

MULTI V™

Ducted Indoor Units

Installation Manual

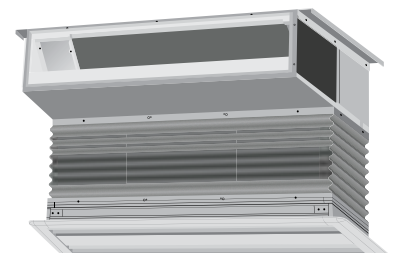
High-Static Ducted Indoor Unit



**Low-Static Convertible
Ducted Indoor Unit**



**Low-Static Bottom Return
Ducted Indoor Unit**



Do not throw away or destroy this manual.
Please read carefully and store in a safe place for future reference.

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

"⚠ WARNING" *This symbol indicates that the action or lack thereof could possibly cause death or personal injury.*

"⚠ CAUTION" *This symbol indicates that the action or lack thereof could possibly cause property damage.*

"⚠ Note: " *This symbol indicates that the action or lack thereof could possibly cause equipment malfunction or failure.*

"⊘" *This symbol indicates that the following action should not be performed.*

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ROUGHING IN

⚠ WARNING

All electric work must be performed by a licensed electrician and conform to local building codes or, in the absence of local codes, with the National Electrical Code NFPA 70/ANSI C1-1993 or current edition, and the instructions given in this manual.

If the electrical work is not performed properly, it may result in fire, electric shock, physical injury or death.

The customer should not install, remove, or re-install the unit.

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

The dealer or an authorized technician should install the unit.

Improper installation by the user may result in water leaks, fire, electric shock, physical injury or death.

For re-installation of an installed unit, always contact the dealer or an authorized technician.

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

Be very careful when transporting the product.

Indoor unit weight and size preclude one person carrying the unit. Use two or more people to transport the product without the assistance of mechanical transport equipment. There is a risk of personal injury.

Do not handle indoor units without the use of gloves and protective clothing. The product may have sharp edges.

There is a risk of personal injury.

Dispose the packing materials safely.

Destroy the structure of plastic packaging and boxes to prevent children from playing with them. There is a risk of injury, suffocation and / or death to humans, animals and wildlife.

Do not install the unit on an unstable structure.

It may result in the failure of the structure, property damage, equipment damage, and / or personal injury or death.

R410A refrigerant creates toxic gases when burned. Do not store or use flammable products near the unit.

There is risk of product failure, fire, and physical injury or death.

Replace all control box and panel covers after completing work.

Failure to do so may result in dust or water infiltration, causing fire, electric shock, and physical injury or death.

Always wear safety glasses and work gloves when installing the product. A rapid release of R410A refrigerant may cause frostbite.

⚠ CAUTION

Properly insulate all cold surfaces when installing this product.

Uninsulated cold surfaces may generate condensation that could drip and damage wall and floors.

This product is engineered to be used for comfort cooling / heating. It is not to be used in applications that require precision cooling or heating such as data centers, food preservation, wine coolers, refrigeration and / or freezer applications.

There is risk of property damage.

Provide field-installed electrical isolation devices to protect sensitive equipment sharing a power source with this product.

Provide sufficient protection against the effects of electromagnetic fields (EMF) and electrical noise.

Inverter equipment, private power generators, high-frequency medical equipment, or radio communication equipment may cause the air conditioner to malfunction.

Provide sufficient electrical system protection against lighting strikes.

The risk is loss of warranty, product damage, and / or complete loss of this product.

ROUGHING IN, CONTINUED

⚠ Note:

Ductwork and other installed airflow restriction devices such as filters shall not exceed the rated maximum static pressure limits of the indoor unit fan assembly.
Doing so will cause product malfunction.

Do not install this product outdoors or where it will be directly exposed to coastal conditions.

Sea air may cause the condenser and evaporator fins to corrode, which could cause product malfunction, improper operation, and shorten the expected useful life of the product.

Do not install this product in a location that is sensitive to acoustic noise. Provide additional acoustical protection as needed.

The risk may be occupant discomfort.

When installing refrigerant piping, use flare connections and plan accordingly for possible pipe expansion.
Improper pipe installation may lead to pipe fatigue, failure, and a rapid release of refrigerant, frostbite, suffocation, physical injury, and or death.

Verify the piping system has been properly evacuated (<500 ppm), and the system's refrigerant charge is correct before commissioning and after any repair is made.
Improper system evacuation and / or an improper refrigerant charge may cause product malfunction.

POWER WIRING

⚠ WARNING

The information contained in this manual is intended for use by a qualified, experienced service technician familiar with safety procedures, and who is equipped with the proper tools and test instruments.

Failure to carefully read and follow all instructions in this manual can result in equipment malfunction, property damage, personal injury or death.

This equipment uses high voltage electricity. Only a qualified, experienced electrician should wire this system. Never assume that the electrical power has been disconnected. Verify with a meter.

Failure to follow to properly respect electricity, use industry best grounding practices, follow suggested wiring instructions, local, and NEC codes can lead to electrical shock, physical injury, seizures, and death.

Use a properly sized circuit protective device. Using an undersized protective device will lead to equipment malfunction. Installing an oversized protective device may cause burns, fire, and death.

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

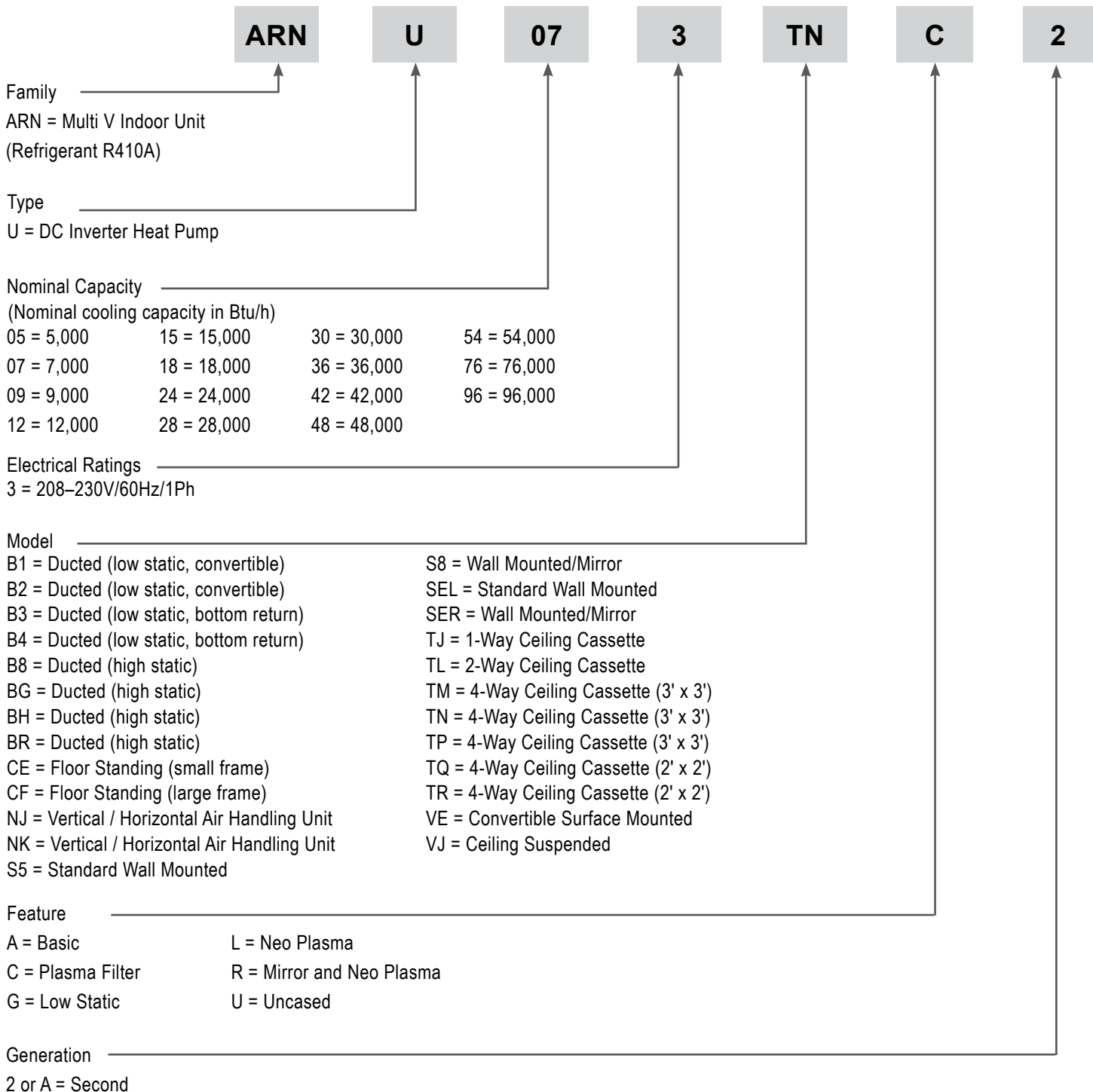
Do not use a field-provided communications cable between the indoor unit and wired zone controllers. Only use LG-provided communications cable. Do not shorten, modify, or lengthen the LG provided communications power cable.
The product will malfunction.

Properly secure power wires and communications cables at connectors to eliminate wire strain.
Inadequate connections may generate heat, cause a fire and physical injury or death.

Verify all power, ground, and communications wires and cables are properly terminated before applying power to the product. Securely tighten all wire terminations.
Improper and/or loose wire and communications cable terminations may cause product malfunction, fire, physical injury or death.

Turn power off at the unit disconnect before servicing.
Electrical shock can cause physical injury or death.

Indoor Units (IDU)



High-Static Ducted Indoor Unit



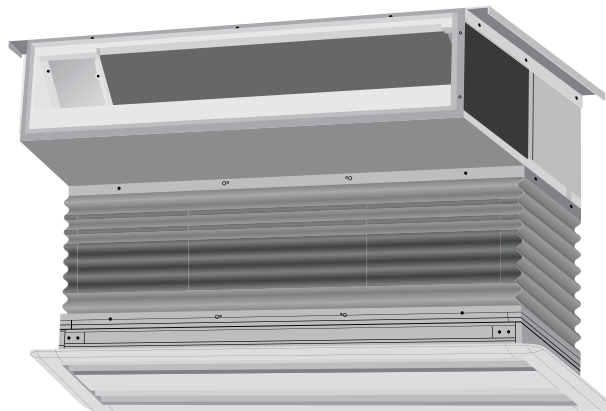
- Capacities from 1/2 to 8 tons.
- Short supply and return ducts help minimize static pressure losses (when compared to conventional ducted systems).

Low-Static Convertible Ducted Indoor Unit



- Vertical height of 7-1/2" to allow installation in ceilings.
- Can be converted between rear and bottom return for maximum ducting flexibility.

Low-Static Bottom Return Ducted Indoor Unit



- Vertical depth of just 7-1/2" to allow installation in ceilings or soffits with minimal vertical clearance.
- Easily tailored to installation in an entry soffit with optional suction canvas and / or grille.

