



MULTI F MULTI F MAX WITH LGRED^o

HEAT PUMP OUTDOOR UNIT ENGINEERING MANUAL

Multi-Zone Heat Pump Systems
1.5 to 4.0 Tons

Dual-, Tri-, and Quad-Zone
Multi F



Up to Eight Zones
Multi F MAX



PROPRIETARY DATA NOTICE

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A summary list of safety precautions is on page 3.

To access additional technical documentation such as submittals, indoor unit engineering manuals, installation, service, product data performance, general best practice, and building ventilation manuals, as well as white papers, catalogs, LATS software programs, and more, log in to www.lghvac.com.

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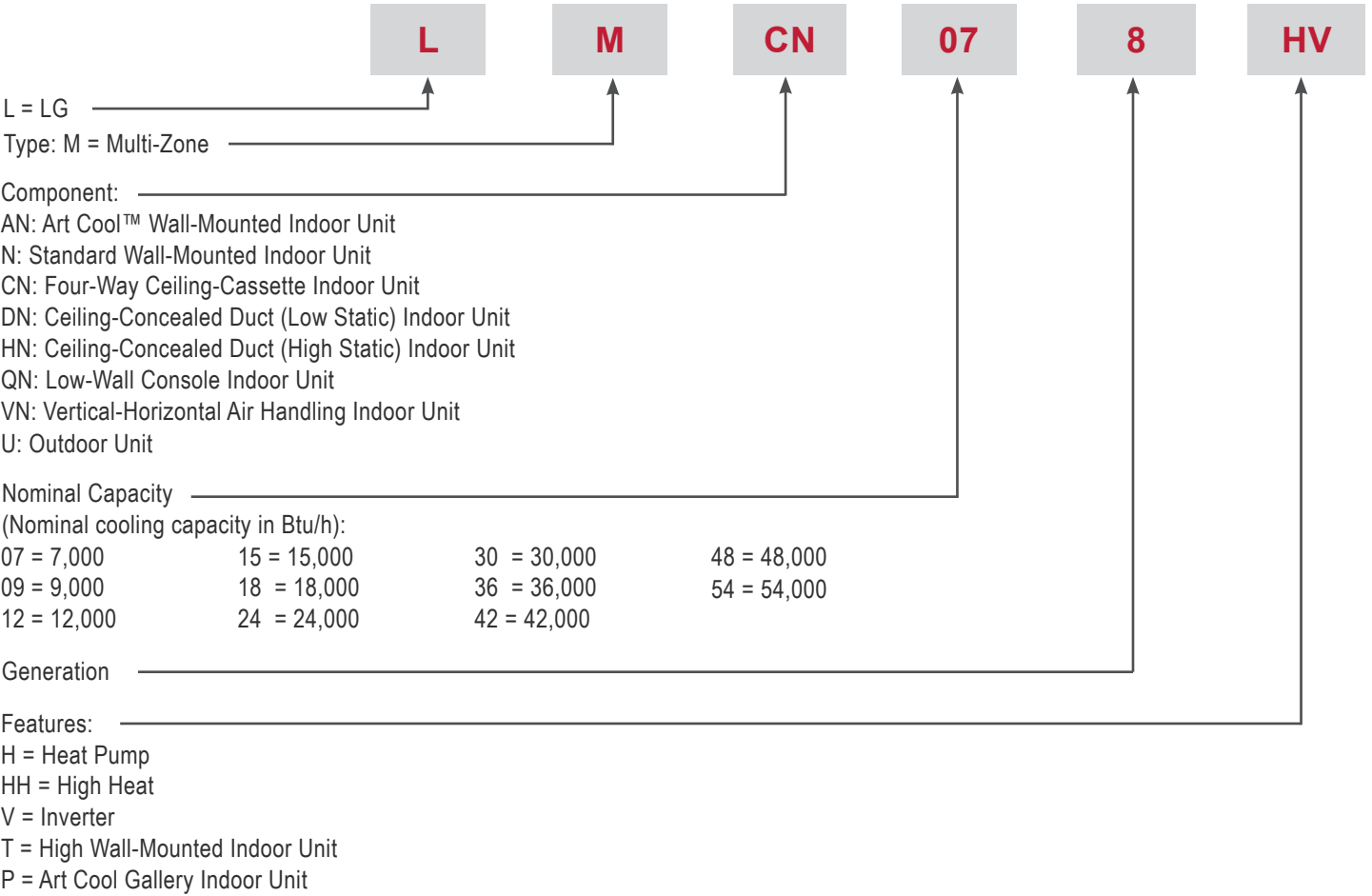
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TABLE OF SYMBOLS

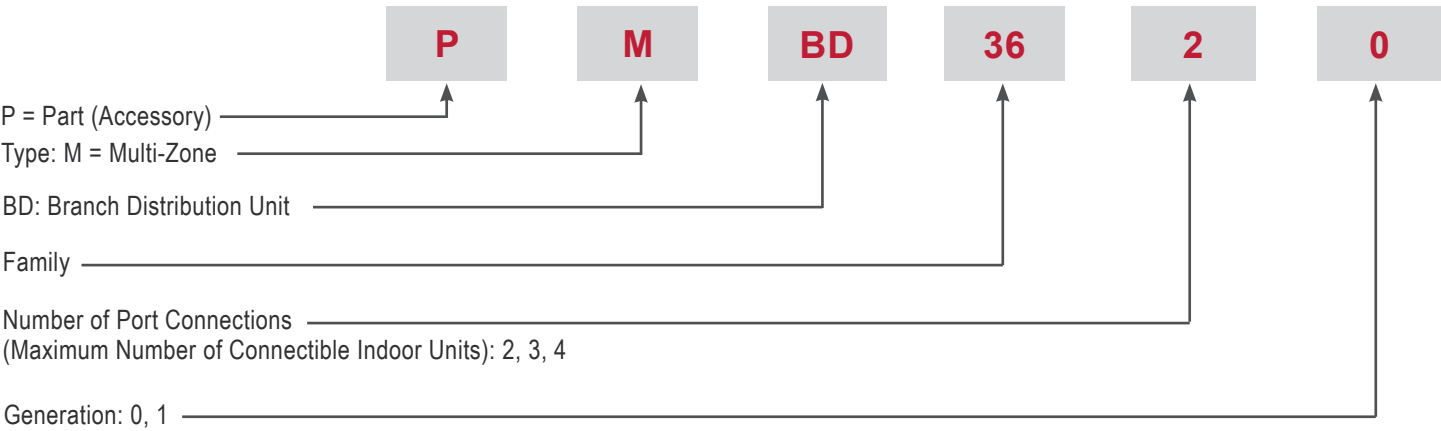
 DANGER	This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	This symbol indicates a potentially hazardous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

UNIT NOMENCLATURE

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.



LG Air Conditioner Technical Solution (LATS) Software

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

Note:

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

Formats

LATS is available to LG customers in three user interfaces: LATS HVAC, LATS CAD2, and LATS Revit. All three LATS formats are available through www.myLGHVAC.com, or contact an LG Sales Representative.

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

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

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

LATS Revit integrates the LG LATS program with Revit® software**. It permits engineers to layout and validate Multi V VRF systems directly into Revit drawings.

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

Features

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

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

The program can also:

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

Note:

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

Figure 1: Example of LATS CAD2.



LG AIR CONDITIONER TECHNICAL SOLUTION (LATS)

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LATS Generates a Complete Project Report

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

Proper Design to Install Procedure

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

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

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

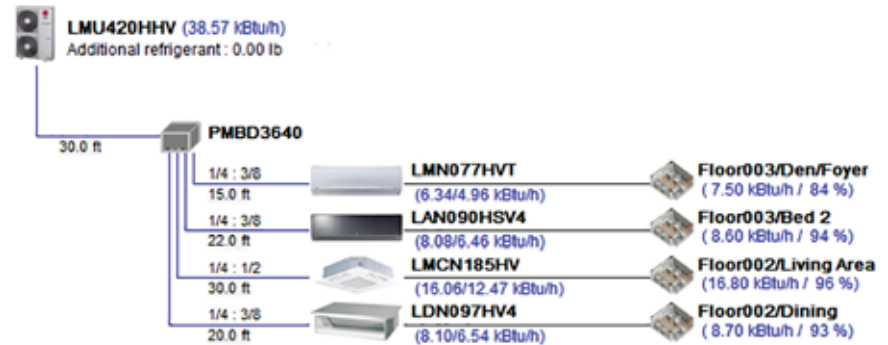
- Differences in pipe diameter(s). If incorrect diameters have been installed, the piping must be changed out. If pipe diameters have changed, check to see if Y-Branches will also need to be changed.
- Changes to outdoor unit and indoor unit capacities. Capacities changes may impact line length changes.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

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

Note:

Contact your LG representative for the best software program for your application.

Figure 2: Example of a LATS Tree Diagram.



To use the manual equipment selection procedure in choosing 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:
 - 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 with LGRED heat pump systems or a Multi F MAX with LGRED 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 2 for allowable indoor unit to outdoor unit connections, and the maximum number of connectible indoor units on each Multi F with LGRED and Multi F MAX with LGRED 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 with LGRED 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 must be at least the minimum connection capacity index specified for the outdoor unit (see Table 2 on page 9), and not exceed the maximum connection capacity index specified for the outdoor unit (see Table 2 on page 9).
3. To calculate the connected total indoor unit nominal capacity, simply sum up the nominal capacities of all indoor units.
 - For 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 indoor units (when connected to an outdoor unit other than the LMU361HHV, LMU421HHV, and LMU480HHV).
 - When 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 with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.com.



MANUAL EQUIPMENT SELECTION PROCEDURE

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Examples

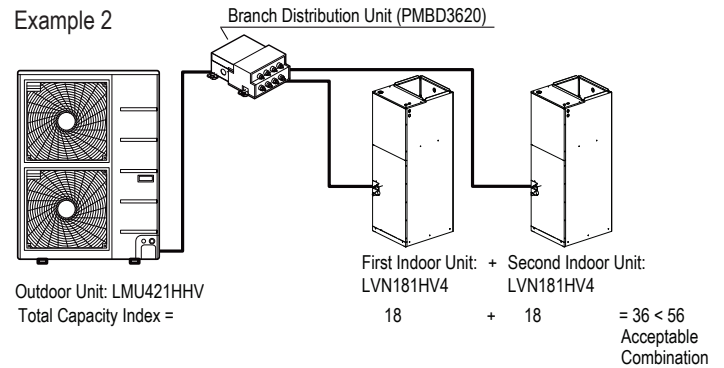
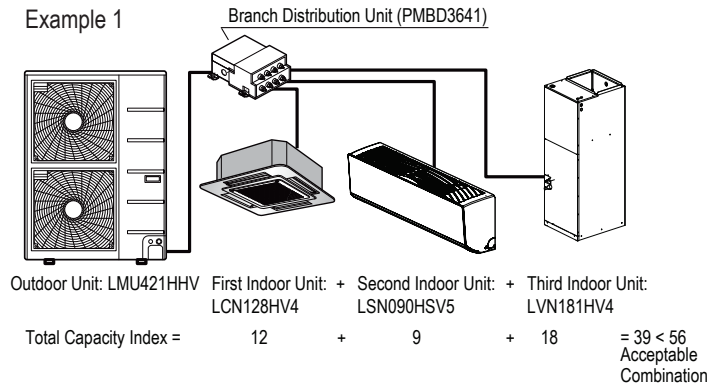


Table 1: Allowable Indoor Unit to Outdoor Unit Connections.

Indoor units		Outdoor Units					
Model Type	Indoor Unit Nominal Capacity (Btu/h)	LMU180HHV	LMU240HHV	LMU300HHV	LMU361HHV	LMU421HHV	LMU480HHV
		Maximum No. of Connectible Indoor Units					
		2	3	4	5	6	8
ART COOL Mirror	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	18,000	-	0	0	0	0	0
ART COOL Gallery	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	18,000	-	0	0	0	0	0
Standard Wall Mounted	7,000	0	0	0	0	0	0
	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	15,000	0	0	0	0	0	0
	18,000	-	0	0	0	0	0
Ceiling Concealed Duct-Low Static	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	18,000	-	0	0	0	0	0
Ceiling Concealed Duct-High Static	24,000	-	-	0	0	0	0
	36,000	-	-	-	-	0	0
Four-Way Ceiling Cassette	7,000	0	0	0	0	0	0
	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	18,000	-	0	0	0	0	0
Low-Wall Console	9,000	0	0	0	0	0	0
	12,000	0	0	0	0	0	0
	15,000	0	0	0	0	0	0
Vertical-Horizontal Air Handler	18,000	-	0	0	0	0	0
	24,000	-	-	0	0	0	0
	36,000	-	-	-	-	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 must 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 must 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 2: Rated Outdoor Unit Capacity.

		Outdoor Units					
		LMU180HHV	LMU240HHV	LMU300HHV	LMU361HHV	LMU421HHV	LMU480HHV
Rated Capacity (Btu/h)*	Cooling	18,000	24,000	28,400	36,000	42,000	48,000
	Heating	22,000	26,000	28,600	45,000	48,000	52,500
Connectible Indoor Units	Min. No. of IDUs	2	2	2	2	2	2
	Max. No. of IDUs	2	3	4	5	6	8
	Min. Capacity Index	14,000	14,000	14,000	18,000	18,000	18,000
	Max. Capacity Index	24,000	33,000	40,000	48,000	56,000	65,000

*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 software (preferred method) or reference the Performance Data Capacity Tables in the Multi F / Multi F MAX with LGRED Performance Data Manual on www.lghvac.com. 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:

$$(y - y_1) / (y_2 - y_1) = (x - x_1) / (x_2 - x_1)$$

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:

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

Where

Q_{idu}(combi) = Individual Indoor Unit Combination Capacity.

Q_{odu}(rated) = Outdoor Unit Rated Capacity.

Q_{idu}(rated) = Individual Indoor Unit Rated Capacity.

ΣQ_{idu}(rated) = Total Connected Indoor Unit Rated Capacity.

Note:

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

MANUAL EQUIPMENT SELECTION PROCEDURE

MULTI F^{WITH LGRED°}
MULTI F MAX

Using the System Combination Tables

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

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

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 with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.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 3 to 5.

Table 3: Multi F with LGRED Outdoor Unit (Multiple Piping) to Indoor Unit Refrigerant Line Length Derates.

Piping Length (feet)	Cooling Capacity (%)	Heating Capacity (%)
7,000 Btu/h Indoor Unit Models		
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
9,000 Btu/h Indoor Unit Models		
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
12,000 Btu/h Indoor Unit Models		
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
15,000 Btu/h Indoor Unit Models		
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
18,000 Btu/h Indoor Unit Models		
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
24,000 Btu/h Indoor Unit Models		
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 4: Multi F MAX with LGRED 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 3: Multi F MAX with LGRED Outdoor Unit to Branch Distribution Unit Refrigerant Line Length Derate Chart.

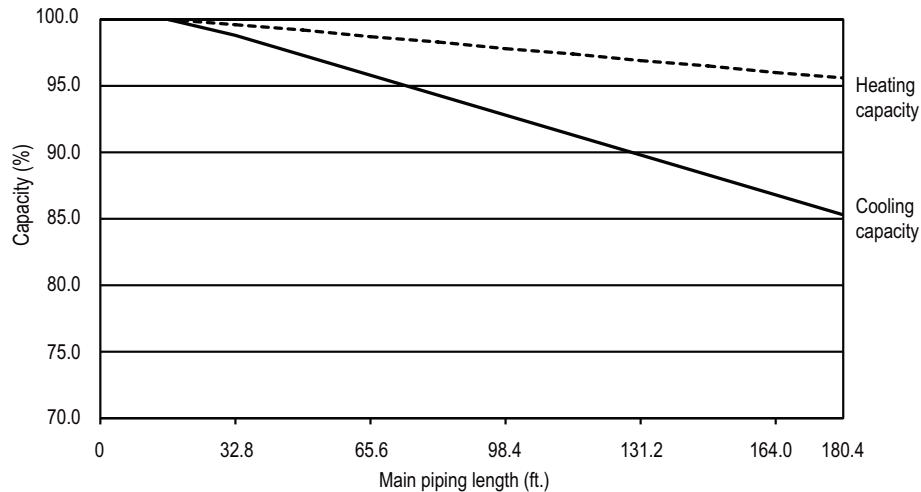


Table 5: Multi F MAX with LGRED Branch Distribution Unit to Indoor Unit Refrigerant Line Length Derates.

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

MANUAL EQUIPMENT SELECTION PROCEDURE

MULTI F^{WITH LGRED°}
MULTI F MAX

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 6).

Table 6: Outdoor Unit Frost Accumulation Factor (Heating)¹.

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

¹At 85% outdoor air relative humidity.

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

Note:

There will be 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.

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 must be within the minimum and maximum indoor unit connection capacity index, and 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 must 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 representative.

MULTI F WITH LGRED PRODUCT DATA

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MULTI F WITH LGRED

MULTI F WITH LGRED[®]

Mechanical Specifications

Multi F with LGRED Heat Pump Units

General

A Multi F with LGRED 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 with LGRED multi zone heat pump system components comply with Underwriters Laboratories (UL) 1995 Heating and Cooling Equipment Standard for Safety. 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). The heat pump outdoor units are capable of operating in heating mode from -13°F to +64°F ambient wet bulb without additional low ambient controls.

Frame

The Multi F with LGRED 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 with LGRED 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 with LGRED 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 with LGRED 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.

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 with LGRED 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.

Figure 4: Dual-Zone (LMU180HHV) Multi F with LGRED System.



Table 7: Multi F with LGRED Outdoor Unit Specifications.

Model Number	LMU180HHV	LMU240HHV	LMU300HHV
Capacity			
Nominal	18,000	24,000	30,000
Cooling (Btu/h) (Min.~Rated~ Max.) ¹	8,400 ~ 18,000 ~ 19,980	8,400 ~ 24,000 ~ 30,000	8,400 ~ 28,400 ~ 34,080
Cooling Power Input (kW) (Min.~Rated~ Max.)	0.88 ~ 1.33 ~ 1.87	0.94 ~ 1.78 ~ 2.49	0.95 ~ 2.27 ~ 3.18
Cooling Running Current (A) (Min.~Rated~ Max.)	4.0 ~ 6.0 ~ 8.5	4.3 ~ 8.1 ~ 11.3	4.3 ~ 10.3 ~ 14.5
Heating (Btu/h) (Min.~Rated~ Max.) ¹	10,248 ~ 22,000 ~ 24,000	10,248 ~ 26,000 ~ 31,200	10,248 ~ 28,600 ~ 34,320
Heating Power Input (kW) (Min.~Rated~ Max.)	1.25 ~ 2.22 ~ 3.11	1.26 ~ 2.12 ~ 2.96	1.30 ~ 2.33 ~ 3.26
Heating Running Current (A) (Min.~Rated~ Max.)	5.7 ~ 10.1 ~ 14.1	5.7 ~ 9.6 ~ 13.5	5.9 ~ 10.6 ~ 14.8
Operating Range			
Cooling (°F DB) ²	14 to 118		
Heating (°F WB)	-13 to +64		
Compressor			
Inverter Quantity	Twin Rotary x 1		
Oil / Type	FVC68D		
Fan (Side Discharge)			
Type	Propeller		
Motor Output (W) x Qty.	124.2 x 1		
Motor / Drive	Brushless Digitally Controlled / Direct		
Maximum Air Flow Rate (ft. ³ / min.)	2,295		
Unit Data			
Refrigerant Type	R410A		
Refrigerant Control / Location	Electronic Expansion Valve / Outdoor Unit		
Min. Number Indoor Units/System ³	2		
Max. Number Indoor Units/System ³	2	3	4
Maximum Allowable Total Indoor Unit Connected Capacity (Btu/h)	24,000	33,000	40,000
Sound Pressure ±3 dB(A) (Cooling / Heating) dB(A) ⁴	50 / 54	52 / 55	
Dimensions (W x H x D [inch])	37-13/32 x 32-27/32 x 13		
Net Unit Weight (lbs.)	147.7	152.1	
Power Supply (V, Phase, Hz)	208 / 230V, 1, 60		
Communication / Connection (Power) Cable (No. x AWG) ^{5,6}	4C x 14		
Heat Exchanger			
Material and Fin Coating	Copper Tube/Aluminum Fin and GoldFin™ / Hydrophilic		
Rows/Columns / Fins per inch x Qty.	(3 x 38 x 16) x 1		
Piping			
Liquid Line Connection (in., O.D.) x Qty.	Ø1/4 x 2	Ø1/4 x 3	Ø1/4 x 4
Vapor Line Connection (in., O.D.) x Qty.	Ø3/8 x 2	Ø3/8 x 3	Ø3/8 x 4
Factory Charge oz. of R410A	98.8	112.8	
Additional Charging Volume (oz. / ft.)	0.22		
Piping Lengths			
Maximum Total Piping (ft.) ⁷	164	246.1	
Maximum Outdoor Unit to Indoor Unit Piping (ft.)	82.0		
Piping Length (No Additional Refrigerant [ft.])	49.2	73.8	98.4
Maximum Elevation between Outdoor Unit and Indoor Unit (ft.)	49.2		
Maximum Elevation between Indoor Unit and Indoor Unit (ft.)	24.6		

¹Capacity is rated with non-ducted IDUs, 0 ft. above sea level, with a 0 ft. level difference between ODU and IDUs, and the following refrigerant pipe lengths:

LMU180HHV: 16.4 ft. x 2 = 32.8 ft.

LMU240HHV: 16.4 ft. x 3 = 49.2 ft.

LMU300HHV: 16.4 ft. x 4 = 65.6 ft.

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).

²Cooling operation range with Low Ambient Wind Baffle Kit (sold separately) is -4°F to +118°F.

³At least two indoor units must be connected. For allocated capacity information, see the combination

tables in the "Multi F / Multi F MAX with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.com.

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

⁵Power wiring to the outdoor unit is field supplied, solid or stranded, and must comply with all the applicable local and national codes. For detailed information, please refer to electrical characteristics on page 16.

⁶All communication / connection (power) cable from the outdoor units to the indoor units must be a minimum of four conductor, 14 AWG 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 16.

⁷Piping lengths are equivalent.

General Data, continued.

Table 8: LMU180HHV 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)
LMU180HHV	Non-Ducted Indoor Units	18,000	13.5	21.0	22,000	2.9	10.0	14,700	2.5
	Ducted Indoor Units	16,500	12.0	17.5	22,000	2.6	9.0	14,700	2.3
	Mixed Non-Ducted and Ducted Indoor Units	17,250	12.75	19.25	22,000	2.75	9.5	14,700	2.4

Table 9: LMU240HHV 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)
LMU240HHV	Non-Ducted Indoor Units	24,000	13.5	21.0	26,000	3.6	10.7	17,400	2.8
	Ducted Indoor Units	20,000	11.5	17.0	24,000	2.9	9.0	15,200	2.3
	Mixed Non-Ducted and Ducted Indoor Units	22,000	12.5	19.0	25,000	3.25	9.85	16,300	2.5

Table 10: LMU300HHV 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)
LMU300HHV	Non-Ducted Indoor Units	28,400	12.5	20.0	28,600	3.6	11.0	18,900	2.8
	Ducted Indoor Units	24,600	10.5	17.5	27,000	3.1	9.5	17,700	2.5
	Mixed Non-Ducted and Ducted Indoor Units	26,500	11.5	18.75	27,800	3.35	10.25	18,300	2.7

¹Capacity is rated 0 ft. above sea level, with a 0 ft. level difference between ODU and IDUs, and the following refrigerant pipe lengths:

LMU180HHV: 16.4 ft. x 2 = 32.8 ft.

LMU240HHV: 16.4 ft. x 3 = 49.2 ft.

LMU300HHV: 16.4 ft. x 4 = 65.6 ft.

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 must be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.com.

Electrical Data

Table 11: Electrical Data.

Nominal Tons	Unit Model No.	Hertz	Voltage	Voltage Range (Min. to Max.)	MCA	MOP	RFA	Compressor Quantity	Compressor Motor RLA	Outdoor Fan Motor		Indoor Fan Motor
										kW	FLA	FLA
1.5	LMU180HHV	60	208 - 230	187 - 253	18.6	30	25	1	13	0.12	0.73	1.6
2	LMU240HHV				19	30	25	1	13	0.12	0.73	2.0
2.5	LMU300HHV				19.4	30	25	1	13	0.12	0.73	2.4

Voltage tolerance is ±10%.

