LG
Life's Good

MULTI V™ WATER 5

INSTALLATION MANUAL

Variable Refrigerant Flow
Water Source Units

6.0 to 48.0 Tons

PROPRIETARY DATA NOTICE

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This document is for design purposes only.

⃠ Do not throw away, destroy, or lose this manual.

Please read carefully and store in a safe place for future reference.
Content familiarity required for proper installation and safety of personnel and property.

Follow the instructions in this manual to prevent product malfunction, property damage, injury, or death to users or other people. Incorrect operation due to ignoring any instructions can cause harm to personnel, or damage to property or equipment.

A summary of safety precautions begins on page 4.

For more technical materials such as submittals, engineering databooks, and catalogs, visit www.lghvac.com.

Freight Damage and Unit Replacements	Your LG Manufacturer Representative
Missing Parts	Your LG Manufacturer Representative
Received Wrong Water Source Unit Model	Your LG Manufacturer Representative
Installation, Startup, and Startup Technical Assistance	Your LG Manufacturer Representative

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MULTI V WATER 5

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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 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 use or store flammable gas or combustibles near the unit.**
There is risk of fire, explosion, and physical injury or death.

⚠WARNING

The information in this manual is intended for use by trained heating, ventilation, and air conditioning (HVAC) technicians who are familiar with variable refrigerant flow (VRF) HVAC systems and are equipped with the proper tools and test equipment. Have an emergency plan. Know how to obtain emergency medical and firefighting assistance.
Failure to carefully read and follow all instructions in this manual can result in equipment malfunction, property damage, personal injury or death.

If any system components containing refrigerant are 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 the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 15. If the refrigerant leaks and safety limits are exceeded, it could result in personal injuries or death from oxygen depletion.

Install the unit in a safe location. Avoid areas where it can be stepped on or fallen into.
There is risk of unit damage, physical injury or death.

⃠ **Do not install, remove, or re-install the unit by yourself (end-user). Ask the dealer or a 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 authorized LG service provider.
There is risk of fire, electric shock, explosion, and physical injury or death.

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

Water source units are shipped with refrigerant and the service valves closed. ⃠ **Do not open service valves on the unit until all non-condensibles have been removed from the piping system and authorization has been obtained from the startup agent.**
There is a risk of physical injury or death.

⃠ **Do not run the compressor with the service valves closed.**
There is risk of explosion, physical injury, or death.

Periodically check that the water source unit is not damaged.
There is risk of explosion, 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 unit, causing fire, electric shock, and physical injury or death.

Always check for system refrigerant leaks after the unit has been installed or serviced.
Exposure to high concentration levels of refrigerant gas may lead to illness or death.

⃠ **Do not install the unit using inadequate attaching, or mounting hardware.** ⃠ **Do not install the unit on an inadequate stand.**
There is risk of physical injury or death.

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

INSTALLATION, CONTINUED

⚠ WARNING

Dispose of 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 may not play with them and risk suffocation and death.*

⃠ Do not install the unit in any location exposed to open flame or extreme heat. ⃠ Do not touch the unit with wet hands.
There is risk of fire, electric shock, explosion, and physical injury or death.

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

⃠ Do not change the settings of the protection devices.
If the pressure switch, thermal switch, or other protection device is shorted and 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.

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.

⚠ CAUTION

Be careful when transporting the product.

- *⃠ Do not attempt to carry the product without assistance.*
- *Some products use polypropylene bands for packaging. ⃠ Do not use polypropylene bands to lift the unit.*
- *Suspend the unit from the base at specified positions.*
- *Support the unit at a minimum of four points to avoid slippage from rigging apparatus.*
- *Failure to follow these Cautions may result in minor or moderate physical injury.*

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.

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

When installing the unit in a hospital, mechanical room, 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.

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

⃠ 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 be damaged.

When connecting refrigerant pipe, allow for pipe expansion.
Improper piping may cause refrigerant leaks and system malfunction.

Periodically check that the water source unit is not damaged.
There is a risk of equipment damage.

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.

Install the water source unit in a safe location where no one can step on or fall onto it. ⃠ Do not install the unit with inadequate attaching or mounting hardware.
There is risk of unit and property damage.

Install the drain hose to ensure adequate drainage.
There is a risk of water leakage and property damage.

⃠ Don't store or use flammable gas combustibles near the unit.
There is risk of product failure.

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

The unit is shipped with refrigerant and the service valves closed. ⃠ Do not open service valves on the unit until all non-condensibles have been removed from the piping system and authorization to do so has been obtained from the startup agent.
There is a risk of refrigerant contamination, refrigerant loss and equipment damage.

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.
A solid, level foundation may prevent water damage and reduce abnormal vibration.

⃠ Do not install the unit in a noise sensitive area.

WIRING

⚠ DANGER

High voltage electricity is required to operate this system. Adhere to the NEC code and these instructions when wiring.
Improper connections and inadequate grounding can cause serious 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.

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

Turn the power off at the nearest disconnect before servicing the equipment.
Electrical shock can 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 in this manual is intended for use by a trained electrician who is familiar with the U.S. National Electric Code (NEC) and 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 National Electrical Code, 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.

High voltage electricity is required to operate this system. Adhere to the NEC code 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.

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.

Properly tighten all power lugs.
Loose wiring may cause a fire by overheating at connection points, resulting in equipment or property damage, 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.

