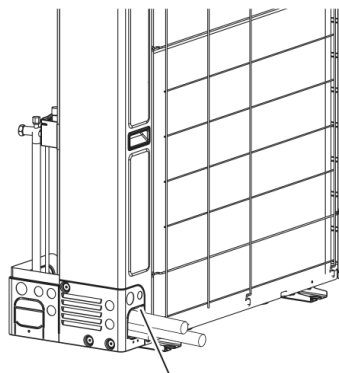


Figure 75: Rear Access Hole for Multi V S Piping.



Pipe Knock Out for Liquid/Gas pipes

### Knock Outs

- If piping from the left / right or bottom, use the access holes on the base pan. ⚠ Do not damage the piping / base while knocking out the holes.
- Add a protection sleeve to prevent damage when passing the wiring through the access holes.
- Pipe system connection is done by connecting from the end of the pipe to the branching pipes, and the refrigerant pipe coming out of the outdoor unit is divided at the end to connect to each indoor unit.
- Flare connections are used to connect the piping on the indoor units, and braze connections are used to connect the piping on the outdoor unit (see piping dimensions below), Y-branches, and headers.

### Note:

- To avoid damaging the piping and power wiring / communication cables, remove any burrs that may have formed during the knock out procedure. Make sure the access holes have smooth edges.
- To avoid damaging the power wiring / communication cables, install sleeves.
- After piping installation is complete, to prevent animals or foreign materials from damaging the outdoor unit cables / wiring, seal any holes in with sealant, plugs, foam, caulk, putty, etc.

### Avoid Pipe Damage

- When routing field-provided piping inside the outdoor 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 install and insulate refrigerant pipes separately up to the service valve body inside the confines of the unit frame.

Figure 76: Heat Recovery Outdoor Unit Bottom Access Panel.

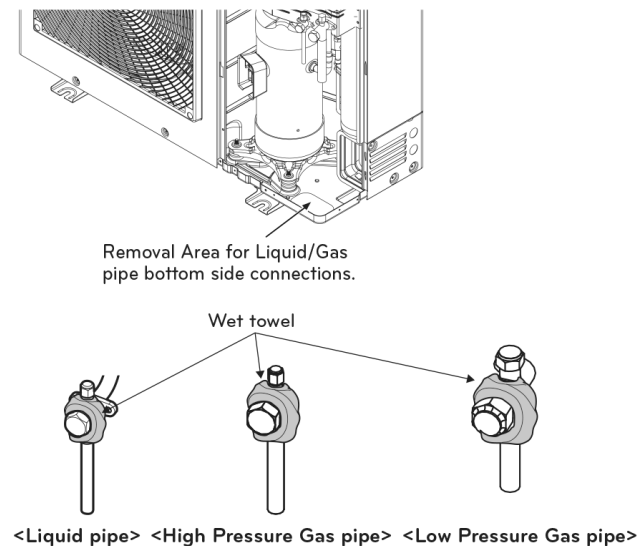


Figure 77: Heat Recovery Outdoor Unit Knock Outs.

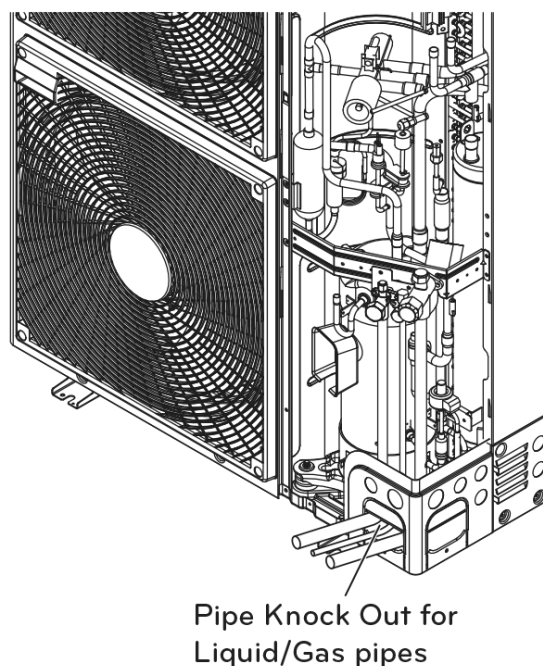


Table 25: Heat Recovery Outdoor Unit Refrigerant Piping Connections.

Model	Liquid Conn. (in.)	Type	High Pressure Vapor Conn. (in.)	Type	Low Pressure Vapor Conn. (in.)	Type
ARUB060GSS4	3/8	Brazed	5/8	Brazed	3/4	Brazed

# INSTALLING FOR HEAT RECOVERY OPERATION



## Knock Outs /Removing the Leak Prevention Caps

### Opening the Shut Off Valve

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

#### Note:

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

3. Securely tighten the shut off valve cap.

### Closing the Shut Off Valve

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

#### Note:

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

3. Securely tighten the shut off valve cap.

### Insulating the Shut Off Valve

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

#### ⚠ WARNING

- Outdoor units ship with a factory charge of refrigerant. Always take extreme caution to prevent refrigerant gas (R410A) from leaking during use, around fire or flame, and during brazing. If the refrigerant gas comes in contact with a flame from any source, it may break down and generate a poisonous gas. ⊘ Do not braze in a small room, or a room that is not ventilated.
- After refrigerant piping work is complete, verify that the Schrader port and service port caps are securely tightened to help prevent refrigerant gas from leaking. Verify the system is free of leaks after refrigerant piping installation is complete. Exposure to high concentration levels of refrigerant gas may lead to illness or death.
- ⊘ Do not attempt to remove the service valve stem. Physical injury or death may occur from the uncontrolled rapid release of refrigerant.

#### Note:

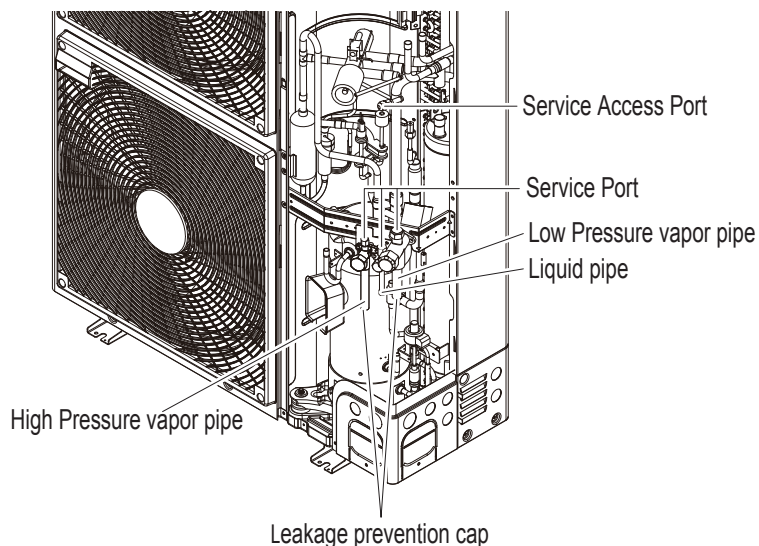
- Before connecting the refrigerant piping, make sure the service port valves of the outdoor unit are completely closed (factory setting).  
⊘ Do not open the service port valves or attempt to operate the system until the refrigerant pipe system installation has been completed. Never open the valves before a pressure test is performed, a leak test performed, the system is evacuated, and the LG trained Commissioner provides authorization to do so. ⊘ Do not use polyolester (POE) or any other type of mineral oil as a thread lubricant. If introduced to the refrigerant circuit, it will create oil sludge leading to system malfunction. Use PVE (polyvinyl ether) type refrigeration oil only.
- Protect the liquid and vapor piping / ports with a wet towel during brazing.
- Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow. ⊘ 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.
- When brazing the field-supplied refrigerant piping to the outdoor unit connections, flow 3 psig nitrogen into the piping. If nitrogen was not flowed during brazing, the piping may oxidize and cause membranes to form, which may negatively impact valve and condenser operation.

### Removing the Leak Prevention Caps

Before brazing the field-supplied refrigerant piping to the outdoor unit connections, the leak prevention caps **MUST** be removed from the liquid, high pressure vapor, and low pressure vapor pipe connections.

- Verify whether all the pipes are closed.
- Purge or vacuum any remaining refrigerant or air through the service ports.
- Remove the leak prevention caps from the liquid, high pressure vapor, and low pressure vapor pipe outdoor unit connections.

Figure 78: Removing the Leak Prevention Caps.



## Note:

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

## Refrigerant Piping System Insulation

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

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

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

All insulation joints 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 the sun and outdoor elements must be properly protected with PVC, aluminum vapor barrier, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover; and meet local codes. LG-provided Y-branches are shipped from the factory with pre-formed peel-and-stick foam insulation jackets, with a 1.84 lb./ft.<sup>3</sup> density, 1/2 inch thickness, and meet UL94 MF-1 flammability.

The design engineer must perform calculations to determine if the factory-supplied insulation jackets are sufficient to meet local codes and avoid sweating. Add additional insulation if necessary. Check the fit of the insulation jacket after the header fitting and all run-out pipes are installed. Mark all pipes at the point where the insulation jacket ends. Remove the jacket. Install field provided insulation on the run-out and main trunk pipes first. Install the LG-provided insulation plugs on the ends of all unused header ports. Peel the adhesive glue protector slip from the insulation jacket and install the clam-shell jacket over the fitting.

Figure 79: Typical Pipe Insulation, Power Wire and Communications Cable Arrangement.

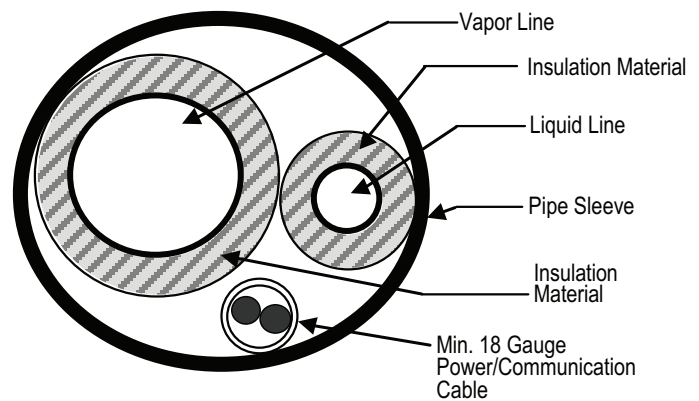


Figure 80: Typical Insulation Butt-Joint at Indoor Unit Casing.

Figure 81: Typical Refrigerant Flare Fitting Insulation Detail.

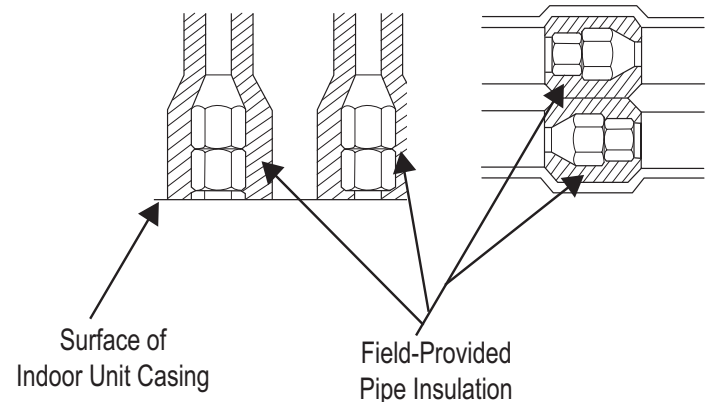
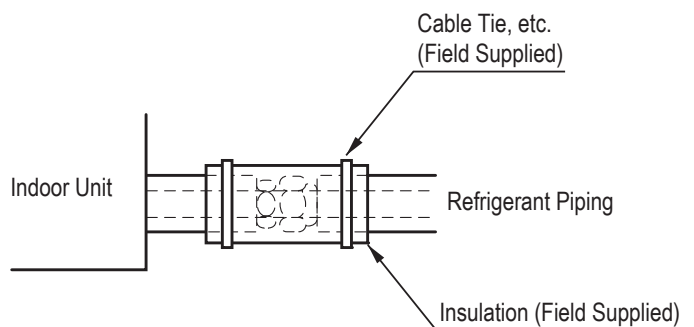


Figure 82: Insulating the Shut Off / Insulation Ball Valve (If Present).





**Note:**


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

Table 26: Minimum Refrigerant Pipe EPDM Insulation Wall Thickness Requirements.<sup>1</sup>

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

<sup>1</sup>The thickness of the above insulation material is based on heat conductivity of 0.61 Btu/in/h/ft<sup>2</sup>/°F.

**1. Typical Conditioned Location**

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

**2. Special Conditioned Location**

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

**3. Typical Unconditioned Location**

An unconditioned space inside a building.

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

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

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

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



## Applying Insulation to Y-Branch and Header Fittings

LG Y-branches and Headers must be insulated with the clam-shell insulation jacket that is provided with each component. Check the fit of the insulation jacket after all pipes are brazed to fittings. Mark all pipes at the point where the insulation jacket ends. Remove the insulation 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 insulation jacket over the fitting.

Figure 83: Y-branch Insulation.

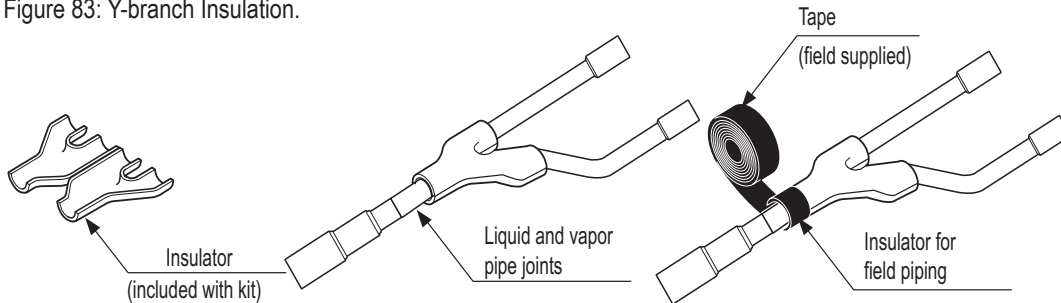


Figure 84: Header Insulation.

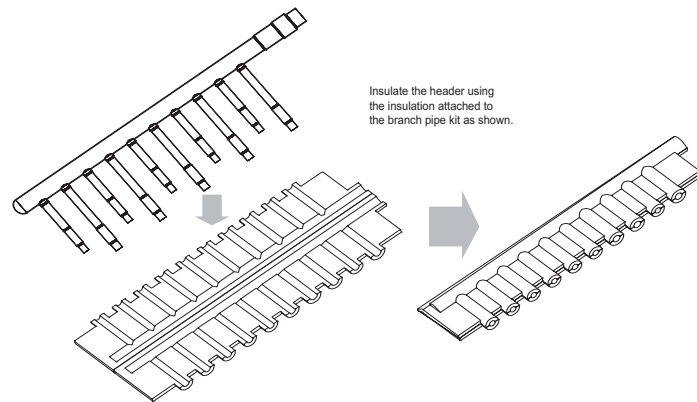


Figure 85: Joints between branch and pipe must be sealed with tape included in each kit.

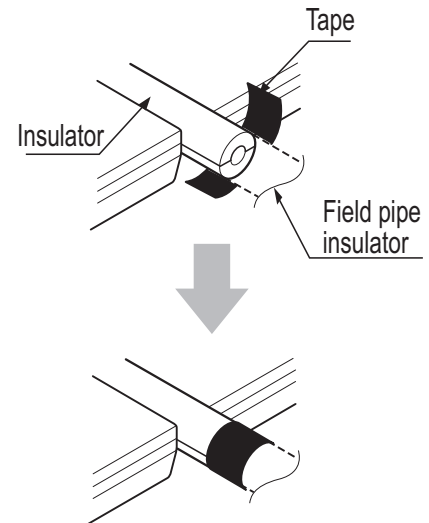
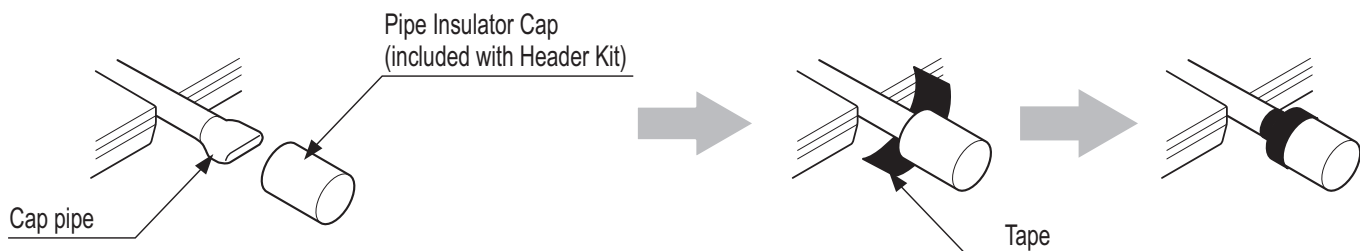


Figure 86: Capped pipes must be insulated using the cap included in each kit, and then taped as shown.



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

### Note:

- Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.
- Properly ground the outdoor units. Improperly ground wire can cause communication problems from electrical noise, and motor current leakage. Ground wiring must always be installed by a qualified technician.
- If the system operates in reversed phase, it may damage the compressors and other components.
- If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Using an oversized breaker or fuse may result in equipment malfunction and property damage.
- ⚡ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a National Electrical Code-approved earth ground can result in property damage and equipment malfunction.
- If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit. If the system operates in reversed phase, it may damage the compressors and other components.

# ELECTRICAL

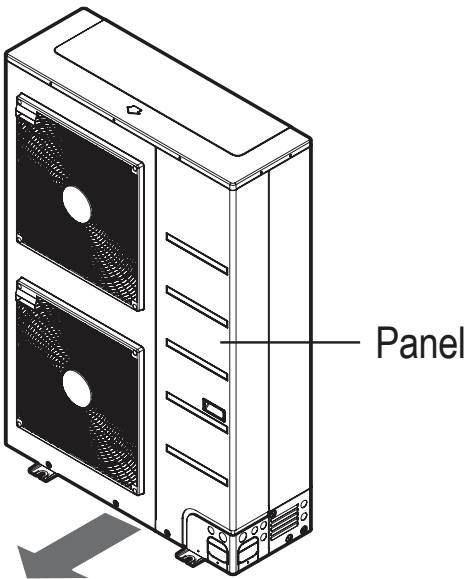


## General Information

### Accessing the Power Wiring and Communications Cable Connections

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

Figure 87: Removing the Multi V S Outdoor Unit Access Panel.



**Note:**

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

### Separating Power Wires and Communication Cables

- Avoid running the power wiring and communication cable alongside each other; there is a strong likelihood of operation malfunction due to electrostatic and electromagnetic 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 27: Power Wire and Communications Cable Minimum Allowable Separation Distances.

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

<sup>1</sup>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.

<sup>2</sup>If the power supply waveform continues to exhibit some distortion, the space between the power wiring and communication cable must be increased.

### ⚠ WARNING

Properly ground all outdoor units. Ground wiring must always be installed by a qualified technician. Ground wiring is required to prevent accidental electrical shock during current leakage, which may cause bodily injury or death.

**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.



## Location of Outdoor Unit PCBs and Other Electrical Components

Figure 88: Power Wiring / Communications Cable Paths and Terminations Inside Multi V S ARUN038, 048, 053, and 060GSS4.

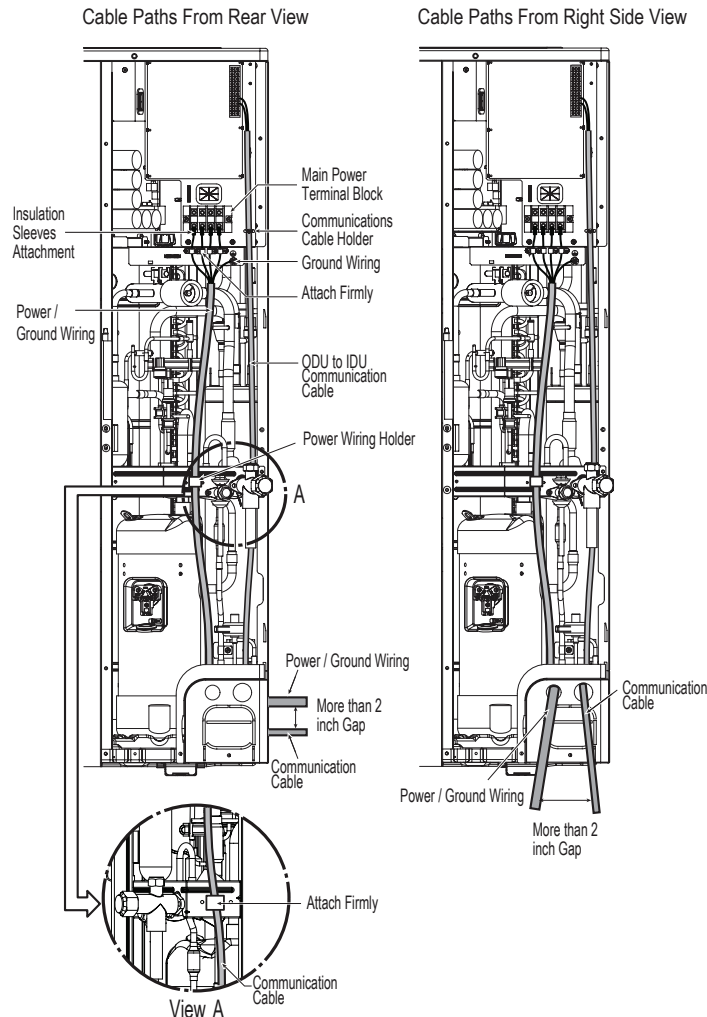


Figure 89: Multi V S ARUN038, 048, 053, and 060GSS4 and ARUB060GSS4 Electrical Component Location.

