

MULTI F

MULTI F MAX

HEAT PUMP SYSTEM ENGINEERING MANUAL

Multi-Zone Heat Pump Systems 1.5 to 5 Tons



Dual and Tri-Zone
Multi F



Quad-Zone
Multi F



Eight-Zone
Multi F MAX

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TABLE OF SYMBOLS

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

Multi-Zone Systems

LG HVAC systems offer a range of solutions that are cost efficient, quiet and attractive. Multi-zone 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.

Benefits of Multi F Systems

- Individual zone control
- Long refrigerant piping lengths
- High refrigerant piping elevation differences
- Maximum flexibility
- Operating ranges of 14°F to 118°F (DB) in cooling and -4°F to 64°F (WB) in heating
- Quiet and comfortable environment
- Reduced ductwork



Multi F Systems

LG's inverter heat pumps can support two, three, or four indoor units that are typically installed in separate rooms. Each indoor unit includes its own remote control, allowing the customer to set the temperature individually. Indoor units are available in several different configurations: Art Cool™ Mirror wall-mounted, Art Cool Gallery wall-mounted, standard wall-mounted, four-way ceiling cassettes, ceiling-concealed duct (high and low static), and vertical-horizontal air handling models. Multi F MAX systems, released in 2012, can operate up to eight indoor units through two-, three-, or four-port branch distribution units.

Adaptable and Flexible

Multi F outdoor units can be adapted to a wide range of building applications and sizes such as schools, hotels, hospitals, offices, and residences. The system components are lightweight and compact so they can be placed in buildings without expensive cranes, they easily fit into most service elevators, and they can be set in place with minimal structural reinforcements requirements.

Multi F technology allows you to pipe farther by reaching areas of the building that would require the installation of a second system when using traditional direct-expansion cooling and heating equipment. Multi F provides the designer with uncompromised pipe system engineering flexibility—long pipe runs and large elevation differences. Whether your building is a condominium, a hotel, a school, or an office complex, Multi F is best suited to reach the farthest corners and elevations.

Smaller Chases and Plenums

LG Multi F systems use refrigerant piping to move heat, resulting in smaller space requirements for piping as compared to chilled water or roof top systems. This helps reduce the overall construction and material cost of the building, and gives back leasable space. Flexible and logical placement of system components, reduced back-and-forth pipe lengths, and fewer joints lowers installation costs and minimizes potential leaking.

Quality Commitment

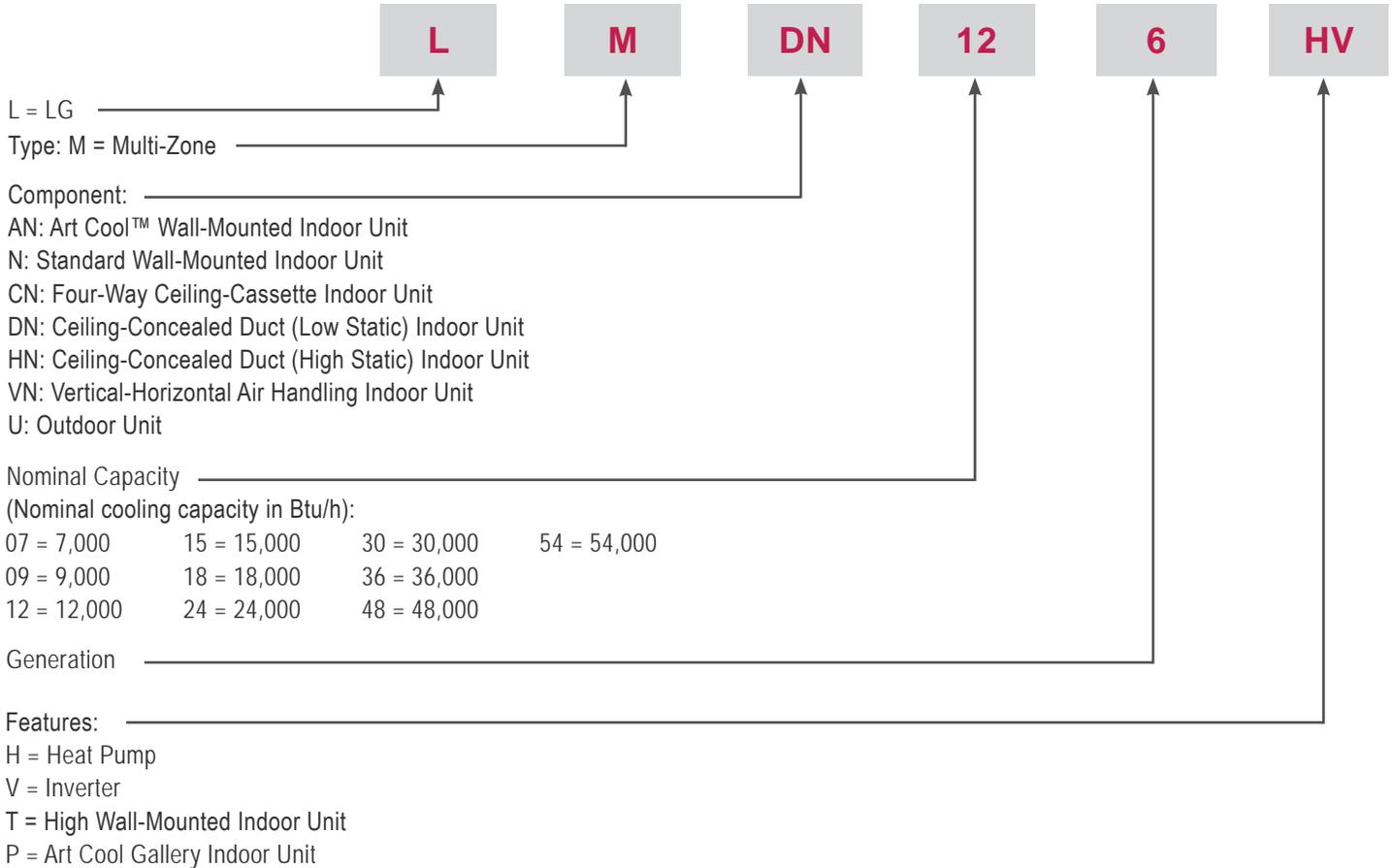
LG is committed to the success of Duct-Free Split projects. We provide technical support during installation and commissioning. LG offers a variety of classes designed for installers and on Multi F installation. Classes are conducted at LG's training centers and in field locations at various times throughout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



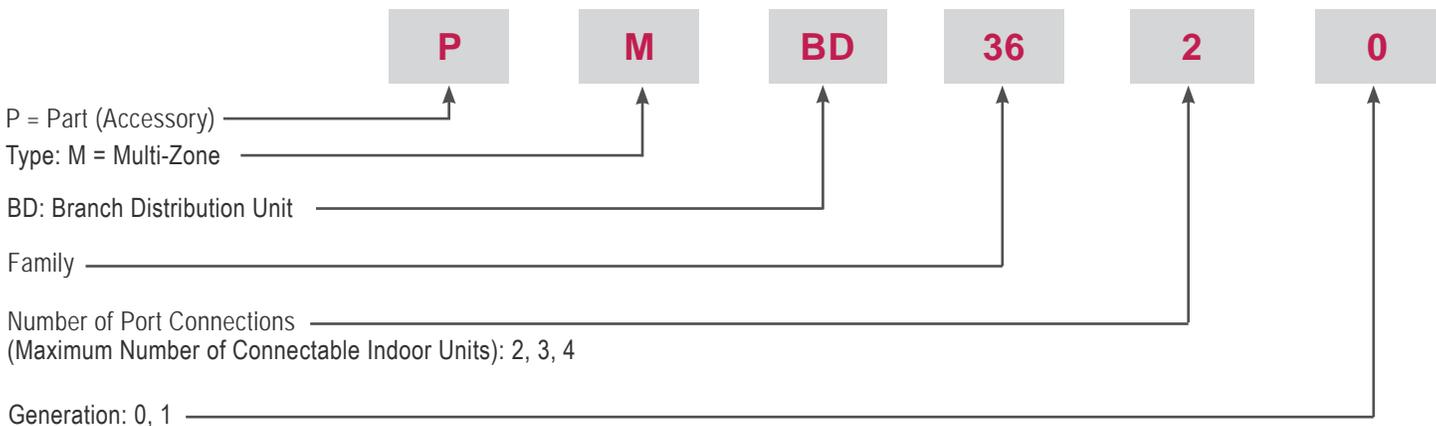
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Multi-Zone Systems — Indoor Units and Outdoor Units



Branch Distribution Units



Note:

- Voltage for all equipment is 208-230V, 60 Hz, 1-phase.
- All indoor units are compatible with wired controllers.
- All outdoor units are LGAP control network compatible with PI-485 V-net Control Integration Board (PMNFP14A1, sold separately).
- Compatible single zone IDU nomenclature is listed in the Single Zone Wall-Mounted IDU Engineering Manual.

MULTI F OUTDOOR UNIT DATA

“Product Features and Benefits” on page 8

“Mechanical Specifications” on page 9

“General Data” on page 10

“Dimensions” on page 12

“Electrical Data” on page 15

“Acoustic Data” on page 15

“Refrigerant Flow Diagrams” on page 16

“Wiring Diagrams” on page 19

“Operation Range” on page 22

MULTI F SYSTEMS

Features and Benefits

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The multiple piping of Multi F systems can support two, three or four indoor units that are typically mounted in separate rooms. Compact refrigerant pipes work in tandem with wiring to link the outdoor unit with all indoor units directly. Most indoor units include its own remote control, allowing the user to set the temperature individually in different rooms. The indoor units are available in a variety of capacities and styles, including Art Cool™ Mirror and Gallery Wall Mounts, Standard Wall Mount, Four-Way Ceiling Cassette, Horizontal Ceiling Concealed Duct, and Vertical-Horizontal Air Handling models.

Features

- Defrost
- Restart delay (three [3] minutes)
- Self diagnosis
- Soft start
- Inverter (Variable speed compressor)
- Low ambient operation to 14°F (DB, Cooling mode)
- Optional low ambient baffle kit allows cooling operation down to -4°F (DB)
- Heating operation down to -4°F (WB)
- Auto operation / auto restart operation
- Gold Fin™ anti-corrosion
- Outdoor unit includes sufficient refrigerant for charging two (2), three (3), or four (4) indoor units using 24.6 feet of pipe to each

Benefits

- Long refrigerant piping lengths allow for extra design flexibility in indoor unit placement
- Easy installation: Little to no ductwork required; most indoor units can mount on any wall
- Indoor unit and outdoor unit dimensions ensure space saving convenience
- All-season use—heat pump models have both cooling and heating capabilities



Figure 1: Dual-Zone Multi F Heat Pump Inverter System — Mix and match for 9,000-24,000 Btu/h.



Figure 2: Tri-Zone Multi F Heat Pump Inverter System — Mix and match for 12,000-33,000 Btu/h.



Figure 3: Quad-Zone Multi F Heat Pump Inverter System — Mix and match for 18,000-48,000 Btu/h.

Multi F Heat Pump Condensing Units

General

A Multi F multi-zone system is comprised of one heat pump outdoor unit connected to two, three, or four indoor units using a shared refrigerant piping circuit between the outdoor unit and each indoor unit, and includes integrated controls supplied by LG. The outdoor unit is internally assembled, wired, and piped from the factory; all LG components are manufactured in a facility registered to ISO 9001 and ISO 14001, set by the International Organization for Standardization (ISO). The LG Multi F multi zone heat pump system components comply with Underwriters Laboratories (UL) 1995 Heating and Cooling Equipment Standard for Safety, and bear the Electrical Testing Laboratories (ETL) mark. The units are certified to AHRI 210 / 240.

Temperature Ranges

The heat pump outdoor units are capable of operating in cooling mode from 14°F to +118°F ambient dry bulb (installing an optional Low Ambient Wind Baffle Kit will allow operation down to -4°F in cooling mode for Multi F systems). The heat pump outdoor units are capable of operating in heating mode from -4°F to +64°F ambient wet bulb without additional low ambient controls.

Frame

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

Refrigerant System

Multi F systems have a shared refrigerant circuit field piped to multiple (ducted, non-ducted or mixed) indoor units to effectively and efficiently control the heating or cooling operation of the multi zone system. All refrigerant lines from the outdoor unit to the indoor units are field-installed and must be insulated separately.

All Multi F systems use R410A refrigerant. The outdoor units are equipped with a refrigerant strainer, check valves, oil separator, accumulator, four-way reversing valve, electronic expansion valve(s) (EEV), high side and low side refrigerant charging ports, and a service port. Each outdoor unit also includes sensors for suction temperature, discharge temperature, high-pressure, low-pressure, heat exchanger temperature, and outdoor temperature conditions.

Refrigeration Oil Control

The outdoor units have an oil separator to separate oil mixed with the refrigerant gas during compression and return oil to the compressor. The outdoor units also have an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts at low speed.

Compressor

Multi F condensing units are equipped with one hermetically sealed, digitally controlled, inverter driven twin-rotary compressor that

Figure 4: Multi F LMU18CHV and LMU24CHV Outdoor Units.



Figure 5: Multi F LMU30CHV and LMU36CHV Outdoor Units.



includes Teflon™ coated bearings. The inverter motor is capable of providing a modulation range of 20Hz to 100Hz with control in 1Hz increments. The compressor is protected with phase-reversal protection, uses a factory-charge of Polyvinyl Ether (PVE) oil, and is mounted to avoid the transmission of vibration.

Fan and Motors

Each outdoor unit includes one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a horizontal air discharge. Fan blades are statically and dynamically balanced propeller fans made of durable Acrylonitrile Butadiene Styrene (ABS) plastic, and include a raised fan guard to limit contact with moving parts. The motors have inherent overload protection, permanently lubricated bearings, and a maximum speed up to 950 rpm. All Multi F outdoor units have a horizontal discharge airflow.

Outdoor Unit Coil

The outdoor unit coils are factory-built of aluminum fins mechanically bonded on copper tubing. Coils have a minimum of two rows, a minimum of 14 fins per inch, and have been factory pressure-tested. Coil fins also have a factory applied corrosion-resistant GoldFin™ material with hydrophilic coating that has been tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1,000 hours.

Electrical

All Multi F outdoor units shall have 208/230V, 1 phase, 60Hz electrical power capable of operating within ±10% of the rated voltage.

Controls

Factory installed microprocessor controls in the outdoor unit and indoor units shall perform functions to efficiently operate the multi-zone system. System wiring must be installed in a tree configuration from outdoor unit to indoor units through four conductor power/transmission cable. The system is capable of performing continuous operation, even when power is turned off to an individual indoor unit.

MULTI F OUTDOOR UNIT

General Data

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Table 1: Multi F Outdoor Unit Specifications.

Model Number	LMU18CHV	LMU24CHV	LMU30CHV	LMU36CHV
Cooling Capacity (Btu/h) ¹ (Min.~Rated~ Max.)	8,400~17,000~19,000	8,400~20,000~25,000	8,400~30,000~36,000	8,400~32,000~38,400
Heating Capacity (Btu/h) ¹ (Min.~Rated~ Max.)	10,248~22,000~24,000	9,240~24,000~28,800	9,240~32,000~38,400	9,240~36,000~41,600
<i>Operating Range</i>				
Cooling (°F DB)	14 ⁷ - 118	14 ⁷ - 118	14 ⁷ - 118	14 ⁷ - 118
Heating (°F WB)	-4 - 64	-4 - 64	-4 - 64	-4 - 64
<i>Compressor</i>				
Inverter Quantity	Twin Rotary x 1	Twin Rotary x 1	Twin Rotary x 1	Twin Rotary x 1
Oil/Type	FVC68D	FVC68D	FVC68D	FVC68D
<i>Fan (Side Discharge)</i>				
Type	Propeller	Propeller	Propeller	Propeller
Motor Output (W) x Qty.	85.4 x 1	85.4 x 1	124.2 x 1	124.2 x 1
Motor/Drive	Brushless Digitally Controlled / Direct			
Maximum Air Volume (CFM)	1,766	1,766	2,119	2,119
<i>Unit Data</i>				
Refrigerant Type	R410A	R410A	R410A	R410A
Refrigerant Control/Location	EEV/Outdoor Unit	EEV/Outdoor Unit	EEV/Outdoor Unit	EEV/Outdoor Unit
Min. Number Indoor Units/System ²	2	2	2	2
Max. Number Indoor Units/System ²	2	3	4	4
Maximum Allowable Total Indoor Unit Connected Capacity (Btu/h)	24,000	33,000	40,000	48,000
Sound Pressure (Cooling / Heating) dB(A) ³	49 / 52	49 / 52	52 / 55	52 / 55
Net Unit Weight (lbs.)	100	100	137	137
Shipping Weight (lbs.)	108	108	148	148
Power Wiring / Communications Cable (No. x AWG) ^{4,5}	4C x 18	4C x 18	4C x 18	4C x 18
<i>Heat Exchanger</i>				
Material and Fin Coating	Copper Tube/Aluminum Fin and GoldFin™/Hydrophilic			
Rows/Columns/Fins per inch x Qty.	(2 x 28 x 14) x 1	(2 x 28 x 14) x 1	(2 x 38 x 14) x 1	(2 x 38 x 14) x 1
<i>Piping</i>				
Liquid Line Connection (in., OD) x Qty.	1/4 x 2	1/4 x 3	1/4 x 4	1/4 x 4
Vapor Line Connection (in., OD) x Qty.	3/8 x 2	3/8 x 3	3/8 x 4	3/8 x 4
Factory Charge lbs. of R410A	3.96	3.96	6.18	6.18
<i>Piping Lengths</i>				
Maximum Total Piping (ft.) ⁶	164.0	246.1	246.1	246.1
Maximum Outdoor Unit to Indoor Unit Piping (ft)	82.0	82.0	82.0	82.0
Piping Length (No Additional Refrigerant [ft])	49.2	73.8	98.4	98.4
Maximum Elevation between Outdoor Unit and Indoor Unit (ft.)	49.2	49.2	49.2	49.2
Maximum Elevation between Indoor Unit and Indoor Unit (ft.)	24.6	24.6	24.6	24.6

¹Rated capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a combination ratio between 95 – 105%.

Rated cooling capacity 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).

Rated heating capacity 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).

²At least two indoor units should be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

³Sound 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.

⁴Power wiring to the outdoor unit is field supplied, solid or stranded, and must comply with the applicable local and national codes. For detailed information, please refer to electrical characteristics on page 11.

⁵All power wiring / communication cable to be minimum 18 AWG from the outdoor unit to the indoor units, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes. For detailed electrical information, please refer to electric characteristics on page 11.

⁶Piping lengths are equivalent.

⁷Installation of an optional Low Ambient Wind Baffle Kit will allow operation down to -4°F in cooling mode.

Table 2: LMU18CHV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)
LMU18CHV	Non-Ducted Indoor Units	17,000	13.0	22.0	22,000	3.2	9.7	13,500	2.4
	Ducted Indoor Units	14,000	10.7	17.2	19,800	2.9	9.7	13,000	2.4
	Mixed Non-Ducted and Ducted Indoor Units	15,500	11.8	19.6	20,900	3.0	9.7	13,250	2.4

Table 3: LMU24CHV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)
LMU24CHV	Non-Ducted Indoor Units	20,000	13.5	21.7	24,000	3.9	10.6	14,500	2.7
	Ducted Indoor Units	17,800	11.5	17.5	22,500	3.4	9.8	14,000	2.5
	Mixed Non-Ducted and Ducted Indoor Units	18,900	12.5	19.6	23,250	3.7	10.2	14,250	2.6

Table 4: LMU30CHV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)
LMU30CHV	Non-Ducted Indoor Units	30,000	13.0	22.0	32,000	3.8	10.0	19,600	2.7
	Ducted Indoor Units	27,400	11.0	18.2	33,000	3.5	9.7	19,000	2.5
	Mixed Non-Ducted and Ducted Indoor Units	28,700	12.0	20.1	32,500	3.6	9.85	19,300	2.6

Table 5: LMU36CHV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)
LMU36CHV	Non-Ducted Indoor Units	32,000	13.0	22.0	36,000	3.9	10.0	20,000	2.6
	Ducted Indoor Units	28,000	11.0	18.2	34,000	3.5	9.7	19,500	2.4
	Mixed Non-Ducted and Ducted Indoor Units	30,000	12.0	20.1	35,000	3.7	9.9	19,750	2.5

¹Rated capacity is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a combination ratio between 95 – 105%.

Rated 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).

Rated 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).

²Rated capacity is certified under AHRI Standard 210 / 240. EER, IEER, COP, and HSPF are subject to change. See www.ahrinet.org for the latest values.

Note:

At least two indoor units should be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

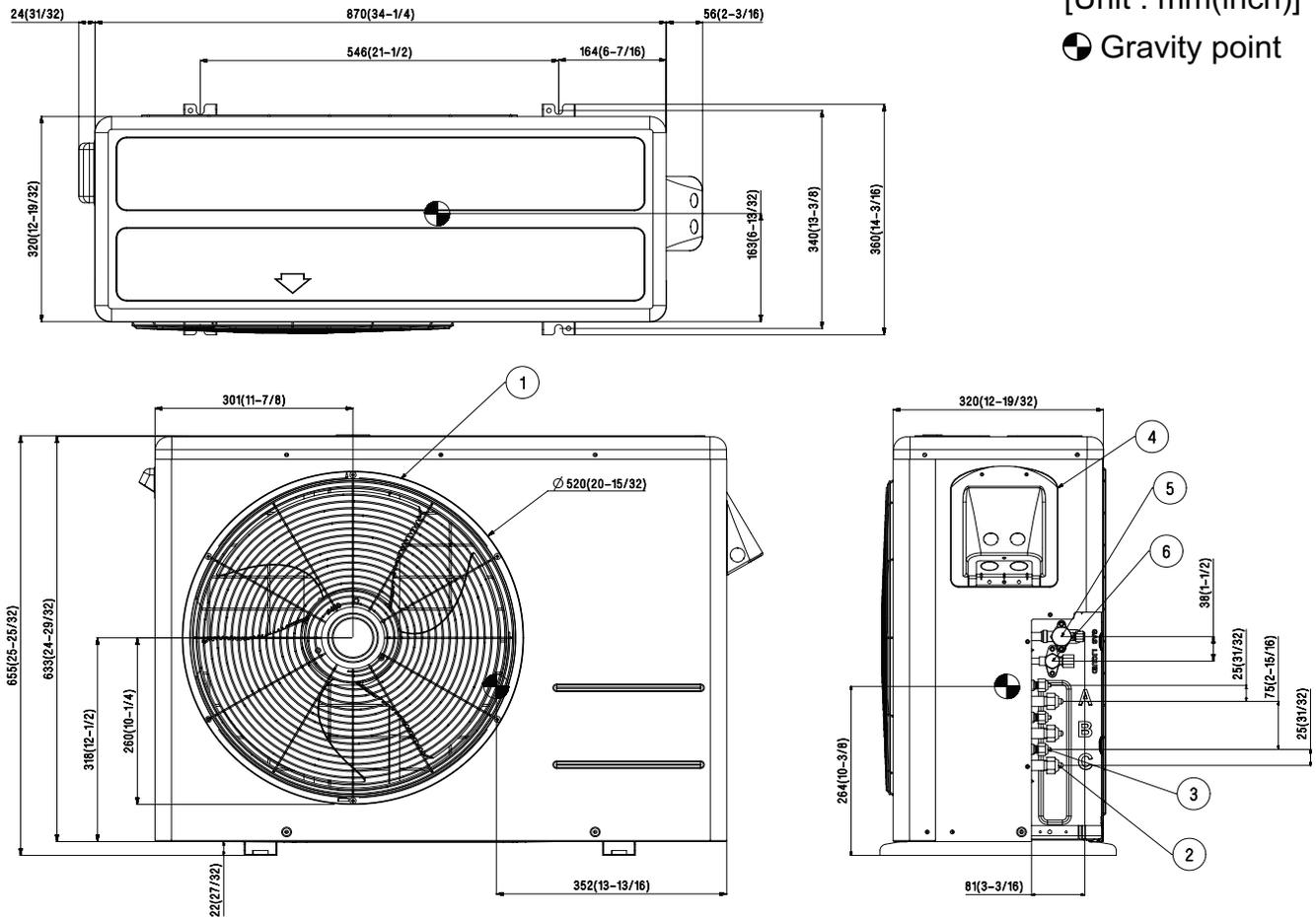


MULTI F OUTDOOR UNIT

Dimensions

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Figure 6: LMU18CHV External Dimensions.

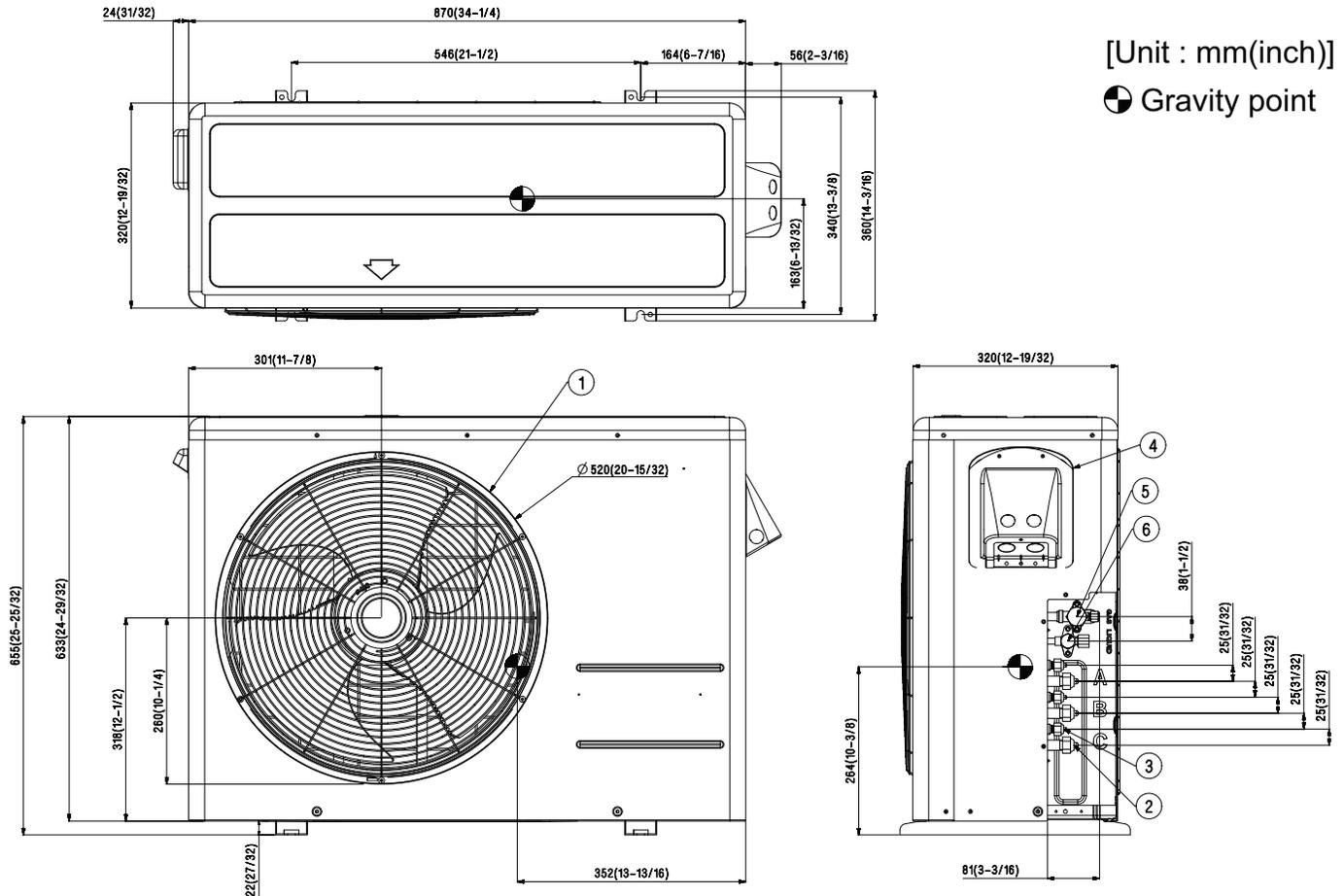


No.	Part Name
1	Air discharge grille
2	Gas pipe connection
3	Liquid pipe connection
4	Power & transmission connection
5	Main service valve(Gas)
6	Main service valve(Liquid)

■ Note

1. Unit should be installed in compliance with the installation manual in the product box.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials to be supplied on the site must comply with the local regulations or international codes.
4. Electrical characteristics chapter should be considered for electrical work and design. Especially the capacity of power cable and circuit breaker for outdoor unit should be more than that of electrical characteristics chapter.

Figure 7: LMU24CHV External Dimensions.



No.	Part Name
1	Air discharge grille
2	Gas pipe connection
3	Liquid pipe connection
4	Power & transmission connection
5	Main service valve(Gas)
6	Main service valve(Liquid)

■ Note

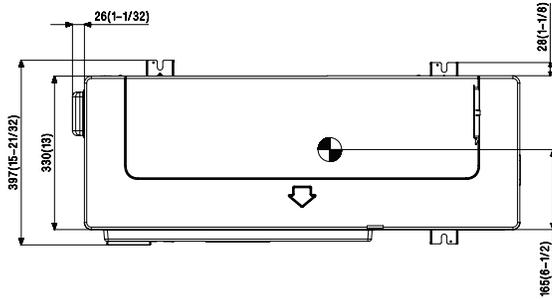
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- Unit should be grounded in accordance with the local regulations or applicable national codes.
- All electrical components and materials to be supplied on the site must comply with the local regulations or international codes.
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MULTI F OUTDOOR UNIT

Dimensions

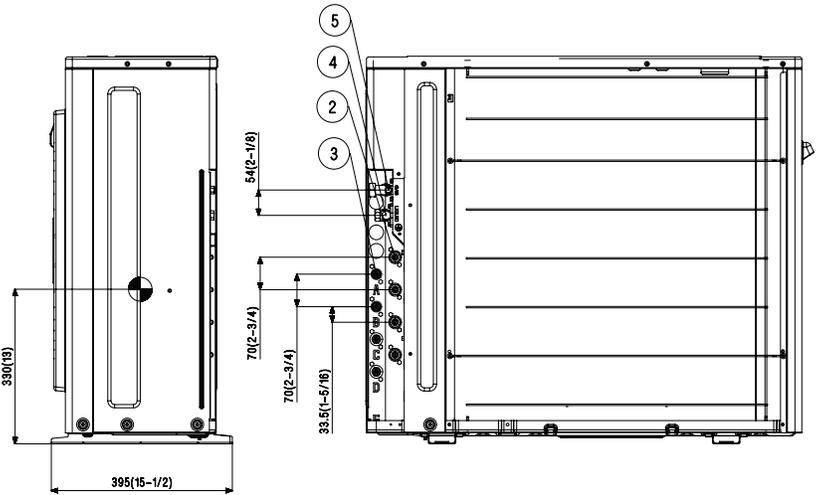
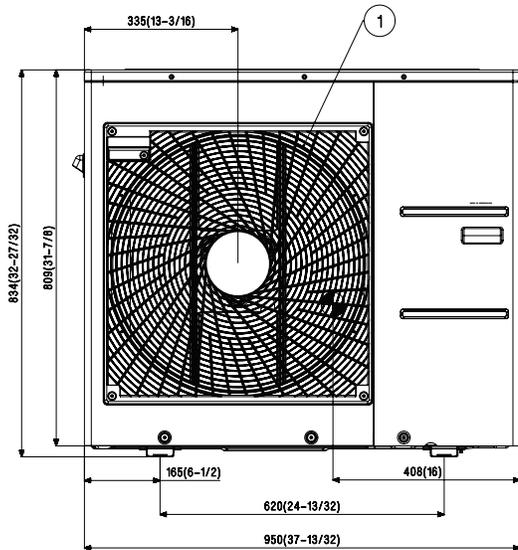
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Figure 8: LMU30CHV and LMU36CHV External Dimensions.



[Unit : mm(inch)]

● Gravity point



No.	Part Name
1	Air discharge grille
2	Gas pipe connection
3	Liquid pipe connection
4	Main service valve(Liquid)
5	Main service valve(Gas)

Note

- Unit should be installed in compliance with the installation manual in the product box.
- Unit should be grounded in accordance with the local regulations or applicable national codes.
- All electrical components and materials to be supplied on the site must comply with the local regulations or international codes.
- Electrical characteristics chapter should be considered for electrical work and design. Especially the capacity of power cable and circuit breaker for outdoor unit should be more than that of electrical characteristics chapter.

Electrical Data

Table 6: Electrical Data.

Nominal Tons	Unit Model No.	Hertz	Voltage	Voltage Range (Min. to Max.)	MCA	MOP	Compressor Quantity	Compressor Motor RLA	Outdoor Fan Motor		Indoor Fan Motor
									kW	FLA	FLA
1.5	LMU18CHV	60	208 - 230	187 - 253	13.3	20	1	8.9	0.09	0.59	1.60
2	LMU24CHV				14.3	20	1	9.4	0.09	0.59	2.00
2.5	LMU30CHV				16.6	25	1	10.8	0.12	0.73	2.40
3	LMU36CHV				17.9	25	1	11.2	0.12	0.73	3.20

Voltage tolerance is ±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.

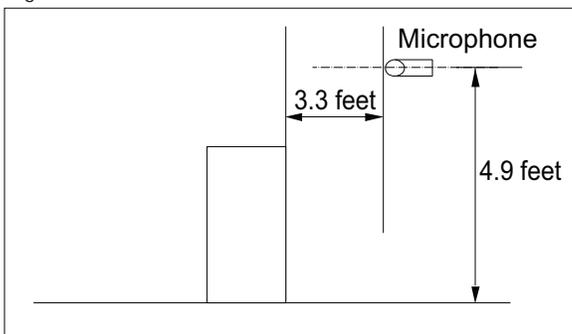
Indoor Fan Motor (FLA) is based on the maximum combination of indoor units.

The max combination for each outdoor unit is:

- 18,000 ODU (LMU18CHV): 12,000 IDU x 2
- 24,000 ODU (LMU24CHV): 12,000 IDU x 2 + 9,000 IDU x 1
- 30,000 ODU (LMU30CHV): 12,000 IDU x 3
- 36,000 ODU (LMU36CHV): 12,000 IDU x 4

Acoustic Data

Figure 9: Acoustic Measurement Location.

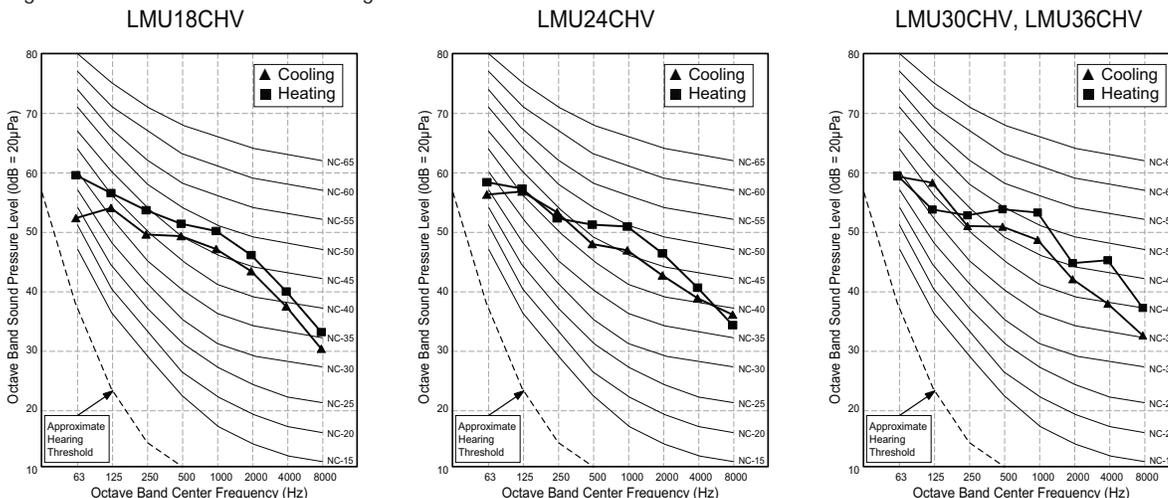


- Measurement taken 4.9' above finished floor, and at a distance of 3.3' from face of unit.
- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) of particular area in which the equipment is installed.
- Sound level may be increased in static pressure mode or if air guide is used.
- Sound pressure levels are measured in dB(A)±3.
- Tested in anechoic chamber per ISO Standard 3745.

Table 7: Sound Pressure Levels (dB[A]).

Model No.	Sound Pressure Level (dB[A])	
	Cooling	Heating
LMU18CHV	49	52
LMU24CHV	49	52
LMU30CHV	52	55
LMU36CHV	52	55

Figure 10: Sound Pressure Level Diagrams.



