LG
Life's Good

MULTI V™ SPACE II

ENGINEERING MANUAL

Variable Refrigerant Flow Outdoor Unit

4.4 Tons

PROPRIETARY DATA NOTICE

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About LG Electronics, Inc.

LG Electronics, Inc. is a global leader and technology innovator in consumer electronics, mobile communications, and home appliances. LG Electronics comprises four business units—Home Entertainment, Mobile Communications, Home Appliance, and Air Conditioning and Energy Solutions. LG is one of the world's leading producers of flat panel televisions, audio and video products, mobile handsets, compressors, air conditioners, and washing machines. LG's commercial air conditioning business unit was established in 1968 and has built its lineup of residential and commercial products to include VRF, Multi-Zone systems, Duct Free Split Systems, Packaged Terminal Air Conditioners (PTACs), and room air conditioners. In 2011, the air conditioning and energy solutions business unit grew to include LED lighting and solar products. For more information visit www.lg.com.

Variable Refrigerant Flow (VRF) Technology

In the early 1980s, VRF technology was introduced to the world as an alternative method of cooling and heating in commercial structures, and is designed to minimize utility consumption. VRF systems have become the system of choice for designers internationally because these systems offer better comfort at lower costs when compared to traditional boiler/chiller/Variable Air Volume (VAV) air handler systems. Today, VRF is gaining popularity in the United States.

LG Multi V air-source systems offer the opportunity to minimize ductwork in the same configuration. The system offers zoning without the need for zone damper systems. The LG Multi V Space II system's advanced controls provide exceptional building dehumidification and temperature control, and can rapidly adapt system operating parameters to the ever-changing building load. The LG Multi V Space II system is easy to design, install, and maintain. The modular design allows occupants to control their environmental condition, providing individualized control of the set-point temperature and allowing occupants to condition only the occupied zones.

Quality Commitment

LG is committed to the success of every Multi V project by providing the best industry technical support during project engineering, installation, and commissioning. LG offers a variety of classes designed for engineers, architects, installers, and servicers to ensure that every Multi V installation is completed successfully. Classes are conducted at LG's training centers and in field locations at various times throughout the year and upon special request.

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TABLE OF SYMBOLS

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

INTRODUCTION

“Architectural Appeal” on page 6
“Engineers’ Advantage” on page 7

ARCHITECTURAL APPEAL

Convergence of Technological Innovation with Flexibility and Style

Benefits of Multi V II Space Systems

- Provides VRF system zoning and efficiency
- Rear side air intake / air discharge
- Suitable for indoor installation behind a louver
- Compact size for installation
- Operating ranges of 23°F to 118°F in cooling mode
- Quiet and comfortable environment
- Reduced ductwork

Multi V Space II

Multi V Space II, a variable refrigerant flow (VRF) system, is among the industry's best air-conditioning units with great advantage on vertical rise and piping lengths. Choosing an LG Multi V Space II VRF system provides a system designer an edge to engineer a system with individual control, and design flexibility with advanced controls. Multi V Space II heat pump is available in a nominal capacity of 4.4 tons. These are best suited for applications with zones that require heating or cooling, such as residential and small office buildings.

Multi V Space II outdoor unit is available in 208–230V/60Hz/1Ph.

Adaptable and Flexible

Multi V Space II outdoor units can be adapted to a wide range of building applications and sizes such as high rise condos, apartments, schools, hotels, hospitals, offices, and residences. The lightweight and small footprint allows system components to be placed in the building without expensive cranes, easily fitting into most service elevators and set in place with minimal requirements for structural reinforcements. The modular design of VRF systems means Multi V Space II can be commissioned in stages so tenants can move in as each floor or even each room is completed.

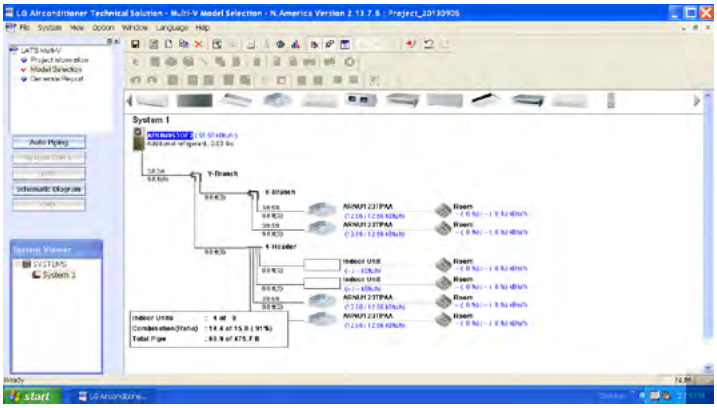
Multi V Space II technology allows you to pipe farther by reaching areas of the building that would require the installation of a second system when using traditional direct-expansion cooling and heating equipment. Multi V Space II provides the designer with uncompromised pipe system engineering flexibility—long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

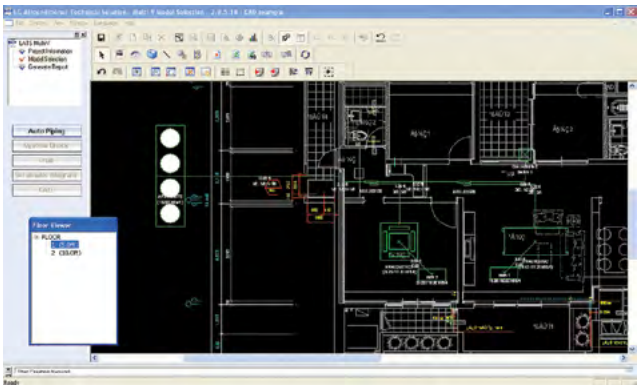
Smaller Chases and Plenums

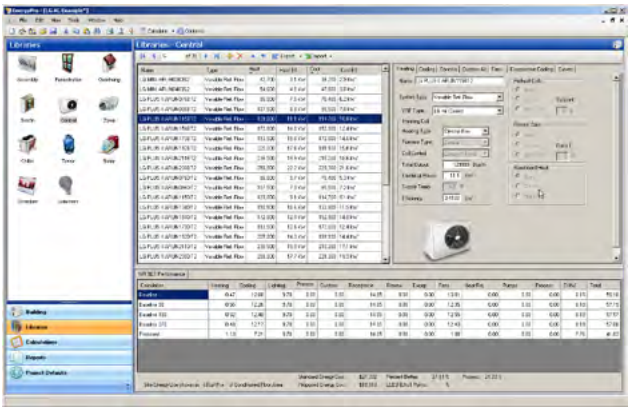
LG Multi V Space II systems use refrigerant piping to move heat, resulting in smaller space requirements for piping as compared to chilled water or roof top systems. This helps reduce the overall construction and material cost of the building, and gives back leasable space. Flexible and logical placement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

Intuitive Design

The LATS (LG Air Conditioning Technical Solution) Multi V design and layout software provides an intuitive, quick, and simple method to design a Multi V Space II refrigerant pipe system. LATS Multi V checks piping lengths and elevations, and it assists with the sizing of indoor and outdoor units by calculating component capacity based on design conditions. LATS Multi V can import AutoCAD™ drawings and lay out the Multi V Space II system to scale. When the designer finishes the AutoCAD system layout, all of the piping lengths will be calculated, and a drawing file with the Multi V system will be available for export and integration into the building drawing set.

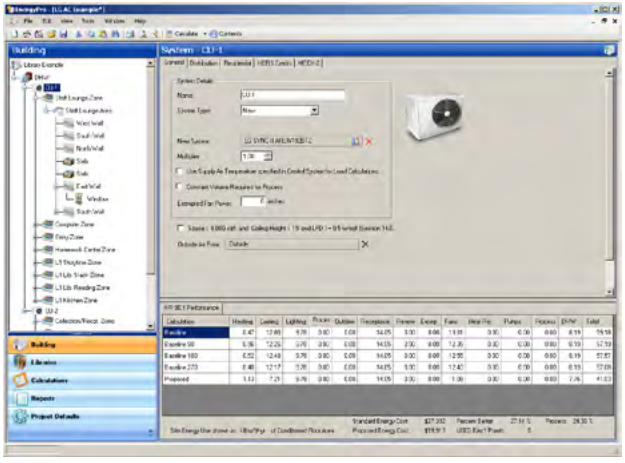






Energy Modeling

LG stands behind performance. You will find Multi V Space II in the EnergyPro™ building energy simulation software from EnergySoft. EnergyPro is approved by the California Energy Commission to accurately model and provide necessary documentation to comply with the rigourous California Title 24 Standards, ASHRAE 90.1 compliance, and calculate the number of LEED credits earned by the design team. The software accurately models utility costs based on building design, orientation, location, and other design conditions.



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PRODUCT DATA

PRODUCT FEATURES AND BENEFITS

Multi V Space II

Multi V Space II units, equipped with an inverter rotary compressor, offers superior load matching and long piping installation. The product works for optimizing power consumption in high-rise buildings. Sophisticated electronic control and unique refrigerant flow gives these systems a unique capability to perform in extreme/ unusual working conditions.

Low Sound Levels

When Multi V outdoor units operate fully loaded, they have one of the quietest sound levels in the industry. Sound is almost undetectable during off-peak operation. To promote a quiet, comfortable environment, the LG Multi V indoor units operate at sound levels as low as 23dB(A) and outdoor units as low as 53dB(A) at full load. LG customers often ask if the outdoor unit is running after commissioning is complete.

All rotating components are soft-started by the controller using digitally controlled inverters, which reduce undesirable noise caused by fans and compressors cycling on and off.

Comfort Control at Its Best

Tight temperature control through precise load matching maximizes the time that the indoor units remove moisture. This ensures maximum comfort and delivers the industry's best indoor humidity levels.

Precision Load Matching

Unlike traditional air conditioning control systems, which use thermostatic controls to maintain room temperatures, LG Multi V controls continuously vary the indoor unit fan speed and refrigerant flow, indirectly providing lower and more consistent humidity levels in the conditioned space. The longer the indoor coil temperature is below the dew-point of the room in conjunction with air movement across the coil, the space humidity level will vary little, compared to technologies that cycle fans and compressors on and off multiple times per hour.

The outdoor unit responds by varying the compressor speed and outdoor fan motors as needed to maintain system operating pressure. As a result, the Multi V Space II system delivers precise space temperature control.

Advanced Compressor Technology

Oil Management

Oil migration is no longer a concern when choosing Multi V Space II. A two-stage oil management system ensures a safe level of oil in the compressor sump. An oil injection mechanism provides a consistent film of oil on moving parts, even at low speeds. The compressor discharge is specially designed to minimize the amount of oil leaving the compressor.

Oil-return algorithms flush the oil from the distribution system back to the compressor.

Inverter Driven

The rotary compressor is optimized to maximize compressor efficiency, which reduces power consumption and monthly utility bills. This latest inverter technology allows the LG Multi V Space II to vary the compressor motor shaft speed to deliver an appropriate amount of cooling to all indoor units. Precise refrigerant volume delivery translates into long periods with coil surface temperatures below dew point and minimizes compressor and fan component run time. Occupants remain comfortable while utility costs are reduced.

Simplified Installation

Cooling and heating systems that use the LG Multi V Space II simplify and reduce the mechanical and control system design time. The designer no longer has to be concerned with interconnecting chilled and condenser water piping, air-distribution duct systems, matching and selecting chillers, towers, pumps, coils, fans, air handlers, or Variable Air Volume (VAV) boxes.

System integration with existing building management systems has never been easier. Because all of the Multi V Space II system components are engineered and provided by LG, the system components and controls come pre-engineered and do not need any custom programming from third-party contractors.

Operating Range

Multi V Space II product has a capacity of 4.4 tons and features a connected indoor unit combination ratio of 50% to 130%. Operating ranges include:

Figure 1: Multi V Space II

Heat Pump Units

Cooling: 23°F DB to 118°F DB

Heating: -4°F WB to +60°F WB

Compact Size

Single-frame Multi V Space II units are available in 4.4 tons. The 4.4-ton units have a footprint of 29-17/32" W x 25-19/32" D.

Heat Transfer Efficiency

Fin Design with GoldFin™ Coating

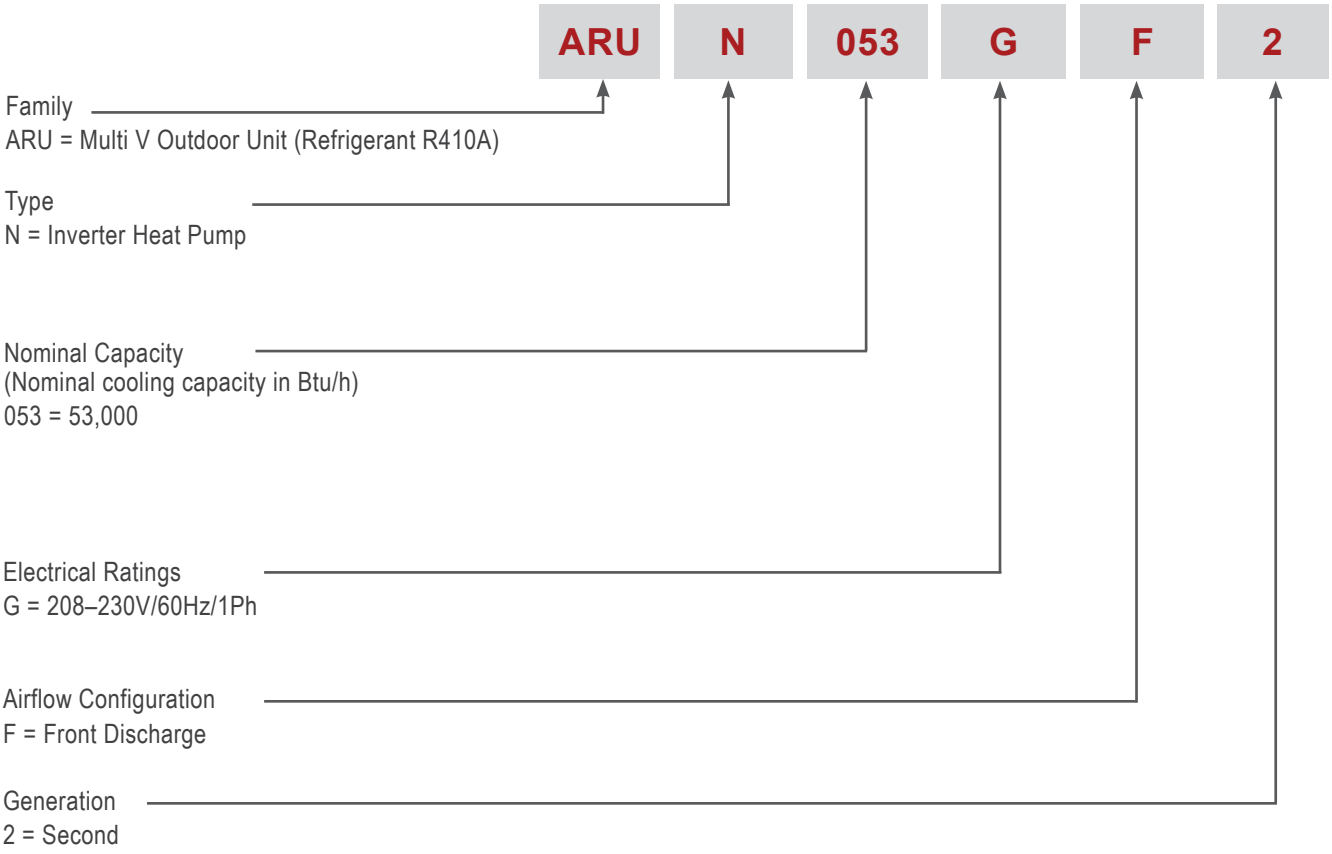
All Multi V Space II units are provided with large surface coils made of copper tubes with aluminum fins designed to maximize unit operating efficiency over a wide range of ambient conditions.

Standard from the factory, every LG Multi V Space II outdoor coil fin surface is coated with LG's exclusive GoldFin™ anti-corrosive paint designed to prevent natural surface corrosion of the aluminum fins. This maintains heat transfer properties of the coil for an extended time.

Other Features

- Rotary Compressor
- Elevation Advantage
- Smaller Footprint
- Precision Load Matching
- Follows AHRI 210/240

Outdoor Units (ODU)



UNIT NOMENCLATURE

Indoor Units

Indoor Units (IDU)

ARN	U	07	3	TN	C	2

Family
ARN = Multi V Indoor Unit
(Refrigerant R410A)

Type
U = DC Inverter Heat Pump

Nominal Capacity
(Nominal cooling capacity in Btu/h)

05 = 5,000	15 = 15,000	30 = 30,000	54 = 54,000
07 = 7,000	18 = 18,000	36 = 36,000	
09 = 9,000	24 = 24,000	42 = 42,000	
12 = 12,000	28 = 28,000	48 = 48,000	

Electrical Ratings
3 = 208–230V/60Hz/1Ph

Model

B1 = Ducted (low static, convertible)	SEL = Standard Wall Mounted
B2 = Ducted (low static, convertible)	SER = Wall Mounted/Mirror
B3 = Ducted (low static, bottom return)	TJ = 1-Way Ceiling Cassette
B4 = Ducted (low static, bottom return)	TL = 2-Way Ceiling Cassette
BG = Ducted (high static)	TM = 4-Way Ceiling Cassette (3' x 3')
BH = Ducted (high static)	TN = 4-Way Ceiling Cassette (3' x 3')
BR = Ducted (high static)	TP = 4-Way Ceiling Cassette (3' x 3')
CE = Floor Standing (small frame)	TQ = 4-Way Ceiling Cassette (2' x 2')
CF = Floor Standing (large frame)	TR = 4-Way Ceiling Cassette (2' x 2')
NJ = Vertical / Horizontal Air Handling Unit	VE = Convertible Surface Mounted
NK = Vertical / Horizontal Air Handling Unit	VJ = Ceiling Suspended
S5 = Standard Wall Mounted	
S8 = Wall Mounted/Mirror	

Feature

A = Basic	L = Neo Plasma
C = Plasma Filter	R = Mirror and Neo Plasma
G = Low Static	U = Uncased

Generation
2 = Second

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

Combination Unit Model Number		4.4 Ton ARUN053GF2
Cooling Performance		
Nominal Cooling Capacity (Btu/h)[1]		53,000
Rated Cooling Capacity (Btu/h)[2]		54,000
Heating Performance		
Nominal Heating Capacity (Btu/h)[1]		59,000
Rated Heating Capacity (Btu/h)[2]		60,000
Operating Range		
Cooling (°F DB)		23 - 118
Heating (°F WB)		(-4) - +60
Compressor		
Inverter Quantity		DC Inverter Rotary
Oil/Type		PVE/FVC68D
Fan (Rear Discharge)		
Type		Propeller (BLDC)
Motor Output (kW) x Qty.		0.90 x 1
Motor/Drive		Brushless Digitally Controlled/Direct
Operating Range (RPM)	Cooling	80-813
	Heating	80-813
Maximum Air Volume (CFM)		3,532
External Static Pressure (ESP) (in. WG)		0.12 - 0.20
Unit Data		
Refrigerant Type		R410A
Refrigerant Control/Location		EEV/Indoor Unit
Max. Number Indoor Units/System[3]		9
Sound Pressure dB(A) (Rear Fan Side/Front Side)[4]		68.3/52.7
Net Unit Weight (lbs.)		320
Shipping Weight (lbs.)		346
Communication Cables[5,6]		2 x 18
Heat Exchanger		
Material and Fin Coating		Copper Tube/Aluminum Fin and GoldFin™
Rows/Fins per inch		2/14
Piping[7]		
Liquid Line Connection (in., OD)		3/8 Braze
Vapor Line Connection (in., OD)		3/4 Braze
Factory Charge lbs. of R410A		7.7

[1]Nominal capacity applied with non-ducted indoor units, and is rated 0 ft. above sea level with 25 ft. of refrigerant line per indoor unit and a 0 ft. level difference between outdoor and indoor units. All capacities are net with a Combination Ratio between 95–105%. (Nominal capacity is outside the scope of AHRI Standard 210/240.)
Nominal cooling capacity rating obtained with air entering the indoor unit at 80°F dry bulb (DB) and 67°F wet bulb (WB) and outdoor ambient conditions of 95°F dry bulb (DB) and 75°F wet bulb (WB).
Nominal heating capacity rating obtained with air entering the indoor unit at 70°F dry bulb (DB) and 59°F wet bulb (WB) and outdoor ambient conditions of 47°F dry bulb (DB) and 43°F wet bulb (WB).

[2]Rated capacity is certified under AHRI Standard 210/240. See www.ahrinet.org for information.

[3]The System Combination Ratio must be between 50–130%.

[4]Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745

[5]All communication cable to be minimum 18 AWG, 2-conductor, stranded, shielded, and must comply with applicable local and national codes.

[6]Power wiring cable is field provided and must comply with the applicable local and national codes. See page 14 for detailed electrical data.

[7]Refer to the Refrigerant Piping section of this manual for correct line sizing. Contractor must use LG manufactured Y-Branch and Header Kits only. Designer must verify refrigerant piping design configuration using LG's computerized refrigerant piping (LATS Multi V) software to validate the pipe design.

ELECTRICAL DATA

ARUN053GF2 Heat Pump Outdoor Unit

Table 2: Multi V Space II Electrical Data

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

Voltage tolerance is ±10%.

Maximum allowable voltage unbalance is 2%.

MCA = Minimum Circuit Ampacity.

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

Table 3: Summary Data—Wall-Mounted / Ceiling Cassette Indoor Units.

Unit / Type[1]	ARNU*****[2]	Nominal Capacity Btu/h	
		Cooling[3]	Heating[3]
Wall Mounted–ART COOL™ Mirror 	073 SER2	7,500	8,500
	093 SER2	9,600	10,900
	123 SER2	12,300	13,600
	153 SER2	15,400	17,100
	183 S8R2	19,100	21,500
	243 S8R2	24,200	27,300
Wall Mounted–Standard Finish 	073 SEL2	7,500	8,500
	093 SEL2	9,600	10,900
	123 SEL2	12,300	13,600
	153 SEL2	15,400	17,100
	183 S5L2	19,100	21,500
	243 S5L2	24,200	27,300
Ceiling Cassette–1 Way 	073 TJC2	7,500	8,500
	093 TJC2	9,600	10,900
	123 TJC2	12,300	13,600
Ceiling Cassette–2 Way 	183 TLC2	19,100	21,500
	243 TLC2	24,200	27,300
Ceiling Cassette–4 Way (2' x 2') 	053 TRC2	5,500	6,100
	073 TRC2	7,500	8,500
	093 TRC2	9,600	10,900
	123 TRC2	12,300	13,600
	153 TQC2	15,400	17,100
	183 TQC2	19,100	21,500
Ceiling Cassette–4 Way (3' x 3') 	093 TPAA	9,600	10,900
	123 TPAA	12,300	13,600
	153 TPAA	15,400	17,100
	183 TNAA	19,100	21,500
	243 TNAA	24,200	27,300
	243 TPC2	24,200	27,300
	283 TPC2	28,000	31,500
	363 TNC2	36,200	40,600
	423 TMC2	42,000	43,800
	483 TMC2	48,100	51,200

[1]All indoor units require 208–230V/60Hz/1Ph and an AWG18-2 communication cable. Reference LG's Multi V Indoor Unit Engineering Manual for complete detailed engineering data and selection procedures.

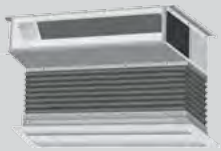
[2]Model number shows nominal capacity and frame size designator.

[3]Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB) and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB). Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB) and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

GENERAL DATA

Indoor Unit Specifications

Table 4: Summary Data—Recessed Mounted Indoor Units.

Unit / Type[1]	ARNU***[2]	Nominal Capacity Btu/h	
		Cooling[3]	Heating[3]
Ducted High Static 	073 BHA2	7,500	8,500
	093 BHA2	9,600	10,900
	123 BHA2	12,300	13,600
	153 BHA2	15,400	17,100
	183 BHA2	19,100	21,500
	243 BHA2	24,200	27,300
	153 BGA2	15,400	17,100
	183 BGA2	19,100	21,500
	243 BGA2	24,200	27,300
	283 BGA2	28,000	31,500
	363 BGA2	36,200	40,600
	423 BGA2	42,000	43,800
	483 BRA2	48,100	51,200
	543 BRA2	54,000	61,400
Ducted Low Static–Convertible 	073 B1G2	7,500	8,500
	093 B1G2	9,600	10,900
	123 B1G2	12,300	13,600
	153 B1G2	15,400	17,100
	183 B2G2	19,100	21,500
	243 B2G2	24,200	27,300
Ducted Low Static–Bottom Return 	073 B3G2	7,500	8,500
	093 B3G2	9,600	10,900
	123 B3G2	12,300	13,600
	153 B3G2	15,400	17,100
	183 B4G2	19,100	21,500
	243 B4G2	24,200	27,300
Vertical / Horizontal Air Handling Unit 	123 NJ2	12,000	13,500
	183 NJA2	18,000	20,000
	243 NJA2	24,000	27,000
	303 NJA2	30,000	34,000
	363 NJA2	36,000	40,000
	423 NKA2	42,000	46,000
	483 NKA2	48,000	54,000
	543 NKA2	54,000	60,000

[1]All indoor units require 208–230V/60Hz/1Ph and an AWG18-2 communication cable. Reference LG's Multi V Indoor Unit Engineering Manual for complete detailed engineering data and selection procedures.

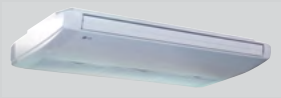
[2]Model number shows nominal capacity and frame size designator.

[3] Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB) and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB). Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB) and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

GENERAL DATA

Indoor Unit Specifications

Table 5: Summary Data—Surface Mounted / Floor Standing Indoor Units.

Unit / Type[1]	ARNU****[2]	Nominal Capacity Btu/h	
		Cooling[3]	Heating[3]
Ceiling Suspended 	183VJA2	19,100	21,500
	243VJA2	24,200	27,300
Convertible Surface Mounted 	093VEA2	9,600	10,900
	123VEA2	12,300	13,600
Floor Standing–with Case 	073 CEA2	7,500	8,500
	093 CEA2	9,600	10,900
	123 CEA2	12,300	13,600
	153 CEA2	15,400	17,100
	183 CFA2	19,100	21,500
	243 CFA2	24,200	27,300
Floor Standing–without case 	073 CEU2	7,500	8,500
	093 CEU2	9,600	10,900
	123 CEU2	12,300	13,600
	153 CEU2	15,400	17,100
	183 CFU2	19,100	21,500
	243 CFU2	24,200	27,300

[1]All indoor units require 208–230V/60Hz/1Ph and an AWG18-2 communication cable. Reference LG's Multi V Indoor Unit Engineering Manual for complete detailed engineering data and selection procedures.

[2]Model # shows nominal capacity and frame size designator.

[3]Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB) and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB). Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB) and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

GENERAL DATA

Indoor Unit Controls and Options

Table 6: Indoor Units—Controls and Options.

	Indoor Unit Type	Wall Mounted—Standard Finish	Wall Mounted—ART COOL™ Mirror	1-Way Cassette	2-Way Cassette	4-Way Cassette		Ducted High Static	Ducted Low Static-Convertible	Ducted Low Static—Bottom Return	Vert.-Horiz. AHU (NJ)	Vert.-Horiz. AHU (NK)	Ceiling Suspended	Convertible Surface Mount	Floor Mount—Cased	Floor Mount—Uncased
	Nominal Chassis Size (MBH)	7–24	7–24	7–12	18–24	5–18	24–48	7–54	7–24	7–24	1–3	3.5–4.5	18–24	9–12	7–24	7–24
Airflow	Air supply outlets	1	1	1	2	4	4	1	1	1	1	1	1	1	1	1
	Airflow direction (left/right)	manual / auto	auto										manual	manual		
	Auto airflow direction (up/down)	√	√	√	√	√	√						√	√		
	Fan speed (Heating mode) (qty.)	(3)	(3)	(4)	(4)	(4)	(4)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
	Fan speed (Cooling mode) (qty.)	(4)	(4)	(5)	(5)	(5)	(5)	(3)	(3)	(3)	(3)	(3)	(4)	(4)	(3)	(3)
	Fan speed (Fan mode) (qty.)	(3)	(3)	(4)	(4)	(4)	(4)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
	Chaos swing (random louver swing)	√	√													
	Chaos wind (random fan speed)	√	√	√	√	√	√						√	√		
	Jet-cool (power cooling)	√	√	√	√	√	√						√	√		
Operation	E.S.P. control			√	√	√	√	√	√	√	√	√			√	√
	High ceiling			√	√	√	√						√	√		
	Auto-restart after power restore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Hot Start	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Diagnostics	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Soft Dry (dehumidification)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Auto changeover (HR)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Auto clean (coil dry)	√	√													
	Child lock	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Forced operation	√	√	√	√	√	√						√	√		
	Group control – Requires the use of one Group control Cable Kit (PZCWRCG3) for every additional indoor unit	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Sleep mode	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Timer (on/off)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Weekly schedule	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Two thermistor control	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Test operation mode	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Filter	Plasma[2]	√	√	√	√[5]	√[5]	√[5]									
	Washable anti-fungal[1]	√	√	√	√	√	√	√	√	√			√	√	√	√
Controllers	LG Programmable Thermostat	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Simple controller w/mode	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Simple controller w/o mode	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
	Wireless hand held controller	o	o	o	o	o	o	o[3]	o[3]	o[3]			o	o	o[3]	o[3]
Others	Condensate lift			√	√	√	√	√	√	√						
	Ventilation air			√		√[4]	√[4]	√	√	√						
	Casing	√	√	√	√	√	√						√	√	√	
	Standard grille			√	√	√	√									
	Auto elevation grille						√[5]									
	Color Panels (qty.)		(3)													
	Suction grille									o						
	Suction canvas									o						
	Aux. Heat Kit										√	√				

[1]Primary washable filters.