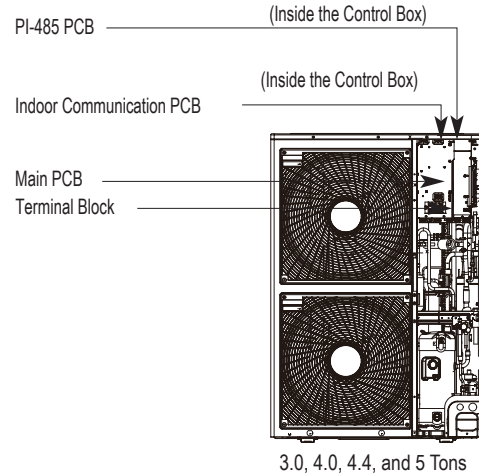
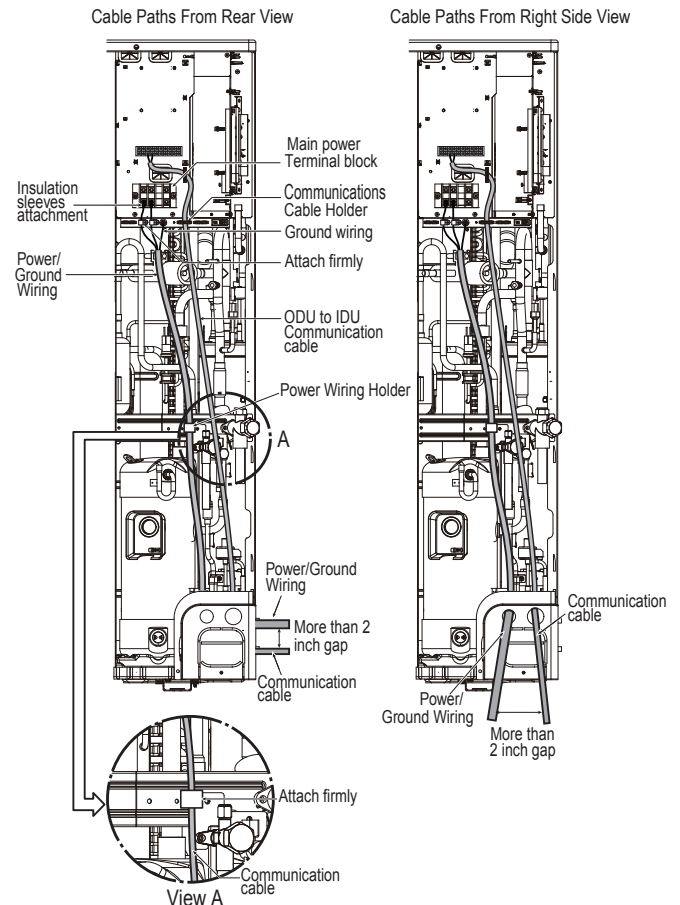


Figure 90: Power Wiring / Communications Cable Paths and Terminations Inside Multi V S ARUB060GSS4.



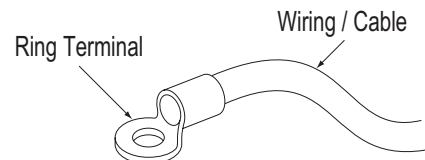
\*Presentation may differ depending on the Model.

### Power Wiring / Communication Cable Connections

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

- Firmly attach the wire; secure in a way to prevent external forces from being imparted on the terminal block.
- Use an appropriately sized screwdriver for tightening the terminals.
- ⓧ Do not overtighten the connections; overtightening may damage the terminals.

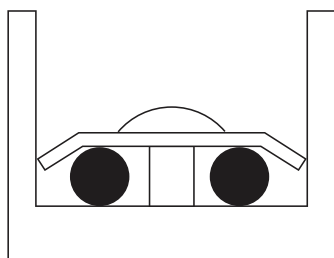
Figure 91: Close up of a Typical Ring Terminal.



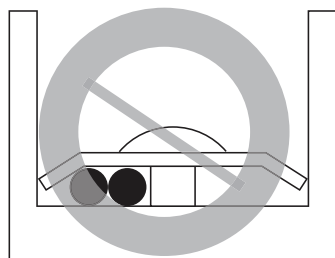
If ring terminals or fork terminals are not available, then:

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

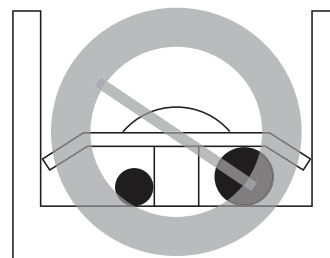
Figure 92: Proper and Improper Power Wiring Connections.



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



ⓧ Do not terminate two wires on one side.



ⓧ Do not terminate different gauge wires to a terminal block.

● :Copper Wire

### ⚠ WARNING

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

### Note:

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

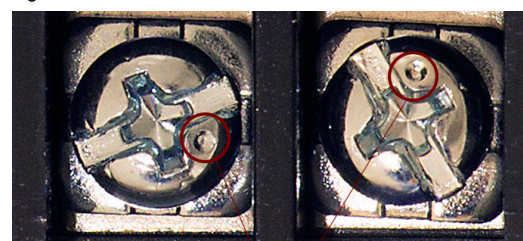
### Terminal Connections

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

### Note:

- The terminals labeled "GND" are NOT ground terminals. The terminals labeled ⓧ ARE ground terminals.
- Polarity matters. Always connect "A" to "A" and "B" to "B."
- Always create a wiring diagram that contains the exact sequence in which all the indoor units and heat recovery units are wired in relation to the outdoor unit.
- ⓧ Do not include splices or wire nuts in the communication cable.

Figure 93: JIS Screws.



JIS DIMPLES



### Power Supply / Power Wiring Specifications

Multi V S outdoor unit(s) and indoor units must be provided power from separate breakers.

#### Outdoor Units

- Multi V S outdoor units operate at 1Ø, 208-230V, 60Hz.
- Power supplies, wire types and sizes must be selected based on National Electrical Code and local codes. Maximum allowable voltage fluctuation  $\pm 10\%$  or nameplate rated value.
- Properly ground each outdoor unit per National Electrical Code and local codes.
- Ground wire must be longer than the common power / communication wires.
- Connect the wiring firmly so the wires cannot be easily pulled out.
- Refer to the inside of the chassis cover for circuit and terminal block diagrams for your model unit.
- Always match color codes of each wire and follow wiring diagram.
- Outdoor unit wiring can be found on the inside of the outdoor unit control cover.
- Power wiring / power wiring gauge to the outdoor unit(s) must be solid or stranded, and must comply with all NEC and local electrical codes.
- 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 the power wiring and the communication cable in the same conduit.

#### Indoor Units / Heat Recovery Units

- Indoor units and heat recovery units require 1Ø, 208-230V, 60Hz power, but each unit draws minimal power.
- Where permitted by NEC and local codes, multiple indoor units and heat recovery units may be powered from a single breaker.
- Service switches typically must be installed for each indoor unit and heat recovery unit.
- Ground each indoor unit and heat recovery unit separately to a solid earth ground source per NEC and local code requirements.

#### **⚠ WARNING**

- *All power wiring installation must be performed by authorized service providers working in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Failure to do so may lead to electric shock and bodily injury or death.*
- *Use specified wiring for connections, and ensure that external force is not imparted to terminal connections. If connections firmly attached, it may generate heat and / or cause a fire, resulting in physical injury or death.*
- *Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in electric shock, physical injury or death.*
- *Use the appropriate type of overcurrent protection. Generated overcurrent may include some amount of direct current, and if the appropriate type of overcurrent protection is not installed, there is a risk of fire, electric shock, and physical injury or death.*
- *Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Ⓢ Do not connect the ground line to the pipes. There is risk of fire, electric shock, explosion, physical injury or death.*
- *Install a main shutoff switch that interrupts all power sources simultaneously. There is risk of fire, electric shock, explosion, physical injury or death.*
- *The GND terminal at the main PCB is a negative terminal for dry contact, not a ground. Inadequate connections may generate heat, cause a fire, and physical injury or death.*

## Power Wiring Specifications

### Note:

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

Figure 94: Example of a Multi V S ARUN024GSS4 Heat Pump System Power Wiring / Communications Cable Connection Schematic.

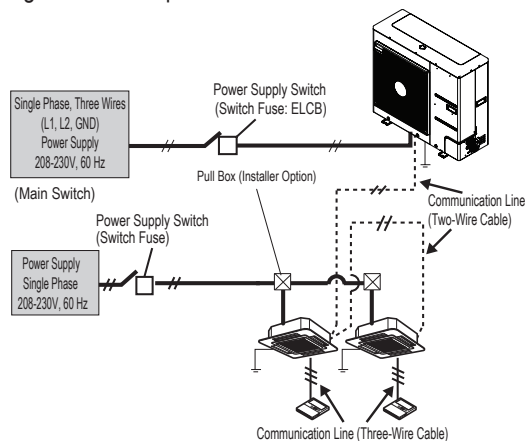
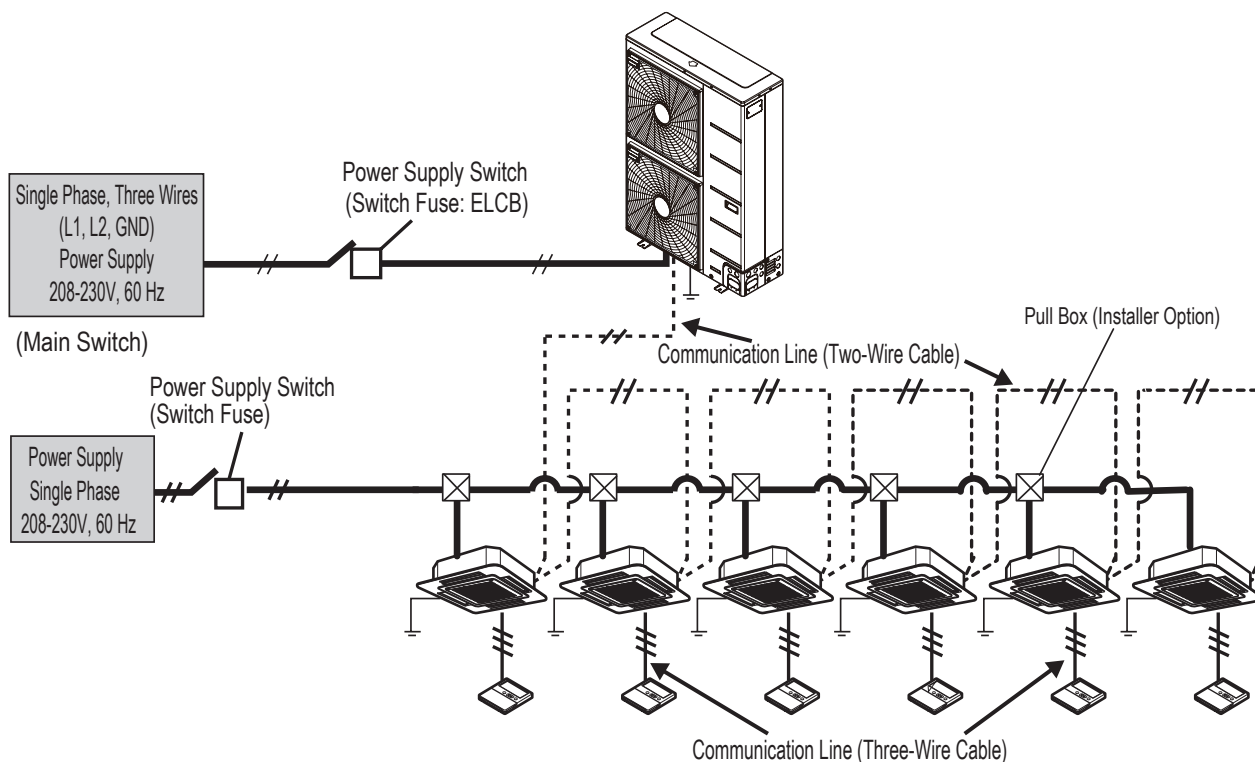


Figure 95: Example of a Multi V S ARUN038, 048, 053, and 060GSS4 Heat Pump System Power Wiring / Communications Cable Connection Schematic





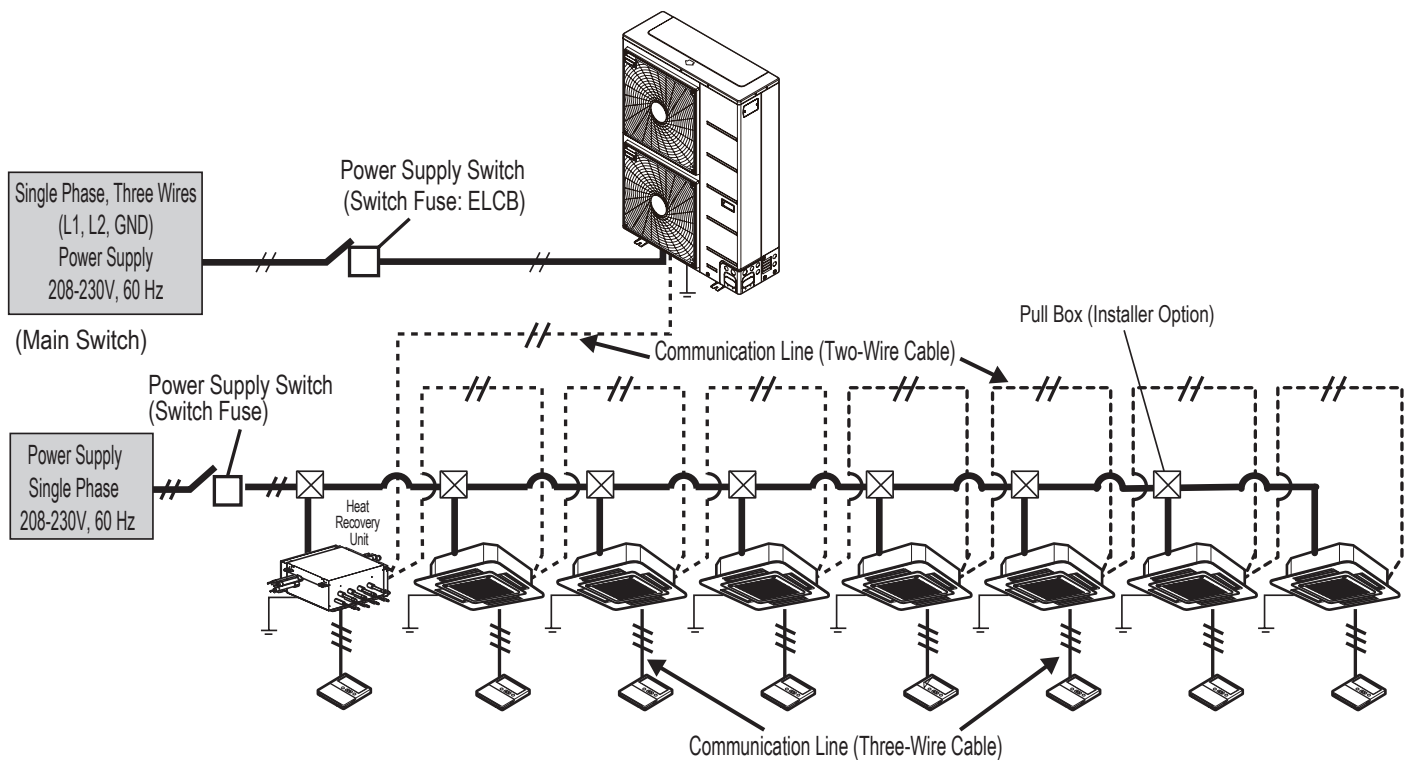
### ⚠ DANGER

Refer to Electrical Data table in Multi V S Outdoor Unit Engineering Manual for full load ampere ratings. Properly size all circuit breakers / fuses, wiring and field provided components per local codes. There is risk of fire, electric shock, explosion, physical injury or death.

### Note:

Refer to the Product Data section in Multi V S Outdoor Unit Engineering Manual for dimensional drawings, wiring, and refrigerant piping diagrams for the exact locations of the piping and electrical connection locations.

Figure 96: Example of a Multi V S ARUB060GSS4 Heat Recovery System Power Wiring / Communications Cable Connection Schematic



## Communications Cable Specifications

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### Communication Cable Specifications From Outdoor Unit to Indoor Units/Heat Recovery Units

Communication cable from Outdoor Unit to Indoor Units / Heat Recovery Units must be 18 AWG, 2-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the Outdoor Unit chassis only.

⊘ Do not ground the Outdoor Unit to Indoor Units / Heat Recovery Units communication cable at any other point. Wiring must comply with all applicable local and national codes.

- Cable shields between the connected devices must be tied together and continuous from the outdoor unit to the last component connected.
- Start the communication cable at the outdoor unit and route to the indoor units / heat recovery units in a daisy chain configuration.

⊘ Do not install in a starburst configuration.

- Insulation as required by NEC and local codes.
- Rated for continuous exposure of temperatures up to 140°F.
- Maximum allowable communication cable length is 984 feet.

#### **⚠ WARNING**

- *Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage.* ⊘ *Do not connect the ground line to the pipes. There is risk of fire, electric shock, explosion, physical injury or death.*
- ⊘ *Never ground the shield of the communications cable to the indoor unit frame or other grounded entities of the building. Inadequate connections may generate heat, cause a fire, and physical injury or death.*

#### **Note:**

- *Always verify the communication cable is connected to a communications terminal on the outdoor unit(s). Never apply line voltage power to the communication cable connection. If contact is made, the PCBs may be damaged.*
- ⊘ *Never use a common multiple-core communications cable. Each communications bus must be provided a separate cable (i.e., between outdoor unit(s) and indoor units, outdoor units and central controller(s). If communications cables of separate systems are wired using a common multiple-core cable, it will result in a poor communications signal and unacceptable system operation.*

Figure 97: Multi V S System Communications Wiring — Outdoor Unit to Indoor Unit.

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

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

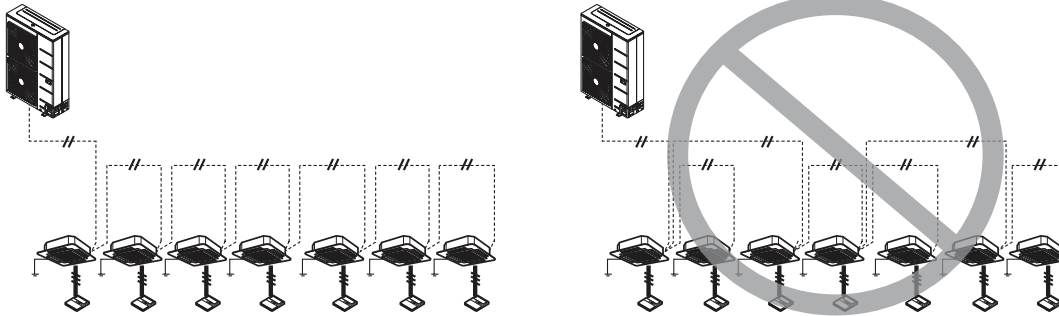


Figure 98: Correct Outdoor Unit to Indoor Unit / Heat Recovery Unit Communications Wiring — Daisy Chain Configuration.

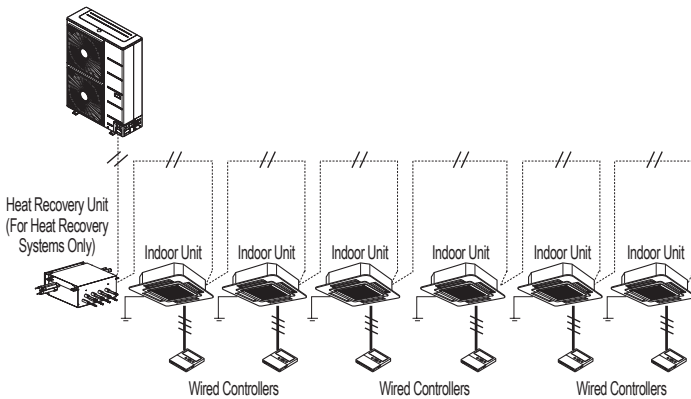
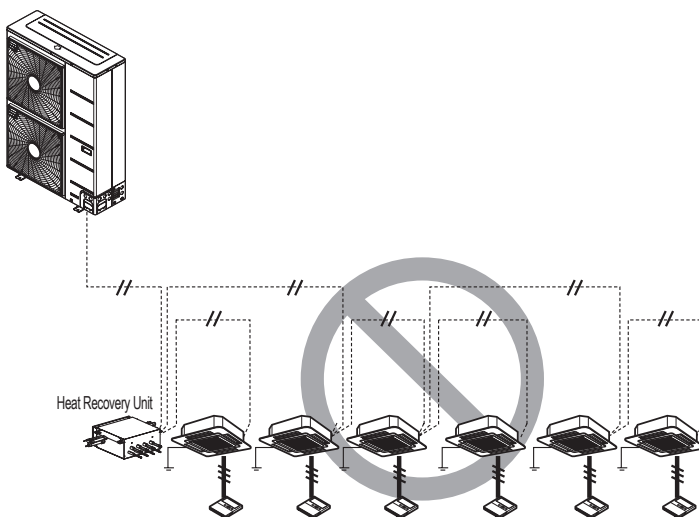


Figure 99: Incorrect Outdoor Unit to Indoor Unit / Heat Recovery Unit Communications Wiring — Starburst Chain Configuration.



## Communications Cable Specifications

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### From Outdoor Unit(s) to Central Controllers

- Communication cable from Outdoor Unit to Central Controller must be 18 AWG, 2-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. ⓧ Do not ground the communication cable at any other point
- Wiring must comply with all applicable local and national codes.
- Connect all central control devices on the same cable if cable requirements are the same.
- Order does not matter, but polarity does. Keep “A” terminals with “A” terminals, and “B” terminals with “B” terminals. Starting at the outdoor unit, terminate the cable on terminals Internet A and Internet B.
- Route the cable as needed between each device.
- Tie shields together at each termination point.
- Add insulation material as recommended by local code.

Cable requirements may differ depending on connected controller and other components:

- Communication cable from Outdoor Unit to Mode Selector Switch must be 18 AWG, 3-conductor, twisted or non-twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. ⓧ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

## From Indoor Units to Remote Controllers

- Communication cable from Indoor Unit to Remote Controller(s) is to be 22 AWG, 3-conductor, twisted, stranded, unshielded. Wiring must comply with all applicable local and national codes.
- 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.
- Remote controllers have hardwired connections: SIG - 12V - GND (Comm.) terminals.
- Indoor unit controller connections depend on type of indoor unit being installed. Some indoor units use terminal block connections; other indoor units use Mollex connections. See diagrams below for the two options. Refer to the wiring diagram schematic found in the indoor unit itself, or to the indoor unit wiring diagrams in the Engineering and Installation Manuals.
- ⚠ NEVER splice, cut, or extend cable length with field provided cable. Always include enough cable to cover distance between the indoor unit and the remote controller.
- 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.

Figure 100: One Example of Indoor Unit to Zone Controller Connection.

