



SINGLE-ZONE CEILING-CONCEALED DUCT (HIGH STATIC) SYSTEM ENGINEERING MANUAL

Single-Zone Ceiling-Concealed
Duct (High Static)
Heat Pump Systems
2 and 3 Tons



PROPRIETARY DATA NOTICE

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DFS-EM-AM-001-US 014D02

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TABLE OF SYMBOLS

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

CONVERGENCE OF TECHNOLOGY, INNOVATION, FLEXIBILITY, & STYLE



About LG Electronics, Inc.

LG Electronics, Inc. is a global leader and technology innovator in consumer electronics, mobile communications, and home appliances, employing more than 213,000 people in more than 60 countries worldwide. LG Electronics, Inc. comprises five business units—Home Entertainment, Mobile Communications, Air Conditioning, Business Solutions, and Home Appliance. LG is one of the world's leading producers of flat panel televisions, audio and video products, mobile handsets, air conditioners, and washing machines. LG's commercial air conditioning business unit was established in 1968 and has built its lineup of residential and commercial products to include VRF, Multi F, duct-free split systems, packaged terminal air conditioners (PTACs), and room air conditioners. In 2011, the air conditioning and energy solutions business unit grew to include LED lighting and solar products. For more information, visit www.lghvac.com.

Duct-Free Split (DFS) Systems

LG HVAC systems offer a range of solutions that are cost efficient, quiet and attractive. Duct-Free Split (DFS) systems are "split" into indoor and outdoor units, and provide a smart alternative to both central HVAC and window-mounted air conditioners. These inverter heat pump systems are available in a variety of configurations to suit different cooling and heating situations. Installation by a qualified HVAC contractor is safe and easy – little to no duct work or sheet metal is required.

Inverter Technology

LG DFS air-source systems offer zoning without the need for zone damper systems. The advanced controls of the ceiling-concealed duct system provide exceptional building dehumidification and temperature control, and can rapidly adapt system operating parameters to the ever changing building load. Single-zone DFS systems are easy to design, install, and maintain. The modular design allows occupants to control their environmental condition, providing individualized control of the set-point temperature and allowing occupants to condition only the occupied zones.

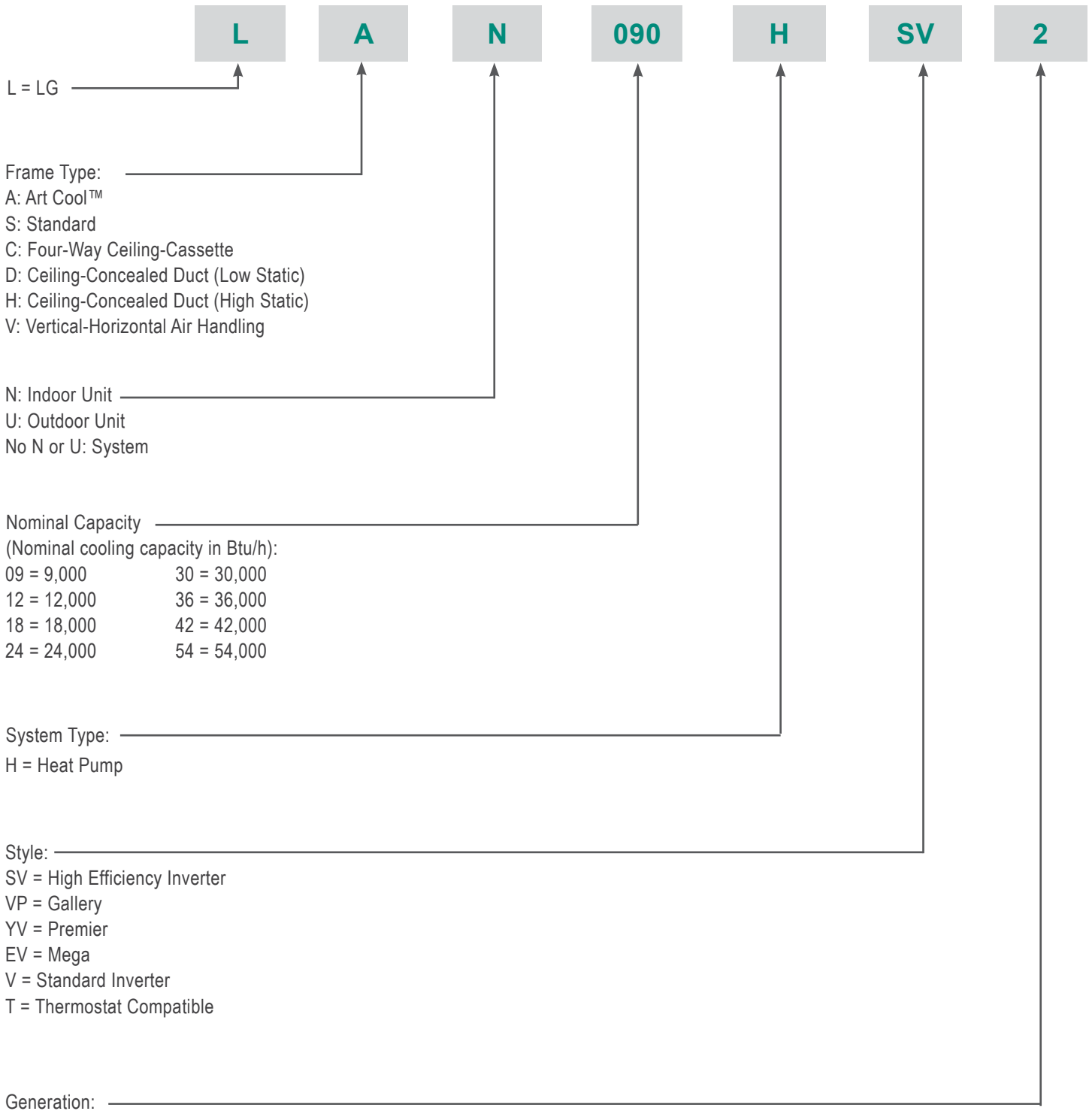
Inverter variable-speed compressors are also measurably quieter and consume less energy than those in conventional air conditioners. The Inverter compressor ramps up or down to match the required room capacity and maintain the comfort level. When the selected temperature is reached, the inverter compressor operates at low speed to maintain that comfort level, thereby using less energy.

Quality Commitment

LG is committed to the success of DFS projects. We provide technical support during installation and commissioning. LG offers a variety of classes designed for installers and service providers on DFS installation. Classes are conducted at LG's training centers and in field locations at various times throughout the year and upon special request.



UNIT NOMENCLATURE



ARCHITECTURAL APPEAL

Convergence of Technological Innovation with Flexibility and Style

Ceiling-Concealed Duct DFS Systems

A ceiling-concealed duct (high static) DFS system provides a system designer an edge to engineer a system with individual control, and design flexibility with advanced controls. Ceiling-concealed duct systems are 208-230V/60Hz/1PH systems available in a nominal capacities of 2 and 3 tons, and are best suited for applications with zones that require heating or cooling, such as residential, and small business office buildings.

Inverter Technology

LG ceiling-concealed duct (high static) air-source systems offer zoning without the need for zone damper systems. The advanced controls of the ceiling-concealed duct system provide exceptional building dehumidification and temperature control, and can rapidly adapt system operating parameters to the ever changing building load. Single-zone ceiling-concealed duct systems are easy to design, install, and maintain. The modular design allows occupants to control their environmental condition, providing individualized control of the set-point temperature and allowing occupants to condition only the occupied zones.

Inverter variable-speed compressors are also measurably quieter and consume less energy than those in conventional air

conditioners. The Inverter compressor ramps up or down to match the required room capacity and maintain the comfort level. When the selected temperature is reached, the inverter compressor operates at low speed to maintain that comfort level, thereby using less energy.

Adaptable and Flexible

Ceiling-concealed duct DFS systems allow cooling or heating for a single room without the need for extensive remodeling. Long refrigerant piping lengths allow for extra design flexibility in indoor unit installation. These units may be used for a number of residential or commercial environments such as:

- Older homes
- New home construction
- Office buildings
- Restaurants
- Hospitals / Medical facilities
- Schools
- Nursing homes
- Retail establishments
- Houses of worship

Benefits of Ceiling-Concealed Duct (High Static) Systems

- Inverter technology
- Available in 24,000 and 36,000 Btu/h capacities
- All-season use—heat pump models for both cooling and heating capabilities
- Operating ranges for outdoor units of 5°F (DB) to 118°F for cooling; 0°F to 64°F (WB) for heating
- Operating ranges for indoor units of 64°F to 86°F for cooling; 60°F to 86°F for heating
- Quiet operation inside and outside



Figure 1: Ceiling-Concealed Duct (High Static) System.

PRODUCT DATA

“Product Features and Benefits” on page 8

“General Data” on page 9

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“Dimensions” on page 11

“Acoustic Data” on page 15

“Refrigerant Flow Diagrams” on page 18

“Wiring Diagrams” on page 20

“Accessories” on page 24

PRODUCT FEATURES AND BENEFITS

Ceiling-Concealed Duct (High Static) Systems

Single zone ceiling-concealed duct (high static) systems are equipped with inverter components that offer superior load matching and long piping installation. The product works for optimizing power consumption in residential and small office buildings. Using a ducted indoor unit with custom temperature controls allow for precise temperature settings in each zone of the building. Ceiling-concealed duct (high static) indoor units allow flexibility in interior design.

Lower Sound Levels

When outdoor units operate fully loaded, they have one of the quietest sound levels in the industry, operating as low as 48 dB(A). To promote a quiet, comfortable environment, ceiling-concealed duct (high static) indoor units operate as low as 35 dB(A). LG customers often ask if the outdoor unit is running after commissioning is complete. All rotating components are soft-started by the controller using digitally controlled inverters, which reduce undesirable noise caused by fans and compressors cycling on and off.

Comfort Control at its Best

Tight temperature control through precise load matching. Unlike traditional air conditioning control systems, which use thermostatic controls to maintain room temperatures, LG inverters continuously vary the indoor unit fan speed and refrigerant flow, indirectly providing lower and more consistent humidity levels in the conditioned space. The longer the indoor coil temperature is below the dewpoint of the room in conjunction with air movement across the coil, the space humidity level will vary little, compared to technologies that cycle fans and compressors on and off multiple times per hour. The outdoor unit responds by varying the compressor speed and fan motors as needed to maintain system operating pressure. As a result, ceiling-concealed duct systems delivers precise space temperature control.

Inverter Driven

The compressor is optimized to maximize compressor efficiency, which reduces power consumption and monthly utility bills. This inverter technology allows the LG ceiling-concealed duct (high static) outdoor unit to vary the compressor motor shaft speed and deliver an appropriate amount of cooling to the indoor unit. Occupants remain comfortable while utility costs are reduced.

Simplified Installation

The LG ceiling-concealed duct (high static) system simplifies and reduces mechanical and control system design time. The designer no longer has to be concerned with interconnecting chilled and condenser water piping, complicated air distribution duct systems, matching and selecting chillers, towers, pumps, coils, fans, air handlers, or Variable Air Volume (VAV) boxes.

Operating Range

Ceiling-concealed duct (high static) systems are available in 2 or 3 ton capacities. Operating ranges for the outdoor units are Cooling: 5°F DB to 118°F DB; Heating: 0°F WB to 64°F WB.

Compact Size

The LUU247HV outdoor unit has a footprint of 37-13/32 W x 32-27/32 H x 13 D; the LUU247HV outdoor unit has a footprint of 37-13/32 W x 54-11/32 H x 13 D. The LHN247HV indoor unit is 46-17/32 W x 11-23/32 H x 17-23/32 D; the LHN367HV indoor unit is 48-7/16

x 14-31/32 x 23-7/32, allowing the products to be installed in ceiling plenums.

Heat Transfer Efficiency Fin Design with GoldFin™ Coating

All ceiling-concealed duct outdoor units are provided with large surface coils made of copper tubes with louvered aluminum fins designed to maximize unit operating efficiency over a wide range of ambient conditions. Standard from the factory, the LG ceiling-concealed duct outdoor coil fin surface is coated with LG's exclusive GoldFin™ anti-corrosive coating designed to prevent natural surface corrosion of the aluminum fins. This maintains heat transfer properties of the coil for an extended time. A hydrophilic coating is applied to the outdoor unit coil fin surface over the GoldFin coating. This coating enhances the development of heavier water droplets gathering on the fin surface. As a result, the droplets roll off the fin surfaces, delaying the point when frost forms on the coil surface during heating operation. This coating also makes it possible to easily clean the outdoor unit coil using a mild soap.

Other Features

- Inverter (Variable Speed Compressor)
- Auto restart
- Auto operation
- Auto changeover
- Sleep mode
- Internal condensate pump included
- Precision Load Matching
- Follows AHRI 210/240

The following table shows the available outdoor and indoor unit, along with the factory provided controller.

Table 1: Ceiling Concealed Duct (High Static) System Pairing Table

Outdoor Unit Model (Btu/h)		Indoor Unit Model (Btu/h)	Controller
LUU247HV (24,000)	LUU367HV (36,000)	LHN247HV (24,000), LHN367HV (36,000)	PQRCVCLQW
			

GENERAL DATA / SPECIFICATIONS

Table 2: Ceiling-Concealed Duct (High Static) System General Data.

Type	Single Zone Ceiling-Concealed Duct (High Static)	
System (Model) (Indoor Unit / Outdoor Unit)	LH247HV (LHN247HV / LUU247HV)	LH367HV (LHN367HV / LUU367HV)
Nominal Cooling Capacity (Btu/h)	24,000	36,000
Cooling Power Input ¹ (kW)	2.0	2.91
Nominal Heating Capacity (Btu/h)	27,000	40,000
Heating Power Input ¹ (kW)	2.28	3.36
Power Supply V, Ø, Hz ²	208-230 / 1 / 60	
Outdoor Unit Operating Range		
Cooling (°F DB)	5-118	
Heating (°F WB)	0-64	
Indoor Unit Operating Range		
Cooling (°F WB)	57-77	
Heating (°F DB)	59-81	
Indoor Temperature Setting Range		
Cooling (°F)	65-86	
Heating (°F)	61-86	
Unit Data		
Refrigerant Type ³	R410A	
Refrigerant Control	EEV	
Indoor Unit Sound Pressure Level ±3 dB(A) (H/M/L) ⁴	38 / 36 / 35	39 / 38 / 37
Outdoor Unit Sound Pressure Level ±3 dB(A) (Cool/Heat) ⁴	48 / 52	52 / 54
Indoor Unit Net / Shipping Weight (lbs.)	73 / 95	125 / 139
Outdoor Unit Net / Shipping Weight (lbs.)	133 / 146	203 / 227
Power Wiring / Communications Cable (No. x AWG) ²	4 x 18	
Power Supply (No. AWG)	3 x 12	
Compressor (Type x Qty.)	Twin Rotary x 1	
Fan		
Indoor Unit Type x Qty.	Sirocco x 1	
Outdoor Unit Type x Qty.	Propeller x 1	Propeller x 2
Motor / Drive	Brushless Digitally Controlled / Direct	
Airflow Rate		
Indoor Unit (Max. / H / M / L [CFM])	688 / 618 / 530	1,130 / 953 / 706
Outdoor Unit (CFM)	2,048	1,942 x 2
Factory Set (High) External Static Pressure (in. wg)	0.39	
Piping		
Liquid (in.)	3/8	
Vapor (in.)	5/8	
Indoor Unit Condensate Drain O.D. / I.D. (in.)	1-1/4 / 1	
Additional Refrigerant Charge (oz./ft.)	0.43	
Maximum Pipe Length (ft.)	164	246
Piping Length (no additional refrigerant, ft.)	25	
Maximum Elevation Difference (ft.)	98	

EEV: Electronic Expansion Valve

IDU: Indoor Unit

ODU: outdoor Unit

Power wiring is field supplied and must comply with the applicable local and national codes.

This unit comes with a dry helium charge.

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

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

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

¹Power Input is rated at high speed.

²All power/communication cables to be minimum 18 AWG, 4-conductor, stranded, shielded and must comply with applicable and national code.

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

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



ELECTRICAL DATA

Electrical Data

Table 3: Electrical Data.

Nominal Tons	Unit Model No.	Hertz	Voltage	Voltage Range (Min. to Max.)	MCA	MOP	Compressor Quantity	Compressor Motor RLA (Cooling)	Condenser Fan Motor(s)	
									Condenser Fan Quantity.	Condenser Fan Motor FLA
2	LUU247HV	60	208 - 230	187 - 253	18.1	30	1	13.5	1	0.6
3	LUU367HV				24.5	40	1	18.0	2	0.6 x 2

Voltage tolerance is $\pm 10\%$.

Maximum allowable voltage unbalance is 2%.

RLA = Rated Load Amps.

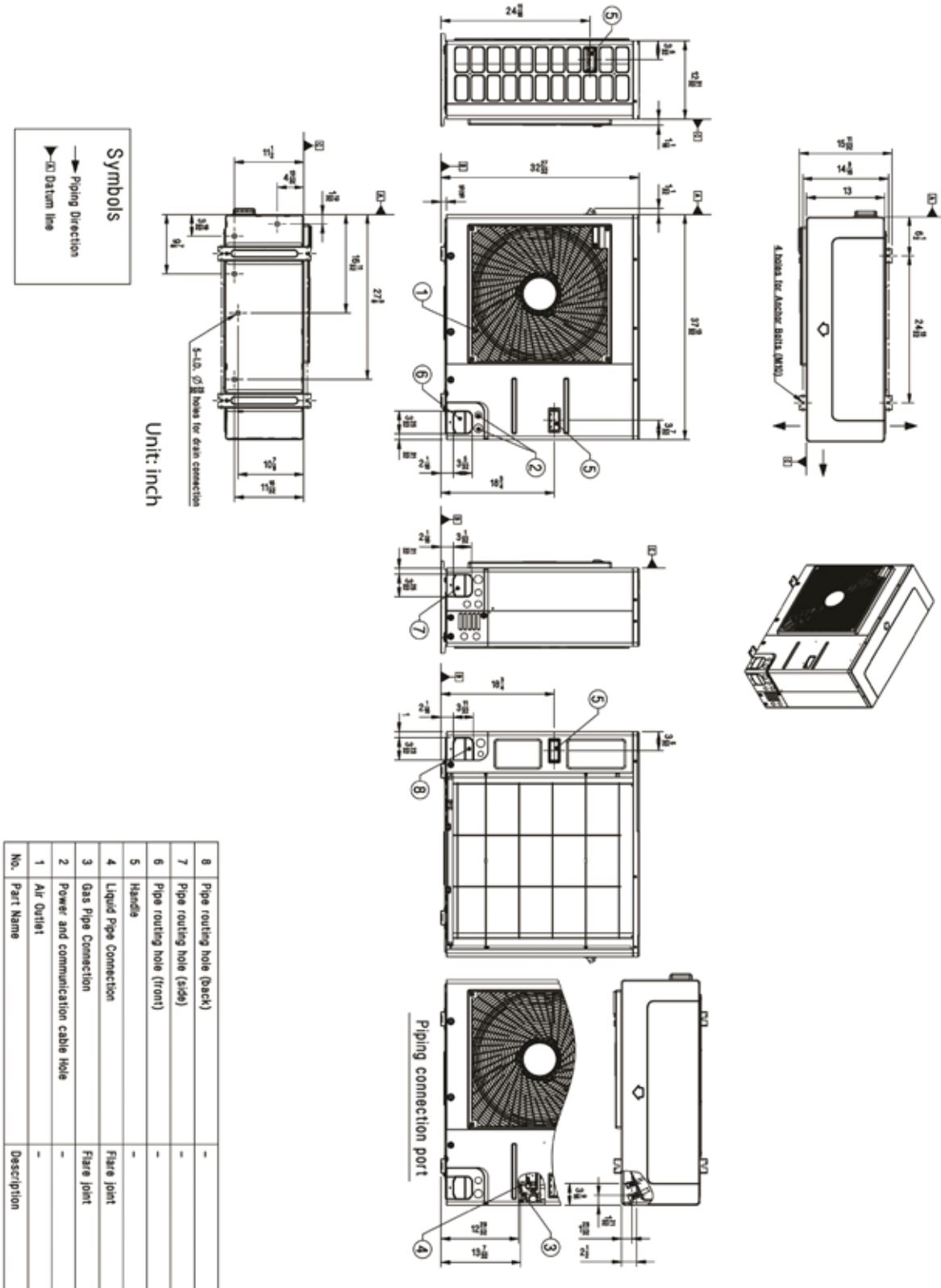
MCA = Minimum Circuit Ampacity.

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

OUTDOOR UNIT DIMENSIONS

LUU247HV

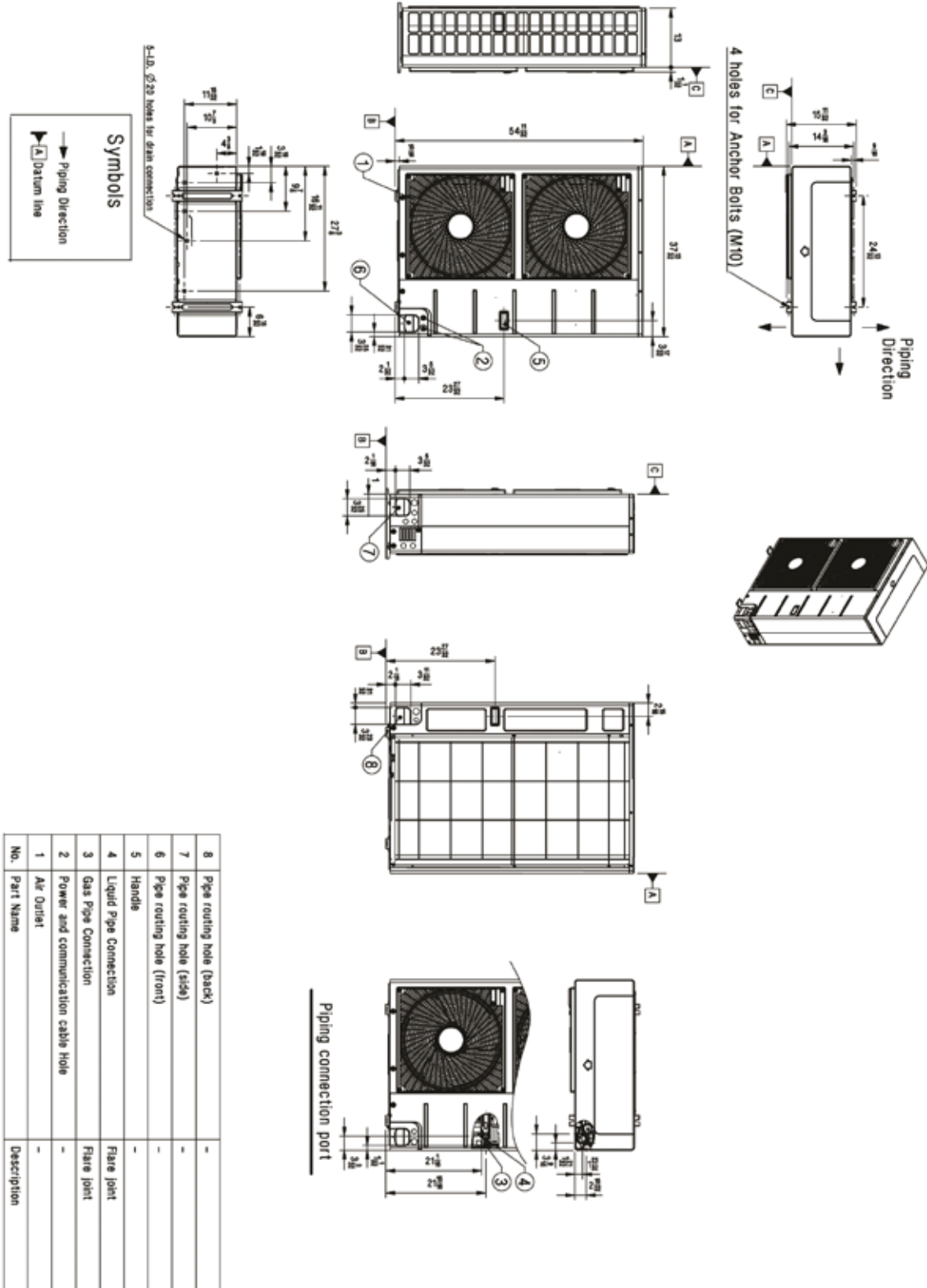
Figure 2: LUU247HV Outdoor Unit Dimensions.