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

⃠ **Do not supply power to the unit until all installation and prestartup tasks are complete and the LG authorized startup agent indicates it is safe to do so.**

Note

⃠ **Do not supply power to the unit until all installation and prestartup tasks are complete and the LG authorized startup 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-qualifed, 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.

LG

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 power disconnect switch for this product.
There is risk of fire, electric shock, physical injury or death.

⃠ Do not operate the power 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 gas 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 can cause a fire, electric shock, 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.

⃠ Do not open the inlet during operation.
There is risk of electric shock, physical injury, or death.

⚠ 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 special purpose applications such as preserving food, 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 allow water, dirt, or animals to enter the unit.
It can cause burns or frostbite.

⃠ Do not open the inlet during operation.
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 air conditioner ⃠ Do not use wax, thinner, or strong detergents.
Strong cleaning products will damage the surface of the air conditioner, or cause it to deteriorate

Provide power to the outdoor unit to warm the compressor crankcase at least six (6) hours before operation begins.
Starting operation with a cold compressor sump(s) will result in severe bearing damage to the compressor(s). Keep the power switch on during the operational season

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

Auto-addressing must be performed after connecting the power of all indoor and outdoor units. Auto-addressing must also be performed after servicing an indoor unit.
There is risk of unit failure

UNIT NOMENCLATURE

Water Source Units

ARW	M	072	B	A	S	5

Family
ARW = Multi V Water 5 Water Source Unit (Refrigerant R410A)

Type
M = Inverter Heat Pump and Heat Recovery

Nominal Capacity
(Nominal cooling capacity in Btu/h)

072 = 72,000	168 = 168,000	288 = 287,700	432 = 430,500
096 = 96,000	192 = 192,000	336 = 336,000	480 = 472,500
121 = 119,700	216 = 216,000	360 = 360,000	576 = 571,200
144 = 144,000	240 = 239,400	384 = 384,000	

Electrical Ratings
B = 208–230V/60Hz/3Phase (for 208–230V systems, acceptable voltage range is 187–253V)
D = 460V/60Hz/3Phase (for 460V systems, acceptable voltage range is 414–528V)

Airflow Configuration
A = Not Applicable

System Efficiency
S = Standard Efficiency

Generation
5 = Fifth*

**The latest versions of LG's indoor units and water source units are designated Generation 4 (Gen 4). For Gen 4 units to operate with Gen 4 features, the air conditioning system must meet the requirements listed on page 6.*

Heat Recovery Units (HRU)

PRHR	02	3A

Family
PRHR = Multi V Heat Recovery (HR) unit (Refrigerant R410A)

Number of Ports
02 = Two Ports
03 = Three Ports
04 = Four Ports
06 = Six Ports
08 = Eight Ports

Series Number
2A = Series Number
3A = Series Number

Table 1: Single-Frame 208-230V Units.

Combination Unit Model Number	6.0 Ton ARWM072BAS5	8.0 Ton ARWM096BAS5	10.0 Ton ARWM121BAS5	12.0 ARWM144BAS5
Individual Component Model Numbers	–	–	–	–
Cooling Performance				
Nominal Cooling Capacity (Btu/h)[1]	72,000	96,000	119,700	144,000
Heating Performance				
Nominal Heating Capacity (Btu/h)[1]	81,000	108,000	135,000	162,000
Operating Range (Entering Water Temperature)[2]				
Cooling (°F)	50 – 113	50 – 113	50 – 113	50 – 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113	23 – 113
Compressor				
Inverter Quantity	HSS DC Scroll x 1			
Oil/Type	PVE/FVC68D			
Unit Data				
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit			
R410A Refrigerant Factory Charge (lbs)	7.7	7.7	7.7	7.7
Max. Number Indoor Units / System	13	16	20	23
Sound Pressure dB(A)[4]	48 (62)	50 (62)	56 (62)	56 (62)
Net Unit Weight (lbs.)	322	322	322	322
Shipping Weight (lbs.)	340	340	340	340
Communication Cables[6,7]	2 x 18 AWG			
Heat Exchanger (Stainless Steel Plate)				
Maximum Pressure Resistance (psi)	640	640	640	640
Flow at Rated Condition (GPM)	20.3	25.4	30.4	35.5
Total Heat of Rejection (Btu/h)	94,100	125,900	157,900	190,100
Total Heat of Absorption (Btu/h)	74,200	98,600	122,700	146,800
Pressure Drop (ft-wg)	3.47	5.20	7.23	9.63
Δt[5] (°F)	9.3	9.9	10.4	10.7
Piping[8]				
Liquid Line (in.,OD)	3/8 Braze	3/8 Braze	1/2 Braze	1/2 Braze
Low Pressure Vapor Line (in.,OD)	3/4 Braze	7/8 Braze	1-1/8 Braze	1-1/8 Braze
High Pressure Vapor Line (in.,OD)	5/8 Braze	3/4 Braze	3/4 Braze	7/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 FPT	1-1/2 FPT	1-1/2 FPT	1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 MPT	3/4 MPT	3/4 MPT	3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59°F (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

GENERAL DATA

ARWM Series Water Source Unit Specifications

Table 2: Single Frame 460V Units.