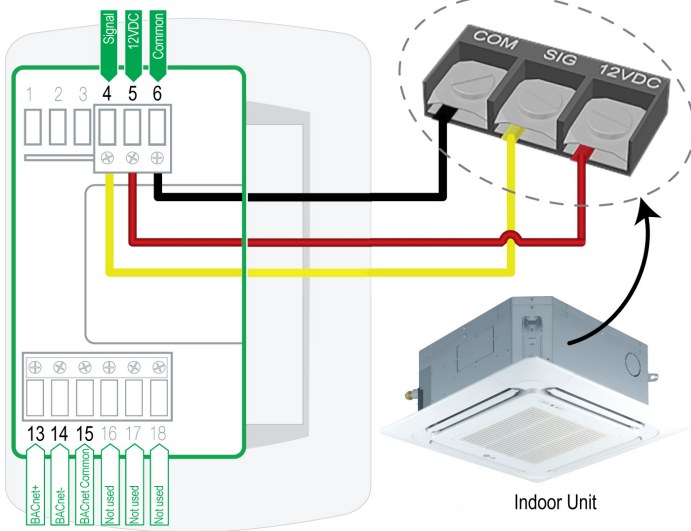
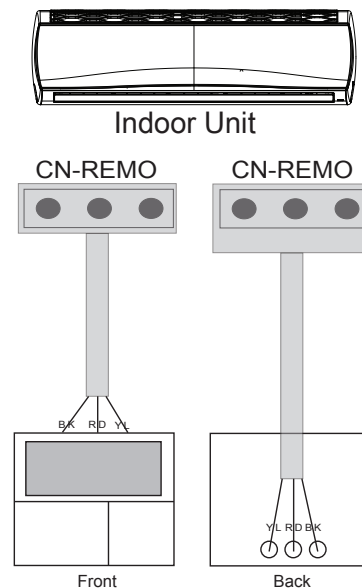


Figure 101: Another Example of Indoor Unit to Zone Controller Connection.



### Note:

Cable connected to Zone Controller is the factory default connection.

## Communications Cable Specifications

### Between Multiple Indoor Units Operating as a Group (Group Control)

#### If any indoor units were specified to operate in unison:

- Before running cable, decide which indoor unit will be the "Master." The other indoor units in that group will be designated as "Slave(s)." The zone controller will be connected to the "Master."
- Set the pertinent DIP switch at each indoor unit to identify the Master and Slave(s). 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.
- ⚠ NEVER splice, cut, or extend cable length with field provided cable. Always include enough cable to cover distance between all components.

#### For indoor units with hardwired connections SIG - 12V - GND (Comm.) terminals:

- From the controller to the master indoor unit, use 22 AWG, 3-conductor, twisted, stranded, unshielded. All wiring must comply with all applicable local and national codes.
- From the master indoor unit to the slave indoor unit(s), daisy chain using 22 AWG, 3-conductor, twisted, stranded, unshielded (⚠ Do not attach wire to 12VDC terminal to the slave indoor units). All wiring must comply with all applicable local and national codes.

#### For indoor units with CN-REMO connections:

Use Group Control Kit (sold separately) containing extension and Y-splitter cables. Use one (1) group control cable kit for each indoor unit in the group except for the last indoor unit.

#### Note:

- Cable connected to zone controller is the factory default connection.
- Indoor unit connections depend on indoor unit type.

Figure 102: Example of Indoor Unit Group to Zone Controller Connections (Sig-12V-GND [Comm.] Terminal).

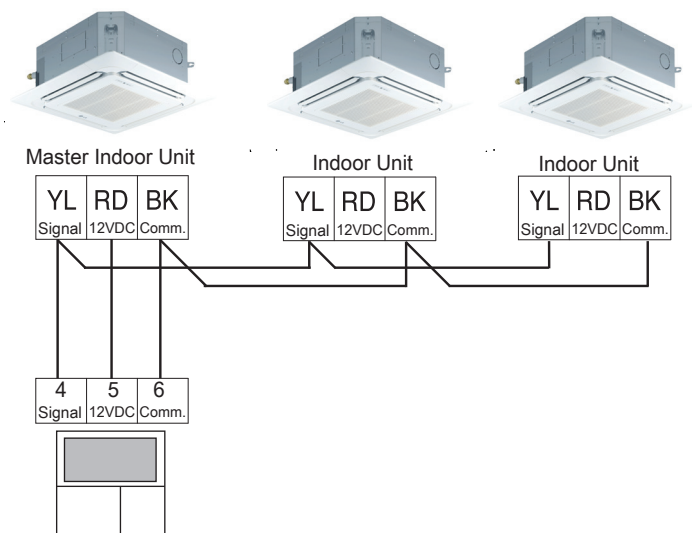
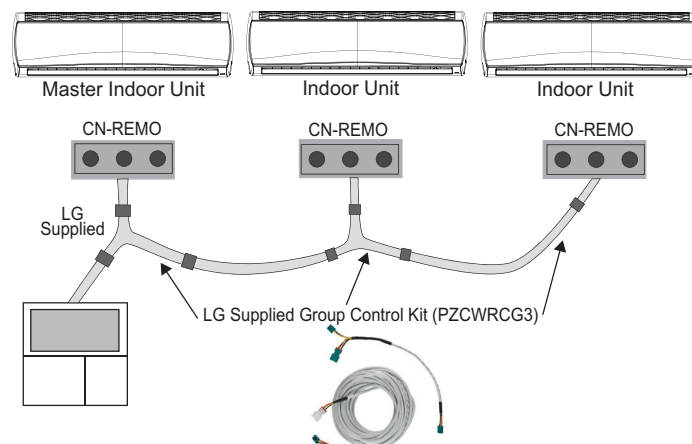


Figure 103: Example of Indoor Unit Group to Zone Controller Connections (CN-REMO).





## Triple Leak / Pressure Check

After the refrigerant piping installation is complete, perform a triple leak / pressure test to check for leaks at any joints or connections within the piping system.

### **⚠ DANGER**

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

### **Note:**

- ⓧ Do not apply power to the Multi V outdoor unit(s), the indoor units, and the heat recovery units before performing a system leak test. There is a possibility that the EEV valves may close and isolate sections of the piping system, making the leak test inconclusive. Contact your LG Applied Rep or service technician for the procedure to reopen the EEV valves before the leak test **ONLY** if the power has been applied.
- ⓧ Never perform the leak test using refrigerant.
- To avoid nitrogen entering the refrigerant system in a liquid state, the top of the cylinder must be higher than its bottom (used in a vertical standing position) when the system is pressurized.
- Use only a leak-free gauge manifold set.

### **Triple Leak / Pressure Check Procedure Steps**

1. After the refrigerant piping installation is complete, open the isolation ball valves, if any, that may have been included in the piping system.
2. Verify that all outdoor unit service ports are closed. The leak / pressure check is to be performed to only the refrigerant piping system and connected indoor units / heat recovery units.
  - For systems designed for heat pump operation, verify that the liquid and suction (vapor) line service ports (and to the unused port) are closed, and the stem head access caps are tight.
  - For systems designed for heat recovery operation, verify that the hot gas line (high pressure vapor), liquid line, and suction (low pressure vapor) line service ports are closed, and the stem head access caps are tight.
3. Remove the caps on the Schrader ports. Connect the (medical-grade dry) nitrogen cylinder regulator to a gauge manifold, then connect the gauge manifold to the Schrader ports on the service ports.
  - For systems designed for heat pump operation, connect the nitrogen cylinder regulator to the gauge manifold, then connect the gauge manifold to the Schrader ports on the liquid and suction (vapor) line service ports. ⓧ Do not connect to the unused port.
  - For systems designed for heat recovery operation, connect the nitrogen cylinder regulator to the gauge manifold, then connect the gauge manifold to the Schrader ports on the hot gas line (high pressure vapor), liquid line, and suction (low pressure vapor) service ports.

# TRIPLE LEAK / PRESSURE CHECK



## Triple Leak / Pressure Check Procedure Steps, continued.

4. Perform the leak / pressure check at 150 psig for five (5) minutes (standing pressure check).
5. Perform the leak / pressure check at 300 psig for fifteen (15) minutes (standing pressure check).
6. Perform the leak / pressure check at 550 psig for 24 hours to make sure the piping system is leak-free. After the gauge reading reaches 550 psig, isolate the system by first closing the gauge manifold, then close the nitrogen cylinder valve. Check the flared and brazed connections for leaks by applying a bubble solution to all joints.

### Note:

*The bubble solution must be a solution designed for refrigerant leak testing. Common soap solution must never be used on refrigerant piping as those contain chemicals that could corrode copper and brass, and cause product malfunction.*

7. If the pressure does NOT drop for 24 hours, the system passes the test. See how ambient conditions may affect the pressure test below.

#### Ambient Conditions and the Leak / Pressure Check

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 0.79 psi for each 1°F of temperature difference.

Correction formula:  $(^{\circ}\text{F Temperature when pressure was applied} - ^{\circ}\text{F Temperature when pressure drop was checked}) \times 0.79$ .

Example: When pressure (550 psig) was applied, temperature was 80°F; 24 hours later when pressure drop (540 psig) was checked, temperature was 68°F.

Thus,  $(80^{\circ}\text{F} - 68^{\circ}\text{F}) \times 0.79 = 9.5$  psig.

In this case, the pressure drop of 9.5 psig was due to temperature differences, therefore, there is no leak in the refrigerant piping system.

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

Figure 104: Leak Test Diagram for Systems Designed for Heat Pump Operation.

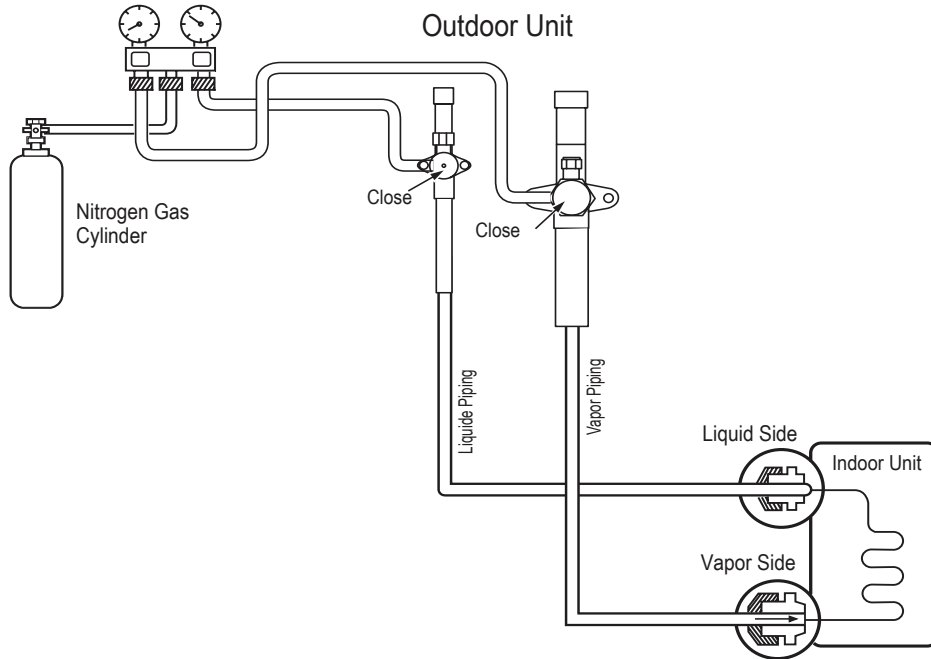
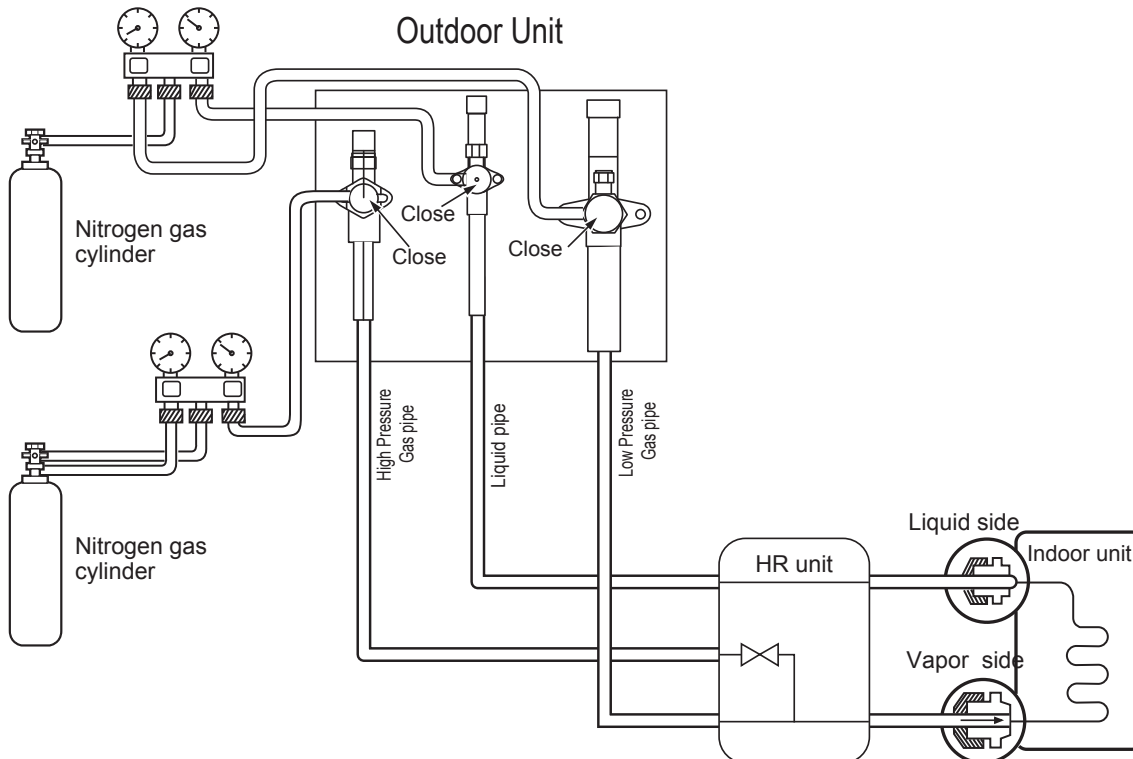


Figure 105: Leak / Pressure Test Diagram for Systems Designed for Heat Recovery Operation.



## Triple Evacuation Procedure

After the leak / pressure check is complete, perform a Triple Evacuation with the entire system. Evacuation must be performed through the Schrader ports on the outdoor unit service ports.

### Note:

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

For Heat Pump systems, evacuate through both the liquid and suction (vapor) refrigerant lines. For Heat Recovery systems, evacuate through all three (3) hot gas line (high pressure vapor), liquid line, and suction (low pressure vapor) refrigerant lines.

The outdoor unit service valves must remain closed and the stem head access caps tight. ⚠ Do not open the outdoor unit service valves and release the factory refrigerant charge until the LG trained Commissioner authorizes to do so. The system must be left in vacuum until the LG-trained Commissioner verifies the quality of the evacuation.

Any field-installed ball valves in the refrigerant system (if used) must be open to ensure all piping is free and clear for evacuation on all piping and connected indoor units / heat recovery units.

### Note:

- ⚠ Do not apply power to the Multi V outdoor unit(s), the indoor units, and the heat recovery units before performing a system evacuation. There is a possibility that the EEV valves may close and isolate sections of the pipe system, making the evacuation procedure inconclusive. Contact your LG Applied Rep or service technician for the procedure to reopen the EEV valves before evacuation only if the power has been applied.
- ⚠ Never perform evacuation using refrigerant.
- Use only a vacuum pump that can reach 500 microns, vacuum rated hoses or copper tubing, and a leak-free gauge manifold set.
- Use only new vacuum pump oil from a properly sealed (unopened) container, and change oil in pump before **EVERY** use.
- Subsequent oil changes will be necessary after several hours of continuous operation; have extra oil on hand.
- Use a quality micron gauge in good operating order and install as far away from pump as possible.

## Triple Evacuation Procedure Steps

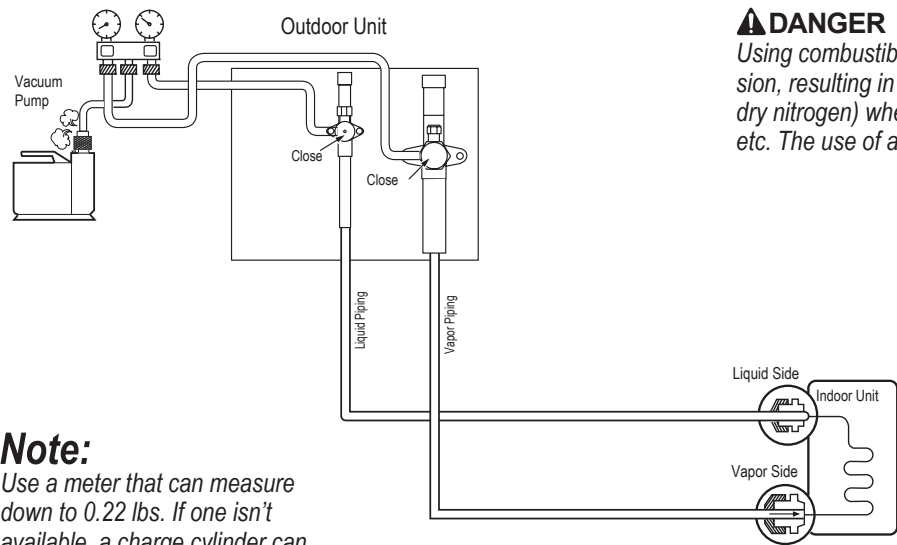
1. If this procedure is performed shortly after the leak / pressure test, the caps and cores on the Schrader ports must have already been removed, and the manifold must already be connected. If the procedure was not performed shortly after the leak / pressure test, make sure to remove the caps and cores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

### Note:

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

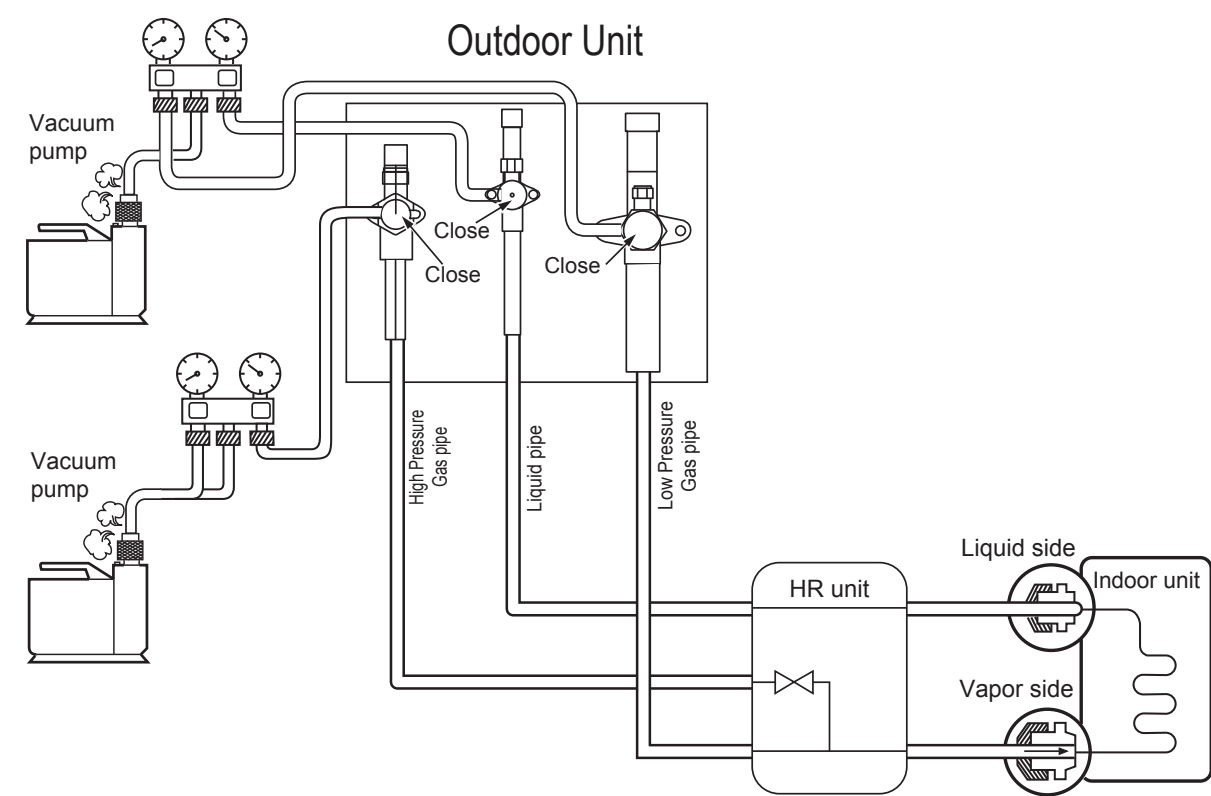
3. Operate the vacuum pump and evacuate the system to the 2,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level may rise a bit, but **MUST** eventually stop rising for fifteen (15) minutes.
  - If the micron level **DOES NOT** stop rising, there is a leak, and the leak test must be performed again.
  - If the micron level **DOES** rise above 2,000 micron, re-open the manifold gauges and the vacuum pump valve and continue evacuation back down to 2,000 micron level.
  - If the micron level holds at 2,000 micron, continue to step 4.
4. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time (this is to “sweep” moisture from piping).
5. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
6. Evacuate to 1,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level may rise a bit, but **MUST** eventually stop rising for fifteen (15) minutes.
  - If the micron level **DOES NOT** stop rising, there is a leak, and the leak test must be performed again.
  - If the micron level **DOES** rise above 1,000 micron, re-open the manifold gauges and the vacuum pump valve, and continue evacuation back down to 1,000 micron level.
  - If the micron level holds at 1,000 micron, continue to step 7.
7. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time.
8. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
9. Evacuate to static micron level  $\leq 500$ .
10. Micron level must remain  $\leq 500$  for 24 hours. If the vacuum gauge rises and stops, the system may contain moisture, therefore, it will be necessary to repeat the steps of vacuum break and drying.
11. After maintaining the system in vacuum for 24 hours, check if the vacuum gauge rises or not. If it doesn't rise, then the system is properly evacuated.
12. Close manifold gauges.
13. Shut the valve before turning off the vacuum pump.

Figure 106: Vacuum Procedure Diagram for Heat Pump Systems..