[2]Secondary plasma filters. Not available with ARNU093-153TPAA, ARNU183-243TNAA.

[3]Requires LG Programmable Thermostat.

[4]Requires ventilation kit PTVK430 (For TR, TQ frames) or PTVK410+PTVK420 (For TP, TN, TM frames)(Temperature, humidity, and volume limitations apply).

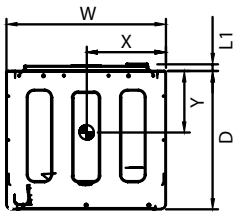
[5]Requires standard grille.

√ = Standard feature

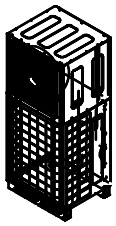
o = Unit option

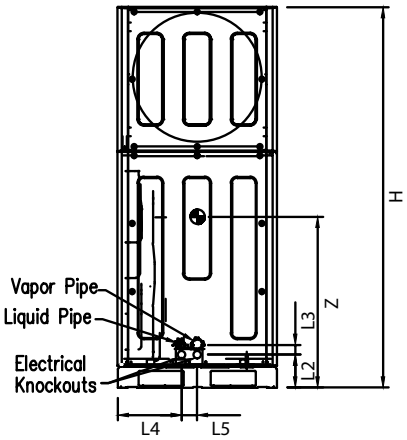
OUTDOOR UNIT DIMENSIONS

ARUN053GF2

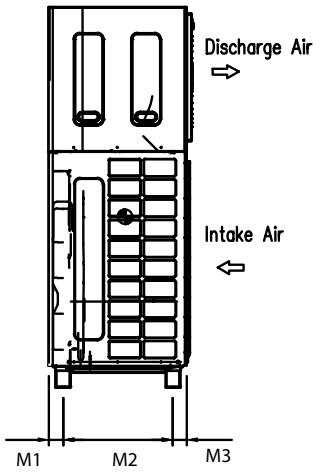


Top View

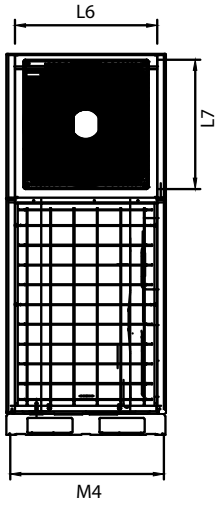




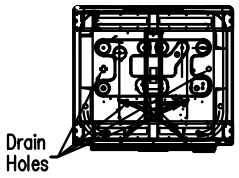
Front View



Side View



Rear View



Bottom View

Dimensions

W	29-1/2"
D	25-1/2"
H	70-1/2"
L1	1-1/4"
L2	6"
L3	1-13/16"
L4	11-13/16"
L5	2-13/16"
L6	26-3/8"
L7	23-15/16"
M1	2-5/8"
M2	20-5/16"
M3	2-9/16"
M4	28-1/2"

Center of Gravity

X	14-5/8"
Y	11-3/8"
Z	31-1/2"

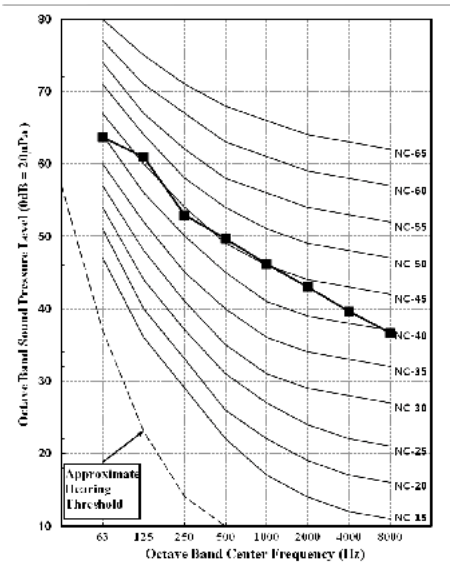
SOUND PRESSURE LEVELS

ARUN053GF2

Multi V Space II Acoustical Data

Multi V Space II Model	dB(A)
208-230V	
ARUN053GF2	Front: 52.7
	Rear: 68.3

Sound Pressure Level - Panel Side (Front)



Sound Pressure Level - Fan Side (Rear)

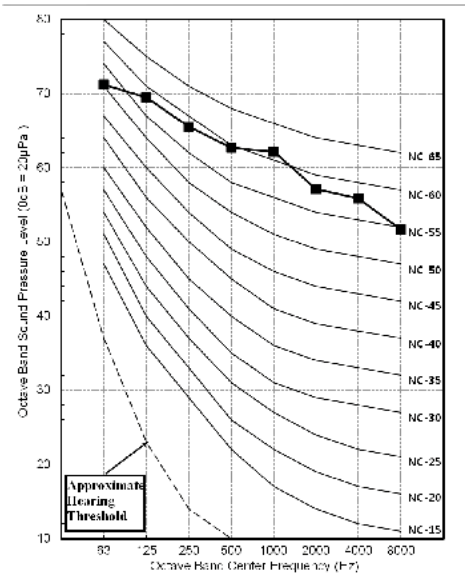


Figure 2: Multi V Space II Acoustics - Panel Side (Front)

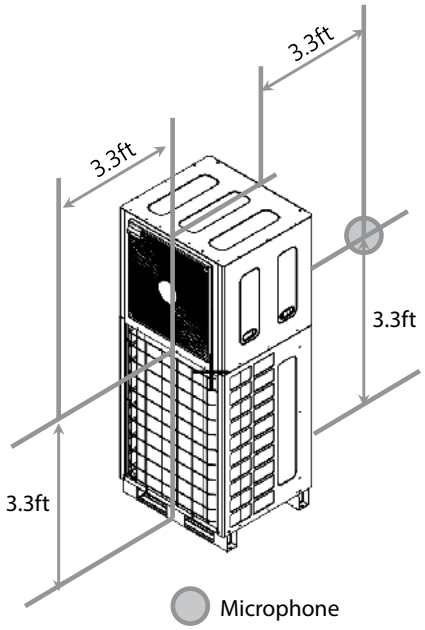
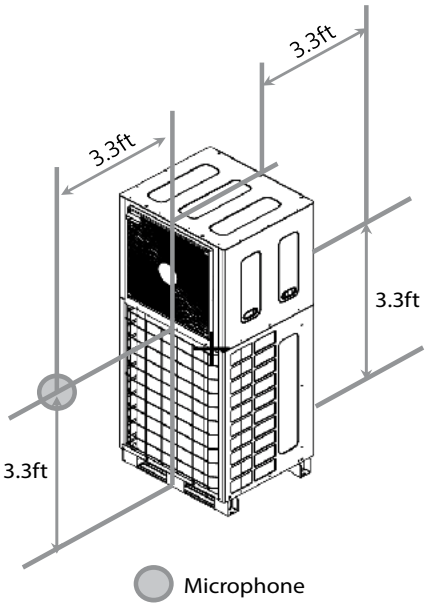


Figure 3: Multi V Space II Acoustics - Fan Side (Rear)

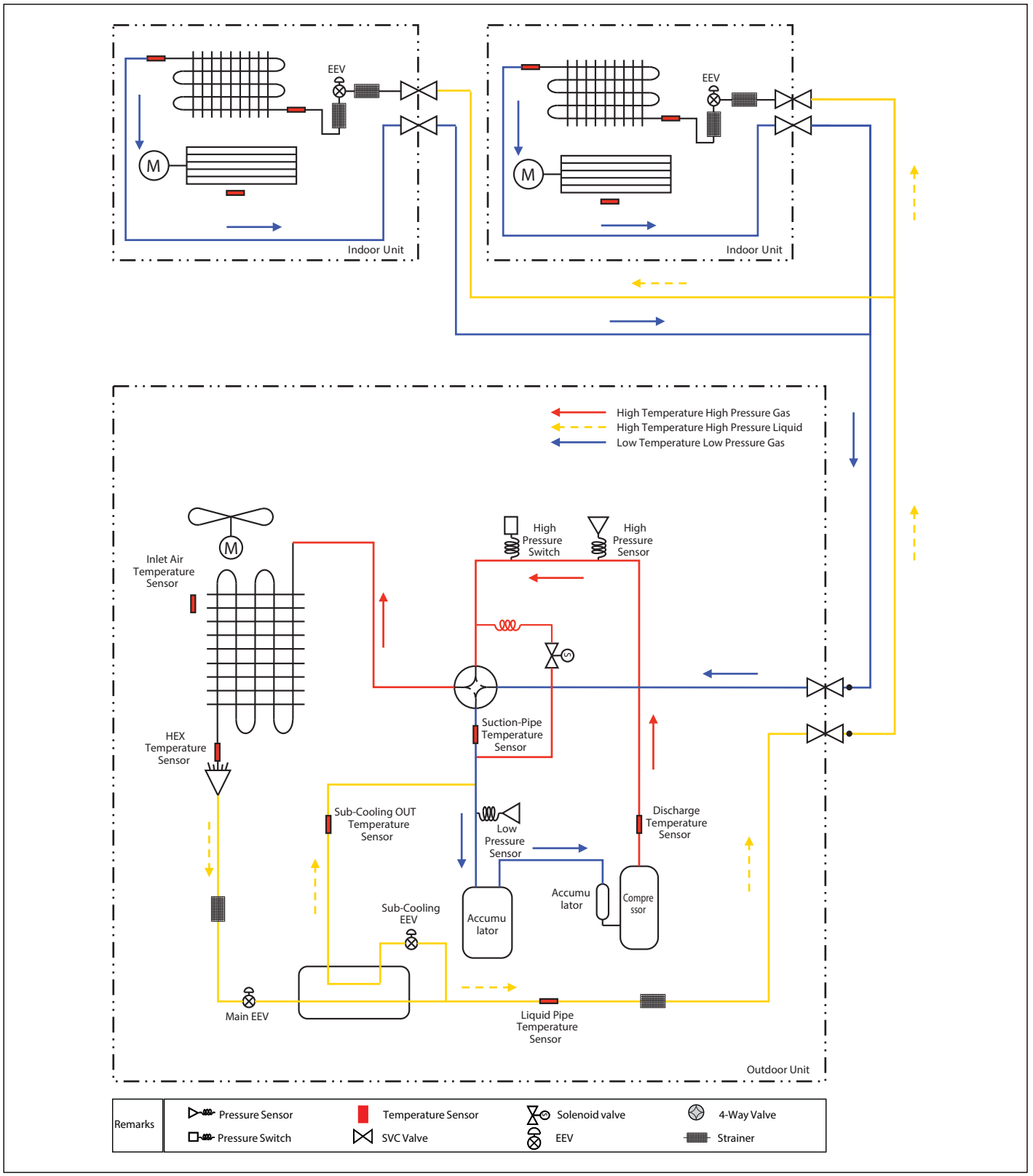


- Measurement taken 3.3' above finished floor, and at a distance of 3.3' from face of unit.
- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) 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 power levels are measured in dB(A)±3.
- Tested in anechoic chamber per ISO Standard 3745.

REFRIGERANT FLOW DIAGRAMS

ARUN053GF2 - Heat Pump

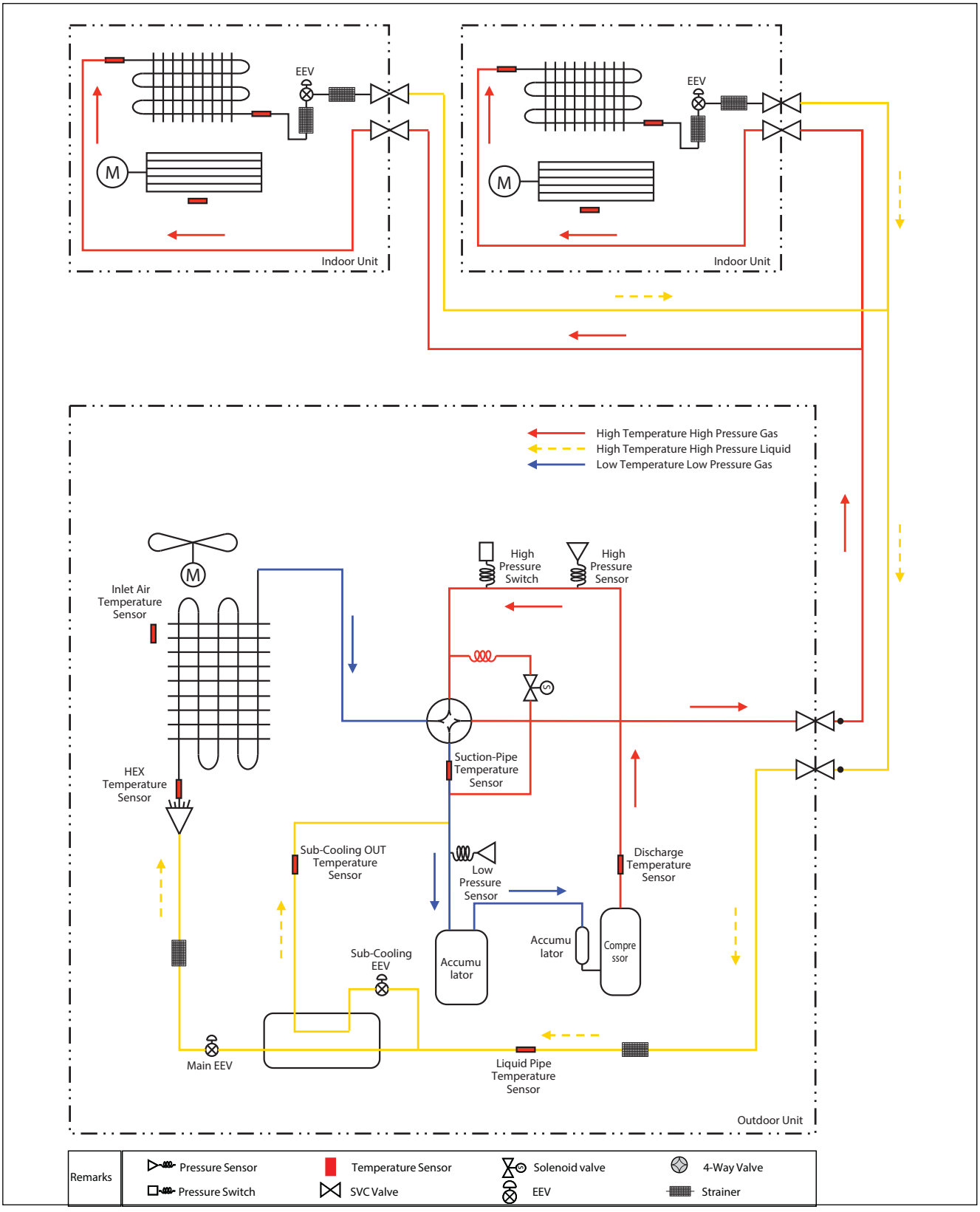
Cooling Mode

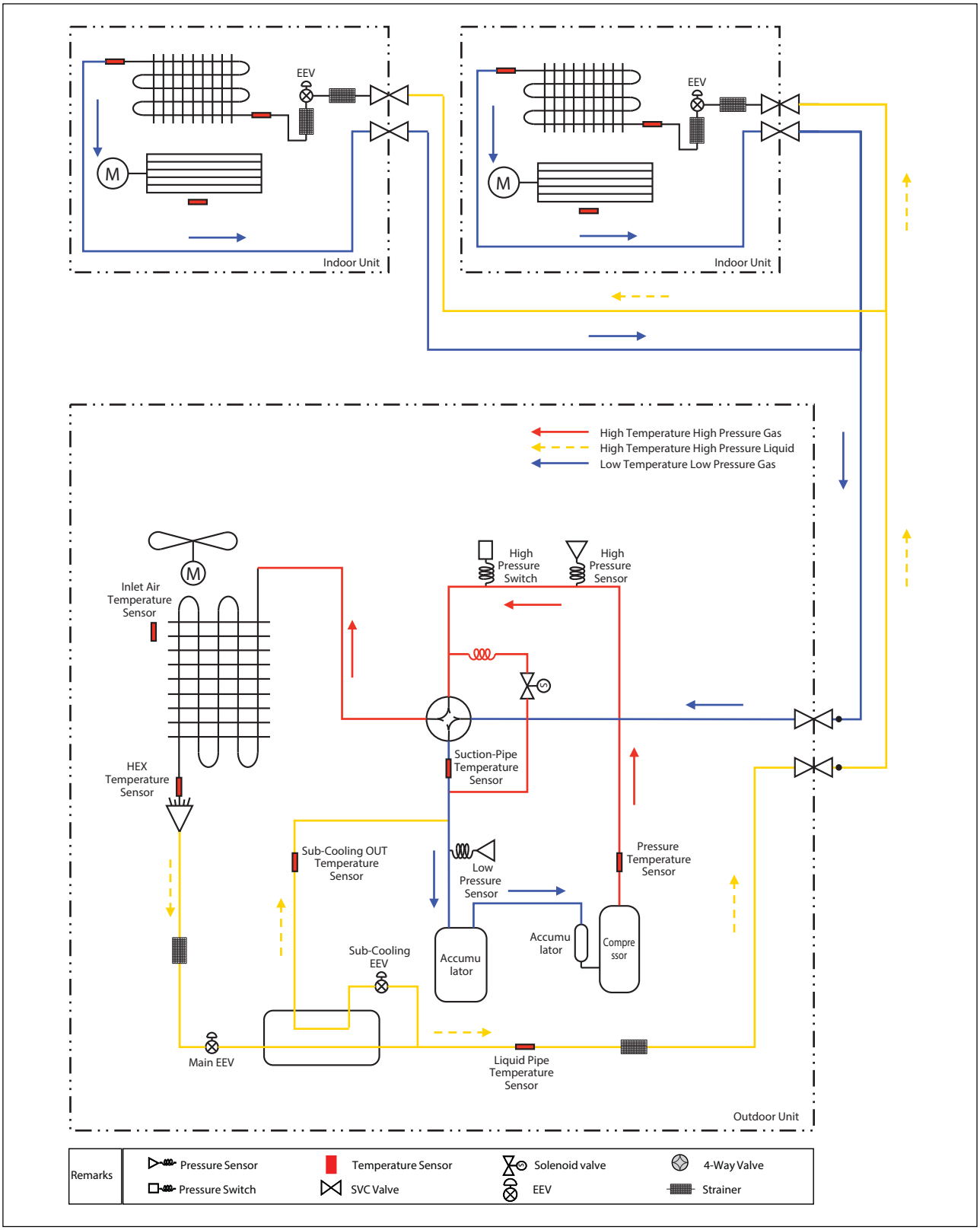


REFRIGERANT FLOW DIAGRAMS

Heating Mode

ARUN053GF2 - Heat Pump




EEV
EEV
M
M
Indoor Unit
Indoor Unit
High Temperature High Pressure Gas
High Temperature High Pressure Liquid
Low Temperature Low Pressure Gas
M
Inlet Air Temperature Sensor
High Pressure Switch
High Pressure Sensor
HEX Temperature Sensor
Suction-Pipe Temperature Sensor
Sub-Cooling OUT Temperature Sensor
Low Pressure Sensor
Pressure Temperature Sensor
Sub-Cooling EEV
Accumu lator
Accumu lator
Compre ssor
Main EEV
Liquid Pipe Temperature Sensor
Outdoor Unit
Remarks
Pressure Sensor
Temperature Sensor
Solenoid valve
4-Way Valve
Pressure Switch
SVC Valve
EEV
Strainer

WIRING DIAGRAM

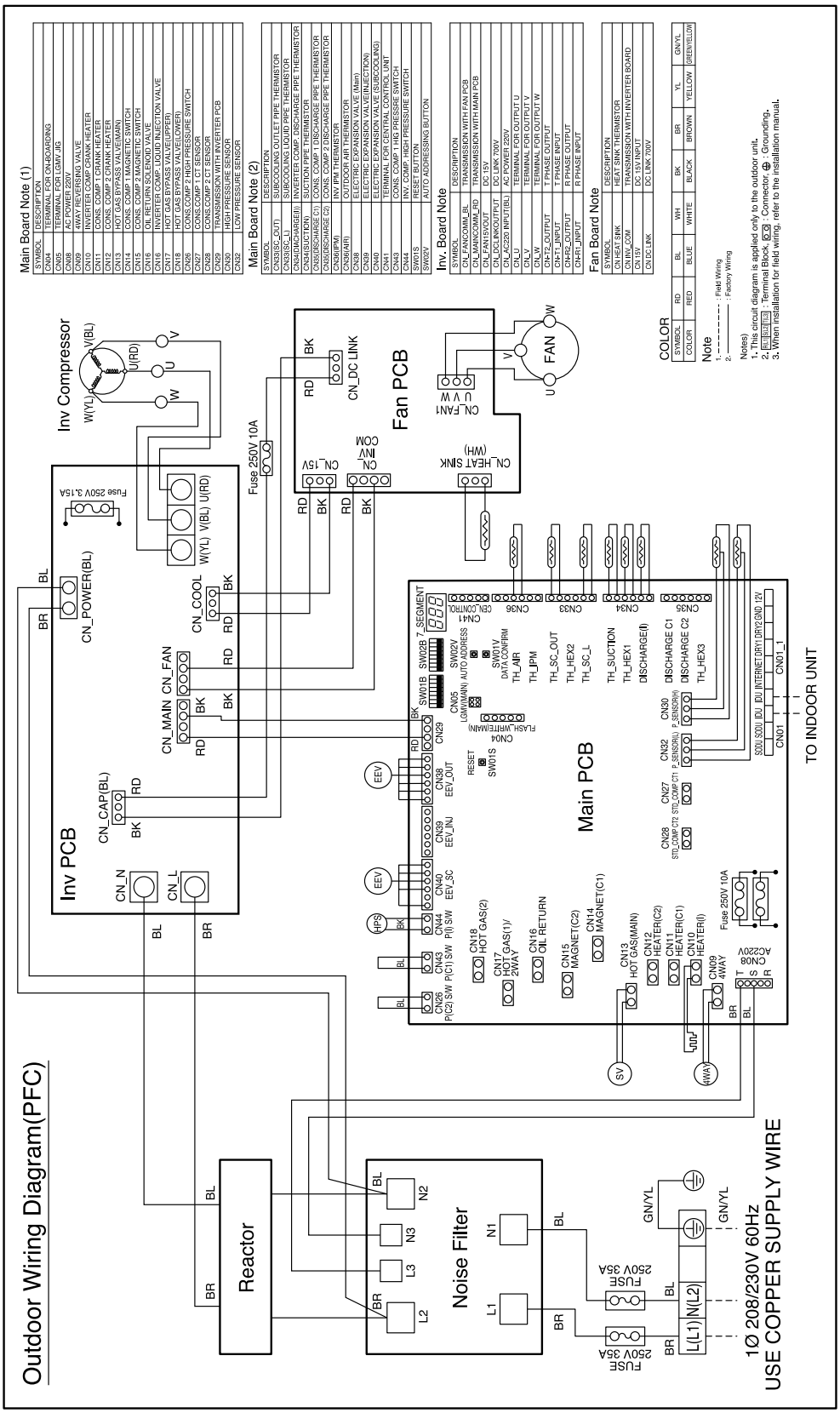


Table 7: Summary Data - Zone Controllers

Zone Controller	Name	Model No.	Case Color	Max. Wire Length (ft.)	Description
	Simple Controller with Mode Selection	PQRCVCL0Q	Black	164	Allows control of indoor unit ON / OFF, operation mode, fan speed, and temperature setpoint for up to 16 indoor units.
		PQRCVCL0QW	White		
	Simple Controller without Mode Selection	PQRCHCA0Q	Black	164	Allows control of indoor unit ON / OFF, fan speed, and temperature setpoint for up to 16 indoor units.
		PQRCHCA0QW	White		
	LG Programmable Thermostat	PREMTB10U	White	164	Allows control of indoor unit ON / OFF, operation mode, occupied / unoccupied temperature setpoints, fan speed, and airflow direction for up to 16 indoor units. Programmable schedule with five events per day.
	Wireless Handheld	PQWRHDF0	Ivory	—	Allows control of indoor unit ON / OFF, operation mode, fan speed, and temperature setpoint. Also provides subfunction control.
	Wall-Mounted Remote Temperature Sensor	PQRSTA0	Ivory	50	Allows remote temperature measurement for cassette and ducted indoor units.

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

For information, refer to the Controls and Options Table on page 18.

Table 8: Summary Data - Zone Controller Communication Cables

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

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

For information, refer to the Controls and Options Table on page 18.

Table 9: Summary Data—Specialty Application Devices

Specialty Application Device	Name	Model No.	Connects To	Application	Binary Signals Input / Output	Description
	Dry Contact Unit 24 VAC	PQDSB1	Indoor Unit	ON / OFF, Run Status, Error Status	1 / 2	Enables the indoor unit to be controlled and monitored by third-party controls using binary inputs and outputs.
	Dry Contact Unit for Setback	PQDSBC		ON / OFF, Mode, Controller Lock, Power Save, Run Status, Error Status	2 / 2	
	Dry Contact Unit for Thermostat	PQDSBNGCM1		ON / OFF, Thermo ON / OFF, Mode, Fan Speed, Run Status, Error Status	—	Enables the indoor unit to be controlled and monitored by a third-party thermostat or controller.
	Digital Output (DO) Kit	PQNFP00T0	Comm. BUS	ON / OFF	0 / 1	One 25A DPST normally open relay. Used with central controller to control third-party device manually or by schedule.
	Auxiliary Heater Relay Kit	PRARH0	Indoor Unit	Third-party Supplemental Heat Control	0 /1	Adds coordinated control of an external heater with normal heat pump operations. Contact energizes at 2.7°F below setpoint. De-energizes at 2.7°F above setpoint.
		PRARS0				
	Power Distribution Indicator (PDI) Premium	PQNUD1S41	Comm. BUS	Energy Consumption Monitoring	8 / 0	Monitors total water source unit power consumption for up to eight systems, and distributes per indoor unit based on weighted calculation.
	Mode Selector Switch	PRDSBM	Outdoor Unit	Multi V Heat Pumps Only	—	Locks outdoor unit into Heat, Cool, or Fan mode.

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

For information, refer to the Controls and Options Table on page 18.

Table 10: Summary Data—Central Controllers (Connect to the Outdoor Unit Terminals Internet A, Internet B)

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

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

For information, refer to the Controls and Options Table on page 18.

Table 11: Summary Data—Integration Solutions (Connect to Outdoor Unit Terminals Internet A, Internet B).

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

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

For information, refer to the Controls and Options Table on page 18

LG Monitoring (LGMV) Diagnostic Software and Cable

(PRCTSL1 and PRCTFE1)

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

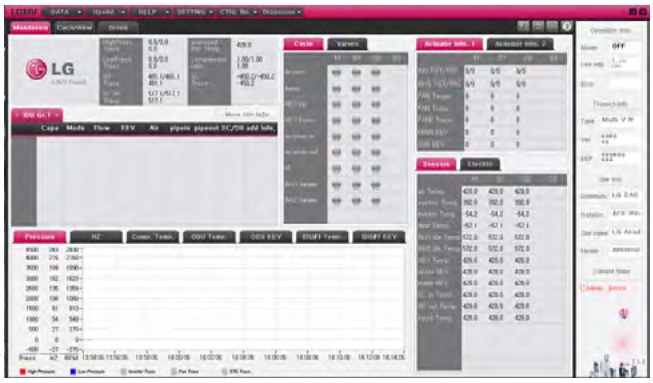


Figure 4: MV Real-time Data Screen.