OUTDOOR UNIT DIMENSIONS

LUU367HV

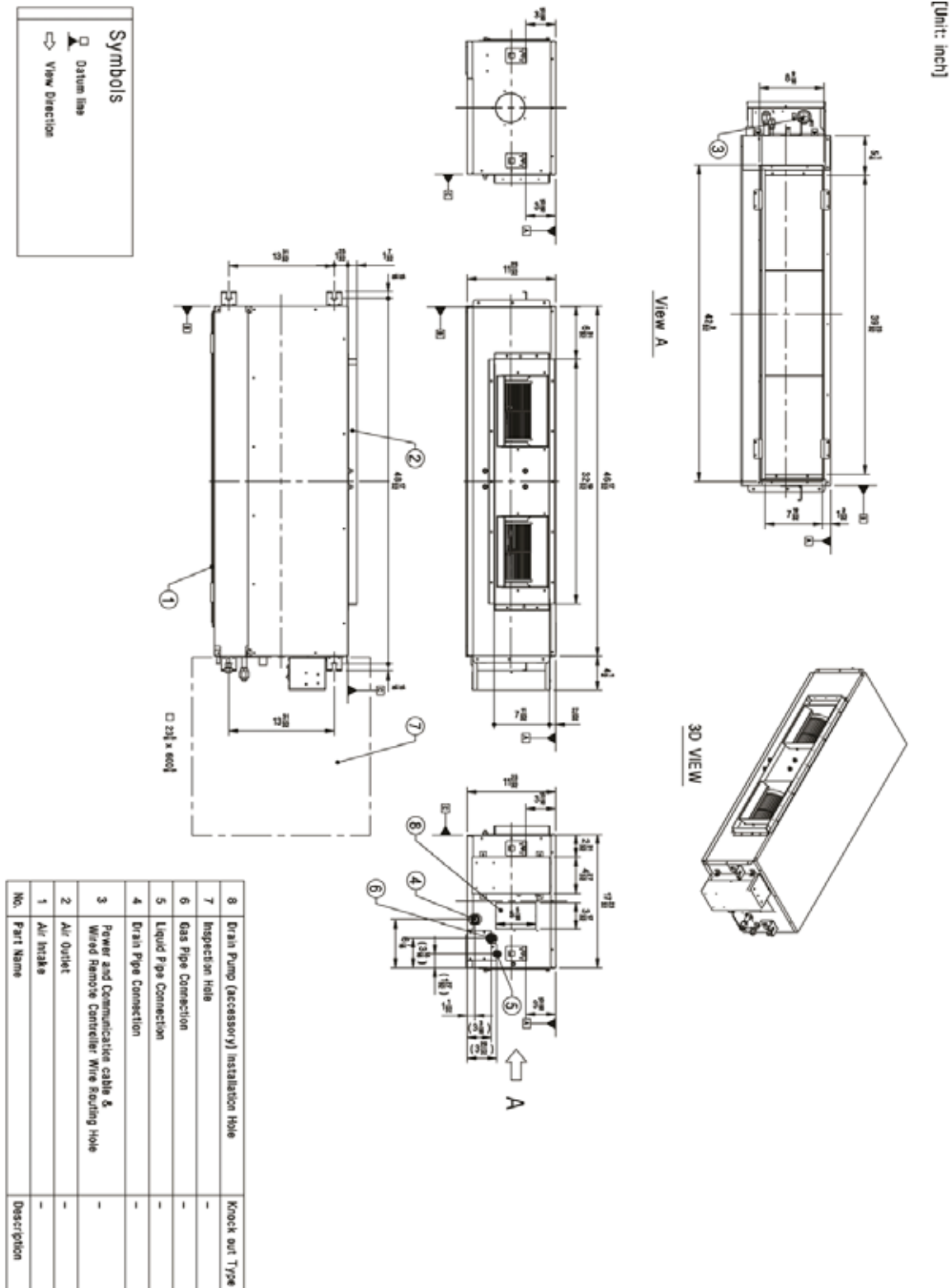
Figure 3: LUU367HV Outdoor Unit Dimensions.



INDOOR UNIT DIMENSIONS

LHN247HV

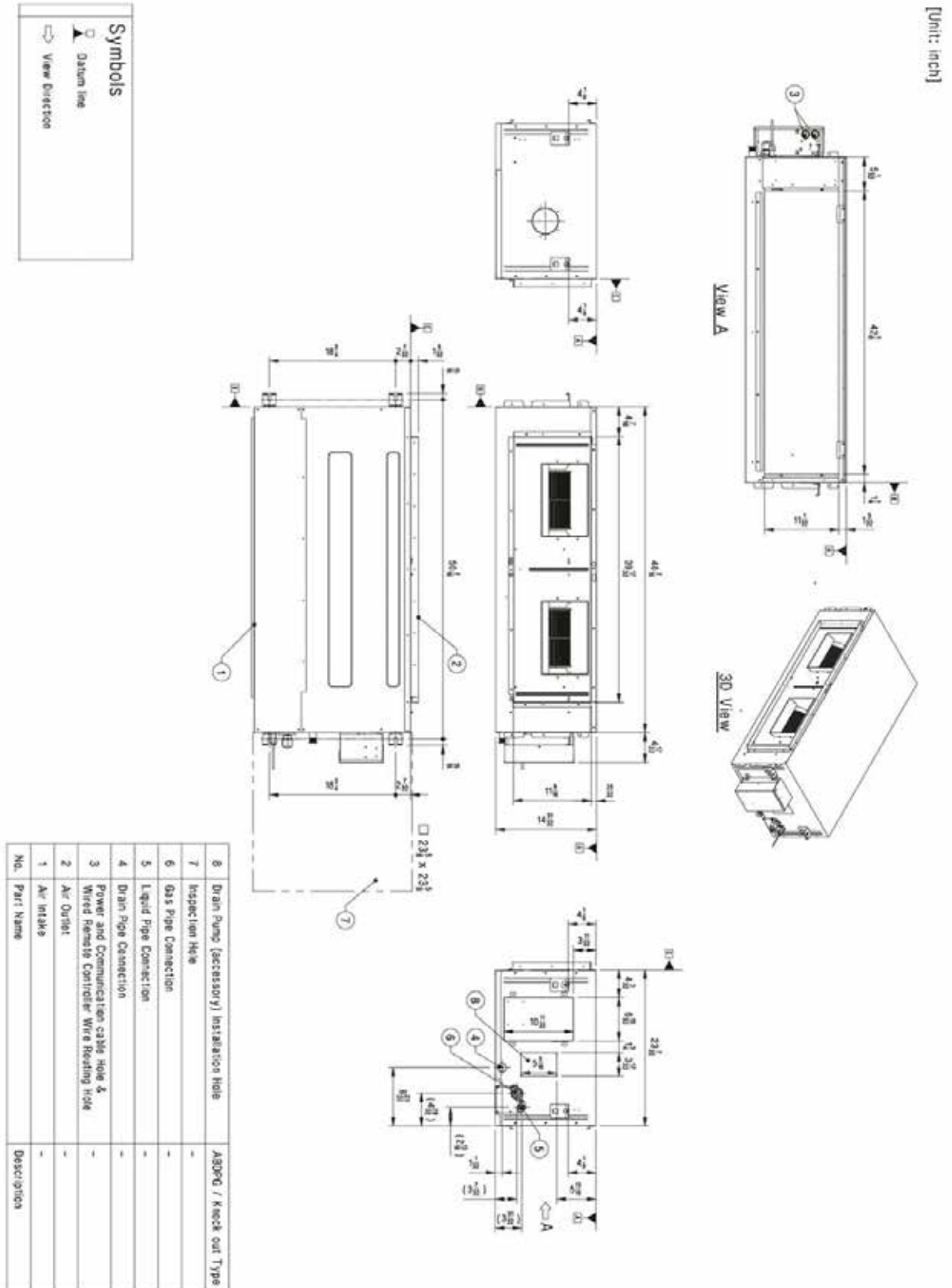
Figure 4: LHN247HV Indoor Unit Dimensions.



INDOOR UNIT DIMENSIONS

LHN367HV

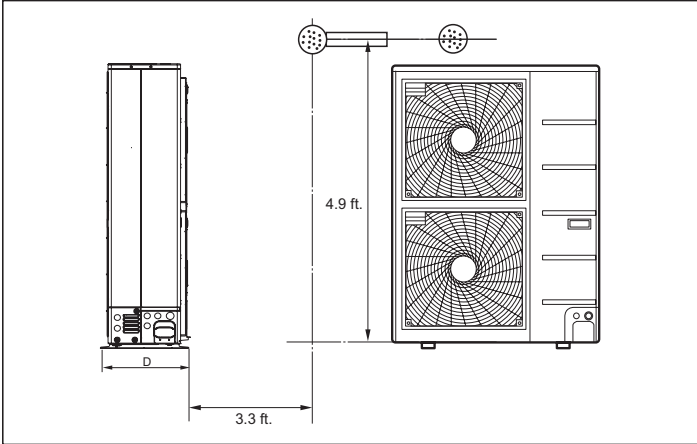
Figure 5: LHN367HV Indoor Unit Dimensions.



ACOUSTIC DATA

Outdoor Units

Figure 6: Ceiling-Concealed Duct (High Static) Outdoor Unit Sound Pressure Level Measurement Location.



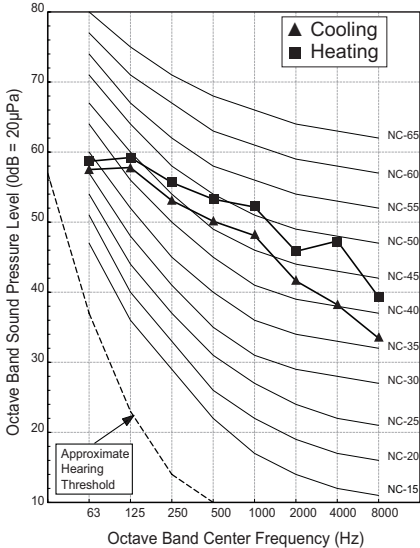
- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) of particular area in which the equipment is installed.
- Sound power levels are measured in dB(A)±3.
- Tested in anechoic chamber per ISO Standard 3745.

Table 4: Ceiling-Concealed Duct (High Static) Outdoor Unit Sound Pressure Levels (dB[A]).

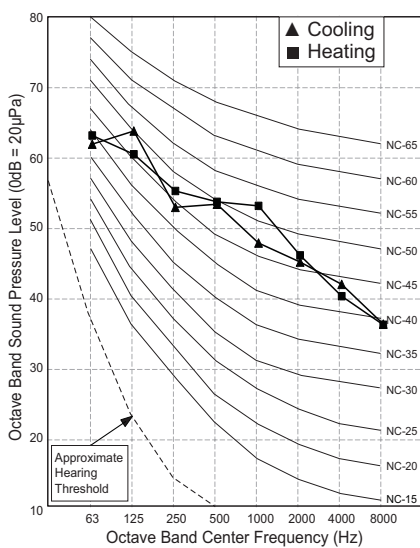
Model	Sound Pressure Levels (dB[A])	
	Cooling	Heating
LUU247HV	48	52
LUU367HV	52	54

Figure 7: Ceiling-Concealed Duct (High Static) Outdoor Unit Sound Pressure Level Diagrams.

LUU247HV



LUU367HV



EXTERNAL STATIC PRESSURE

Indoor Units

Table 5: Ceiling-Concealed Duct (High Static) Indoor Unit External Static Pressure Setting Values Table.

Static Pressure (in. wg)		0.1	0.15	0.23	0.31	0.39	0.47	0.55	0.60	0.62	0.70	0.78
Model No. / Nominal Capacity of System (Btu/h)	Airflow Rate / CFM	Setting Value (in. wg)										
	LHN247HV 24,000	High 688	90	97	108	119	126	134	143	146	149	157
Mid 618		86	93	105	115	123	131	140	143	146	153	156
Low 530		82	90	102	112	120	128	137	140	143	150	153
LHN367HV 36,000	High 1,130	-	96	103	109	115	120	126	129	-	-	-
	Mid 953	-	85	96	102	109	115	121	124	-	-	-
	Low 706	-	76	85	95	100	107	113	116	-	-	-

Note:

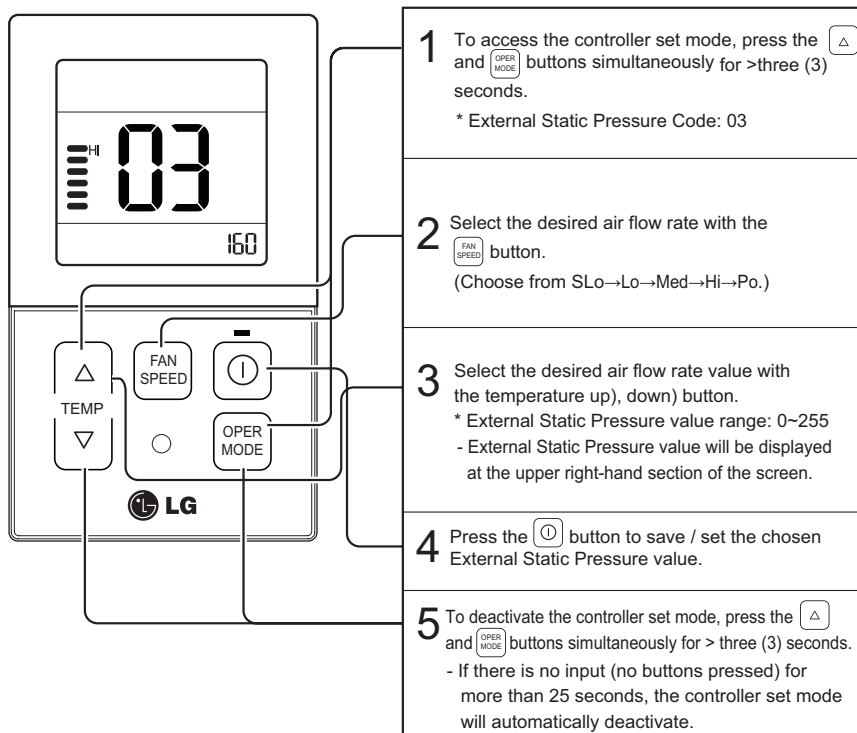
- To get the desired air flow and external static pressure combination, use the setting value from the table. Using a setting value other than that listed in the table will not provide the desired combination.
- Table data is based at 230V. Air flow rate varies according to voltage fluctuation.

Setting the External Static Pressure on the Remote Controller

Use this function to set the wind strength for each airflow level.

⚠ WARNING

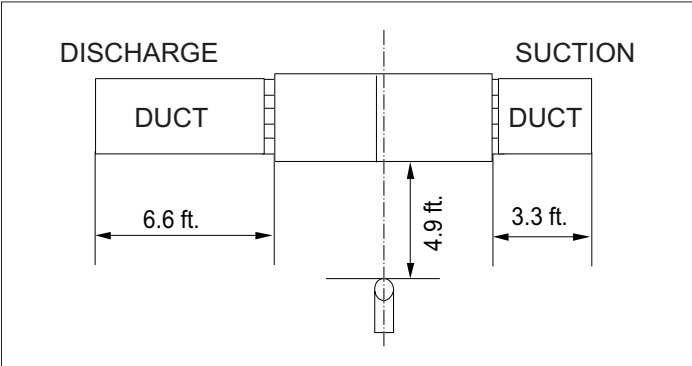
- The external static pressure must be set by a trained service provider, and it must be set correctly. If the external static pressure is set incorrectly, the product may malfunction.
- Do not alter the external static pressure value that corresponds to each airflow level.
- External static pressure values vary according to the model.
- When the airflow rate is increased to a higher value, during the external static value setup, the previous airflow value will be stored in the system memory. (External static pressure values are saved to system memory before the changes are implemented).



ACOUSTIC DATA

Indoor Units

Figure 8: Indoor Unit Sound Pressure Level Measurement Location.

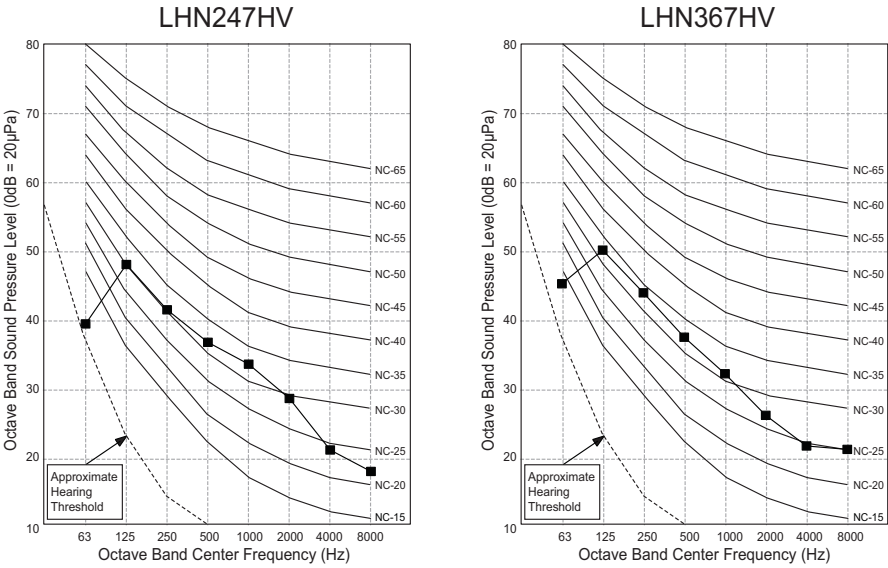


- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) of particular area in which the equipment is installed.
- Sound power levels are measured in dB(A)±3.
- Tested in anechoic chamber per ISO Standard 3745.

Table 6: Ceiling-Concealed Duct (High Static) Indoor Unit Sound Pressure Levels (dB[A]).

Model	Sound Pressure Levels (dB[A])		
	H	M	L
LHN247HV	38	36	35
LHN367HV	39	38	37

Figure 9: Ceiling-Concealed Duct (High Static) Indoor Unit Sound Pressure Level Diagrams.



OUTDOOR UNIT REFRIGERANT FLOW DIAGRAM

LUU247HV and LUU367HV

Cooling / Heating Mode

Figure 10: LUU247HV and LUU367HV Refrigerant Flow Diagram.

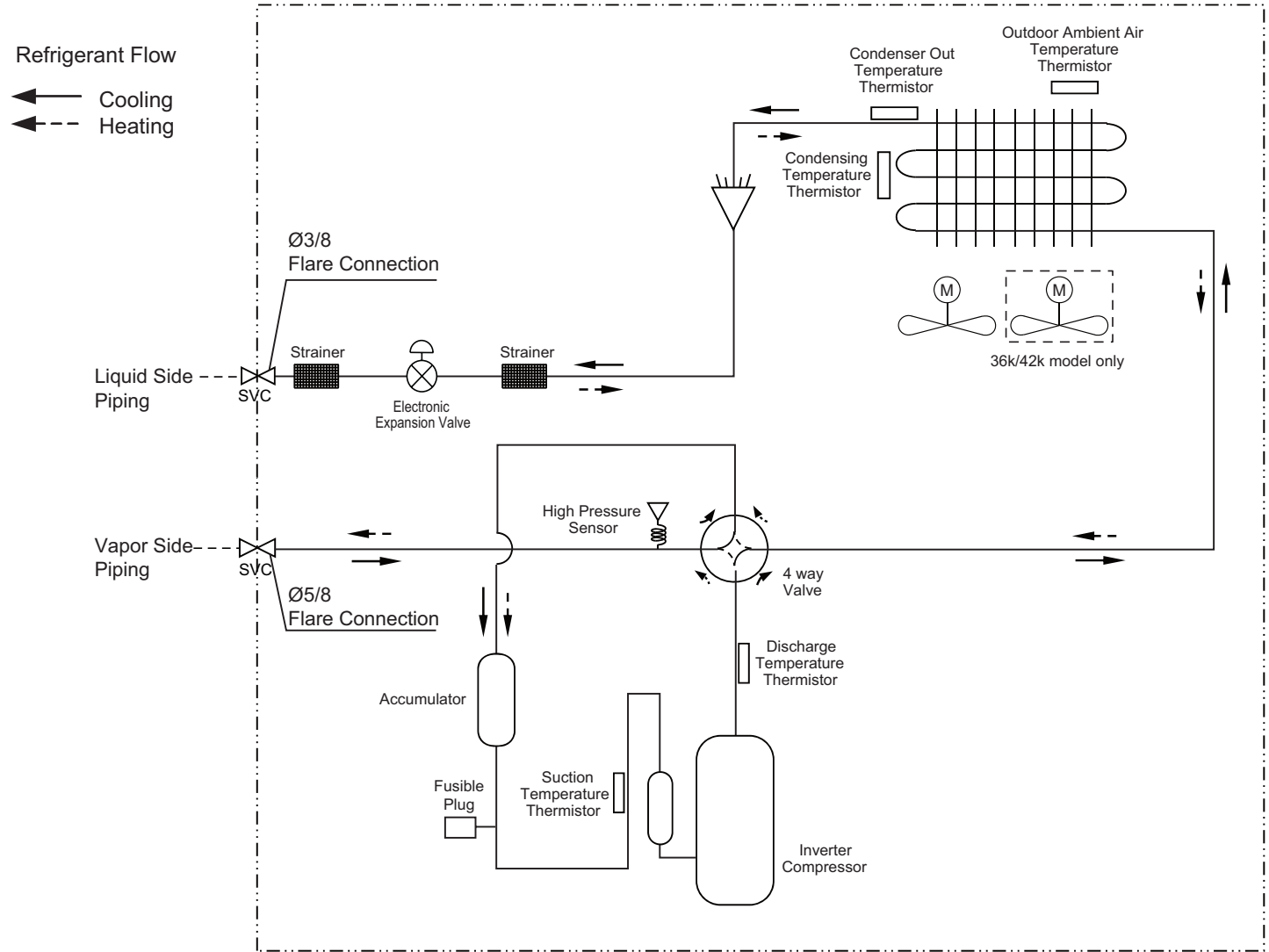


Table 7: Ceiling-Concealed Duct (High Static) Outdoor Unit Thermistor Details.

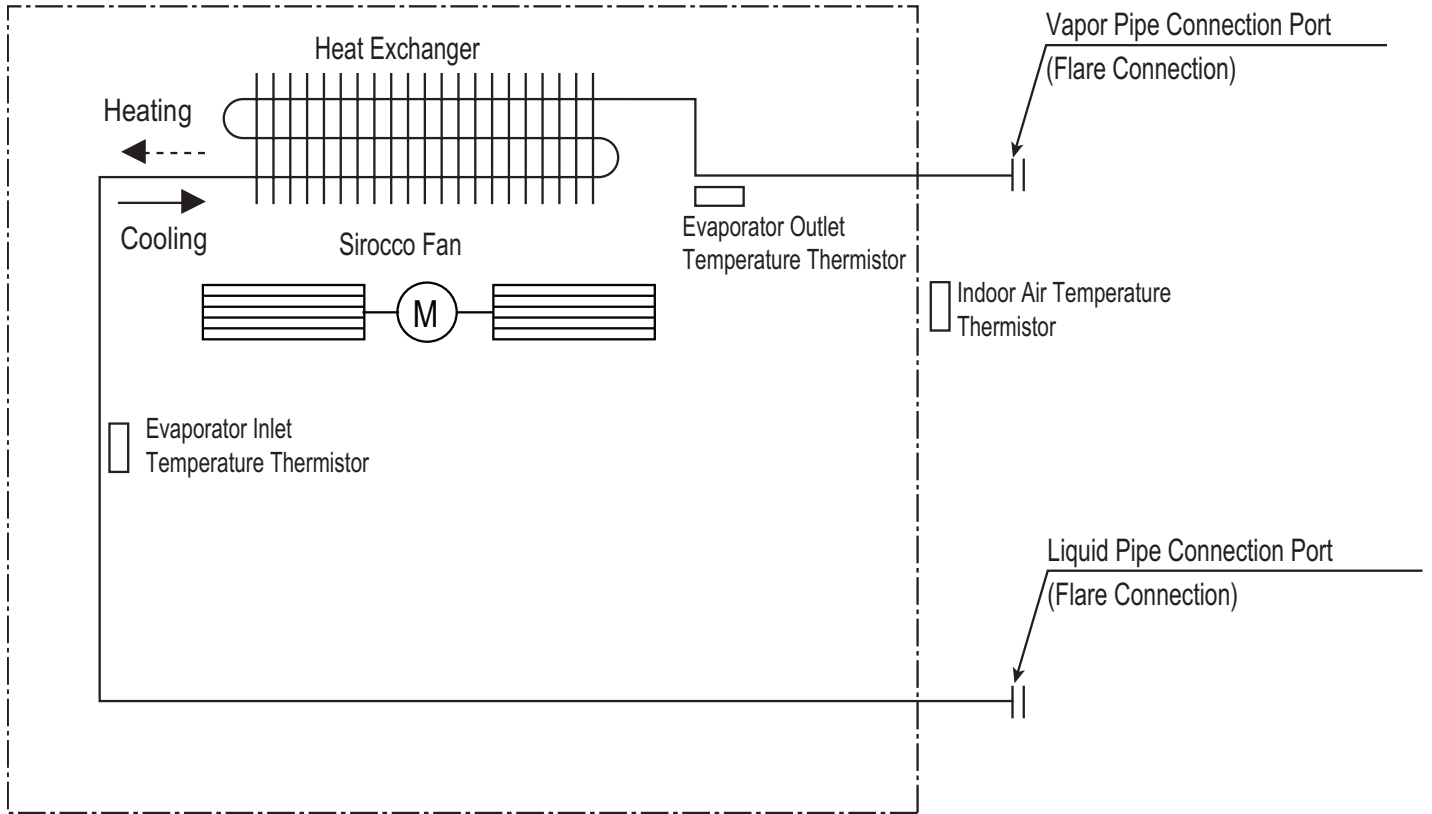
Description (Based on Cooling Mode)	PCB Connector	
	LUU247HV	LUU367HV
Suction Temperature Thermistor	CN-TH3	CN-TH3
Discharge Temperature Thermistor	CN-TH3	CN-TH3
Condenser Outlet Temperature Thermistor	CN-TH2	CN-TH2
Outdoor Ambient Air Temperature Thermistor	CN-TH2	CN-TH2
Condenser Inlet Temperature Thermistor	CN-TH4	CN-TH4
Pressure Sensor	CN-TH1	P-SENSOR(H)

INDOOR UNIT REFRIGERANT FLOW DIAGRAM

Cooling / Heating Mode

LHN247HV and LHN367HV

Figure 11: LHN247HV and LHN367HV Refrigerant Flow Diagram.



Product Data

Table 8: Ceiling-Concealed Duct (High Static) Indoor Unit Refrigerant Pipe Connection Port Diameters.