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

Figure 107: Vacuum Procedure Diagram for Heat Recovery Systems.



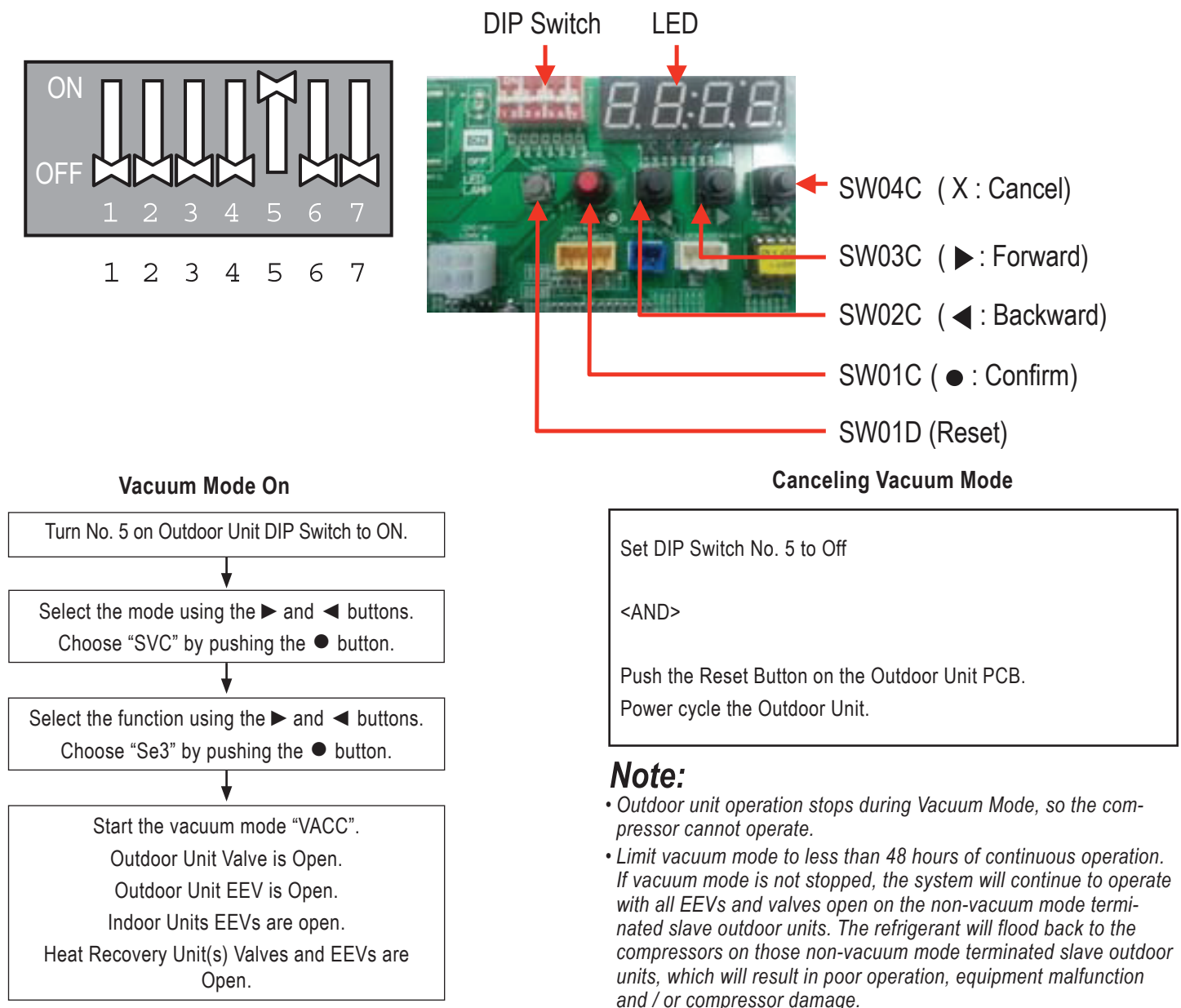


## Vacuum Mode (Option) (Se3)

The vacuum mode can be used as an option for creating vacuum in the system when the outdoor unit is first installed if power is available, and if the system has already been auto addressed. Vacuum mode enables the system to fully open all valves, and can help speed up the evacuation process.

Vacuum mode can also be used when compressor and / or outdoor unit parts are replaced, or when an indoor unit is added or replaced.

Figure 108: Multi V S Outdoor Unit DIP Switch Vacuum Mode Setting and PCB Location.



# DIP SWITCH SETTINGS FOR USE WITH GEN 4 INDOOR UNITS

## Generation 4 Equipment

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

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

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

Figure 109: Location and Setting of Outdoor Unit DIP Switch 3.

Air/Water Source Unit DIP Switch No. 3

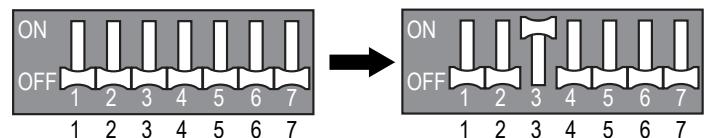
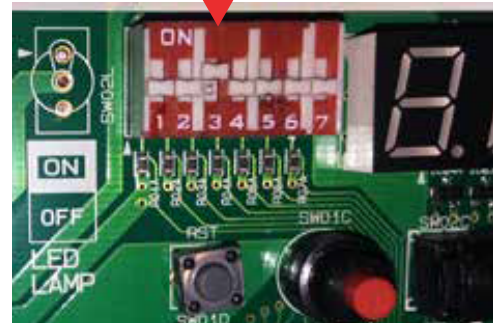


Table 28: System Component Combinations and Operation Status.

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

\*Gen 4 or Higher Air / Water Source Units = Multi V 5, Multi V IV or Multi V Water IV with Gen 4 or Higher software (see table below for Gen 4 or higher serial numbers) or Multi V S.

Gen 2 Air / Water Source Units = Multi V II, Multi V III, Multi V IV without Gen. 4 software, Multi V Water II, Multi V Water IV without Gen. 4 software, Multi V Mini, Multi V Water Mini, or Multi V Space II.

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

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

\*\*\*\*0A Model Heat Recovery units are not for use with Multi V 5, Multi V IV, Multi V Water IV, or Multi V III heat recovery systems.

Table 29: Serial Numbers of Air / Water Source Units with Gen 4 or Higher Software.

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

## Setting the Functions

To access and set the different modes/functions, first turn No. 5 on DIP Switch SW01 is set to ON. Then select the functions (mode, option, value, etc.) by using the SW03C forward ► button and the SW02C backward ◀ buttons. Choose the particular function by pushing the confirm ● button.

Figure 110: OutdoorUnitDIPSwitch SW01 Function Setting.

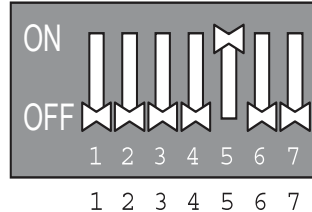


Figure 111: DIP Switch SW01 PCB Location.

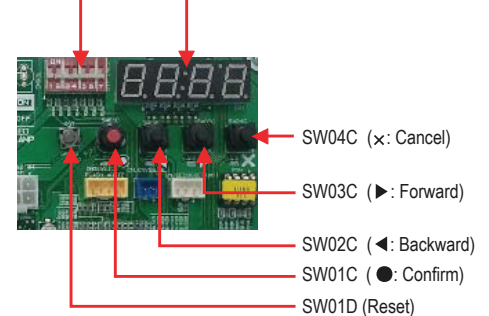


Table 30: Setting the Functions.

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

## Note:

- To set the optional modes / functions, all indoor units must be OFF. Mode / function settings won't save, nor will operate unless all indoor units are OFF.
- If system power was reset, some modes / function settings will be automatically saved in the EPROM. Other modes / functions will reset when power is cycled off. See next pages for details on specific modes / functions.

# SETTING THE OPTIONAL FUNCTIONS

## Cool / Heat Selector (Fn1)

The setting communicates to the outdoor unit that the optional LG Cool / Heat Selector is connected.

Use the Cool / Heat Selector in heat pump systems (when all indoor units have to be in the same mode) to set the system mode for all cooling operation, all heating operation, or fan operation.

Recommended for use in heat pump systems only.

Figure 113: Setting the Cool / Heat Selector Function.

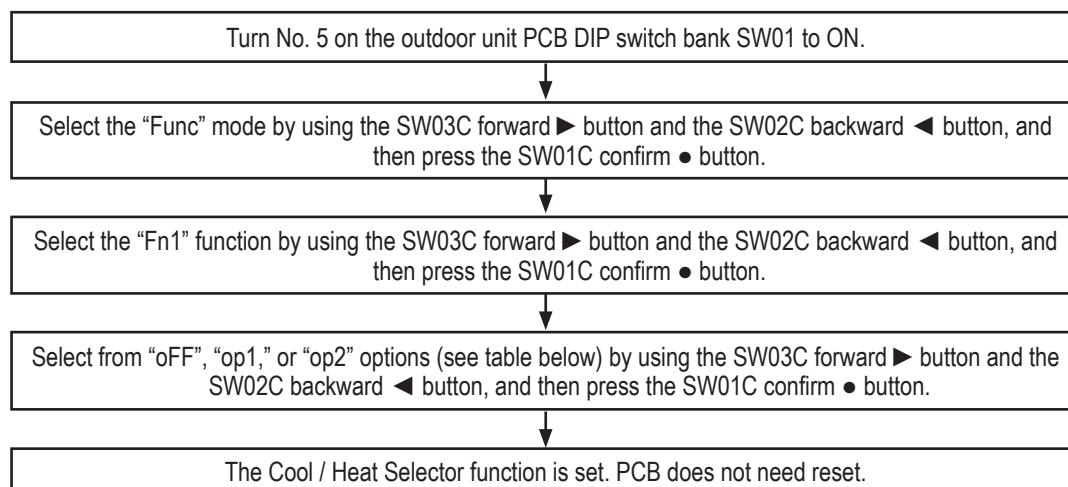


Figure 112: Cool / Heat Selector.

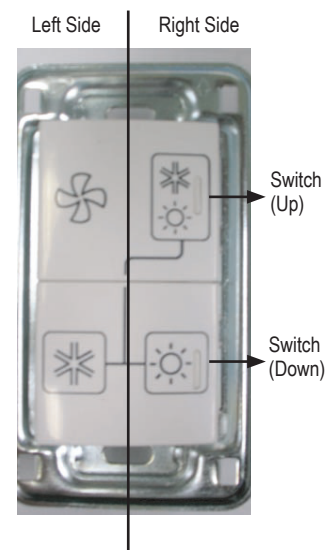


Table 31: Cool / Heat Selector Function Settings.

Switch Control		Function		
Switch (Up)	Switch (Down)	oFF	op1 (Mode)	op2 (Mode)
Right Side (On)	Left Side (On)	Not Operating	Cooling	Cooling
Right Side (On)	Right Side (On)	Not Operating	Heating	Heating
Left Side (Off)	-	Not Operating	Fan Mode	Off

### Note:

- The Cool / Heat Selector must be installed first before setting the cool / heat operation function.
- A trained LG service provider must set this function during system installation.
- If cool or heat function is not used, set to OFF.
- Cool / Heat Selector is not for use with central control.

## Static Pressure Compensation Function (Fn2)

The Static Pressure Compensation function secures the air flow rate of the outdoor unit for installations where static pressure has been applied. For example, when a duct has been added to the outdoor unit fan discharge.

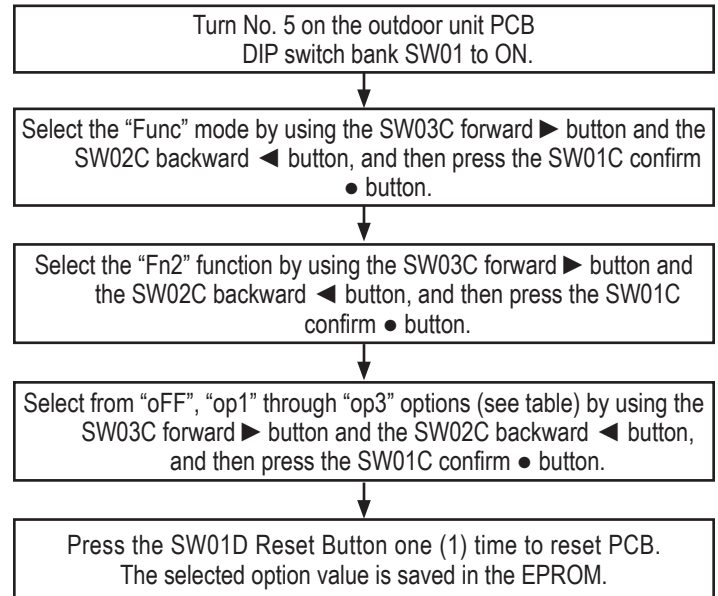
Table 32: Maximum Fan RPM For Each Step.

Model	ARUN060GSS4 ARUN053GSS4, ARUN048GSS4, ARUN038GSS4	
Maximum RPM	Standard	800
	op1	850
	op2	850

### Note:

- Ask a trained LG service provider to set this function during system installation.
- Cooling capacity may be reduced if the outdoor unit RPM is lowered.

Figure 114: Setting the Static Pressure Compensation Function.



## Night Low Sound Function (Fn3)

The Night Low Sound Function reduces the operating speed of the outdoor unit fans (according to the input signal) when in cooling mode. Operating at a low RPM reduces the fan sound levels of the outdoor unit at night, which usually has a low cooling load.

On a rolling 24 hour basis, an internal timer begins counting hours after the start time (delay set after peak cooling recorded operation), switching to restricted fan speed duration operation, following whatever settings have been chosen.

For use on both heat pump and heat recovery systems.

Figure 115: Setting the Night Low Sound Function.

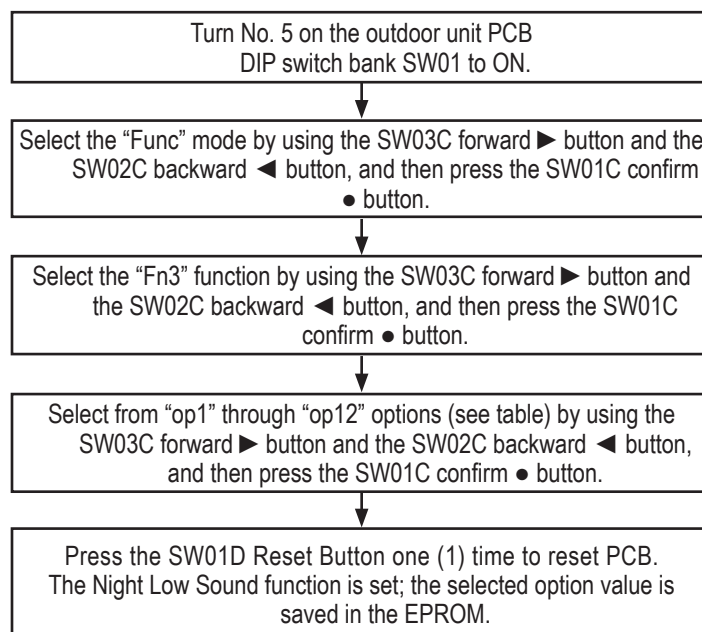


Table 33: Night Low Sound Function Time Settings.

Settings	Start Time (Delay after Peak Cooling Recorded) (Hour)*	Restricted Fan Speed Duration (Hour)
op1	8.0	9.0
op2	6.5	10.5
op3	5.0	12.0
op4	8.0	9.0
op5	6.5	10.5
op6	5.0	12.0
op7	8.0	9.0
op8	6.5	10.5
op9	5.0	12.0
op10 (Default)	0.0 (Continuous Operation)	24.0
op11	0.0 (Continuous Operation)	24.0
op12	0.0 (Continuous Operation)	24.0

\*The system measures ambient temperature (minimum and maximum) in "Wait Time" to help determine when the system can start operating in Night Low Sound.



## Outdoor Unit Addressing Function (Fn5)

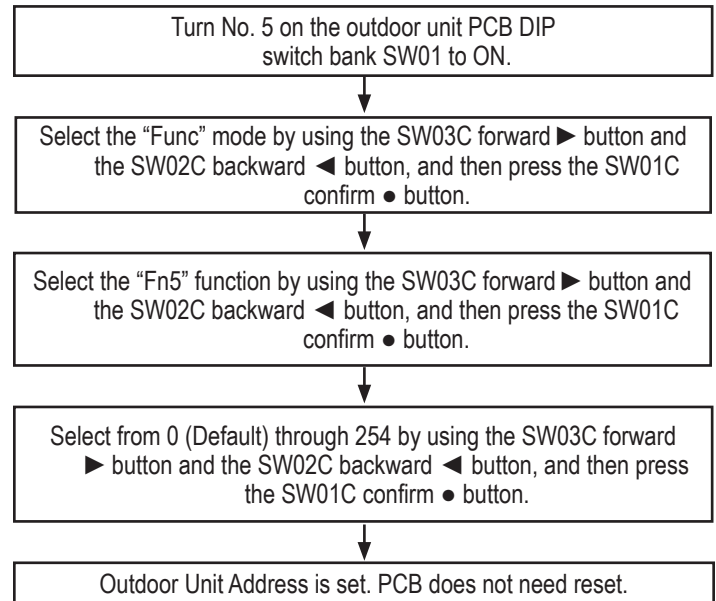
Use this function to set the system address of the outdoor unit when a central controller has been installed. If multiple systems (master units) are wired to the central control bus, each system is assigned to a unique outdoor unit address. If not properly addressed, a communication error could occur or one (1) or more of the systems.

For use on both heat pump and heat recovery systems.

### Note:

- The central controller must be installed first before setting the outdoor unit address.
- A trained LG service provider must set this function during system installation.

Figure 116: Setting the Outdoor Unit Address Function.



# SETTING THE OPTIONAL FUNCTIONS

## Snow Removal Assist / Rapid Defrost Mode (Fn6)

### Snow Removal Assist

Snow removal assist function allows the outdoor unit(s) fans to operate at regular intervals, for two (2) minutes, at specified speeds below to remove snow.

The function will only operate when the system has not called for a compressor start (no demand for heating or cooling) for thirty (30) minutes, and the outdoor air temperature is <37°F.

### Rapid Defrost

Rapid defrost function puts the entire system in defrost at the same time, and limits the amount of frost and ice allowed to build on the coil between defrost cycles. System pressure is monitored, and when system performance is reduced, the defrost cycle is initiated.

Snow Removal Assist and Rapid Defrost can be used on both heat pump and heat recovery systems.

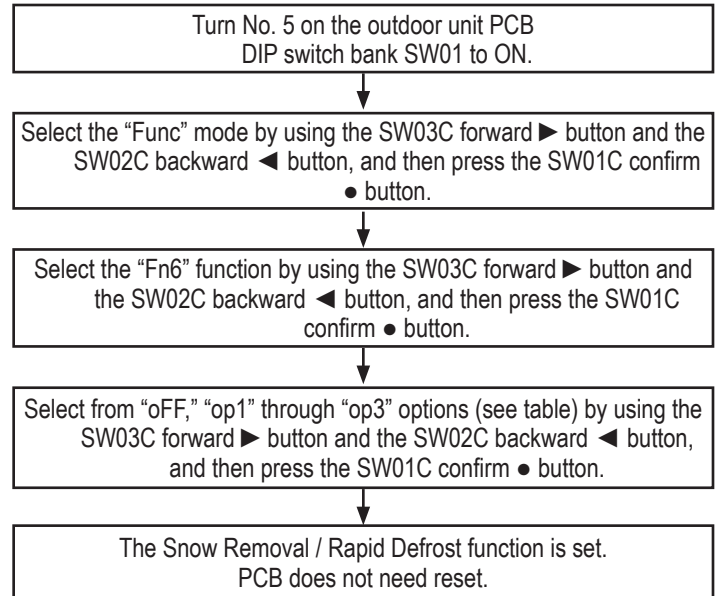
Table 34: Setting the Snow Removal / Rapid Defrost Mode.

Settings	Details
oFF	Mode Is Not Set
op1	Snow Removal Mode
op2	Rapid Defrost Mode
op3	Snow Removal Mode and Rapid Defrost Mode

### Note:

- A trained LG service provider must set this function during system installation.
- If the snow removal / rapid defrost mode is not used, set to OFF.

Figure 117: Setting the Snow Removal / Rapid Defrost Function.



## Run Self Diagnostics Check

### Using the DIP Switches

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

### **⚠ WARNING**

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

### Using the Initial Display

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

Table 35: Display Code Definitions—Outdoor Unit Nominal Capacity.

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

Table 36: Display Code Definitions—Voltage.

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

Table 37: Segment Display Sequence (Two [2] seconds per segment following a forty-five [45] second wait).

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

\*See tables above for code definitions.

## Indoor Unit Auto Addressing Procedure

### **⚠ WARNING**

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

### **Note:**

- Supply power to the indoor units. If power is not supplied, an operation error will occur.
- During the pre-commissioning process for systems with Gen 4 indoor units, Ⓢ do not change any DIP switch settings except for No. 3 on SW01B, which must be ON to enable Gen. 4 features. All other combinations of switches (one [1] through seven [7]) must be left in the OFF position on the outdoor unit DIP switch bank SW01B. Refer to System Combinations and Outdoor Unit Operation Settings for proper setting of No. 3 on SW01B.
- If the Auto Address Procedure has never been successfully completed for the system, the compressor(s) will not start when power is applied to the unit.
- Auto addressing is only possible on the main PCB of the outdoor unit.

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

### **Note:**

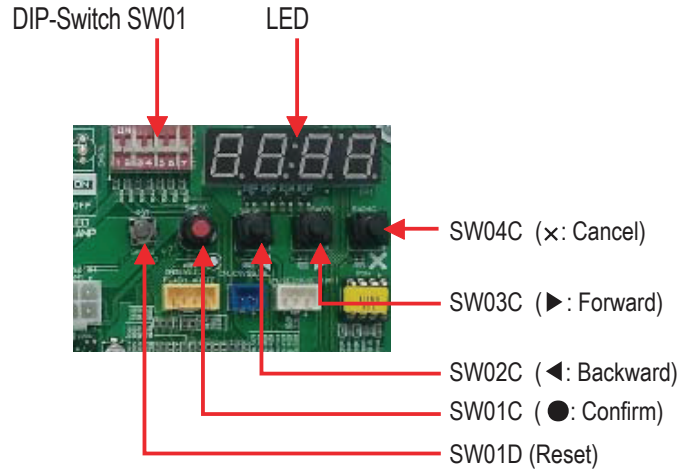
After the self-diagnostics check is complete, the LED must be clear and nothing displayed. Diagnostic process must take from three (3) to seven (7) minutes.