MULTI F OUTDOOR UNIT

Refrigerant Flow Diagram

MULTI F
MULTI F MAX

Figure 11: LMU18CHV Refrigerant Flow Diagram.

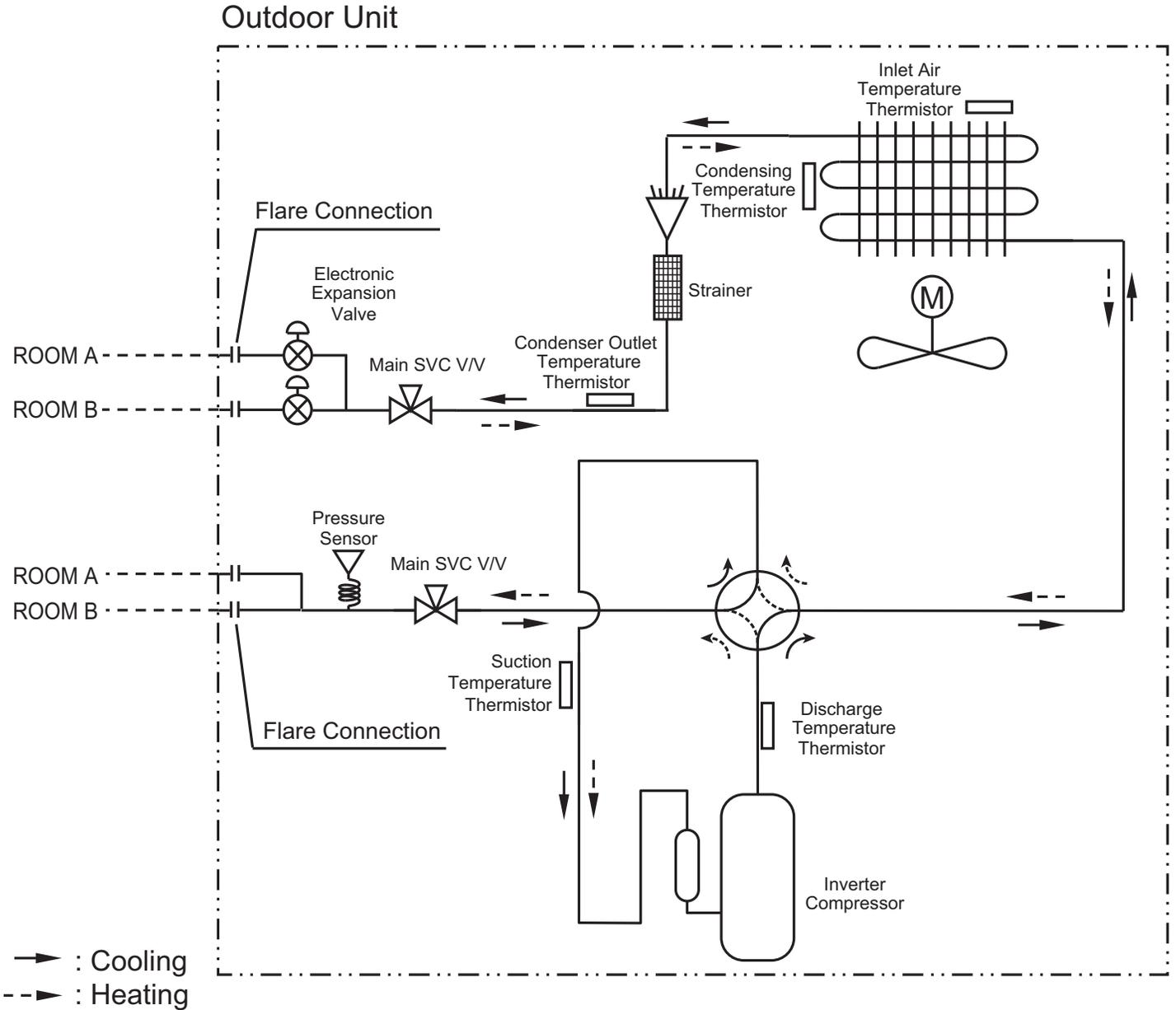
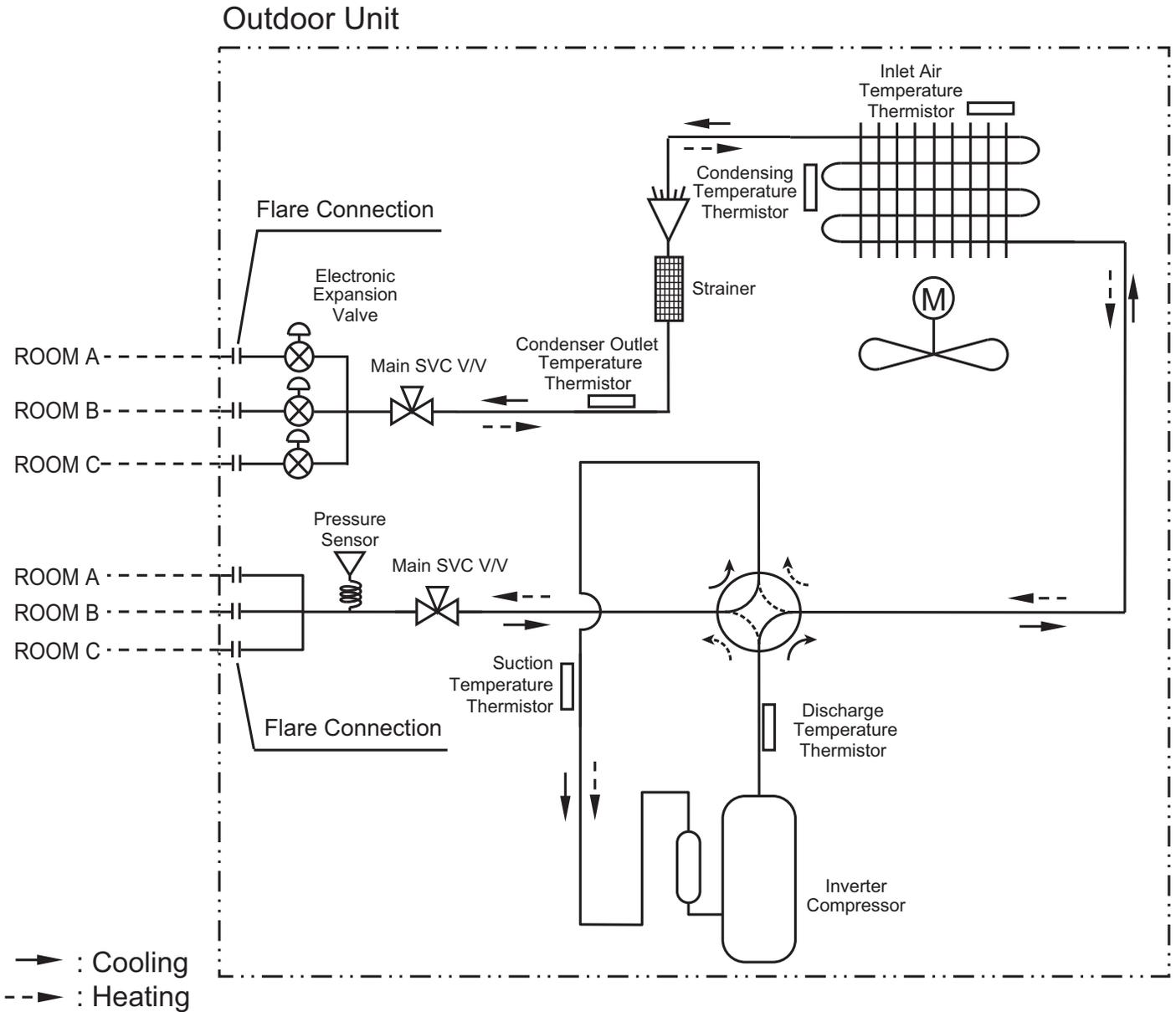


Table 8: LMU18CHV Thermistor Details.

Description	PCB Connector
Condenser Outlet Temperature Thermistor	CN_C/PIPE
Condensing Temperature Thermistor	CN_MID
Inlet Air Temperature Thermistor	CN_AIR
Discharge Temperature Thermistor	CN_DISCHARGE
Suction Temperature Thermistor	CN_SUCTION
Pressure Sensor	CN_H/PRESS

Figure 12: LMU24CHV Refrigerant Flow Diagram.



Multi F Outdoor Unit Data

Table 9: LMU24CHV Thermistor Details.

Description	PCB Connector
Condenser Outlet Temperature Thermistor	CN_C/PIPE
Condensing Temperature Thermistor	CN_MID
Inlet Air Temperature Thermistor	CN_AIR
Discharge Temperature Thermistor	CN_DISCHARGE
Suction Temperature Thermistor	CN_SUCTION
Pressure Sensor	CN_H/PRESS

MULTI F OUTDOOR UNIT

Refrigerant Flow Diagram

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Figure 13: LMU30CHV and LMU36CHV Refrigerant Flow Diagram.

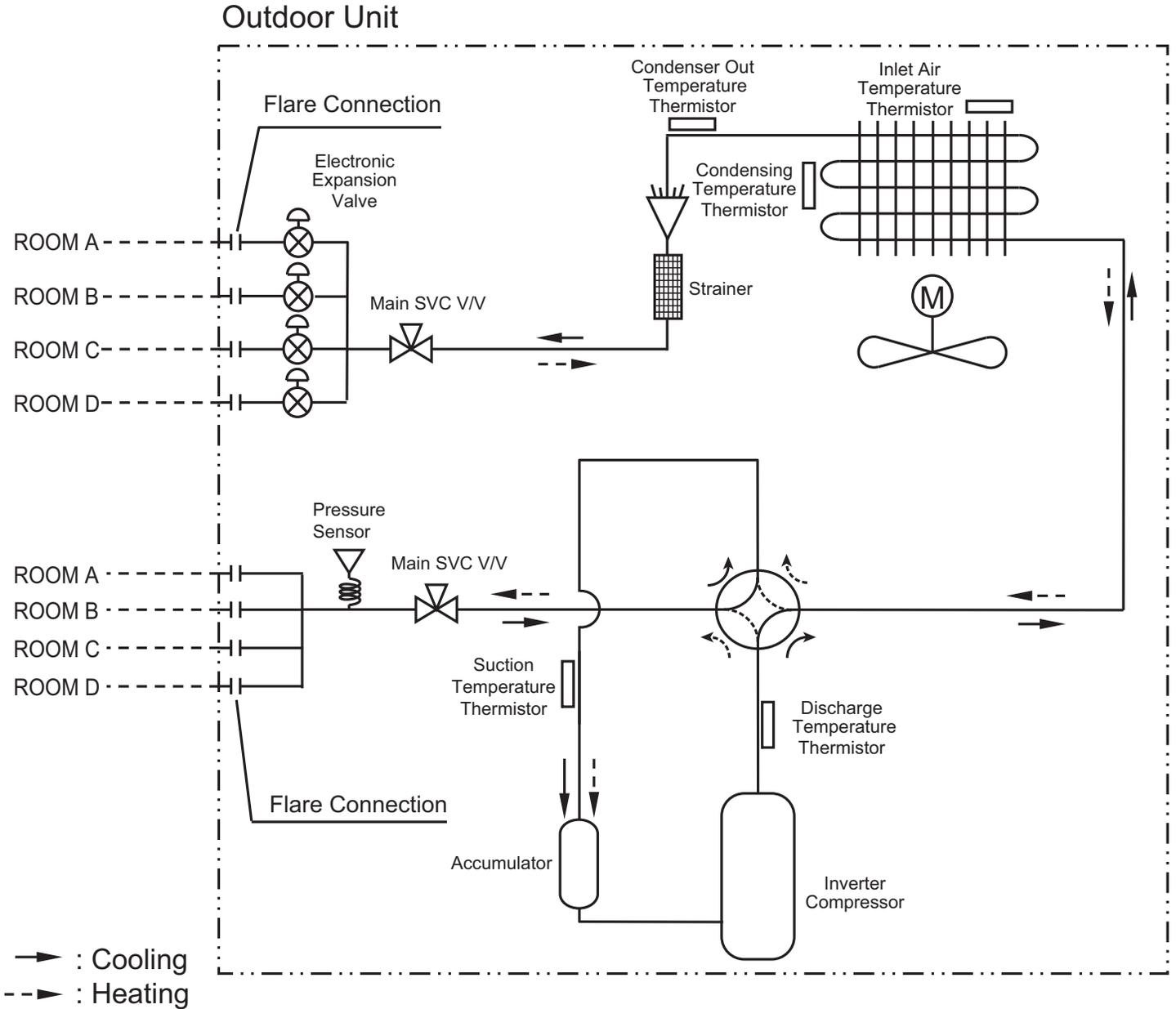
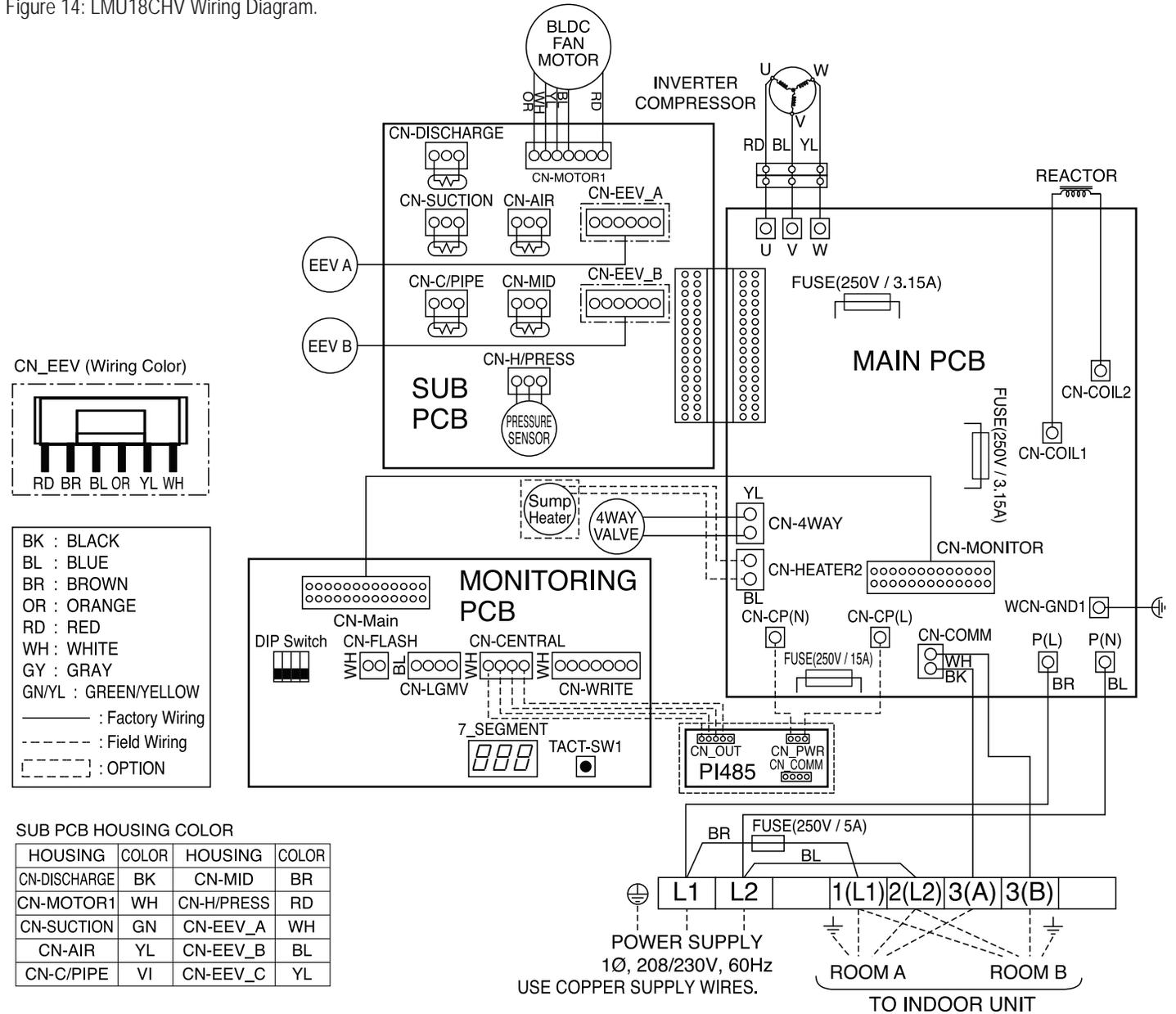


Table 10: LMU30CHV and LMU36CHV Thermistor Details.

Description	PCB Connector
Condensing Temperature Thermistor	CN_TH4
Condenser Outlet Temperature Thermistor	CN_TH2
Inlet Air Temperature Thermistor	
Discharge Temperature Thermistor	CN_TH3
Suction Temperature Thermistor	
Pressure Sensor	CN_TH1

Figure 14: LMU18CHV Wiring Diagram.



Multi F Outdoor Unit Data

MULTI F OUTDOOR UNIT

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Wiring Diagram

Figure 15: LMU24CHV Wiring Diagram.

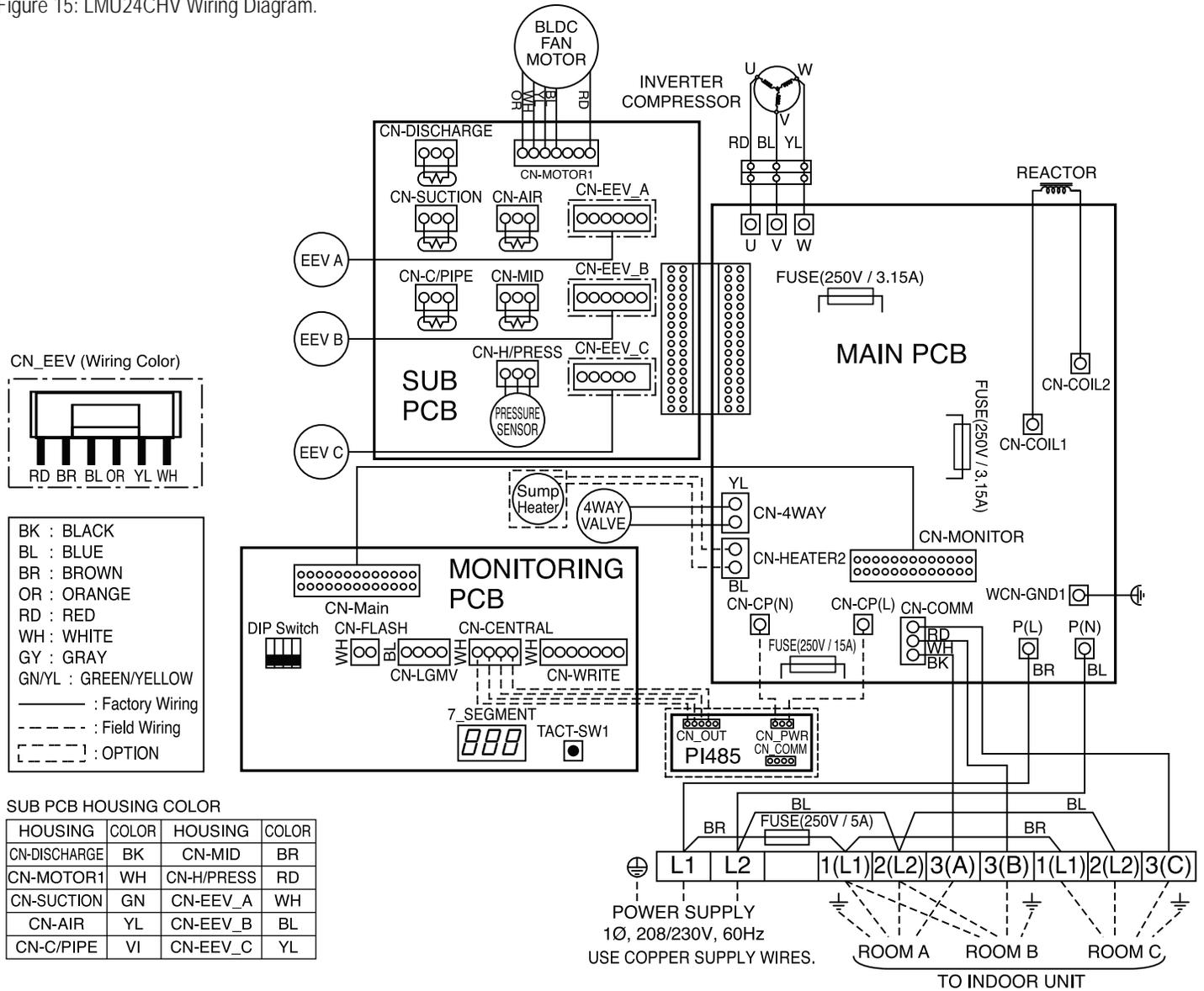
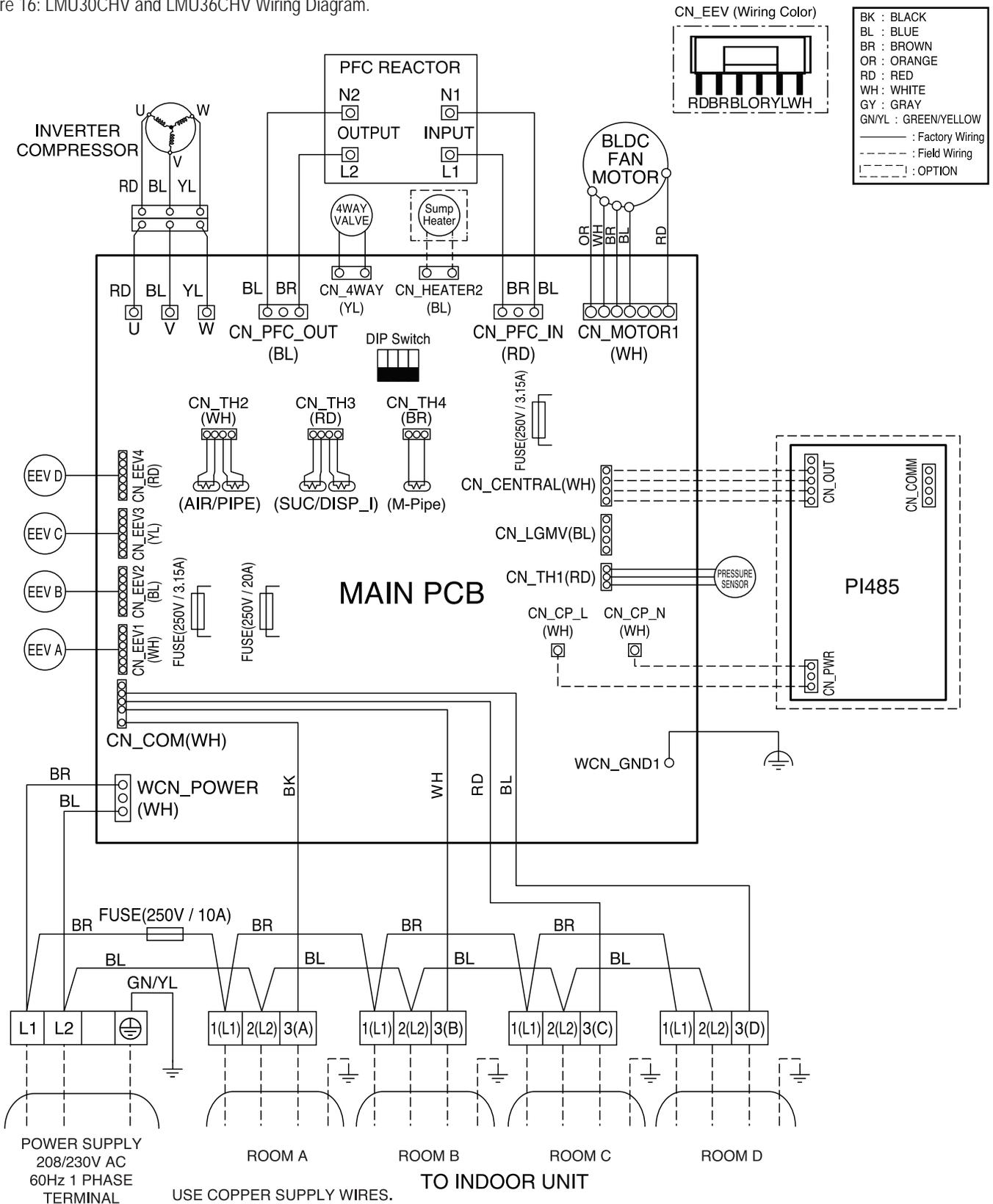


Figure 16: LMU30CHV and LMU36CHV Wiring Diagram.

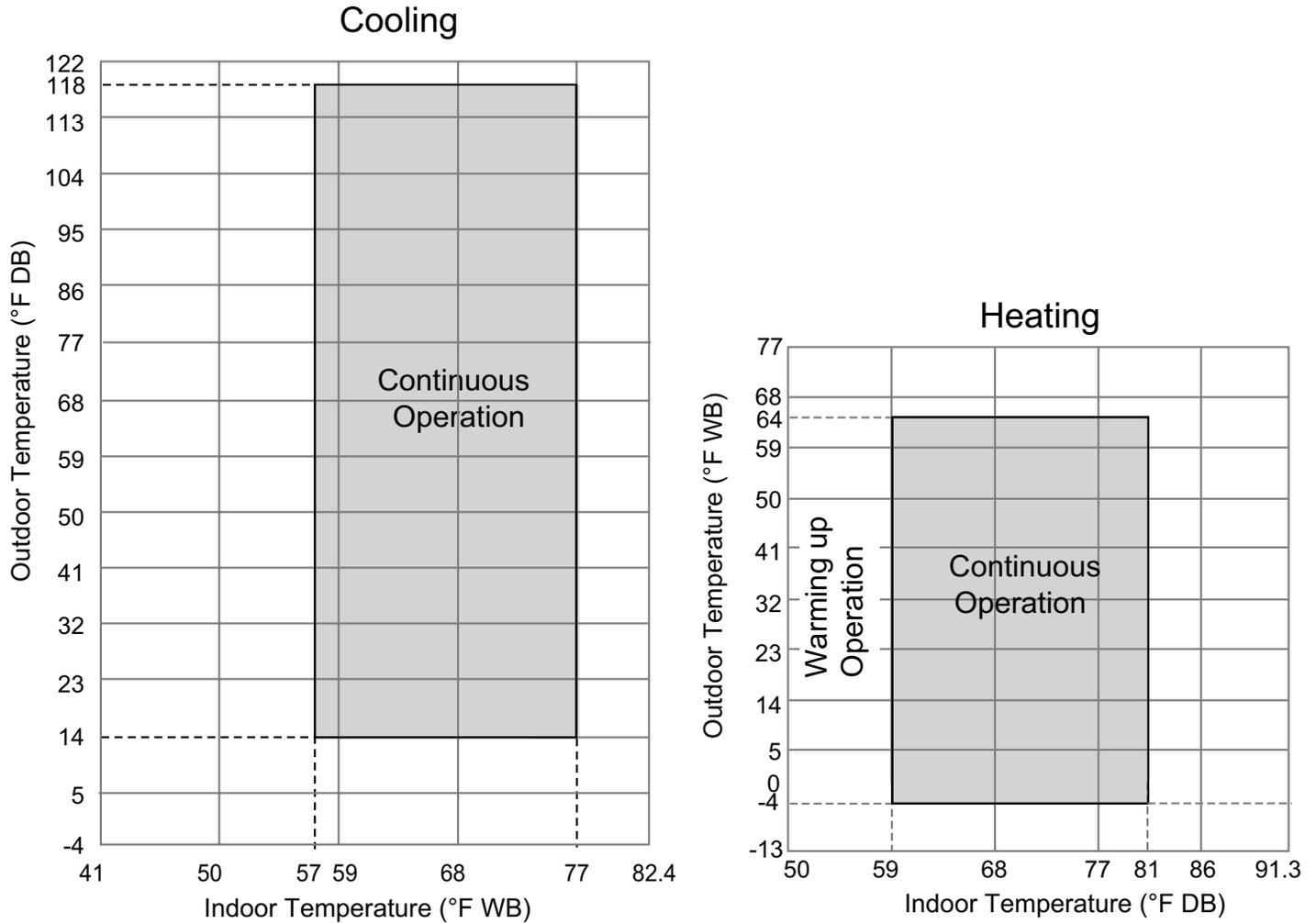


MULTI F OUTDOOR UNIT

Operation Range

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Figure 17: Cooling and Heating Operation Ranges.



Note:

Cooling operation range can extend down to -4 °F outdoor temperature if Low Ambient Kit is installed (sold separately).

MULTI F MAX OUTDOOR UNIT DATA

“Product Features and Benefits” on page 24

“Mechanical Specifications” on page 25

“General Data” on page 26

“Dimensions” on page 28

“Electrical Data” on page 29

“Acoustic Data” on page 29

“Refrigerant Flow Diagrams” on page 30

“Wiring Diagrams” on page 31

“Operation Range” on page 33

MULTI F MAX OUTDOOR UNIT

MULTI F
MULTI F MAX

Features and Benefits

Multi F MAX inverter-driven heat pump systems can operate up to eight indoor units, providing cooling or heating for an entire home and zoning capabilities. Compact refrigerant pipes work in tandem with wiring to link the outdoor unit with all indoor units through a single or pair of branch distribution (BD) unit(s). Most indoor units include its own remote control, allowing the user to set the temperature individually in different rooms. The indoor units are available in a variety of capacities and styles, including Art Cool™ Mirror and Gallery Wall Mount, Standard Wall Mount, Four-Way Ceiling Cassette, Horizontal Ceiling Concealed Duct, and Vertical-Horizontal Air Handling models.

Features

- Advanced climate control for up to eight (8) zones
- Inverter (Variable speed compressor)
- DC inverter technology – load matches to reduce power consumption
- Low ambient operation to 14°F (DB, Cooling)
- Optional low ambient baffle kit allows cooling operation down to -4°F (DB)
- Heating operation down to -4°F (WB)
- Defrost
- Restart delay (three [3] minutes)
- Self diagnosis
- Soft start
- Auto operation / auto restart operation
- Gold Fin™ anti-corrosion

Benefits

- Refrigerant piping lengths allow for extra design flexibility in indoor unit installation
- Easy installation: Little to no ductwork required; most indoor units can mount on any wall
- Indoor unit and outdoor unit dimensions ensure space saving convenience
- All-season use—heat pump models have both cooling and heating capabilities

Figure 18: Multi F MAX Heat Pump Inverter System — Mix and match for 21,000-65,000 Btu/h (48 MBH), 22,000-73,000 (54MBH), and 24,000-81,000 (60MBH)



Multi F MAX Heat Pump Condensing Units

General

A Multi F MAX multi-zone system is comprised of one heat pump outdoor unit connected up to eight indoor units through a branch distribution unit (BD) using a single refrigerant piping circuit, and includes integrated controls supplied by LG. Factory-designed and supplied Y-branches may be used as well.

The outdoor unit is internally assembled, wired, and piped from the factory; all LG components are manufactured in a facility registered to ISO 9001 and ISO 14001, set by the International Organization for Standardization (ISO). The LG Multi F MAX multi-zone heat pump system components comply with Underwriters Laboratories (UL) 1995 Heating and Cooling Equipment Standard for Safety, and bear the Electrical Testing Laboratories (ETL) mark. The units are certified to AHRI 210 / 240.

Temperature Ranges

The heat pump outdoor units are capable of operating in cooling mode from 14°F to 118°F ambient dry bulb (installing an optional Low Ambient Wind Baffle Kit will allow operation down to -4°F in cooling mode for Multi F MAX systems). The heat pump outdoor units are capable of operating in heating mode from -4°F to +64°F ambient wet bulb without additional low ambient controls.

Frame

Multi F MAX condensing unit case is constructed from pre-coated metal that has been tested in accordance with ASTM B-117 salt spray procedure for a minimum of 1,000 hours. Case has a removable front panel to allow access to major components and control devices, and legs to secure the unit during installation.

Refrigerant System

Multi F MAX systems have a single refrigerant circuit field piped with a manufacturer-supplied BD unit(s) and Y-branches (if applicable) to multiple (ducted, non-ducted or mixed) indoor units to effectively and efficiently control the heating or cooling operation of the multi zone system. All refrigerant lines from the outdoor unit to the BD unit(s) and from the BD unit(s) to indoor units are field-installed and must be insulated separately.

Multi F MAX systems use R410A refrigerant. The outdoor units are equipped with a refrigerant strainer, check valves, oil separator, accumulator, four-way reversing valve, electronic expansion valve(s) (EEV), high side and low side refrigerant charging ports, and a service port. The outdoor unit also includes sensors for suction temperature, discharge temperature, high-pressure, low-pressure, heat exchanger temperature, and outdoor temperature conditions.

Refrigeration Oil Control

The outdoor unit has an oil separator to separate oil mixed with the refrigerant gas during compression and return oil to the compressor. The outdoor unit also has an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts at low speed.

Figure 19: Multi F MAX LMU480HV, LMU540HV, LMU600HV Outdoor Units.



Compressor

Multi F condensing units are equipped with one hermetically sealed, digitally controlled, inverter driven twin-rotary compressor that includes Teflon™ coated bearings. The inverter motor is capable of providing a modulation range of 20Hz to 100Hz with control in 1Hz increments. The compressor is protected with phase-reversal protection, uses a factory-charge of Polyvinyl Ether (PVE) oil, and is mounted to avoid the transmission of vibration. Compressor in the Multi F MAX outdoor unit is equipped with a hot gas bypass valve.

Fan and Motors

The Multi F MAX outdoor unit includes two direct drive variable speed propeller fans with Brushless Digitally Controlled (BLDC) motor with a horizontal air discharge.

Fan blades are statically and dynamically balanced propeller fans made of durable Acrylonitrile Butadiene Styrene (ABS) plastic, and include a raised fan guard to limit contact with moving parts. The motors have inherent overload protection, permanently lubricated bearings, and a maximum speed up to 950 rpm. Multi F MAX outdoor unit has a horizontal discharge airflow.

Outdoor Unit Coil

The outdoor unit coils are factory-built of aluminum fins mechanically bonded on copper tubing. Coils have a minimum of two rows, a minimum of 14 fins per inch, and have been factory pressure-tested.

Coil fins also have a factory applied corrosion-resistant GoldFin™ material with hydrophilic coating that has been tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1,000 hours.

Electrical

Multi F MAX outdoor unit shall be 208/230V, 1 phase, 60Hz electrical power capable of operating within ±10% of the rated voltage.

Controls

Factory installed microprocessor controls in the outdoor unit, BD unit(s), and indoor units shall perform functions to efficiently operate the multi zone system. System wiring must be installed in a tree configuration from outdoor unit to BD unit(s) to indoor units through four conductor power/transmission cable. The system is capable of performing continuous operation, even when power is turned off to an individual indoor unit.

MULTI F MAX OUTDOOR UNIT

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MULTI F MAX

General Data

Table 11: Multi F MAX Outdoor Unit General Data.

Model Number	LMU480HV	LMU540HV	LMU600HV
Cooling Capacity (Btu/h) (Minimum - Rated - Maximum) ¹	14,400-48,000-58,000	14,400-52,500-63,200	15,600-60,000-68,000
Heating Capacity (Btu/h) (Minimum - Rated - Maximum) ¹	15,840-54,000-61,000	16,272-58,000-64,000	17,940-64,000-70,000
Operating Range			
Cooling (°F DB)	14 ⁷ - 118	14 ⁷ - 118	14 ⁷ - 118
Heating (°F WB)	-4 - 64	-4 - 64	-4 - 64
Compressor			
Inverter Quantity	Twin Rotary x 1	Twin Rotary x 1	Twin Rotary x 1
Oil/Type	FVC68D	FVC68D	FVC68D
Fan (Side Discharge)			
Type	Propeller	Propeller	Propeller
Motor Output (W) x Qty.	124.2 x 2	124.2 x 2	124.2 x 2
Motor/Drive	Brushless Digitally Controlled/Direct		
Maximum Air Volume (CFM)	2,119 x 2	2,119 x 2	2,119 x 2
Unit Data			
Refrigerant Type	R410A	R410A	R410A
Refrigerant Control/Location	EEV / Outdoor Unit, Branch Distribution Unit		
Min. Number Indoor Units/System ²	2	2	2
Max. Number Indoor Units/System ²	8	8	8
Maximum Allowable Total Indoor Unit Connected Capacity (Btu/h)	65,000	73,000	81,000
Sound Pressure ±3 dB(A) ³ (Cooling / Heating)	54 / 56	54 / 56	56 / 58
Net Unit Weight (lbs.)	214	214	223
Shipping Weight (lbs.)	236	236	249
Power/Communications Wiring Between ODU and BDU (No. X AWG) ^{4,5}	4C x 16	4C x 16	4C x 16
Heat Exchanger			
Material and Fin Coating	Copper Tube / Aluminum Fin and GoldFin™/Hydrophilic		
Rows/Columns/Fins per inch x Qty.	(2 x 32 x 14) x 2	(2 x 32 x 14) x 2	(3 x 32 x 14) x 2
Piping			
Liquid Line Connection (in., OD) x Qty.	3/8 x 1	3/8 x 1	3/8 x 1
Vapor Line Connection (in., OD) x Qty.	3/4 x 1	3/4 x 1	3/4 x 1
Factory Charge lbs. of R410A	9.7	9.7	12.3
Piping Lengths			
Maximum Total System Piping (ft.) ⁶	475.7	475.7	475.7
Maximum Main Pipe Length (ODU to BDU [ft.])	180.4	180.4	180.4
Total Branch Piping (BDU to all IDUs [ft.])	295.3	295.3	295.3
Maximum Branch Pipe Length (Length between each BDU and IDU [ft.])	49.2	49.2	49.2
Maximum Outdoor Unit to Indoor Unit Pipe Length (ft.)	229.6	229.6	229.6
Piping Length (No Additional Refrigerant [ft.]; approx. 16 ft. of Main Piping + 131 ft. of Branch Piping)	147.6	147.6	147.6
Maximum Elevation between ODU and IDU (ft.)	98.4	98.4	98.4
Maximum Elevation between IDU and IDU (ft.)	49.2	49.2	49.2
Maximum Elevation between BDU and IDU (ft.)	32.8	32.8	32.8
Maximum Elevation between BDU and BDU (ft.)	49.2	49.2	49.2

¹Rated capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with a 0 ft. level difference between outdoor and indoor units. All capacities are net with a combination ratio between 95 - 105%.