Maximum allowable voltage unbalance is 2%.

MCA = Minimum Circuit Ampacity.

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

RFA = Recommended Fuse Amps.

RLA = Rated Load Amps.

FLA = Full Load Amps.

Indoor Fan Motor (FLA) is based on the max. combination of IDUs.

The maximum combination for each outdoor unit is:

- 18,000 ODU (LMU180HHV): 12,000 IDU x 2

- 24,000 ODU (LMU240HHV): 12,000 IDU x 2 + 9,000 IDU x 1

- 30,000 ODU (LMU300HHV): 12,000 IDU x 3

Table 12: Functions, Controls, Options, and Accessories.

Functions		LMU180HHV	LMU240HHV	LMU300HHV
Reliability	Defrost / Deicing	√	√	√
	High Pressure Switch	X	X	X
	Low Pressure Switch	X	X	X
	Phase Protection	X	X	X
	Restart Delay (Three [3] Minutes)	√	√	√
	Self Diagnosis	√	√	√
	Soft Start	√	√	√
	Test Function	X	X	X
Convenience	Night Silent Operation	√	√	√
	Wiring Error Check	√	√	√
	Peak Control	√	√	√
	Mode Lock	√	√	√
	Forced Cooling Operation (Outdoor Unit)	√	√	√
Central Controllers	PI-485	PMNFP14A1	PMNFP14A1	PMNFP14A1
Integration Solution	MultiSITE Communications Manager	PBACNBTR0A	PBACNBTR0A	PBACNBTR0A
Building Network Unit	AC Smart 5	PACS5A000	PACS5A000	PACS5A000
	ACP 5	PACP5A000	PACP5A000	PACP5A000
Installation	Y-Branch	X	X	X
	Header Branch	X	X	X
	Air Guide	X	X	X
Other	Power Distribution Indication (PDI) Premium	PQNUD1S41	PQNUD1S41	PQNUD1S41
	Dry Contact	X	X	X
	Low Ambient Wind Baffle Kit	ZLABGP04A (Logical Operation)	ZLABGP04A (Logical Operation)	ZLABGP04A (Logical Operation)
	Factory-Supplied Drain Heater	√	√	√
	Compatibility w / prior generation of Multi F	√	√	√
	Computer LG Monitoring View (LGMV)	PRCTILO	PRCTILO	PRCTILO
	Mobile LGMV for Android Smartphones / Tablets	PLGMVW100	PLGMVW100	PLGMVW100
	Mobile LGMV for iOS Tablet	PLGMVW100	PLGMVW100	PLGMVW100

√ = Standard feature

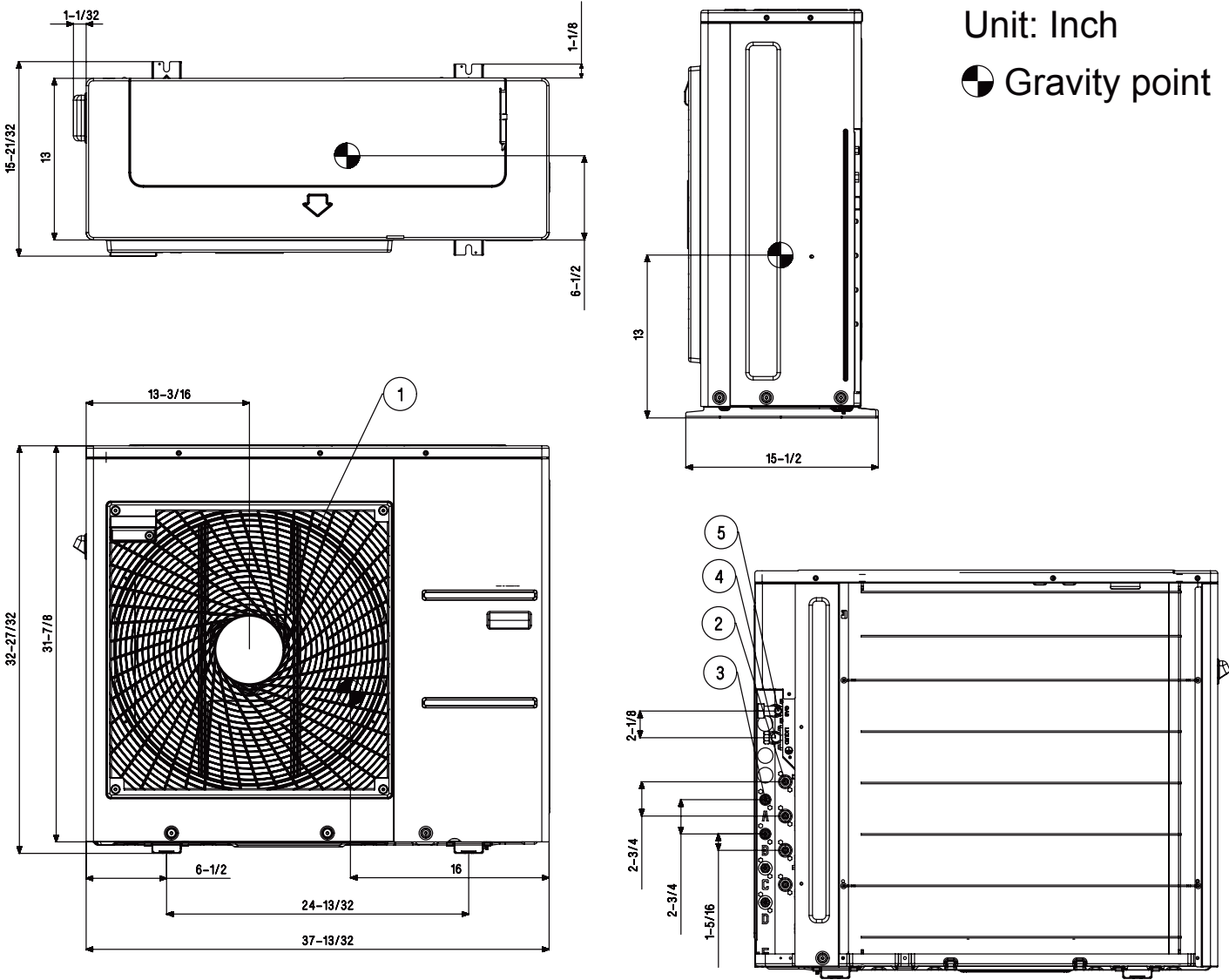
o = Optional accessory (must be purchased separately)

X = Not available

MULTI F WITH LGRED

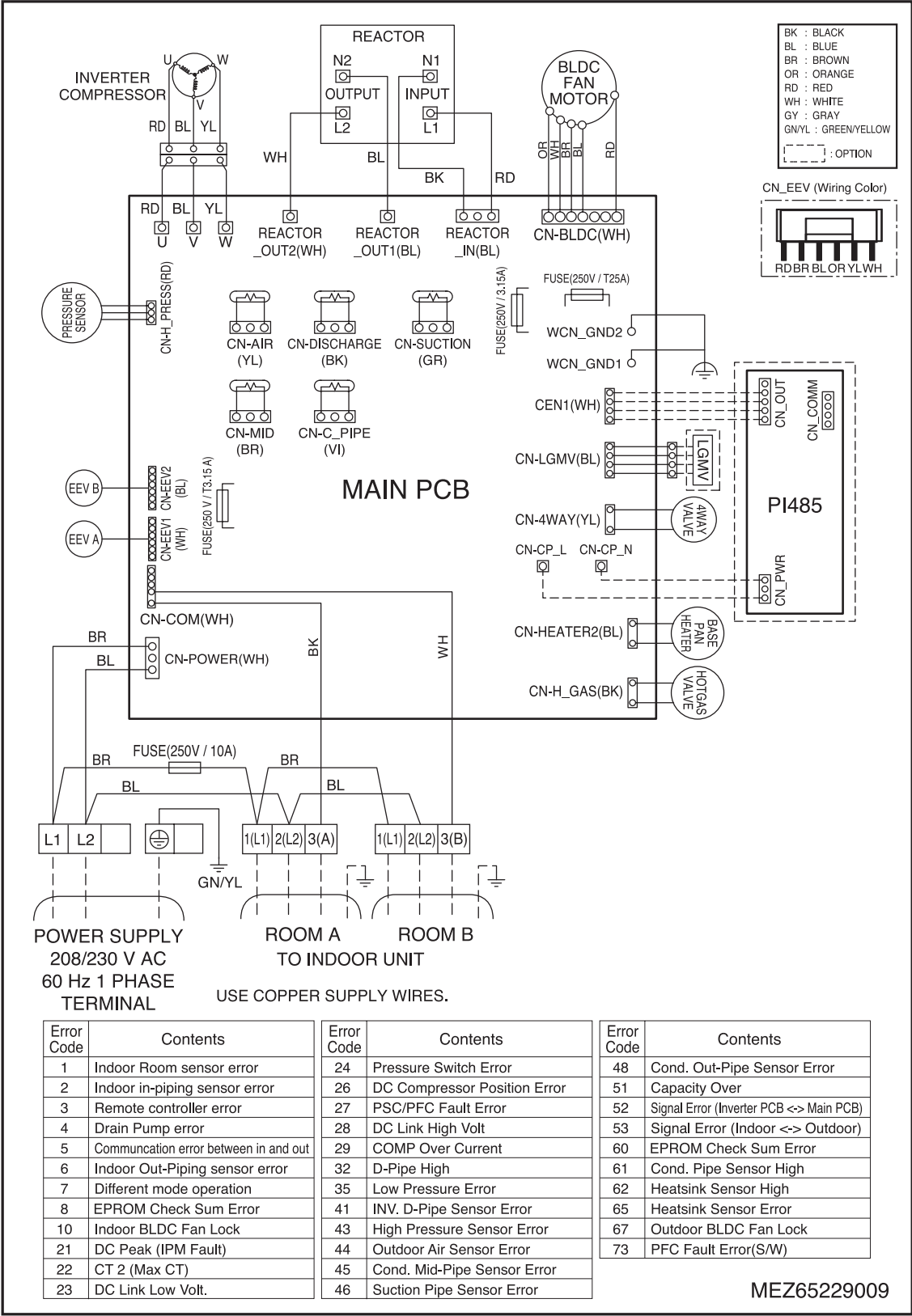
Dimensions

Figure 5: LMU180HHV, LMU240HHV, and LMU300HHV External Dimensions.



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)

Figure 6: LMU180HHV Wiring Diagram.



MULTI F WITH LGRED

MULTI F WITH LGRED°

Wiring Diagram

Figure 7: LMU240HHV Wiring Diagram.

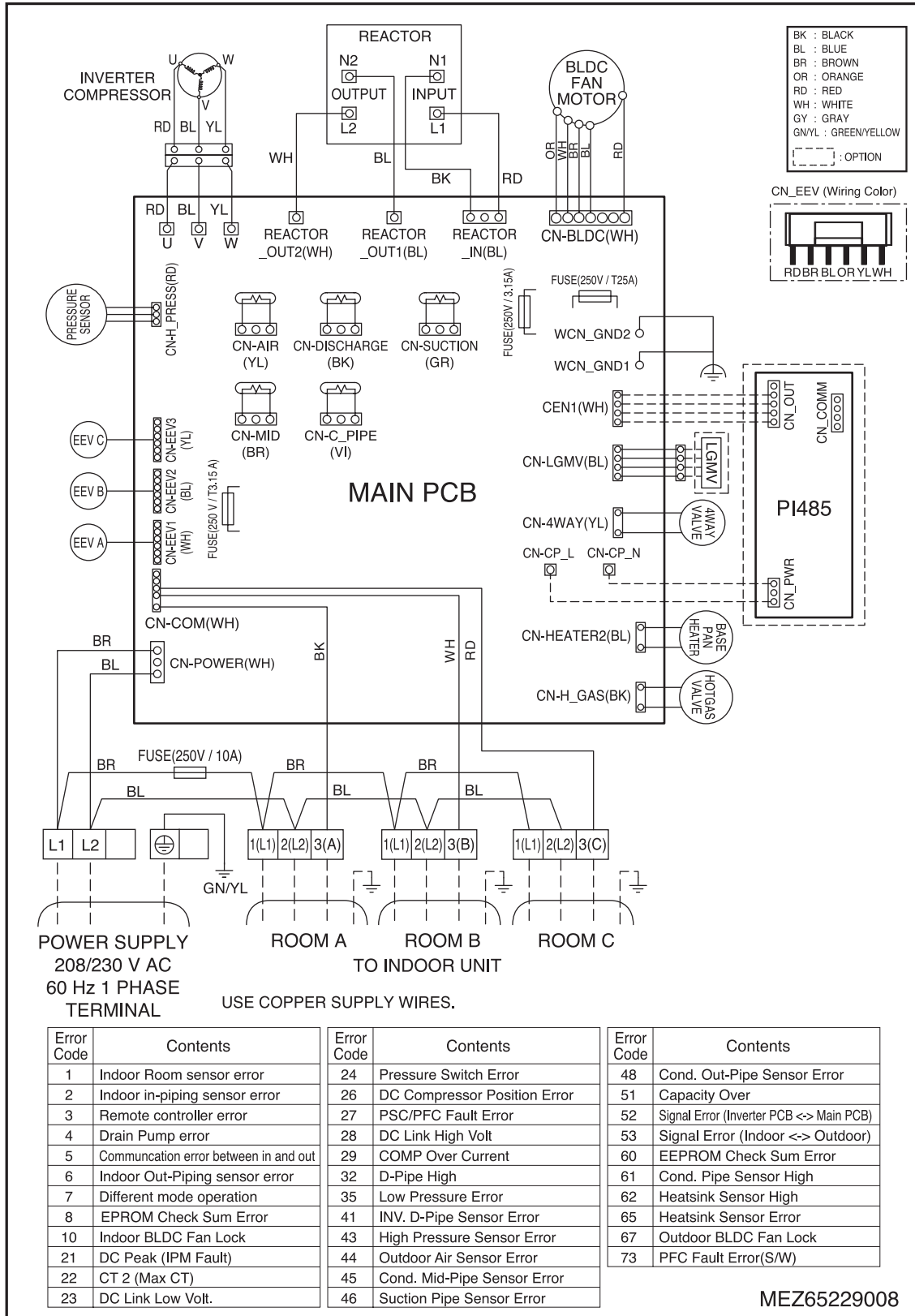
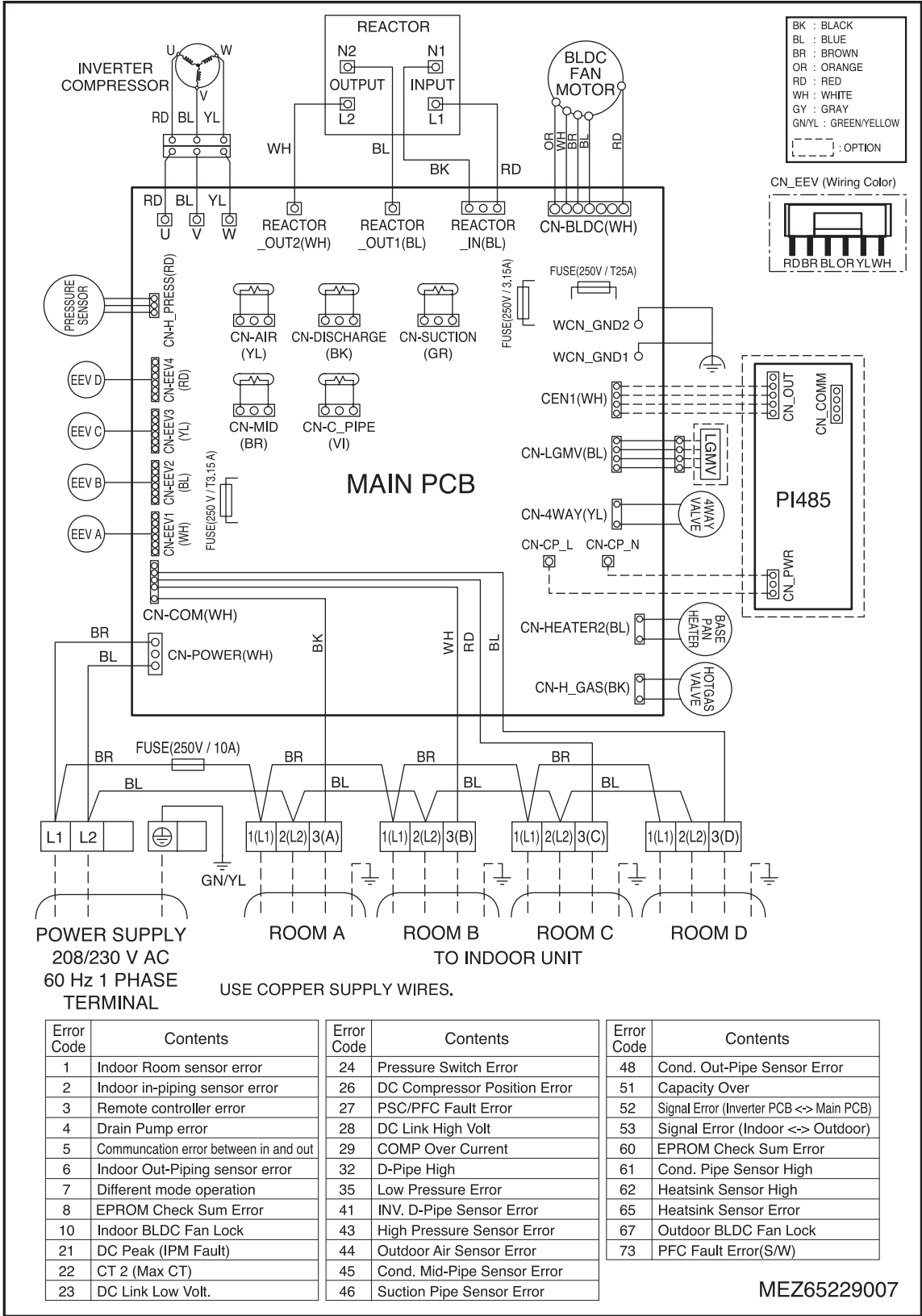


Figure 8: LMU300HHV Wiring Diagram.



MULTI F WITH LGRED

MULTI F WITH LGRED°

Refrigerant Flow Diagram

Figure 9: LMU180HHV Refrigerant Flow Diagram.

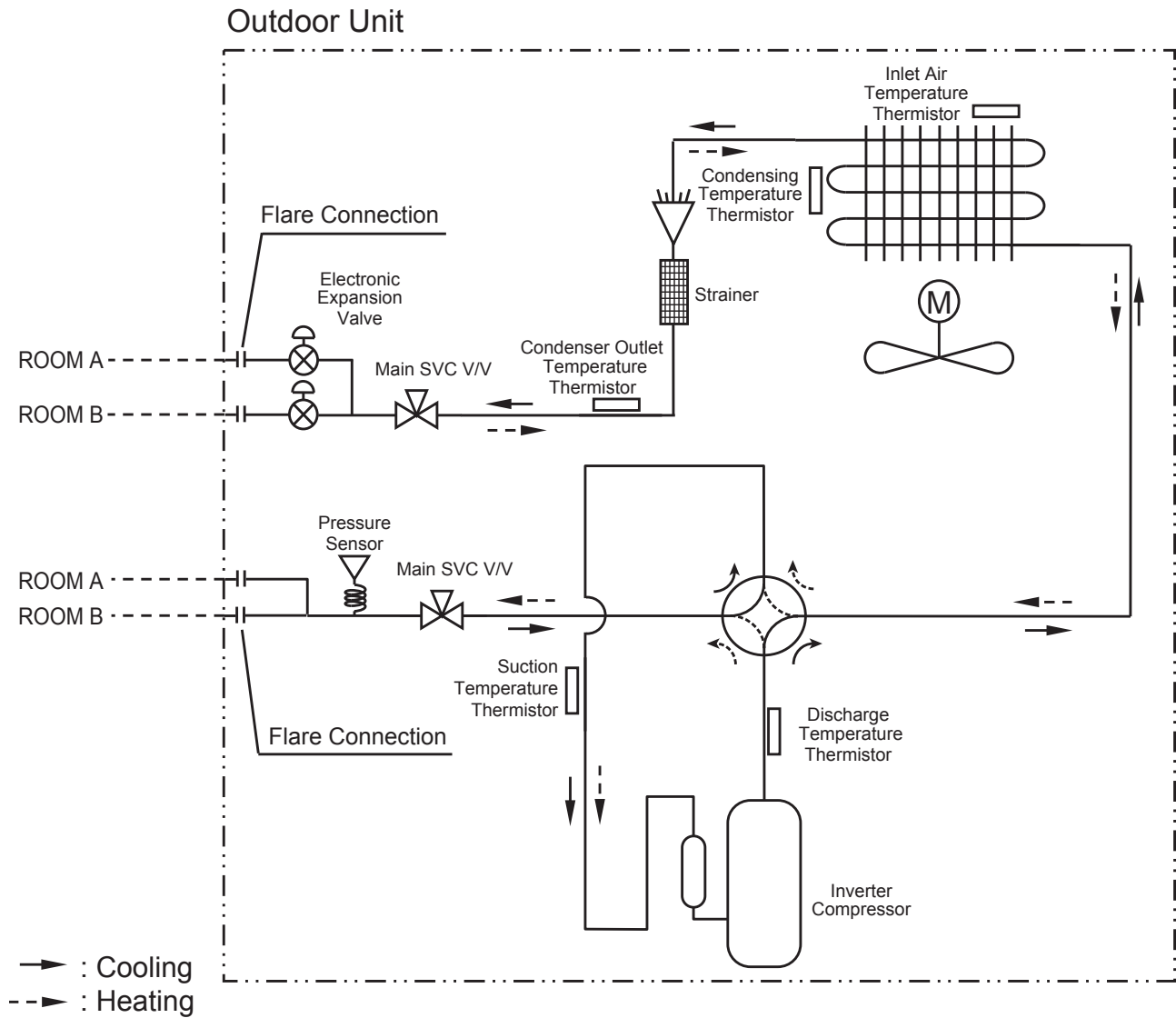


Table 13: LMU180HHV PCB Connection Details.

Description	PCB Connection
Condensing Temperature Middle Thermistor	CN_MID_BR
Discharge Temperature Thermistor	CN_DISCHARGE_BK
Condenser Outlet Temperature Thermistor	CN_C_PIPE_VI
Suction Temperature Thermistor	CN_SUCTION_GR
Inlet Air Temperature Thermistor	CN_AIR_YL
Pressure Sensor	CN_H_PRESS_RD
Hot Gas Valve	CN_H_GAS_BK
Four-Way Valve	CN_4WAY_YL
Base Pan Heater	CN_HEATER_BL

Figure 10: LMU240HHV Refrigerant Flow Diagram.