Unpack the Indoor Unit / Inspect for Freight Damage

Choose a location in the vicinity of the installation before removing the protective materials.

▲ Note:

After opening, if the unit is damaged, repack the unit as it was shipped to you. RETAIN ALL PACKING MATERIALS. In general, freight damage claims will be denied if the original packing materials are not retained for the claims adjuster to inspect. Call your supervisor on how to proceed with filing a freight claim and to order a replacement unit.

1. Before opening, check the unit model number on the box. Verify it is the correct capacity, unit type and voltage. Refer to the Nomenclature chart on page 6.
2. Place the box on a solid surface right side up.
3. Cut the white reinforced nylon straps.
4. Open the top of the box and fold back all four flaps.
5. Remove the protective cardboard / Styrofoam® top sheet and place to the side.
6. The walls and top panels are not attached to the bottom of the box. Lift the cardboard carton by the flaps and remove the box walls and top and place it to the side.
7. Remove the moisture barrier plastic bonnet.
8. Check the unit nameplate data and model number. Verify the unit voltage, and capacities are correct before proceeding.
9. Locate and retain the piping / condensate accessory kit located in the bottom of the box under the refrigerant pipe stubs.
10. Remove and retain the installation manual. It is located under the unit, on top of the unit, or taped and inserted into the fan discharge.

▲ Note:

Check the throat and fan wheels for obstructions. Verify the installation manual has been located and removed from the fan outlet before connecting ductwork.

11. Lift the unit and inspect for freight damage. If damage is found, repack the unit as it was received in the original container.

▲ Note:

DO NOT lift the unit by the refrigerant piping, the drain pan pipe stub, or the control panel. Use the hanger brackets or the unit case only to lift the unit. Damage to the piping components may occur.

Location Selection

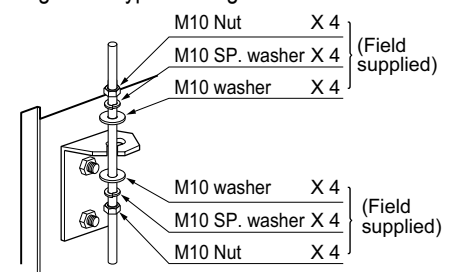
Choose a location that conforms to the following:

- The structure will support the weight of the unit and field provided ductwork and accessories.
- Allows the unit to easily be hung in a level position.
- Provides clearance around the unit considering ductwork, refrigerant piping, condensate line installation, control panel, and major component maintenance access.
- Is free from electrical noise caused by nearby generators and high voltage wiring.
- Is away from airborne sources of grease, steam, excessive environmental conditions, flammable, salt, and / or acidic vapors.
- Ambient airborne particulate is at nominal levels.

Roughing In the Indoor Unit

1. Using the support location dimensions provided in Table 1, hang the unit from four field-supplied and engineered all-thread rods.
2. Level the unit if the factory mounted condensate pump will be used. On High-Static Ducted models (BH, BG, BR, B8) there is an optional gravity drain connection. If the gravity drain connection is used, tilt the indoor unit slightly so condensation flows into the gravity drain nipple properly.
3. If local code requires an auxiliary drain pan under the unit, install it at this time.
4. Connect any necessary ductwork.

Figure 1: Typical Hanger Detail.



Roughing-In Wall-Mounted Zone Controllers

▲ Note:

- It may be necessary to use a handy box that is sized in metric units, depending on the controller model. Check with your LG representative to verify which size of handy box is needed for the zone controller in question.
 - Use only LG-supplied communications cable. Using field-supplied cable may result in communications problems between the zone controller and the indoor unit.
 - DO NOT cut the quick-connect plugs off or adjust the length of the cable.
 - Keep the communications cable away from high voltage wires and electromagnetic field (EMF) producing equipment.
 - Do not route power wiring and communications cables in the same conduit.
 - Maintain the minimum distance required between the communications cable and power wiring. The minimum required space between the two is dependent on the voltage of the power wiring. Refer to the appropriate Multi V Outdoor Unit Engineering Manual for minimum distance specifications.
1. Proper indoor unit operation depends on the location of the room sensor. A good location will protect the zone controller from direct sunlight and external local sources of water vapor, and heated or cooled air. If no mounting height was specified by the building designer, place the handy box approximately fifty-five (55) inches above the finished floor.
 2. Pull LG communications cable between the zone controller handy box and the indoor unit. A thirty (30) foot length of cable will be found with the wall-mounted zone controller.
 3. Store a minimal amount of cable in the handy box. Any additional cable should be coiled and stored near the indoor unit control panel.
 4. If additional cable length is needed, order a thirty (30) foot LG Wired Remote Group Control Extension cable (Model No. PZCWRC1).
 5. If the cable between the zone controller and the indoor unit is too long, do not cut the cable and shorten. Coil any spare communications cable, tie-wrap it, and leave it next to the indoor unit location.
 6. Zone controller rough-in is complete.

ROUGHING IN



Indoor Unit Dimensions

Figure 2: High-Static Ducted Indoor Unit Dimensions.

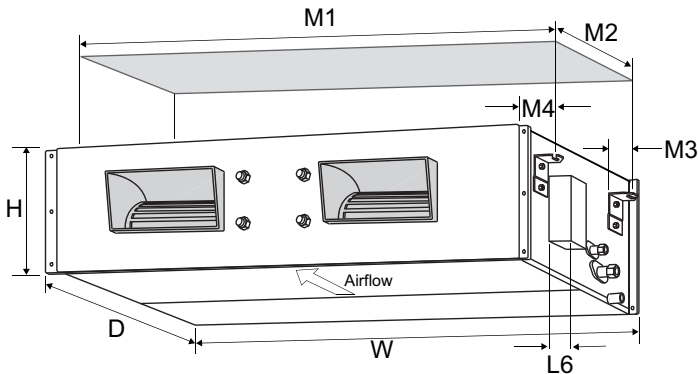


Figure 3: Low-Static Ducted Indoor Unit Dimensions.

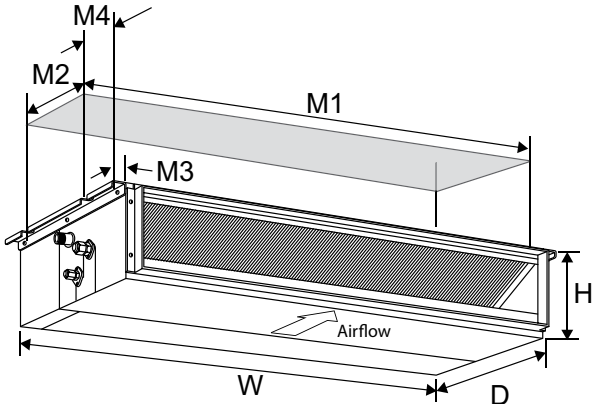


Table 1: Ducted Indoor Unit Dimensions and Weights.

Frame Code	Weight (lbs.)	Major Dimensions (in.) ¹				Mounting Dimensions (in.)			
		W	D	H	L6	M1	M2	M3	M4
High-Static Ducted Indoor Units									
BH	59	34-3/4	17-3/4	10-1/4	4-1/4	36-11/16	14	1	1-7/8
BG	84	46-1/2	17-3/4	11-5/8	4-1/4	48-3/4	14	1	1-9/16
BR	117	48-1/2	23-5/8	15	4-7/16	51-1/4	18-3/4	1-1/4	2-7/8
B8	192	66-3/4	27-3/8	18-1/8	4-1/2	64-1/8	23	1-3/16	2-1/2
Low-Static Convertible Ducted Indoor Units									
B1	47	32-5/8	21-5/8	7-1/2	—	33-15/16	15-1/16	13/16	3-11/16
B2	58	43-5/16	21-3/4	7-1/2	—	44-9/16	15-1/16	13/16	3-11/16
Low-Static Bottom Return Ducted Indoor Units									
B3	47	35-1/2	23-3/8	7-1/2	—	33-7/16	15	15/16	3-11/16
B4	58	46-7/16	22-5/8	7-1/2	—	44-7/16	15	15/16	3-11/16

¹Case dimensions exclude insulation. Add approximately 1/8" for factory-applied external insulation for each side. High-Static models are insulated on all sides. Low-Static models are insulated on the bottom and end cold surfaces only between the fan discharge and midway to the rear of the unit.

Figure 4: High-Static Ducted (BH, BG, BR, B8) Indoor Unit Duct Connection Dimensions.

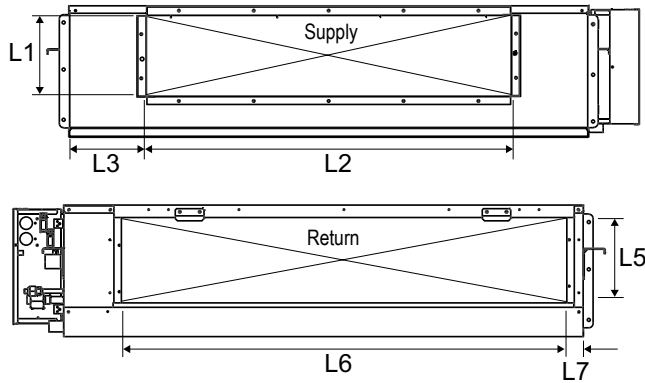


Figure 5: Low-Static Convertible Ducted (B1, B2) Indoor Unit Duct Connection Dimensions.

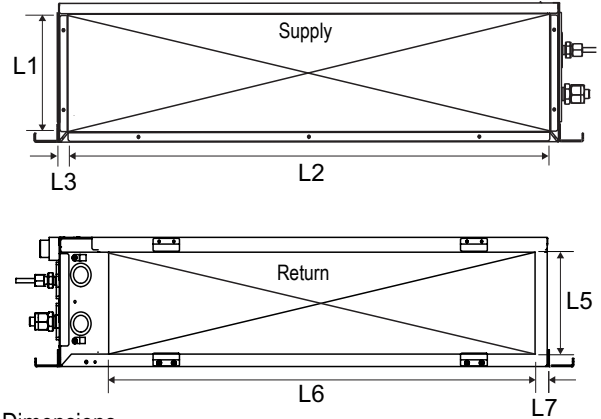


Figure 6: Low-Static Bottom Return Ducted (B3, B4) Indoor Unit Duct Connection Dimensions.

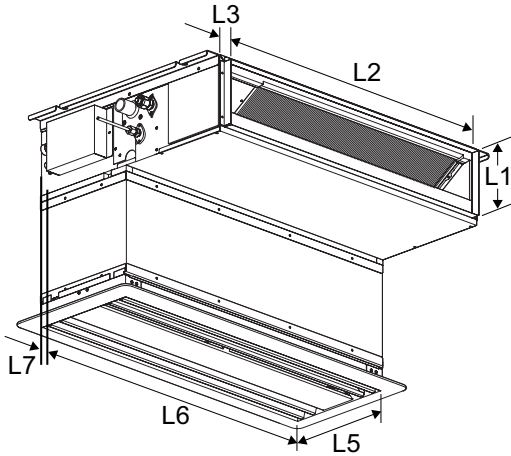


Table 2: Duct Connection Dimensions (in.).