Model No.	Vapor (inch)	Liquid (inch)
LHN247HV	5/8	3/8
LHN367HV		

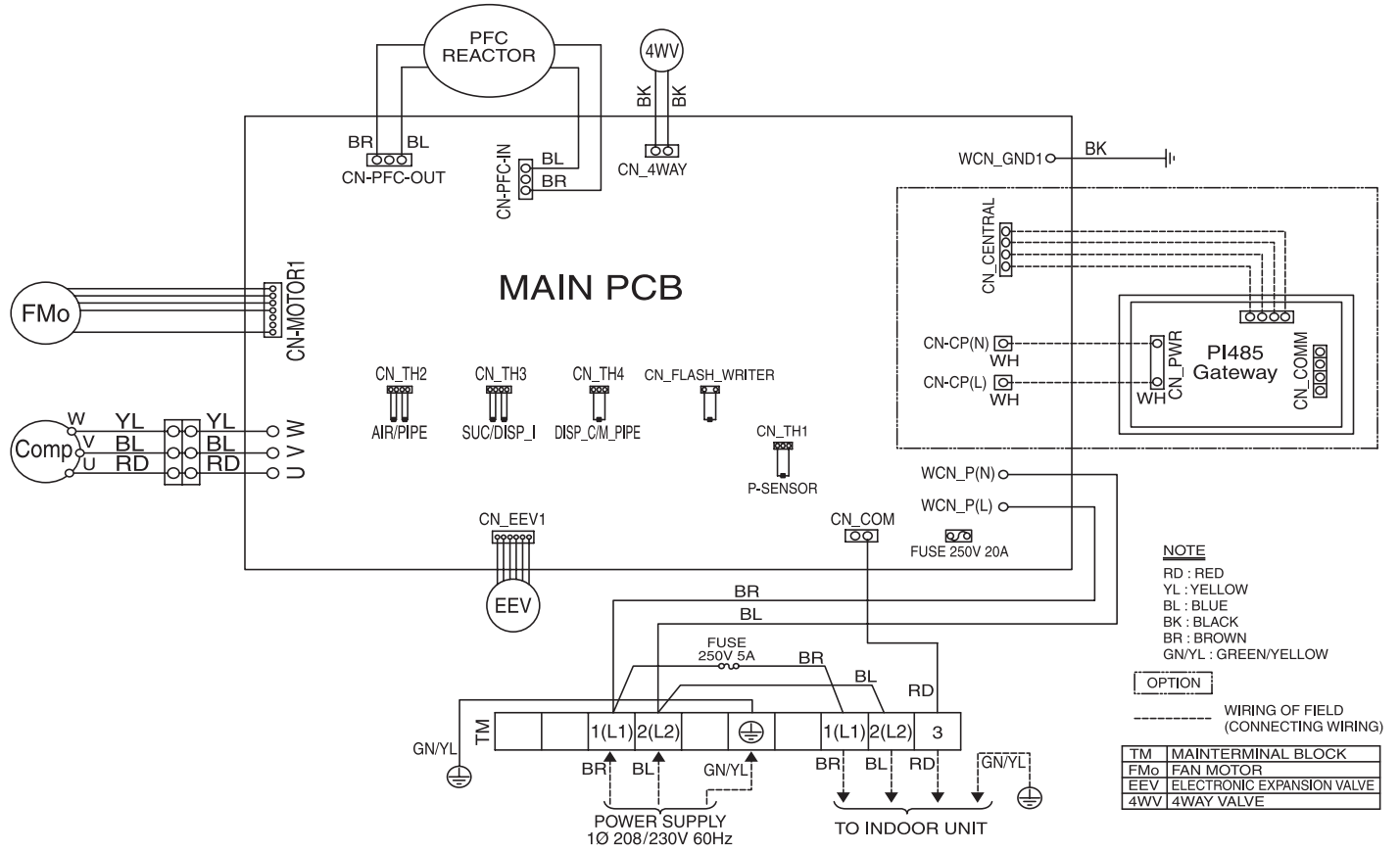
Table 9: Ceiling-Concealed Duct (High Static) Indoor Unit Thermistor Details.

Description (Based on Cooling Mode)	PCB Connector
Indoor Air Temperature Thermistor	CN-ROOM
Evaporator Inlet Temperature Thermistor	CN-PIPE / IN
Evaporator Outlet Temperature Thermistor	CN-PIPE / OUT

OUTDOOR UNIT WIRING DIAGRAM

LUU247HV

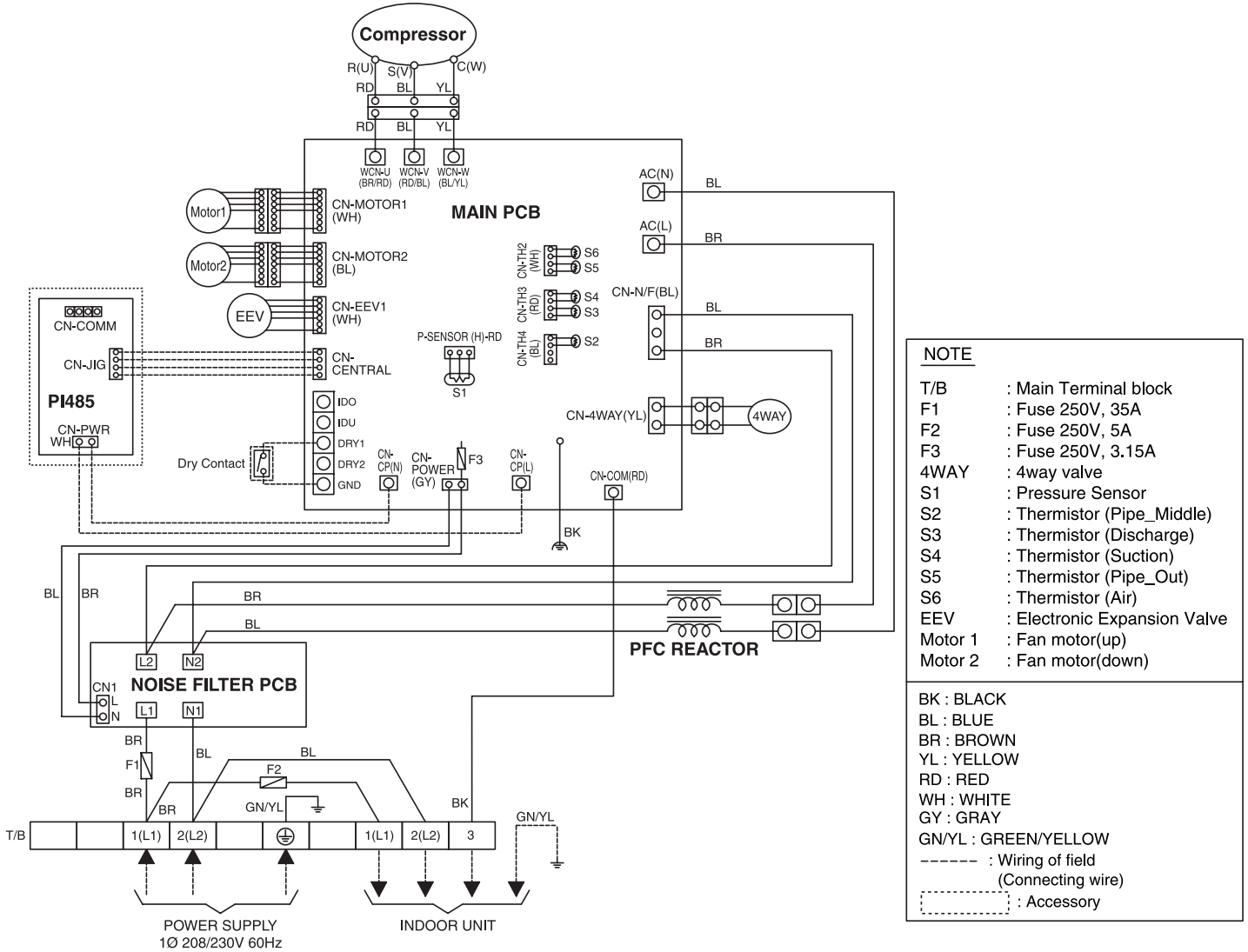
Figure 12: Ceiling-Concealed Duct (High Static) LUU247HV Outdoor Unit Wiring Diagram.



OUTDOOR UNIT WIRING DIAGRAM

LUU367HV

Figure 13: Ceiling-Concealed Duct (High Static) LUU367HV Outdoor Unit Wiring Diagram.

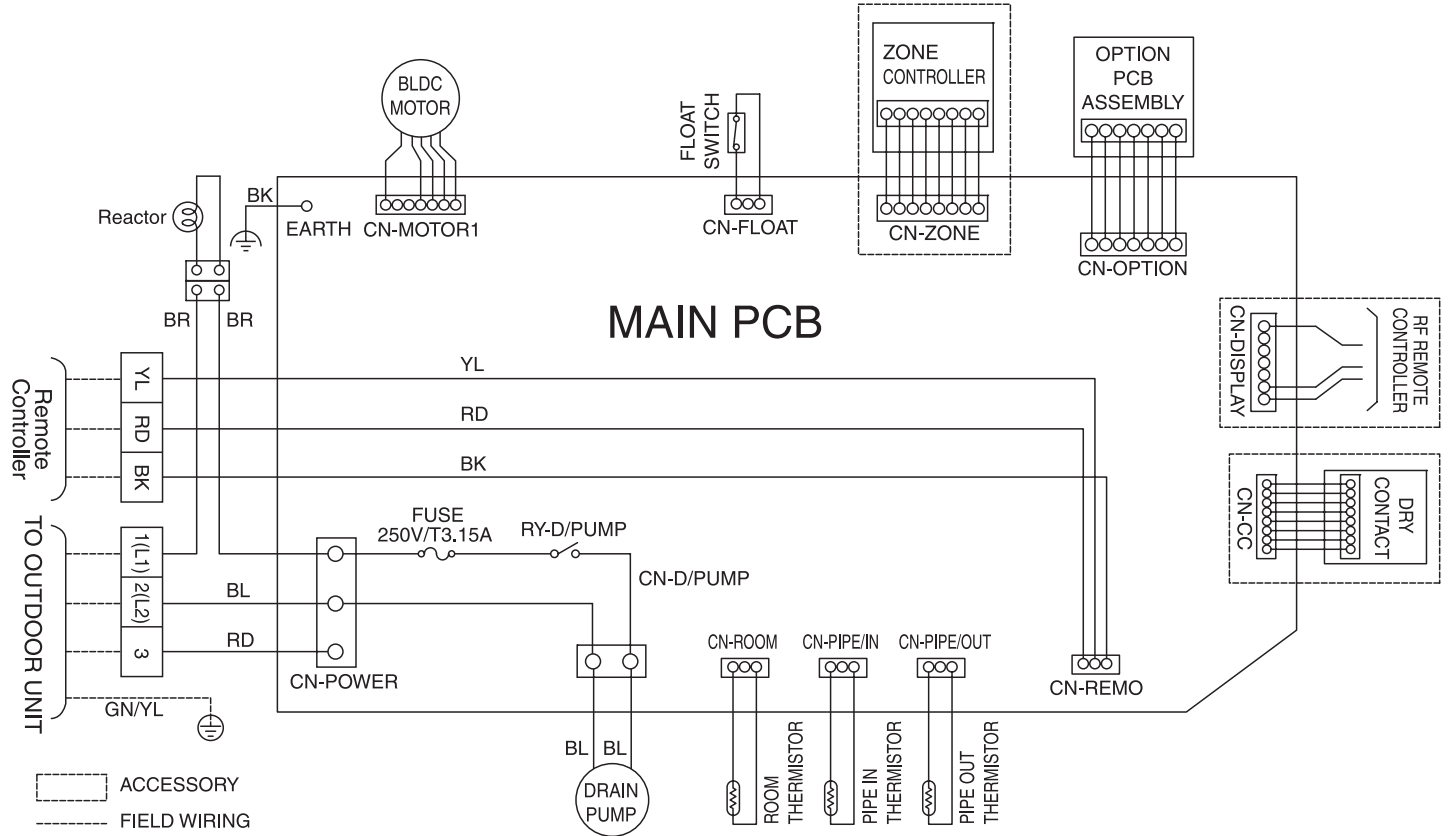


Product Data

INDOOR UNIT WIRING DIAGRAM

LHN247HV

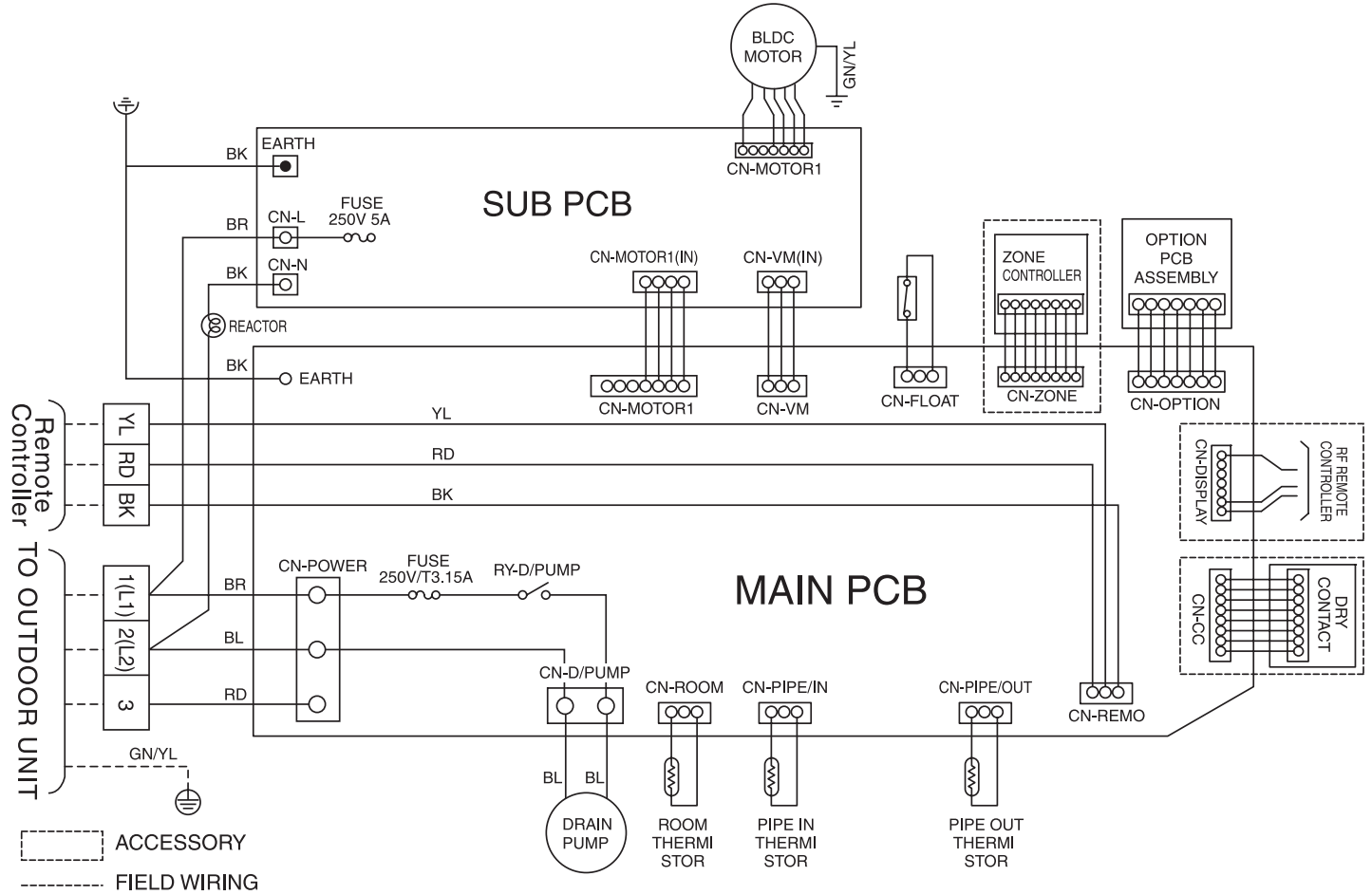
Figure 14: Ceiling-Concealed Duct (High Static) LHN247HV Indoor Unit Wiring Diagram.



INDOOR UNIT WIRING DIAGRAM

LHN367HV

Figure 15: Ceiling-Concealed Duct (High Static) LHN367HV Indoor Unit Wiring Diagram.








Product Data

ACCESSORIES

Zone Controllers



Table 10: Summary Data—Zone Controllers.

Zone Controller	Name	Model / Part No.	Case Color	Max. Wire Length (ft.)	Description
	Simple Controller with Mode Selection	PQRCVCL0	Black	164	Allows control of indoor unit ON / OFF, operation mode, fan speed, and temperature setpoint for up to 16 indoor units. Included with Ceiling-Concealed Duct (High Static ¹) indoor units.
		PQRCVCL0QW	White		
	Simple Controller without Mode Selection	PQRCHCA0	Black	164	Allows control of indoor unit ON / OFF, fan speed, and temperature setpoint for up to 16 indoor units.
		PQRCHCA0QW	White		
	LG 7-Day Programmable Thermostat	PREMTB10U	White	164	Allows control of indoor unit ON / OFF, operation mode, occupied / unoccupied temperature setpoints, fan speed, and airflow direction for up to 16 indoor units. Programmable schedule with five events per day.
	Wireless Handheld Controller	PQWRHDF0	Ivory	-	Allows control of indoor unit ON / OFF, operation mode, fan speed, and temperature setpoint. Also provides subfunction control. Optional accessory for Duct indoor units with use of wired controller.
	Wall-Mounted Remote Temperature Sensor	PQRSTA0	Ivory	50	Allows remote temperature measurement for four-way ceiling cassette, ceiling-concealed duct indoor units.

Before specifying or placing an order, refer to the V-Net Network Solutions Engineering Product Data Book, and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

For information on controller capabilities, refer to the Controls and Options Table on page 27.

Table 11: Summary Data— Zone Controller Communication Cables.

Communication Cable	Name	Model No.	Max. Wire Length (ft.)	Description
	Wired Remote Group Control Cable Assembly	PZCWRCG3	32	Required when grouping multiple indoor units with a single zone controller.
	Wired Remote / Group Control Extension Cable	PZCWRC1	32	Increases the distance between a remote controller and an indoor unit.




Before specifying or placing an order, refer to the V-Net Network Solutions Engineering Product Data Book, and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

For information on controller capabilities, refer to the Controls and Options Table on page 27.

ACCESSORIES

Specialty Application Devices

Table 12: Summary Data—Specialty Application Devices.

Specialty Application Device	Name	Model No.	Connects to	Application	Binary Signals Input / Output	Description
	Dry Contact Unit 24 VAC	PQDSB1	Indoor Unit	ON / OFF, Run Status, Error Status	1 / 2	Enables the indoor unit to be controlled and monitored by third-party controls using binary inputs and outputs.
	Dry Contact Unit for Setback	PQDSBC		ON / OFF, Mode, Controller Lock, Power Save, Run Status, Error Status	2 / 2	
	Dry Contact Unit for Thermostat	PQDSBNGCM1		ON / OFF, Thermo ON / OFF, Mode, Fan Speed, Run Status, Error Status	—	
	PI-485 V-net Control Integration Board	PMNFP14A0/A1	Outdoor Unit	—	—	Control integration to LG V-net controls (AC Smart Premium, ACP, BACnet, LonWorks, etc.)
	Digital Output (DO) Kit	PQNFP00T0	Comm. BUS	ON / OFF	0 / 1	One 25A DPST normally open relay. Used with central controller to control third-party device manually or by schedule.




Before specifying or placing an order, refer to the V-Net Network Solutions Engineering Product Data Book, and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

For information on controller capabilities, refer to the Controls and Options Table on page 27.

ACCESSORIES

Central Controllers / Integration Solutions



Table 13: Summary Data—Central Controllers (Connect to the Outdoor Unit Through the PI-485 Board accessory, sold separately).

Central Controller	Name	Model No.	Devices per Controller	Systems per Comm. BUS	Devices per Comm. BUS	No. of Comm. BUS ports	Binary Signals Input / Output	Power / Connection	Description
	AC Smart Premium	PQCSW421E0A	128	16	128	1	2 DI / 2 DO	24 VAC	Provides for scheduling, auto-changeover, setback, remote controller lock, setpoint range limit, run time limit, web access, email alarm notification, visual floorplan navigation, peak/demand control, software device interlocking, PDI integration, and AC Manager Plus integration advanced functionality in addition to basic unit control and monitoring.
	AC Ez	PQCSZ250S0	32	16	256	1	—	12 VDC / Outdoor Unit	Provides for scheduling in addition to basic indoor unit control and monitoring.
	Advanced Control Platform (ACP) Standard	PQCPC22N1	256	16	64 (128 with PDI Premium)	4	2 / 2	24 VAC	Provides for scheduling, remote controller lock, setpoint range limit, web access, peak / demand control, PDI integration, and AC Manager Plus integration advanced functionality in addition to basic unit control and monitoring.
	Advanced Control Platform (ACP) Premium	PQCPC22A1	256	16	64 (128 with PDI Premium)		10 / 4	24 VAC	

Before specifying or placing an order, refer to the V-Net Network Solutions Engineering Product Data Book, and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

For information on controller capabilities, refer to the Controls and Options Table on page 27.

Table 14: Summary Data—Integration Solutions (Connect to Outdoor Unit Through the PI-485 Board accessory, sold separately).

Central Controller	Name	Model No.	Devices per Controller	Systems per Comm. BUS	Devices per Comm. BUS	No. of Comm. BUS ports	Binary Signals Input / Output	Power / Connection	Description
	BACnet® Gateway	PQNFB17C1	256	16	64 (128 with PDI Premium)	4	2 / 2	24 VAC	Allow integration of LG equipment for control and monitoring by open protocol BACnet and LonWorks building automation and controls systems.
	LonWorks® Gateway	PLNWKB100	64	16	64 (128 with PDI Premium)	1	2 / 2	24 VAC	

Before specifying or placing an order, refer to the V-Net Network Solutions Engineering Product Data Book, and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

For information on controller capabilities, refer to the Controls and Options Table on page 27.

ACCESSORIES

Functions, Controls, and Options

Table 15: Indoor Units—Functions, Controls and Options.

Indoor Unit Type		Ceiling Concealed (High Static) Ducted
Air-flow	Air supply outlets	2
	Airflow steps (fan/cool/heat)	3 / 3 / 3
	Washable anti-fungal ¹	√
Operation	Drain pump	√
	E.S.P. control	√
	Hot Start	√
	Self diagnostics	√
	Soft Dry (dehumidification)	√
	Auto changeover	√
	Auto restart	√
	Child lock	o
	Group control – Requires the use of one Group Control Cable Kit (PZCWRCG3) for every additional indoor unit	o
	Sleep mode	√
	Timer (on/off)	√
	Weekly schedule	√
	Two thermistor control	o
	Controllers	7-Day programmable controller
Simple wired remote controller		√
Wireless LCD remote control		o ²
Dry contact		o
Dry contact (temperature setting)		o
Central control (LGAP)		√

¹Primary washable filters.

√ = Standard feature

²Requires wired zone controller.

o = Unit option

Table 16: Ceiling-Concealed Duct (High Static) Indoor Unit Accessories Overview.

Model No.	Description
ZFBXBG01A	High Efficiency Filter Box
ZFBXD201A	Dynamic V8 2VL Low Profile Air Cleaner
ZPLMV201A	Dynamic 2VL Air Cleaner Low Profile Return Air Plenum
ZFBXD402A	Dynamic V8 4VL Low Profile Air Cleaner
ZPLMV402A	Dynamic 4VL Air Cleaner Low Profile Return Air Plenum
ZFLT1301A	4-Pack Dynamic V8 VL Air Cleaner Replacement Filter Pads
ZFLT1302A	24-Pack Dynamic V8 VL Air Cleaner Replacement Filter Pads
ZGRLRA01A	Dynamic V8 Air Cleaner Louvered Return Air Grille (one per plenum)
ZGRLRA02A	Dynamic V8 Air Cleaner Egg Crate Return Air Grille (one per plenum)

ACCESSORIES

LGMV Diagnostic Software

LG Monitoring View (LGMV) Diagnostic Software and Cable

LGMV software allows the service technician or commissioning agent to connect a computer USB port to the outdoor unit main printed circuit board (PCB) using an accessory cable without the need for a separate interface device. The main screen for LGMV allows the user to view the following real time data on one screen:

- Actual inverter compressor speed
- Target inverter compressor speed
- Actual outdoor fan speed
- Target outdoor unit fan speed
- Actual superheat
- Inverter compressor current value
- Outdoor air temperature
- Actual high pressure/saturation temperature
- Actual low pressure/saturation temperature
- Suction temperature
- Inverter compressor discharge temperature
- Outdoor coil pipe temperature
- Liquid line 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
- Total number of connected indoor units (for multi zone systems)
- Communication indicator lights
- Unit error code

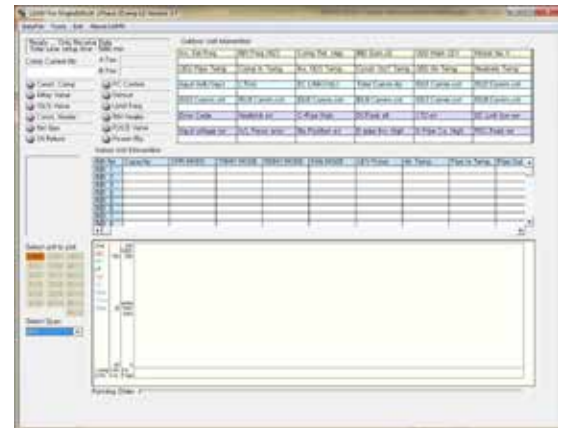


- Indoor unit capacity
- Indoor unit operating mode
- Indoor unit fan speed
- Indoor unit room temperature
- Indoor unit inlet pipe temperature
- Indoor unit outlet pipe temperature

Additional information that can be gathered from the main screen:

1. Graph: Graphic shows the following:
 - Compressors showing actual speeds
 - Temperature sensors
 - EEVs
 - IDUs
 - Low and high pressures
 - Four-way reversing valve
 - Outdoor fans showing status and speeds
2. Setting: Converts metric values to imperial values.
3. Making Data: Recording of real time data to a separate file created to be stored on the user's computer.
4. Loading Data: Recorded data from a saved ".CSV" file can be loaded to create an LGMV session.
5. Electrical Data: The lower half of main screen is changed to show the following:
 - Inverter compressor
 - Power Hz
 - Amps
 - Volts
 - Inverter control board fan Hz

Figure 16: MV Diagnostic Screen



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

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

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

Recommended Minimum PC Configuration:

- CPU: Pentium® IV 1.6 GHz
- Operating System: Windows® NT/2000/XP/Vista
- Main Memory: 256 MB
- Hard Disk: 600 MB when operating
- Web Browser: Internet Explorer® 5.0

PERFORMANCE DATA

“Cooling Capacity Data” on page 30

“Heating Capacity Data” on page 32

PERFORMANCE DATA

Cooling Capacity Tables

Table 17: LH247HV Ceiling-Concealed Duct (High Static) System Cooling Capacity Table.