- Actual inverter compressor speed
- Target inverter compressor speed
- Actual outdoor fan speed
- Target outdoor unit fan speed
- Actual superheat
- Target superheat
- Actual subcooler circuit superheat
- Target subcooler circuit superheat
- Main EEV position
- Subcooling EEV position
- Inverter compressor current transducer value
- Outdoor air temperature
- Actual high pressure/saturation temperature
- Actual low pressure/saturation temperature
- Suction temperature
- Inverter compressor discharge temperature
- Constant speed compressor discharge temperature
- Front outdoor coil pipe temperature
- Back outdoor coil pipe temperature
- Liquid line pipe temperature
- Subcooler inlet temperature
- Subcooler outlet temperature
- Average indoor unit (IDU) pipe temperature
- Inverter compressor operation indicator light
- Constant speed compressor operation indicator light
- Liquid injection valves' operation indicator lights
- Hot gas bypass valve operation indicator light
- Four-way reversing valve operation indicator light
- Pressure graph showing actual low pressure and actual high pressure levels
- Error code display
- Operating mode indicator
- Target high pressure
- Target low pressure
- PCB (printed circuit board) version
- Software version
- Installer name
- Model number of outdoor units
- Site name
- Total number of connected indoor units
- Communication indicator lights
- Indoor unit capacity
- Indoor unit operating mode
- Indoor unit fan speed
- Indoor unit EEV position
- Indoor unit room temperature
- Indoor unit inlet pipe temperature
- Indoor unit outlet pipe temperature
- Indoor unit error code

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

1. Cycleview: Graphic of internal components including:
   - Compressors showing actual speeds
   - EEVs
   - IDUs
   - Liquid injection valves
   - Temperature and pressure sensors
   - Four-way reversing valve
   - Outdoor fans showing status and speeds

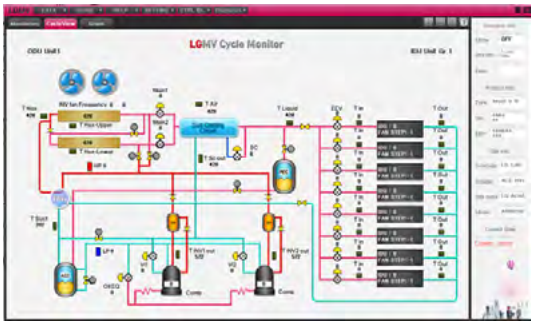


Figure 5: MV Cycleview

2. Graph: Full screen graph of actual high and low pressures and high and low pressure limits. A sliding bar enables user to go back in time and view data.
3. Control IDU: Enables user to turn on all IDU's default setpoints of 86°F in heat mode or 64°F in cool mode.
4. Setting: Converts metric values to imperial values.
5. Making Data: Recording of real time data to a separate file created to be stored on the user's computer.
6. Loading Data: Recorded data from a saved ".CSV" file can be loaded to create an LGMV session.
7. Electrical Data: The lower half of main screen is changed to show the following:
   - Inverter compressor
     - Amps
     - Volts
     - Power Hz
     - Inverter control board fan Hz
   - Constant compressor
     - Current transducer value
     - Phase

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

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

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

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

Recommended Minimum PC Configuration:

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

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PERFORMANCE DATA

“Cooling Capacity Data” on page 32
“Heating Capacity Data” on page 35

PERFORMANCE DATA

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

MULTI V SPACE II

Cooling Capacity

Combination (%)	Outdoor air temp. (°F DB)	Indoor Air Temp. °F DB/°F WB													
		68/57		73/61		79/64		80/67		85/70		88/73		91/76	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW
130	23	49.1	2.03	58.3	2.46	67.8	2.91	70.3	3.15	71.3	3.38	73.8	3.88	75.5	4.01
	25	49.1	2.04	58.3	2.47	67.8	2.93	70.3	3.16	71.3	3.41	73.8	3.90	75.5	4.04
	30	49.1	2.07	58.3	2.51	67.8	2.96	70.3	3.20	71.3	3.44	73.8	3.95	75.5	4.09
	35	49.1	2.09	58.3	2.54	67.8	3.00	70.3	3.24	71.3	3.49	73.8	3.99	75.5	4.13
	40	49.1	2.12	58.3	2.57	67.8	3.03	70.3	3.28	71.3	3.53	73.8	4.04	75.5	4.18
	45	49.1	2.14	58.3	2.59	67.8	3.07	70.3	3.31	71.3	3.56	73.8	4.09	75.5	4.23
	50	49.1	2.16	58.3	2.62	67.8	3.10	70.3	3.35	71.3	3.60	73.8	4.13	75.5	4.27
	55	49.1	2.20	58.3	2.67	67.8	3.16	69.3	3.42	70.3	3.67	72.8	4.20	74.5	4.30
	60	49.1	2.27	58.3	2.76	66.8	3.29	67.8	3.55	68.5	3.81	71.0	4.33	72.8	4.35
	65	49.1	2.32	58.3	2.82	65.8	3.35	66.8	3.62	67.6	3.89	70.0	4.47	71.8	4.51
	70	49.1	2.23	58.3	2.71	64.6	3.34	65.3	3.67	66.3	4.03	68.7	4.48	70.5	4.52
	75	49.1	2.29	58.3	2.89	63.6	3.57	64.3	3.94	65.3	4.32	67.7	4.69	69.5	4.72
	80	49.1	2.60	58.3	3.29	61.8	4.08	62.6	4.51	63.6	4.95	66.0	5.09	67.7	5.13
	85	49.1	2.77	58.3	3.52	60.8	4.36	61.8	4.81	62.6	5.26	65.0	5.30	66.7	5.35
	90	49.1	3.14	57.3	4.00	59.1	4.95	59.8	5.48	60.8	5.67	63.2	5.71	65.0	5.77
	95	49.6	3.33	56.9	4.25	58.7	5.29	59.7	5.85	60.5	5.87	62.8	5.93	64.6	5.98
	100	49.6	3.60	55.9	4.60	57.7	5.73	58.7	6.15	59.5	6.19	62.1	6.25	63.9	6.30
	105	49.6	4.06	54.4	5.20	56.2	6.47	57.0	6.62	57.9	6.65	59.9	6.71	60.8	6.78
	110	49.6	4.56	52.2	5.86	54.4	7.05	54.5	7.09	55.3	7.11	56.5	7.18	56.7	7.25
	115	49.4	5.27	50.3	6.74	50.3	7.44	50.3	7.44	50.3	7.44	51.0	7.45	51.2	7.46
	118	42.9	4.47	43.7	5.71	43.8	6.25	43.8	6.31	43.8	6.31	44.4	6.32	44.2	6.33
	*122	34.3	3.39	35.1	4.34	34.9	4.76	35.0	4.77	35.1	4.78	35.7	4.79	35.6	4.81
120	23	44.7	1.91	53.3	2.31	62.0	2.73	66.4	2.95	69.4	3.18	72.5	3.64	74.0	3.77
	25	44.7	1.92	53.3	2.32	62.0	2.75	66.4	2.97	69.4	3.20	72.5	3.66	74.0	3.79
	30	44.7	1.94	53.3	2.35	62.0	2.78	66.4	3.01	69.4	3.23	72.5	3.71	74.0	3.83
	35	44.7	1.97	53.3	2.38	62.0	2.82	66.4	3.05	69.4	3.27	72.5	3.75	74.0	3.88
	40	44.7	1.99	53.3	2.41	62.0	2.85	66.4	3.08	69.4	3.31	72.5	3.80	74.0	3.93
	45	44.7	2.02	53.3	2.44	62.0	2.88	66.4	3.12	69.4	3.35	72.5	3.84	74.0	3.98
	50	44.7	2.04	53.3	2.47	62.0	2.92	66.4	3.15	69.4	3.39	72.5	3.88	74.0	4.02
	55	44.7	2.07	53.3	2.51	62.0	2.97	66.4	3.22	68.6	3.46	71.5	3.95	73.3	4.05
	60	44.7	2.14	53.3	2.60	62.0	3.10	65.9	3.34	66.7	3.59	69.8	4.08	71.3	4.15
	65	44.7	2.18	53.3	2.66	62.0	3.15	64.9	3.41	65.9	3.66	68.7	4.21	70.5	4.24
	70	44.7	2.14	53.3	2.60	62.0	3.20	63.7	3.52	64.4	3.87	67.5	4.30	69.0	4.34
	75	44.7	2.20	53.3	2.77	62.0	3.43	62.7	3.78	63.7	4.15	66.5	4.50	68.2	4.53
	80	44.7	2.50	53.3	3.16	60.2	3.92	61.0	4.33	61.7	4.76	64.7	4.89	66.2	4.93
	85	44.7	2.66	53.3	3.37	59.3	4.19	60.0	4.62	61.0	5.05	63.7	5.09	65.5	5.13
	90	44.7	3.01	53.3	3.84	57.5	4.76	58.3	5.26	59.0	5.44	61.9	5.49	63.5	5.54
	95	45.2	3.19	53.9	4.08	57.1	5.08	57.9	5.61	58.9	5.64	61.6	5.69	63.4	5.74
	100	45.2	3.46	53.9	4.41	56.1	5.50	57.1	5.91	57.9	5.94	60.8	6.00	62.3	6.05
	105	45.2	3.89	53.0	5.00	54.6	6.21	55.5	6.35	56.2	6.39	59.0	6.44	60.0	6.50
	110	45.2	4.37	51.7	5.63	53.4	6.77	53.5	6.81	54.3	6.83	56.0	6.90	56.2	6.96
	115	43.9	5.06	49.8	6.47	49.8	7.14	49.8	7.14	49.8	7.14	51.0	7.15	51.2	7.17
	118	39.2	4.47	43.3	5.49	43.3	6.00	43.3	6.06	43.3	6.06	44.4	6.07	44.2	6.08
	*122	31.3	3.39	34.7	4.17	34.6	4.57	34.6	4.58	34.7	4.59	35.7	4.60	35.6	4.62
110	23	41.4	1.75	49.4	2.12	57.4	2.51	61.4	2.71	65.4	2.92	72.0	3.34	73.5	3.45
	25	41.4	1.76	49.4	2.13	57.4	2.52	61.4	2.73	65.4	2.93	72.0	3.36	73.5	3.47
	30	41.4	1.79	49.4	2.16	57.4	2.56	61.4	2.76	65.4	2.97	72.0	3.40	73.5	3.52
	35	41.4	1.81	49.4	2.19	57.4	2.59	61.4	2.80	65.4	3.01	72.0	3.45	73.5	3.57
	40	41.4	1.84	49.4	2.22	57.4	2.63	61.4	2.84	65.4	3.05	72.0	3.50	73.5	3.62
	45	41.4	1.87	49.4	2.26	57.4	2.67	61.4	2.89	65.4	3.11	72.0	3.56	73.5	3.68
	50	41.4	1.90	49.4	2.30	57.4	2.72	61.4	2.94	65.4	3.16	72.0	3.62	73.5	3.74
	55	41.4	1.93	49.4	2.34	57.4	2.77	61.4	3.00	65.4	3.22	71.0	3.68	72.5	3.77
	60	41.4	1.99	49.4	2.42	57.4	2.88	61.4	3.11	65.4	3.34	69.2	3.80	70.7	3.83
	65	41.4	2.03	49.4	2.47	57.4	2.94	61.4	3.18	65.4	3.41	68.2	3.92	69.7	3.95
	70	41.4	2.05	49.4	2.50	57.4	3.07	61.4	3.38	64.1	3.71	66.9	4.12	68.5	4.16
	75	41.4	2.11	49.4	2.66	57.4	3.29	61.4	3.63	63.1	3.98	65.9	4.31	67.4	4.35
	80	41.0	2.39	48.9	3.03	56.8	3.76	60.0	4.15	60.7	4.56	63.5	4.68	65.0	4.73
	85	41.0	2.55	48.9	3.24	56.8	4.02	59.0	4.43	59.8	4.84	62.5	4.88	64.0	4.92
	90	41.0	2.89	48.9	3.68	56.5	4.56	57.3	5.04	58.0	5.22	60.7	5.26	62.2	5.31
	95	41.0	3.06	48.9	3.91	55.6	4.87	56.3	5.38	57.0	5.40	59.7	5.45	61.2	5.51
	100	41.0	3.31	48.9	4.23	54.8	5.28	55.6	5.67	56.3	5.70	58.9	5.75	60.4	5.80
	105	41.0	3.73	48.9	4.79	53.1	5.96	53.8	6.09	54.6	6.12	57.2	6.18	58.7	6.24
	110	41.0	4.19	48.9	5.40	51.5	6.49	51.6	6.53	52.4	6.55	54.0	6.61	54.2	6.67
	115	41.0	4.85	48.9	6.21	49.3	6.85	49.3	6.85	49.5	6.85	50.5	6.86	50.7	6.87
	118	39.6	4.42	42.5	5.26	42.9	5.76	42.9	5.81	43.1	5.81	44.0	5.82	43.8	5.83
	*122	31.7	3.35	34.1	4.00	34.2	4.38	34.3	4.39	34.5	4.40	35.3	4.41	35.2	4.43

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

* 122ºF is above the operational range of 118ºF. Space has not been fully tested at this temperature.

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB), and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB).

LG

PERFORMANCE DATA

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

Combination (%)	Outdoor air temp. (°F DB)	Indoor Air Temp. °F DB/°F WB													
		68/57		73/61		79/64		**80/67**		85/70		88/73		91/76	
		TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW
100	23	36.4	1.59	43.4	1.92	50.4	2.27	54.0	2.45	59.3	2.68	66.5	3.07	70.3	3.19
	25	36.4	1.60	43.4	1.93	50.4	2.29	54.0	2.48	59.3	2.70	66.5	3.10	70.3	3.22
	30	36.4	1.64	43.4	1.98	50.4	2.34	54.0	2.53	59.3	2.77	66.5	3.17	70.3	3.30
	35	36.4	1.66	43.4	2.01	50.4	2.38	54.0	2.58	59.3	2.81	66.5	3.22	70.3	3.35
	40	36.4	1.69	43.4	2.05	50.4	2.42	54.0	2.62	59.3	2.85	66.5	3.27	70.3	3.40
	45	36.4	1.73	43.4	2.09	50.4	2.47	54.0	2.67	59.3	2.91	66.5	3.34	70.3	3.47
	50	36.4	1.76	43.4	2.13	50.4	2.52	54.0	2.73	59.3	2.97	66.5	3.41	70.3	3.54
	55	36.4	1.79	43.4	2.17	50.4	2.57	54.0	2.78	59.3	3.03	66.5	3.47	69.5	3.60
	60	36.4	1.85	43.4	2.25	50.4	2.68	54.0	2.89	59.3	3.15	66.3	3.58	67.5	3.66
	65	36.4	1.89	43.4	2.30	50.4	2.73	54.0	2.95	59.3	3.21	65.3	3.69	66.8	3.77
	70	36.4	1.95	43.4	2.37	50.4	2.91	54.0	3.20	59.3	3.57	64.1	3.96	65.3	4.03
	75	36.4	2.00	43.4	2.52	50.4	3.11	54.0	3.44	59.3	3.82	63.1	4.15	64.6	4.20
	80	36.4	2.27	43.4	2.87	50.4	3.56	54.0	3.93	59.3	4.39	61.3	4.50	62.6	4.57
	85	36.4	2.41	43.4	3.07	50.4	3.81	54.0	4.19	59.1	4.65	60.3	4.69	61.8	4.76
	90	36.4	2.73	43.4	3.48	50.4	4.32	54.0	4.78	57.1	5.02	58.6	5.06	59.8	5.13
	95	36.4	2.90	43.4	3.71	50.4	4.61	**54.0**	**5.10**	56.4	5.20	57.6	5.25	59.1	5.32
	100	36.4	3.13	43.4	4.00	50.4	4.99	53.0	5.36	55.4	5.47	56.9	5.52	58.1	5.59
	105	36.4	3.52	43.4	4.51	50.1	5.61	51.6	5.74	53.7	5.85	55.1	5.91	56.5	5.99
	110	36.4	3.93	43.4	5.06	49.5	6.09	50.7	6.12	51.7	6.23	52.5	6.29	53.5	6.38
	115	36.4	4.52	43.4	5.78	47.1	6.38	48.6	6.38	49.8	6.47	50.3	6.48	50.5	6.53
	118	36.4	4.56	38.1	5.42	41.0	5.36	42.3	5.41	43.4	5.49	43.8	5.50	43.6	5.54
	*122	31.1	4.13	30.5	4.12	32.7	4.08	33.8	4.09	34.7	4.16	35.2	4.17	35.1	4.21
90	23	32.8	1.42	39.1	1.71	45.6	2.01	48.7	2.17	51.8	2.34	58.1	2.65	64.4	2.93
	25	32.8	1.44	39.1	1.73	45.6	2.04	48.7	2.20	51.8	2.36	58.1	2.69	64.4	2.97
	30	32.8	1.48	39.1	1.78	45.6	2.10	48.7	2.26	51.8	2.44	58.1	2.77	64.4	3.06
	35	32.8	1.52	39.1	1.84	45.6	2.16	48.7	2.33	51.8	2.51	58.1	2.85	64.4	3.15
	40	32.8	1.57	39.1	1.89	45.6	2.23	48.7	2.40	51.8	2.59	58.1	2.94	64.4	3.24
	45	32.8	1.61	39.1	1.93	45.6	2.28	48.7	2.46	51.8	2.65	58.1	3.00	64.4	3.32
	50	32.8	1.64	39.1	1.98	45.6	2.33	48.7	2.51	51.8	2.71	58.1	3.07	64.4	3.39
	55	32.8	1.66	39.1	2.01	45.6	2.37	48.7	2.56	51.8	2.76	58.1	3.13	64.4	3.42
	60	32.8	1.72	39.1	2.09	45.6	2.46	48.7	2.66	51.8	2.87	58.1	3.25	63.8	3.46
	65	32.8	1.75	39.1	2.13	45.6	2.51	48.7	2.72	51.8	2.92	58.1	3.31	63.4	3.64
	70	32.8	1.80	39.1	2.19	45.6	2.60	48.7	2.87	51.8	3.13	58.1	3.70	62.2	3.91
	75	32.8	1.83	39.1	2.29	45.6	2.79	48.7	3.07	51.8	3.36	58.1	3.86	61.2	4.08
	80	32.8	2.06	39.1	2.59	45.6	3.18	48.7	3.51	51.8	3.84	58.1	4.26	59.5	4.44
	85	32.8	2.19	39.1	2.77	45.6	3.40	48.7	3.74	51.8	4.10	57.4	4.49	58.6	4.62
	90	32.8	2.47	39.1	3.13	45.6	3.86	48.7	4.26	51.8	4.67	55.7	4.91	56.9	4.99
	95	32.8	2.63	39.1	3.32	45.6	4.11	48.7	4.54	51.8	4.98	54.7	5.10	55.9	5.17
	100	32.8	2.72	39.1	3.46	45.6	4.29	48.7	4.72	51.8	5.09	54.0	5.32	55.0	5.38
	105	32.8	3.15	39.1	4.02	45.6	4.85	48.7	5.17	51.2	5.46	52.3	5.70	53.0	5.77
	110	32.8	3.62	39.1	4.63	45.6	5.32	48.7	5.58	49.2	5.92	49.8	6.12	50.2	6.19
	115	32.8	3.92	39.1	5.02	42.7	5.60	46.2	5.84	46.8	6.11	47.3	6.25	47.5	6.33
	118	32.8	4.16	38.1	5.42	37.2	4.71	40.2	4.95	40.8	5.19	41.2	5.30	41.0	5.37
	*122	31.1	4.13	30.5	4.12	29.6	3.58	32.1	3.75	32.7	3.93	33.0	4.02	33.0	4.08
80	23	29.2	1.24	34.7	1.48	40.5	1.74	43.2	1.88	46.0	2.01	51.6	2.31	57.1	2.58
	25	29.2	1.25	34.7	1.50	40.5	1.75	43.2	1.90	46.0	2.03	51.6	2.33	57.1	2.61
	30	29.2	1.29	34.7	1.54	40.5	1.81	43.2	1.95	46.0	2.09	51.6	2.40	57.1	2.68
	35	29.2	1.32	34.7	1.59	40.5	1.86	43.2	2.00	46.0	2.15	51.6	2.46	57.1	2.76
	40	29.2	1.36	34.7	1.63	40.5	1.91	43.2	2.06	46.0	2.21	51.6	2.53	57.1	2.83
	45	29.2	1.38	34.7	1.65	40.5	1.94	43.2	2.09	46.0	2.23	51.6	2.57	57.1	2.87
	50	29.2	1.40	34.7	1.67	40.5	1.96	43.2	2.12	46.0	2.27	51.6	2.60	57.1	2.91
	55	29.2	1.42	34.7	1.70	40.5	2.00	43.2	2.15	46.0	2.31	51.6	2.65	57.1	2.96
	60	29.2	1.47	34.7	1.76	40.5	2.07	43.2	2.23	46.0	2.40	51.6	2.74	57.1	3.08
	65	29.2	1.49	34.7	1.79	40.5	2.11	43.2	2.27	46.0	2.45	51.6	2.79	57.1	3.15
	70	29.2	1.53	34.7	1.84	40.5	2.17	43.2	2.34	46.0	2.55	51.6	3.01	57.1	3.49
	75	29.2	1.56	34.7	1.88	40.5	2.28	43.2	2.50	46.0	2.72	51.6	3.20	57.1	3.67
	80	29.2	1.71	34.7	2.13	40.5	2.60	43.2	2.84	46.0	3.10	51.6	3.68	57.1	4.11
	85	29.2	1.82	34.7	2.27	40.5	2.77	43.2	3.03	46.0	3.32	51.6	3.92	57.1	4.21
	90	29.2	2.05	34.7	2.57	40.5	3.13	43.2	3.44	46.0	3.78	51.6	4.31	56.2	4.46
	95	29.2	2.17	34.7	2.72	40.5	3.34	43.2	3.66	46.0	4.02	51.6	4.46	55.0	4.58
	100	29.2	2.34	34.7	2.93	40.5	3.61	43.2	3.92	46.0	4.18	51.6	4.65	53.8	4.73
	105	29.2	2.67	34.7	3.36	40.5	4.01	43.2	4.20	46.0	4.48	51.0	4.83	52.2	4.97
	110	29.2	3.03	34.7	3.83	40.5	4.26	43.2	4.49	46.0	4.82	49.2	5.01	49.4	5.22
	115	29.2	3.24	34.7	4.09	40.5	4.40	43.2	4.72	43.2	4.94	43.4	5.12	43.4	5.43
	118	29.2	3.44	34.7	4.34	37.2	4.71	37.9	4.48	37.6	4.19	37.8	4.35	37.5	4.61
	*122	29.2	3.72	30.6	4.10	29.6	3.58	30.3	3.39	30.1	3.17	30.4	3.29	30.2	3.50

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

* 122ºF is above the operational range of 118ºF. Space has not been fully tested at this temperature.

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB), and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB).

PERFORMANCE DATA

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

MULTI V SPACE II

Cooling Capacity

Combination (%)	Outdoor air temp. (°F DB)	Indoor Air Temp. °F DB/°F WB													
		68/57		73/61		79/64		80/67		85/70		88/73		91/76	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW	MBh	kW
70	23	25.6	1.09	30.4	1.29	35.4	1.51	37.8	1.62	40.3	1.73	45.1	1.97	50.1	2.22
	25	25.6	1.10	30.4	1.30	35.4	1.52	37.8	1.64	40.3	1.75	45.1	1.99	50.1	2.24
	30	25.6	1.13	30.4	1.33	35.4	1.56	37.8	1.68	40.3	1.80	45.1	2.04	50.1	2.30
	35	25.6	1.16	30.4	1.37	35.4	1.61	37.8	1.72	40.3	1.85	45.1	2.10	50.1	2.36
	40	25.6	1.19	30.4	1.41	35.4	1.65	37.8	1.77	40.3	1.89	45.1	2.15	50.1	2.42
	45	25.6	1.20	30.4	1.43	35.4	1.67	37.8	1.80	40.3	1.92	45.1	2.19	50.1	2.46
	50	25.6	1.23	30.4	1.45	35.4	1.70	37.8	1.83	40.3	1.96	45.1	2.22	50.1	2.50
	55	25.6	1.25	30.4	1.48	35.4	1.73	37.8	1.86	40.3	1.99	45.1	2.27	50.1	2.55
	60	25.6	1.28	30.4	1.53	35.4	1.79	37.8	1.93	40.3	2.06	45.1	2.35	50.1	2.65
	65	25.6	1.30	30.4	1.56	35.4	1.82	37.8	1.96	40.3	2.10	45.1	2.39	50.1	2.69
	70	25.6	1.34	30.4	1.60	35.4	1.88	37.8	2.02	40.3	2.17	45.1	2.48	50.1	2.86
	75	25.6	1.36	30.4	1.63	35.4	1.91	37.8	2.09	40.3	2.27	45.1	2.65	50.1	3.03
	80	25.6	1.47	30.4	1.80	35.4	2.17	37.8	2.37	40.3	2.57	45.1	2.93	50.1	3.36
	85	25.6	1.56	30.4	1.91	35.4	2.32	37.8	2.53	40.3	2.77	45.1	3.12	50.1	3.50
	90	25.6	1.75	30.4	2.16	35.4	2.62	37.8	2.86	40.3	3.13	45.1	3.48	50.1	3.80
	95	25.6	1.85	30.4	2.30	35.4	2.79	37.8	3.05	40.3	3.32	45.1	3.66	50.1	3.92
	100	25.6	2.00	30.4	2.48	35.4	3.01	37.8	3.29	40.3	3.42	45.1	3.83	50.1	4.03
	105	25.6	2.26	30.4	2.83	35.4	3.32	37.8	3.51	40.3	3.72	45.1	4.03	50.1	4.26
	110	25.6	2.55	30.4	3.20	35.4	3.51	37.8	3.73	40.3	4.03	45.1	4.20	48.7	4.58
	115	25.6	2.74	30.4	3.41	35.4	3.63	37.8	3.94	40.3	4.15	45.1	4.33	45.9	4.88
	118	25.6	2.91	30.4	3.63	35.4	3.86	37.8	4.17	36.6	4.15	37.8	3.67	37.5	4.14
	*122	25.6	3.14	30.4	3.93	31.6	3.69	30.2	3.43	29.3	3.14	30.4	2.78	30.2	3.15
60	23	21.9	.93	26.0	1.10	30.4	1.28	32.3	1.37	34.5	1.47	38.8	1.66	42.9	1.87
	25	21.9	.94	26.0	1.11	30.4	1.29	32.3	1.38	34.5	1.48	38.8	1.68	42.9	1.89
	30	21.9	.97	26.0	1.14	30.4	1.32	32.3	1.42	34.5	1.52	38.8	1.73	42.9	1.94
	35	21.9	.99	26.0	1.17	30.4	1.36	32.3	1.46	34.5	1.56	38.8	1.77	42.9	1.99
	40	21.9	1.02	26.0	1.20	30.4	1.39	32.3	1.50	34.5	1.60	38.8	1.82	42.9	2.04
	45	21.9	1.03	26.0	1.21	30.4	1.40	32.3	1.51	34.5	1.62	38.8	1.83	42.9	2.06
	50	21.9	1.03	26.0	1.22	30.4	1.42	32.3	1.52	34.5	1.63	38.8	1.85	42.9	2.08
	55	21.9	1.05	26.0	1.24	30.4	1.45	32.3	1.55	34.5	1.66	38.8	1.88	42.9	2.11
	60	21.9	1.08	26.0	1.28	30.4	1.49	32.3	1.61	34.5	1.72	38.8	1.95	42.9	2.20
	65	21.9	1.10	26.0	1.30	30.4	1.52	32.3	1.64	34.5	1.75	38.8	1.99	42.9	2.24
	70	21.9	1.13	26.0	1.34	30.4	1.57	32.3	1.68	34.5	1.80	38.8	2.05	42.9	2.32
	75	21.9	1.15	26.0	1.36	30.4	1.59	32.3	1.71	34.5	1.86	38.8	2.17	42.9	2.47
	80	21.9	1.22	26.0	1.49	30.4	1.79	32.3	1.95	34.5	2.11	38.8	2.43	42.9	2.80
	85	21.9	1.30	26.0	1.58	30.4	1.90	32.3	2.08	34.5	2.26	38.8	2.56	42.9	2.89
	90	21.9	1.45	26.0	1.79	30.4	2.15	32.3	2.34	34.5	2.54	38.8	2.86	42.9	3.15
	95	21.9	1.54	26.0	1.89	30.4	2.28	32.3	2.50	34.5	2.69	38.8	2.99	42.9	3.31
	100	21.9	1.65	26.0	2.03	30.4	2.46	32.3	2.69	34.5	2.81	38.8	3.17	42.9	3.46
	105	21.9	1.88	26.0	2.32	30.4	2.71	32.3	2.87	34.5	3.05	38.8	3.37	42.9	3.77
	110	21.9	2.11	26.0	2.63	30.4	2.93	32.3	3.05	34.5	3.30	38.8	3.60	42.9	4.11
	115	21.9	2.26	26.0	2.81	30.4	3.04	32.3	3.22	34.5	3.42	38.8	3.81	42.9	4.39
	118	21.9	2.39	26.0	2.97	30.4	3.23	32.3	3.42	34.5	3.64	37.8	3.67	37.5	4.14
	*122	21.9	2.58	26.0	3.22	30.4	3.50	30.2	3.47	29.2	3.22	30.4	2.78	30.2	3.15
50	23	18.2	.81	21.7	.94	25.3	1.08	27.0	1.15	28.7	1.23	32.3	1.38	35.7	1.53
	25	18.2	.82	21.7	.96	25.3	1.09	27.0	1.16	28.7	1.24	32.3	1.39	35.7	1.55
	30	18.2	.84	21.7	.98	25.3	1.12	27.0	1.20	28.7	1.28	32.3	1.43	35.7	1.59
	35	18.2	.87	21.7	1.00	25.3	1.15	27.0	1.23	28.7	1.31	32.3	1.47	35.7	1.63
	40	18.2	.89	21.7	1.03	25.3	1.18	27.0	1.26	28.7	1.34	32.3	1.50	35.7	1.67
	45	18.2	.90	21.7	1.05	25.3	1.20	27.0	1.28	28.7	1.36	32.3	1.52	35.7	1.70
	50	18.2	.91	21.7	1.06	25.3	1.22	27.0	1.29	28.7	1.38	32.3	1.55	35.7	1.72
	55	18.2	.93	21.7	1.08	25.3	1.24	27.0	1.31	28.7	1.40	32.3	1.58	35.7	1.75
	60	18.2	.95	21.7	1.11	25.3	1.28	27.0	1.36	28.7	1.45	32.3	1.63	35.7	1.82
	65	18.2	.96	21.7	1.13	25.3	1.29	27.0	1.38	28.7	1.47	32.3	1.65	35.7	1.85
	70	18.2	.99	21.7	1.15	25.3	1.32	27.0	1.42	28.7	1.51	32.3	1.70	35.7	1.91
	75	18.2	1.00	21.7	1.17	25.3	1.35	27.0	1.44	28.7	1.54	32.3	1.73	35.7	1.95
	80	18.2	1.03	21.7	1.24	25.3	1.45	27.0	1.57	28.7	1.68	32.3	1.94	35.7	2.21
	85	18.2	1.10	21.7	1.30	25.3	1.54	27.0	1.66	28.7	1.79	32.3	2.06	35.7	2.36
	90	18.2	1.23	21.7	1.46	25.3	1.73	27.0	1.87	28.7	2.01	32.3	2.33	35.7	2.67
	95	18.2	1.29	21.7	1.55	25.3	1.83	27.0	1.99	28.7	2.14	32.3	2.47	35.7	2.83
	100	18.2	1.36	21.7	1.64	25.3	1.94	27.0	2.10	28.7	2.27	32.3	2.63	35.7	3.01
	105	18.2	1.49	21.7	1.81	25.3	2.14	27.0	2.32	28.7	2.51	32.3	2.91	35.7	3.35
	110	18.2	1.64	21.7	2.00	25.3	2.37	27.0	2.58	28.7	2.79	32.3	3.25	35.7	3.74
	115	18.2	1.76	21.7	2.14	25.3	2.55	27.0	2.77	28.7	3.01	32.3	3.50	35.7	4.03
	118	18.2	1.90	21.7	2.32	25.3	2.77	27.0	3.02	28.7	3.27	32.3	3.67	35.7	4.14
	*122	18.2	2.10	21.7	2.57	25.3	3.07	27.0	3.35	28.7	3.22	30.4	2.78	30.2	3.15

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

* 122ºF is above the operational range of 118ºF. Space has not been fully tested at this temperature.