Frame Code	Supply Duct Connection					Return Duct Connection				
	Type	L1	L2	L3	Flange Depth	Opening Location	L5	L6	L7	Flange Depth
High-Static Ducted Indoor Units										
BH	Flange	6-1/4	29-1/2	1-5/8	1-3/16	Rear	6-3/8	29-1/2	7/8	No Flange
BG	Flange	7-5/16	32-11/16	6-7/8	1	Rear	7-7/8	41-1/8	1	No Flange
BR	Flange	11-5/8	39-5/8	4-9/16	1	Rear	10-7/8	42-15/16	7/8	No Flange
B8	Flange	11-5/8	44-1/4	8-3/4	1	Rear	15-7/16	55-1/16	2-5/16	1-1/8
Low-Static Convertible Ducted Indoor Units										
B1	Flange	6-1/2	31-3/8	3/4	3/4	Rear	6	28-11/16	7/8	No Flange
						Bottom	6	28-11/16	7/8	No Flange
B2	Flange	6-5/16	42-3/16	1/2	3/4	Rear	6	39-11/16	3/4	No Flange
						Bottom	6	39-11/16	3/4	No Flange
Low-Static Bottom Return Ducted Indoor Units										
B3	Flange	6-7/16	31-5/16	1/2	3/4	Bottom	7	28-9/16	1-1/2	No Flange
B4	Flange	6-7/16	41-15/16	1/2	3/4	Bottom	7	39-9/16	1-1/2	No Flange

ROUGHING IN

Maintenance Clearances

Figure 7: High-Static Ducted (BH, BG, BR, B8) Indoor Unit Maintenance and Optional Unit Replacement Clearances.

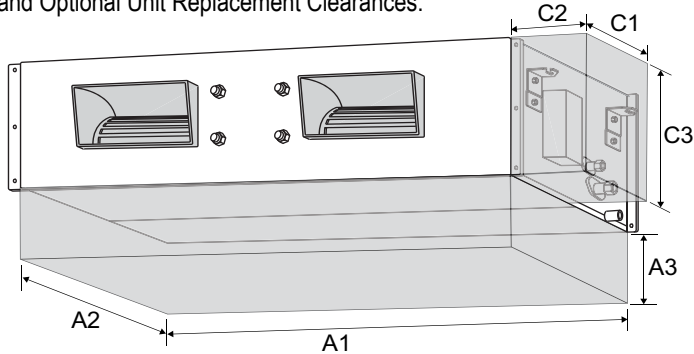


Figure 8: Low-Static Convertible Ducted (B1, B2) Indoor Unit Maintenance and Optional Unit Replacement Clearances.

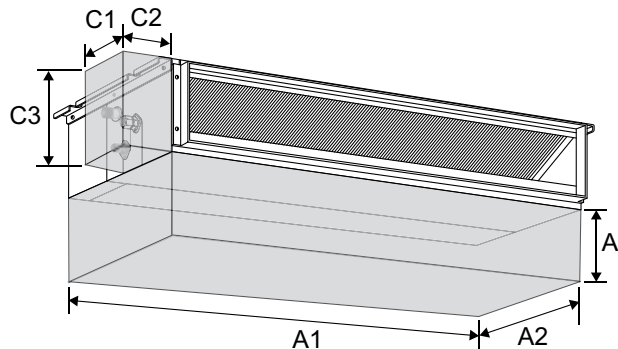
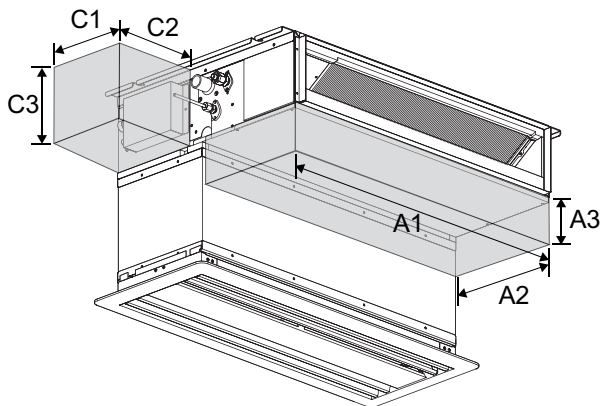


Figure 9: Low-Static Bottom Return Ducted (B3, B4) Indoor Unit Maintenance and Optional Unit Replacement Clearances.



⚠ Note:

- All routine maintenance and inspection activity is accomplished from the area delineated by Routine Maintenance in Table 3. During installation, keep the area delineated under Routine Maintenance free and clear of obstructions.
- Optional unit replacement dimensions are provided to assist the installer with their coordination of trade activity only.
- Leave adequate room for visual inspection, pipe installation, brazing, power wiring, control wiring, and pipe insulating activities. Provide adequate access to service nearby piping, drain lines, shutoff valves, etc.

Table 3: Minimum Maintenance Clearances (in.).

Frame Code	Routine Maintenance				Unit Replacement			
	Location*	C1	C2	C3	Location	A1	A2	A3*
High-Static Ducted Indoor Units								
BH	Right End	12	12	10-1/2	Bottom	35	18	11
BG	Right End	12	14	12	Bottom	47	18	12
BR	Right End	12	13-1/2	15	Bottom	49	24	15
B8	Right End	12	12-1/2	18	Bottom	62	18	19
Low-Static Convertible Ducted Indoor Units								
B1	Left End	10	12	8	Bottom	36	23	8
B2	Left End	10	12	8	Bottom	44	22	8
Low-Static Bottom Return Ducted Indoor Units								
B3	Left End	10	12	8	Bottom	36	23	8
B4	Left End	10	12	8	Bottom	44	22	8

*Does not apply when the ceiling surface below can be removed.

Figure 10: High-Static Ducted (BH, BG, BR, B8) Indoor Unit Piping Connection Dimensions.

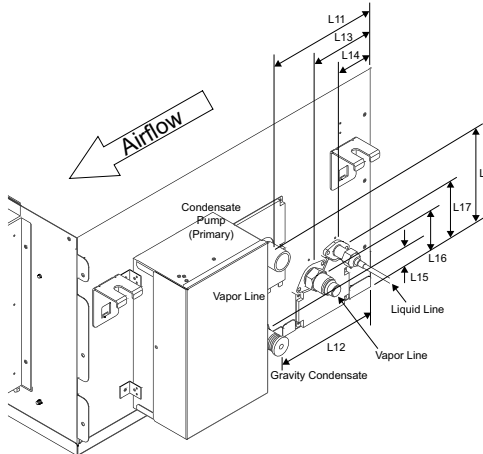


Figure 11: Low-Static Convertible Ducted (B1, B2) Indoor Unit Piping Connection Dimensions.

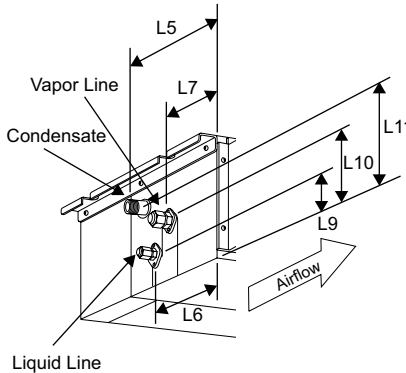


Figure 12: Low-Static Ducted Bottom Return (B3, B4) Indoor Unit Piping Connection Dimensions.

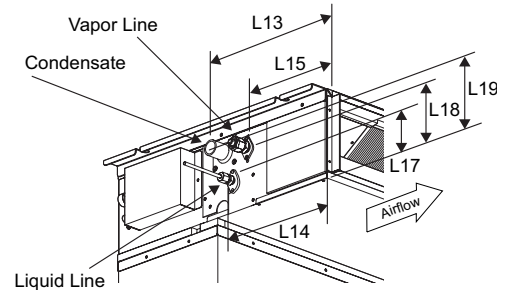


Table 4: Ducted Indoor Unit Pipe Connections (in.).

Size / Frame	Liquid Line				Vapor Line				Condensate Pump Drain				Gravity Drain (Plugged)			
	Dia. ¹	Conn.	L14	L17	Dia. ¹	Conn.	L13	L16	Dia. ¹	Conn. ²	L11	L18	Dia. ³	Conn. ²	L12	L15
High-Static Ducted Indoor Units																
7-18 BH	1/4	45° Flare	1-7/8	3-15/16	1/2	45° Flare	3-15/16	3-1/4	1.0	Plain	6-9/16	6-3/4	1.0"-14	MPT	1-1/8	6-9/16
24 BH	1/4	45° Flare	1-7/8	3-15/16	5/8	45° Flare	3-15/16	3-1/4	1.0	Plain	6-9/16	6-3/4	1.0"-14	MPT	1-1/8	6-9/16
15-42 BG	3/8	45° Flare	1-7/8	3-15/16	5/8	45° Flare	3-15/16	3-1/4	1.0	Plain	6-9/16	6-3/4	1.0"-14	MPT	1-1/8	6-9/16
28-54 BR	3/8	45° Flare	2-13/16	3-15/16	5/8	45° Flare	4-13/16	3-1/4	1.0	Plain	8-3/4	6-3/4	1.0"-14	MPT	1-1/4	8-3/4
76 B8	3/8	45° Flare	2-1/2	5-1/2	3/4	45° Flare	5-1/4	4-3/4	1.0	Plain	7-5/8	6-7/8	1.0"-14	MPT	1-1/4	7-5/8
96 B8	3/8	45° Flare	2-1/2	5-1/2	7/8	45° Flare	5-1/4	4-3/4	1.0	Plain	7-5/8	6-7/8	1.0"-14	MPT	1-1/4	7-5/8
Low-Static Convertible Ducted Indoor Units																
Frame	Liquid Line				Vapor Line				Condensate Pump (Primary)							
	Dia. ¹	Conn.	L6	L9	Dia. ¹	Conn.	L7	L10	Dia. ¹	Conn. ²	L5	L11				
B1	1/4	45° Flare	10-1/8	2-3/4	1/2	45° Flare	8-5/8	5-3/16	1.0	Plain	11-1/16	5-3/8				
B2	3/8	45° Flare	10-1/8	2-3/4	5/8	45° Flare	8-5/8	5-3/16	1.0	Plain	11-1/16	5-3/8				
Low-Static Bottom Ducted Indoor Units																
Frame	Liquid Line				Vapor Line				Condensate Pump (Primary)							
	Dia. ¹	Conn.	L14	L17	Dia. ¹	Conn.	L15	L18	Dia. ¹	Conn. ²	L13	L19				
B3	1/4	45° Flare	9-7/16	2-9/16	1/2	45° Flare	8-1/2	4-15/16	1.0	Plain	10-7/8	5-1/16				
B4	3/8	45° Flare	9-7/16	2-9/16	5/8	45° Flare	8-1/2	4-15/16	1.0	Plain	10-7/8	5-1/16				

¹Inches O.D.