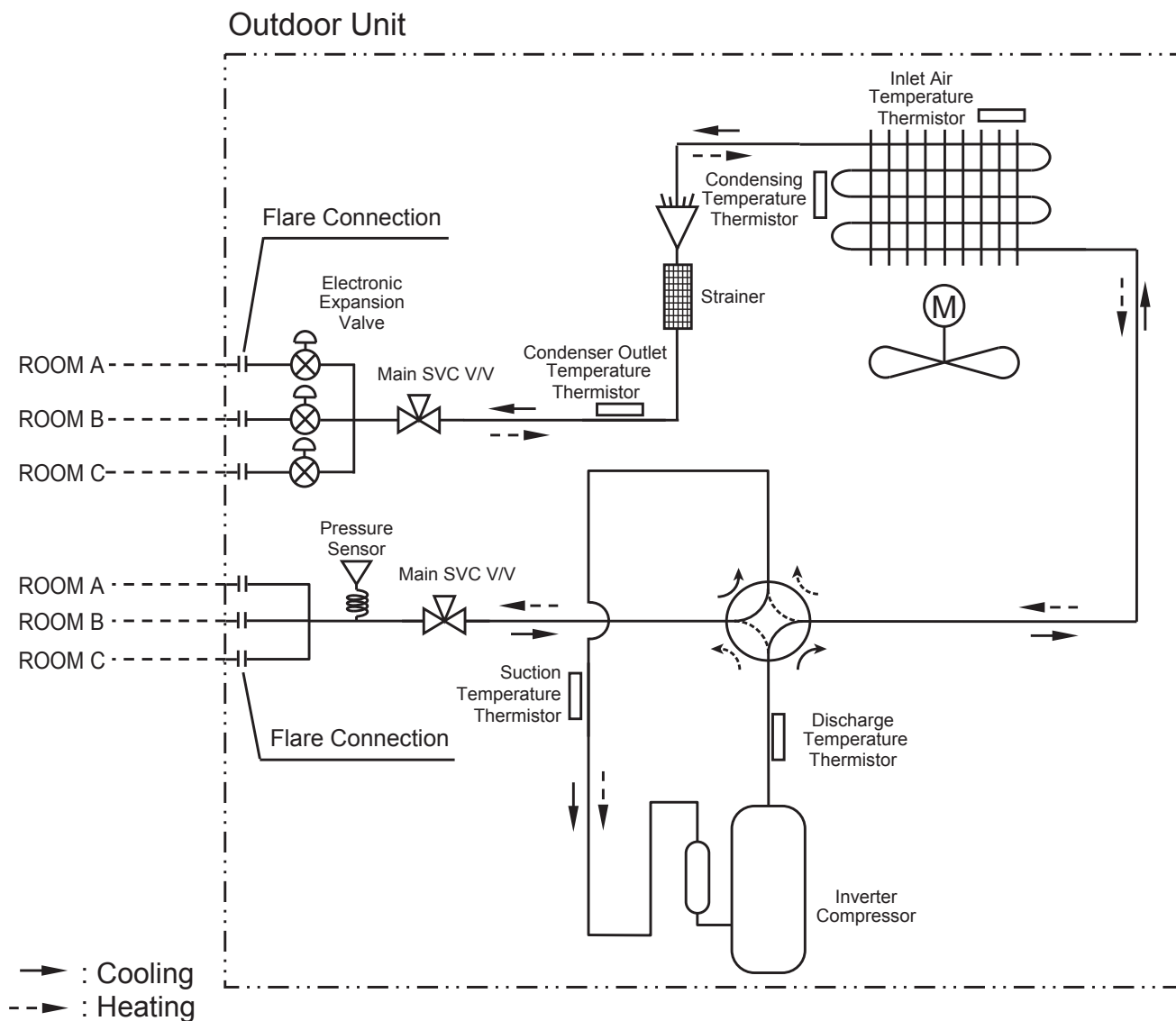


Table 14: LMU240HHV PCB Connection Details.

Description	PCB Connection
Condensing Temperature Middle Thermistor	CN_MID_BR
Discharge Temperature Thermistor	CN_DISCHARGE_BK
Condenser Outlet Temperature Thermistor	CN_C_PIPE_VI
Suction Temperature Thermistor	CN_SUCTION_GR
Inlet Air Temperature Thermistor	CN_AIR_YL
Pressure Sensor	CN_H_PRESS_RD
Hot Gas Valve	CN_H_GAS_BK
Four-Way Valve	CN_4WAY_YL
Base Pan Heater	CN_HEATER_BL

MULTI F WITH LGRED

MULTI F WITH **LGRED°**

Refrigerant Flow Diagram

Figure 11: LMU300HHV Refrigerant Flow Diagram.

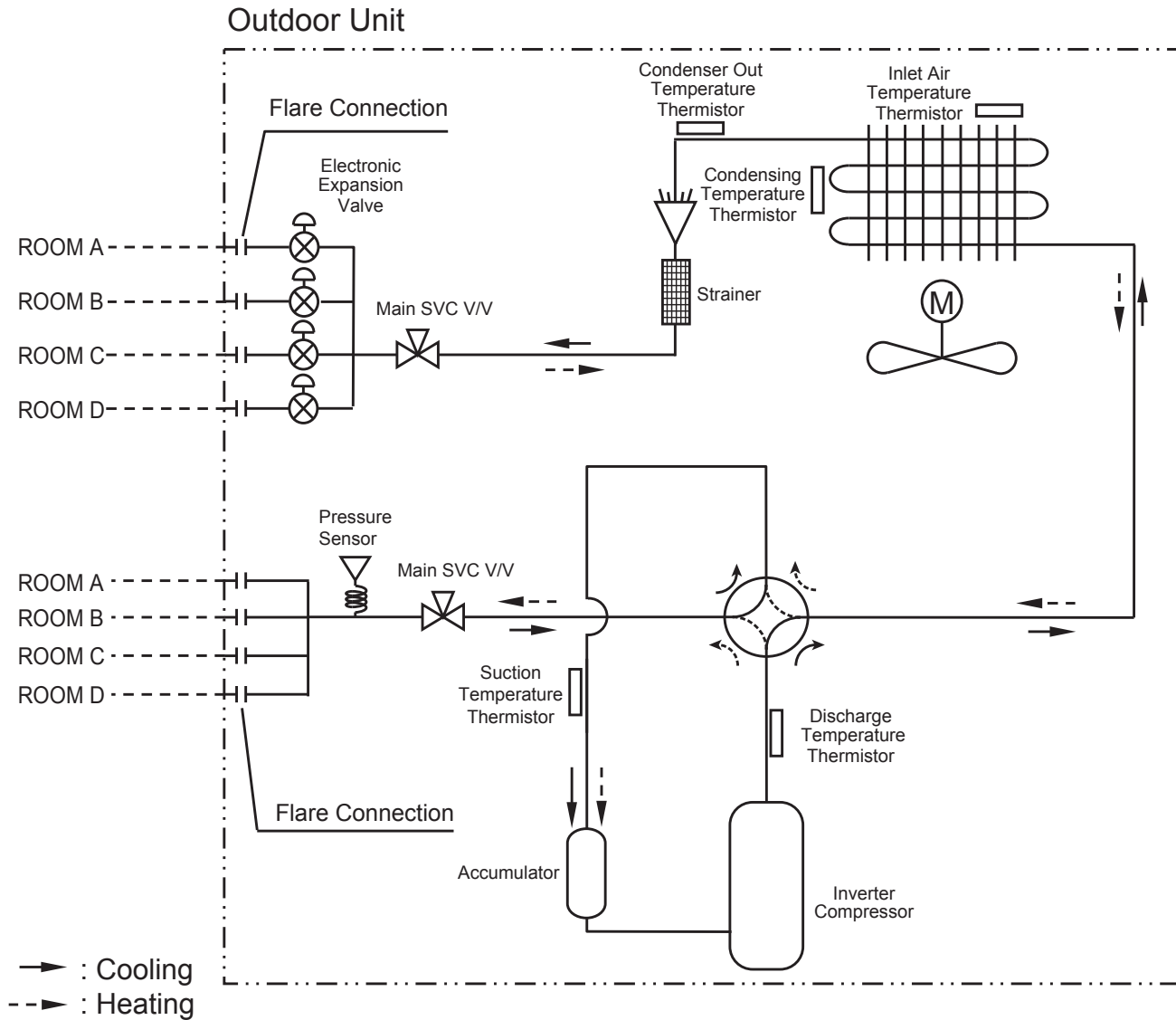
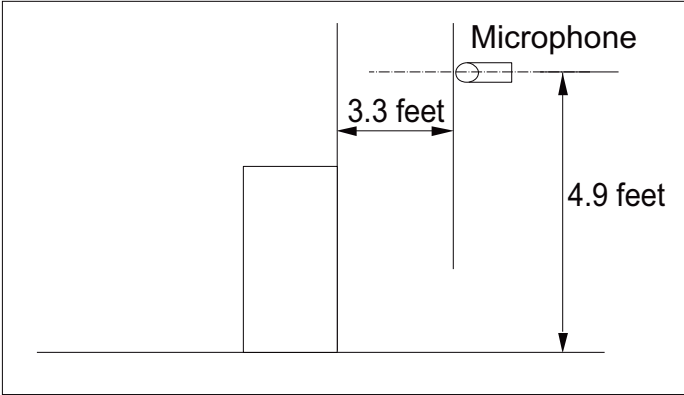


Table 15: LMU300HHV PCB Connection Details.

Description	PCB Connection
Condensing Temperature Middle Thermistor	CN_MID_BR
Discharge Temperature Thermistor	CN_DISCHARGE_BK
Condenser Outlet Temperature Thermistor	CN_C_PIPE_VI
Suction Temperature Thermistor	CN_SUCTION_GR
Inlet Air Temperature Thermistor	CN_AIR_YL
Pressure Sensor	CN_H_PRESS_RD
Hot Gas Valve	CN_H_GAS_BK
Four-Way Valve	CN_4WAY_YL
Base Pan Heater	CN_HEATER_BL

Figure 12: Acoustic Measurement Location.

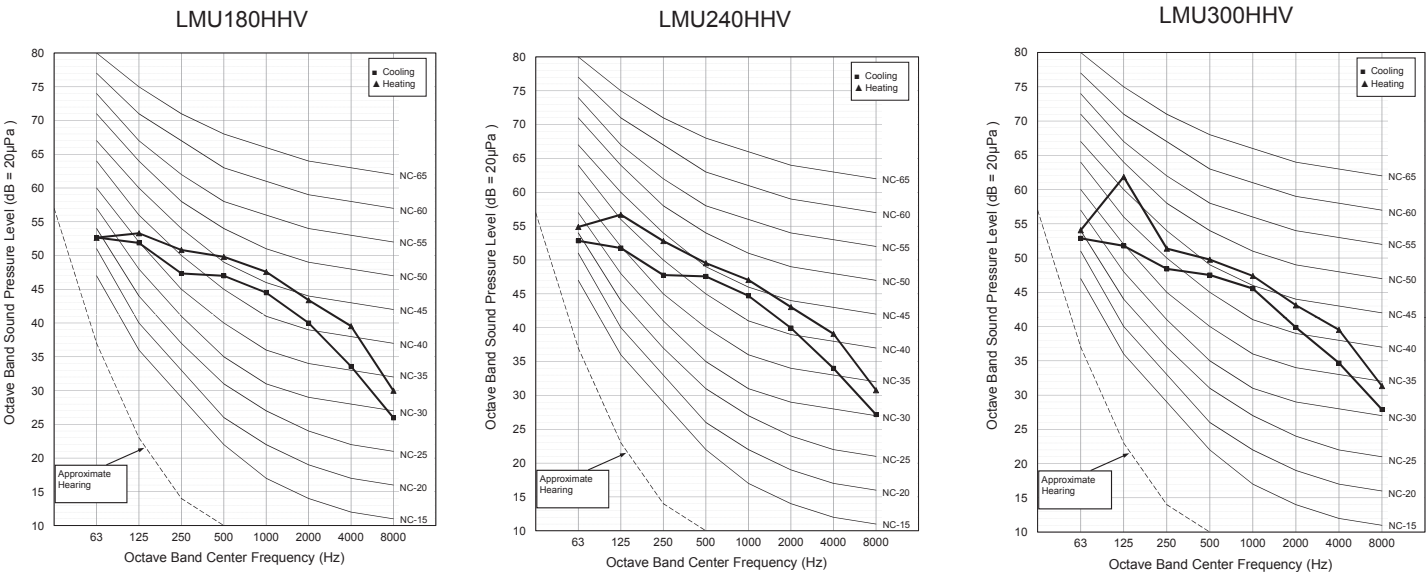


- Measurement taken 4.9' above finished floor, and at a distance of 3.3' from face of unit.
- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) 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 16: Sound Pressure Levels (dB[A]).

Model No.	Sound Pressure Level (dB[A])	
	Cooling	Heating
LMU180HHV	50	54
LMU240HHV	52	55
LMU300HHV	52	55

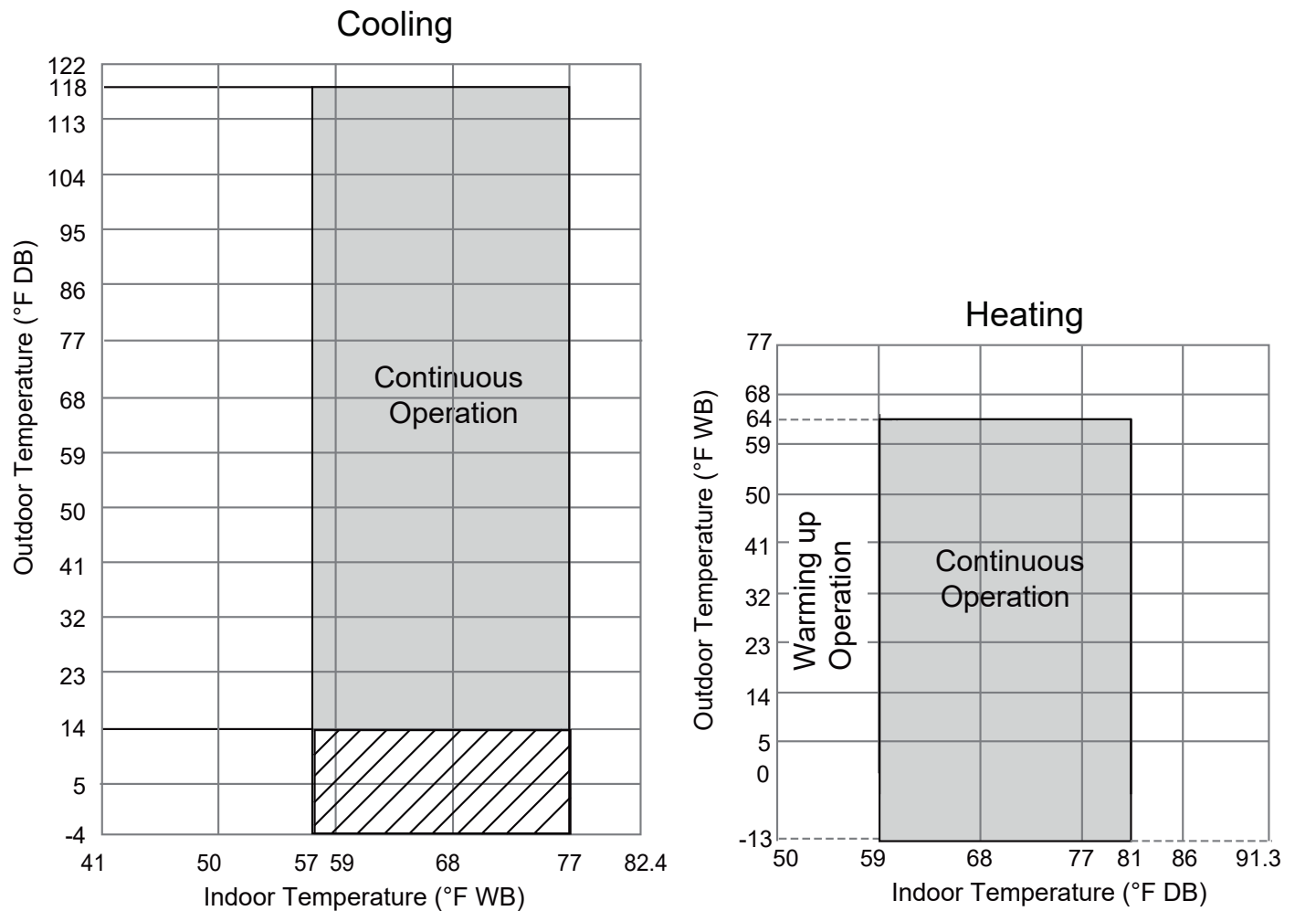
Figure 13: Sound Pressure Level Diagrams.



MULTI F WITH LGRED

Operation Range

Figure 14: Multi F with LGRED Cooling and Heating Operation Ranges.



Note:
Cooling range with Low Ambient Baffle Kit (sold separately) is -4°F to +118°F.

MULTI F MAX WITH LGRED PRODUCT DATA

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Center of Gravity / Corner Weight on page 33

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Refrigerant Flow Diagram on page 35

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Operation Range on page 38

Mechanical Specifications

Multi F MAX with LGRED Heat Pump Condensing Units

General

A Multi F MAX with LGRED 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 with LGRED multi-zone heat pump system components comply with Underwriters Laboratories (UL) 1995 Heating and Cooling Equipment Standard for Safety. 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 with LGRED systems). The heat pump outdoor units are capable of operating in heating mode from -13°F to +64°F ambient wet bulb without additional low ambient controls.

Frame

Multi F MAX with LGRED 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 with LGRED 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 with LGRED systems use R410A refrigerant. The outdoor units are equipped with a sub-cooled heat exchanger, vapor injection, vapor bypass circuit, 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.

Compressor

Multi F MAX with LGRED condensing units are equipped with one hermetically sealed, digitally controlled, inverter driven R1 scroll compressor that includes Teflon™ coated bearings. The inverter motor is capable of providing a modulation range of 10Hz to 130Hz (cooling) and 10Hz to 150Hz (heating) with control in 1Hz increments. The compressor is uses a factory-charge of Polyvinyl Ether (PVE) oil, and is mounted to avoid the transmission of vibration.

Fan and Motors

The Multi F MAX with LGRED 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 750 rpm. Multi F MAX with LGRED 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 three 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 with LGRED outdoor unit 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, BD unit(s), and indoor units 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.

Figure 15: Multi F MAX with LGRED LMU361HHV ~ LMU480HHV Outdoor Units.



Table 17: Multi F MAX with LGRED Outdoor Unit Specifications.

Model Number	LMU361HHV	LMU421HHV	LMU480HHV
Capacity			
Cooling (Btu/h) (Min.~Rated~ Max.) ¹	10,800~36,000~47,000	10,800~42,000~53,000	10,800~48,000~58,000
Cooling Power Input (kW) (Min.~Rated~ Max.)	0.64~2.48~4.07	0.64~3.04~4.71	0.64~3.66~5.17
Cooling Running Current (A) (Min.~Rated~ Max.)	2.9~11.2~18.5	2.9~13.8~21.3	2.9~16.6~23.4
Heating (Btu/h) (Min.~Rated~ Max.) ¹	12,420~45,000~50,000	12,420~48,000~54,500	12,420~52,500~59,000
Heating Power Input (kW) (Min.~Rated~ Max.)	0.71~3.30~4.31	0.71~3.70~4.70	0.71~4.25~5.09
Heating Running Current (A) (Min.~Rated~ Max.)	3.2~14.9~19.5	3.2~16.8~21.3	3.2~20.0~23.0
Operating Range			
Cooling (°F DB) ²	14 to 118		
Heating (°F WB)	-13 to +64		
Compressor			
Inverter Quantity	R1 Scroll x 1		
Oil / Type	FVC68D		
Fan (Side Discharge)			
Type	Propeller		
Motor Output (W) x Qty.	124.2 x 2		
Motor / Drive	Brushless Digitally Controlled / Direct		
Maximum Air Flow Rate (CFM)	2,119 x 2		
Unit Data			
Refrigerant Type	R410A		
Refrigerant Control / Location	Electronic Expansion Valve / Outdoor Unit		
Minimum ~ Maximum Number Indoor Units / System ³	2~5	2~6	2~8
Max. Number of Branch Distribution Units	2		
Min. ~ Max. Allowable Total Indoor Unit Connected Capacity (Btu/h)	18,000 ~ 48,000	18,000 ~ 56,000	18,000 ~ 65,000
Sound Pressure ±3 dB(A) (Cooling / Heating) ⁴	53 / 55	54 / 56	
Dimensions (W x H x D [inch])	37-13/32 x 54-11/32 x 13		
Net / Shipping Unit Weight (lbs.)	218 / 243		
Power Supply (V, Phase, Hz)	208 / 230V, 1, 60		
Comm. / Conn. (Power) Cable from ODU & BDU / BDU & IDU (No. X AWG) ^{5,6}	4C x 14 / 4C x 14		
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, (1 x 32 x 14) x 2		
Piping			
Liquid Line Connection (in., O.D.) x Qty.	Ø3/8 x 1		
Vapor Line Connection (in., O.D.) x Qty.	Ø3/4 x 1		
Factory Charge oz. of R410A	183.4		
Additional Charging Volume (oz. / ft.)	Main Pipe	0.54	
	Branch Pipe	0.22	
Piping Lengths			
Maximum Total Piping (ft.) ⁷	475.7		
Maximum Piping Length (No Additional Refrigerant [ft.])	49.2 ft. of Main Piping + 131.2 ft. of Branch Piping		
Maximum Main Pipe Length (ODU to BDU [ft.])	180.4		
Total Branch Piping (BDU to all IDU [ft.])	295.3		
Maximum Branch Pipe Length (Length between each BDU & IDU [ft.])	49.2		
Maximum Outdoor Unit to IDU Pipe Length (ft.)	229.6		
Maximum Elevation between ODU and IDU (ft.)	98.4		
Maximum Elevation between Indoor Unit and Indoor Unit (ft.)	49.2		
Maximum Elevation between BDU and IDU (ft.)	32.8		
Maximum Elevation between BDU and BDU (ft.)	49.2		

¹Capacity is rated with non-ducted IDUs, 0 ft. above sea level, with a 0 ft. level difference between ODU and IDUs, and the following refrigerant pipe lengths:

LMU361HHV: 16.4 ft. Main + (16.4 ft. Branch x 5) = 98.4 ft.

LMU421HHV: 16.4 ft. Main + (16.4 ft. Branch x 6) = 114.8 ft.

LMU480HHV: 16.4 ft. Main + (16.4 ft. Branch x 8) = 147.6 ft.

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).

²Cooling operation range with Low Ambient Wind Baffle Kit (sold separately) is -4°F to +118°F.

³At 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 must be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX

with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.com.

⁴Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745. These values can increase due to ambient conditions during operation.

⁵Power 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 30.

⁶All communications / connection (power) cable must be a minimum of 14 AWG, 4-conductor from the outdoor unit to the BD unit, and 14 AWG, 4-conductor 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 30.

⁷Piping lengths are equivalent.

MULTI F MAX WITH LGRED

MULTI F MAX WITH LGRED°

General Data / Electrical Data

General Data

Table 18: LMU361HHV 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)
LMU361HHV	Non-Ducted Indoor Units	36,000	14.5	22.0	45,000	4.00	11.5	29,600	2.81
	Ducted Indoor Units	36,000	13.5	19.0	45,000	3.57	10.5	29,600	2.66
	Mixed Non-Ducted and Ducted Indoor Units	36,000	14.0	20.5	45,000	3.77	11.0	29,600	2.73

Table 19: LMU421HHV 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)
LMU421HHV	Non-Ducted Indoor Units	42,000	13.8	21.5	48,000	3.80	11.5	31,600	2.72
	Ducted Indoor Units	42,000	13.1	19.0	48,000	3.52	10.5	31,600	2.60
	Mixed Non-Ducted and Ducted Indoor Units	42,000	13.5	20.3	48,000	3.65	11.0	31,600	2.66

Table 20: LMU480HHV 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)
LMU480HHV	Non-Ducted Indoor Units	48,000	13.1	20.5	52,500	3.62	11.0	35,000	2.63
	Ducted Indoor Units	48,000	12.6	18.5	52,500	3.45	10.5	35,000	2.55
	Mixed Non-Ducted and Ducted Indoor Units	48,000	12.9	19.5	52,500	3.53	10.8	35,000	2.59

¹Capacity is rated 0 ft. above sea level, with a 0 ft. level difference between ODU and IDUs, and the following refrigerant pipe lengths:

LMU361HHV: 16.4 ft. Main + (16.4 ft. Branch x 5) = 98.4 ft.

LMU421HHV: 16.4 ft. Main + (16.4 ft. Branch x 6) = 114.8 ft.

LMU480HHV: 16.4 ft. Main + (16.4 ft. Branch x 8) = 147.6 ft.

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 must be connected. For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.com.

Electrical Data

Table 21: Electrical Data.

Nominal Tons	Unit Model No.	Phase	Hertz	Voltage	Voltage Range (Min. to Max.)	MCA	MOP	Compressor Quantity	Compressor Motor RLA	Outdoor Unit Fan Motor(s)			Indoor Unit Fan Motor
										kW x Qty.	FLA x Qty.	FLA	
3.0	LMU361HHV	1	60	208 -230	187 - 253	32.7	40	1	22.0	0.12 x 2	1.60 x 2	3.6	4.2
3.5	LMU421HHV					32.7	40	1	22.0	0.12 x 2	1.60 x 2	4.2	
4.0	LMU480HHV					32.7	40	1	22.0	0.12 x 2	1.60 x 2	4.9	

Voltage tolerance is ±10%.