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal cooling capacity rating obtained with air entering the indoor unit at 80ºF dry bulb (DB) and 67ºF wet bulb (WB), and outdoor ambient conditions of 95ºF dry bulb (DB) and 75ºF wet bulb (WB).

LG

PERFORMANCE DATA

Heating Capacity

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

Combination (%)	Outdoor air temp.		Indoor Air Temp. °F DB/°F WB															
			59		61		64		67		70		73		76		80	
	°F DB	°F WB	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW
130	-4	-4.4	44.8	5.19	44.8	5.31	44.8	5.43	44.6	5.54	44.5	5.64	44.5	5.75	44.5	5.88	44.2	6.02
	0	-0.4	45.9	5.30	45.9	5.40	45.9	5.51	45.7	5.61	45.6	5.71	45.6	5.80	45.3	5.94	45.3	6.10
	5	4.5	50.3	5.51	50.3	5.62	50.3	5.73	50.2	5.84	50.1	5.90	50.1	6.07	50.1	6.24	49.8	6.40
	10	9	52.9	5.60	52.6	5.72	52.3	5.83	52.3	5.95	52.3	5.99	52.0	6.18	52.0	6.38	52.0	6.53
	15	14	55.9	5.78	55.9	5.90	55.9	6.03	55.8	6.15	55.7	6.20	55.7	6.38	55.7	6.57	55.4	6.72
	20	19	58.9	5.94	58.6	6.06	58.4	6.17	58.4	6.29	58.4	6.35	58.1	6.52	58.1	6.72	58.1	6.61
	25	23	60.9	6.04	60.9	6.17	60.9	6.29	60.7	6.42	60.6	6.49	60.6	6.67	60.6	6.67	60.3	6.52
	30	28	63.5	6.15	63.2	6.27	63.0	6.40	62.8	6.53	62.7	6.62	62.7	6.72	62.7	6.58	62.5	6.42
	35	32	66.6	6.32	66.3	6.44	66.0	6.55	66.0	6.67	66.0	6.72	66.0	6.59	65.8	6.41	65.8	6.25
	40	36	69.7	6.50	69.5	6.59	69.2	6.66	69.2	6.72	69.2	6.62	69.2	6.40	68.9	6.25	68.9	6.06
	45	41	71.5	6.60	71.5	6.68	71.5	6.72	71.4	6.62	71.3	6.45	71.3	6.27	71.0	6.11	71.0	5.92
	47	43	73.6	6.69	73.6	6.72	73.6	6.59	73.4	6.46	73.3	6.32	73.3	6.13	73.3	5.95	72.5	5.77
	50	46	75.6	6.72	75.6	6.61	75.6	6.48	75.4	6.35	75.3	6.16	75.3	5.97	75.3	5.81	72.3	5.59
	55	51	78.1	6.62	77.8	6.47	77.6	6.32	77.4	6.18	77.3	6.02	77.3	5.82	77.3	5.62	72.0	5.43
	60	56	77.5	6.27	77.5	6.13	77.5	6.00	77.4	5.86	77.3	5.61	75.4	5.43	72.8	5.25	67.7	5.05
120	-4	-4.4	45.1	5.62	44.9	5.68	44.6	5.74	44.4	5.80	44.3	5.91	44.3	6.02	44.3	6.11	44.0	6.24
	0	-0.4	45.7	5.68	45.7	5.74	45.7	5.80	45.6	5.87	45.4	5.98	45.4	6.08	45.4	6.16	45.1	6.29
	5	4.5	50.7	5.86	50.4	5.94	50.2	6.02	50.0	6.10	49.9	6.17	49.9	6.29	49.9	6.38	49.6	6.57
	10	9	52.4	5.97	52.4	6.04	52.4	6.12	52.3	6.19	52.1	6.26	52.1	6.39	52.1	6.49	51.9	6.70
	15	14	56.0	6.17	55.8	6.25	55.5	6.31	55.5	6.37	55.5	6.47	55.2	6.58	55.2	6.70	55.0	6.66
	20	19	58.5	6.30	58.5	6.37	58.5	6.44	58.3	6.51	58.2	6.64	58.2	6.70	58.2	6.64	57.9	6.56
	25	23	60.9	6.39	60.7	6.46	60.4	6.54	60.4	6.62	60.4	6.70	60.2	6.61	60.2	6.54	60.2	6.47
	30	28	63.1	6.50	62.8	6.57	62.5	6.63	62.5	6.70	62.5	6.60	62.5	6.51	62.3	6.44	62.3	6.38
	35	32	66.1	6.59	66.1	6.64	66.1	6.70	66.0	6.56	65.8	6.45	65.8	6.35	65.8	6.27	65.6	6.20
	40	36	69.3	6.66	69.3	6.70	69.3	6.56	69.2	6.40	69.0	6.27	69.0	6.18	69.0	6.12	67.5	6.04
	45	41	71.3	6.70	71.3	6.58	71.3	6.45	71.2	6.29	71.1	6.17	71.1	6.06	71.1	5.99	67.2	5.91
	47	43	73.4	6.59	73.4	6.46	73.4	6.34	73.2	6.17	73.1	6.05	73.1	5.93	72.1	5.88	67.0	5.77
	50	46	73.6	6.48	73.4	6.35	73.1	6.23	73.1	6.07	73.1	5.92	71.9	5.79	69.6	5.75	64.7	5.64
	55	51	74.6	6.37	74.3	6.24	74.1	6.11	73.6	5.94	73.1	5.79	70.7	5.66	68.5	5.60	63.6	5.49
	60	56	78.9	6.09	78.3	5.96	77.7	5.84	75.4	5.60	73.1	5.40	70.7	5.23	68.5	5.15	63.6	5.01
110	-4	-4.4	44.6	6.07	44.3	6.11	44.1	6.16	44.1	6.20	44.1	6.27	44.1	6.35	43.8	6.46	43.8	6.56
	0	-0.4	45.7	6.12	45.5	6.17	45.2	6.22	45.2	6.26	45.2	6.35	44.9	6.44	44.9	6.53	44.9	6.63
	5	4.5	50.2	6.31	49.9	6.37	49.7	6.43	49.7	6.48	49.7	6.54	49.7	6.62	49.4	6.76	49.4	6.72
	10	9	52.2	6.40	52.2	6.46	52.2	6.53	52.0	6.58	51.9	6.64	51.9	6.77	51.9	6.72	51.6	6.61
	15	14	55.8	6.53	55.5	6.62	55.3	6.70	55.3	6.77	55.3	6.73	55.3	6.67	55.0	6.58	55.0	6.45
	20	19	58.2	6.66	58.2	6.77	58.2	6.68	58.1	6.63	57.9	6.57	57.9	6.52	57.9	6.43	57.7	6.28
	25	23	60.7	6.77	60.4	6.64	60.2	6.56	60.2	6.50	60.2	6.45	60.2	6.38	59.9	6.30	59.9	6.17
	30	28	62.6	6.64	62.6	6.52	62.6	6.44	62.4	6.37	62.3	6.32	62.3	6.25	62.3	6.18	62.0	6.04
	35	32	65.6	6.43	65.6	6.35	65.6	6.27	65.6	6.19	65.6	6.14	65.4	6.08	65.4	5.99	62.2	5.85
	40	36	65.9	6.25	65.9	6.17	65.9	6.09	65.7	6.01	65.6	5.96	65.6	5.88	63.4	5.80	59.2	5.68
	45	41	66.3	6.15	66.1	6.06	65.8	5.98	65.7	5.90	65.6	5.83	63.5	5.76	61.3	5.69	57.3	5.54
	47	43	68.5	6.02	68.2	5.94	68.0	5.86	66.8	5.77	65.6	5.71	63.5	5.64	61.3	5.57	57.3	5.39
	50	46	70.9	5.88	70.4	5.80	69.9	5.72	67.8	5.65	65.6	5.55	63.5	5.49	61.3	5.39	57.3	5.24
	55	51	75.2	5.75	72.5	5.67	69.9	5.58	67.8	5.49	65.6	5.39	63.5	5.33	61.3	5.25	57.3	5.09
	60	56	78.0	5.34	74.0	5.29	69.9	5.24	67.8	5.19	65.6	5.09	63.5	5.03	61.3	4.94	57.3	4.80

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB), and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

PERFORMANCE DATA

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

MULTI V SPACE II

Heating Capacity

Combination (%)	Outdoor air temp.		Indoor Air Temp. °F DB/°F WB															
			59		61		64		67		**70**		73		76		80	
	°F DB	°F WB	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW
100	-4	-4.4	44.2	6.38	44.2	6.43	44.2	6.47	44.0	6.52	43.9	6.58	43.9	6.69	43.9	6.74	43.6	6.73
	0	-0.4	45.5	6.42	45.3	6.48	45.0	6.54	45.0	6.60	45.0	6.65	45.0	6.74	44.7	6.79	44.7	6.65
	5	4.5	49.7	6.58	49.7	6.63	49.7	6.68	49.6	6.74	49.5	6.79	49.5	6.69	49.5	6.51	49.2	6.36
	10	9	52.2	6.63	52.0	6.68	51.7	6.73	51.7	6.79	51.7	6.66	51.7	6.58	51.4	6.39	51.4	6.21
	15	14	55.3	6.75	55.3	6.79	55.3	6.75	55.2	6.59	55.1	6.45	55.1	6.34	55.1	6.15	54.8	5.97
	20	19	58.3	6.74	58.0	6.66	57.8	6.58	57.8	6.43	57.8	6.27	57.5	6.16	57.5	5.98	57.5	5.81
	25	23	60.3	6.63	60.3	6.55	60.3	6.47	60.1	6.32	60.0	6.14	60.0	6.04	60.0	5.79	57.4	5.64
	30	28	60.3	6.49	60.3	6.41	60.3	6.32	60.1	6.17	60.0	6.01	60.0	5.89	59.2	5.66	55.2	5.52
	35	32	61.0	6.28	60.7	6.20	60.5	6.12	60.2	5.95	60.0	5.82	58.1	5.66	56.2	5.46	52.3	5.30
	40	36	64.3	6.11	64.1	6.02	63.8	5.93	61.9	5.75	60.0	5.64	58.1	5.48	56.2	5.24	52.3	5.08
	45	41	68.6	5.98	66.2	5.88	63.8	5.79	61.9	5.63	60.0	5.52	58.1	5.31	56.2	5.10	52.3	4.93
	47	**43**	71.5	5.85	67.7	5.76	63.8	5.67	61.9	5.50	**60.0**	**5.40**	58.1	5.17	56.2	4.94	52.3	4.75
	50	46	71.5	5.72	67.7	5.62	63.8	5.53	61.9	5.39	60.0	5.27	58.1	5.05	56.2	4.80	52.3	4.64
	55	51	71.5	5.59	67.7	5.49	63.8	5.40	61.9	5.23	60.0	5.10	58.1	4.91	56.2	4.66	52.3	4.50
	60	56	71.5	5.34	67.7	5.24	63.8	5.14	61.9	4.94	60.0	4.78	58.1	4.59	56.2	4.39	52.3	4.21
90	-4	-4.4	44.0	6.06	44.0	6.13	44.0	6.20	43.8	6.29	43.7	6.35	43.7	6.41	43.7	6.38	43.7	6.17
	0	-0.4	45.1	6.10	45.1	6.17	45.1	6.25	45.0	6.34	44.8	6.39	44.8	6.44	44.8	6.30	44.5	6.08
	5	4.5	49.6	6.26	49.6	6.33	49.6	6.40	49.4	6.44	49.3	6.37	49.3	6.20	49.3	6.04	49.3	5.79
	10	9	52.1	6.34	51.8	6.39	51.5	6.44	51.5	6.33	51.5	6.21	51.5	6.06	51.5	5.88	51.3	5.63
	15	14	55.2	6.44	55.2	6.38	55.2	6.25	55.0	6.14	54.9	5.93	54.9	5.82	54.9	5.66	52.2	5.44
	20	19	55.4	6.29	55.2	6.20	54.9	6.06	54.9	5.92	54.9	5.76	54.9	5.66	53.1	5.51	49.4	5.29
	25	23	55.6	6.16	55.6	6.05	55.6	5.89	55.3	5.76	54.9	5.63	53.2	5.52	51.5	5.36	47.8	5.12
	30	28	58.3	6.04	58.1	5.92	57.8	5.78	56.4	5.64	54.9	5.50	53.2	5.39	51.5	5.23	47.8	5.00
	35	32	64.7	5.84	61.5	5.75	58.3	5.61	56.6	5.45	54.9	5.32	53.2	5.18	51.5	5.01	47.8	4.79
	40	36	65.6	5.67	62.0	5.56	58.3	5.43	56.6	5.30	54.9	5.15	53.2	5.00	51.5	4.85	47.8	4.58
	45	41	65.6	5.55	62.0	5.44	58.3	5.30	56.6	5.18	54.9	5.02	53.2	4.86	51.5	4.70	47.8	4.46
	47	43	65.6	5.43	62.0	5.32	58.3	5.19	56.6	5.03	54.9	4.89	53.2	4.72	51.5	4.58	47.8	4.32
	50	46	65.6	5.32	62.0	5.21	58.3	5.05	56.6	4.86	54.9	4.73	53.2	4.58	51.5	4.44	47.8	4.16
	55	51	65.6	5.21	62.0	5.07	58.3	4.89	56.6	4.71	54.9	4.57	53.2	4.43	51.5	4.27	47.8	4.04
	60	56	65.6	4.87	62.0	4.73	58.3	4.56	56.6	4.40	54.9	4.26	53.2	4.11	51.5	3.96	47.8	3.76
80	-4	-4.4	43.5	5.38	43.5	5.43	43.5	5.48	43.5	5.53	43.5	5.62	43.5	5.68	43.2	5.69	43.2	5.54
	0	-0.4	44.6	5.43	44.6	5.48	44.6	5.53	44.6	5.59	44.6	5.66	44.4	5.71	44.4	5.63	44.4	5.46
	5	4.5	49.1	5.59	49.1	5.63	49.1	5.68	49.1	5.71	49.1	5.64	49.1	5.49	48.8	5.36	47.0	5.19
	10	9	49.4	5.65	49.4	5.68	49.4	5.71	49.2	5.60	49.1	5.48	49.1	5.33	48.1	5.23	44.7	5.04
	15	14	50.6	5.71	50.6	5.65	50.6	5.53	49.8	5.38	49.1	5.22	47.6	5.12	45.9	5.01	42.7	4.85
	20	19	54.8	5.64	53.5	5.49	52.3	5.34	50.7	5.18	49.1	5.03	47.6	4.93	45.9	4.85	42.7	4.69
	25	23	58.7	5.52	55.5	5.37	52.3	5.22	50.7	5.05	49.1	4.90	47.6	4.80	45.9	4.71	42.7	4.54
	30	28	58.7	5.39	55.5	5.25	52.3	5.08	50.7	4.92	49.1	4.77	47.6	4.66	45.9	4.56	42.7	4.38
	35	32	58.7	5.17	55.5	5.03	52.3	4.88	50.7	4.74	49.1	4.60	47.6	4.47	45.9	4.35	42.7	4.17
	40	36	58.7	4.94	55.5	4.82	52.3	4.69	50.7	4.54	49.1	4.40	47.6	4.26	45.9	4.14	42.7	3.96
	45	41	58.7	4.79	55.5	4.67	52.3	4.55	50.7	4.43	49.1	4.29	47.6	4.12	45.9	3.99	42.7	3.80
	47	43	58.7	4.66	55.5	4.54	52.3	4.42	50.7	4.29	49.1	4.16	47.6	3.99	45.9	3.86	42.7	3.68
	50	46	58.7	4.52	55.5	4.40	52.3	4.27	50.7	4.13	49.1	4.00	47.6	3.83	45.9	3.70	42.7	3.53
	55	51	58.7	4.37	55.5	4.25	52.3	4.13	50.7	4.00	49.1	3.84	47.6	3.69	45.9	3.59	42.7	3.38
	60	56	58.7	4.05	55.5	3.94	52.3	3.84	50.7	3.68	49.1	3.53	47.6	3.39	45.9	3.28	42.7	3.08

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB), and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

LG

PERFORMANCE DATA

Heating Capacity

ARUN053GF2

54,000 Btu/h 208-230V Heat Pump

Combination (%)	Outdoor air temp.		Indoor Air Temp. °F DB/°F WB															
			59		61		64		67		70		73		76		80	
	°F DB	°F WB	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW	TC MBh	PI kW
70	-4	-4.4	43.7	5.21	43.5	5.27	43.2	5.33	42.5	5.41	41.8	5.53	40.4	5.56	39.2	5.56	36.6	5.47
	0	-0.4	46.8	5.35	45.6	5.39	44.4	5.43	43.1	5.51	41.8	5.57	40.4	5.57	39.2	5.53	36.6	5.42
	5	4.5	49.7	5.53	47.1	5.55	44.4	5.57	43.1	5.57	41.8	5.45	40.4	5.34	39.2	5.24	36.6	5.04
	10	9	49.7	5.55	47.1	5.56	44.4	5.57	43.1	5.38	41.8	5.21	40.4	5.07	39.2	4.94	36.6	4.66
	15	14	49.7	5.57	47.1	5.50	44.4	5.27	43.1	5.02	41.8	4.76	40.4	4.56	39.2	4.44	36.6	4.26
	20	19	49.7	5.28	47.1	5.11	44.4	4.91	43.1	4.70	41.8	4.54	40.4	4.37	39.2	4.26	36.6	4.08
	25	23	49.7	5.05	47.1	4.90	44.4	4.71	43.1	4.53	41.8	4.39	40.4	4.22	39.2	4.10	36.6	3.95
	30	28	49.7	4.86	47.1	4.72	44.4	4.56	43.1	4.40	41.8	4.26	40.4	4.12	39.2	4.01	36.6	3.82
	35	32	49.7	4.59	47.1	4.47	44.4	4.34	43.1	4.16	41.8	4.05	40.4	3.91	39.2	3.81	36.6	3.58
	40	36	49.7	4.43	47.1	4.29	44.4	4.15	43.1	3.98	41.8	3.84	40.4	3.70	39.2	3.59	36.6	3.38
	45	41	49.7	4.31	47.1	4.16	44.4	4.01	43.1	3.83	41.8	3.70	40.4	3.55	39.2	3.43	36.6	3.26
	47	43	49.7	4.15	47.1	4.00	44.4	3.85	43.1	3.69	41.8	3.57	40.4	3.41	39.2	3.30	36.6	3.11
	50	46	49.7	4.03	47.1	3.88	44.4	3.72	43.1	3.54	41.8	3.43	40.4	3.29	39.2	3.18	36.6	2.96
	55	51	49.7	3.93	47.1	3.76	44.4	3.59	43.1	3.40	41.8	3.27	40.4	3.12	39.2	3.02	36.6	2.81
	60	56	49.7	3.62	47.1	3.46	44.4	3.30	43.1	3.09	41.8	2.95	40.4	2.81	39.2	2.71	36.6	2.54
60	-4	-4.4	37.5	5.12	37.5	5.21	37.5	5.30	36.7	5.39	35.8	5.48	34.6	5.41	33.4	5.39	31.3	4.99
	0	-0.4	39.2	5.13	38.7	5.23	38.2	5.33	37.0	5.44	35.8	5.51	34.6	5.39	33.4	5.24	31.3	4.81
	5	4.5	42.5	5.33	40.4	5.45	38.2	5.57	37.0	5.33	35.8	4.93	34.6	4.74	33.4	4.57	31.3	4.20
	10	9	42.5	5.45	40.4	5.57	38.2	5.36	37.0	4.99	35.8	4.63	34.6	4.48	33.4	4.29	31.3	3.96
	15	14	42.5	5.41	40.4	5.16	38.2	4.93	37.0	4.59	35.8	4.29	34.6	4.14	33.4	3.98	31.3	3.67
	20	19	42.5	5.14	40.4	4.93	38.2	4.72	37.0	4.41	35.8	4.09	34.6	3.94	33.4	3.82	31.3	3.50
	25	23	42.5	4.92	40.4	4.71	38.2	4.50	37.0	4.20	35.8	3.91	34.6	3.75	33.4	3.63	31.3	3.35
	30	28	42.5	4.69	40.4	4.49	38.2	4.30	37.0	4.02	35.8	3.76	34.6	3.61	33.4	3.49	31.3	3.23
	35	32	42.5	4.37	40.4	4.20	38.2	4.03	37.0	3.78	35.8	3.53	34.6	3.40	33.4	3.28	31.3	3.02
	40	36	42.5	4.06	40.4	3.92	38.2	3.79	37.0	3.57	35.8	3.31	34.6	3.19	33.4	3.08	31.3	2.86
	45	41	42.5	3.89	40.4	3.75	38.2	3.60	37.0	3.38	35.8	3.17	34.6	3.04	33.4	2.95	31.3	2.74
	47	43	42.5	3.70	40.4	3.55	38.2	3.41	37.0	3.20	35.8	3.05	34.6	2.93	33.4	2.81	31.3	2.61
	50	46	42.5	3.57	40.4	3.44	38.2	3.31	37.0	3.11	35.8	2.91	34.6	2.84	33.4	2.71	31.3	2.54
	55	51	42.5	3.40	40.4	3.28	38.2	3.17	37.0	2.98	35.8	2.80	34.6	2.71	33.4	2.61	31.3	2.44
	60	56	42.5	3.21	40.4	3.09	38.2	2.98	37.0	2.80	35.8	2.61	34.6	2.52	33.4	2.44	31.3	2.28
50	-4	-4.4	35.6	5.17	33.7	5.13	31.8	5.09	30.8	4.91	29.9	4.74	28.9	4.56	28.0	4.38	26.0	4.02
	0	-0.4	35.6	5.10	33.7	5.09	31.8	4.91	30.8	4.74	29.9	4.58	28.9	4.40	28.0	4.23	26.0	3.90
	5	4.5	35.6	4.59	33.7	4.45	31.8	4.31	30.8	4.15	29.9	4.00	28.9	3.87	28.0	3.72	26.0	3.44
	10	9	35.6	4.30	33.7	4.18	31.8	4.05	30.8	3.91	29.9	3.77	28.9	3.64	28.0	3.52	26.0	3.24
	15	14	35.6	3.95	33.7	3.84	31.8	3.72	30.8	3.60	29.9	3.47	28.9	3.37	28.0	3.24	26.0	2.99
	20	19	35.6	3.71	33.7	3.62	31.8	3.52	30.8	3.39	29.9	3.26	28.9	3.17	28.0	3.04	26.0	2.84
	25	23	35.6	3.54	33.7	3.44	31.8	3.34	30.8	3.23	29.9	3.11	28.9	3.01	28.0	2.91	26.0	2.71
	30	28	35.6	3.41	33.7	3.30	31.8	3.19	30.8	3.09	29.9	2.99	28.9	2.88	28.0	2.79	26.0	2.58
	35	32	35.6	3.14	33.7	3.08	31.8	3.01	30.8	2.91	29.9	2.81	28.9	2.71	28.0	2.63	26.0	2.43
	40	36	35.6	2.97	33.7	2.90	31.8	2.84	30.8	2.75	29.9	2.66	28.9	2.55	28.0	2.48	26.0	2.30
	45	41	35.6	2.88	33.7	2.81	31.8	2.73	30.8	2.64	29.9	2.55	28.9	2.48	28.0	2.41	26.0	2.23
	47	43	35.6	2.75	33.7	2.68	31.8	2.61	30.8	2.55	29.9	2.48	28.9	2.36	28.0	2.28	26.0	2.13
	50	46	35.6	2.68	33.7	2.62	31.8	2.55	30.8	2.48	29.9	2.41	28.9	2.33	28.0	2.26	26.0	2.10
	55	51	35.6	2.59	33.7	2.54	31.8	2.48	30.8	2.41	29.9	2.33	28.9	2.26	28.0	2.17	26.0	2.05
	60	56	35.6	2.45	33.7	2.39	31.8	2.33	30.8	2.27	29.9	2.20	28.9	2.13	28.0	2.05	26.0	1.92

TC = Total Capacity (MBh).

PI = Power Input (kW) (includes compressor and outdoor fan).

The System Combination Ratio must be between 50–130%.

Nominal capacity as rated: 0 ft. above sea level with 25 ft. of refrigerant piping.
0 ft. level difference between outdoor and indoor units.

Nominal heating capacity rating obtained with air entering the indoor unit at 70ºF dry bulb (DB) and 59ºF wet bulb (WB), and outdoor ambient conditions of 47ºF dry bulb (DB) and 43ºF wet bulb (WB).

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APPLICATION GUIDELINES

EQUIPMENT SELECTION PROCEDURE

Note:

The following procedure should not replace LG's LATS Multi V complimentary selection software, but should instead be used in conjunction with it. Contact your LG representative to obtain a copy of the software and the user's manual.

Always use LATS Multi V Software

To properly select, size, and verify that the Multi V Space II system components are optimized, follow the recommendations and instructions provided in this section:

- Zone the building.
- Determine the ventilation method.
- Select the indoor unit(s).
- Select the outdoor unit(s).
- Perform system sizing checks.
  - Calculate the Corrected Capacity Ratio (CCR).
  - Determine the system Combination Ratio (CR).

When using the LATS Multi V software, the default indoor design day conditions of 80.6°F DB / 67 °F WB in cooling mode and 68°F DB / 56.7°F WB in heating mode may need to be adjusted to reflect the designer's preferred indoor room design temperature.

Note:

These indoor room temperature values are entering coil conditions.

Note:

Data provided in the LATS tree mode diagram or report file is not valid until the "Auto-Piping" and "System Check" routines are run without errors. Errors will be reported immediately in pop-up dialog boxes or red lines surrounding indoor unit(s) and/or along pipe segments. If errors are indicated, modify the pipe system design and/or system components and re-run LATS.

Zone the Building–Multi V Space II Heat Pump Systems

Multi V Space II Heat Pump is a two-pipe heat pump system that can cool or heat, but not both simultaneously. When designing a heat pump system, the designer typically combines spaces with similar load profiles located near or adjacent to each other into "thermal zones." After combining like spaces into thermal zones that will be served by a single (or grouped) indoor unit(s), calculate the peak cooling and heating loads for each thermal zone.

Determine the Ventilation Method

Decide how ventilation air will be introduced to each space. Some models of Multi V indoor units have field-installed accessories available to accommodate the direct connection of ventilation ductwork to the unit. It is recommended, however, that additional considerations be assessed and understood when using direct connection accessories. For more information, contact your LG applied equipment representative or visit www.lg-vrf.com for technical product information.

Oversize the outdoor unit in order to address those times when the weather conditions may exceed the design conditions and minimize the possibility of ventilation systems which 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.

Note:

In all cases, LG recommends ducting pre-treated room neutral, ventilation air directly to the space. If the ventilation air is not tempered to room neutral conditions before introduction to the conditioned space, remember to add the ventilation air load(s) to the space load before sizing the indoor unit(s). Local codes or other professional design guidelines, such as ASHRAE 62.1, will dictate the volume of ventilation air required.

Select the Indoor Unit(s)

The building cooling load is typically the critical load to satisfy. In areas where the cooling and heating loads are similar or the heating load may exceed the total cooling load, the designer should verify the indoor unit selection satisfies both the heating and cooling requirements.

Determine how many indoor units will be required. Refer to "Table 1: Single-Frame 208-230V Heat Pump Unit." to obtain the maximum number of indoor units allowed on Multi V Space II. If the quantity of indoor units exceeds the maximum allowed for the outdoor model selected, consider adding more than one outdoor unit in order to split the indoor unit loads more evenly.

Calculate the entering mixed air conditions. Verify the entering air temperature is below 76˚F WB in cooling mode and above 59 ˚F in heating mode.

To calculate the indoor unit entering mixed air temperature:

Note:

When the indoor unit entering air temperature is outside the cataloged operational limits, the Multi V Space II system may continue to operate properly; however operational abnormalities may occur. These include frost accumulating on the coil, low or high suction temperature, low or high head pressure, low or high discharge temperature, or complete system shutdown.

$$MAT = \frac{(RAT \times \%RA) + (OAT \times \%OA)}{100}$$

Where:

MAT = Mixed air temperature

RAT = Return air temperature

OAT = Outside air temperature

%RA = Percentage of return air

%OA = Percentage of outdoor air

Indoor unit *nominal* cooling capacity ratings, among other paramters, are based on an entering air condition of 80°F DB/67°F WB and a 95°F DB outdoor ambient temperature. *Nominal* heating capacity ratings are based on an indoor unit entering air condition of 70°F DB and an outdoor ambient air temperature of 47°F DB/43°F WB.