²Plastic Resin

³14 Threads Per Inch, Straight Thread

Refrigerant Safety

ASHRAE Standards 15-2010 and 34-2010 offer guidelines that 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 for this to occur safely. For R410A refrigerant, the maximum allowable concentration of refrigerant is twenty-six (26) lbs. per 1,000 cubic feet of an occupied space. Buildings with twenty-four (24) hour occupancy allow half of that concentration.¹

ASHRAE Standards 15 and 34 assume that if a system develops a leak, its entire refrigerant charge will dump into the area where the leak occurs. To meet ASHRAE Standards 15 and 34, calculate the refrigerant concentration that may occur in the smallest room volume on the system, and compare the results to the maximum allowable concentration number.¹ Also consult state and local codes in regards to refrigerant safety.

¹Information about ASHRAE Standard 15-2010 / 34-2010 and addenda current as of the date of this publication.

⚠ WARNING

Verify the maximum refrigerant concentration level is the space where the indoor unit will be mounted meets the concentration limit for the application.

A properly installed pipe system will have sufficient support so that pipes will not sag 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.

Figure 13: Pipe Support at Indoor Unit.

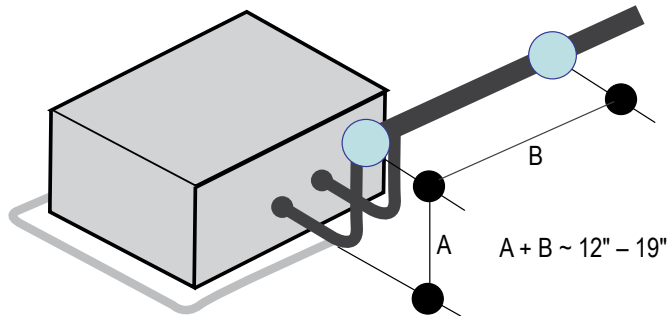
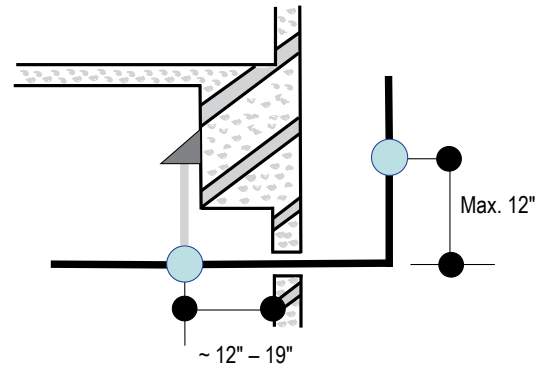


Figure 14: Typical Pipe Support Location—Change in Pipe Direction.



Refrigerant Pipe Connections

Indoor units come with flare type connections. It is the installer's option to use the flare fittings provided or braze the indoor unit to the refrigerant piping system.

Flare Fittings

- All unit flare fittings are 45° and rate for high-pressure R410A refrigerant.
- Properly form all flare fittings using best practices.
- Place a drop of PVE oil on the fitting threads before tightening.

⚠ **Note:** **Important!**

Do not use any other type of oil (including traditional POE refrigeration oil as a lubricant. Failure to follow this procedure may lead to restrictions in the refrigeration components.

- Do not over-tighten flare nuts. Excessive tightening will cause fittings to crack.

Brazed Connections

⚠ **Note:**

Multi V outdoor unit refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, and heat exchangers that can easily become blocked.

While brazing, ALWAYS follow these guidelines:

- Keep pipe supplies capped, clean, and store in a dry location.
- Use a tubing cutter, do not use a saw to cut pipe. De-burr and clean all cuts before assembly. Blow clean the pipe with dry nitrogen prior to assembly.
- 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 refrigerant shut-off valves (optional field provided), electronic expansion valves, unit case, insulation, and control components from excessive heat by using a wet rag or a heat barrier spray product while brazing.
- While brazing, always use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.

All ducted indoor models are provided with a factory-mounted condensate pump that runs continuously while the indoor unit is operating in the cooling mode. The pump is equipped with an internal high level float switch that stops cooling operation if the water level in the pan is excessive.

All units ship with a flexible drain hose kit and two clamps. The hose can be used to connect the condensate pipe to the condensate pump connection. On High-Static models, there is the option to directly connect a one (1) inch FPT fitting to the drain pan's gravity drain connection.

⚠ Note:

While making condensate pipe connections, be careful not to exert lateral force on the drain nipple. Internal damage may occur. See Table 4 for condensate pipe connection sizes.

Condensate Pump Connection

Note the following when connecting the condensate pipe to the indoor unit.

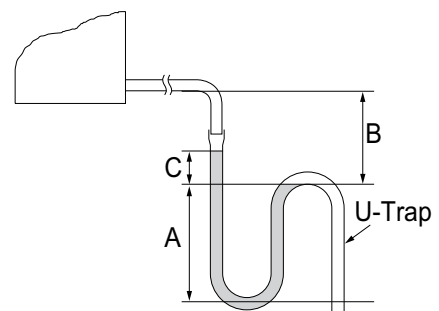
- Indoor units DO NOT come with check valves or a backflow prevention device. If check valves are needed, they are to be field supplied.
- The maximum lift of all condensate pumps is 23 in.-wg.
- The lift distance should be measured from the bottom surface of the indoor unit, NOT from the condensate pipe connection.
- When connecting the pipe coming from the indoor units to the condensate pump, always connect it to the top side of the main drain at a maximum angle of $\pm 45^\circ$ of vertical using an inverted trap pipe configuration.
- All horizontal segments of condensate pipe should be sloped a minimum of 1/4 inch per foot away from the indoor unit.

Gravity Condensate Pipe Connection

All High Static Ducted models (BH, BG, BR, B8) are equipped with an auxiliary gravity condensate drain connection just below the condensate pump pipe connection on the control panel end of the unit. This connection may be used in lieu of using the condensate pump.

- Verify the unit is installed with a slight cant toward the gravity drain connection.
- Remove the rubber plug before connecting the condensate line to the indoor unit.
- The gravity condensate line must be equipped with a condensate trap for proper condensate flow engineered per guidelines shown in Figure 15.
- All horizontal segments of condensate pipe should be sloped a minimum of 1/4 inch per foot away from the indoor unit.
- Use materials acceptable by local code.

Figure 15: Gravity Condensate Trap Detail.



Where:

$$A = 2-1/2"$$

$$B \geq 2 \times C$$

$$C \leq 2 \times \text{External Static Pressure (in.-wg)}$$

- Insulate all cold surfaces sufficiently to prevent moisture from forming. All pipes must be insulated and each pipe must be wrapped separately.
- Use field-provided half (1/2) of an inch thick (or better) closed cell insulation. The thickness may need to be increased based on ambient conditions and local codes.
- All refrigerant and condensate piping including field-provided isolation ball valves and flexible pipe connection kits provided by LG should be wrapped.
- All insulation joints should be glued with no air gaps between insulation segments, and between insulation segments and the unit case. Insulation material shall fit snugly against the refrigeration pipe with no air space between the pipe surface and the surrounding insulation. See Figure 16.
- All pipe passing through pipe hangers, inside conduit, and/or sleeves must not be compressed. Protect insulation inside hangers and supports with a second layer.

Figure 16: Refrigerant Line Flare Fitting Insulation Detail (Typical for All Refrigerant Specialties).

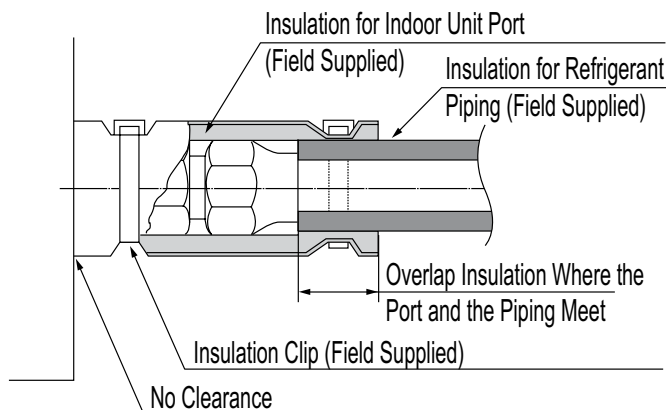
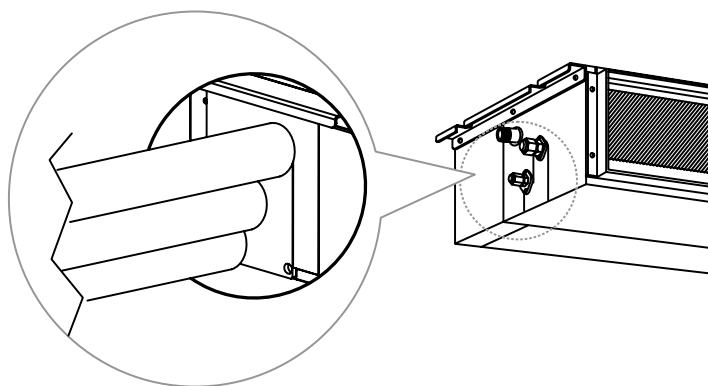


Figure 17: Insulation to Indoor Unit Cabinet Detail Showing No Air Gaps.



WARNING

Keep line voltage power away from the communications terminals 3(A) and 4(B). Line voltage power applied to the communications terminals will damage the indoor unit control board and it will have to be replaced.

Note:

Size all field provided electrical components per NEC and local code. Always use copper wire.

Maintain a minimum of two (2) inches between line voltage wires and communications or zone controller cables.

Table 5: Electrical Data.

Size / Frame	Rated Amps (A)	MCA	MOP
High-Static Ducted Indoor Units			
7-24 BH	0.92	1.32	15
15-42 BG	2.3	3.31	
28-48 BR	2.3	3.45	
54 BR	3.0		
76-96 B8	4.5	6.47	
Low-Static Convertible Ducted Indoor Units			
B1	0.1	0.22	15
B2	0.25	0.55	
Low-Static Bottom Return Ducted Indoor Units			
B3	0.1	0.22	15
B4	0.25	0.55	

Power Wiring Instructions

1. Provide clean 208/60/1 power to the unit. Maximum acceptable power fluctuation range is 188 volts to 228 volts.
2. To access the power and communications terminal block, remove the control box cover on the High-Static Ducted models BH, BG, BR, B8 and the Low-Static Bottom Return models B3 and B4.
3. On the Low-Static Convertible models, the terminal block is behind the end panel of the case. Refer to Figure 19.
4. Remove a knock-out plug from the control box. Do not use the same knock-out occupied by communications and zone controller cables.
5. Field-install a plastic or rubber grommet at the entrance to the control box to prevent wire chaffing.
6. If using conduit, connect the conduit to the control box using field-provided fittings and following industry best practice procedures.
7. Provide enough slack wire at each indoor unit to connect to the terminal block without tension on the wire. Route the wire inside the control box paying special attention to keep the wire away from communications cables by a minimum of two (2) inches.
8. Secure the wire to the inside surface of the control box using a field provide nylon wire clamp.
9. Strip approximately half (1/2) of an inch of insulation from each communications cable conductor. At each indoor unit, insert the conductors under the terminal screw as shown in Figure 19.
10. Securely tighten the terminal screws to prevent the communications conductors from coming loose from the terminal block.
11. If needed, secure the wire in appropriate locations outside the indoor unit to prevent damage to the wire or injury to maintenance personnel.
12. Strip approximately half (1/2) of an inch of insulation from each of the power wire conductors. Tightly crimp a spade connector to the Hot, Neutral and Ground Wires. Insert the spade connector under the appropriate terminal block screw and tighten. Refer to Figure 19 for a detail of the terminal block wiring.
13. Securely tighten the terminal screws to prevent the conductors from coming loose.

