LG
Life's Good

MULTI V™ WATER MINI

Installation, Operation & Maintenance Manual

Variable Refrigerant Flow Water Source Units

4.4 Tons

Heat Pump 208-230V, 60Hz, 1 Phase

ARWN053GA2

PROPRIETARY DATA NOTICE

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Please read carefully and store in a safe place for future reference.
Content familiarity is required for proper installation.

The instructions included in this manual 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 by the summary list of safety precautions on page 4.

For more technical materials such as submittals, catalogs, engineering, owner's, best practices, and service manuals, visit www.lghvac.com.

TABLE OF CONTENTS

SAFETY PRECAUTIONS

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.

TABLE OF SYMBOLS

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

INSTALLATION

⚠ DANGER

⃠ **Do not store or use flammable gas or combustibles near the unit.**
There is risk of fire, explosion, and physical injury or death.

⃠ **Do not supply power to the unit until all wiring and piping are completed or reconnected and checked.**
There is risk of physical injury or death due to electric shock.

⚠ WARNING

⃠ **Do not install or remove the unit by yourself (end user). Ask the dealer or an LG trained technician to install the unit.**
Improper installation by the user may result in water leakage, fire, explosion, electric shock, physical injury or death.

For replacement of an installed unit, always contact an LG trained service provider.
There is risk of fire, electric shock, explosion, and physical injury or death.

Wear protective gloves when handling equipment. Sharp edges may cause personal injury.

⃠ **Do not install the water-source units outside.**
There is risk of fire, electric shock, explosion, and physical injury or death.

The water source unit is shipped with refrigerant and the service valves closed. ⃠ **Do not run the compressor with the service valves closed.** ⃠ **Do not open service valves on the water source unit until all non-condensables have been removed from the piping system and authorization to do so has been obtained from the commissioning agent.**
There is a risk of explosion and / or refrigerant leaks, which will result in physical injury or death.

Dispose the packing materials safely.
- *Packing materials, such as nails and other metal or wooden parts, may cause puncture wounds or other injuries.*
- *Tear apart and throw away plastic packaging bags so that children will not play with them and risk suffocation and death.*

Install the unit considering the potential for earthquakes.
Improper installation may cause the unit to fall over, resulting in physical injury or death.

If the air conditioner is installed in a small space, take measures to prevent the refrigerant concentration from exceeding safety limits in the event of a refrigerant leak.
Consult the latest edition of ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers) Standard 15. If the refrigerant leaks and safety limits are exceeded, it could result in personal injuries or death from oxygen depletion.

⃠ **Do not change the settings of the protection devices.**
If the protection devices have been bypassed, or are forced to operate improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, and physical injury or death.

Replace all control box and panel covers.
If cover panels are not installed securely, dust, water and animals may enter the water source unit, causing fire, electric shock, and physical injury or death.

INSTALLATION, Continued.

⚠WARNING

Install the unit in a safe location where nobody can step on, fall onto it, or place objects on it . ⃠ Do not install the unit on a defective stand.
It may result in an accident that causes physical injury or death.

Always check for system refrigerant leaks after the unit has been installed or serviced.
Exposure to highly concentrated levels of refrigerant gas will lead to illness or death.

Properly insulate all cold surfaces to prevent "sweating."
Cold surfaces such as uninsulated piping can generate condensate that could drip, causing a slippery surface that creates a risk of slipping, falling, and personal injury.

⚠CAUTION

Be very careful when transporting the product. There is a risk of the product falling and causing physical injury

- *Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed.*
- *Some products use polypropylene bands for packaging. ⃠ Do not use polypropylene bands to lift the unit.*
- *Suspend the water source unit from the base at specified positions (at a minimum of six [6] points) to avoid slipping from the rigging apparatus.*

Note:

LG Electronics U.S.A., Inc., is not responsible for any piping calculations, refrigerant leaks, degradation of performance, or any other potential problems or damages as a result of interconnecting piping, their joint connections, isolation valves, introduced debris inside the piping system, or other problems caused by the interconnecting piping system.

When installing the water source unit in a low-lying area, or a location that is not level, use a raised concrete pad or concrete blocks to provide a solid, level foundation.
This may prevent water damage and reduce abnormal vibration.

Properly insulate all cold surfaces to prevent "sweating."
Cold surfaces such as uninsulated piping can generate condensate that will drip and cause a slippery surface condition and / or water damage to walls.

Always check for system refrigerant leaks after the unit has been installed or serviced.
Low refrigerant levels will cause product failure.

⃠ Do not make refrigerant substitutions. Use R410A only.
If a different refrigerant is used, or air mixes with original refrigerant, the unit will malfunction and damage will occur.

⃠ Do not use the product for mission critical or special purpose applications such as preserving foods, works of art, or other precision air conditioning applications. The equipment is designed to provide comfort cooling and heating.
There is risk of property damage.

⃠ Do not install the unit on a defective stand. Periodically check and verify that the stand and/or water source frame is not damaged.
It will result in an accident that causes product damage.

Keep the unit upright during installation to avoid vibration or water leakage.

When installing the unit in a hospital, data center, or similar electromagnetic field (EMF) sensitive environment, provide sufficient protection against electrical noise.
Inverter equipment, power generators, high-frequency medical equipment, or radio communication equipment may cause the air conditioner to operate improperly. The unit may also affect such equipment by creating electrical noise that disturbs medical treatment or image broadcasting.

When connecting refrigerant piping, remember to allow for pipe expansion.
Improper piping installation will cause system malfunction.

⃠ Do not install the water source unit in a noise sensitive area.

Take appropriate actions at the end of HVAC equipment life to recover, recycle, reclaim or destroy R410A refrigerant according to applicable U.S. Environmental Protection Agency (EPA) rules.

The water source unit is shipped with refrigerant and the service valves closed. ⃠ Do not run the compressor with the service valves closed. ⃠ Do not open service valves on the water source unit until all non-condensables have been removed from the piping system and authorization to do so has been obtained from the commissioning agent.
There is a risk of refrigerant contamination and / or refrigerant loss, resulting in equipment malfunction and / or damage.

WIRING

⚠ DANGER

High voltage electricity is required to operate this system. Adhere to the U.S. National Electric Codes (NEC) and these instructions when wiring.
Improper connections and inadequate grounding can cause accidental injury or death.

Always ground the unit following local, state, and NEC codes.
There is risk of fire, electric shock, and physical injury or death.

Turn the power off at the nearest disconnect before servicing the equipment.
Electrical shock will cause physical injury or death.

Properly size all circuit breakers or fuses.
There is risk of fire, electric shock, explosion, physical injury or death.

⃠ **Do not share the electrical circuit with other devices.**
There is risk of fire, electric shock, and physical injury or death due to heat generation.

⃠ **Do not use damaged or loose power wiring.** ⃠ **Do not modify or extend the outdoor unit's power wiring. Ensure that the power wiring will not be pulled nor weight be placed on the power wiring during operation.**
There is risk of fire, electric shock, and physical injury or death.

⚠ WARNING

The information contained in this manual is intended for use by an industry-qualified, experienced, certified electrician familiar with the U.S. National Electric Code (NEC) 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.

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 NEC and the instructions given in this manual.
If the power source capacity is inadequate or the electric work is not performed properly, it may result in fire, electric shock, physical injury or death.

Refer to local, state, and federal codes, and use power wires of sufficient current capacity and rating.
Wires that are too small may generate heat and cause a fire.

Secure all field wiring connections with appropriate wire strain relief.
Improperly securing wires will create undue stress on equipment power lugs. Inadequate connections may generate heat, cause a fire and physical injury or death.

Ensure the system is connected to a dedicated power source that provides adequate power.
If the power source capacity is inadequate or the electric work is not performed properly, it will result in fire, electric shock, physical injury or death.

Properly tighten all power connections.
Loose wiring will overheat at connection points, causing a fire, physical injury or death.

⃠ **Do not change the settings of the protection devices.**
If the pressure switch, thermal switch, or other protection devices are bypassed or forced to work improperly, or parts other than those specified by LG are used, there is risk of fire, electric shock, explosion, and physical injury or death.

Note:

⃠ **Do not supply power to the unit until all installation and pre-commissioning tasks are complete and the commissioning agent indicates it is safe to do so.**
The system will malfunction.

The information contained in this manual is intended for use by an industry-qualified, experienced, licensed electrician familiar with the NEC 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 and property damage.

OPERATION

⚠ DANGER

⃠ Do not provide power to or operate the unit if it is flooded or submerged.
There is risk of fire, electric shock, physical injury or death.

Use a dedicated outlet for this product.
There is risk of fire, electric shock, physical injury or death.

⃠ Do not operate the disconnect switch with wet hands.
There is risk of fire, electric shock, physical injury or death.

Periodically verify the equipment mounts have not deteriorated.
If the base collapses, the unit could fall and cause physical injury or death.

Use inert (nitrogen) gas when performing leak tests or air purges. ⃠ Do not use compressed air, oxygen, or flammable gases.
Using these substances will cause fire, explosion, and physical injury or death.

If refrigerant leaks out, ventilate the area before operating the unit.
If the water source unit is mounted in an enclosed, low-lying, or poorly ventilated area, and the system develops a refrigerant leak, it will cause a fire, electric shock, explosion, physical injury or death.

⚠ WARNING

⃠ Do not allow water, dirt, or animals to enter the unit.
There is risk of fire, electric shock, physical injury or death.

⃠ Do not operate the unit with the panel(s) or protective cover(s) removed; keep fingers and clothing away from moving parts.
The rotating, hot, cold, and high-voltage parts of the unit can cause physical injury or death.

⃠ Do not touch the refrigerant piping during or after operation.
It can cause burns or frostbite.

⚠ CAUTION

To avoid physical injury, use caution when cleaning or servicing the air conditioner.
There is risk of electric shock, physical injury or death.

Note:

Clean up the site after servicing is finished, and check that no metal scraps, screws, or bits of wiring have been left inside or surrounding the unit.

⃠ Do not use the product for mission critical or special-purpose applications such as preserving foods, or other precision air conditioning applications. The equipment is designed to provide comfort cooling and heating.
There is risk of property damage.

⃠ Do not allow water, dirt, or animals to enter the unit.
There is risk of unit failure.

⃠ Do not operate the unit with the panel(s) or protective cover(s) removed; keep fingers and clothing away from moving parts.
Non-secured covers can result in malfunction due to dust or water in the service panel.

Periodically verify the equipment mounts have not deteriorated.
If the base collapses, the unit could fall and cause property damage or product failure.

Use only a soft cloth to clean the unit. ⃠ Do not use wax, thinner, or strong detergents.
Strong cleaning products will damage the surface of the air conditioner, or cause its appearance to deteriorate.

⃠ Do not turn off the main power switch after operation has been stopped.
Wait at least five (5) minutes before turning off the main power switch, otherwise it may result in product malfunction.

UNIT NOMENCLATURE

Water Source Units (WSU)

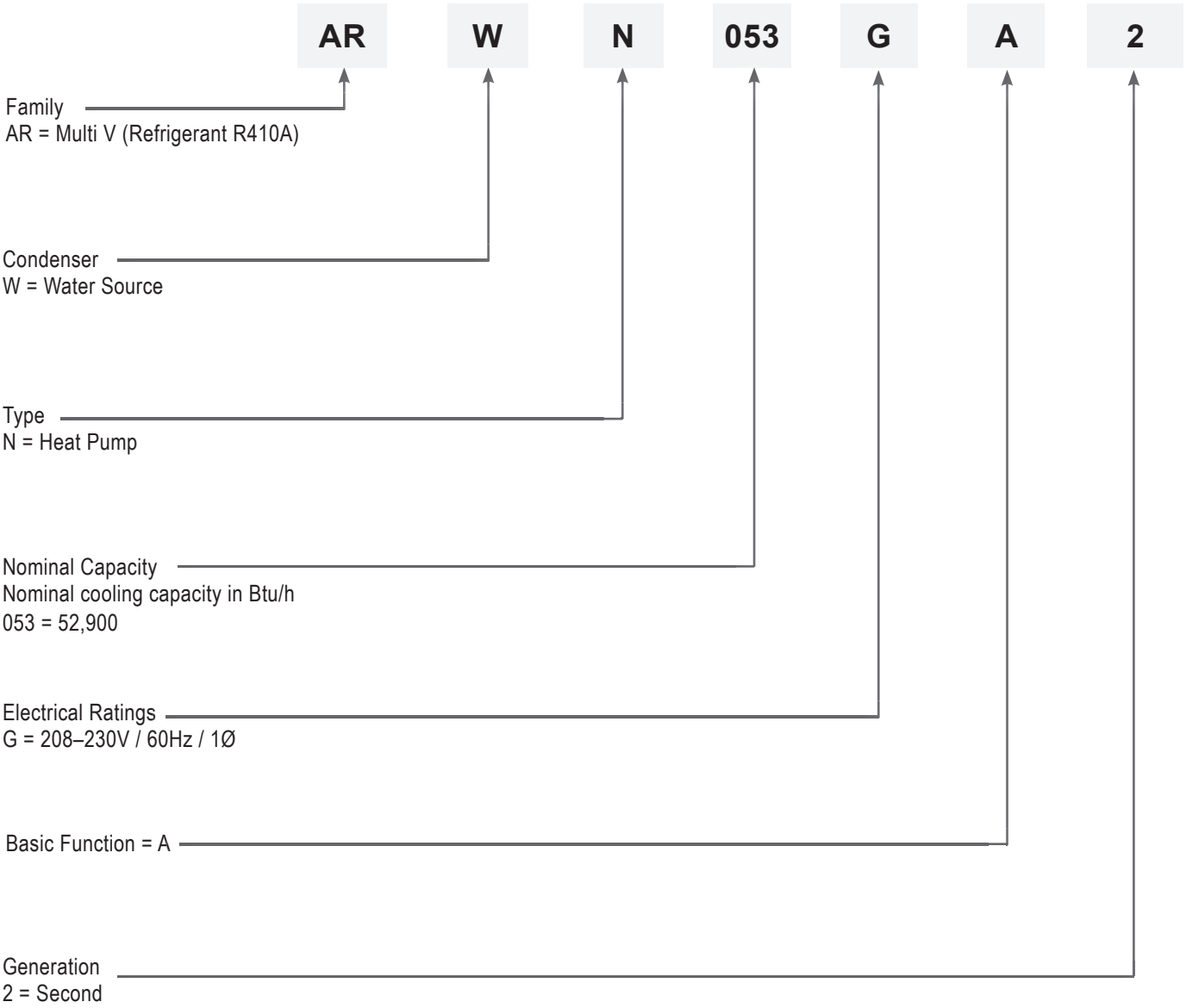


Table 1: ARWN053GA2 Water Mini Unit Specifications.

	4.4 Ton
Model Number	ARWN053GA2
Nominal Capacity / Input Power	
Cooling Capacity (Btu/h)[1]	52,900
Cooling Input Power (kW)	3.2
Heating Capacity (Btu/h)[1]	61,400
Heating Input Power (kW)	3.5
Compressor	
Type	Inverter Rotary
Power Supply (volt/hz/phase)[2]	208-230 / 60 / 1
MCA (A)	27
MOP (A)	45
System Data	
Sound Pressure (dBA)[3]	54
Heat Rejected to Equipment Room (Btu/h)	512
Net Weight (lbs)	168
Shipping Weight (lbs)	181
Dimensions (W x H x D)	20-5/8 x 42-1/2 x 13-1/8
Max. Qty Indoor Units	9
Refrigerant Piping Connections[4]	
Vapor Line OD (in)	3/4 Braze
Liquid Line OD (in)	3/8 Braze
Expansion Device	Electronically Controlled (EEV)
Factory Refrigerant Charge (R410A [lbs])	2.2
Water Side	
Heat Exchanger	Stainless Steel Plate
Water Volume in Heat Exchanger (gal.)	0.2
Water Inlet/Outlet Connection Size (in)	1-1/4 FPT
Nominal Flow Rate Total (GPM)	15.9
Range of Flow (GPM)	8.3-19.9
Entering water temp. range (°F)– Cooling[5]	23-113
Entering water temp. range (°F)– Heating[5]	23-113
Total Heat of Rejection (Btu/h)	56,640
Total Heat of Absorption (Btu/h)	49,448
Pressure Drop (ft)	9.5
Maximum Water Pressure (psi)	640
ΔT (°F)[6]	7

[1]Rated capacity is certified under AHRI Standard 1230. Ratings are subject to change without notice. Current certified ratings are available at www.ahridirectory.org.

[2]Power wiring is field provided, solid or stranded, and must comply with the applicable local and national codes.

[3]Sound pressure levels as tested in an anechoic chamber under ISO Standard 3745.

[4]LG requires that LATS software be used on all projects to ensure correct line sizing. Designer must verify the shop drawing design against the as built design using LATS. Contractor must also use LG manufactured Y-Branch and Header Kits only.

[5]Variable water flow control kit (PRVC1) is required for all entering water temperatures (one kit per frame). If entering water temperatures fall below 42°F, glycol must be added to the system.

[6]Calculated from ΔT = Total Heat of Rejection / (Nominal flow rate x 500).

[7]Communication cable between WSU to IDUs to be 18 AWG, 2-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. ⃠ Do not ground the WSU to IDUs communication cable at any other point. Wiring must comply with all applicable local and national codes.

Table 2: ARWN053GA2 Water Mini Unit Electrical Data.

Nominal Tons	Unit Model No.	Compressor Qty.	Compressor Motor RLA	MSC	MCA	MOP
4.4	ARWN053GA2	1	21.6	-	27	45

MCA = Minimum Circuit Ampacity.

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

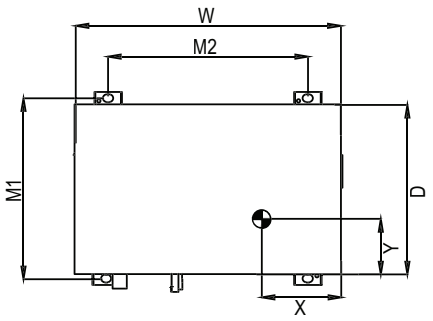
Allowable voltage range is between 208–230 volts only (tolerance is 10%).

Maximum allowable voltage imbalance is 2%.

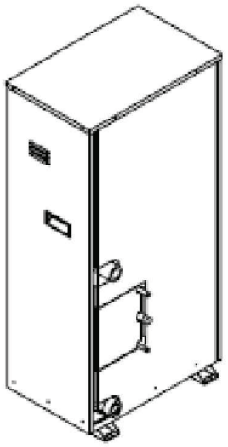
DIMENSIONS

ARWN053GA2

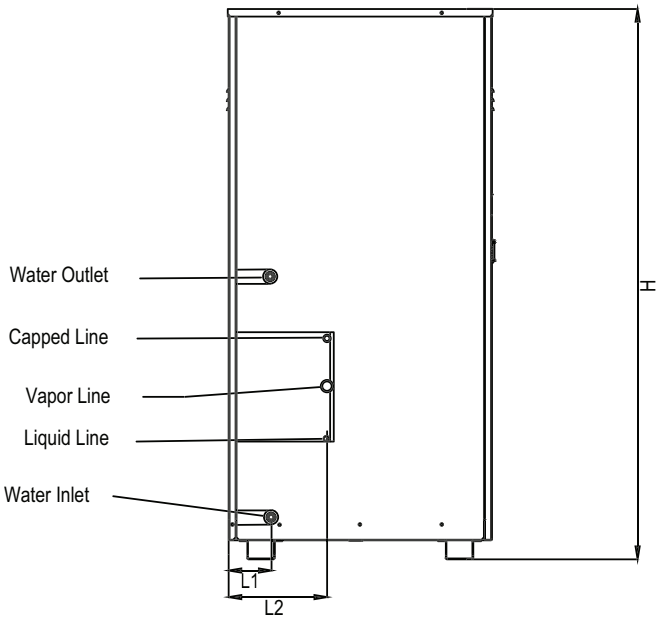
Figure 1: ARWN053GA2 Dimensions.



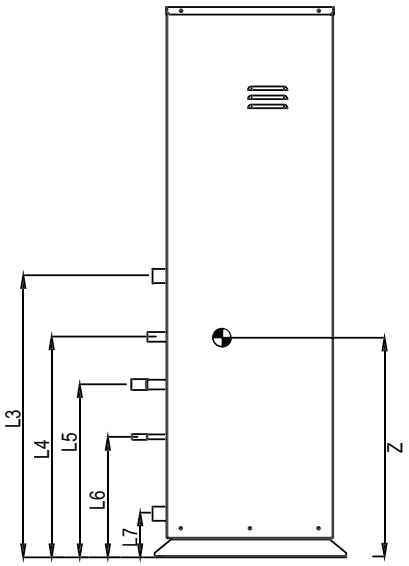
Top View



Isometric



Front View



Side View

W	20-5/8″
D	13-1/8″
H	42-1/2″
L1	3-5/16″
L2	7-5/8″
L3	21-13/16″
L4	17-1/16″
L5	13-5/8″
L6	9-5/16″
L7	3-7/16″
L8	23-11-16″
M1	13-15/16″
M2	15-1/4

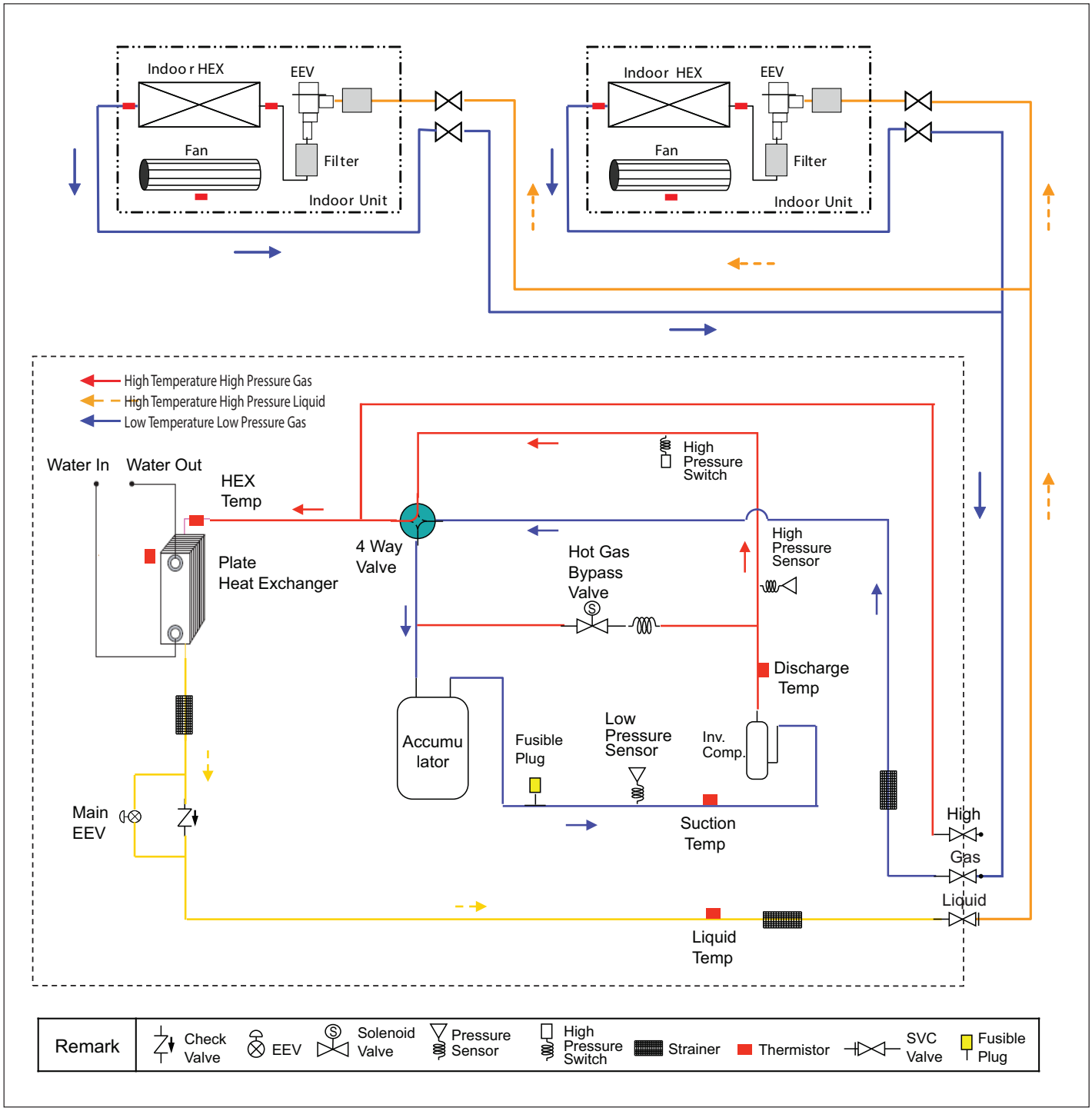
X	8-5/16″
Y	4-7/16
Z	15-7/8

REFRIGERANT FLOW DIAGRAMS

Cooling Mode

ARWN053GA2

Figure 2: ARWN053GA2—Cooling Mode.

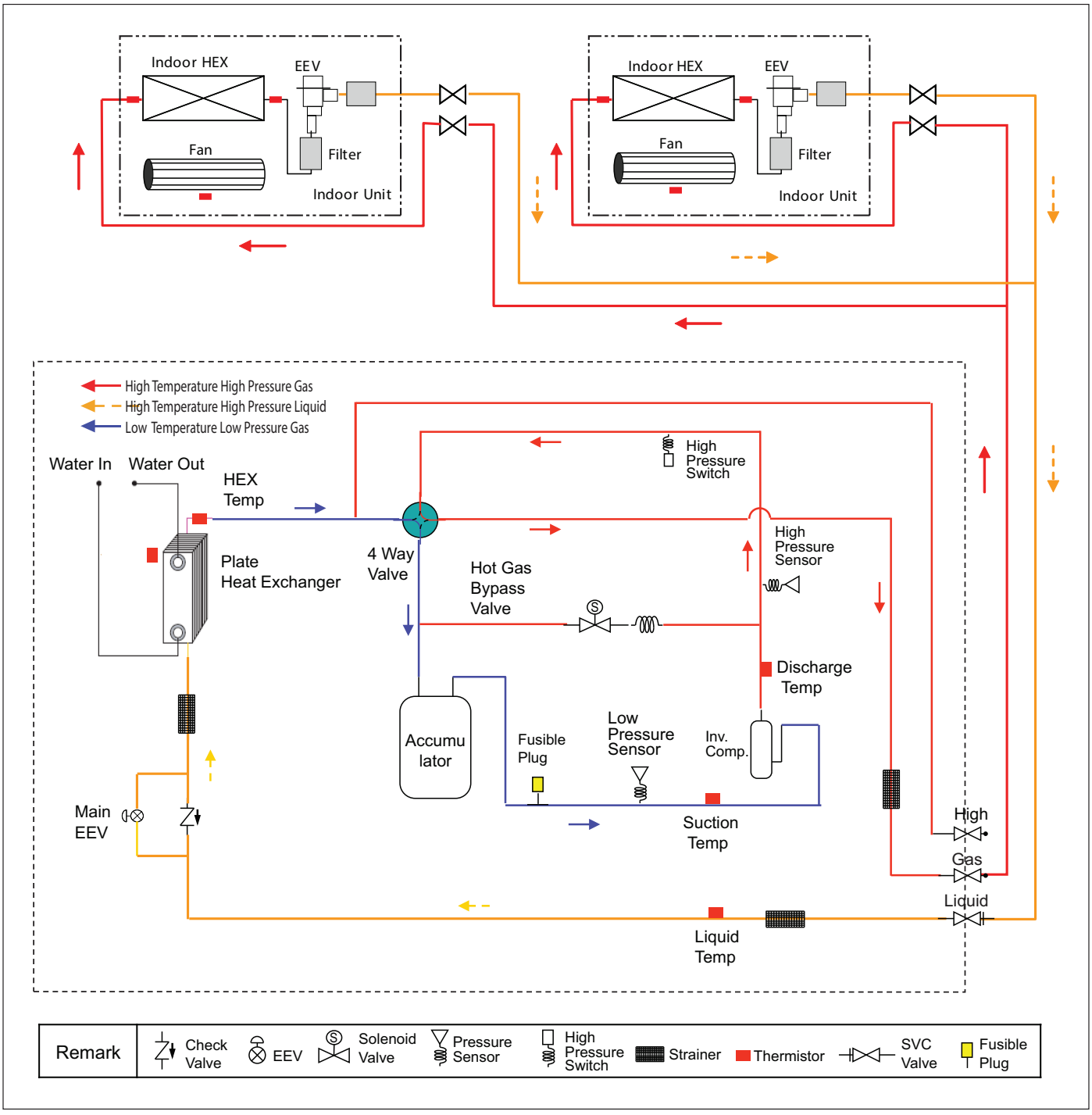


REFRIGERANT FLOW DIAGRAMS

Heating Mode

ARWN053GA2

Figure 3: ARWN053GA2—Heating Mode.

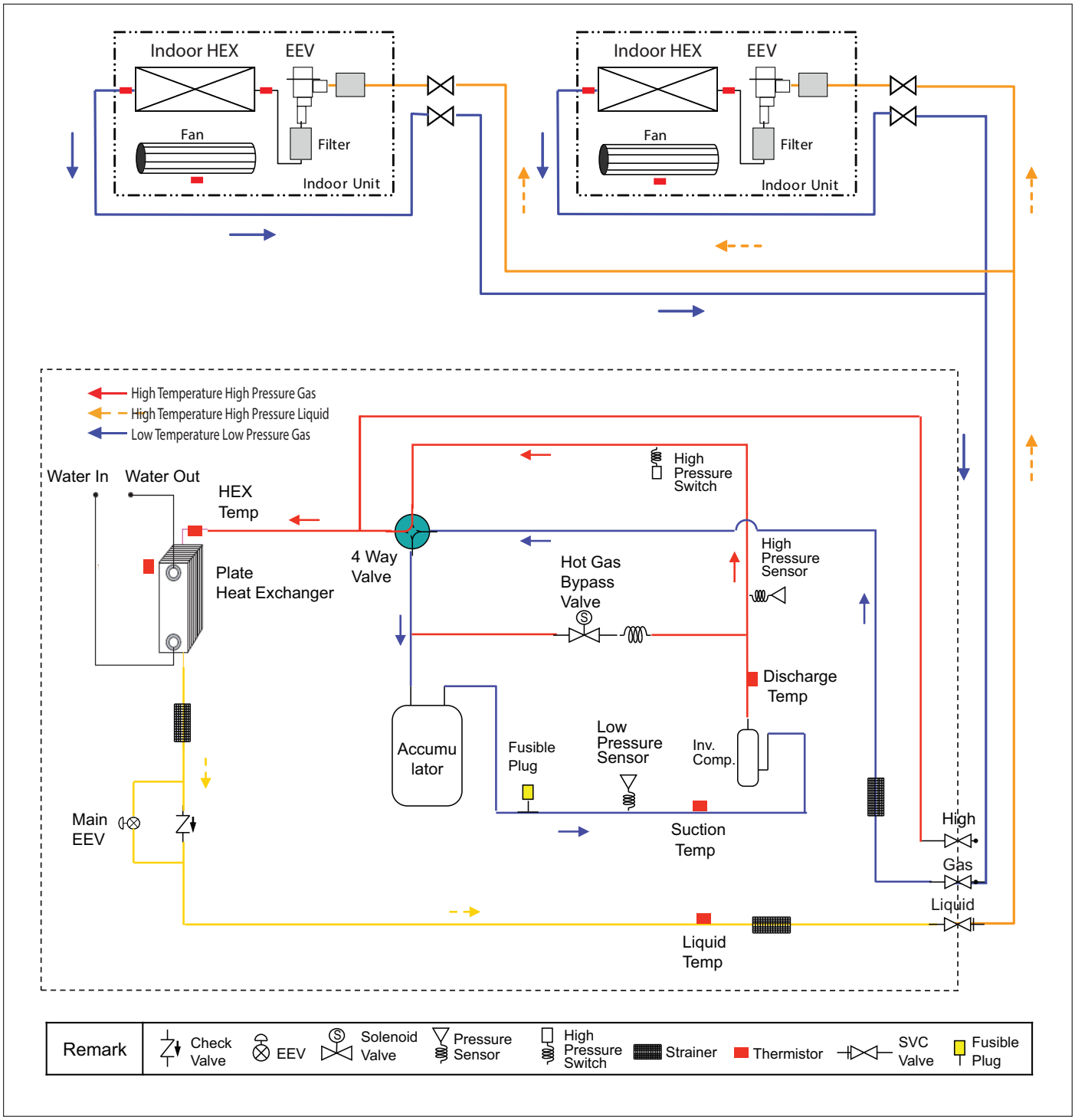


REFRIGERANT FLOW DIAGRAMS

Oil Return Operation

ARWN053GA2

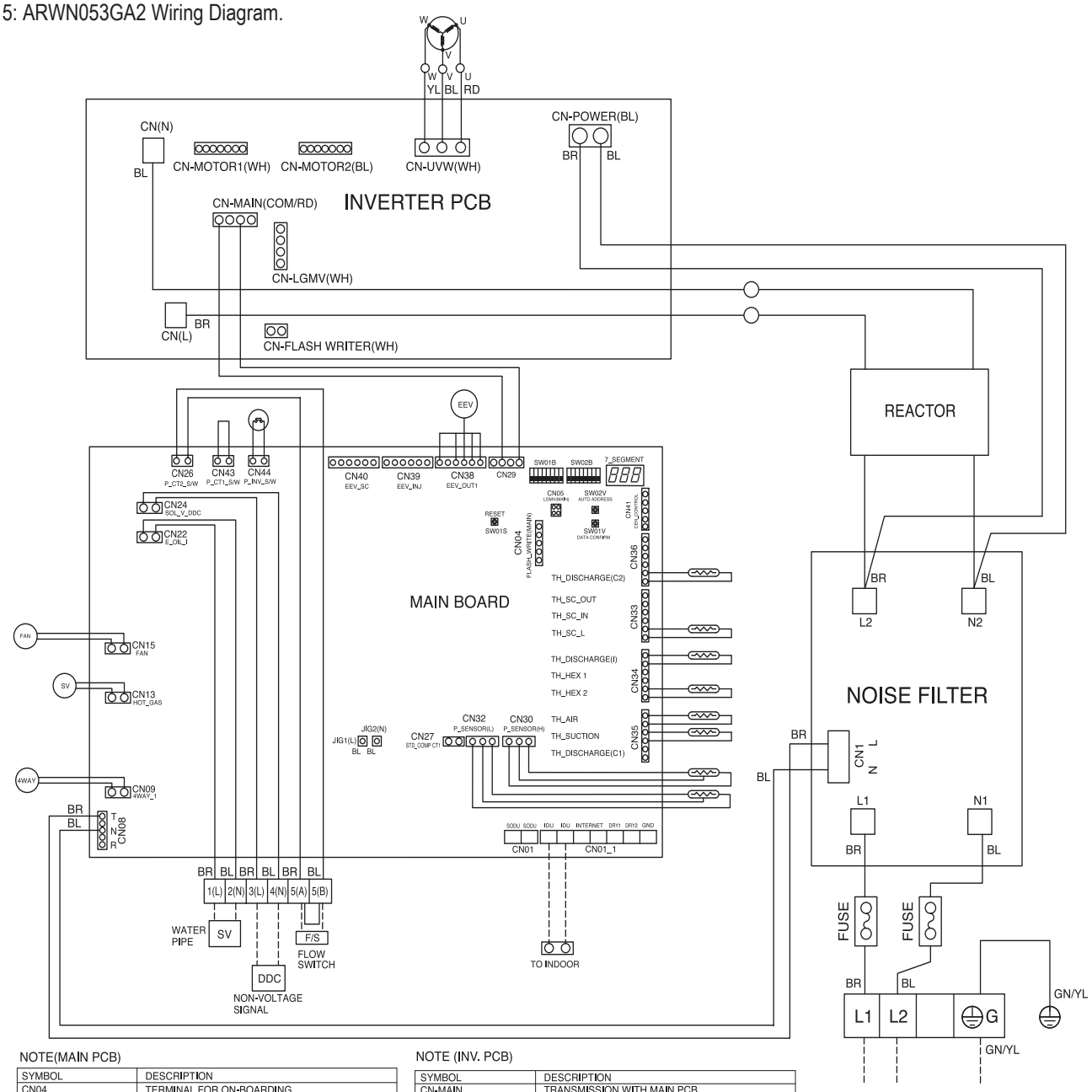
Figure 4: ARWN053GA2—Oil Return.



WIRING DIAGRAM

ARWN053GA2

Figure 5: ARWN053GA2 Wiring Diagram.



NOTE(MAIN PCB)

SYMBOL	DESCRIPTION
CN04	TERMINAL FOR ON-BOARDING
CN05	TERMINAL FOR LGMV JIG
CN08	AC POWER
CN09	4WAY REVERSING VALVE
CN10	INVERTER COMP CRANK HEATER
CN13	HOT GAS BYPASS VALVE
CN15	AC POWER TO FAN
CN29	TRANSMISSION WITH INVERTER PCB
CN30	HIGH PRESSURE SENSOR
CN32	LOW PRESSURE SENSOR
SW01S	RESET BUTTON
SW02V	AUTO ADDRESSING BUTTON
CN33(SC_L)	SUBCOOLING LIQUID PIPE THERMISTOR
CN34(DIACHARGE(I))	INVERTER COMP. DISCHARGE PIPE THERMISTOR
CN34(HEX1)	CONDENSOR PIPE THERMISTOR 1
CN35(AIR)	OUTDOOR AIR THERMISTOR
CN35(SUCTION)	SUCTION PIPE THERMISTOR
CN36(DIACHARGE(C2))	TH_WATER
CN38	ELECTRIC EXPANSION VALVE(MAIN)
CN40	ELECTRIC EXPANSION VALVE(SUBCOOLING)
CN41	TERMINAL FOR CENTRAL CONTROL UNIT
CN44	INV. COMP. HIGHT PRESSURE SWITCH

NOTE (INV. PCB)

SYMBOL	DESCRIPTION
CN-MAIN	TRANSMISSION WITH MAIN PCB
CN-FLASH-WRITER	TERMINAL FOR ON-BOARDING
CN-POWER	AC POWER
CN-LGMV	TERMINAL FOR LGMV JIG
CN-UVW	TERMINAL FOR L U.V.W OUTPUT
CN(L)	LIVE INPUT
CN(N)	NEUTRAL INPUT
CN-MOTOR1	TRANSMISSION & POWER INPUT OF FAN MOTOR1
CN-MOTOR2	TRANSMISSION & POWER INPUT OF FAN MOTOR2

COLOR

SYMBOL	RD	BL	WH	BK	BR	YL	GY	GN/YL
COLOR	RED	BLUE	WHITE	BLACK	BROWN	YELLOW	GRAY	GREEN/YELLOW

NOTES

1. THIS WIRING DIAGRAM IS APPLIED ONLY TO THE MAIN CONTROL BOX.
2. – – – – – – – – – – – – : FIELD WIRING

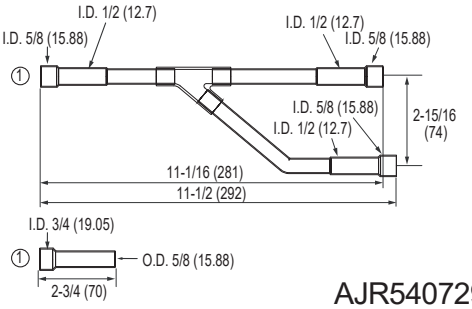
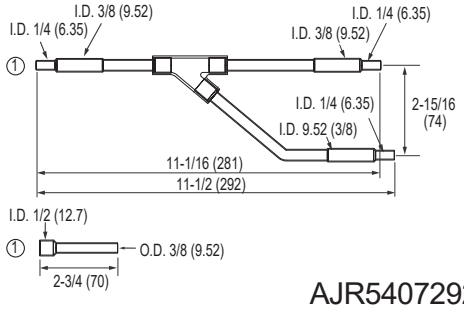
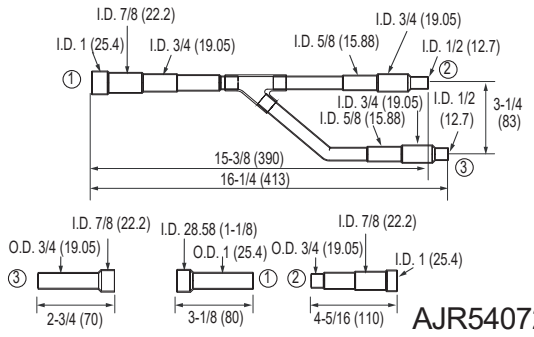
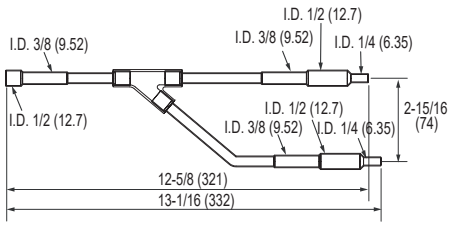
Table 4: Required Accessories.