To determine an indoor unit's peak capacity using LATS, the system's Combination Ratio must be ≤100%. If the system is designed with a Combination Ratio above 100%, temporarily select an outdoor unit that drives the combination ratio ≤100%. Record the indoor unit corrected capacity cooling and heating values.

Capacity Correction

The *corrected* cooling/heating capacity is different from the nominal cooling/heating capacity. The corrected capacity reported by LATS includes changes in unit performance after considering refrigerant line pressure drop, the system's Combination Ratio (CR), and the effect design ambient operating conditions has on the system's cooling capability.

Depending on the location of the building, additional capacity correction factors may need to be applied to the corrected capacity values provided by LATS.

Altitude Correction

On air-cooled systems, the impact of air density must be considered on systems installed at a significant altitude above sea level. To calculate the effect on the indoor unit's cooling capacity, manually apply locally accepted altitude correction factors to the IDU capacities.

Minimum Air Change Requirements

Avoid over-sizing indoor units in an attempt to increase the air exchange rate in the space. VRF 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, over-sizing indoor units may compromise the outdoor unit's ability to effectively match the space load(s).

Check the Indoor Unit Selection(s)

Verify the sensible (and total) corrected cooling capacity. For each indoor unit the corrected capacity must be at least equal to the sum of the appropriate cooling design day space load(s) (plus ventilation load, if applicable) for the space(s) served by the indoor unit.

Verify the corrected heating capacity. For each indoor unit, the corrected capacity must be at least equal to the sum of the heating design day space load (plus ventilation load, if applicable) for all spaces served by the indoor unit.

Select the Outdoor Unit

After all indoor units are properly sized to offset the applicable loads in each space, begin the selection of the outdoor unit by choosing a size that meets both the block load cooling requirement and offsets the sum of the peak heating load. (Only one size is currently available for the Multi V Space II outdoor unit.)

After making an outdoor unit selection, look up the outdoor unit's corrected cooling and heating capacity at the specified ambient design conditions. Use values reported by LATS or find it in the tables provided in the Performance Data section of this manual.

Capacity Correction

For air-cooled systems operating in cooling mode, a capacity correction factor may apply to account for the length of the system's liquid pipe and elevation difference between the outdoor unit and the indoor unit(s). If the outdoor unit's corrected cooling capacity was derived from the LATS report, the elevation difference correction factor has already been applied. If the corrected cooling capacity was found using corrected capacity tables found in the Performance Data section, apply the appropriate elevation difference factor found in Table 15 and Table 16 (choice of table depends on the architecture of the system design). Multiply the outdoor unit corrected cooling capacity by the elevation difference correction factor.

Frost Accumulation

The outdoor unit heating capacity may need to be adjusted for frost accumulation on air-cooled systems. If design day conditions are below the dew-point 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.

LATS will automatically apply a frost accumulation factor if the check box labeled "Defrost Factor" in the outdoor unit selection dialog box is marked. The dialog box can be accessed by double-clicking on the outdoor unit image. If checked, the corrected outdoor unit capacity provided by the LATS report and displayed on the tree mode piping diagram will already be adjusted for outdoor unit coil frost accumulation.

If the corrected heating capacity was found using the Performance Data tables, the frost accumulation factor must be applied. Multiply the outdoor unit's corrected heating capacity by the appropriate frost accumulation factor found in Table 13.

Check the Indoor Unit Selection(s)

After applying the appropriate correction factors to the outdoor unit, verify the corrected cooling capacity is at least equal to the total building load (considering building diversity, if applicable), and the corrected heating capacity is at least equal to the sum of the peak heating loads for all spaces and/or thermal zones served by the system.

System Sizing Checks

Calculate the Corrected Capacity Ratio (CCR)

The system's CCR is defined as the sum of the space loads divided by the outdoor unit corrected capacity after all applicable correction factors are applied. Calculate this ratio for both the cooling and heating design days.

$$CCR\%_{(Clg)} = \left(\frac{\text{Total Cooling Block Load}}{\text{Actual Corrected Outdoor Unit Cooling Capacity}} \right) \times 100 \leq 100\%$$

$$CCR\%_{(Htg)} = \left(\frac{\text{Heating Peak Load}}{\text{Actual Corrected Outdoor Unit Heating Capacity}} \right) \times 100 \leq 100\%$$

The outdoor unit selected should be large enough to offset the total block cooling load for all spaces served by the VRF system during the peak cooling load hour on the cooling design day (account for ventilation air cooling load if the ventilation air has not been pretreated to room neutral conditions).

The corrected cooling capacity ratio (CCR% [clg]) should never exceed 100% plus building diversity. If it does, increase the size of the outdoor unit or change the system design by moving some of the building load and associated indoor unit(s) to another Multi V system.

The outdoor unit should also be large enough to offset the sum of the building's space heating loads without considering building diversity. In the heating season, it is typical that all spaces served by the system will peak simultaneously in the early morning, thus building diversity should never be considered. If the corrected heating capacity ratio (CCR% [htg]) exceeds 100%, increase the size of the outdoor unit or change the system design by moving some of the building load to another Multi V system.

Determine the System Combination Ratio (CR)

The system's CR compares the nominal capacity of all connected indoor units with the nominal capacity of the outdoor unit serving them. Locate nominal capacity information for indoor and outdoor units in the General Data Tables of their respective Engineering Manuals.

For example,

If a VRF system has an outdoor unit with a nominal capacity of C and four indoor units having nominal capacity ratings of W, X, Y, and Z respectively, the CR would be determined as follows:

$$CR\% = \left(\frac{W + X + Y + Z}{C} \right) \times 100$$

If the CR is over 100%, the designer is under-sizing the outdoor unit relative to the combined nominal capacity of the connected indoor units. In some applications, under-sizing of the outdoor unit is prudent as it reduces the initial equipment investment and will properly perform as long as the designer:

1. Knows the indoor unit(s) are oversized relative to the actual load(s) in the spaces served.
2. Knows the space loads will peak at different times of the day (i.e., building has "load diversity").

In some designs, over-sized 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 space load. This scenario may 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.

Note:

The Multi V Space system will not commission, start or operate unless the CR is between 50% and 130%.

Note:

If the outdoor unit is properly sized to offset the building's total cooling block load and the system's combination ratio is above 130%, indoor units are likely oversized. In applications where all indoor units are "right-sized" and there is no building diversity, the system's CR will likely be ≤100%.

If the CR is above 130%, review the indoor unit choices and downsize, or select a larger outdoor unit. Consider moving indoor units to another Multi V, Flex-Multi, or single-split system if the outdoor unit size cannot be increased.

If the CR falls below 50%, select a smaller outdoor unit or consider adding more or larger indoor unit(s) to the system. This situation is common on multi-phase projects where the design calls for the majority of indoor units be added to the system at a later date. To raise the CR above the minimum 50% requirement:

1. Consider including additional indoor units on the first phase
2. Design two smaller systems in lieu of a single larger system. Connect all "first phase" indoor units to the outdoor unit being installed on the first phase, and delay the installation of the additional outdoor unit until a later date.

Conclusions and Recommendations

- Always use LATS Multi V system design software to check a design.
- Validate that each indoor unit is appropriately sized. Before validating, if the indoor units have been properly sized, the outdoor unit's size must be temporarily adjusted to make the system's CR ≤100%.
- Using the indoor unit's corrected capacity for cooling and heating provided by LATS and apply a correction factor for altitude if appropriate.
- Verify that the outdoor unit selection for each system is properly sized. Verify that the corrected capacity for cooling and heating provided by LATS is sufficient to offset the block building space load after applying additional correction factors for capacity and frost accumulation, if appropriate.
- For each Multi V system, calculate the cooling and heating design days
  1. Corrected Capacity Ratio (CCR).
  2. Combination Ratio (CR).

After these system checks are complete and design limitations are adhered, the system's indoor and outdoor components should be properly sized and the system's performance should now be optimized. The VRF system component size selections should be acceptable.

At any time, if further system design assistance is needed or you have a unique application you would like to discuss, contact your LG applied equipment representative for assistance.

Operating Temperature Ranges

Table 12: Published Operating Temperature Ranges for LG Multi V Space II[1].

Product	Cooling Mode (°F DB)	Heating Mode (°F WB)
Multi V Space II Heat Pump	23 – 118	-4 – +60

[1]Equivalent pipe length distance between outdoor and indoor units is 25 feet and no elevation difference between outdoor and indoor units.

[2]Reversing valve in cooling position.

[3]Reversing valve in heating position.

Frost Accumulation Factor

Table 13: Outdoor Unit Frost Accumulation Factor (Heating)

Entering DB (°F)	19.4	23.0	26.6	32.0	37.4	41.0	44.6
De-rate Factor	0.98	0.95	0.93	0.86	0.93	0.96	1.0

At 85% outdoor air relative humidity.
The frost accumulation factor does not account for effects of snow accumulation restricting airflow through the outdoor unit coil.

Table 14: Multi V Space II Heat Pump Outdoor Unit / Indoor Unit Matching Limitations

Model	Nominal Cooling (Btu/h)	Indoor Units		
		Max. Qty..	Sum of Indoor Unit Nominal Cooling Capacities (Btu/h)	
			Min. Capacity (Btu/h) (50%)[1]	Max. Capacity (Btu/h) (130%)[2]
Heat Pump (208-230V)				
ARUN053GF2	54,000	9	37,000	70,200

[1]50% = Minimum Combination Ratio.

[2]130% = Maximum Combination Ratio.

Cooling / Heating Correction Factors

For the Multi V Space II outdoor unit, calculate the equivalent length of the liquid line from the outdoor unit to the farthest indoor unit. Also, determine the elevation difference of farthest indoor unit above or below the outdoor unit. Find corresponding cooling capacity correction factor in tables below. Multiply the cooling correction factor by standard cooling capacity. The resultant is the NET cooling capacity. Repeat for heating correction factor.

Note:

The correction factors shown below are calculated in the LATS Multi V software program. These factors are only to be used when performing manual calculations.

Table 15: Outdoor Unit Cooling Capacity Correction Factor - Indoor Units above Outdoor Unit

	Equivalent Pipe Length in Feet (ELF)*											
Elevation Differences (ft)	25	33	66	98	131	164	197	230	263	295	328	≥ 361
0	1.00	0.99	0.97	0.95	0.93	0.91	0.88	0.87	0.85	0.83	0.83	0.82
25	1.00	0.99	0.97	0.95	0.93	0.91	0.88	0.87	0.85	0.83	0.83	0.82
33		0.99	0.97	0.95	0.93	0.91	0.88	0.86	0.85	0.83	0.82	0.82
66			0.96	0.95	0.93	0.9	0.88	0.86	0.85	0.83	0.82	0.82
98				0.94	0.92	0.9	0.88	0.86	0.84	0.83	0.82	0.82
131					0.92	0.9	0.88	0.86	0.84	0.83	0.82	0.82
164						0.9	0.88	0.86	0.84	0.83	0.82	0.82

* ELF = Equivalent Pipe Length in Feet—Sum of the actual pipe length plus allocations for pressure drop through elbows, valves, and other fittings in equivalent length.

Table 16: Outdoor Unit Cooling Correction Factor - Outdoor Unit above Indoor Units

	Equivalent Pipe Length in Feet (ELF)*											
Elevation Differences (ft)	25	33	66	98	131	164	197	230	263	295	328	≥ 361
0	1.00	0.99	0.97	0.95	0.93	0.91	0.9	0.87	0.88	0.84	0.86	0.84
25	1.00	0.99	0.97	0.95	0.93	0.91	0.9	0.87	0.88	0.84	0.86	0.84
33		0.99	0.98	0.95	0.93	0.91	0.9	0.88	0.88	0.84	0.86	0.84
66			0.98	0.95	0.93	0.91	0.9	0.88	0.88	0.84	0.86	0.84
98				0.96	0.93	0.91	0.9	0.88	0.89	0.84	0.86	0.84
131					0.93	0.91	0.9	0.88	0.89	0.84	0.86	0.84

* ELF = Equivalent Pipe Length in Feet—Sum of the actual pipe length plus allocations for pressure drop through elbows, valves, and other fittings in equivalent length.

Note:

The correction factors shown below are calculated in the LATS Multi V software program. These factors are only to be used when performing manual calculations.

Defrost Correction Factor for Heating Operation

Capacity tables do not take into consideration capacity reduction when frost has accumulated on the condenser coil, nor during defrost operation. Integrated heating capacity values can be obtained as follows:

Formula: A = B x C

Where: A = Integrated heating capacity
B = Value given in table of capacity characteristics
C = Integrated correction factor for frost accumulation

Table 17: 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

[1]At 85% outdoor air relative humidity.

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

Note:

There will be temporary reduction in capacity when snow piles up 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.

Equivalent Length Calculation for Correction Factors

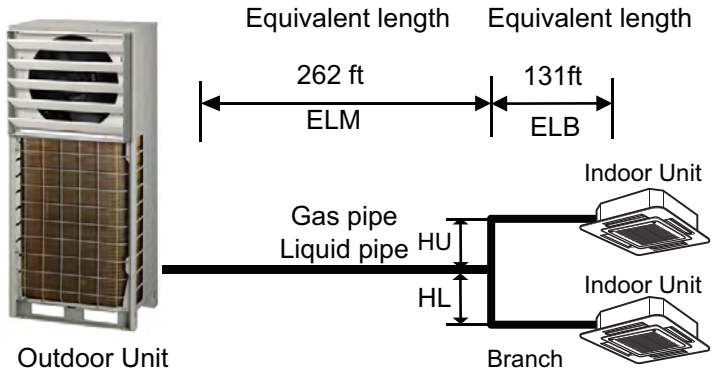
TEL = (ELM x Correction Factor) + ELB, where

TEL = Total equivalent length
ELM = Equivalent length to first Y-branch
ELB = Equivalent length from first Y-branch to farthest indoor unit
HU = Indoor units above outdoor unit
HL = Indoor units below outdoor unit

Example: ELM = 230'
ELB = 131'
HU = 33'
Outdoor Unit = *ARUN053GF2*

Total equivalent length = (230' x 1.0) + 131' = 361'. The cooling capacity correction factor from table below, when HU = 33' would be approximately 0.90.

Figure 6: Equivalent Length



Correction Factor	Overall Equivalent Pipe Length	
	Standard Application	Overall Equivalent Length 295[1]
ARUN053GF2		
Cooling	1.0	0.5
Heating	1.0	0.2

Equivalent Piping Length for Piping Components

Table 18: Equivalent Piping Length for Y-branches, Headers, and Other Piping Components

Component	Size (Inches)													
	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-5/8	1-3/4	2-1/8
Elbow (ft.)	0.5	0.6	0.7	0.8	1.2	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.5	2.8
Y-branch (ft.)	1.6													
Header (ft.)	3.3													
Heat Recovery Unit (ft.)	8.2													

Building Ventilation Design Guide

ASHRAE 62.1 and local codes specify the minimum volume of outdoor air that must be provided to an occupied space. Outdoor air is required to minimize adverse health effects, and it provides acceptable indoor air quality for building occupants. The five methods of accomplishing this with LG Multi V Space II systems are summarized here.

Note:

Disclaimer

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

- *For a complete copy of Standard 62.1-2010, refer to the American Standard of Heating and Air Conditioning Engineers (ASHRAE) website at www.ashrae.org.*
- *For more information on how to properly size a ventilation air pretreatment system, refer to the article, "Selecting DOAS Equipment with Reserve Capacity" by John Murphy, published in the ASHRAE Journal, April 2010.*

Method 1: Decoupled Dedicated Outdoor Air System (DDOAS)

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

Note:

LG recommends using the DDOAS method in all installations.

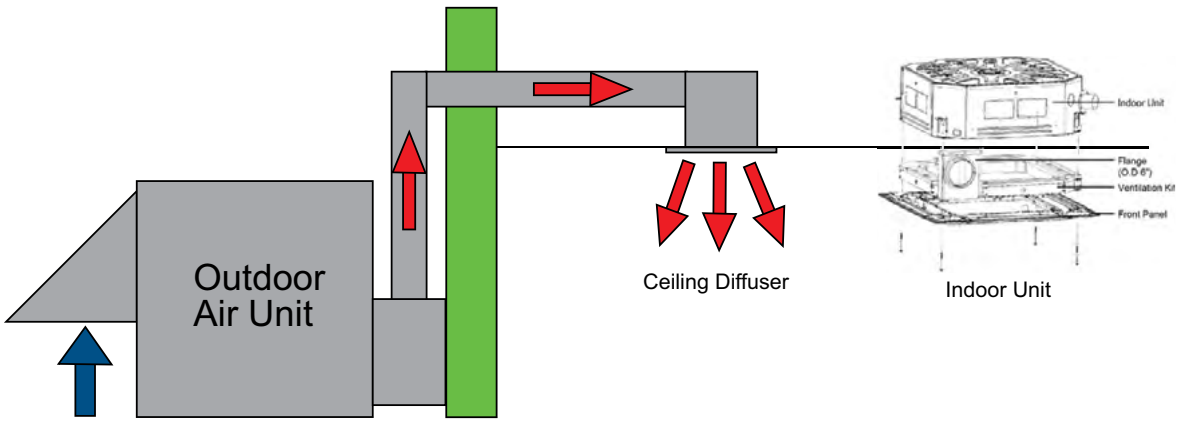
Advantages

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

Disadvantages

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

Figure 7: Decoupled Dedicated Outdoor Air System



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

Natural ventilation devices, such as operable windows or louvers may be used to ventilate the building when local code permits. The open area of a window or the free area of a louver must meet the minimum percentage of the net occupied floor area.

Advantages

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

Disadvantages

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

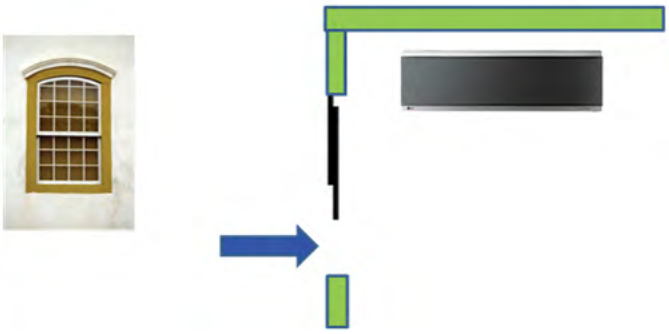


Figure 8: Unconditioned Outdoor Air (Non-Ducted)

Method 3: Unconditioned Outdoor Air Ducted to Indoor Units

Untreated outdoor air is channeled through a duct system that is piped to the return air duct on concealed indoor units or to the chassis of 1-way and 4-way cassettes.

Note:

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

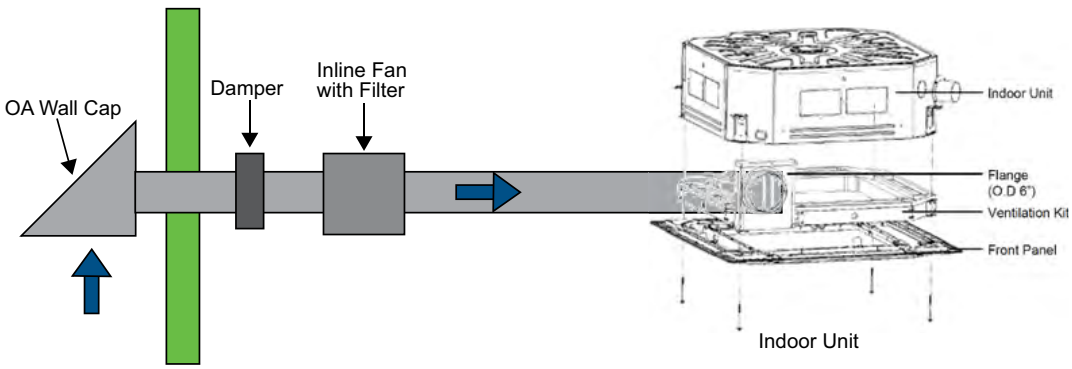
Advantages

- May require less ductwork if indoor units are placed near outdoor walls or a roof deck.
- Controls must be interlocked to shut off the outdoor air supply fan when the space is unoccupied.
- Third-party demand-control ventilation controls may be installed to regulate outdoor intake based on the CO_2 levels of the occupied space.

Disadvantages

- Fan(s) will be required to push outdoor air to the indoor unit. Indoor units are engineered for low sound levels and are not designed to overcome the added static pressure caused by the outdoor air source ductwork.
- Ventilation air must be pre-filtered before mixing with the return air stream. LG indoor cassette models are configured to introduce the ventilation air downstream of the return air filter media.
- Ducted, 1-way, and 4-way cassette models are the only indoor units that accept the connection of an outdoor air duct to the unit case.

Figure 9: Unconditioned Outdoor Air Ducted to Indoor Units.



Disadvantages (Continued)

- Mixed air conditions must be between a minimum of 59°F DB while operating in Heating mode and a maximum of 76°F WB while operating in Cooling mode. Depending on the ventilation air volume requirement, the location choices are limited where untreated outside air may be introduced to the building using this method.
- Larger indoor units may be required to satisfy for additional outdoor air.
- Motorized dampers may be required to prevent outdoor air flow through the indoor unit when the indoor unit is not operating.
- An LG Dry Contact adapter may be necessary to interlock the motorized damper with the indoor unit.
- While operating in Heating mode, the untreated outdoor air may delay the start of the indoor unit fan impacting building comfort.
- In most cases, in lieu of using the factory mounted return-air thermistor on indoor units, a remote wall temperature sensor or zone controller will be needed for each indoor unit to provide an accurate reading of the conditioned area temperature.

Method 4: Unconditioned Outdoor Air (Non-Ducted, Fan Assisted Ventilation)

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

Note:

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

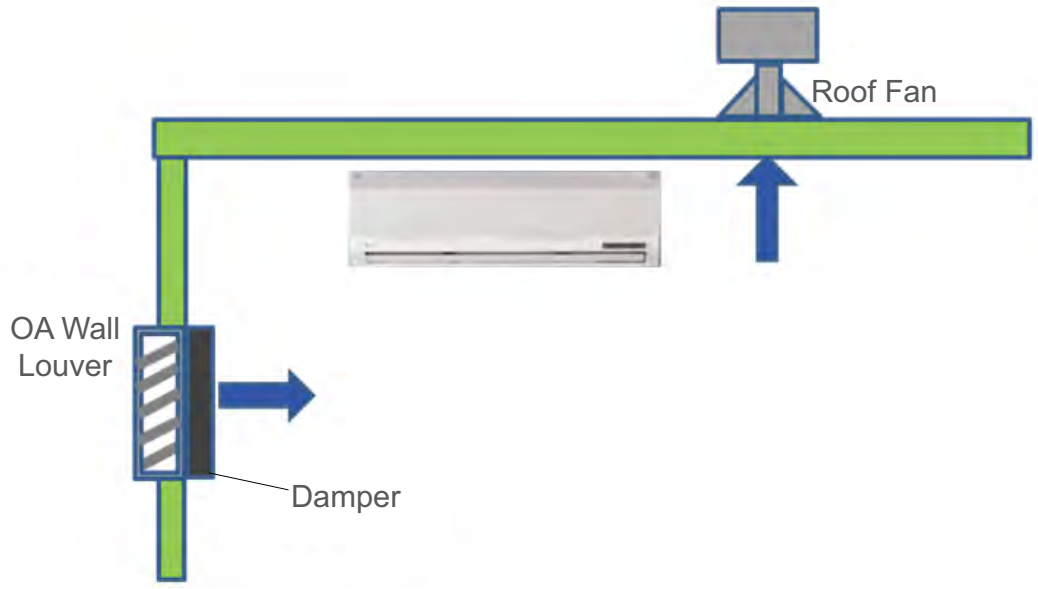
Advantages

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

Disadvantages

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

Figure 10: Unconditioned Outdoor Air (Non-Ducted)



Method 5: Coupled Dedicated Outdoor Air (CDOA)

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

Note:

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

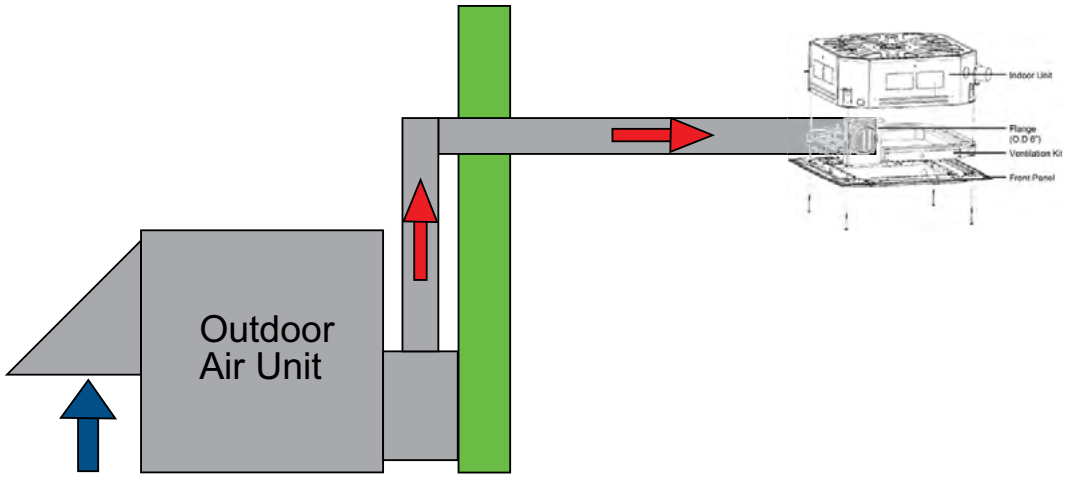
Advantages

- Separate ceiling registers or grilles for introduction of the outside air to the conditioned space may be avoided.

Disadvantages

- Ducted, 1-way, and 4-way cassette indoor units are the only models designed for direct connection of an outside air duct.
- The building occupant may not notice the outdoor air pretreatment system has malfunctioned until the unconditioned outdoor air exceeds the indoor unit mixed air limits of 59°F DB for heating and 76°F WB for cooling.
- If the coil entering air condition limitation is exceeded, the indoor unit may malfunction and prevent the indoor unit from operating.
- If the outdoor air unit cooling or heating system fails, the malfunction may be masked by the indoor unit ramping up operating parameters to compensate for the failure.
- Motorized dampers may be required to prevent outdoor air from entering the indoor unit while the indoor unit has cycled off.
- An LG Dry Contact adapter is necessary to interlock the motorized damper with the indoor unit fan operation.
- In lieu of using the factory mounted return-air thermistor, a remote wall temperature sensor or zone controller may be required to provide an accurate conditioned space temperature reading.

Figure 11: Coupled Dedicated Outdoor Air



PLACEMENT CONSIDERATIONS

Heat Pump Outdoor Units

Selecting the Best Location

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

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

To ensure the 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. Place the outdoor unit on a raised platform at least 19-11/16 inches higher than the average annual snowfall for the area. In environments where there is a possibility of heavy snow, the H frame height must be more than two (2) times the amount of average annual snowfall, and should not exceed the width of the outdoor unit. If the frame width is wider than the outdoor unit, snow may accumulate.
4. Install a snow protection hood.
5. To prevent snow and heavy rain from entering the outdoor unit, install the suction and discharge ducts facing away from direct winds.

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

- If the 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.)
- Sidewalks or parking lots near the outdoor unit may accumulate moisture after unit operates in defrost mode that can turn to ice.

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

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

General Mounting

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

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

B: Use a 3/8 inch anchor bolt.

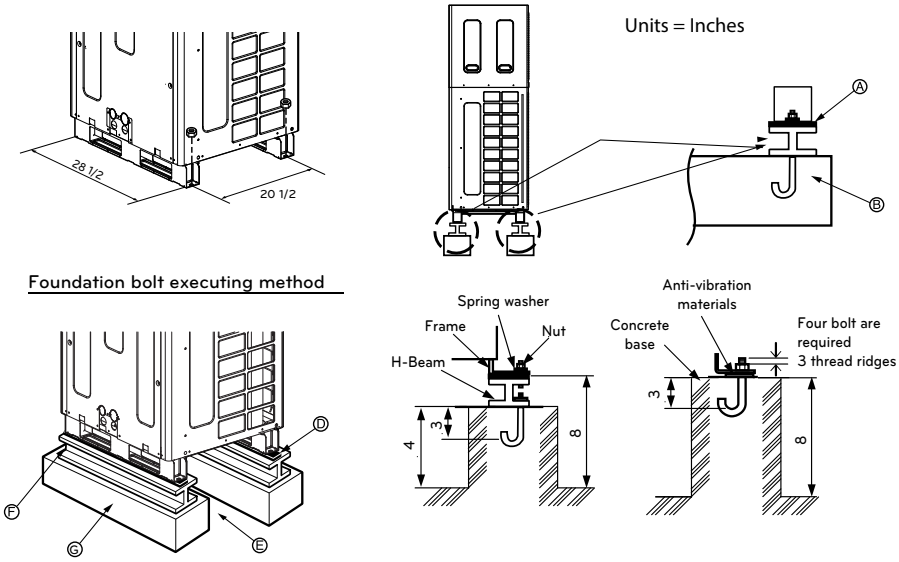
D: Insert cushion pad between outdoor unit and base support to ensure sufficient anti-vibration coverage.

E: Pipe and wiring space.

F: H-beam support.

G: Concrete base support.