Outdoor / Indoor Unit Communications Cable Installation Guidelines

WARNING

Violating any of the power and communications wiring guidelines or instructions provided herein will likely cause communications errors and unit malfunction.

Polarity matters. When connecting the communications cable conductors at each Multi V system component, be careful the conductor connected to the IDU(A) terminal on the outdoor unit is connected to the 3(A) terminals at each indoor unit. Likewise, the conductor connected to the IDU(B) terminal on the outdoor unit must be connected to the 4(B) terminals at each indoor unit. Cross connecting between the "A" and "B" terminals will cause a communications error and the system will not run.

Note:

The minimum distance required between power wires and the communications cable is voltage/amperage dependent and in cases where either are relatively high the minimum distance may be more than two (2) inches. Refer to the respective LG Multi V Outdoor Unit Engineering Manual on www.lg-vrf.com for detailed information.

Keep communications cables away from line voltage wiring, lighting ballasts, and other devices emitting EMF energy. Maintain a minimum of two (2) inches between line voltage wires and communications or zone controller cables.

Field provide a minimum of 18-2 AWG, stranded and shielded, PVC or vinyl jacket communications wiring between the indoor units, heat recovery boxes (if applicable), and outdoor units.

The outdoor / indoor unit communications cable must be run between components in a daisy chain configuration.

Communications cable terminations must occur at the communications screw terminals 3(A) and 4(B) at indoor units and / or heat recovery units.

Ground the shield of the communications cable at the OUTDOOR UNIT END ONLY.

Don'ts

- Never use wire caps.
- Never splice communications cables.
- Star and Wye communications cable configurations are not acceptable.
- Never connect zone controllers or other central control products such as AC Smart, PDI, or LG building management system gateway products to the indoor unit to outdoor unit communications cable.

Cable Connection Instructions

1. When connecting the communications bus between the outdoor unit, indoor unit(s), and heat recovery unit(s), it does not matter what path or route the wire takes. The installer may use discretion when choosing the order the components are connected to the communications bus.
2. If not already done so, read the Outdoor / Indoor Unit Communications Installation Guidelines.
3. Remove a knock-out plug from the control box.
4. Field-install a plastic or rubber grommet at the entrance to the control box to prevent wire chaffing.
5. If using conduit, connect the conduit to the control box using field-provided fittings and industry best-practice procedures.
6. Provide at least three (3) to four (4) inches of slack cable at each indoor unit.
7. Secure the communications cable to the inside surface of the control box using a field provide nylon wire clamp.
8. Strip approximately half of an inch of insulation from each communications cable conductor. At each indoor unit, insert the conductors under the terminal screw as shown in Figure 19.
9. Securely tighten the terminal screws to prevent the communications conductors from coming loose from the terminal block.
10. Secure the communications cable in appropriate locations outside the indoor unit to prevent damage to the cable or injury to maintenance personnel.

Figure 18: Low-Static Ducted Convertible—Accessing the Control Compartment (Bottom View).

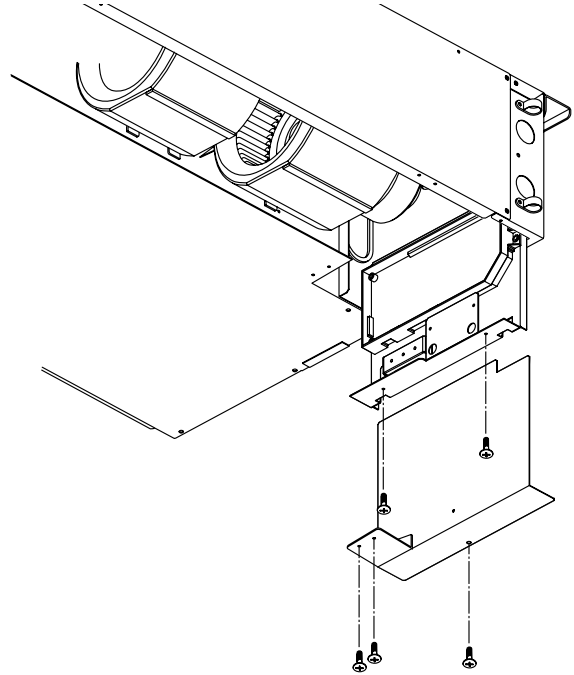
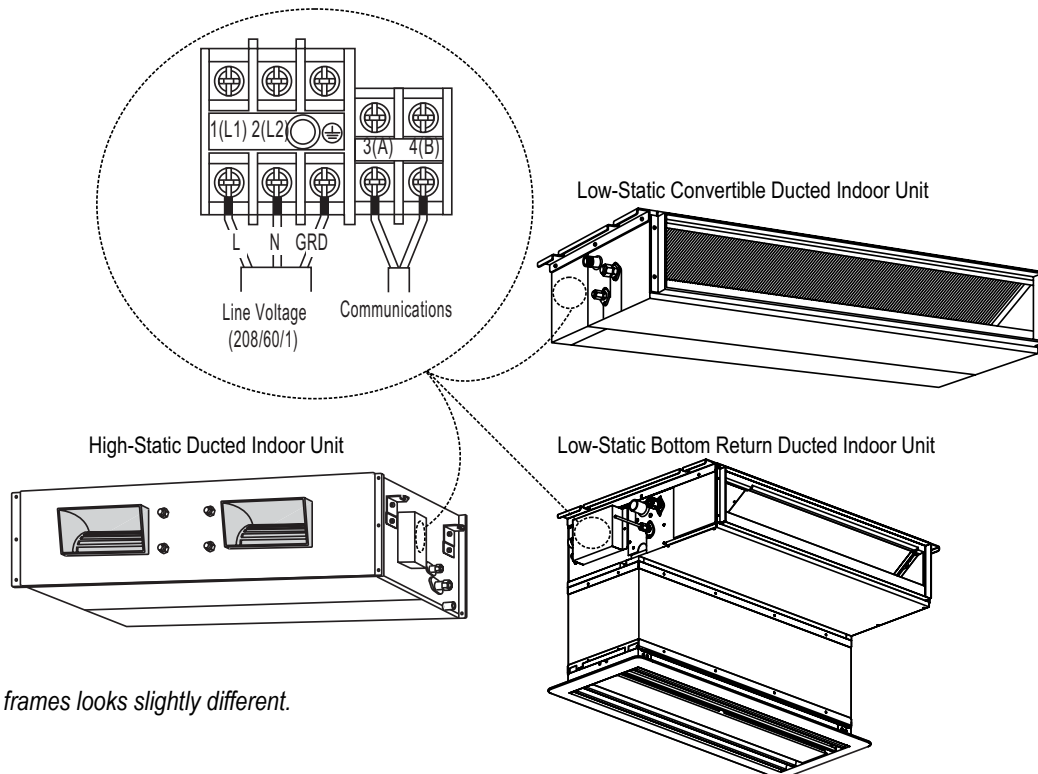


Figure 19: Power and Indoor Unit to Outdoor Unit Communications Wiring Detail.



Note:
Terminal on B8 frames looks slightly different.

Zone Controller Cable Installation

Zone Controller Cable Installation

▲ Note:

- Communications cables between wall-mounted zone controllers and the indoor unit(s) can be provided by LG.
- NEVER cut, shorten, splice zone controller communications cables or use wire caps.
- Never use field-provided wire between zone controller and indoor units.

Zone Controller Cable Connection Instructions

1. Each zone controller is supplied with thirty (30) feet of communications cable with a male or female plug-end. Route the wire between the zone controller location and the indoor unit. If the distance between the zone controller and indoor unit exceeds thirty (30) feet, purchase a thirty-two (32) foot zone controller communications extension cable (Model No. PZCWRCG3). This cable comes complete with a female plug on one end and a male on the other.
2. Keep zone controller cables away from line voltage wiring, lighting ballasts, and other devices emitting EMF energy. Maintain a minimum of two (2) inches between line voltage wires and communications or zone controller cables.

▲ Note:

The minimum distance required between power wires and the zone controller cables is voltage / amperage dependent and, in cases where either are relatively high, the minimum distance may be more than two (2) inches. Refer to the LG Multi V Outdoor Unit Engineering Manual for detailed information.

3. Choose and remove knock-out plug from the indoor unit control box.
4. Field-install a plastic or rubber grommet at the entrance to the control box to prevent wire chaffing.
5. If using conduit, make sure the conduit diameter is sufficient to accommodate the LG zone controller communications cable factory mounted plug-ends. Connect the conduit to the control box using field-provided fittings and following industry best-practice procedures.

▲ Note:

The MALE plug-end of the communications cable must be located at the indoor unit.

6. Pull the communications cable through the conduit. Provide three (3) to four (4) inches of slack cable at the indoor unit.
7. If conduit is not needed, secure the zone controller communications cable in appropriate locations between the indoor unit and the zone controller to prevent damage to the cable or injury to maintenance personnel.
8. Secure the zone controller cable to the inside surface of the control box using a field provided nylon wire clamp.
9. Plug the male plug-end of the zone controller communications cable into the CN-REMO socket on the Indoor Unit PC Board (See Figures 20 to 23, and Table 6).
10. Plug the female plug-end of the communications cable to the male plug-end of the pigtail supplied with the zone controller.

Group Control Communications

For detailed information on how to wire two (2) zone controllers to one (1) indoor unit, or one (1) zone controller to a group of indoor units, refer to the Multi V Controls Engineering Manual.

Figure 20: High-Static Ducted Indoor Unit Printed Circuit Board (Single Motor - BH Frames).