Maximum allowable voltage unbalance is 2%.

MCA = Minimum Circuit Ampacity.

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

RLA = Rated Load Amps.

FLA = Full Load Amps.

Indoor Fan Motor (FLA) is based on the max. combination of IDUs.

Table 22: Functions, Controls, Options, and Accessories.

Functions		LMU361HHV	LMU421HHV	LMU480HHV
Reliability	Defrost / Deicing	√	√	√
	High Pressure Switch	X	X	X
	Low Pressure Switch	X	X	X
	Phase Protection	X	X	X
	Restart Delay (Three [3] Minutes)	√	√	√
	Self Diagnosis	√	√	√
	Soft Start	√	√	√
	Test Function	√	√	√
Convenience	Night Silent Operation	√	√	√
	Wiring Error Check	√	√	√
	Peak Control	√	√	√
	Mode Lock	√	√	√
	Forced Cooling Operation (Outdoor Unit)	√	√	√
Central Controllers	PI-485	PMNFP14A1	PMNFP14A1	PMNFP14A1
Integration Solution	MultiSITE Communications Manager	PBACNBTR0A	PBACNBTR0A	PBACNBTR0A
Building Network Unit	AC Smart 5	PACS5A000	PACS5A000	PACS5A000
	ACP 5	PACP5A000	PACP5A000	PACP5A000
Installation	Branch Distribution Units	PMBD3620, PMBD3630, PMBD3640, PMBD3641	PMBD3620, PMBD3630, PMBD3640, PMBD3641	PMBD3620, PMBD3630, PMBD3640, PMBD3641
	Y-Branch	PMBL5620	PMBL5620	PMBL5620
	Header Branch	X	X	X
	Air Guide	X	X	X
Other	Power Distribution Indication (PDI) Premium	PQNUD1S41	PQNUD1S41	PQNUD1S41
	Dry Contact	X	X	X
	Low Ambient Wind Baffle Kit	ZLABGP04A x 2 (Logical Operation)	ZLABGP04A x 2 (Logical Operation)	ZLABGP04A x 2 (Logical Operation)
	Factory-Supplied Drain Pan Heater	√	√	√
	Compatibility w / prior generation of Multi F	√	√	√
	Computer LG Monitoring View (LGMV)	PRCTILO	PRCTILO	PRCTILO
	Mobile LGMV for Android Smartphones / Tablets	PLGMVW100	PLGMVW100	PLGMVW100
	Mobile LGMV for iOS Tablet	PLGMVW100	PLGMVW100	PLGMVW100

√ = Standard feature

o = Optional accessory (must be purchased separately)

X = Not available

Multi F and Multi F MAX with LGRED Heat Pump Outdoor Unit Engineering Manual

Multi F and Multi F MAX with LGRED Heat Pump Outdoor Unit Engineering Manual

Multi F and Multi F MAX with LGRED Heat Pump Outdoor Unit Engineering Manual

Multi F and Multi F MAX with LGRED Heat Pump Outdoor Unit Engineering Manual



Figure 17: LMU361HHV, LMU421HHV, and LMU480HHV Center of Gravity and Corner Weight Diagram.

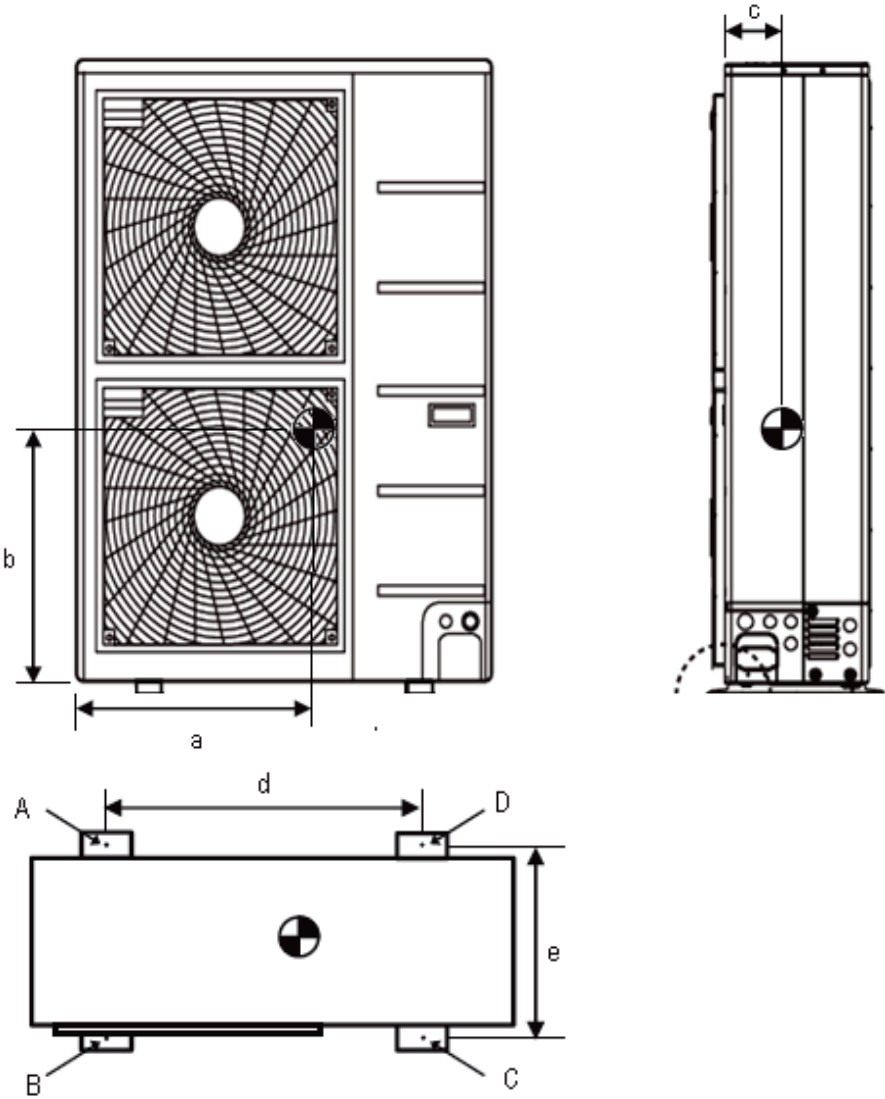


Table 23: LMU361HHV, LMU421HHV, and LMU480HHV Center of Gravity and Corner Weight Dimensions.

Model No.	Frame	Weight (lb.)		Center of Gravity (in.)			Leg (in.)		Corner Weight (lb.)			
		Shipping	Net	a	b	c	d	e	A	B	C	D
LMU361HHV	U60A-B	242.5	218.3	27-7/32	21-15/32	6-5/8	24-13/32	14-3/16	17.9	20.4	96.0	84.0
LMU421HHV	U60A-B	242.5	218.3	27-7/32	21-15/32	6-5/8	24-13/32	14-3/16	17.9	20.4	96.0	84.0
LMU480HHV	U60A-B	242.5	218.3	27-7/32	21-15/32	6-5/8	24-13/32	14-3/16	17.9	20.4	96.0	84.0

MULTI F MAX WITH LGRED

MULTI F MAX WITH LGRED°

Wiring Diagram

Figure 18: LMU361HHV, LMU421HHV, and LMU480HHV Wiring Diagram.

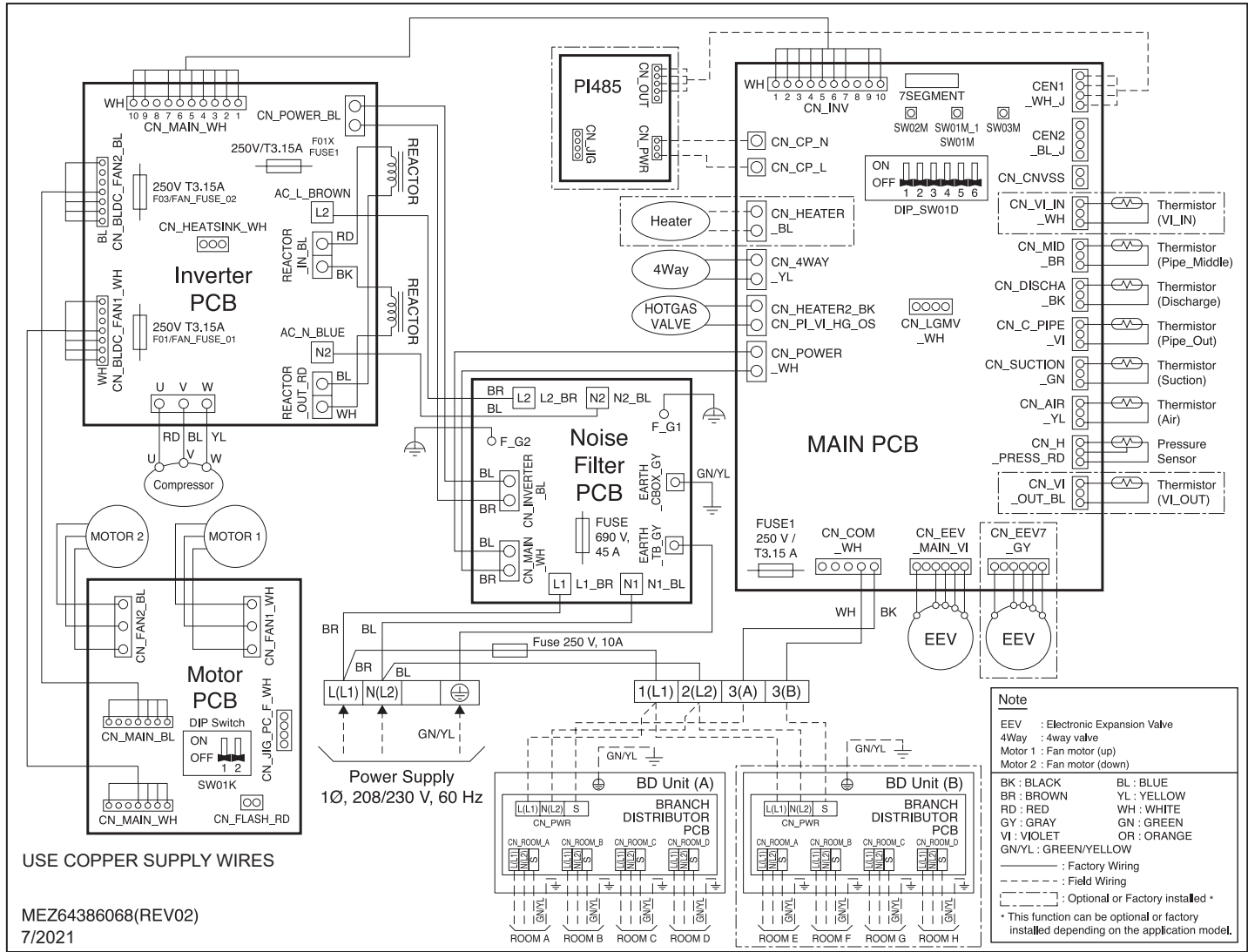
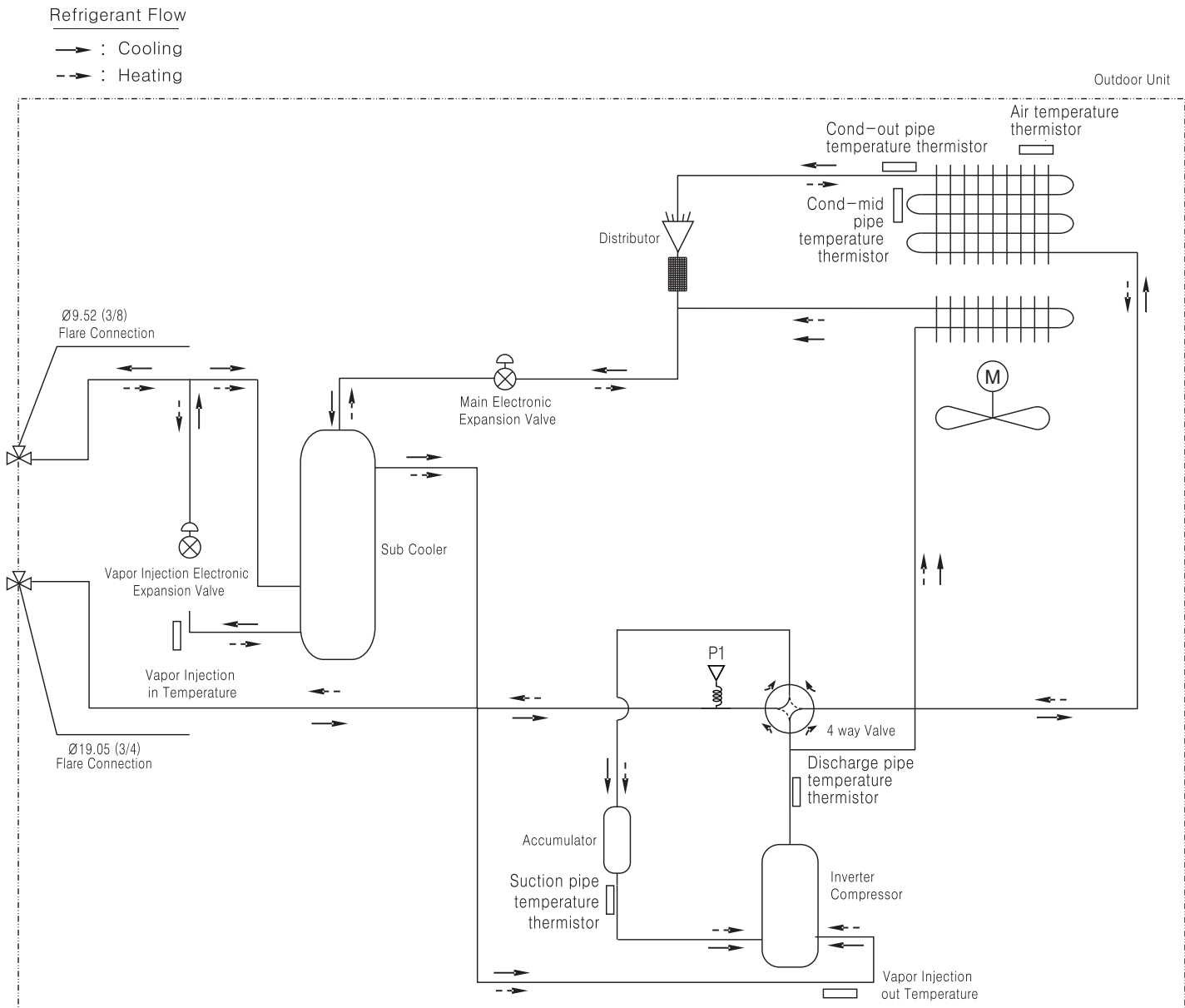


Figure 19: LMU361HHV, LMU421HHV, and LMU480HHV Refrigerant Flow Diagram.



Multi F MAX with LGRED Product Data

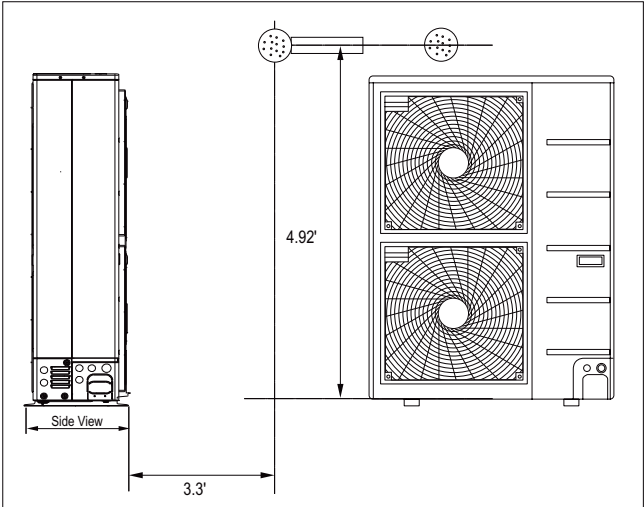
Table 24: LMU361HHV, LMU421HHV, and LMU480HHV PCB Connection Details.

Description	PCB Connection
Discharge Pipe Temperature Thermistor	CN_DISCHA_BK
Suction Pipe Temperature Thermistor	CN_SUCTION_GN
Condenser Outlet Pipe Temperature Thermistor	CN_C_PIPE_VI
Air Temperature Thermistor	CN_AIR_YL
Condenser Middle Pipe Temperature Thermistor	CN_MID_BR
Vapor Injection Inlet Temperature Thermistor	CN_VI_IN_WH
Vapor Injection Outlet Temperature Thermistor	CN_VI_OUT_BL
Pressure Sensor	CN_H_PRESS_RD

MULTI F MAX WITH LGRED

Acoustic Data

Figure 20: Acoustic Measurement Location.



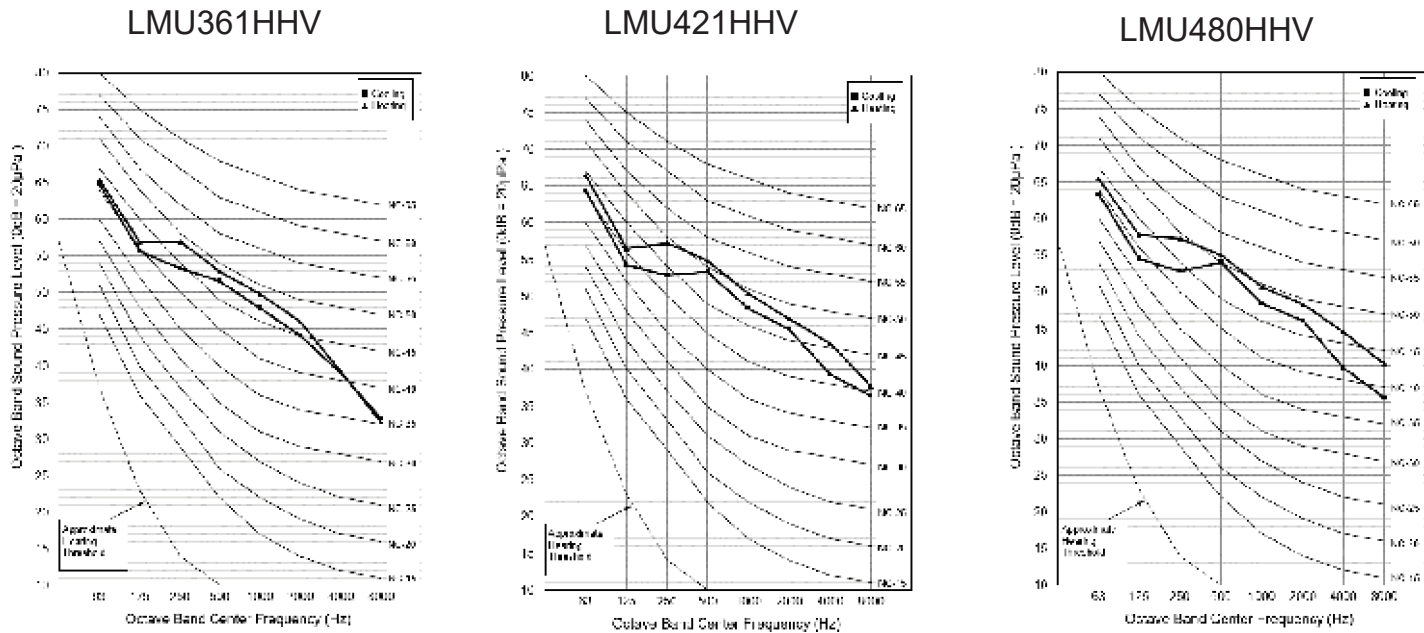
Sound Pressure Levels

- Measurement taken 4.92' above finished floor, and at a distance of 3.3' from face of fan discharge.
- 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 25: Sound Pressure Levels (dB[A]).

Model No.	Sound Pressure Levels (dB[A])	
	Cooling (High)	Heating (High)
LMU361HHV	53	55
LMU421HHV	54	56
LMU480HHV	54	56

Figure 21: Sound Pressure Level Diagrams.



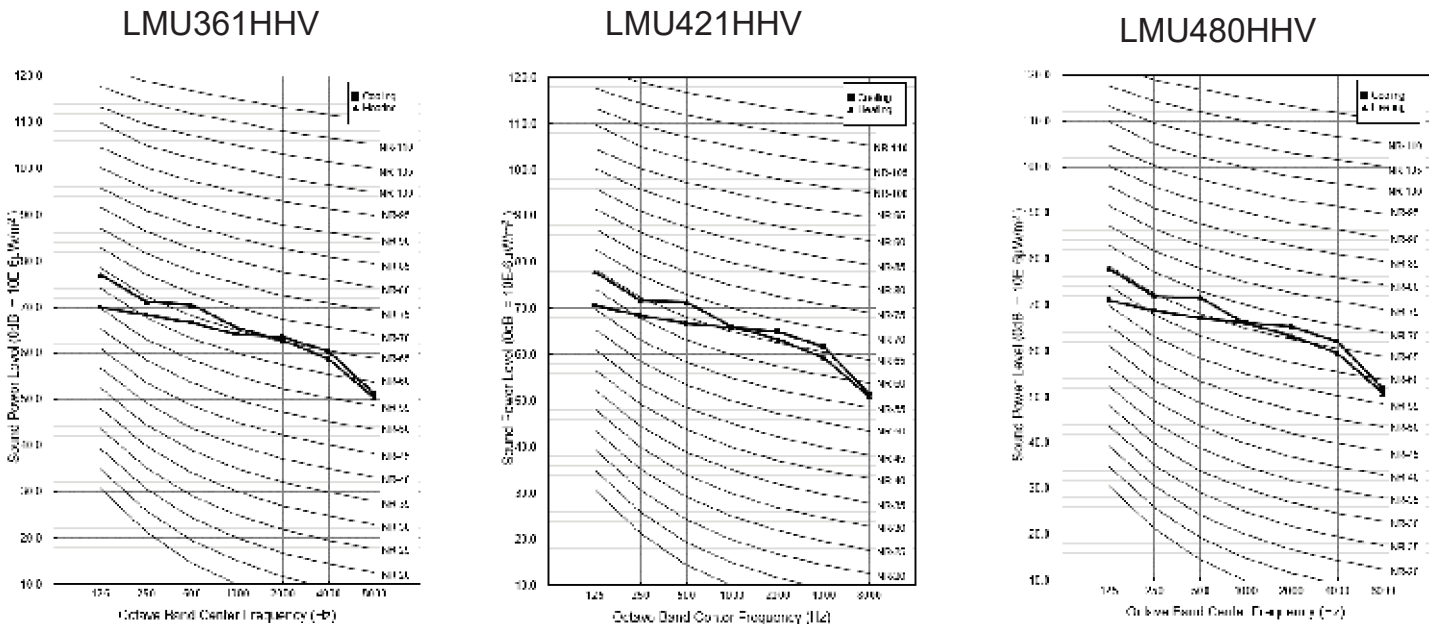
Sound Power Levels

- Data is valid under diffuse field conditions.
- Data is valid under nominal operating conditions.
- Sound power level is measured using rated conditions, and tested in a reverberation room per ISO 3741 standards.
- 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.
- Reference acoustic intensity: 0dB = 10E-6µW/m²

Table 26: Sound Power Levels (dB[A]).

Model No.	Sound Power Levels (dB[A])	
	Cooling (High)	Heating (High)
LMU361HHV	71	72
LMU421HHV	72	73
LMU480HHV	72	73

Figure 22: Sound Power Level Diagrams.