Rated cooling capacity 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).
Rated heating capacity 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).

²At least one Branch Distribution Unit is required for system operation; a maximum of two can be installed per outdoor unit with use of Y-branch accessory (PMBL5620). At least two indoor units should be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

³Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745. These values can increase due to ambient conditions during operation.

⁴Power wiring to the outdoor unit is field supplied, solid or stranded, and must comply with the applicable local and national codes. For detailed information, please refer to electrical characteristics on page 27.

⁵All power wiring / communication cable to be minimum 16 AWG from the outdoor unit to the BD unit (Multi F MAX systems only), and 18 AWG from the BD unit to the indoor unit, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes. For detailed electrical information, please refer to electric characteristics on page 27.

⁶Piping lengths are equivalent.

⁷Installation of an optional Low Ambient Wind Baffle Kit will allow operation down to -4°F in cooling mode.

Table 12: LMU480HV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)	Energy Star
LMU480HV	Non-Ducted Indoor Units	48,000	12.5	19.35	54,000	3.7	10.0	34,080	3.3	Yes
	Ducted Indoor Units	44,000	10.8	17.5	50,000	3.3	9.7	32,720	3.0	No
	Mixed Non-Ducted and Ducted Indoor Units	46,000	11.6	18.5	52,000	3.5	9.9	33,400	3.2	No

Table 13: LMU540HV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)	Energy Star
LMU540HV	Non-Ducted Indoor Units	52,500	10.3	18.4	58,000	3.1	8.7	36,600	2.6	Yes
	Ducted Indoor Units	51,000	10.0	15.8	58,000	3.0	8.3	38,500	2.6	No
	Mixed Non-Ducted and Ducted Indoor Units	51,750	10.2	17.1	58,000	3.1	8.5	37,550	2.6	No

Table 14: LMU600HV Efficiency Ratings.^{1,2}

System	Combined With	Rated Cooling Capacity (Btu/h)	EER (95°F)	SEER	Rated Heating Capacity (Btu/h)	COP (47°F)	HSPF	Low Heating Capacity (Btu/h)	COP (17°F)	Energy Star
LMU600HV	Non-Ducted Indoor Units	60,000	11.4	20.5	64,000	3.5	11.0	41,000	2.7	No
	Ducted Indoor Units	58,000	10.5	18.5	64,000	3.3	10.5	43,000	2.8	No
	Mixed Non-Ducted and Ducted Indoor Units	59,000	10.9	19.5	64,000	3.4	10.8	42,000	2.8	No

¹Rated capacity is rated 0 ft. above sea level with Piping Length as Main pipe (16.4 ft.) + Branch pipe (98.4 ft.) = 115 ft., and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a combination ratio between 95 - 105%.

Rated 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).

Rated 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).

²Rated capacity is certified under AHRI Standard 210 / 240. EER, IEER, COP, and HSPF are subject to change. See www.ahrinet.org for the latest values.

Note:

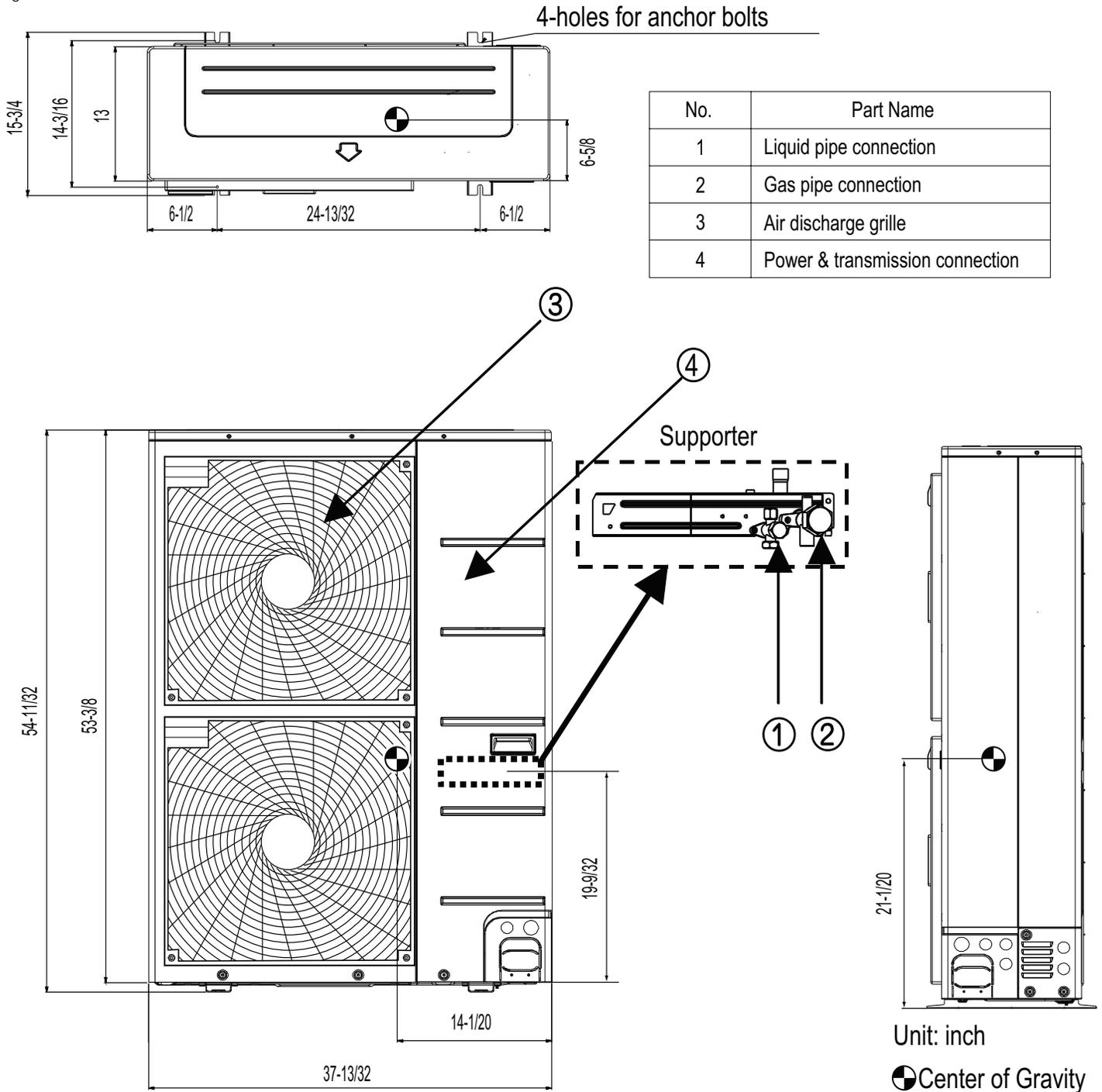
At least two indoor units should be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

MULTI F MAX OUTDOOR UNIT

Dimensions

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Figure 20: LMU480HV, LMU540HV, and LMU600HV External Dimensions.



Electrical Data

Table 15: LMU480HV, LMU540HV, and LMU600HV Electrical Data.

Nominal Tons	Unit Model No.	Hertz	Voltage	Voltage Range (Min. to Max.)	MCA	MOP	Compressor Quantity	Compressor Motor RLA	Condenser Fan Motor(s)	
									Condenser Fan Quantity x kW	Condenser Fan Motor FLA
4.0	LMU480HV	60	208 - 230	187 - 253	27.3	40	1	17.5	2 x 0.12	0.73 x 2
4.5	LMU540HV	60	208 - 230	187 - 253	29.4	40	1	18.5	2 x 0.12	0.73 x 2
5.0	LMU600HV	60	208 - 230	187 - 253	32.2	45	1	20.4	2 x 0.12	0.73 x 2

Voltage tolerance is ±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.

Acoustic Data

Figure 21: Sound Pressure Level Measurement Location.

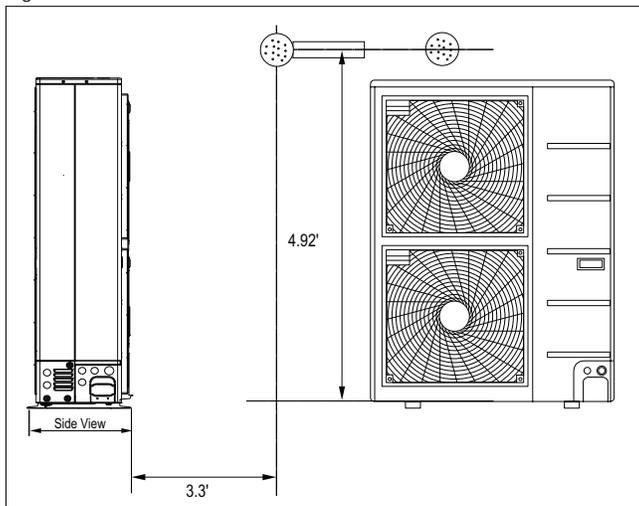
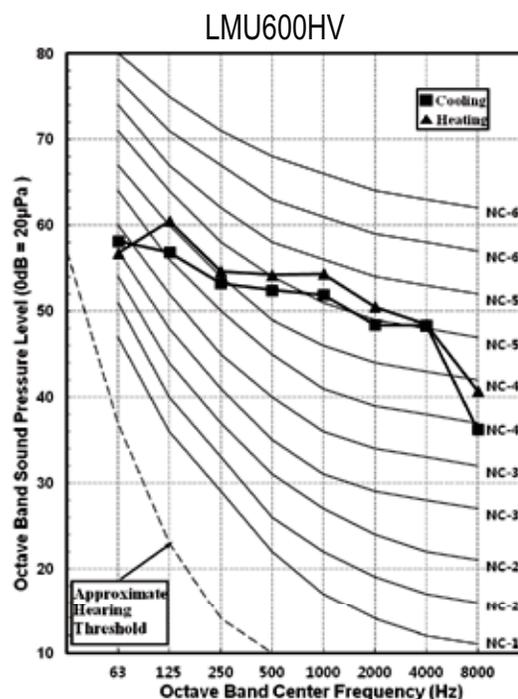
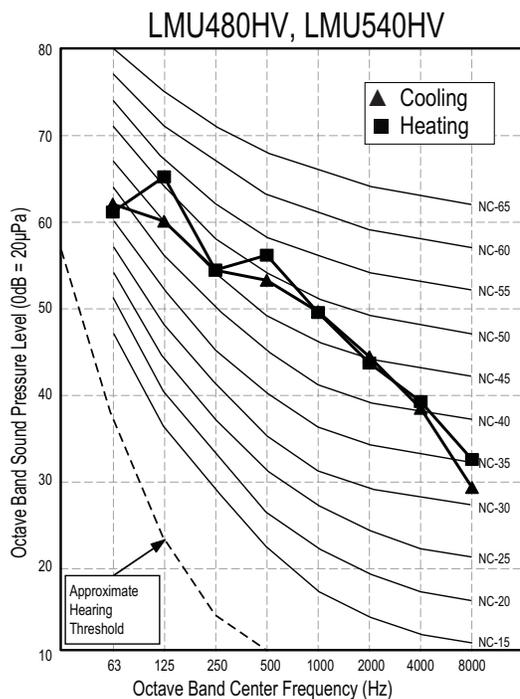


Figure 22: Sound Pressure Diagrams.

- Measurement taken 4.92' above finished floor, and at a distance of 3.3' from face of unit.
- 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 pressure levels are measured in dB(A) ±3.
- Tested in anechoic chamber per ISO Standard 3745.

Table 16: Sound Pressure Levels (dB[A]).

Model No.	Sound Pressure Levels (dB[A])	
	Cooling	Heating
LMU480HV	54	56
LMU540HV	54	56
LMU600HV	56	58



MULTI F MAX OUTDOOR UNIT

Refrigerant Flow Diagram

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Figure 23: LMU480HV, LMU540HV, and LMU600HV Refrigerant Flow Diagram.

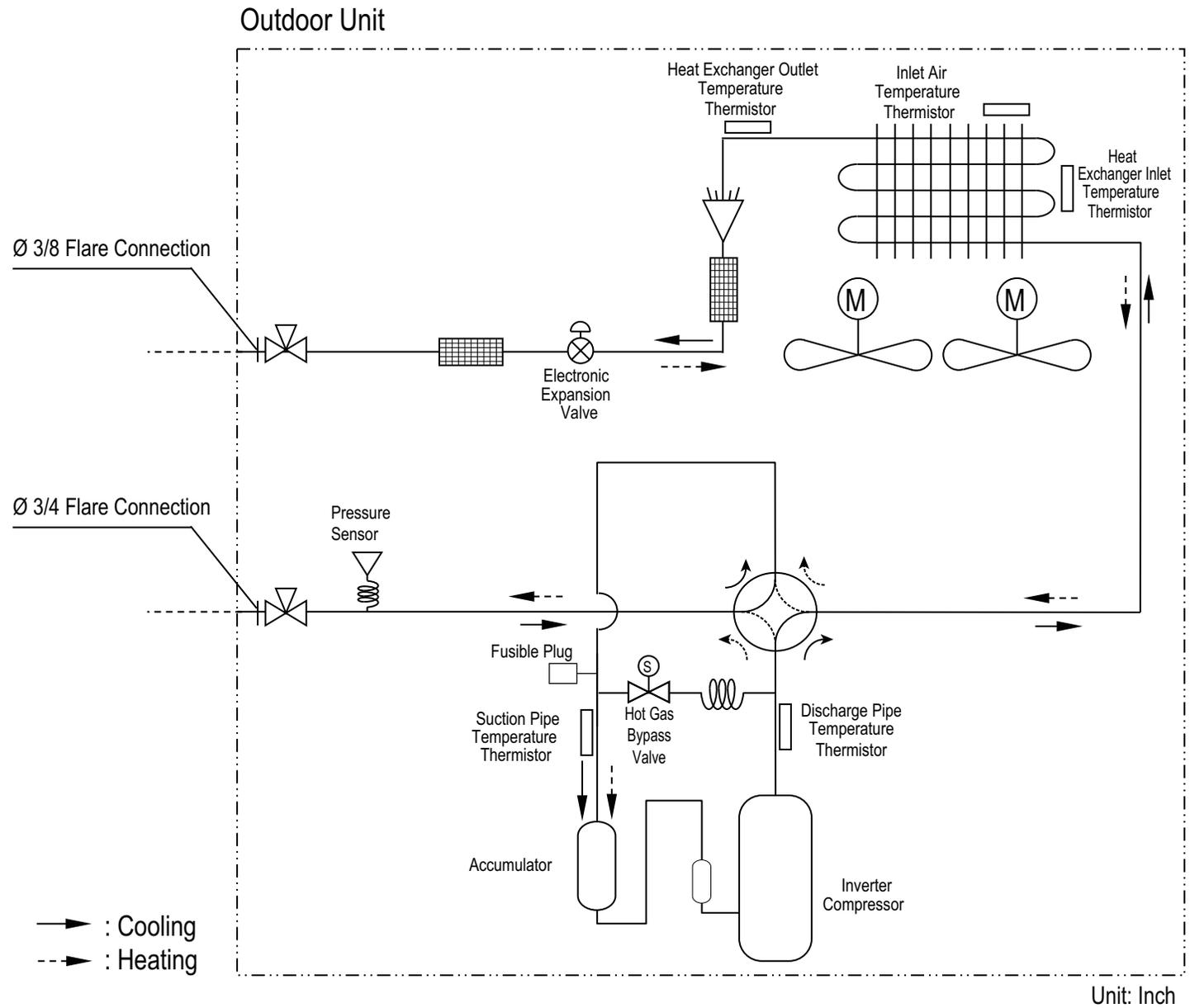
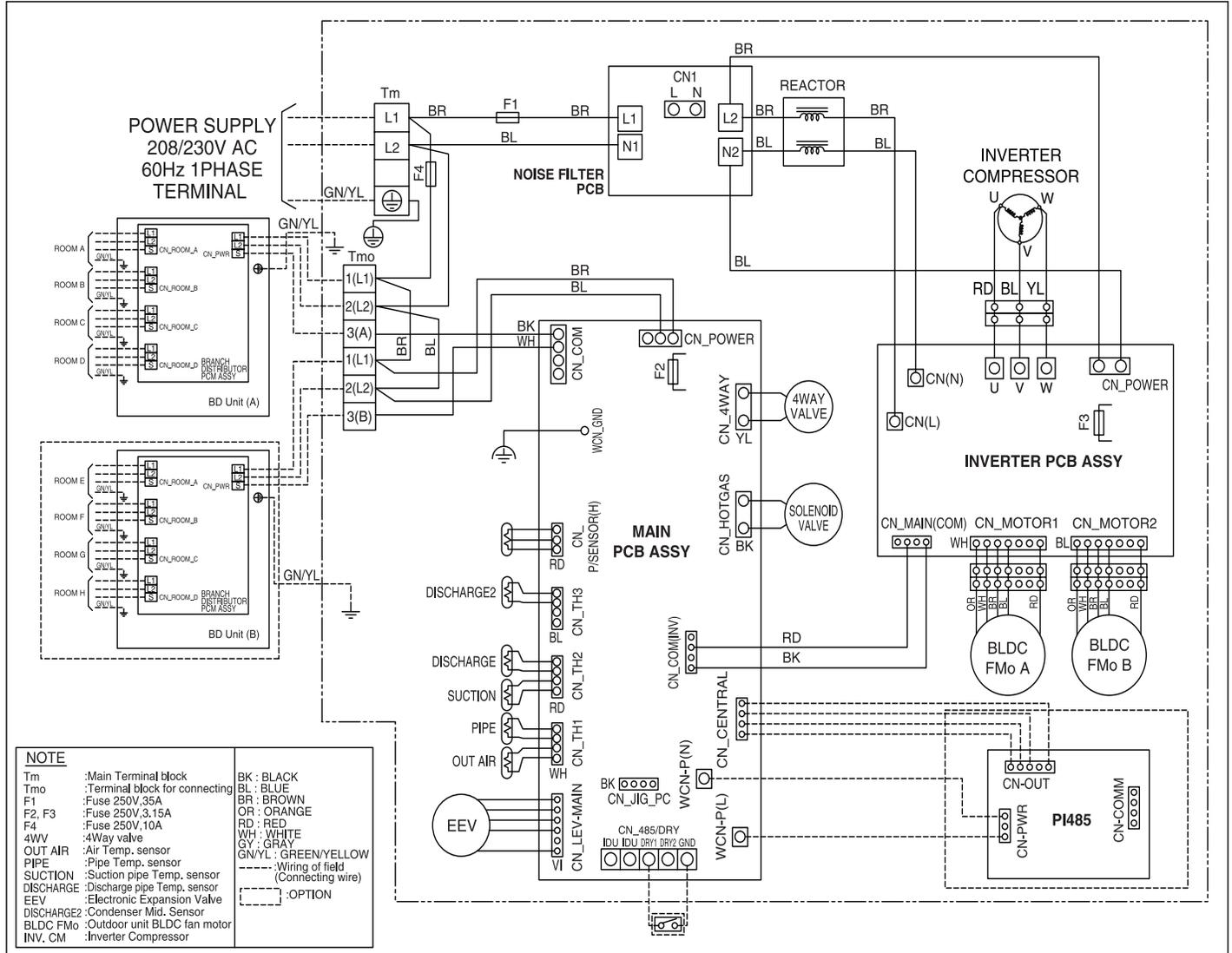


Table 17: LMU480HV, LMU540HV, LMU600HV Thermistor Details.

Description	LMU480-540HV PCB Connectors	LMU600HV PCB Connectors
Heat Exchanger Inlet Temperature Thermistor	CN-TH3	CN_MID_BR
Heat Exchanger Outlet Temperature Thermistor	CN-TH1	CN_C_PIPE_VI
Inlet Air Temperature Thermistor		CN_AIR_YL
Discharge Pipe Temperature Thermistor	CN-TH2	CN_DISCHA_BK
Suction Pipe Temperature Thermistor		CN_SUCTION_GR
Pressure Sensor		CN_H_PRESS_RD

Figure 24: LMU480HV and LMU540HV Wiring Diagram.



MULTI F OUTDOOR UNIT

Wiring Diagram

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Figure 25: LMU600HV Wiring Diagram.

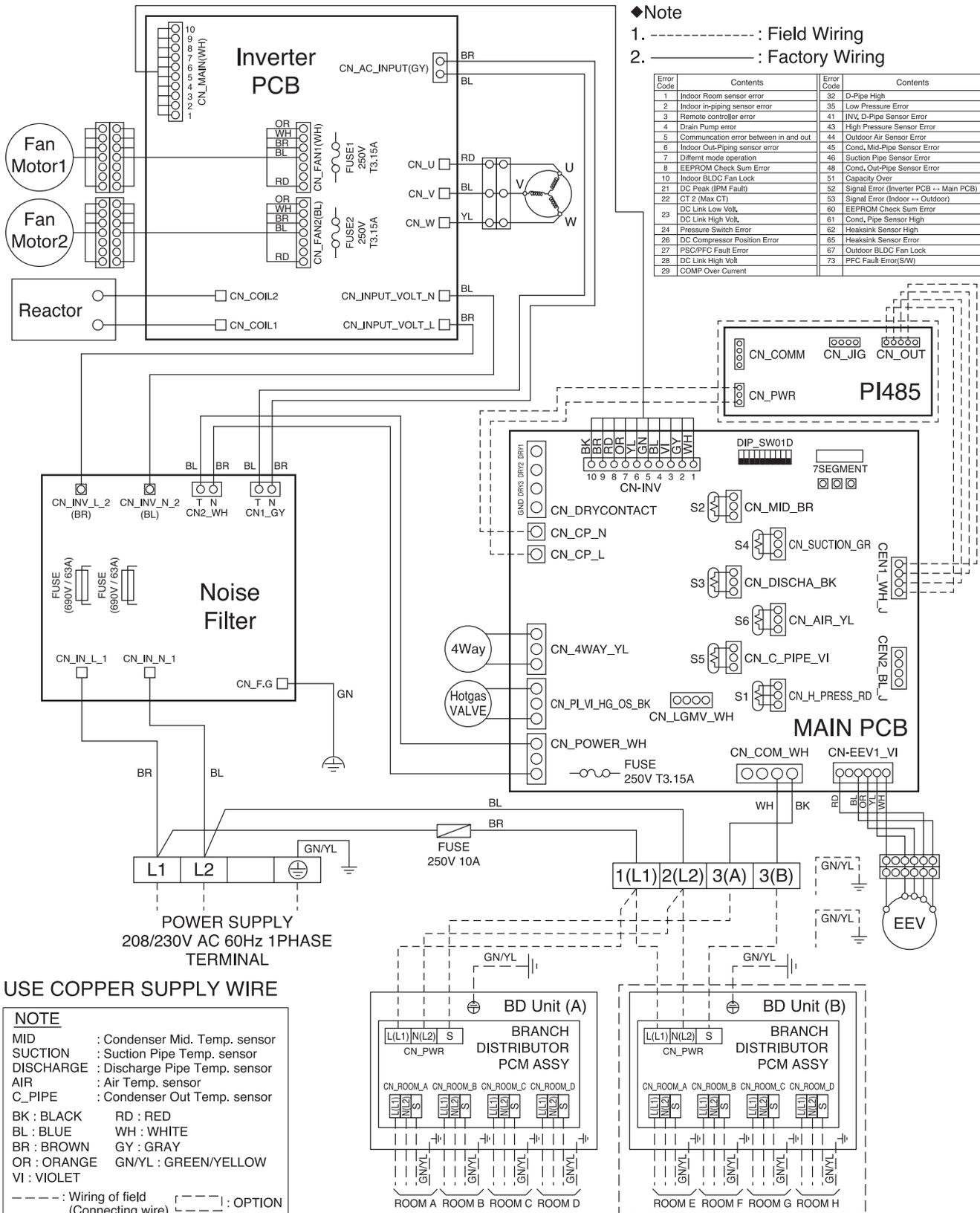
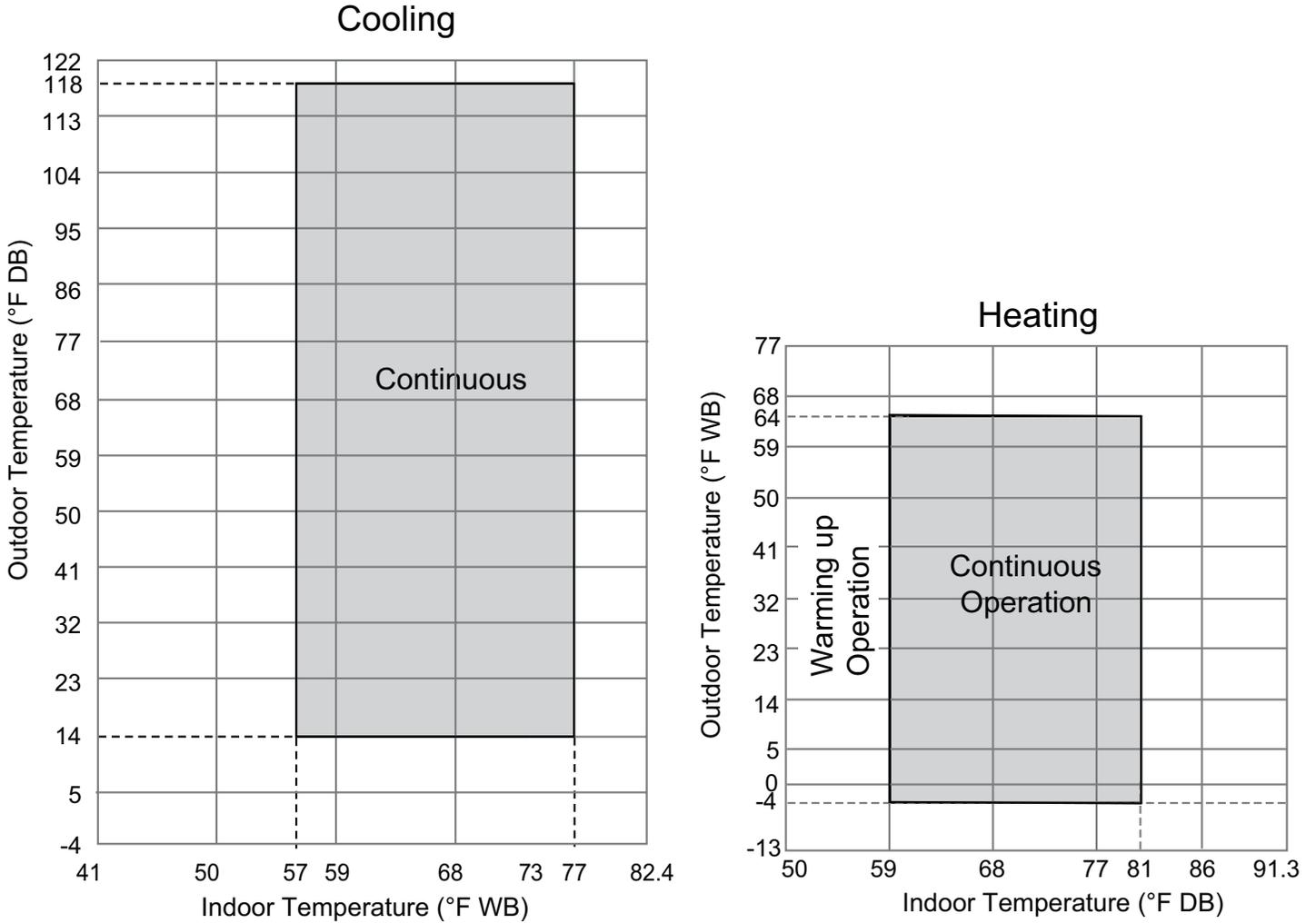


Figure 26: LMU480HV, LMU540HV, and LMU600HV Cooling and Heating Operation Ranges.



Multi F MAX Outdoor Unit Data

Note:

Cooling operation range can extend down to -4 °F outdoor temperature if Low Ambient Kit is installed (sold separately).

MULTI F MAX BD UNIT DATA

“Features and Benefits” on page 36

“Mechanical Specifications” on page 37

“General Data” on page 38

“Dimensions” on page 39

“Refrigerant Flow Diagram” on page 40

“Wiring Diagram” on page 41

“Y-Branch Accessory” on page 42

“Branch Distribution Unit Orientation” on page 43

MULTI F MAX BD UNIT

Features and Benefits

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The Branch Distribution (BD) unit is a required accessory of Multi F MAX inverter-driven heat pump systems. Choose from two (2) port, three (3) port, or four (4) port BD units.

Two (2) refrigerant pipes—one (1) liquid line and one (1) vapor line—run from the outdoor unit to the BD unit that is installed inside of a building. Two (2), three (3), or four (4) sets of refrigerant lines will run from the BD unit to the indoor units, depending on type of BD unit selected. A Multi F MAX system can include up to two BD units (installed with the use of the Y-branch accessory PMBL5620) that support a total of eight (8) indoor units (up to four [4] indoor units per BD unit).

Figure 27: Example of Multi F MAX Heat Pump Inverter System with two BD Units



Branch Distribution Unit

General

Branch distribution units are designed for use with LG Multi F MAX (LMU480HV and LMU540HV) outdoor units, and are internally piped, wired, assembled and run-tested at the factory. The branch distribution unit is used as an intermediate refrigerant control device between the outdoor unit and the indoor units to effectively and efficiently control the heating or cooling operation of the system through the use of electronic expansion valves.

Refrigerant System

System is designed for use with R410A refrigerant. All refrigerant lines from the outdoor unit to the branch distribution unit, and from the branch distribution unit to the indoor units, must be field insulated. The units may be connected to optional field-supplied and field-installed isolation valves for servicing without evacuating the entire system.

Piping Capabilities

Maximum piping length from the branch distribution unit to the indoor unit is 49.2 equivalent feet. Maximum elevation difference between branch distribution unit and indoor unit is 32.8 feet. Maximum elevation difference between two parallel branch distribution units is 49.2 feet.

Electrical

Each branch distribution unit is designed to operate using 208–230/60/1 power with voltage variances of $\pm 10\%$.

Casing

The casing is designed to mount fully concealed above a finished ceiling, is manufactured of galvanized steel plate, and is internally insulated. Branch distribution units do not require a condensate drain.

Port Assembly

Branch distribution units have a two-pipe system consisting of one vapor pipe and one liquid pipe. Units are available in a choice of two (PMBD3620), three (PMBD3630) or four ports (PMBD3640 and PMBD3641); branch distribution units include two, two-positioned solenoid valves per port. Each port for PMBD3620, PMBD3630, and PMBD3640 units connects to one indoor unit for a maximum nominal capacity of 24,000 Btu/h. For PMBD3641 units, ports A, B, C each connect to one indoor unit for a maximum nominal capacity of 24,000 Btu/h; port D connects to one indoor unit for a nominal capacity of 36,000 Btu/h. Maximum nominal capacity per branch distribution unit is 73,000 Btu/h. Two branch distribution units can be piped in parallel using accessory Y-branch kit PMBL5620.

Controls

The unit is provided with factory-installed control boards and an integral microprocessor to communicate with the main control board in the outdoor unit. All power wiring / communication cable to be minimum 16 AWG from the outdoor unit to the BD unit, and 18 AWG from the BD unit to the indoor unit, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes.

Figure 28:PMBD3620 Two-Port Branch Distribution Unit.



Figure 29:PMBD3630 Three-Port Branch Distribution Unit.



Figure 30:PMBD3640 and PMBD3641 Four-Port Branch Distribution Unit.



MULTI F MAX BD UNIT

General Data

MULTI F
MULTI F MAX

Table 18: Multi F MAX BD Unit General Data.

Model Number	PMBD3620	PMBD3630	PMBD3640	PMBD3641
No. of Connectable Indoor Units ¹	1-2	1-3	1-4	1-4
Max. Nominal Capacity / Port (Btu/h) ²	24,000	24,000	24,000	24,000 for A,B,C Ports; 36,000 for D Port
Max. Nominal Capacity / BD Unit (Btu/h)	48,000	72,000	73,000	73,000
Operation Temperature Range (°F DB)	0 ~ 122	0 ~ 122	0 ~ 122	0 ~ 122
<i>Unit Data</i>				
Refrigerant Type	R410A	R410A	R410A	R410A
Power Supply V, Ø, Hz	208-230, 1, 60	208-230, 1, 60	208-230, 1, 60	208-230, 1, 60
Power Input (W)	16	24	32	32
Rated Amps (A)	0.08	0.12	0.16	0.16
Dimensions W x H x D (in.)	17-3/32 x 6-13/32 x 10-23/32			
Net Unit Weight (lbs.)	13	14.3	15.7	15.7
Shipping Weight (lbs.)	15	17	18	18
<i>Power Wiring / Communication Cables³</i>				
From Outdoor Unit to BD Unit (Qty. x AWG) ³	4 x 16	4 x 16	4 x 16	4 x 16
From BD Unit to Indoor Unit (Qty. x AWG) ³	4 x 18	4 x 18	4 x 18	4 x 18
<i>Piping Connections</i>				
Outdoor Unit to BD Unit	Liquid (in., OD)	Ø3/8	Ø3/8	Ø3/8
	Vapor (in., OD)	Ø3/4	Ø3/4	Ø3/4
BD Unit to Indoor Units	Liquid (in., OD) x Qty.	Ø1/4 x 2	Ø1/4 x 3	Ø1/4 x 4
	Vapor (in., OD) x Qty.	Ø3/8 x 2	Ø3/8 x 3	Ø3/8 x 4 Ø1/2 x 1
<i>Piping Lengths</i>				
Maximum Total System Piping (ft.) ⁴	475.7	475.7	475.7	475.7
Maximum Main Pipe Length (Outdoor Unit to BD Units [ft.])	180.4	180.4	180.4	180.4
Total Branch Piping (BD Units to Indoor Units [ft.])	295.3	295.3	295.3	295.3
Maximum Branch Pipe Length Between BD Unit and Each Indoor Unit [ft.]	49.2	49.2	49.2	49.2
Maximum Outdoor Unit to Indoor Unit Pipe Length (ft.)	229.6	229.6	229.6	229.6
Piping Length (No Additional Refrigerant [ft.]; approx. 16 ft. of Main Piping + 131 ft. of Branch Piping)	147.6	147.6	147.6	147.6
Maximum Elevation between BD Unit and Indoor Unit (ft.)	32.8	32.8	32.8	32.8
Maximum Elevation between BD Unit and BD Unit (ft.)	49.2	49.2	49.2	49.2

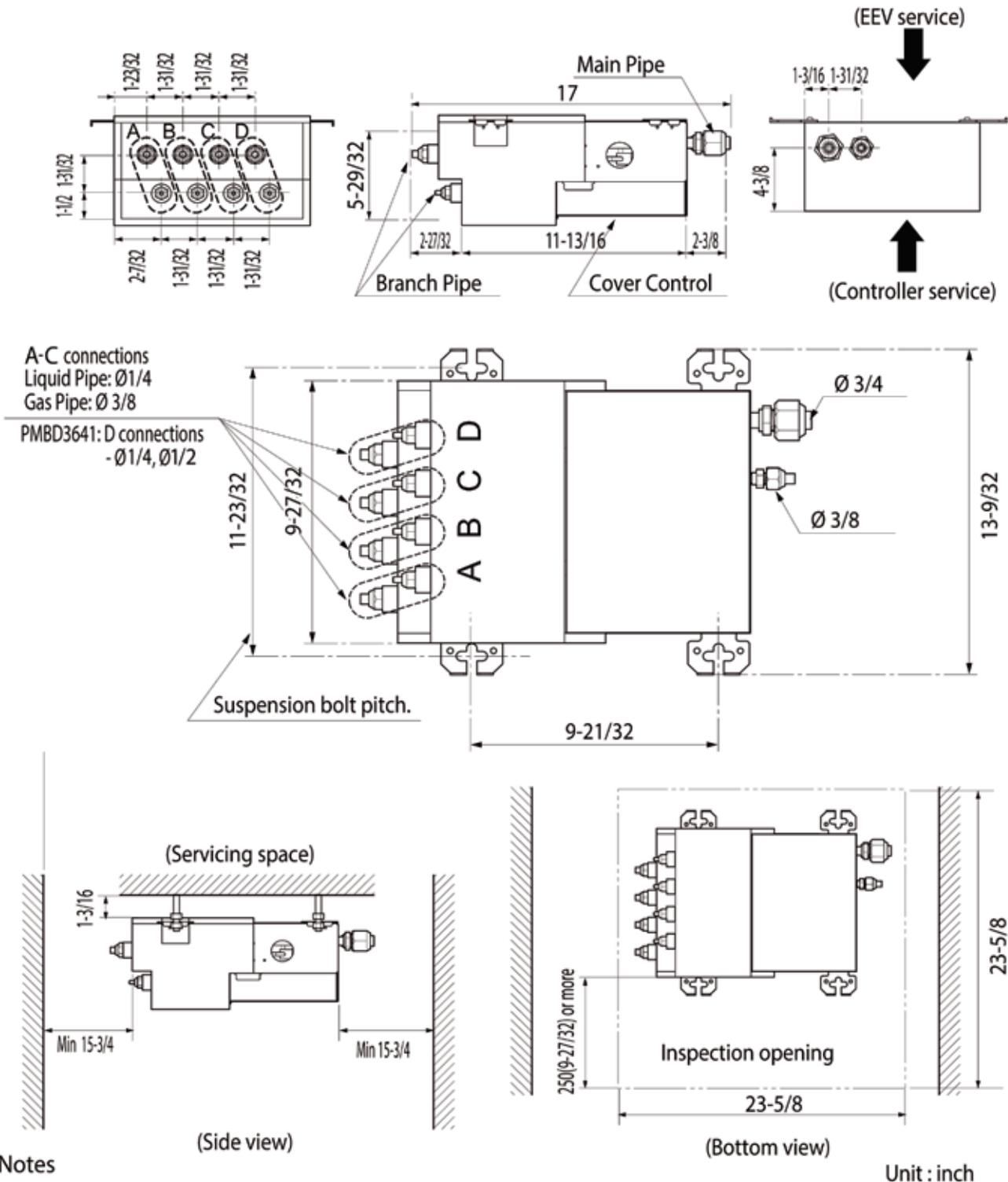
¹At least one Branch Distribution Unit is required for system operation; a maximum of two can be installed per outdoor unit with use of Y-branch accessory (PMBL5620) To connect only one (1) indoor unit to a branch distribution unit, the system must include another branch distribution unit with at least one (1) connected indoor unit.