Combination Unit Model Number	6.0 Ton ARWM072DAS5	8.0 Ton ARWM096DAS5	10.0 Ton ARWM121DAS5	12.0 ARWM144DAS5
Individual Component Model Numbers	–	–	–	–
Cooling Performance				
Nominal Cooling Capacity (Btu/h)[1]	72,000	96,000	119,700	144,000
Heating Performance				
Nominal Heating Capacity (Btu/h)[1]	81,000	108,000	135,000	162,000
Operating Range (Entering Water Temperature)[2]				
Cooling (°F)	50 – 113	50 – 113	50 – 113	50 – 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113	23 – 113
Compressor				
Inverter Quantity	HSS DC Scroll x 1			
Oil/Type	PVE/FVC68D			
Unit Data				
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit			
R410A Refrigerant Factory Charge (lbs)	7.7	7.7	7.7	7.7
Max. Number Indoor Units / System	13	16	20	23
Sound Pressure dB(A)[4]	48 (62)	50 (62)	56 (62)	56 (62)
Net Unit Weight (lbs.)	328	328	328	328
Shipping Weight (lbs.)	346	346	346	346
Communication Cables[6,7]	2 x 18 AWG			
Heat Exchanger (Stainless Steel Plate)				
Maximum Pressure Resistance (psi)	640	640	640	640
Flow at Rated Condition (GPM)	20.3	25.4	30.4	35.5
Total Heat of Rejection (Btu/h)	94,100	125,900	157,900	190,100
Total Heat of Absorption (Btu/h)	74,200	98,600	122,700	146,800
Pressure Drop (ft-wg)	3.47	5.20	7.23	9.63
Δt[5] (°F)	9.3	9.9	10.4	10.7
Piping[8]				
Liquid Line (in.,OD)	3/8 Braze	3/8 Braze	1/2 Braze	1/2 Braze
Low Pressure Vapor Line (in.,OD)	3/4 Braze	7/8 Braze	1-1/8 Braze	1-1/8 Braze
High Pressure Vapor Line (in.,OD)	5/8 Braze	3/4 Braze	3/4 Braze	7/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 FPT	1-1/2 FPT	1-1/2 FPT	1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 MPT	3/4 MPT	3/4 MPT	3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

Table 3: Single Frame 460V Units.

Combination Unit Model Number	14.0 Ton ARWM168DAS5	16.0 Ton ARWM192DAS5
Individual Component Model Numbers	–	–
Cooling Performance		
Nominal Cooling Capacity (Btu/h)[1]	168,000	192,000
Heating Performance		
Nominal Heating Capacity (Btu/h)[1]	189,000	216,000
Operating Range (Entering Water Temperature)[2]		
Cooling (°F)	50 – 113	50 – 113
Heating (°F))[3]	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113
Compressor		
Inverter Quantity	HSS DC Scroll x 1	
Oil/Type	PVE/FVC68D	
Unit Data		
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit	
R410A Refrigerant Factory Charge (lbs)	9.9	9.9
Max. Number Indoor Units / System	29	32
Sound Pressure dB(A)[4]	58 (62)	60 (62)
Net Unit Weight (lbs.)	348	348
Shipping Weight (lbs.)	366	366
Communication Cables[6,7]	2 x 18 AWG	
Heat Exchanger (Stainless Steel Plate)		
Maximum Pressure Resistance (psi)	640	640
Flow at Rated Condition (GPM)	45.7	50.7
Total Heat of Rejection (Btu/h)	220,000	253,500
Total Heat of Absorption (Btu/h)	172,800	193,600
Pressure Drop (ft-wg)	8.32	10.08
Δt[5] (°F)	9.6	10.0
Piping[8]		
Liquid Line (in.,OD)	5/8 Braze	5/8 Braze
Low Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze
High Pressure Vapor Line (in.,OD)	7/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 FPT	1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 MPT	3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

GENERAL DATA

ARWM Series Water Source Unit Specifications

Table 4: Dual Frame 208-230V Units.

Combination Unit Model Number	14.0 Ton ARWM168BAS5	16.0 Ton ARWM192BAS5	18.0 Ton ARWM216BAS5
Individual Component Model Numbers	ARWM072BAS5 x 1 + ARWM096BAS5 x 1	ARWM096BAS5 x 2	ARWM096BAS5 x 1 + ARWM121BAS5 x 1
Cooling Performance			
Nominal Cooling Capacity (Btu/h)[1]	168,000	192,000	216,000
Heating Performance			
Nominal Heating Capacity (Btu/h)[1]	189,000	216,000	243,000
Operating Range (Entering Water Temperature)[2]			
Cooling (°F)	50 - 113	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113
Compressor			
Inverter Quantity	HSS DC Scroll x 2		
Oil / Type	PVE / FVC68D		
Unit Data			
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit		
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7	7.7 + 7.7	7.7 + 7.7
Max. Number Indoor Units / System	29	32	35
Sound Pressure dB(A)[4]	52 (65)	53 (65)	57 (65)
Net Unit Weight (lbs.)	322 + 322	322 + 322	322 + 322
Shipping Weight (lbs.)	340 + 340	340 + 340	340 + 340
Communication Cables[6,7]	2 x 18 AWG		
Heat Exchanger (Stainless Steel Plate)			
Maximum Pressure Resistance (psi)	640	640	640
Flow at Rated Condition (GPM)	20.3 + 25.4	25.4 + 25.4	25.4 + 30.4
Total Heat of Rejection (Btu/h)	220,000	251,800	283,800
Total Heat of Absorption (Btu/h)	172,800	197,200	221,300
Pressure Drop (ft-wg)	3.47 / 5.20	5.20 / 5.20	5.20 / 7.23
Δt[5] (°F)	9.6	9.9	10.2
Piping[8]			
Liquid Line (in.,OD)	5/8 Braze	5/8 Braze	5/8 Braze
Low Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-1/8 Braze
High Pressure Vapor Line (in.,OD)	7/8 Braze	1-1/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 MPT	3/4 + 3/4 MPT	3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

Table 5: Dual Frame 208-230V Units.