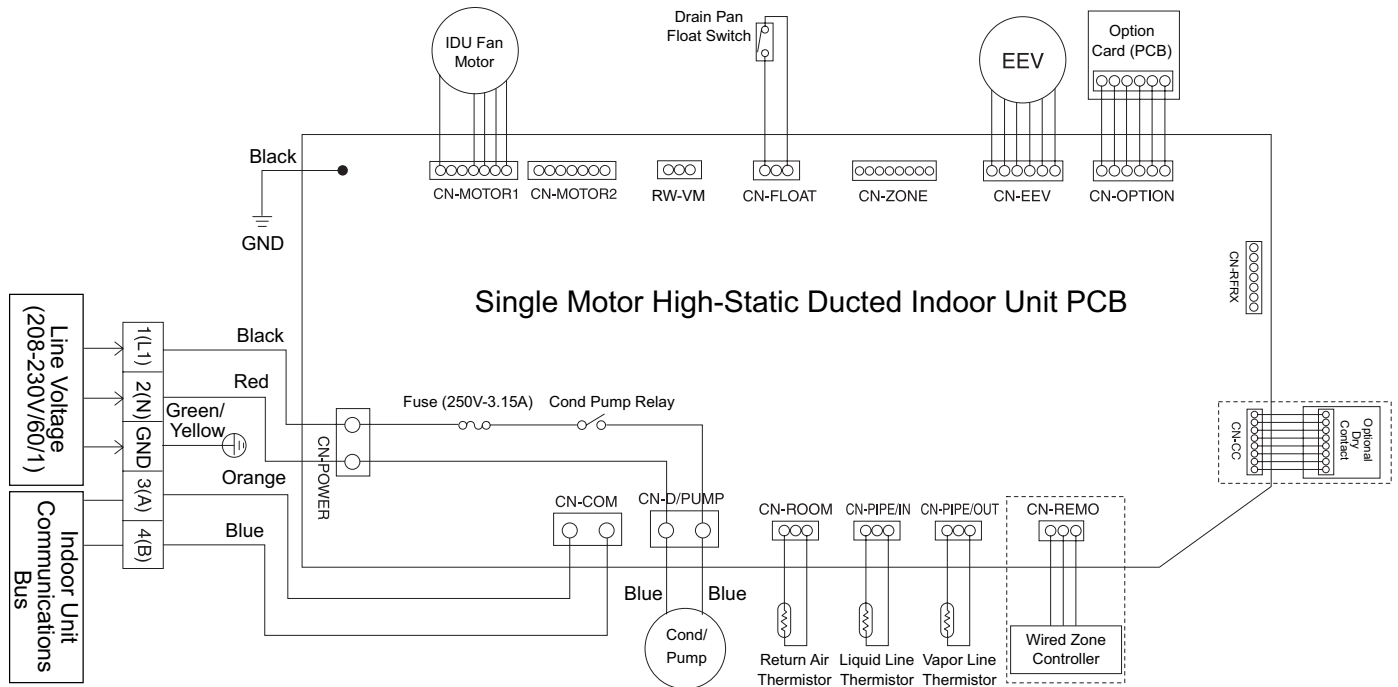
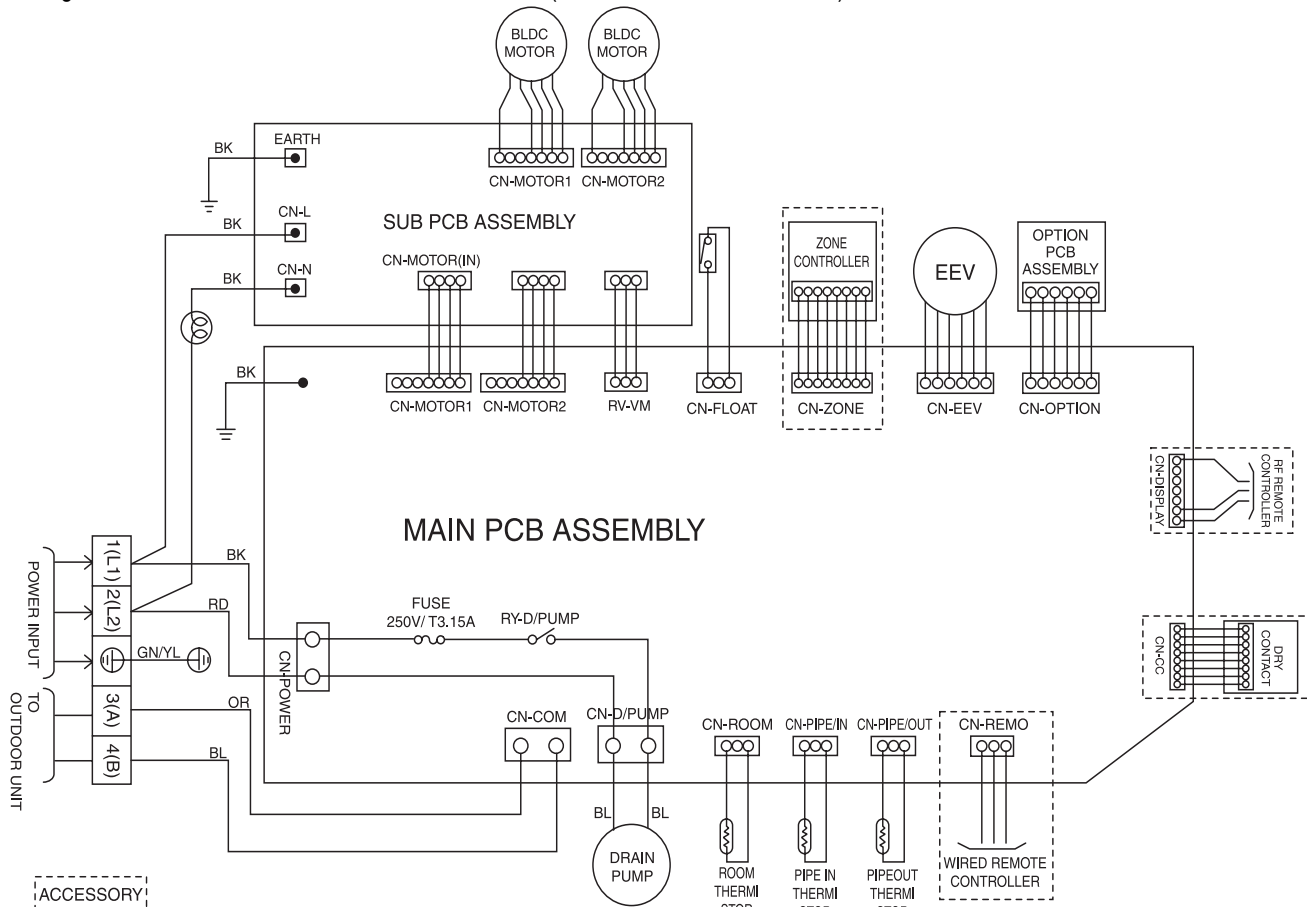


Figure 21: High-Static Ducted Indoor Unit Printed Circuit Board (Dual Motor - BG, BR Frames).



LOW VOLTAGE COMMUNICATIONS



Ducted Indoor Unit Printed Circuit Boards

Figure 22: High-Static Ducted Indoor Unit Printed Circuit Board (Dual Motor - B8 Frames).

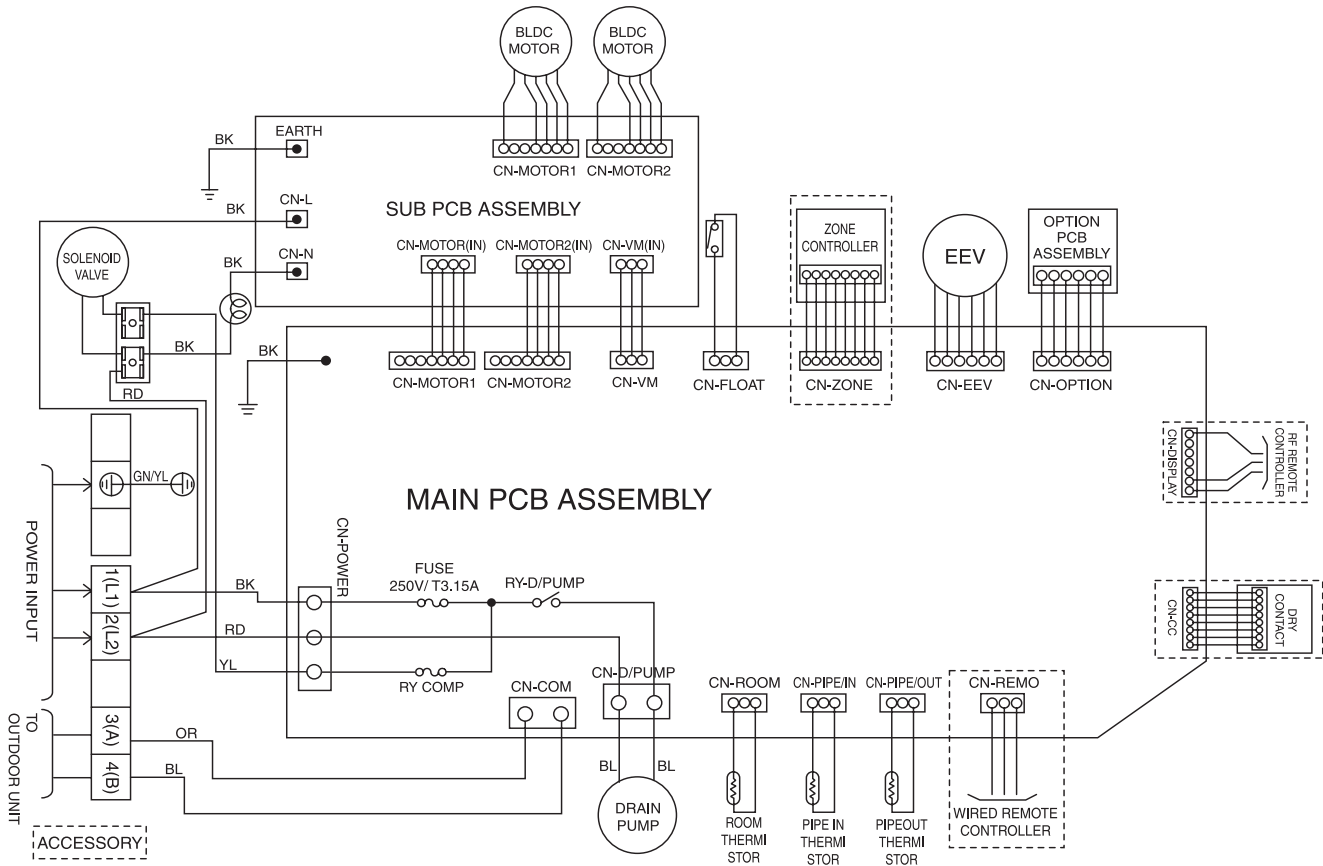
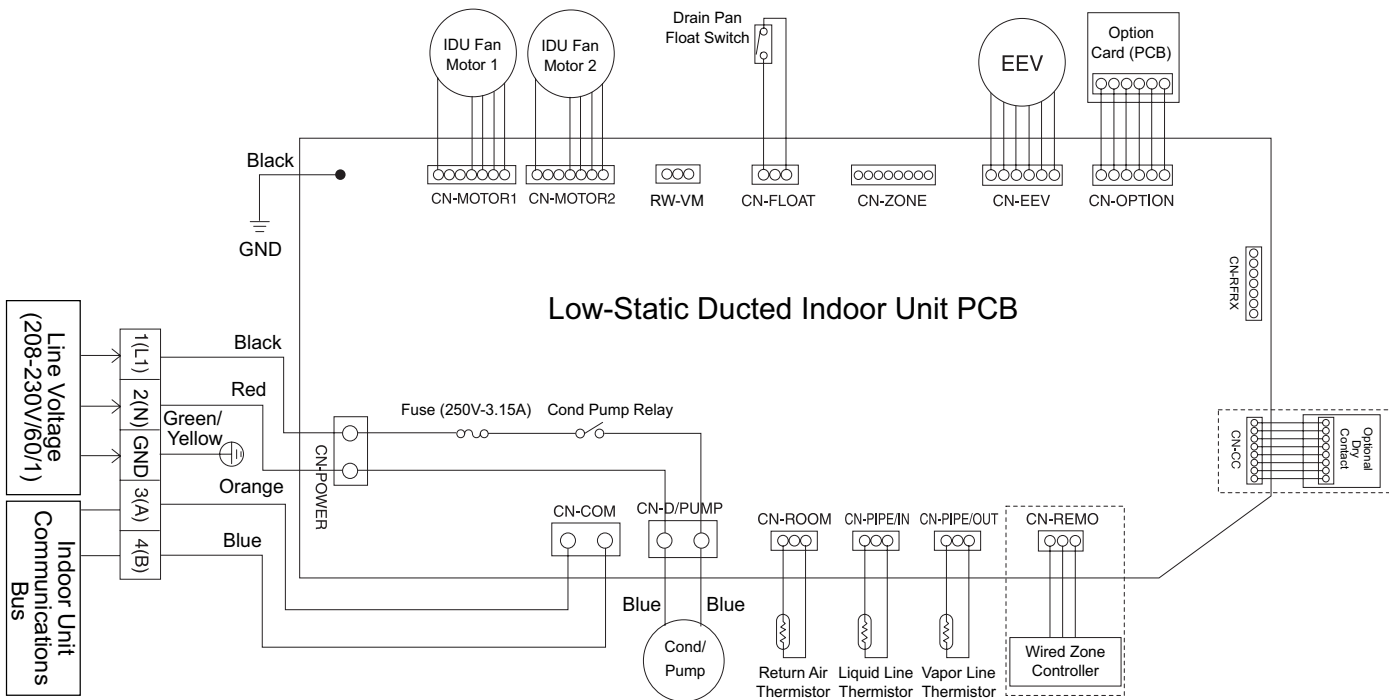