Required Accessories	Model No.		
Y-branches (for indoor unit connection)	ARBLN01621		
	ARBLN03321		
Headers (for indoor unit connection)	Four (4) branch	Seven (7) branch	Ten (10) branch
	ARBL054	ARBL057	ARBL1010
	ARBL104	ARBL107	ARBL2010

Y-branches (for indoor unit connection)

Table 3: Y-branch Table.

(Unit: Inch [mm])

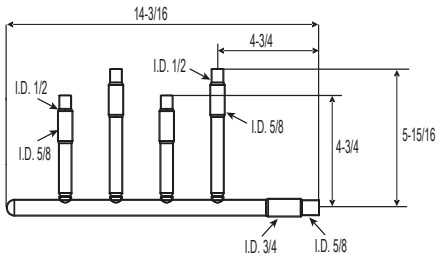
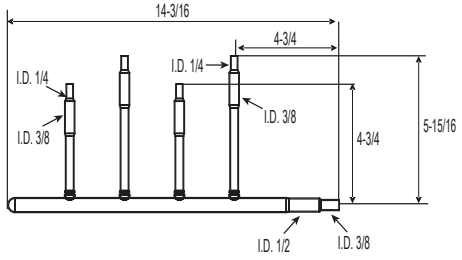
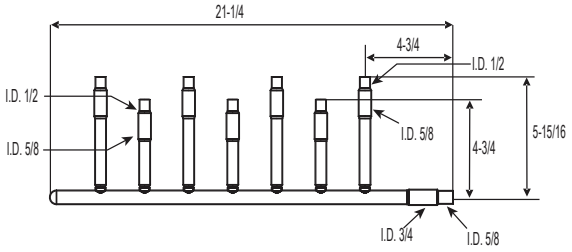
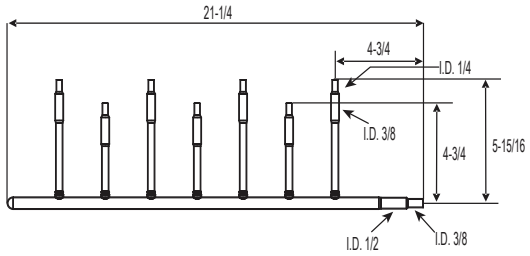
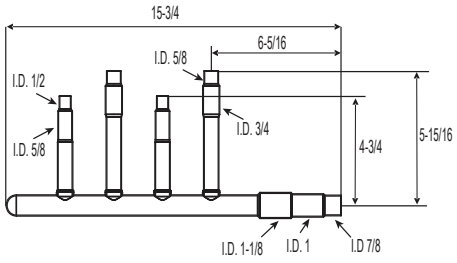
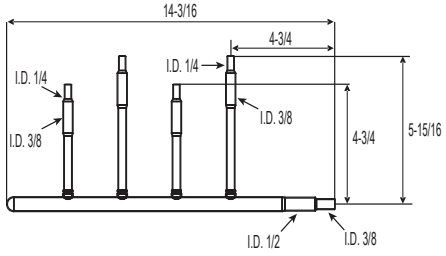
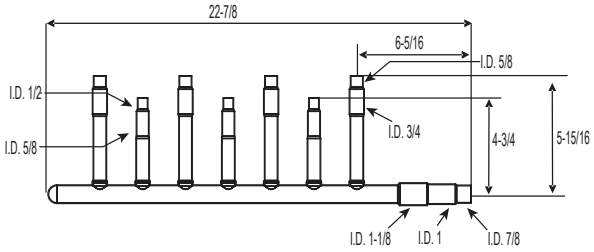
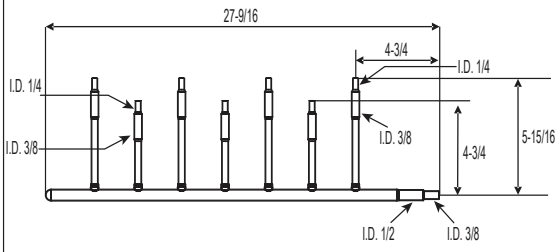
Models	Pipe	
	Vapor Pipe	Liquid Pipe
ARBLN01621	 AJR54072929	 AJR54072927
	Vapor Pipe	Liquid Pipe
ARBLN03321	 AJR54072930	 AJR54072928

Product Data

Headers (for indoor unit connection)

Table 5: Header Table.

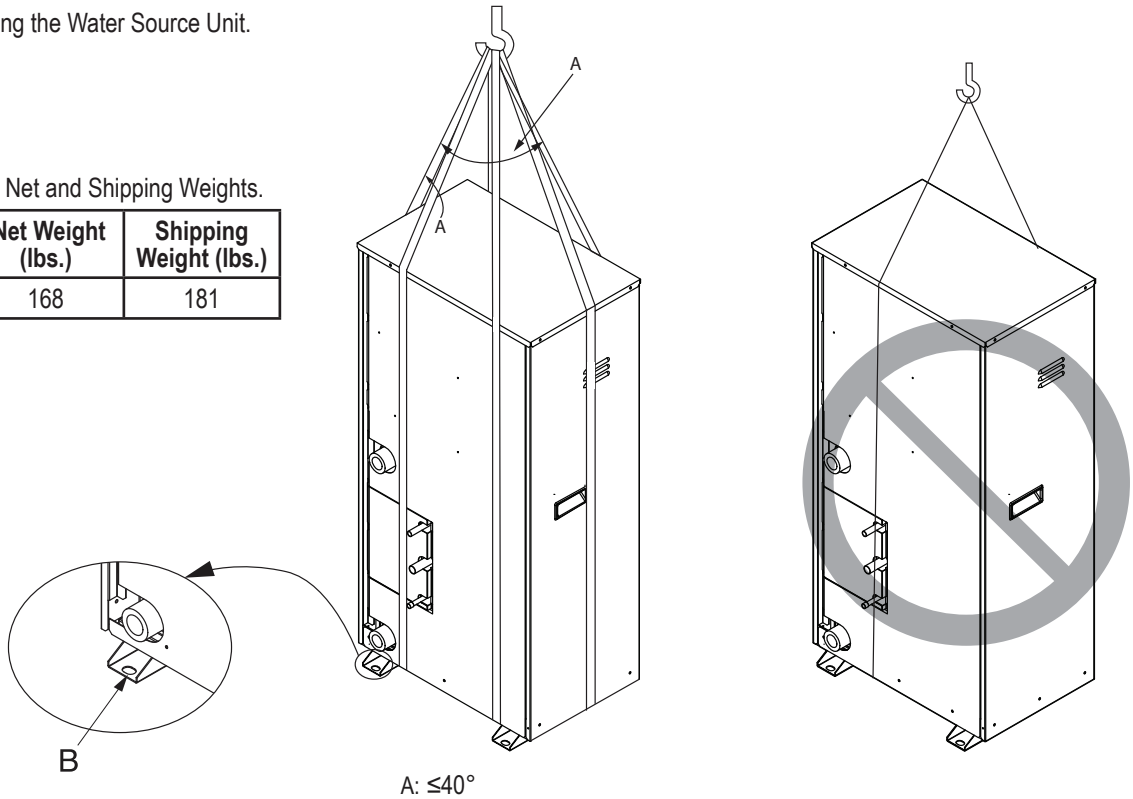
Unit: Inch

Models	Vapor pipe	Liquid pipe
4 branch ARBL054		
7 branch ARBL057		
4 branch ARBL104		
7 branch ARBL107		

Transporting / Lifting

- When lifting the unit, use lifting straps and place around the unit as shown below.
- Always lift the unit using properly sized lifting straps rated to carry the unit weight.
- Ensure the straps are long enough to maintain a maximum of a 40° angle as shown at “A”.

Figure 6: Transporting the Water Source Unit.



A: ≤40°
B: Mounting Rail

Table 6: Water Mini Net and Shipping Weights.

Capacity (ton)	Net Weight (lbs.)	Shipping Weight (lbs.)
4.5	168	181

⚠WARNING

- *Use appropriate moving equipment to transport the frame; ensure the equipment is capable of supporting the weights listed above. If the equipment is not properly secured, it will result in an accident that causes physical injury or death.*
- *Wear protective gloves when handling equipment. Sharp edges will cause personal injury.*
- *Some products include polypropylene bands around the unit for packaging. ⃠ Do not use polypropylene bands to lift the unit. There is a risk of the product falling and causing physical injury.*
- *Tear apart and throw away plastic packaging bags so that children will not play with them and risk suffocation and death.*
- *Consider where the unit’s center of gravity is before lifting. Hoist the unit with the center of gravity centered among the lifting straps. There is a risk of the product falling and causing physical injury.*
- *Lift the water source unit from the base at specified locations. Support the outdoor unit at a minimum of six (6) points to avoid slippage from the rigging apparatus, and use a minimum of three (3) lifting straps. There is a risk of the product falling and causing physical injury.*
- *Use caution when using forklift to transport an unpackaged unit. ⃠ Do not drop the unit when carrying it with a forklift. There is a risk of the product falling and causing physical injury.*

Note:

Place a protective cloth or other soft material at the locations where the casing comes in contact with the lifting straps to prevent damage to painted surfaces.

INSTALLATION

Placement Considerations

Selecting the Best Location

⚠DANGER

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

Note:

Avoid exposure to electromagnetic waves from EMF radiating machinery such as generators, MRI equipment, or other equipment that emits electromagnetic energy. The control system may be affected by electromagnetic energy, which may result in abnormal system operation. Also, the inverter components in the water source units may generate electromagnetic noise, therefore, ensure the water-source unit is placed at an acceptable distance from computer, audio, and other sensitive electronic equipment. Route power wiring and communications cables in separate conduits.

The water source unit must be installed indoors in a mechanical room. The mechanical room must be designed such that equipment vibration or noise does not affect surrounding rooms, and is properly ventilated or conditioned to maintain an acceptable ambient temperature range between 32°F and 104°F. Mechanical room temperature is required to be maintained between 32°F and 104°F. The water source unit will reject heat to the mechanical room. See “General Data” for the amount of heat rejected to the equipment room.

- The water source unit must also be located where the refrigerant pipe system does not exceed the design limits. Location of the water source unit should be strategically located in the building to minimize refrigerant piping materials, labor, and refrigerant.

- The underlying structure or foundation must be designed per local codes and support the weight of the unit. Units can be stacked above each other as long as each water source unit is independently supported. Minimum clearances must be maintained either per recommendations shown in the figures on the next page, or local codes, whichever is greater. Include enough space in the installation area for service access (refer to the installation space requirements).

- The mechanical room floor must be waterproof. Periodic flushing of the water heat exchanger will be required, and a floor drain will help facilitate this maintenance.

- The water-source unit should be installed with a closed-loop water system. If an open-loop system is used, it is recommended that an intermediate heat exchanger be installed.

- If the Water Mini system will be installed in areas where the entering water temperatures fall below 42°F, glycol must be added to the system. Frozen water will damage the plate heat exchanger. Antifreeze solution includes proper mixtures of ethylene glycol, propylene glycol, or methanol mixed to the water to prevent freezing. Addition of water heater/boiler to maintain minimum temperatures must be considered.

Installation Space

When installing the water-source unit, consider service / minimum allowable space requirements as illustrated. If local code requires additional clearance, comply with local codes.

Note:

Job site conditions may require routing utilities—including the refrigerant piping and electrical wiring—under the unit base. If job site conditions warrant, consider adding mounting rails under the unit.

Figure 7: Required Minimum Space for Water Mini Unit Installation.

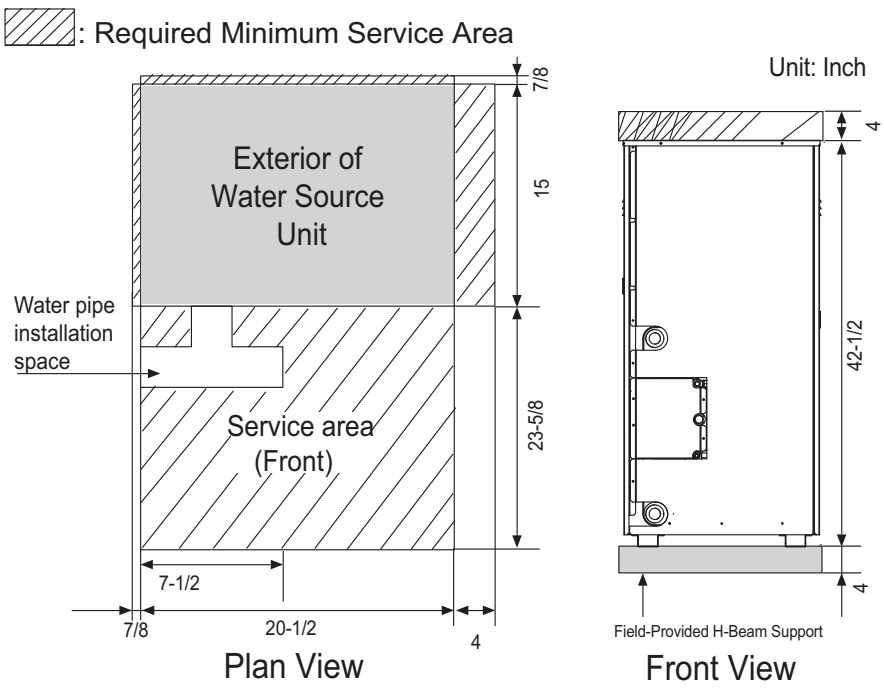
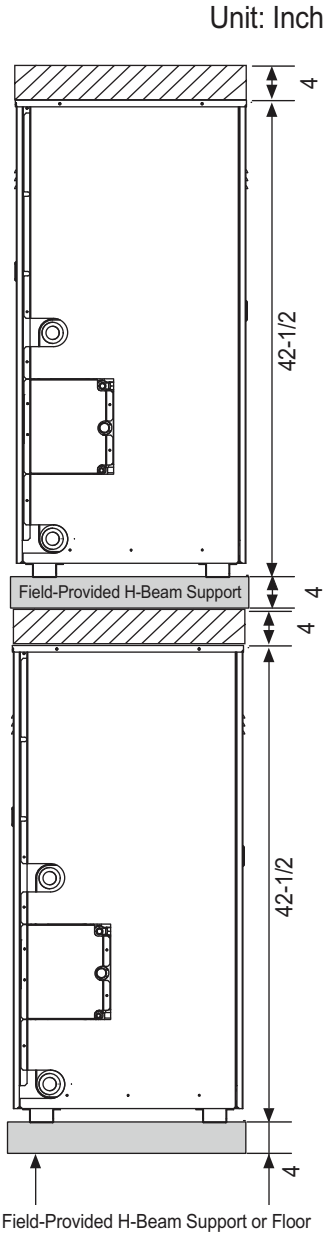


Figure 8: Stacked Water Source Units.



INSTALLATION

MULTI V WATER MINI

General Mounting / Anchoring the Water Source Unit

General Mounting

Securely attach the water source unit to a concrete pad, base rails, or other mounting platform that is anchored to the building structure. Avoid placing the unit in a low lying area where water may accumulate. Refer to dimensional drawing in the "Product Data" section, and follow the applicable local code for clearance, mounting, anchor, and vibration attenuation requirements.

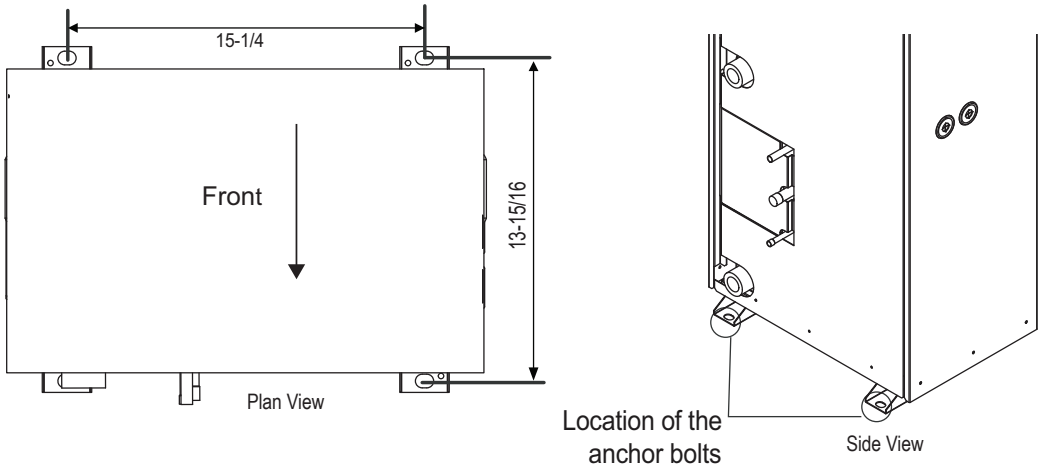
⚠ WARNING

- *When building a base support for the water source unit, ensure that the floor surface / location has enough strength to support the weight of the unit, and enough space for pipes and wiring when installing through the bottom of the unit.*
- *Install the water source unit to a base and in a manner approved by the structural engineer to minimize damage to the unit in the event of an earthquake. Any deficiency in installation may cause unit to fall, resulting in physical injury or death.*

Anchoring the Water Source Unit

Figure 9: Location of the Anchor Bolts.

Unit: Inch

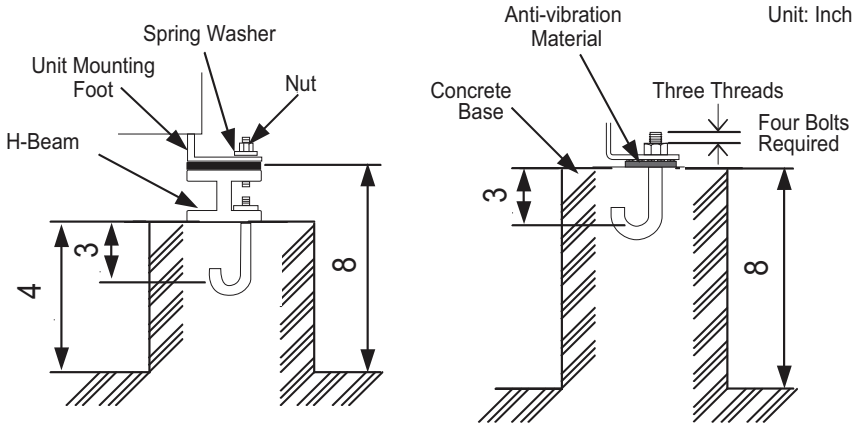


Mounting Platform

- 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.
- Securely fasten all four (4) corners to the supporting base, otherwise, the support will bend.
- If not otherwise directed by the structural engineer or local codes, Use a 7/16 inch or 1/2 inch diameter J-bolt. Use a hexagon nut with a spring washer.
- Include anti-vibration material chosen by the acoustics engineer.
- Include enough space for refrigerant piping and electrical wiring when installing through the bottom of the unit.
- Use an H-beam, concrete support, or other acceptable support structure designed by a structural engineer.

Figure 10: Close up of Anchor Bolts.

Unit: Inch



Note:

All referenced materials are to be field-supplied. Images are not to scale, are for reference only, and are not intended to be used for design purposes.

LG

LG Air Conditioner Technical Solution (LATS) Software

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

Note:

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

Formats

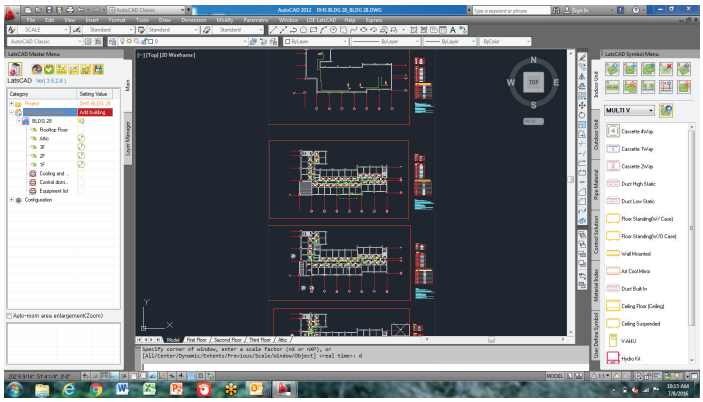
LATS is available to LG customers in three user interfaces: LATS HVAC, LATS CAD2, and LATS REVIT. All three LATS formats are available through www.myLGHVAC.com, or contact an LG Sales Representative.

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

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

LATS Revit integrates the LG LATS program with Revit® software**. It permits engineers to layout and validate Multi V VRF systems directly into Revit drawings.
***AutoCAD® and Revit® are both registered marks of Autodesk, Inc.*

Figure 11: Example of LATS CAD2.



Features

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

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

The program can also:

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

Note:

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

LG AIR CONDITIONER TECHNICAL SOLUTION (LATS)

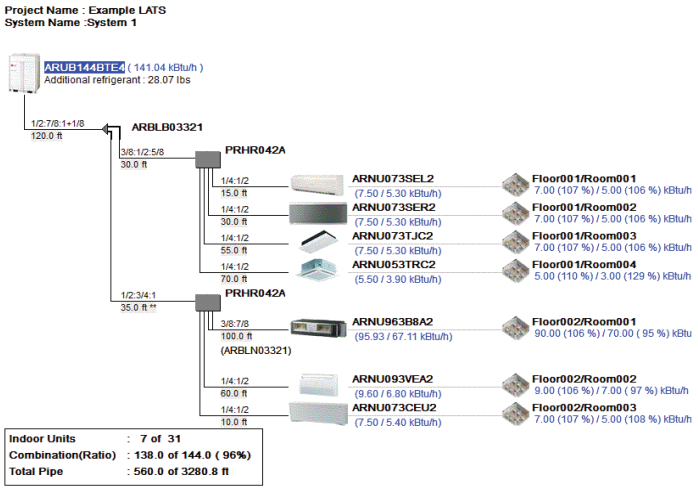
LATS Generates a Complete Project Report

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

Proper Design to Install Procedure

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

Figure 12: Example of a LATS Tree Diagram.



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

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

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

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

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 must be done with caution and ALWAYS VERIFIED in LATS MULTI V SOFTWARE BEFORE supplies are purchased or installed. Doing so will lead to a more profitable installation, reduce the potential for rework, and will reduce the potential for multiple visits to the job site to complete the system commissioning.

REFRIGERANT CHARGE WORKSHEET

System R410A Refrigerant Charge Calculator (lbs.)

Table 7: System Refrigerant Charge Calculator (lbs.).

System Tag or ID:	Job Name: _____ Project Manager: _____ Date: _____

Line #	Description	Chassis I.D.	Size	Quantity	CF (Ref.)[1]	Total (lbs.)
1	Linear feet of 1/4" liquid line tubing[2]	—	—		0.015	
2	Linear feet of 3/8" liquid line tubing[2]	—	—		0.041	
3	Linear feet of 1/2" liquid line tubing[2]	—	—		0.079	
4	Linear feet of 5/8" liquid line tubing[2]	—	—		0.116	
5	Linear feet of 3/4" liquid line tubing[2]	—	—		0.179	
6	Linear feet of 7/8" liquid line tubing[2]	—	—		0.238	
7	Linear feet of 1" liquid line tubing[2]	—	—		0.323	
8	Standard + Art Cool Mirror	SJ, SK	5k to 15k		0.53	
9	Standard + Art Cool Mirror	SJ, SK	18k to 24k		0.62	
10	Standard	SV	30k to 36k		1.01	
11	Art Cool Gallery	SF	9k to 12k		0.22	
12	1-Way Cassette	TU	7k to 12k		0.44	
13	1-Way Cassette	TT	18k to 24k		0.64	
14	2-Way Cassette	TS	18k to 24k		0.75	
15	4-Way 2' x 2' Cassette	TR	5k to 7k		0.40	
16	4-Way 2' x 2' Cassette	TR	9k to 12k		0.55	
17	4-Way 2' x 2' Cassette	TQ	15k to 18k		0.71	
18	4-Way 3' x 3' Cassette	TN	7k to 24k		0.88	
19	4-Way 3' x 3' Cassette	TM	28k to 36k		1.08	
20	4-Way 3' x 3' Cassette	TM	42k to 48k		1.41	
21	High Static Ducted	M1	7k to 24k		0.57	
22	High Static Ducted	M2	7k to 24k		0.77	
23	High Static Ducted	M2	28k to 42k		1.15	
24	High Static Ducted	M3	28k to 54k		1.35	
25	High Static Ducted	B8	36k to 96k		2.20	
26	Low Static Ducted, Low Static Ducted Bottom Return	L1	5k to 9k		0.31	
27	Low Static Ducted, Low Static Ducted Bottom Return	L2	12k to 18k		0.42	
28	Low Static Ducted, Low Static Ducted Bottom Return	L3	21k to 24k		0.55	
29	Vertical / Horizontal Air Handling Unit	NJ	12k to 30k		1.04	
30	Vertical / Horizontal Air Handling Unit	NJ	36k		1.57	
31	Vertical / Horizontal Air Handling Unit	NK	42k to 54k		2.00	
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** (Sum of lines 1 – 33)					
35	Water Source Unit Factory Refrigerant Charge	ARWN053GA2	52,900		2.2	
36	**Total System Charge: Sum of Additional Refrigerant Charge Required and Total Factory Refrigerant Charge**					

[1]CF (Ref.) = Correction Factor for Refrigerant Charge.

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

REFRIGERANT SAFETY STANDARDS / DEVICE CONNECTION LIMITATIONS

Refrigerant Safety Standards

ASHRAE Standards 15-2010 and 34-2010 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 (Addendum L modified the RCL to 26) 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:

- Split dual-frame and triple-frame systems into single-frame systems that have lower refrigerant charges.
- Add transfer grilles in the ceiling or walls of the smaller rooms to increase the volume of the room.
- Remove the smallest space from the system and serve it with a smaller mini-split system.

Device Connection Limitations

The minimum number of connected and operating indoor units to a Multi V Water Mini system is one, taking into consideration of the minimum combination ratio. The maximum number of indoor units on a Multi V Water Mini ARWN053GA2 heat pump system is nine (9).

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

Table 8: Multi V Water Mini Liquid Refrigerant Pipe Design Limitations.

Pipe Length (ELF = Equivalent Length of pipe in Feet)	**Longest total equivalent piping length**	≤475.7 feet
	Longest distance from water source unit to indoor unit	230 feet (Actual) 295.2 feet (Equivalent)
	Distance between fittings and indoor units	≥20 inches
	Distance between fittings and Y-branches	≥20 inches
	Distance between two Y-branches	≥20 inches
	Distance between Header and indoor units	≥20 inches
	Minimum distance between indoor unit to any Y-branch	3 feet from indoor unit to Y-branch
	Maximum distance between first Y-branch to farthest indoor unit	≤131 feet
Elevation (All Elevation Limitations are Measured in Actual Feet)	**Water-source unit above or below indoor unit**	≤98.4 feet
	Between any two indoor units	≤49 feet

Table 9: Equivalent Piping Length for Y-branches, Headers, and Typical Refrigeration Elbows.

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

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

Selecting Field-Supplied Copper Piping

Note:

Always follow local codes when selecting and installing copper pipe and piping system components.

Approved piping for use with Multi V products will be marked "R410 RATED" along the length of the pipe. Piping wall thickness must meet local code requirements and be approved for a maximum operating pressure of 551 psi. When bending piping, try to keep the number of bends to a minimum, and use the largest radii possible to reduce the equivalent length of installed piping; also, bending radii greater than ten (10) piping diameters can minimize pressure drop. Be sure no traps or sags are present.

For Heat Pump Systems

LG prefers the use of ACR hard drawn copper for all pipe segments in the piping system except segments located between Y-branch fittings (or header fittings) and indoor units.

Note:

Always properly support the piping as per the instructions under "Pipe Supports" later in this section.

Table 10: ACR Rated Copper Tubing Material.

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

Table 11: ACR Rated Piping Wall 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 or Soft ACR Rated for R410A			Rigid or Soft ACR Rated for R410A					
Min. Bend Radius (in)	0.563	0.9375	1.5	2.25	3.0	3.0	3.5	4.0	4.5
Min. Wall Thickness (in)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05

Table 12: ACR Copper Tubing Dimensions and Physical Characteristics[1-3]

Nominal Pipe Outside Diameter (in)	**Actual Outside Diameter (in)**	**Drawn Temper**			**Annealed Temper**		
		Nominal Wall Thickness (in)	**Weight (lb/ft)**	**Cubic ft per Linear ft**	**Nominal Wall Thickness (in)**	**Weight (lb/ft)**	**Cubic ft per Linear ft**
1/4	0.250	--	--	--	0.030	0.081	.00020
3/8	0.375	0.030	0.126	.00054	0.032	0.134	.00053
1/2	0.500	0.035	0.198	.00101	0.032	0.182	.00103
5/8	0.625	0.040	0.285	.00162	0.035	0.251	.00168
3/4	0.750	0.042	0.362	.00242	0.042	0.362	.00242
7/8	0.875	0.045	0.455	.00336	0.045	0.455	.00336
1-1/8	1.125	0.050	0.655	.00573	0.050	0.655	.00573

[1]All dimensions provided are in accordance with ASTM B280 – Standard.
[2]Design pressure = 551 psig.
[3]The Copper Tube Handbook, 2010, Copper Development Association Inc., 260 Madison Avenue, New York, NY 10016.

Note:

- *Commercially available piping often contains dust and other materials. Always blow it clean with a dry inert gas.*
- *Prevent dust, water or other contaminants from entering the piping during installation.*

COPPER EXPANSION AND CONTRACTION

Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of an LG HVAC system can vary as much as 180°F. With this large variance in pipe temperature, the designer must consider pipe expansion and contraction to avoid pipe and fitting fatigue failures.

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

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

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

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

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

1. From the table "Linear Thermal Expansion of Copper Tubing in Inches," find the row corresponding with the actual length of the straight pipe segment.

2. Estimate the minimum and maximum temperature of the pipe. Typical pipe temperature change ranges:

• Heat Pump Systems include Vapor: ambient temperature to 215°F; Liquid pipe: ambient, 80°F, 110°F.

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

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

General Example:

A system is installed and the design shows that there is a 260 feet straight segment of piping between a Y-branch and an indoor unit. The system operates 24 hours per day. In heating, this pipe transports hot gas vapor to the indoor units at 120°F. In cooling, the same pipe (Heat Pump systems) is a suction line returning refrigerant vapor to the outdoor unit at 40°F. Look up the copper piping expansion at each temperature using the table "Linear Thermal Expansion of Copper Tubing in Inches," and calculate the difference.

Heat Pump System Vapor Line

Transporting Hot Vapor: 260 ft. pipe at 120°F = 3.64 in.

Transporting Suction Vapor: 260 ft. pipe at 40°F = 1.04 in.

Anticipated Change in Length: 3.64 in. – 1.04 in. = 2.60 in.

Heat Pump System Liquid Line

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

When creating an expansion joint, the joint depth must 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 the table "Coiled Expansion Loops and Offsets (Plan View)." 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.

COPPER EXPANSION AND CONTRACTION

See table below for precalculated anticipated expansion for various pipe sizes and lengths of refrigerant tubing.

To find the anticipated expansion value:

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

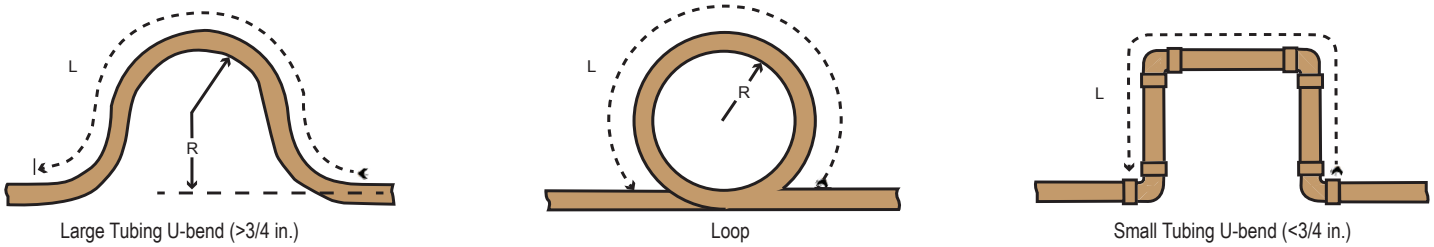
Table 13: Linear Thermal Expansion of Copper Tubing in Inches.

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.

COPPER EXPANSION AND CONTRACTION

Figure 13: Coiled Expansion Loops and Offsets.



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

Table 14: Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets.

Anticipated Linear Expansion (LE) (in)		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

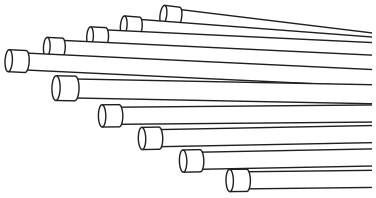
[1]R = Centerline Length of Pipe.
[2]L = Centerline Minimum Radius (inches).

Piping Handling

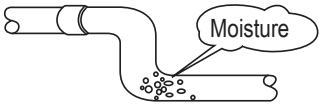
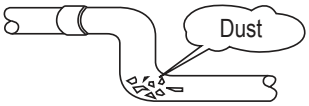
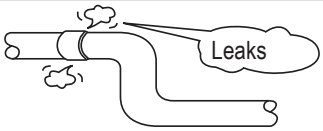
Pipes used for the refrigerant piping system must include the specified thickness, and the interior must be clean.

While handling and storing, ⃠ do not bend or damage the pipes, and take care not to contaminate the interior with dust, moisture, etc.

Keep Pipes Capped While Storing.



Keep refrigerant pipe dry, clean, and airtight.

	Dry	Clean	Airtight
	No moisture should be inside the piping.	No dust should be inside the piping.	No leaks should occur.
			
Possible Problems	- Significant hydrolysis of refrigerant oil. - Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly. - EEVs, capillary tubes are clogged.	- Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly. - EEVs and capillary tubes become clogged.	- Refrigerant gas leaks / shortages. - Refrigerant oil degradation. - Poor insulation of the compressor. - System does not operate properly.
Solutions	- Remove moisture from the piping. - Piping ends should remain capped until connections are complete. - ⃠ Do not install piping on a rainy day. - Connect piping properly at the unit's side. - Remove caps only after the piping is cut, the burrs are removed, and after passing the piping through the walls. - Evacuate system to a maximum of 500 microns and insure the vacuum holds at that level for 1 hour.	- Remove dust from the piping. - Piping ends should remain capped until connections are complete. - Connect piping properly at the side of the unit. - Remove caps only after the piping is cut and burrs are removed. - Retain the cap on the piping when passing it through walls, etc.	- Test system for air tightness. - Perform brazing procedures that comply with all applicable standards. - Perform flaring procedures that comply with all applicable standards. - Perform flanging procedures that comply with all applicable standards. - Ensure that refrigerant lines are pressure tested to 550 psig and hold for 24 hours.

Proper system operation depends on the installer using utmost care while assembling the piping system. The following pages are an overview of best practices when installing the refrigerant piping system.

Note:

LG Electronics U.S.A.,Inc., is not responsible for any piping calculations, refrigerant leaks, degradation of performance, any other potential problems or damages caused by the interconnecting piping, their joint connections, isolation valves, or introduced debris inside the piping system.

⃠ No Pipe Size Substitutions

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

⃠ No In-line Refrigeration Components

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

Field-Provided Isolation Ball Valves

LG maintains a neutral position on using isolation valves in VRF refrigerant piping systems. LG does not endorse any manufacturer of isolation valves. It is recognized that installing isolation valves could simplify future maintenance requirements, and, if used, considerations must be taken including, but not limited to, the following:

- Pressure drops for any component used, including isolation valves, must be known in equivalent pipe length and calculated into the total and segment equivalent piping lengths and compared to product design limitations.
- In all cases, materials must be suitable for the application and any applicable codes, including, but not limited to, diameter and wall thickness continuity per ACR standards.

Failure to do so will cause significant performance degradation. Proper leak checks must be performed. Using isolation valves does not automatically void any LG product warranty, however, a limited warranty will be voided in whole or part if any field supplied accessory fail in any way that causes product failure.

Using Elbows

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

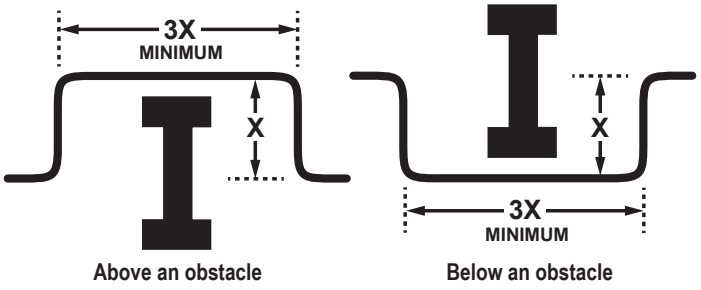
Pipe Bends

When bending soft copper, use long radius bends. Refer to the “Radii of Coiled Expansion Loops and Developed Lengths of Expansion Offsets” table for minimum radius specifications.

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 length of the horizontal section of pipe above or below the obstacle be a minimum of three (3) times the longest vertical rise (or fall) at either end of the segment.

Figure 19: Installing Piping Above and Below an Obstacle.



Pipe Supports

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

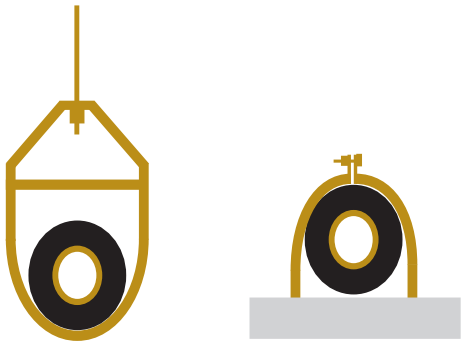
Pipe supports must ⃠ never touch the pipe wall; supports must be installed outside (around) the primary pipe insulation jacket. Insulate the pipe first because pipe supports must be installed outside (around) the primary pipe insulation jacket. Clevis hangers must be used with shields between the hangers and insulation. Field provided pipe supports must 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 in the confines of the support 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 must meet local codes. If local codes do not specify pipe support spacing, pipe must be supported:

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

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

Figure 14: Pipe Hanger Details.



Note:

Use a 4" + long sheet curved sheet metal saddles between hanger bracket and insulation to promote linear expansion/contraction.

Figure 15: Typical Pipe Support Location—Change in Pipe Direction.

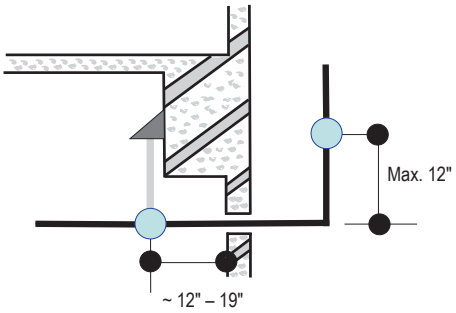


Figure 16: Pipe Support at Indoor Unit.

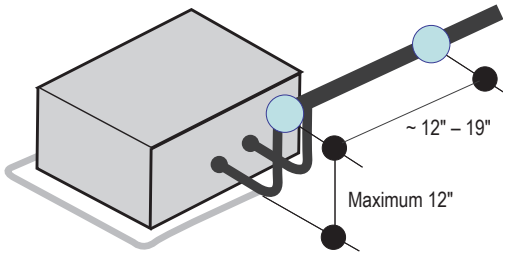


Figure 17: Pipe Support at Y-branch Fitting.