Figure 12: Outdoor Unit—Mounting Methods[1]



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

Mounting Platform

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

⚠ WARNING

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

Note:

- *When deciding on a location to place the outdoor unit, be sure to choose an area where run-off from defrost mode will not accumulate and freeze on sidewalks or driveways.*
- *Don't use a tube or pipe for water in the base pan. Perform water drain processing by using the drain path.*
- *Do not install the suction hole and discharge hole of the outdoor unit to face seasonal wind as this can cause freeze.*

Ambient Air Conditions

⚠ WARNING

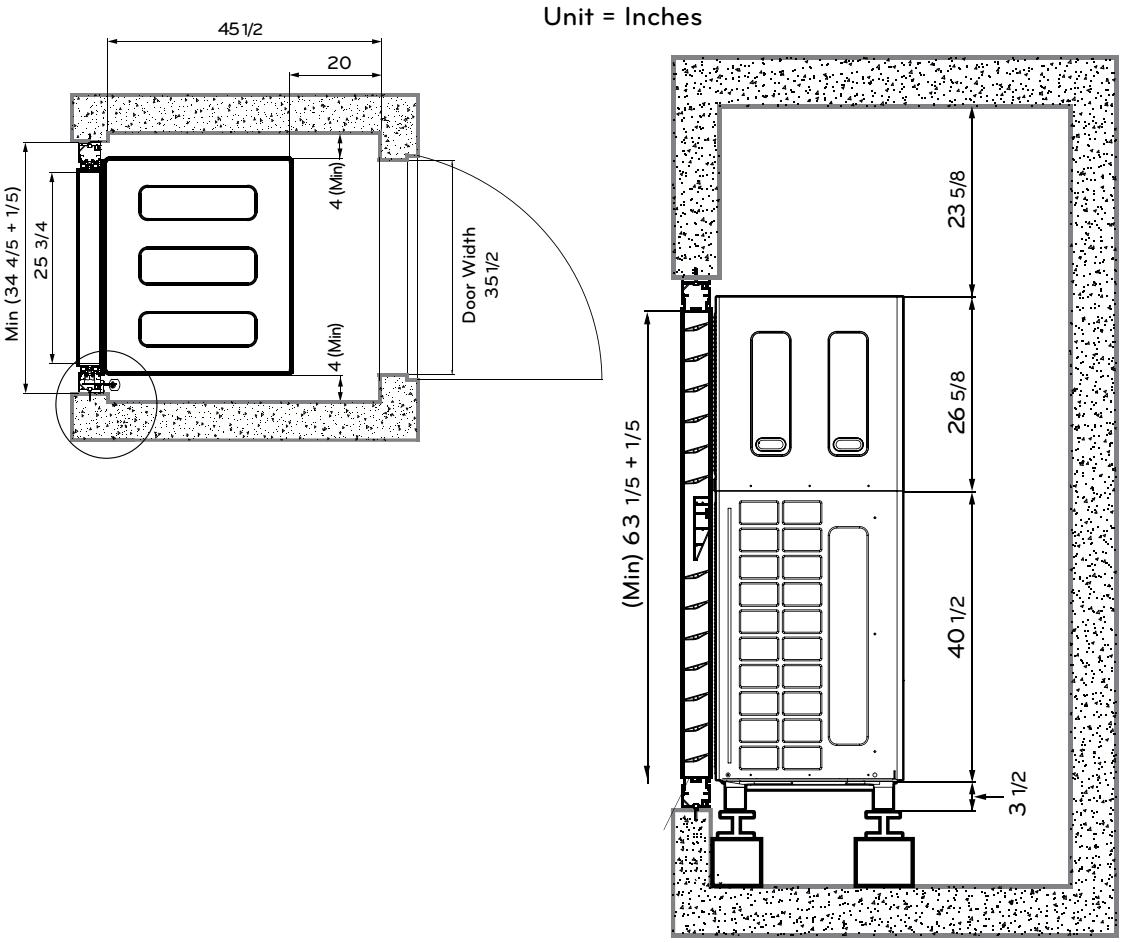
Avoid exposing the outdoor unit to steam, combustible gases, or other corrosive elements. Avoid exposing the unit to discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperature, gases, or substances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

Installation Space II - Outdoor Unit Room

Follow the diagrams as shown for proper installation of the Multi V Space II unit. Allow adequate clearance for the system louver (See, Figure 13).

Be sure to place the product so that the door of the outdoor unit's enclosure is able to be opened completely to allow for smooth installation and later service access.

Figure 13: Multi V Space II Installation of Unit



A water drain outlet is required to allow rain water drainage from the bottom of the outdoor unit enclosure. Otherwise, condensation of water could possibility form during unit operation (Figure 14).

Figure 14:Water Drainage Outlet

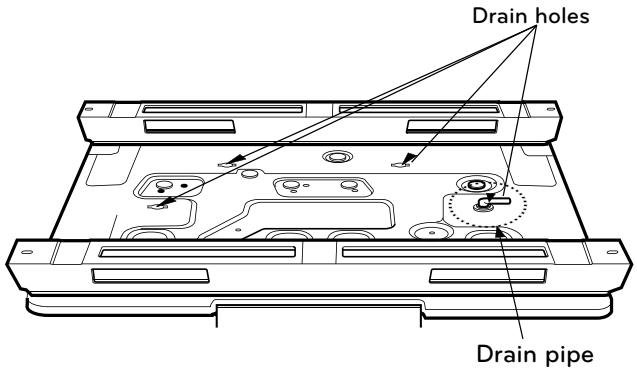


Figure 15 shows the recommended clearance around the sides and top of the Multi V Space II louver

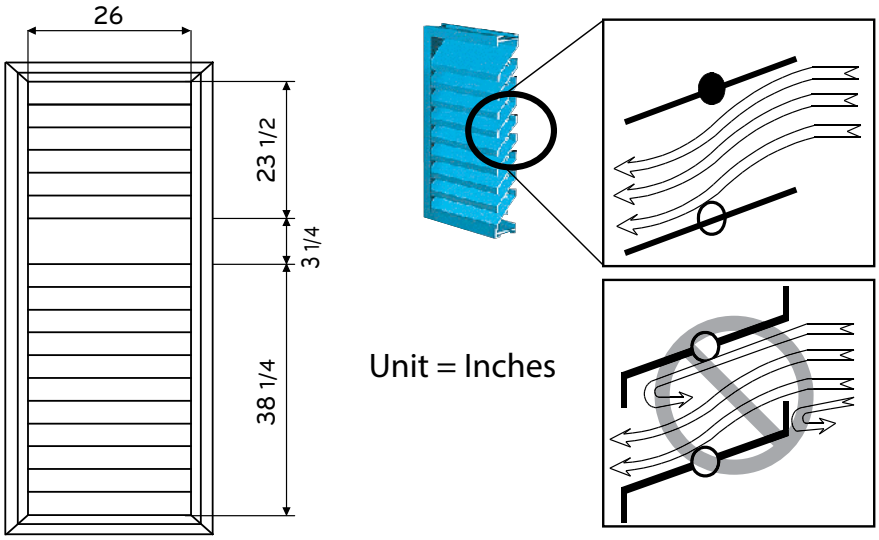
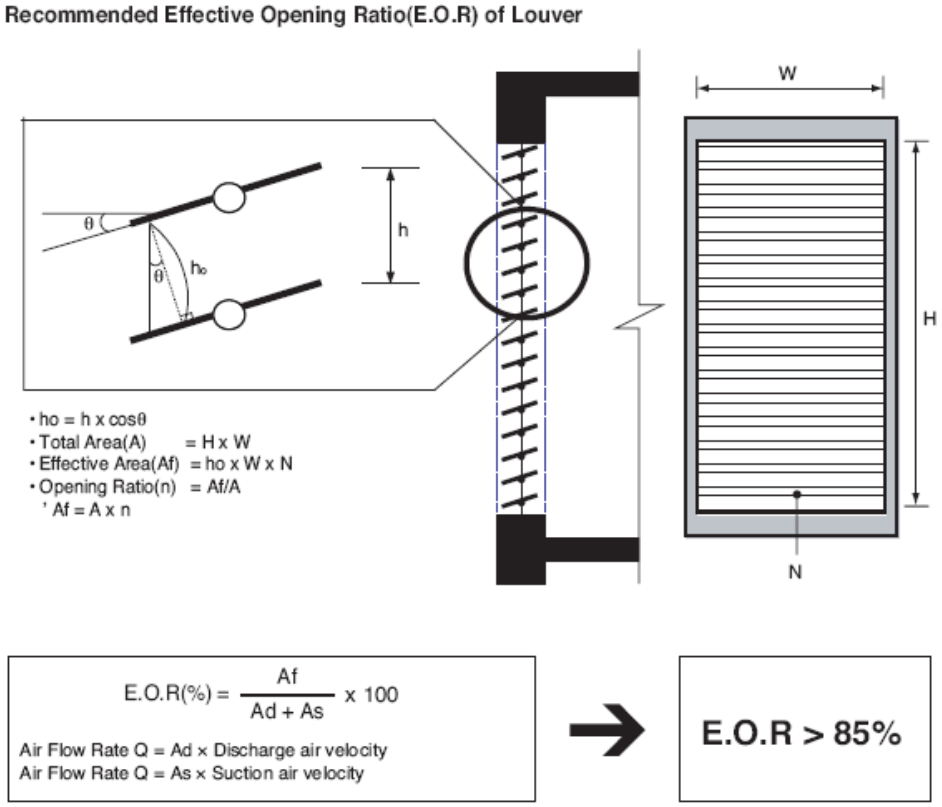


Figure 15: Recommended Installation Space Clearance for Louver

Note:

Do not bend the louver as shown in Figure 15 since this will disrupt the air circulation..

Figure 16: Recommended Effective Opening Ratio of Louver



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REFRIGERANT PIPING DESIGN & LAYOUT BEST PRACTICES

REFRIGERANT PIPING DESIGN

LATS Multi V Piping Design Software

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

Refrigerant Piping Quality Assurance

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

The piping system can be engineered manually using the procedure outlined in the"Manual Layout Procedure" on page 62, however, the preferred method is to design the system using LG's LATS Multi V software. **To ensure that the refrigerant piping design meets LG's quality standards, a LATS refrigerant piping design must be provided with every Multi V Space II order. Following the installation, if any changes or variations to the design are necessary, a new LATS file must be created and provided to LG prior to system commissioning to ensure the proper pipe size has not changed.**

Adjusting LATS Multi V Output for Altitude

When a system is installed at elevations significantly above sea level, the designer must also consider the impact air density has on the capacity of the indoor and outdoor units. An Altitude Correction Factor must be manually applied to the indoor and water source unit data provided in the LATS report. Use locally accepted altitude correction factors to adjust capacities.

Design Choices

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

CAD Mode

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

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

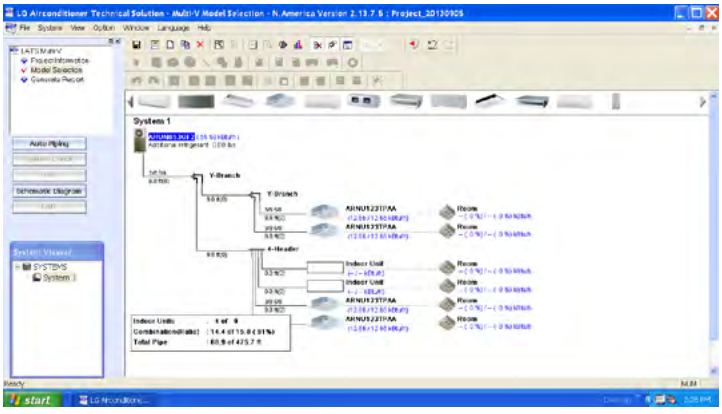
Tree Mode

Using the TREE mode, the engineer can quickly create a one-line schematic drawing of the Multi V system. Integration of the engineered pipe system into the building drawings is done at a later date by the draftsperson using standard drafting software tools.

- Import building loads from an external file (.xls format).
- System components selected using an easy drag and drop process.
- Automatically analyzes and checks the design complies with most piping design limitations.
- Sizes refrigerant piping.
- Generates a system engineering report (.xls format).

In either case, LATS Multi V software generates a report file (.xls format) containing project design parameters, cooling and heating design day system component performance, and capacity data. The report calculates the system combination ratio, calculates the system refrigerant charge, and provides detailed bill of material information including a list of Multi V outdoor units, air handlers, control devices, accessories, refrigerant pipe sizes segregated by building, by system, by pipe size, and by pipe segments.

Figure 17: LATS Pipe System Design Tool in Tree Mode



Device Connection Limitations

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

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

Table 19: Multi V Space II Refrigerant Piping System Limitations

Pipe Length (ELF = Equivalent Length of pipe in Feet)	Longest total equivalent piping length	≤ 475 feet
	Longest distance from outdoor unit (ODU) to indoor unit (IDU)	230 feet (Actual) 296 feet (Equivalent)
	Distance between fittings and indoor units	≥ 20 inches
	Minimum distance between Indoor unit to any Y-branch	≤ 131 feet
	Minimum distance from indoor unit to Y-branch	3 feet
	Maximum distance between first Y-branch to farthest indoor unit	131 feet
Elevation (All Elevation Limitations are Measured in Actual Feet)	If outdoor unit is above indoor unit	98.4 feet
	If outdoor unit is below indoor unit	98.4 feet
	Between any two indoor units	49 feet

Table 20: Equivalent Piping Length for Y-branches, Headers, and Other Piping Components

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

Figure 18: Typical Y Branch Method.

Refrigerant piping system

Unit = Feet

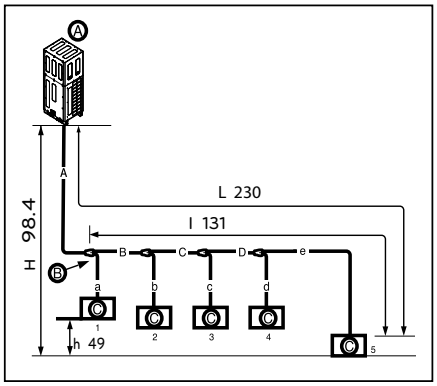
Y branch method

Example : 5 Indoor Units connected

Ⓐ : Outdoor Unit

Ⓑ : 1st branch (Y branch)

Ⓒ : Indoor Units



* Total Pipe length = A+B+C+a+b+c+d+e ≤ 475.7 ft

L	Longest pipe length	Equivalent pipe length
	A+f ≤ 230 ft	A+f ≤ 295.2 ft
l	Longest pipe length after 1st branch	
	f ≤ 131 ft	
H	Difference in height (Outside Unit ↔ Indoor Unit)	
	H ≤ 98.4 ft	
h	Difference in height (Indoor Unit ↔ Indoor Unit)	
	h ≤ 49 ft	

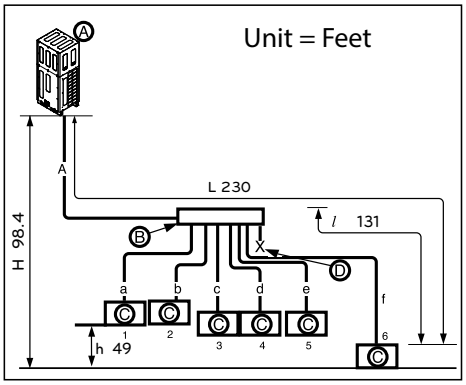
REFRIGERANT PIPING DESIGN

Piping Size Examples

Figure 19: Typical Header Method

Example : 6 Indoor Units connected

Ⓐ : Outdoor Unit
Ⓑ : 1st branch (Y branch)
Ⓒ : Indoor Units
Ⓓ : Sealed piping



Branch pipe can not be used after header

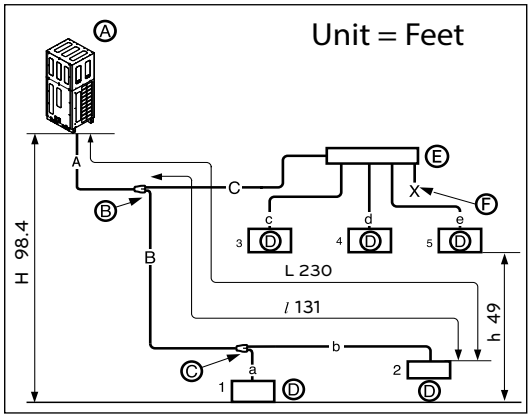
⚠ WARNING

- *It is recommended that indoor unit be installed at a lower position than the header.*
- *It is recommended that difference of piping length for pipes connected to the indoor unit be minimized to avoid functional capabilities between units.*

* Total Pipe length = A+a+b+c+d+e+f ≤ 475.7 ft

L	Longest pipe length	Equivalent pipe length
	A+f ≤ 230 ft	A+f ≤ 295.2 ft
l	Longest pipe length after 1st branch	
	f ≤ 131 ft	
H	Difference in height (Outside Unit ↔ Indoor Unit)	
	H ≤ 98.4 ft	
h	Difference in height (Indoor Unit ↔ Indoor Unit)	
	h ≤ 49 ft	

Figure 20: Typical Combination Y Branch/Header Method



Example : 5 Indoor Units connected

Ⓐ : Outdoor Unit
Ⓑ : 1st branch (Y branch)
Ⓒ : Y branch
Ⓓ : Indoor Unit
Ⓔ : Header
Ⓕ : Sealed piping

* Total Pipe length = A+B+C+a+b+c+d+e ≤ 475.7 ft

L	Longest pipe length	Equivalent pipe length
	A+B+b ≤ 230 ft	A+B+b ≤ 295.2 ft
l	Longest pipe length after 1st branch	
	B+b ≤131 ft	
H	Difference in height (Outside Unit ↔ Indoor Unit)	
	H ≤ 98.4 ft	
h	Difference in height (Indoor Unit ↔ Indoor Unit)	
	h ≤ 49 ft	

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

Table 21: Main Pipe (A) Diameter from Outdoor Unit to First Y-branch / Header Branch

ODU Capacity (ton)	Pipe diameter Pipe length must be ≤ 295.2 feet		Pipe diameter Pipe height must be (ODU ↔ IDU) ≤ 98.4 feet	
	Liquid pipe (inches OD)	Vapor pipe (inches OD)	Liquid pipe (inches OD	Vapor pipe (inches OD)
4.4	3/8Ø	3/4Ø	3/8Ø	3/4Ø

Table 22: Refrigerant Pipe Diameter (B) from Y-branch to Y-branch / Header

Downstream Total Capacity of IDUs (Btu/h)[1]	Liquid pipe (inches OD)	Vapor pipe (inches OD)
≤19,100	1/4Ø	1/2Ø
≤54,600	3/8Ø	5/8Ø
≤76,400	3/8Ø	3/4Ø

[1]For the first branch pipe, use the branch pipe that matches main pipe A diameter.

Table 23: Indoor Unit Connecting Pipe from Branch (B,C)

Indoor Unit Capacity[1]	Liquid pipe (inches OD)	Vapor pipe (inches OD)
≤19,100	1/4Ø	1/2Ø
≤54,600	3/8Ø	5/8Ø
≤76,400	3/8Ø	3/4Ø

[1]9,600-24,200 Btu/h 4-way 3 feet x 3 feet Cassette and 15,400-24,200 Btu/h High Static Ducted indoor units have 3/8Ø (liquid) and 5/8Ø (vapor).

REFRIGERANT PIPING DESIGN

Pipe Sizing for Multi V Space II Heat Pump Systems

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

Table 24: Pipe Capabilities

Length	Total pipe length	Longest actual pipe length	Equivalent pipe length[1]
	A + ΣB + ΣC ≤ 475 feet	≤ 230 feet	≤ 558 feet
ℓ	Longest pipe length after first branch		
	≤131 feet (295 feet conditional application)		
Elevation 1	Elevation differential (Outdoor Unit ↔ Indoor Unit)		
	Height ≤ 98 feet		
Height 1	Elevation differential (Indoor Unit ↔ Indoor Unit)		
	Height ≤ 49 feet		
Distance between fittings and IDU		≥20 inches	
Distance between fittings and Y-branches / Headers		≥20 inches	
Distance between two Y-branches / Headers		≥20 inches	

[1]For calculation purposes, assume equivalent pipe length of Y branches to be 1.6 feet, and the equivalent pipe length of headers to be 3.3 feet.

Note:

- *Connection piping from branch to branch cannot exceed the main pipe diameter (A) used by the outdoor unit.*
- *Y-branches and other header branches cannot be installed downstream of the initial header branch.*
- *Indoor units must be installed at a position lower than the header.*
- *Install the header branch so that the pipe distances between the between the connected indoor units are minimized. Large differences in pipe distances can cause indoor unit performances to fluctuate.*
- *Always reference the LATS Multi V software report.*

Creating a Balanced Piping System

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

Note:

It is imperative the designer avoids creating excessive pressure drop. When liquid refrigerant is subjected to excessive pressure drop, liquid refrigerant will change state and "flash" to vapor. Vapor present in a stream of liquid refrigerant before reaching the electronic expansion valve (EEV) results in a loss of system control and causes damage to the valve. The pipe system must be designed in a manner that avoids the creation of unwanted vapor.

Refrigerant Piping System Quality Assurance

To ensure that the refrigerant piping design meets LG's quality standards, a LATS refrigerant piping design software report must be provided with every Multi V Space II order. Following the installation, if any changes or variations to the design were necessary, an "as-built" LATS piping design software report must be provided to LG prior to system commissioning.

Systems that are close to the standard application limits may be converted into a conditional application by field changes to pipe equivalent lengths. User should always check the LATS report actual pipe layout versus pipe limits. The user may want to increase pipe lengths when conditions close to the standard application limits are present, forcing increased pipe diameters seen in conditional applications to be used and avoiding pipe changes due to field installation variations.

Note:

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

REFRIGERANT PIPING DESIGN

Manual Layout Procedure

1. Choose the location of the indoor unit on the building drawing.
2. Choose the location of all Y-branch fittings, header fittings, and if possible, and draw them on the building drawings. Verify that all fittings are positioned per the guideline limitations set forth in "Y-Branch Kits" on page 63 and "Header Kits" on page 64.
3. Plan the route for interconnecting piping. Draw a one-line depiction of the pipe route chosen on the building drawings.
4. Calculate the actual length of each pipe segment and note it on the drawing.
5. Using the data obtained while selecting the system components on "Table 5: Summary Data—Surface Mounted / Floor Standing Indoor Units." on page 17, list the nominal cooling capacity next to each indoor unit on the drawing.
6. Starting at the indoor unit located farthest from the outdoor unit, sum the connected nominal capacity of all indoor units served by the pipe segment for each branch and runout pipe. Record these values next to each segment on the drawing.
7. Use tables in the "Design Guideline Summary" on page 57, determine the pipe size of the liquid and vapor lines of all pipes.
8. Starting at the indoor unit located farthest from the outdoor unit, sum the capacity of liquid line pipe segments located between the indoor unit and each Y-branch fitting, and header fitting. Record these values next to each Y-branch, and header fitting on the drawing.
9. Use tables at "Pipe Sizing for Heat Pump Systems" on page 59 to verify the pipe size of the liquid and vapor line(s) of all pipes.
10. Refer to "Y-Branch Kits" on page 63 and "Header Kits" on page 64 to determine the part number of each Y-branch, and header based on the connected downstream nominal capacity served.
11. Calculate the equivalent pipe length in feet of each pipe segment. Y-branch and header equivalent lengths should be totaled with the upstream segment only. Use equivalent pipe length data when it is provided with the field purchased fittings. If not available, use the data provided on "Cooling / Heating Correction Factors" on page 44 to estimate the equivalent length of field-provided pipe and fittings for each segment. Y-branch and header equivalent lengths are also found in "Table 37: Heat Pump Unit Refrigerant Pipe Connections (All Brazed Type)" on page 73. Equivalent lengths should be totaled with the upstream segment only.
12. Verify if the equivalent pipe length complies with the limitations in "Table 19: Multi V Space II Refrigerant Piping System Limitations" on page 57. If the limitations are exceeded, either reroute the pipe or change the location of the Y-branch fittings, and header fittings; and/or indoor unit locations so the design conforms with all limitations.
13. If adjusted as per Step 12 above, verify again if the length of the design complies with the limitations set in "Table 19: Multi V Space II Refrigerant Piping System Limitations" on page 57.
14. Verify that the manually sized pipe design is acceptable using LATS Multi V. When entering the length of pipe segments in LATS Multi V software, enter the equivalent pipe length. Account for the additional pressure drop created by elbows, valves, and other fittings present in each segment by adding their respective equivalent pipe length to the actual pipe length.

LG Y-branch and Header kits are highly engineered devices designed to evenly divide the flow of refrigerant, and are used to join one pipe segment to two or more segments.

Note:

No Substitutions

Only LG supplied Y-branch and Header fittings can be used to join one pipe segment to two or more segments. Third-party or field-fabricated Tee's, Y-fittings, Headers, or other branch fittings are not qualified for use with LG Multi V Space systems. The only field-provided fittings allowed in a Multi V Space piping system are 45° and 90° elbows.

LG Y-branch kits consist of:

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

LG Header kits consist of:

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

Y-Branch Kits

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

Y-branches may be installed in horizontal or vertical configurations. When installed vertically, position the Y-branch so the straight-through leg is ±3° of plumb. See Figure 22. When installed horizontally, position the Y-branch so the take-off leg is level and shares the same horizontal plane as the straight-through leg ±10° rotation as shown in Figure 23.

There is no limitation on the number of Y-branches that can be installed, but there is a limitation on the number of indoor units connected to a single outdoor unit. "Table 14: Multi V Space II Heat Pump Outdoor Unit / Indoor Unit Matching Limitations"

Y-branches should always be installed with the single port facing the outdoor unit, the two-port end facing indoor units (see Figure 21 Do not install Y-branches backwards as shown in Figure 23. Refrigerant flow cannot make U-turns through Y-branches. The first Y-branch kit must be located at least three (3) feet from the outdoor unit. Provide a minimum of 20 inches between a Y-branch and any other fittings or indoor unit piped in series.

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

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

Figure 25: Diagram of an Incorrect Y-branch Installation

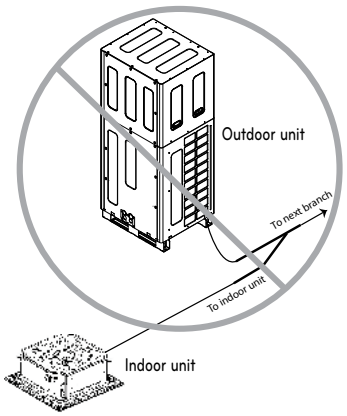


Figure 21: Y-branch Connections

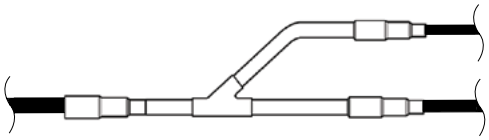
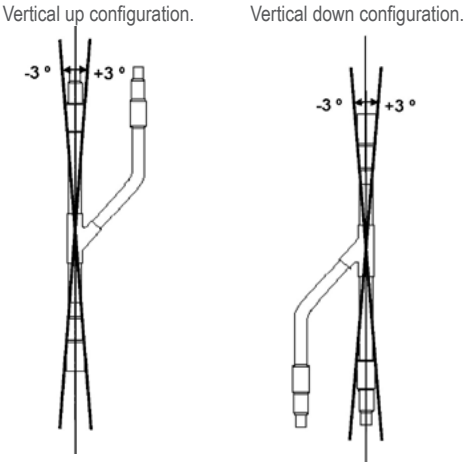


Figure 22: Y-branch Installation Alignment Specification



Y-branch Insulation

Each Y-branch kit comes with clam-shell type peel-and-stick insulation jackets molded to fit the Y-branch fittings as shown in Figure 24—one for the liquid line, one for the vapor line(s).

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

Figure 23: Horizontal Configuration End View

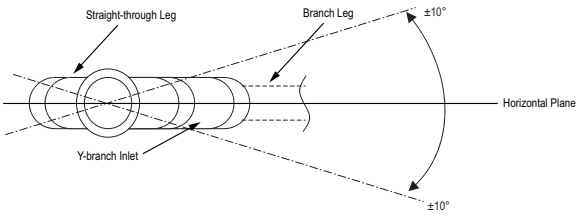
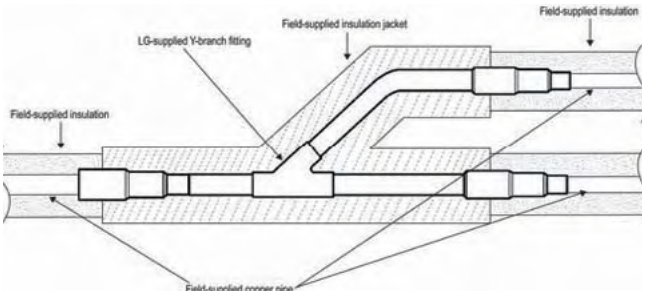


Figure 24: Y-branch Insulation and Pipe Detail



Header Kits

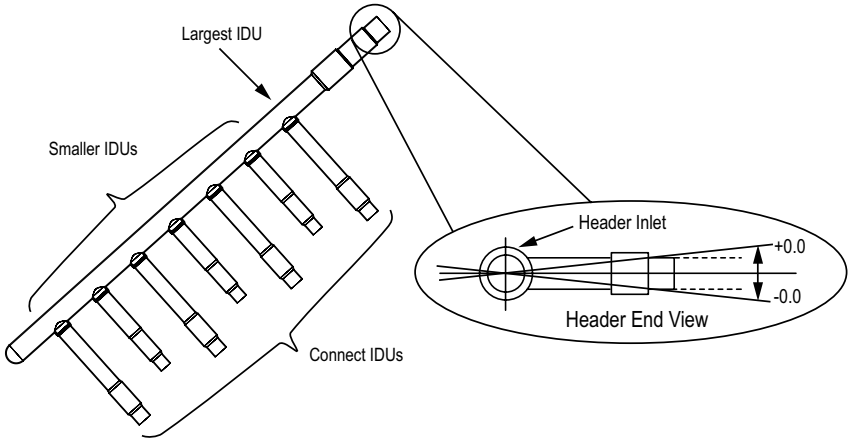
Note:

Install Correctly

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

Header kits are intended for use where multiple indoor units are in the same vicinity and it would be better to "home-run" the run-out pipes back to a centralized location. If connecting multiple indoor units that are far apart, Y-branches may be more economical. "Single-Frame Heat Pump System" on page 64 for Header kit specifications and capacities.