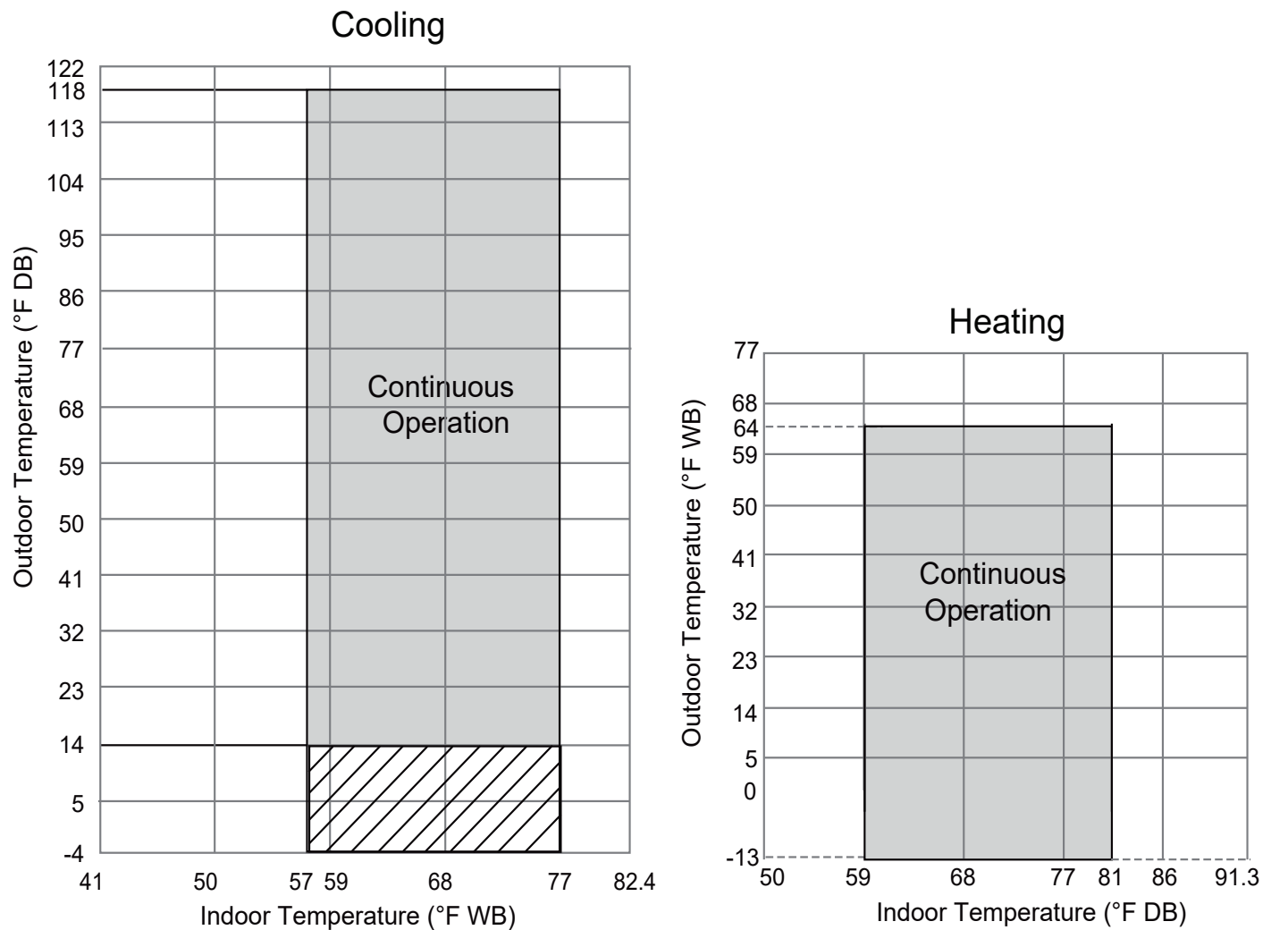


MULTI F MAX WITH LGRED

MULTI F MAX WITH LGRED°

Operation Range

Figure 23: Multi F MAX with LGRED Cooling and Heating Operation Ranges.



Note:
Cooling range with Low Ambient Baffle Kit (sold separately) is -4°F to +118°F.

MULTI F MAX WITH LGRED BRANCH DISTRIBUTION (BD) UNIT DATA

Mechanical Specifications on page 40

General Data on page 41

Dimensions on page 42

Wiring Diagram on page 43

Refrigerant Flow Diagram on page 42

Y-Branch Accessory on page 45

Branch Distribution Unit Orientation on page 46

Mechanical Specifications

Branch Distribution Unit

General

Branch distribution units are designed for use with LG Multi F MAX with LGRED (LMU361HHV, LMU421HHV, and LMU480HHV) 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 either 24,000 Btu/h or 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 14 AWG from the outdoor unit to the branch distribution unit, and 14 AWG from the branch distribution 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 24: PMBD3620 Two-Port Branch Distribution Unit.



Figure 25: PMBD3630 Three-Port Branch Distribution Unit.



Figure 26: PMBD3640 and PMBD3641 Four-Port Branch Distribution Unit.



Table 27: Multi F MAX with LGRED Branch Distribution 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	Ports A, B, C: 24,000; Port D: 36,000
Connected Indoor Unit Capacity (Btu/h)	7,000 ~ 24,000	7,000 ~ 24,000	7,000 ~ 24,000	Ports A, B, C: 7,000 ~ 24,000; Port D: 24,000 or 36,000
Max. Nominal Capacity / Branch Distribution Unit (Btu/h)	48,000	72,000	73,000	73,000
Operation Temperature Range (°F DB)	0 ~ 150	0 ~ 150	0 ~ 150	0 ~ 150
Maximum Humidity	80%	80%	80%	80%
Unit Data				
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	17-3/32 x 6-13/32 x 10-23/32	17-3/32 x 6-13/32 x 10-23/32	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
Communication / Connection (Power) Cables³				
From Outdoor Unit to Branch Distribution Unit (Qty. x AWG) ³	4C x 14	4C x 14	4C x 14	4C x 14
From Branch Distribution Unit to Indoor Unit (Qty. x AWG) ³	4C x 14	4C x 14	4C x 14	4C x 14
Piping Connections				
Outdoor Unit to Branch Distribution Unit	Liquid (in., OD)	Ø3/8	Ø3/8	Ø3/8
	Vapor (in., OD)	Ø3/4	Ø3/4	Ø3/4
Branch Distribution 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
Piping Lengths				
Maximum Total System Piping (ft.) ⁴	475.7	475.7	475.7	475.7
Maximum Main Pipe Length (Outdoor Unit to Branch Distribution Units [ft.])	180.4	180.4	180.4	180.4
Total Branch Piping (Branch Distribution Units to Indoor Units [ft.])	295.3	295.3	295.3	295.3
Maximum Branch Pipe Length Between Branch Distribution 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. 49.2 ft. of Main Piping + 131.2 ft. of Branch Piping)	180.4	180.4	180.4	180.4
Maximum Elevation between Branch Distribution Unit and Indoor Unit (ft.)	32.8	32.8	32.8	32.8
Maximum Elevation between Branch Distribution Unit and Branch Distribution 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 communication / power (connection) cable must be a minimum of 14 AWG, 4-conductor from the outdoor unit to the branch distribution unit (Multi F MAX with LGRED systems only), and 14 AWG, 4-conductor from the branch distribution 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.

Dimensions

Figure 27: PMBD3620, PMBD3630, PMBD3640, and PMBD3641 External Dimensions.

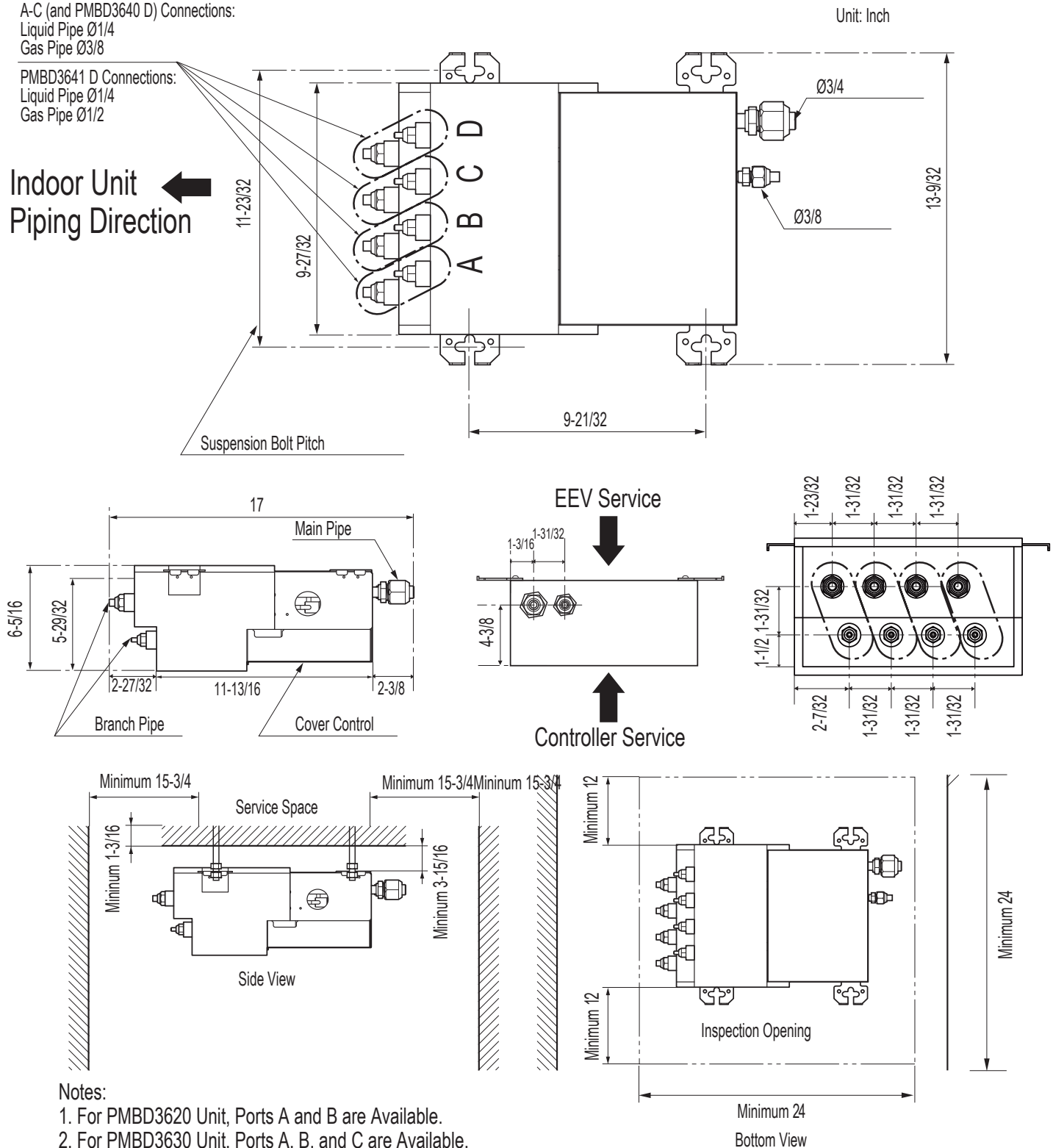
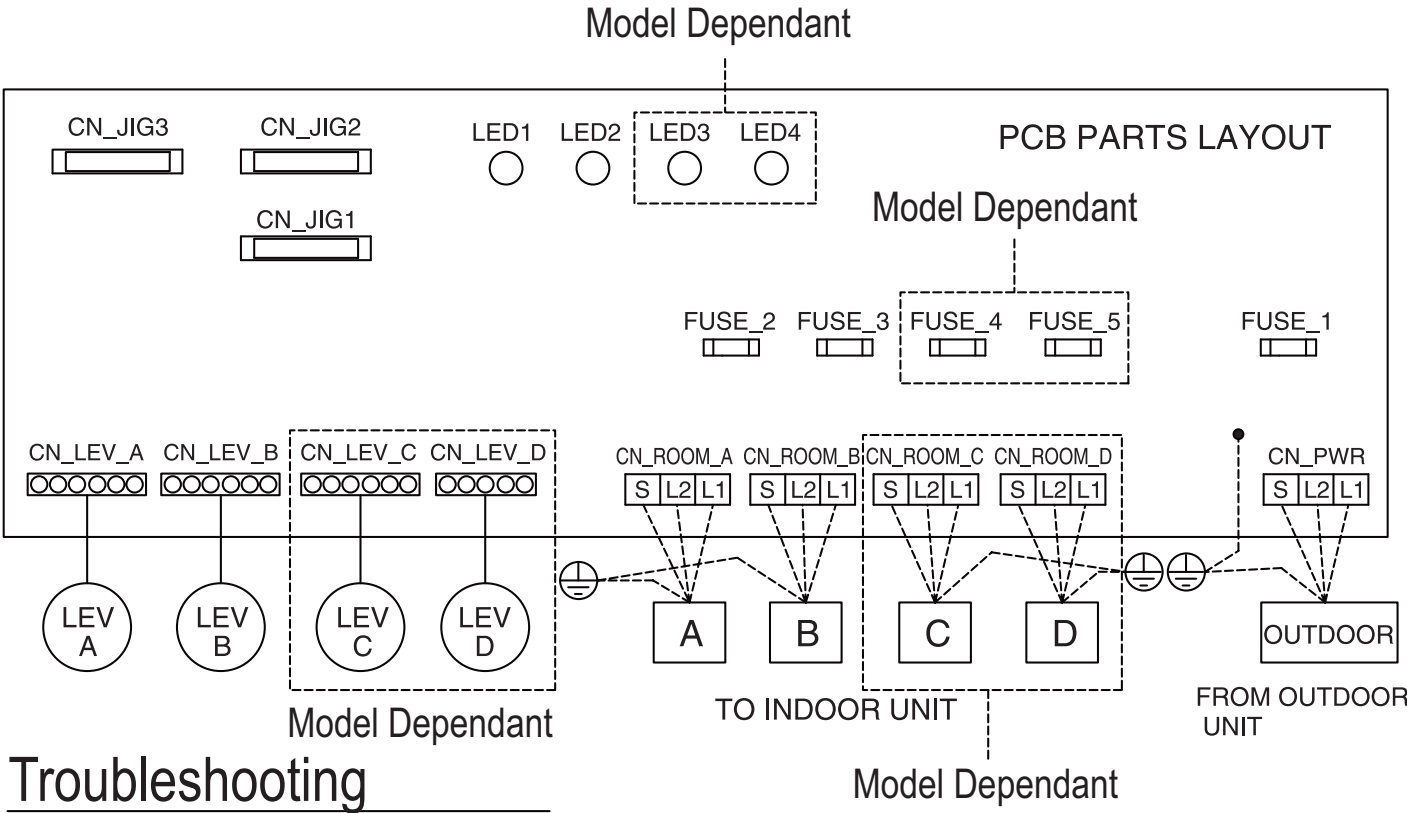


Figure 28: PMBD3620, PMBD3630, PMBD3640, PMBD3641 Wiring Diagram.

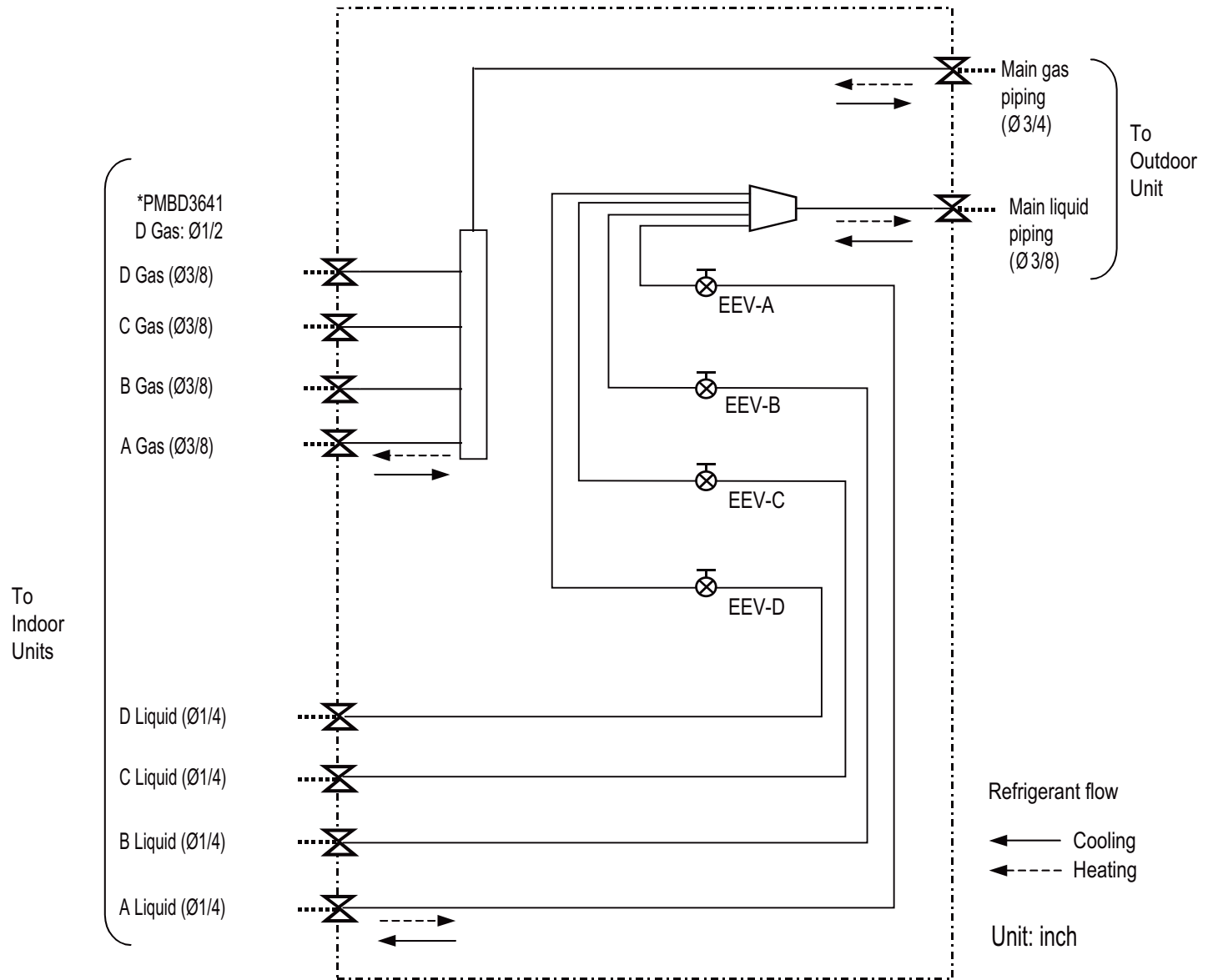


LED	DIAGNOSIS
	NORMAL
	ABNORMALITY -->CHECK BRANCH DISTRIBUTOR UNIT
	ABNORMALITY -->CHECK INDOOR OR OUTDOOR UNIT CHECK CONNECTING CABLE

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".

Refrigerant Flow Diagram

Figure 29: PMBD3620, PMBD3630, PMBD3640, PMBD3641 Refrigerant Flow Diagram.



Note:

1. Flare connections for field piping installation.
2. Match the branch distribution 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 branch distribution unit supplied with "A, B".
PMBD3630 branch distribution unit supplied with "A, B, C".
PMBD3640 and PMBD3641 branch distribution units supplied with "A, B, C, D".

Multi F MAX with LGRED Y-Branch Kit PMBL5620

The LG-supplied Y-Branch kit PMBL5620 MUST be used when installing two (2) branch distribution units in parallel on one (1) Multi F MAX with LGRED system. ⚠ Field-supplied fittings are not permitted. Each Y-Branch kit includes 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 ±3° of plumb. When installed horizontally, position the Y-branch so the take-off leg is level and shares the same horizontal plane as the straight-through leg ±5° rotation.

Y-branches must be properly installed following instructions in the applicable LG manual. Y-branches must 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 must 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.

Note:

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

Figure 32: Horizontal Configuration End View.

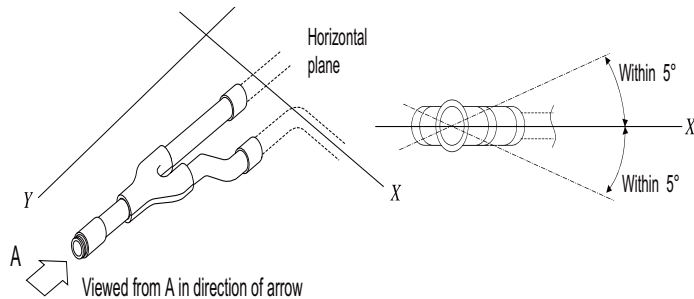


Figure 30: Y-Branch Port Identifier Diagram.

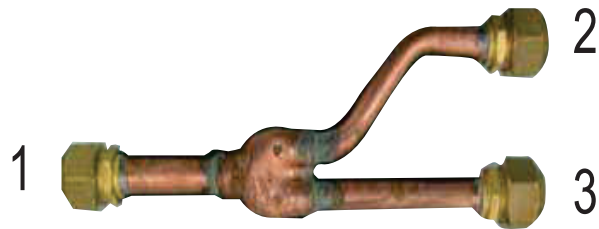
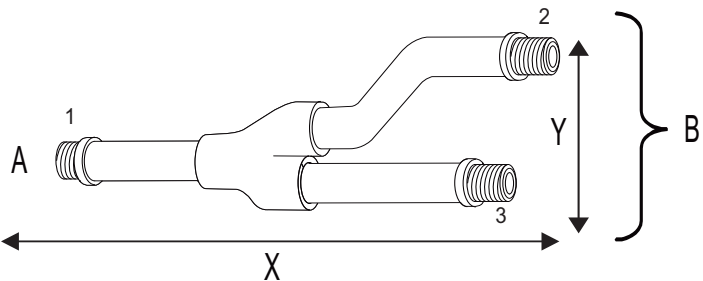


Figure 31: Y-Branch Dimensions Diagram.

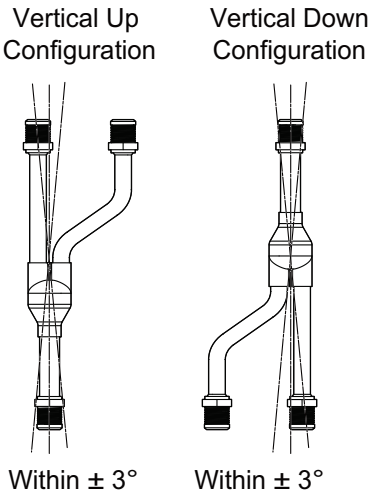


A = To Outdoor Unit
B = To Branch Distribution Unit

Table 28: Multi F MAX with LGRED 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		3.24
		Vapor		3.02

Figure 33: Y-branch Installation Alignment Specification.



Branch Distribution Unit Orientation

Multi F MAX with LGRED branch distribution units can be installed in a multitude of options to fit various building configurations and job or application requirements. Multi F MAX with LGRED branch distribution units include electronic expansion valves that properly seat only if the branch distribution unit is installed in an acceptable orientation. Installations with improper branch distribution 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 34: Acceptable Branch Distribution Unit Ceiling Mount Orientations.

Ceiling Mounting Options

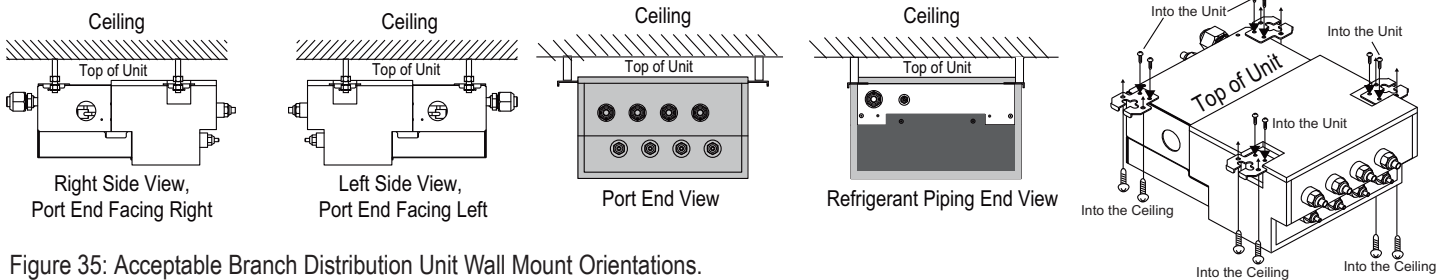


Figure 35: Acceptable Branch Distribution Unit Wall Mount Orientations.