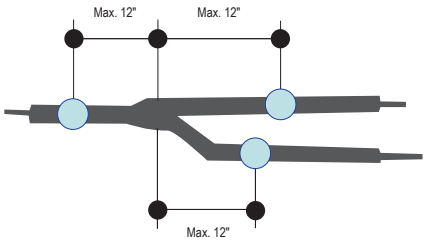
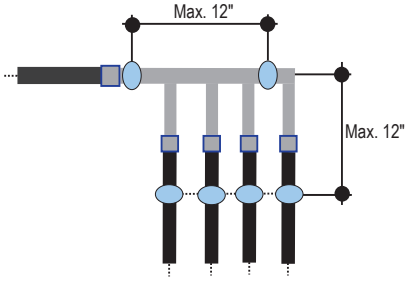


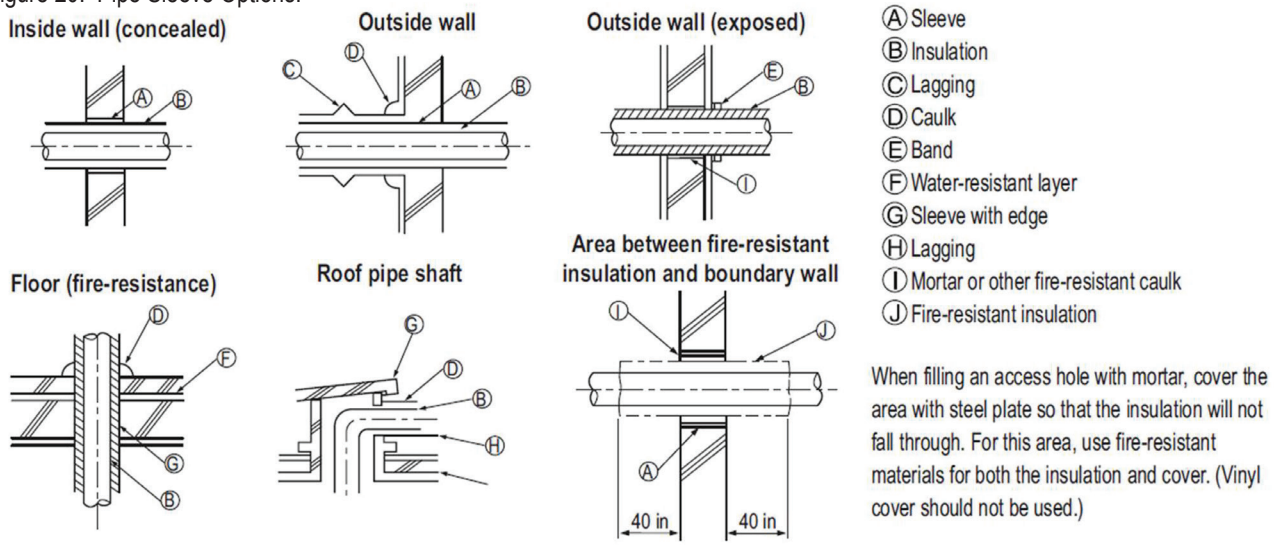
Figure 18: Pipe Support at Header Fitting.



Pipe Sleeves at Penetrations

LG recommends 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 promote free movement of the pipe within the sleeve. Use 4"+ curved sheet metal saddles between the bottom surface of the pipe and the bottom surface of the penetration.

Figure 20: Pipe Sleeve Options.



Note:

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

Underground Refrigerant Piping

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

Table 15: Utility Conduit Sizes.

Liquid Pipe[1]	Vapor Pipe[1]			
	3/8 (2.0[2,5])	1/2 (2.0[2,5])	5/8 (2-1/8[2,5])	3/4 (2-1/4[2,5])
1/4 (1.0)[3]	4	4	4	4
3/8 (1-1/8)[3]	4	4	4	5
1/2 (1-1/2)[4]	5	5	5	5
5/8 (1-5/8)[4]	5	5	5	5
3/4 (1-3/4)[4]	5	5	5	5

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

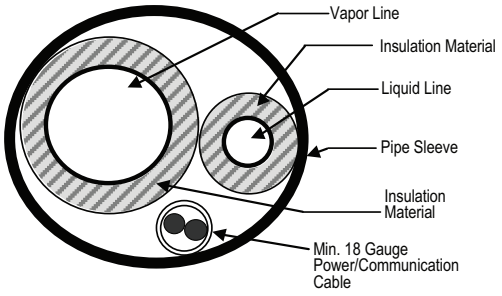
[2]Diameter of pipe with insulation. Thickness of pipe insulation is typical. Actual required thickness will vary based on surrounding ambient conditions and must be calculated and specified by the design engineer.

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

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

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

Figure 21: Typical Arrangement of Refrigerant Pipe and Cable(s) in a Utility Conduit.



Note:

Provide expansion joints in long pipe segments and place in an accessible conduit box for inspection. Use galvanized curved sheet metal saddles at all mounting points. Pipe must be allowed to move freely linearly.

Flaring and Brazing Procedures

One of the main causes of refrigerant leaks is a defective connection. For VRF systems, the installer needs to know how to perform both flared and brazed connections successfully.

Note:

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

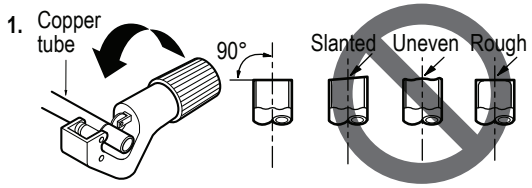
• ⃠ Do not use kinked pipe caused by excessive bending in one specific area on its length.

Flaring Procedure

Note:

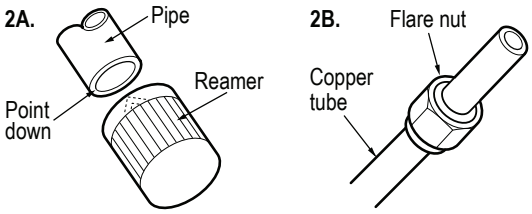
When selecting flare fittings, always use a 45° fitting rated for use with high pressure refrigerant R410A. Selected fittings must also comply with local, state, or federal standards.

1. Cut the pipe to length.
   - Measure the distance between the indoor unit and the outdoor unit.
   - Cut the pipes a little longer than measured distance.

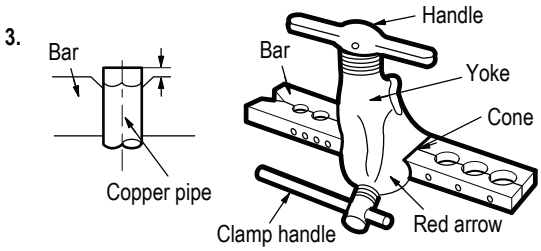


2A. Remove the burrs.
   - Completely remove all burrs from pipe ends.
   - When removing burrs, point the end of the copper pipe down to avoid introducing foreign materials in the pipe.

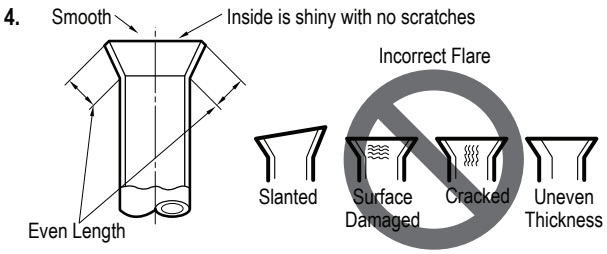
2B. Slide the flare nut onto the copper tube.



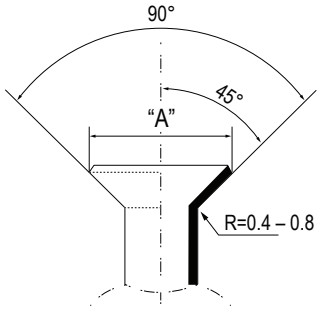
3. Flaring the pipe end.
   - Use the proper size flaring tool to finish flared connections as shown.
   - ALWAYS create a 45° flare when working with R410A.



4. Carefully inspect the flared pipe end.
   - Compare the geometry with the figure to the right
   - If the flare is defective, cut it off and re-do procedure.
   - If flare looks good, blow the pipe clean with dry nitrogen.



Dimensions of the Flare.



Flared Connection Dimensions / Tightening Torque.

Pipe Size (in. O.D.)	Outside Diameter (mm)	"A" Dimension (mm [in.])
1/4	6.35	~ 9.1 (11/32 - 23/64)
3/8	9.52	~ 13.2 (1/2 - 33/64)
1/2	12.7	~ 16.6 (41/64 - 21/32)
5/8	15.88	~ 19.7 (49/64 - 25/32)
3/4	19.05	-

Tightening the Flare Nuts

Tightening Torque for Flare Nuts.

Pipe Size (in. O.D.)	Outside Diameter (mm)	Tightening Torque (ft-lbs.)
1/4	6.35	13.0 - 18.0
3/8	9.52	24.6 - 30.4
1/2	12.7	39.8 - 47.7
5/8	15.88	45.4 - 59.3
3/4	19.05	71.5 - 87.5

1. When connecting the flare nuts, coat the flare (outside only) with polyvinyl ether (PVE) refrigeration oil only.

Note:

⃠ *Do not use polyolyester (POE) or any other type of mineral oil as a thread lubricant. These lubricants are not compatible with the PVE oil used in this system and create oil sludge leading to equipment damage and system malfunction.*

⃠ *Do not add any contaminants inside the refrigerant piping.*

2. Initially hand tighten the flare nuts using three (3) or four (4) turns.
3. To finish tightening the flare nuts, use both a torque wrench and a backup wrench.
4. After all the piping has been connected and the caps have been tightened, check for refrigerant gas leaks.

Loosening the Flare Nuts

Always use two (2) wrenches to loosen the flare nuts.

Brazing Procedure

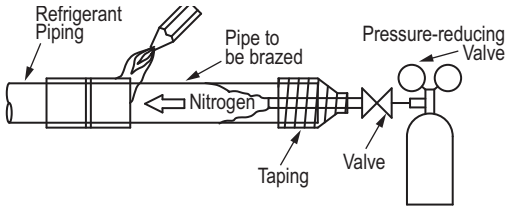
⚠WARNING

⃠ **Do not braze in an enclosed location.** ⃠ **Do not allow the refrigerant to leak during brazing. Always test for gas leaks before and after brazing.**
If the refrigerant combusts, it generates a toxic gas the will cause physical injury or death.

Note:

Braze the pipes to the service valve pipe stub of the outdoor unit.

Figure 22: Refrigerant Pipe Brazing.



1. All joints are brazed in the field. Multi V refrigeration system components contain very small capillary tubes, small orifices, electronic expansion valves, oil separators, 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.
2. Store pipe stock in a dry place; keep stored pipe capped and clean.
3. Blow clean all pipe sections with dry nitrogen prior to assembly.
4. Use adapters to assemble different sizes of pipe.
5. Always use a non-oxidizing material for brazing. ⃠ Do not use flux, soft solder, or anti-oxidant agents. If the proper material is not used, oxidized film will accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.
6. Use a tubing cutter, ⃠ do not use a saw to cut pipe. De-bur and clean all cuts before assembly.
7. Brazing joints:
   - Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
   - Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow.
   - Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

⃠ No Substitutions on Piping Components

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, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V Water Mini piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).

Install Correctly

- *Y-branches can be installed upstream between the header and the water source 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.*

Y-Branch Kits

LG Y-branch and 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. There is one type of Y-branch used in LG Water Mini systems: Y-branches used with the indoor units in the refrigerant piping system at each transition. ⃠ Field-supplied "T" fittings or "Y" branches will not be accepted. ⃠ Do not install Y-branches backwards; refrigerant flow cannot make U-turns through Y-branches. The equivalent pipe length of each Y-branch (1.6') must be added to each pipe segment entered into LATS piping design software.

LG Y-Branch Kits Consist of:

- One liquid line and one vapor line (two [2] total).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers.

Indoor Unit Y-Branches

Indoor unit Y-branches can be installed in horizontal or vertical configurations. When installed vertically, the straight-through leg must be within ±3° of plumb. When installed horizontally, the straight-through leg must be level, and the branch leg must be within ±5° of horizontal rotation.

Indoor unit Y-branches must always be installed with the single port end towards the outdoor unit, and the two-port end towards the indoor units. The first indoor unit Y-branch kit must be located no closer than at least three (3) feet from the outdoor unit. Provide a minimum of twenty (20) inches between a Y-branch and any other fittings or indoor units.

There is no limitation on the number of indoor unit Y-branches that can be installed, but there is a limitation on the number of indoor units connected to a single outdoor unit. It is recommended that when a Y-branch is located in a pipe chase or other concealed space, access doors must be provided for inspection access.

Figure 24: Indoor Unit Y-branch Vertical Installation Alignment Specifications.

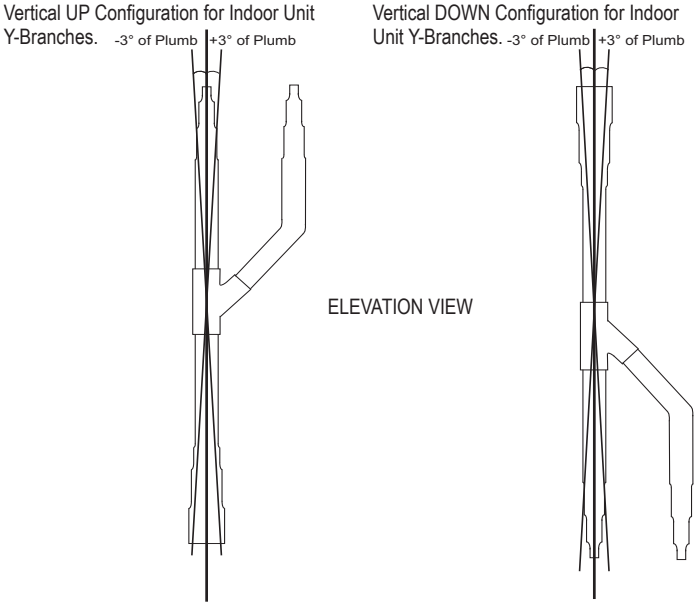


Figure 23: Indoor Unit Y-Branch Horizontal Configuration.

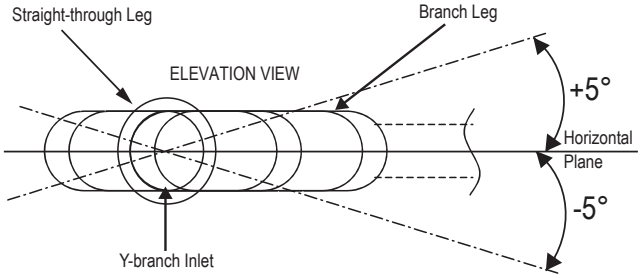
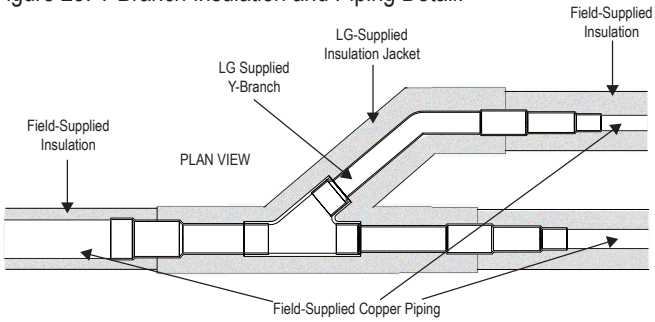


Figure 25: Y-Branch Insulation and Piping Detail.

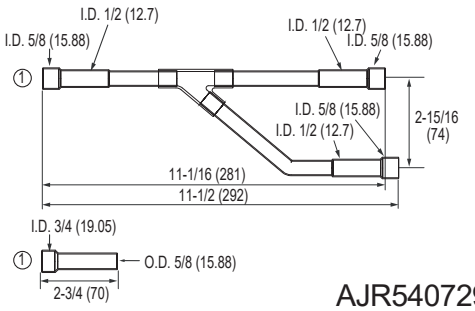
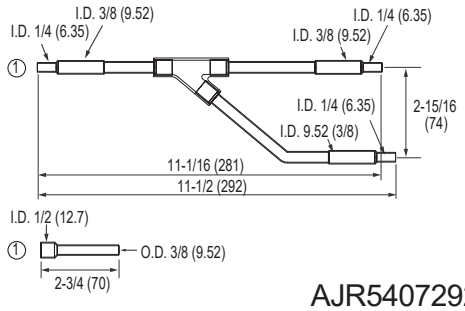
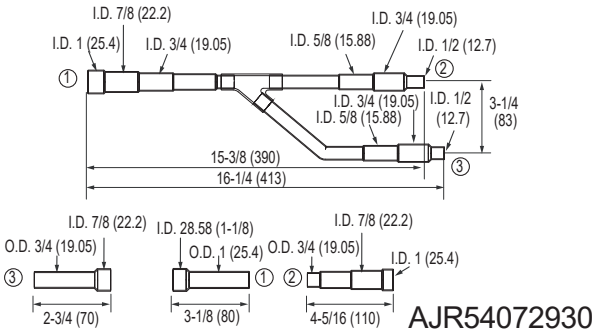
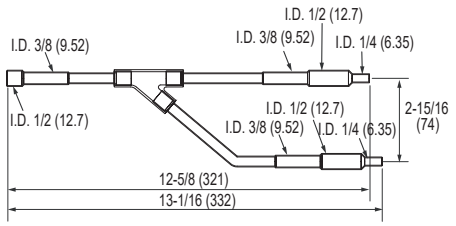


Indoor Unit Y-Branch Kits

Table 16: Indoor Unit Y-Branch Kit Model Nos.

	Model No.
Y-branches (for indoor unit connection)	ARBLN01621
	ARBLN03321

(Unit: Inch [mm])

Models	Pipe	
	Vapor Pipe	Liquid Pipe
ARBLN01621	 AJR54072929	 AJR54072927
	Vapor Pipe	Liquid Pipe
ARBLN03321	 AJR54072930	 AJR54072928

LG

⃠ No Substitutions on Piping Components

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, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V Water Mini piping system are 45° and 90° long radius elbows and full port ball valves (if applicable).

Install Correctly

- *Y-branches can be installed upstream between the header and the water source 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

LG 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. 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 can be more economical.

LG Header Kits Consist of:

- Two headers (one liquid line, one vapor line).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers—one for the liquid line and one for the vapor line.

Headers must be installed with the main pipe level in the horizontal plane. Distribution ports must be either level in the horizontal plane or within ±3° of plumb in the vertical plane.

When connecting indoor units to a Header, always connect the unit with the largest nominal capacity to the port closest to the water source unit. Then install the next largest indoor unit to the next port, working down to the smallest indoor unit. ⃠ Do not skip ports. All indoor units connected to a single Header fitting must be located with an elevation difference between indoor units that does not exceed 49 feet.

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 water-source unit and the Header fitting, and connect the elevated indoor unit to the Y-branch.

Figure 26: Header Kit—Horizontal Rotation Limit (Ports Must Point to a Horizontal Direction).

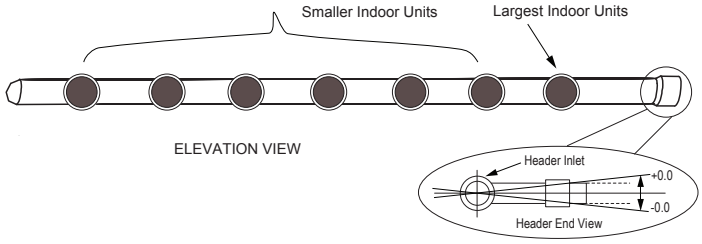


Figure 27: Vertical Header Insulation and Piping Detail (Ports Must Point to an Upright Direction).

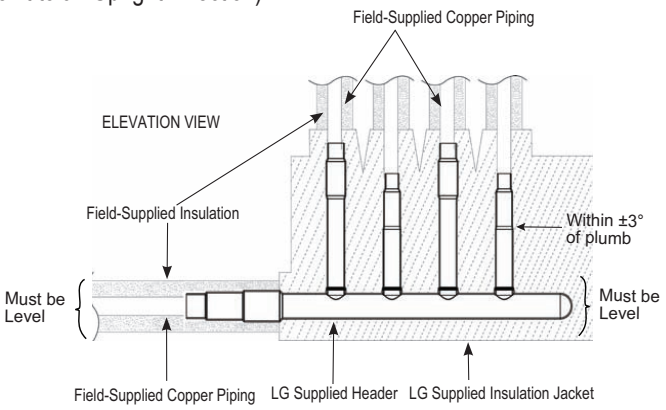


Figure 28: Incorrect Header Configuration.

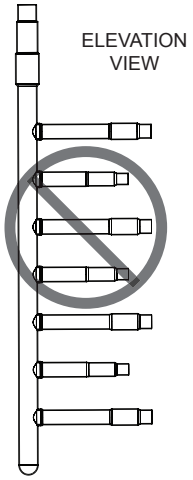
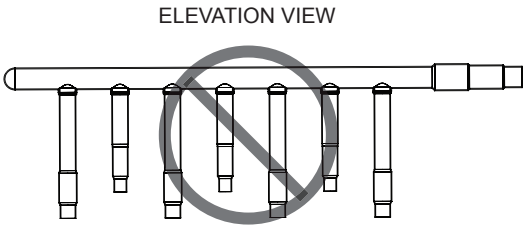


Figure 29: Incorrect Header Configuration (Ports Pointing Downward).

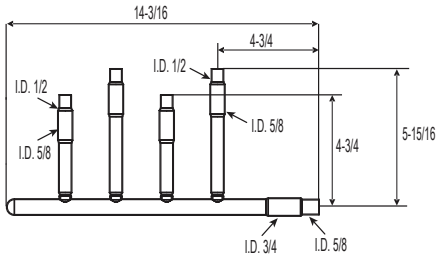
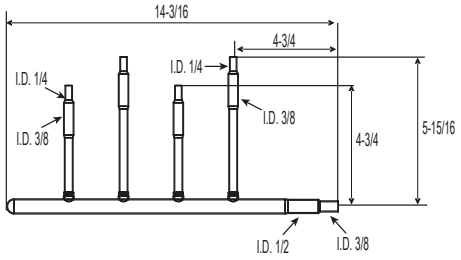
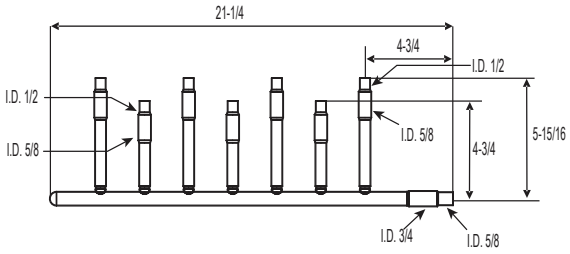
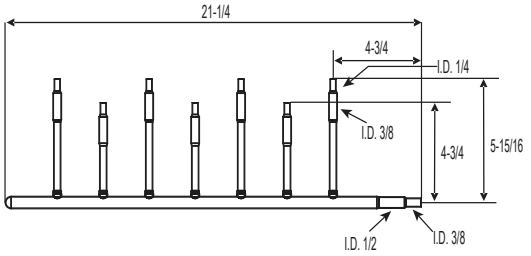
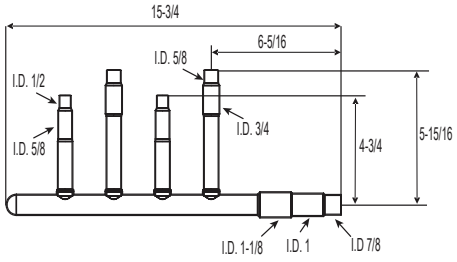
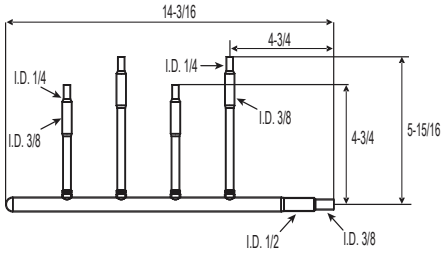
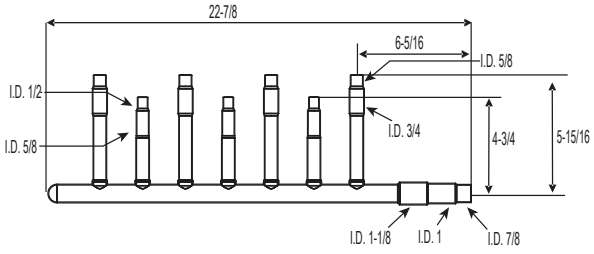
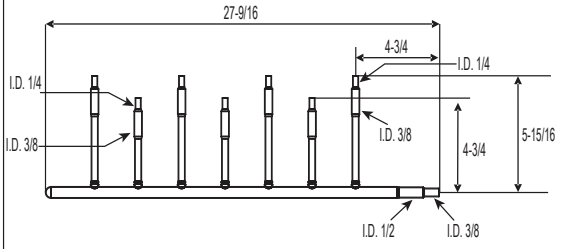


Headers

Table 17: Header Model Nos.

Headers	
Four Branch	**Seven Branch**
ARBL054	ARBL057
ARBL104	ARBL107

Unit: Inch

Models	Vapor pipe	Liquid pipe
4 branch ARBL054		
7 branch ARBL057		
4 branch ARBL104		
7 branch ARBL107		

LG

Sample Layouts

Note:

Images are for illustrative purposes only and are not accurate representations. For specific details on piping limitations and other refrigerant system rules, review the information in this entire piping section, see the Multi V Water Mini Engineering Manual, and follow the LATS diagram.

System Using Y-branches

Example: Five (5) indoor units connected

Water-Source Unit (WSU).

IDU: Indoor Units.

A: Main Pipe from Water-Source Unit to Y-branch.

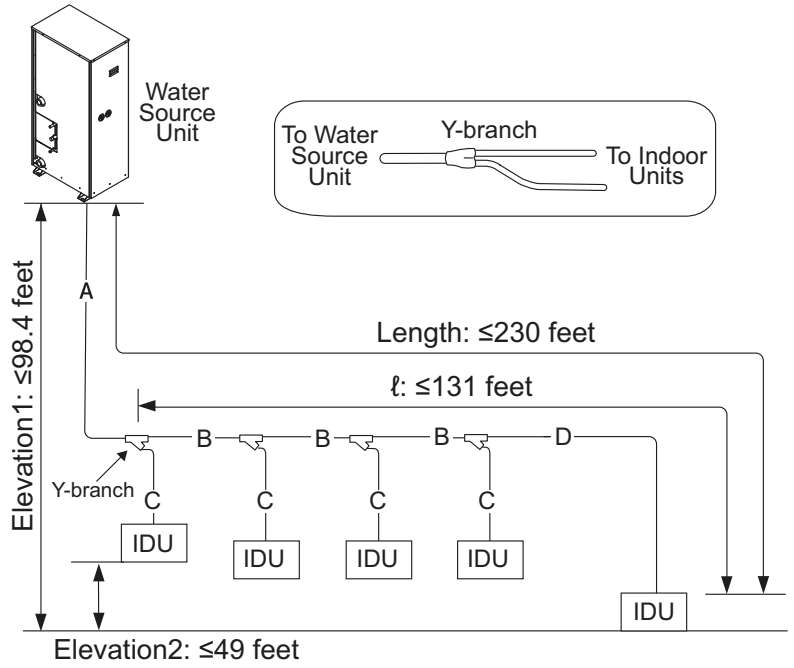
B: Y-branch to Y-branch.

C: Y-branch to Indoor Unit.

D: Y-branch to Farthest Indoor Unit.

Note:

- *Always reference the LATS software report.*
- *See pages 40-41 for refrigerant pipe diameter and pipe length tables.*



System Using a Header

Example: Six (6) indoor units connected

Water-Source Unit (WSU).

IDU: Indoor Units.

Header.

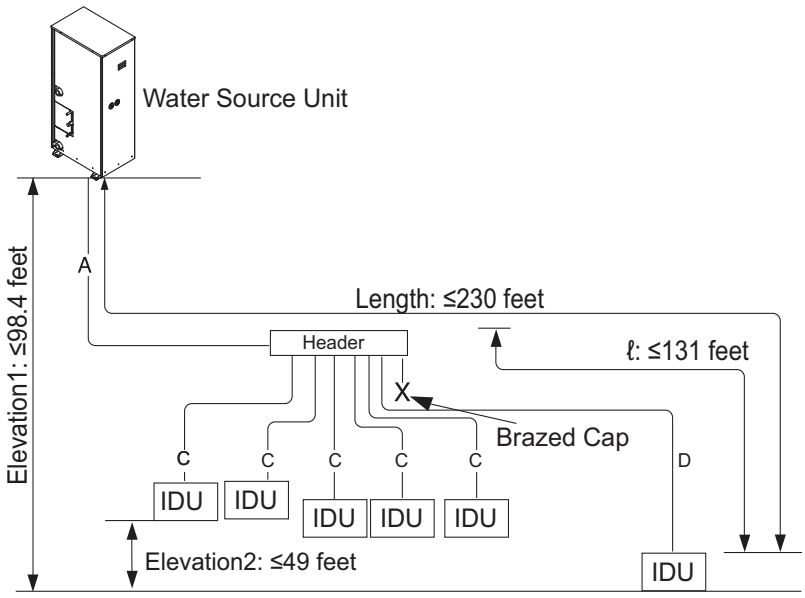
A: Main Pipe from Water-Source Unit to Header.

C: Header to Indoor Unit.

D: To Farthest Indoor Unit.

Note:

- *Indoor units should be installed at a lower position than the Header.*
- *Y-branch pipes cannot be used after Headers.*
- *Install the Header 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.*
- *See pages 40-41 for refrigerant pipe diameter and pipe length tables.*



INSTALLING THE REFRIGERANT PIPING

Sample Layouts

System Using Y-branches and Header

Example: Five (5) indoor units connected

Water-Source Unit (WSU).

IDU: Indoor Units.

Y-branches.

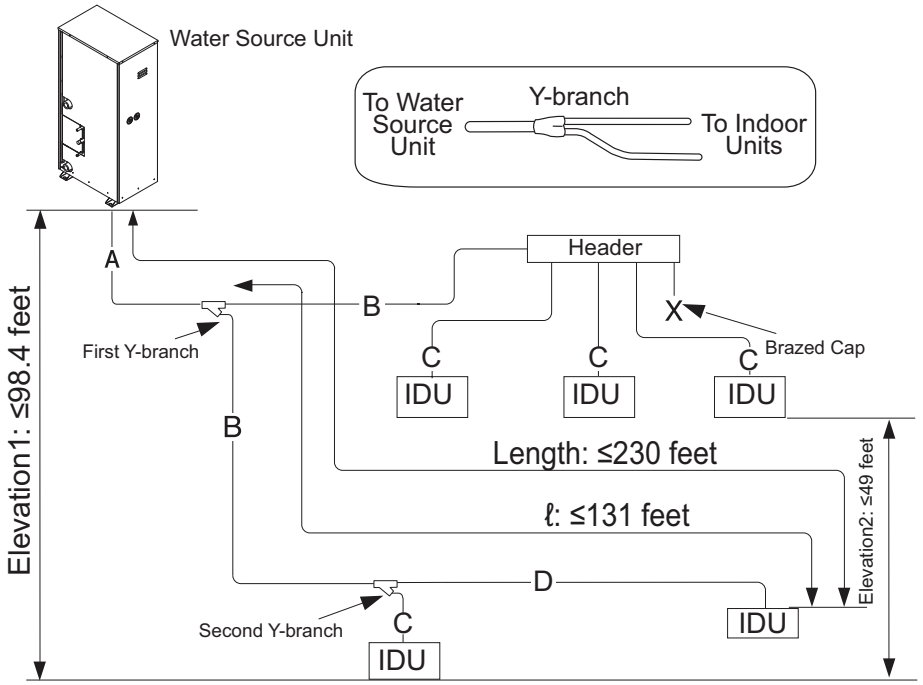
Header.

A: Main Pipe from First Y-branch.

B: Pipe from Y-branch to Y-branch or Header.

C: Pipe from Y-branch or Header to Indoor Unit.

D: Pipe to Farthest Indoor Unit.



Note:

- *Indoor units should be installed at a lower position than the Header.*
- *Y-branch pipes cannot be used after Headers.*
- *Install the Header 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 software report.*

Table 18: Pipe Capabilities.

Length	Total pipe length	Longest actual pipe length	Longest Equivalent pipe length[1]
	A + ΣB + ΣC + D ≤475.7 feet	A + B + D ≤230 feet	A + B + D ≤295.2 feet
ℓ	Longest pipe length after first branch		
	B + D ≤ 131 feet		
Elevation1	Elevation differential (Water-source unit ↔ Indoor unit)		
	≤ 98.4 feet		
Elevation2	Elevation differential (Indoor unit ↔ Indoor unit)		
	≤ 49 feet		
Distance between fittings and indoor units		≥20 inches	
Distance between fittings and Y-Branches		≥20 inches	
Distance between two Y-Branches		≥20 inches	
Distance between Header and indoor units		≥20 inches	

[1]For calculation purposes, assume equivalent pipe length of Y-branch is 1.6 feet, and equivalent pipe length of header is 3.3 feet.

Table 19: Refrigerant Pipe Diameter (B) from Y-branch to Y-branch / Header.

Downstream Total Capacity of IDUs (Btu/h)	Liquid Pipe (Inches O.D.)	Vapor Pipe (Inches O.D.)
≤19,100	Ø1/4	Ø1/2
≤ 54,600	Ø3/8	Ø5/8
≤76,400	Ø3/8	Ø3/4

Note:

- *Connection piping from branch to branch cannot exceed the main pipe diameter (A) used by the water-source unit.*
- *Y-branches and other header branches cannot be installed downstream of the initial header branch.*

Selecting the Refrigerant Piping Size

Example: Five (5) indoor units connected

Water-Source Unit (WSU).

IDU: Indoor Units.

A: Main Pipe from Water-Source Unit to Y-branches.

B: Branch Piping.

C: Branch Piping to Indoor Unit (IDU).

Figure 30: Selecting Refrigerant Piping.

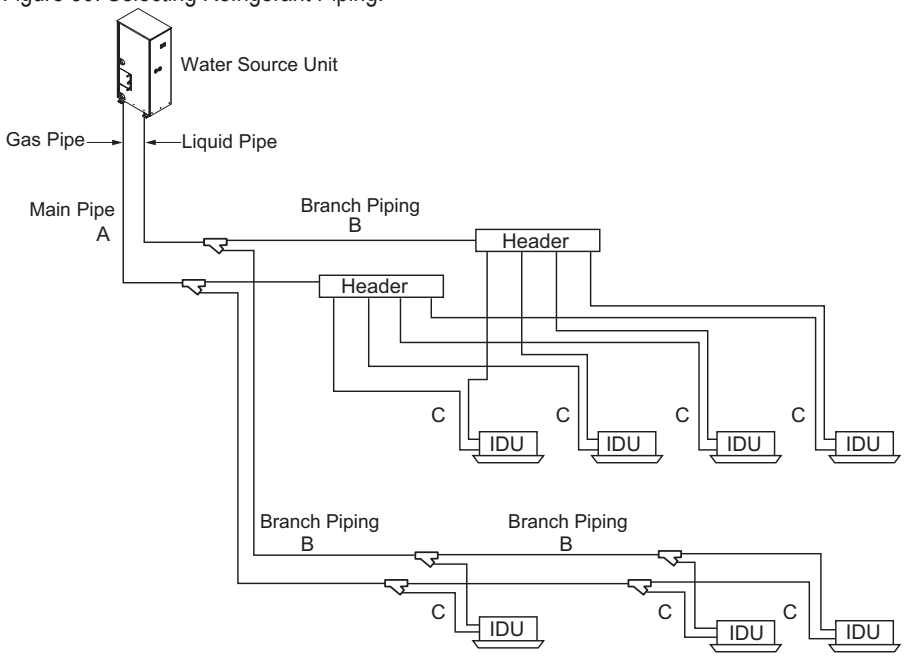


Table 20: Size of Main Pipe (A) (From Water-Source Unit to Y-branches).

Water-Source Unit Capacity (Btu/h)	Liquid Pipe (Inches O.D.)	Gas Pipe (Inches O.D.)
54,600	Ø3/8	Ø3/4

Table 21: Size of Branch Piping (B) to Branch Piping (B).

Indoor Unit Capacity (Btu/h)	Liquid Pipe (Inches O.D.)	Gas Pipe (Inches O.D.)
19,100	Ø1/4	Ø1/2
54,600	Ø3/8	Ø5/8

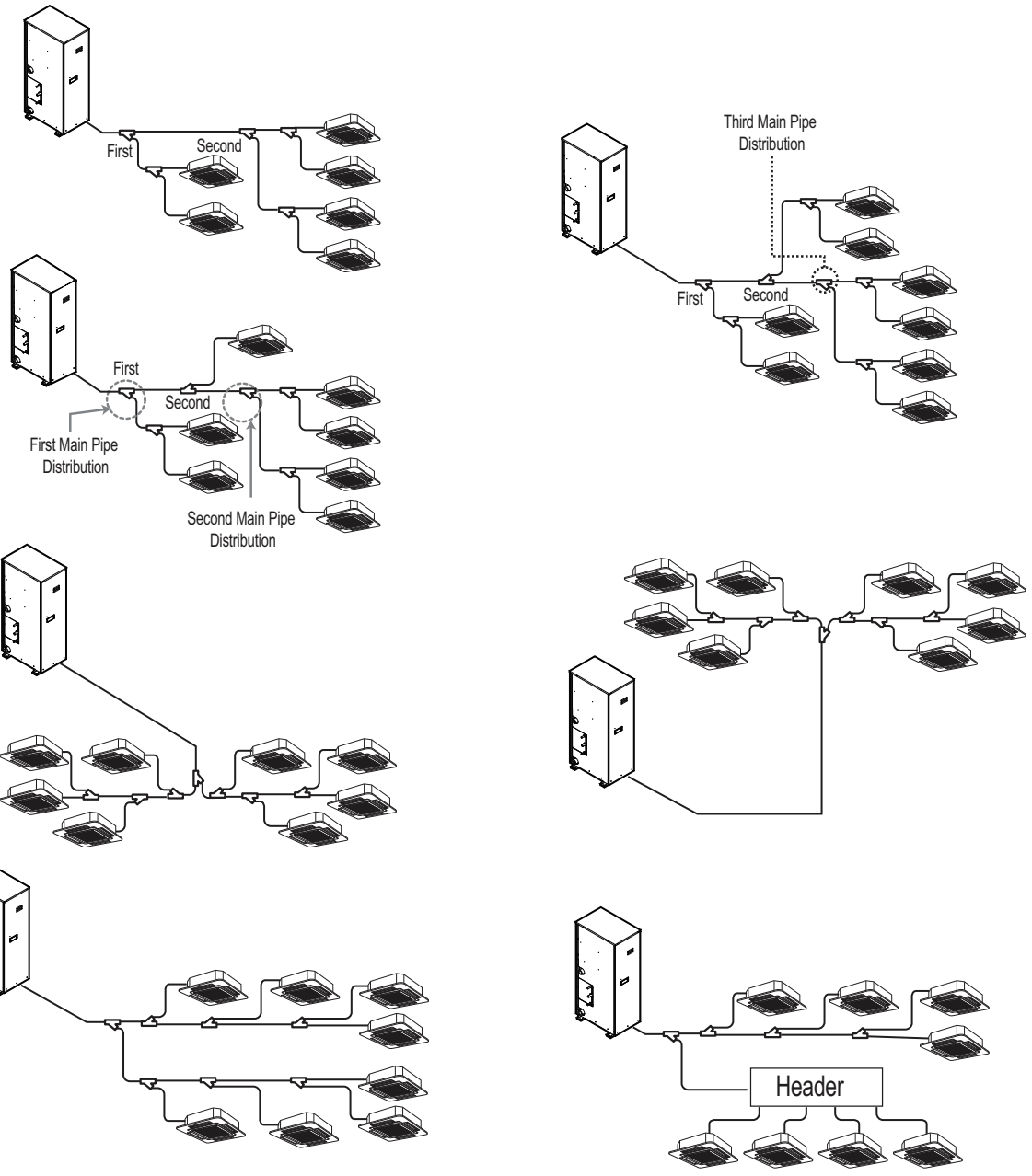
Table 22: Size of Branch Piping to Indoor Unit (C).

Indoor Unit Capacity (Btu/h)	Liquid Pipe (Inches O.D.)	Gas Pipe (Inches O.D.)
19,100	Ø1/4	Ø1/2
54,600	Ø3/8	Ø5/8

INSTALLING THE REFRIGERANT PIPING

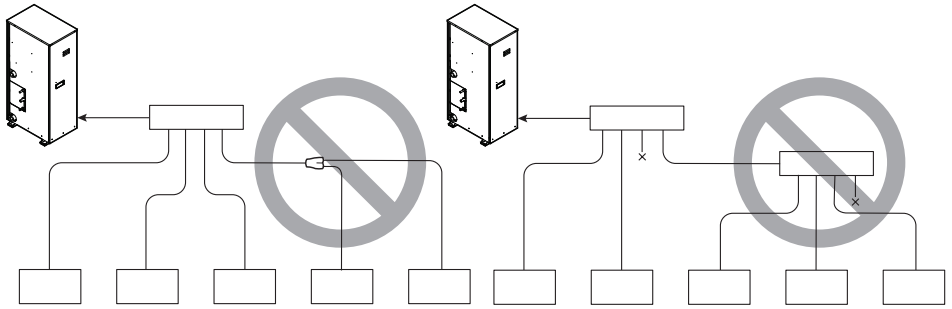
Sample Layouts

Various Acceptable Layouts



Unacceptable Piping System Layouts

A second branch cannot be installed after a header.