Figure 23: Low-Static Ducted Indoor Unit Printed Circuit Board (B1, B2, B3, B4 Frames).



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Table 6: Ducted Indoor Unit Printed Circuit Board Diagram Legend.

Descriptor	Description
CN	Socket Connection
CN-CC	Auxiliary Controller Connection (Optional; i.e., Dry Contact)
CN-COM	Indoor Unit Communications Bus (3[A] and 4[B])
CN-Display	Not Used
CN-D/PUMP	Condensate Pump Power
CN-EEV	Electronic Expansion Valve
CN-FLOAT	Condensate Drain Pan Overflow Protection Switch (Normally Open)
CN-L	Power Wire Connection (+)
CN-N	Power Wire Connection (-)
CN-MOTOR 1	Indoor Unit Fan Motor 1
CN-MOTOR 2	Indoor Unit Fan Motor 2
CN-OPTION	Indoor Unit Option Card Socket
CN-PIPE / IN	Liquid Pipe Temperature Thermistor
CN-PIPE / OUT	Vapor Pipe Temperature Thermistor
CN-POWER	Line Voltage Power (208, 60, 1)
CN-REMO	Wall-Mounted Zone Controller
CN-ROOM	Unit-Mounted Return Air Thermistor
CN-ZONE	Not Used
EARTH	Ground Required
RW-VM	Dual Indoor Unit Fan Board Communications Link
1(L1)	Terminal Block Line Voltage (+)
2(N or L2)	Terminal Block Line Voltage (-)
3(A)	Indoor Unit Communications Bus ("A" Conductor)
4(B)	Indoor Unit Communications Bus ("B" Conductor)
	Terminal Block Ground

Connecting an LG Dry Contact Device / Smoke Detector

Connecting an LG Dry Contact Device

1. Remove the control panel cover.
2. Find the CN-CC socket on the Indoor Unit Control Board. Refer to Figures 20 to 23.
3. Plug the dry contact five (5) lead matching plug into the socket.
4. Mount the dry contact securely to the wall of the indoor unit using field-provided Velcro® type material.
5. Refer to the installation manual for the particular dry contact in use for instructions on how the dry contract works, and how to ready the dry contact device for commissioning.

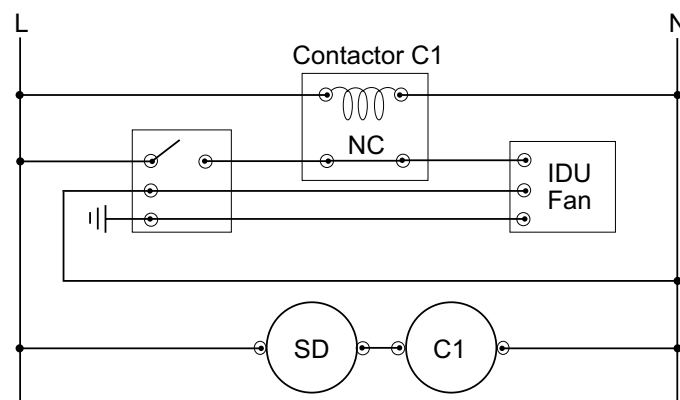
Connecting a Smoke Detector

Indoor unit fan operation can be stopped using:

1. LG-provided Dry Contact device.
2. A command initiated from LG's AC Smart central controller.
3. A command initiated from building automation system.
4. A field-provided relay in series with the unit disconnect breaking power to the Indoor Unit

In locations where code requires the fan shut down to occur within thirty (30) seconds of smoke being detected, methods one (1) through three (3) should not be used. In these locations, employ method four (4) (Refer to Figure 24).

Figure 24: Smoke Detector Field Wiring.¹



¹Diagram indicates connection to a 208-230V, 60Hz, 1-phase smoke detector. For smoke detectors with other voltages, provide the proper transformer and isolation relays.

⚠ Note:

Disclaimer

Wiring diagram provided for illustrative purposes only. Actual wiring and circuit employed depends on the design engineer's requirements, and national, local, and other building codes.

Canvas Boot and Grille – Low-Static Bottom Return Indoor Units

- LG Model No. PBSC10 – B3 frames (7-15 Mbh)
- LG Model No. PBSC20 – B4 frames (18-24 Mbh)

The flexible return air duct canvas boot kit comes complete with one (1) canvas duct extension, one (1) flush-mount return air grille and frame, four (4) hanger chains, and M5x18 screws.

Installation Procedure

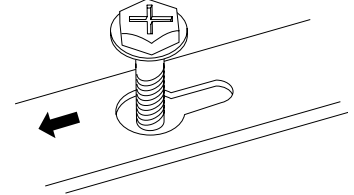
1. Mount the indoor unit.
2. Place four (4) screws provided in the bottom of the indoor unit frame. Do not thread the screw all the way in.

⚠ Note:

Using the canvas ducted extension is optional. If the distance between the ceiling grid and the bottom of the indoor unit is minimal, the canvas duct may be eliminated. The return air grille may be mounted directly to the bottom of the unit. If this is the case, skip step 3.

3. Position the metal frame located on one end of the canvas boot over the heads of the four (4) screws concurrently. Offset the frame so the shanks of the screws are positioned in the slots provided. Tighten the screws and secure the canvas extension into place (Figure 25).

Figure 25: Close Up of the Screws.

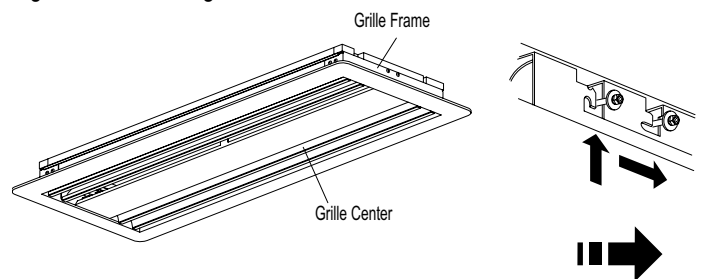


4. Cut a hole in the ceiling surface that fits the return air grille frame.

5. If the canvas boot was used, lower the end of the canvas boot through the hole in the ceiling, otherwise, proceed to Step 6.

Figure 26: Removing the Grille Center.

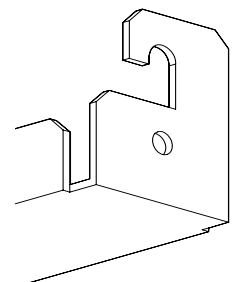
6. Loosely thread four (4) screws into the holes in the bottom of the indoor unit or the flexible canvas frame.



7. Locate the return air grille assembly. Remove the center of the return air grille and filter from the return air grille frame by loosening the four (4) screws on the short edges of the frame (Figure 26).

8. Mount the return air grille frame. Position the four (4) holes of the return air grille frame over the heads of the four (4) screws on the bottom of the unit or on the lower end of the canvas boot. After the heads of the screws are through the frame, offset the frame so the shafts of the screws are positioned in the slots provided. Tighten the screws and secure the return air grille frame in place (Figure 25).

Figure 27: Low-Static Ducted Bottom-Return Canvas Boot Adjustment Chain Hanger Detail.



9. If the flexible canvas was used, install the four (4) hanger chains. Connect the upper end of each chain on the hooks provided. For a non-adjustable permanent installation, use field-provided screws and secure the chain to the upper hooks using the hole provided (Figure 27).

INSTALLING ACCESSORIES

Canvas Boot and Grille – Low-Static Bottom Return Indoor Units

Installation Procedure, continued.

10. Raise the return air grille assembly into position in the ceiling. Cut the four (4) hanger chains to the length and loop one end of each chain over the hooks provided on the lower canvas frame. If a non-adjustable installation is preferred, use field provided screws and nuts and attach the chains to the holes in the canvas boot frame hooks (Figure 28).
11. Install the filter in the frame.
12. Install the return air grille center in the frame. Tighten the four (4) screws on the side of the frame.

Figure 28: Low-Static Ducted Bottom-Return Canvas Boot Hanger Chain Detail.

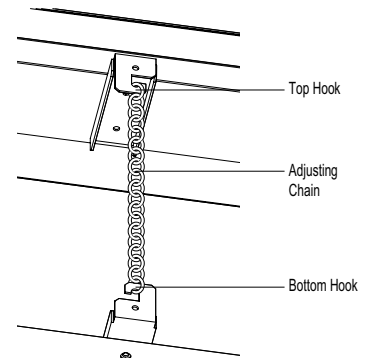


Figure 29: Completed Installation With Return Air Canvas.