Model No. / Nominal Capacity (Btu/h)	Outdoor Air Temp. (°F DB)	Indoor Air Temp. °F DB / °F WB																	
		68 / 57			73 / 61			77 / 64			80 / 67			86 / 72			90 / 75		
		TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI
LH247HV 24,000	5	23.77	19.04	0.80	25.25	20.11	1.08	26.73	20.70	1.17	27.79	19.88	1.19	29.68	20.05	1.19	31.15	20.43	1.19
	10	23.74	19.18	0.82	25.21	20.26	1.11	26.69	20.85	1.20	27.75	20.03	1.22	29.64	20.20	1.22	31.11	20.58	1.22
	15	23.70	19.32	0.84	25.18	20.41	1.14	26.65	21.00	1.24	27.71	20.17	1.25	29.59	20.34	1.26	31.07	20.73	1.25
	20	23.67	19.45	0.86	25.14	20.55	1.17	26.61	21.15	1.27	27.67	20.32	1.29	29.55	20.49	1.29	31.02	20.88	1.29
	25	23.64	19.59	0.89	25.10	20.70	1.20	26.57	21.30	1.30	27.63	20.46	1.32	29.51	20.63	1.32	30.98	21.02	1.32
	30	23.60	19.73	0.91	25.07	20.84	1.23	26.53	21.45	1.33	27.59	20.60	1.35	29.47	20.78	1.36	30.93	21.17	1.35
	35	23.57	19.87	0.93	25.03	20.98	1.26	26.50	21.60	1.37	27.55	20.75	1.39	29.42	20.92	1.39	30.89	21.32	1.39
	40	23.53	20.00	0.95	25.00	21.13	1.29	26.46	21.75	1.40	27.51	20.89	1.42	29.38	21.06	1.42	30.84	21.46	1.42
	45	23.50	20.14	0.98	24.96	21.27	1.32	26.42	21.90	1.43	27.47	21.03	1.45	29.34	21.21	1.46	30.80	21.61	1.45
	50	23.47	20.27	1.00	24.92	21.41	1.35	26.38	22.04	1.46	27.43	21.17	1.49	29.30	21.35	1.49	30.75	21.75	1.49
	55	23.43	20.41	1.02	24.89	21.56	1.38	26.34	22.19	1.50	27.39	21.31	1.52	29.25	21.49	1.52	30.71	21.90	1.52
	60	23.40	20.54	1.04	24.85	21.70	1.41	26.30	22.34	1.53	27.35	21.45	1.55	29.21	21.63	1.56	30.66	22.04	1.55
	65	23.36	20.67	1.07	24.81	21.84	1.44	26.27	22.48	1.56	27.31	21.59	1.59	29.17	21.77	1.59	30.62	22.19	1.59
	70	23.33	20.81	1.09	24.78	21.98	1.47	26.23	22.63	1.60	27.27	21.73	1.62	29.13	21.91	1.62	30.57	22.33	1.62
	75	22.77	20.46	1.16	24.21	21.65	1.52	25.66	22.31	1.64	26.70	21.44	1.67	28.55	21.65	1.68	29.99	22.08	1.69
	80	22.21	20.11	1.23	23.65	21.30	1.57	25.09	21.98	1.68	26.13	21.14	1.71	27.97	21.38	1.74	29.42	21.82	1.76
	85	21.65	19.75	1.40	23.09	20.95	1.70	24.53	21.64	1.81	25.57	20.83	1.84	27.40	21.09	1.87	28.84	21.54	1.90
	90	21.09	19.37	1.56	22.53	20.58	1.84	23.96	21.29	1.93	25.00	20.51	1.96	26.83	20.79	2.00	28.27	21.26	2.03
	95	20.49	19.17	1.73	21.92	20.40	1.96	23.35	21.13	2.03	24.00	20.06	2.00	26.20	20.68	2.10	27.63	21.17	2.14
	100	19.99	18.66	1.82	21.42	19.88	2.00	22.85	20.62	2.05	23.69	19.75	2.03	25.70	20.23	2.10	27.13	20.73	2.14
105	19.49	18.14	1.90	20.92	19.37	2.04	22.35	20.12	2.06	23.38	19.44	2.07	25.20	19.79	2.10	26.63	20.30	2.14	
110	18.99	17.52	1.85	20.42	18.74	1.93	21.85	19.50	1.92	22.88	18.86	1.91	24.70	19.23	1.93	26.13	19.74	1.98	
115	18.49	17.00	1.66	19.92	18.21	1.68	21.35	18.98	1.64	22.38	18.38	1.61	24.20	18.77	1.62	25.63	19.29	1.66	
118	17.47	16.20	1.47	18.84	17.38	1.45	20.21	18.13	1.38	21.20	17.56	1.35	22.95	17.96	1.35	24.32	18.47	1.38	
122	17.12	15.93	1.41	18.48	17.10	1.37	19.83	17.84	1.30	20.80	17.29	1.26	22.53	17.68	1.26	23.88	18.19	1.29	

TC = Total Capacity (kBtu/h).

SHC: Sensible Heat Capacity (kBtu/h).

PI = Power input (KW). Power input (KW) includes compressor and fan(s).

Nominal capacity as rated 0 ft. above sea level and a 0 ft. level difference between outdoor and indoor unit. Corresponding refrigerant piping length is accordance with standard length of each outdoor unit.

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).

The shaded table rows indicate reference data. When operating at this temperature, these values can be different if the system is not running consistently.

PERFORMANCE DATA

Cooling Capacity Tables

Table 18: LH367HV Ceiling-Concealed Duct (High Static) System Cooling Capacity Table.

Model No. / Nominal Capacity (Btu/h)	Outdoor Air Temp. (°F DB)	Indoor Air Temp. °F DB / °F WB																	
		68 / 57			73 / 61			77 / 64			80 / 67			86 / 72			90 / 75		
		TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI	TC	SHC	PI
LH367HV 36,000	5	35.66	26.60	1.16	37.87	28.10	1.57	40.09	28.93	1.70	41.69	27.78	1.73	44.52	28.02	1.73	46.73	28.55	1.73
	10	35.61	26.80	1.19	37.82	28.31	1.62	40.03	29.14	1.75	41.63	27.99	1.78	44.45	28.22	1.78	46.67	28.76	1.78
	15	35.56	26.99	1.22	37.77	28.51	1.66	39.97	29.35	1.80	41.57	28.19	1.83	44.39	28.43	1.83	46.60	28.97	1.82
	20	35.51	27.18	1.26	37.71	28.72	1.70	39.92	29.56	1.85	41.51	28.39	1.87	44.33	28.63	1.88	46.53	29.17	1.87
	25	35.45	27.38	1.29	37.66	28.92	1.75	39.86	29.77	1.89	41.45	28.59	1.92	44.26	28.83	1.93	46.46	29.38	1.92
	30	35.40	27.57	1.32	37.60	29.12	1.79	39.80	29.98	1.94	41.39	28.79	1.97	44.20	29.03	1.97	46.40	29.58	1.97
	35	35.35	27.76	1.35	37.55	29.32	1.84	39.74	30.18	1.99	41.33	28.99	2.02	44.13	29.23	2.02	46.33	29.79	2.02
	40	35.30	27.95	1.39	37.49	29.52	1.88	39.69	30.39	2.04	41.27	29.19	2.07	44.07	29.43	2.07	46.26	29.99	2.07
	45	35.25	28.14	1.42	37.44	29.72	1.92	39.63	30.60	2.08	41.21	29.39	2.12	44.01	29.63	2.12	46.20	30.19	2.11
	50	35.20	28.33	1.45	37.39	29.92	1.97	39.57	30.80	2.13	41.15	29.58	2.16	43.94	29.83	2.17	46.13	30.40	2.16
	55	35.15	28.51	1.48	37.33	30.12	2.01	39.51	31.01	2.18	41.09	29.78	2.21	43.88	30.03	2.22	46.06	30.60	2.21
	60	35.10	28.70	1.52	37.28	30.32	2.06	39.46	31.21	2.23	41.03	29.97	2.26	43.82	30.23	2.27	46.00	30.80	2.26
	65	35.05	28.89	1.55	37.22	30.52	2.10	39.40	31.41	2.27	40.97	30.17	2.31	43.75	30.42	2.31	45.93	31.00	2.31
	70	34.99	29.07	1.58	37.17	30.71	2.15	39.34	31.61	2.32	40.91	30.36	2.36	43.69	30.62	2.36	45.86	31.20	2.36
	75	34.15	28.59	1.68	36.32	30.25	2.21	38.49	31.17	2.39	40.05	29.96	2.43	42.82	30.25	2.45	44.99	30.85	2.46
	80	33.31	28.11	1.79	35.47	29.77	2.28	37.64	30.71	2.45	39.20	29.55	2.49	41.96	29.87	2.53	44.12	30.49	2.57
	85	32.48	27.59	2.03	34.63	29.27	2.48	36.79	30.24	2.63	38.35	29.11	2.67	41.10	29.46	2.72	43.26	30.10	2.76
	90	31.64	27.07	2.28	33.79	28.76	2.68	35.94	29.75	2.81	37.50	28.66	2.85	40.25	29.05	2.90	42.40	29.71	2.96
	95	30.74	26.79	2.52	32.88	28.50	2.86	35.02	29.52	2.96	36.00	28.03	2.91	39.30	28.90	3.05	41.44	29.58	3.11
	100	29.99	26.07	2.64	32.13	27.78	2.91	34.27	28.82	2.98	35.53	27.60	2.96	38.55	28.27	3.05	40.69	28.97	3.11
105	29.24	25.35	2.77	31.38	27.06	2.96	33.52	28.11	3.00	35.07	27.16	3.01	37.80	27.65	3.05	39.94	28.36	3.11	
110	28.49	24.49	2.69	30.63	26.18	2.80	32.77	27.24	2.79	34.32	26.35	2.78	37.05	26.87	2.81	39.20	27.59	2.87	
115	27.74	23.75	2.41	29.88	25.45	2.44	32.02	26.52	2.38	33.57	25.68	2.35	36.31	26.23	2.36	38.45	26.96	2.41	
118	26.20	22.64	2.14	28.26	24.28	2.11	30.31	25.33	2.01	31.80	24.54	1.97	34.42	25.09	1.96	36.48	25.81	2.01	
122	25.69	22.26	2.04	27.71	23.89	1.99	29.74	24.93	1.89	31.21	24.16	1.84	33.80	24.71	1.83	35.82	25.42	1.88	

TC = Total Capacity (kBtu/h).

SHC: Sensible Heat Capacity (kBtu/h).

PI = Power input (KW). Power input (KW) includes compressor and fan(s).

Nominal capacity as rated 0 ft. above sea level and a 0 ft. level difference between outdoor and indoor unit. Corresponding refrigerant piping length is accordance with standard length of each outdoor unit.

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).

The shaded table rows indicate reference data. When operating at this temperature, these values can be different if the system is not running consistently.

PERFORMANCE DATA

Heating Capacity Tables

Table 19: LH247HV Ceiling-Concealed Duct (High Static) System Heating Capacity Table.

Model No. / Nominal Capacity (Btu/h)	Outdoor Air Temp.		Indoor Air Temp. °F DB											
	°F DB	°F WB	61		64		68		70		72		75	
			TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
LH247HV 24,000	0	-0.4	13.59	1.70	12.80	1.77	12.79	1.79	12.50	1.81	12.26	1.82	11.75	1.89
	5	4.5	15.90	1.73	15.16	1.79	14.93	1.83	14.62	1.85	14.36	1.87	13.79	1.93
	10	9	17.45	1.75	16.74	1.81	16.37	1.86	16.04	1.88	15.77	1.90	15.15	1.96
	17	15	19.15	1.78	18.48	1.84	17.95	1.90	17.60	1.93	17.32	1.96	16.65	2.01
	20	19	20.18	1.81	19.54	1.86	18.91	1.93	18.55	1.96	18.26	1.99	17.56	2.04
	25	23	21.90	1.85	21.25	1.90	20.51	1.97	20.12	2.01	19.81	2.04	19.07	2.10
	30	28	23.63	1.90	22.89	1.96	22.11	2.02	21.70	2.06	21.38	2.10	20.59	2.15
	35	32	25.35	1.95	24.54	2.02	23.71	2.07	23.28	2.12	22.94	2.15	22.11	2.21
	40	36	26.64	2.00	25.89	2.07	25.07	2.13	24.63	2.18	24.29	2.21	23.41	2.27
	45	41	28.26	2.07	27.58	2.14	26.77	2.21	26.32	2.25	25.97	2.28	25.02	2.35
	47	43	28.90	2.10	28.26	2.17	27.45	2.24	27.00	2.28	26.64	2.31	25.67	2.38
	50	46	28.99	2.09	28.40	2.15	27.70	2.21	27.30	2.25	26.98	2.27	26.07	2.34
	55	51	29.13	2.07	28.65	2.12	28.12	2.17	27.79	2.19	27.54	2.21	26.72	2.26
	60	56	29.27	2.04	28.89	2.08	28.53	2.12	28.29	2.14	28.09	2.15	27.38	2.18
	63	59	29.35	2.03	29.03	2.06	28.78	2.10	28.59	2.11	28.43	2.11	27.77	2.14
	68	64	29.44	2.02	29.18	2.04	29.04	2.07	28.89	2.07	28.77	2.08	28.17	2.10

TC = Total Capacity (kBtu/h).

PI = Power input (KW). Power input (KW) includes compressor and fan(s).

Nominal capacity as rated 0 ft. above sea level and a 0 ft. level difference between outdoor and indoor unit. Corresponding refrigerant piping length is accordance with standard length of each outdoor unit.

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

Table 20: LH367HV Ceiling-Concealed Duct (High Static) System Heating Capacity Table.

Model No. / Nominal Capacity (Btu/h)	Outdoor Air Temp.		Indoor Air Temp. °F DB											
	°F DB	°F WB	61		64		68		70		72		75	
			TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
LH367HV 36,000	0	-0.4	10.89	2.36	10.10	2.45	10.27	2.49	10.02	2.51	9.82	2.53	9.38	2.62
	5	4.5	16.13	2.42	15.33	2.51	15.16	2.56	14.83	2.59	14.57	2.61	13.98	2.70
	10	9	19.64	2.47	18.83	2.56	18.43	2.62	18.06	2.66	17.75	2.69	17.05	2.77
	17	15	23.50	2.54	22.68	2.62	22.03	2.70	21.60	2.75	21.25	2.79	20.44	2.87
	20	19	25.84	2.59	25.02	2.67	24.21	2.76	23.75	2.81	23.38	2.85	22.49	2.93
	25	23	29.74	2.67	28.86	2.75	27.86	2.86	27.33	2.91	26.91	2.96	25.89	3.04
	30	28	33.65	2.77	32.61	2.86	31.49	2.95	30.91	3.02	30.45	3.07	29.33	3.14
	35	32	37.55	2.87	36.36	2.97	35.12	3.05	34.49	3.12	33.98	3.18	32.76	3.25
	40	36	39.47	2.95	38.36	3.05	37.14	3.14	36.49	3.21	35.98	3.26	34.68	3.34
	45	41	41.86	3.06	40.86	3.16	39.66	3.26	39.00	3.32	38.47	3.36	37.07	3.46
	47	43	42.82	3.10	41.86	3.20	40.66	3.30	40.00	3.36	39.47	3.41	38.03	3.51
	50	46	42.94	3.08	42.08	3.17	41.04	3.26	40.44	3.31	39.97	3.35	38.62	3.44
	55	51	43.15	3.05	42.44	3.12	41.65	3.20	41.18	3.23	40.79	3.26	39.59	3.33
	60	56	43.36	3.01	42.80	3.07	42.27	3.13	41.91	3.15	41.62	3.17	40.56	3.22
	63	59	43.49	2.99	43.01	3.04	42.64	3.09	42.35	3.10	42.12	3.12	41.14	3.15
	68	64	43.61	2.97	43.23	3.01	43.02	3.05	42.80	3.06	42.62	3.06	41.73	3.09

TC = Total Capacity (kBtu/h).

PI = Power input (KW). Power input (KW) includes compressor and fan(s).

Nominal capacity as rated 0 ft. above sea level and a 0 ft. level difference between outdoor and indoor unit. Corresponding refrigerant piping length is accordance with standard length of each outdoor unit.

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

APPLICATION GUIDELINES

“Equipment Selection Procedure” on page 34

“Building Ventilation Design Guide” on page 36

“Placement Considerations” on page 41

EQUIPMENT SELECTION PROCEDURE

Cooling / Heating Correction Factors

For Ceiling-Concealed Duct (High Static) systems, calculate the equivalent length of the liquid line from the outdoor unit to the indoor unit. Also, determine the elevation difference of the indoor unit above or below the outdoor unit. Find corresponding cooling or heating capacity correction factors as shown below. Multiply the correction factors by the cooling or heating capacity obtained from the capacity table using design conditions. The result is the NET cooling or heating capacity.

Refrigerant Line Length Derates

For air-cooled systems, a capacity correction factor may have to be applied to account for the length of the system's refrigerant pipe. Rate of change in capacity due to increased piping lengths is shown below.

Table 21: Cooling Capacity Coefficient Factor.

Piping Length (ft.)		16.4	32.8	49.2	65.6	98.4	131.2	164.0	196.9	229.7	246.0
Rate of Capacity Change (%)	LH247HV (24,000 Btu/h)	100	99.3	97.9	96.6	93.8	91.1	88.4	-	-	-
	LH367HV (36,000 Btu/h)	100	99.3	97.9	96.6	93.8	91.1	88.4	85.6	82.9	81.5

Table 22: Heating Capacity Coefficient Factor.

Piping Length (ft.)		16.4	32.8	49.2	65.6	98.4	131.2	164.0	196.9	229.7	246.0
Rate of Capacity Change (%)	LH247HV (24,000 Btu/h)	100	99.7	99.2	98.7	97.7	96.6	95.6	-	-	-
	LH367HV (36,000 Btu/h)	100	99.7	99.2	98.7	97.7	96.6	95.6	94.6	93.5	93.0

Equivalent Piping Length for Piping Components

Table 23: Equivalent Piping Length for Elbows.

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

Altitude Correction Factor

The impact of air density must be considered on systems installed at a significant altitude above sea level, therefore, locally accepted altitude correction factors must be applied.

EQUIPMENT SELECTION PROCEDURE

Defrost Correction Factor for Heating Operation

The outdoor unit heating capacity may need to be adjusted for frost accumulation on air-cooled systems. If design day conditions are below the dewpoint of the surrounding air, frost may not be a problem and no correction factor is needed. In certain weather conditions, however, frost may form and accumulate on the air-cooled outdoor unit coil and impact the coils ability to transfer heat. If significant frost accumulates on the outdoor unit coil, a defrost algorithm will start automatically. The timing between defrost periods is determined by the system's ability to achieve a target head pressure value.

Capacity and AHRI ratings tables do not factor in capacity reduction when frost has accumulated on the condenser coil, nor during defrost operation.

Integrated heating capacity values can be obtained using the formula:

$$A = B \times C$$

Where:

A = Integrated Heating Capacity.

B = Value found in the Capacity Table.

C = Correction Factor for Frost Accumulation Factor (from Table 24).

Table 24: Outdoor Unit Frost Accumulation Factor (Heating)¹.

Entering DB (°F)	19.4	23.0	26.6	32.0	37.4	41.0	44.6
Derate factor	0.98	0.95	0.93	0.86	0.93	0.96	1.0

¹At 85% outdoor air relative humidity.

The frost accumulation factor does not account for effects of snow accumulation restricting airflow through the outdoor unit coil.

Note:

There will be temporary reduction in capacity when frost / ice accumulates on the outside surface of the outdoor unit heat exchanger. The level of capacity reduction depends on a number of factors, for example, outdoor temperature (°F DB), relative humidity (RH), and the amount of frost present.

Check the Indoor and Outdoor Unit Selection(s)

Compare the corrected cooling and heating capacities to the load calculations. Is each capacity sufficient for the zone it serves?

For each indoor unit, the corrected capacity must be at least equal to the total of the cooling design load (plus ventilation load, if applicable) for the space(s) served by the indoor unit. For each indoor unit, the corrected capacity also must be at least equal to the total of the heating design load (plus ventilation load, if applicable) for the space(s) and / or thermal zones served by the indoor unit.

The outdoor unit selected should be large enough to offset the total cooling load for all spaces it serves (account for ventilation air cooling load if the ventilation air has not been pretreated to room neutral conditions). The outdoor unit should also be large enough to offset the total heating load for all spaces it serves.

If the corrected heating capacity ratio exceeds 100%, reselect the equipment, or change the system design by moving some of the load to another system.

System Sizing Check Formulas

1. Outdoor Unit Rated Capacity.

$Q_{odu(rated)}$ (From capacity tables).

2. Outdoor Unit Capacity at T_i , T_o Temperature.

$Q_{odu(T_i, T_o)}$ (From capacity tables).

3 Outdoor Unit Capacity Coefficient Factor.

$$F_{(T_i, T_o)} = Q_{odu(T_i, T_o)} / Q_{odu(rated)}$$

4. Piping Correction Factor (From Capacity Coefficient Factor Tables).

$F_{(length)}$ for each piping length

5. Individual Indoor Unit Combination Capacity.

$$Q_{idu(combi)} = Q_{odu(rated)} \times Q_{idu(rated)} / Q_{idu(rated-total)}$$

6. Individual Indoor Unit Actual Capacity.

$$Q_{idu(actual)} = Q_{odu(combi)} \times F_{(T_i, T_o)} \times F_{(length, altitude)}$$

Conclusions and Recommendations

- Understand the design safety factors.
- Reference load calculations for actual cooling and heating capacities (applies in 99% of applications – consider total load when latent load is greater than 30%).
- Verify that the sensible load of the zone is satisfied.

- Use caution when sizing to meet listed capacity specifications for the scheduled manufacturer's equipment.
- If further system design assistance is needed, or you have a unique application you would like to discuss, contact your LG sales rep.

BUILDING VENTILATION DESIGN GUIDE

ASHRAE Standards 62.1 and 62.2 (depending on if the building is residential or commercial), and local codes specify the minimum volume of airflow that must be provided to an occupied space. Outdoor air is required to minimize adverse health effects, and it provides acceptable indoor air quality for building occupants. Indoor units located within the zone typically require less airflow to condition the space. During the design phase, refer to the airflow capabilities listed in the specification tables for each product. Choose the best method for the application out of the five (5) ventilation options available.

Note:

Disclaimer

Although we believe that these building ventilation methods have been portrayed accurately, none of the methods have been tested, verified, or evaluated by LG Electronics, U.S.A., Inc.. In all cases, the designer, installer, and contractor should understand if the suggested method is used, it is used at their own risk. LG Electronics U.S.A., Inc., takes no responsibility and offers no warranty, expressed or implied, of merchantability or fitness of purpose if this method fails to perform as stated or intended.

• For a complete copy of ASHRAE Standard 62.1 and 62.2, refer to the American Standard of Heating and Air Conditioning Engineers (ASHRAE) website at www.ashrae.org.

Method 1: Natural Ventilation (Non-Ducted, Unconditioned Outdoor Air)

Natural ventilation devices, such as operable windows or louvers may be used to ventilate the building when local code permits.

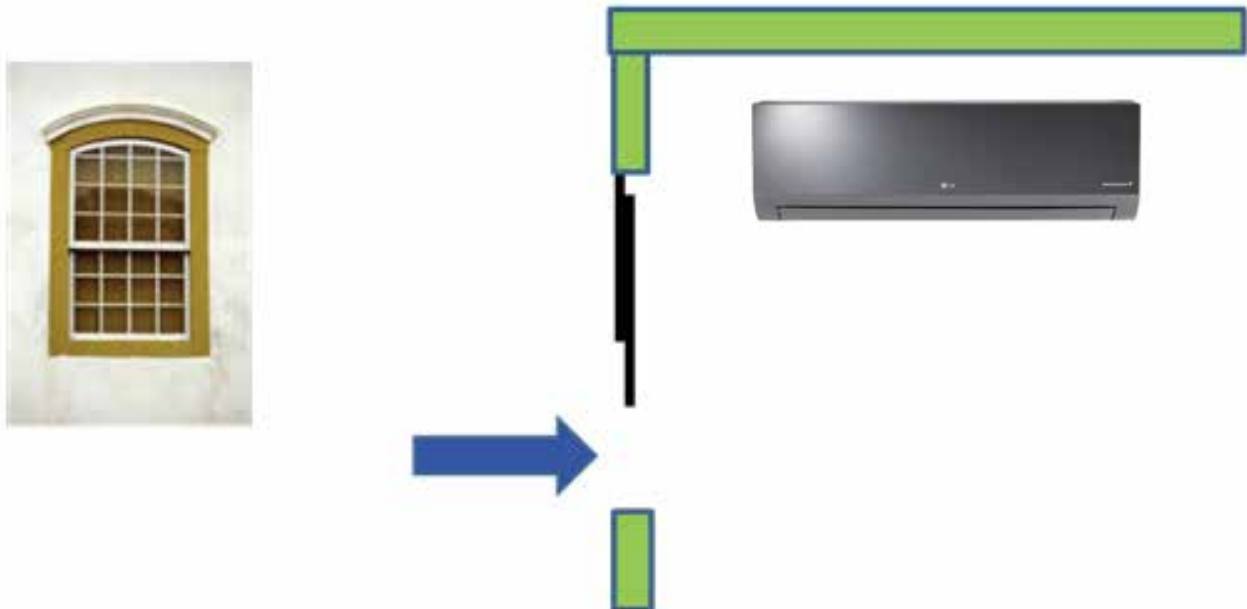
Advantages

- Occupants control the volume of the ventilation air manually.
- Useful for historic buildings that have no ceiling space available for outdoor air ductwork.
- May be used with the full lineup of Duct-Free Split system indoor units.