Piping Connections

Before connecting the piping:

- Remove the front panel.
- Check the pipes (liquid and vapor).

Water Mini Unit Service Valves

1. Field piping.
2. Ball type service valves with caps. Remove the caps and operate valves.
3. Schrader valves.
4. Liquid pipe.
5. Vapor pipe.
6. Field-supplied 90° elbow.

Note:

⃠ Do not expose the service valves of the water source unit to heat. Protect the service valve with a wet towel during brazing.

Operating the Service Valves

1. Loosen or tighten the flare nut by using a torque wrench and backup wrench. Coat the flare connection with polyvinyl ether (PVE) refrigeration oil.
2. Remove service valve cap. To operate the shutoff valve, turn ball valve stem 90° using an open-end wrench. Always backseat the valve. After operation, always replace the caps (Tightening torque of service valve cap = 18.0 lb-ft). Closed should be perpendicular to pipe; open should be parallel to pipe.
3. Evacuate the system, and then charge the refrigerant using the Schrader valve. Re-attach the Schrader valve cap after servicing is complete. (Tightening torque of service cap: =10.0 lb-ft).

Figure 31: Water Mini Unit Front Panel.

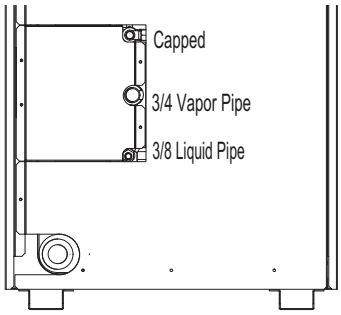


Figure 32: Service and Schrader Valve Detail.

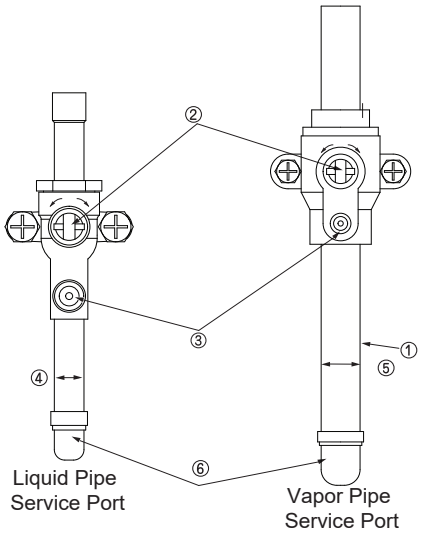
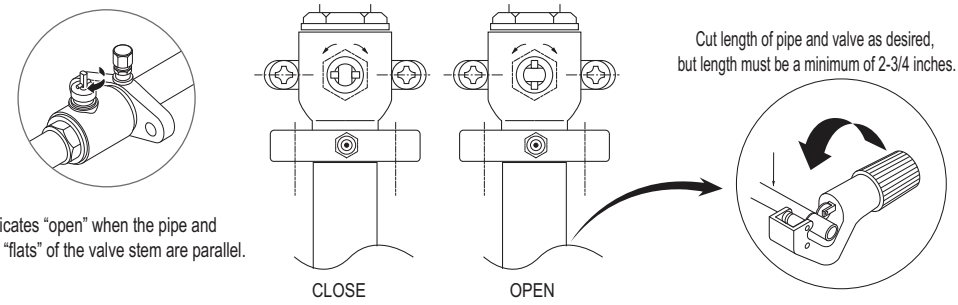


Figure 33: Service Valves - Open and Closed Positions.



⚠ WARNING

- *Water Mini units ship with a factory charge of refrigerant. Always take extreme caution to prevent refrigerant gas (R410A) from leaking during use, around fire or flame, and during brazing. If the refrigerant gas comes in contact with a flame from any source, it will break down and generate a poisonous gas. ⃠ Do not braze in a small room, or a room that is not ventilated. Physical injury or death can occur.*
- *After refrigerant piping work is complete, verify that the service ports and caps are securely tightened to prevent leaking refrigerant gas. Verify the system is free of leaks after refrigerant piping installation is complete. Exposure to high concentration levels of refrigerant gas will lead to illness or death.*
- *⃠ Do not attempt to remove the service valve stem. Physical injury or death will occur from the uncontrolled rapid release of refrigerant.*

Note:

- *Before connecting the refrigerant piping, make sure the service ports and caps are completely closed..*
  ⃠ Do not open the service port valves or attempt to operate the system until the refrigerant pipe system installation has been completed.
  ⃠ Never open the valves before a pressure test is performed, a leak test performed, the system is evacuated, and the Commissioning Agent provides authorization to do so.⃠ Do not use polyolester (POE) or any other type of mineral oil as a thread lubricant. If introduced to the refrigerant circuit, it will create oil sludge leading to system malfunction. Use PVE (polyvinyl ether) type refrigeration oil only.
- *Protect the liquid and vapor piping / ports with a wet towel during brazing.*
- *Use a 15% silver phosphorous copper brazing alloy to avoid overheating and produce good flow. ⃠ Do not use flux, soft solder, or anti-oxidant agents. If the proper material is not used, oxidized film will accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.*
- *When brazing the field-supplied refrigerant piping to the outdoor unit connections, flow 3 psig nitrogen into the piping. If nitrogen was not flowed during brazing, the piping will oxidize and cause membranes to form, which will negatively impact valve and condenser operation.*

Note:

For information regarding insulation for underground or penetration situations, see the "General Refrigerant Piping System Information" section.

Refrigerant Piping System Insulation

All refrigerant piping from the water-source unit to the indoor units must be insulated correctly for safety and usage. Y-branch connections, header branch connections, refrigerant piping, field-provided isolation ball valves (if present), service valves, and elbows must be properly and completely insulated using closed-cell pipe insulation (up to the indoor unit piping connections). To prevent heat loss / heat gain through the refrigerant piping, all refrigerant piping including liquid lines and vapor lines must be insulated separately. Insulation must be a minimum 1/2 inches thick, and thickness may need to be increased based on ambient conditions and local codes. Table on next page lists minimum wall thickness requirements for Ethylene Propylene Diene Methylene (EPDM) insulation.

Inside the water-source unit, maximum pipe temperature is 248°F and minimum pipe temperature is -40°F. For field insulation of refrigerant piping between the water-source unit and indoor units, consider the following pipe temperature ranges for an operating heat pump system:

- Heating mode refrigerant temperature ranges: Liquid, 75-118°F; High Pressure Vapor, 95-220°F
- Cooling mode refrigerant temperature ranges: Liquid, 75-118°F; Low Pressure Vapor, 40-90°F

All insulation joints must be glued with no air gaps. Insulation material must 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 must 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 and headers are shipped from the factory with pre-formed peel-and-stick foam insulation jackets, with a 1.84 lb./ft.^{3} density, 1/2 inch thickness, and meet UL94 MF-1 flammability.

The design engineer must perform calculations to determine if the factory-supplied insulation jackets are sufficient to meet local codes, and to 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 clamshell jacket over the fitting.

Figure 34: Typical Pipe Insulation, Power Wire and Communications Cable Arrangement.

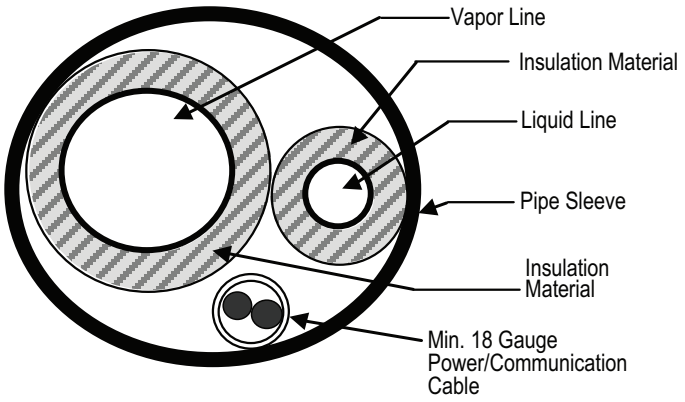


Figure 35: Typical Insulation Butt-Joint at Indoor Unit Casing.

Figure 36: Typical Refrigerant Flare Fitting Insulation Detail.

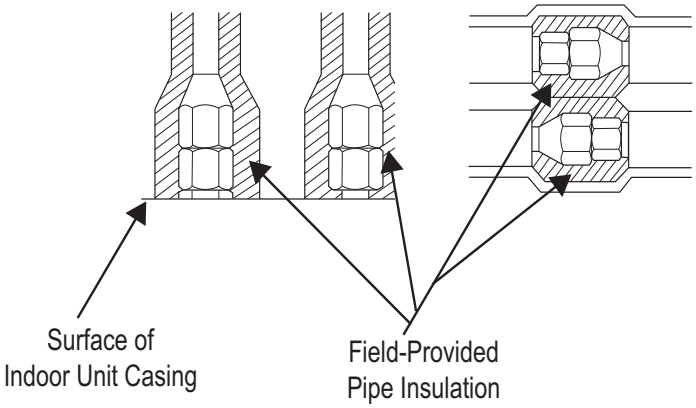
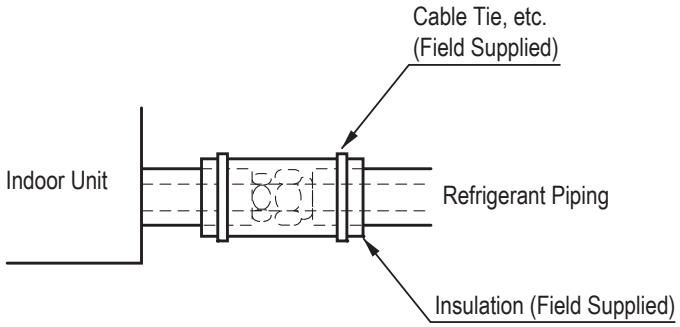


Figure 37: Insulating the Shut Off / Isolation Ball Valve (If Present).



Note:

- ⃠ *Do not insulate gas and liquid pipes together as this can result in pipe leakage and malfunction due to extreme temperature fluctuations.*
- *Always properly insulate the piping. Insufficient insulation will result in condensation, reduced heating/cooling performance, etc. Also, if the pipes aren't insulated properly, condensation could potentially cause damage to building finishes. Pay special attention to insulating the pipes installed in the ceiling plenum.*
- *Fully insulate the piping connections.*
- *Follow local codes and the designer's instructions when selecting ethylene propylene diene methylene (EPDM) insulation wall thickness.*

Table 23: Minimum Refrigerant Pipe EPDM Insulation Wall Thickness Requirements.[1]

<table>
<tr><th colspan="2" rowspan="2">Classification / Piping O.D.</th><th colspan="2">Air-conditioned location</th><th colspan="2">Non-air conditioned location</th></tr>
<tr><th>1. Typical Conditioned Location</th><th>2. Special Conditioned Location</th><th>3. Typical Unconditioned Location</th><th>4. Special Unconditioned Location</th></tr>
<tr><td rowspan="2">Liquid pipe</td><td>ø1/4 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td><td rowspan="2">>1/2 inches</td></tr>
<tr><td>ø3/8 inches</td></tr>
<tr><td></td><td>≥ø1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td><td>>1/2 inches</td></tr>
<tr><td rowspan="12">Vapor pipe</td><td>ø3/8 inches</td><td rowspan="6">>1/2 inches</td><td rowspan="7">>3/4 inches</td><td rowspan="7">>3/4 inches</td><td rowspan="12">>1 inch</td></tr>
<tr><td>ø1/2 inches</td></tr>
<tr><td>ø5/8 inches</td></tr>
<tr><td>ø3/4 inches</td></tr>
<tr><td>ø7/8 inches</td></tr>
<tr><td>ø1 inch</td></tr>
<tr><td>ø1-1/8 inches</td><td rowspan="6">>3/4 inches</td><td rowspan="6">>1 inch</td><td rowspan="6">>1 inch</td></tr>
<tr><td>ø1-1/4 inches</td></tr>
<tr><td>ø1-3/8 inches</td></tr>
<tr><td>ø1-1/2 inches</td></tr>
<tr><td>ø1-3/4 inches</td></tr>
</table>

[1]The thickness of the above insulation material is based on heat conductivity of 0.61 Btu/in/h/ft²/°F.

1. Typical Conditioned Location

A building plenum or space that contains conditioned air that does not exceed 80°F DB.

2. Special Conditioned Location

1. When the location is air conditioned, but there is severe temperature/humidity difference due to high ceilings.

• Church, auditorium, theater, lobby, etc.

2. When the location is air conditioned, but internal temperature/humidity are high

• Bathroom, swimming pool, locker room, etc.

3. Typical Unconditioned Location

An unconditioned space inside a building.

4. Special Unconditioned Location: If conditions 1 and 2 below are present.

1. An unconditioned space or plenum of a building.
2. An area where there is an elevated humidity level.

5. Additional Insulation for Indoor Units Will be Required in Humid Environments.

The air conditioner factory insulation has been tested according to "ISO Conditions with Mist," and it satisfies the requirements. If the system has been operating for a long time in a high humidity environment (dew point temperature: more than 73°F), condensate is likely to form. If this happens, install 3/8 inch thick EPDM insulation that is plenum-rated with a heat-resistance factor of more than 248°F.

Applying Insulation to Y-Branch and Header Fittings

LG Y-branches and Headers must be insulated with the clam-shell insulation jacket that is provided with each component. Check the fit of the insulation jacket after all pipes are brazed to fittings. Mark all pipes at the point where the insulation jacket ends. Remove the insulation jacket. Install field-supplied insulation on the pipe segments first, and then install the LG provided insulation plugs on the ends of all unused Header ports. Apply the clam-shell insulation on jackets to Y-branch and Header fittings last. Peel the adhesive glue protector slip from the insulation jacket and install the insulation jacket over the fitting.

Figure 38: Y-branch Insulation.

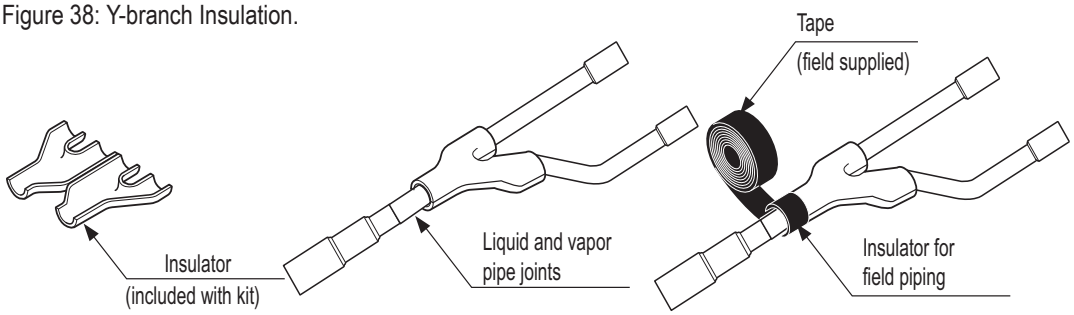


Figure 39: Header Insulation.

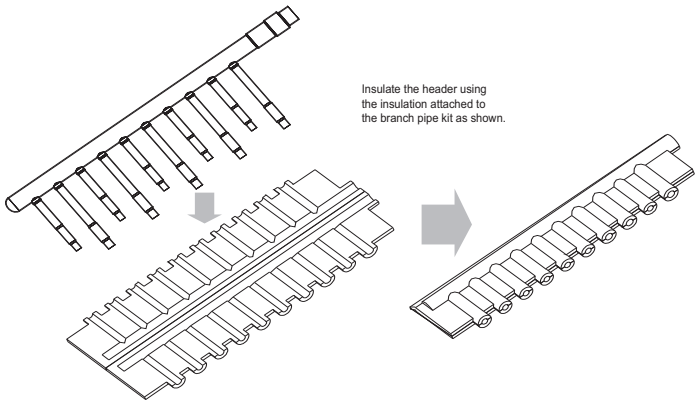


Figure 40: Joints between branch and pipe must be sealed with tape included in each kit.

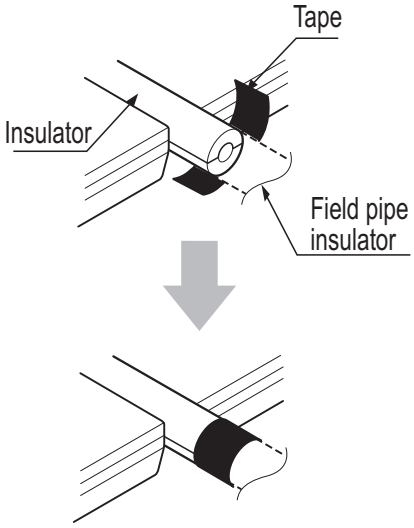
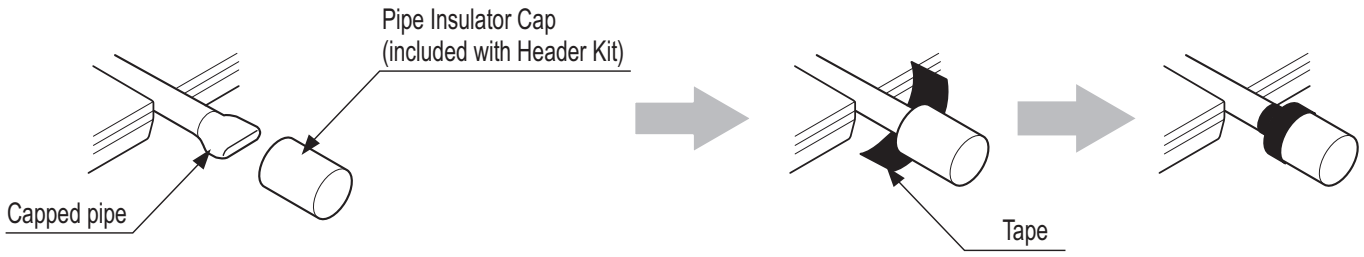


Figure 41: Capped pipes must be insulated using the cap included in each kit, and then taped as shown.



Note:

Additional Insulation for Y-Branches and Headers Will be Required in Humid Environments.

If the system has been operating for a long time in a high humidity environment (dew point temperature: more than 73°F), condensate is likely to form. If this happens, install 3/8 inch thick ethylene propylene diene methylene (EPDM) insulation that is plenum-rated with a heat-resistance factor of more than 248°F.

Design Steps

The Multi V Water Mini requires require a water cooling / heating source. This year-round heating and cooling system uses a two (2) pipe closed loop water circuit which circulates water continuously and maintains water temperature between 23°F and 113°F for cooling mode, 23°F and 113°F for heating mode. Variable water flow control kit (PRVC1) is required for all entering water temperatures; one kit per frame. See capacity tables provided in the Multi V Water Mini Engineering Manual for performance at different entering water temperatures. At the high end of this temperature range, heat is rejected through a cooling tower (dry cooler or geothermal well), while at the low end of the temperature range an auxiliary heat source like a boiler, solar panel, or geothermal well adds heat. If entering water temperature falls below 42°F, glycol must be added to the system.

Piping, pumps, and accessories shall be sized to provide adequate water flow to the water cooled unit based on nominal flow rates listed per model number.

Design Schematic

The Multi V Water Mini units have factory installed stainless steel plate heat exchangers. In order to protect these heat exchangers, it is recommended to use closed cooling towers. If open cooling towers or other open loop systems are used, an intermediate heat exchanger should be added to protect the water cooled unit from contaminants and debris in the water system that may foul or clog the heat exchanger. Open loop systems without an intermediate heat exchanger are not recommended due to risk of freezing, reduction of flow due to scaling or clogging, or other potential problems caused by improper water quality.

Figure 42: Cooling Cycle Diagram with Cooling Tower.

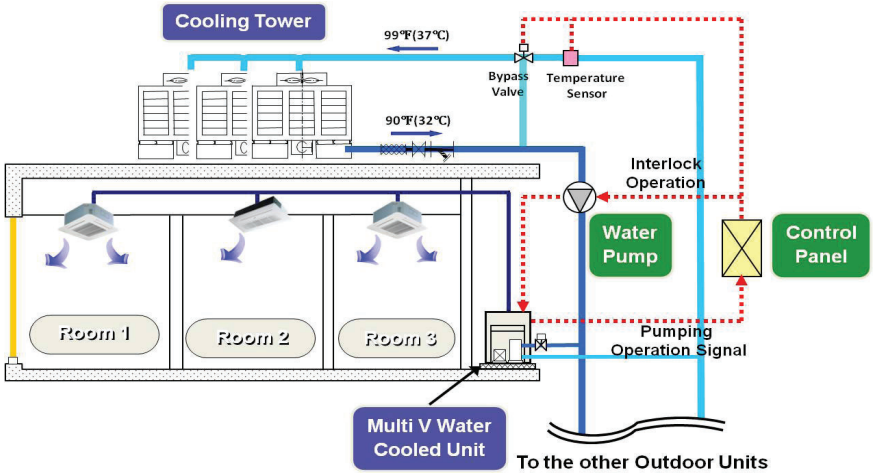
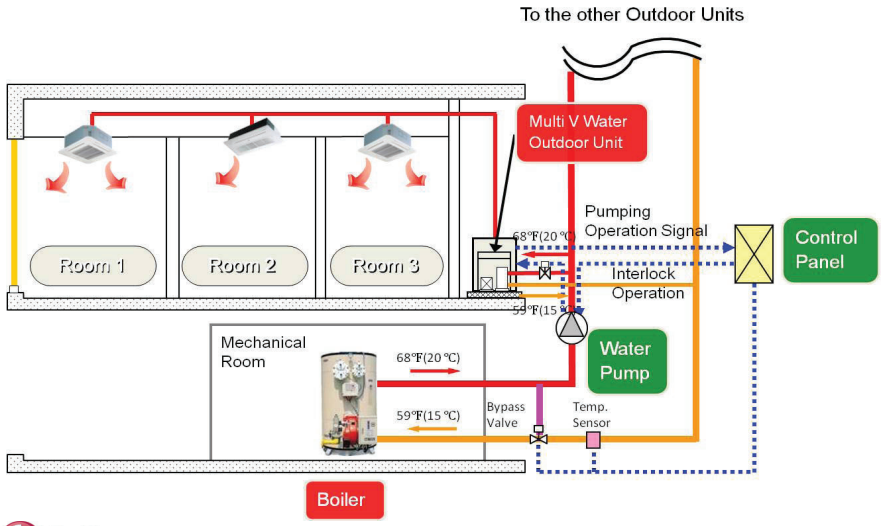


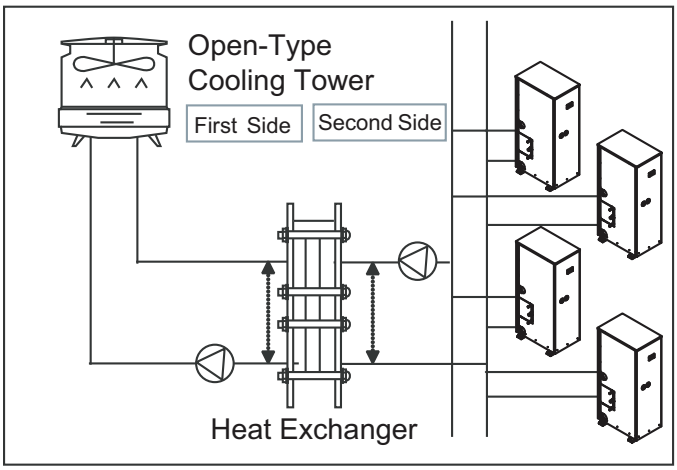
Figure 43: Heating Cycle Diagram with Boiler.

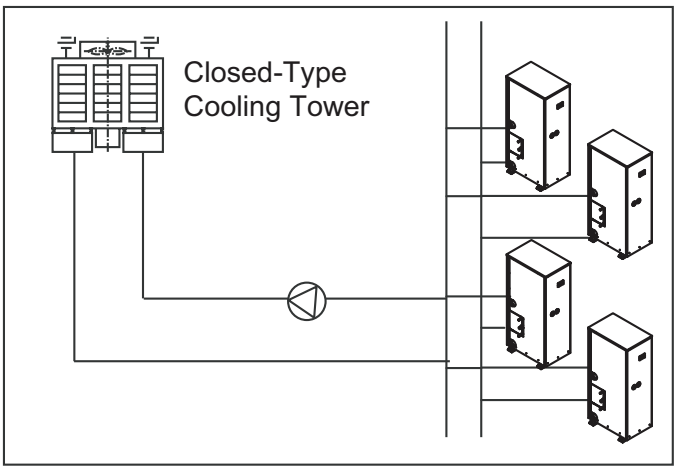


WATER CIRCUIT INSTALLATION

Water Circuit Design

Figure 44: Open-Type and Closed-Type Tower Design Schematic.





Open-Type Cooling Tower + Heat Exchanger

Heat exchanger is installed between the cooling tower and water-source unit system piping, and the temperature difference between the first and second sides is maintained constantly.

Closed-Type Cooling Tower

Heat-source water of the cooling tower is supplied directly to the water-source unit system.

Note:

When using an open cooling tower or open geothermal wells, an intermediate heat exchanger is recommended to be installed to protect the water source unit from contamination.

Expansion Tank

All closed loop systems should have a bladder type expansion tank installed. The expansion tank will protect the equipment from excess pressures due to expansion and contraction of water in the loop as the temperature changes.

Heat Source and Storage Tank

There are several sources for heat that can be used for this system. They include the following:

- Electric boiler
- Gas boiler
- Solar heat with storage tanks
- Ground source heat
- Steam heat from remote central plant

To deal with thermal flux of the system, if floor space is allowed, a heat storage tank can be installed. The heat storage tank can store surplus heat or store heat at nighttime when electric rates are lower. Closed type storage tanks are recommended to prevent contamination of the water system.

Geothermal Water Circuit Design

In lieu of a cooling tower / boiler, Multi V Water Mini units may use a geothermal system that is properly sized to match the water cooled unit capacity. This year round heating and cooling system will utilize a two (2) pipe closed loop water circuit that circulates water continuously, maintaining water temperatures between 23°F and 113°F for heating, 23°F and 113°F for cooling (Variable water flow control kit [PRVC1] required for all entering water temperatures; one kit per frame). When the Multi V Water Mini unit is in cooling mode, heat is rejected to the geothermal system. When the Multi V Water Mini unit is in heating mode, heat is absorbed from the geothermal system.

Multi V Water Mini units have factory-installed stainless steel plate heat exchangers. To protect these heat exchangers, it is recommended to use closed geothermal water loops. Should open geothermal systems be used, an intermediate heat exchanger should be installed to isolate Multi V Water Mini units from contaminants in the water system. Open geothermal loops may contain minerals, biological contaminants, corrosive agents, or other substances which can cause scale, fouling or corrosion, that could degrade performance or shorten the life of the heat exchanger and unit.

If entering water temperature falls below 42°F, glycol must be added to the system. Refer to antifreeze information on page 50 for recommended levels of antifreeze and correction factors.

Piping System

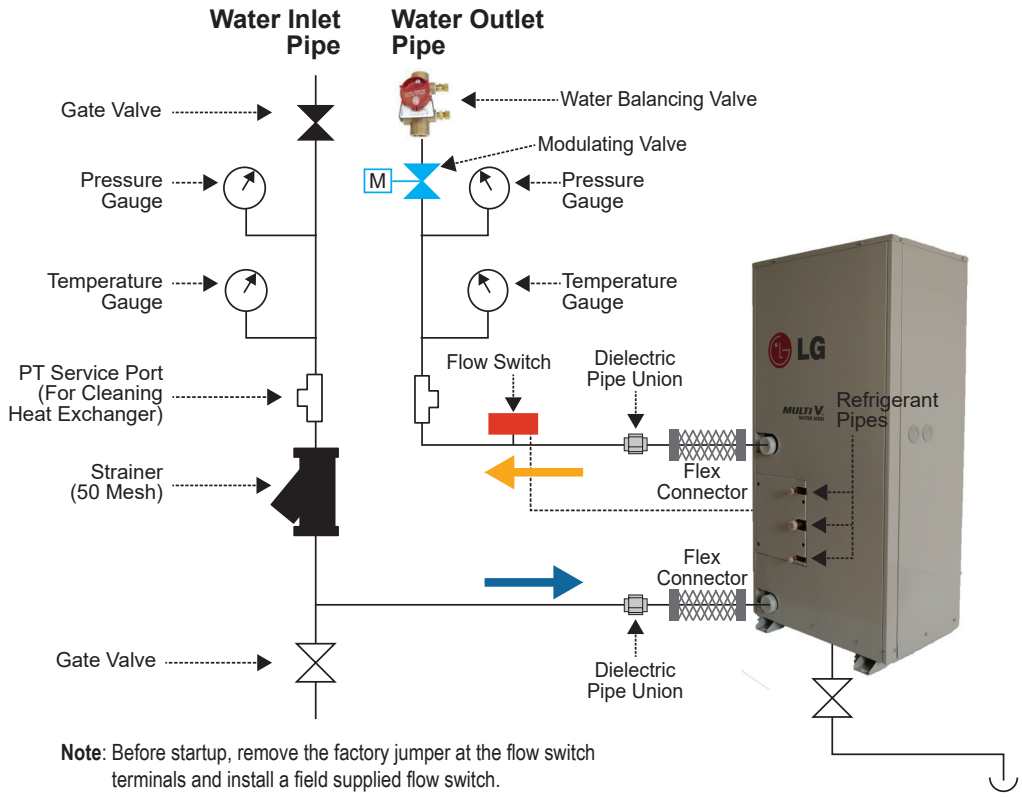
As shown on the "Typical connections for water cooled units" diagram below, the following components must be installed at each Multi V Water Mini unit (field supplied):

- Flow switch or differential pressure switch at the outlet in the horizontal pipe. Wire the flow switch to communication terminals and set to shut off the water-source unit if flow falls below 50% of water-source unit design flow. The flow switch must be the normally open (closed on increase of flow) type. The flow switch must be installed within at least five (5) pipe diameters downstream and at least three (3) pipe diameters upstream of elbows, valves, or reducers which can cause turbulence and lead to flow switch flutter.
- Strainer with minimum 50 mesh screen at inlet. Clean the mesh screen twenty-four (24) hours after startup, and then clean regularly to prevent water flow blockage.
- A water balancing valve, circuit setter, or flow control valve to regulate proper water flow to each water-source unit.
- Dielectric pipe unions to prevent the possibility of galvanic corrosion.
- Pressure gauges at inlet and outlet.
- Thermometers at inlet and outlet.
- Flexible connectors at inlet and outlet.
- Shutoff valves at the inlet and outlet to permit service of the water-source unit.
- Condensate drain trap per local code.
- Service port with hose connections at inlet and outlet to flush the water-source unit heat exchanger when isolated from the water loop system.
- Modulating water valve, pressure independent type.

Other considerations:

- Inhibitors must be used in the water loop, especially if water temperature operates above 104°F.
- Maintain water quality requirements.

Figure 45: Typical connections for water cooled units (all components shown here are field-supplied).



Note: Before startup, remove the factory jumper at the flow switch terminals and install a field supplied flow switch.

Freeze Protection

The piping system must be protected from freezing during winter conditions. Heating mode of the water cooled unit will reduce water loop temperature and methods must be taken to prevent freezing of the loop water. If entering water temperature falls below 42°F, glycol must be added to the system. Use of ethylene glycol, propylene glycol, or methanol is acceptable. Manufacturers recommended levels of concentration must be followed, however, the addition of antifreeze may lower the performance of the water cooled unit due to reduced heat transfer and added pressure drop.

1. Find the corresponding correction factor from table below.
2. Multiply by the water cooled unit capacity to find the net water cooled unit capacity.
3. Apply the corresponding pressure drop correction factor from table below, and multiply by the water cooled unit pressure drop to find the net water cooled unit pressure drop.

Table 24: Antifreeze Correction Factors.

Antifreeze Type	Item	Antifreeze % by Weight				
		10%	20%	30%	40%	50%
Methanol	Cooling	0.998	0.997	0.995	0.993	0.992
	Heating	0.995	0.99	0.995	0.979	0.974
	Pressure Drop	1.023	1.057	1.091	1.122	1.160
Ethylene Glycol	Cooling	0.996	0.991	0.987	0.983	0.979
	Heating	0.993	0.985	0.997	0.969	0.961
	Pressure Drop	1.024	1.068	1.124	1.188	1.263
Propylene Glycol	Cooling	0.993	0.987	0.98	0.974	0.968
	Heating	0.986	0.973	0.96	0.948	0.935
	Pressure Drop	1.040	1.098	1.174	1.273	1.405

Note:

If entering water temperature falls below 42°F, glycol must be added to the system.

Figure 46: Cooling Capacity Correction Factor Chart.

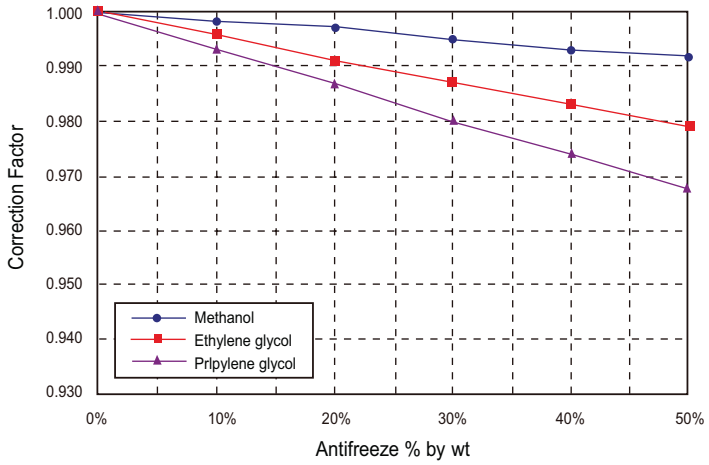
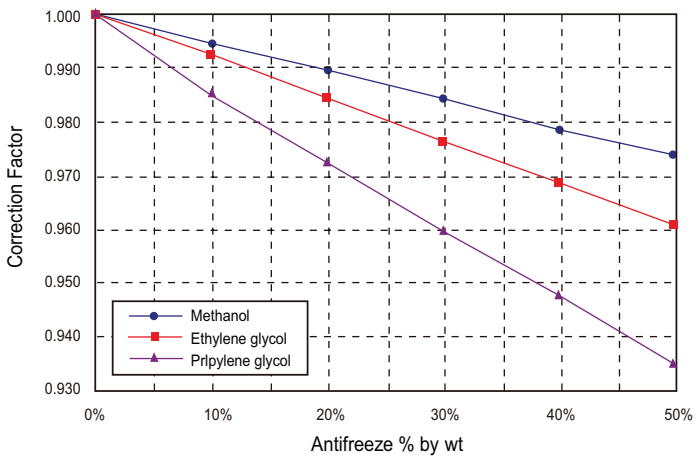


Figure 47: Heating Capacity Correction Factor Chart.



Water Quality Requirements

Impurities in the water can influence the performance and life expectancy of the water cooled unit. The water should be tested and treated using a local water treatment professional. The following levels should be maintained:

Table 25: Minimum Water Quality Requirements.

	Closed Type System		Effect	
	Circulating Water	Supplemented Water	Corrosion[1]	Scale[1]
Basic Item				
pH (77°F)	7.0 ~ 8.0	7.0 ~ 8.0	●	●
Conductivity (77°F) mS/m	Below 30	Below 30	●	●
Chlorine ions (mg Cl^-/ℓ)	Below 50	Below 50	●	
Sulfate ions (mg SO_4^{2}/ℓ)	Below 50	Below 50	●	●
Acid consumption (pH4.8) (mg$CaCO_3$/ℓ)	Below 50	Below 50		●
Total Hardness (mg $CaCO_3$/ℓ)	Below 70	Below 70		●
Calcium Hardness (mg $CaCO_3$/ℓ)	Below 50	Below 50		●
Ionic-static silica (mg SiO_2/ℓ)	Below 30	Below 30		●
Reference Item				
Iron (mg Fe/ℓ)	Below 1.0	Below 0.3	●	●
Copper (mg Cu/ℓ)	Below 1.0	Below 0.1	●	
Sulfate ion (mg SO42/ℓ)	Must not be detected	Must not be detected	●	
Ammonium ion (mg NH4+)ℓ	Below 0.3	Below 0.1	●	
Residual chlorine (mg Cl/ℓ)	Below 0.25	Below 0.3	●	
Free carbon dioxide (mg CO2/ℓ)	Below 0.4	Below 4.0	●	
Stability index			●	●

[1]The "●" mark for corrosion and scale means that there is a possibility of occurrence.

Note:

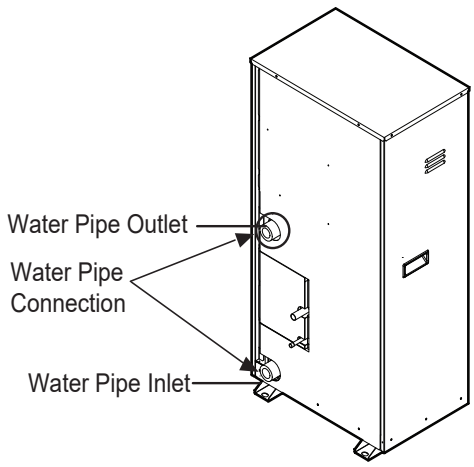
- *Inhibitors should be used in the water loop, especially if water temperature operates above 104°F.*
- *Air shall be purged from the system.*

Pipe Insulation

Water pipe insulation is suggested in the following conditions:

- Where water pipe is subject to freezing.
- Water pipe where water can condense on surface of pipe from ambient room temperatures higher than temperature of water in the pipe. If water temperature is maintained at 68°F in winter and 86°F in summer, insulation will not be required.
- On boiler water pipes to save energy losses from heat source.
- On condensate drain lines.
- Where required by local code.

Figure 48: Water Pipe Outlet Connection.



WATER CIRCUIT INSTALLATION

Piping System Specifications

Water Control

- Properly control the water velocity or it may cause operation sound, piping vibration or contraction, expansion according to temperature. Use the same water piping size connected with the water source unit, or larger.
- Refer to the water-source unit piping diameter and water velocity table below. When the water velocity is fast, air bubbles will increase.

Table 27: Water Piping Diameter and Water Velocity.

Diameter(inch [mm])	Velocity Range (m/s)
<1-31/32 (< 50)	0.6 ~ 1.2
1-31/32 (50) ~ 5-7/8 (100)	1.2 ~ 2.1
>5-7/8 (100)	2.1 ~ 2.7

- Be aware of the water purity control. If impurities infiltrate the water circuit, the pipes can corrode and lead to system malfunction. (See the Minimum Water Quality Requirements table.)
- If the water temperature can rise above 104°F (40°C), prevent corrosion by adding an anticorrosive agent.
- Install the piping, valve, and gauge sensors in an area where these are easy to maintain. Install the water valve (if required) at a lower position in the water circuit so the water can drain out easier.
- Take care not to introduce air in the water circuit. If the water circuit contains air bubbles, water velocity will be unstable, and pump efficiency can also decrease, causing pipe vibration. Install an air purge where the water circuit may generate air.

- Choose from the following antifreezing methods:

Note:

If antifreeze methods are not applied, the water piping may burst in low temperature conditions, causing product damage.

- Use a pump to circulate water before the temperature drops.
- If the cooling tower will not be used for an extended period, drain the water out.
- Add antifreeze. If antifreeze is included, change the DIP switch on main PCB for the water-source unit to enable geothermal mode. See table below for percentage amounts to add at different freezing temperatures.

Table 26: Percentage of Antifreeze at Different Temperatures.

Antifreeze	Minimum Temperature for Antifreeze [°F (°C)]					
	0	23 (-5)	14 (-10)	5 (-15)	-4 (-20)	-13 (-25)
Ethylene Glycol (%)	0	12	20	30	-	-
Propylene Glycol (%)	0	17	25	33	-	-
Methanol (%)	0	6	12	16	24	30

Note:

If antifreeze is added, it can cause a pressure change in the water circuit, and reduce the water-source unit performance.

- Use a closed-type cooling tower. If an open-type cooling tower is to be used, install a second heat exchanger to make the water supply system a closed type system.