Combination Unit Model Number	20.0 Ton ARWM240BAS5	22.0 Ton ARWM264BAS5	24.0 Ton ARWM288BAS5
Individual Component Model Numbers	ARWM121BAS5 x 2	ARWM121BAS5 x 1 + ARWM144BAS5 x 1	ARWM144BAS5 x 2
Cooling Performance			
Nominal Cooling Capacity (Btu/h)[1]	239,400	264,000	287,700
Heating Performance			
Nominal Heating Capacity (Btu/h)[1]	269,000	297,000	324,000
Operating Range (Entering Water Temperature)[2]			
Cooling (°F	50 - 113	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113
Compressor			
Inverter Quantity	HSS DC Scroll x 2		
Oil / Type	PVE / FVC68D		
Unit Data			
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit		
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7	7.7 + 7.7	7.7 + 7.7
Max. Number Indoor Units / System	39	42	45
Sound Pressure dB(A)[4]	59 (65)	59 (65)	59 (65)
Net Unit Weight (lbs.)	322 + 322	322 + 322	322 + 322
Shipping Weight (lbs.)	340 + 340	340 + 340	340 + 340
Communication Cables[6,7]	2 x 18 AWG		
Heat Exchanger (Stainless Steel Plate)			
Maximum Pressure Resistance (psi)	640	640	640
Flow at Rated Condition (GPM)	30.4 + 30.4	30.4 + 35.5	35.5 + 35.5
Total Heat of Rejection (Btu/h)	315,800	348,000	380,200
Total Heat of Absorption (Btu/h)	245,400	269,500	293,600
Pressure Drop (ft-wg)	7.23 / 7.23	7.23 / 9.63	9.63 / 9.63
Δt[5] (°F)	10.4	10.6	10.7
Piping[8]			
Liquid Line (in.,OD)	5/8 Braze	3/4 Braze	3/4 Braze
Low Pressure Vapor Line (in.,OD)	1-3/8 Braze	1-3/8 Braze	1-3/8 Braze
High Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 MPT	3/4 + 3/4 MPT	3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

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ARWM Series Water Source Unit Specifications

Table 6: Dual Frame 460V Units

Combination Unit Model Number	16.0 Ton ARWM191DAS5	18.0 Ton ARWM216DAS5	20.0 Ton ARWM240DAS5
Individual Component Model Numbers	ARWM096DAS5 x 2	ARWM096DAS5 x 1 + ARWM121DAS5 x 1	ARWM121DAS5 x 2
Cooling Performance			
Nominal Cooling Capacity (Btu/h)[1]	192,000	216,000	239,400
Heating Performance			
Nominal Heating Capacity (Btu/h)[1]	216,000	243,000	269,000
Operating Range (Entering Water Temperature)[2]			
Cooling (°F)	50 - 113	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113
Compressor			
Inverter Quantity	HSS DC Scroll x 2		
Oil / Type	PVE / FVC68D		
Unit Data			
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit		
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7	7.7 + 7.7	7.7 + 7.7
Max. Number Indoor Units / System	32	35	39
Sound Pressure dB(A)[4]	53 (65)	57 (65)	59 (65)
Net Unit Weight (lbs.)	328 + 328	328+ 328	328 + 328
Shipping Weight (lbs.)	346 + 346	346 + 346	346 + 346
Communication Cables[6,7]	2 x 18 AWG		
Heat Exchanger (Stainless Steel Plate)			
Maximum Pressure Resistance (psi)	640	640	640
Flow at Rated Condition (GPM)	25.4 + 25.4	25.4 + 30.4	30.4 + 30.4
Total Heat of Rejection (Btu/h)	253,500	283,800	315,800
Total Heat of Absorption (Btu/h)	193,600	221,300	245,400
Pressure Drop (ft-wg)	5.20 / 5.20	5.20 / 7.23	7.23 / 7.23
Δt[5] (°F)	10.0	10.2	10.4
Piping[8]			
Liquid Line (in.,OD)	5/8 Braze	5/8 Braze	5/8 Braze
Low Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-3/8 Braze
High Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 MPT	3/4 + 3/4 MPT	3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

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Table 7: Dual Frame 460V Units.