Disadvantages

- In some locations, it may be difficult to control humidity levels when windows are open.
- Thermal comfort levels may be substandard when windows are open.
- Indoor units may have to be oversized to account for the added heating and cooling loads when windows are open.
- Provides outdoor air to perimeter spaces only. Additional mechanical ventilation system may be required to satisfy requirements for interior spaces.
- Outdoor air loads may be difficult to calculate since the quantity of outdoor air is not regulated.
- May affect indoor unit proper operation when open.

Figure 17: Natural Ventilation (Non-Ducted, Unconditioned Outdoor Air).



BUILDING VENTILATION DESIGN GUIDE

Method 2: Unconditioned Outdoor Air (Non-Ducted, Fan Assisted Ventilation)

When approved by local codes, the fan assisted ventilation method uses exhaust fans to remove air from the building, and outdoor air is drawn into occupied spaces through a wall louver or gravity roof intake hood. Supply fans can also be used to push the outdoor air into the space and building positive pressure will vent the exhaust air through louvers or roof-mounted exhaust hoods. Outdoor air is neither cooled nor heated before entering the building.

Note:

This may result in loss of building pressurization control, increasing infiltration loads with adverse effects.

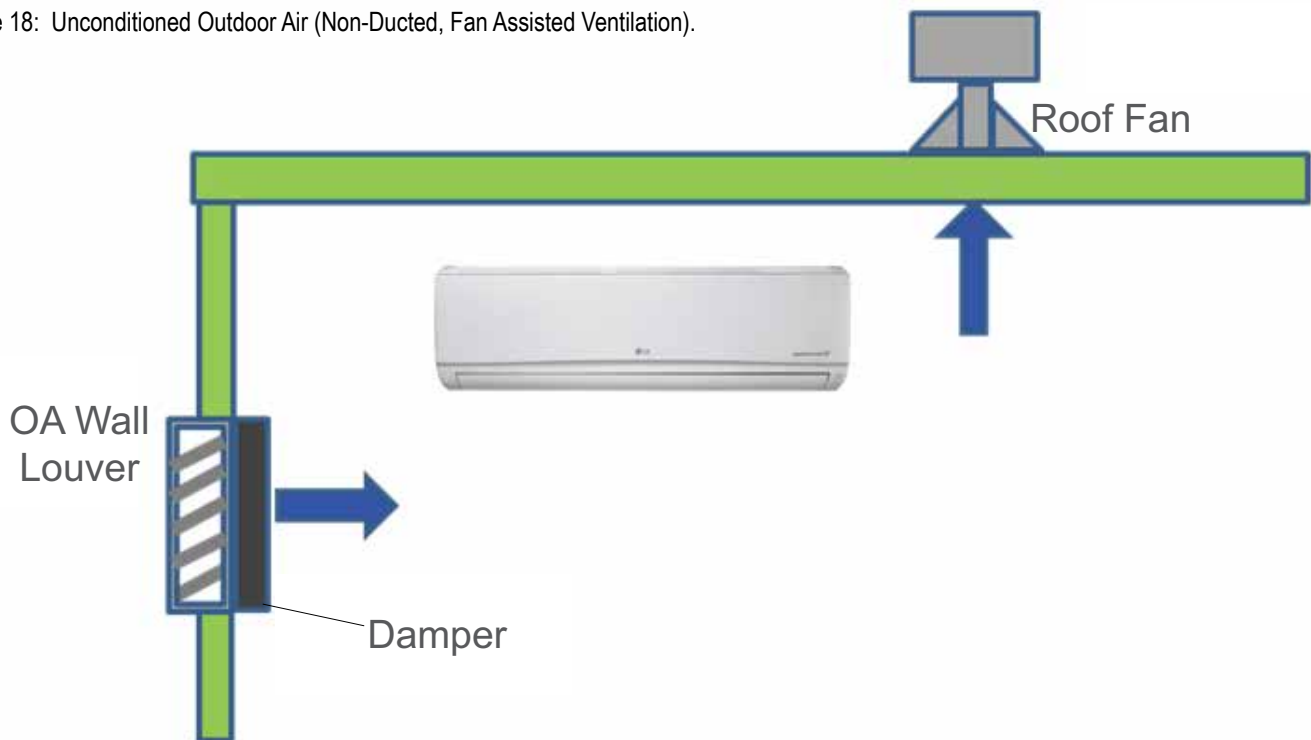
Advantages

- Outdoor air may be manually controlled by the occupant or automatic controls may be installed to open/close outdoor air dampers or to turn on/off ventilation fans.
- Useful for large open spaces like warehouses, garages, and workshops.
- Outdoor air volume is a known quantity. Air loads may be easier to calculate since fans will regulate the amount of outdoor air.
- May be used with the full lineup of Duct-Free Split system indoor units.

Disadvantages

- In some locations of the country, it may be difficult to control humidity levels.
- Indoor units may have to be oversized to account for the added heating/cooling loads when louvers/hoods are open.
- Hot, cold, and/or humid areas may be present if the outdoor air is not evenly distributed to the different spaces.

Figure 18: Unconditioned Outdoor Air (Non-Ducted, Fan Assisted Ventilation).



BUILDING VENTILATION DESIGN GUIDE

Method 3: Unconditioned Outdoor Air Ducted to Indoor Units

Untreated outdoor air is channeled through a duct system that is piped to the return air duct on Duct-Free Split system ducted indoor units or to the frame of Duct-Free Split system four-way cassettes.

Note:

Outside air may flow backward through the return air-filter grille when the indoor unit fan speed slows or stops in response to changes in the space load. This may result in captured particulate on the filter media being blown back into the conditioned space.

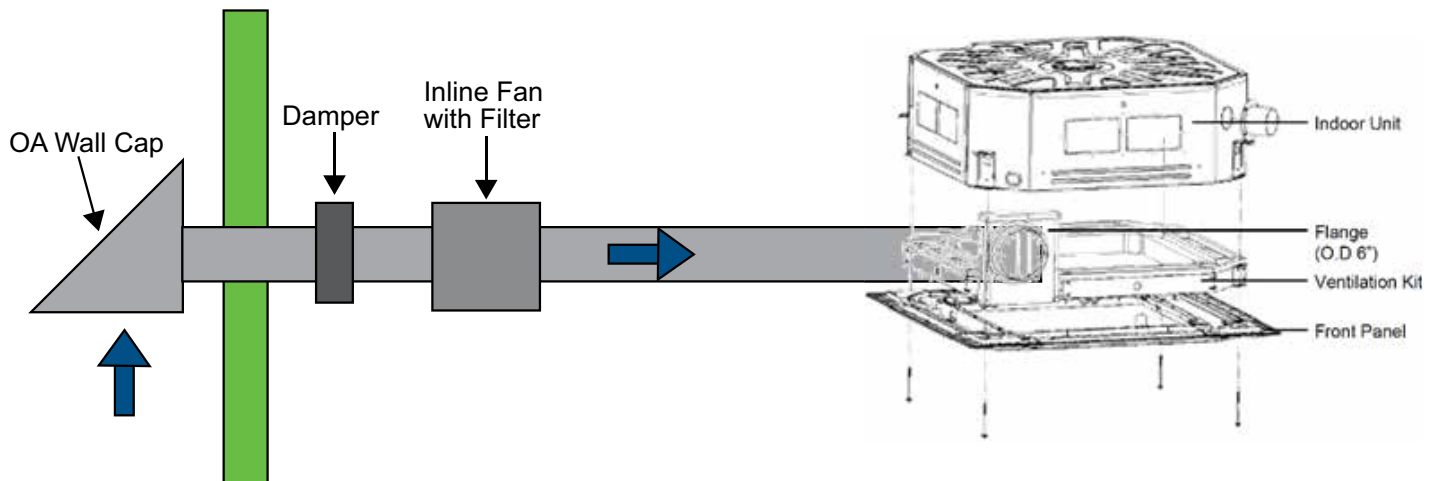
Advantages

- May require less ductwork if indoor units are placed near outdoor walls or a roof deck.
- Controls must be interlocked to shut off the outdoor air supply fan when the space is unoccupied.
- Third-party demand-control ventilation controls may be installed to regulate outdoor intake based on the CO₂ levels of the occupied space.

Disadvantages

- Fan(s) will be required to push outdoor air to the indoor unit to overcome the additional static pressure.
- Filter required to be added to the outdoor air duct.
- Ducted and four-way cassette models are the only indoor units that accept the connection of an outdoor air duct to the unit case.
- In most cases, in lieu of using the factory mounted return-air thermistor on indoor units, a remote wall temperature sensor or zone controller will be needed to provide an accurate reading of the conditioned area temperature.
- Unconditioned outdoor air may affect indoor unit performance, which may necessitate oversizing the indoor unit.

Figure 19: Unconditioned Outdoor Air Ducted to Indoor Units.



BUILDING VENTILATION DESIGN GUIDE

Method 4: Coupled Dedicated Outdoor Air (CDOA)

A separate, dedicated outdoor air system delivers air directly to a Duct-Free Split system indoor unit or to the return air duct system. After mixing with the return air stream, ventilation air passes through the indoor unit and into the conditioned space. The pretreatment system is capable of filtering, conditioning, and dehumidifying outdoor air to room neutral conditions.

Note:

Outside air may flow backward through the return air-filter grille when the indoor unit fan speed is reduced or stops when the space load is satisfied. This may result in captured particulate on the filter media being blown back into the conditioned space.

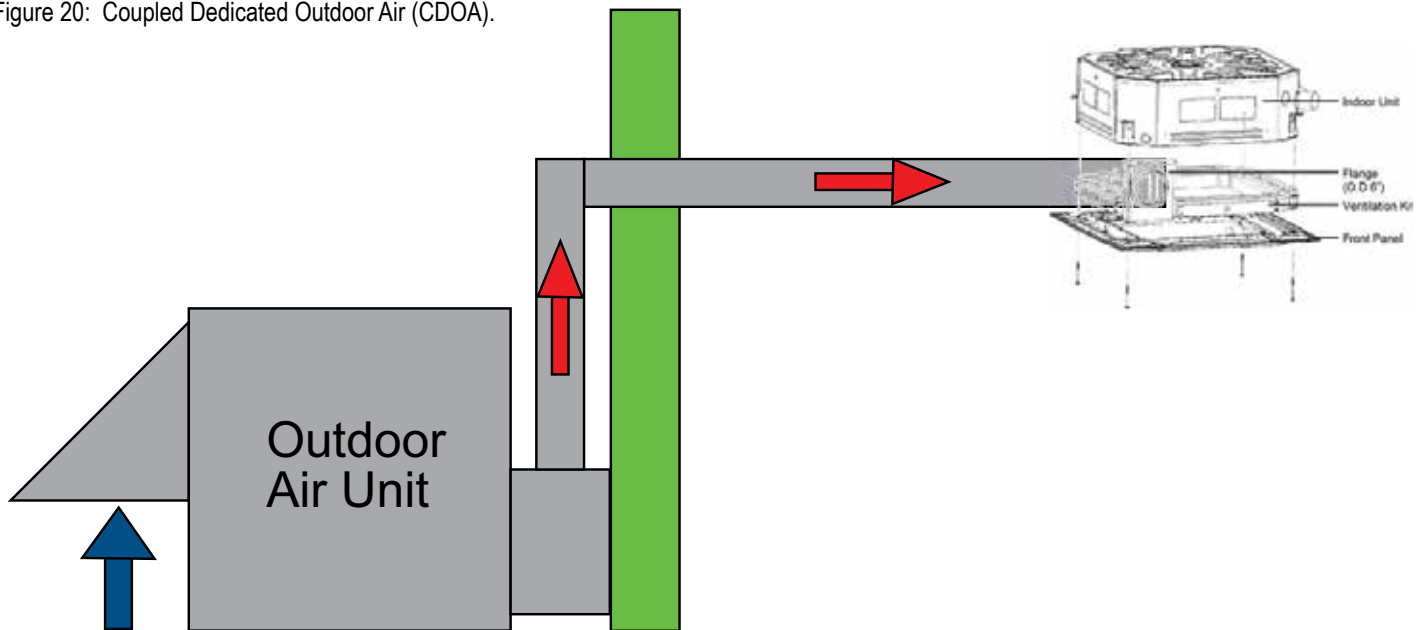
Advantages

- Indoor unit capacity may not need to be increased because of outdoor air.
- Fan and filter system is centralized to the main outdoor air unit.

Disadvantages

- Ducted and four-way cassette indoor units are the only models designed for direct connection of an outside air duct.
- Ceiling space is required for ductwork.
- Failure of outdoor air may impact indoor unit operation.
- In lieu of using the factory mounted return-air thermistor, a remote wall temperature sensor or zone controller may be required to provide an accurate conditioned space temperature reading.

Figure 20: Coupled Dedicated Outdoor Air (CDOA).



BUILDING VENTILATION DESIGN GUIDE

Method 5: Decoupled Dedicated Outdoor Air System (DDOAS)

Provide a separate, dedicated outdoor-air system designed to filter, condition, and dehumidify ventilation air and deliver it directly to the conditioned space through a separate register or grille. This approach requires a separate independent ventilation duct system not associated with the Duct-Free Split system.

Note:

LG recommends using the DDOAS method in all installations.

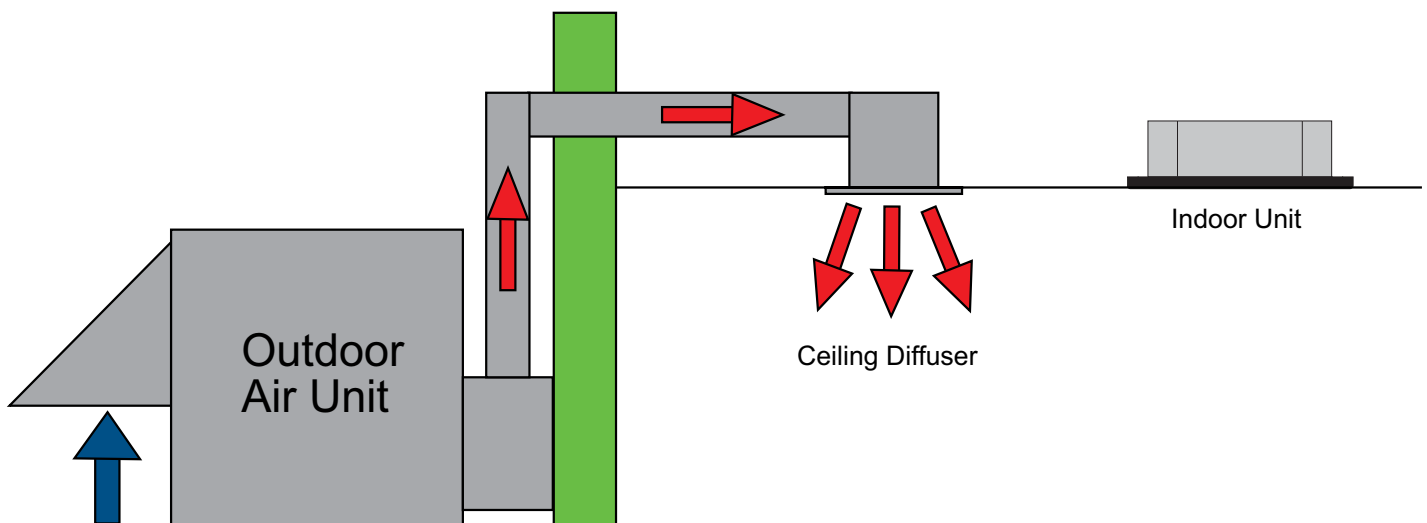
Advantages

- Does not add additional heating or cooling loads to indoor units.
- May be used with the full lineup of Duct-Free Split system indoor units.
- Failure of outdoor unit does not impact operation of indoor unit, the resulting untreated air will be readily noticed by the occupants.
- The outdoor air unit may supply “neutral” air to the occupant space even when the Duct-Free Split system indoor unit fan changes speed or cycles on and off. DDOAS controls do not have to be interlocked with the Duct-Free Split system.
- In lieu of installing localized smaller outside air treatment equipment throughout the building, this method centralizes the ventilation air source making service and filter changes easier and less disruptive for the building occupants.
- Third-party demand control ventilation controls are more readily accommodated.
- Indoor unit operation and performance will not be affected by the condition of outdoor air.

Disadvantages

- Ceiling space is required to accommodate ductwork between the outdoor air unit and ceiling diffusers.

Figure 21: Decoupled Dedicated Outdoor Air System (DDOAS).



Selecting the Best Location for the Indoor Unit

Do's

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

- No obstacles to air circulation around the indoor unit; keep proper distances from ceilings, doorways, floor, walls, etc.
- So that condensation drainage can be conveniently routed away.
- Include enough space around the indoor unit so that it is accessible for maintenance and service purposes.
- Where electrical noise / electromagnetic waves will not affect indoor unit operation. Maintain proper distances between the indoor units and electric wires, audio and visual appliances, breaker / circuit panels, etc. If the frequency signal of the appliance is unstable, then install the indoor unit a minimum of ten (10) feet away, and run the power and transmission cables through a conduit.
- An area that has sufficient strength to bear the load of the indoor unit.
- An area where operation sound won't disturb occupants.
- An area that does not expose the indoor unit to heat, water, steam, oil splattering or spray.
- Locate the indoor unit in a location that is level, and where it can be easily connected to the outdoor unit.

WARNING

Don'ts

- *The indoor unit should not be installed near a heat or steam source, or where considerable amounts of oil, iron powder, or flour are used.*
- *The indoor unit should not be installed where sulfuric acid and flammable or corrosive gases are generated, vented into, or stored.*
- *Avoid installing the indoor unit near high-frequency generators or near any equipment that generates an electromagnetic field (minimum 3-1/3 feet away).*
- *Do not install the indoor unit near a doorway.*

The indoor unit may be damaged, may malfunction, and / or will not operate as designed if installed in any of the conditions listed.

Note:

If the indoor unit is installed near a body of water, certain components are at risk of being corroded. Appropriate anti-corrosion methods should be taken for the indoor unit and all components.

Installing in an Area Exposed to Unconditioned Air

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

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

Installing in an Area with High Humidity Levels

If the environment is prone to humidity levels of 80% or more (near the ocean, lakes, etc.) or where steam could collect in the plenum:

- Install additional insulation to the indoor unit (glass wool insulation >13/32 inches thick).
- Install additional insulation to the refrigerant piping (insulation >13/16 inches thick).
- Seal all gaps between the indoor unit and the ceiling tiles (make the area air tight) so that humidity does not transfer from the plenum to the conditioned space. Also, add a ceiling grille for ventilation.

PLACEMENT CONSIDERATIONS

Indoor Unit

Figure 22: Access Panel and General Service Space Required Dimensions.

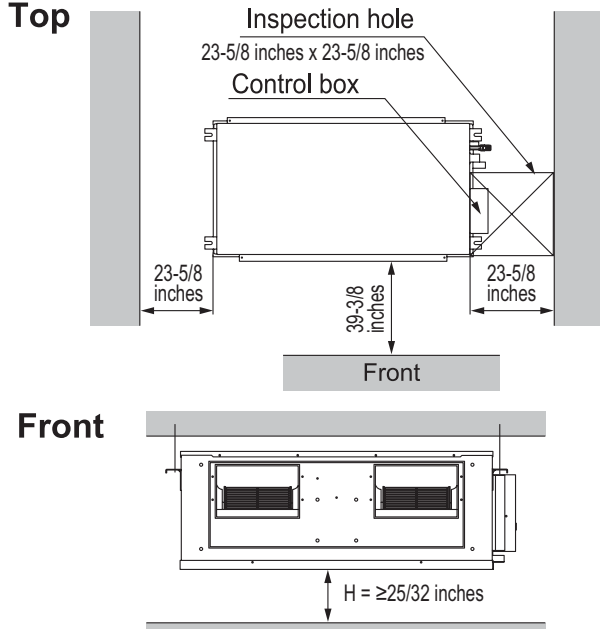


Figure 23: Indoor Unit Bolt Locations.

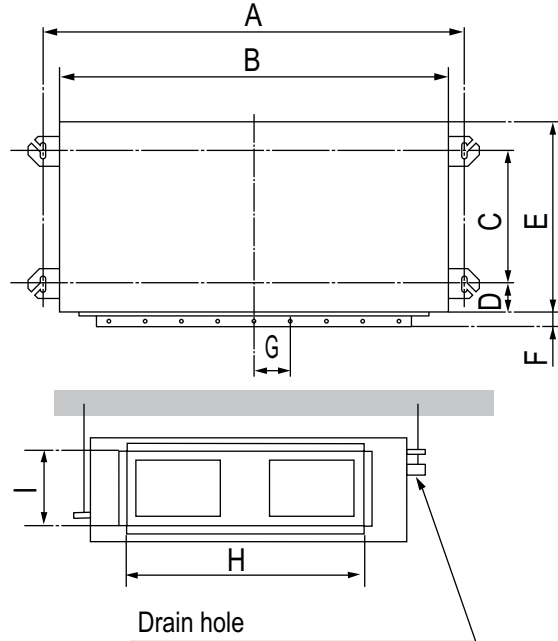


Table 25: Indoor Unit Bolt Location Dimensions.

Model / Capacity (Btu/h)	Dimensions (inches)								
	A	B	C	D	E	F	G	H	I
LHN247HV / 24,000	48-17/32	46-17/32	13-31/32	1-3/4	17-23/32	1-3/16	3-5/8	32-11/16	7-5/16
LHN367HV / 36,000	50-15/32	48-7/16	18-13/16	2-1/4	23-7/32	1-3/16	4-3/4	39-19/32	11-9/16

Indoor Unit Drain System

- Drain piping must have downward gradient of at least 1/50 to 1/100; to prevent reverse flow, slope should not be straight up and down.
- Do not damage the drain port on the indoor unit when connecting the field-supplied drain piping.
- Drain piping specifications:
 - Indoor Unit Drain Connection: 1-1/4 inch outside diameter.
 - Field-Supplied Drain Piping: Polyvinyl chloride piping with 1-inch inside diameter and pipe fittings.

Figure 24: Indoor Unit Drain Piping.

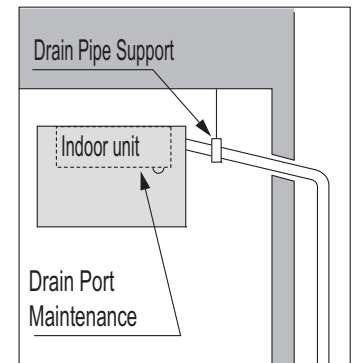
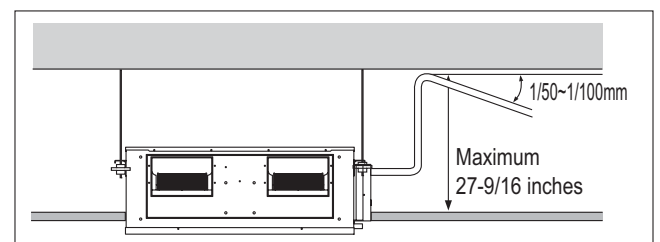
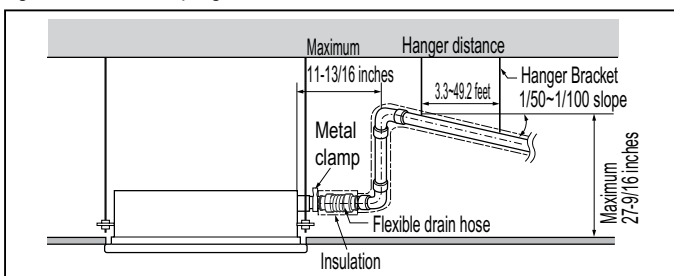


Figure 25: Drain Piping Installation Dimensions.



PLACEMENT CONSIDERATIONS

Outdoor Unit

Selecting the Best Location for the Outdoor Unit

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

- A location strong enough to bear the weight of the outdoor unit.
- A location that allows for optimum air flow and is easily accessible for inspection, maintenance, and service.
- Where piping between the outdoor unit and indoor unit are within allowable limits.
- Where it will not be subjected to direct thermal radiation from other heat sources, nor an area that would not expose the outdoor unit to heat or steam like discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperatures.
- Where operating sound from the unit will not disturb inhabitants of surrounding buildings.
- Where the unit will not be exposed to direct, strong winds.
- Where high-frequency electrical noise / electromagnetic waves will not affect operation.
- 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.

Note:

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

- To avoid the possibility of fire, do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak.
- Don't install the unit in a location where oil, acidic solutions, sprays, or dust (sulfur, carbon, other corrosive materials) are present / often used.
- Install a fence to prevent vermin from crawling into the unit or unauthorized individuals from accessing it.

Snow and Ice Conditions

In climates that experience snow buildup, place the unit on a suitably high platform to ensure proper condenser airflow. The raised support platform must be high enough to allow the unit to remain above possible snow drifts. Mount the unit on a field-provided snow stand at a minimum height that is equal to the average annual snowfall, plus 20 inches. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit case. If necessary, provide a field fabricated hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces. Use inlet and discharge duct or hoods to prevent snow or rain from accumulating on the fan inlet and outlet guards. Best practice prevents snow from accumulating on top of the unit. Consider tie-down requirements in case of high winds or where required by local codes.

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.