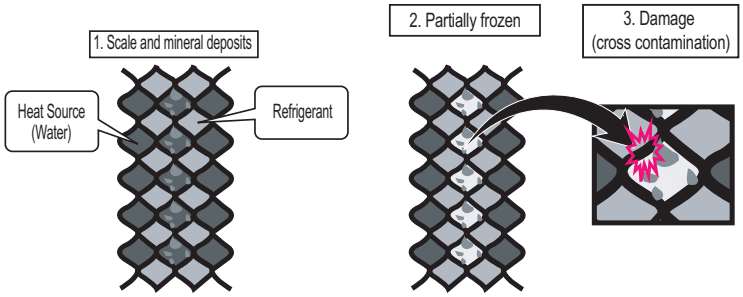
Device Protection Details

Strainer on Water Pipe

To protect the water-source unit, a strainer with ≥50 mesh must be installed on the water-source unit inlet piping. If not installed, the heat exchanger can be damaged by particles in the water supply.

1. The water-supply circuitry within the plate-type heat exchanger is comprised of many small paths / channels.
2. If a strainer with 50 mesh or more is not included, foreign particles can partially block the water flow.
3. When the system operates in heating, the plate-type heat exchanger functions as an evaporator, therefore, the temperature of the coolant supply drops the temperature of the heat source water supply, which can result in ice forming in the water circuitry.
4. As heating operation progresses, the channels can be partially frozen, which may damage the plate-type heat exchanger.
5. If the heat exchanger is damaged, the coolant supply and the heat-source water supply will mix, and the system will not function.

Figure 49: Potential Heat Exchanger Damage.



Flow Switch / Differential Pressure Switch

- A flow switch is a required installation component on the water pipes connected to the water-source unit.
- Flow switch must be rated for 208-230V and must be a normally open (closed on increase of flow) type. (Flow switch will perform as the first protection device when heated water is not supplied. If the required water level is not present after installing the flow switch, the water source unit will display a CH24 error code and will stop operating.)
- When setting the flow switch, it is recommended to use the default set value of the water source unit to satisfy the minimum flow rate. (Minimum flow rate range is 50%; Reference flow rate: 4.4-ton - 15.9 gpm.) When the Variable Water Flow Control kit is also installed, set the flow switch minimum flow rate to 40% of the nominal flow rate instead of 50%.
- Select a flow switch following the pressure specification of the water supply system.

Note:

- *If the set value does not satisfy the minimum flow rate, or if the set value is changed by the user arbitrarily, it can result in performance deterioration or system failure.*
- *If the water-source unit operates with a hard water supply, the heat exchanger can be damaged or system failure can occur.*
- *If the water-source unit displays a CH24 or CH180 error code, it is possible that the interior of the plate-type heat exchanger is partially frozen. If this occurs, resolve the partial freezing issue and then operate the water-source unit again. (Causes of partial freezing: Insufficient heat water flow rate, water not supplied, insufficient coolant, foreign particles inside plate-type heat exchanger.)*

WATER CIRCUIT INSTALLATION

Flow Switches and Solenoid Valve Wiring

See diagrams below for suggested flow switch wiring. Also shown is wiring for solenoid valves (optional) to turn water flow on / off to the unit.

Figure 52: Water Solenoid Valve Controlled by Building Management System (BMS).

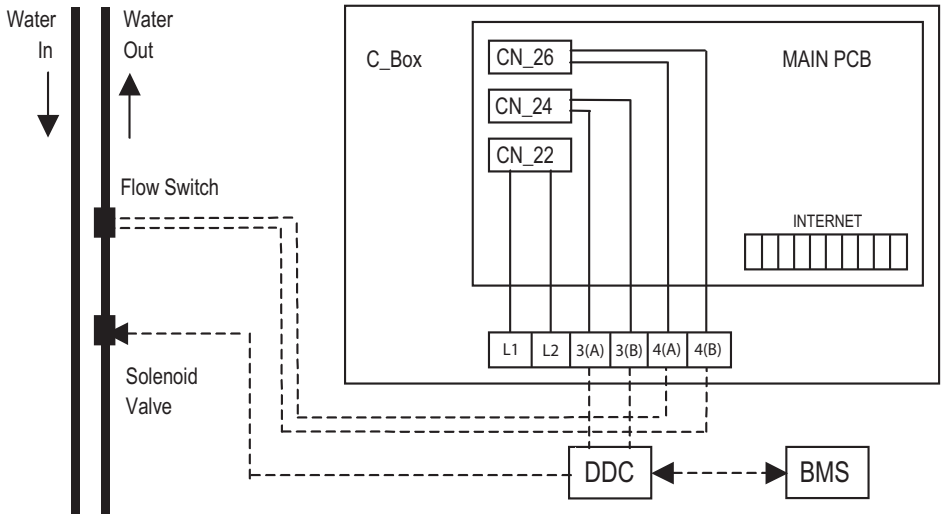


Figure 51: Water Solenoid Valve Controlled by Water Source Unit.

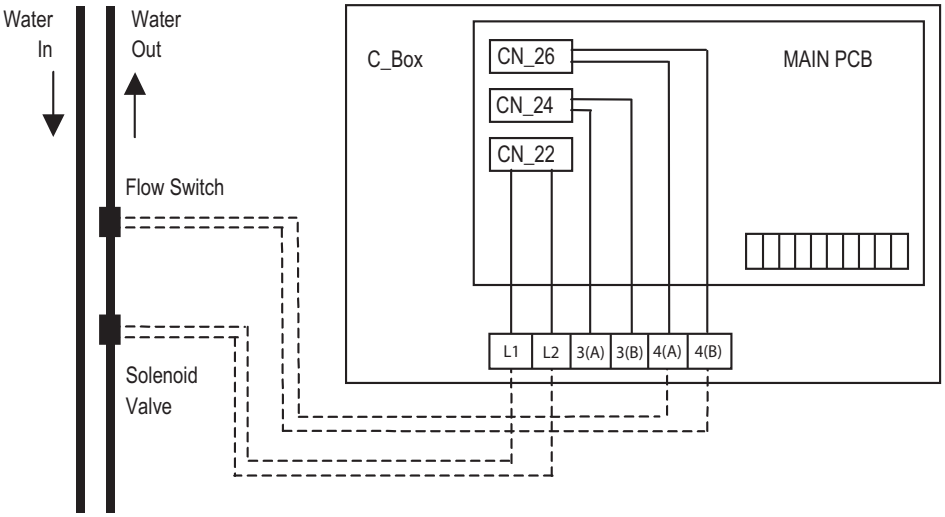
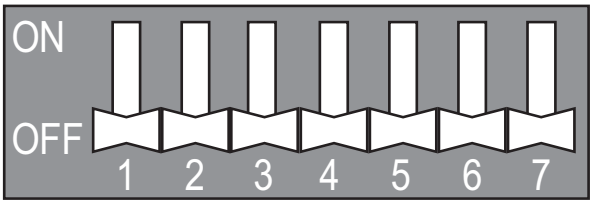
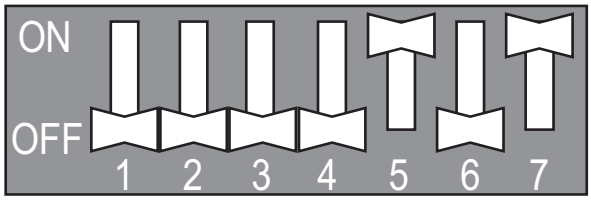


Figure 50: Set the DIP switches as below and turn on the power (For water solenoid valve controlled by water source unit).

SW01B Setting



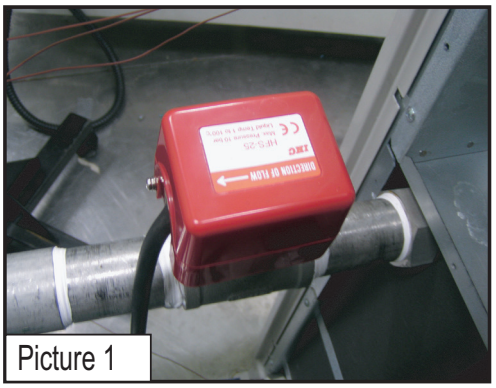
SW02B Setting



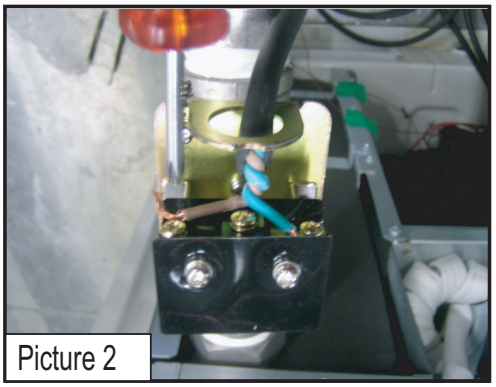
WATER CIRCUIT INSTALLATION

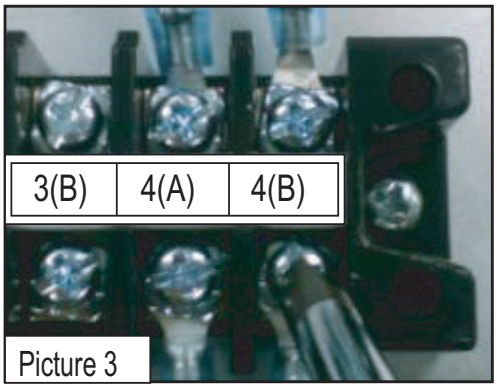
Flow Switches and Solenoid Valves

- The flow switch is a required installation component on the horizontal pipe of the water source unit's heat water-supply outlet. Verify the direction of the water flow before installation. The flow switch must be the normally open (closed on increase of flow) type. (Picture 1)
- Remove the jumper wire and connect to the communication terminals (4[A] and 4[B]) of the water source unit's control box. (Pictures 2, 3) Open the flow switch cover and check the wiring diagrams before connecting the wires. Wiring methods can vary by flow switch manufacturer.
- When setting the flow switch, it is recommended to use the default set value of the water source unit to satisfy the minimum flow rate. (Minimum flow rate range is 50%; Reference flow rate: 4.4-ton - 15.9 gpm.) When the Variable Water Flow Control kit is also installed, set the flow switch minimum flow rate to 40% of the nominal flow rate instead of 50%.

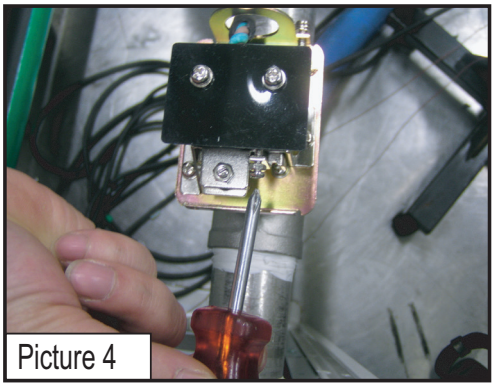


Picture 1


Picture 2



Picture 3


Picture 4

Note:

- *If the product operates while the flow switch contact point is out of the permitted range, it can result in performance deterioration or system failure.*
- *The flow switch must be the normally open (closed on increase of flow) type.*

Solenoid Valves (Optional)

Solenoid valves may be installed to shut off water flow to the water source unit when the unit turns off. Solenoid valves are field supplied, must be rated for 208-230V, and must be wired to terminals L1 and L2 on the water source unit PCB.

Note:

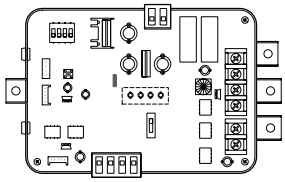
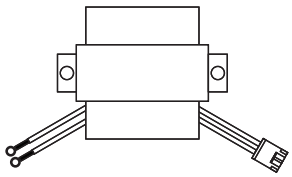
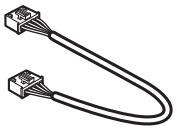
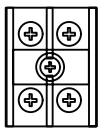
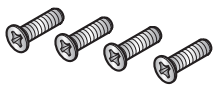
Field-supplied solenoid valve must be the normally open (closed on increase of flow) type.

WATER CIRCUIT INSTALLATION

Variable Water Flow Control Kit (Required Accessory)

Variable Water Flow Control Kit (Model No. PRVC1) allows connection of Multi V Water Mini units to a variable pumping condenser water systems. The control board, transformer, and wiring provide connections to a field-supplied modulating water valve.

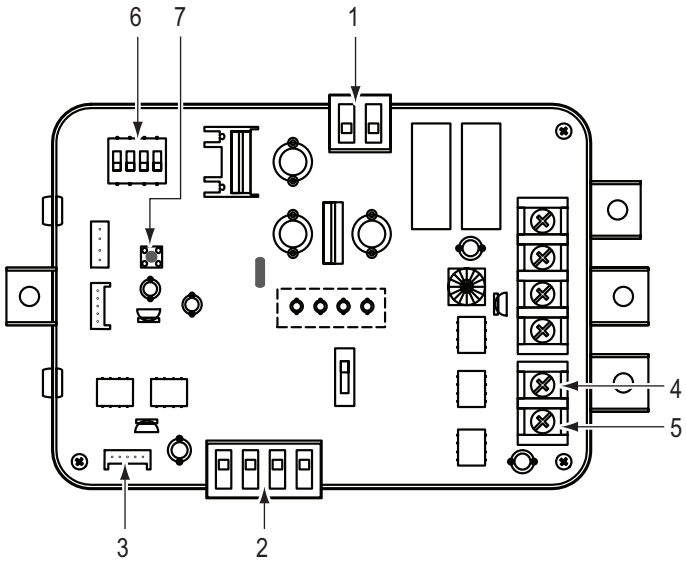
Variable Water Flow Control Kit Parts (included)

 Variable Water Flow Control PCB	 Transformer
 Cable Assembly	 Terminal Block Assembly
 Screws	

Variable Water Flow Control Kit PCB

1. CN_PWR: Power input terminal (DC 12V)
2. CN_AO: Signal output terminal to control a water flow control valve (DC 0~10V)
3. CN_OUT: Water source unit connector
4. BUS_A: RS-485 (+) terminal
5. BUS_B: RS-485 (-) terminal
6. SWDIP: Switch to select main function
7. SW1: Reset switch

Figure 53: Variable Water Flow Control Kit PCB Diagram.



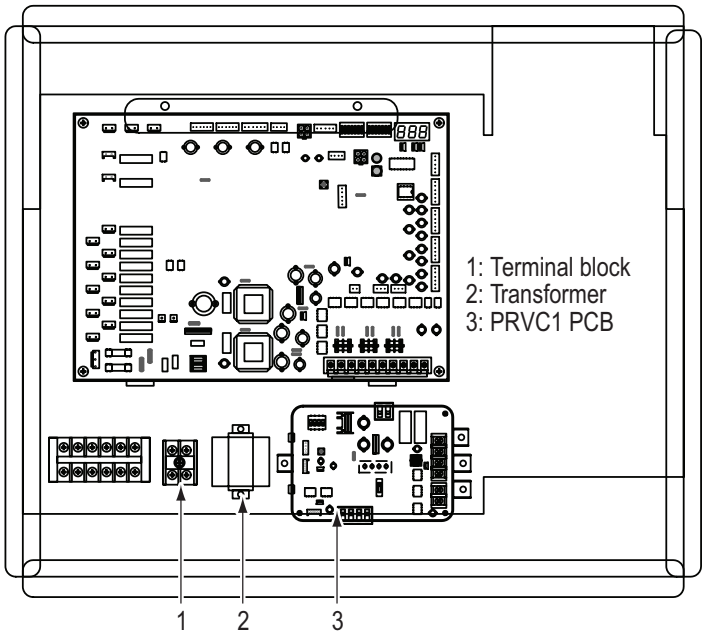
WATER CIRCUIT INSTALLATION

Variable Water Flow Control Kit (Required Accessory)

Installation

1. Shut off the main power to the water source unit.
2. Install the Variable Water Flow Control (PRVC1) PCB in the control box by using the included screws.
3. Install the transformer in the control box by using the included screws.
4. Install the terminal block in the control box by using the included screws.
5. Connect the Main PCB (CN41) to the PRVC1 (CN_OUT) by using the cable assembly.
6. Connect the blue wire of transformer to the Main PCB (JIG1[L], JIG2[N]).
7. Connect the red wire of transformer to the terminal block (two-pin, yellow terminal block).
8. Connect a power cable (DC 12V) to CN_PWR (12V, GND) of the PRVC1.
9. Connect a signal cable (DC 0~10V) of the water flow control valve to CN_AO (AO_01[A+], GND[A-]) of the PRVC1.
10. If there are two water flow control valve, connect a signal cable (DC 0~10V) of water flow control valve to CN_AO (AO_02[B+], GND[B-]) of PRVC1.
11. Connect a power cable (AC 24V) of the water flow control valve to the terminal block (two-pin, yellow terminal block, max. current 0.42A).
12. Connect the RS-485 communication cable to CN_COMM (BUS_A, BUS_B) of PRVC1.
13. Set the main function DIP Switch of the PRVC1 PCB.
14. Set the DIP Switch of the water-source unit main PCB.
15. Turn on the main power to the water-source unit.
16. Check the signal of water flow control valve to CN_AO (AO_01, GND) of PRVC1, and check the water flow rate.

Figure 54: Control Kit within the Water Mini Unit.



Note:

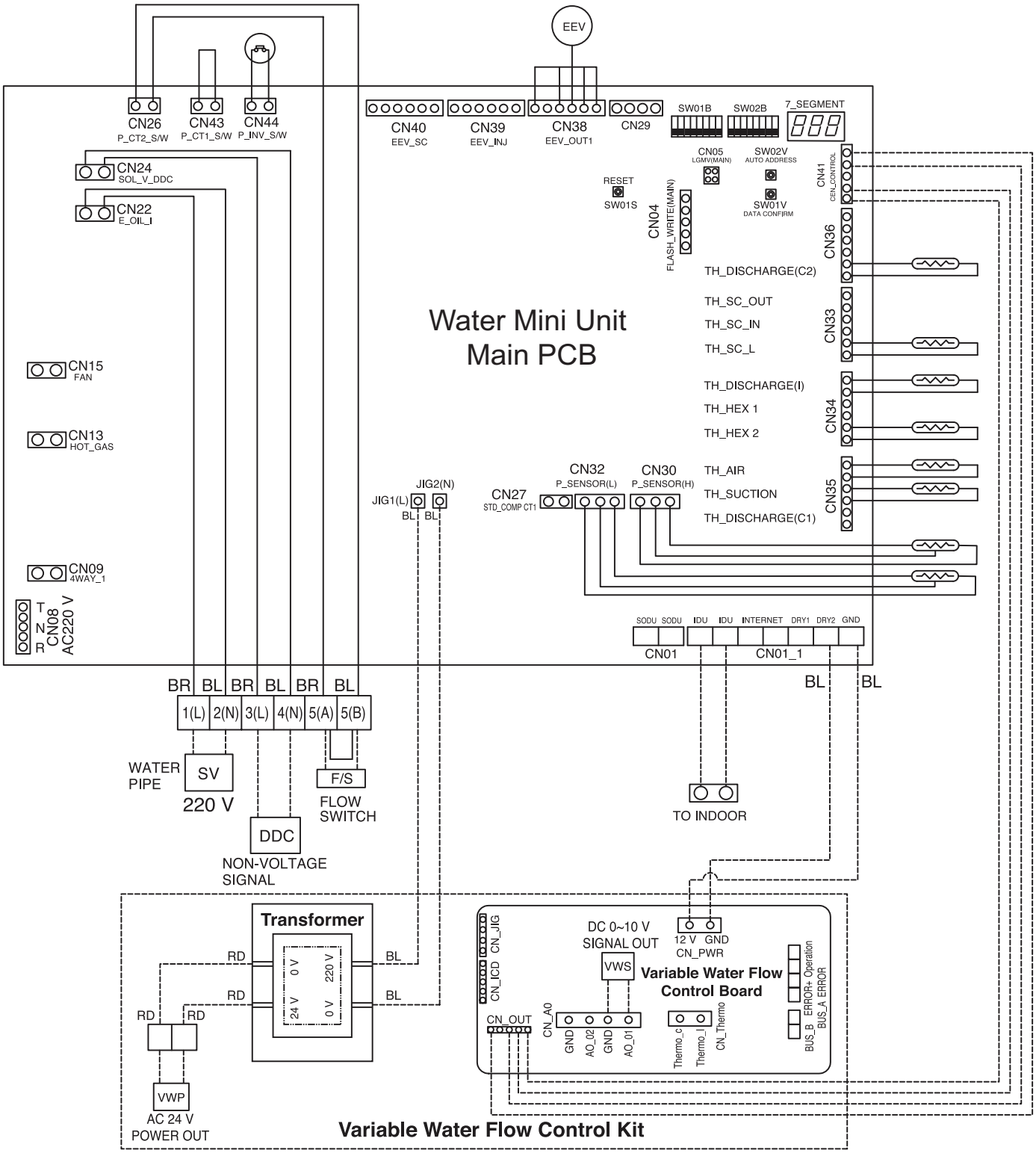
- *Install the product on a flat surface with the enclosed screws, otherwise, the PRVC1 PCB may not be anchored properly.*
- *⃠ Do not damage the case of the Variable Water Flow Control Kit as it may cause the PCB to malfunction.*

WATER CIRCUIT INSTALLATION

Variable Water Flow Control Kit (Required Accessory)

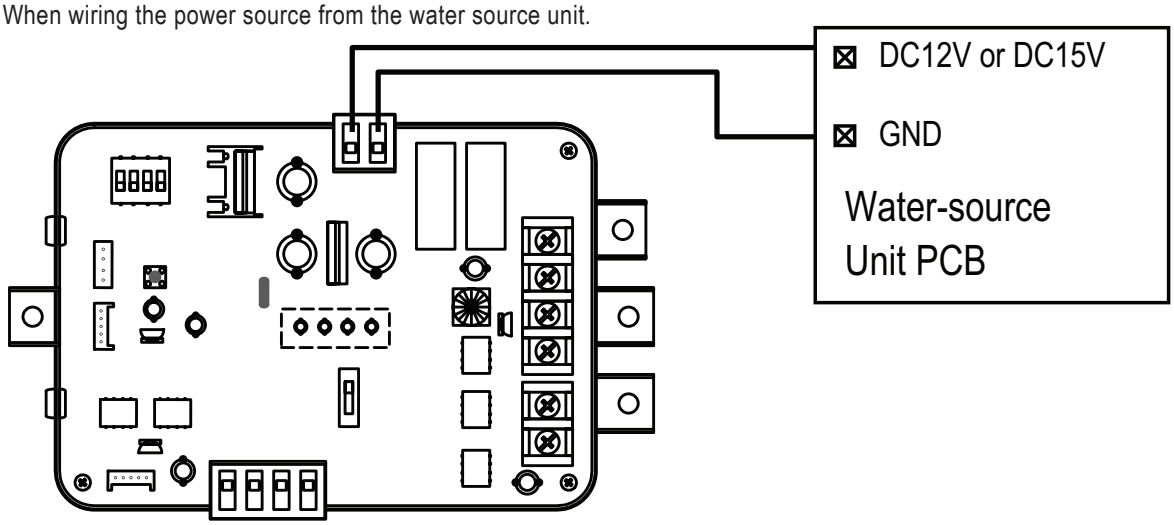
Variable Water Flow Control Kit Wiring Diagram

Figure 55: Variable Water Flow Control Kit Wiring Diagram.

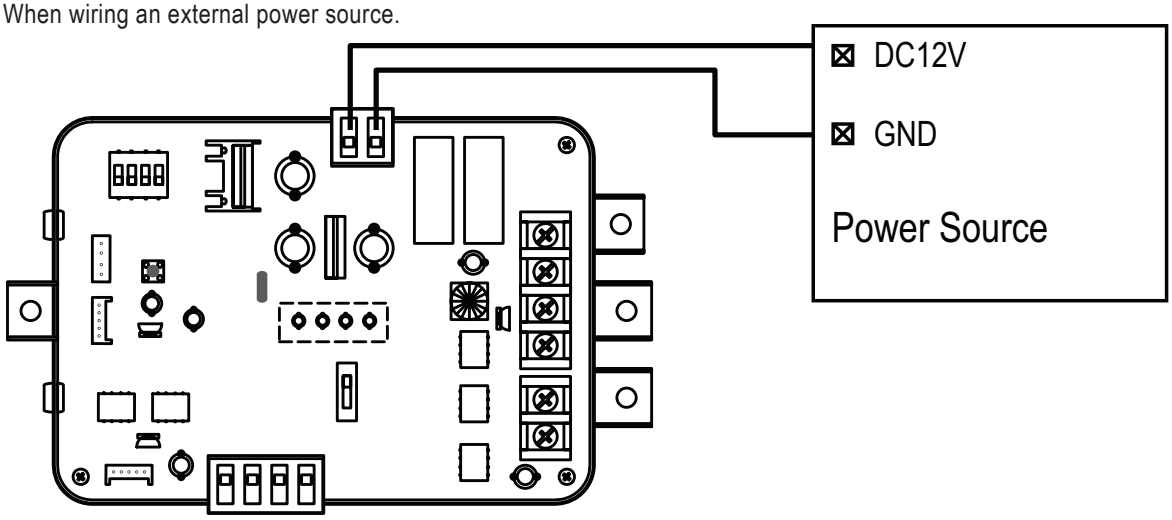


Variable Water Flow Control Kit Power Source Input

When wiring the power source from the water source unit.



When wiring an external power source.



Note:

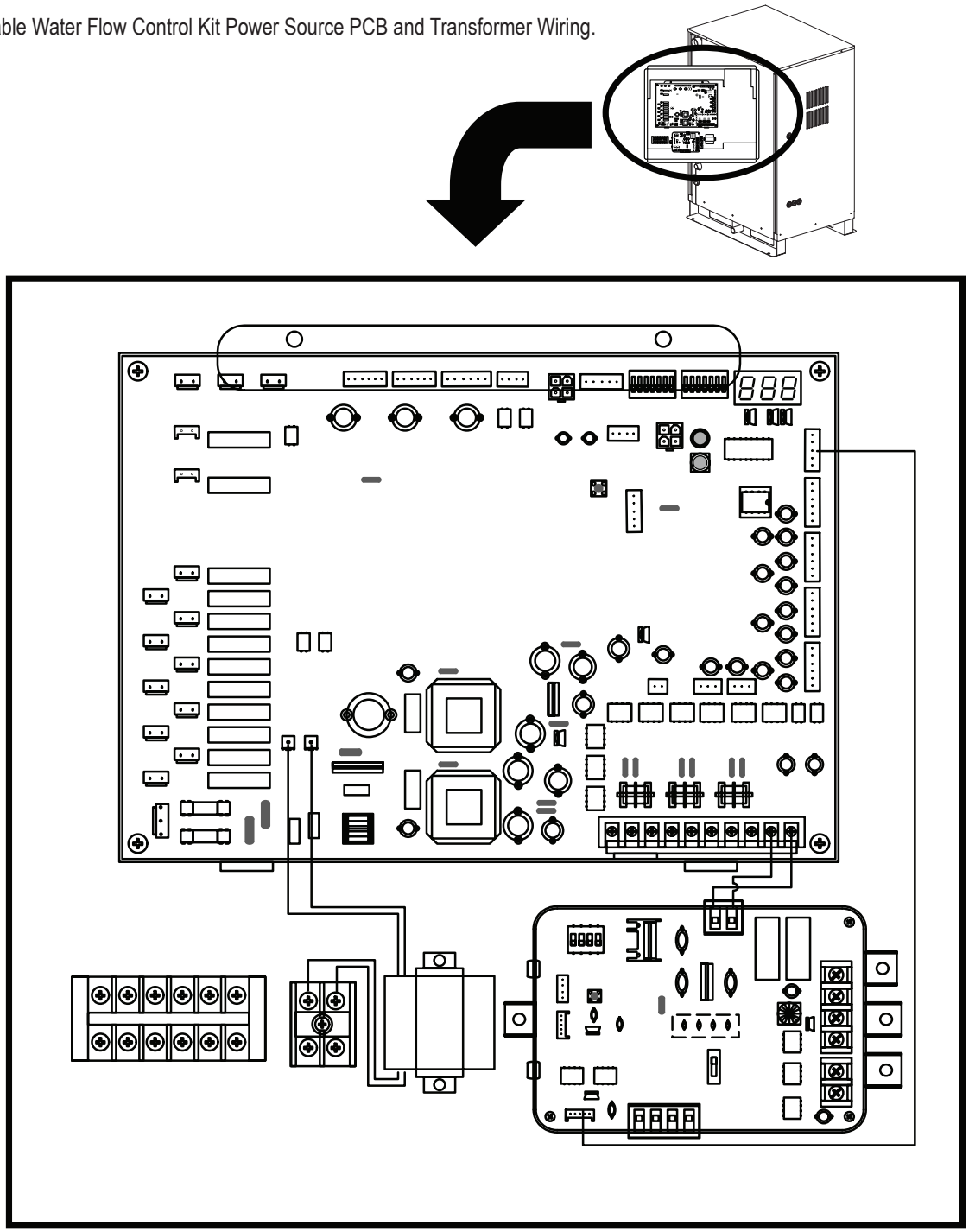
- *The Variable Water Flow Control Kit can accept only DC power input. ⃠ Do not use 220VAC power input as it will damage the unit.*
- *The use of an external power source is recommended.*

WATER CIRCUIT INSTALLATION

Variable Water Flow Control Kit (Required Accessory)

Wiring for the Variable Water Flow Control Kit Power Source PCB and Transformer

Figure 56: Variable Water Flow Control Kit Power Source PCB and Transformer Wiring.

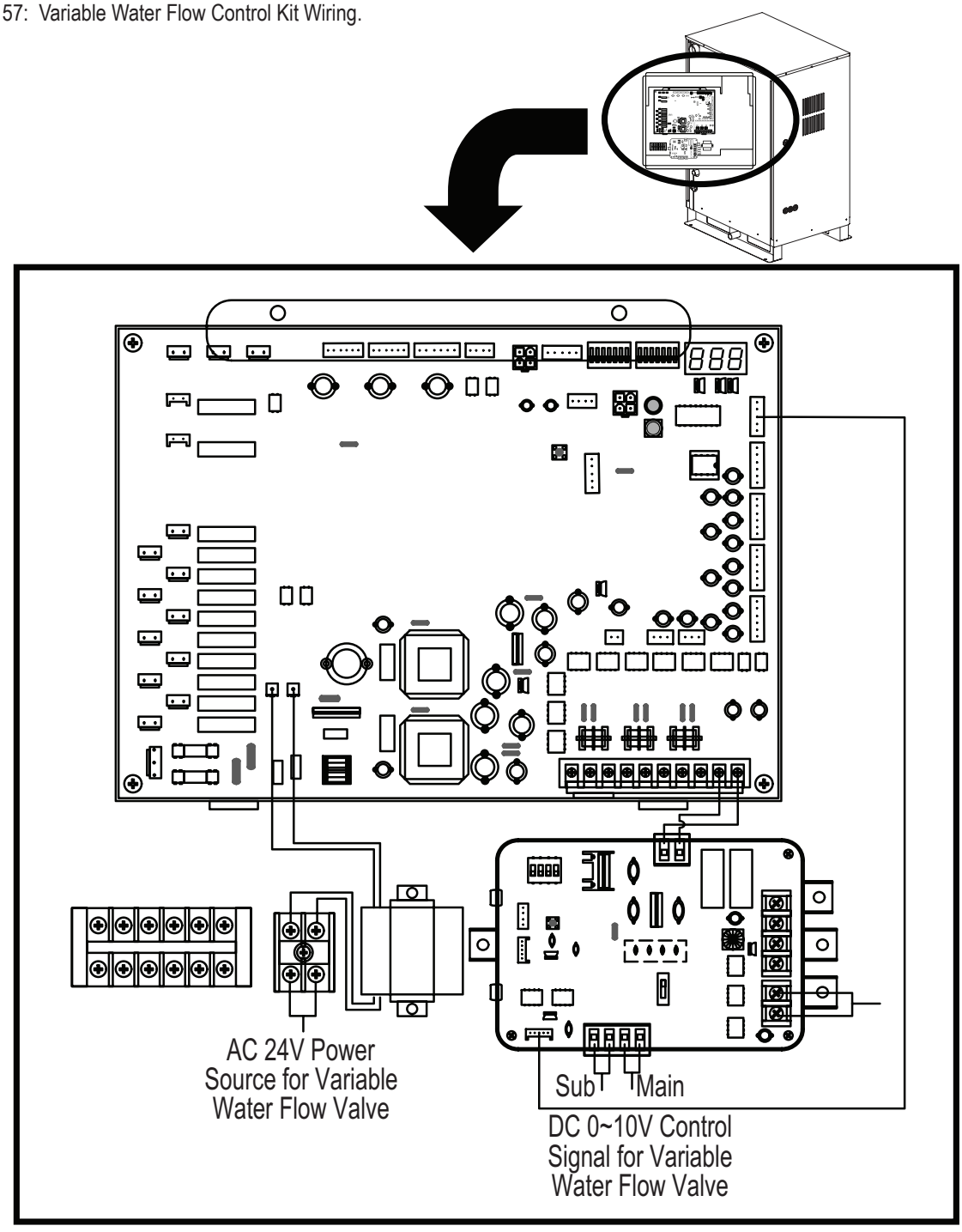


Note:

- *PCB and transformer can accept only DC 12V power input. ⃠ Do not use AC power input as it will damage the unit.*
- *AWG 23 wiring is recommended for the power (DC 12V) line.*

Wiring for the Variable Water Flow Control Kit Valve

Figure 57: Variable Water Flow Control Kit Wiring.



Note:

- *The Variable Water Flow Control Kit can control a maximum of two valves. If only one valve is present, then the sub signal connector must not be used.*
- *AWG 23 wiring is recommended for the power (AC 12V) line and signal (DC 0~10V) line.*

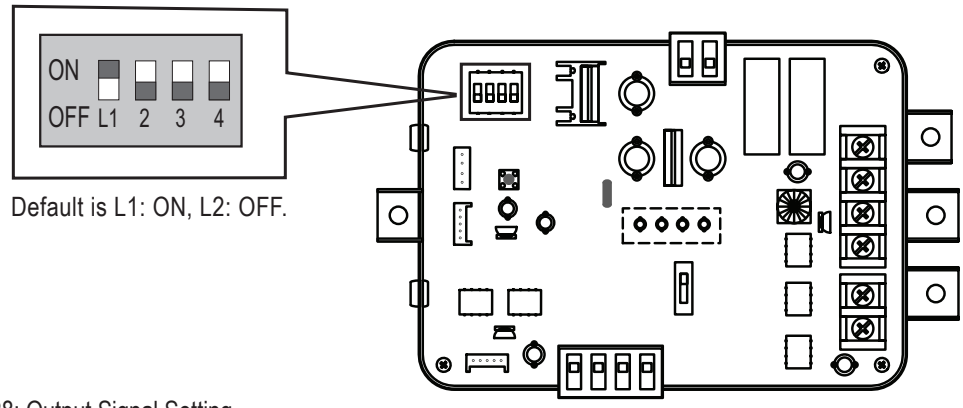
WATER CIRCUIT INSTALLATION

Variable Water Flow Control Kit (Required Accessory)

Variable Water Flow Control Kit DIP Switch Settings

Using 'SWDIP', select the control function using the DIP switches as described below.

Figure 58: DIP Switch Setting.



Default is L1: ON, L2: OFF.

Table 28: Output Signal Setting.

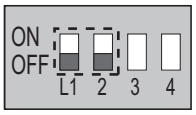
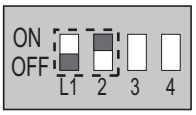
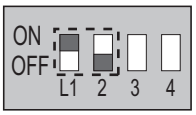
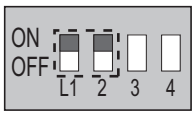
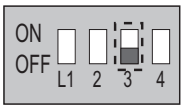
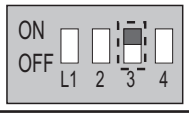
DIP Switch Setting	Function
	Control signal : DC 0V(OFF), DC 8~10V(ON)
	Control signal : DC 0V(OFF), DC 6~10V(ON)
	Control signal : DC 0V(OFF), DC 4~10V(ON) Default status
	Control signal : DC 0V(OFF), DC 2~10V(ON)

Table 29: RS-485 Communication Function Setting.

DIP Switch Setting	Function
	RS-485 communication function enable
	RS-485 communication function disable

Note:

- *After the DIP switch is changed, the reset switch must be pressed to reflect the setting.*
- *Before operating the water source unit, check the water flow rate and the PCB voltage signal.*
- *Minimum flow rate range is 50%; Reference flow rate: 4.4-ton - 15.9 gpm.) When the Variable Water Flow Control kit is also installed, set the flow switch minimum flow rate to 40% of the nominal flow rate instead of 50%. If the flow rate is lower, it will damage the water source unit.*

Water Source Unit DIP Switch Settings

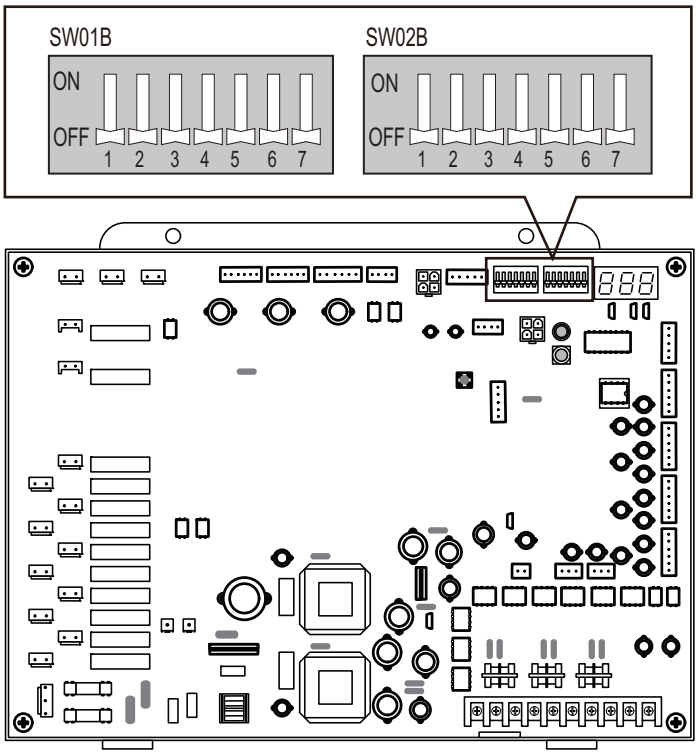
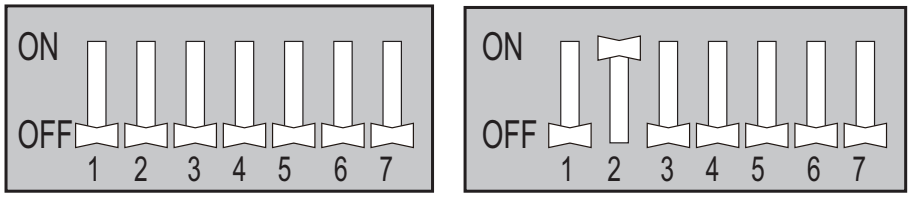


Table 30: Water Source Unit DIP Switch Settings.

DIP Switch Setting	Function
	Variable Water Flow Control Mode

Note:

- *After the DIP switch is changed, the reset switch must be pressed to reflect the setting.*
- *Before operating the water source unit, check the water flow rate and the PCB voltage signal.*
- *Minimum flow rate range is 50%; Reference flow rate: 4.4-ton - 15.9 gpm.) When the Variable Water Flow Control kit is also installed, set the flow switch minimum flow rate to 40% of the nominal flow rate instead of 50%. If the flow rate is lower, it will damage the water source unit.*

Water Circuit Test Run

Before executing the test run for the water-source unit, test the water circuit first. The water-source unit test run must be executed after checking the flow rate and temperature of the water supply.

Equipment Design.

Design the water circuit system, including the cooling tower, boiler, pump, etc.

- Check the equipment capacity (water volume, temperature control range).

Water Pipe System Installation.

Install the water pipe.

Water Supply Piping and Water-Source Unit Connection.

Connect the water pipe to the water-source unit inlet/outlet.

Start the Water Supply System Test Run.

Start the water supply system test run.

- The variable water flow valve will need to be manually driven open for testing water flow. Flow should be checked at ranges at full open and at minimum settings.
- The water-source unit does not operate, but the pump and water supply equipment will operate to flow water to the heat exchanger.
- Flow water to all water circuit piping to remove any particles. Perform an air purge to remove any air bubbles within the pipes any make the water supply flow smoothly.
- Clean all the strainers of water piping, including those near the water-source units.