²Branch Distribution Unit can accommodate from one (1) indoor unit up to four (4) indoor units depending on the ports available on the Branch Distribution Unit.

³All power wiring / communication cable to be minimum 16 AWG from the outdoor unit to the BD unit (Multi F MAX systems only), and 18 AWG from the BD unit to the indoor unit, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes.

⁴Piping lengths are equivalent.

Figure 31: PMBD3620, PMBD3630, PMBD3640, and PMBD3641 External Dimensions.

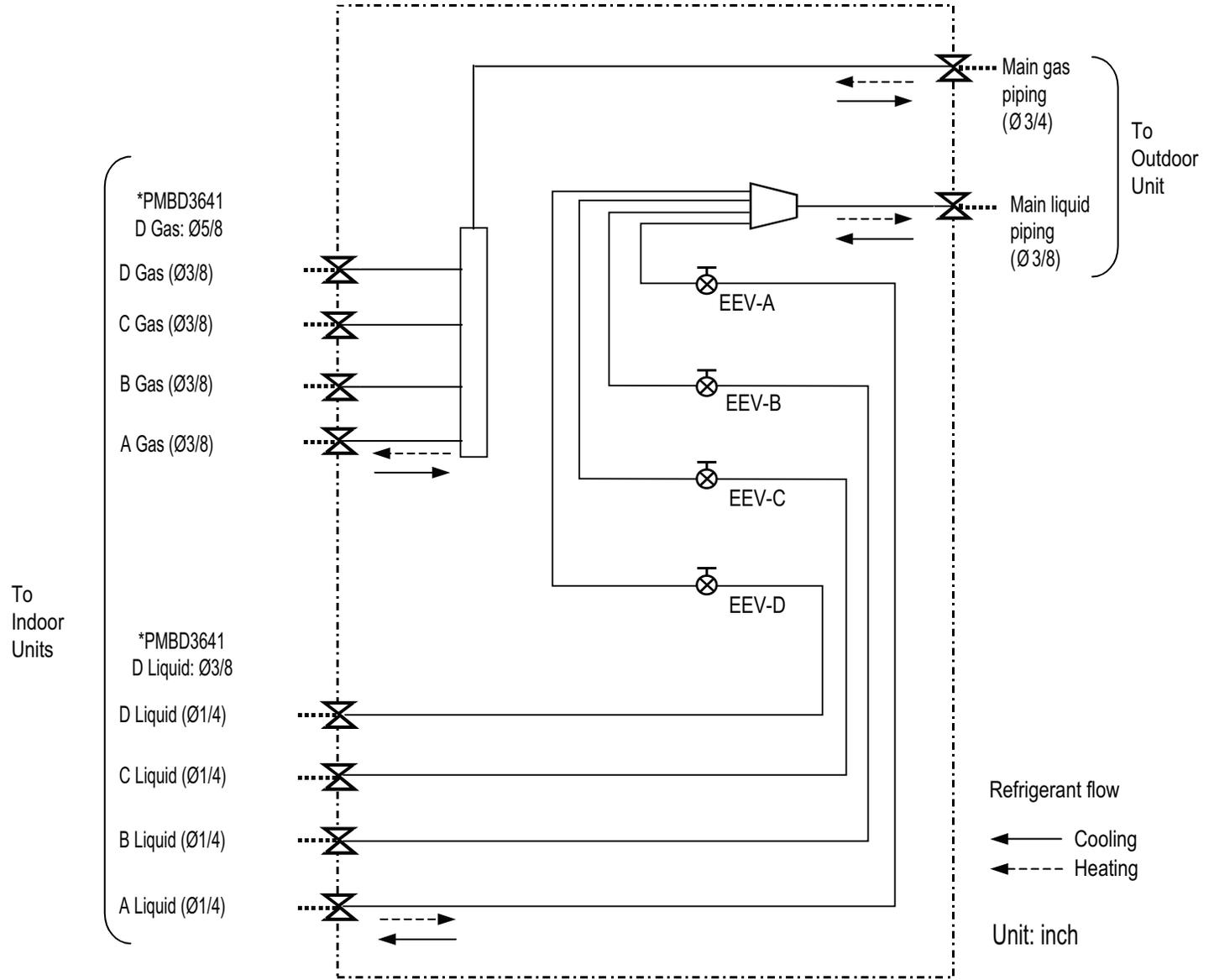


MULTI F MAX BD UNIT

Refrigerant Flow Diagram

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MULTI F MAX

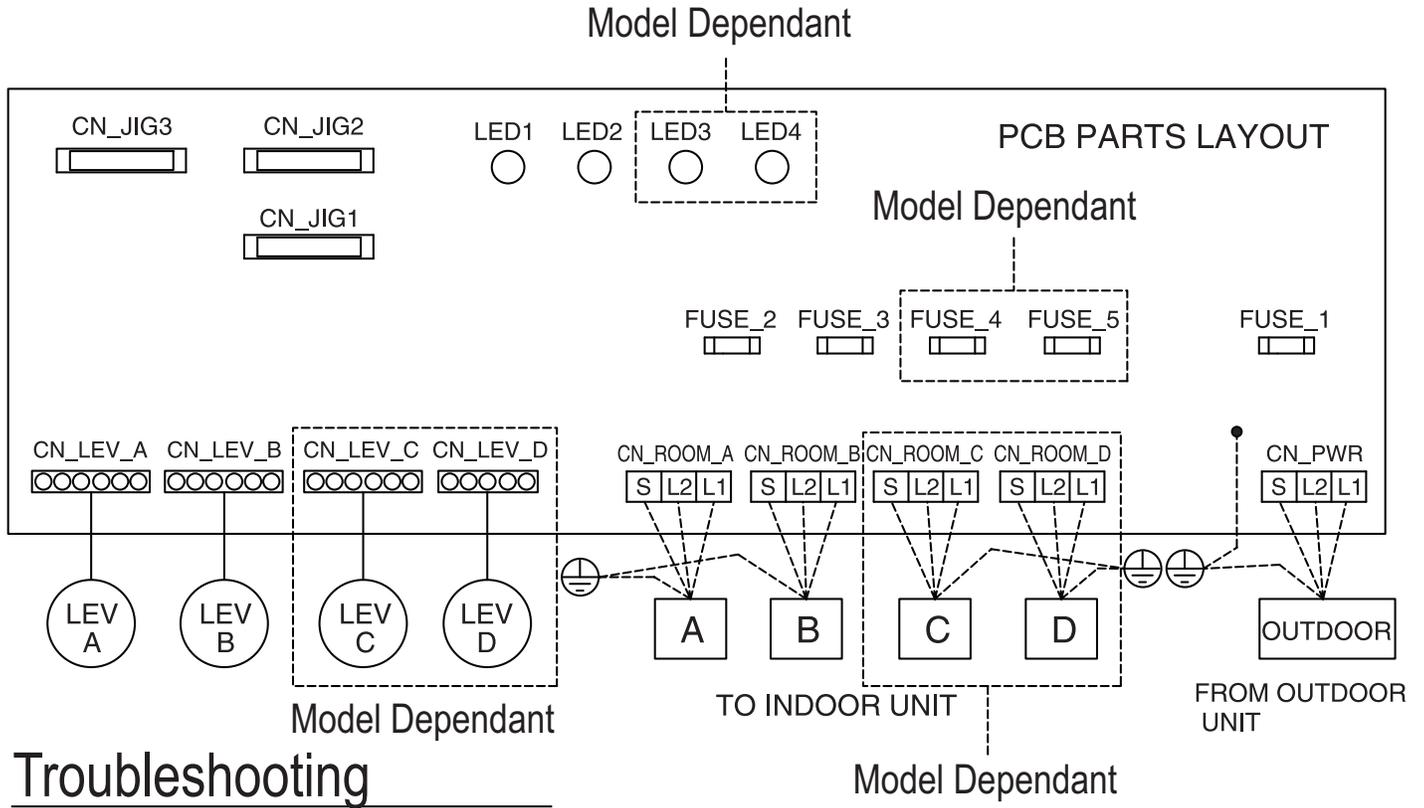
Figure 32: PMBD3620, PMBD3630, PMBD3640, PMBD3641 Refrigerant Flow Diagram.



Note:

1. Flare connections for field piping installation.
2. Match the BD ports to the indoor unit and outdoor unit piping sizes. Use an adapter if the piping size does not match the piping size of the connecting indoor unit.
3. EEV: Electronic Expansion Valve
4. PMBD3620 BD Unit supplied with "A, B".
PMBD3630 BD Unit supplied with "A, B, C".
PMBD3640 and PMBD3641 BD Units supplied with "A, B, C, D".

Figure 33: PMBD3620, PMBD3630, PMBD3640, PMBD3641 Wiring Diagram.



Troubleshooting

LED	DIAGNOSIS
	NORMAL
	ABNORMALITY -->CHECK BRANCH DISTRIBUTOR UNIT
	ABNORMALITY -->CHECK INDOOR OR OUTDOOR UNIT CHECK CONNECTING CABLE

Note:

PMBD3620 BD Unit supplied with "A, B".
 PMBD3630 BD Unit supplied with "A, B, C".
 PMBD3640 and PMBD3641 BD Units supplied with "A, B, C, D".

MULTI F MAX BD UNIT

Multi F MAX Y-Branch Accessory

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Y-Branch accessory PMBL5620 is required when installing two branch distribution units in parallel on one Multi F MAX system.

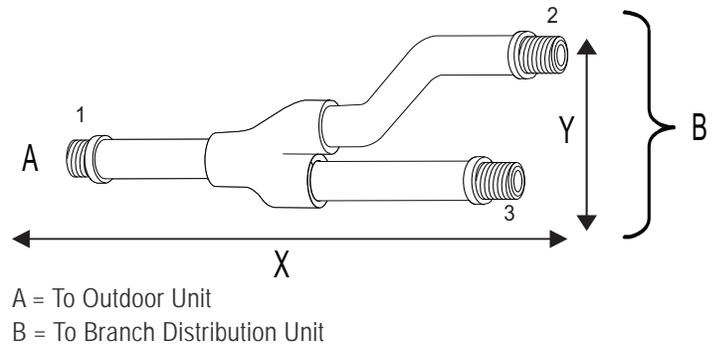
Table 19: Multi F MAX Y-Branch Specifications.

Model	Y-Branch Type	Port Identifier (inch)		
		1	2	3
PMBL5620	Liquid	Ø3/8	Ø3/8	Ø3/8
	Vapor	Ø3/4	Ø3/4	Ø3/4
	Y-Branch Type	Dimensions (inch)		
		X	Y	
	Liquid	13.80	3.24	
Vapor	12.48	3.02		

Figure 34: Y-Branch Port Identifier Diagram.



Figure 35: Y-Branch Dimensions Diagram.



Multi F MAX Branch Distribution (BD) Units can be installed in a multitude of options to fit various building configurations and job or application requirements. Multi F MAX BD Units include electronic expansion valves that properly seat only if the BD Unit is installed in an acceptable orientation. Installations with improper BD Unit orientation risk incomplete valve seating and system performance degradation from potential refrigerant leakage through the electronic expansion valve.

Note:

This material is for informational or educational purposes only. It is not intended to be a substitute for professional advice. Consult with your engineer or design professionals for specific applications to your system

Figure 36: Acceptable BD Unit Ceiling Mount Orientations.

Ceiling Mounting Options

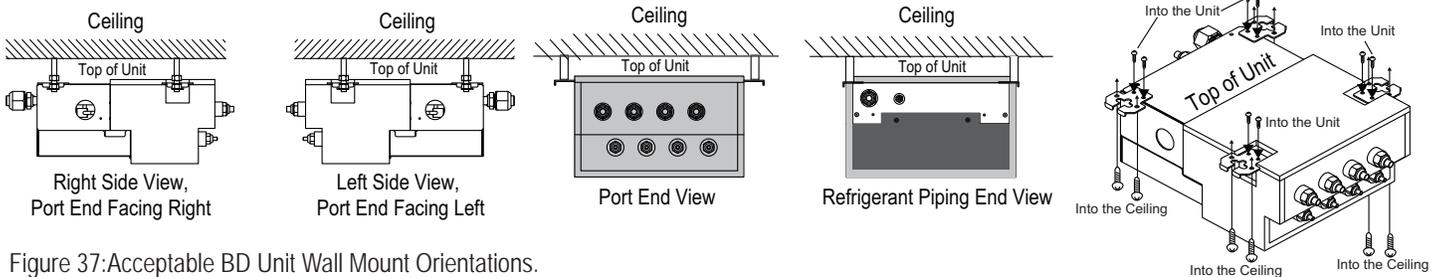


Figure 37: Acceptable BD Unit Wall Mount Orientations.

Wall Mounting Options

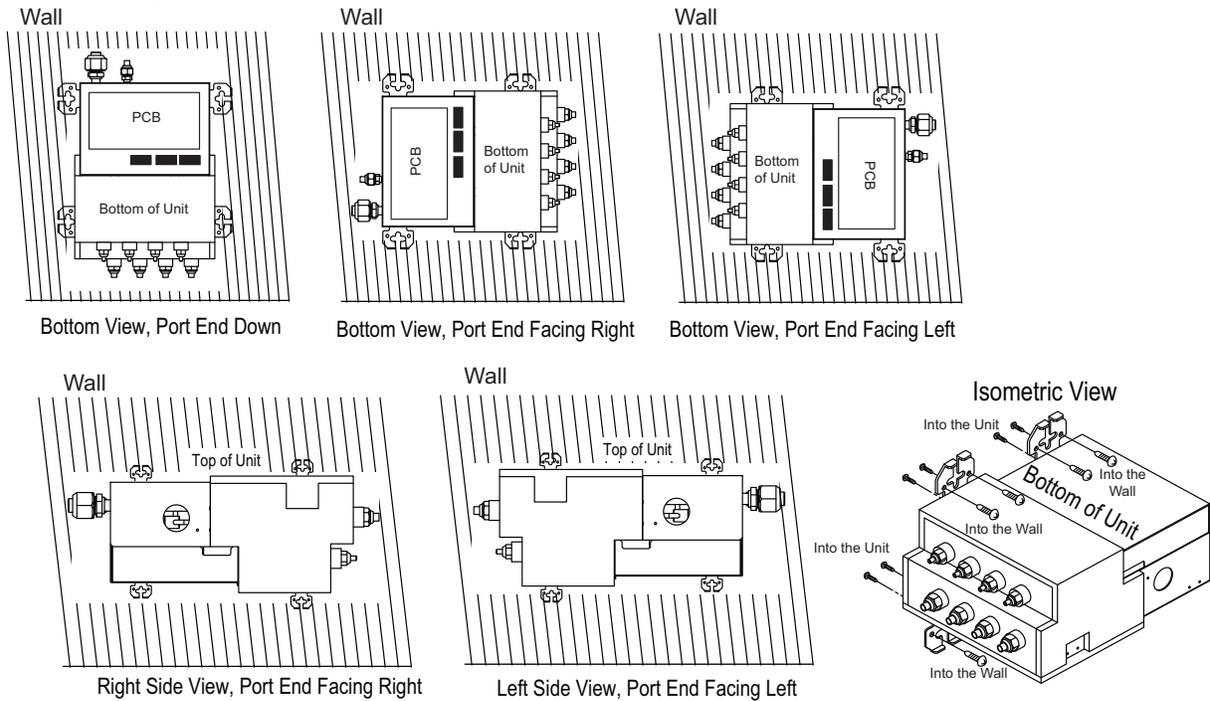
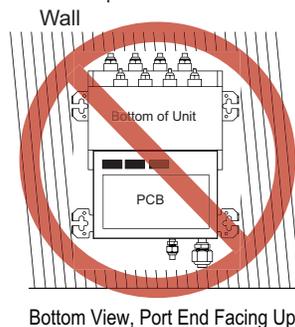


Figure 38: Unacceptable BD Unit Orientation.



Bottom View, Port End Facing Up

APPLICATION GUIDELINES

“Equipment Selection Procedure” on page 46

“Building Ventilation Design Guide” on page 52

“Placement Considerations” on page 57

To choose the multi-zone system that is the most appropriate for the space, as with traditional air-conditioning systems, follow similar protocols outlined in Manual J from the Air Conditioning Contractors of America (ACCA; see www.acca.org).

1. Obtain the design conditions, and calculate the maximum cool and heat loads for the structure.
2. Select the equipment (choosing the appropriate indoor units and outdoor unit):
 - Determine number of zones.
 - Determine total number of indoor units (refer to zone load calculations when choosing indoor units).
 - Determine number of indoor units allocated to each outdoor unit, considering allowable indoor unit connections, both indoor unit and outdoor unit capacities, and system piping capabilities.
3. Determine the corrected capacity for the indoor units and outdoor unit using LATS Multi F software (preferred method) or:
 - System Combination Tables.
 - Capacity Tables (it may be necessary to interpolate).
 - Capacity Coefficient Factors (such as refrigerant line length derates, design condition derates, defrost operation derate [heating mode], altitude derate [if applicable]).
4. Compare corrected capacities to load calculations.
5. Reselect equipment if necessary.

Obtain Design Conditions, Calculate Maximum Cool / Heat Loads

Obtain the winter outdoor / indoor temperature and summer and winter outdoor / indoor temperature design parameters for the location in which the system is installed. Determine if summer or winter design gains, relative humidity, and building features like skylights, orientation, number of occupants, etc., would change the total heat loss / gain and sensible / latent heat gain, and then calculate the maximum cool and heat loads for the space (using Manual J or energy modeling programs).

Select the Equipment

Determine the Number of Zones

Multi F heat pump systems can cool or heat, but not simultaneously. When designing larger-capacity Multi F heat pump systems or a Multi F MAX system, the designer may be able to combine spaces with similar load profiles located near or adjacent to each other into "thermal zones." After combining like spaces into zones that will be served by a single (or grouped) indoor unit(s), calculate the peak cooling and heating loads for each zone.

Choosing the Appropriate Indoor Units

Determine the appropriate indoor unit capacity that satisfies the given zone load calculations, and choose how many (and which styles of) indoor units will be required. See Table 20 for allowable indoor unit to outdoor unit connections, and the maximum number of connectable indoor units on each Multi F and Multi F MAX outdoor unit. When choosing indoor units, also consider the cooling and heating CFM, featured airflow specifications, and static pressure (if applicable) for each indoor unit.

Avoid oversizing indoor units in an attempt to increase the air exchange rate in the space. Multi F and Multi F MAX systems are designed for minimum airflow over the coil to maximize latent capacity while cooling, maintain a comfortable, consistent discharge air temperature while heating, and minimize fan motor power consumption. In extreme cases, oversizing the indoor units may affect outdoor unit size selection and compromise the outdoor unit's ability to effectively match the space load(s).

For proper system operation:

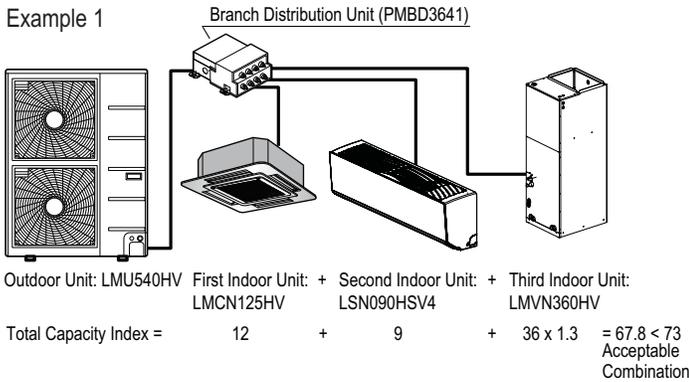
1. At least two indoor units must be connected to the outdoor unit.
2. Total connected indoor unit nominal capacity should be a minimum 40% and a maximum of 133% of outdoor unit nominal capacity.
3. To calculate the connected total indoor unit nominal capacity, simply sum up the nominal capacities of all indoor units.
 - For 24,000 and 36,000 Btu/h high static duct and vertical-horizontal air handling indoor units, a 1.3 multiplier must first be applied before adding to the sum of other smaller indoor units.
 - When two 24,000 Btu/h or one 24,000 Btu/h and one 36,000 Btu/h high static duct and / or vertical-horizontal air handling indoor units are the only connected indoor units, the multiplier is 1.2.

Note:

For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

Multiplier Examples

Example 1



Example 2

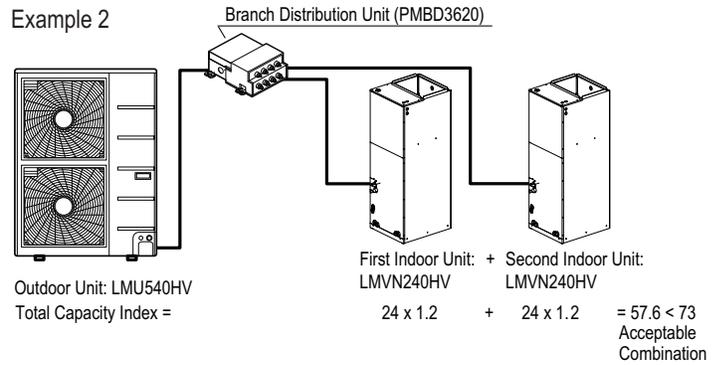


Table 20: Allowable Indoor Unit to Outdoor Unit Connections.

Indoor units		Outdoor units						
Model Type	Indoor Unit Nominal Capacity (Btu/h)	LMU18CHV	LMU24CHV	LMU30CHV	LMU36CHV	LMU480HV	LMU540HV	LMU600HV
		Maximum No. of Connectable Indoor Units						
		2	3	4	4	8	8	8
ART COOL Mirror	9,000	0	0	0	0	0	0	0
	12,000	0	0	0	0	0	0	0
	18,000	-	0	0	0	0	0	0
ART COOL Gallery	9,000	0	0	0	0	0	0	0
	12,000	0	0	0	0	0	0	0
	18,000	-	0	0	0	0	0	0
Standard Wall Mounted	7,000	0	0	0	0	0	0	0
	9,000	0	0	0	0	0	0	0
	12,000	0	0	0	0	0	0	0
	15,000	0	0	0	0	0	0	0
	18,000	-	0	0	0	0	0	0
Ceiling Concealed Duct-Low Static	9,000	0	0	0	0	0	0	0
	12,000	0	0	0	0	0	0	0
	18,000	-	0	0	0	0	0	0
Ceiling Concealed Duct-High Static	24,000	-	-	0	0	0	0	0
	36,000	-	-	-	-	0	0	0
Four-Way Ceiling Cassette	7,000	0	0	0	0	0	0	0
	9,000	0	0	0	0	0	0	0
	12,000	0	0	0	0	0	0	0
	18,000	-	0	0	0	0	0	0
Vertical-Horizontal Air Handler	24,000	-	-	0	0	0	0	0
	36,000	-	-	-	-	0	0	0

Choosing the Appropriate Outdoor Unit

After all indoor units are properly sized to offset the applicable loads in each zone, select the outdoor unit by choosing a size that meets both the load-cooling requirement, and offsets the sum of the heating load. Then, the system's combination ratio should be evaluated and confirmed it is within the allowable range (the combination ratio compares the nominal capacity of all connected indoor units to the nominal capacity of the outdoor unit serving them). The total nominal capacity of all indoor units should be smaller than the total nominal capacity of the outdoor unit. If the combination ratio is more than 100%, the designer is undersizing the outdoor unit relative to the combined nominal capacity of the connected indoor units. In some designs, oversized indoor units may be unavoidable in the case where the smallest size indoor unit available from LG is larger than what is necessary to satisfy the zone load. This scenario may also occur when an indoor unit selection one size down from the selected unit is slightly short of fulfilling the design load requirements, and the designer must choose the next largest size unit. Sometimes it is recommended to choose a larger capacity outdoor unit if the installation space is big enough. Also, it may be prudent to oversize the outdoor unit to address those times when the weather conditions may exceed the design conditions, to minimize the possibility of ventilation systems that causes the space temperature to drift outside design parameters, or when the indoor unit's entering air temperature falls outside the approved design temperature range.

Table 21: Rated Outdoor Unit Capacity.

		Outdoor Units						
		LMU18CHV	LMU24CHV	LMU30CHV	LMU36CHV	LMU480HV	LMU540HV	
Rated Capacity (Btu/h)*	Cooling	17,000	20,000	30,000	32,000	48,000	52,500	60,000
	Heating	22,000	24,000	32,000	36,000	54,000	58,000	64,000
Connectable Indoor Units	Minimum No. of Connectable IDUs	2	2	2	2	2	2	2
	Maximum No. of Connectable IDUs	2	3	4	4	8	8	8
	Maximum Capacity Index	24,000	33,000	40,000	48,000	65,000	73,000	81,000

*Rated capacity shown is based on a non-ducted indoor unit combination. Refer to combination tables for rated capacity of other combinations.

Determine the Corrected Capacity

The *corrected* cooling / heating capacity is different from the rated cooling / heating capacity. The corrected capacity includes changes in unit performance after considering design temperatures, available capacity that can be allocated from the outdoor unit, pressure drop due to refrigerant line length, defrost operation in heating mode, and (if applicable) altitude. Depending on the location of the building, additional capacity correction factors may need to be applied.

Using the Outdoor Unit Cooling and Heating Capacity Tables

Rated cooling capacity ratings are 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). Rated heating capacity ratings are 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).

To evaluate the total outdoor unit capacity at design conditions, using LATS Multi F software (preferred method) or reference the Performance Data Capacity Tables found in the Multi F outdoor unit section in this manual. All design temperatures are not explicitly shown in the charts, therefore, interpolation may be necessary to calculate the capacity for specific design conditions. Based on the premise that capacity follows a linear curve, the following formula can be applied:

$$(y - y1) / (y2 - y1) = (x - x1) / (x2 - x1)$$

Where

- y = Missing Capacity (Capacity at the Design Temperature).¹
- y1 = Capacity at Lower Temperature (Smaller value of the two nearest published TC datapoints).
- y2 = Capacity at Higher Temperature (Higher value of the two nearest published TC datapoints).
- x = Design Temperature (Temperature not shown in published capacity tables).²
- x1 = (Smaller value of the two nearest published temperature datapoints).
- x2 = (Larger value of the two nearest published temperature datapoints).

¹Median between two published Total Capacity [TC] Btu/h datapoints in the capacity table.

²Median between two nearest published temperature datapoints.

Using the Indoor Unit Cooling and Heating Capacity Tables

The datapoints shown in the indoor unit cooling and heating capacity charts are based on (and convey) an indoor unit operating with maximum possible refrigerant flow from the outdoor unit and before any derates are applied. In other words, the capacities displayed reflect what the indoor unit would produce if it was the only indoor unit that required capacity, and the outdoor unit did not have to allocate any capacity to another indoor unit.

System operation with a combination of indoor units is not conveyed in these charts, however, the information can be used to calculate indoor unit allocated capacity (without using the system combination tables). Simply calculate by using the formula:

$$Qidu(\text{combi}) = \frac{Qodu(\text{rated}) \times Qidu(\text{rated})}{\Sigma Qidu(\text{rated})}$$

Where

- Qidu(combi) = Individual Indoor Unit Combination Capacity.
- Qodu(rated) = Outdoor Unit Rated Capacity.

- Qidu(rated) = Individual Indoor Unit Rated Capacity.
- ΣQidu(rated) = Total Connected Indoor Unit Rated Capacity.

Note:

- The formula can be used to find individual indoor unit capacity for Multi F MAX systems.
- A more accurate method to determine expected capacity would be to apply the outdoor unit's corrected capacity instead of rated capacity.

Using the System Combination Tables

Multi F system combination tables illustrate how each indoor unit receives a percentage of total outdoor unit rated capacity. Allocation is based on:

- Combinations of Non-Ducted Indoor Units
- Combinations of Ducted Indoor Units
- Combinations of Mixed Non-Ducted and Ducted Indoor Units

Multi F MAX system combination tables only show the total connected indoor unit capacity, but individual indoor unit capacity can be calculated using the formula:

$$Q_{idu}(combi) = \frac{Q_{odu}(rated) \times Q_{idu}(rated)}{\sum Q_{idu}(rated)}$$

Note:

- A more accurate method to determine expected capacity would be to apply the outdoor unit's corrected capacity instead of rated capacity.
- For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

Capacity Coefficient Factors

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 in Tables 22 to 24.

Table 22: Multi F Outdoor Unit (Multiple Piping) to Indoor Unit Refrigerant Line Length Derates.

Piping Length (feet)	Cooling Capacity (%)	Heating Capacity (%)
<i>7,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	98.4	99.2
49.2	95.8	97.8
65.6	93.2	96.4
82.0	90.6	95.0
<i>9,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	98.0	99.0
49.2	94.8	97.4
65.6	91.6	95.8
82.0	88.4	94.2
<i>12,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	97.6	98.6
49.2	93.8	96.4
65.6	89.9	94.1
82.0	86.1	91.9
<i>15,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	97.2	98.2
49.2	93.0	95.4
65.6	88.8	92.6
82.0	84.6	89.8
<i>18,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	98.6	99.6
49.2	96.4	99.0
65.6	94.1	98.3
82.0	91.9	97.7
<i>24,000 Btu/h Indoor Unit Models</i>		
25.0	100.0	100.0
32.8	98.2	99.2
49.2	95.4	98.0
65.6	92.4	96.6
82.0	89.6	95.4

Table 23: Multi F MAX Outdoor Unit to Branch Distribution Unit Refrigerant Line Length Derates.

Main Piping Length (feet)	16.4	32.8	49.2	65.6	82.0	98.4	114.8	131.2	147.6	164.0	180.4
Cooling Capacity (%)	100.0	98.8	97.3	95.8	94.3	92.8	91.3	89.8	88.3	86.8	85.3
Heating Capacity (%)	100.0	99.6	99.2	98.7	98.3	97.8	97.4	96.9	96.5	96.0	95.6

Figure 39: Multi F MAX Outdoor Unit to Branch Distribution Unit Refrigerant Line Length Derate Chart.

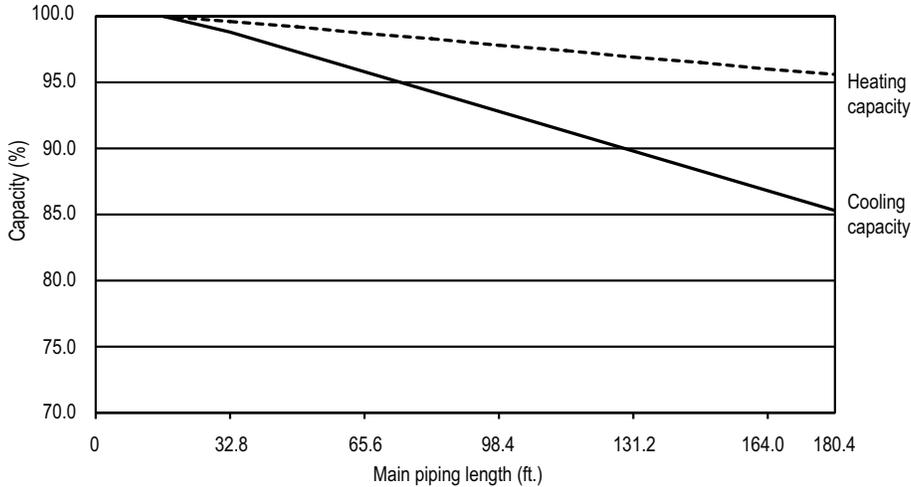


Table 24: Multi F MAX Branch Distribution Unit to Indoor Unit Refrigerant Line Length Derates.

Piping Length (feet)	Cooling Capacity (%)	Heating Capacity (%)
7,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	98.0	99.5
49.2	96.0	98.9
9,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	97.5	98.8
49.2	95.0	97.5
12,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	97.0	98.3
49.2	94.0	96.5
15,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	97.2	98.2
49.2	93.0	95.4
18,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	98.3	99.5
49.2	96.5	99.0
24,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	97.8	99.2
49.2	95.5	98.4
36,000 Btu/h Indoor Unit Models		
16.4	100.0	100.0
32.8	97.9	98.8
49.2	95.7	97.6

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.

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 25).

Note:

There will be a 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.

Table 25: 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.

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.

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:

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 express, implied, or statutory and the implied warranties of merchantability and fitness for a particular purpose are excluded should the building ventilation methods fail to perform as stated or intended.

• For a complete copy of Standard 62.1-2010, refer to the American Standard of Heating and Air Conditioning Engineers (ASHRAE) website at www.ashrae.org.

• For more information on how to properly size a ventilation air pretreatment system, refer to the article, "Selecting DOAS Equipment with Reserve Capacity" by John Murphy, published in the ASHRAE Journal, April 2010.

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. The open area of a window or the free area of a louver must meet the minimum percentage of the net occupied floor area.

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 Multi F indoor units.

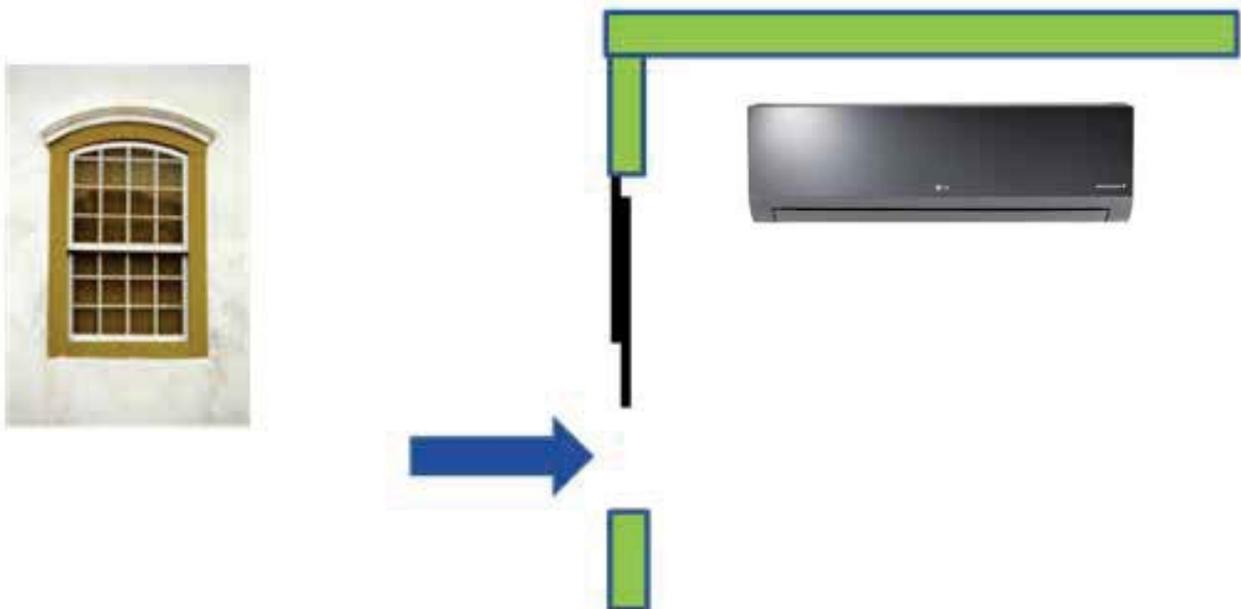
Note:

Methodology illustrations are for examples only and do not depict actual indoor units for the specific outdoor unit pairing. These are generic illustrations to show ventilation design only.