PLACEMENT CONSIDERATIONS

Outdoor Unit

Tie-Downs / Wind Restraints and Lightening Protection

The strength of the Ceiling-Concealed Duct (High Static) system outdoor unit frame is adequate to be used with field-provided wind restraint tie-downs.

Tie-Downs / Wind Restraints

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

Lightening Protection

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

Table 26: Safety Zone Specifications.

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

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

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

Attaching the Outdoor Unit to the Bracket

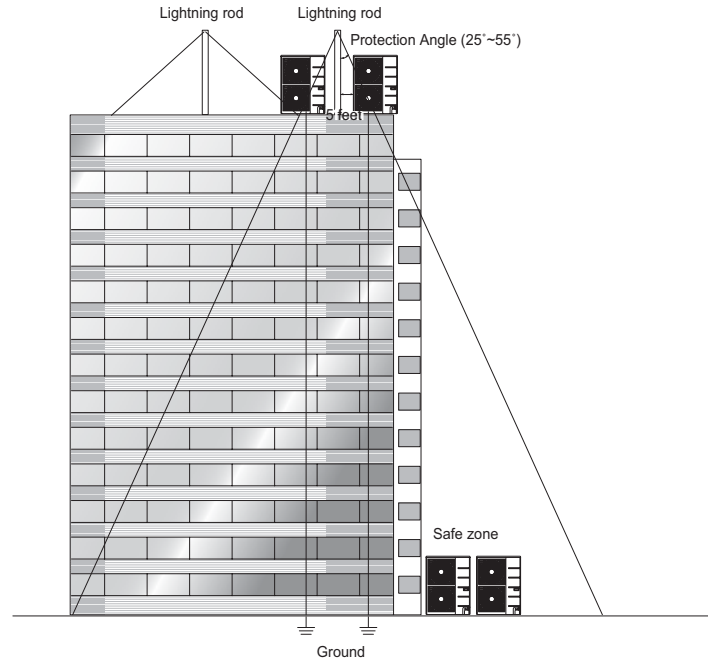
When installing the outdoor unit on a wall or roof top, anchor the mounting base securely using nails or wire with regard to wind and earthquake or vibration.

Refer to installation manual, and follow the applicable local code for clearance, mounting, anchor, and vibration attenuation requirements.

Note:

- All referenced materials are to be field-supplied.
- Images are not to scale.

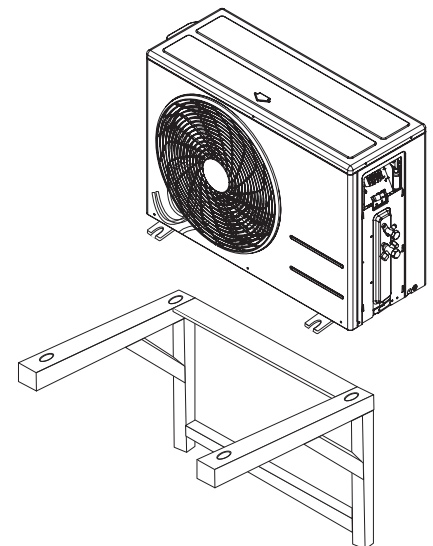
Figure 26: Lightening Protection Diagram.



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 27: Bracket Mounting.



PLACEMENT CONSIDERATIONS

Outdoor Unit

Bolting the Outdoor Unit to the Platform

Figure 28: Bolting the Outdoor Unit to the Platform.

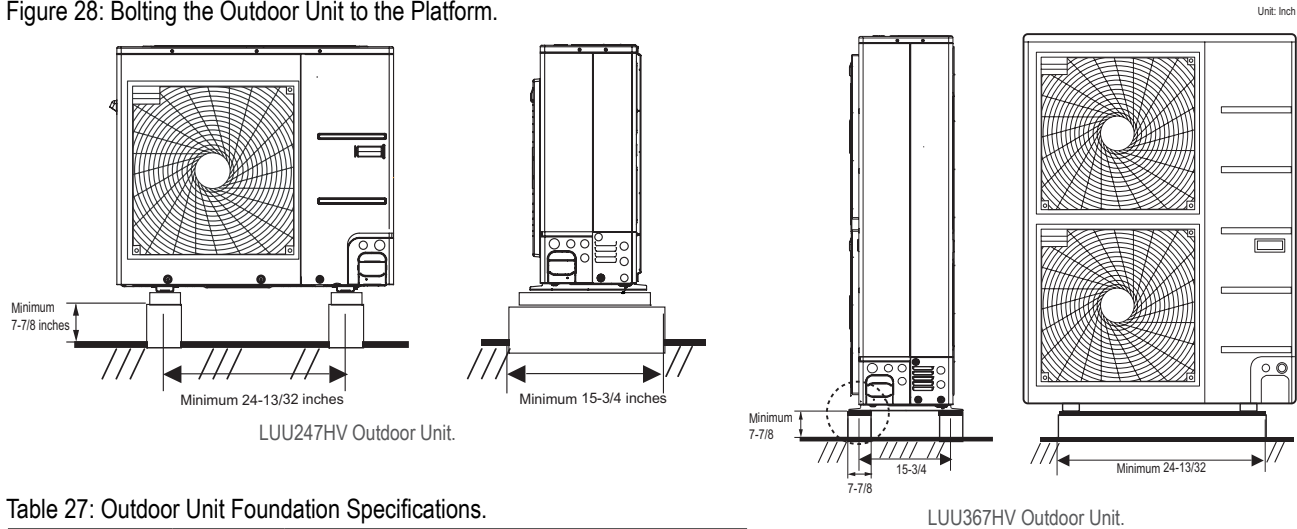


Table 27: Outdoor Unit Foundation Specifications.

Outdoor Unit	Bolt Type	Concrete Height	Bolt Depth
LUU247HV	M10-J	Minimum 7-7/8 inches	Minimum 2-3/4 inches
LUU367HV	M10-J		Minimum 2-3/4 inches

Bolting the Outdoor Unit to the Platform Procedure

When installing the outdoor unit onto a concrete or rigid mount, use a bolt and nut.

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

Concrete Platform Specifications

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

Note:

- All referenced materials are to be field-supplied.
- Images are not to scale.

Figure 30: Platform Mounting.

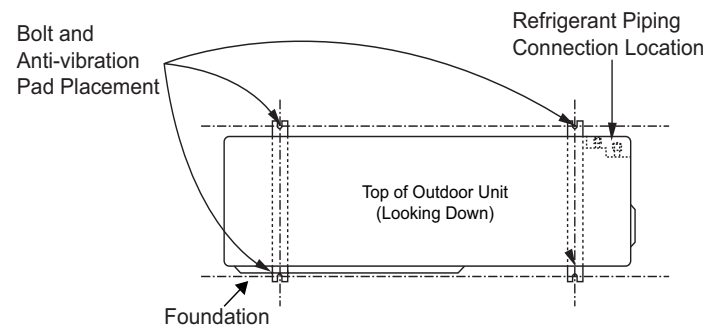
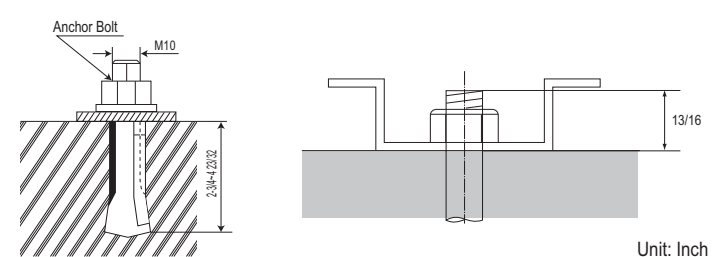


Figure 29: Close up of Bolt Attachment.



PLACEMENT CONSIDERATIONS

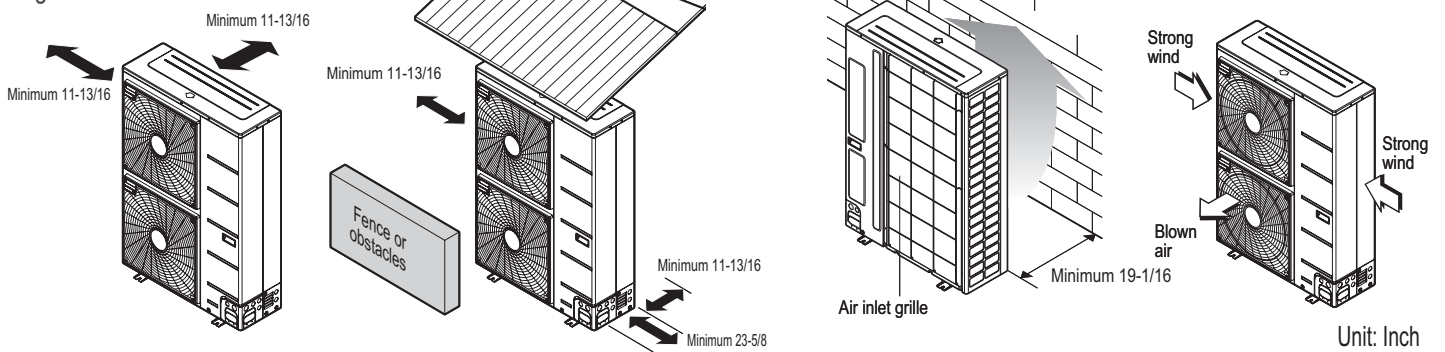
Outdoor Unit

Outdoor Unit Service Access and Allowable Clearances

Appropriate airflow through the outdoor unit coil is critical for proper unit operation.

- Include enough space for airflow and for service access. If installing multiple outdoor units, avoid placing the units where the discharge of one unit will blow into the inlet side of an adjacent unit.
- No obstacles to air circulation around the unit; keep proper distances from ceilings, fences, floor, walls, etc. (Install a fence to prevent pests from damaging the unit or unauthorized individuals from accessing it.)
- If an awning is built over the unit to prevent direct sunlight or rain exposure, make sure that the discharge air of the outdoor unit isn't restricted.

When installing the outdoor unit, consider service, inlet, and outlet, and minimum allowable space requirements as illustrated in the following diagrams.



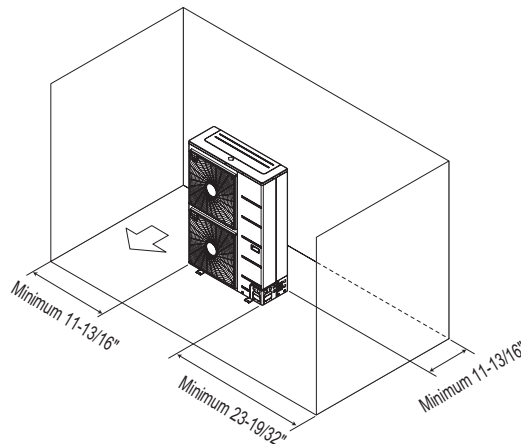
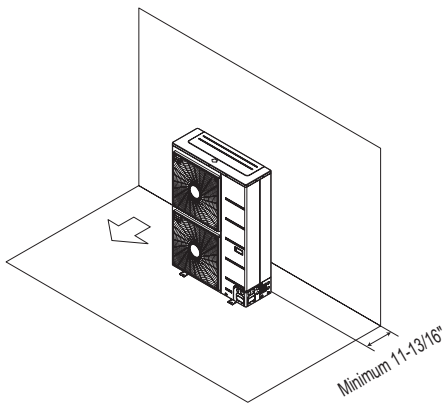
Ensure that the space at the back of the outdoor unit is a minimum of 11-13/16 inches, and include a minimum of 23-5/8 inches at the right side of the unit for service.

If the outdoor unit discharge side faces a wall, include a minimum of 19-11/16 inches between the outdoor unit and the wall. Install the outdoor unit so that the discharge port is set at a right angle to the wind direction.

Clearance Requirements when Different Obstacles are Present (Unit: Inch).

Obstacle on the suction side only.

Obstacles on the suction side and on both left and right sides.

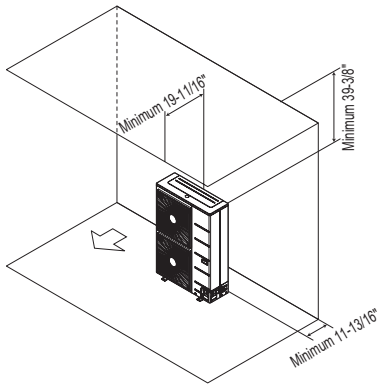


PLACEMENT CONSIDERATIONS

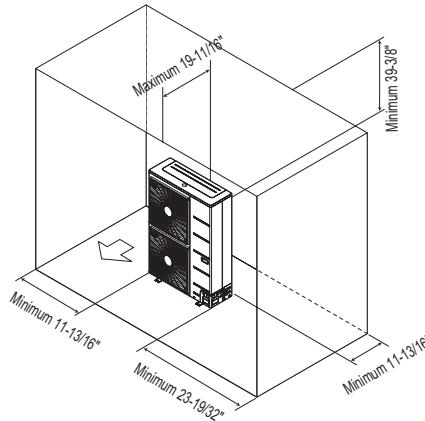
Outdoor Unit

Clearance Requirements when Different Obstacles are Present (Unit: Inch), continued.

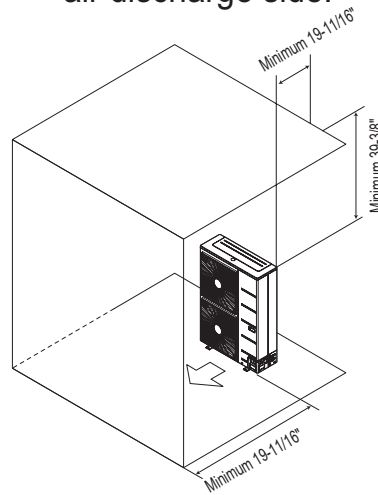
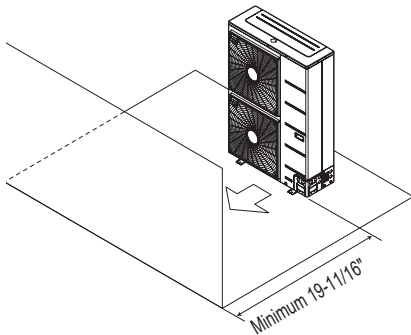
Obstacles above and on the air intake side. Obstacles above, on the air intake side, and on both left and right sides



Obstacle just on the air discharge side.



Obstacles above and on the air discharge side.



Where there are obstacles on both suction and discharge sides (discharge side obstacle is higher than the outdoor unit).

Where there are obstacles above, and on both suction and discharge sides (discharge side obstacle is higher than the outdoor unit).

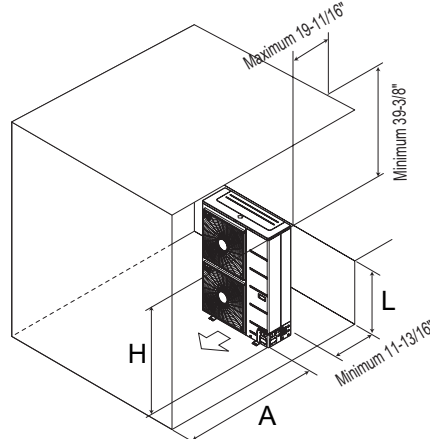
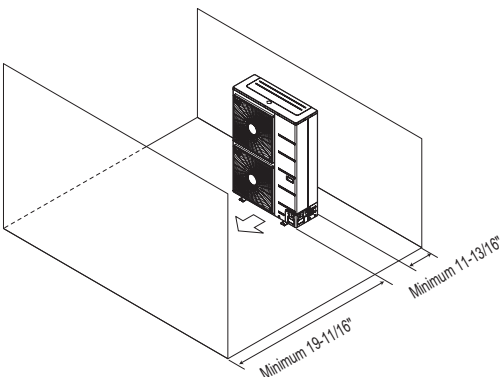


Table 28: Ratio among H, A, and L.

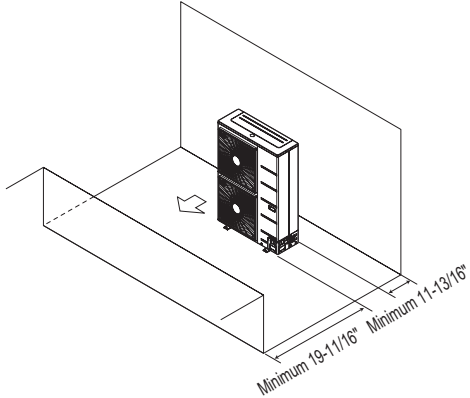
	L	A
L ≤ H	0 < L ≤ 1/2 H	29-1/32 inches
	1/2 H < L	39-3/8 inches
H < L	Set Stand as: L ≤ H	

If a stand is necessary, it should be contained (not open frame) to prevent the discharge air from short cycling.

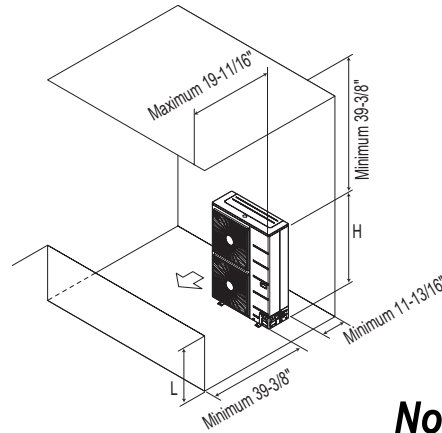
PLACEMENT CONSIDERATIONS

Clearance Requirements when Different Obstacles are Present, continued. (Unit: Inch)

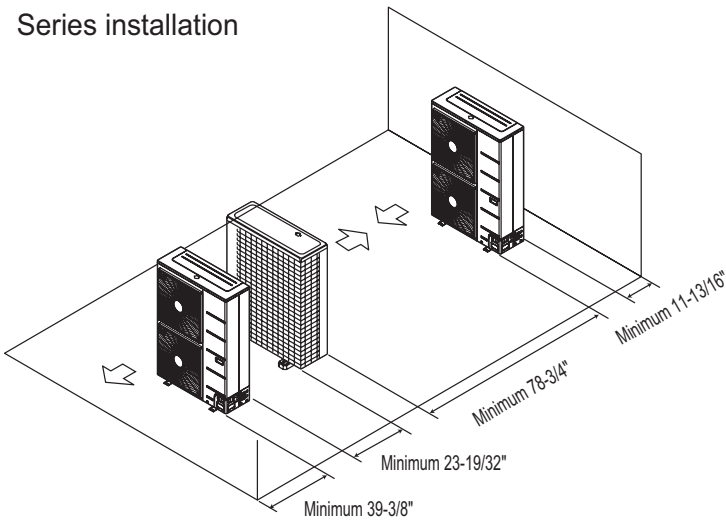
Where there are obstacles on both suction and discharge sides (discharge side obstacle is lower than the outdoor unit).



Where there are obstacles above, and on both suction and discharge sides (discharge side obstacle is lower than the outdoor unit).



Series installation



Note:

"L" should be lower than "H". If a stand is necessary, it should be contained (not open frame) to prevent the discharge air from short cycling.

REFRIGERANT PIPING DESIGN & LAYOUT BEST PRACTICES

“Design Guideline Summary” on page 50

“Selecting Field-Supplied Copper Tubing” on page 51

“Refrigerant Piping System Layout” on page 53

“Piping Insulation” on page 58

“Condensate Drain Piping” on page 59

REFRIGERANT PIPING DESIGN

Design Guideline Summary

Device Connection Limitations

A single-zone ceiling-concealed duct (high static) system consists of one outdoor unit and one indoor unit. One of the most critical elements of a single-zone ceiling-concealed duct (high static) system is the refrigerant piping. The table below lists pipe length limits that must be followed in the design of a single-zone ceiling-concealed duct (high static) refrigerant pipe system:

Table 30: Single-Zone Ceiling-Concealed Duct (High Static) Refrigerant Piping System Limitations.

System Model Name		LH247HV	LH367HV
Pipe Length (ELF = Equivalent Length of Pipe)	Longest total equivalent piping length	164 feet	246 feet
	Distance between fittings and indoor or outdoor units	≥20 inches	≥20 inches
Elevation (All Elevation Limitations are Measured in Actual Feet)	If outdoor unit is above indoor unit	98 feet	98 feet
	If outdoor unit is below indoor unit	98 feet	98 feet

DFS System Layout

Figure 31: Typical LH247HV System Layout.

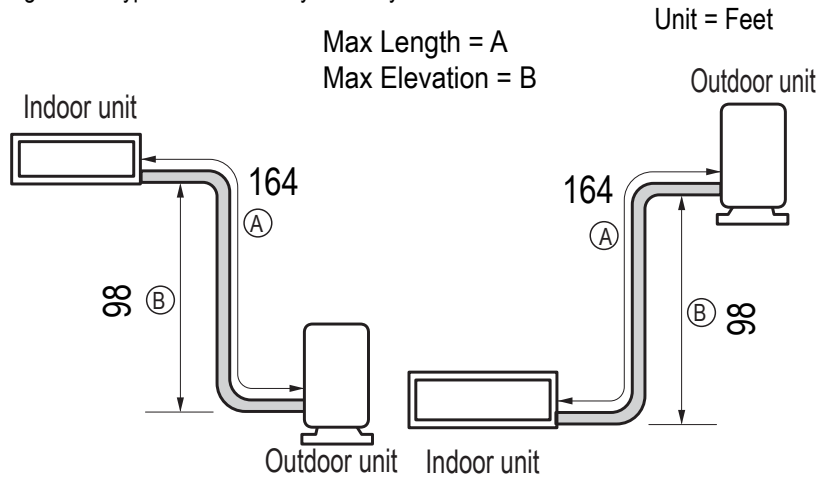
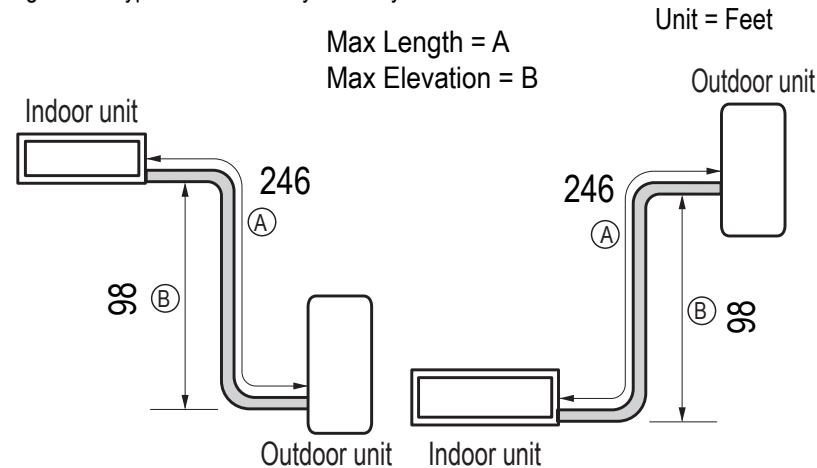


Figure 32: Typical LH367HV System Layout.



REFRIGERANT PIPING DESIGN

Selecting Field-Supplied Copper Tubing

Copper is the only approved refrigerant pipe material for use with LG DFS air conditioning products, and LG recommends hard-drawn rigid type “K” or “L”, or annealed-tempered, copper pipe.

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

Table 31: ACR Copper Tubing Material.

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

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

Table 32: Piping Tube Thicknesses.

OD (in)	1/4	3/8	1/2	5/8	3/4
Material	Rigid Type “K” or “L” - Soft ACR Acceptable			Rigid Type “K” or “L” Only	
Min. Bend Radius (in)	.563	.9375	1.5	2.25	3.0
Min. Wall Thickness (in)	.031	.031	.031	.039	.039

Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of a DFS system can vary as much as 280°F. With this large variance in pipe temperature, the designer must consider pipe expansion and contraction to avoid pipe and fitting fatigue failures. Refrigerant pipe, along with the insulation jacket, form a cohesive unit that expands and contracts together. During system operation, thermal heat transfer occurs between the pipe and the surrounding insulation.

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

The refrigerant pipe support system must be engineered to allow free expansion to occur. When a segment of pipe is mounted between two fixed points, provisions must be provided to allow pipe expansion to naturally occur. The most common method is the inclusion of expansion Loop or U-bends. See Figure 33 on page 53. Each segment of pipe has a natural fixed point where no movement occurs. This fixed point is located at the center point of the segment assuming the entire pipe is insulated in a similar fashion. The natural fixed point of the pipe segment is typically where the expansion Loop or U-bend should be. Linear pipe expansion can be calculated using the following formula:

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

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

1. From Table 33, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

Example:

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

Vapor Line

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

Liquid Line

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

When creating an expansion joint, the joint height should be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an Expansion Loop is provided in Table 34. 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.

REFRIGERANT PIPING DESIGN

Selecting Field-Supplied Copper Tubing

Table 33: Linear Thermal Expansion of Copper Tubing in Inches.