Assess the Water Supply Test Run.

Test the water supply system test without operating the water-source unit.

- Check if the water-source unit inlet/outlet flow rate follows product specifications.
- Check if the water supply temperature is within specifications.

Test Run the Water-Source Unit.

After checking if the water supply follows specifications, test the water-source unit.

To prevent the heat exchanger from freezing when the refrigerant is discharged with the water supply blocked, discharge the refrigerant after draining out around the water-source unit.

Precautions Before Test Run

Table 31: Precautions Before Test Run.

1	Check if air is completely remove from the pipes, and the water is flowing smoothly.
2	• Check for refrigerant leaks. • Check for disconnected or loose communication cables or power wiring. Refer to the wiring diagram for connections.
3	Check if the power wiring terminals are correctly connected. Check the insulation resistance with the mega tester (DC 500V) between the power terminal block and ground; Insulation resistance must be 2.0MΩ or above when measured; if the insulation resistance is less than 2.0MΩ, ⃠ do not operate the water-source unit. ***Note:*** *Never check the insulation resistance for the terminal control board. The control board can be damaged.*
4	Check if the liquid and vapor pipes are open.
5	***Note:*** **Precautions When Main Power Was Shut Off to the Water-Source Unit** *When operating the water-source unit (cooling season / heating season), always make sure the main power is supplied.*

Note:

Always verify if the water supply is flowing smoothly before the test run. If the water flow is not sufficient, the water-source unit can burn out.

Troubleshooting a Failed Test Run

Table 32: Troubleshooting a Failed Test Run.

Condition	Error Code	Description	Details
Whether the water source is supplied.	CH24	After connecting the flow switch, water supply is not flowing to the water-source unit, or the flow amount is insufficient according to system specifications.	Check if the water supply pump is operating.
			Check if the water supply piping is clogged. (Clean the strainer, verify if a valve is locked or has another issue, if air is trapped in the piping, etc.)
			Check the flow switch. (Flow switch problem, arbitrary control, disconnection, etc.)
	CH32	Water not supplied or flow rate is insufficient (during air conditioning operation).	Check if the water supply pump is operating.
			Check if the water supply piping is clogged. (Clean the strainer, verify if a valve is locked or has another issue, if air is trapped in the piping, etc.)
	CH34	Water not supplied or flow rate is insufficient.	Check if the water supply pump is operating.
			Check if the water supply piping is clogged. (Clean the strainer, verify if a valve is locked or has another issue, if air is trapped in the piping, etc.)
	CH180	Water not supplied or flow rate is insufficient (during heating operation).	Check if the water supply pump is operating.
			Check if the water supply piping is clogged. (Clean the strainer, verify if a valve is locked or has another issue, if air is trapped in the piping, etc.)

Note:

If CH24 or CH180 occurs during the test run, the inside of the panel heat exchanger may be partially frozen. If so, defrost the heat exchanger and then resume operation. (Cause of a partially frozen heat exchanger: The lack of water flow, suspension of water, lack of refrigerant, foreign particles in the panel heat exchanger.)

⚠ WARNING

- *All power wiring and communication cable installation must be performed by authorized service providers working in accordance with local, state, and National Electrical Code (NEC) regulations related to electrical equipment and wiring, and following the instructions in this manual. Failure to do so will lead to electric shock and bodily injury or death.*
- *Be sure that main power to the unit is completely off before proceeding. Follow all safety and warning information outlined at the beginning of this manual. Failure to do so will cause electric shock and bodily injury.*
- *Familiarize yourself with the location of the circuit breaker. Be sure that a circuit breaker or some other emergency power cutoff device is in place before any power wiring is done to the system. Failure to do so will cause bodily injury or death.*
- ⃠ *Never touch any power lines or live cables before all power is cutoff to the system. To do so, will cause bodily injury or death.*
- *Undersized wiring will lead to unacceptable voltage at the unit and will cause a fire, which will cause bodily injury or death.*
- *Properly ground the water-source unit and indoor units. Ground wiring must always be installed by a qualified technician. Ground wiring is required to prevent accidental electrical shock during current leakage, which will cause bodily injury or death.*
- *The water-source unit is inverter driven.* ⃠ *Do not install a phase-leading capacitor; if installed, it will deteriorate the power factor improvement effect, cause the capacitor to generate an abnormal amount of heat, which will result in physical injury.*
- *Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent could include some amount of direct current. Using an oversized breaker or fuse will result in electric shock, physical injury or death.*
- ⃠ *Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a NEC-approved earth ground can result in electric shock, physical injury or death.*

Note:

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

Water-Source Unit Wiring / Cable Access Holes and Connections

1. Remove all of the screws that hold the front panel to the water-source unit frame.
2. Detach the front panel by pulling it forward.
3. Locate the terminal block and the main PCB.
4. Knock out the holes in the side panel for the power wiring and communication cable. Touch up any scratches with paint to prevent rust.
5. Route the power wiring and communication cable through the knock out holes. Use separate conduits to prevent damage to the wiring and cable.
6. Connect the power wiring and communication cable to the correct terminals.

Figure 59: Removing the Water Mini Front Panel.

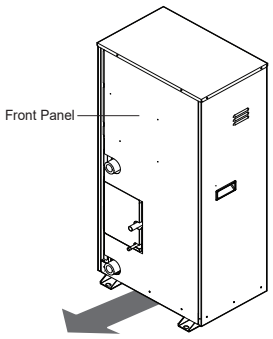
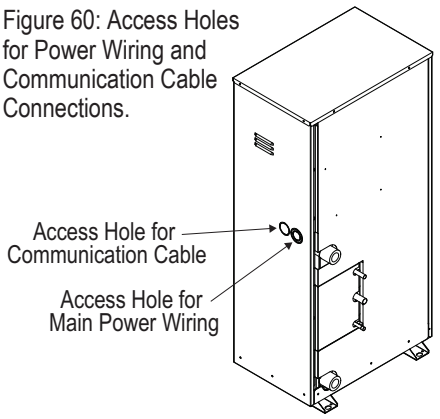


Figure 60: Access Holes for Power Wiring and Communication Cable Connections.



Separating Power Wiring and Communication Cables

- ⃠ Avoid running the power wiring and communication cable alongside each other; there is a strong likelihood of operation malfunction due to electrostatic and electromagnetic interference. ⃠ Do not run both in the same conduit.
- If running the power wiring and communication cable alongside each other cannot be avoided, see the table below for minimum required distances.

Figure 61: Example of Power Wiring Path.

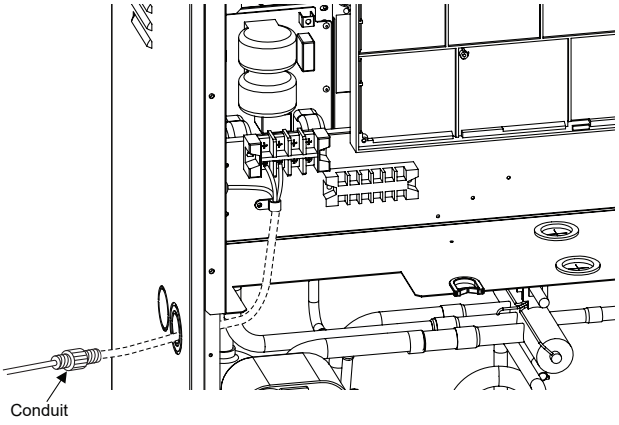


Table 33: Power Wire and Communications Cable Minimum Required Separation Minimum Allowable Distances.

Capacity of Power Supply Wiring (current)		Required Minimum Distance[1,2]
100V or more	10A	12 inches
	50A	20 inches
	100A	40 inches
	Exceed 100A	60 inches

[1]The figures above are based on parallel lengths up to 328 feet long. For lengths in excess of 328 feet, the distances will have to be recalculated in direct proportion to the additional line lengths involved.
[2]If the power supply waveform continues to exhibit some distortion, the space between the power wiring and communication cable must be increased.

⚠WARNING

Properly ground the water-source unit. Ground wiring must always be installed by a qualified technician. Ground wiring is required to prevent accidental electrical shock during current leakage, which will cause bodily injury or death.

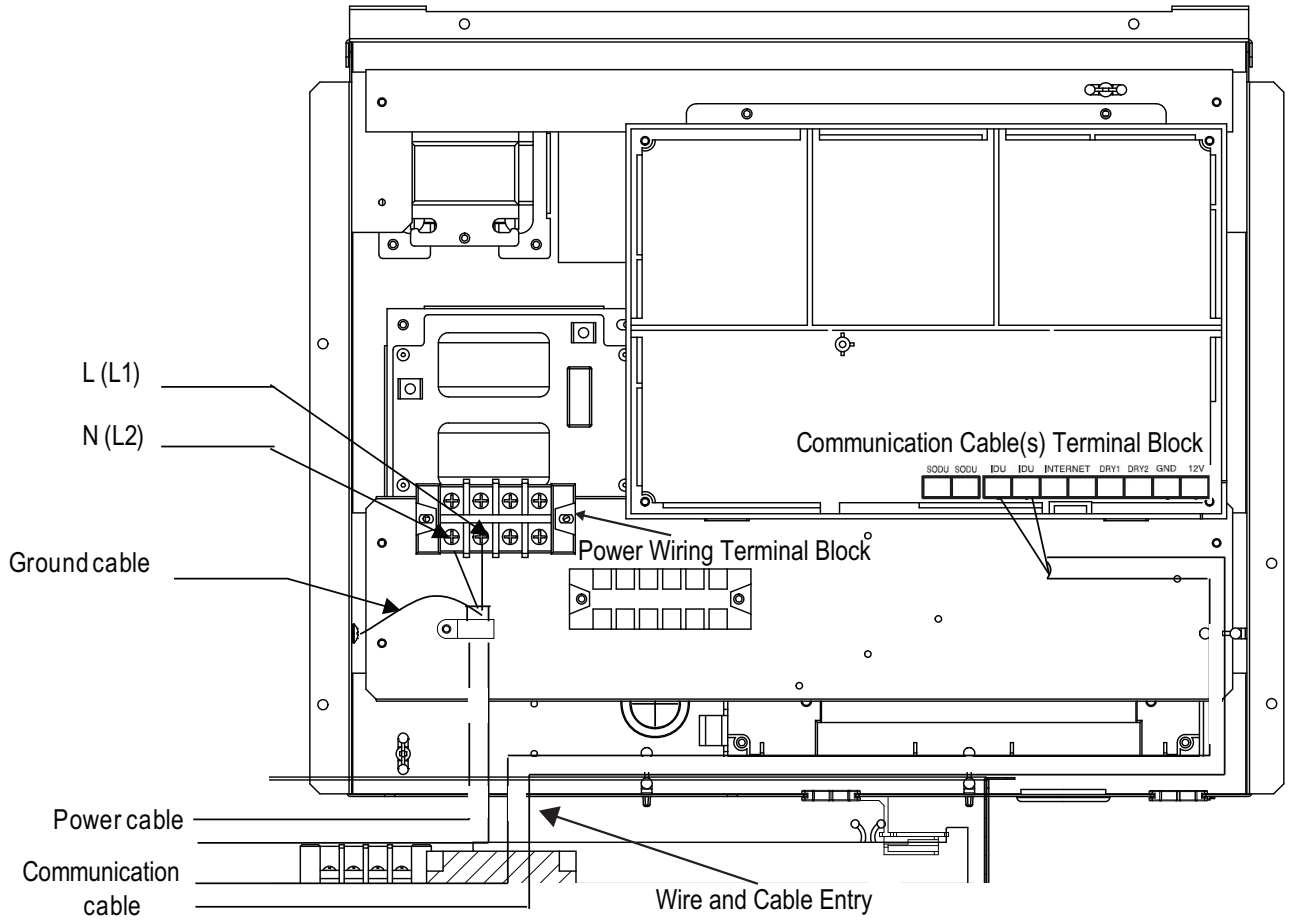
Note:

- ⃠ *Do not secure the power wiring and communication cables together. It will result in equipment malfunction.*
- ⃠ *Do not run the power wiring and the communication cable in the same conduit. It will result in equipment malfunction.*

Location of Water-Source Unit PCBs and Other Electrical Components

1. Connect power supply wiring to the terminal block using clamps as shown in the figures from the previous page and below.
2. Connect communication cable to main PCB terminal block using clamps as shown in the figure below.

Figure 62: Power Wiring and Communication Cable Connections in the Water Source Unit.



⚠WARNING

⃠ *Never apply line voltage power to the communications cable terminal block. If contact is made, it will result in fire, electric shock, physical injury and /or death.*

Note:

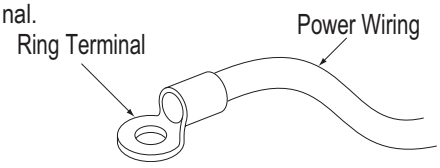
- ⃠ *Never apply line voltage power to the communications cable terminal block. If contact is made, it will damage the PCB.*
- *Always include some allowance in the wiring length when terminating. Provide some slack to facilitate removing the electrical panels while servicing.*

Power Wiring / Communication Cable Connections

Best practice dictates using solderless ring or fork terminals at all power wiring and communication cable terminations. Use copper bearing ring or fork terminals; ⃠ do not use galvanized or nickle plate over steel. Use appropriate crimping tool to attach the ring or fork terminals at all power wiring and control cable terminations. To install:

- Firmly attach the wire; secure in a way to prevent external forces from being imparted to the terminal block.
- Use an appropriately sized screwdriver for tightening the terminals.
- ⃠ Do not overtighten the connections; overtightening will damage the terminals.

Figure 63: Close up of a Typical Ring Terminal.

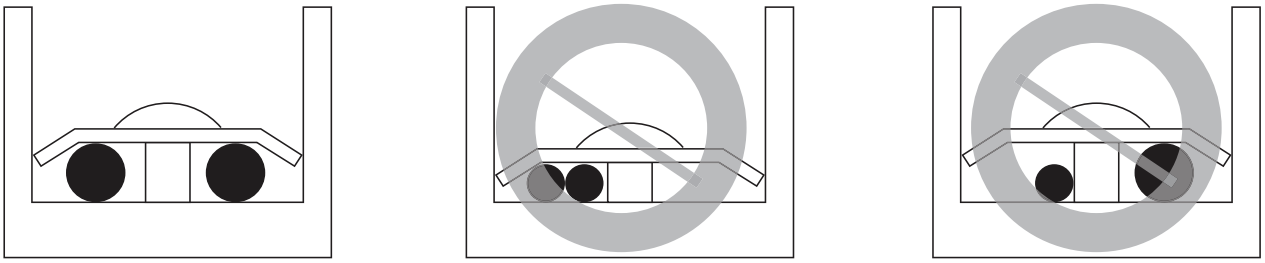


If ring terminals or fork terminals are not available, then:

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

Figure 64: Proper and Improper Power Wiring Connections.

● :Copper Wire



Terminate multiple power wires of the same gauge to both sides.

Do not terminate two wires on one side.

Do not terminate different gauge wires to a terminal block.

⚠WARNING

If power wires are not properly terminated and firmly attached, there is risk of fire, electric shock, and physical injury or death.

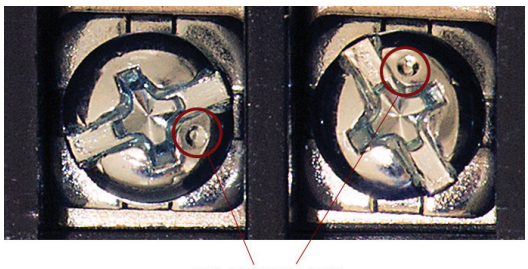
Note:

- ⃠ *Never apply line voltage power to the communications cable terminal block. If contact is made, the PCBs will be damaged.*
- *Always include some allowance in the wiring length when terminating. Firmly attach the wiring or cable, but provide some slack to facilitate removing the electrical panels while servicing, and to prevent external forces from damaging the terminal block.*

Terminal Connections

LG uses a "JIS" type of screw for all terminals; use a JIS screwdriver to tighten and loosen these screws and avoid damaging the terminal. ⃠ Do not overtighten the connections — overtightening will damage the terminals — but firmly and securely attach the wiring in a way to prevent external forces from being imparted to the terminal block.

Figure 65: JIS Screws.



JIS DIMPLES

Note:

- *The terminals labeled "GND" are NOT ground terminals. The terminals labeled ⏚ ARE ground terminals.*
- *Polarity matters. Always connect "A" to "A" and "B" to "B."*
- *Always create a wiring diagram that contains the exact sequence in which all the indoor units are wired in relation to the water-source unit.*
- ⃠ *Do not include splices or wire nuts in the communication cable.*

Power Supply / Power Wiring Specifications

Water-source unit and indoor units must be provided power from separate breakers.

Water-Source Units

- Water-source unit: 1Ø, 208-230V, 60Hz.
- Power wiring / power wiring gauge to the water-source unit must be solid or stranded, and must comply with all local and NEC electrical codes.
- Water-source unit must be provided a dedicated fused disconnect or breaker. Properly ground the water-source unit per NEC and local codes.
- Power supply must not decrease or increase more than 10% of the rated voltage.
- Position the power wiring a minimum of two (2) inches away from the communication cable to avoid operation problems caused by electrical interference.
- ⃠ Do not run both the power wiring and the communication cable in the same conduit.

Indoor Units

- Indoor units require 1Ø, 208-230V, 60Hz power, but each unit draws minimal power.
- Where permitted by NEC and local codes, multiple indoor units will be powered from a properly sized single breaker.
- Power supply wire type and size should be selected based on NEC and local codes. Maximum allowable voltage fluctuation ±10% or nameplate rated value.
- Properly ground each indoor unit per NEC and local code requirements.

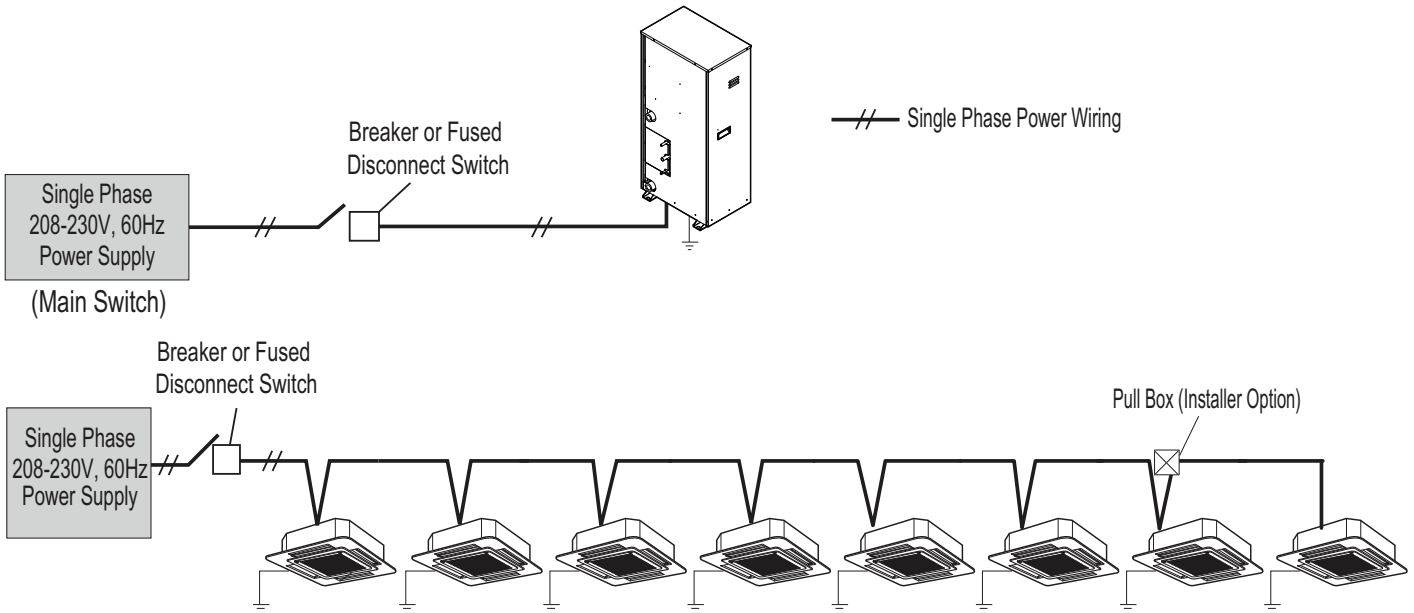
⚠WARNING

- *All power wiring installation must be performed by trained service providers working in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Failure to do so will lead to electric shock and bodily injury or death.*
- *Use specified wiring for connections, and ensure that external force is not imparted to terminal connections. If connections firmly attached, it will generate heat and / or cause a fire, resulting in physical injury or death.*
- *Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent will include some amount of direct current. Using an oversized breaker or fuse will result in electric shock, physical injury or death.*
- *Use the appropriate type of overcurrent protection. Generated overcurrent will include some amount of direct current, and if the appropriate type of overcurrent protection is not installed, there is a risk of fire, electric shock, and physical injury or death.*
- *Ground wiring is required to prevent accidental electrical shock during current leakage, communication problems from electrical noise, and motor current leakage. ⃠ Do not connect the ground line to the pipes. There is risk of fire, electric shock, explosion, physical injury or death.*
- *Install a main shutoff switch that interrupts all power sources simultaneously. There is risk of fire, electric shock, explosion, physical injury or death.*
- *The GND terminal at the main PCB is a negative terminal for dry contact, not a ground. Inadequate connections will generate heat, cause a fire, and physical injury or death.*

Note:

- *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. If the system operates in reversed phase, etc., it will damage the compressors and other components.*
- *Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent could include some amount of direct current. Using an oversized breaker or fuse will result in equipment malfunction and property damage.*
- *⃠ Do not connect ground wire to refrigerant, gas, or water piping; to lightning rods; to telephone ground wiring; or to the building plumbing system. Failure to properly provide a National Electrical Code-approved earth ground can result in property damage and equipment malfunction.*

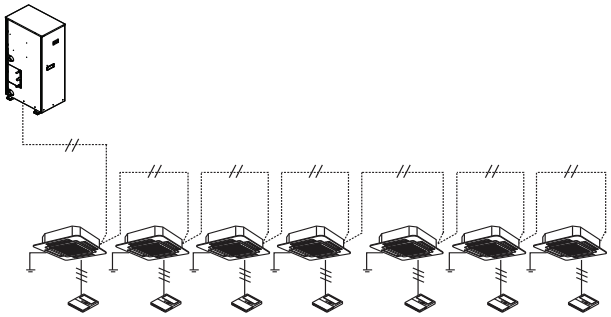
Figure 66: Example of a Typical Water-Source Unit Heat Pump Power Wiring Schematic.



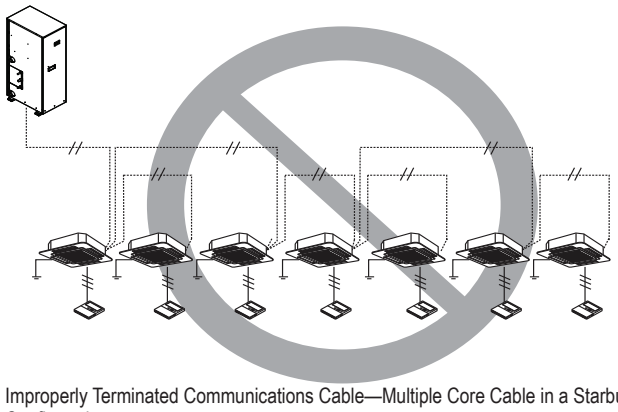
Communication Cable Specifications from Water-Source Unit to Indoor Units

- Communication cable between water-source unit to indoor units is to be 18 AWG, 2-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the water-source unit chassis only. ⃠ Do not ground the water-source unit to indoor units communication cable at any other point. Wiring must comply with all applicable local and national codes.
- Cable shields between the connected devices must be tied together and continuous from the water-source unit to the last component connected.
- Start the communication cable at the water-source unit and route to the indoor units in a daisy chain configuration. ⃠ Do not install in a starburst configuration.
- Indoor Unit Communication Bus: The communication terminals are labeled differently among the indoor units, depending on type (currently for indoor units: A / B, 3[A] / 4[B], or 3 / 4. Refer to the wiring diagram schematic found in the indoor unit itself, or to the indoor unit wiring diagrams in the Engineering Manuals for more information. Match the correct IDU terminals on the water-source unit to the correct terminals on the indoor units.
- Insulation as required by NEC and local codes.
- Rated for continuous exposure of temperatures up to 140°F.
- Maximum allowable communication cable length is 984 feet.

Figure 67: Water Source Unit Communications Labeling Schematic.



Recommended—Two-Core Shielded, Stranded Cable in a Daisy Chain Configuration



Improperly Terminated Communications Cable—Multiple Core Cable in a Starburst Configuration

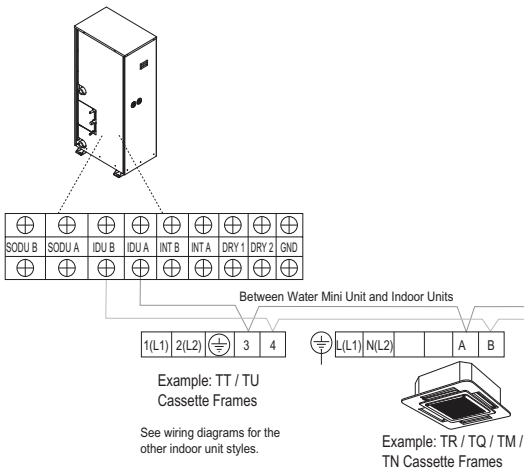
⚠ WARNING

- *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. There is risk of fire, electric shock, explosion, physical injury or death.*
- *⃠ Never ground the shield of the communications cable to the indoor unit frame or other grounded entities of the building. Inadequate connections will generate heat, cause a fire, and physical injury or death.*

Note:

- *Always verify the communication cable is connected to a communications terminal on the water-source unit. ⃠ Never apply line voltage power to the communication cable connection. If contact is made, the PCBs will be damaged.*
- *The terminal tagged "GND" on the water source unit main PCB is not an earth ground terminal. It is a neutral (-) terminal provided to connect the water source unit to central control devices.*
- *⃠ Never use a common multiple-core communications cable. Each communications bus must be provided a separate cable (i.e., between water-source unit and indoor units, water-source unit and central controller(s). If communications cables of separate systems are wired using a common multiple-core cable, it will result in a poor communications signal and unacceptable system operation.*

Figure 68: Water Source to Indoor Unit Communications Cable Termination Detail.



ELECTRICAL

Communication Cable Specifications

From Water-Source Unit to the Central Controllers

- Communication cable from the Water-Source Unit to the Central Controller is to be 18 AWG, 2-conductor, twisted, stranded, shielded. If shielded, ensure the communication cable shield is properly grounded to the Water-Source unit chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
- Connect all central control devices on the same cable if cable requirements are the same.
- Order does not matter, but polarity does. Keep “A” terminals with “A” terminals, and “B” terminals with “B” terminals. Starting at the water-source unit, terminate the cable on terminals Internet A and Internet B.
- Route the cable as needed between each device.
- Tie shields together at each termination point.
- Add insulation material as required by local code.

Communications Cable Specifications From Indoor Units to Remote Controllers

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

Figure 69: One Example of Indoor Unit to Zone Controller Connection.

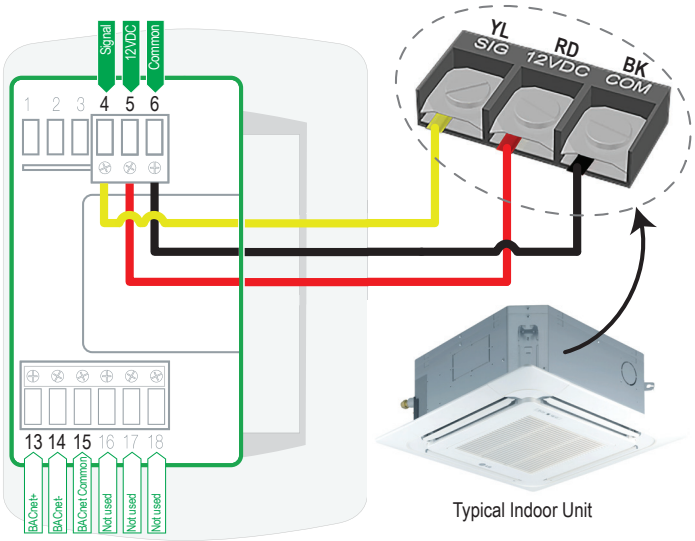
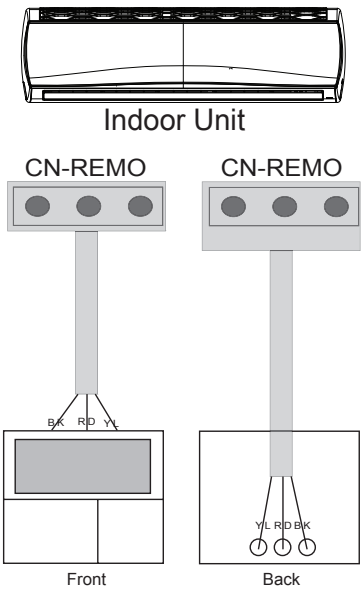


Figure 70: Another Example of Indoor Unit to Zone Controller Connection.



Note:

Cable connected to Zone Controller is the factory default connection.

Communications Cable Specifications Between Multiple Indoor Units Operating as a Group (Group Control)

If any indoor units were specified to operate in unison:

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

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

- From the controller to the Main indoor unit, use 22 AWG, 3-conductor, twisted, stranded, unshielded. All wiring must comply with all applicable local and national codes.
- From the Main indoor unit to the Sub indoor unit(s), daisy chain using 22 AWG, 3-conductor, twisted, stranded, unshielded (⃠ Do not attach wire to 12VDC terminal to the Sub indoor units). All wiring must comply with all applicable local and national codes.

For indoor units with CN-REMO connections:

Use Group Control Kit (sold separately) containing extension and Y-splitter cables. Use one (1) group control cable kit for each indoor unit in the group except for the last indoor unit.

Figure 71: Example of Indoor Unit Group to Zone Controller Connections (Sig-12V-GND [Comm.] Terminal).

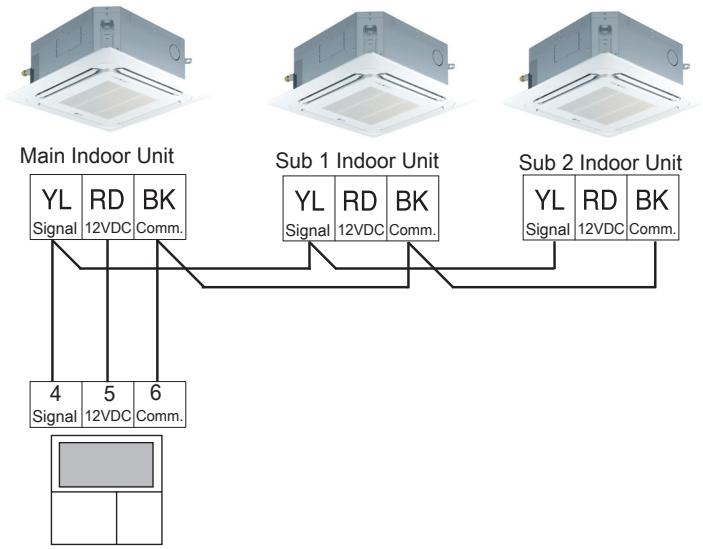
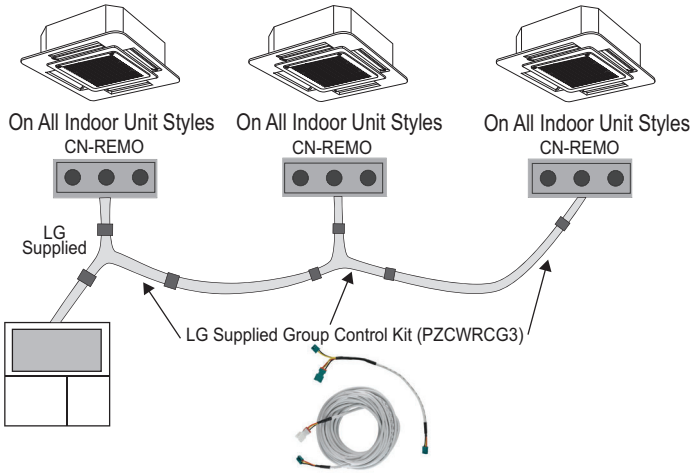


Figure 72: Example of Indoor Unit Group to Zone Controller Connections (CN-REMO).



Note:

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

Triple Leak / Pressure Check

After the refrigerant piping installation is complete, perform a triple leak / pressure test to check for leaks at any joints or connections within the piping system.

⚠DANGER

Using combustible gases, including oxygen, will result in fire or explosion and result in severe personal injury or death. Use inert gas (medical-grade dry nitrogen) when checking leaks, cleaning, installing/repairing pipes, etc. The use of an 800 psig or higher nitrogen regulator is required for safety.

Note:

- ⃠ *Do not apply power to the Multi V water-source unit or the indoor units before performing a system leak test. There is a possibility that the EEV valves will close and isolate sections of the piping system, making the leak test inconclusive. Contact your LG Applied Rep or service technician for the procedure to reopen the EEV valves before the leak test* ***ONLY*** *if the power has been applied.*

- ⃠ *Never perform the leak test using refrigerant.*

- ⃠ *To avoid nitrogen entering the refrigerant system in a liquid state, the top of the cylinder must be higher than its bottom (used in a vertical standing position) when the system is pressurized.*

- *Use only a leak-free gauge manifold set.*

Triple Leak / Pressure Check Procedure Steps

1. After the refrigerant piping installation is complete, open the isolation ball valves, if any, that will have been included in the piping system.

2. Verify that the water-source unit liquid and vapor line service ports are closed, and the stem head access caps are tight. The leak / pressure check is to be performed to only the refrigerant piping system and connected indoor units.

3. Remove the caps on the Schrader ports. Connect the (medical-grade dry) nitrogen cylinder regulator to a gauge manifold, then connect the gauge manifold to the Schrader ports on the liquid and vapor line service ports.

4. Perform the leak / pressure check at 150 psig for five (5) minutes (standing pressure check).

5. Perform the leak / pressure check at 300 psig for fifteen (15) minutes (standing pressure check).

6. Perform the leak / pressure check at 550 psig for 24 hours to make sure the piping system is leak-free. After the gauge reading reaches 550 psig, isolate the system by first closing the gauge manifold, then close the nitrogen cylinder valve. Check the flared and brazed connections for leaks by applying a bubble solution to all joints.

Note:

The bubble solution must be a solution designed for refrigerant leak testing. Common soap solution must ⃠ never be used on refrigerant piping as those contain chemicals that could corrode copper and brass, and cause product malfunction.

7. If the pressure does NOT drop for 24 hours, the system passes the test. See how ambient conditions will affect the pressure test on the next page.

Triple Leak / Pressure Check Procedure Steps, continued.

Ambient Conditions and the Leak / Pressure Check

If the ambient temperature changed between the time when pressure was applied and when the pressure drop was checked, adjust results by factoring in approximately 0.79 psi for each 1°F of temperature difference.

Correction formula: (°F Temperature when pressure was applied - °F Temperature when pressure drop was checked) x 0.79.

Example: When pressure (550 psig) was applied, temperature was 80°F; 24 hours later when pressure drop (540 psig) was checked, temperature was 68°F.

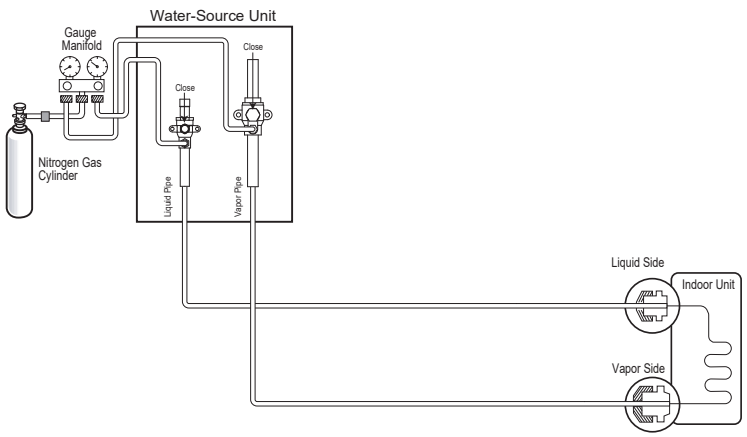
Thus, (80°F - 68°F) x 0.79 = 9.5 psig.

In this case, the pressure drop of 9.5 psig was due to temperature differences, therefore, there is no leak in the refrigerant piping system.

8. If the pressure drops and it is not due to ambient conditions, there is a leak and it must be found. Remove the bubble solution with a clean cloth, repair the leak(s), and perform the leak / pressure check again.

9. After the system has been thoroughly tested and no leaks are found, depressurize by loosening the charging hose connector at the nitrogen cylinder regulator. When system pressure returns to normal, completely disconnect the charging hose from the cylinder, and release the nitrogen charge from all refrigerant piping. Wipe off any remaining bubble solution with a clean cloth.

Figure 73: Leak / Pressure Test.



Triple Evacuation Procedure

After the leak / pressure check is complete, perform a Triple Evacuation with the entire system. Evacuation must be performed through the Schrader ports on the water-source unit service ports.

Note:

- *The water source unit can be put in vacuum mode to assist with the vacuum process, but it is not necessary if a vacuum pump is connected to all charging ports at the water source unit simultaneously.*
- *For faster evacuation, the Schrader core can be removed, and an auxiliary service port can used. Make sure to re-install the original Schrader core before operating the system.*
- *Evacuate through both the liquid and vapor refrigerant lines.*
- *The water-source unit service valves must remain closed and the stem head access caps tight. ⃠ Do not open the water-source unit service valves and release the factory refrigerant charge until the LG trained commissioner authorizes to do so. The system must be left in vacuum until the LG trained commissioner verifies the quality of the evacuation. If the evacuation procedure was not conducted properly, the system will malfunction.*
- *Any field-installed ball valves in the refrigerant system (if used) must be open to ensure all piping is free and clear for evacuation on all piping and connected indoor units.*

Note:

- ⃠ *Do not apply power to the Multi V water-source unit or the indoor units before performing a system evacuation. There is a possibility that the EEV valves will close and isolate sections of the pipe system, making the evacuation procedure inconclusive. Contact your LG Applied Rep or service technician for the procedure to reopen the EEV valves before evacuation only if the power has been applied.*
- ⃠ *Never perform evacuation using refrigerant.*
- *Use only a vacuum pump that can reach 500 microns, vacuum rated hoses or copper tubing, and a leak-free gauge manifold set.*
- *Use only new vacuum pump oil from a properly sealed (unopened) container, and change oil in pump before **EVERY** use.*
- *Subsequent oil changes will be necessary after several hours of continuous operation; have extra oil on hand.*
- *Use a quality micron gauge in good operating order and install as far away from pump as possible.*

Triple Evacuation Procedure Steps

1. If this procedure is performed shortly after the leak / pressure test, the caps and cores on the Schrader ports must have already been removed, and the manifold must already be connected. If the procedure was not performed shortly after the leak / pressure test, make sure to remove the caps and cores on the Schrader ports. Verify that the service valves on the outdoor unit are closed, and the stem head access caps are tight.

Note:

Connect the vacuum pump to the gauge manifold and hoses. Once the vacuum pump is first operated, if hoses, manifold, and vacuum valves are leak free (and oil is not moisture laden), the gauge must read <100 microns within one (1) minute. ⃠ Do not proceed if the gauge does not read <100 microns within one (1) minute. There is a leak in the hose, gauge manifold, or vacuum valve, and the equipment must be replaced.

2. Connect the gauge manifold along with the vacuum pump to the Schrader ports (with core removed) using vacuum hoses. Open the gauge manifold and the vacuum pump valves.

3. Operate the vacuum pump and evacuate the system to the 2,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level could rise a bit, but MUST eventually stop rising for fifteen (15) minutes.
   - If the micron level DOES NOT stop rising, there is a leak, and the leak test must be performed again.
   - If the micron level DOES rise above 2,000 micron, re-open the manifold gauges and the vacuum pump valve and continue evacuation back down to 2,000 micron level.
   - If the micron level holds at 2,000 micron, continue to step 4.