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



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.

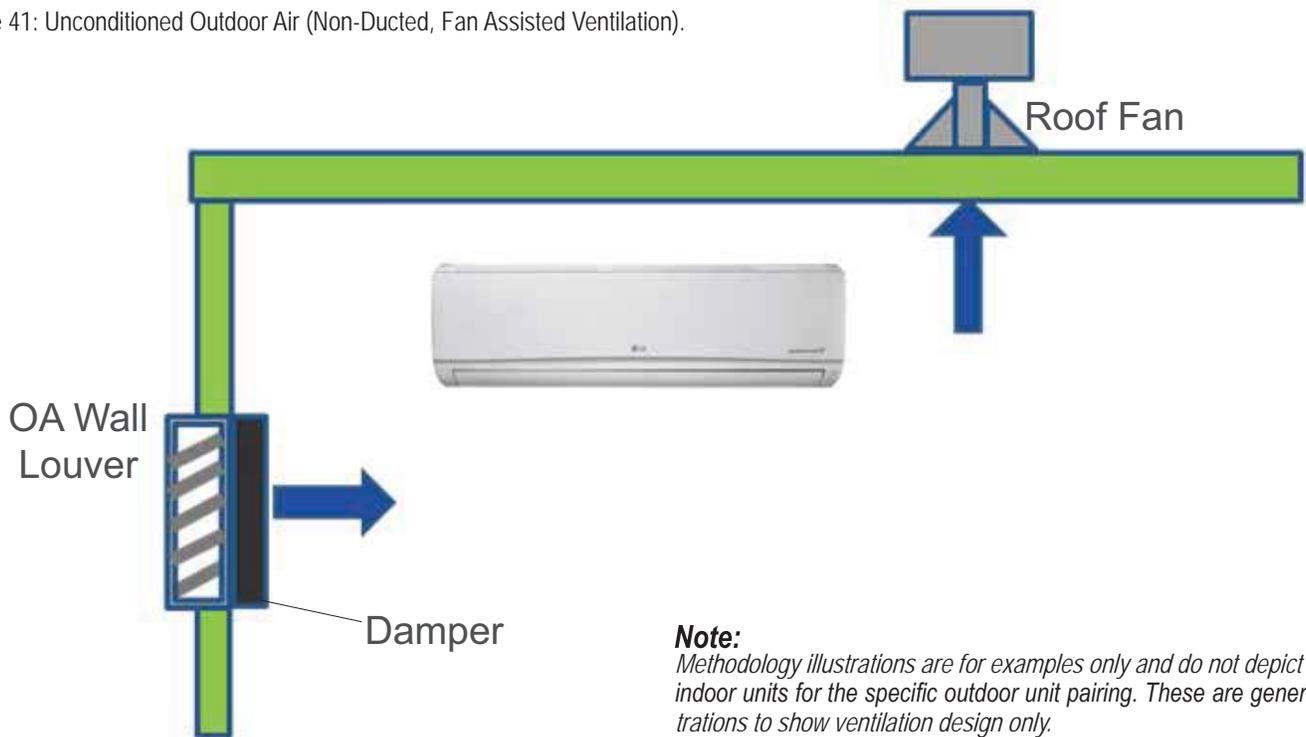
Advantages

- 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 Multi F indoor units.

Disadvantages

- In some locations of the country, it may be difficult to control humidity levels while outdoor air louvers/hoods are opened.
- Thermal comfort levels may be substandard when louvers/hoods are opened.
- 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 41: Unconditioned Outdoor Air (Non-Ducted, Fan Assisted Ventilation).



Note:

Methodology illustrations are for examples only and do not depict actual indoor units for the specific outdoor unit pairing. These are generic illustrations to show ventilation design only.

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 Multi F ducted indoor units or to the frame of Multi F 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.

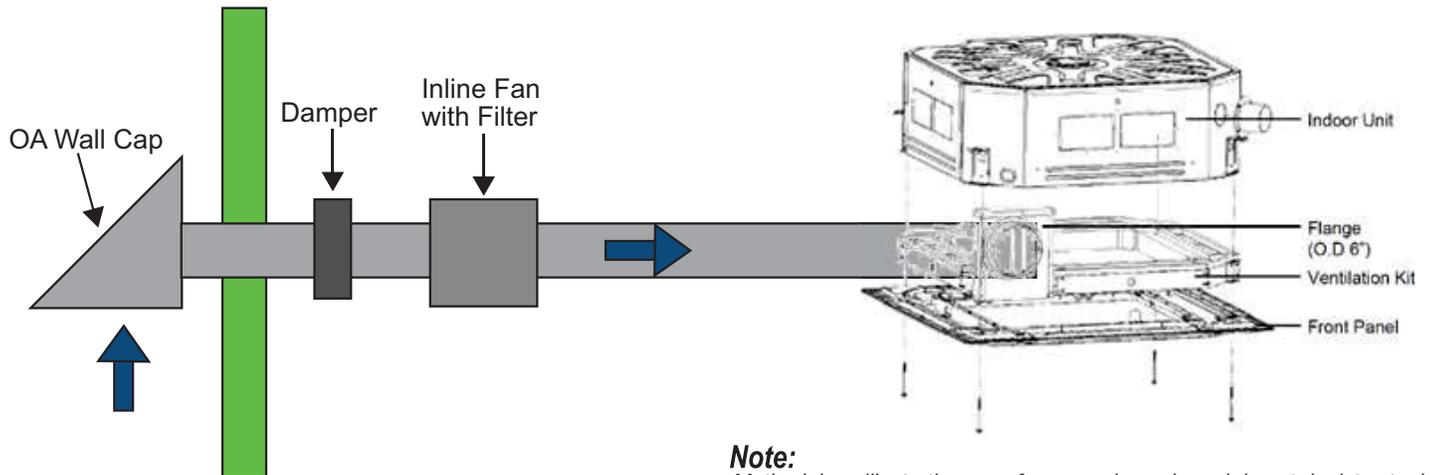
Advantages

- 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 42: Unconditioned Outdoor Air Ducted to Indoor Units.



Note:

Methodology illustrations are for examples only and do not depict actual indoor units for the specific outdoor unit pairing. These are generic illustrations to show ventilation design only.

Method 4: Coupled Dedicated Outdoor Air (CDOA)

A separate, dedicated outdoor air system delivers air directly to a Multi F 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.

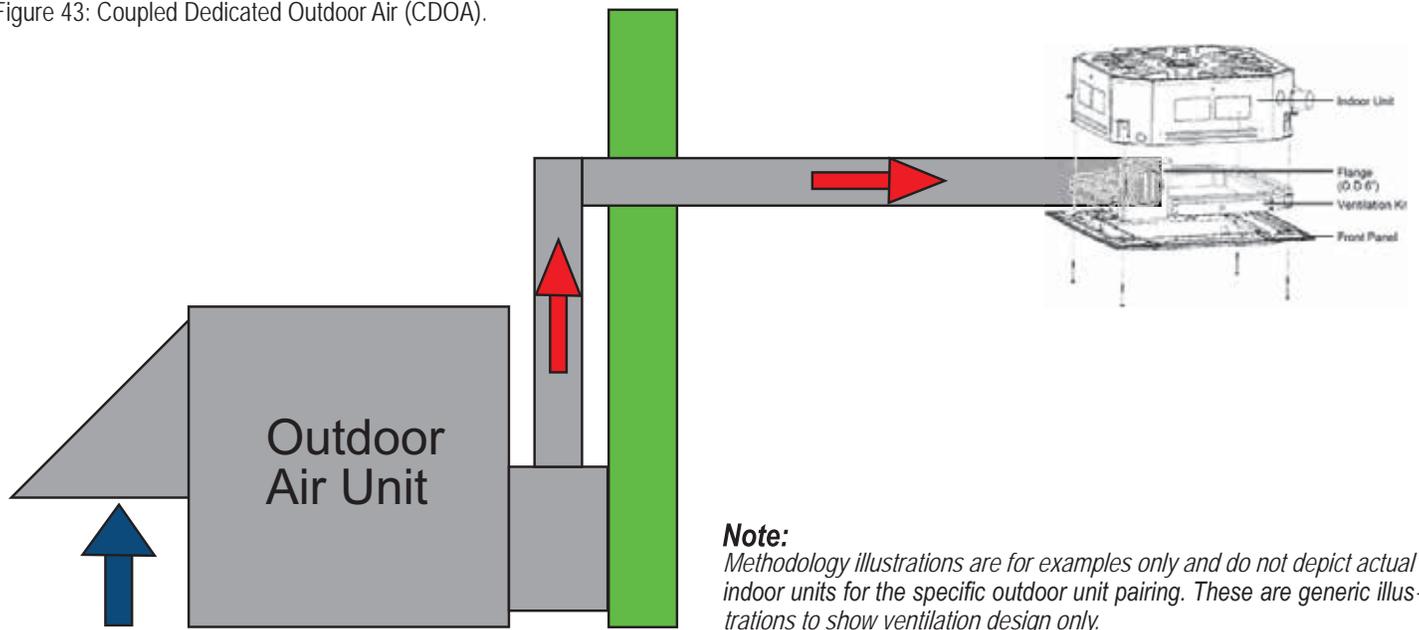
Advantages

- 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 43: Coupled Dedicated Outdoor Air (CDOA).



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 Multi F system.

Note:

LG recommends using the DDOAS method in all installations.

Advantages

- May be used with the full lineup of Multi F indoor units.
- The outdoor air unit may supply “neutral” air to the occupant space even when the Multi F indoor unit fan changes speed or cycles on and off. DDOAS controls do not have to be interlocked with the Multi V F 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.

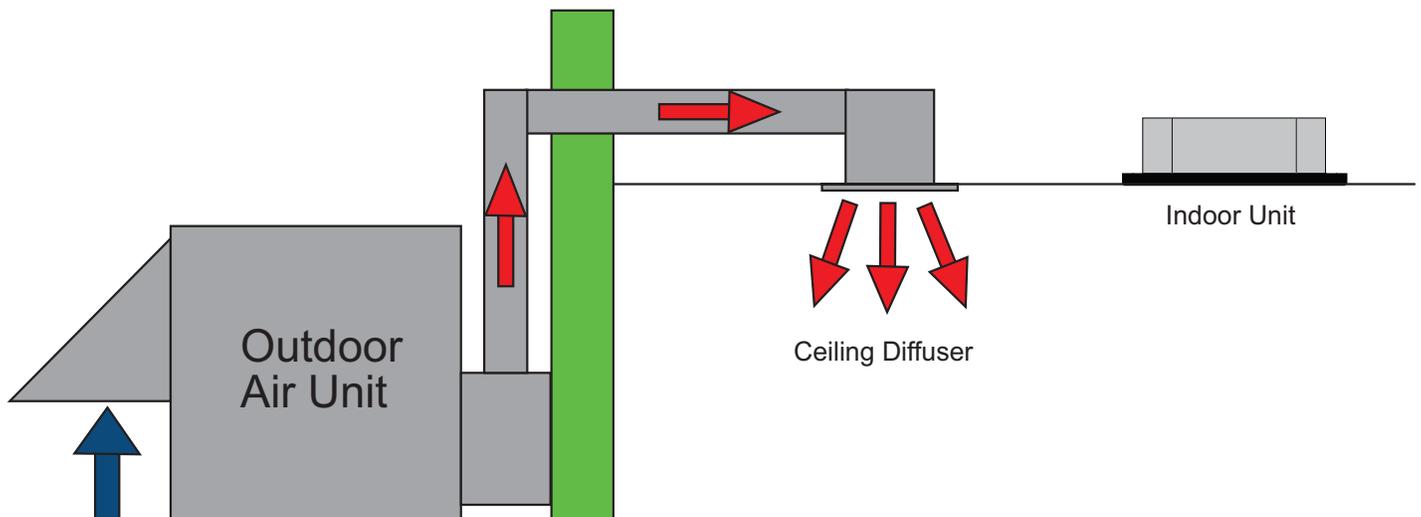
Disadvantages

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

Note:

Methodology illustrations are for examples only and do not depict actual indoor units for the specific outdoor unit pairing. These are generic illustrations to show ventilation design only.

Figure 44: Decoupled Dedicated Outdoor Air System (DDOAS).



Selecting the Best Location for the Indoor Units

Note:

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

- Within allowable parameters for proper connection to the outdoor unit (or Branch Distribution unit, if a Multi F MAX system).
- 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 is level and with enough strength to bear the weight of the indoor unit(s).



- No obstacles to air circulation around the unit; keep proper distances from ceilings, doorways, floor, walls, etc.
- An area where operation sound won't disturb occupants.
- An area that does not expose the indoor unit(s) to heat, water, steam, oil splattering or spray.

Selecting the Best Location for the Branch Distribution (BD) Unit

Note:

Branch Distribution (BD) units are used only with Multi F MAX systems to distribute the refrigerant from the outdoor unit to up to eight indoor units. Select location indoors that will meet the following conditions:

- Within allowable parameters for proper connection to the Multi F MAX outdoor unit and indoor unit(s); refrigerant piping and wire lengths must not exceed amounts specified by LG Electronics, U.S.A., Inc.
- Condensate drain piping is not required.
- Ensure there is enough space in the installation area for service purposes; install the refrigerant piping and electrical wiring system in an easily accessible location.
- Level where there is enough strength to bear the weight of the BD unit.



- Do not install the BD unit in a location where it would be subjected to strong radiation heat from heat sources.
- Avoid an installation environment where the BD unit would be exposed to heat, water, steam, oil splattering or spray.
- Install the unit in a location where any sound it generates will not disturb occupants in the surrounding rooms.
- No obstacles to air circulation around the unit; keep proper distances from ceilings, doorways, floor, walls, etc.
- Where high-frequency electrical noise / electromagnetic waves will not affect operation. Maintain proper distances between the BD unit(s) and electric wires, audio and visual appliances, breaker / circuit panels, etc.

Selecting the Best Location for the Outdoor Unit

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Note:

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

- A location strong enough to bear the weight of the outdoor unit.
- A location that allows for optimum air flow and is easily accessible for inspection, maintenance, and service.
- Where piping between the outdoor unit, indoor unit(s), and BD units (Multi F MAX systems only) are within allowable limits.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in heating mode. Avoid placing the outdoor unit in a low-lying area where water could accumulate.

Selecting the Best Location for the Outdoor Unit, continued.



- Where it will not be subjected to direct thermal radiation from other heat sources, nor an area that would not expose the outdoor unit to heat or steam like discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperatures.
- Where high-frequency electrical noise / electromagnetic waves will not affect operation.
- Where operating sound from the unit will not disturb inhabitants of surrounding buildings.
- Where the unit will not be exposed to direct, strong winds.

Rooftop Installations

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

Oceanside Installation Precautions

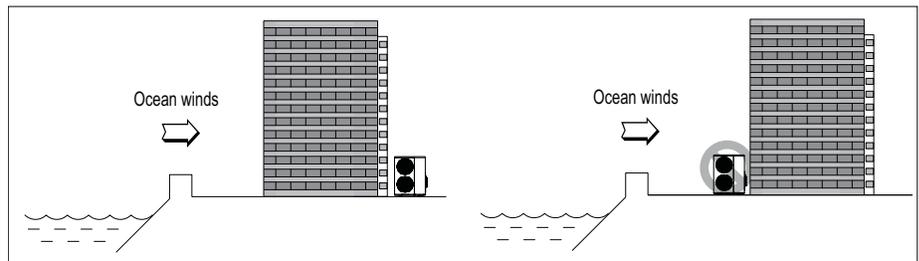
- Install the outdoor unit on the side of the building opposite from direct ocean winds.
- Select a location with good drainage.
- Periodically clean dust or salt particles off of the heat exchanger with water.



- Avoid installing the outdoor unit where it would be directly exposed to ocean winds.

Note:

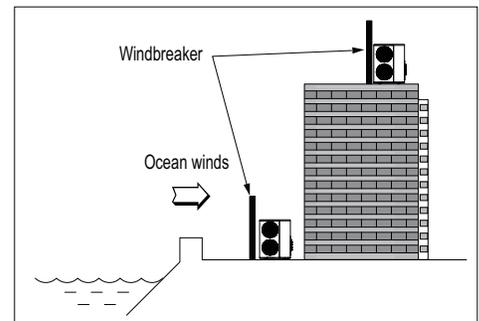
Ocean winds may cause corrosion, particularly on the condenser and evaporator fins, which, in turn could cause product malfunction or inefficient performance.



Note:

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

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



Planning for Snow and Ice

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

Outdoor Unit Platform Requirements

Figure 45: Outdoor Unit Foundation Requirements.

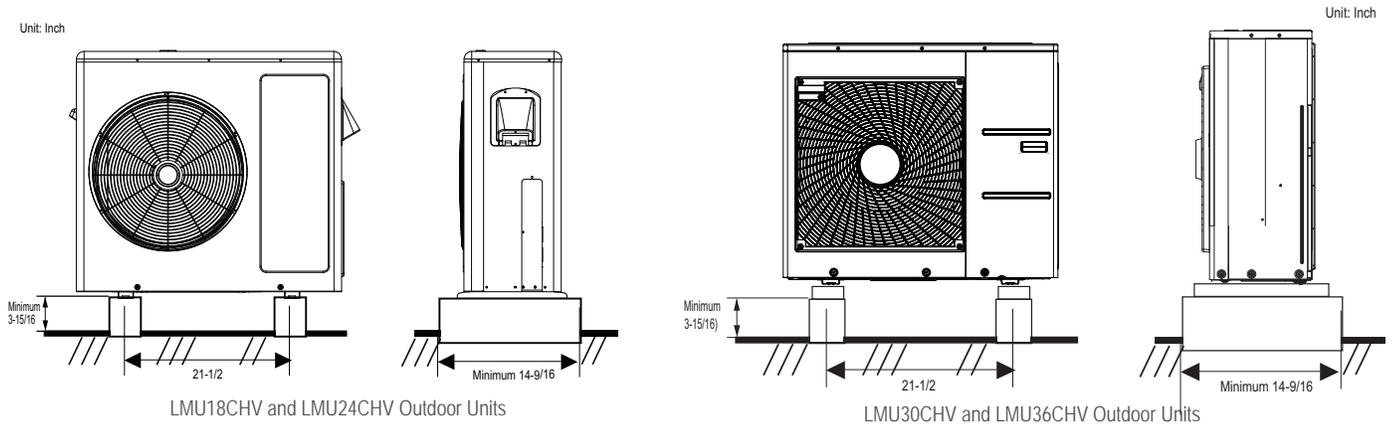
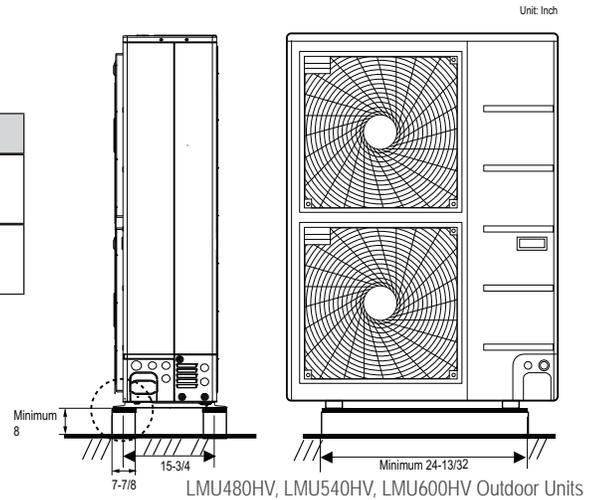


Table 26: Outdoor Unit Foundation Specifications.

Outdoor Unit Type	Bolt Type	Concrete Height	Bolt Depth
LMU18CHV, LMU24CHV, LMU30CHV, LMU36CHV	M10-J	Minimum 3-15/16 inches	Minimum 2-3/4 inches
LMU480HV, LMU540HV, LMU600HV	M10-J	Minimum 7-7/8 inches	Minimum 2-3/4 inches



Bolting the Outdoor Unit to the Platform

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

Figure 46: Bolting the Outdoor Unit to the Platform.

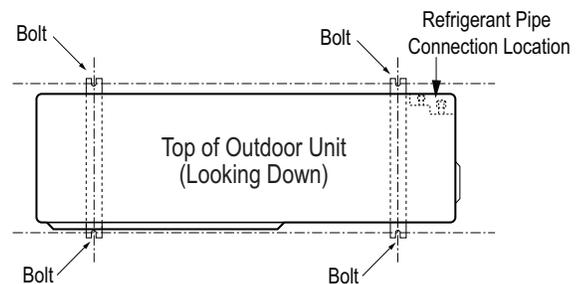
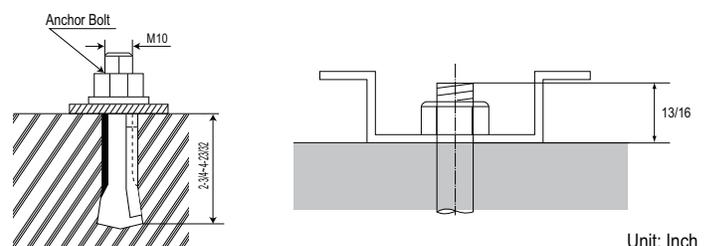


Figure 47: Close up of Bolt Attachment.



Unit: Inch

Tie-Downs and Lightening Protection

Tie-Downs

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

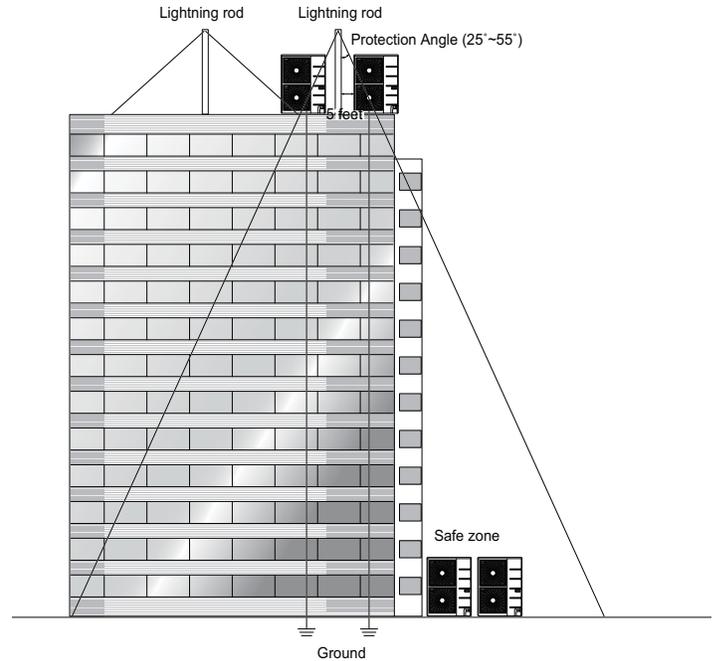
- To protect the outdoor unit from lightning, it should be placed within the specified lightning safety zone.

Table 27: 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.

Figure 48: 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.

Outdoor Unit Service Access and Allowable Clearances

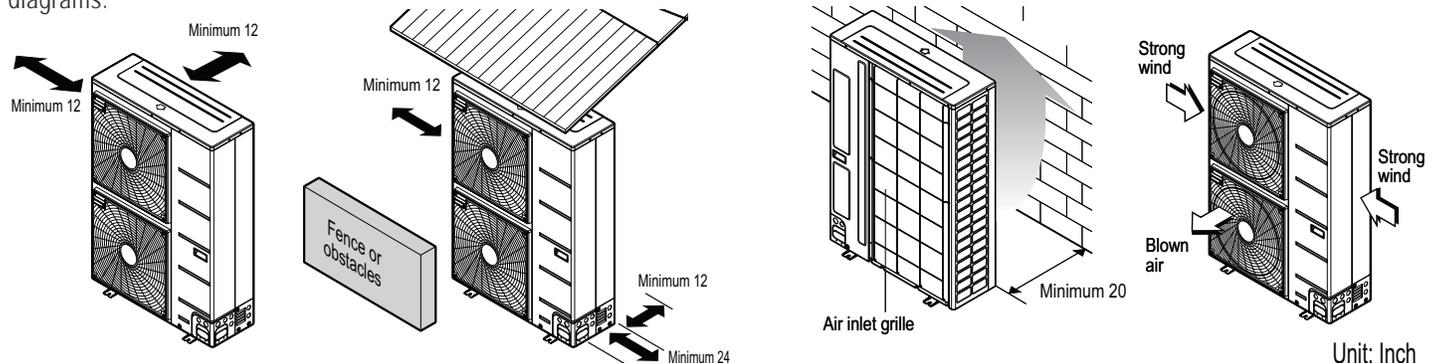
Appropriate airflow through the outdoor unit coil is critical for proper unit operation.

- 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.
- 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.



- 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.)

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

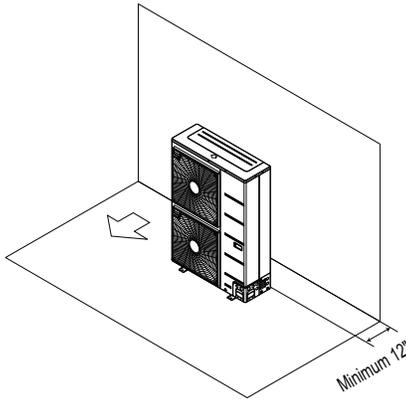


Ensure that the space at the back of the outdoor unit is a minimum of 11-13/16 inches, and include a minimum of 23-5/8 inches at the right side of the unit for service.

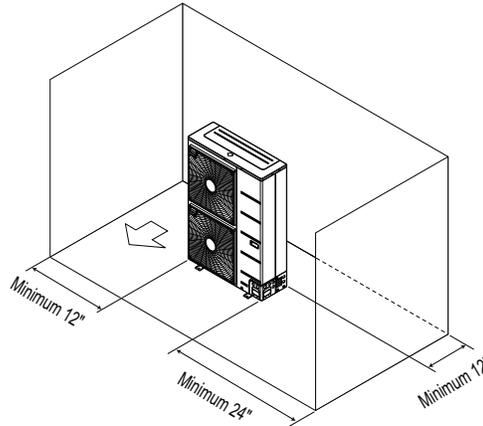
If the outdoor unit discharge side faces a wall, include a minimum of 19-11/16 inches between the outdoor unit and the wall. Install the outdoor unit so that the discharge port is set at a right angle to the wind direction.

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

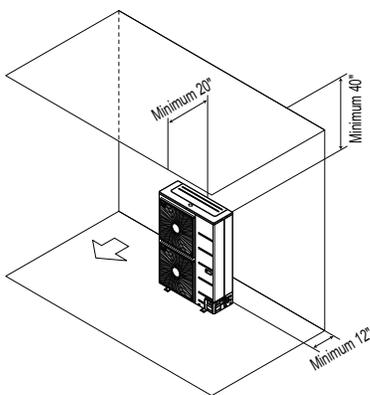
Obstacle on the suction side only.



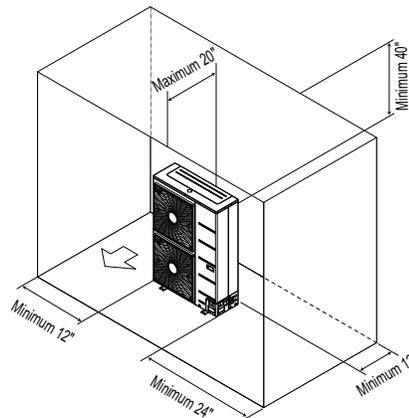
Obstacles on the suction side and on both left and right sides.



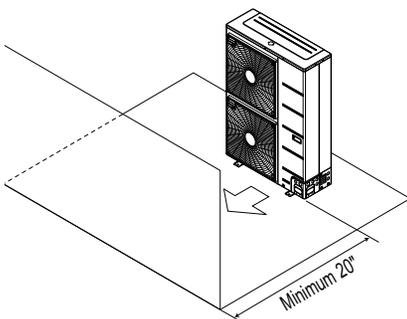
Obstacles above and on the air intake side.



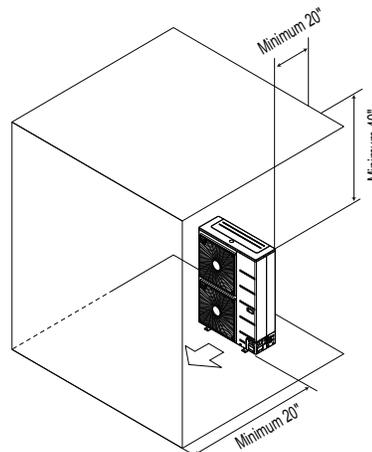
Obstacles above, on the air intake side, and on both left and right sides



Obstacle just on the air discharge side.



Obstacles above and on the air discharge side.



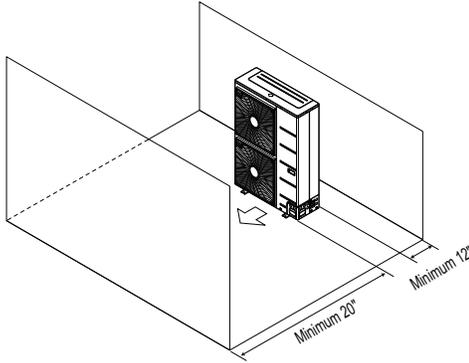
PLACEMENT CONSIDERATIONS

MULTI F
MULTI F MAX

Multi F and Multi F MAX Indoor Unit Engineering Manual

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

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).

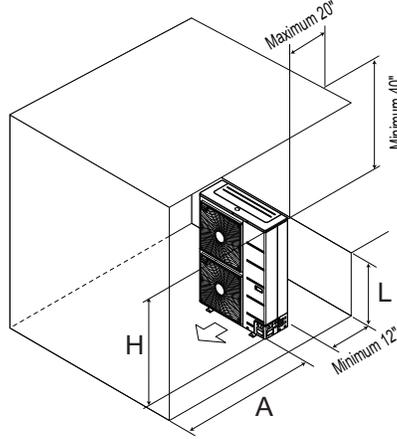
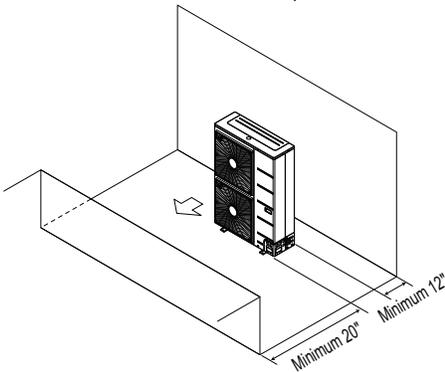


Table 28: Ratio among H, A, and L.

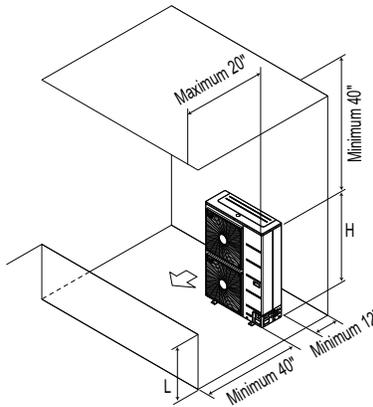
	L	A
L ≤ H	0 < L ≤ 1/2 H	29-1/32 inches
	1/2 H < L	39-3/8 inches
H < L	Set Stand as: L ≤ H	

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

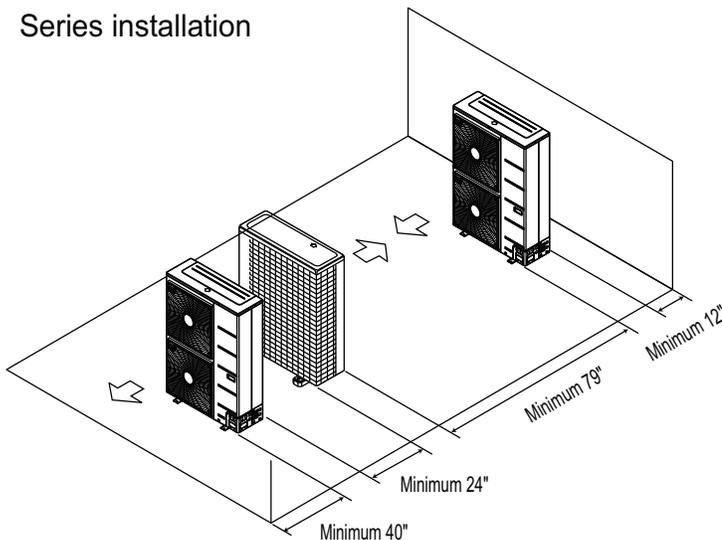
Where there are obstacles on both suction and discharge sides (discharge side obstacle is lower than the outdoor unit).



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.

Installing Outdoor Units Indoors

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

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

Benefits of Installing Outdoor Units Indoors

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

Design Considerations Include:

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

General Guidelines

- Follow ASHRAE 62.1 design guidelines.
- Depending on the project / application, a roof over the outdoor units in combination with a wind break may be all that is necessary.
- Consider the potential for snow accumulation near louvers / roof openings. Outside air intakes and discharge ducts/louvers should be engineered to clear anticipated snow accumulation levels by at least one (1) foot.
- In situations where operation is anticipated at temperatures of -4°F and lower, ancillary heat should be provided to heat the outdoor unit coils to assure continuous compressor operation and heating.
- It may be necessary to use a field-fabricated air guide to prevent discharge air from short-cycling back to the coil inlet.
- Consider the direction of prevailing winds and opening placement. If possible, locate inlet openings upwind of discharge openings and other exhaust outlets.
- When inlet and outlet openings are placed on the same wall, minimum distance between the two openings should be approximately three (3) feet (minimum distance varies significantly with variations in outlet opening face velocity).
- If roof-mounted ventilation openings are used, strategically locate the inlet ventilation opening(s) upwind of the outlet opening(s).
- Discharge and supply ductwork should be designed to avoid weather related long periods of water entrainment and the potential for microbial growth.

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

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

⚠ CAUTION

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

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

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

Note:

For louver recommendations, see below and on the next page.

As always, the best solution for each project balances acceptable heating performance (considering local weather conditions), capital costs, life cycle energy consumption, and limitations set forth by local building codes.

Louver Recommendations for Outdoor Unit Enclosure

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

Note:

- *Open Rate and Inlet should be taken into consideration when designing the louvered outdoor unit enclosure.*
-  Do not use “S” type louvers.

Note:

If the Louver Open Rate is Too Small

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

Figure 49: Louver Recommendations.

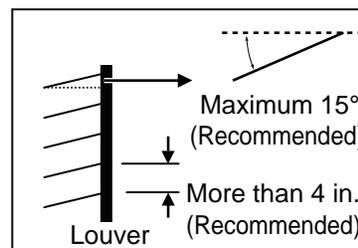
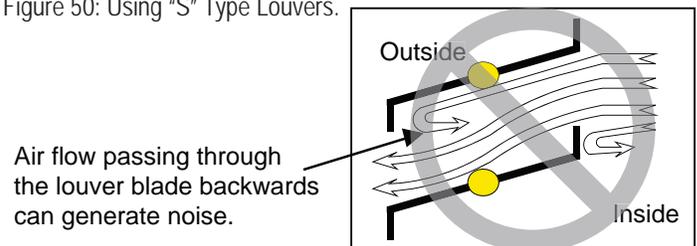
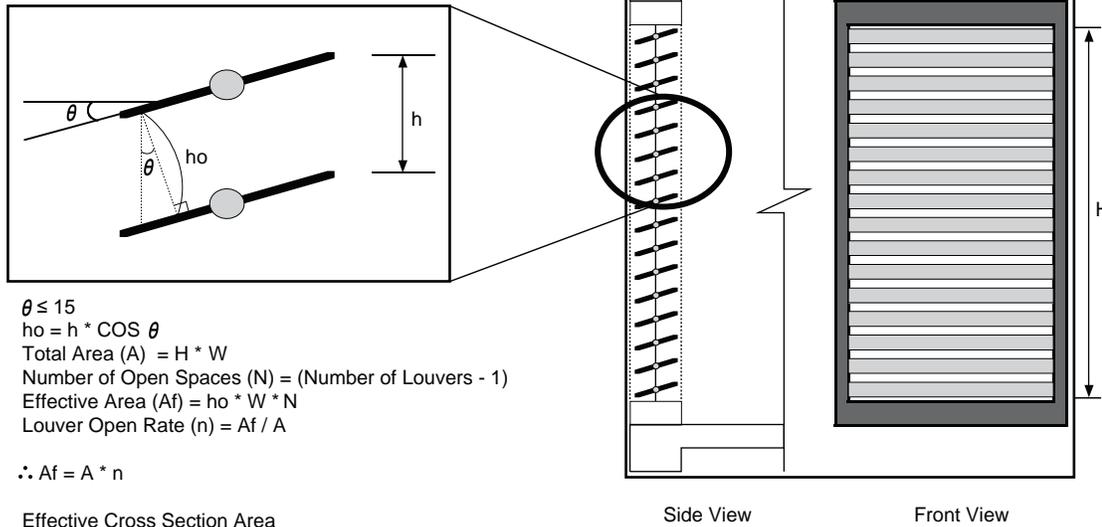


Figure 50: Using “S” Type Louvers.