Combination Unit Model Number	22.0 Ton ARWM264DAS5	24.0 Ton ARWM288DAS5	30.0 Ton ARWM360DAS5
Individual Component Model Numbers	ARWM121DAS5 x 1 + ARWM144DAS5 x 1	ARWM144DAS5 x 2	ARWM168DAS5 x 1 + ARWM192DAS5 x 1
Cooling Performance			
Nominal Cooling Capacity (Btu/h)[1]	264,000	287,700	360,000
Heating Performance			
Nominal Heating Capacity (Btu/h)[1]	297,000	324,000	405,000
Operating Range (Entering Water Temperature)[2]			
Cooling (°F)	50 - 113	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113
Compressor			
Inverter Quantity	HSS DC Scroll x 2		
Oil / Type	PVE / FVC68D		
Unit Data			
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit		
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7	7.7 + 7.7	9.9 + 9.9
Max. Number Indoor Units / System	42	45	58
Sound Pressure dB(A)[4]	59 (65)	59 (65)	62 (65)
Net Unit Weight (lbs.)	328 + 328	328 + 328	348 + 348
Shipping Weight (lbs.)	346 + 346	346 + 346	366 + 366
Communication Cables[6,7]	2 x 18 AWG		
Heat Exchanger (Stainless Steel Plate)			
Maximum Pressure Resistance (psi)	640	640	640
Flow at Rated Condition (GPM)	30.4 + 35.5	35.5 + 35.5	45.7 + 50.7
Total Heat of Rejection (Btu/h)	348,000	380,200	473,500
Total Heat of Absorption (Btu/h)	269,500	293,600	366,400
Pressure Drop (ft-wg)	7.23 / 9.63	9.63 / 9.63	8.32 / 10.08
Δt^5 (°F)	10.6	10.7	9.8
Piping[8]			
Liquid Line (in.,OD)	3/4 Braze	3/4 Braze	3/4 Braze
Low Pressure Vapor Line (in.,OD)	1-3/8 Braze	1-3/8 Braze	1-5/8 Braze
High Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 MPT	3/4 + 3/4 MPT	3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

GENERAL DATA

ARWM Series Water Source Unit Specifications

Table 8: Triple Frame 208-230V Units.

Combination Unit Model Number	30.0 Ton ARWM360BAS5	36.0 Ton ARWM432BAS5
Individual Component Model Numbers	ARWM121BAS5 x 3	ARWM144BAS5 x 3
Cooling Performance		
Nominal Cooling Capacity (Btu/h)[1]	360,000	430,500
Heating Performance		
Nominal Heating Capacity (Btu/h)[1]	405,000	486,000
Operating Range (Entering Water Temperature)[2]		
Cooling (°F)	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113
Compressor		
Inverter Quantity	HSS DC Scroll x 3	
Oil / Type	PVE / FVC68D	
Unit Data		
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit	
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7 + 7.7	7.7 + 7.7 + 7.7
Max. Number Indoor Units / System	58	64
Sound Pressure dB(A)[4]	61 (67)	61 (67)
Net Unit Weight (lbs.)	322 + 322 + 322	322 + 322 + 322
Shipping Weight (lbs.)	340 + 340 + 340	340 + 340 + 340
Communication Cables[6,7]	2 x 18 AWG	
Heat Exchanger (Stainless Steel Plate)		
Maximum Pressure Resistance (psi)	640	640
Flow at Rated Condition (GPM)	30.4 + 30.4 + 30.4	35.5 + 35.5 + 35.5
Total Heat of Rejection (Btu/h)	473,700	570,300
Total Heat of Absorption (Btu/h)	368,100	440,400
Pressure Drop (ft-wg)	7.23 / 7.23 / 7.23	9.63 / 9.63 / 9.63
Δt[5] (°F)	10.4	10.7
Piping[8]		
Liquid Line (in.,OD)	3/4 Braze	3/4 Braze
Low Pressure Vapor Line (in.,OD)	1-5/8 Braze	1-5/8 Braze
High Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 + 3/4 MPT	3/4 + 3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

Table 9: Triple-Frame 460V Units

Combination Unit Model Number	36.0 Ton ARWM432DAS5	42.0 Ton ARWM504DAS5	48.0 Ton ARWM576DAS5
Individual Component Model Numbers	ARWM144BAS5 x 3	ARWM144DAS5 x 1 + ARWM168DAS5 x 1 + ARWM192DAS5 x 1	ARWM192DAS5 x 3
Cooling Performance			
Nominal Cooling Capacity (Btu/h)[1]	430,500	504,000	571,200
Heating Performance			
Nominal Heating Capacity (Btu/h)[1]	486,000	567,000	648,000
Operating Range (Entering Water Temperature)[2]			
Cooling (°F)	50 - 113	50 - 113	50 - 113
Heating (°F))[3]	23 – 113	23 – 113	23 – 113
Synchronous Operation (°F))[3]	23 – 113	23 – 113	23 – 113
Compressor			
Inverter Quantity	HSS DC Scroll x 3		
Oil / Type	PVE / FVC68D		
Unit Data			
Refrigerant Type / Control / Location	R410A / EEV / Indoor Unit		
R410A Refrigerant Factory Charge (lbs)	7.7 + 7.7 + 7.7	7.7 + 9.9 + 9.9	9.9 + 9.9 + 9.9
Max. Number Indoor Units / System	64	64	64
Sound Pressure dB(A)[4]	61 (67)	63 (67)	65 (67)
Net Unit Weight (lbs.)	328 + 328 + 328	328 + 348 + 348	348 + 348 + 348
Shipping Weight (lbs.)	346 + 346 + 346	346 + 366 + 366	366 + 366 + 366
Communication Cables[6,7]	2 x 18 AWG		
Heat Exchanger (Stainless Steel Plate)			
Maximum Pressure Resistance (psi)	640	640	640
Flow at Rated Condition (GPM)	35.5 + 35.5 + 35.5	35.5 + 45.7 + 50.7	50.7 + 50.7 + 50.7
Total Heat of Rejection (Btu/h)	570,300	663,600	760,500
Total Heat of Absorption (Btu/h)	440,400	513,200	580,800
Pressure Drop (ft-wg)	9.63 / 9.63 / 9.63	9.63 / 8.32 / 10.08	10.08 / 10.08 / 10.08
Δt^5 (°F)	10.7	10.1	10.0
Piping[8]			
Liquid Line (in.,OD)	3/4 Braze	3/4 Braze	3/4 Braze
Low Pressure Vapor Line (in.,OD)	1-5/8 Braze	1-5/8 Braze	1-5/8 Braze
High Pressure Vapor Line (in.,OD)	1-1/8 Braze	1-1/8 Braze	1-3/8 Braze
Water Inlet / Outlet Connection (in.,ID)	1-1/2 + 1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 + 1-1/2 FPT	1-1/2 + 1-1/2 + 1-1/2 FPT
Condensate Pipe Diameter (in.,ID)	3/4 + 3/4 + 3/4 MPT	3/4 + 3/4 + 3/4 MPT	3/4 + 3/4 + 3/4 MPT