8. Know how many indoor units are connected to the system.
9. Press and hold the red SW01C 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) to thirty (30) seconds indicating how many indoor units the system successfully communicated with.
10. This number must match the known installed number of indoor units if the auto addressing procedure was successful. If using LGMV, read the address of each indoor unit. The address of each indoor unit is also indicated on wired remote control displays.
11. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.

## Initiate the Auto Addressing Procedure, continued.

12. Upon successful completion of the auto address procedure, record the system address assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.
13. After recording the system addresses assigned to each device, open the outdoor unit disconnect. Remove the outdoor unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends.
14. Close the disconnect to reapply power to the outdoor unit and energize the compressor crankcase heater. Once again, verify that the outdoor unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the outdoor unit.
15. Replace the control panel door.

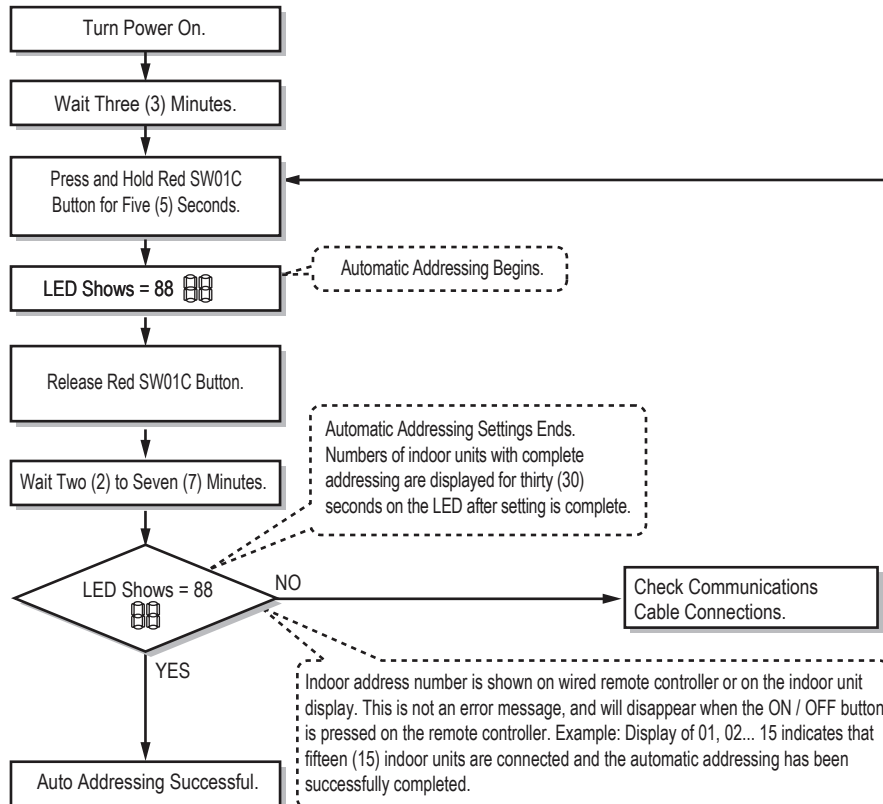
Figure 119: Auto Address Button Location on Outdoor Unit PCB.



## ⚠ WARNING

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

Figure 118: Indoor Unit Auto Addressing Procedure Flowchart.



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## Troubleshooting a Failed Indoor Unit Auto Addressing Procedure

### **Note:**

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, follow these steps.

1. Verify ALL indoor unit ON / OFF buttons are in the OFF position (i.e., ON / OFF button NOT illuminated).
2. Check the terminations, polarity, and continuity of each conductor on the communications cable between the outdoor unit and the indoor units. Verify the indoor unit to outdoor unit communications cable is wired correctly.
3. Verify the shield of the communications cable is grounded at the outdoor unit only. All segment shields must be spliced together at each indoor unit and ⓪ NOT grounded.
4. After repairing the communications cable, go to Step 9 of the Initiate the Auto Addressing Procedure and repeat the process until successful: Press and hold the red SW01C button for about five (5) seconds. Release when "88" appears on the LED. After 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.
5. This number must match the known installed number of indoor units if the auto addressing procedure was successful.
6. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.
7. Record the system address the outdoor unit assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.
8. After recording the system addresses assigned to each device, open the outdoor unit disconnect. Remove the outdoor unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends to prevent an accidental compressor start from occurring before the LG trained Commissioner arrives.
9. Close the disconnect to reapply power to the outdoor unit and energize the compressor crankcase heater. Once again, verify the outdoor unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the outdoor unit.
10. Replace the control panel cover.



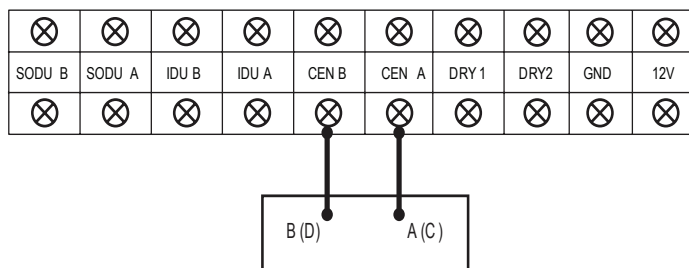
# INDOOR UNIT AUTO ADDRESSING / GROUP CONTROLLING INDOOR UNITS

## Group Addressing Procedure

1. Verify that the power is OFF to both the indoor units and the Multi V S outdoor unit. If power is still on, shut it off.
2. Communication cables must be connected to B and A terminals on the central controller, and to central controller terminals B and A on the Multi V S outdoor unit, matching polarities (A → A, B → B).
3. Apply power to the entire system.
4. Set the group numbers and indoor unit numbers using a wireless handheld or wired controller (see below and next few pages).
5. To designate several indoor units into one group, set the group ID from 0 to F (see next page).

Table 38: Controller Connections on the Multi V S Outdoor Unit PCB for Group Addressing.

Multi V S Outdoor Unit



## Group Controlling 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 field wiring (with indoor units that have SIG - 12V - GND [Comm.] terminals), or a group control cable kit (with indoor units that have CN-RE-MO).

1. Before proceeding with group control cable terminations, verify power is OFF at all applicable indoor units.
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. SIG - 12V - GND [Comm.] Terminal Procedure
  - From the controller to the master indoor unit, use 22 AWG, 3-conductor, twisted, stranded, unshielded.
  - From the master indoor unit to the slave indoor unit(s), daisy chain using 22 AWG, 3-conductor, twisted, stranded, unshielded (⊗ Do not attach wire to 12VDC terminal to the slave indoor units). All wiring must comply with all applicable local and national codes.
  - All wiring must comply with all applicable local and national codes.
4. CN-REMO Termination Procedure:
  - Starting with the master indoor unit, plug in the male end of the pigtail cable into the CN-REMO socket. At the last slave indoor unit in the group, a pigtail cable is not required. Plug the male end of the extension cable coming from the previous indoor unit into the CN-REMO socket.
  - Plug the Y-cable into the pigtail at each indoor unit except for the last slave indoor unit in the group where no Y-cable cable will be needed.
  - Connect two extension cable segments to each "Y" cable except for the "Y" cable connected to the master indoor unit. At the master indoor unit, connect one extension cable and the communications cable from the zone controller to the Y-cable.

## Central Control

### Plan the Central Control Addresses Assignments

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

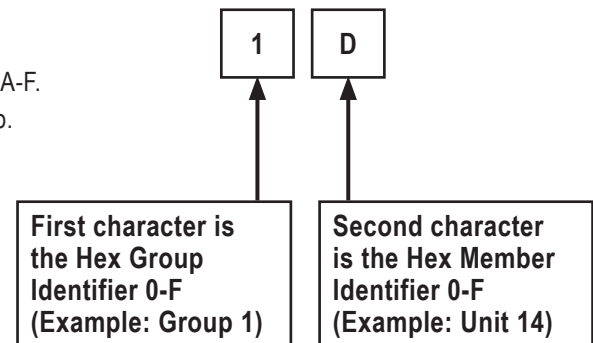
- Hex assignments do not have to be assigned in any particular order, or an order defined by the routing of the communications cable between the indoor units. In most cases, Hex addresses can be skipped.
- All members of a Hex Group are not required to be on the same Multi V S system.
- Addresses can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

### Indoor Unit Central Control Address Assignments

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

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

Figure 120: 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).

### Central Controller Communications Limitations

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

Table 40: Central Controller Indoor Unit Connection Limitations.

Central Control Device	Maximum Indoor Unit Quantity
ACP IV	256
AC SMART IV	128

Table 41: Integration Solutions Indoor Unit Connection Limitations.

Integration Solutions	Maximum Indoor Unit Quantity
MultiSITE™ Communications Manager	128
AC Smart BACnet® Gateway	128
ACP IV BACnet Gateway	256
ACP LonWorks® Gateway	64

BACnet is a registered trademark of ASHRAE. LonWorks is a trademark of Echelon Corporation.

### Group Number

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

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

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

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

Table 39: Central Controller Identifier Table.

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


## Member Number

This 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 wiring / cable is connected properly to the indoor unit PCB. For more information on the different connections in LG indoor units, see the Electrical System Installation Section in this manual.
2. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for details.)
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

### For the Master Indoor Unit in a Group Setting:

1. Identify which unit will be the Master indoor unit and which indoor units are going to be the Slave units.
2. Go to the Master indoor unit and access the PCB.
3. Verify the group control cable / group control wiring is installed into CN-REMO or the SIG - 12V - GND (Comm.) terminal on the Master indoor unit PCB. If it is not, install now.
4. Detach group control cable / wiring.
5. Attach the zone controller to the Master indoor unit.
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 will be restored later.
8. If the zone controller and associated communications cable has already been permanently mounted in place, reattach cable / wiring and obtain a loose zone controller with a communications cable to continue programming the Slave indoor units (see procedure below).

### For the Slave Indoor Unit(s) in a Group Setting:

For grouped control indoor units, using DIP Switch No. 3 to set slave units automatically sets these units to Central Control address "FF. If the application calls for central control addresses to all slave units, follow the procedure below.

1. Go to the first Slave indoor unit and disconnect the cable / wiring from CN-REMO or the SIG - 12V - GND (Comm.) terminal.
2. Attach the zone controller communications cable into the Slave indoor unit.  
 Do not push the ON / OFF button or enable indoor unit operation.
3. 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.
4. Change DIP Switch No. 3 on the Slave indoor unit PCB to the "ON" position.
5. Disable power to the Slave indoor unit using the disconnect switch. Wait one (1) minute.
6. While power is off, detach the zone controller cable.
7. Attach the group control cable / wiring to the Slave indoor unit.
8. Restore power to that Slave indoor unit, and go to the next Slave indoor unit.
9. Repeat Steps 1 to 8 for each Slave indoor unit.
10. After all Slave indoor unit have addresses assigned, go back to the Master indoor unit and restore power.

# ADDRESSING WITH HEAT RECOVERY UNITS



## Setting up the Heat Recovery Unit (For Heat Recovery Systems Only)

### General

Each heat recovery unit will have a unique address assign so the outdoor unit will be able distinguish it from other heat recovery units. Upon completion of the heat recovery unit address, the heat recovery unit operating parameters will be set by adjusting the positions DIP switches on SW02M and SW01M.

### Procedure

Before beginning the physical process of assigning heat recovery addresses, map out the address assignments using a copy of the LATS tree mode diagram.

### Guidelines

1. Addresses must be sequential and cannot be skipped.
2. Assign the lowest address to the heat recovery unit that has the largest capacity indoor unit connected to port number 1. If the capacity of all indoor units connected to port number 1 of each heat recovery unit is the same, assign address "0" to the heat recovery unit farthest away from the outdoor unit. Assign the next address to the next farthest away and so on until all heat recovery units have an address. The heat recovery unit with the highest address must be the one closest to the outdoor unit. Up to 16 heat recovery units can be on a single system.

Possible settings in order of lowest to highest are: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.

### Note:

Addressing must be performed following the detailed steps above because port number 1 on the heat recovery unit addressed "0" will remain open during the auto pipe detect procedure. If the indoor unit capacity connected to the port is relatively small compared with other units on the system, the outdoor unit high head pressure safety will trip and shut down the unit during the procedure.

3. Record the address assigned to each heat recovery unit in the pertinent column on the Pre-Commissioning Device Configuration Worksheet.

### SW05M Function (Rotary Switch for Addressing Heat Recovery Units)

- Rotary switch SW05M must be set to "0" when installing only one heat recovery unit.
- When installing multiple heat recovery units, address each unit with sequentially increasing numbers starting from "0".

Figure 122: Adjusting the Heat Recovery Unit Addresses.

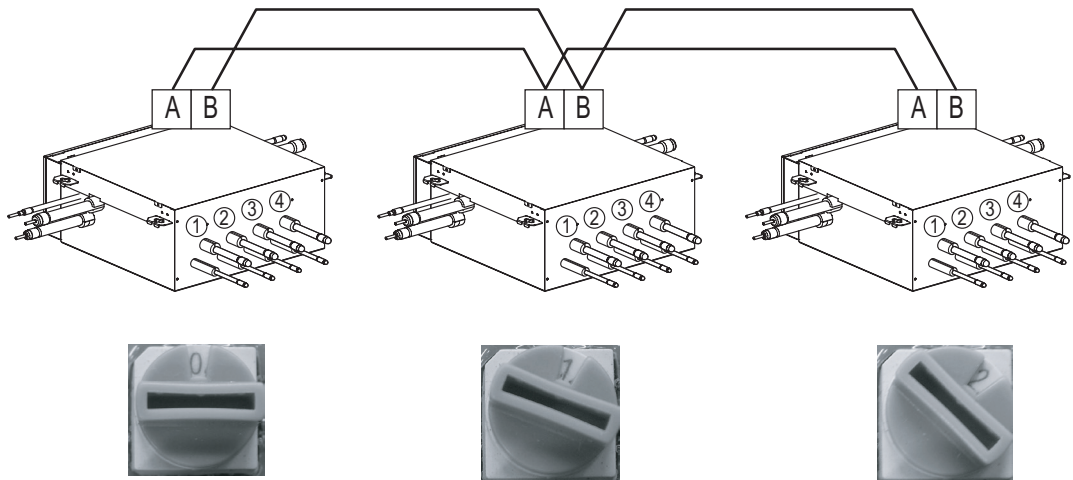


Figure 121: Heat Recovery Unit Main PCB.

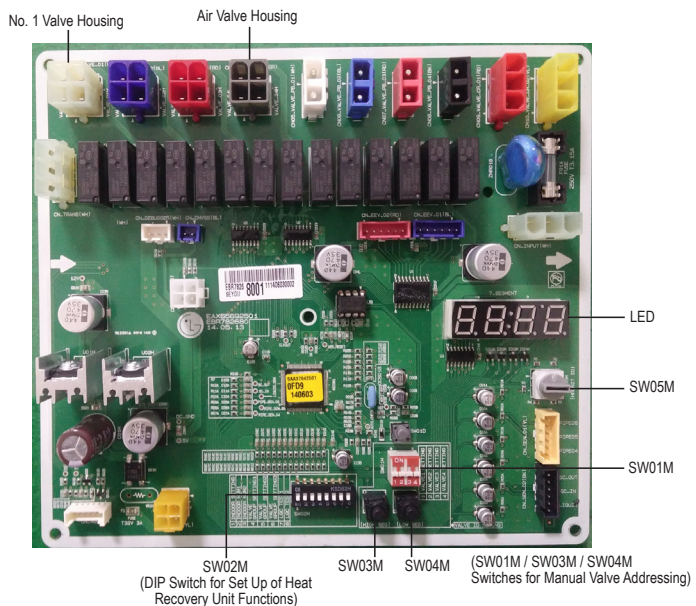
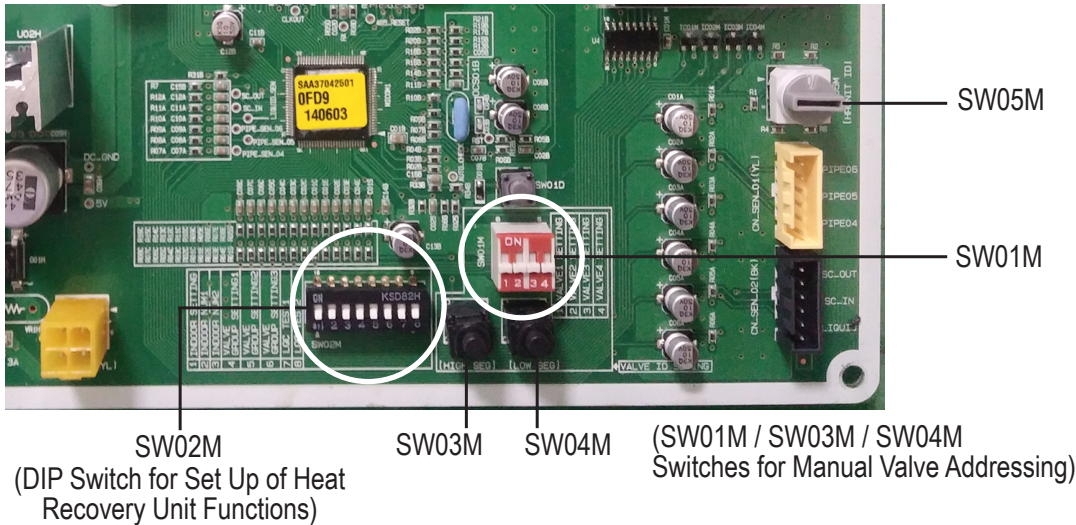




Figure 123: Close Up of DIP Switches and Rotary Dial on the Heat Recovery Unit Main PCB.



### 1. Main Function of SW02M.

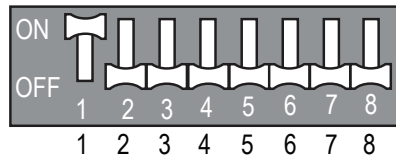
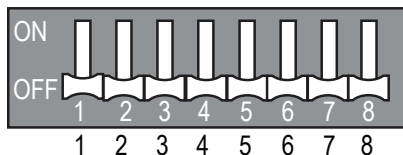
ON S/W	Selection
No. 1	Method for addressing the heat recovery control valves (Auto / Manual)
No. 2	Model of heat recovery unit
No. 3	Model of heat recovery unit
No. 4	Model of heat recovery unit
No. 5	Valve group setting
No. 6	Valve group setting
No. 7	Used only in factory production (preset to "OFF")
No. 8	Used only in factory production (preset to "OFF")

Zone setting ("ON")

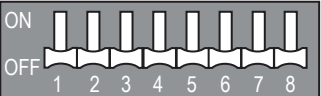
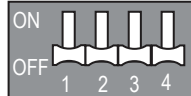
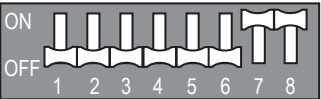

## 2. Selecting the Heat Recovery Unit Valve Addressing Method (Pipe Detection) (Auto / Manual).

Auto (Switch No. 1 on SW02M OFF)

Manual (Switch No. 1 on SW02M ON)



### 3. Zone Control Setting.

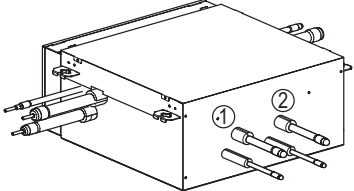
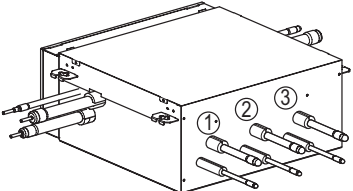
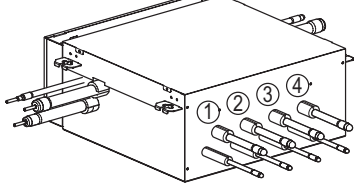
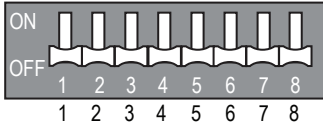
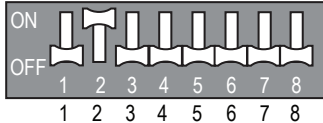
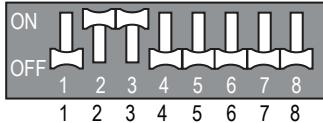
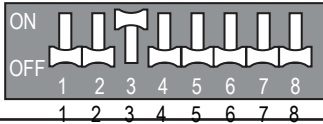
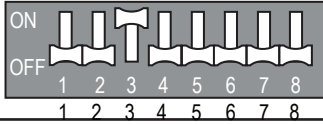
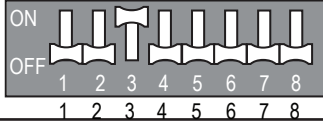
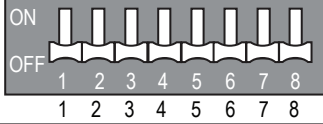
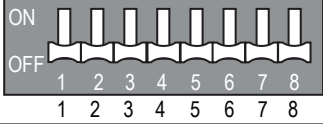
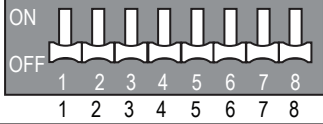
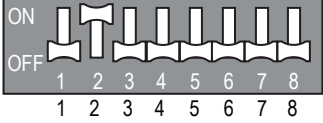
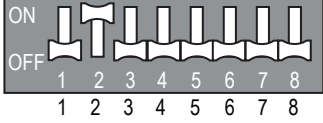
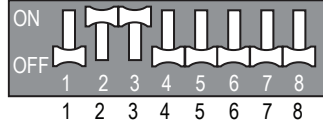
	DIP Switch Settings	
<b>Normal Control</b>	<p>SW02M</p>  <p>ON OFF 1 2 3 4 5 6 7 8</p>	<p>SW01M</p>  <p>ON OFF 1 2 3 4</p>
<b>Zone Control</b>	<p>SW02M</p>  <p>ON OFF 1 2 3 4 5 6 7 8</p>	<p>SW01M</p>  <p>ON OFF 1 2 3 4</p> <p>Turn the DIP Switch of the zoned branch to ON. Example: Branches one (1) and two (2) are set to zone control.</p>

# ADDRESSING WITH HEAT RECOVERY UNITS

## Configure the Heat Recovery Unit Settings (Auto)

1. Identify how many ports are connected (see table below).
2. Group ports if necessary. If any connected indoor units are "large" capacity models (indoor units with >54,000 Btu/h capacity) two heat recovery ports must be "grouped" to serve a large capacity indoor using an inverted 'Y' branch.
3. Set switches on SW02M as outlined in the table below and on the next page.