Wall Mounting Options

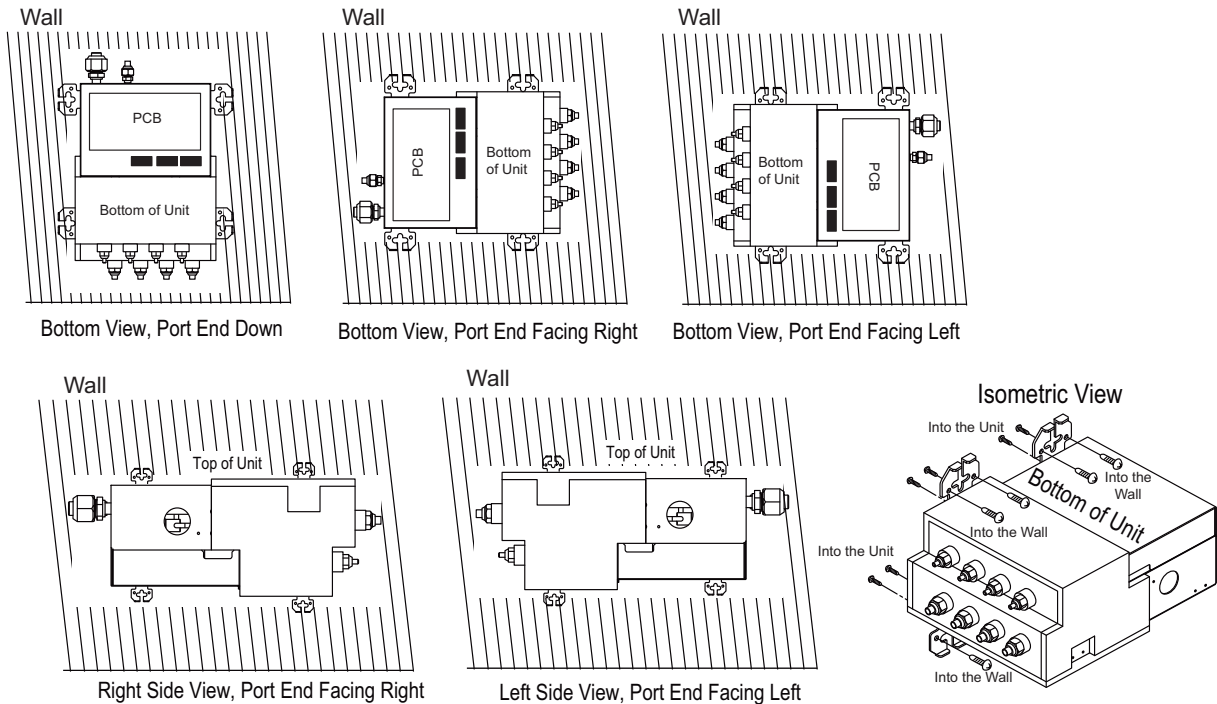
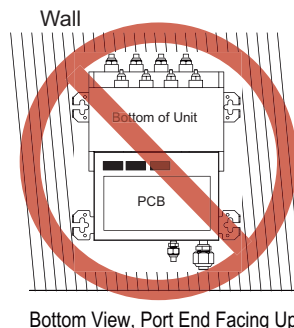


Figure 36: Unacceptable Branch Distribution Unit Orientation.



ELECTRICAL CONNECTIONS

General Information on page 48

Wiring Specifications on page 48

Systems for Multi F / Multi F MAX with LGRED on page 50

Indoor Units / Controllers on page 54

⚠ WARNING

- All power (line voltage) wiring and communication cable installation must be performed by trained service providers working in accordance with all local, state, and National Electrical Code (NEC) / UL 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.
- Be sure that main power to the unit is completely off before proceeding. Follow all safety and warning information. Failure to do so may cause electric shock and bodily injury.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously (circuit breaker must be resistant to electromagnetic currents). Be sure that the circuit breaker or some other emergency power cutoff device is in place before any power wiring is done to the system. Failure to do so may cause bodily injury or death.
- ⓧ Never touch any power lines or live cables before all power is cutoff to the system. To do so, may cause bodily injury or death.
- Power wiring and communication cable sizes must comply with all applicable federal, state, and local codes. Undersized wiring may lead to unacceptable voltage at the unit and may cause a fire, which may cause bodily injury or death.
- Properly ground the outdoor unit, 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, which may cause bodily 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 NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in electric shock, physical injury or death.
- ⓧ 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. Failure to properly provide a NEC-approved earth ground can result in electric shock, fire, physical injury or death.

Note:

- Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.
- Properly ground the outdoor unit, indoor units, and branch distribution units. Ground wiring must always be installed by a trained technician. Improperly grounded wire can cause communication problems from electrical noise, and motor current leakage.
- Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in equipment malfunction and property damage.
- ⓧ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a NEC-approved earth ground can result in property damage and equipment malfunction.
- ⓧ 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.

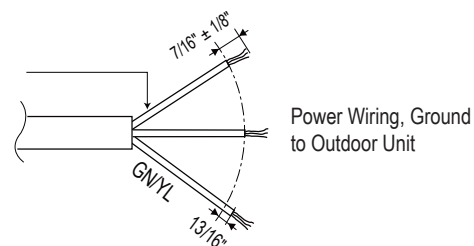
Power Supply / Power Wiring Specifications

- Multi F and Multi F MAX with LGRED systems operate at 1Ø, 208-230V, 60Hz, and power is wired to the outdoor unit only. The outdoor unit will supply power to the indoor units and the branch distribution units (Multi F MAX with LGRED systems only) through the communication / connection (power) cable.
- Power supply to the outdoor unit must be selected based on NEC and local codes. Maximum allowable voltage fluctuation $\pm 10\%$ or nameplate rated value.
- Power wiring to the outdoor unit(s) must be solid or stranded, and must comply with all local and national electrical codes.
- Properly ground the outdoor unit and indoor unit per NEC and local codes.
- Ground wire must be longer than the common power / communication wires.
- Connect the wiring firmly so the wires cannot be easily pulled out.
- Refer to the inside of the chassis cover or control cover for circuit and terminal block diagrams.
- Always match color codes of each wire and follow wiring diagram.
- ⓧ Do not install power wiring to the outdoor unit and the communication / connection (power) cable to the indoor unit in the same conduit. Use separate conduits.

⚠ WARNING

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

Figure 37: Multi F / Multi F MAX with LGRED Outdoor Unit Power Wiring.



Communication / Connection (Power) Cable Specifications

- 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 must be completed without splices.

Multi F with LGRED Systems:

- Communication / connection (power) cable from the outdoor unit to the indoor unit must use a minimum of 14 AWG, four (4) conductor, 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.
- Use of 14 AWG, four (4) conductor, stranded, shielded or unshielded wire is allowed for lengths up to the published maximum pipe length, plus recommended slack at both ends.

Multi F MAX with LGRED Systems:

- All communication / connection (power) cable from the outdoor unit to the branch distribution unit(s) must be a minimum of 14 AWG, four (4) conductor, 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.
- Communication / connection (power) cable from the branch distribution unit(s) to the indoor units must use a minimum of 14 AWG, four (4) conductor, 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.
- Use of 14 AWG, four (4) conductor, stranded, shielded or unshielded wire is allowed for lengths up to the published maximum pipe length, plus recommended slack at both ends.

Note:

- Use a conduit for the communications / connection (power) cable from the outdoor unit to the indoor units and branch distribution unit(s). Electrical interference may cause product malfunction.
- ⚠ Never ground the shield of the communications cable to the indoor unit frame or other grounded entities of the building. Ground the communications cable shield only at the outdoor unit. Improperly grounding this cable can cause communications errors.
- The communications / connection (power) cable from the outdoor unit to the indoor units / branch distribution unit(s) must be separated and isolated from power wiring to the outdoor unit, computers, radio and television broadcasting facilities, as well as medical imaging equipment. Electrical interference may cause product malfunction.

Figure 40: Typical Multi F with LGRED Outdoor Unit to Indoor Unit, and Multi F MAX with LGRED Branch Distribution Unit to Indoor Unit Wiring Diagram.

Power Wiring, Ground, Communication Cable From Outdoor Unit To Indoor Unit or from the Outdoor Unit to the Branch Distribution Unit

GN/YL = (Ground, Yellow)

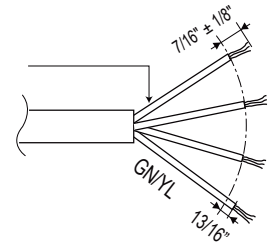


Figure 38: Typical Multi F with LGRED System General Power / Communications System Schematic.

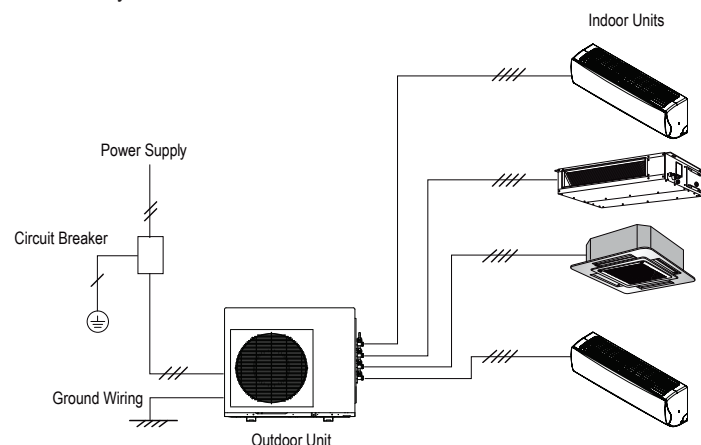
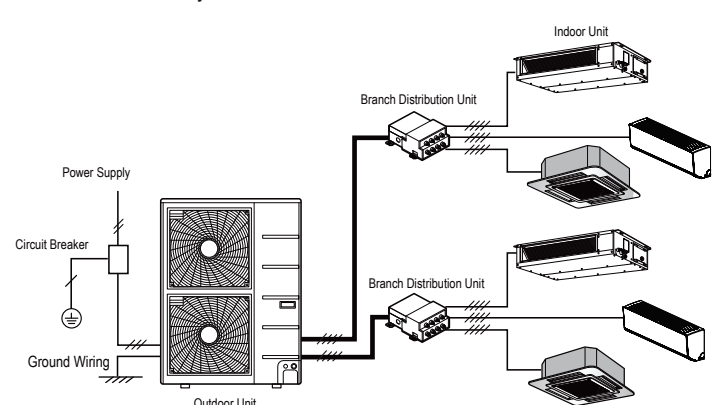


Figure 39: Typical Multi F MAX with LGRED System General Power / Communications System Schematic.

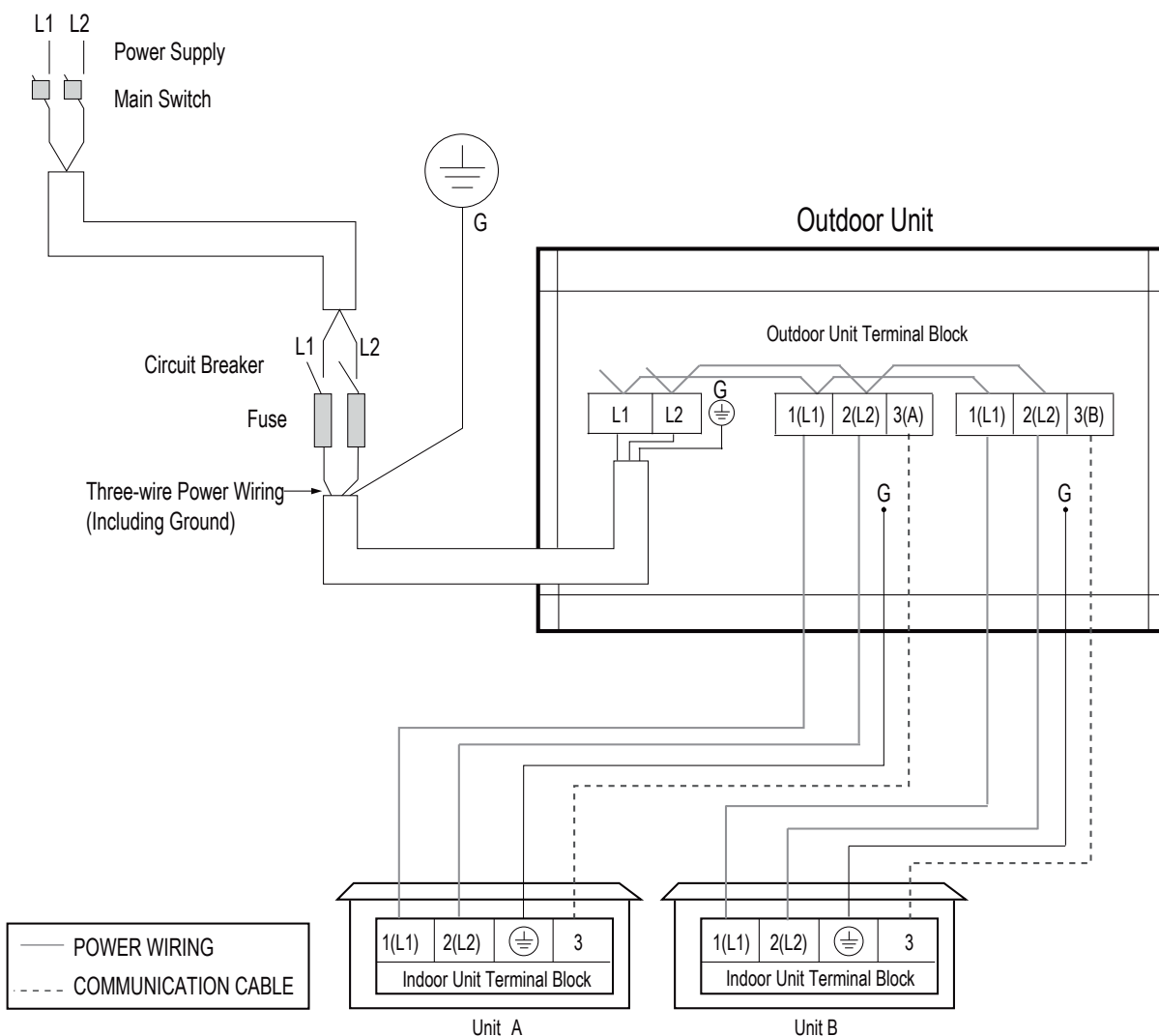


ELECTRICAL CONNECTIONS

Systems for Multi F with LGRED

MULTI F WITH LGRED°
MULTI F MAX

Figure 41: Multi F with LGRED LMU180HHV System Power Wiring and Communications Cable Connections.



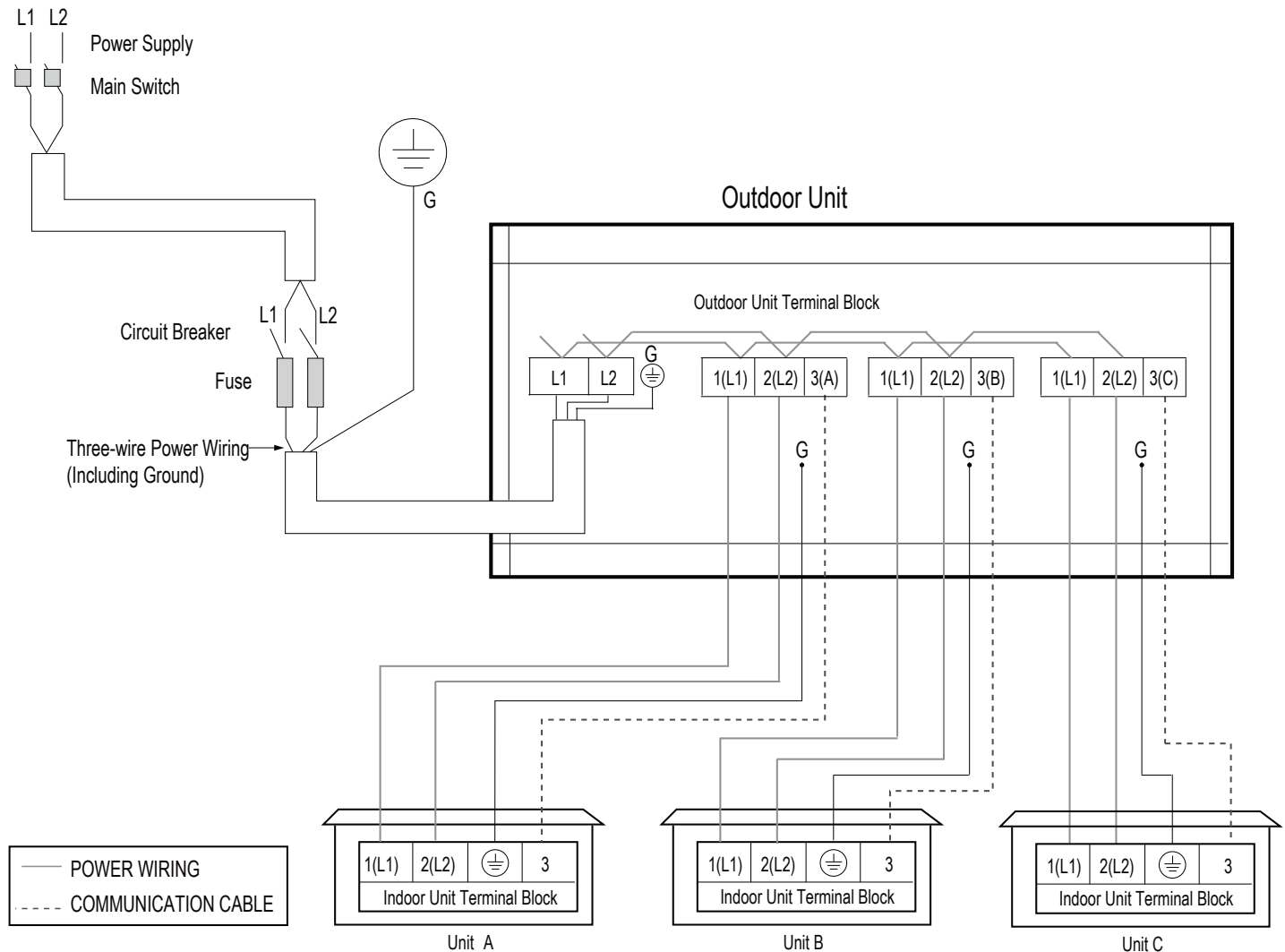
⚠ WARNING

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. 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. There is a risk of fire, electric shock, explosion, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. There is a risk of fire, electric shock, explosion, physical injury or death.

Note:

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- 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.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components may result in property damage and equipment malfunction.
- Maintain polarity throughout the communication network. The system will malfunction if not properly wired.

Figure 42: Multi F with LGRED LMU240HHV System Power Wiring and Communications Cable Connections.



⚠ WARNING

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. 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. There is a risk of fire, electric shock, explosion, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. There is a risk of fire, electric shock, explosion, physical injury or death.

Note:

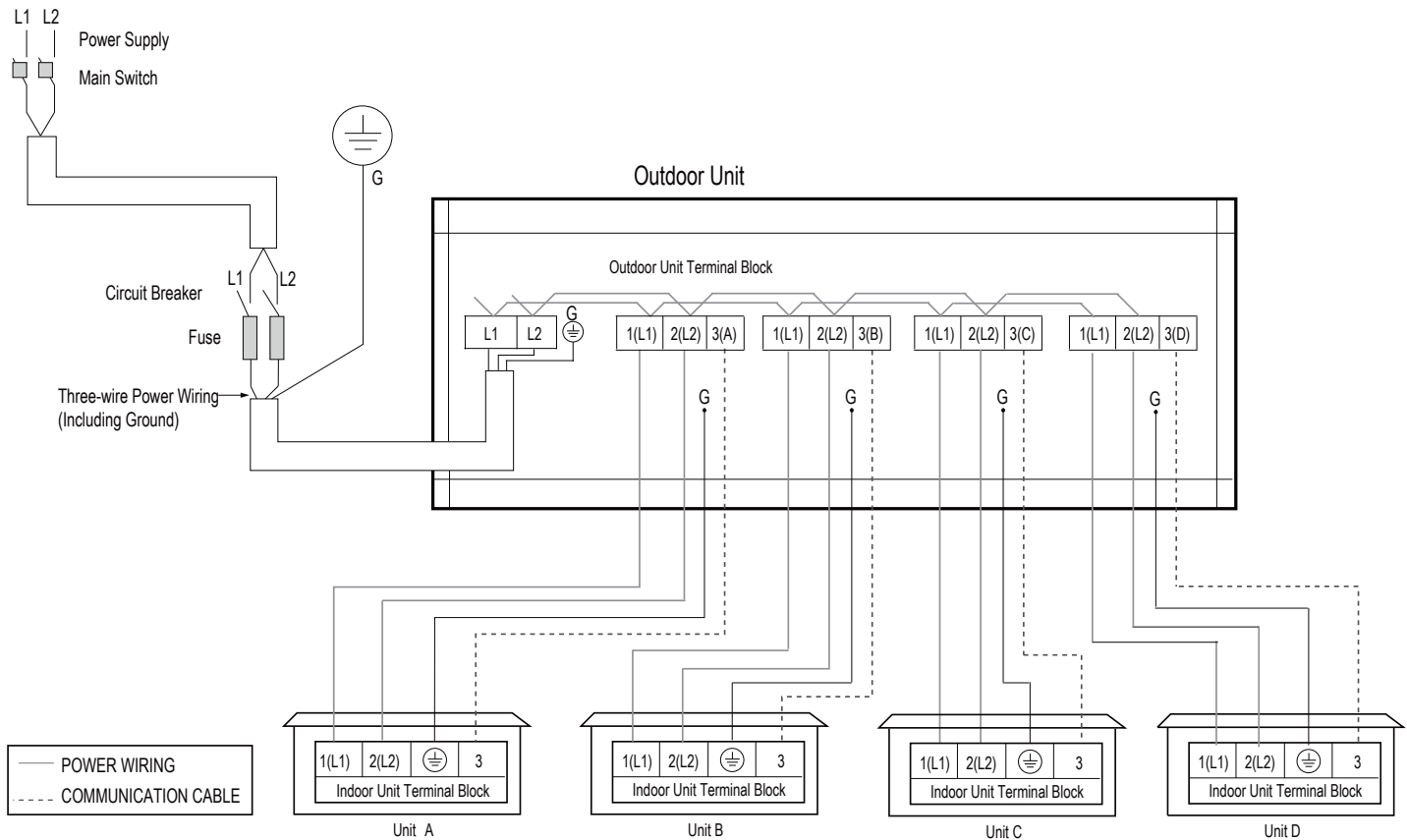
- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- Ground wiring is required to prevent communication problems from electrical noise, and motor current leakage. Failure to provide proper ground wiring can result in property damage and equipment malfunction.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components may result in property damage and equipment malfunction.
- Maintain polarity throughout the communication network. The system will malfunction if not properly wired.

ELECTRICAL CONNECTIONS

Systems for Multi F with LGRED

MULTI F WITH LGRED[®]
MULTI F MAX

Figure 43: Multi F with LGRED LMU300HHV System Power Wiring and Communications Cable Connections.