[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] Variable water flow control kit PWFCKN000 is required for applications with entering water temperatures below 59ºF (one kit per frame). Minimum flow rate must be 40% of the nominal flow rate, 2-10V signal with a linear flow response valve.

[3] For heating and synchronous operation applications with entering water temperatures lower than 50°F, refer to the Water Loop Circuit Design and Installation section in this manual.

[4] Sound pressure levels are tested in an anechoic chamber under ISO 3745 standard at rated AHRI operating conditions.Sound pressure level may increase during heating operation at maximum compressor frequency. Value in parenthesis is the maximum sound pressure at those conditions.

[5] Value is calculated as follows: Δt = Total Heat of Rejection ÷ (Rated Flow Rate x 500). Data is for pure water.

[6] Communication cable between WSU, IDU(s) / HRU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the WSU chassis only. ⃠ Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.

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

[8] 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.

GENERAL DATA

Heat Recovery Unit Specifications and Electrical Data

Figure 1: Two-Port Heat Recovery Unit.

Figure 2: Three-Port Heat Recovery Unit.

Figure 3: Four-Port Heat Recovery Unit.

Figure 4: Six-Port Heat Recovery Unit.

Figure 5: Eight-Port Heat Recovery Unit.

Table 10: Heat Recovery Unit Specifications.

Model			PRHR023A	PRHR033A	PRHR043A	PRHR063A	PRHR083A
Number of Ports			2	3	4	6	8
Max. Connectable No. of Indoor Units			16	24	32	48	64
Max. Connectable No. of Indoor Units on each port			8				
Max. Port Capacity (each port) Btu/h			60,000	60,000	60,000	60,000	60,000
Max. Unit Capacity (sum of ports) Btu/h			120,000	180,000	230,000	230,000	230,000
Shipping Weight / Net Weight lbs.			46 / 33	50 / 37	53 / 40	75 / 60	82 / 68
Dimensions (W x H x D) inches			30-15/16 x 8-9/16 x 25-7/8			43-13/16 x 8-9/16 x 25-7/8	
Casing			Galvanized steel plate				
Connecting Pipes	To Indoor Units	Liquid Pipe (in)	3/8				
		Vapor Pipe (in)	5/8				
	To Water Source Units	Liquid (in)	3/8	1/2	5/8		
		Low-pressure Vapor (in)	7/8	1-1/8	1-1/8		
		High-pressure Vapor (in)	3/4	7/8	7/8		
Insulation Material			Polyethylene Foam				

Table 11: Heat Recovery Unit Electrical Data.

Unit Model No.	Voltage Range	Rated Amps	Max Rated Amps	MCA	MFA	Power Supply			Max Power Input (W)	
						Hz	Volts	Phase	Cooling	Heating
PRHR023A	187-253	0.06	0.18	0.17	15	60	208-230	1	39.8	37.2
PRHR033A										
PRHR043A										
PRHR063A		0.09	0.35	0.27					75.9	72.1
PRHR083A										

Table 12: 208-230V, 60Hz, 3-Phase Systems

Nom. Tons	System Model No.	Compressor				MCA			MOCP		
		Comp. Qty.	Motor RLA			Frame 1	Frame 2	Frame 3	Frame 1	Frame 2	Frame 3
			Frame 1	Frame 2	Frame 3						
6	ARWM072BAS5	1	11.1	-	-	13.8	-	-	20	-	-
8	ARWM096BAS5	1	15.5	-	-	19.4	-	-	30	-	-
10	ARWM121BAS5	1	22.2	-	-	27.7	-	-	45	-	-
12	ARWM144BAS5	1	26.2	-	-	32.7	-	-	50	-	-
14	ARWM168BAS5	2	15.5	11.1	-	19.4	13.8	-	30	20	-
16	ARWM192BAS5	2	15.5	15.5	-	19.4	19.4	-	30	30	-
18	ARWM216BAS5	2	22.2	15.5	-	27.7	19.4	-	45	30	-
20	ARWM240BAS5	2	22.2	22.2	-	27.7	27.7	-	45	45	-
22	ARWM264BAS5	2	26.2	22.2	-	32.7	27.7	-	50	45	-
24	ARWM288BAS5	2	26.2	26.2	-	32.7	32.7	-	50	50	-
30	ARWM360BAS5	3	22.2	22.2	22.2	27.7	27.7	27.7	45	45	45
36	ARWM432BAS5	3	26.2	26.2	26.2	32.7	32.7	32.7	50	50	50

For component model numbers, see the specification tables.