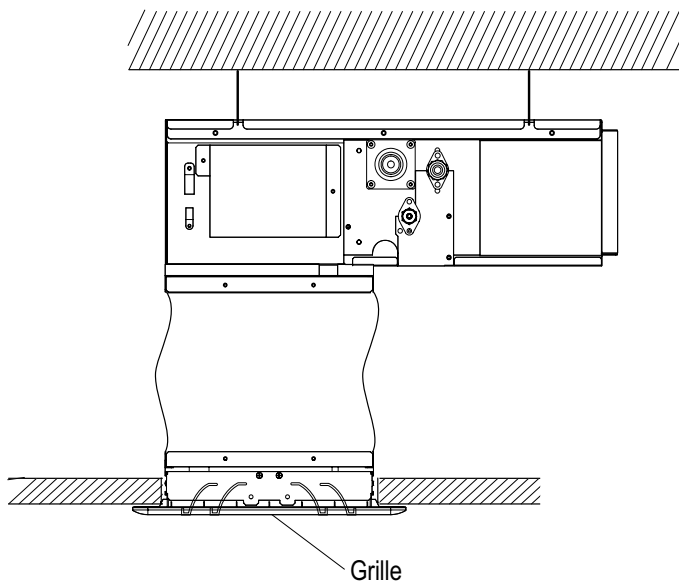
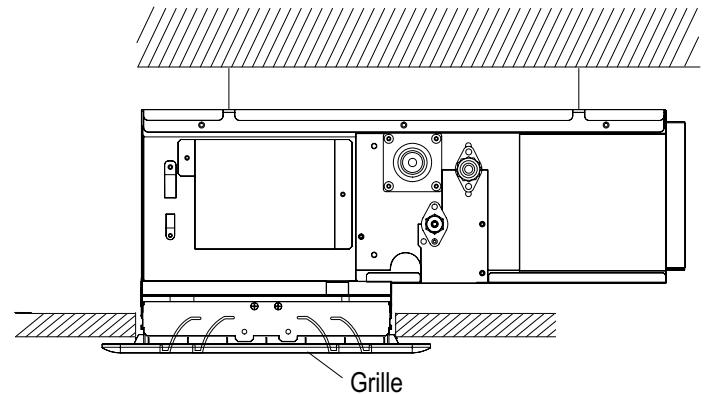


Figure 30: Completed Installation Without Return Air Canvas.



- Set indoor unit circuit board DIP switches as needed for the application. Switches 1, 2, 6, 7 and 8 are not used with Multi V and must remain in the OFF position. See Table 7 below.

Table 7: DIP Switch Positions.

DIP Switch	Description	Switch Position		Remarks
		Off	On	
SW3	Indoor Unit Group Control Authority	Master	Slave	When set to MASTER, the operating parameters and connected zone controller settings of the subject indoor unit controls the operation of all indoor units wired with the subject indoor unit for group operation.
SW4	Dry Contact Auto-Restart Authorization	No	Yes	If set to YES, the Dry Contact has ultimate authority to stop and restart the indoor unit based on binary input(s) to the Dry Contact device. If set to NO, the Dry Contact device retains authority to stop Indoor Unit operation based on Dry Contact binary input(s), however, the Dry Contact will only "enable" the unit to restart. The actual start command is provided by pressing the local wall-mounted zone controller On / Off button.
SW5	Continuous Fan Operation	No	Yes	Enables continuous 24-hour fan operation at set speed until DIP switch is changed.

- Choose a room temperature sensing method.

By default, the room temperature is sensed by the factory mounted return air thermistor. If an optional wall-mounted zone controller is present, the room temperature can be sensed by one of three methods.

- At the indoor unit return air sensor.
- At the wall-mounted zone controller.
- At both the return air thermistor and zone controller.

▲ Note:

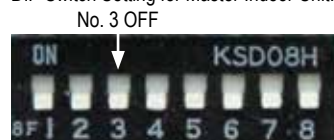
- If the return air thermistor and zone controller method is chosen, the indoor unit does not average the readings. The indoor unit is controlled using the reading that is farthest away from set point at a given time.
- Refer to the zone controller installation manual for detailed information on setting the sensor control DIP switch.

- Is the indoor unit going to be operated as a member of a Group of indoor units?

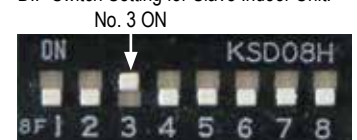
If the subject indoor unit is going to control the actions of other units wired in a Group configuration, then set DIP switch 3 to the OFF (Master) position. If the subject indoor unit is going to be a member of a Group controlled by another indoor unit, set DIP switch 3 to the ON (Slave) position.

Figure 31: Indoor Unit DIP Switch Settings for Group Control.

DIP Switch Setting for Master Indoor Unit.



DIP Switch Setting for Slave Indoor Unit.



▲ Note:

For detailed information on how to wire multiple indoor units to operate in unison as a Group, refer to the LG white paper on Wiring Multi V Indoor Units for Group Control on www.lg-vrf.com.

- Is the condensate pipe connected to the upper condensate pump outlet.

If it is not used, the condensate pump power must be cutoff. Locate the IDU control board, find the socket labeled CN-D/PUMP, remove the plug, and abandon in place. Refer to Figures 20 through 23.

- Fill out the Installation Checklist provided on the following pages.

Using the checklist provided on the follow page, verify all tasks have been completed prior to calling for the Multi V system to be commissioned. Place the System ID and Indoor Unit ID at the top of the page, sign and date. Provide a copy to your company's project manager or your Multi V System Commissioning Technician.

- Finish up.

Reinstall the control panel cover and check the installation area for tools and debris that may have been left behind. The indoor unit is ready for power-up and commissioning.

INDOOR UNIT INSTALLATION CHECKLIST



PAGE 1

System ID No.: _____ Indoor Unit ID.: _____

Checked by: _____ Date: _____ Signature: _____

MULTI V Ducted Indoor Unit Installation Manual

Rough-In	N/A	Not Complete	Complete
Packing materials and literature removed from fan discharge.			
Airflow direction correct.			
Fan wheels spin without obstruction.			
Unit is properly supported – mounting bolts tight.			
Unit is level (condensate pump installations).			
Unit is canted toward gravity drain pan nipple (gravity drain installations only).			
Recommended minimum service clearances followed.			
Air filter is clean and properly installed.			
Does local code require a secondary drain pan under the indoor unit? Is a secondary drain line connected to the pan?			
Ductwork	N/A	Not Complete	Complete
All seams sealed – no air leaks.			
High-static models only – minimum external static pressure requirements met.			
Ductwork is properly sized considering the available external static pressure rating of the indoor unit fan.			
No kinks present in the flexible ductwork. Ductwork is properly supported.			
Ductwork balancing dampers have been installed and are correctly adjusted or open.			
Grilles and registers are properly sized and installed.			
Refrigerant Piping	N/A	Not Complete	Complete
A dry nitrogen purge rate of three (3) psig was maintained during all brazing activity.			
PVE refrigerant oil was used as a lubricant on flare fittings (POE type was NOT used).			
Field formed pipe flares are 45°.			
Flare fittings were properly tightened.			
Refrigerant pipe is properly supported to keep lateral pressure off unit connections.			
Refrigerant shutoff valves are full port design with integral Schrader port rated for R410A (option).			
Shutoff valves have the same internal pipe diameter as the connected pipe (option).			
Two shutoff valves were installed; one (1) high pressure liquid, one (1) low pressure vapor (option).			
Shutoff valves installed with Schrader port between the indoor unit and the ball of the valve (option).			
Condensate System	N/A	Not Complete	Complete
Condensate pipe is properly sized and supported to keep lateral pressure off unit connections.			
Condensate pipe horizontal segments are sloped a minimum of 1/4"/100' of pipe away from the indoor unit.			
Condensate pipe and drain traps were sized using LG recommendations.			
Field-provided condensate line check valve was installed in the condensate pipe riser (option).			
Condensate traps were installed on gravity drain pipes (High-Static models only).			
Condensate line vertical rise between indoor unit bottom and high point of the line does not exceed 27-1/2".			
Condensate pump power has been disconnected (High-Static indoor unit gravity-drain installations only).			
Condensate pump riser intersects the building main drain using an inverted trap with connection to the top half of the drain line with no more of a ±45° of vertical.			
If required by local code, is a secondary high level condensate shutoff switch present/wired properly (factory provided internal high level float switch will shut down cooling operation if high water level in the pan is detected)?			
Insulation	N/A	Not Complete	Complete
Additional housing, refrigerant and condensate pipe insulation has been supplemented to prevent sweating while operating if indoor unit installed in abnormal environmental conditions. (Optional - job condition specific.)			
All pipes are independently insulated. All insulation seams and joints are airtight. Insulation is not compressed. Double layer insulation is provided at pipe supports and wall penetrations.			

Electrical	N/A	Not Complete	Complete
Power provided is single phase, $\pm 10\%$ of indoor unit nameplate specifications.			
Power wires properly sized and protected per NEC and local codes. Indoor unit is properly grounded.			
Power and communications conductors are separated by the recommended minimum distance.			
Terminal block screws are tight. Power wires are not in contact with terminals 3(A) and / or 4(B). Line voltage wires have spade connectors installed.			
Power wires are properly secured to the control box case to prevent wire tension at the terminal block.			
Wires are protected from chaffing at control box and conduit pipe penetrations.			
(Optional) Smoke detector is properly installed and wired. New batteries are installed (if applicable).			
Low voltage control cables are properly secured to the control panel case. Terminal block screws are tight and the cable is protected from sharp edges at control box case and conduit openings.			
Cables are installed at recommended distances from high voltage and EMF generating equipment.			
Outdoor unit / Indoor unit communications cable (terminals 3[A] and 4[B]).			
Field provided communications cable is 18-2 stranded and shielded. All terminations are made at the terminal block. No inline splices or wire caps are present.			
Communications cable is plenum rated.			
Communications cable shield is tied back and is grounded at only ONE end.			
Wall Mounted Zone Controller Communications	N/A	Not Complete	Complete
LG factory provided zone controller stranded, shielded (white jacket) cable was used between the zone controller(s) and indoor unit(s).			
Zone controller cable has not been cut, spliced, or tied together with wire caps. Factory plugs are present.			
Cable is securely plugged into the socket on the zone controller or the three screw terminals (controller model specific); Yellow to "Y", Red to "R", and Black to "B".			
Zone controller DIP switches have been adjusted for the application's space temperature sensing strategy.			
Indoor Unit Control Panel	N/A	Not Complete	Complete
Zone controller cable is securely plugged into the CN-REMO socket on the indoor unit circuit board.			
If an optional remote temperature sensor was installed, the associated cable is plugged into socket CN-ROOM (the factory return air thermistor has been unplugged).			
Indoor unit DIP switches have been adjusted for application (group control-master/slave; continuous fan operation; dry contact).			
If a gravity drain primary condensate system is used (condensate pipe ONLY connected to the lowest nipple) the CN-D / Pump plugged has been removed from the socket on the control board (High-Static models only).			
All plugs are properly seated in the sockets on the control board.			
Power and communications cables are properly restrained and separated.			

WHO TO CALL FOR ASSISTANCE

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

For warranty information, visit www.lg-vrf.com.

Inverter



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Commercial Air Conditioning Division
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www.lg-vrf.com

LG Customer Information Center, Commercial Products
1-888-865-3026 USA
Follow the prompts for commercial A/C products and parts.

IM-MultiV-DuctedIDU-08-14
Supersedes: IM-MultiV-DuctedIDU-07-14
Supersedes: VRF-IM-DF-001-US 013E09