Figure 26: Header Kit—Horizontal Rotation Limit (Must be Installed Level with No Rotation).



Y-branches can be installed upstream between the Header and the outdoor unit, but a Y-branch cannot be installed between a Header and an indoor unit. Headers must be installed in a horizontal and level position with the distribution ports of the fitting in the same horizontal plane as the straight-through branch as shown in Figure 26.

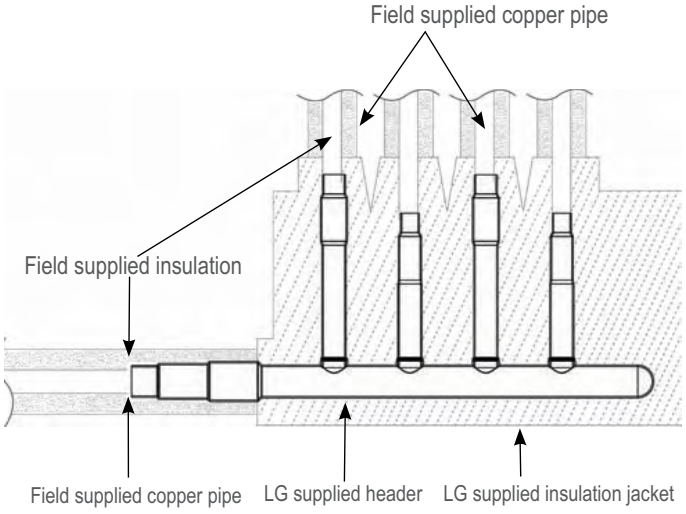
When connecting indoor units to a Header, always connect the unit with the largest nominal capacity to the port closest to the outdoor unit. Then install the next largest indoor unit to the next port, working down to the smallest indoor unit. Do not skip ports. See Figure 26.

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

Header Insulation

Each Header kit comes with clam-shell type peel and stick insulation jackets molded to fit the Header fittings—one for the liquid line and one for the vapor line. See Figure 27.

Figure 27: Header Insulation and Pipe Detail



Note:

Disclaimer

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

- *For a complete copy of Standards 15 and 34, refer to the American Standard of Heating and Air Conditioning Engineers (ASHRAE) website at www.ashrae.org.*
- *For more information on how to properly size a ventilation air pretreatment system, refer to the article, "Selecting DOAS Equipment with Reserve Capacity" by John Murphy, published in the ASHRAE Journal, April 2010.*

LG Multi V Space II outdoor units ship from the factory with a charge of R410A refrigerant. This charge serves as the base charge and will not be sufficient for the system to operate. A trim charge will need to be added after the system is installed that is based on system design. LATS Multi V Space II piping design software will calculate the size of the refrigerant piping and calculate the refrigerant charge; this added trim refrigerant charge is shown on the LATS Multi V output.

The example LATS Multi V design software report below shows both the base charge and the calculated trim charge (Table 25 - Table 30).

The information used in the tables below are obtained from a LATS-generated report.

Table 25: Outdoor Unit Specifications Per Design Conditions

Model Name	Max. Indoor Unit Connectivity	Max. Total Over Load (kBtu/h/%)	Indoor Unit to Outdoor Unit Ratio	Product Charge (lbs.)	Additional Ref. Amount (lbs.)	Rated / Corrected Capacity (kBtu/h)		Rated / Corrected Power Input (kW)	
						Cooling	Heating	Cooling	Heating
ARNU053GF2	9	70.5 (130%)	0.83:1	7.72	13.48	54.0 / 43.4	60.0 / 43.2	5.1 / 4.4	5.4 / 6.0

Table 26: Piping Specifications

Index (from LATS selection)	Piping Dia. (Inches) Liquid : Vapor	Length (Feet)[1]
P0	1/4 : 1/2	88.6
P2	3/8 : 3/4	209.8

[1]It is imperative to know the "as-built" physical length of each segment of liquid line, to calculate the total refrigerant charge required. An accurate "as built" field-verified piping diagram is required to verify within LATS that piping is within limits, proper pipe sizing, and refrigerant charge.

Table 27: Branches / Headers / Common Pipes

Model Name	Quantity
ARBLN03321	1
ARBL1010	1

Table 28: Total Heat Pump Outdoor Unit (208-230V) Refrigerant Charge

Nominal Tons	Combination Model Numbers	Individual Component Model Numbers	Refrigerant Charge	Total
4.4	ARUN053GF2	—	7.7	7.7

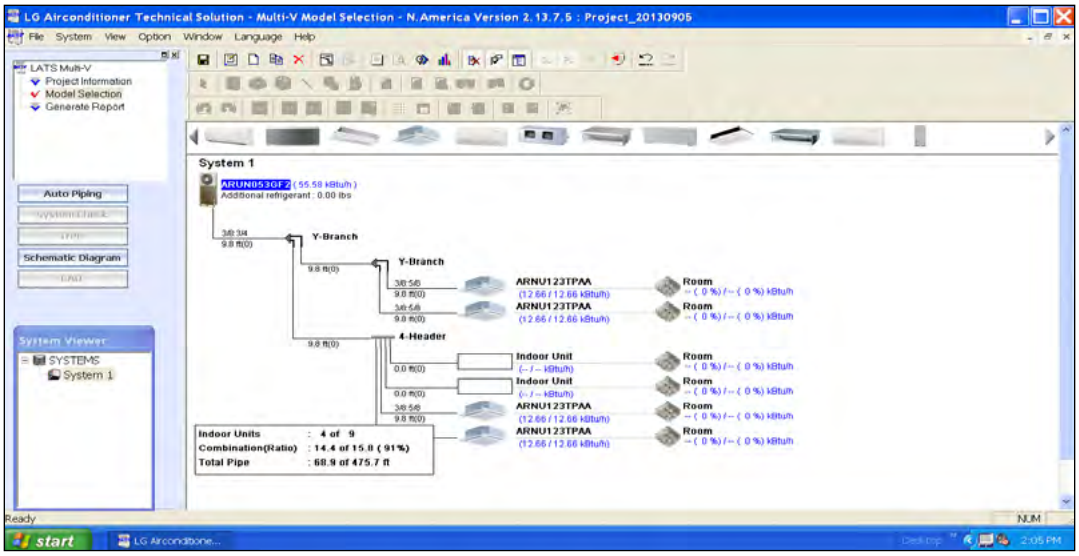
Table 29: Accessories

Index	Model Name	Quantity	Description
IDU	PT-UQC	9	Grille - Four-way Cassette (Tr, TQ)

Table 30: Indoor Units

Model Name	Quantity	Description
ARNU053TRC2	9	Ceiling Cassette - 4-Way (5MBh_2X2
Total	9	

Figure 28: LATS Tree Diagram for Multi V Space II Refrigerant Piping



Determining the Total System Charge (Refer to Table 31, "System Refrigerant Charge Calculator (lbs.)")

1. Using the LATS Tree diagram, document the linear feet of straight liquid piping and the quantity and type of each fitting by pipe diameter into System Refrigerant Charge Calculator page 67.
2. Calculate the total linear feet of liquid line piping in the system. It is imperative to know the “as-built” physical length of each segment of liquid line to calculate the total refrigerant charge required. An accurate “as built” field-verified piping diagram is required to verify within LATS that piping is within limits, proper pipe sizing, and refrigerant charge. Record the values on lines 1–7.
3. Count the number of indoor units. Group them by model type and nominal capacity as indicated in the description field on lines 8–33 of the Calculator Table. Record the quantity of units in each group, multiply each by their specific correction factor, and add the sum in the Total (lbs.) column.
4. Count the number of heat recovery units, record the quantity, multiply by the specific correction factor, and record the sum in the Total (lbs.) column on line 34.
5. Sum the total values on lines 1-34 and place in the field labeled "Additional Refrigerant Charge Required" on line 34.
6. Record the quantity of each outdoor unit frame, multiple total of each by their specific correction factor on line 35, and enter the total on line 36 (Total Factory Refrigerant Charge).
7. Add the Additional Refrigerant Charge Required to the Total Factory Refrigerant Charge. This is the Total System Charge. Record on line 37.

Table 31: System Refrigerant Charge Calculator (lbs.)

System Tag or ID_____	Job Name_____ Project Manager_____ Date_____			
Line #	Description	Chassis I.D.	Size	CF (Ref.)[1]
1	Linear feet of 1/4" liquid line tubing[1]	—	—	0.015
2	Linear feet of 3/8" liquid line tubing[1]	—	—	0.041
3	Linear feet of 1/2" liquid line tubing[1]	—	—	0.079
4	Linear feet of 5/8" liquid line tubing[1]	—	—	0.116
5	Linear feet of 3/4" liquid line tubing[1]	—	—	0.179
6	Linear feet of 7/8" liquid line tubing[1]	—	—	0.238
7	Linear feet of 1" liquid line tubing[1]	—	—	0.323
8	Wall Mounted + Art Cool Mirror	SE	7k to 15k	0.53
9	Wall Mounted + Art Cool Mirror	S8, S5	18k to 24k	0.62
10	1-Way Cassette	TJ	7k to 12k	0.44
11	2-Way Cassette	TL	18k to 24k	0.35
12	4-Way 2' x 2' Cassette	TR	5k to 7k	0.40
13	4-Way 2' x 2' Cassette	TR	9k to 12k	0.55
14	4-Way 2' x 2' Cassette	TQ	15k to 18k	0.71
15	4-Way 3' x 3' Cassette	TN	9k to 15k	1.06
16	4-Way 3' x 3' Cassette	TM	18k to 24k	1.41
17	4-Way 3' x 3' Cassette	TP	24k to 28k	1.06
18	4-Way 3' x 3' Cassette	TN	36k	1.41
19	4-Way 3' x 3' Cassette	TM	42k to 48k	1.41
20	High Static Ducted	BH	7k to 24k	0.57
21	High Static Ducted	BG	15k to 42k	0.97
22	High Static Ducted	BR	48k	1.37
23	High Static Ducted	B8	76k to 95k	2.20
24	Low Static Ducted, Low Static Ducted Bottom Return	B1, B3	7k to 15k	0.37
25	Low Static Ducted, Low Static Ducted Bottom Return	B2, B4	18k to 24k	0.82
26	Vertical / Horizontal Air Handling Unit	NJ	18k to 24k	1.04
27	Vertical / Horizontal Air Handling Unit	NJ	30k	1.04
28	Vertical / Horizontal Air Handling Unit	NJ	36k	1.57
29	Vertical / Horizontal Air Handling Unit	NK	42k to 54k	2.00
30	Ceiling Suspended	VJ	18k to 24k	0.77
31	Convertible Surface Mount—Ceiling/Wall	VE	9k to 12k	0.22
32	Floor Standing	CE (U)	7k to 15k	0.37
33	Floor Standing	CF (U)	18k to 24k	0.82
34	**Additional Refrigerant Charge Required**			
35	Outdoor Unit Factory Refrigerant Charge (To obtain factory refrigerant charge for each frame, see page 65.)	36a ARNU053GF2	53k	7.7
36	Total Factory Refrigerant Charge (sum of refrig. charge for all Outdoor Units in the system)			
37	Total System Charge: Sum of Additional Refrigerant Charge Required to the Total Factory Refrigerant Charge			

[1]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).

INSTALLATION & LAYOUT BEST PRACTICES

Selecting Field-Supplied Copper Tubing

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

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

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

Table 32: ACR Copper Tubing Material

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

Table 33: Piping Tube Thicknesses

OD (in)	1/4	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8	1-5/8
Material	Rigid Type "K" or "L" - Soft ACR Acceptable			Rigid Type "K" or "L" Only					
Min. Bend Radius (in)	.563	.9375	1.5	2.25	3.0	3.0	3.5	4.0	4.5
Min. Wall Thickness (in)	.03	.03	.03	.03	.03	.03	.03	.04	.05

Copper Expansion and Contraction

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

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

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

The refrigerant pipe support system must be engineered to allow free expansion to occur. When a segment of pipe is mounted between two fixed points, provisions must be provided to allow pipe expansion to naturally occur. The most common method is the inclusion of expansion Loop or U-bends. See "Figure 29: Coiled Expansion Loops and Offsets" on page 70 Each segment of pipe has a natural fixed point where no movement occurs. This fixed point is located at the center point of the segment assuming the entire pipe is insulated in a similar fashion. The natural fixed point of the pipe segment is typically where the expansion Loop or U-bend should be. Linear pipe expansion can be calculated using the following formula:

1. From Table 34, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe.

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

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

In the column showing the minimum pipe temperature, look up the anticipated expansion distance. Do the same for the maximum pipe temperature.

3. Calculate the difference in the two expansion distance values. The result will be the anticipated change in pipe length.

Example:

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

Vapor Line

Transporting Hot Vapor: 120 ft. pipe at 120°F = 1.68 in.
Transporting Suction Vapor: 120 ft. pipe at 40°F = .48 in.
Anticipated Change in Length: 3.64 in. – 1.04 in. = 1.2 in.

Liquid Line

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

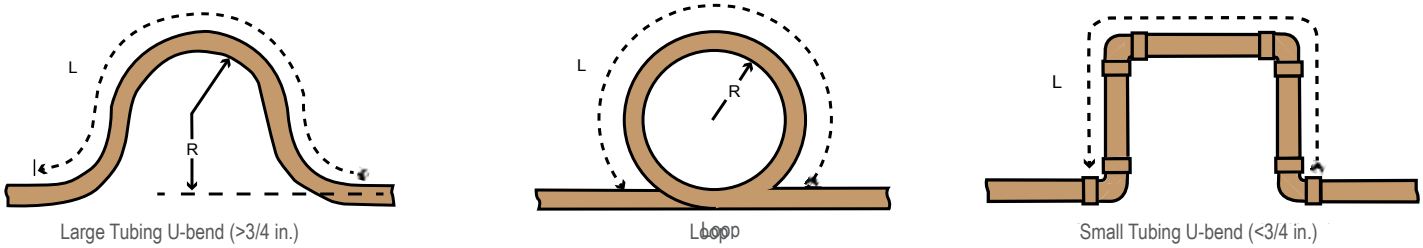
When creating an expansion joint, the joint height should be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an Expansion Loop is provided in Table 35. Use soft copper with long radius bends on longer runs or long radius elbows for shorter pipe segments. Using the anticipated linear expansion (LE) distance calculated, look up the Expansion Loop or U-bend minimum design dimensions. If other types of expansion joints are chosen, design per ASTM B-88 Standards.

Table 34: Linear Thermal Expansion of Copper Tubing in Inches

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

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

Figure 29: Coiled Expansion Loops and Offsets



Large Tubing U-bend (>3/4 in.) Loop Small Tubing U-bend (<3/4 in.)

Table 35: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets

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

[1]R = Centerline Length of Pipe.

[2]L = Centerline Minimum Radius (inches).

Definitions

Main: The piping segment between the outdoor unit and the first Y-branch.

Branch: A segment of pipe between two Y-branches.

Run-out: The segment of pipe connecting an indoor unit to a Y-branch.

Physical Pipe Length: Actual length of straight segment(s) of pipe.

Equivalent Pipe Length: Actual length of pipe plus equivalent lengths of elbows, Y-branches, and valves.

Layout Procedure

1. Draft a one-line diagram of the proposed piping system connecting outdoor unit to indoor units. Follow the pipe limitations listed at "Table 19: Multi V Space II Refrigerant Piping System Limitations" on page 57.
2. Calculate the physical length of each pipe segment and note it on the drawing.
3. Calculate the equivalent pipe length of each pipe segment.
4. Input the pipe lengths into the LATS software and perform “Auto Pipe Sizing” check and “System Check”. LATS will automatically calculate pipe sizes.

Using Elbows

Field-supplied elbows are allowed as long as they are designed for use with R410A refrigerant. The designer, however, should be cautious with the quantity and size of fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment in the LATS program. See Table 36 for equivalent lengths.

Table 36: Equivalent Piping Length for Y-branches, Headers, and Other Piping Components

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

[1] *Kit for ARUN Heat Pump systems contains two Y-branches: one for liquid and one for vapor; Kit for ARUB Heat* Recovery systems contains three Y-branches: one for liquid, one for low-pressure vapor, one for high-pressure vapor.

Field-Provided Isolation Ball Valves

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

If valves are not installed and a single indoor unit needs to be removed or repaired, the entire system must be shut down and evacuated. If isolation ball valves are installed, and an indoor unit needs to be repaired, the unaffected indoor units can remain operational with readdressing and the proper combination ratio (See “Determine the System Combination Ratio [CR]” on page 42). Reclamation of refrigerant, then, can be restricted to a single indoor unit.

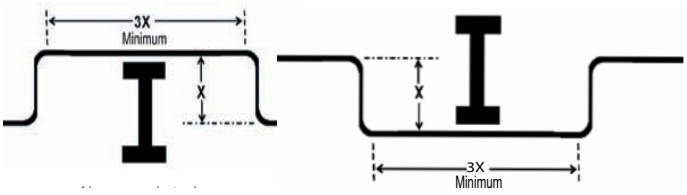
Position valves with a minimum distance of three (3) to six (6) inches of pipe on either side of the valve Y-branch, or header.

Valves shall be easily accessible for service. If necessary, install drywall access doors or removable ceiling panels, and position the valves to face the access door or ceiling panel opening. Mount valves with adequate space between them to allow for placement of adequate pipe insulation around the valves. Recommended best practice is to clearly label and document locations of all service valves, Y-branches, and headers. The equivalent pipe length of each ball valve must be added to each pipe segment entered into LATS program. See "Table 36: Equivalent Piping Length for Y-branches, Headers, and Other Piping Components" for equivalent lengths of ball valves.

Obstacles

When an obstacle, such as an I-beam or concrete T, is in the path of the planned refrigerant pipe run, it is best practice to route the pipe over the obstacle. If adequate space is not available to route the insulated pipe over the obstacle, then route the pipe under the obstacle. In either case, it is imperative the horizontal section of pipe above or below the obstacle be a minimum of three (3) times greater than the longest vertical rise (or fall) distance (Figure 30).

Figure 30: Installing Piping Above and Below an Obstacle



Above an obstacle Below an obstacle

INSTALLATION & LAYOUT BEST PRACTICES

Refrigerant Piping System Layout

In-line Refrigeration Components

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

No Pipe Size Substitutions

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

Pipe Supports

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

Pipe supports should never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket (see Figure 31). Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers should be used with shields between the hangers and insulation. Field provided pipe supports should be designed to meet local codes. If allowed by code, use fiber straps or split-ring hangers suspended from the ceiling on all-thread rods (fiber straps or split ring hangers can be used as long as they do not compress the pipe insulation). Place a second layer of insulation over the pipe insulation jacket to prevent chafing and compression of the primary insulation within the confines of the support pipe clamp.

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

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

Wherever the pipe changes direction, place a hanger within twelve (12) inches on one side and within twelve to nineteen (12 to 19) inches of the bend on the other side as shown in Figure 32. Support piping at indoor units as shown in Figure 33. Support Y-Branch and Header fittings as shown in Figure 34 and Figure 35.

Figure 31: Pipe Hanger Details

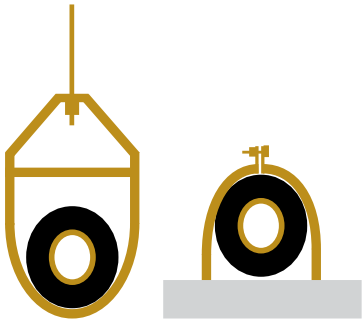


Figure 32: Typical Pipe Support Location—Change in Pipe Direction

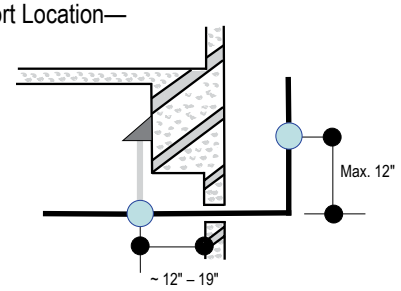


Figure 33: Pipe Support at Indoor Unit

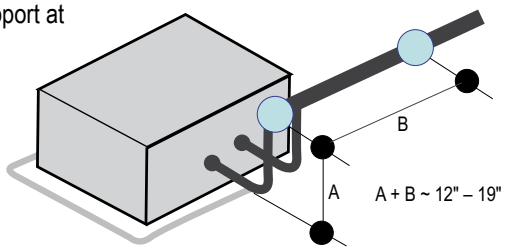


Figure 34: Pipe Support at Y-branch Fitting.

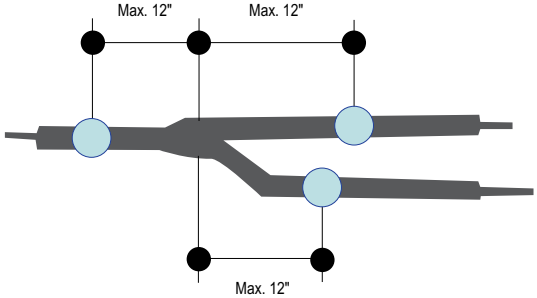
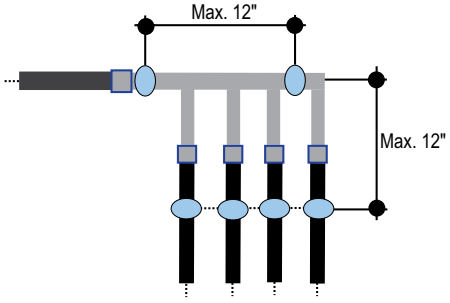


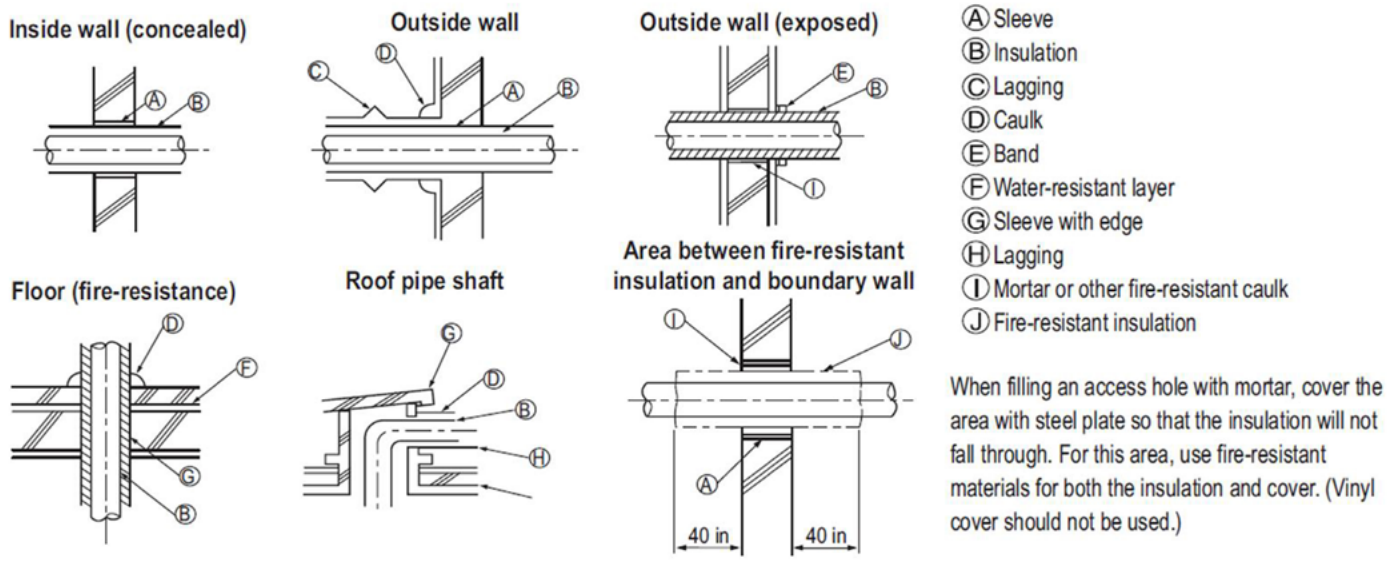
Figure 35: Pipe Support at Header Fitting



Pipe Sleeves at Penetrations

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

Figure 36: Pipe Sleeve Options



Note:

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

Note:

Avoid Pipe Damage

- *When routing field-provided piping inside the outdoor unit frame, take care to avoid damage due to vibration.*
- *Correctly route the piping so it does not make contact with the compressor casing, terminal cover, or mounting bolts. Allow room for field installation.*
- *Properly insulate the liquid and vapor lines separately up to the point of connection inside the confines of the unit frame.*
- *Refer to Figure 37 for unit piping routing options, and Table 37 for unit pipe connection sizes.*

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

- Use nitrogen at 2.8 psi flow during welding.
- If nitrogen was not used during welding, oxidized contaminants may build inside the piping and effect valve and condenser operation.

Figure 37: Space Refrigerant Pipe Option

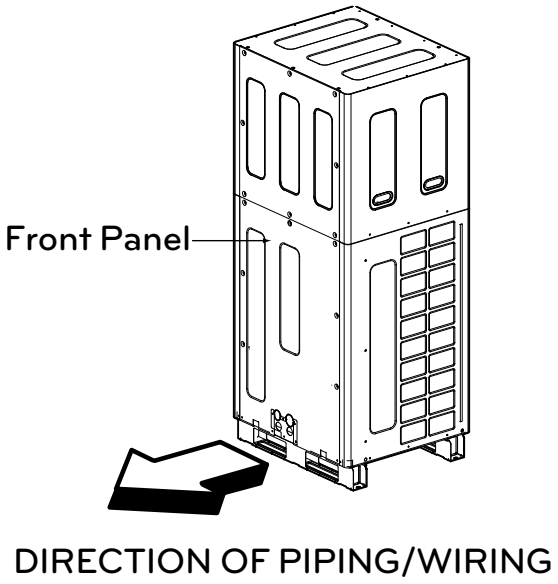


Table 37: Heat Pump Unit Refrigerant Pipe Connections (All Brazed Type)

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

Heat Pump Unit Pipe Connections

Note:

The leak-prevention cap attached to the outdoor unit service valves must be removed before pipe installation.

1. Remove the leak-prevention cap.
2. Check if the liquid and vapor pipes are fully locked (Figure 38).
3. Vacuum out any remaining refrigerant or air through the service port.

Guidelines and Cautions in Pipe Connection / Valve Operation

1. Follow call outs of Figure 40 below while adhering to these guidelines.
2. At the Pipe Joint (1) in Figure ; securely perform brazening with a nitrogen blow into the service valve port. Releasing pressure: 2.9 psi or less.
3. At the Cap (2) in Figure; remove caps and then operate valves. After operation always secure the caps again, tightening at a torque of 221 lbf-in or more. Do not remove the internal part of the port!
4. At Service Ports (3) in Figure; complete the refrigerant vacuum and then charge it using the appropriate service ports to each valve. Always replace cap after completion of work and tighten using a torque of 124 lbf-in or more.
5. The Liquid Pipe is shown at (4) on the figure.
6. The Gas Pipe is shown at (5) on the figure.
7. Additional information regarding these pipes is shown in Figure 39.

Note:

If the pipe cap is not properly installed, the outdoor unit may leak refrigerant and the system will not operate properly.

⚠ WARNING

After completing work, be sure to securely tighten both service ports and caps in order to prevent leaks.

Figure 38: Heat Pump Outdoor Unit Pipe Connections.