Open Rate by Louver Radian

Figure 52: Open Rate by Louver Radian Formula.



Confirming Air Flow Rate / Total Opening Rate

Figure 51: Example of Installing Outdoor Unit Indoors.

• Example: LMU36CHV

• Airflow Rate: 2,119 ft.³/min.

• Velocity of Outlet Air: 16.4 ft./s

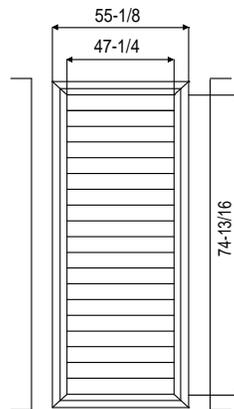
• Velocity of Inlet Air: 8.2 ft./s

• Open Rate = 80% or More

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

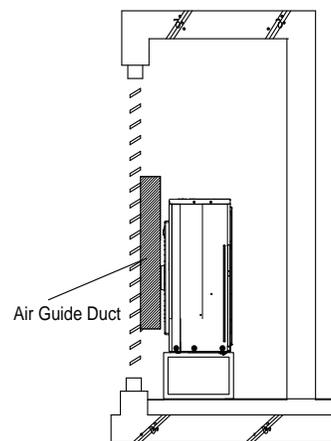
• Discharge Air Guide should be installed.

Louver Dimensions

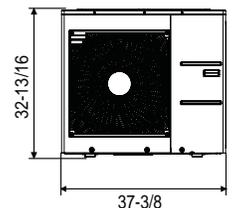


Unit: Inch

Air Guide Duct on Outdoor Unit



Outdoor Unit Dimensions



Formula

• Total Louver Dimension (Excluding Frame) (A) = 3.9 feet x 6.2 feet = 24.2 ft.²

• Louver Shield Dimension by Product (B) = 3.12 feet x 2.74 feet = 8.55 ft.²

• Inlet Louver Dimension (A - B) = 15.7 ft.²

• Equivalent Inlet Dimension (Open Rate 80%) = 15.7 ft.² x 0.8 = 12.56 ft.²

• Equivalent Inlet Air Volume = 12.56 ft.² x 8.2 ft./s x 60 sec./min. = 6,179.5 ft.³/min.

• Required Air Volume / Equivalent Volume = 6,179.5 ft.³/min. / 2,119 ft.³/min. = 291% (Within Allowable Limits)

REFRIGERANT PIPING DESIGN & LAYOUT BEST PRACTICES

“Design Guideline Summary” on page 68

“Creating a Balanced / Quality Piping System” on page 70

“Manual Layout Procedure” on page 70

“LG Engineered Multi F MAX Y-Branch Kits” on page 71

“Refrigerant Charge” on page 72

“Selecting Field-Supplied Copper Tubing” on page 74

“Refrigerant Piping System Layout” on page 76

“Piping Insulation” on page 84

“Condensate Drain Piping” on page 85

“Cut Sheet” on page 87

REFRIGERANT PIPING DESIGN

MULTI F
MULTI F MAX

Design Guideline Summary

The following are examples of manual pipe size calculations. Designers are highly encouraged to use LATS for Multi F systems.

Device Connection Limitations

- The minimum number of connected and operating indoor units to Multi F / Multi F MAX systems is two, taking into consideration the minimum combination ratio.
- The maximum number of indoor units for each Multi F / Multi F MAX heat pump systems is:

LMU18CHV = 2 LMU24CHV = 3 LMU30CHV = 4 LMU36CHV = 4 LMU480HV = 8 LMU540HV = 8 LMU600HV = 8

Note:

For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX Combination Data Manual" on www.lg-dfs.com. For performance data, see "Multi F / Multi F MAX Performance Data Manual" on www.lg-dfs.com.

One of the most critical elements of multi-zone systems is the refrigerant piping. The following pages list pipe length limits that must be followed in the design of Multi F and Multi F MAX refrigerant pipe systems:

Using Refrigerant Components

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 fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment.

Table 29: Equivalent Piping Length for Elbows, Y-branches, and Branch Distribution Units.

Component	Size (Inches)				
	1/4	3/8	1/2	5/8	3/4
Elbow (ft.)	0.5	0.6	0.7	0.8	1.2
Y-Branch Kit (ft., Multi F MAX systems only) ¹	1.6				
Branch Distribution Unit (ft., Multi F MAX systems only)	8.2				

¹Kit contains two Y-branches: one for liquid and one for vapor.

Multi F System

Example: LMU36CHV outdoor unit with four (4) indoor units connected.

ODU: Outdoor Unit.

IDU: Indoor Unit.

A, B, C, D: Pipes from Outdoor Unit to Indoor Unit.

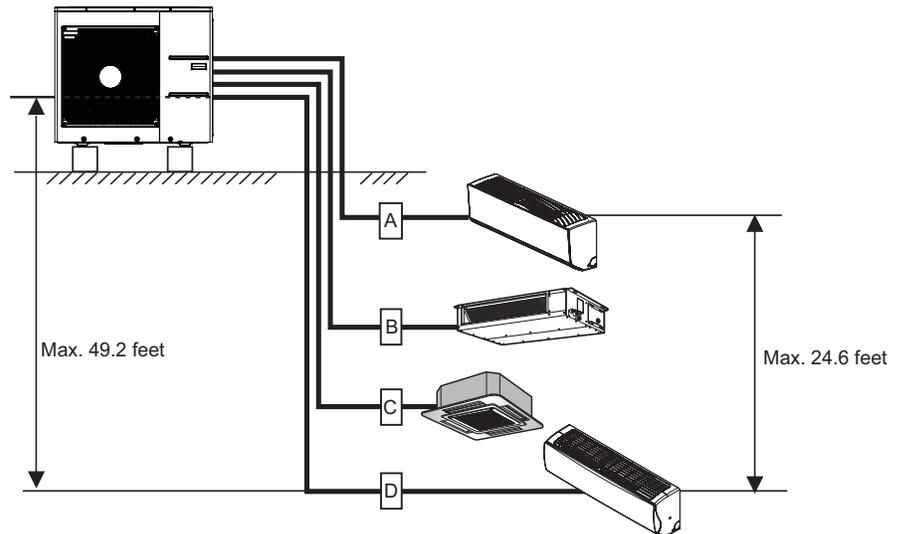


Table 30: Multi F Outdoor Unit Refrigerant Piping System Limitations.

Outdoor Unit	Minimum Length for Each Pipe (ft.)	Maximum Piping Length to Each Indoor Unit (ft.)				Maximum Total Piping Length for Each System (ft.)
		A	B	C	D	
LMU18CHV	10	82	82	-	-	164
LMU24CHV	10	82	82	82	-	246.1
LMU30CHV	10	82	82	82	82	246.1
LMU36CHV	10	82	82	82	82	246.1

The following are examples of manual pipe size calculations. Designers are highly encouraged to use LATS for Multi F systems.

Multi F MAX System with One Branch Distribution Unit

Example: LMU540HV outdoor unit with four (4) indoor units, and one (1) branch distribution unit connected.

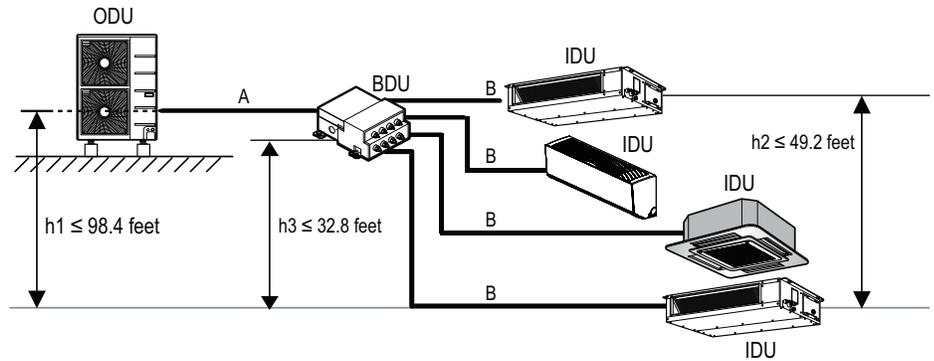
ODU: Outdoor Unit.

IDU: Indoor Unit.

BDU: Branch Distribution Unit.

A: Main Pipe.

B: Branch Pipe (Branch Distribution Unit to Indoor Unit[s]).



Multi F MAX System with Two Branch Distribution Units

Example: LMU540HV outdoor unit with seven (7) indoor units, and two (2) branch distribution units connected.

ODU: Outdoor Unit.

IDU: Indoor Unit.

BD: Branch Distribution Unit(s).

ΣA : Main Pipe.

ΣB : Branch Pipe (Branch Distribution Unit[s] to Indoor Unit[s]).

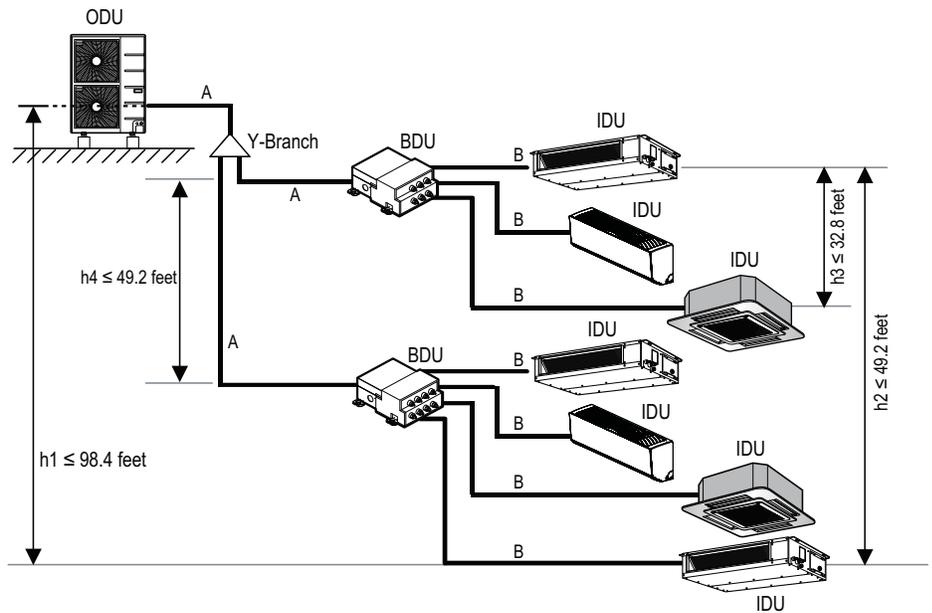


Table 31: Multi F MAX Outdoor Unit Refrigerant Piping System Limitations.

Pipe Length (ELF = Equivalent Length of pipe in Feet)	Total piping length ($\Sigma A + \Sigma B$)		≤475.7 feet
	Main pipe (Outdoor Unit to Branch Distribution Units: ΣA)	Minimum	10 feet
		Maximum	≤180.4 feet
	Total branch piping length (ΣB)		≤295.3 feet
Branch pipe (Branch Distribution Units to Indoor Units: B)	Minimum	10 feet	
	Maximum	≤49.2 feet	
Elevation Differential (All Elevation Limitations are Measured in Actual Feet)	If outdoor unit is above or below indoor unit (h_1)		≤98.4 feet
	Between the farthest two indoor units (h_2)		≤49.2 feet
	Between branch distribution unit and farthest connected indoor unit(s) (h_3)		≤32.8 feet
	Between branch distribution units (h_4)		≤49.2 feet

Table 32: Multi F MAX Piping Sizes.

Piping	Main Pipe A (inch)	Branch Pipe B
Liquid	Ø3/8	Depends on the size of the indoor unit piping
Gas	Ø3/4	

Creating a Balanced / Quality Piping System

Unlike designing duct-work or chilled and hot water pipe systems where balancing dampers, ball valves, orifices, circuit setters, or other flow control devices can be installed to modify or balance the flow of cooling medium, these cannot be used in a Multi F system. Therefore, variable refrigerant flow systems have to be designed to be “self balanced.” Balanced liquid refrigerant distribution is solely dependent on the designer using the correct pipe size for each segment. Pipe sizing considerations include pipe length, pipe segment pressure drop relative to other pipe segments in the system, type and quantity of elbows, bends present, fitting installation orientation, and end use device elevation differences.

Note:

The designer should avoid creating excessive pressure drop. When liquid refrigerant is subjected to excessive pressure drop, liquid refrigerant will change state and “flash” to vapor. Vapor present in a stream of liquid refrigerant before reaching the indoor unit coil (or branch distribution unit for Multi F MAX systems) results in a loss of system control and causes damage to the components. The pipe system must be designed in a manner that avoids the creation of unwanted vapor.

Refrigerant Piping System Verification

To ensure that the refrigerant piping design is suitable for the system, a LATS refrigerant piping design software report must be provided with every Multi F order. Following the installation, if any changes or variations to the design were necessary, an “as-built” LATS piping design software report must be provided to LG prior to system commissioning. User should always check the LATS report actual pipe layout versus pipe limits.

Note:

Any field changes, such as re-routing, shortening or lengthening a pipe segment, adding or eliminating elbows and/or fittings, re-sizing, adding, or eliminating indoor units, changing the mounting height or moving the location of a device or fitting during installation should be done with caution and ALWAYS VERIFIED in LATS MULTI F SOFTWARE before supplies are purchased or installed. Doing so ensures profitable installation, eliminates rework, and ensures easier system commissioning.

Manual Layout Procedure

1. Choose the location of the indoor units on the building drawing.
2. Choose the location of all Y-branch and branch distribution units (if a Multi F MAX system) and note them on the building drawing. Verify that all fittings are positioned per the guideline limitations set forth in “Y-branch Kits” on page 67.
3. Plan the route for interconnecting piping. Draw a one-line depiction of the pipe route chosen on the building drawing.
4. Calculate the actual length of each pipe segment and note it on the building drawing.
5. Using the data obtained while selecting the system components, list the corrected cooling capacity next to each indoor unit on the drawing.
6. Starting at the indoor unit located farthest from the outdoor unit, sum the corrected cooling capacity of all indoor units served by the pipe segment for each branch and runout pipe (indoor units and branch distribution units [Multi F MAX systems only]). Record these values next to each segment.
7. Verify the size of the liquid and vapor lines.
8. If a Multi F MAX system, refer to “Y-branch Kits” on page 42 and branch distribution units on page 38 to verify the part number of each Y-branch and branch distribution unit based on the connected downstream nominal capacity served.
9. Calculate the equivalent pipe length in feet of each pipe segment. If a Multi F MAX system, Y-branch equivalent lengths should be totaled with the upstream segment only. Use equivalent pipe length data when it is provided with field-purchased fittings. If not available, use the data provided on page 64 to estimate the equivalent length of field-provided pipe and fittings for each segment. Equivalent lengths should be totaled with the upstream segment only.
10. Verify if the equivalent pipe length complies with the limitations in the “Multi F and Multi F MAX Refrigerant Piping System Limitations” tables on pages 64 and 65. If the limitations are exceeded, either reroute the pipe or change the location of the indoor unit, Y-branch fittings and branch distribution units (if Multi F MAX systems), so the design conforms with all limitations.
11. If adjusted as per Step 10 above, verify again if the length of the design complies with the limitations set in “Multi F and Multi F MAX Refrigerant Piping System Limitations” tables on pages 64 and 65.
12. Verify that the manually sized pipe design is acceptable using LATS Multi F. When entering the length of pipe segments in LATS Multi F software, enter the equivalent pipe length. Account for the additional pressure drop created by elbows, valves, and other fittings present in each segment by adding their respective equivalent pipe length to the actual pipe length.

Multi F MAX Y-Branch Kit PMBL5620

The LG supplied Y-Branch Kit PMBL5620 MUST be used when two branch distribution units are connected on one Multi F MAX system. Field-supplied fittings are not permitted. Each Y-Branch kit comes with two (2) Y-branches (one for the liquid line and one for the vapor line) and insulation covers.

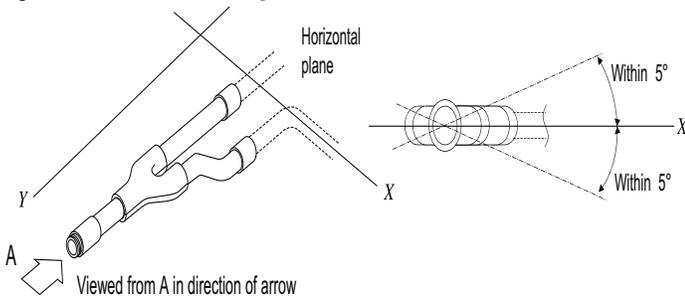
Y-branches may be installed in horizontal or vertical configurations. When installed vertically, position the Y-branch so the straight-through leg is $\pm 3^\circ$ of plumb. When installed horizontally, position the Y-branch so the take-off leg is level and shares the same horizontal plane as the straight-through leg $\pm 5^\circ$ rotation.

Y-branches must be properly installed following instructions in the applicable LG manual. Y-branches should always be installed with the single port facing the outdoor unit and the two-port end facing the branch distribution units. Do not install Y-branches backwards as refrigerant flow cannot make U-turns. The Y-branch kit must be located at least three (3) feet from the outdoor unit. Provide a minimum of 20 inches between a Y-branch and the branch distribution unit.

It is recommended that when a Y-branch is located in a pipe chase or other concealed space, access doors should be provided for inspection access.

The equivalent pipe length of each Y-branch (1.6') must be added to the main pipe segment entered into LATS piping design software.

Figure 55: Horizontal Configuration End View.



Y-Branch Kit Insulation

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

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

Figure 53: Y-Branch Connections.

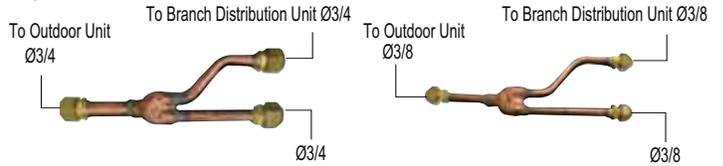
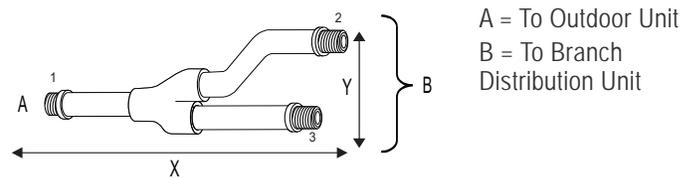


Table 33: Y-Branch Connection Diameters.

Model	Y-Branch Type	Port Identifier (inch)			Dimensions	
		1	2	3	X	Y
PMBL5620	Liquid	3/8	3/8	3/8	13.80	3.24
	Vapor	3/4	3/4	3/4	12.48	3.02

Figure 54: Y-Branch Dimensions Diagram.



Note:

- Design pressure is 551 psig.
- All dimensions in inches. Tolerance $\pm 1/4$ inch.
- Images are not to scale.

Figure 56: Y-branch Installation Alignment Specification.

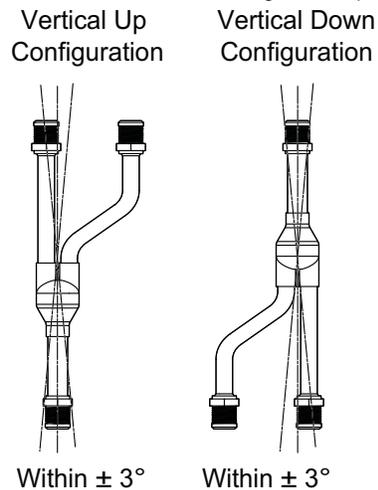
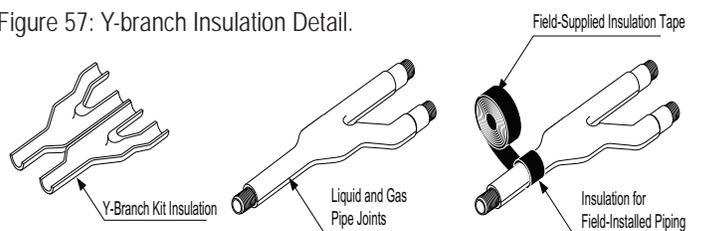


Figure 57: Y-branch Insulation Detail.



REFRIGERANT PIPING DESIGN

MULTI F
MULTI F MAX

Refrigerant Charge

LG Multi F and Multi F MAX outdoor units ship from the factory with a charge of R410A refrigerant. A trim charge may need to be added to take into account additional piping length.

To determine the additional refrigerant that is needed, apply the formulas below, and record the results. If the total additional refrigerant charge value is a negative number, then an additional trim charge does not need to be added to the system.

Table 34: Outdoor Unit Factory Charge.

Outdoor Unit	Factory Charge lbs. of R410A
LMU18CHV	3.96
LMU24CHV	3.96
LMU30CHV	6.18
LMU36CHV	6.18
LMU480HV	9.7
LMU540HV	9.7
LMU600HV	12.3

Multi F Systems

$$\begin{aligned} \text{Additional charge (lbs.)} &= (\text{Installed Length of Branch [A]} - \text{Chargeless Pipe Length [L]}) \times a \\ &+ (\text{Installed Length of Branch [B]} - \text{Chargeless Pipe Length [L]}) \times a \\ &+ (\text{Installed Length of Branch [C]} - \text{Chargeless Pipe Length [L]}) \times a \\ &+ (\text{Installed Length of Branch [D]} - \text{Chargeless Pipe Length [L]}) \times a \\ &- \text{CF (Correction Factor)} \times 5.29 \end{aligned}$$

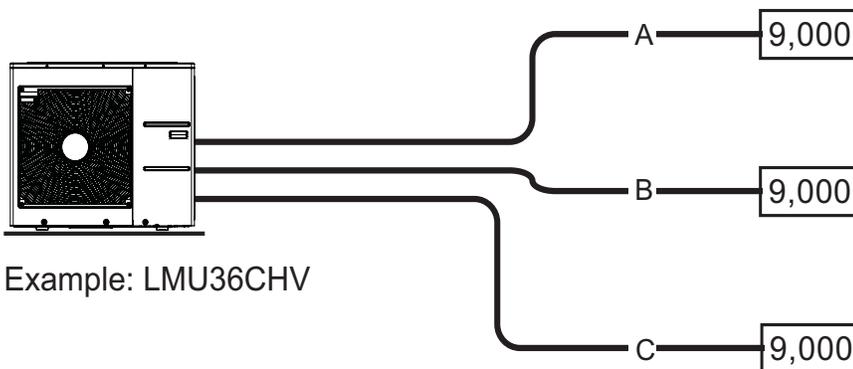
Note:

- Number of installed length of branches depends on the specifications of the outdoor unit model.
- CF = Maximum number of connectable indoor units – Total number of connected indoor units.

Table 35: Multi F Outdoor Unit Piping Specifications.

Outdoor Unit Model	Min. to Max. Piping Length for One Branch (ft.)	Max. Total System Piping Length (ft.)	Chargeless Pipe Length per Branch (L) (ft.)	Additional Charge Needed (a) (oz./ft.)
LMU18CHV	10 to 82	164	24.6	0.22
LMU24CHV	10 to 82	246.1	24.6	0.22
LMU30CHV	10 to 82	246.1	24.6	0.22
LMU36CHV	10 to 82	246.1	24.6	0.22

Figure 58: Multi F Additional Refrigerant Charge Example.



Example: LMU36CHV

Each branch pipe
A = 82 ft.
B = 16 ft.
C = 49 ft.

$$\begin{aligned} \text{Additional Charge} &= (82 - 24.6) \times 0.22 \\ &+ (16 - 24.6) \times 0.22 \\ &+ (49 - 24.6) \times 0.22 \\ &- (4 - 3) \times 5.29 \\ &= 10.82 \text{ oz.} \end{aligned}$$

Multi F MAX Systems

Additional charge (lbs.) = (Total Main Piping Length [A] - Chargeless Pipe Length of Main Pipe [L]) x a
 + (Installed Length of Branch [B1] - Chargeless Pipe Length [B]) x b
 + (Installed Length of Branch [B2] - Chargeless Pipe Length [B]) x b
 + (Installed Length of Branch [B3] - Chargeless Pipe Length [B]) x b ...
 - CF (Correction Factor) x 3.53

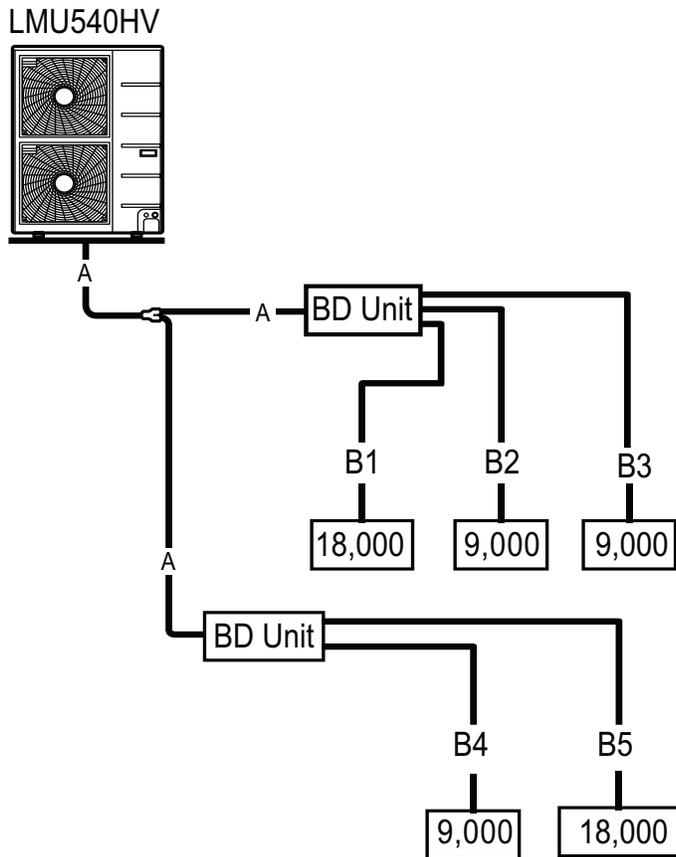
Note:

- Number of installed length of branches depends on system specifications.
- CF = Maximum number of connectable indoor units - Total number of connected indoor units

Table 36: Multi F MAX Outdoor Unit Piping Specifications.

Outdoor Unit Model	Main Piping Length		Branch Piping Length	
	Chargeless Pipe Length of Main Pipe (L) (ft.)	Additional Charge Needed (a) (oz./ft.)	Chargeless Pipe Length per Branch Pipe (B) (ft.)	Additional Charge Needed (b) (oz./ft.)
LMU480HV	16.4	0.54	16.4	0.22
LMU540HV	16.4	0.54	16.4	0.22
LMU600HV	16.4	0.54	16.4	0.22

Figure 59: Multi F MAX Additional Refrigerant Charge Example.



- Total main pipe (A) = 60 ft.
- Each branch pipe
 B1 = 49 ft.
 B2 = 17 ft.
 B3 = 17 ft.
 B4 = 10 ft.
 B5 = 23 ft.

Additional Charge
 = (60 - 16.4) x 0.54
 + (49 - 16.4) x 0.22
 + (17 - 16.4) x 0.22
 + (17 - 16.4) x 0.22
 + (10 - 16.4) x 0.22
 + (23 - 16.4) x 0.22
 - (8 - 5) x 3.53
 = 20.43 oz.

REFRIGERANT PIPING DESIGN

Selecting Field-Supplied Copper Tubing

MULTI F
MULTI F MAX

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

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

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

Tube wall thickness should meet local code requirements and be approved for a maximum operating pressure of 551 psi. 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 37: ACR Rated Copper Tubing Material.

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

Table 38: ACR Rated Piping Tube Thicknesses.

OD (in)	1/4	3/8	1/2	5/8	3/4
Material	Rigid or Soft ACR Acceptable			Rigid or Solid ACR Rated for R410A	
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 Multi F system can vary as much as 180°F. With this large variance in pipe temperature, the designer must consider pipe expansion and contraction to avoid pipe and fitting fatigue failures. Refrigerant pipe, along with the insulation jacket, form a cohesive unit that expands and contracts together. During system operation, thermal heat transfer occurs between the pipe and the surrounding insulation.

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

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

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

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

1. From Table 39, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. Typical pipe temperature change range: High Pressure Vapor: ambient temperature to 215°F; Low Pressure Vapor: ambient to 35°F; Liquid pipe: ambient, 80°F, 110°F. Choose the two most extreme. In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

Example:

A Multi F MAX system is installed and the design shows that there is a 100 foot straight segment of tubing between a Y-branch and a branch distribution unit. The system operates 24 hours per day. In heating, this pipe transports hot gas vapor to the indoor units at 120°F. In cooling, the same tube is a suction line returning refrigerant vapor to the outdoor unit at 40°F. Look up the copper tubing expansion at each temperature and calculate the difference.

Vapor Line

Transporting Hot Vapor: 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 depth should be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an expansion loop is provided in Table 40. Use soft copper with long radius bends on longer runs or long radius elbows for shorter pipe segments. Using the anticipated linear expansion (LE) distance calculated, look up the Expansion Loop or U-bend minimum design dimensions. If other types of expansion joints are chosen, design per ASTM B-88 Standards.

Table 39: Linear Thermal Expansion of Copper Tubing in Inches.

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

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

Figure 60: Coiled Expansion Loops and Offsets (Plan View shown).

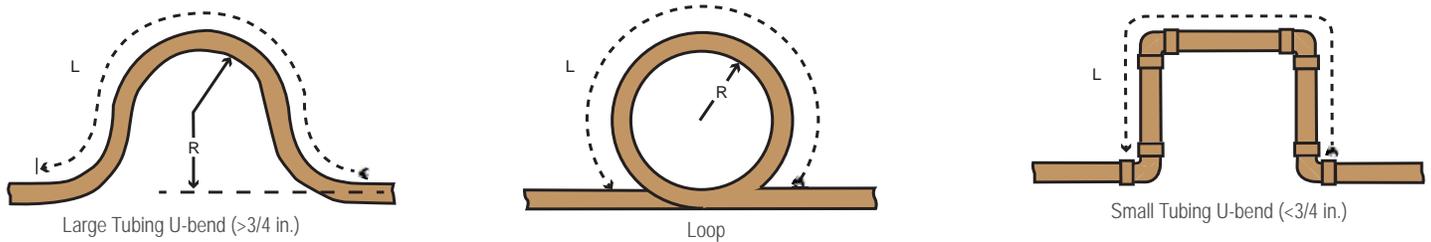


Table 40: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets.

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).

Note:

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

Field-Provided Isolation Ball Valves

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

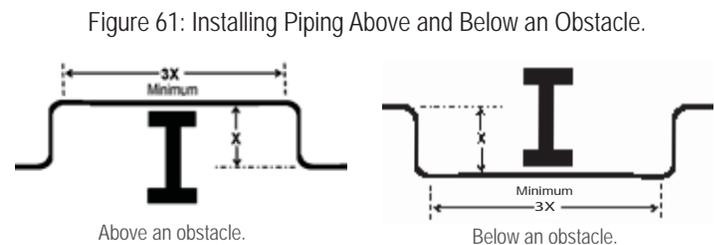
If valves are not installed and a single indoor unit needs to be removed or repaired, the entire system must be shut down and evacuated. If isolation ball valves are installed, and an indoor unit needs to be repaired, the unaffected indoor units can remain operational with the proper combination ratio.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

For Multi F MAX systems, position valves with a minimum distance of three (3) to six (6) inches of pipe on either side of the valve, and placed between six (6) and twelve (12) inches from the first upstream Y-branch or branch distribution unit. If ball valves are installed away from the first Y-branch and / or branch distribution unit and closer to the indoor unit, oil may accumulate where it cannot be returned to the outdoor unit and may cause a shortage of oil in the compressor.

Valves shall be easily accessible for service. If necessary, install drywall access doors or removable ceiling panels, and position the valves to face the access door or ceiling panel opening. Mount valves with adequate space between them to allow for placement of adequate pipe insulation around the valves. Recommended best practice is to clearly label and document locations of all service valves, Y-branches, and branch distribution units. The equivalent pipe length of each ball valve must be added to each pipe segment entered into the LATS program.

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.



Pipe Slope

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

In-line Refrigeration Components

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

No Pipe Size Substitutions

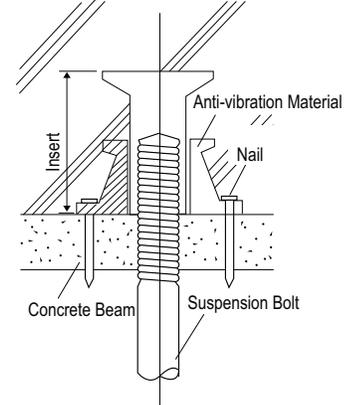
Use only the pipe size selected by the LATS Multi pipe system design software or as conveyed in the product installation instructions. Using a different size is prohibited and may result in a system malfunction or failure to work at all.

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.

Figure 62: Installing an Insert Into a Concrete Beam.

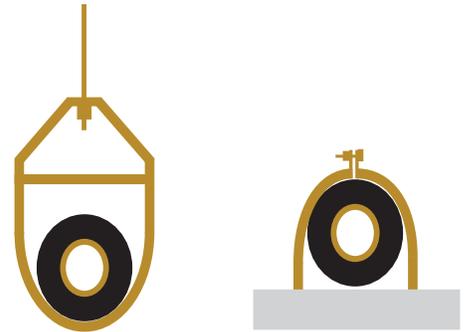


Pipe Supports

Note:

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

Figure 63: Pipe Hanger Details.

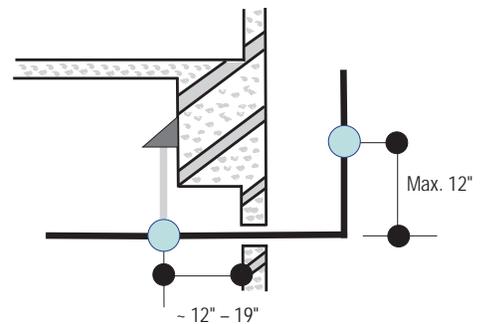


Pipe supports should never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket.

Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers should be used with shields between the hangers and insulation.

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

Figure 64: Typical Pipe Support Location—Change in Pipe Direction.



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 five (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. Support piping at indoor units as shown. Support Y-Branch fittings as shown.

Figure 65: Pipe Support at Indoor Unit.

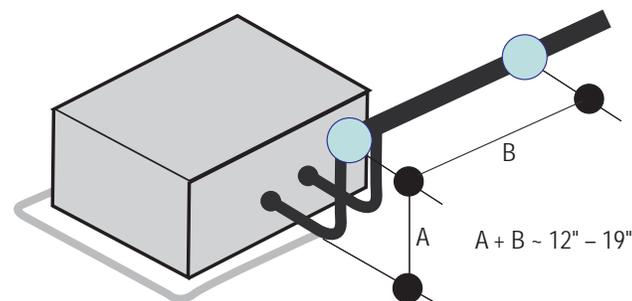
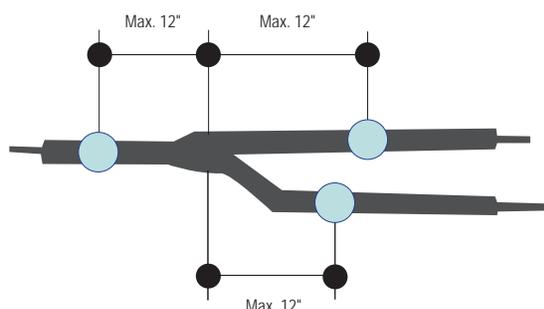


Figure 66: Pipe Support at Y-branch Fitting.



Examples of Supports

Figure 67: U-Bolt Support with Insulation.