Table 42: Selecting the Heat Recovery Unit Model.

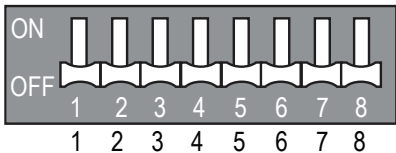
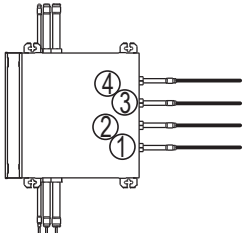
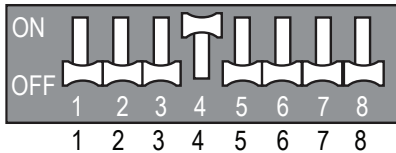
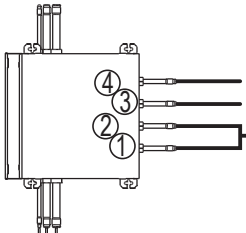
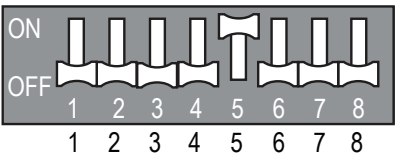
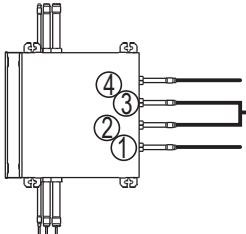
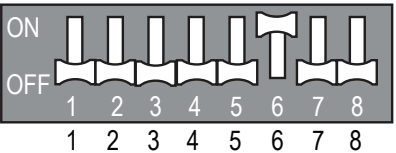
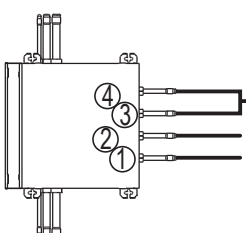
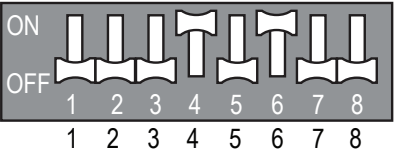
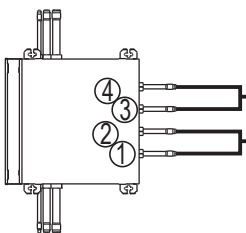
	 PRHR022A (Two [2] ports)	 PRHR032A (Three [3] ports)	 PRHR042A (Four [4] ports)
Factory Setting			
One port connected			
Two ports connected			
Three ports connected			
Four ports connected			

### Note:

Each heat recovery unit has switches No. 2 and No. 3 (on SW02M) factory set as shown above in initial setting.

- To use a PRHR022A for one port, cap off the second pipe, and set the DIP switches on the heat recovery unit for "one port connected" as shown in the table above.
- To use a PRHR032A for two ports, cap off the third port, and set the DIP switches on the heat recovery unit for "two ports connected" as shown in the table above.
- To use a PRHR042A for three ports, cap off the fourth port, and set the DIP switches on the heat recovery unit for "three ports connected" as shown in the table above.
- To use a PRHR042A for two ports, cap off the third and fourth ports, and set the DIP switches on the heat recovery unit for "two ports connected" as shown in the table above.
- Any unused port must be sealed with a brazed copper cap, not with a plastic cap.

Table 43: SW02M Valve Group Settings.

	DIP Switch Setting	Example
No Valve Group Control		 <p>Indoor unit Indoor unit Indoor unit Indoor unit</p>
No. 1, 2 Valve Control		 <p>Indoor unit Indoor unit Large capacity indoor unit</p>
No. 2, 3 Valve Control		 <p>Indoor unit Large capacity indoor unit Large capacity indoor unit</p>
No. 3, 4 Valve Control		 <p>Large capacity indoor unit Indoor unit Indoor unit</p>
No. 1, 2 Valve Control No. 3, 4 Valve Control		 <p>Large capacity indoor unit Large capacity indoor unit Large capacity indoor unit Large capacity indoor unit</p>



# ADDRESSING WITH HEAT RECOVERY UNITS

## SW01M / SW03M / SW04M (DIP and Tact Switches) for Manual Valve Addressing

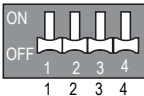


### Non-zoning (Normal Setting).

- Set the address of the heat recovery unit valve to the central control address of the connected indoor unit.
- SW01M: Select the valve to address.
- SW03M: Increases the valve address by ten (10).
- SW04M: Increases the valve address by one (1).

### Note:

Each indoor unit must have a unique, preset central control address (using its wired controller) before manual valve addressing can occur.

Table 44: Settings for Manual Valve Addressing, Non-Zoning.

PCB Component	S/W No.	Set Up
	No. 1	Manual Addressing Valve No. 1
	No. 2	Manual Addressing Valve No. 2
	No. 3	Manual Addressing Valve No. 3
	No. 4	Manual Addressing Valve No. 4
	SW03M	Increases the Valve Address by Ten (10)
	SW04M	Increases the Valve Address by One (1)

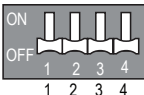



### Zoning

- Set the address of the heat recovery unit valve to the central control address of the connected indoor unit.
- SW01M: Select the valve to address.
- SW03M: Increases the valve address by ten (10).
- SW04M: Increases the valve address by one (1).
- SW05M: Rotary switch

### Note:


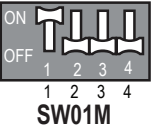

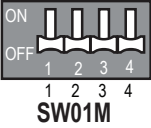
Each indoor unit must have a unique, preset central control address (using its wired controller) before manual valve addressing can occur.

Table 45: Settings for Manual Valve Addressing, Zoning.


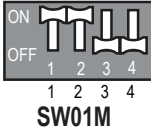
PCB Component	S/W No.	Set Up
	No. 1	Manual Addressing Valve No. 1
	No. 2	Manual Addressing Valve No. 2
	No. 3	Manual Addressing Valve No. 3
	No. 4	Manual Addressing Valve No. 4
	SW03M	Increases the Valve Address by Ten (10)
	SW04M	Increases the Valve Address by One (1)
	SW05M	Manual Addressing of Zoned indoor Units

Checking the Pipe Detection Procedure Result at the Heat Recovery Unit

Example: An indoor unit with a central control address of “11” is connected to heat recovery unit valve No. 1.

No.	Display / Setup	Description
1	<div> LED</div> <div> SW01M</div>	<ul style="list-style-type: none"><li>• Operation: Turn DIP switch No. 1 to ON.</li><li>• Display: “11” displays on LED.</li></ul>
2	<div> LED</div> <div> SW01M</div>	<ul style="list-style-type: none"><li>• Operation: Turn DIP switch No. 1 to OFF.</li><li>• Display: LED is blank.</li></ul>

Identifying the Manual Valve Address

No.	Display / Setup	Description
1	<div> LED</div> <div> SW01M</div>	<ul style="list-style-type: none"><li>• Operation: More than two (2) DIP switches are on.</li><li>• Display: LED displays “Er.”</li></ul>

# ADDRESSING WITH HEAT RECOVERY UNITS

## Manual Pipe Detection Addressing

1. Enter the central control address into each indoor unit using its wired remote control.
2. Turn No. 1 of DIP switch bank SW02M of the heat recovery unit PCB ON.
3. Reset the power of the heat recovery unit PCB.
4. Through the heat recovery unit PCB, manually set address of each heat recovery unit valve to the central control address of the indoor unit connected to that valve.
5. Reset the power to the outdoor unit PCB.
6. The number of the indoor unit installed will be displayed after about five (5) minutes. (Example: Heat Recovery Unit to the Number of the Indoor Unit.)
7. Reset the power of the outdoor unit PCB and the heat recovery unit.
8. Manual pipe detection addressing is complete.

Figure 125: Location of DIP Switch SW02M on the Heat Recovery Unit Main PCB.

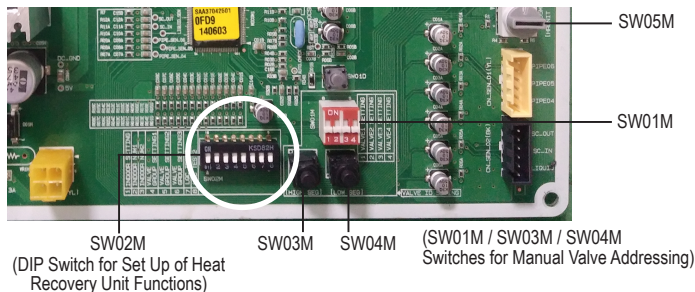
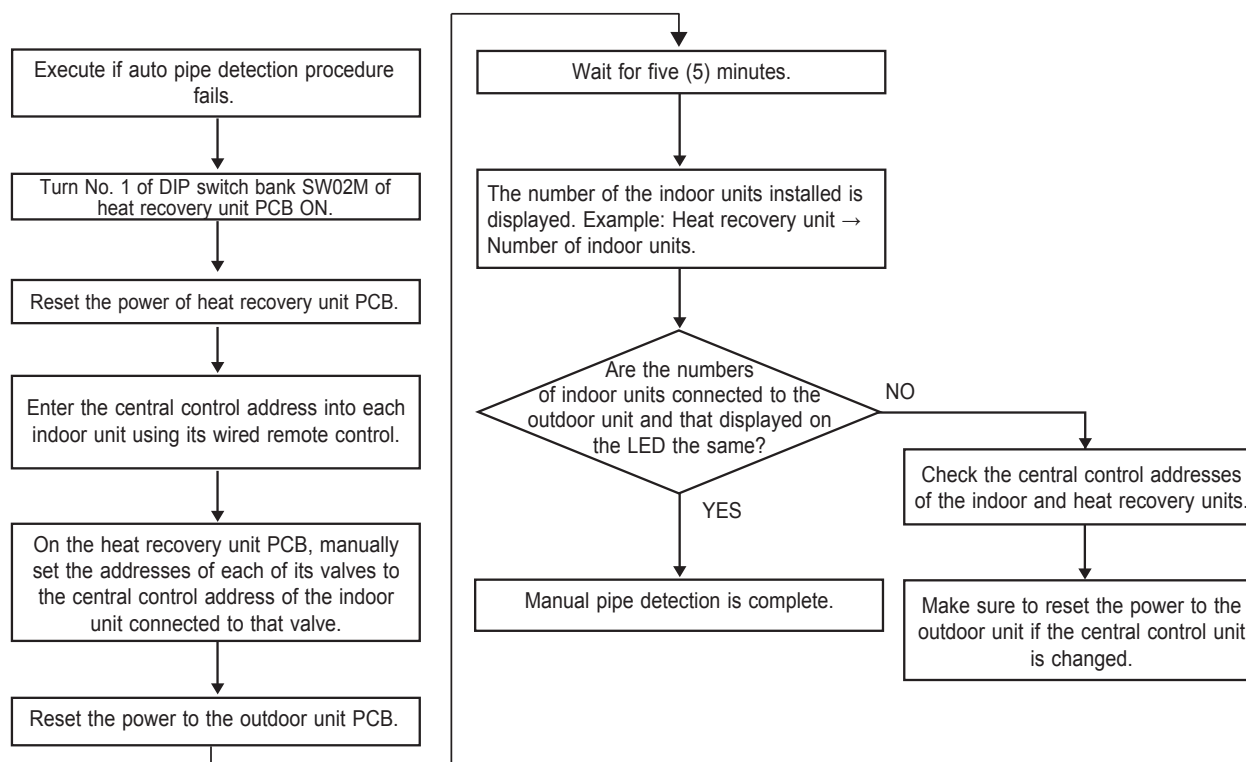


Figure 124: Manual Pipe Detection Addressing Flowchart.




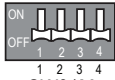


















## Note:

1. If a central controller is not installed yet, leave the address data alone until the installer adds the central controller, and sets the central control address as desired.
2. If a central controller is already installed, the wired remote controller of the indoor units will provide the central control addresses. (In this case, manually set the heat recovery unit pipe address following the central control address of the indoor unit.)
3. Central controller addresses must be set manually at each individual controller.
4. A pipe that does not have an indoor unit connected to it must be set with a different address than a pipe that does have an indoor unit connected to it. (If addresses are the same, the valves will not operate.)
5. Change the manual pipe settings using the heat recovery unit PCB.
6. An error indicates that the manual pipe detection procedure was not completed properly.
7. To save the pipe detection results automatically, Ⓢ do not turn off the main outdoor unit PCB for five (5) minutes after the procedure has finished.

## Manual Pipe Detection Example (Non-Zone Setting)

Before performing manual pipe addressing, input a different central control address to every indoor unit through either a wired or a wireless controller (depending on indoor unit type).

Example: An indoor unit with a central control address of "11" is connected to valve "1" of a heat recovery unit.

No.	Display / Setup	Description
1	 LED  SW01M  SW03M  SW04M	Operation: None Display: None
2	 LED  SW01M  SW03M  SW04M	Operation: Turn DIP switch No. 1 on to address valve No. 1 (SW01M). Display: Existing value saved in EPROM is displayed on LED.
3	 LED  SW01M  SW03M  SW04M	<ul style="list-style-type: none"> <li>Operation: Set the "10" digit of the Group High data number of the wired remote control connected to the corresponding indoor unit to the valve No. 1 by pressing left tact switch (SW03M).</li> <li>Display: Digit increases with the number of times the tact switch is pressed, shown on left LED numeral.</li> </ul>
4	 LED  SW01M  SW03M  SW04M	<ul style="list-style-type: none"> <li>Operation: Set the "1" digit of the Group Low data number of the wired remote control connected to the corresponding indoor unit to the valve No. 1 by pressing right tact switch (SW04M).</li> <li>Display: Digit increases with the number of times the tact switch is pressed; shown on right LED numeral.</li> </ul>
5	 LED  SW01M  SW03M  SW04M	<ul style="list-style-type: none"> <li>Operation: Turn DIP switch No. 1 off to save the address of valve No. 1 (SW01M)</li> <li>Display: "11" displayed on LED disappears</li> </ul>

### Note:

- The procedure described above must be performed for all heat recovery unit valves.
- Valves that do not have indoor units connected to them must be addressed with a number that has not been used. (Valves will not work if the address numbers are the same.)


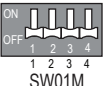




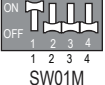




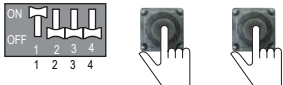




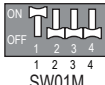




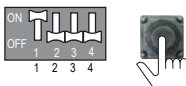




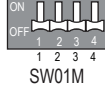




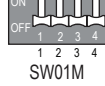



# ADDRESSING WITH HEAT RECOVERY UNITS

## Manual Pipe Detection Example (Zone Setting)

Zone control is when two (2) or more indoor units are connected to one (1) valve of the heat recovery unit. For this application, set the controls with the multiple indoor connections using the rotary switch; i.e., only the rotary switch changes the same valve set condition and set indoor units connection.

1. Set the DIP switch on the corresponding valves and the rotary switch to "0".
2. Set the number using the tact switches.
3. If additional indoor units are connected to one heat recovery unit valve, increase the rotary switch setting by one (1) and set the number using the tact switches.
4. To verify the number of the corresponding valve, turn the DIP switch to ON and set the number on the rotary switch.
5. One heat recovery unit valve can support up to eight (8) indoor units per port (rotary switch settings 0~7). An error will display if more than eight (8) indoor units per heat recovery valve are set with the rotary switch.
6. Return the rotary switch to its original setting (heat recovery unit number settings) after all pipe settings are complete.
7. The rotary switch setting valve of the number of indoor units connected to "FF" prevents a malfunction. Example: Where three (3) indoor units are connected to valve 1; rotary switch settings are 0,1,2 and 3,4,5,6,7 with "FF" used. (Prerequisite for manual pipe detection: The central control address of each indoor unit must be preset differently using its wired remote control.)

Example: An indoor unit with a central control address of "11" is connected to valve no. "1" of an heat recovery unit.

No.	Display / Setup					Description
1						Operation: None Display: None
2						Operation: Turn DIP switch No. 1 on to address valve No. 1. Display: Existing value saved in EPROM is displayed on LED.
3						<ul style="list-style-type: none"> <li>• Operation: Set the "10" digit to the number in Group High data of the wired remote control connected to the corresponding indoor unit with the valve No. 1 by pressing left tact switch.</li> <li>• Display: Digit increases with the number of times the tact switch is pressed, shown on left LED.</li> </ul>
4						<ul style="list-style-type: none"> <li>• Operation: Set SW05M to "1".</li> <li>• Display: Former set value is shown on LED.</li> </ul>
5						<ul style="list-style-type: none"> <li>• Operation: Set SW03M, SW04M, and SW05M to "1".</li> <li>• Display: Set value is shown on LED.</li> </ul>
6						<ul style="list-style-type: none"> <li>• Operation: Turn DIP switch No.1 to off to save the address of valve No. 1.</li> <li>• Display : Set value from previous step disappears; LED is blank.</li> </ul>
7						<ul style="list-style-type: none"> <li>• Operation: Addressing the return valve of the heat recovery unit.</li> <li>• Display: LED is blank.</li> </ul>

### Note:

- The procedure described above must be performed for all heat recovery unit valves.
- Valves that do not have connected indoor units must be addressed with a number that has not been used. (Valves will not work if the address numbers are the same.)

## Indoor Unit Temperature Sensing Location

To maintain optimal comfort, proper operation and efficiency, considerations must be taken when selecting temperature sensing options. Choose from one of four methods for temperature sensing, and record what method is used for each indoor unit on the Pre-commissioning Device Configuration Worksheet.

1. Return air temperature sensor at the indoor unit. Sensing at the return air is the default method. LG indoor units are factory-built with a return air temperature sensor and do not require a remote controller. For more information, visit [www.lghvac.com](http://www.lghvac.com), and refer to the Engineering and Installation manuals for each particular indoor unit.
2. Use the sensor embedded in the remote controller. (Remote controllers are separate purchases.)
3. Remote temperature button sensor. (Not compatible with wall-mounted indoor units. Temperature button sensor is a separate purchase.)
4. Combination of remote controller with embedded sensor and remote temperature button sensor. When a remote controller is used in combination with the return air temperature sensor or a remote temperature button sensor, the indoor unit uses the sensed value farthest from the set point.

### Temperature Sensor Location Considerations

- The indoor unit's return air sensor can be used when air is directly returned to the indoor unit without mixing with other sources such as outside air or open plenum air.
- Temperature sensor must be installed in a location where the temperature of the area is representative of the desired zone temperature, and in an easily accessible location.

⊘ Do not install the temperature sensors in the following areas:

- Areas affected by drafts.
- Dead spots behind doors or in corners.
- Areas affected by hot/cold air flow.
- Areas affected by sun or appliances.
- Near concealed pipes or chimneys.
- Unconditioned areas such as an exterior wall

### Note:

*If it is not possible to locate the remote controller in an area that is both accessible and representative of the desired zone temperature, using a remote controller for control, and a remote temperature button sensor for the sensing location is also an option.*

### Temperature Sensing Options in a Single Zone—Single Zone, Single Indoor Unit

- A remote controller in an appropriate location is often used, which allows the system to sense the actual temperature that the occupants are experiencing. (Function Code 4 must be set to 001.)
- If an appropriate location for the remote controller is not available, use the remote controller with a remote temperature button sensor. Connect the button sensor to the indoor unit and locate it in an appropriate location.

### Temperature Sensing Options in a Single Zone—Single Zone, Multiple Units, Group Control

- Using the return air temperature sensor of each individual unit will allow the indoor unit to adjust to the load in its portion of the space.
- Using a remote temperature button sensor with each indoor unit will also allow the indoor unit to adjust to the load in its portion of the space, and may also better reflect the temperature at the occupant level.

# TEMPERATURE SENSING LOCATION / SETTING EXTERNAL STATIC PRESSURE



## Indoor Unit Temperature Sensing Location, continued.

### Considerations for Ducted Units—Single Zone, Single Unit

- When using the return air temperature sensor of a ducted indoor unit, ensure that the air temperature being sensed is directly from the space and not air mixed with outside air or open plenums. Also, the temperature sensed by the return air temperature sensor when the ducted indoor unit fan is not operating could be affected by the distance of the duct run.
- If the return air is not representative of the space due to outside air introduction, open plenum, or other reasons, using a remote controller or remote temperature button sensor is required.

### Considerations for Ducted Units—Multiple Spaces, Single Indoor Unit

In some applications, a single ducted unit is used to serve multiple smaller spaces. The indoor unit will still control based on the sensed space temperature.

1. Use the return air temperature sensor to sense a common return from all of the spaces served by the indoor unit.

### Note:

If outside air is introduced into the indoor unit or an open plenum is used,  do not use this option for sensing temperature.

2. Use a remote controller in the most often occupied area along with a remote temperature button sensor in another area. When the combination sensing method is used, the indoor unit uses the sensed value farthest from the set point. (Function Code 4 must be set to 003.)
3. Use multiple remote temperature button sensors in a series-parallel configuration to average the space temperature across multiple spaces.

### Note:

For more information, see the “Temperature Sensing Applications Guide” on [www.mylghvac.com](http://www.mylghvac.com).

## Setting External Static Pressure

Ducted units may need the fan speed adjusted in order to deliver the required airflow at the external static pressure (ESP) of the duct system. Settings are made using a wired remote controller and the air flow information found the specific indoor unit's engineering manual. For instructions on how to set the ESP through the wired remote controller, consult the user's, owner's, and / or installation manual for that particular controller.

### Note:

*It is always best if the air balance is completed prior to a request for a LG trained Commissioner. If the air balancing contractor has not completed the work before commissioning, the Commissioner is not responsible for setting the indoor unit air flow rates, fan speed, or ensure the air volume delivered at each indoor unit is per project specifications, only to spot check. Excessive or restricted airflow may impact the ability of the Commissioner to successfully complete system commissioning. If problem exists, request verification from the Test and Balance contractor. If necessary, provide instruction to the air balance technician on how to adjust the indoor unit fan setting value.*

### Summary of External Static Pressure Procedure

1. Request / review the final air balance report (that includes the actual measured ESP[s] and required air flow rate[s]).
2. Note all required fan setting value changes.
3. Perform all required ESP (fan) setting value changes. A separate ESP (fan) setting value must be selected for each available indoor unit fan speed.
4. Check all fan setting values on zone controllers to verify adjustments were made.
5. Record the values on the Pre-Commissioning Device Configuration Worksheet.