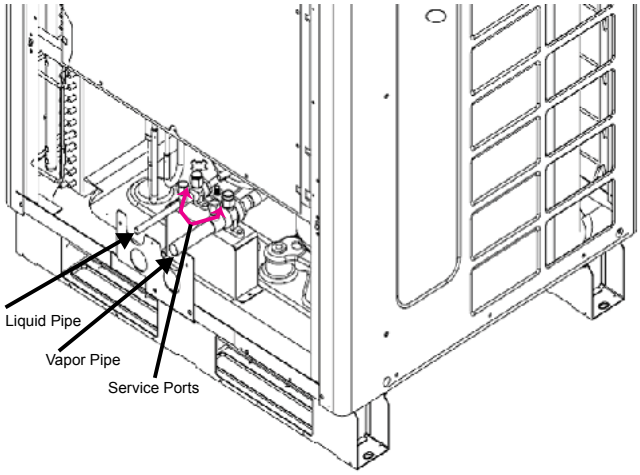


Figure 39: Service Ports and Cutting Pipe Length

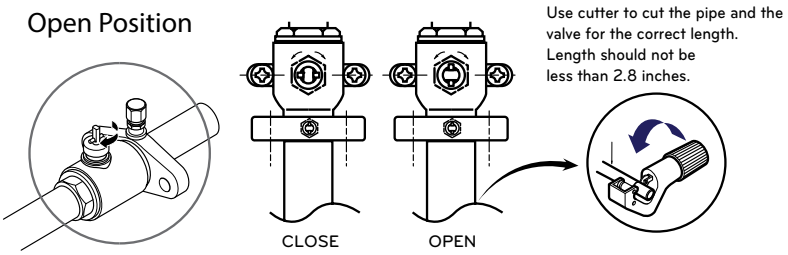
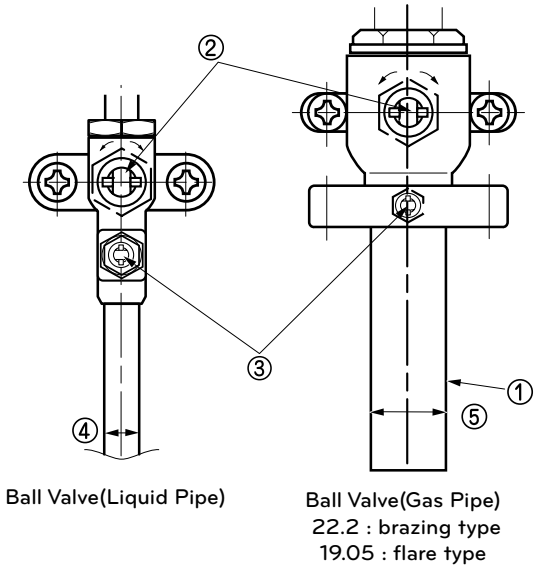


Figure 40: Ball Valve on Liquid and Gas Pipes



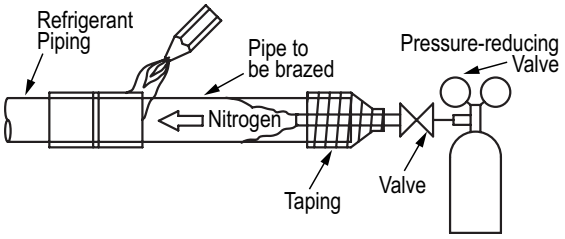
Installation of Refrigerant Piping / Brazing Practices

Note:

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

All joints are brazed in the field. Multi V Space II refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, and heat exchangers that can easily become blocked. Proper system operation depends on the installer using best practices and utmost care while assembling the piping system.

Figure 41: Refrigerant Pipe Brazing.



- While brazing, use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
- Blow clean all pipe sections with dry nitrogen prior to assembly.
- Use a tubing cutter, do not use a saw to cut pipe. De-burr and clean all cuts before assembly.
- Store pipe stock in a dry place. Keep pipe capped and clean.
- Use adapters to assemble different sizes of pipe.
- Do not use flux, soft solder, or anti-oxidant agents.
- Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
- Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or a heat barrier spray product

Refrigerant Safety Standards

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

If a VRF system develops a refrigerant leak, the entire refrigerant charge of the system will dump into the area where the leak occurs. To meet ASHRAE Standards 15 and 34, the smallest room volume on the system must be calculated and compared to the maximum allowable concentration. If the concentration level is higher than allowed, the following are some design suggestions to eliminate the problem:

- Add transfer grilles in the ceiling or walls of the smaller rooms to increase the volume of the room.

Refrigerant Piping System Insulation

All refrigerant piping including Y-branch and Header connections, field-provided isolation ball valves, service valves, and elbows shall be completely insulated using closed cell pipe insulation. The liquid and vapor lines must be insulated separately.

To prevent heat loss/heat gain through the refrigerant piping, all refrigerant piping including liquid lines, high-pressure vapor lines, and low-pressure vapor lines shall be insulated separately. Insulation shall be a minimum 1/2" thick, and thickness needs to be increased based on ambient conditions and local codes.

All insulation joints are to be glued with no air gaps. Insulation material shall fit snugly against the refrigeration pipe with no air space between it and the pipe. Insulation passing through pipe hangers, inside conduit, and/or sleeves must not be compressed. Protect insulation inside hangers and supports with a second layer. All pipe insulation exposed to the sun and outdoor elements shall be properly protected with PVC, aluminum vapor barrier, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover; and meet local codes. LG-provided Y-branches are shipped from the factory with pre-formed peel-and-stick foam insulation jackets, with a 1.84 lb./ft.^{3} density, 1/2" thickness, and meet UL94 MF-1 flammability.

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

CUT SHEETS

Indoor Unit Y-branch Kits (For ARUN Heat Pump Systems)

- LG indoor unit Y-branch fittings must be used with LG systems and be properly installed following the instructions in the applicable LG manual. Field-supplied branch fittings are not permitted.
- Kit components must be kept free of debris and dry before installation.
- All Y-branch kits include a clam shell, peel-and-stick insulation jacket.

Note:

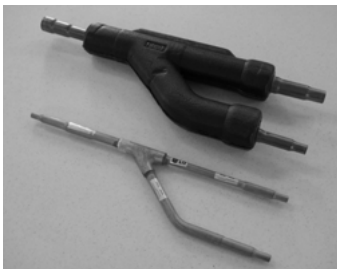
- *Design pressure is 551 psig.*
- *All dimensions in inches. Tolerance ±1/4 inch.*
- *Images are not to scale.*

Table 38: Nominal Capacity Range (Btu/h).

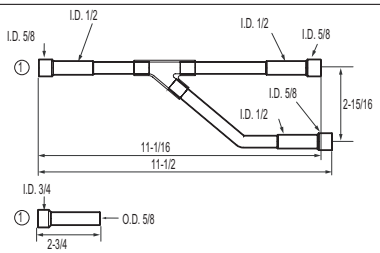
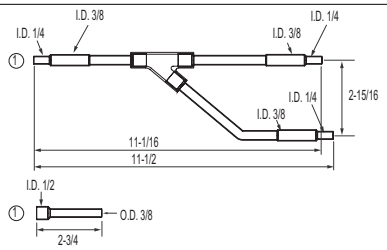
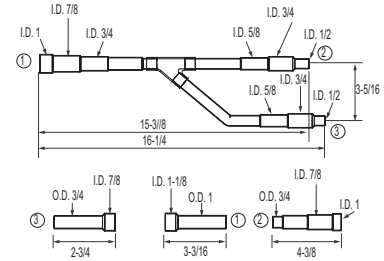
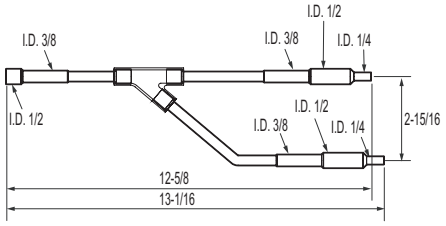
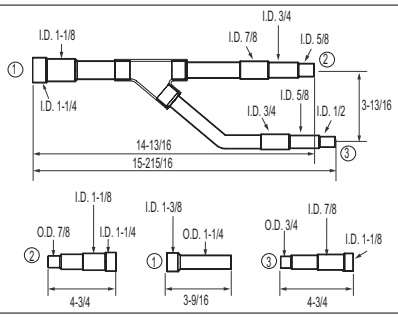
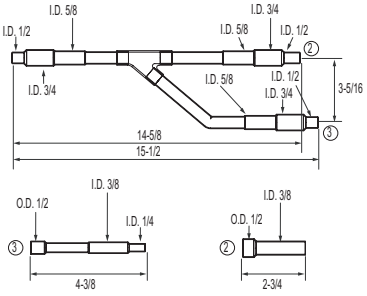
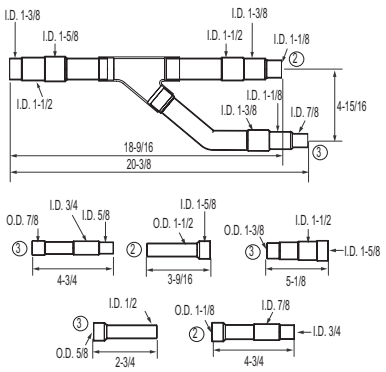
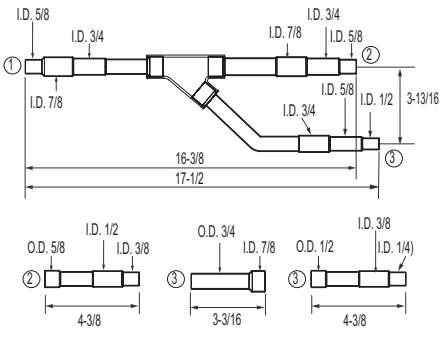
Model	Fitting Capacity
ARBLN01621	≤72,000 connected capacity
ARBLN03321	≤144,000 connected capacity
ARBLN07121	≤336,000 connected capacity
ARBLN14521	≤432,000 connected capacity

Table 39: Insulation Jacket Properties.

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



Unit: Inch

Models	Vapor pipe	Liquid pipe
ARBLN01621		
ARBLN03321		
ARBLN07121		
ARBLN14521		

Header Kits

- LG Headers serve as central connections for multiple runout pipe segments terminating at indoor units.
- Headers must be used with LG systems and be properly installed following the instructions in the applicable LG manual. Field-supplied headers are not permitted.
- Kit components must be kept free of debris and dry before installation.
- All Header Kits include:
- Insulation jacket (one each for vapor and liquid pipes)
- Plugging tubes / Insulation for plugging tubes (see Table 41).

Table 40: Nominal Capacity Range

Model	Fitting Capacity	Port Capacity
ARBL054 (4 branch)	≤72,000 connected capacity	≤54,300 per port
ARBL057 (7 branch)	≤75,100 connected capacity	≤54,300 per port
ARBL1010 (10 branch)	≤172,200 connected capacity	≤76,300 per port
ARBL104 (4 branch)	≤305,200 connected capacity	≤76,300 per port
ARBL107 (7 branch)	≤534,000 connected capacity	<76,300 per port
ARBL2010 (10 branch)	≤560,000 connected capacity	≤76,300 per port

Table 41: Plugging Tubes and Plugging Tube Insulation Amounts

Header Kits	Plugging Tubes			Insulation for Plugging Tubes
	1/4Ø	1/2Ø	5/8Ø	
ARBL054 (4 port)	—	—	—	—
ARBL057 (7 port)	2	2	—	4
ARBL1010 (10 port)	2	2	2	6
ARBL104 (4 port)				
ARBL107 (7 port)	2	2	2	6
ARBL2010 (10 port)	2	2	2	6

Note:
- *All dimensions in inches.*
- *Tolerance ±1/4 inch.*
- *Images are not to scale.*

Table 42: Insulation Jacket Properties

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

Table 43: Fitting Properties

Material	Copper
Design Pressure	551 psig

CUT SHEETS

Header Kits

Unit: Inch

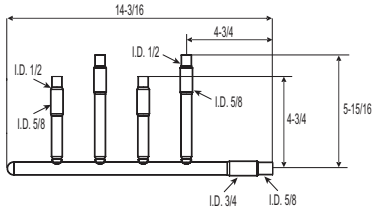
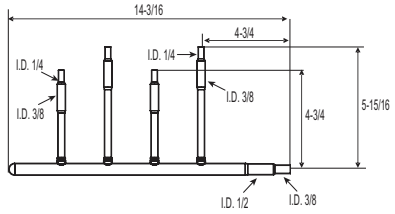
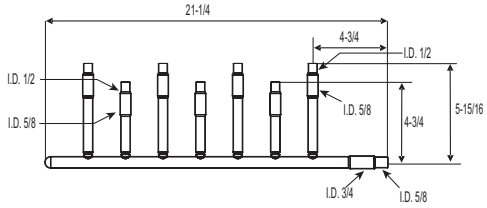
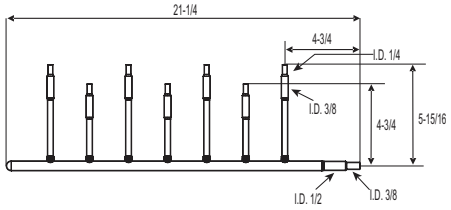
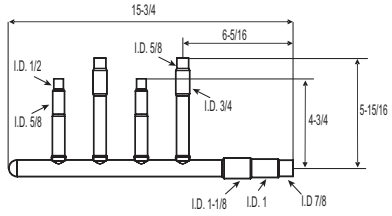
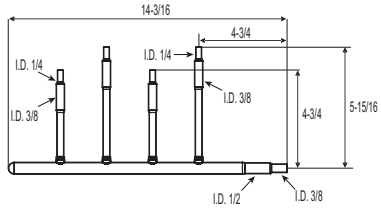
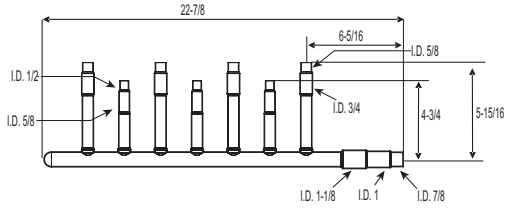
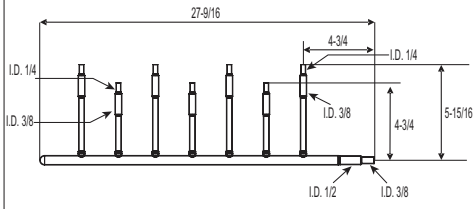
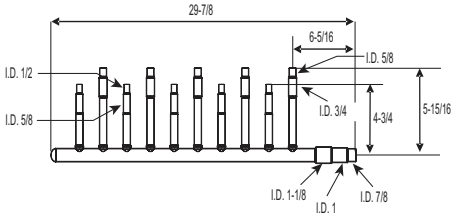
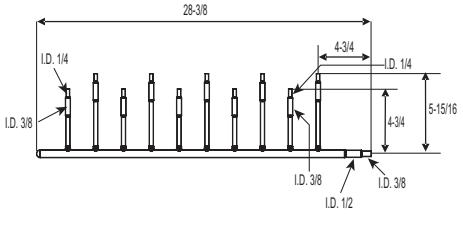
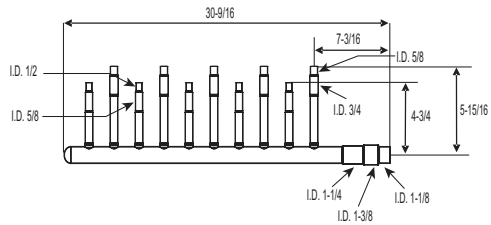
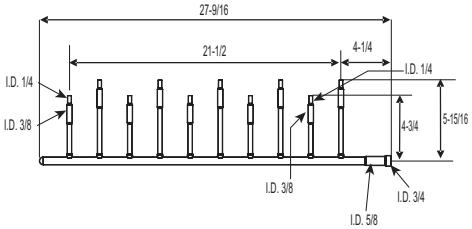
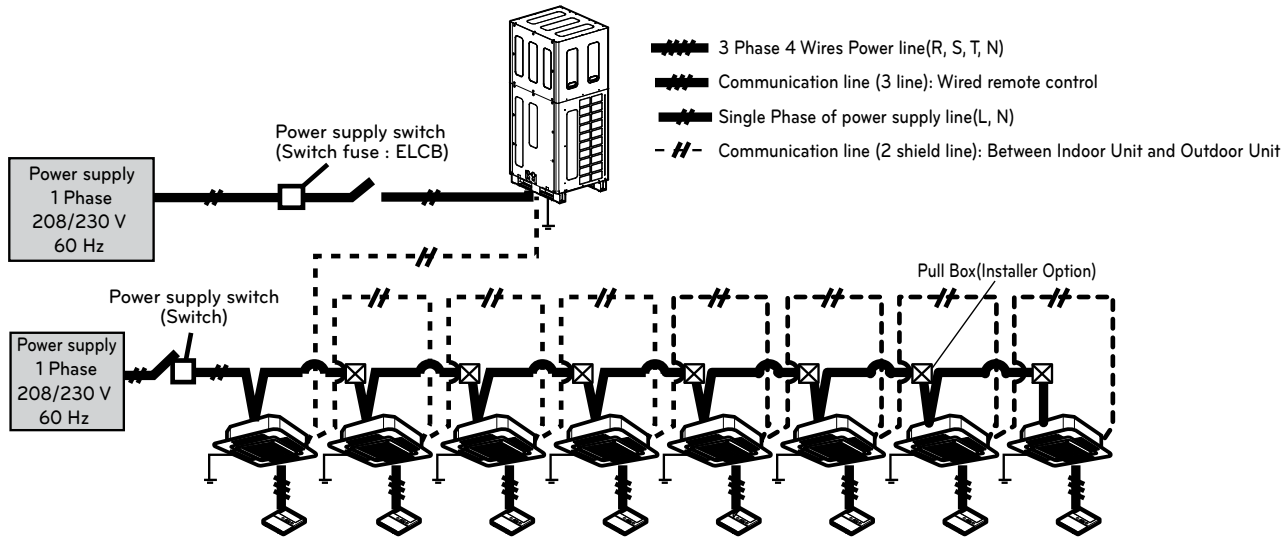
Models	Vapor pipe	Liquid pipe
4 branch ARBL054		
7 branch ARBL057		
4 branch ARBL104		
7 branch ARBL107		
10 branch ARBL1010		
10 branch ARBL2010		

Figure 42: Multi V Space II Heat Pump System—Daisy-Chain Configuration



⚠ WARNING

- *Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. Do not connect the ground line to the pipes.*
- *Install a main shutoff switch that interrupts all power sources simultaneously.*
- *If the system operates in reversed phase, it may damage the compressors and other components.*
- *If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off while the system is operating, install a field-supplied phase loss protection circuit.*

Figure 43: Multi V Space II Heat Pump System—Communication Wiring

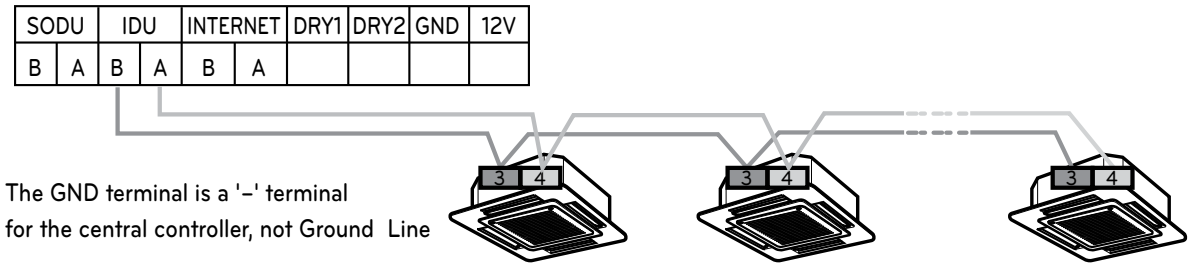
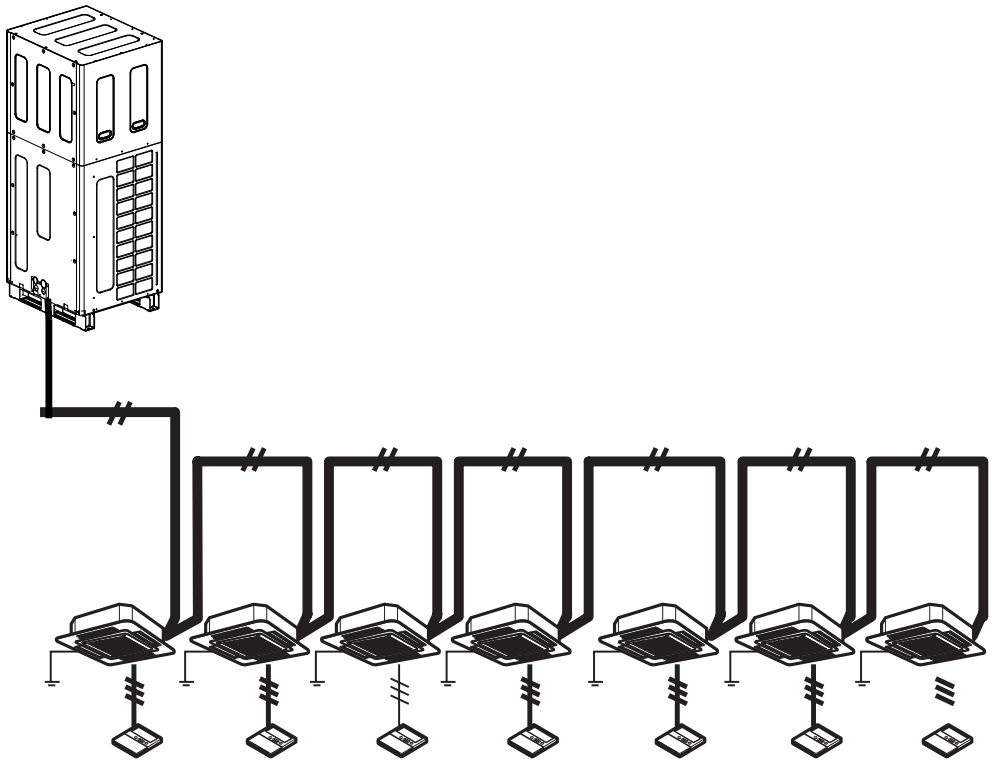


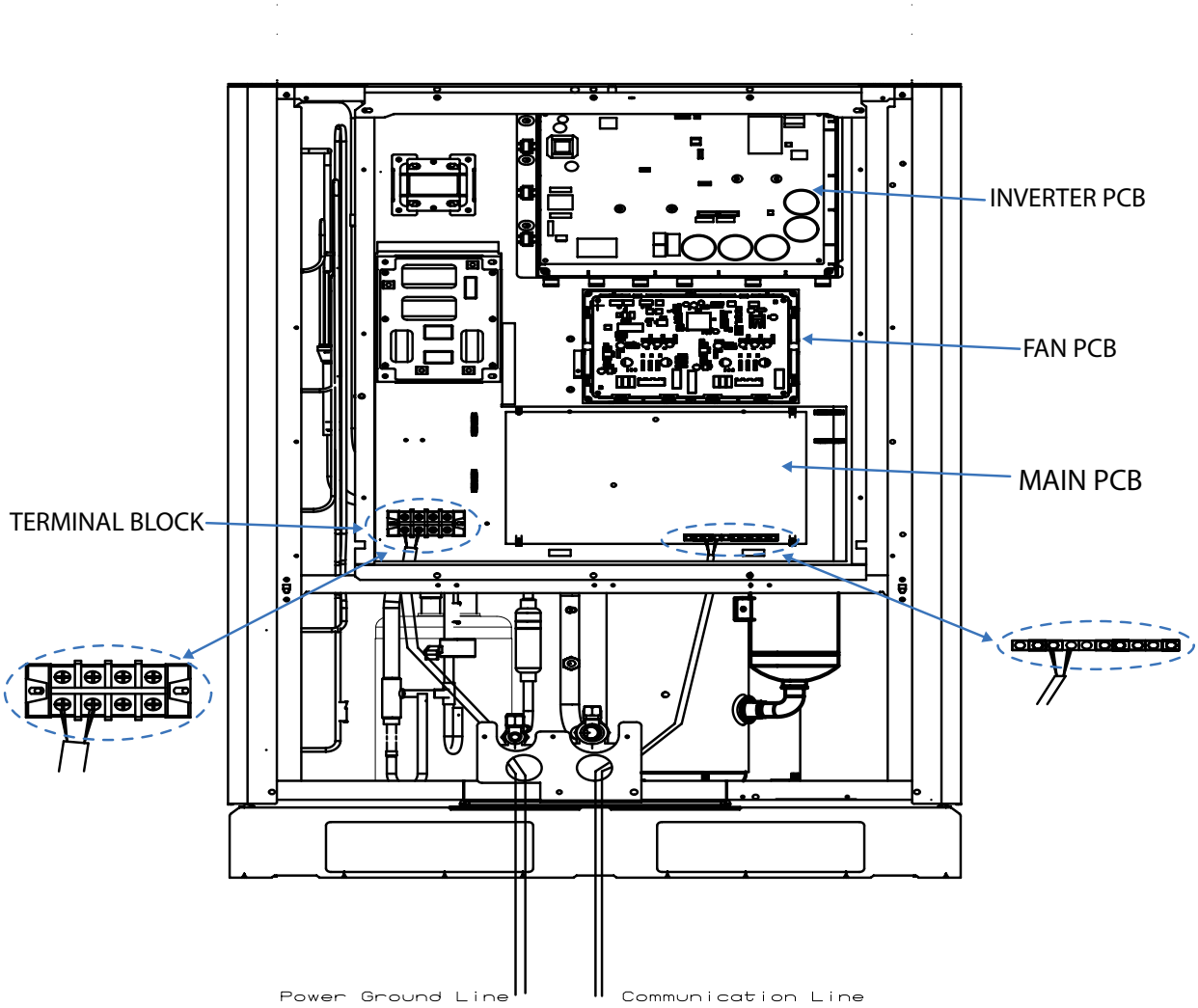
Figure 44: Multi V Space II Heat Pump System—Daisy-Chain Communications Cable Wiring



Note:

Communications cables are shielded, grounded at the outdoor unit(s) only. Maintain polarity throughout the communication network.

Figure 45: Multi V Space II Heat Pump System—Electrical Connections



MECHANICAL SPECIFICATIONS

Multi V Space II Heat Pump Unit

General

LG Multi V Space II Variable Refrigerant Flow (VRF) comprises of a Heat Pump system with a single frame outdoor unit connected to up to 9 indoor units with a single refrigerant piping system connectable using factory designed and supplied Y-branches and headers, and having integrated controls.

An LG Multi V Space II Heat pump system is a VRF system that can operate in either cooling or heating mode.

LG components are manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Organization for Standardization (ISO). The units are listed by Intertek Electrical Testing Laboratories (ETL) and bear the ETL label. Wiring in these units are in accordance with the National Electrical Code (NEC).

Temperature Ranges

Heat Pump Systems

Multi V Space II can operate in heating only mode from -4°F to +60°F ambient wet bulb without additional low ambient controls.

Multi V Space II can operate in cooling only mode from 23°F to +118°F ambient dry bulb.

Casing / Frame

Multi V Space II is constructed with galvanized steel, bonderized and finished with powder coat baked enamel paint.

Frames are completely factory assembled, piped and wired.

Refrigerant System

The refrigeration system consists of a single refrigeration circuit and uses R410A refrigerant. The outdoor unit is provided with factory installed components, including a refrigerant strainer, accumulator, hot gas bypass valve, four-way reversing valve, electronic controlled expansion valve (EEV), high and low side charging ports, high pressure safety switch, service valves, and interconnecting piping. Also included is an integral subcooler assembly consisting of a double spiral tube-type subcooling heat exchanger and EEV providing refrigerant subcooling modulation up to 35ºF.

Refrigeration Oil Control

Multi V Space II units have a compressor and controls to ensure sufficient oil supply is maintained, and that oil does not travel with the refrigerant.

Compressors

The Multi V Space II is equipped with one hermetic digitally controlled inverter driven rotary compressor to modulate capacity (variable from 21 to 100Hz, modulate in 1 Hz increments). Internal thermal overload protection is included.

Outdoor Unit Coil

Multi V Space II coils are of a nonferrous construction with louvered fins on copper tubing, and are protected with an integral metal guard. Coil fins have a factory applied corrosion resistant GoldFin™ material.

Fans and Motors

The frame includes one direct drive, variable speed fan.

The fan motor has inherent protection, permanently lubricated bearings, and is a variable speed with a maximum speed up to 813 rpm. Raised guards are provided to limit contact with moving parts.

The Multi V Space II unit has front discharge airflow.

The unit has a static pressure capability up to 0.2" WG with Dip switch to accommodate additional external static pressure.

Electrical

The Multi V Space II Heat Pump unit is available in a 208-230V 60 Hz, 1-phase power supply. The unit is capable of operating within voltage limits of ±10% rated voltage, and include overcurrent protection.

Controls

The Multi V Space II Heat Pump is factory wired with necessary electrical control components, integral microprocessors, printed circuit boards, thermistors, sensors, terminal blocks, and lugs for power wiring.

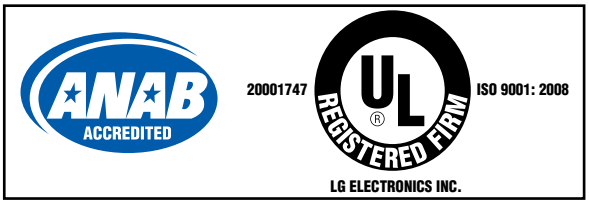
Microprocessor-based algorithms provide component protection, soft-start capability, refrigeration system pressure, temperature, defrost, and ambient control.

ACRONYMS

Table 44: Table of Acronyms

%OA	Percentage Outdoor Air
%RA	Percentage Return Air
ABS	Acrylonitrile Butadiene Styrene
AC	Air Conditioner/Alternate Current
ACP	Advanced Control Platform
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AHU	Air Handling Unit
AWG	American Wire Gauge
BLDC	Brushless Digitally Controlled
Btu/h	British Thermal Units per hour
CCR	Corrected Capacity Ratio
CDOA	Coupled Dedicated Outdoor Air
CFM	Cubic Feet per Minute
CR	Combination Ratio
CR	Credit (LEED Related)
DB	Dry Bulb
dB(A)	Decibels with “A” frequency weighting
DDOAS	Decoupled Dedicated Outdoor Air Source
DFS	Duct Free System
DI	Digital Input

DO	Digital Output
EEV	Electronic Expansion Valve
ELF	Equivalent Length in Feet
ETL	Electrical Testing Laboratories
IDU	Indoor Unit
ISO	International Standards Organization
LEED	Leadership in Energy and Environmental Design
MAT	Mixed Air Temperature
MBh	Thousand BTUs per hour
MCA	Maximum Circuit Ampacity
NEC	National Electrical Code
OAT	Outdoor Air Temperature
ODU	Outdoor Unit
PDI	Power Distribution Integrator
PI	Power Input
RAT	Return Air Temperature
RUR	Running Unit Ratio
VAV	Variable Air Volume
VRF	Variable Refrigerant Flow



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