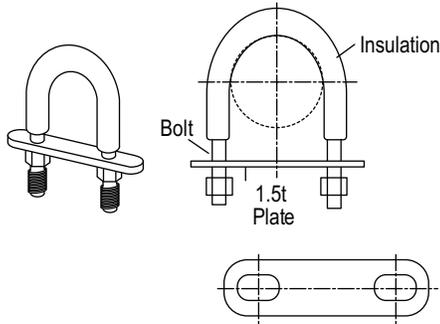


Figure 68: O-Ring Support with Insulation.

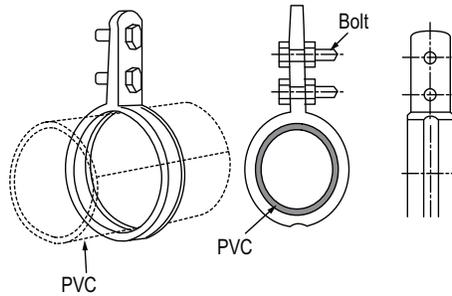
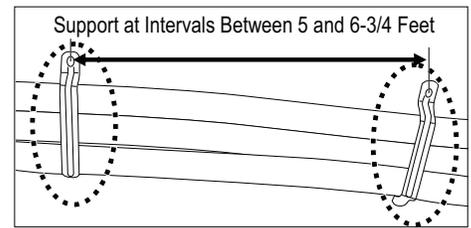


Figure 69: Saddle-Type Support.



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

Figure 70: U-Bolt Support with an Insulated Pipe.

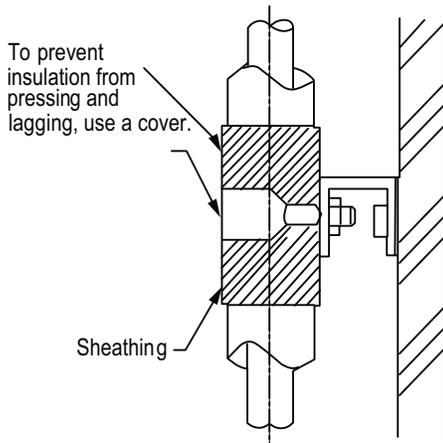


Figure 71: O-Ring Band Support with an Insulated Pipe.

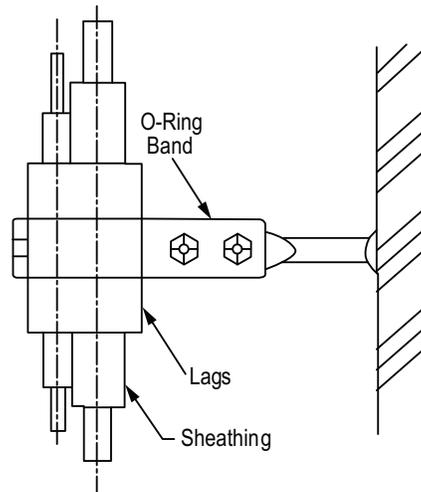


Figure 72: One-Point Down-Stop Support (>441 lbs.).

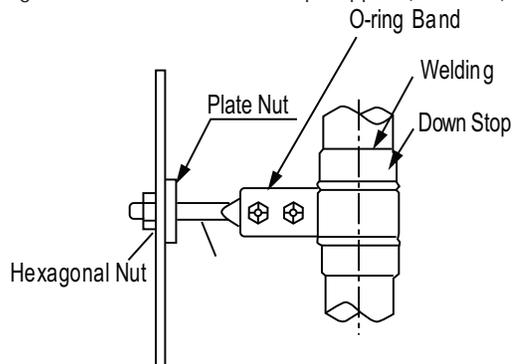
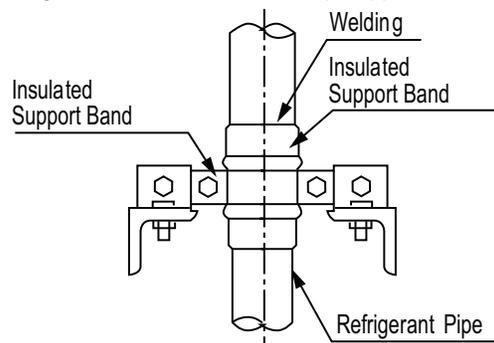


Figure 73: Two-Point Down-Stop Support.



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.

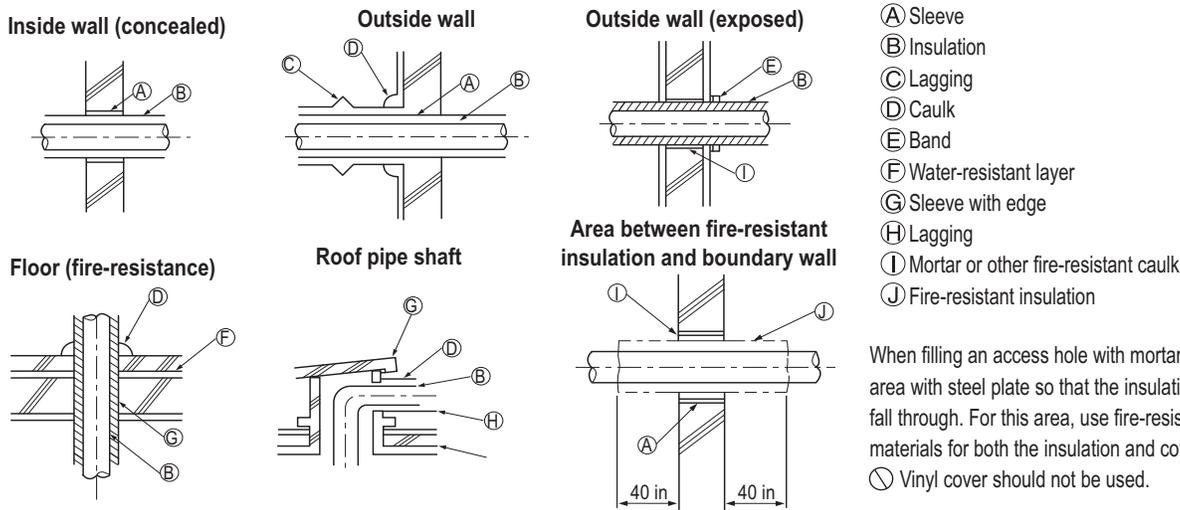
Note:

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

For example:

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

Figure 74: Pipe Sleeve Options.



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

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 41: 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 75: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.

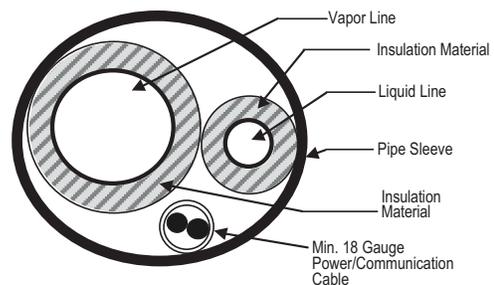


Figure 76: Underground Refrigerant Piping.



Multi F Outdoor Unit to Indoor Unit Piping Connections

Note:

Avoid Pipe Damage

- When routing field-provided piping, avoid damaging the outdoor unit from excessive vibration.
- Properly insulate the liquid and gas lines separately up to the point of connection at the unit frame.
- See table below for Multi F outdoor unit connection types.



- Correctly route the piping so it does not make contact with mounting bolts. Allow room for field installation.

Table 42: Outdoor Unit Piping Connections.

Outdoor Unit Piping Connections	LMU18CHV	LMU24CHV	LMU30CHV	LMU36CHV
Liquid Line Connection (in., OD) x Qty.	1/4 x 2	1/4 x 3	1/4 x 4	1/4 x 4
Vapor Line Connection (in., OD) x Qty.	3/8 x 2	3/8 x 3	3/8 x 4	3/8 x 4

Table 43: Indoor Unit Pipe Sizes.

Indoor Unit Capacity	Vapor Line Piping Size (in., OD)	Liquid Line Piping Size (in., OD)
7,000 Btu/h	Ø3/8	Ø1/4
9,000 Btu/h		
12,000 Btu/h		
15,000 Btu/h		
18,000 Btu/h	Ø1/2	
24,000 Btu/h		

Connection sockets (included as a factory-supplied accessory with the indoor units) may need to be used when piping the indoor units to the outdoor unit. If a 36K indoor unit is included, the connection sockets are included with the Branch Distribution unit.

Table 44: Connection Socket Dimensions.

Indoor Unit Capacity	Vapor (in., OD)		Liquid (in., OD)	
	A	B	A	B
18,000 Btu/h: Wall-Mounted	Ø3/8 → Ø1/2, Ø1/2 → Ø5/8		Ø1/4 → Ø3/8	
18,000 Btu/h: Low Static Duct, Four-Way Cassette	Ø3/8 → Ø1/2		N/A	
24,000 Btu/h	Ø3/8 → Ø1/2		N/A	

Using the Connection Socket

1. Align the center of the piping sections and tighten the flare nut by hand.
2. Tighten the flare nut with a torque wrench, using the arrows on the wrench as a guide, until a click is heard.

Figure 77: Multi F Refrigerant Pipe Connections (LMU36CHV shown as example).

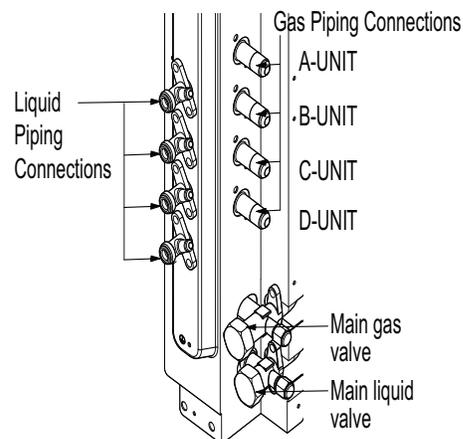


Table 45: Indoor Unit Piping Connections.

Indoor Unit Capacity	Vapor Line Conn. (in., OD)	Liquid Line Conn. (in., OD)
7,000 Btu/h	Ø3/8	Ø1/4
9,000 Btu/h		
12,000 Btu/h		
15,000 Btu/h		
18,000 Btu/h: Wall-Mounted	Ø5/8	Ø3/8
18,000 Btu/h: Low Static Duct, Four-Way Cassette	Ø1/2	Ø1/4
24,000 Btu/h	Ø1/2	Ø1/4

Figure 78: Connection Socket Diagram.

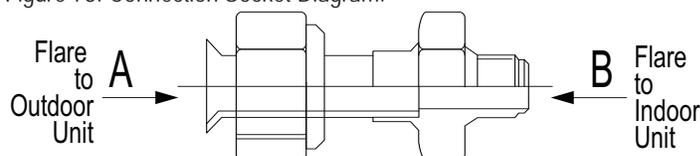
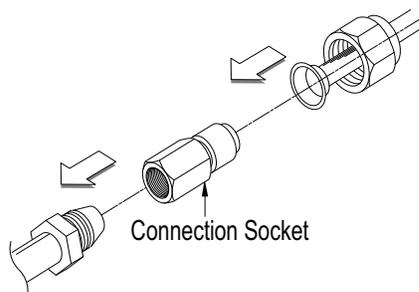


Figure 79: Performing Connections.



Multi F MAX Outdoor Unit System Piping Connections

Note:

Avoid Pipe Damage

- When routing field-provided piping, avoid damaging the outdoor unit from excessive vibration.
- Properly insulate the liquid and gas lines separately up to the point of connection at the unit frame.
- See table below for Multi F MAX outdoor unit connection types.



- Correctly route the piping so it does not make contact with mounting bolts. Allow room for field installation.

Table 46: Outdoor Unit Piping Connections.

Outdoor Unit Piping Connections	LMU480HV and LMU540HV
Liquid Line Connection (in., OD) x Qty.	3/8 x 1
Vapor Line Connection (in., OD) x Qty.	3/4 x 1

Branch Distribution to Indoor Unit Piping Connections

- Install indoor unit liquid and vapor refrigerant pipes (and connection wiring) to the appropriate branch distribution ports.
- Clearly note on the indoor unit's refrigerant piping (liquid, vapor) which branch distribution port it is connected to (A, B, C, D).

Table 47: Branch Distribution Unit Piping Connections.

Branch Distribution Unit	PMBD3620	PMBD3630	PMBD3640	PMBD3641
<i>Piping Connections to Outdoor Unit</i>				
Liquid (in., OD) x Qty.	Ø3/8 x 1			
Vapor (in., OD) x Qty.	Ø3/4 x 1			
<i>Piping Connections to Indoor Units</i>				
Liquid (in., OD) x Qty.	Ø1/4 x 2	Ø1/4 x 3	Ø1/4 x 4	Ø1/4 x 4
Vapor (in., OD) x Qty.	Ø3/8 x 2	Ø3/8 x 3	Ø3/8 x 4	Ø3/8 x 3, Ø1/2 x 1

Figure 80: Branch Distribution Ports to Indoor Units.

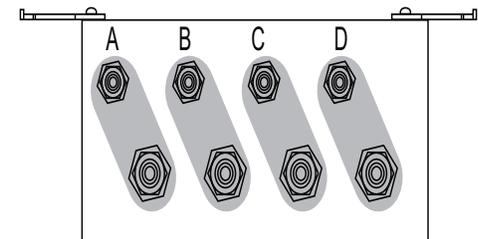


Table 50: Indoor Unit Pipe Sizes.

Indoor Unit Capacity	Vapor Line Piping Size (in., OD)	Liquid Line Piping Size (in., OD)
7,000 Btu/h	Ø3/8	Ø1/4
9,000 Btu/h		
12,000 Btu/h		
15,000 Btu/h		
18,000 Btu/h	Ø1/2	Ø3/8
24,000 Btu/h		
36,000 Btu/h	Ø5/8	Ø3/8

Table 48: Indoor Unit Piping Connections.

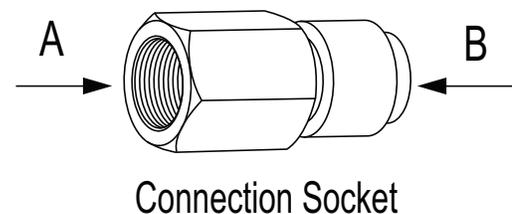
Indoor Unit Capacity	Vapor Line Conn. (in., OD)	Liquid Line Conn. (in., OD)
7,000 Btu/h	Ø3/8	Ø1/4
9,000 Btu/h		
12,000 Btu/h		
15,000 Btu/h		
18,000 Btu/h: Wall-Mounted	Ø5/8	Ø3/8
18,000 Btu/h: Low Static Duct, Four-Way Cassette	Ø1/2	Ø1/4
24,000 Btu/h	Ø1/2	Ø1/4
36,000 Btu/h	Ø5/8	Ø3/8

Connection sockets (included as a factory-supplied accessory with the indoor units) may need to be used when piping the indoor units to the branch distribution unit. If a 36K indoor unit is included, the connection sockets are included with the Branch Distribution unit.

Table 49: Connection Socket Dimensions.

Indoor Unit Capacity	Vapor (in., OD)		Liquid (in., OD)	
	A	B	A	B
18,000 Btu/h: Wall-Mounted	Ø3/8 → Ø1/2, Ø1/2 → Ø5/8		Ø1/4 → Ø3/8	
18,000 Btu/h: Low Static Duct, Four-Way Cassette	Ø3/8 → Ø1/2		N/A	
24,000 Btu/h	Ø3/8 → Ø1/2		N/A	
36,000 Btu/h	Ø1/2 → Ø5/8		Ø1/4 → Ø3/8	

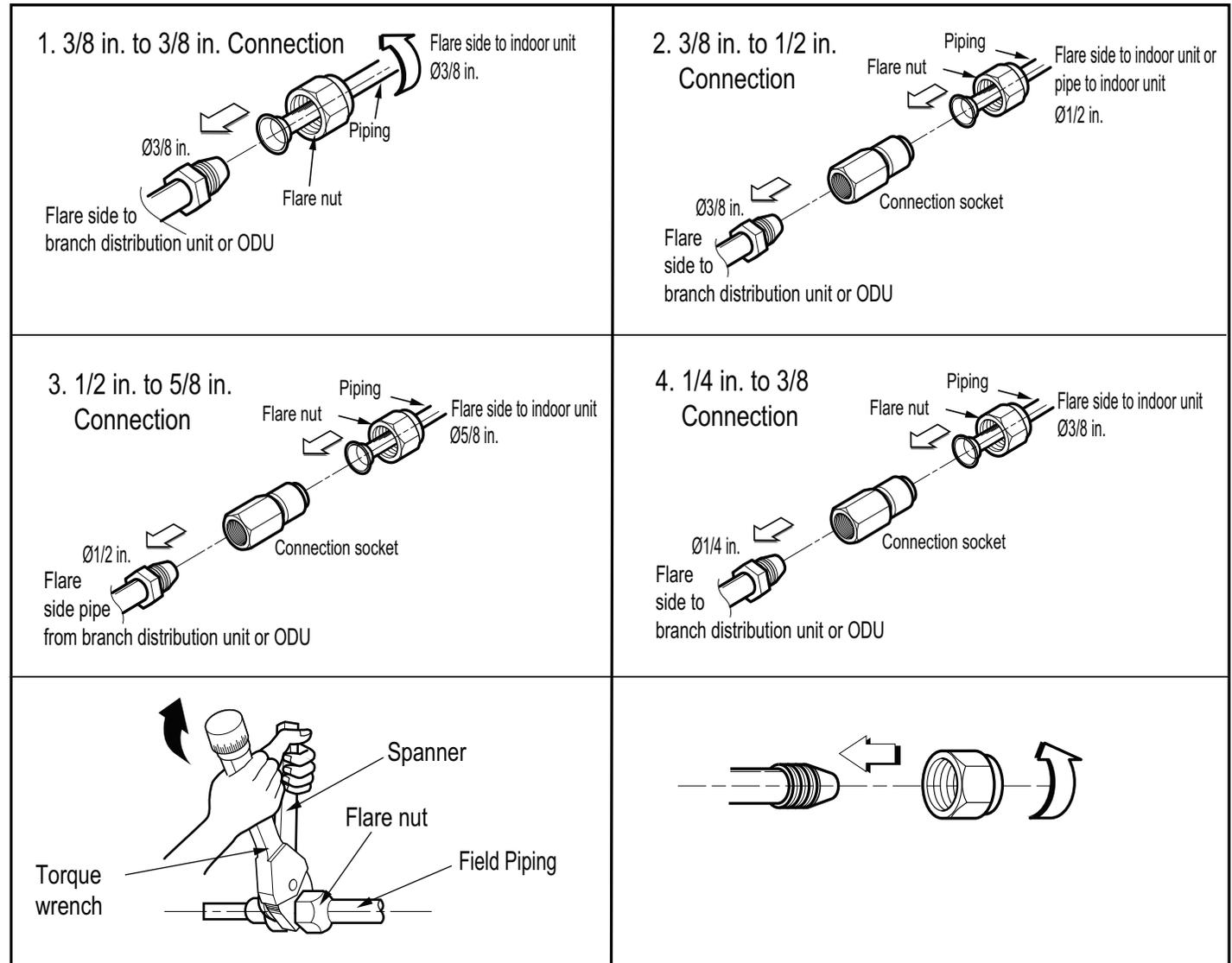
Figure 81: Connection Socket Diagram.



Multi F MAX Outdoor Unit System Piping Connections, continued.

1. Align the center of the piping sections and tighten the flare nut by hand.
2. Tighten the flare nut with a torque wrench, using the arrows on the wrench as a guide, until a click is heard.
3. Wrap insulation around the connection.

Figure 82: Possible Outdoor Unit or Branch Distribution Unit to Indoor Unit Connections.



Brazing Practices

Note:

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

- All joints are brazed in the field. Multi F refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, and heat exchangers that can easily become 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.
 - Use a tubing cutter; De-burr and clean all cuts before assembly.



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

3. Brazing Joints:

- Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
- Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
- Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or a heat barrier spray product

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 51 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.

Note:

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

Table 51: 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 83: Refrigerant Pipe Brazing.

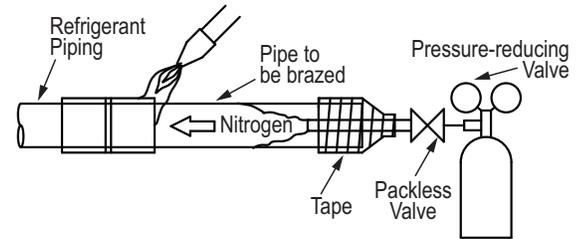


Figure 84: Flare Connection, Isometric View.

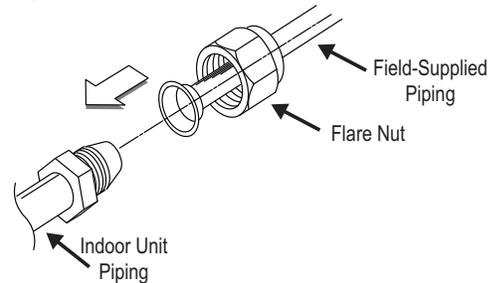
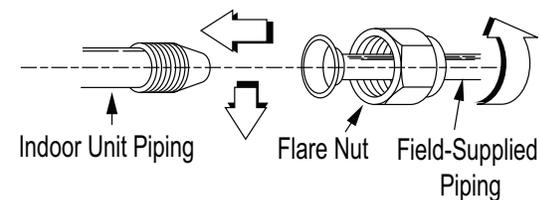


Figure 85: Flare Connection, Side View.



Refrigerant Piping System Insulation

All refrigerant piping including Y-branch connections, field-provided isolation ball valves, service valves, and elbows shall be completely insulated 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. 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. Pay special attention to insulating the pipes installed in the ceiling plenum.

LG-provided Y-branches are shipped from the factory with pre-formed peel-and-stick foam insulation jackets, with a 1.84 lb./ft.³ density, 1/2" thickness, and meet UL94 MF-1 flammability.

The design engineer should perform calculations to determine if the factory-supplied insulation jackets are sufficient to meet local codes and avoid sweating. Maximum refrigerant piping temperature is +227°F; minimum refrigerant piping temperature is -4°F. 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 52: 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.

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

Outdoor Units

Outdoor unit requires condensate drain piping. Condensate drain pipe is constructed with materials approved by local code. See pages 60 to 62 for information in reference to outdoor unit placement and condensate drainage.

Indoor Units

All indoor units generate water during cooling operation, therefore, how to properly handle this condensation must be considered. Some indoor units include factory-installed drain pumps; others apply the gravity drain method.

Depending on the location of the indoor unit, condensation can be drained directly to the outside of the building, or a common indoor unit drainage piping system can be installed, both incorporating PVC piping.

Table 53: Indoor Unit Drain Piping Specifications.

Indoor Unit	Drain Type	Drain Pipe Diameter (OD / ID, in.)	Drain Amount (gal. / min. at 0.033 ft. height)
Art Cool Wall-Mounted	Gravity	13/16 / 5/8	—
Art Cool Gallery	Gravity	13/16 / 5/8	—
Standard Wall-Mounted	Gravity	13/16 / 5/8	—
Ceiling-Concealed Ducted (Low Static and High Static)	27-1/2 in. Lift Drain Pump, Factory Installed	Ø1-1/4 / Ø1	0.105
Four-Way Ceiling Cassette	27-1/2 in. Lift Drain Pump, Factory Installed	Ø1-1/4 / Ø1	0.105
Vertical-Horizontal Air Handling Unit	Gravity	Ø3/4 / —	—

Figure 86: Diagram of an Indoor Unit with a Gravity Drain.

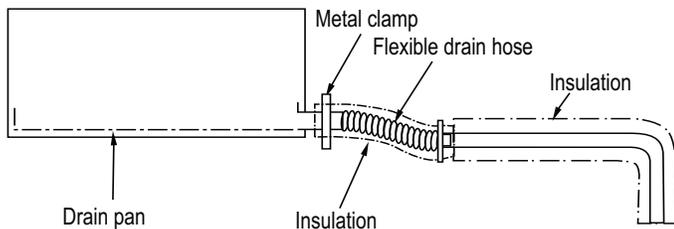
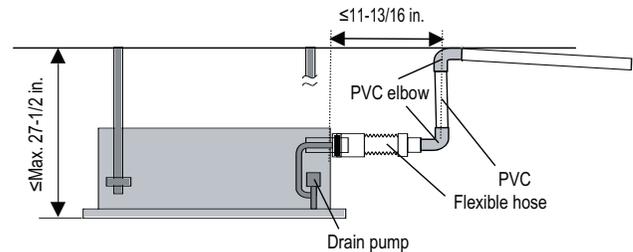


Figure 87: Diagram of an Indoor Unit with a Drain Pump.



Note:

Ensure the indoor unit, refrigerant piping, power wiring / communication cables, and drain piping is properly supported with anchor bolts and clamp hangers positioned at 3.3 to 4.9 foot intervals.

Flexible Drain Hose

Some indoor units include a factory-provided flexible drain pipe for installation.

- Install the flexible drain pipe as straight as possible; sharp angles may cause the pipe to deteriorate and may crack over time.
- Connect the flexible drain pipe with a round clamp. If the flexible drain pipe is not installed properly, water will leak from the connection.

Figure 88: Flexible Drain Hose Connection.

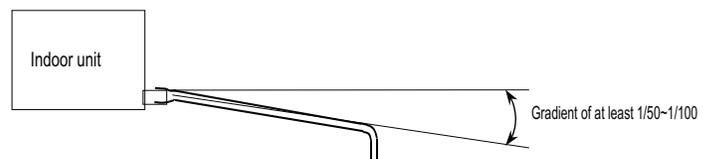


Clamp the Flexible Drain Hose Connection

Drainage Gradient

The gradient for drain piping should be at least 1/50 to 1/100. Ensure any holes through ceilings, walls, etc., are large enough to accommodate both the drain piping and any insulation.

Figure 89: Drain Piping Gradient Recommendation.



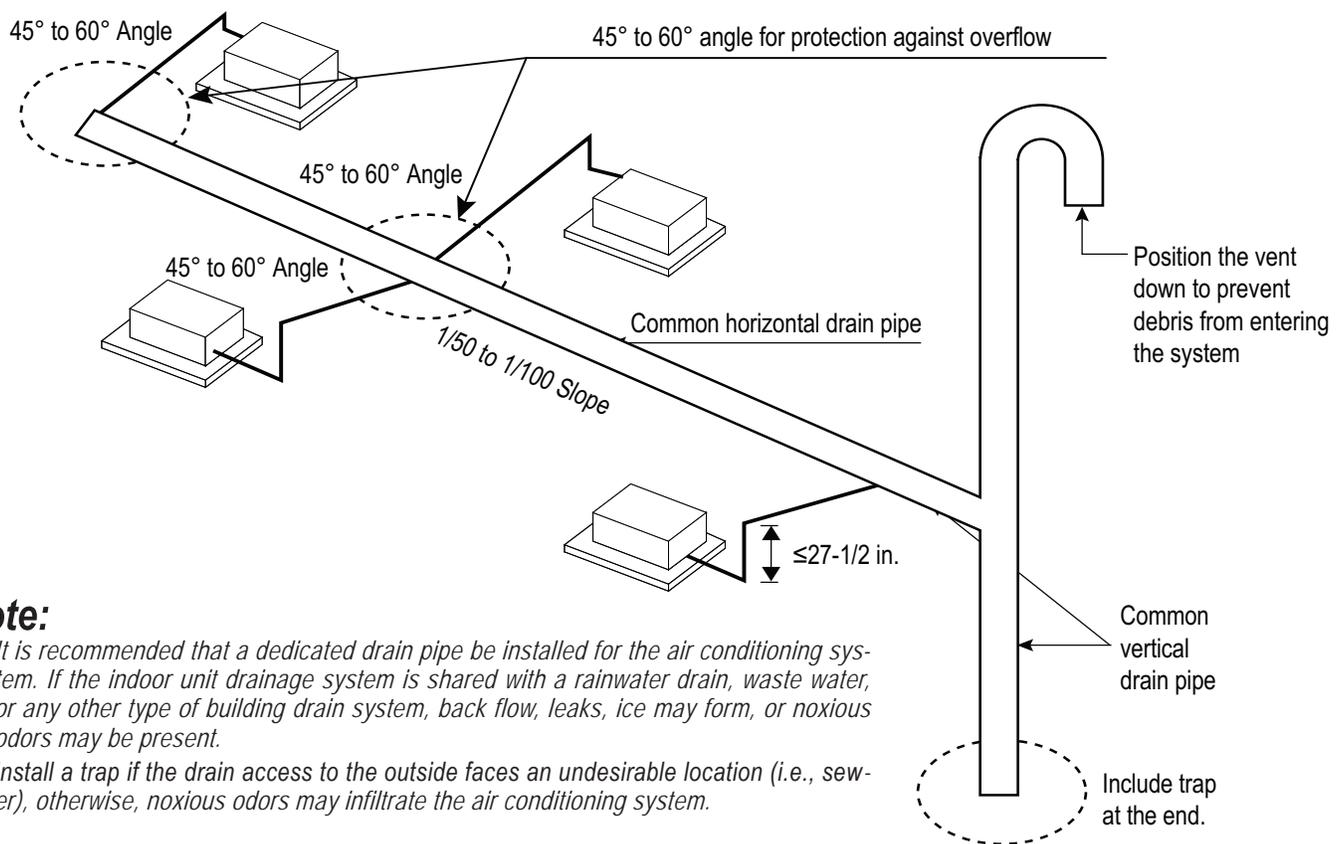
- Do not include a reverse slope in the drain connection.

Condensate Drain Piping

Common Indoor Unit Drainage System

It is usual work practice to connect individual indoor unit drain pipes to one common indoor unit drainage system. The diameter of the common vertical drain pipe should be as large as necessary. (For systems with <80,000 Btu/h total capacity of all connected indoor units, the standard size for the common vertical drain pipe is 0.98 ID, in. and 1.26 OD, in.) The diameter of the horizontal pipe should be the same or larger than the vertical drain pipe. To avoid property damage in the event of the primary drain becoming clogged, and to optimize drain system performance, it may be prudent to install a secondary drain line. Design the drain system to plan for winter operation (condensate line may freeze up if condensate does not properly drain away). Drain all generated condensate from the external condensate pan to an appropriate area. Install a trap in the condensate lines as near to the indoor unit coil as possible; to prevent overflow the outlet of each trap should be positioned below its connection to the condensate pan. All traps should be primed, insulated, and leak tested if located above an inhabited space.

Figure 90: Example of a Common Indoor Unit Drainage System.



Note:

- It is recommended that a dedicated drain pipe be installed for the air conditioning system. If the indoor unit drainage system is shared with a rainwater drain, waste water, or any other type of building drain system, back flow, leaks, ice may form, or noxious odors may be present.
- Install a trap if the drain access to the outside faces an undesirable location (i.e., sewer), otherwise, noxious odors may infiltrate the air conditioning system.

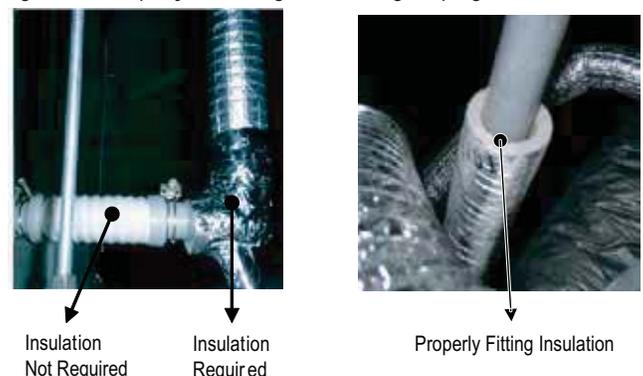
Drain Leak Test

A leak test should be performed 24 hours after the drainage system has been installed. Only use water for the test; other liquids are unacceptable.

Drain Pipe Insulation

To prevent condensate from forming on the drain piping, install field-supplied 0.4 inch thick polyethylene. The insulation should be securely fastened with all connected joints and ends properly covered.

Figure 91: Properly Insulating the Drainage Piping.



- LG Y-Branch Kit PMBL5620 is required when installing two branch distribution units in parallel on one LG Multi F MAX system.
- The kit must be properly installed following instructions in the applicable LG manual. Field-supplied branch fittings are not permitted.
- Kit components must be kept free of debris and be dry before installation.
- All Y-Branch Kits include a clam shell, peel-and-stick insulation jacket.

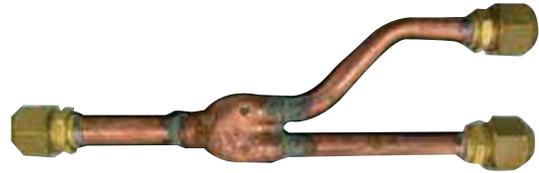


Table 54: Fitting Properties.

Material	Copper
Design Pressure	551 psig

Table 55: Multi F MAX Y-Branch Connection Diameters.

Model	Y-Branch Type	Port Identifier (inch)		
		1	2	3
PMBL5620	Liquid	Ø3/8	Ø3/8	Ø3/8
	Vapor	Ø3/4	Ø3/4	Ø3/4
	Y-Branch Type	Dimensions (inch)		
		X	Y	
	Liquid	13.80	3.24	
	Vapor	12.48	3.02	

Figure 92: Y-Branch Port Identifier Diagram.



Figure 93: Y-Branch Dimensions Diagram.

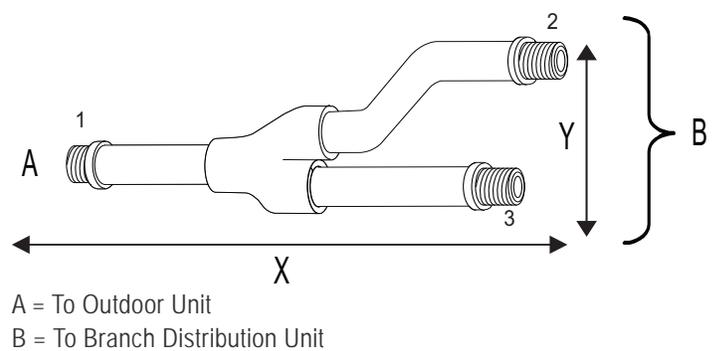
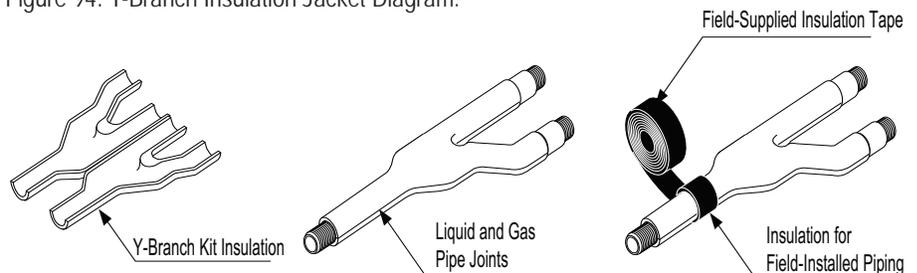


Table 56: Insulation Jacket Properties.

Material	Polyolefin Foam
UL94 Flame Classification	HF-1
Density	1.84 lbs./ft. ³
Thermal Conductivity	.0208 Btu/h/ft. °R
Thickness	1/2 inch

Figure 94: Y-Branch Insulation Jacket Diagram.



WIRING CONNECTIONS

“General Information” on page 90

**“Power Wiring (208-230V) and Communications Cable
Details” on page 91**

“Indoor Unit Group Control” on page 99

⚠ WARNING

- All power (line voltage) wiring and communication cable installation must be performed by trained service providers working in accordance with local, state, and National Electrical Code (NEC) / UL / ETL federal regulations related to electrical equipment and wiring, and following the manufacturer product diagrams, requirements, and instructions in this manual. Electric shock can cause physical injury or death.
- Undersized wiring may lead to unacceptable voltage at the unit and may cause unit malfunction and be a fire hazard.
- Properly ground the Multi Zone outdoor, indoor units, and branch distribution units. Ground wiring must always be installed by a trained technician. Ground wiring is required to prevent accidental electrical shock during current leakage.
- ⓧ Do not connect ground wire to refrigerant, gas, sewage, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Use clamps to prevent the wires from touching the piping. Failure to properly provide a National Electrical Code-approved earth ground can result in explosion, electric shock, fire, physical injury or death.
- Verify that the branch switch and circuit breaker are set to OFF before installing the wiring system. Electric shock can cause physical injury or death.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Using an oversized breaker or fuse may result in electric shock, physical injury or death.

Note:

- Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.
- Properly ground the Multi Zone outdoor and indoor unit. Improperly grounded wire can cause communication problems from electrical noise, and motor current leakage. Ground wiring must always be installed by a trained technician.
- If the system operates in reversed phase, it may damage the compressors and other components.
- If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit.
- ⓧ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a National Electrical Code-approved earth ground can result in property damage and equipment malfunction.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and National Electrical Code regulations related to electrical equipment and wiring, and following the instructions in this manual. Using an oversized breaker or fuse may result in equipment malfunction and property damage.
- For power to the outdoor unit, use only copper wiring that is solid or stranded and complies with all local and national electrical codes.
- ⓧ 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.
- ⓧ 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 units, indoor units, and branch distribution units.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously (circuit breaker should be resistant to electromagnetic currents).
- 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.