## Determining External Static Pressure and Setting the Values

- For ducted indoor units, the Engineering Manual includes tables listing setting values as they relate to ESP and airflow. The installer can use the available range of ESP settings to adjust for ductwork in the system. See table below for an example.

### Note:

The indoor unit fan(s) cannot be allowed to operate outside manufacturer's parameters. Extended operation in these conditions will result in

- Fan surge (noisy & slow pulsating airflow), and / or
- Fan motor failure

Table 47: BR Unit External Static Pressure and Air Flow Table from Ducted Indoor Unit Engineering Manual.

Set Value	Static Pressure (in. wg)										
	0.19	0.23	0.31	0.39	0.47	0.55	0.59	0.62	0.66	0.70	0.78
91	1,642	1,543	1,349	1,105	819	494	317	130	-	-	-
96	1,762	1,628	1,518	1,183	1,098	649	483	317	91	-	-
101	1,839	1,772	1,691	1,395	1,320	964	889	628	314	215	-
106	1,815	1,808	1,779	1,568	1,522	1,176	1,133	1,020	741	632	293
111	1,892	1,896	1,868	1,762	1,705	1,433	1,419	1,158	1,112	960	618
116	-	-	-	1,967	1,794	1,582	1,504	1,416	1,327	1,147	974
121	-	-	-	-	1,843	1,794	1,776	1,613	1,575	1,370	1,137
126	-	-	-	-	-	-	1,921	1,808	1,779	1,624	1,536

- The table below presents the ESP settings that the unit comes with from the factory, plus an additional "standard" setting.

Table 46: Example of BR Unit External Static Pressure and Air Flow (with Settings) from Ducted Indoor Unit Engineering Manual.

Model	Capacity (MBh)	Mode		Setting Value	Standard ESP (in. wg)	CFM	Min. ESP (in. wg)	Max. ESP (in. wg)
ARNU483BRA4	48.1	High (Factory Set)	High	116	0.55	1,582	0.39	0.78
			Mid	111		1,434		
			Low	106		1,176		
		Standard	High	106	0.39	1,568	0.27	0.55
			Mid	102		1,395		
			Low	95		1,183		

- Once the available system static pressure requirements and the desired airflow rate are known, select the required ESP (fan) setting value(s). A separate ESP (fan) setting value must be selected for each available indoor unit fan speed.

### Note:

$Fan\ RPM = fan\ setting\ value \times 10.$

- Record the values on the Pre-Commissioning Device Configuration Worksheet. If the fan setting value was left at the factory default, insert "000" in the blank.

# PACKAGE PRE-COMMISSIONING DOCUMENTS / INITIATE A REQUEST



## Prepare Pre-commissioning Package Documents

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 2. Notes must include changes to the line lengths and number of elbows used for each liquid line segment. Verify that the sum of the indoor unit nominal capacity connected to the piping system is between 50% and 130% of the nominal capacity of the outdoor unit(s). If this rule is violated, the system will not start.
4. Air balance report showing proper airflow at all indoor units.
5. A copy of a completed and verified Installation Checklist for the outdoor unit(s), indoor units, heat recovery units, ERVs, Air Cleaners, and Control Devices. Correct any procedures needing attention before initiating a request for commissioning.
6. A completed Pre-commissioning Device Configuration Worksheet with the models and serial numbers of all equipment to assist in full Warranty activation.
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®, and AC Smart devices. (BACnet is a registered trademark of ASHRAE; LonWorks is a trademark of Echlelon Corporation.)

The contractor must ONLY request commissioning when everything is completed and all components tested / addressed (if a component is not operating within the usual parameters at the time of commissioning, then adjustments must be made that may prevent the Commissioner from signing off and approving the system). Before commissioning, the Commissioner may contact you to discuss specific job points, scheduled day(s) and expected duration. It is the contractor's responsibility to provide all of the necessary start-up labor, refrigerant, tools and test equipment needed to complete the process in the expected time frame.

⊘ Do not attempt to start the outdoor unit(s), charge refrigerant, or open service valves until directed by your Commissioner. After commissioning, the contractor will be notified if there are any corrections needed to allow warranty activation. The Distributor or LG Rep / Controls Contractor may provide assistance with controls setup, final device programming, BMS integration, air balance adjustments, etc.; and proceed with any owner training (if included).

### Note:

Using LGMV monitoring software is encouraged for ease of future diagnostic and maintenance related checks.

## Initiate a Request for a System Commissioning

The system must now be ready for commissioning procedures and additional trim charge. Send all Pre-Commissioning Package Documents to your LG Applied Representative and request commissioning assistance.

### System Commissioning

The Multi V System commissioning process and procedures are provided in a separate manual and/or in training materials provided by the LG Academy Training Team. To obtain a copy, you must be a LG-trained Commissioner.

### After Commissioning Has Been Requested

The LG trained Commissioner may contact you to discuss specific job points, scheduled day(s) and expected duration. It is the contractor's responsibility to provide all of the necessary start-up labor, refrigerant, tools and test equipment needed to complete the process in the expected time frame. Please note that the commissioner's allotted time at your project DOES NOT include owner training.

It is understood that the contractor is to request for a LG-trained Commissioner when all required project readiness points are complete; not based on an "expected" completion date. The contractor also acknowledges that they will assume all responsibility for costs incurred by the Commissioner including but not limited to airfare, travel costs, transportation, shipping, labor, and tool costs due to lack of readiness.

The commissioner's schedule is usually very rigid, and may have no flexibility regarding duration. It also involves advance travel arrangements that may be impractical or impossible to change.

Freight Damage and Unit Replacements .....	Your LG Manufacturer Representative
Missing Parts .....	Your LG Manufacturer Representative
Received Wrong Outdoor Unit Model(s) .....	Your LG Manufacturer Representative
Installation, Startup, and Commissioning Technical Assistance .....	1-888-865-3026



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

## General Information

LG VRF system's core logic uses error codes to indicate that an abnormal operation occurred. Error codes help guide a trained service technician to identify why and what caused the error to display, and help track the frequency of malfunction occurrences.

There are four (4) levels of error code responses; the system responds accordingly, depending on the severity of the malfunction assigned to the malfunction. The level of responses range from "notify and keep operating" (Level 4), to "immediate system shutdown" (Level 1).

All error codes can be viewed at the outdoor unit seven segment display (SSD) and with LGMV software. If an error codes shows on one (1) or more indoor unit zone controllers, it will display on LGMV, central controllers, BMS, or any other LG device connected to Comm bus - Internet A/B. Indoor unit error code notifications will display differently based on location of the problem.

### Level 4 Responses

Level 4 responses display the error code, but the system continues to operate (operate indefinitely). When the malfunction is fixed, the error code remains until the master outdoor unit's microprocessor is reset, and operation has resumed for 130 minutes without the malfunction reoccurring.

### Level 3 Responses

Level 3 responses display the error code on all zone controllers, central controllers, and on BMS systems. For Level 3 responses, the Multi V system will shut down for three (3) minutes, and then the master microprocessor in the outdoor unit will automatically restart the system.

If the malfunction reoccurs up to a total of nine (9) times within one (1) hour, the system will display the error code, shut down, and restart again each time. If the malfunction occurs a tenth (10th) time within the same one (1) hour, the system shuts down permanently, assigning the error to a Level 1 response that requires a manual restart. The error code displays on the zone controllers and central controllers until the malfunction is fixed.

### Level 2 Responses

Level 2 responses are communications related errors only. Level 2 responses activate after ten (10) attempts to communicate have occurred. After communications have been re-established, the error codes display for one (1) minute. If the communications are restored, then the error code disappears. If the communication is lost within one (1) minute, the error code remains.

Error codes for Level 2 responses stop appearing on the zone and central controllers as soon as communications are restored, without the need to reset power at the Master outdoor unit or to restart the entire system.

Multi V error codes for Level 2 responses appear where the problem occurs, and time limits differ depending on type:

1. Communications lost between outdoor unit PCBs – no time delay.
2. Communications lost between the indoor unit and the outdoor unit for three (3) minutes.
3. Communications lost between the indoor unit and heat recovery unit for ten (10) seconds.
4. Communications lost between outdoor unit external PCBs for ten (10) seconds.

### Level 1 Responses

Many Level 1 responses call for an immediate system shutdown, and, in almost all abnormal operational situations, occur after the algorithm monitoring system verifies that the malfunction is real (to avoid nuisance alarms and false positives). Level 1 responses are displayed at zone controllers, central controllers, BMS, LGMV, and the outdoor unit SSD. They cannot be cleared until the problem that caused it is fixed.

Before a Level 1 response is assigned, the Multi V algorithm initially assigns a Level 3 response to any system malfunction that is not communications related. The system follows Level 3 protocol until the tenth (10th) time a malfunction occurs, at which time the system shuts down, the malfunction changes from Level 3 to Level 1, and a manual restart is required. The entire Level 3 auto restart to Level 1 shut down sequence will repeat until the malfunction is fixed.

## Note:

For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on [www.lghvac.com](http://www.lghvac.com).

# ERROR CODE TABLES

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

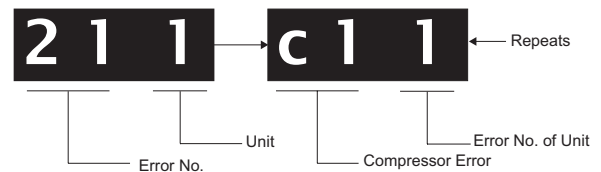
## Error Code Display

The seven segment display on the main board displays error codes. Error codes are 3 or 4 digit numbers. The rightmost number designates the ODU frame (1=Master; 2=Slave1; 3=Slave2). The other two or three digits indicate the error.

Examples: 211 = Error No. 21 on master unit; 212 = Error No. 21 on slave 1 unit; 213 = Error No. 21 on slave2 unit, 1051 = Error No. 105 on master unit.

- If two or more errors occur simultaneously, the lower error code number is displayed first.
- After error is resolved, the error code disappears.

Figure 126: Example of an Error Code.



## Nomenclature Definitions

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

The error code tables on the following pages list the error codes used for Multi V systems. For detailed information on how to troubleshoot each error, see the Multi V S Service Manual on [www.lghvac.com](http://www.lghvac.com).

Table 48: 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 disconnected or shorted. (Check the wiring, connection 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 is disconnected or shorted. (Check the connection on the indoor unit PCB, then check the thermistor.)
	0 3 Communication error between zone controller and indoor unit.	Indoor unit PCB is not receiving communications signal from zone controller.
	0 4 Indoor unit drain overflow error.	Drain pump and/or flow switch is/are malfunctioning. Also check drain line for obstructions.
	0 5 Communication error between outdoor unit PCB and indoor unit PCB.	Indoor unit communications PCB is not receiving signal from outdoor unit communications PCB for more than 5 minutes. Check indoor unit PCB for issues.
	0 6 Indoor unit outlet pipe temperature sensor error.	Indoor unit outlet pipe temperature sensor is disconnected or shorted. (Check the connection on the indoor unit PCB, then check the thermistor.)
	0 7 Indoor units are not operating in the same mode. (Heat pump applications only)	Different operation mode between indoor units.
	0 9 Indoor unit EEPROM error.	<ul style="list-style-type: none"> <li>• Communication error between the indoor unit PCB board and its option card. (The option card is about 1' x 1' and is plugged into the indoor unit PCB board. Check connection between the two.)</li> <li>• Communication error between EEPROM on indoor unit main PCB.</li> <li>• Indoor unit EEPROM data is not available.</li> </ul>
	1 0 Indoor unit BLDC fan motor communications error.	<ul style="list-style-type: none"> <li>• Fan motor has been removed or is defective. Refer to the resistance and voltage check charts in this service manual.</li> <li>• The system has detected the fan motor is not spinning.</li> <li>• On new installs, verify installation manual and paperwork were removed from fan discharge shroud during installation.</li> <li>• Check the wiring plug and connections (if applicable).</li> </ul>

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

Table 49: Error Codes, continued.

Error Code				Description	Details
Indoor Unit	2	3	0	Refrigerant leak sensor error. Only displayed at the indoor unit and its wired remote controller.	<ul style="list-style-type: none"> <li>Refrigerant leak sensor error; sensor is malfunctioning.</li> <li>Error will also be displayed if the function is enabled on the wired remote controller, and there is not a sensor installed.</li> <li>Refrigerant leak is detected when &gt;6,000 ppm.</li> <li>Enable the function through the function code on the remote controller.</li> <li>Operation stop.</li> <li>Solenoid valve closes on the indoor unit side.</li> <li>CH230 is displayed. If the communication baud is 1,200 bps, then only the zone controller can display the CH230; central controller cannot display the error due to lack of information.</li> <li>Buzzer rings 2 long buzzes every 1 second. Ringing stops when there is an input from the controller. (If there is a hard lock, then only the controller can make the hard lock to stop buzzing. If leak sensor measures under 1.5V, then it is considered normal and the buzzing stops.</li> <li>To release the error, power needs reset.</li> </ul>
	2	3	7	Communication error between outdoor unit PCB and indoor unit PCB. Only displayed at the indoor unit and its wired remote controller.	Indoor unit communications PCB is not receiving signal from outdoor unit communications PCB for more than 3 minutes. Check RS-485 communications for issues.
	2	3	8	Communication error between outdoor unit PCB and indoor unit PCB. Displayed at the indoor unit and its wired remote controller.	Indoor unit communications PCB is not receiving signal from outdoor unit communications PCB for more than 3 minutes. Check outdoor unit PCB for issues.
Outdoor Unit	2	1		Outdoor unit inverter board IPM fault error. Error code is determined by overcurrent in any one phase of compressor.	<ul style="list-style-type: none"> <li>Overcurrent conditions have been detected at the inverter compressor (U,V,W).</li> <li>Compressor motor or insulation has been damaged.</li> <li>IPM has overheated due to damage or disconnection of the heat sink fan, or the heat sink has been disassembled.</li> <li>Inverter compressor terminal has been disconnected or loosened.</li> <li>Inverter PCB assembly has been damaged.</li> <li>Low input current to the outdoor unit. Damaged inverter board – input voltage too low. For 208-230V: On 068 compressors = 143A for a minimum of 3μs; on 048 compressors = 96A for a minimum of 3μs.</li> </ul>
	2	2		Outdoor unit inverter PCB AC input overcurrent (RMS) error.	<ul style="list-style-type: none"> <li>Overcurrent of outdoor unit inverter board PCB.</li> <li>Under voltage.</li> <li>Refrigerant flow restriction from defective EEV.</li> <li>Refrigerant charge is too high (overcharged).</li> </ul>
	2	3		Low or high DC voltage sensed at the outdoor unit inverter compressor DC link.	<p>There is a capacitor that is not working properly, or the voltage at the capacitor is out of range. System shut off because outdoor unit inverter compressor DC link voltage fell below 50V or exceeded 550V for a minimum of 250μs.</p> <ul style="list-style-type: none"> <li>Start diagnosis at the inverter socket on the outdoor unit noise filter PCB.</li> <li>Disconnected DC link.</li> <li>Damaged electrical condenser component (serving capacitor) on inverter driver board. Improper wiring at DC link terminal or disconnected contact..</li> </ul>
	2	4		System has been turned off by the outdoor unit high pressure switch.	<p>Outdoor unit high pressure switch error.</p> <ul style="list-style-type: none"> <li>Check the connection on the outdoor unit PCB.</li> <li>Use chart in Troubleshooting section of the manual to check signal output (V DC) versus actual pressure.</li> </ul>
	2	5		Input voltage to the outdoor unit is too high or too low.	Outdoor unit has an input voltage of ≤140V or ≥300V (for 208-230V units).
	2	6		Outdoor unit inverter compressor operation error.	Inverter compressor failed to start.



# ERROR CODE TABLES

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

Table 50: Error Codes, continued.

Error Code			Description	Details
Outdoor Unit	2	9	Outdoor unit inverter compressor overcurrent error.	<ul style="list-style-type: none"> <li>Outdoor unit inverter compressor current draw is too high.</li> <li>Compressor defect and restriction in refrigerant piping are possible causes.</li> </ul>
	3	2	Excessive increase in outdoor unit inverter compressor gas discharge temperature.	<ul style="list-style-type: none"> <li>System shutdown happens when discharge pipe temperature rises &gt;115°C (239°F) for 10 seconds, or compressor temperature equals 105°C (221°F) for 10 seconds.</li> <li>Check the inverter compressor discharge pipe temperature sensor.</li> <li>Check for low refrigerant / leaks.</li> <li>Check for a defective EEV.</li> <li>Check for a defective liquid spray valve.</li> </ul>
	3	4	Outdoor unit compressor high pressure safety tripped.	<ul style="list-style-type: none"> <li>Shutdown due to if compressor high pressure is &gt;4,000 kPa (580 psi) for ten (10) seconds.</li> <li>Check the high pressure sensor, indoor unit or outdoor unit fan(s), refrigerant, EEV, service valve (may be clogged); check for defective outdoor unit PCB, indoor unit pipe temperature sensor, or hot gas valve. Also, outdoor unit may not have enough clearance (cooling operation), or indoor unit filter may be clogged (heating operation).</li> </ul>
	3	5	Outdoor unit low side pressure below allowable limits.	<ul style="list-style-type: none"> <li>System will shut down when an abnormal low pressure condition occurs.</li> <li>Shut down occurs when the compressors inverter frequency &lt;30Hz = low &lt;110 kPa for 1 minute.</li> <li>When operating in cooling mode: Low side pressure &lt;400 kPa for 1 minute; High side pressure is &lt;2,200 kPa. Check for refrigerant leaks (low refrigerant charge), or a defective indoor unit EEV.</li> <li>When operating in heating mode: Low side pressure &lt;230 kPa for 1 minute; High side pressure is &lt;1,800 kPa. Check for refrigerant leaks (low refrigerant charge), or a defective outdoor unit EEV.</li> </ul>
	3	6	Outdoor unit inverter low compression ratio.	<ul style="list-style-type: none"> <li>Outdoor unit is experiencing a problem developing compressor lift. Error is calling out low compression ratio. System will shut down and display error code "CH36".</li> <li>Error occurs if the compression ratio is &lt;1.6 (scroll compressor) or &lt;1.8 (rotary compressor) for 2 minutes following a change in position of the reversing valve (either direction), and for 5 minutes following a compressor start.</li> <li>Pressure differential: &lt;400kPa (scroll compressor), and 500kPa (rotary compressor).</li> </ul>
	4	0	Outdoor unit inverter compressor current transducer (CT) sensor error.	Outdoor unit inverter compressor current transducer (CT) detection sensor disconnected or shorted.
	4	1	Outdoor unit inverter compressor discharge pipe temperature sensor error.	<ul style="list-style-type: none"> <li>Error can also occur if the system is operating in cooling at extremely low temperatures with no low ambient kit.</li> <li>Compressor discharge pipe temperature sensor (TH3) is not installed or connected properly.</li> <li>Defective compressor discharge pipe sensor (TH3) (opened or shorted).</li> <li>Defective outdoor unit PCB.</li> <li>Standard values of sensor resistance at different temperatures (5% variation): 50°F = 362 kΩ, 77°F = 200 kΩ, 122°F = 82 kΩ, 212°F = 18.5 kΩ.</li> <li>Other temperature sensor resistance values: 77°F = 10 kΩ ± 1%; 77°F = 5 kΩ ± 1%; 77°F = 200 kΩ ± 1%; 185°F = 1.07 kΩ ± 3.3%; 185°F = 535 kΩ ± 3.3%; 185°F = 28 kΩ ± 7.7%.</li> </ul>

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

Table 51: Error Codes, continued.

	Error Code		Description	Details
Outdoor Unit	4	2	Outdoor unit low pressure sensor error.	<ul style="list-style-type: none"> <li>Check the connection on the outdoor unit PCB.</li> <li>Thermistor shorted or opened.</li> </ul>
	4	3	Outdoor unit high pressure sensor error.	<ul style="list-style-type: none"> <li>Check for 12 V DC between 12 V and GND (red to black) for 5 V DC.</li> <li>Check the Signal to GND (white to black) and use correct chart from Troubleshooting section to compare with actual system pressure.</li> </ul>
	4	4	Outdoor unit ambient temperature sensor error.	Check the connection on the outdoor unit PCB.
	4	5	Outdoor unit heat exchanger pipe temperature sensor.	Thermistor shorted or opened.
	4	6	Outdoor unit suction pipe temperature sensor error.	<ul style="list-style-type: none"> <li>Check the connection on the outdoor unit PCB.</li> <li>Thermistor shorted or opened.</li> <li>Check suction sensor in cooling mode; check hot gas sensor located near the heat exchanger in heating mode.</li> </ul>
	5	0	Outdoor unit loss of phase.	Input power line connection is / are missing for the outdoor unit.
	5	1	Combination ratio is out of range.	The total of the nominal indoor unit capacity is less than 50% or more than 130% of the nominal outdoor unit capacity.
	5	2	Communication error between outdoor unit main PCB and inverter PCB.	<ul style="list-style-type: none"> <li>Communication error between main PCB and inverter PCB.</li> <li>Check connections at both sockets.</li> <li>Inspect interconnecting cable for wear.</li> </ul>
	5	3	Communication error between outdoor unit main PCB and indoor unit(s) PCB.	<ul style="list-style-type: none"> <li>Check if outdoor unit to indoor unit(s) communications cable disconnected or shorted.</li> <li>Check A terminals are connected to indoor unit A(3) (5 on 3 x 3 cassette) terminals; B(4) (6 on 3 x 3 cassette) terminals.</li> </ul>
	5	7	Outdoor unit main PCB and inverter PCB communication error.	Outdoor unit inverter PCB is not receiving signal from main PCB.
	6	0	Outdoor unit inverter PCB EEPROM error.	<ul style="list-style-type: none"> <li>Verify the EEPROM is present and in the socket correctly.</li> <li>Check if all pins are in and are not bent.</li> <li>Check if notch in the chip lines up with the arrow on the socket.</li> </ul>
	6	2	High temperature at the outdoor unit inverter heat sink.	System shut off because of high temperatures at the outdoor unit inverter heat sink.
	6	5	Outdoor unit inverter heat sink temperature sensor error.	<ul style="list-style-type: none"> <li>Check the connection on the outdoor unit PCB.</li> <li>Thermistor shorted or opened.</li> <li>Check for 12 V DC between 12 V and GND (red to black) for 5 V DC.</li> <li>Check the Signal to GND (white to black) and use correct chart from Troubleshooting section to compare with actual system temperature.</li> </ul>
	6	7	Outdoor unit fan has locked up.	No airflow.
	7	1	Outdoor unit inverter CT sensor error.	Outdoor unit is restricted.
	8	6	Outdoor unit main PCB onboard EEPROM error.	<ul style="list-style-type: none"> <li>Verify the EEPROM is present and in the socket correctly.</li> <li>Check if all pins are in and are not bent.</li> <li>Check if notch in the chip lines up with the arrow on the socket.</li> </ul>



# ERROR CODE TABLES



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

Table 52: Error Codes, continued.