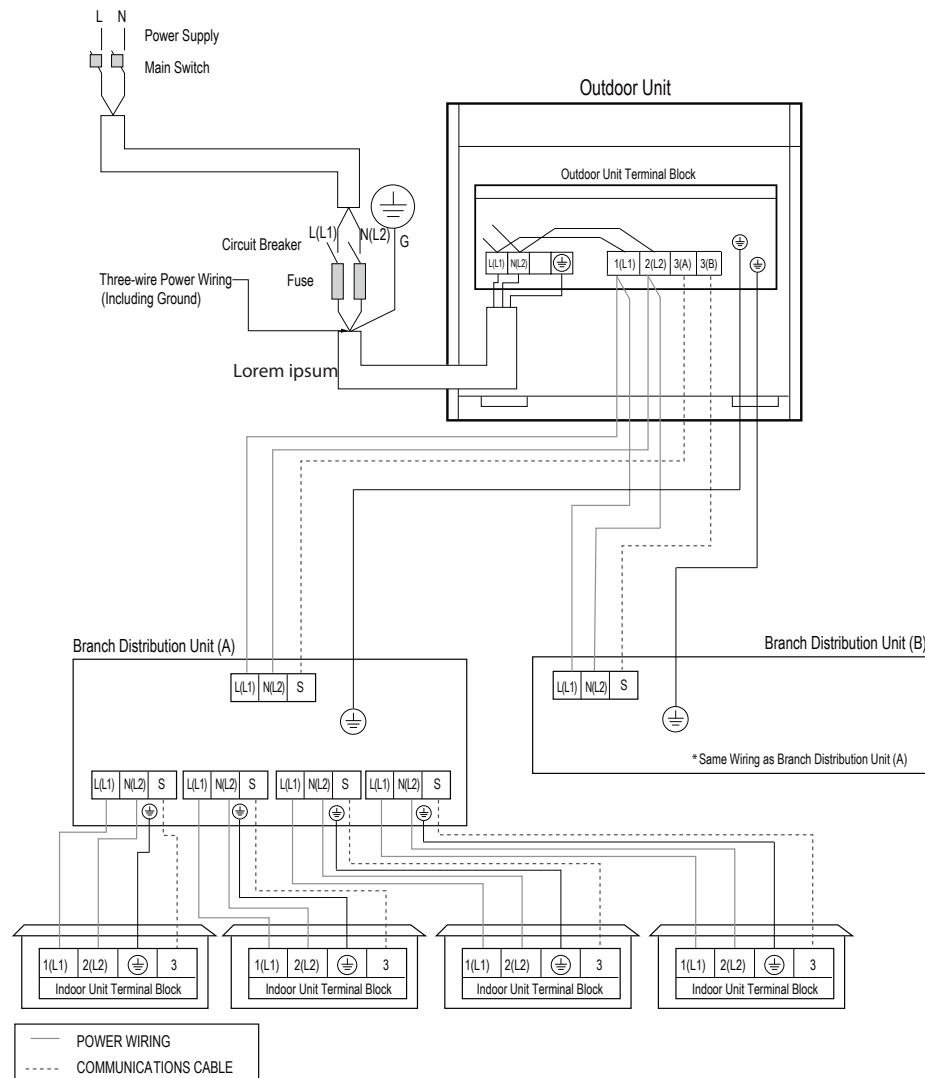
⚠ WARNING

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. 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. There is a risk of fire, electric shock, explosion, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. There is a risk of fire, electric shock, explosion, physical injury or death.

Note:

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- 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.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components may result in property damage and equipment malfunction.
- Maintain polarity throughout the communication network. The system will malfunction if not properly wired.

Figure 44: Multi F MAX with LGRED LMU361HHV, LMU421HHV, and LMU480HHV System Power Wiring and Communications Cable Connections.



⚠ WARNING

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. 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. There is a risk of fire, electric shock, explosion, physical injury or death.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. There is a risk of fire, electric shock, explosion, physical injury or death.

Note:

- All field-supplied wiring, components, sizes, and materials must comply with all applicable national, state, and local codes and requirements. Failure to install proper electrical components can result in property damage and equipment malfunction.
- 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.
- Install a main shutoff switch or circuit breaker that interrupts all power sources simultaneously. Failure to install proper electric components may result in property damage and equipment malfunction.
- Maintain polarity throughout the communication network. The system will malfunction if not properly wired.

ELECTRICAL CONNECTIONS

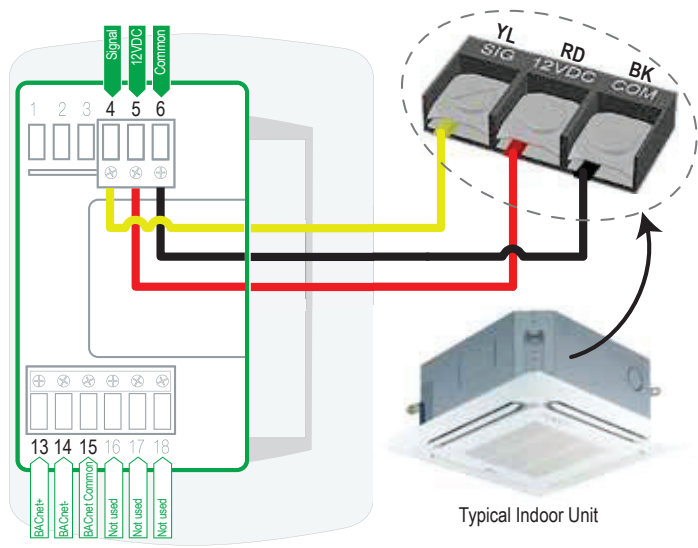
Indoor Units / Controllers

MULTI F WITH LGRED[®]
MULTI F MAX

From Indoor Units to Remote Controllers

- Communication cable from indoor unit to remote controller(s) is to be 22 AWG, 3-conductor, twisted, stranded, unshielded. Wiring must comply with all applicable local and national codes.
- If using the LG Controller / Extension cable and the length needs to be extended, the LG Extension Kit (sold separately) must be used. A maximum of four (4) kits (up to 165 feet) can be used.
- Remote controllers have hardwired connections: SIG - 12V - GND (Comm.) terminals.
- Indoor unit controller connections depend on type of indoor unit being installed. Some indoor units use terminal block connections; other indoor units use Mollex connections. See diagrams below for the two options. Refer to the wiring diagram schematic found in the indoor unit itself, or to the indoor unit wiring diagrams in the Engineering Manuals for more information.
- ⚠ NEVER splice, cut, or extend cable length with field provided cable. Always include enough cable to cover distance between the indoor unit and the remote controller.
- Set the indoor unit operating parameters using DIP switches, or by setting up the remote controller. Refer to the indoor unit installation manuals for more details.

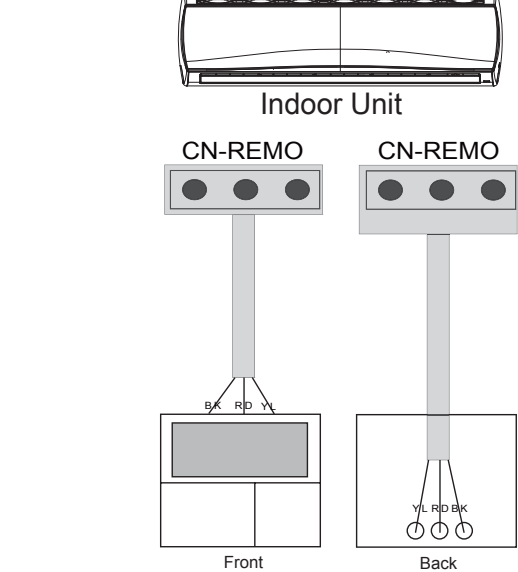
Figure 45: One Example of Indoor Unit to Zone Controller Connection.



Note:

Cable connected to Zone Controller is the factory default connection.

Figure 46: Another Example of Indoor Unit to Zone Controller Connection.



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

If any indoor units were specified to operate in unison:

- Before running cable, decide which indoor unit will be the “Main.” The other indoor units in that group will be designated as “Sub(s).” The zone controller will be connected to the “Main.”
- Set the pertinent DIP switch at each indoor unit to identify the Main and Sub(s). On wall mounted indoor unit models, set the assignment using the handheld remote controller.
- Use a daisy chain configuration and connect all of the group's indoor units together starting at the “Main” unit.
- ⚠ NEVER splice, cut, or extend cable length with field provided cable. Always include enough cable to cover distance between all components.

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

- From the controller to the main indoor unit, use 22 AWG, 3-conductor, twisted, stranded, unshielded. All wiring must comply with all applicable local / national codes.
- From the main indoor unit to the sub indoor unit(s), daisy chain using 22 AWG, 3-conductor, twisted, stranded, unshielded. All wiring must comply with all applicable local / national codes.
- (⚠ Do not attach wire to 12VDC terminal to the sub indoor units). All wiring must comply with all applicable local and national codes.
- ⚠ NEVER splice, cut, or extend cable length; always include enough cable to cover distance between all components.

For indoor units with CN-REMO connections:

Use one (or multiple) Group Control Kit(s) (sold separately) containing extension and Y-splitter cables. Use one (1) group control cable kit for each indoor unit in the group except for the last indoor unit. ⚠ NEVER splice, cut, or extend cable length with field provided cable.

Note:

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

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 main 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 main indoor unit only.
 - Sub indoor unit cannot be individually controlled by central controller.
 - Sub indoor unit will operate like main 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 47: Example of Indoor Unit Group to Zone Controller Connections (Sig-12V-GND [Comm.] Terminal).

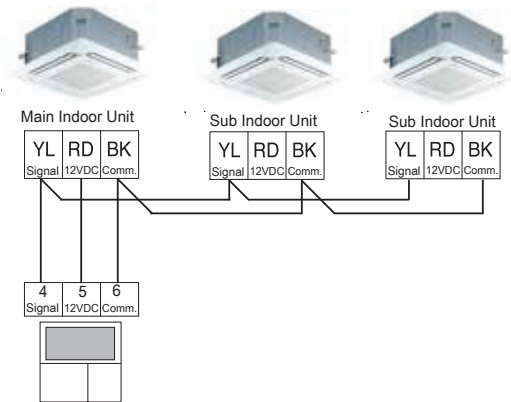


Figure 48: Example of Indoor Unit Group to Zone Controller Connections (CN-REMO).

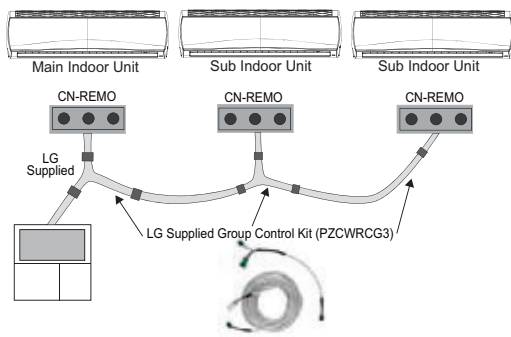


Table 29: Accessories for Some Group Control Applications.

Accessory	Model Number	Image
Wired Remote Group Control Cable Assembly - Required for connecting multiple indoor units to a control group	PZCWRG3	
Wired Remote/Wired Remote Extension Cable - Required for extending the distance between indoor units or remote controllers in a control group	PZCWRC1	

PIPING LIMITATIONS AND PLACEMENT CONSIDERATIONS

Piping Limitations on page 57

Selecting the Best Location for the Outdoor Unit on page 59

Outdoor Unit Clearance Requirements on page 61

Installing Outdoor Units Indoors on page 64

**Selecting the Best Location for the Indoor Units /
Branch Distribution Units on page 67**

Following pages present Multi F / MAX with LGRED piping limitations and are for illustrative purposes only. Designers are highly encouraged to use LATS when designing Multi F / MAX with LGRED systems.

Device Connection Limitations

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

LMU180HHV = 2 LMU240HHV = 3 LMU300HHV = 4 LMU361HHV = 5 LMU421HHV = 6 LMU480HHV = 8

Note:

For allocated capacity information, see the combination tables in the "Multi F / Multi F MAX with LGRED Combination Data Manual" on www.lghvac.com. For performance data, see "Multi F / Multi F MAX with LGRED Performance Data Manual" on www.lghvac.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 with LGRED 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, must be cautious with the quantity and size of fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment.

Table 31: 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 with LGRED systems only) ¹	1.6				
Branch Distribution Unit (ft., Multi F MAX with LGRED systems only)	8.2				

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

Example of a Multi F with LGRED System

Example: LMU300HHV 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.

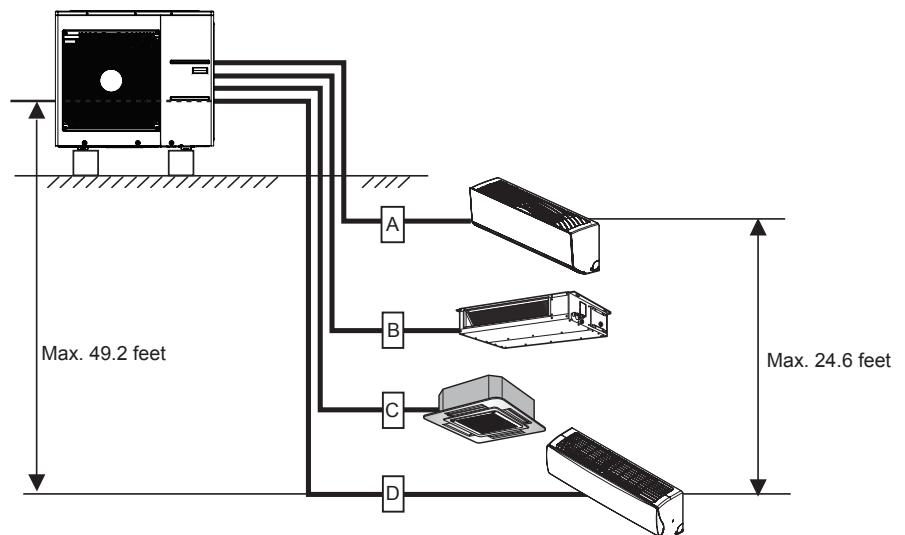


Table 30: Multi F with LGRED Outdoor Unit Refrigerant Piping System Limitations.

Outdoor Unit	Minimum Length for Each Pipe (ft.)	Maximum Piping Length to Each Indoor Unit (ft.)				Maximum Total Piping Length for Each System (ft.)	Maximum Height Difference (Max. [ft.]) Outdoor Unit ~ Indoor Unit	Maximum Height Difference (Max. [ft.]) Indoor Unit ~ Indoor Unit
		A	B	C	D			
LMU180HHV	10	82	82	-	-	164	49.2	24.6
LMU240HHV	10	82	82	82	-	246.1	49.2	24.6
LMU300HHV	10	82	82	82	82	246.1	49.2	24.6

PIPING LIMITATIONS

MULTI F WITH LGRED[®]
MULTI F MAX

Following pages present Multi F / MAX with LGRED piping limitations and are for illustrative purposes only. Designers are highly encouraged to use LATs when designing Multi F / MAX with LGRED systems.

Example of a Multi F MAX with LGRED System with One Branch Distribution Unit

Example: LMU361HHV outdoor unit with four (4) indoor units and one (1) branch distribution unit connected.

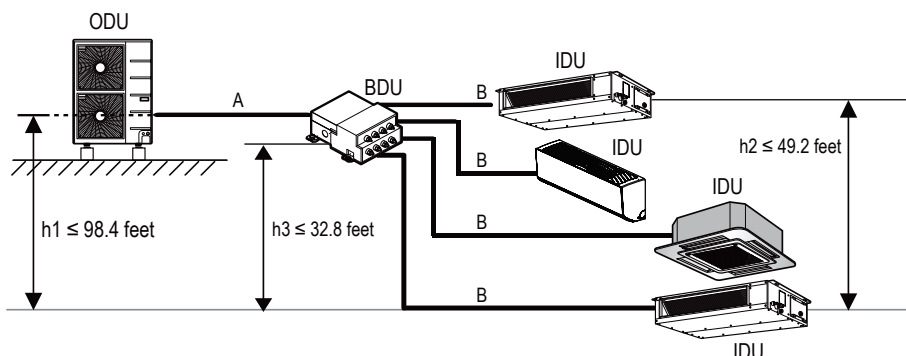
ODU: Outdoor Unit.

IDU: Indoor Unit.

BDU: Branch Distribution Unit.

A: Main Pipe.

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



Example of a Multi F MAX with LGRED System with Two Branch Distribution Units

Example: LMU421HHV outdoor unit with six (6) indoor units and two (2) branch distribution units connected.

ODU: Outdoor Unit.

IDU: Indoor Unit.

BDU: Branch Distribution Unit(s).

A: Main Pipe.

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

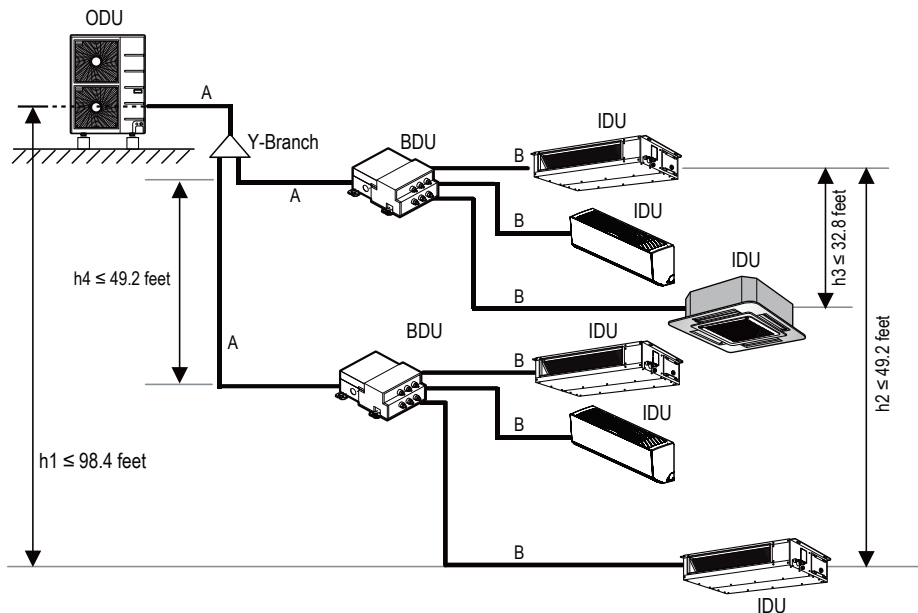


Table 32: Multi F MAX with LGRED Outdoor Unit Refrigerant Piping System Limitations.

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: A)	Minimum for Each (A) Piping Segment	16.4 feet
		Maximum (ΣA)	≤180.4 feet
	Total branch piping length (ΣB)		≤295.3 feet
Elevation Differential (All Elevation Limitations are Measured in Actual Feet)	Branch pipe (Branch Distribution Units to Indoor Units: B)	Minimum	16.4 feet
		Maximum	≤49.2 feet
	If outdoor unit is above or below indoor unit (h1)		≤98.4 feet
	Between the farthest two indoor units (h2)		≤49.2 feet
	Between branch distribution unit and farthest connected indoor unit(s) (h3)		≤32.8 feet
	Between branch distribution units (h4)		≤49.2 feet

Table 33: Multi F MAX with LGRED Piping Sizes.

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

Selecting the Best Location for the Outdoor Unit

⚠ DANGER

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

⚠ CAUTION

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

⚠ WARNING

Install a fence to prevent vermin from crawling into the unit or unauthorized individuals from accessing it. Vermin and unauthorized individuals may cause a fire, electric shock, physical injury or death. Follow the placement guidelines set forth in "Clearance Requirements".

Note:

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

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

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

⚠ Don't's

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

Outdoor Unit Condensate Drain Piping

Outdoor unit requires condensate drain piping. Condensate drain pipe is constructed with materials approved by local code. See pages 61 to 63 for information in reference to outdoor unit placement.

Planning for Snow and Ice

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

1. Prepare for severe winter wind chills and heavy snowfall, even in areas of the country where these are unusual phenomena.
2. Position the outdoor unit so that its airflow fans are not buried by direct, heavy snowfall. If snow piles up and blocks the airflow, the system may malfunction.
3. Remove any snow that has accumulated four (4) inches or more on the top of the outdoor unit.
4. In climates that may experience significant snow buildup, mount the outdoor unit on a raised, field-provided platform or stand. The raised support platform must be high enough to allow the unit to remain above possible snow drifts, and must be higher than the maximum anticipated snowfall for the location.
5. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit frame.
6. Provide a field fabricated snow protection hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces.
7. To prevent snow and heavy rain from entering the outdoor unit, install the condenser air inlets and outlets facing away from direct winds.
8. Consider tie-down requirements in case of high winds or where required by local codes.

PLACEMENT CONSIDERATIONS

Selecting the Best Location for the Outdoor Unit

MULTI F WITH LGRED°
MULTI F MAX

Planning for Snow and Ice, continued.

⚠ CAUTION

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

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:

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

Tie-Downs and Lightning Protection

Tie-Downs

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

Lightning Protection

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

Table 34: Safety Zone Specifications.

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

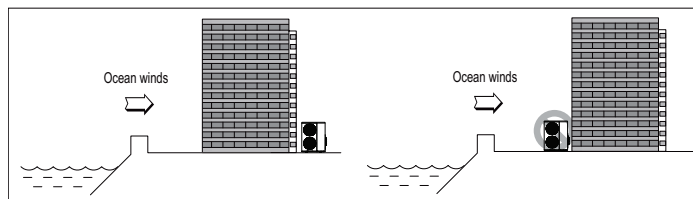
- Power cable and communication cable must be installed five (5) feet away from lightning rod.
- A high-resistance ground system must be included to protect against induced lightning or indirect strike.

Note:

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

Note:

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



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

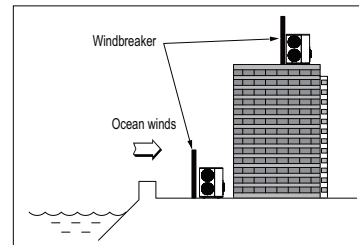
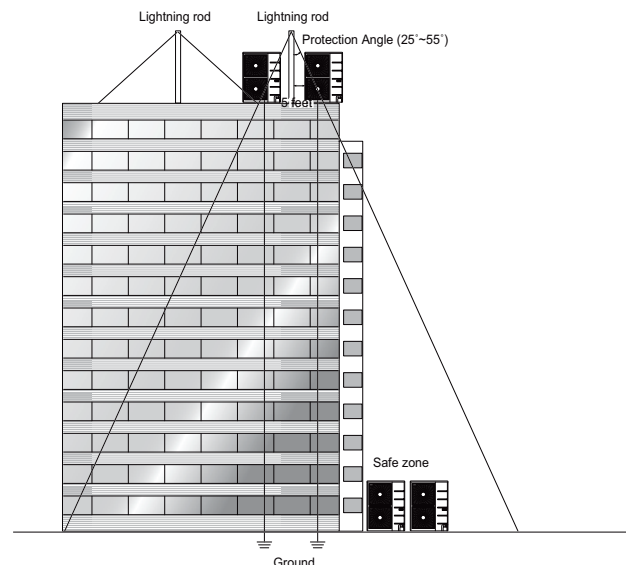


Figure 49: Lightning Protection Diagram.



Minimum Allowable Clearance and Service Access Requirements

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

- 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.)

Multi F with LGRED Outdoor Unit (18,000, 24,000, 30,000 Btu/h Capacities) Service Access and Allowable Clearances

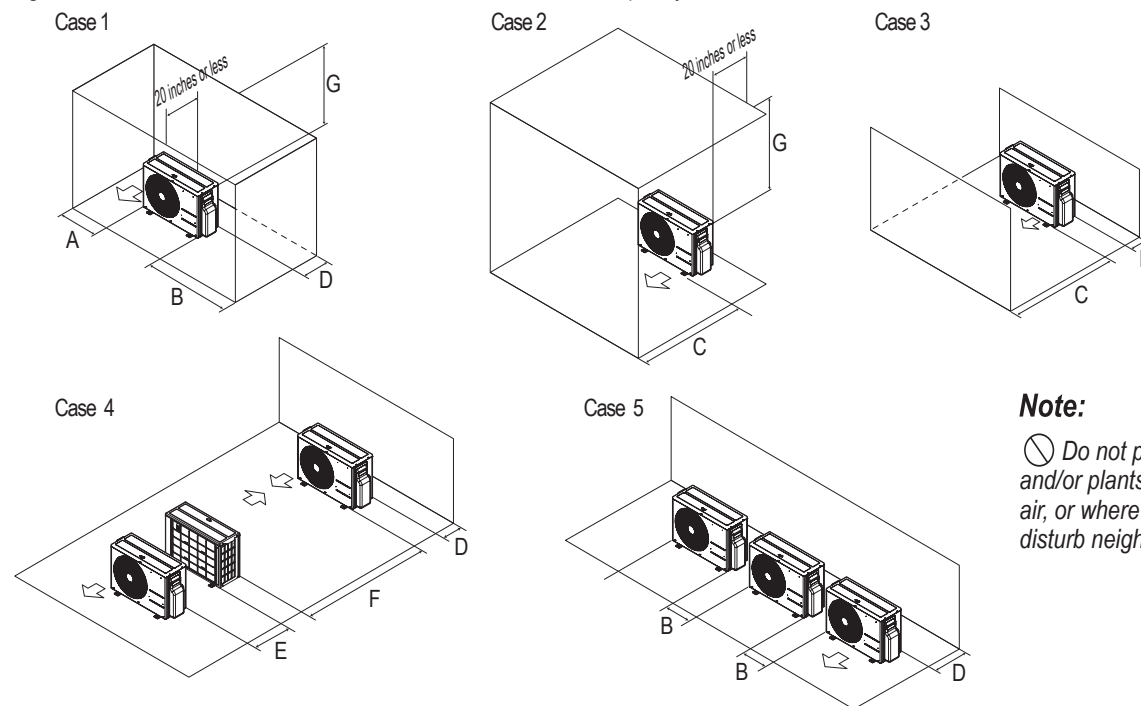
Specific clearance requirements in the diagram below are for 18,000, 24,000, 30,000 Btu/h capacities. The figure below shows the overall minimum clearances that must be observed for safe operation and adequate airflow around the outdoor unit.