Pipe Length ¹	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.26	0.28	0.29	0.30
30	0.12	0.12	0.15	0.18	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.32	0.35	0.39	0.42	0.44	0.45
40	0.16	0.16	0.20	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.43	0.46	0.52	0.56	0.58	0.60
50	0.20	0.20	0.25	0.30	0.33	0.35	0.38	0.40	0.43	0.45	0.48	0.50	0.53	0.55	0.54	0.58	0.65	0.70	0.73	0.75
60	0.24	0.24	0.30	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.65	0.69	0.78	0.84	0.87	0.90
70	0.28	0.28	0.35	0.42	0.46	0.49	0.53	0.56	0.60	0.63	0.67	0.70	0.74	0.77	0.76	0.81	0.91	0.98	1.02	1.05
80	0.32	0.32	0.40	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.86	0.92	1.04	1.12	1.16	1.20
90	0.36	0.36	0.45	0.54	0.59	0.63	0.68	0.72	0.77	0.81	0.86	0.90	0.95	0.99	0.97	1.04	1.17	1.26	1.31	1.35
100	0.40	0.40	0.50	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.08	1.15	1.30	1.40	1.45	1.50
120	0.48	0.48	0.60	0.72	0.78	0.84	0.90	0.96	1.02	1.08	1.14	1.20	1.26	1.32	1.30	1.38	1.56	1.68	1.74	1.80
140	0.56	0.56	0.70	0.84	0.91	0.98	1.05	1.12	1.19	1.26	1.33	1.40	1.47	1.54	1.51	1.61	1.82	1.96	2.03	2.10
160	0.64	0.64	0.80	0.96	1.04	1.12	1.20	1.28	1.36	1.44	1.52	1.60	1.68	1.76	1.73	1.84	2.08	2.24	2.32	2.40
180	0.72	0.72	0.90	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	1.94	2.07	2.34	2.52	2.61	2.70
200	0.80	0.80	1.00	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.16	2.30	2.60	2.80	2.90	3.00
220	0.88	0.88	1.10	1.32	1.43	1.54	1.65	1.76	1.87	1.98	2.09	2.20	2.31	2.42	2.38	2.53	2.86	3.08	3.19	3.30
240	0.96	0.96	1.20	1.44	1.56	1.68	1.80	1.92	2.04	2.16	2.28	2.40	2.52	2.64	2.59	2.76	3.12	3.36	3.48	3.60
260	1.04	1.04	1.30	1.56	1.69	1.82	1.95	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.81	2.99	3.38	3.64	3.77	3.90
280	1.12	1.12	1.40	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94	3.08	3.02	3.22	3.64	3.92	4.06	4.20

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

Figure 33: Coiled Expansion Loops and Offsets.

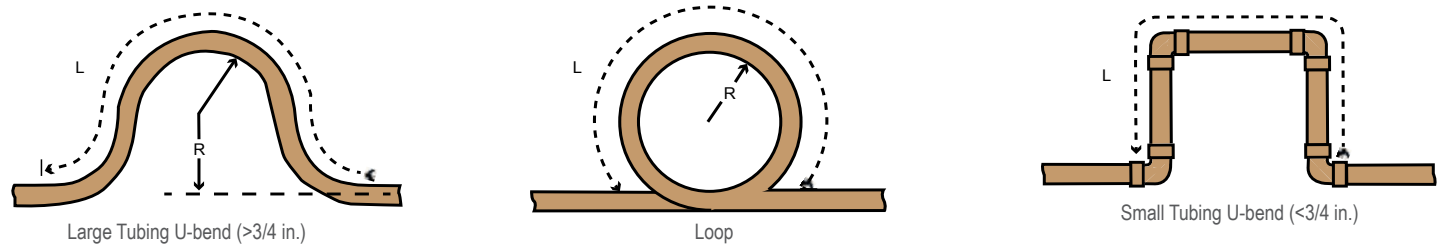


Table 34: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets.

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

¹R = Centerline Length of Pipe.

²L = Centerline Minimum Radius (inches).

REFRIGERANT PIPING DESIGN

Refrigerant Piping System Layout

Using Elbows

Field-supplied elbows are allowed as long as they are designed for use with R410A refrigerant. The designer, however, should be cautious with the quantity and size of fit-tings used, and must account for the additional pressure losses in equivalent pipe length calculation. The equivalent pipe length of each elbow must be added to each pipe segment.

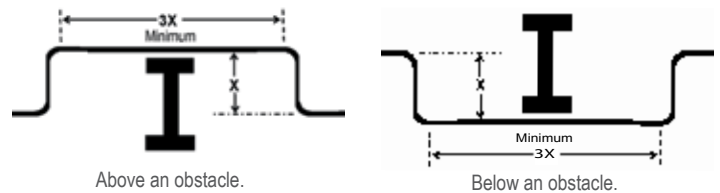
Table 35: Equivalent Piping Length for Piping Components.

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

Obstacles

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

Figure 34: Installing Piping Above and Below an Obstacle.



Pipe Slope

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

In-line Refrigeration Components

The designer and installer should verify the refrigerant piping system is free of traps, sagging pipes, sight glasses, filter dryers, solenoid valves, tee fittings, etc., on the refrigerant piping system between the outdoor units and the indoor units. The components may cause vapor to form in the liquid stream. Over time, dryers may deteriorate and introduce debris into the system.

No Pipe Size Substitutions

Use only the pipe size as conveyed in the product installation instructions. Using a different size is prohibited and may result in a system malfunction or failure to work at all.

REFRIGERANT PIPING DESIGN

Refrigerant Piping System Layout

Inserts and Pipe Supports

Inserts

An insert can be installed into a floor or beam before the concrete sets so that fittings such as ducts, pipes, or suspension bolts can be added at a later time. Decide where the inserts should be placed before support installation.

Pipe Supports

Note:

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

Pipe supports should never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket (see Figure 36). Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers should be used with shields between the hangers and insulation.

Field provided pipe supports should be designed to meet local codes. If allowed by code, use fiber straps or split-ring hangers suspended from the ceiling on all-thread rods (fiber straps or split ring hangers can be used as long as they do not compress the pipe insulation). Place a second layer of insulation over the pipe insulation jacket to prevent chafing and compression of the primary insulation within the confines of the support pipe clamp.

A properly installed pipe system will have sufficient supports to avoid pipes from sagging during the life of the system. As necessary, place supports closer for segments where potential sagging could occur. Maximum spacing of pipe supports shall meet local codes. If local codes do not specify pipe support spacing, pipe shall be supported a maximum of 5 feet on center for straight segments of pipe up to 3/4" outside diameter size.

Wherever the pipe changes direction, place a hanger within twelve (12) inches on one side and within twelve to nineteen (12 to 19) inches of the bend on the other side as shown in Figure 37.

Figure 35: Installing an Insert Into a Concrete Beam.

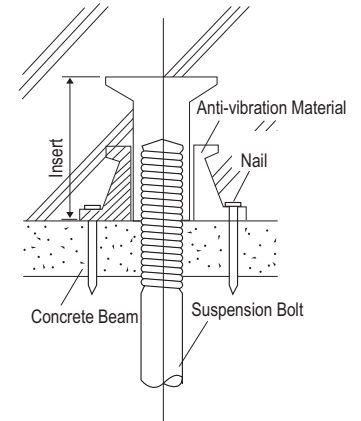


Figure 36: Pipe Hanger Details.

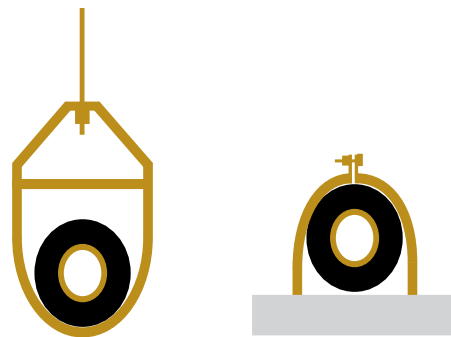


Figure 37: Typical Pipe Support Location—Change in Pipe Direction.

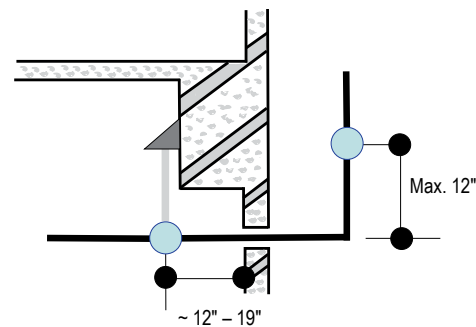
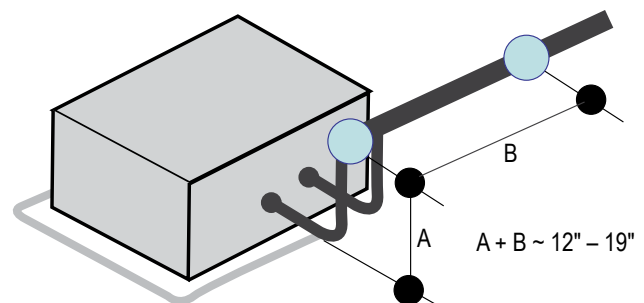


Figure 38: Pipe Support at Indoor Unit.



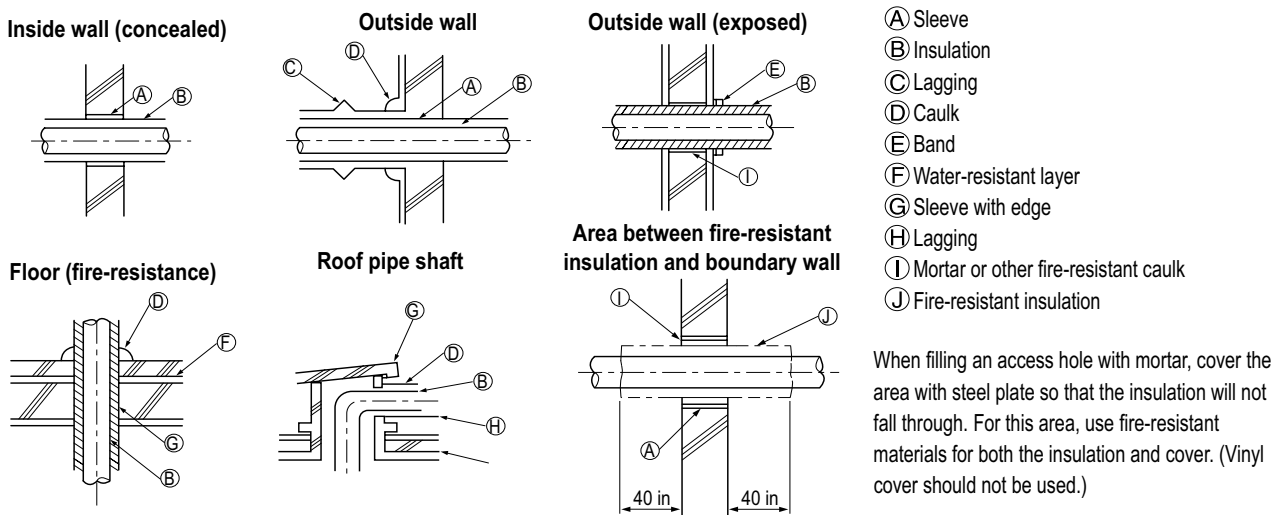
REFRIGERANT PIPING DESIGN

Refrigerant Piping System Layout

Pipe Sleeves at Penetrations

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

Figure 39: Pipe Sleeve Options.



Underground Refrigerant Piping

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

Table 36: Utility Conduit Sizes.

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

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

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

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

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

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

Figure 40: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.

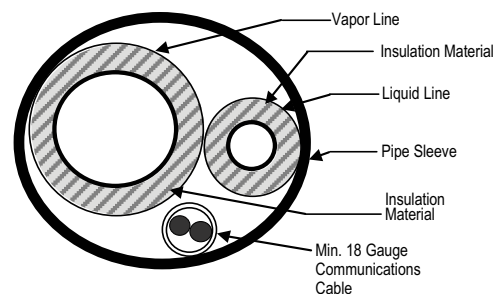


Table 37: Heat Pump Unit Refrigerant Pipe Connections (Flared).

System Model No.	Liquid Conn. (inches, O.D.)	Vapor Conn. (inches, O.D.)
LH247HV, LH367HV	3/8	5/8

REFRIGERANT PIPING DESIGN

Refrigerant Piping System Layout

Outdoor Unit Refrigerant Piping Connections

Figure 41: Removing the Refrigerant Piping Connection Cover (LUU247HV).

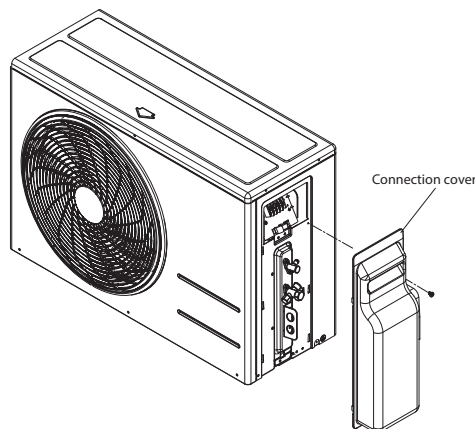


Figure 42: LUU247HV Refrigerant Piping Connections.

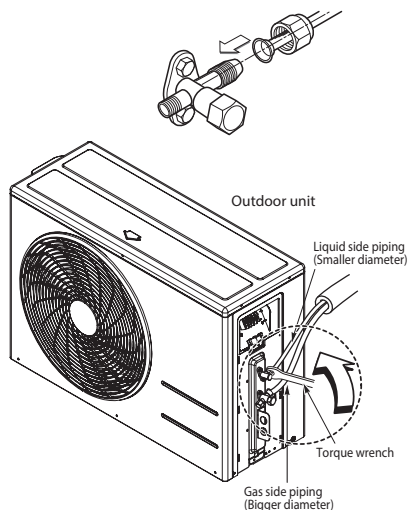
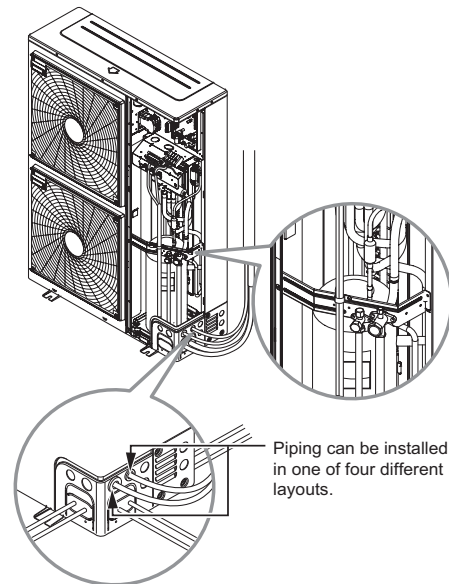


Figure 43: LUU367HV Refrigerant Piping Connections.

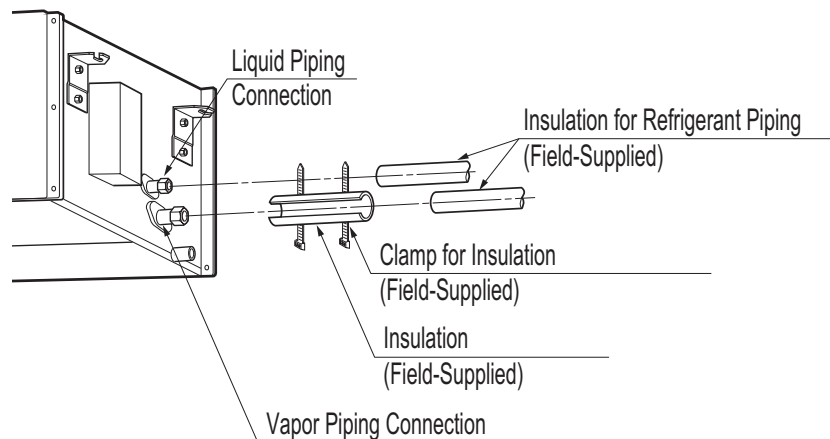


Piping Connection for a Single Zone System

1. Remove the connection cover from the unit by loosening the screws.
2. Align the center of the refrigerant pipe and corresponding connection, and tighten the flare nut by hand.
3. Tighten the flare nut with a torque wrench until the wrench clicks. See page 57 for guidelines for the torque amount to use.

Indoor Unit Refrigerant Piping Connections

Figure 44: Ceiling-Concealed Duct (High Static) Refrigerant Piping Connections.



REFRIGERANT PIPING DESIGN

Refrigerant Piping System Layout

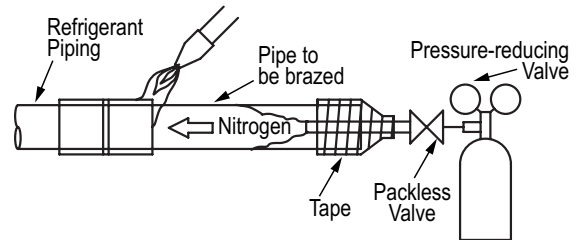
Brazing Practices

Note:

Keep the piping system free of contaminants and debris such as copper burrs, slag, or carbon dust during installation.

- The refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, heat exchangers. When joints are brazed in field these components can easily get blocked.
 - Store pipe stock in a dry place; keep stored pipe capped and clean.
 - Blow clean all pipe sections with dry nitrogen before assembly.
- Proper system operation depends on the installer using best practices and utmost care while assembling the piping system.
 - Use adapters to assemble different sizes of pipe.
 - Do not use flux, soft solder, or anti-oxidant agents.
 - Use a tubing cutter; do not use a saw to cut pipe. De-burr and clean all cuts before assembly.
- 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 a heat barrier spray product

Figure 45: Refrigerant Pipe Brazing.



Flare Connection Practices

Note:

Improperly installed flare connections can lead to refrigerant leaks.

- Place a couple of drops of refrigerant oil on the opening rim of the flare before assembling. Take care not to add any contaminants.
- Align the center of the refrigerant pipe and corresponding connection and tighten the flare nut by hand.
- Following the guidelines as outlined in Table 38 for the amount of torque to use, tighten the flare nut with a torque wrench until the wrench clicks.
- When flare is sufficiently tightened and the system has been tested for refrigerant leaks, wrap insulation around the connection.

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

Table 38: Torque Wrench Tightening.

Piping O.D. (in.)	Torque (lbs. / ft.)
1/4	13-18
3/8	24.6-30.4
1/2	39.8-47.7
5/8	45.6-59.3
3/4	71.6-87.5

Figure 46: Flare Connection, Isometric View.

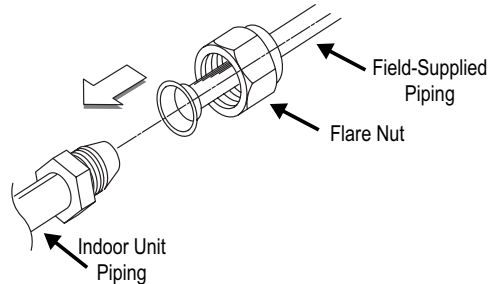


Figure 47: Flare Connection, Side View.

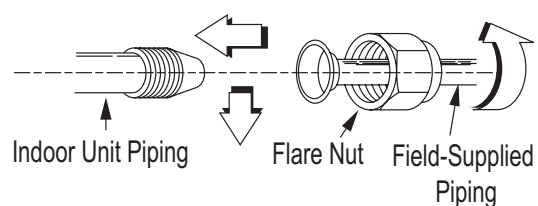
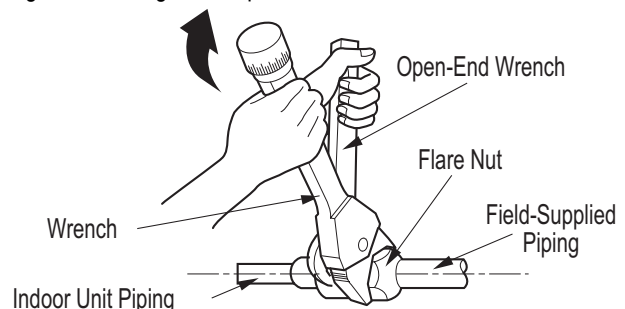


Figure 48: Using the Torque Wrench.



REFRIGERANT PIPING DESIGN

Piping Insulation

Refrigerant Piping System Insulation

All refrigerant piping including field-provided isolation ball valves, service valves, and elbows shall be completely insulated (up to the indoor unit piping connections) using closed cell pipe insulation. To prevent heat loss / heat gain through the refrigerant piping, all refrigerant piping including liquid lines and vapor lines shall be insulated separately. Any exposed piping may generate condensate or will cause burns if touched. Insulation shall be a minimum 1/2" thick, and thickness may need to be increased based on ambient conditions and local codes.

All insulation joints shall be glued with no air gaps. Insulation material shall fit snugly against the refrigeration pipe with no air space between it and the pipe. 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 shall be properly protected with PVC, aluminum vapor barrier, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover; and meet local codes. Because Duct (High Static) indoor units are often installed in the ceiling plenum, pay special attention to insulating the pipes.

The design engineer should 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.

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

Note:

Follow local codes when selecting EPDM insulation wall thickness.

Table 39: Insulation Guidelines for Typical and Special Circumstances.

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

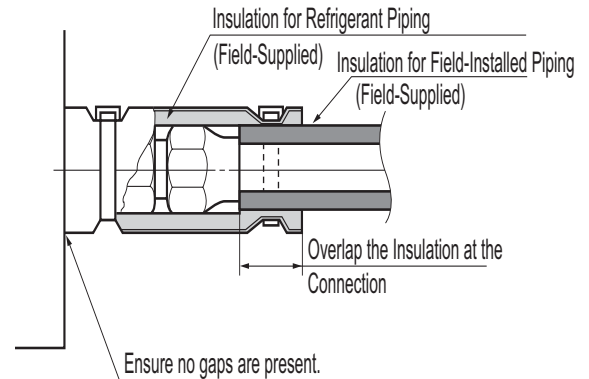
1. Air-conditioned, Typical location: When the piping passes through an indoor area where the indoor unit operates.

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

2. Air-conditioned, Special 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.

Figure 49: Close Up of Refrigerant Piping Insulation at the Connection to the Indoor Unit.



REFRIGERANT PIPING DESIGN

Piping Insulation / Condensate Drain Piping

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

3. Non-air conditioned, Typical location: When the piping passes through an indoor area where the indoor unit does not operate.

- Hallway or a dormitory or school, etc.

4. Non-air conditioned, Special location: If conditions 1 and 2 below are present.

1. When the piping passes through an indoor area where the indoor unit does not operate.
2. When the humidity is high and there is no air flow in the location where the piping is installed.
 - The thickness of the above insulation material is based on heat conductivity of 0.61 Btu/in/h/ft²/°F.

Condensate Drain Piping

Condensate drain piping should be constructed out of materials approved by local codes (generally PVC). Slope gradient for the drain should be 1/50~1/100, and support hangers should be used at 3-5/16 to 5 foot intervals to keep the condensate drainage system stable (see table below), and to reduce vibration.

Figure 50: Condensate Drain Piping Gradient.

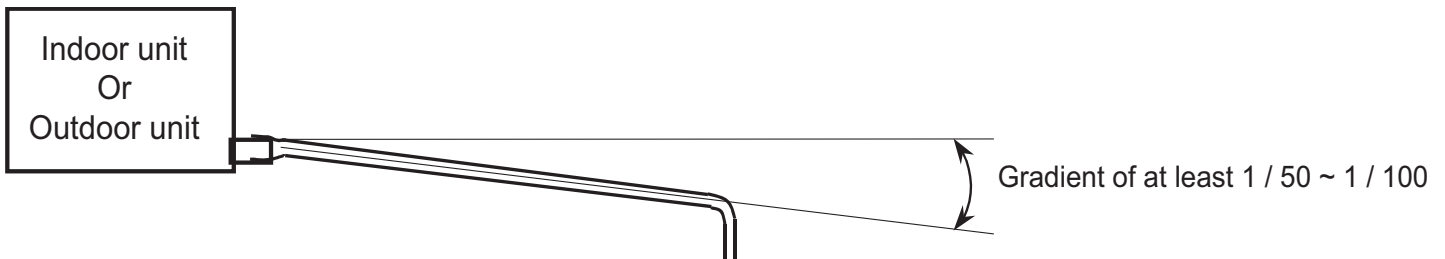


Table 41: Interval per Drainage Pipe Diameter.

Pipe Diameter (Inches)	13/16 ~ 1-9/16	1-9/16 ~ 2	2-9/16 ~ 4-15/16
Maximum Interval (feet)	≤3.28	≤4	≤5

Outdoor Units

See page 43 to 48 for information in reference to outdoor unit placement and condensate drainage.

Indoor Units

The Ceiling-Concealed Duct (High Static) indoor units include a factory-installed drain pump. Depending on the location of the indoor unit, condensation can be drained directly to the outside of the building, or tied into a drainage piping system.

Table 40: Drain Piping Specifications.

Indoor Unit	Drain Pipe Dia. (inches) (External / Internal)	Drain Pump	Drain Lift Height (inches)	Amount of Drainage (gpm) (at 0.4 inches high)
Ceiling Concealed Duct (High Static)	1-1/4 / 1	Standard	27-9/16	0.106

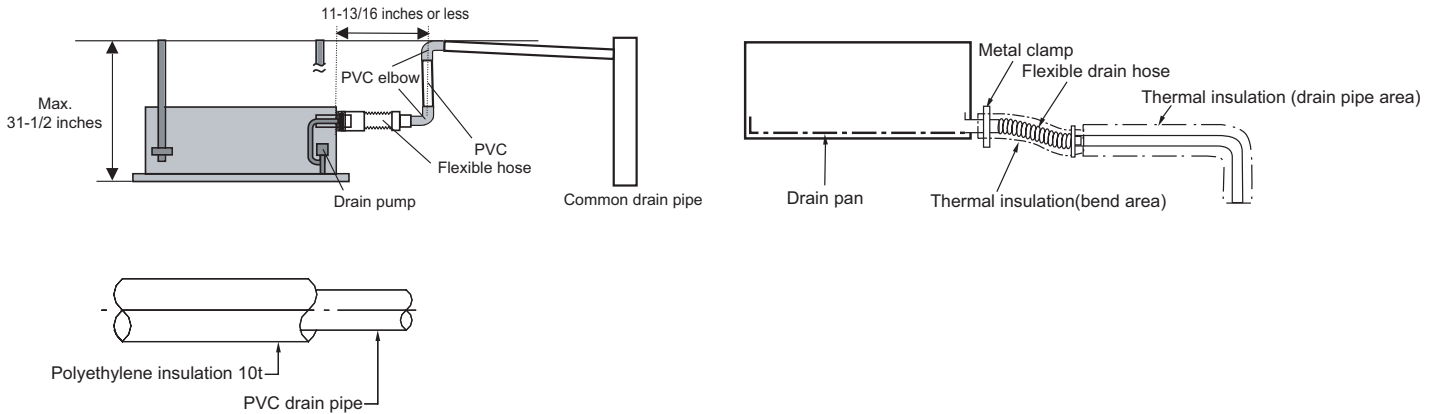
REFRIGERANT PIPING DESIGN

Condensate Drain Piping

Figure 51: Condensate Drain Piping Trap.