Error Code				Description	Details
Outdoor Unit	1	1	3	Outdoor unit liquid pipe temperature sensor error.	<ul style="list-style-type: none"> <li>Check the connection on the outdoor unit PCB.</li> <li>Thermistor shorted or opened.</li> </ul>
	1	1	4	Outdoor unit subcooling inlet temperature sensor error.	<ul style="list-style-type: none"> <li>Check for 12 V DC between 12 V and GND (red to black) for 5 V DC.</li> </ul>
	1	1	5	Outdoor unit subcooling outlet temperature sensor error.	<ul style="list-style-type: none"> <li>Check the Signal to GND (white to black) and use correct chart from Troubleshooting section to compare with actual system temperature.</li> </ul>
	1	5	0	Outdoor unit compressor discharge superheat not satisfied. (ARUN / ARUB60GSS4 only)	<p>Code indicates that based on current superheat measurements, there is a high possibility of liquid refrigerant flooding back and damaging the compressor.</p> <ul style="list-style-type: none"> <li>Outdoor unit compressor discharge superheat not satisfied for ≥5 minutes.</li> <li>Code can only occur when the outdoor is operating in cooling mode (all indoor units must be in cooling mode; error cannot occur during simultaneous operation).</li> <li>After at least 10 minutes of compressor operation, the master outdoor unit microprocessor will calculate the system's compressor superheat. If at any time during compressor operation where all indoor units in thermal on are in cooling mode and the compressor superheat falls &lt;4.8°F (&lt;3°C) for ≥5 minutes, there is a high probability that liquid could flood back to the inlet of the compressor scroll, resulting in compressor damage.</li> <li>If error occurs 3 times within any 1 hour period of compressor operation, the system will shut down and remain off. A manual restart will be necessary.</li> </ul>
	1	5	1	The difference between the high and low pressure is too low.	Not enough pressure difference between high and low. Function error of outdoor unit four-way reversing valve.

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Table 53: Error Codes, continued.

Error Code				Description	Details
Heat Recovery Unit	-	5	1	C + No. of HR Unit Capacity of indoor units connected to the heat recovery unit exceeds allowable limits.	<p>The amount of nominal cooling capacity of indoor units connected to a heat recovery unit, or a heat recovery unit port, or grouped heat recovery unit port is excessive. After auto-pipe detection is complete, wait 5 minutes, then verify connected capacity. System will display error if:</p> <ul style="list-style-type: none"><li>• The heat recovery unit port addresses are all unique, then &gt;54 Mbh single indoor unit connected; &gt;54 Mbh total of multiple indoor units connected.</li><li>• If 2 heat recovery unit port addresses are the same and the ports are twinned; &gt;108 Mbh total of multiple indoor units are connected.</li><li>• If 3 heat recovery unit port addresses are the same and the ports are all connected, &gt;162 Mbh total of multiple indoor units connected.</li><li>• If the total connected indoor unit nominal capacity exceeds 192 Mbh for a single heat recovery unit.</li><li>• Error code displays on the outdoor unit SSD, the heat recovery unit SSD, or in LGMV.</li></ul>
	2	0	0	1	Auto pipe search failure. Auto piping procedure did not complete properly.
	2	0	1	C + No. of HR Unit	Heat recovery unit liquid sensor error. (C = Heat recovery unit + Heat recovery unit number). Disconnection or short circuit of heat recovery unit liquid pipe sensor.
	2	0	2		Heat recovery unit subcooling pipe inlet sensor error. (C = Heat recovery unit + Heat recovery unit number). Disconnection or short circuit of heat recovery unit subcooling pipe inlet sensor.
	2	0	3		Heat recovery unit subcooling pipe outlet sensor error. (C = Heat recovery unit + Heat recovery unit number). Disconnection or short circuit of heat recovery unit subcooling pipe outlet sensor.
	2	0	4		Communication error between outdoor unit and heat recovery unit. (C = Heat recovery unit + Heat recovery unit number). Outdoor unit does not receive signal from heat recovery unit.
	2	0	5		Communication error between heat recovery unit (2A Series) and the 485 modem. The 2A Series heat recovery unit applies only to heat recovery systems communicating at a baud rate of 9,600 bps. <ul style="list-style-type: none"><li>• The 485 modem is the communications style on the bus that is 1e outdoor unit to many indoor units.</li></ul> <ul style="list-style-type: none"><li>• Communication problem occurred between the heat recovery unit PCB and the connection to the communications bus.</li><li>• Error displays if the outdoor unit signal is not received for three (3) minutes. The error clears after the signal is received from the modem. (2A Series Heat Recovery Units.)</li></ul>
	2	0	6		Duplicate address error of the heat recovery unit (2A Series). <ul style="list-style-type: none"><li>• The 2A Series heat recovery unit applies only to heat recovery systems communicating at a baud rate of 9,600 bps.</li><li>• The 485 modem is the communications style on the bus that is 1e outdoor unit to many indoor units.</li></ul> <ul style="list-style-type: none"><li>• A heat recovery unit address is duplicated for 485 communication.</li><li>• There are two heat recovery units with one or more HEX addresses that are the same.</li><li>• Adjust the hex address dial found on the heat recovery units.</li></ul>
Network	2	4	2	Network error of central controller. Inability of the central controller to receive information from the outdoor unit.	

# LG MONITORING VIEW (LGMV) DIAGNOSTIC SOFTWARE

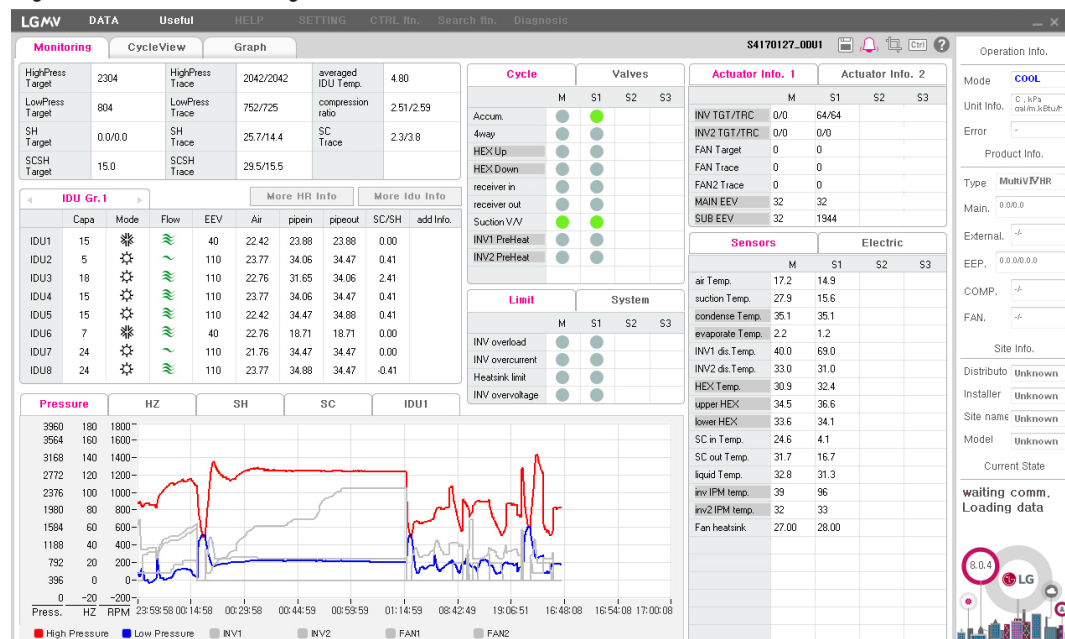


## LG Monitoring View (LGMV) Diagnostic Software

LG Monitoring View (LGMV) software allows real-time monitoring of Multi V system operating parameters, and can be used to commission new systems. LGMV software can also help the service technician or LG trained commissioner to troubleshoot existing system operation issues by displaying error codes. Also, LGMV data can be recorded to a .csv file and emailed to an LG representative to assist with diagnostic evaluations.

LGMV is available in different formats, including Mobile LGMV, which is an app for use on wireless devices. Contact your LG Sales Representative for more information, including recommended PC or mobile device configurations.

Figure 127: LGMV Monitoring Screen.



### Note:

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

### LGMV Display

LGMV displays the following real-time data:

- 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
- Constant speed 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
- Four-way reversing valve operation indicator light
- Pressure graph showing actual low pressure and actual 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 no. of outdoor units
- Site name
- Total number of connected indoor units
- Communication indicator lights
- Indoor unit capacity
- Indoor unit operating mode
- Indoor unit fan speed
- Indoor unit EEV position
- Indoor unit room temperature
- Indoor unit inlet pipe temperature
- Indoor unit outlet pipe temperature
- Indoor unit error code



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

1. Cycleview: Graphic of internal components including:

- Compressors showing actual speeds
- EEVs
- Indoor units
- Liquid injection valves
- Temperature and pressure sensors
- Four-way reversing valve
- Outdoor fans showing status and speeds

2. Graph: Full screen graph of actual high and low pressures and high and low pressure limits. A sliding bar allows viewing of previously recorded data.

3. Control IDU: Enables user to turn on IDU's default setpoints of 86°F in heat mode or 64°F in cool mode.

4. Setting: Converts metric values to imperial values.

5. Making Data: Recording of real time data to a separate file created to be stored on the user's computer.

6. Loading Data: Recorded data from a saved ".CSV" file can be loaded to create an LGMV session.

7. Electrical Data: The electric tab on the main screen is changed to show the following:

- Inverter compressor
  - Amps
  - Volts
  - Power Hz
  - Inverter control board fan Hz
- Constant compressor
  - Current transducer value
  - Phase

## 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.

Figure 128: LGMV Cycleview.

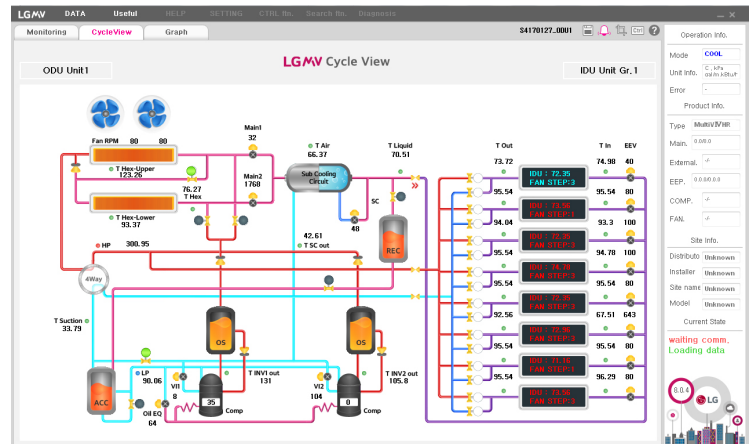


Figure 129: LGMV Graph Screen.

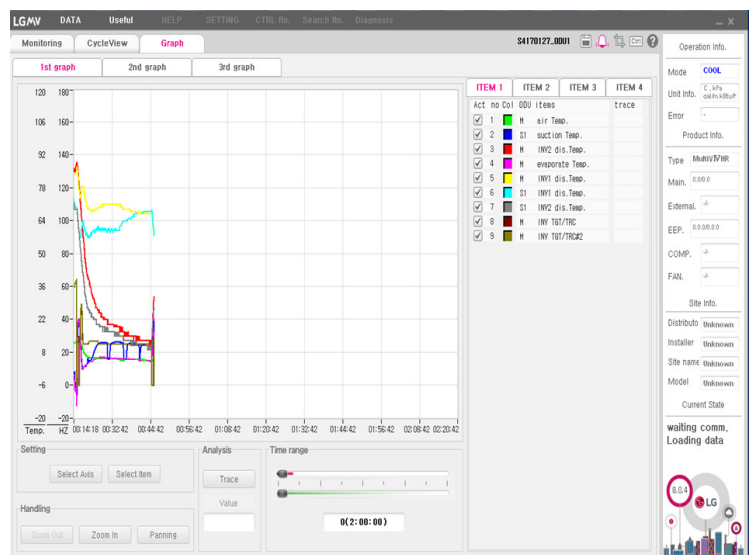


Table 54: Maintenance Recommendations.

Component	Maintenance	Occurrence (Minimum)
Indoor Units	Wash filters	On a regular basis / as needed
	Clean coils	Once a year
Outdoor Unit(s)	Clean coils	Once or twice a year
Communications Cable and Power Wiring	Verify that all cables and wiring are properly connected	Once or twice a year

## Note:

*It is also recommended to monitor system operation using LGMV Software at least once a year.*

**Major Component Rough-In**

Description	Check
All Multi V outdoor 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).	
All indoor units and heat recovery units (for Heat Recovery systems only) are installed, properly supported, and located indoors in a non-corrosive environment.	
Duct work installation completed (ducted indoor units only).	

**Piping Material, Components, and Insulation**

Description	Check
Heat recovery systems: LG prefers the use of ACR hard drawn copper on pipe segments located between heat recovery units and outdoor units, between heat recovery units piped in series, and between heat recovery units and multiple indoor units sharing an heat recovery unit port.	
Heat pump systems: LG prefers the use of ACR hard drawn copper for all pipe segments in the piping system except segments located between Y-branch fittings (or header fittings) and indoor units.	
DOAS Units: LG prefers the use of hard drawn copper in pipe segments connecting a DOAS products and an outdoor unit.	
Single-zone and multi-zone duct-free split systems: ACR copper piping rated at the system working pressure was used.	
LG Y-branch fittings or headers were used as per LATS Multi V report.	
All refrigerant pipes and valves were insulated separately. Insulation is positioned up against the walls of the indoor units and heat recovery units (for Heat Recovery systems only). No gaps shown. Insulation was not compressed at clamps and hangers.	

**Brazing Practices**

Description	Check
Use medical grade dry nitrogen for purging during brazing (constant 3 psig while brazing).	
15% silver brazing material only.	
Minimum 3/4 inch, maximum 1 inch condensate piping installed on indoor units – material used is acceptable under local code. Insulated to prevent condensation.	

**Refrigerant Piping Design and System**

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.	
Expansion loops, coils or other acceptable measures are provided where necessary to absorb temperature-change based pipe movement.	
A torque wrench and backup wrench were used to tighten all flare connections.	
The back side of all flares were lubricated with a small drop of PVE refrigeration oil before tightening flare fittings.	
Ensure all field made flares are 45°. Use factory-supplied flare nuts only.	
Pipe segments, Y-branches, and/or header fittings are secured to the structure using a combination of fixed and floating clamps, and all wall penetrations were sleeved.	
All pipe insulation is not compressed at any point.	
Y-branch and header fittings were properly INSTALLED per details provided in the Multi V Outdoor Unit Installation Manual.	
Y-branch and header fittings were properly SUPPORTED per details provided in the Multi V Outdoor Unit Installation Manual.	
No oil traps, solenoid valves, sight glasses, filter driers, or any other unauthorized refrigerant specialties are present.	
(Optional) High quality R-410A rated full port ball valves (Schrader between the valve body and the indoor units) used at all indoor units and at will in the refrigerant piping network.	
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.	
Inverted traps on vapor lines installed if required per installation manual.	





# INSTALLATION CHECKLIST

PAGE 2



## Heat Recovery Unit

Description	Check
Heat recovery unit is installed properly: Cannot be installed upside down or at any angle. It must be installed indoors, top-side up, level.	
Piping is insulated properly per the design engineer's specifications. Insulation is snug against the housing of the heat recovery unit.	
DIP switches and rotary dial settings are correct.	
If large capacity indoor unit, a Y-branch is installed properly.	

## 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).	
Condensate lines are properly insulated to prevent condensation.	

## Power Wire and Communications Cables

Description	Check
Power wiring was connected to a single phase 208-230V source.	
Ground wire was installed and properly terminated at the unit.	
The power supplied was clean with voltage fluctuations within specifications. ( $\pm 10\%$ of nameplate).	
Power wiring to the outdoor unit (s) was installed per all local, state, and NEC requirements.	
Power wiring to the indoor units was installed per all local, state, and NEC requirements.	
Communications cable between the outdoor unit(s) and indoor units was connected in a daisy chain configuration (i.e., single parallel chain). No "Star" or multiple parallel circuits. No cable splices or wire caps were used to connect communications cables.	
Record Communication Voltage Range High _____ VDC    Low _____ VDC	
LG-supplied cable was used between each indoor unit and its zone controller where applicable. No cables were spliced and no wire caps are present.	
Communication type RS-485-BUS type.	
Power wiring to the outdoor unit must be solid or stranded, and must comply with all local and national electrical codes.	
Communication cable between ODU to IDUs / HRUs must be 18 AWG, 2-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. Cable segment shields are tied together.	
Use appropriate crimping tool to attach ring or spade terminals at all power wiring and control cable terminations.	
Only LG-supplied Y-cables and extension cables were used between indoor units.	
All power and control wires were properly separated using the recommended distance provided in the product installation manual.	

**Major Component Rough-In**

**Piping and Insulation**

**Brazing Practices**



# INSTALLATION CHECKLIST

PAGE 4



## Installation—Refrigerant Piping

## Installation—Heat Recovery Unit

## Installation—Condensate Pump / Drain Installation

## Installation—Power Wire and Communications Cables

# PRE-COMMISSIONING CHECKLIST

Page 1

Job Name / Location \_\_\_\_\_ Tag # \_\_\_\_\_

Date: \_\_\_\_\_

Address: \_\_\_\_\_

## Refrigerant Circuit Preparation

Description	Check
Using a copy of the LATS Multi V pipe design diagram, verify the sum of the indoor unit nominal capacity connected to the piping system is between 50% and 130% of the outdoor unit's(s') nominal capacity. If this rule is violated, the system will not start.	
Check all indoor units for power at the unit disconnect and power is present at the indoor unit PCB board. (LED is lit.) <input type="radio"/> DO NOT TURN ON THE UNIT using the ON/OFF button.	
Successful auto address routine is complete. All device addresses have been recorded on the Indoor Unit Device Configuration Worksheet.	
Ensure all field-installed full-port ball valves are open.	
<p>The piping system must hold a constant 550 psig pressure for a minimum of 24 hours with all isolation valves open.</p> <p>Correction Formula: <math>(^{\circ}\text{F Temp. when pressure was applied} - ^{\circ}\text{F Temp. when pressure drop was checked}) \times 0.79 = \text{psig.}</math></p> <p>_____ <math>^{\circ}\text{F}</math> - _____ <math>^{\circ}\text{F}</math> = _____ psig.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Pressure Measurement Data</b></p> <p>Initial Pressure _____ End Pressure _____</p> <p>Start Date _____ End Date _____</p> <p>Start Time _____ End Time _____</p> <p>Initial Ambient Temperature _____ End Ambient Temperature _____</p> </div>	
<p>A triple system evacuation has been performed. Micron gauge reading held at a maximum of 500 for 24 hours with all isolation valves open and without the vacuum pump connected.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Evacuation</b></p> <p>Initial Micron Level _____ End Micron Level _____</p> <p>Start Date _____ End Date _____</p> <p>Start Time _____ End Time _____</p> <p>Rise _____</p> </div>	
Power was energized to the outdoor unit(s) 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 outdoor unit(s).	
None of the outdoor unit(s) service valves have been opened during the installation and preparation of the system for commissioning. (If the valves were opened, the factory refrigerant charge has been released.)	



# PRE-COMMISSIONING CHECKLIST

Page 2

**MULTI V<sup>™</sup>**

## 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 must include changes to the line lengths used for each liquid line segment.	
4. A copy of a completed and verified Installation Checklist for the outdoor unit(s), indoor units, heat recovery unit (for Heat Recovery systems only), and Control Devices. Correct any procedures needing attention before initiating a request for commissioning.	
5. A copy of the air balance report showing proper airflow at all indoor units.	
6. A completed Pre-commissioning Device Configuration Worksheet.	
7. A completed copy of the Pre-commissioning Checklist.	
8. If available, a list of IP addresses obtained from the building owners IT department for each ACP, BacNet, LonWorks, AC Smart devices.	

## Initiate a Commissioning Request

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

Contractor Name: \_\_\_\_\_

(Authorized Signature)

Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_ Date: \_\_\_\_\_

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

**Notes for the LG trained Commissioner**





# PRE-COMMISSIONING CHECKLIST

Page 4



**Notes for the LG trained Commissioner**



# COMMISSIONING NOTES



Job Name / Location \_\_\_\_\_ Tag # \_\_\_\_\_

Date: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

## Refrigerant Circuit Preparation

## Prepare Pre-commissioning Package Documents

## Initiate a Commissioning Request



# COMMISSIONING CHECKLIST EXCEPTION REPORT

**MULTI V<sup>™</sup> S**

Job Name / Location \_\_\_\_\_ Tag # \_\_\_\_\_

Date: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

## Refrigerant Circuit Preparation

## Prepare Pre-commissioning Package Documents

## Initiate a Commissioning Request

Date of Commissioning Report: \_\_\_\_\_

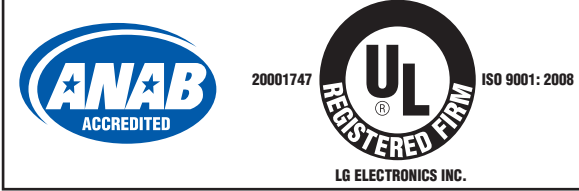
LG Trained Commissioner Name: \_\_\_\_\_

LG Trained Commissioner Signature: \_\_\_\_\_



**To access additional technical documentation such as submittals, indoor unit engineering manuals, installation, service, product data performance, general best practice, and building ventilation manuals, as well as white papers, catalogs, LATS software programs, and more, log in to [www.lghvac.com](http://www.lghvac.com).**

*Inverter*



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