For 208−230V systems, acceptable voltage range is 187−253V.

Maximum allowable voltage imbalance is 2%.

MCA = Minimum Circuit Ampacity.

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

SCCR rating: 56 kA RMS symmetrical 208V maximum / 62 kA RMS symmetrical 230V maximum

ELECTRICAL DATA

460V Models

Table 13: 460V, 60Hz, 3-Phase Systems

Nom. Tons	System Model No.	Compressor				MCA			MOCP		
		Comp. Qty.	Motor RLA			Frame 1	Frame 2	Frame 3	Frame 1	Frame 2	Frame 3
			Frame 1	Frame 2	Frame 3						
6	ARWM072DAS5	1	7.8	-	-	9.8	-	-	15	-	-
8	ARWM096DAS5	1	8.8	-	-	11.1	-	-	15	-	-
10	ARWM121DAS5	1	11.1	-	-	13.8	-	-	20	-	-
12	ARWM144DAS5	1	13.3	-	-	16.6	-	-	25	-	-
14	ARWM168DAS5	1	15.5	-	-	19.4	-	-	30	-	-
16	ARWM192DAS5	1	20.0	-	-	24.9	-	-	40	-	-
16	ARWM191DAS5	2	8.8	8.8	-	11.1	11.1	-	15	15	-
18	ARWM216DAS5	2	11.1	8.8	-	13.8	11.1	-	20	15	-
20	ARWM240DAS5	2	11.1	11.1	-	13.8	13.8	-	20	20	-
22	ARWM264DAS5	2	13.3	11.1	-	16.6	13.8	-	25	20	-
24	ARWM288DAS5	2	13.3	13.3	-	16.6	16.6	-	25	25	-
30	ARWM360DAS5	2	20.0	15.5	-	24.9	19.4	-	40	30	-
36	ARWM432DAS5	3	13.3	13.3	13.3	16.6	16.6	16.6	25	25	25
42	ARWM504DAS5	3	20.0	15.5	13.3	24.9	19.4	16.6	40	30	25
48	ARWM576DAS5	3	20.0	20.0	20.0	24.9	24.9	24.9	40	40	40

For component model numbers, see the specification tables.

For 460V systems, acceptable voltage range is 414~528V.

Maximum allowable voltage imbalance is 2%.

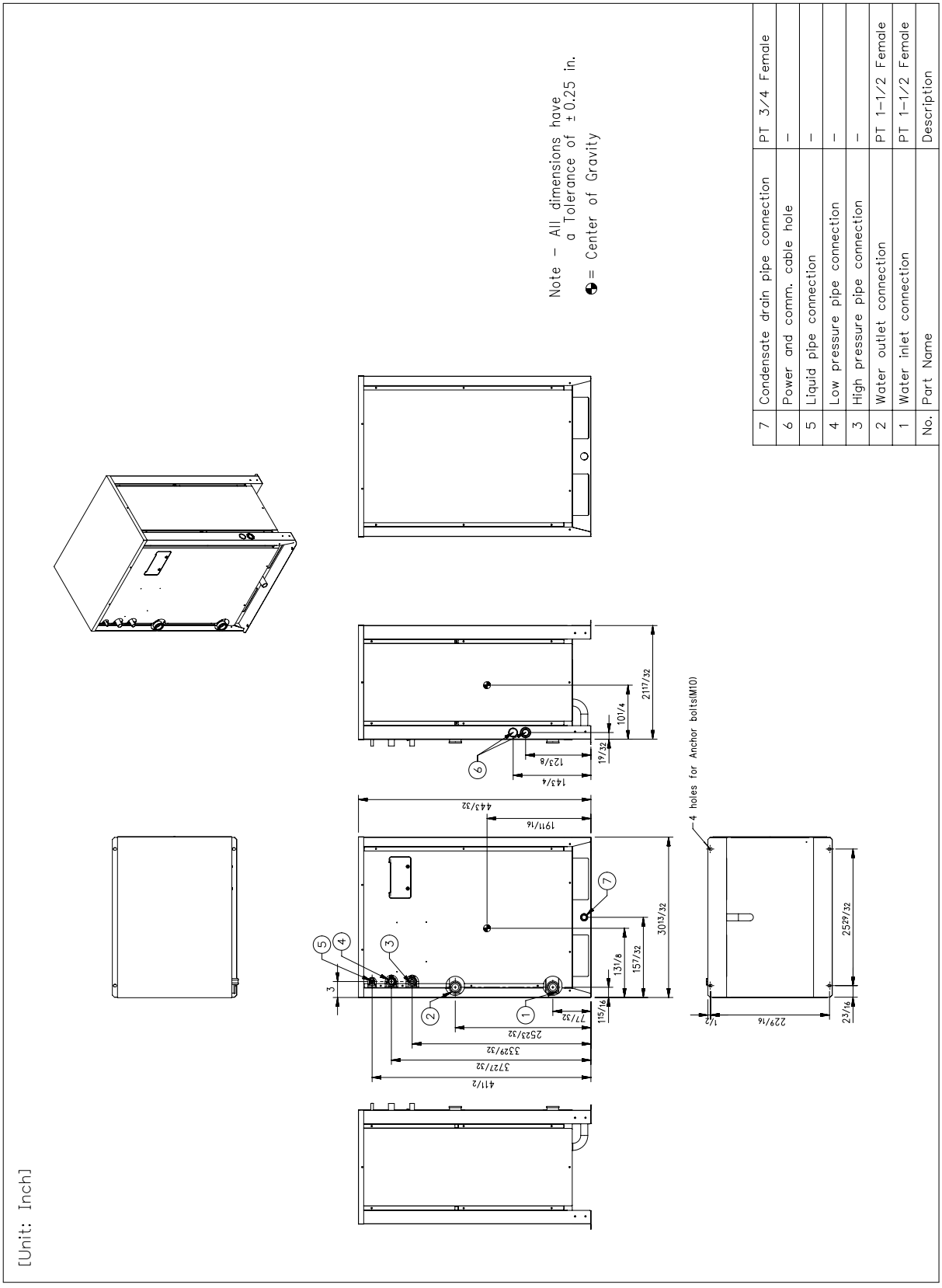
MCA = Minimum Circuit Ampacity.