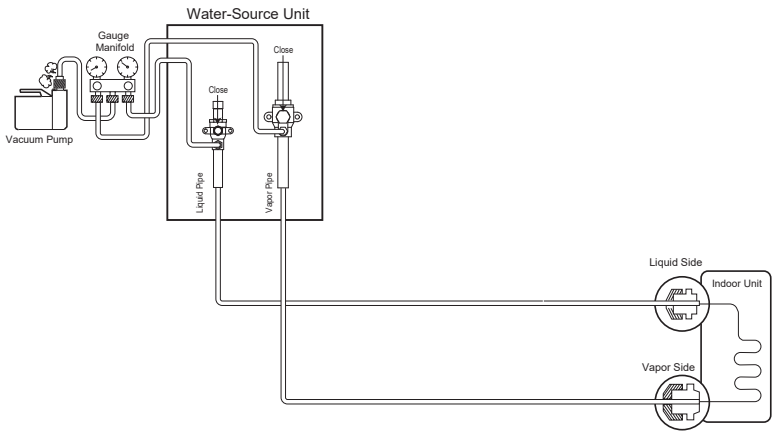
4. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time (this is to “sweep” moisture from piping).
5. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
6. Evacuate to 1,000 micron level. Isolate the pump by closing the manifold gauges and the vacuum pump valve, and then watch the micron level. Micron level could rise a bit, but MUST eventually stop rising for fifteen (15) minutes.
   - If the micron level DOES NOT stop rising, there is a leak, and the leak test must be performed again.
   - If the micron level DOES rise above 1,000 micron, re-open the manifold gauges and the vacuum pump valve, and continue evacuation back down to 1,000 micron level.
   - If the micron level holds at 1,000 micron, continue to step 7.

7. Break vacuum with 50 psig nitrogen purge for an appropriate amount of time.
8. Purge nitrogen from the system until the pressure drops down to 1 to 3 psig.
9. Evacuate to static micron level ≤500.
10. Micron level must remain ≤500 for one (1) hour. If the vacuum gauge rises and stops, the system could contain moisture, therefore, it will be necessary to repeat the steps of vacuum break and drying.
11. After maintaining the system in vacuum for one (1) hour, check if the vacuum gauge rises or not. If it doesn’t rise, then the system is properly evacuated.
12. Close manifold gauges.
13. Shut the valve before turning off the vacuum pump.

Note:

- *If the water-source unit is moved to and installed in another site, only charge with new refrigerant after successful leak test and triple evacuation procedures have been performed. If a different refrigerant or air is mixed with the original refrigerant, the refrigerant cycle will malfunction and the unit will be damaged.*
- ⃠ *Do not open the water source unit service valves and release the factory refrigerant charge until the LG trained commissioner authorizes to do so.*

Figure 74: Vacuum Test.



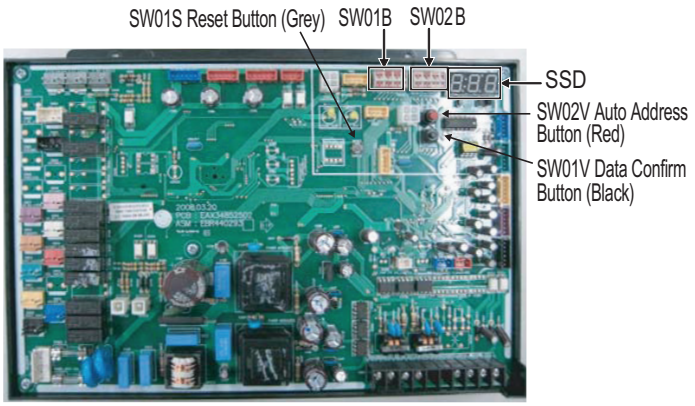
Vacuum Mode (Option)

The vacuum mode can be used as an option for creating vacuum in the system when the water-source unit is first installed, and if power is available. Vacuum mode enables the system to fully open all valves, and can help speed up the evacuation process.

Vacuum mode can also be used when compressor and / or water source unit parts are replaced, or when an indoor unit is added or replaced.

1. Reset the water-source unit power by pressing SW01S on the main PCB.
2. Turn SW02B DIP Switches 11 (4) and 14 (7) to ON.
3. The code “254” will appear on the seven-segment display (SSD).
4. Press the black SW01V “Data Confirm” button SW01V. SSD is blank. Wait for five (5) seconds.
5. In vacuum mode, all necessary valves are open within the water-source unit system.
6. To cancel the vacuum mode, turn SW02B DIP Switches Nos. 11 (4) and 14 (7) to OFF, and push the SW01S reset button to reset the water-source power.

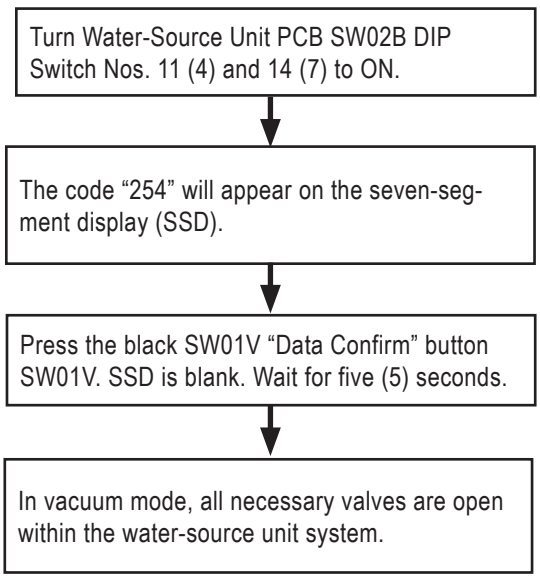
Figure 75: Water-Source Unit PCB Vacuum Mode Switch and Button Locations.



Note:

The water source unit can be put in vacuum mode to assist with the vacuum process, but it is not necessary if a vacuum pump is connected to all charging ports at the water source unit simultaneously.

Setting Vacuum Mode



Canceling Vacuum Mode

Turn SW02B DIP Switches Nos. 11 (4) and 14 (7) to OFF.

<AND>

Push the SW01S reset button on the Water-Source Unit Main PCB.

Note:

Water-source unit operation stops during Vacuum Mode, so the compressor cannot operate.

Pre-Commissioning Process

After successfully completing the leak / pressure check and triple evacuation procedures, begin the pre-commissioning process. The pre-commissioning process will prepare the system for commissioning in several steps:

1. Verify facility power is correct.
2. Power up the system.
3. Verify power at the system is correct.
4. Run self diagnostics check.
5. Assign a system address to indoor units.
6. Assign each central control device an address.

Prepare the Electrical System

Multi V Water Mini water-source units require 208-230V / 60Hz / 1Ø power. Verify that the power is correct. If the electrical power is dirty, the unit will shutdown on a compressor safety and/or the lifespan will be reduced.

Multi V Water Mini water-source units are inverter driven. ⃠ Do not install a phase-leading capacitor. If one is included, it will deteriorate the power factor improvement effect, and will cause the capacitor to generate an abnormal amount of heat.

1. Verify correct, clean, specified power is at the line side of each system component's disconnect.
2. Note if the green LED light on the component PCB board is illuminated.
3. If an air cleaner is installed on a high static ducted model indoor unit, verify power has been provided to the air cleaner controller. Verify by observing the LED in the center of the disconnect plate is illuminated.
4. If a zone controller is connected to the component, verify the screen displays current operational characteristics.

Water-Source Unit Settings

DIP Switch Settings

DIP switch settings must be changed with the system power OFF (power must be cycled ON or settings won't be applied). Settings are displayed on the water-source unit SSD for two to five (2 to 5) seconds after power is applied.

Note:

If the applicable DIP Switches are not set correctly, the unit will not operate properly.

Checking Water-Source Unit Settings

The code sequence and identity codes are displayed in order on the SSD after the power is connected. The number represents the settings.

Figure 76: Location of DIP Switches.

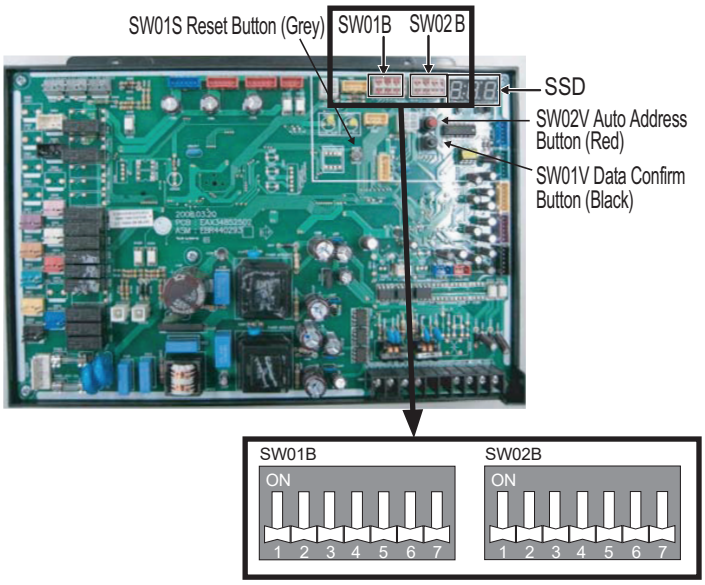


Table 34: Code Display Sequence.

Sequence	Code	Description
1	-	Model code
2	-	Total capacity in horsepower
3	2	Heat pump model
4	25	Normal mode display (If the DIP switch is not set correctly, this number is not displayed.)
5	136	Model type (Water Mini)

Table 35: Water Mini Unit Model Identification Codes.

Model Code	Capacity (Horsepower / Tons)	Power Supply	Refrigerant
122	6 / 4.4	1Ø, 208/230V	R410A

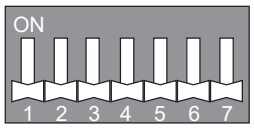
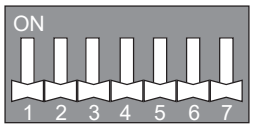
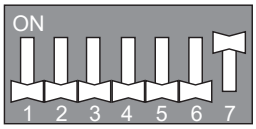
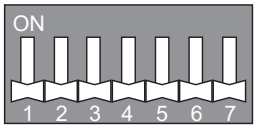
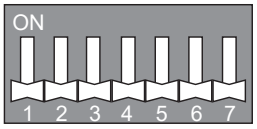
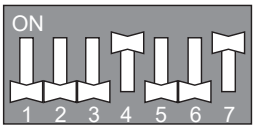
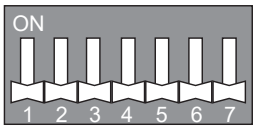
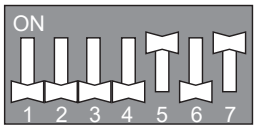
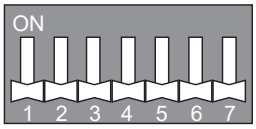
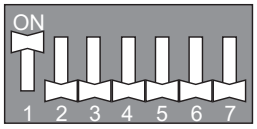
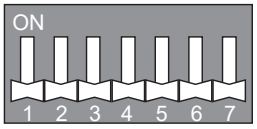
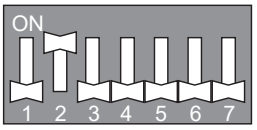
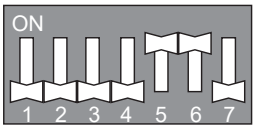
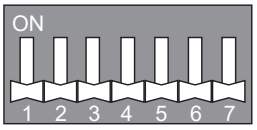
Note:

While this procedure operates, the unit runs a self-diagnostics check. At completion, the SSD should be clear and nothing displayed. Diagnostic process should take from three (3) to seven (7) minutes.

PRE-COMMISSIONING

Water-Source DIP Switch Settings

Table 36: Water Mini Unit DIP Switch Settings.

Function	SW01B Setting	SW02B Setting	Description
Standard			Factory setting; standard mode.
Forced Oil Return			
Vacuum Mode			
Water Pipe Solenoid Valve 208 / 230V			For Water Pipe Solenoid Valve 208 / 230V Power
Ground Source Mode			Use this mode when temperature of circulation inlet water is less than 50°F (10°C) (Anti-freeze must be added.)
Variable Water Flow Control Mode			Variable Water Flow Valve Control Kit must be installed before setting and using this mode.
Dry Contact Mode			

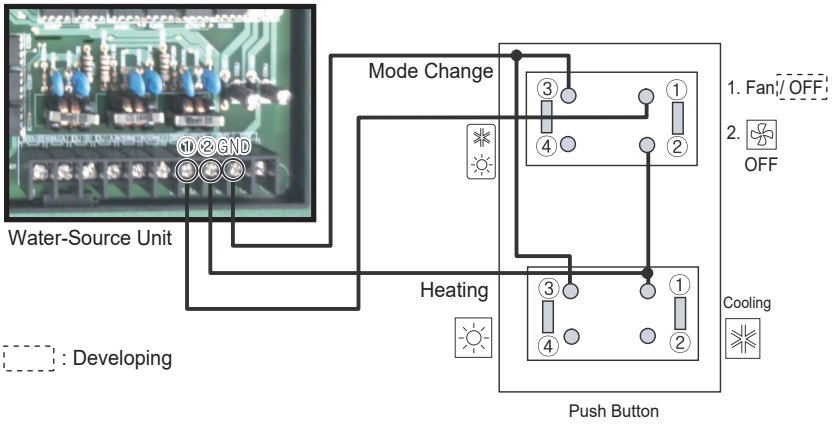
Note:

- *After setting the DIP Switches for the optional functions, the power to the main PCB must be reset or the function will not be applied.*
- *After re-setting the DIP Switches to cancel the optional functions, the power to the main PCB must be reset to reflect the change.*
- *The DIP Switches must be set properly. If the DIP Switches are not set properly, it can cause an excessive load on product operation.*

Cool / Heat Selector Installation and Connections

- Connect wiring as shown in the figure below.
- Insert the wiring in the connection hole pushing the “Push” button.
- Set Main PCB DIP Switch of Water Mini unit.

Table 37: Cool / Heat Selector Connections.



Indoor Unit Auto Addressing

⚠WARNING

Disconnects should only be operated by a properly licensed electrician at this time. Never look at a disconnect switch when closing. Turn away from the switch when closing. Incorrect wiring could cause the disconnect to explode, physical injury, and / or death.

Note:

During the pre-commissioning process, ⃠ do not change any DIP switch settings. All switches should be left in the OFF position on both DIP switches SW01B and SW02B.

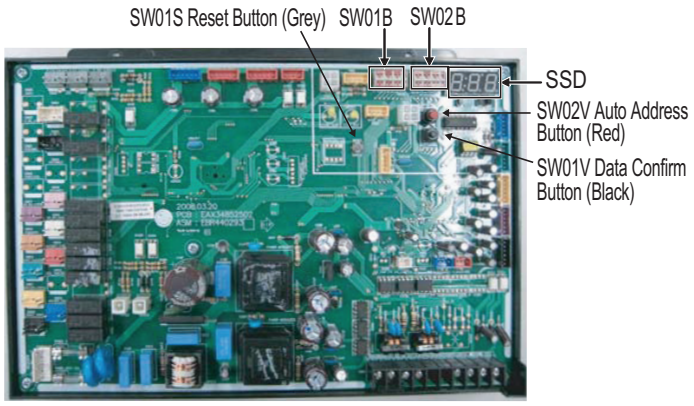
Initiate the Auto Addressing Procedure

Note:

If the Auto Address Procedure has never been successfully completed for the water source system, the compressor(s) will not start when power is applied to the unit.

1. Verify all that all indoor units connected to the system have power to the PCB board AND all zone controller system start buttons are OFF.
2. Remove the maintenance access panel and unit control box cover from the water source unit. Place panels and screws in a secure area.
3. Verify the communications cable between the indoor units and the water source unit is terminated at the water source unit terminals IDU(A) and IDU (B).
4. Verify the shield on the communications cable is grounded at the water source unit.
5. At the water source unit PCB, verify all DIP switches are “OFF” on DIP switches SW01B and SW02B.
6. Cycle power on the water source unit. Leave disconnect in the "ON" position.
7. Check the water source unit current configuration code(s). Observe the unit setup codes using the SSD found on the water-source units PCB. Each code will display for two (2) seconds.
8. Know how many indoor units are connected to the system.
9. Press and hold the red SW02V Auto Address Button for about five (5) seconds. Release when “88” appears on the LED. After three (3) to seven (7) minutes, the display will flash a number for about ten (10) seconds indicating how many indoor units the system successfully communicated with.
10. This number should match the known installed number of indoor units if the auto addressing procedure was successful.
11. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.
12. Upon successful completion of the auto address procedure, record the system address assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.
13. After recording the system addresses assigned to each device, open the water source unit disconnect. Remove the water source unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends.
14. Close the disconnect to reapply power to the water source unit and energize the compressor crankcase heater. Once again, verify the water source unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the water source unit.
15. Replace the control panel door.

Figure 77: Auto Address Button Location.



Initiate the Auto Addressing Procedure, continued

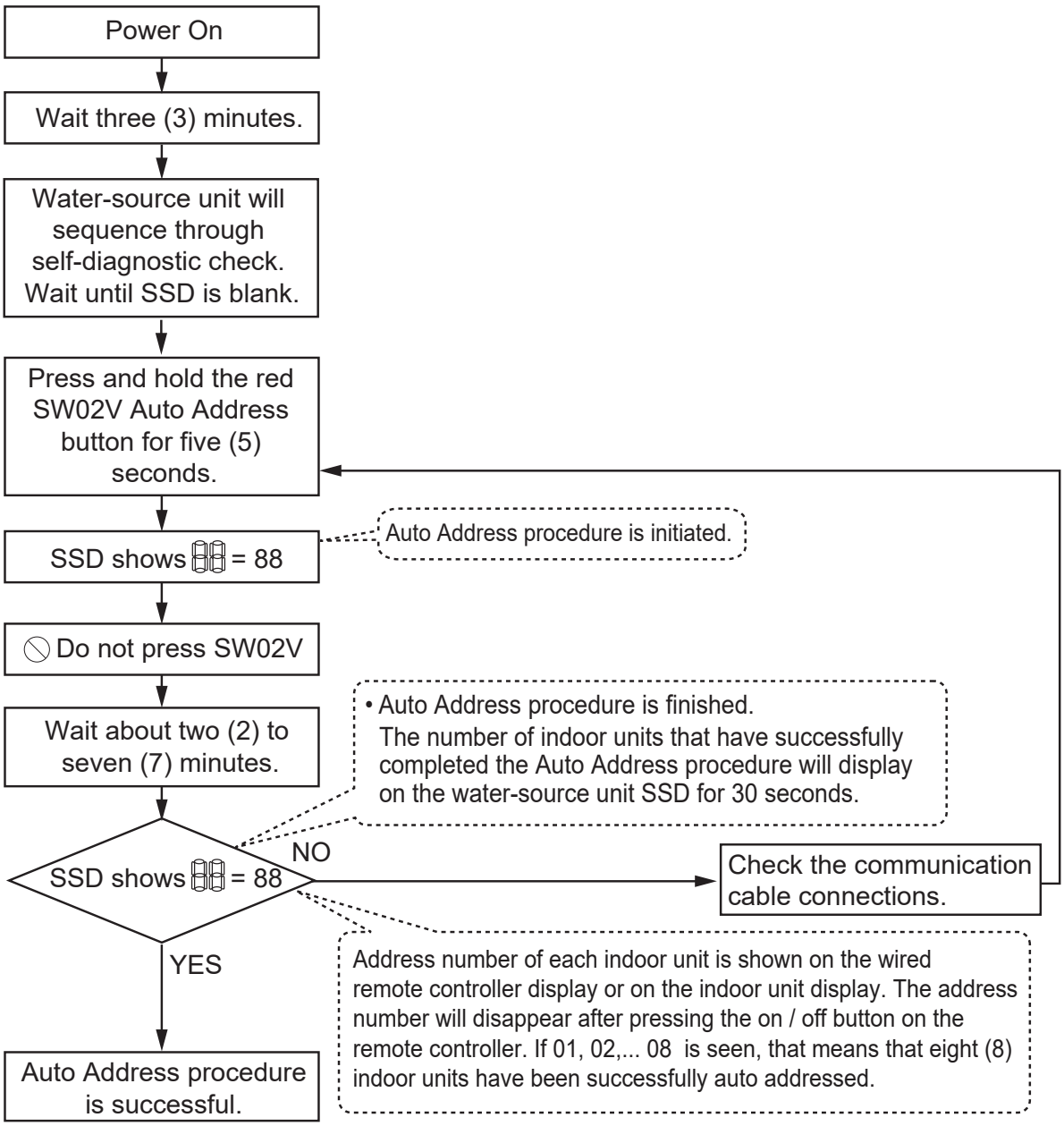
⚠WARNING

Upon successful completion of the auto addressing function, an unintentional compressor start can occur unless the communications cable to the indoor units is removed from the water source unit terminals IDU(A) and IDU(B). ⃠ Do NOT open the service valves or attempt to start water source unit compressors or until directed by the Commissioning Agent. There is a risk of explosion, suffocation, physical injury, and / or death.

Note:

Upon successful completion of the auto addressing function, an unintentional compressor start can occur unless the communications cable to the indoor units is removed from the water source unit terminals IDU(A) and IDU(B). ⃠ Do NOT open the service valves or attempt to start water source unit compressors or until directed by the Commissioning Agent. Major damage to the unit piping and compressors will occur.

Figure 78: Indoor Unit Auto Addressing Procedure Flowchart.



Troubleshooting a Failed Indoor Unit Auto Addressing Procedure

If the quantity of indoor units the auto addressing procedure found is incorrect, or the “88” never disappears from the display for the seven (7) minutes, the auto address routine has failed and a communications problem exists. If the Auto Address Procedure failed:

1. Verify ALL indoor unit ON/OFF buttons are in the OFF position (i.e., on/off button NOT illuminated).
2. Check the terminations, polarity, and continuity of each conductor on the communications cable between the water source unit and the indoor units. Verify the indoor unit to water source unit communications cable is wired correctly.
   - Verify the conductor connected to the correct terminals on all indoor units and is terminated on the water source unit terminal tagged IDU(A).
   - In a similar fashion, verify the conductor connected to all indoor units on the correct terminals and is terminated on the water source unit terminal tagged IDU(B).
3. Verify the shield of the communications cable is grounded at the water source unit only. All segment shields should be spliced together at each indoor unit and NOT grounded.
4. After repairing the communications cable, go to Step 9 of the Initiate the Auto Addressing Procedure and repeat the process until successful: Press and hold red Auto Address Button for about five (5) seconds. Release when “88” appears on the LED. After three (3) to seven (7) minutes, the display will flash a number for about ten (10) seconds indicating how many indoor units the system successfully communicated with.
5. This number should match the known installed number of indoor units if the auto addressing procedure was successful.
6. Upon completion of the auto addressing routine, the display will be blank and the system will be in standby waiting for another command.
7. Record the system address the water source unit assigned to each indoor unit by the auto address procedure in the column provided on the Pre-commissioning Device Configuration Worksheet.
8. After recording the system addresses assigned to each device, open the water source unit disconnect. Remove the water source unit to indoor unit communications cable from terminals IDU(A) and IDU(B). Protect conductors by placing electrical tape over the bare ends to prevent an accidental compressor start from occurring before the Commissioning Agent arrives.
9. Close the disconnect to reapply power to the water source unit and energize the compressor crankcase heater. Once again, verify the water source unit to indoor unit(s) communications cable is not connected to terminals IDU(A) and IDU(B) of the water source unit.
10. Replace the control panel cover.

Group Controlling Indoor Units

If any of the indoor units were specified to operate in unison, create a group control communications circuit between the indoor units using field wiring (with indoor units that have SIG - 12V - GND [Comm.] terminals), or a group control cable kit (with indoor units that have CN-REMO).

1. Before proceeding with group control cable terminations, verify power is OFF at all applicable indoor units.
2. Identify which indoor unit will be the “Main” unit of the group. If not already recorded, record the "Main" and the "Sub" identity assignment to each indoor unit in the group on the Pre-commissioning Device Configuration Worksheet.
3. SIG - 12V - GND [Comm.] Terminal Procedure
   - From the controller to the Main indoor unit, use 22 AWG, 3-conductor, twisted, stranded, unshielded.
   - From the Main indoor unit to the Sub indoor unit(s), daisy chain using 22 AWG, 3-conductor, twisted, stranded, unshielded (⃠ Do not attach wire to 12VDC terminal to the Sub indoor units). All wiring must comply with all applicable local and national codes.
   - All wiring must comply with all applicable local and national codes.
4. CN-REMO Termination Procedure:
   - Starting with the Main indoor unit, plug in the male end of the pigtail cable into the CN-REMO socket. At the last Sub indoor unit in the group, a pigtail cable is not required. Plug the male end of the extension cable coming from the previous indoor unit into the CN-REMO socket.
   - Plug the Y-cable into the pigtail at each indoor unit except for the last Sub indoor unit in the group where no Y-cable will be needed.
   - Connect two extension cable segments to each “Y” cable except for the “Y” cable connected to the Main indoor unit. At the Main indoor unit, connect one extension cable and the communications cable from the zone controller to the Y-cable.

Central Control

Central Control Addresses Assignments

Gather any preferences the project has; if there are no preferences:

- Hex assignments do not have to be assigned in any particular order, or an order defined by the routing of the communications cable between the indoor units. In most cases, Hex addresses can be skipped.
- All members of a Hex Group are not required to be on the same Multi V system.
- Addresses can be assigned at random, not in any particular order, and can be skipped.

Indoor Unit Central Control Address Assignments

A central control address is made up of two hexadecimal characters.

- The first character in the central control address is the Hex Group Identifier.
  Possible Hex Group Identifiers (in order of lowest to highest) are 0-9 followed by A-F. See complete list in table at right.
- The second character in the address is the Hex Member Identifier in a Hex Group.
  Hex Member Identifiers (in order from lowest to highest) are 0-9 followed by A-F. See complete list in table at right.

Figure 79: Central Control Address Nomenclature.

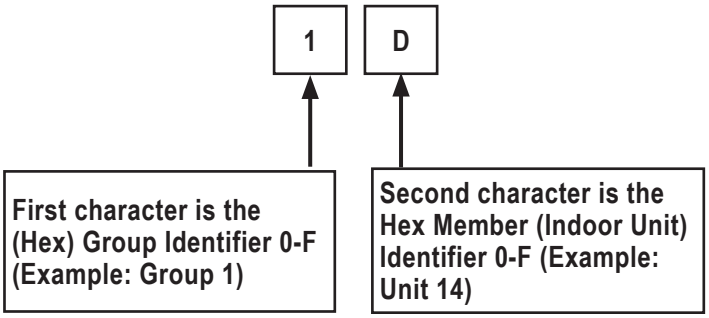


Table 38: Central Control Address Nomenclature List.

Group Control by Central Controller
No. 0 Group (00 ~ 0F)
No. 1 Group (10 ~ 1F)
No. 2 Group (20 ~ 2F)
No. 3 Group (30 ~ 3F)
No. 4 Group (40 ~ 4F)
No. 5 Group (50 ~ 5F)
No. 6 Group (60 ~ 6F)
No. 7 Group (70 ~ 7F)
No. 8 Group (80 ~ 8F)
No. 9 Group (90 ~ 9F)
A Group (A0 ~ AF)
B Group (B0 ~ BF)
C Group (C0 ~ CF)
D Group (D0 ~ DF)
E Group (E0 ~ EF)
F Group (F0 ~ FF)

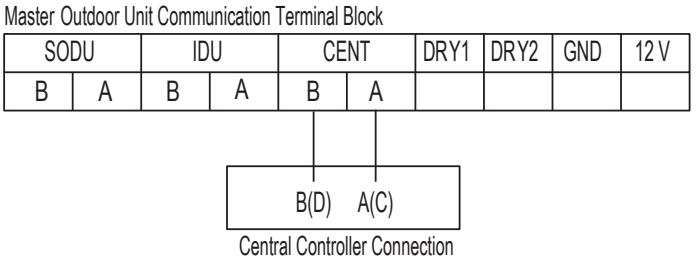
Hex Address Assignment Limitations

- There is a limit of 16 Members per Hex Group
- There is a limit of 16 Hex Groups per system.
- There is a limit of 256 possible Member Identifiers per Central Control (See Central Controller Communications Limitations).

Setting Central Control Addresses

1. Verify power to the whole system, including indoor units and outdoor unit(s), is OFF. If not, turn OFF.
2. If not installed already, connect the communication cable from CEN. A and CEN. B terminals on the outdoor unit to A and B terminals on the central controller. Polarity matters, so make sure A to A and B to B.
3. Power the whole system ON.
4. Set the group and indoor unit numbers using the wired remote controllers.
5. To control several sets of indoor units as a group, set the group I.D. settings from 0 to F.

Figure 80: Outdoor Unit to Central Controller Communication Connections.



Controller Communications Limitations

Each type of Controller device is designed to communicate with a limited quantity of indoor units. The quantity of indoor units that can be connected to a single control communications cable, therefore, will be defined by the control device on that cable with the smallest Maximum Indoor Unit Quantity as shown in the tables at right.

Table 39: Central Control / Integration Solutions Indoor Unit Connection Limitations.

Device	Maximum Indoor Unit Quantity
ACP 5	256
AC Smart 5	128
LG MultiSITE™ Communications Manager	128
ACP LonWorks®	64

LonWorks® is a trademark of Echlelon Corporation.

Group Number

If the building operator wants to know which indoor units are on each outdoor unit, and multiple systems serve a building:

- Assign a Group Number to each system. If there are more than 16 indoor units on a system, multiple Group Numbers will be necessary.

If the building owner wants to know which indoor units are on each floor:

- Assign a different group number for each floor. If there are more than 16 indoor units on a floor, multiple Group Numbers will be necessary.

Member Number

Can be assigned at will or for example, can follow the room layout on each floor.

For each LG Central Controller product provided on the project, devise a central control address schedule and assign a central control address to each indoor unit(s) Hydro Kit(s), and ERV(s) units. Record this central control address for each component in the column provided on the Pre-commissioning Device Configuration Worksheet.

Upload Central Control Address to the Indoor Units

For all ducted, vertical and floor standing indoor units, the central control address must be assigned using a wired zone controller. Wall-mount, ceiling cassette, ceiling suspended, and the wall / ceiling convertible indoor units, the central control address can be assigned using a wireless handheld controller or a wired zone controller.

Note:

During the following procedure, ⃠ NEVER PUSH the ON / OFF (Enable operation) Button on the zone controller.

For Indoor Units That ARE NOT Being Controlled as a Group

1. Verify the zone controller wiring / cable is connected properly to the indoor unit PCB. For more information on the different connections in LG indoor units, see the Electrical System Installation Section in this manual.
2. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for more information.)
3. Type in the Hex Central Control address that has been designated to the unit.
4. Repeat Steps 1 through 3 for each indoor unit in the building.

For Indoor Units That ARE Being Controlled as a Group

For the Main Indoor Unit in a Group Setting

1. Identify which unit will be the Main indoor unit and which indoor units are going to be the Sub units.
2. Go to the Main indoor unit and access the PCB.
3. Verify the group control cable / group control wiring is installed into CN-REMO or the SIG - 12V - GND (Comm.) terminal on the Main indoor unit PCB. If it is not, install now.
4. Detach group control cable / wiring.
5. Attach the zone controller to the Main indoor unit.
6. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for more information.) Type in the Central Control address designated for the Main indoor unit.
7. Disable power to the Main indoor unit. ⃠ Do not restore power to the Main indoor unit at this time. It will be restored later.
8. If the zone controller and associated communications cable has already been permanently mounted in place, reattach cable / wiring and obtain a loose zone controller with a communications cable to continue programming the Sub indoor units (see procedure below).

For the Sub Indoor Unit(s) in a Group Setting

For grouped control indoor units, using DIP Switch No. 3 to set Sub units automatically sets these units to Central Control address "FF. If the application calls for central control addresses to all Sub units, follow the procedure below.

1. Go to the first Sub indoor unit and disconnect the cable / wiring from CN-REMO or the SIG - 12V - GND (Comm.) terminal.
2. Attach the zone controller communications cable into the Sub indoor unit. ⃠ Do not push the ON / OFF button or enable indoor unit operation.
3. Using the controller, go to the setup function 02 (icons are different for each controller. Refer to the controller user's manual for more information.) Type in the Hex address assigned to the unit.
4. Change DIP Switch No. 3 on the Sub indoor unit PCB to the "ON" position.
5. Disable power to the Sub indoor unit using the disconnect switch. Wait one (1) minute.
6. While power is off, detach the zone controller cable.
7. Attach the group control cable / wiring to the Sub indoor unit.
8. Restore power to that Sub indoor unit, and go to the next Sub indoor unit.
9. Repeat Steps 1 to 8 for each Sub indoor unit.
10. After all Sub indoor unit have addresses assigned, go back to the Main indoor unit and restore power.

Indoor Unit Temperature Sensing Location

To maintain optimal comfort, proper operation and efficiency, considerations must be taken when selecting temperature sensing options.

Choose from one of four methods for temperature sensing, and record what method is used for each indoor unit on the Pre-commissioning Device Configuration Worksheet.

1. Return air temperature sensor at the indoor unit. Sensing at the return air is the default method. LG indoor units are factory-built with a return air temperature sensor and do not require a remote controller. For more information, visit www.lghvac.com, and refer to the Engineering and Installation manuals for each particular indoor unit.
2. Use the sensor embedded in the remote controller. (Remote controllers are separate purchases.)
3. Remote temperature button sensor. (Not compatible with wall-mounted indoor units. Temperature button sensor is a separate purchase.)
4. Combination of remote controller with embedded sensor and remote temperature button sensor. When a remote controller is used in combination with the return air temperature sensor or a remote temperature button sensor, the indoor unit uses the sensed value farthest from the set point.

Temperature Sensor Location Considerations

- The indoor unit's return air sensor can be used when air is directly returned to the indoor unit without mixing with other sources such as outside air or open plenum air.
- Temperature sensor must be installed in a location where the temperature of the area is representative of the desired zone temperature, and in an easily accessible location.

⃠ Do not install the temperature sensors in:

- Areas affected by drafts.
- Dead spots behind doors or in corners.
- Areas affected by hot/cold air flow.
- Areas affected by sun or appliances.
- Near concealed pipes or chimneys.
- Unconditioned areas such as an exterior wall

Note:

If it is not possible to locate the remote controller in an area that is both accessible and representative of the desired zone temperature, using a remote controller for control, and a remote temperature button sensor for the sensing location is also an option.

Temperature Sensing Options in a Single Zone—Single Zone, Single Indoor Unit

- A remote controller in an appropriate location is often used, which allows the system to sense the actual temperature that the occupants are experiencing. (Function Code 4 must be set to 001.)
- If an appropriate location for the remote controller is not available, use the remote controller with a remote temperature button sensor. Connect the button sensor to the indoor unit and locate it in an appropriate location.

Temperature Sensing Options in a Single Zone—Single Zone, Multiple Units, Group Control

- Using the return air temperature sensor of each individual unit will allow the indoor unit to adjust to the load in its portion of the space.
- Using a remote temperature button sensor with each indoor unit will also allow the indoor unit to adjust to the load in its portion of the space, and will also better reflect the temperature at the occupant level.

Indoor Unit Temperature Sensing Location, continued.

Considerations for Ducted Units—Single Zone, Single Unit

- When using the return air temperature sensor of a ducted indoor unit, ensure that the air temperature being sensed is directly from the space and not air mixed with outside air or open plenums. Also, the temperature sensed by the return air temperature sensor when the ducted indoor unit fan is not operating could be affected by the distance of the duct run.
- If the return air is not representative of the space due to outside air introduction, open plenum, or other reasons, using a remote controller or remote temperature button sensor is required.

Considerations for Ducted Units—Multiple Spaces, Single Indoor Unit

In some applications, a single ducted unit is used to serve multiple smaller spaces. The indoor unit will still control based on the sensed space temperature.

1. Use the return air temperature sensor to sense a common return from all of the spaces served by the indoor unit.

Note:

If outside air is introduced into the indoor unit or an open plenum is used, ⃠ do not use this option for sensing temperature.

2. Use a remote controller in the most often occupied area along with a remote temperature button sensor in another area. When the combination sensing method is used, the indoor unit uses the sensed value farthest from the set point. (Function Code 4 must be set to 003.)
3. Use multiple remote temperature button sensors in a series-parallel configuration to average the space temperature across multiple spaces.

Note:

For more information, see the "Temperature Sensing Applications Guide" on www.mylghvac.com.

Setting External Static Pressure

Ducted units will need the fan speed adjusted to deliver the required airflow at the external static pressure (ESP) of the duct system. Settings are made using a wired remote controller and the air flow information found in the specific indoor unit's engineering manual. For instructions on how to set the ESP through the wired remote controller, consult the user's, owner's, and / or installation manual for that particular controller.

Note:

It is always best if the air balance is completed prior to a request for an LG trained commissioner. If the air balancing contractor has not completed the work before commissioning, the LG trained commissioner is not responsible for setting the indoor unit air flow rates, fan speeds, or ensuring the air volume delivered at each indoor unit is per project specifications. Excessive or restricted airflow will impact the ability of the LG trained commissioner to successfully complete system commissioning. If any problems exist, request verification from the Test and Balance contractor. If necessary, provide instruction to the air balance technician on how to adjust the indoor unit fan setting value.

Summary of External Static Pressure Procedure

1. Request / review the final air balance report (that includes the actual measured ESP[s] and required air flow rate[s]).
2. Note all required fan setting value changes.
3. Perform all required ESP (fan) setting value changes. A separate ESP (fan) setting value must be selected for each available indoor unit fan speed.
4. Check all fan setting values on zone controllers to verify adjustments were made.
5. Record the values on the Pre-Commissioning Device Configuration Worksheet.

PRE-COMMISSIONING

Setting External Static Pressure

Determining External Static Pressure and Setting the Values

1. For ducted indoor units, the Engineering Manual includes tables listing setting values as they relate to ESP and airflow. The installer can use the available range of ESP settings to adjust for ductwork in the system (consult the latest engineering manual; see www.lghvac.com). See table below for an example.

Note:

The indoor unit fan(s) cannot be allowed to operate outside manufacturer's parameters. Extended operation in these conditions will result in:

- *Fan surge (noisy and slow pulsating airflow), and / or*
- *Fan motor failure*

Table 41: Example of Ducted Unit External Static Pressure and Air Flow Table from an Engineering Manual.

Set Value	Static Pressure (in. wg)										
	0.19	0.23	0.31	0.39	0.47	0.55	0.59	0.62	0.66	0.70	0.78
91	1,642	1,543	1,349	1,105	819	494	317	130	-	-	-
96	1,762	1,628	1,518	1,183	1,098	649	483	317	91	-	-
101	1,839	1,772	1,691	1,395	1,320	964	889	628	314	215	-
106	1,815	1,808	1,779	1,568	1,522	1,176	1,133	1,020	741	632	293
111	1,892	1,896	1,868	1,762	1,705	1,433	1,419	1,158	1,112	960	618
116	-	-	-	1,967	1,794	1,582	1,504	1,416	1,327	1,147	974
121	-	-	-	-	1,843	1,794	1,776	1,613	1,575	1,370	1,137
126	-	-	-	-	-	-	1,921	1,808	1,779	1,624	1,536

2. The table below presents the ESP settings that the unit comes with from the factory, plus an additional "standard" setting.

Table 40: Example of Ducted Unit External Static Pressure and Air Flow (with Settings) from an Engineering Manual.

Model	Capacity (MBh)	Mode		Setting Value	Standard ESP (in. wg)	CFM	Min. ESP (in. wg)	Max. ESP (in. wg)
ARNU483****	48.1	High (Factory Set)	High	116	0.55	1,582	0.39	0.78
			Mid	111		1,434		
			Low	106		1,176		
		Standard	High	106	0.39	1,568	0.27	0.55
			Mid	102		1,395		
			Low	95		1,183		

3. Once the available system static pressure requirements and the desired airflow rate are known, select the required ESP (fan) setting value(s). A separate ESP (fan) setting value must be selected for each available indoor unit fan speed.

Note:

Fan RPM = fan setting value x 10.

4. Record the values on the Pre-Commissioning Device Configuration Worksheet. If the fan setting value was left at the factory default, insert "000" in the blank.

Preparing the Water Circuit

1. Verify the specified waterside piping specialties such as temperature and pressure gauges, Pete's plugs, water balancing valves, shutoff valves, strainers, air vent(s), etc., were installed.

2. Verify the water circuit pump is operating correctly, and the proper flow and temperature of water is provided to the water-source unit.