Models with drain pump

Models without drain pump



Condensate Drain Piping Insulation

The inside temperature of the drain piping can rise to about 50°F. When high temperature and humidity air touch the outside surface of the drain pipe, condensation may form. To prevent condensation from forming, install polyethylene insulation 1/4 to 7/16 inches thick. Drain piping must be properly insulated to prevent damage to the indoor unit and the ceiling.

Figure 52: Condensate Drain Piping Should Be Properly Clamped at the Connections.



Clamp connection

Figure 53: Properly Insulated Condensate Drain Piping.



Insulation not required Insulation required



Insulation that fits

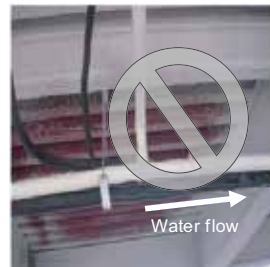
Figure 54: Condensate Drain Piping Should Not Include Sharp Bends.



Sharp bend



Figure 55: Do Not Reverse the Slope for the Drain Connection.



Reverse slope

Figure 56: Improperly Installed Insulation — Too Loose.



Insulation that does not fit—too loose

Drain Piping Leak Test

Test the condensate drain piping system for leaks 24 hours after installation is complete. Use only water to test the drain piping.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

“Wiring Connections” on page 62

“Mechanical Specifications” on page 66

“Acronyms” on page 68

ELECTRICAL CONNECTIONS

Wiring Connections

General Information

⚠ WARNING

- Only qualified technicians—in accordance with federal, state, and local codes, and manufacturer product diagrams and requirements—should install the power wiring and communication cables.
- Use only copper wiring that is stranded, shielded with the wires separately insulated.
- Do not use a multi-conductor cable with more than five (5) wires in one (1) core.
- Power wiring and communications cable sizes must comply with applicable federal UL / ETL, state, and local codes.
- Verify that the branch switch and circuit breaker are set to OFF before installing the wiring system.
- Do not operate the air conditioning system until the refrigerant piping installation is complete. Operating the system before refrigerant piping is finalized may damage the compressor.
- Install a ground wire for the outdoor unit and indoor unit.
- Install a main shutoff switch or circuit breaker that interrupts the power source (circuit breaker should be resistant to electromagnetic currents).
- To avoid the possibility of explosion, fire, etc., do not connect the ground wiring to gas or sewage pipes, lightning rods, and telephone wires. Use clamps to prevent the wires from touching the piping.
- Use ring terminals to attach the wiring. Verify that all power wiring and communications cable terminals are securely attached; ensure enough slack is included in the wiring and cables to avoid damaging the connections.
- Use a conduit to protect the power wiring.
- Do not install a phase-advancing capacitor; the outdoor unit may overheat.
- Verify all wiring / cable connections are appropriately tightened.

Power Wiring and Communication Cable Installation

For Duct-Free Split systems, power is wired to the outdoor unit only. The outdoor unit will supply power to the indoor units through the power wiring / communications cable.

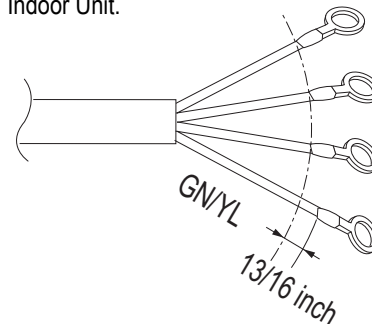
Electrical Specifications

1. Ceiling-Concealed Duct (High Static) Outdoor Unit: 1Ø, 208-230V, 60Hz.
2. Ceiling-Concealed Duct (High Static) Indoor Unit: 1Ø, 208-230V, 60Hz from the outdoor unit (Indoor units draw minimal power.)
3. Power supply wire type and size should be selected based on NEC and local codes. Maximum allowable voltage fluctuation $\pm 10\%$ of the nameplate rated value.
4. Properly ground the outdoor unit per NEC and / or local code.
5. Use only copper wiring that is stranded and shielded with the wires separately insulated.

Power Wiring / Communications Cable Specifications

- From Ceiling-Concealed Duct (High Static) Outdoor Unit to Indoor Unit = 4C x 18 AWG
- Maximum Allowable Temperature: 194°F
- Indoor Unit(s) to Wired Controller: Three-core cable

Figure 57: Power Wiring and Communications Cable from the Outdoor Unit to the Indoor Unit.



ELECTRICAL CONNECTIONS

Wiring Connections

Connecting the Power Wiring / Communications Cable

Best practice dictates using ring or spade terminals to terminate power wiring at the power terminal block. If ring terminals or spade clips are not available, then:

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

Figure 58: Close up of a Typical Ring Terminal.

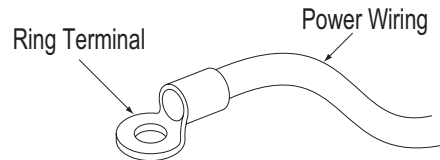
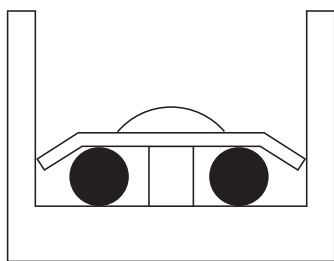
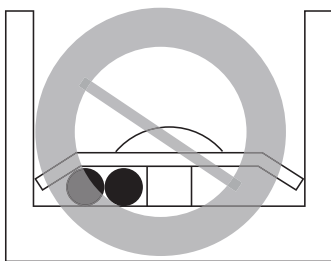


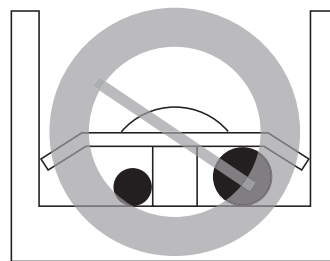
Figure 59: Proper and Improper Power Wiring Connections.



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

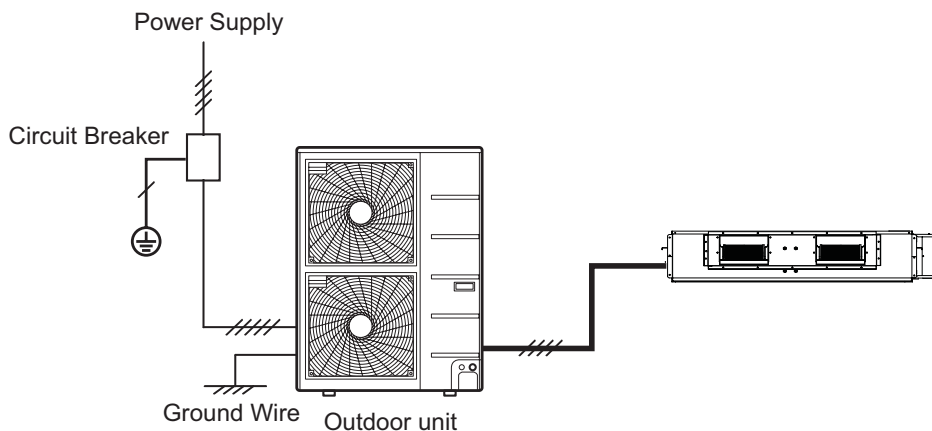
⚠ WARNING

If power wires are not properly terminated and / or firmly attached, there is a risk of fire, electric shock, and / or 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. Provide some slack to facilitate removing the electrical panels while servicing.

Figure 60: General Power / Communications System Schematic.



Note:

- Secure the separate wires in the control box panel using zip ties.
- Secure wiring with accessory clamps so that it does not touch piping.
- Use a conduit for the cable
- Outside the unit, make sure the communications cable and the power wiring are shielded separately, otherwise, the outdoor unit operation may be affected by electrical noise and will malfunction or fail.

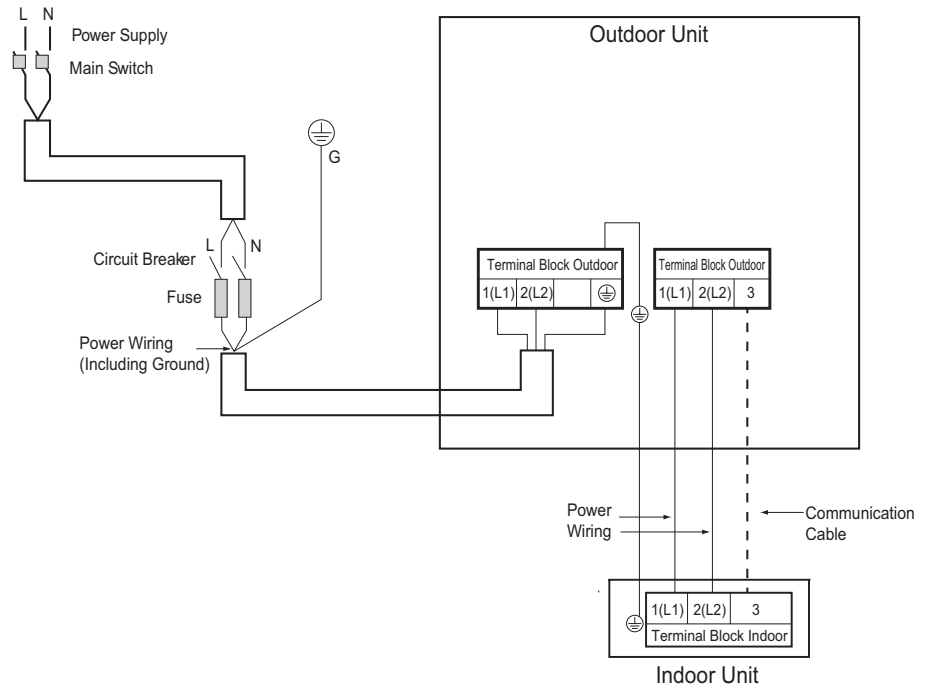
ELECTRICAL CONNECTIONS

Wiring Connections

⚠ WARNING

- Use only copper wiring that is stranded, shielded with the wires separately insulated.
- Power wiring and communications cable sizes must comply with applicable federal UL / ETL, state, and local codes.
- Install a ground wire for the outdoor unit and indoor unit.
- Verify all wiring / cable connections are appropriately tightened.

Figure 61: Detailed Power / Communications System Schematic.

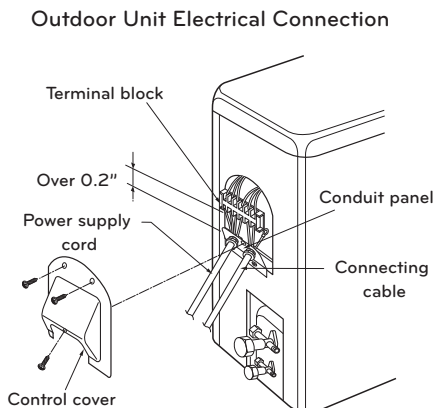


Connecting the Power Wiring / Communications Cable to the Outdoor Unit

LUU247HV Outdoor Unit Connections

1. Remove the control cover from the unit by loosening the screws.
2. Take off the caps on the conduit panel.
3. Connect both the power supply and low voltage lines to the corresponding terminals on the terminal block.
4. Be sure to ground the unit by following local codes.
5. Allow for enough length (add several inches) for each wiring.
6. Secure the cable with the cord clamp.
7. Secure conduit tubes with lock nuts.
8. Reattach the control cover with screws.

Figure 62: LUU247HV Outdoor Unit Terminal Block Location.

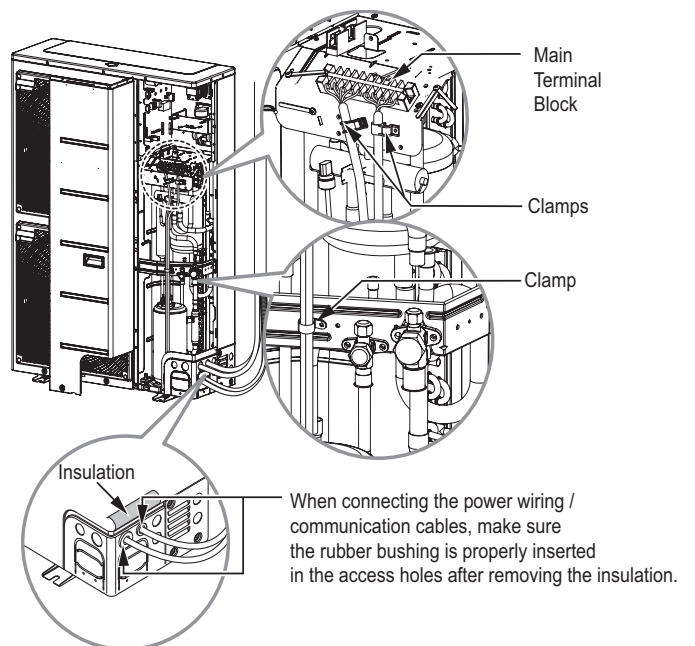


*Connection might look slightly different depending on Single Zone ODU being used.

LUU367HV Outdoor Unit Connections

1. Remove the side panel.
2. Use the clamp to attach the wiring / cable.

Figure 63: LUU367HV Outdoor Unit Terminal Block Location.



ELECTRICAL CONNECTIONS

Wiring Connections

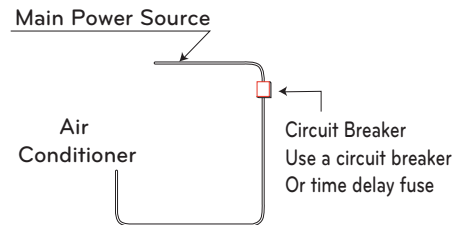
Note:

Always use a circuit breaker or time delay fuse when connecting electrical wiring to the unit.

⚠ WARNING

- The circuit diagram is subject to change without notice.
- Connect the wiring following the wiring diagram and the color codes.
- Firmly attach the wiring so the wires cannot be pulled out easily.
- Comply with local codes while running wire from the indoor unit to the outdoor unit.
- Be sure to firmly connect the wiring.
- Separately wire the high and low voltage lines.
- Use heat-proof electrical wiring capable of withstanding temperatures up to 167°F.
- Use outdoor and waterproof connection cable rated up to 300V for the connection between indoor and outdoor unit.
- Do not allow wire to touch refrigerant tubing, the compressor or any moving parts.

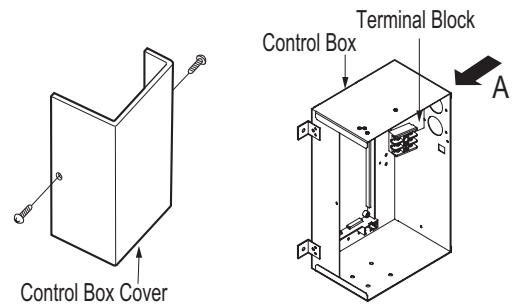
Figure 64: Circuit Breaker/Time Delay Fuse Connection.



Connecting the Power Wiring / Communications Cable to the Indoor Unit

1. To access the terminal block, first unscrew the cover from the control box.
2. Insert the power wiring / communications cable from the outdoor unit through the sides of the indoor unit and control box. Pass the wiring through the designated access holes to prevent damage. To prevent electromagnetic interference and product malfunction, leave a space between the power wiring and communications cable outside of the indoor unit.
3. Connect each wire to its appropriate terminal on the indoor unit control board. Verify that the color and terminal numbers from the outdoor unit wiring match the color and terminal numbers on the indoor unit.
4. Secure the power wiring / communications cable with the cable restraint.
5. Screw the steel clamp to the inside of the control panel.
 - Place the wiring / cables in the clamp and tighten the plastic clamp to an open surface of the control panel.
 - When clamping, do not apply force to the wiring connections.
 - Neatly arrange the wiring, do not catch the wiring in the electric box cover, and ensure the cover firmly closes.
6. Fill in any gaps around the wiring access holes with sealant to prevent foreign particles from entering the indoor unit.

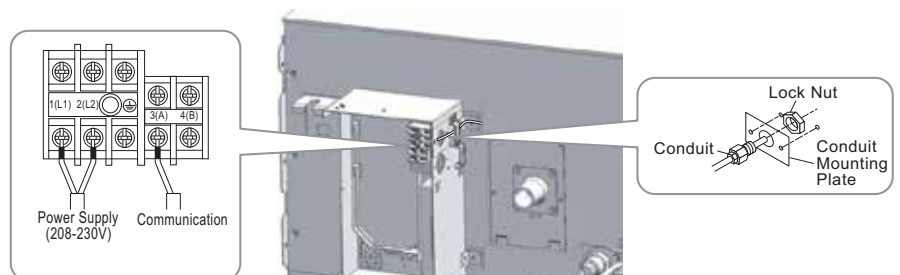
Figure 65: Accessing the Indoor Unit Terminal Block.



Using a Conduit

1. Remove the rubber stopper on the indoor unit. Pass the power wiring / communications cable through the conduit, the conduit mounting plate, and to / through the control panel of the indoor unit.
2. Connect the power wiring / communications cable to the indoor unit terminal block.
3. Screw the conduit mounting plate to the indoor unit.
4. Tighten the conduit and the conduit mounting plate together.

Figure 66: Indoor Unit Terminal Block Location / Using a Conduit.



MECHANICAL SPECIFICATIONS

Ceiling-Concealed Duct (High Static) System

General

System

LG single zone ceiling-concealed duct (high static) system comprises of a single frame outdoor unit connected to a single indoor unit with a single refrigerant circuit. An LG single zone ceiling-concealed duct (high static) system is a DFS system that can operate in either cooling or heating mode. The system is capable of changing mode within a maximum time of three (3) minutes to ensure indoor temperature can be properly maintained. LG components are manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International organization for Standardization (ISO). The system components comply with Underwriters Laboratories (UL) 1995 Heating and Cooling Equipment Standard for Safety and bear the Electrical Testing Laboratories (ETL) label. Wiring in these units are in accordance with the national Electrical Code (NEC). LG single zone ceiling-concealed duct (high static) systems have published performance ratings certified by AHRI (Air-Conditioning, Heating, and Refrigeration Institute) and are listed in the AHRI Standard 210/240 certified product directory.

Outdoor Unit

The outdoor unit has sound levels not exceeding 54 dB(A) tested in an anechoic chamber under ISO Standard 3745.

Indoor Unit

Ceiling-Concealed Duct (High Static) units are designed for high-speed air volume against an external static pressure up to 0.78"WG for the 24,000 Btu/h model; up to 0.6"WG for the 36,000 Btu/h model.

Temperature Ranges

Outdoor Unit

Operating ranges for outdoor units of 5°F to 118°F (DB) for cooling; 0°F to 64°F (WB) for heating.

Indoor Unit

Operating ranges for indoor units of 57°F to 77°F (WB) for cooling; 59°F to 81°F(DB) for heating.

Casing / Frame

Outdoor Unit

The outdoor condensing unit case is constructed from pre-coated metal (PCM) that has been tested in accordance with ASTM B-117 salt spray procedure for a minimum of 1,000 hours. Case has a removable panel to allow access to major internal components, and legs to secure the unit during installation.

Indoor Unit

The indoor unit casing is designed to mount fully concealed above a finished ceiling. Casing is manufactured of galvanized steel plate. Cold surfaces of the unit are covered internally with a coated polystyrene insulating material, and covered externally with sheet insulation made of ethylene propylene diene monomer (M-Class) (EPDM). External insulation is plenum rated and conforms to ASTM Standard D-1418.

Hanger brackets are included on the casing to support the weight on four corners. The indoor unit has a front horizontal supply air discharge, and one dedicated rear horizontal return air. The supply air opening is flanged to accept field-installed ductwork that shall not exceed the external static pressure limitation of the unit.

Figure 67: Ceiling-Concealed Duct (High Static) System (LH247HV Model).



Refrigerant System

System is designed for use with R410A refrigerant, and consists of a single refrigeration circuit. The refrigeration circuit is pressure-tested at the factory and shipped with a holding charge of helium gas. The outdoor unit is provided with factory installed components, including a refrigerant strainer, oil separator, accumulator, four-way reversing valve, electronic expansion valve (EEV), high and low side charging ports, service valves, and interconnecting piping. All refrigerant lines from the outdoor unit to the indoor unit are field-installed and must be insulated separately.

Compressors

The outdoor unit is equipped with one hermetically sealed, digitally controlled, inverter-driven twin rotary compressor to modulate capacity (variable from 20 to 100 Hz, modulate in 1 Hz increments). Teflon coated bearings, overcurrent protection and vibration isolation are integrated with the compressor.

MECHANICAL SPECIFICATIONS

Ceiling-Concealed Duct (High Static) System

Coil

Outdoor Unit

Heat pump outdoor unit coils are made of nonferrous louvered aluminum fins protected with an integral coil guard. The coil for each outdoor unit has a minimum of 14 fins per inch (FPI); heat exchanger has two rows. The coil fins have a factory applied corrosion resistant GoldFin™ material with hydrophilic coating tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1,000 hours. Coils are factory tested to a pressure of 551 psig.

Indoor Unit

Indoor unit coils are factory built and are comprised of aluminum fins mechanically bonded to copper tubing. Each indoor unit has a minimum of three rows of coils, which are pressure tested to 551 psig at the factory. Each unit is provided with a factory installed condensate drain pan below the coil.

Fans and Motors

Outdoor Unit

The two-ton outdoor unit (LUU247HV) includes one direct drive, variable speed propeller type fan with a horizontal air discharge; the three-ton outdoor unit (LUU367HV) includes two fans. Fan blades are made of Acrylonitrile Butadiene Styrene (ABS) material, and have a Brushless Digitally Controlled (BLDC) fan motor. The fan motor has inherent protection, permanently lubricated bearings, and variable speed with a maximum speed up to 950 rpm. Raised guards are provided to limit contact with moving parts.

Indoor Unit

The indoor unit has two direct-drive, Sirocco fans made of high strength ABS GP-2200 polymeric resin; the fans are statically and dynamically balanced. The fans are mounted on a common brushless digitally controlled (BLDC) motor, and is mounted on vibration-attenuating rubber grommets. Fan speed is controlled using a microprocessor-based direct digital control algorithm. The indoor fan has Low, Med, High, and Auto settings for Cooling mode; and has Low, Med, High, and Auto settings for Heating mode. The Auto setting adjusts the fan speed based on the difference between the controller set-point and space temperature.

Air Filter - Indoor Unit

The return air inlet on the indoor unit includes a factory-supplied removable, washable filter that is accessible from the back of the unit. Options include a return filter box that holds a field-provided high efficiency one or two inch MERV-rated filters, and a LG-supplied air cleaner (each sold separately).

Electrical

The system was designed to operate using 208–230/60/1 power with voltage variances of $\pm 10\%$ and includes overcurrent protection. The indoor unit is powered through the outdoor unit.

Controls

Indoor and outdoor units are factory wired with necessary electrical control components, printed circuit boards, thermistors, sensors, terminal blocks, and lugs for power wiring. Factory installed micro-processor controls in the outdoor unit and indoor unit shall perform functions to efficiently operate the single zone system, communicating via an 18 AWG four stranded and shielded conductor power/transmission cable. Microprocessor-based algorithms provide component protection, soft-start capability, refrigeration system pressure, temperature, defrost, and ambient control. System can be operated through a simple wired remote controller supplied with the duct (high static) indoor unit.

Condensate Lift/Pump

The indoor unit is provided with a factory installed and wired condensate lift/pump capable of providing a minimum 27-9/16 inch lift from the bottom surface of the unit. Drain pump has a safety switch to shut off the indoor unit if the condensate rises too high in the drain pan.

Figure 68: Ceiling-Concealed Duct (High Static) System (LH367HV Model).

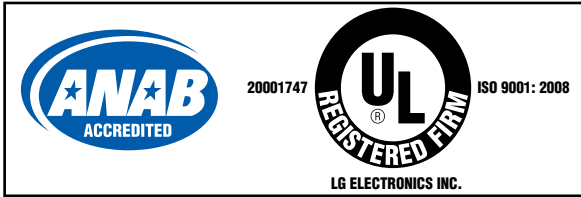


ACRONYMS

Table 42: Table of Acronyms.

ABS	Acrylonitrile Butadiene Styrene	kW	Kilo Watts
AC	Air Conditioner	LED	Light Emitting Diode
ACP	Advanced Control Platform	LEED	Leadership in Energy and Environmental Design
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers	MBh	Thousands BTUs per hour
AWG	American Wire Gauge	MCA	Maximum Circuit Ampacity
BLDC	Brushless Digitally Controlled	MOP	Maximum overcurrent Protection
Btu/h	British Thermal Units per hour	MSC	Maximum Starting Current
BUS	Binary Unit System	NC	Noise Criterion (regarding Sound Pressure Levels)
CFM	Cubic Feet per Minute		New Construction (LEED Related)
DB	Dry Bulb		Normally Closed
dB(A)	Decibels with "A" frequency weighting	NEC	National Electrical Code
DDOAS	Decoupled Dedicated Outdoor Air System	No.	Number
DI	Digital Input	ODU	Outdoor Unit
DFS	Duct Free Split	PCB	Printed Circuit Board
DO	Digital output	PCM	Pre-Coated Metal
DPST	Double-Pole Single-Throw (switch)	PDI	Power Distribution Indicator
EEV	Electronic Expansion Valve	PI	Power Input
ELF	Equivalent Length in Feet	PR	Prerequisite (LEED Related)
ETL	Electronic Testing Laboratories	PVC	Polyvinyl Chloride
H/M/L	High/Medium/Low	SW or S/W	Switch
HIPS	High Impact Polystyrene	USB	Universal Serial BUS
HVAC	Heating, Ventilation and Air Conditioning	VAC	Voltage Alternating Current
ID	Innovations in Design (LEED Related)	VRF	Variable Refrigerant Flow
IDU	Indoor Unit	WB	Wet Bulb
ISO	International organization for Standardization		

Inverter



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