Power Wiring and Communications Cable Installation

For both Multi F and Multi F MAX systems, power is wired to the outdoor unit only. The outdoor unit will supply power to the branch distribution units (Multi F MAX systems only) and the indoor units through the power wiring / communications cable.

Power Supply / Power Wiring Specifications

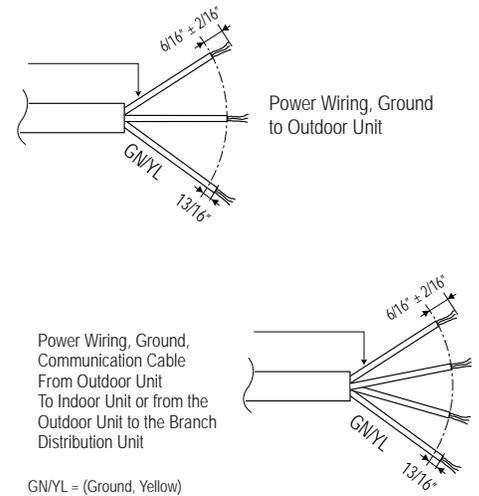
Note:

- Multi F and Multi F MAX systems operate at 1Ø, 208-230V, 60Hz. Power supply, wire type and size should be selected based on National Electrical Code and local codes. Maximum allowable voltage fluctuation $\pm 10\%$ or nameplate rated value.
- Properly ground the outdoor units per National Electrical Code and local codes.
- For power to the outdoor units, use field-supplied copper wiring that is solid or stranded, and shielded with the wires separately insulated.
- Ground wire should be longer than the common power / communication wires.
- Connect the wiring firmly so the wires cannot be easily pulled out.
- Refer to the inside of the chassis cover for circuit and terminal block diagrams for your model unit. Always match color codes of each wire and follow wiring diagram. Outdoor unit wiring can be found on the inside of the outdoor unit control cover.

General Communication Cable Specifications

- Multi F Systems: All power wiring / communication cable to be minimum 18 AWG from the outdoor unit to the indoor unit, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes.
- Multi F MAX Systems: All power wiring / communication cable to be minimum 16 AWG from the outdoor unit to the BD unit, and 18 AWG from the BD unit to the indoor unit, stranded, shielded or unshielded (if shielded, it must be grounded to the chassis of the outdoor unit only), and must comply with applicable local and national codes.
- For power / communication wires between the Multi F and Multi F MAX outdoor units and the indoor units / BD units (Multi F MAX systems only), use a four (4) conductor, stranded, shielded or unshielded wire. If shielded, the wire must be grounded to the chassis at the outdoor unit only.
- Insulation material as required by local code.
- Rated for continuous exposure of temperatures up to 140°F.
- Firmly attach the cable; provide slack but secure in a way to prevent external forces from being imparted on the terminal block.
- Wiring should be completed without splices.

Figure 95: Multi F / Multi F MAX Outdoor and Indoor / Branch Distribution Unit Wiring and Communications Cable Diagram.



GNYL = (Ground, Yellow)

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; overtightening may damage the terminals.

Figure 97: Proper and Improper Power Wiring Connections.

Figure 96: Close up of a Typical Ring Terminal.

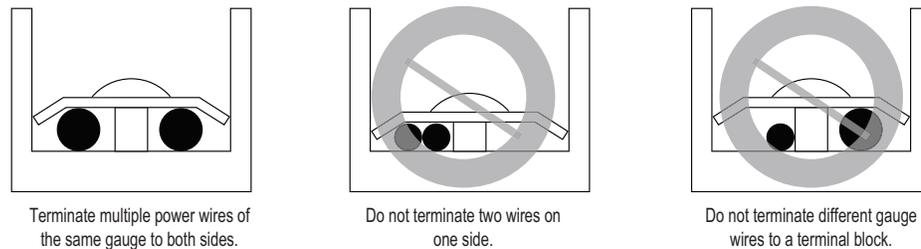
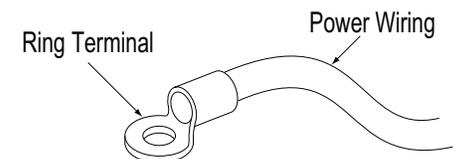
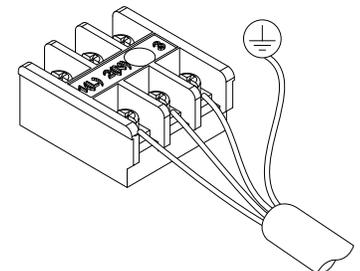


Figure 98: Close up of the Indoor Unit Terminal Block.



WARNING

- There is a risk of fire, electric shock, physical harm or injury, or death if the power wires are not properly terminated and / or firmly attached.
- Never apply line voltage power to the communications cable terminal block. If contact is made, the PCBs may be damaged.

Note:

Always include some allowance in the wiring length when terminating. Provide some slack to facilitate removing the electrical panels while servicing.

WIRING CONNECTIONS

General Information

MULTI F
MULTI F MAX

Figure 99: Multi F System General Power / Communications System Schematic.

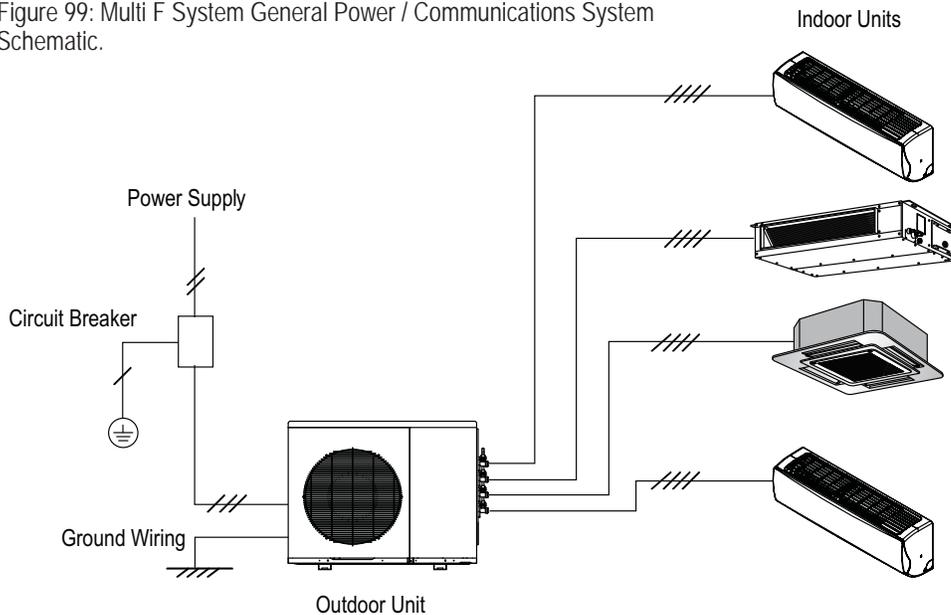
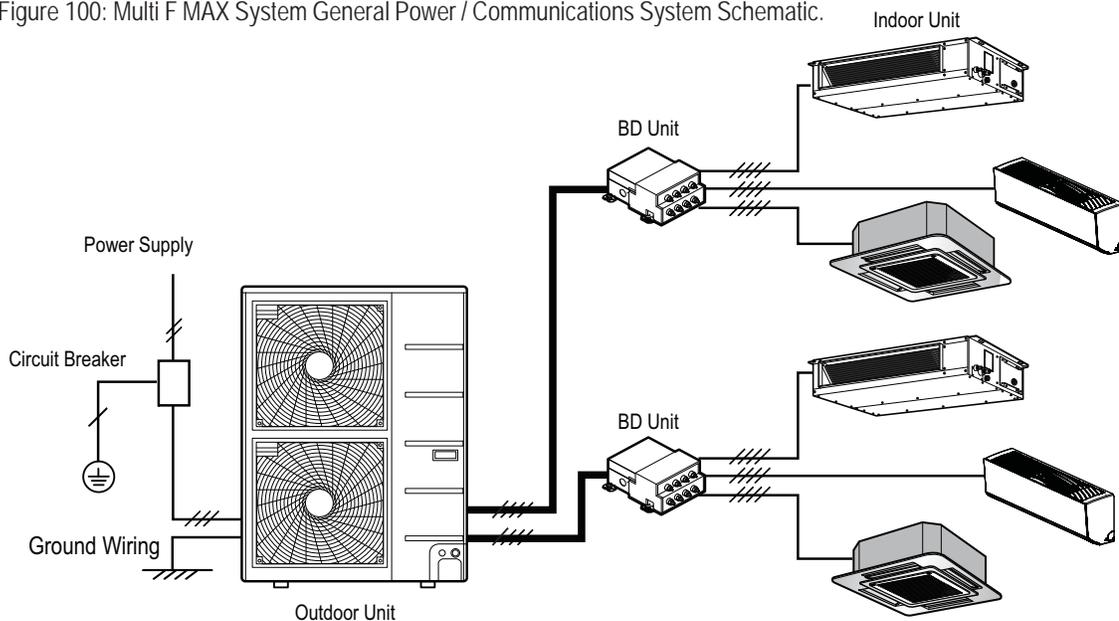


Figure 100: Multi F MAX System General Power / Communications System Schematic.



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 communications cable / power wiring from the outdoor unit to the indoor / branch distribution units.
- Make sure the communications cable / power wiring from the outdoor units to the indoor / branch distribution units and the power wiring to the outdoor unit are separate, otherwise, the outdoor unit operation may be affected by electrical noise and will malfunction or fail.

- Find the outdoor unit terminal block by unscrewing the control access panel.
- Side panel of the outdoor unit has knockout holes for the conduits. After install is complete, seal up any gaps between the panel and the conduits.
- Clamp is included near the terminal block to help protect the connections from strain on the cables.

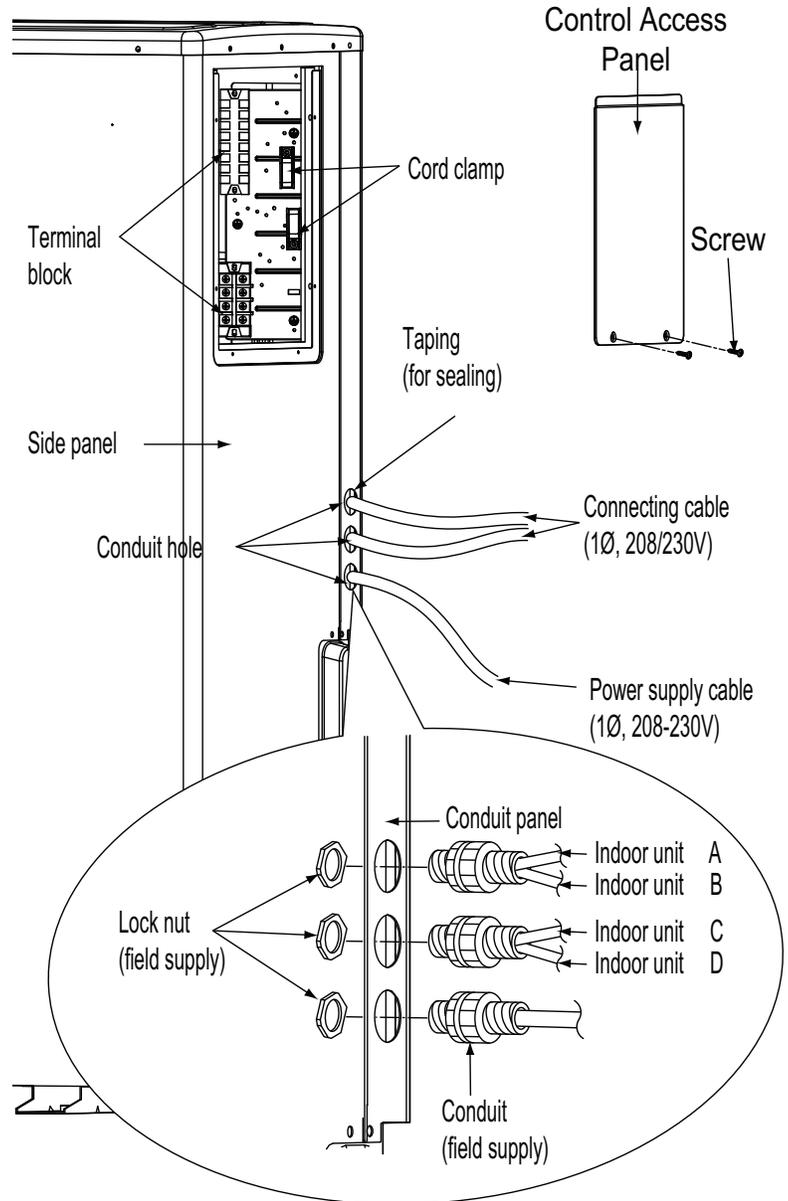
⚠ WARNING

Always have a trained technician properly ground the outdoor unit. If the outdoor unit is not properly grounded, there is a risk of electric shock, physical injury, or death.

Note:

- Use a conduit for the communications cable / power wiring from the outdoor unit to the indoor / branch distribution units.
- The communications cable / power wiring from the outdoor unit to the indoor / branch distribution units should be separated and isolated from power wiring to the outdoor unit, computers, radio and television broadcasting facilities, as well as medical imaging equipment.

Figure 101: Example of Power Wiring and Communications Cable Terminations.

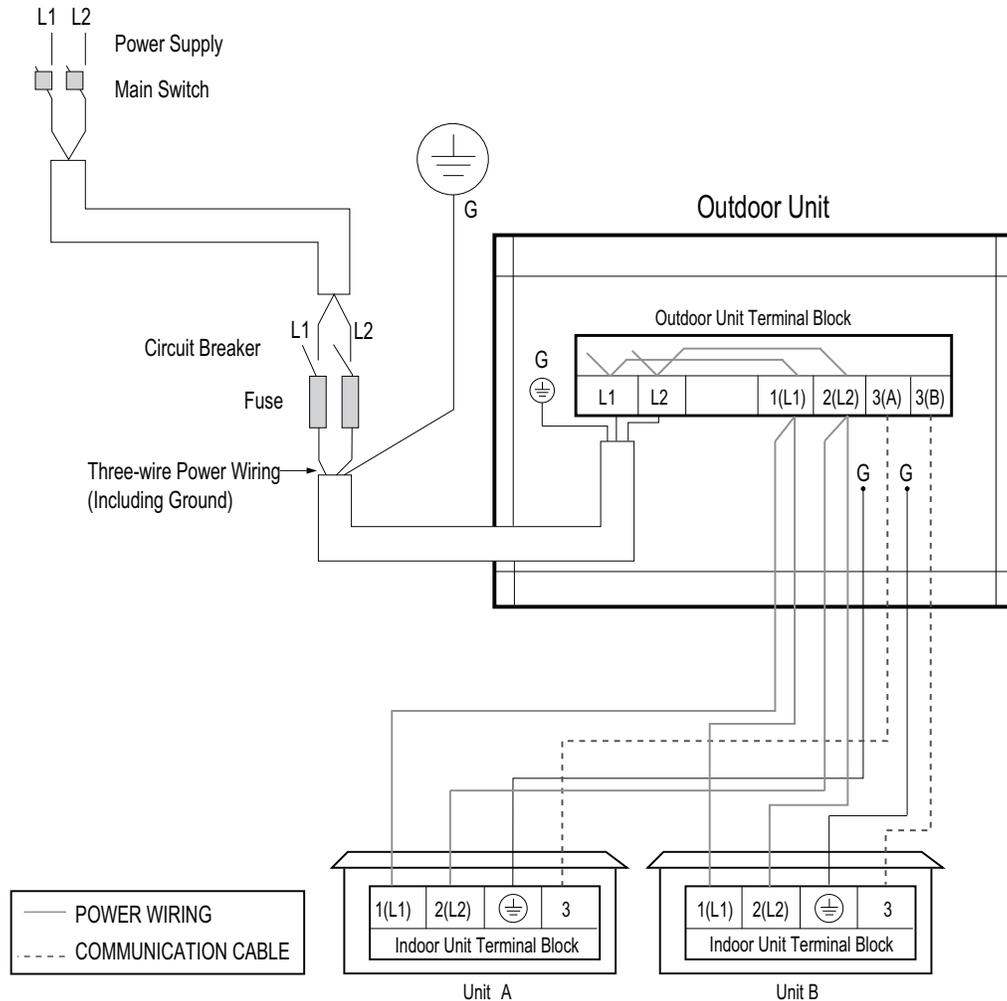


WIRING CONNECTIONS

Power Wiring (208-230V) and Communications Cable Details

MULTI F
MULTI F MAX

Figure 102: Multi F LMU18CHV System Power Wiring and Communications Cable.



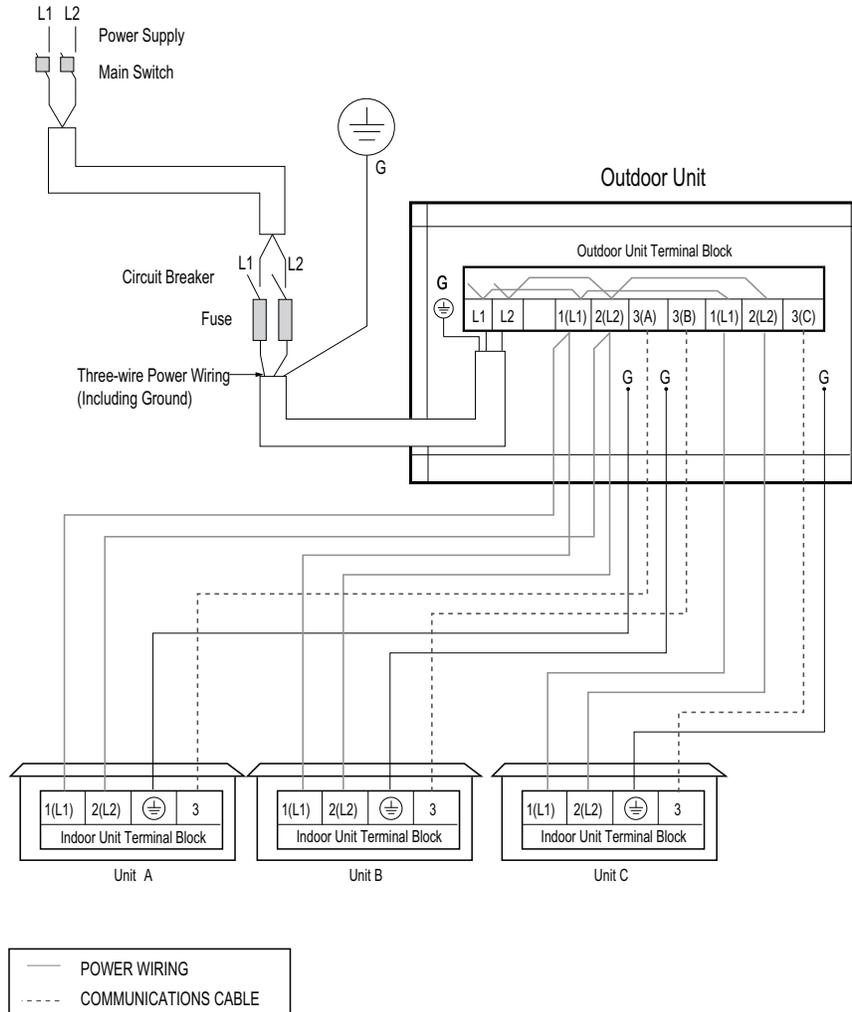
⚠ WARNING

- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Electric shock can cause physical injury or death.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Improper wiring may result in fire, electric shock, physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes. Improper wiring may result in fire, electric shock, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Electric shock can cause physical injury or death.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring may result in fire, electric shock, physical injury or death.

Note:

- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Failure to install proper wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components can result in property damage and equipment malfunction.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring can result in property damage and equipment malfunction.

Figure 103: Multi F LMU24CHV System Power Wiring and Communications Cable.



WARNING

- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Electric shock can cause physical injury or death.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Improper wiring may result in fire, electric shock, physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes. Improper wiring may result in fire, electric shock, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Electric shock can cause physical injury or death.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring may result in fire, electric shock, physical injury or death.

Note:

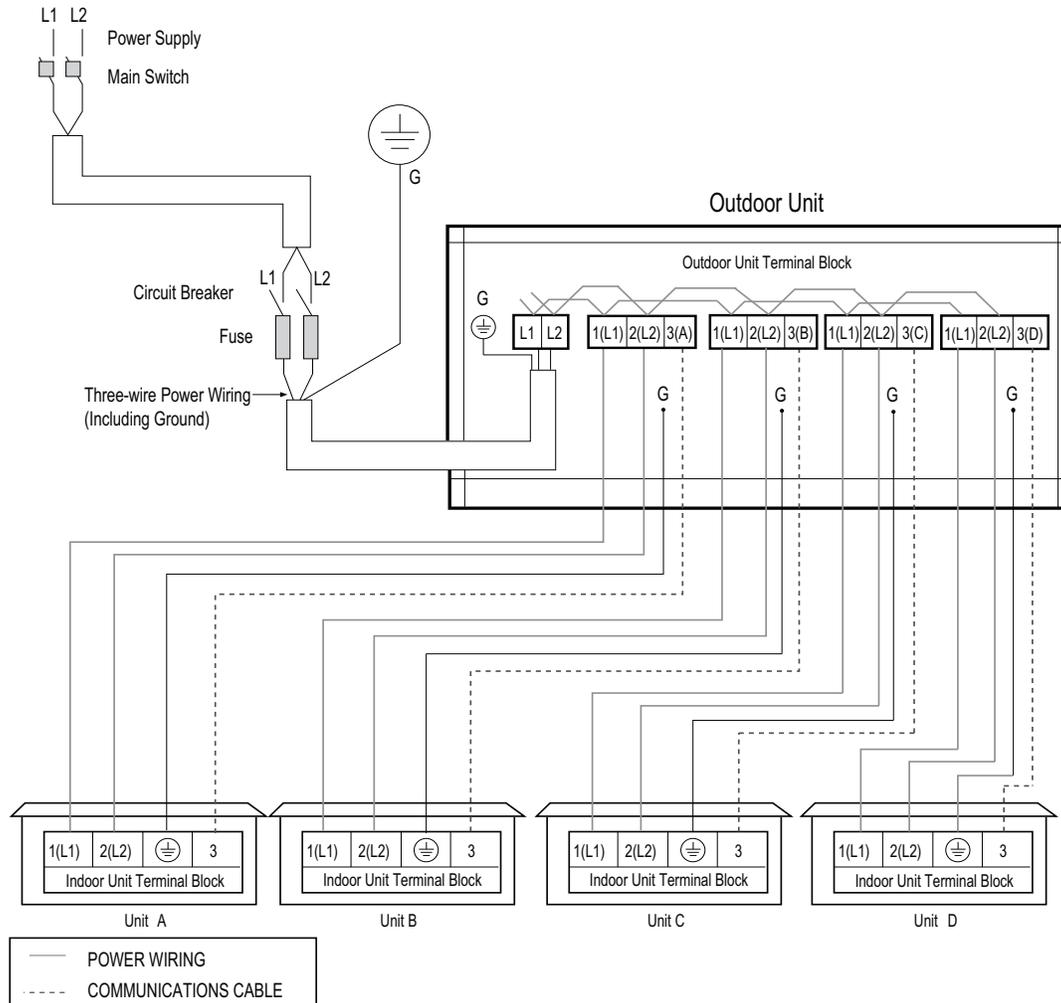
- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Failure to install proper wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components can result in property damage and equipment malfunction.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring can result in property damage and equipment malfunction.

WIRING CONNECTIONS

Power Wiring (208-230V) and Communications Cable Details

MULTI F
MULTI F MAX

Figure 104: Multi F LMU30CHV and LMU36CHV System Power Wiring and Communications Cable.



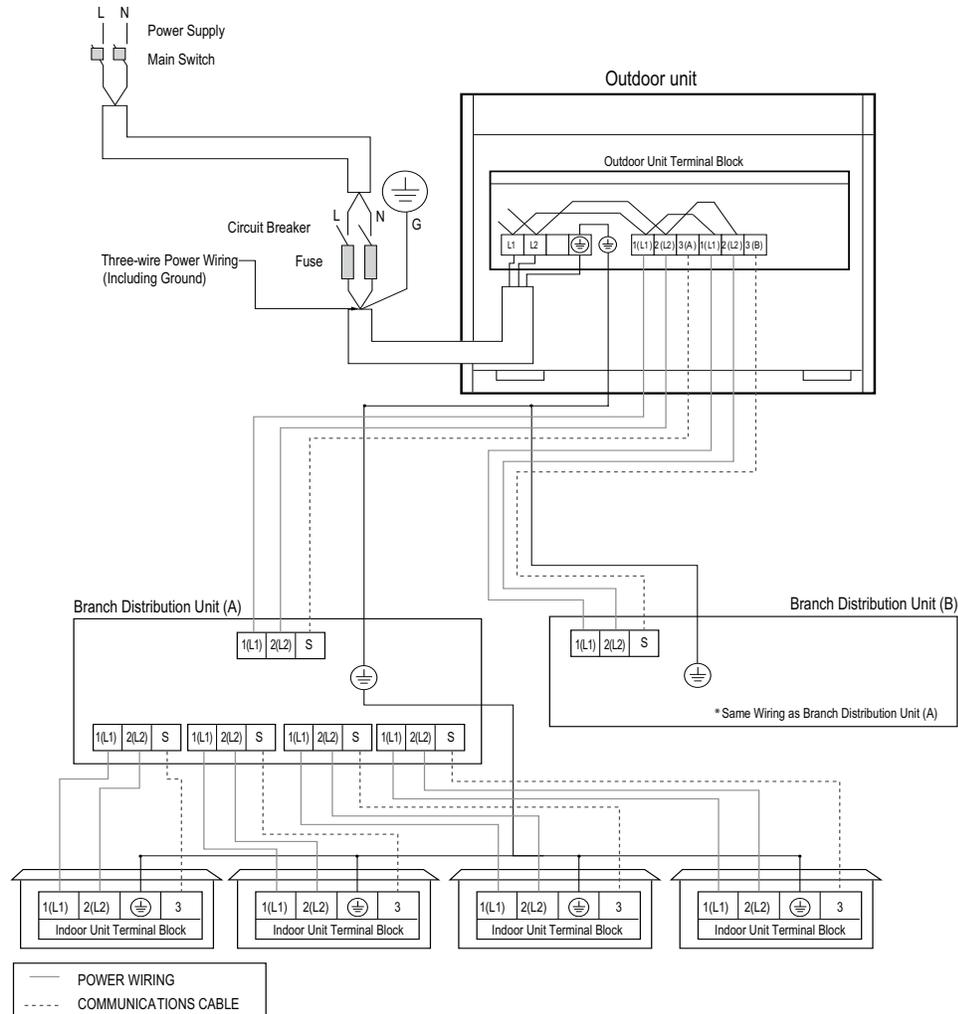
WARNING

- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Electric shock can cause physical injury or death.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Improper wiring may result in fire, electric shock, physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes. Improper wiring may result in fire, electric shock, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Electric shock can cause physical injury or death.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring may result in fire, electric shock, physical injury or death.

Note:

- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Failure to install proper wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components can result in property damage and equipment malfunction.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring can result in property damage and equipment malfunction.

Figure 105: Multi F MAX LMU480HV and LMU540HV System Power Wiring and Communications Cable.



⚠ WARNING

- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Electric shock can cause physical injury or death.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Improper wiring may result in fire, electric shock, physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes. Improper wiring may result in fire, electric shock, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Electric shock can cause physical injury or death.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring may result in fire, electric shock, physical injury or death.

Note:

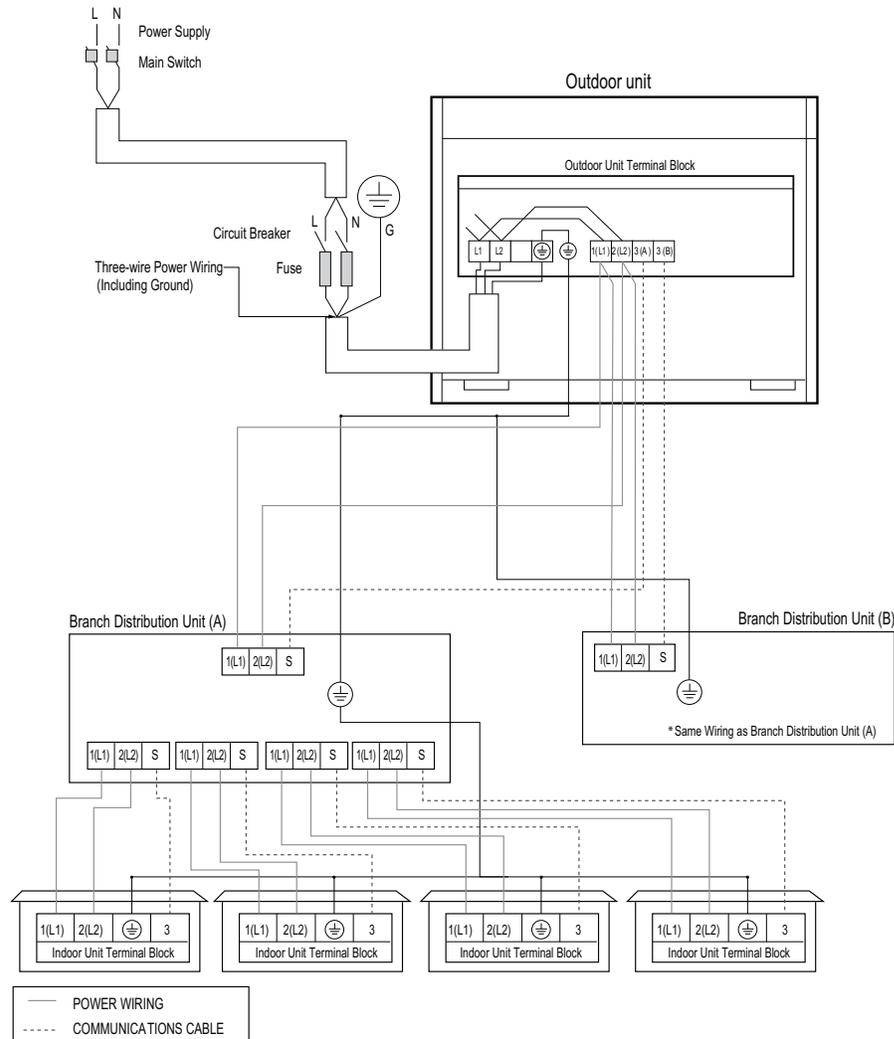
- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Failure to install proper wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components can result in property damage and equipment malfunction.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring can result in property damage and equipment malfunction.

WIRING CONNECTIONS

Power Wiring (208-230V) and Communications Cable Details

MULTI F
MULTI F MAX

Figure 106: Multi F MAX LMU600HV System Power Wiring and Communications Cable.



⚠ WARNING

- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Electric shock can cause physical injury or death.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Improper wiring may result in fire, electric shock, physical injury or death.
- Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes. Improper wiring may result in fire, electric shock, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Electric shock can cause physical injury or death.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring may result in fire, electric shock, physical injury or death.

Note:

- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- All field-supplied wiring, components, and materials should follow national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Use only stranded, shielded or unshielded copper communications / power wiring from the outdoor unit to the indoor units. If shielded, wiring must be grounded to the chassis at the outdoor unit only. Failure to install proper wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components can result in property damage and equipment malfunction.
- Wiring cable size must comply with applicable national, state, and local codes. Improper wiring can result in property damage and equipment malfunction.

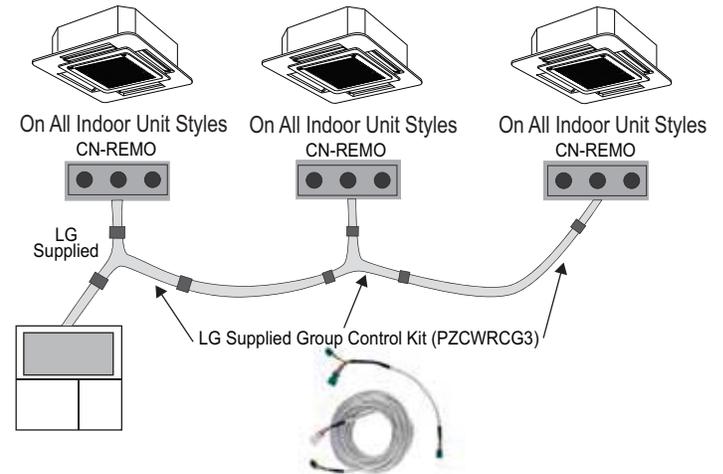
Communication Cables Between Multiple Indoor Units Operating as a Group (Group Control)

1. If any indoor units were specified to operate in unison, use one (or multiple) three-core Group Control Kit (sold separately) containing extension and Y-splitter cables. One (1) group control cable kit for each indoor unit in the group except for the last indoor unit.
2. Always use an LG provided group control communications cable (Group Control Kit; sold separately) between the indoor unit and the wall-mounted zone controller.
3. **NEVER** splice, cut, or extend cable length with field provided cable.
4. A maximum of 16 indoor units can be connected to a wired remote controller (maximum wire length: 164 feet). Before running cable, decide which indoor unit will be the "Master;" set the remaining as "Slave." The zone controller will be connected to the "Master."
5. Identify each indoor unit operating as a group as "Master" or "Slave". Adjust the pertinent DIP switch at each indoor unit. On wall mounted indoor unit models, set the assignment using the wireless remote controller.
6. Use a daisy chain configuration and connect all of the group's indoor units together starting at the "Master" unit.

General Specifications

- Wired remote controllers can be connected to all indoor unit types.
- Wireless controllers can be used in conjunction with wired remote controllers.
- A dry contact unit can be connected with a central controller simultaneously.
 - The master indoor unit is recognized by the dry contact unit and the central controller.
 - Group Control only available for indoor units manufactured after February 2009.
 - The central controller can control indoor units after setting the address of the master indoor unit only.
 - Slave indoor unit cannot be individually controlled by central controller.
 - Slave indoor unit will operate like master indoor unit.
- If an error occurs with the indoor unit, the error will be displayed on the wired remote controller.
- The following functions are available with group control:
 - Selection of operation options (operation/mode/set temperature)
 - Control of air flow rate (High/Medium/Low)

Figure 107: Indoor Unit Group to Zone Controller Connections.



Note:

Cable connected to Zone Controller is the factory default connection.

Table 57: Accessories Required for Group Control.

Accessory	Model Number	Image
Wired Remote Group Control Cable Assembly - Required for connecting multiple indoor units to a control group	PZCWRCG3	
Wired Remote/Wired Remote Extension Cable - Required for extending the distance between indoor units or remote controllers in a control group	PZCWRC1	

Table 58: Table of Acronyms.

ABS	Acrylonitrile Butadiene Styrene	IAQ	Indoor Air Quality
AC	Air Conditioner	IDU	Indoor Unit
ACP	Advanced Control Platform	IUCF	Indoor Unit Correction Factor
ARI	Air Conditioning and Refrigeration Institute	KTL	Korea Testing Laboratories
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning	LATS	LG Air Conditioning Technical Solution
AWG	American Wire Gauge	LGAP	LG Air Conditioner Protocol
BDU	Branch Distribution (Unit)	MAT	Mixed Air Temperature
Btu/h	British Thermal Units per hour	MBh	Thousands BTUs per hour
CCR	Corrected Capacity Ratio	MCA	Maximum Circuit Ampacity
CDOA	Coupled Dedicated Outdoor Air	MFS	Maximum Fuse Size
CFM	Cubic Feet per Minute	NEC	National Electrical Code
CR	Combination Ratio	OAT	Outdoor Air Temperature
DB	Dry Bulb	ODU	Outdoor Unit
dB(A)	Decibels with "A" frequency weighting	OUCF	Outdoor Unit Correction Factor
DDOAS	Decoupled Dedicated Outdoor Air	PDI	Power Distribution Indicator
DFS	Duct-Free Split	PI	Power Input
DI	Digital Input	PTAC	Packaged Terminal Air Conditioner
DO	Digital Output	PVE	Polyvinyl Ether
EEV	Electronic Expansion Valve	RAT	Return Air Temperature
ELF	Equivalent Length in Feet	RCL	Refrigerant Concentration Limit
EPDM	Ethylene Propylene Diene M-Class Rubber	SC	Sensible Capacity
ESP	External Static Pressure	TC	Total Capacity
ETL	Electronic Testing Laboratories	VAV	Variable Air Volume
HACR	Heating, Air Conditioning, and Refrigeration	VRF	Variable Refrigerant Flow
H/ML	High / Medium / Low	VRP	Ventilation Rate Procedure

Inverter



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