3. Thoroughly flush the water circuit. Continually check and clean strainers as necessary. Continue flushing until strainers remain clean.

4. Purge all air from the water circuit. Check all auto or manual air valves installed.

Note:

To prevent the heat exchanger from freezing, drain water out of the unit before charging the refrigerant.

Balance the Water Circuit Flow Distribution

The water flow balancing contractor must complete work before commissioning, and must verify the water flow rate is within project specifications. Excessive or restricted water flow may impact the ability of the Commissioning Agent to successfully complete system commissioning. It is best if the water flow balancing is completed prior to initiating a request for a Commissioning Agent. Upon completion of the waterside balancing, the report should provide the maximum flow rate (GPM) at the water-source unit.

Note:

The Commissioning Agent is not responsible for setting the water flow rate, only to spot check. If a problem exists, request verification from the Test and Balance technician. If necessary, provide instruction to the technician on how to adjust the setting(s).

Prepare Pre-commissioning Package Documents

1. A copy of the refrigerant piping system(s) shop drawing(s) generated by LATS software.
2. A copy of the pipe fitter's pipe changes and field notes.
3. A verified copy of the "As-Built" LATS project file that includes all changes noted by the pipe fitter(s) in 2. Notes should include changes to the line lengths and number of elbows used for each liquid line segment. Verify that the sum of the indoor unit nominal capacity connected to the piping system is between 30% and 130% of the nominal capacity of the water-source unit. If this rule is violated, the system will not start.
4. Air balance report showing proper airflow at all indoor units.
5. A copy of the water circuit control sequence of operation.
6. A water circuit flow balancing report.
7. A copy of a completed and verified Installation Checklist for the water-source unit, indoor units, ERVs, Air Cleaners, and Control Devices. Correct any procedures needing attention before initiating a request for commissioning.
8. A completed Pre-commissioning Device Configuration Worksheet with the models and serial numbers of all equipment to assist in full Warranty activation.
9. A completed copy of the Pre-commissioning Checklist.
10. If available, a list of IP addresses obtained from the IT department for each central controller / integration solutions device.

The contractor must ONLY request commissioning when everything is completed and all components tested / addressed (if a component is not operating within the usual parameters at the time of commissioning, then adjustments must be made that will prevent the Commissioner from signing off and approving the system). Before commissioning, the Commissioner will contact you to discuss specific job points, scheduled day(s) and expected duration. It is the contractor's responsibility to provide all of the necessary start-up labor, refrigerant, tools and test equipment needed to complete the process in the expected time frame.

⃠ Do not attempt to start the water-source unit, charge refrigerant, or open service valves until directed by your Commissioner. After

commissioning, the contractor will be notified if there are any corrections needed to allow warranty activation. The Distributor or LG Rep / Controls Contractor will provide assistance with controls setup, final device programming, BMS integration, air balance adjustments, etc.; and proceed with any owner training (if included).

Note:

Using LGMV monitoring software is encouraged for ease of future diagnostic and maintenance related checks.

Initiate a Request for a System Commissioning

The system is now ready for commissioning procedures and additional trim charge. Send all Pre-Commissioning Package Documents to your LG Applied Representative and request commissioning assistance.

System Commissioning

The Multi V System commissioning process and procedures are provided in a separate manual and/or in training materials provided by the LG Academy Training Team. To obtain a copy, you must be a certified LG commissioning agent.

After Commissioning Has Been Requested

The LG trained commissioner will contact you to discuss specific job points, scheduled day(s) and expected duration. It is the contractor's responsibility to provide all of the necessary start-up labor, refrigerant, tools and test equipment needed to complete the process in the expected time frame. Please note that the LG trained commissioner allotted time at your project DOES NOT include owner training.

It is understood that the contractor is to request for a LG trained commissioner when all required project readiness points are complete; not based on an "expected" completion date. The contractor also acknowledges that they will assume all responsibility for costs incurred by the LG trained commissioner including but not limited airfare, travel costs, transportation, shipping, labor, and tool costs due to lack of readiness.

The LG trained commissioner's schedule is usually very rigid, and has no flexibility regarding duration. It also involves advance travel arrangements that will be impractical or impossible to change.

Freight Damage and Unit Replacements ..... Your LG Manufacturer Representative
Missing Parts ..... Your LG Manufacturer Representative
Received Wrong Water-Source Unit Model(s) ..... Your LG Manufacturer Representative
Installation, Startup, and Commissioning Technical Assistance ..... Your LG Manufacturer Representative

LG

ERROR CODE TABLES

⚠WARNING *Please refer to the Safety Precautions on pages 4-7 for more detail to prevent injury or death regarding the operation and service troubleshooting of the Multi V product.*

Error Code Display

The seven segment display (SSD) on the main board displays error codes. The first and second number on the SSD indicates the error number; the third number on SSD indicates water source unit number.

Example: 01 = Error No. 1 on water source unit 1.

- Error codes indicate different types of unit failures, assists in self-diagnosis and to track the frequency of occurrence.
- Error codes are shown on the LED of indoor units, wired remote controller, the water source unit control board, and LG Monitoring View (LGMV) Diagnostic Software.
- If two or more errors occur simultaneously, the lower error code number is displayed first.
- After error is resolved, the error code disappears.

Nomenclature Definitions

- MICOM: Non-volatile memory chip where unit setup information is stored.
- EEPROM: Non-volatile memory chip where device identification, size, and factory defined default component operating parameters are stored.

The error code tables below and on the following pages list the error codes used for Multi V Water Mini systems. For detailed information on how to troubleshoot each error, see the Multi V Water Mini Service Manual on www.lghvac.com.

Table 42: Error Codes.

	Error Code		Description	Details
Indoor Unit	0	1	Indoor unit return air or optional remote wall temperature sensor communications error.	Indoor unit air temperature sensor has opened or shorted. (Check the wiring, connection on the indoor unit PCB, then check the thermistor.)
	0	2	Indoor unit inlet pipe temperature sensor communication error.	Indoor unit inlet pipe temperature sensor has opened or shorted. (Check the connection at the indoor unit PCB, then check the thermistor.)
	0	3	Communication error between zone controller and indoor unit.	Indoor unit PCB has not received communications signal from zone controller.
	0	4	Indoor unit drain overflow error.	Drain pump and/or flow switch could be malfunctioning. Also check drain line for obstructions.
	0	5	Communication error between water-source unit PCB and indoor unit PCB.	• Indoor unit communications PCB is not receiving signal PCB communications signal from water source unit for more than 5 minutes. • Check indoor unit to water-source unit communication cable or indoor unit PCB for issues.
	0	6	Indoor unit outlet pipe temperature sensor error.	Indoor unit outlet pipe temperature sensor has opened or shorted. (Check the connection on the indoor unit PCB, then check the thermistor.)
	0	9	Indoor unit EEPROM error.	• Communication error between the indoor unit PCB board and its option card. (The option card is about 1' x 1' and is plugged into the indoor unit PCB board. Check the connection between the two.) • Communication error between EEPROM chips on the indoor unit main PCB. • Indoor unit EEPROM data is not available.
	1	0	Indoor unit BLDC fan motor communications error.	• Fan motor has been removed or is defective. Use the OHM and voltage check charts in the product service manual. • The system has detected the fan motor is not spinning. • On new installs, verify the installation manual and paperwork were removed from the fan discharge shroud before the unit was installed. • Check the wiring plug and connection at sockets (if applicable).

For detailed information on how to troubleshoot each error, see the Water Mini Service Manual on www.lghvac.com.

ERROR CODE TABLES

⚠WARNING *Please refer to the Safety Precautions on pages 4-7 for more detail to prevent injury or death regarding the operation and service troubleshooting of the Multi V product.*

Table 43: Error Codes, continued.

	Error Code			Description	Details
Water-Source Unit	2	1	1	Water-source unit inverter compressor board IPM fault error. Error code is determined by overcurrent in any one phase of the compressor.	• Water-source unit inverter compressor IPM error. • Overcurrent conditions have been detected at the inverter compressor (U,V,W). • Damaged IPM on inverter board. • Low input current to the water-source unit. Damaged inverter board – input voltage too low. • Inverter PCB assembly has been damaged. • Compressor motor or insulation has been damaged. • Inverter compressor terminal has been disconnected or loosened. • Refrigerant flow restriction from defective LEV or clogged strainer. • Refrigerant charge is too high (overcharge).
	2	2	1	Water-source unit inverter PCB input overcurrent (RMS) error.	• Overcurrent of water-source unit inverter board PCB. • Under voltage • Refrigerant flow restriction from defective LEV or clogged strainer. • Refrigerant charge is too high (overcharged).
	2	3	1	Low DC voltage sensed at the water-source unit inverter compressor DC link.	• DC voltage failed to charge on power up. • System shut off because the DC link voltage fell below or exceeded voltage limits. • Start diagnosis at the inverter socket on the water-source unit noise filter PCB. • Disconnected DC link. • Damaged electrical condenser component (serving capacitor) on inverter driver board. • Capacitor is not working properly, or the voltage at the capacitor is out of range.
	2	4	1	System has been turned off by the water-source unit high pressure switch error.	• Water-source unit high pressure switch error. Check the connection on the water-source unit PCB. • Flow rate is insufficient. • Flow switch is malfunctioning.
	2	6	1	Water-source unit inverter compressor operation error.	Initial operation failure due to water-source unit inverter compressor error.
	2	8	1	Water-source unit inverter DC link high voltage error.	Compressor shut off because water-source unit inverter PCB DC link voltage is too high.
	2	9	1	Water-source unit inverter compressor overcurrent error.	• Water source unit inverter compressor current draw is too high. • Check for compressor defects and restrictions in refrigerant pipes.
	3	1	1	Water-source unit inverter compressor CT undercurrent error.	Compressor turned off due to water-source unit inverter CT current is too low.
	3	2	1	Excessive increase in water-source unit inverter compressor gas discharge temperature.	• Shutdown due to excessive gas discharge temperature. • Check the inverter compressor discharge pipe temperature sensor. • Check for low refrigerant / leaks. • Check for a defective EEV. • Check the water flow switch, clean the strainer, and verify pump is working properly.
	3	4	1	Water-source unit compressor high pressure safety tripped.	• Shutdown due to excessive compressor high pressure. • Check the high pressure sensor, indoor unit fan(s), refrigerant, EEV, service valve (may be clogged); check for defective water-source unit PCB, indoor unit pipe temperature sensor, or hot gas valve. Also, indoor unit filter may be clogged (heating operation). • Water flow rate may be insufficient, or there is a problem with the flow switch. (Start diagnosis at the inverter socket on the water-source unit noise filter PCB.)

For detailed information on how to troubleshoot each error, see the Water Mini Service Manual on www.lghvac.com.

⚠WARNING *Please refer to the Safety Precautions on pages 4-7 for more detail to prevent injury or death regarding the operation and service troubleshooting of the Multi V product.*

Table 44: Error Codes, continued.

	Error Code			Description	Details
Water-Source Unit	3	5	1	Water-source unit low side pressure below allowable limits.	• System will shutdown due to when an abnormal low pressure condition occurs. • If operating in cooling mode, check for refrigerant leaks (low refrigerant charge), or a defective indoor unit EEV. • If operating in heating mode, check flow switch, clean the strainer, and verify pump is working properly, check for refrigerant leaks, or a defective water-source unit EEV.
	3	6	1	Water-source unit inverter low pressure ratio error.	Water-source unit is experiencing a problem developing compressor lift. Error is calling out low compression ratio. System will shut down and display error code.
	3	9	1	Communication error between water-source unit PFC and inverter board.	Water-source unit inverter compressor current detection (CT) sensor has opened or shorted.
	4	0	1	Water-source unit inverter compressor current transducer (CT) sensor error.	Water-source unit inverter compressor current transducer (CT) detection sensor has opened or shorted.
	4	1	1	Water-source unit inverter compressor discharge pipe temperature sensor error.	• Check the connection on the water-source PCB. • Compressor discharge pipe temperature sensor is not installed or connected properly. • Defective compressor discharge pipe temperature sensor (opened or shorted); • Defective water-source unit PCB.
	4	2	1	Water-source unit low pressure sensor error.	• Check the connection on the water-source PCB. • Check for 12 V DC between 12 V and GND (red to black) for 5 V DC. • Check the Signal to GND (white to black) and use correct chart from Troubleshooting section to compare with actual system pressure. • Water-source unit sensor has opened or shorted.
	4	3	1	Water-source unit high pressure sensor error.	
	4	4	1	Water-source unit ambient temperature sensor error.	• Check the connection on the water-source unit PCB. • Sensor has opened or shorted.
	4	5	1	Water-source unit heat exchanger pipe temperature sensor error.	
	4	6	1	Water-source unit suction pipe temperature sensor error.	• Check the connection on the water-source unit PCB. • Thermistor has opened or shorted. • Check suction sensor in cooling mode; check hot gas sensor located near the heat exchanger in heating mode.
	5	1	1	Combination ratio is out of range.	The total of the nominal indoor unit capacity is less than 30% or more than 130% of the nominal water source unit capacity.
	5	2	1	Communication error between water-source unit main PCB and inverter PCB.	• Communication error between main PCB and inverter PCB. • Check connections at both sockets. • Inspect interconnecting cable for wear.
	5	3	1	Communication error between water-source unit main PCB and indoor unit(s) PCB.	• Check if water-source unit to indoor unit(s) communications cable has opened or shorted. • Check A terminals are connected to indoor unit A(3) (5 on 3 x 3 cassette) terminals; B(4) (6 on 3 x 3 cassette) terminals.
	5	7	1	Communication error between water-source unit main PCB and inverter PCB communication error.	Water-source unit inverter PCB is not receiving signal from main PCB.
	6	0	1	Water-source unit inverter PCB EEPROM error.	• Verify the EEPROM is present and in the socket correctly. • Check if all pins are in and are not bent. • Check if notch in the chip lines up with the arrow on the socket.
	6	2	1	Excessive increase in water-source unit inverter IGBT temperature.	Water-source unit inverter IGBT error when the temperature rises above 230°F (110°C).
	6	5	1	Water-source unit inverter IGBT temperature sensor error.	Water-source unit inverter IGBT temperature sensor has opened or shorted.
	7	0	1	Water-source unit static speed CT sensor error.	Water-source unit static speed CT sensor has opened or shorted.

For detailed information on how to troubleshoot each error, see the Water Mini Service Manual on www.lghvac.com.

ERROR CODE TABLES

⚠WARNING *Please refer to the Safety Precautions on pages 4-7 for more detail to prevent injury or death regarding the operation and service troubleshooting of the Multi V product.*

Table 45: Error Codes, continued.

	Error Code				Description	Details
Water-Source Unit	7	1	1		Water-source unit PFC CT sensor error.	Water-source unit PFC CT sensor has opened or shorted.
	7	3	1		Water-source unit inverter PCB input instant over-current (Peak) error.	Water-source unit inverter PCB input instant overcurrent (Peak) is too high.
	7	4	1		Water-source unit inverter PCB phase imbalance error.	Water-source unit inverter PCB input current is not correct.
	8	6	1		Water-source unit main PCB onboard EEPROM error.	• Verify the EEPROM is present and in the socket correctly. • Check if all pins are in and are not bent. • Check if notch in the chip lines up with the arrow on the socket.
	8	8	1		PFC PCB EEPROM error.	• Communication error between water-source unit PFC and EEPROM. • EEPROM is missing or not inserted properly.
	1	1	3	1	Water-source unit liquid pipe temperature sensor error.	• Check the connection on the water-source PCB. • Thermistor has opened or shorted. • Check for 12 V DC between 12 V and GND (red to black) for 5 V DC. • Check the Signal to GND (white to black) and use correct chart from Troubleshooting section to compare with actual system temperature.
	1	5	1	1	Water-source unit four-way reversing valve switch error. The difference between the high and low pressure is too low.	Not enough pressure difference between high and low. Function error of outdoor unit four-way reversing valve.
	1	8	0	1	Plate type heat exchanger freeze prevention is malfunctioning.	Plate type heat exchanger freeze prevention error.
	1	8	1	1	Inlet water temperature sensor error.	• Check the connection on the water-source PCB. • Thermistor has opened or shorted.
	1	8	2	1	Communication error between water-source unit external board main and sub MICOMs	Water-source unit external board main to sub MICOMs communication failure.

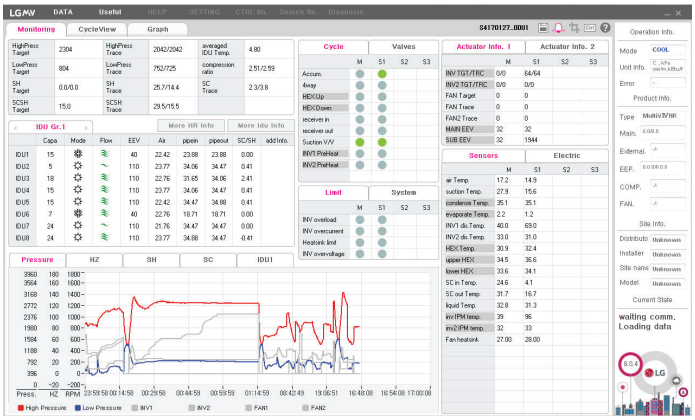
For detailed information on how to troubleshoot each error, see the Water Mini Service Manual on www.lghvac.com.

LG Monitoring View (LGMV) Diagnostic Software

LG Monitoring View (LGMV) software allows real-time monitoring of Multi V system operating parameters, and can be used to commission new systems. LGMV software can also help the service technician or LG trained commissioner to troubleshoot existing system operation issues by displaying error codes. Also, LGMV data can be recorded to a .csv file and emailed to an LG representative to assist with diagnostic evaluations.

LGMV is available in different formats, including Mobile LGMV, which is an app for use on wireless devices. Contact your LG Sales Representative for more information, including recommended PC or mobile device configurations.

Figure 81: LGMV Monitoring Screen.



Note:

Images on these pages are examples of LGMV screenshots. Actual images may differ depending on the version of the software and the units installed.

LGMV Display

LGMV displays the following real-time data:

- 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
- 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 no. 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

LG MONITORING VIEW (LGMV) DIAGNOSTIC SOFTWARE

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

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

2. Graph: Full screen graph of actual high and low pressures and high and low pressure limits. A sliding bar allows viewing of previously recorded data.

3. Control IDU: Enables user to turn on 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 Electric tab on the 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

Figure 83: LGMV Cycleview Screen.

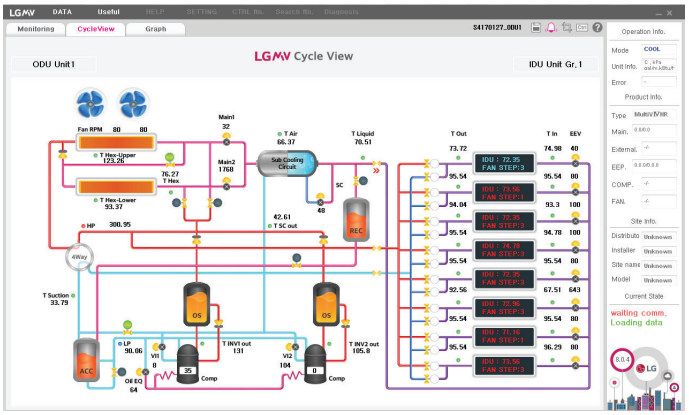
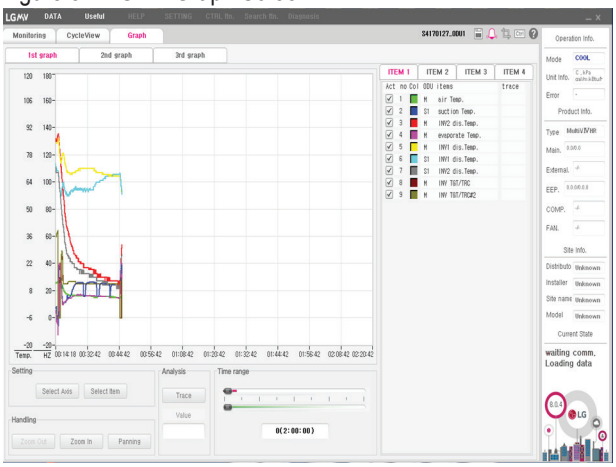


Figure 82: LGMV Graph Screen.



Note:

Images on these pages are examples of LGMV screenshots. Actual images may differ depending on the version of the software and the units installed.

To prevent heat exchanger damage and decreased system performance from scaling, the heat exchanger must be inspected once (1) per year or more, depending on the quality of the water and the water treatment program. For systems using an open tower, clean the heat exchanger annually or more often if local conditions require. Systems using closed cell towers need to be cleaned a minimum of once (1) every five (5) years or more often, if local conditions require.

Yearly Inspection

The plate heat exchanger must be inspected once (1) a year, and should include:

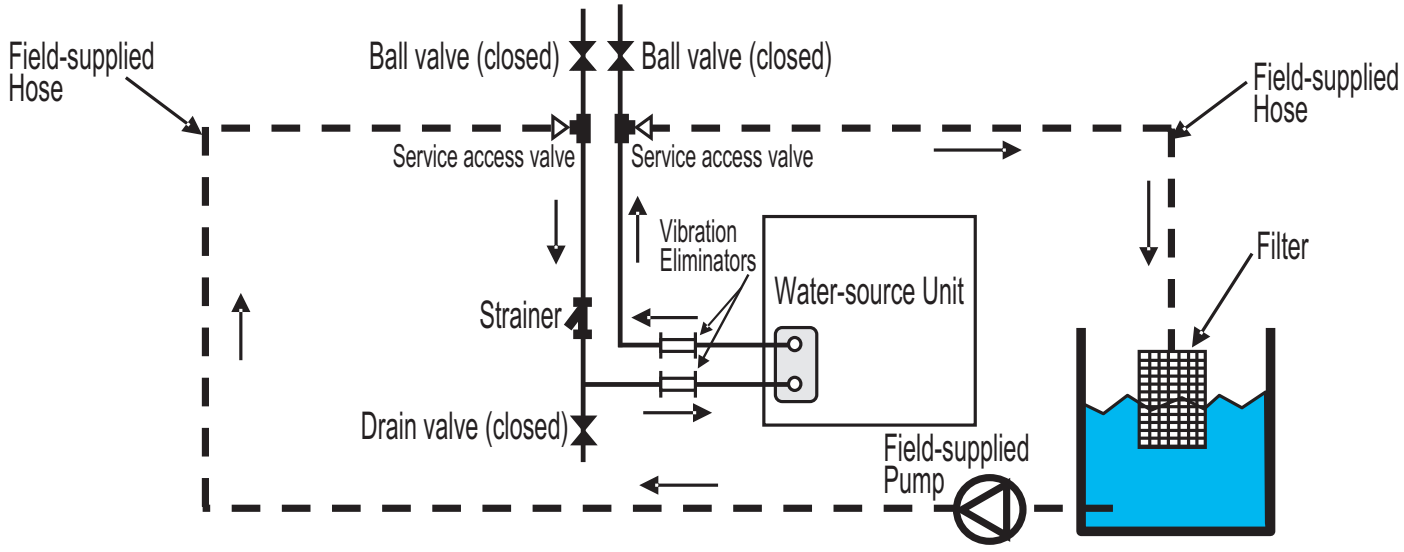
- Water should be tested to see if it is within quality levels listed in the water circuit installation section of this manual.
- Strainer should be cleaned.
- Water flow rate should be checked.
- Water pressure, flow, and inlet / outlet water temperatures should also be checked.

Five (5) Year Cleaning Procedure

The heat exchanger is not designed to be disassembled and does not contain any replaceable parts. If the heat exchanger cannot be cleaned, the entire exchanger must be replaced.

- Heat exchanger cleaning solutions can include 5% diluted formic acid, citric acid, oxalic acid, acetate acid, phosphoric acid. Make sure the cleaning solution used does not include chemicals such as hydrochloric acid, sulfuric acid, nitric acid or calcium chloride that are corrosive to 316 stainless steel or ACR copper.
- Isolate the unit from the pipe system by closing the inlet / outlet ball valves and the drain pipe valve.
- Connect a hose to the service port, fill the heat exchanger with cleaning solution heated between 122°F to 140°F, and circulate the solution for two (2) to five (5) hours using the solution tank pump. Procedure time may depend on the cleaning solution temperature, or the amount of scaling present. Watch for a change in cleaning solution color to determine how long the procedure should last.
- After circulating the cleaning solution, drain the heat exchanger, fill it with 1%-2% NaOH (Sodium Hydroxide) or $NaHCO_3$ (Sodium Bicarbonate), and circulate for 15 to 20 minutes to neutralize the system.
- Flush the heat exchanger with clean water and measure pH. Once the pH is within recommended levels, open the isolation valves, purge air from the system, and check unit operation.

Figure 84: Schematic of Heat Exchanger Maintenance.



Note:

Before using a chemical solution to clean the heat exchanger, note its potential to corrode stainless steel or copper. Consult the chemical solution manufacturer for more information.

MAINTENANCE

General Maintenance Schedule

1. Water Quality Control

- The heat exchanger is not designed to be disassembled, cleaned, and does not contain any replaceable parts. If the heat exchanger is not usable, the entire exchanger must be replaced.
- To prevent corrosion or scaling, water quality must be controlled. Refer to the recommendations in the table below for minimum water quality requirements.
- Use only anti-corrosion agents or corrosion inhibitor additives that do not contain chemicals which damage or attack 316 stainless steel and ACR copper.
- Drain and replace the water / glycol mixture on a regular basis as needed. Frequency will depend upon the quality of the water treatment program used.

Table 46: Minimum Water Quality Requirements.

	Closed Type System		Effect	
	Circulating Water	Supplemented Water	Corrosion[1]	Scale[1]
Basic Item				
pH (77°F)	7.0 ~ 8.0	7.0 ~ 8.0	●	●
Conductivity (77°F) mS/m	Below 30	Below 30	●	●
Chlorine ions (mg Cl^-/ℓ)	Below 50	Below 50	●	
Sulfate ions (mg SO_4^{2}/ℓ)	Below 50	Below 50	●	●
Acid consumption (pH4.8) (mg$CaCO_3$/ℓ)	Below 50	Below 50		●
Total Hardness (mg $CaCO_3$/ℓ)	Below 70	Below 70		●
Calcium Hardness (mg $CaCO_3$/ℓ)	Below 50	Below 50		●
Ionic-static silica (mg SiO_2/ℓ)	Below 30	Below 30		●
Reference Item				
Iron (mg Fe/ℓ)	Below 1.0	Below 0.3	●	●
Copper (mg Cu/ℓ)	Below 1.0	Below 0.1	●	
Sulfate ion (mg SO_4^{2}/ℓ)	Must not be detected	Must not be detected	●	
Ammonium ion (mg NH_4^+)ℓ	Below 0.3	Below 0.1	●	
Residual chlorine (mg Cl/ℓ)	Below 0.25	Below 0.3	●	
Free carbon dioxide (mg CO_2/ℓ)	Below 0.4	Below 4.0	●	
Stability index			●	●

[1]The "●" mark for corrosion and scale means that there is a possibility of occurrence.

2. Flow Rate Control

- The heat exchanger may freeze if the water flow rate is insufficient.
- Check for a restricted strainer or if air is in the water piping system. Also measure the temperature and pressure difference between the inlet and outlet to verify the flow rate is per specifications.
- If the temperature and pressure difference is above the specified range, the flow rate is insufficient. Immediately stop system operation, locate the source of the problem, and repair as needed. After any water circuit maintenance is preformed, always bleed air from the water system at all installed air vents.

3. Antifreeze Concentration Management

- Use the manufacturer's recommended type and amount of antifreeze. ⃠ Do not use solutions with calcium chloride; these can corrode the heat exchanger.
- Maintain antifreeze levels. If there is a drop in the amount of antifreeze, the heat exchanger may freeze. Ensure that the antifreeze is not exposed to the atmosphere, and periodically measure antifreeze levels, adding as necessary.

MAINTENANCE

General Maintenance Schedule

Table 47: Minimum Maintenance Schedule.

Procedure \ Period (Year)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Product operating condition	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Heat exchanger cleaning (Wash)					●					●					●
Strainer cleaning	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Water quality check	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Refrigerant leakage check	●														●
Indoor unit filter cleaning	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Note:

- *The checklist above is based on minimum requirements. Maintenance may need to be increased depending on operating condition and / or water quality.*
- *Before cleaning the heat exchanger, make sure that the water pipe connections are tight so that chemical detergent does not leak. When cleaning the heat exchanger, close the valves so that chemical detergent does not penetrate into the pressure gauge, etc.*
- *Dilute the chemical detergent as recommended by the chemical supplier. Note that cleaning the heat exchanger is easier at the initial stages and becomes difficult after scaling has accumulated. In areas where the water quality is poor, cleaning is required more often.*
- *Because chemical detergent has a strong acid content, the system must be flushed thoroughly with water after cleaning.*
- *To verify the system has been properly cleaned, remove the hose at the heat exchanger and, using a flashlight or other bright light source, visually inspect the interior surfaces of the heat exchanger.*
- *After completing the visual inspection and determining the heat exchanger is clean—free of debris and mineral deposits and the cleaning chemicals have been thoroughly flushed—close the system up, replace the water and purge the air from all air vents located on the pipe system. Purge the air inside the water piping.*
- *Always check if the water supply is flowing normally and in the correct direction before operating the unit.*

MULTI V WATER MINI

INSTALLATION CHECKLIST

LG

Major Component Rough-In

Description	Check
All Multi V water-source units are connected properly per local code and the product installation procedures.	
All literature and bagged accessories have been removed from the fan discharge (ducted and cassette model indoor units).	
All indoor units are installed, properly supported, and located indoors in a non-corrosive environment.	
Duct work installation completed (ducted indoor units only).	
Water source unit's gravity condensate drain line was connected and properly routed to a drain terminal.	

Piping Material, Components, and Insulation

Description	Check
Heat pump systems: LG prefers the use of ACR hard drawn copper for all pipe segments in the piping system except segments located between Y-branch fittings (or header fittings) and indoor units.	
Single-zone and multi-zone duct-free split systems: ACR copper piping rated at the system working pressure was used.	
LG Y-branch fittings or headers were used as per LATS report.	
All refrigerant pipes and valves are insulated separately. Insulation is positioned up against the walls of the indoor units. No gaps shown. Insulation was not compressed at clamps and hangers.	

Brazing Practices

Description	Check
Use medical grade dry nitrogen for purging during brazing (constant 3 psig while brazing).	
15% silver brazing material only.	
Minimum 3/4 inch, maximum 1 inch condensate piping installed on indoor units – material used is acceptable under local code. Insulated as necessary to prevent condensation.	

Refrigerant Piping Design and System

Description	Check
You must have in your possession a copy of the "As-Designed" LATS piping tree diagram. BEFORE ANY FIELD PIPE SIZE OR LENGTH CHANGES ARE MADE, PROPOSED CHANGES MUST BE FORWARDED TO THE DESIGN ENGINEER SO THAT THEY CAN INPUT THE CHANGES INTO LATS and RE-ISSUE A NEW LATS PIPING TREE DIAGRAM. Installer must receive change authorization from the design engineer, because any change made requires the review of the entire tree diagram and verification that the change did not impact the size of piping segments in other parts of the system.	
All pipe materials were properly stored, capped, and clean. All burrs were removed after cutting and pipe ends were reamed before brazing.	
During refrigerant pipe installation, for each segment of pipe, a record was made of the pipe length (including expansion loops, offsets, double-back sections), and sizes, as well as the quantity and type of elbows used.	
Expansion loops, coils or other acceptable measures are provided where necessary to absorb temperature-change based pipe movement.	
A torque wrench and backup wrench were used to tighten all flare connections.	
The back side of all flares were lubricated with a small drop of PVE refrigeration oil before tightening flare fittings.	
Ensure all field made flares are 45°. Use factory-supplied flare nuts only.	
Pipe segments, Y-branches, and/or header fittings are secured to the structure using a combination of fixed and floating clamps, and all wall penetrations were sleeved.	
All pipe insulation is not compressed at any point.	
Y-branch and header fittings were properly INSTALLED per details provided in the Multi V Water Mini Installation Manual.	
Y-branch and header fittings were properly SUPPORTED per details provided in the Multi V Water Mini Installation Manual.	
No oil traps, solenoid valves, sight glasses, filter driers, or any other unauthorized refrigerant specialities are present.	
(Optional) High quality R410A rated full port ball valves (Schrader between the valve body and the indoor units) used at all indoor units and at will in the refrigerant piping network.	
Best practice includes a minimum of 20" of straight pipe was installed between each elbow, and Y-branch or header fitting, and between two Y-branch fittings.	

MULTI V WATER MINI

INSTALLATION CHECKLIST

LG

Water Piping

Description	Check
A No. 50 mesh (or better) minimum one inch diameter strainer is installed on the inlet pipe.	
Strainer service isolation valves, (optional bypass line and shutoff valve) provided on both ends of strainer. Strainer drain line installed.	
A balancing valve has been installed.	
A flow switch has been installed.	
Thermometers (or Pete's plugs) are installed on the inlet and outlet pipes.	
(Optional) Pressure gauges were installed on the inlet and outlet pipes.	
Piping is insulated properly per the design engineer's specifications.	
Pipes are properly supported. No lateral pressure is present on the inlet and outlet connections.	
The inlet and outlet pipes are connected at the water source unit. Water flow direction is correct (pipes are not reversed).	
Shutoff valves present at inlet and outlet of the water source unit.	

Condensate Pump / Drain Installation

Description	Check
Indoor unit condensate drain pipes were installed correctly.	
All condensate vertical risers are equal to or less than 27-9/16 inches from the bottom of the indoor unit.	
Indoor units with condensate pumps were level. Units with gravity drains were level or slightly canted toward the drain connection and are supported properly.	
Pumped condensate drain lines were properly connected (⃠ do not have traps, and connect to the top surface of the main drain line).	
Condensate lines are properly insulated to prevent condensation.	

Power Wire and Communications Cables

Description	Check
Power wiring was connected to a single phase 208-230V source.	
Ground wire was installed and properly terminated at the water-source unit.	
The power supplied was clean with voltage fluctuations within specifications. (±10% of nameplate).	
Power wiring to the water-source unit was installed per all local, state, and NEC requirements.	
Power wiring to each indoor unit was installed per all local, state, and NEC requirements.	
Communications cable between the water-source unit and indoor units was connected in a daisy chain configuration (i.e., single parallel chain). ⃠ No "Star" or multiple parallel circuits. No cable splices or wire caps were used to connect communications cables.	
Proper communications cable was used between each indoor unit and its zone controller where applicable. No cables were spliced and no wire nuts are present.	
Communication type RS-485–BUS type.	
Communication cable between water-source unit to indoor units to be a minimum 18 AWG, two-conductor, twisted, stranded, shielded. Ensure the communication cable shield is properly grounded to the water-source unit only. Cable segment shields are tied together.	
Use appropriate crimping tool to attach ring or fork terminals at all power wiring and control cable terminations.	
All power and control wires were properly separated using the recommended distance provided in the product installation manual.	
Only LG-supplied Y-cables were used between grouped indoor units.	
Flow switch communications cable has been properly terminated at the switch and the water-source unit.	

Major Component Rough-In

Piping and Insulation

Brazing Practices

Installation—Refrigerant Piping

Installation—Water Circuit

Installation—Condensate Pump / Drain Installation

Installation—Power Wire and Communications Cables

MULTI V WATER MINI PRE-COMMISSIONING CHECKLIST

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Description	Check
Using a copy of the LATS pipe design diagram, verify the sum of the indoor unit nominal capacity connected to the piping system is between 30% and 130% of the water-source unit's nominal capacity. If this rule is violated, the system will not start.	
Check all indoor units for power at the unit disconnect and power is present at the indoor unit PCB board. (LED is lit.) ⃠ DO NOT TURN ON THE UNIT using the ON/OFF button.	
Successful auto address routine is complete. All device addresses have been recorded on the Indoor Unit Device Configuration Worksheet.	
Ensure all optional field-installed full-port ball valves are open.	
The piping system must hold a constant 550 psig pressure for a maximum of 24 hours with all isolation valves open. Correction Formula: (°F Temp. when pressure was applied - °F Temp. when pressure drop was checked) x 0.79 = psig. _____ °F - _____ °F = _____ psig. **Pressure Measurement Data** Initial Pressure _____ End Pressure _____ Start Date _____ End Date _____ Start Time _____ End Time _____ Initial Ambient Temperature _____ End Ambient Temperature _____	
A triple system evacuation has been performed. Micron gauge reading held at a maximum of 500 for one (1) hour with all isolation valves open and without the vacuum pump connected. **Evacuation** Initial Micron Level _____ End Micron Level _____ Start Date _____ End Date _____ Start Time _____ End Time _____ Rise _____	
The communications cable to the indoor units has been disconnected from the IDU (B) and IDU (A) terminals at the water-source unit.	
None of the water-source unit service valves have been opened during the installation and preparation of the system for commissioning. (If the valves were opened, the factory refrigerant charge has been released.)	

PRE-COMMISSIONING CHECKLIST

Water Circuit Verification

Description	Check
System has been pressure tested to the designer's requirements. All unions and fittings are leak free.	
System has been filled with fluid, flushed, and all air has been purged from the piping circuit.	
Pump rotation direction is correct.	
Water flow enters on the water-source unit inlet and leaves from the unit outlet.	
Pump and water-source unit strainers are clean.	
Water balance has been completed.	
Proper water flow rate is present at each water-source unit.	
Flow switch has been calibrated to trip at the water-source unit's minimum flow requirement.	
Water has been properly treated with a rust inhibitor and fungicide chemicals.	
If required, an antifreeze chemical has been added to the water circuit.	

Prepare Pre-commissioning Package Documents

Include	Check
1. A copy of the refrigerant piping system(s) shop drawing(s) generated by LATS pipe design software.	
2. A copy of the pipe fitter's pipe changes and field notes.	
3. A verified copy of the "As-Built" LATS Project file (*.mtv) that includes all changes noted by the pipe fitter(s) in Number 2. The tree diagram notes should include changes to the line lengths used for each liquid line segment.	
4. A copy of a completed and verified Installation Checklist for the water-source unit, indoor units, ERVs, Air Cleaners, and Control Devices. Correct any procedures needing attention before initiating a request for commissioning.	
5. A copy of the air balance report showing proper airflow at all indoor units.	
6. A copy of the water circuit's control sequence of operation.	
7. A water circuit flow balancing report.	
8. A completed Pre-commissioning Device Configuration Worksheet.	
9. A completed copy of the Pre-Commissioning Checklist.	
10. If available, a list of IP addresses obtained from the building owners IT department for each Central Controller / Integration Solution device.	

Initiate a Commissioning Request

Description	Check
Verify this checklist and requirements herein have been met. Complete this checklist in its entirety BEFORE initiating a request for Commissioning.	
Send all Pre-Commissioning Package Documents to your LG Applied Representative.	

Contractor Name: _____ _____

(Authorized Signature)

Address: _____

_____

Phone: _____ Date: _____

**This form must be completed and submitted to LG a minimum of three (3) weeks prior to final scheduling of any startup.*
Note: If any of the above items are not complete at time of start-up, back charges will be assessed for additional costs.

PRE-COMMISSIONING CHECKLIST

Notes for the LG Trained Commissioner

PRE-COMMISSIONING CHECKLIST

Notes for the LG Trained Commissioner

MULTI V WATER MINI

COMMISSIONING NOTES

LG

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Prepare Pre-Commissioning Package Documents

Initiate a Commissioning Request

MULTI V WATER MINI

COMMISSIONING CHECKLIST EXCEPTION REPORT

LG

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Prepare Pre-Commissioning Package Documents

Initiate a Commissioning Request

Date of Commissioning Report: _____

LG Trained Commissioner Name: _____

LG Trained Commissioner Signature: _____

LG Multi V Pre-Commissioning Device Configuration Worksheet

Project Name:	**Building ID**
Date: AC Smart Static IP address:	**System ID** **Page #**
Mech Contractor Company Name	MEP Project Mngr Name
Pre-Com Tech Name/Ph#/email	Ph# / Email

IDU's

Unit Tag	Building Floor	Room ID	Type	Model	Serial #	Adjusted Fan Setting Value . Low | Medium | High			System Address	Central Control Address	Group member ID or N/A if not in a group	Group Function M=Master S=Slave	Sensor Strategy (RA/ZC/Both)

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

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

IM_MultiVWaterMini_ARWN053GA2_8_20
Supersedes IM_MultiVWaterMini_5_16
VRF-IM-BM-001-US 013L26
VRF-IM-BM-001-US 013H09