When placing the outdoor unit under an overhang, awning, sunroof or other "roof-like structure", observe the clearance requirements (as shown in Cases 1 and 2) for height in relation to the unit. To have successful service access to the outdoor unit, see Figure 48 for minimum spacing. When installing multiple outdoor units, see Cases 4 and 5 for correct spacing requirements.

Note:

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

Figure 50: Multi F with LGRED 18,000, 24,000, 30,000 Btu/h Capacity Outdoor Unit Service Access and Allowable Clearances Diagram.



Note:

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

Table 35: Multi F with LGRED 18,000, 24,000, and 30,000 Outdoor Unit Service Access and Allowable Clearances Diagram Legend.

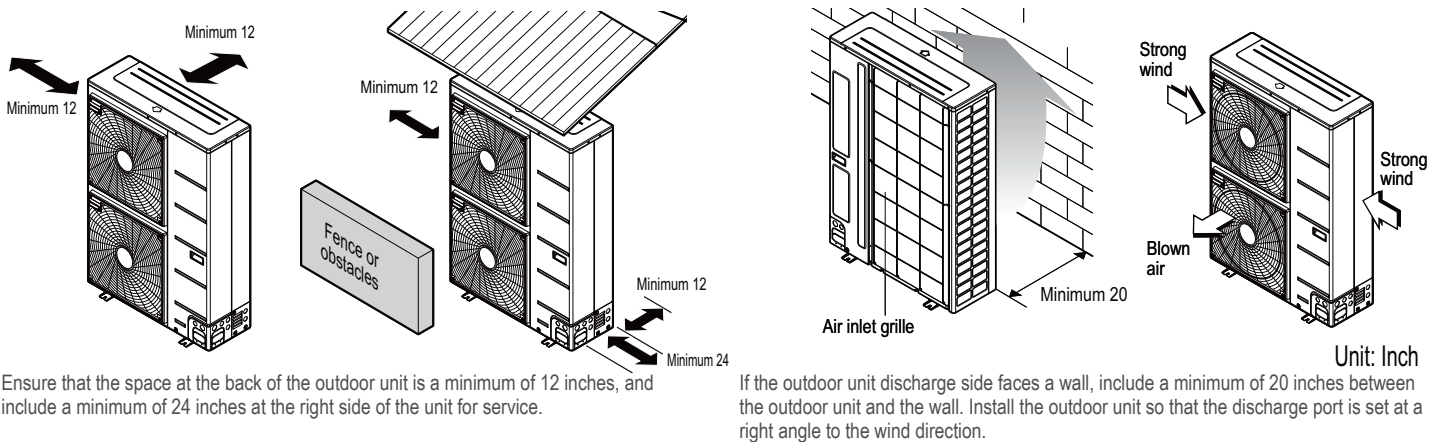
Unit: Inch		A	B	C	D	E	F	G
Case 1	Standard	12	24	-	12	-	-	-
	Minimum	4	10	-	4	-	-	40
Case 2	Standard	-	-	20	-	-	-	-
	Minimum	-	-	14	-	-	-	40
Case 3	Standard	-	-	20	12	-	-	-
	Minimum	-	-	14	4	-	-	-
Case 4	Standard	-	-	-	12	24	-	-
	Minimum	-	-	-	4	8	79	-
Case 5	Standard	-	24	-	12	-	-	-
	Minimum	-	10	-	4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

PLACEMENT CONSIDERATIONS

Outdoor Unit Clearance Requirements

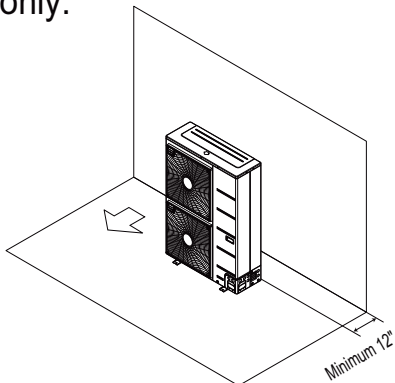
MULTI F WITH LGRED[®]
MULTI F MAX

Multi F MAX with LGRED Outdoor Unit (36,000, 42,000, 48,000 Btu/h Capacity) Service Access and Allowable Clearances
When installing the outdoor unit, consider service, inlet, and outlet, and minimum allowable space requirements as illustrated in the following diagrams.

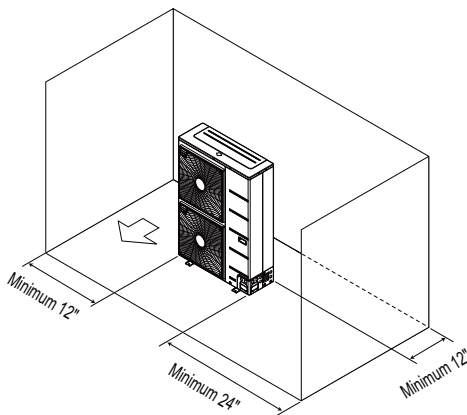


Clearance Requirements when Different Obstacles are Present (Unit: Inch).

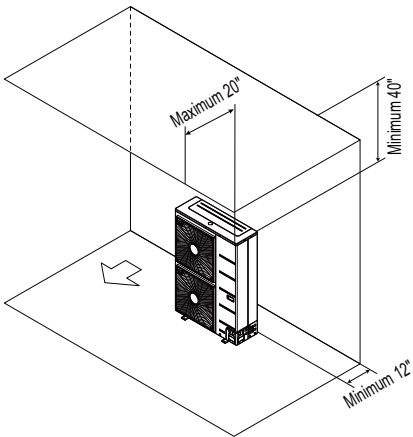
Obstacle on the suction side only.



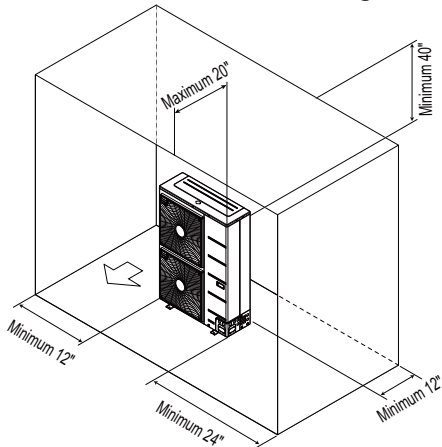
Obstacles on the suction side and on both left and right sides.



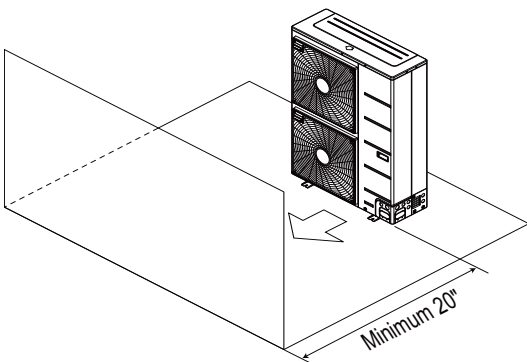
Obstacles above and on the air intake side.



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

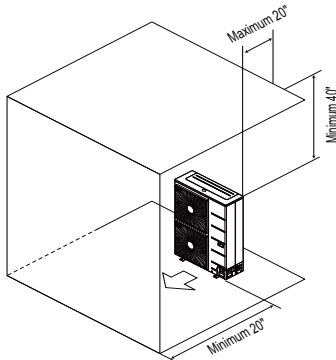


Obstacle just on the air discharge side.

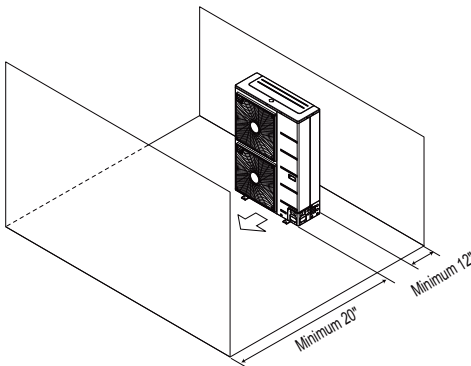


Clearance Requirements when Different Obstacles are Present, continued. (Unit: Inch)

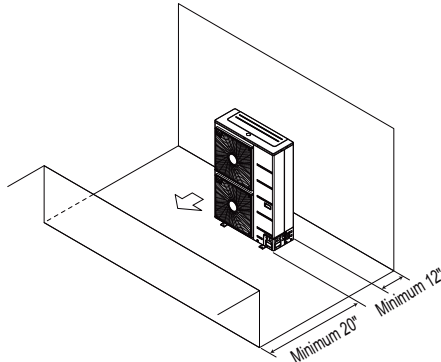
Obstacles above and on the air discharge side.



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



Where there are obstacles 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 higher than the outdoor unit).

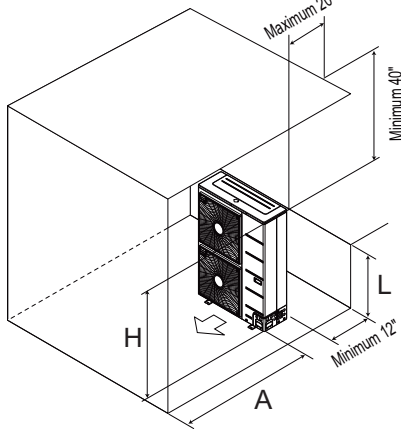


Table 36: Ratio among H, A, and L.

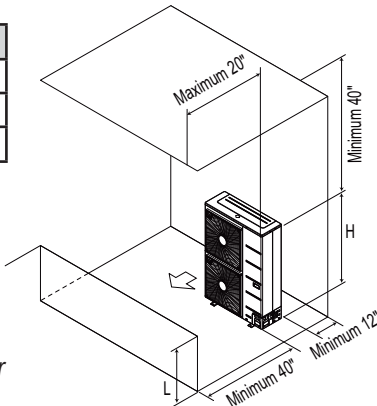
	L	A
$L \leq H$	$0 < L \leq 1/2 H$	30 inches
	$1/2 H < L$	40 inches
$H < L$	Set Stand as: $L \leq H$	

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

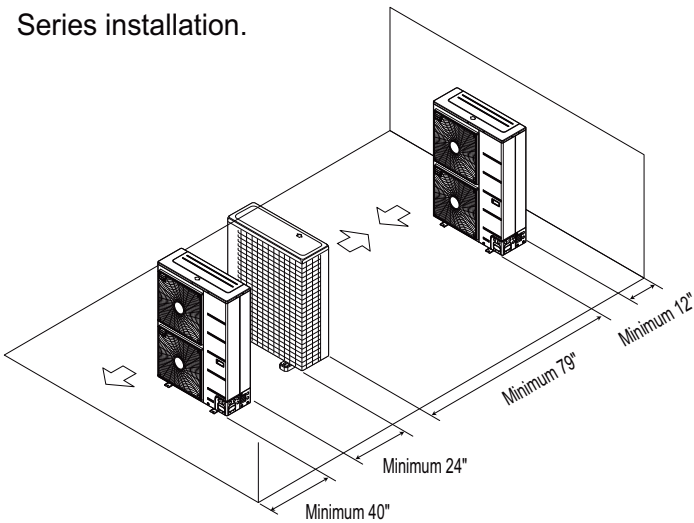
Note:

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

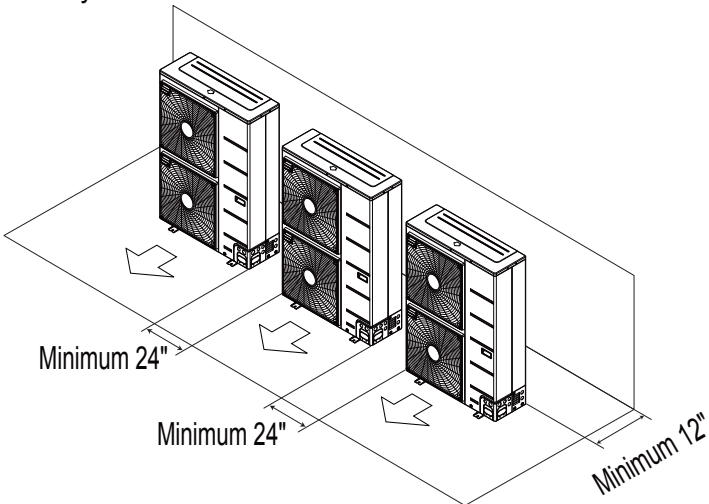
Where there are obstacles above, and on both suction and discharge sides (discharge side obstacle is lower than the outdoor unit).



Series installation.



Side-by-side series installation.



PLACEMENT CONSIDERATIONS

Installing Outdoor Units Indoors

MULTI F^{WITH} LGRED[°]
MULTI F MAX

Installing Outdoor Units Indoors

LG Multi F / Multi F MAX with LGRED 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 with LGRED 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 must be engineered to clear anticipated snow accumulation levels by at least one (1) foot.
- In situations where operation is anticipated at temperatures of -13°F and lower, ancillary heat must be provided to heat the outdoor unit coils to ensure 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 must be approximately three (3) feet (minimum distance varies significantly with variations in outlet opening face velocity).
- If roof-mounted ventilation openings are used, strategically locate the inlet ventilation opening(s) upwind of the outlet opening(s).
- Discharge and supply ductwork must be designed to avoid weather related long periods of water entrainment and the potential for microbial growth.

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 must be placed in front of the louver that could hamper the free flow (throw) of air.
- Roof top openings and / or discharge and supply louvers must be equipped with screens to prevent bird and insect infiltration.

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 must be taken into consideration when designing the louvered outdoor unit enclosure.
- Do not use “S” type louvers.

Note:

If the Louver Open Rate is Too Small

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

Figure 51: Louver Recommendations.

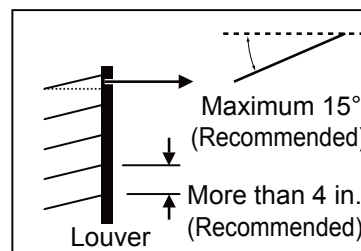
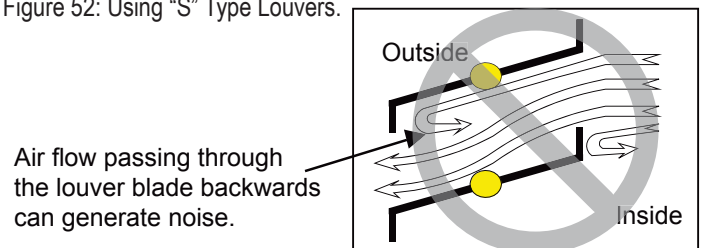


Figure 52: Using “S” Type Louvers.



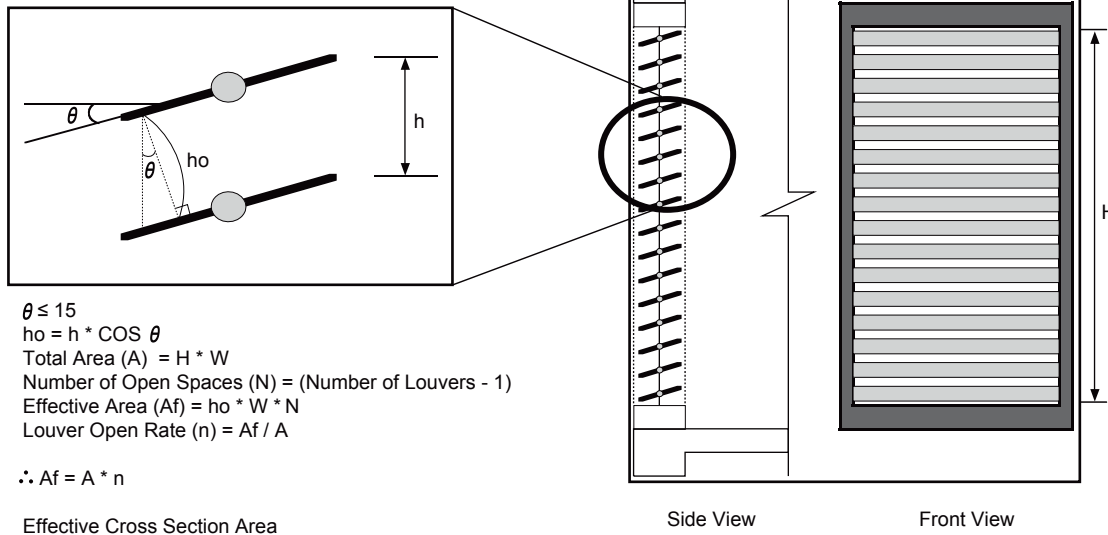
PLACEMENT CONSIDERATIONS

Installing Outdoor Units Indoors

MULTI F WITH LGRED°
MULTI F MAX

Open Rate by Louver Radian

Figure 53: Open Rate by Louver Radian Formula.



Confirming Air Flow Rate / Total Opening Rate

Figure 54: Example of Installing Outdoor Unit Indoors.

• Example: LMU361HHV

• Discharge Airflow Rate: 4,238 ft.³/min.

• Velocity of Outlet Air: 12.9 ft./s

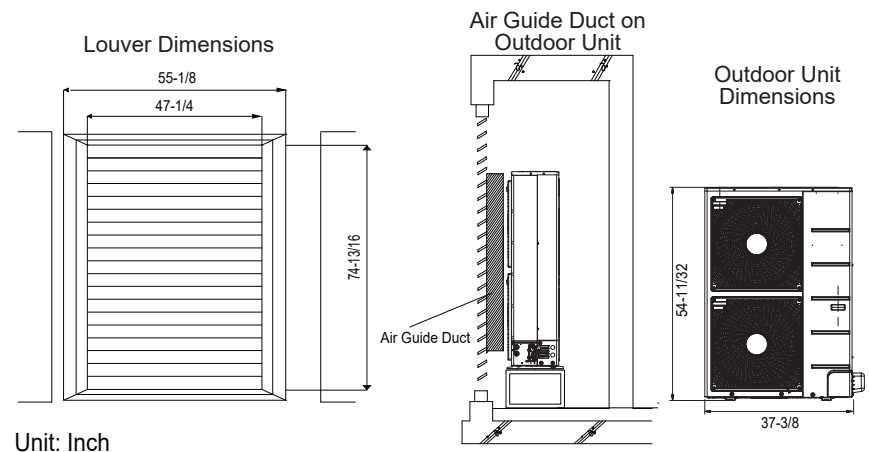
• Velocity of Inlet Air: 7.7 ft./s

• Open Rate = 80% or More

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

• Inlet airflow should match or exceed discharge airflow.

• Separate inlet airflow from discharge airflow to prevent recirculation.



Formula

- Total Louver Dimension (Excluding Frame) (A) = 3.9 feet x 6.2 feet = 24.2 ft.²
- Area Blocked by Outdoor Unit (Discharge) (B) = 3.12 feet x 4.53 feet = 14.13 ft.²
- Inlet Louver Dimension (A - B) = 10.1 ft.²
- Equivalent Inlet Dimension (Open Rate 80%) = 10.1 ft.² x 0.8 = 8.08 ft.²
- Equivalent Inlet Air Volume = 8.08 ft.² x 7.7 ft./s x 60 sec./min. = 3,734 ft.³/min.
- Equivalent Inlet Airflow / Discharge Airflow = 3,734 ft.³/min. / 4,238 ft.³/min. = 88% (Not Allowed; Suction Airflow Must Equal / Exceed Discharge Airflow)

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 (and branch distribution unit, if a Multi F MAX with LGRED 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).

⊘ Dont'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.

Note:

⊘ Indoor units (IDUs) must not be placed in an environment where the IDUs may be exposed to harmful volatile organic compounds (VOCs) or in environments where there is improper air make up or supply or inadequate ventilation. If there are concerns about VOCs in the environment where the IDUs are installed, proper air make up or supply and/ or adequate ventilation must be provided. Additionally, in buildings where IDUs will be exposed to VOCs consider a factory-applied epoxy coating to the fan coils for each IDU.

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

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

Note:

Branch distribution (BD) units are used only with Multi F MAX with LGRED systems to distribute the refrigerant from the outdoor unit up to eight (8) indoor units. Select a location indoors that will meet the following conditions:

- Within allowable parameters for proper connection to the Multi F MAX with LGRED 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 (minimum 24 inches); 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 branch distribution unit.

⊘ Dont's

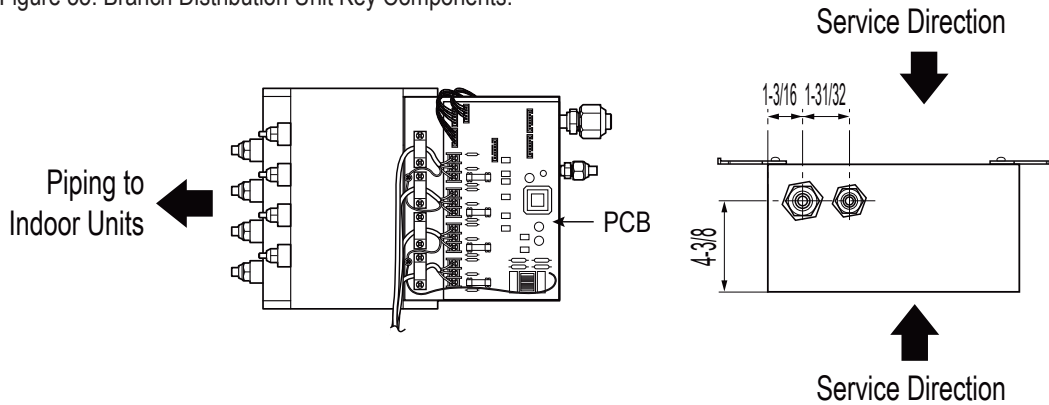
- Install the branch distribution unit in a location where it would be subjected to strong radiation heat from heat sources.
- Install in an installation environment where the branch distribution unit would be exposed to heat, water, steam, oil splattering or spray.
- Install the unit in a location where any sound it generates will disturb occupants in the surrounding rooms.
- No obstacles to air circulation around the unit; keep proper distances from ceilings, doorways, floor, walls, etc.
- Install in an area where high-frequency electrical noise / electromagnetic waves will affect operation. Maintain proper distances between the branch distribution unit(s) and electric wires, audio and visual appliances, breaker / circuit panels, etc.

PLACEMENT CONSIDERATIONS

MULTI F[®] WITH LGRED[®]
MULTI F MAX

Selecting the Best Location for the Indoor Units / Branch Distribution Units

Figure 55: Branch Distribution Unit Key Components.



Branch Distribution Unit Orientation

Multi F MAX with LGRED branch distribution units can be installed in a multitude of options to fit various building configurations and job or application requirements. The installation location of the PCB within the branch distribution unit can be changed for easier service access, depending on the branch distribution unit installation itself. Multi F MAX with LGRED branch distribution units include electronic expansion valves that properly seat only if the branch distribution unit is installed in an acceptable orientation. Installations with improper branch distribution unit orientation risk incomplete valve seating and system performance degradation from potential refrigerant leakage through the electronic expansion valve. See the Branch Distribution Product Section for acceptable installation options.

Inverter

162279



LG Electronics, U.S.A., Inc.
Air Conditioning Technologies
4300 North Point Parkway
Alpharetta, Georgia 30022
www.lghvac.com

EM_MultiF_MAX_LGRED_ODU_1HHV_480HHV_01_22
Supersedes: EM_MultiF_MAX_LGRED_ODU_1HHV_480HHV_11_21
EM_MultiF_MAX_LGRED_ODU_1HHV_480HHV_10_21
EM_MultiF_MAX_LGRED_ODU_06_21
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EM_MultiF_MAX_LGRED_ODU_04_2020
EM_MultiF_MAX_LGRED_ODU_07_18
EM_MultiF_MAX_LGRED_ODU_01_18
EM_MultiF_MAX_LGRED_ODU_11_17
EM_MultiF_MAX_LGRED_ODU_10_17