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

SCCR rating: 65 kA RMS symmetrical 460V maximum

WATER SOURCE UNIT DIMENSIONS

Single Frame

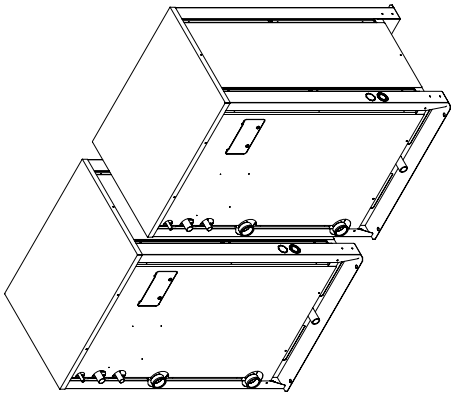


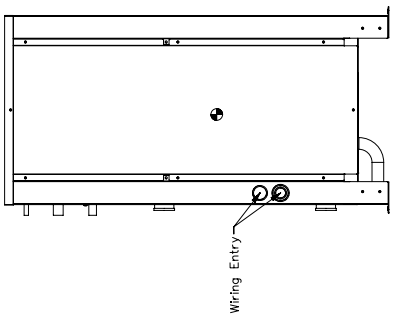
No.	Part Name	Description
7	Condensate drain pipe connection	PT 3/4 Female
6	Power and comm. cable hole	–
5	Liquid pipe connection	–
4	Low pressure pipe connection	–
3	High pressure pipe connection	–
2	Water outlet connection	PT 1-1/2 Female
1	Water inlet connection	PT 1-1/2 Female

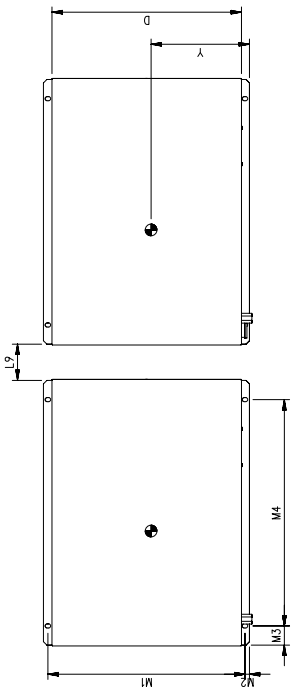
WATER SOURCE UNIT DIMENSIONS

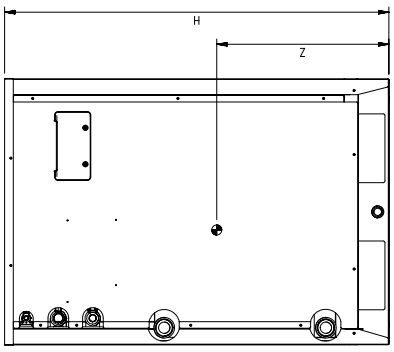
Dual Frame

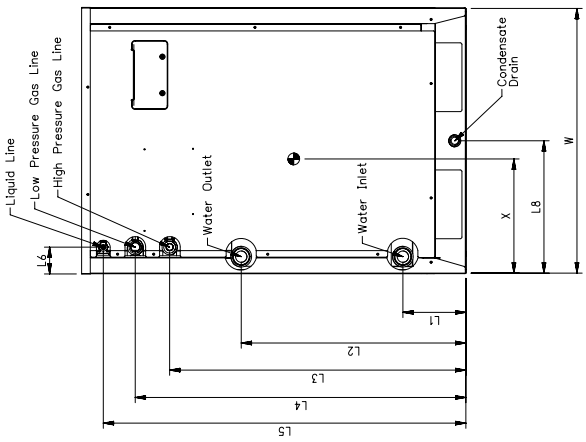
X	13-1/16"
Y	11-1/4"
Z	19-11/16"
W	30-13/32"
D	21-17/32"
H	44-3/32"
L1	7-3/16"
L2	25-3/4"
L3	33-7/8"
L4	37-7/8"
L5	41-1/2"
L6	3"
L7	1-15/16"
L8	15-3/16"
L9	4"
M1	22-9/16"
M2	1/2"
M3	2-3/16"
M4	25-7/8"







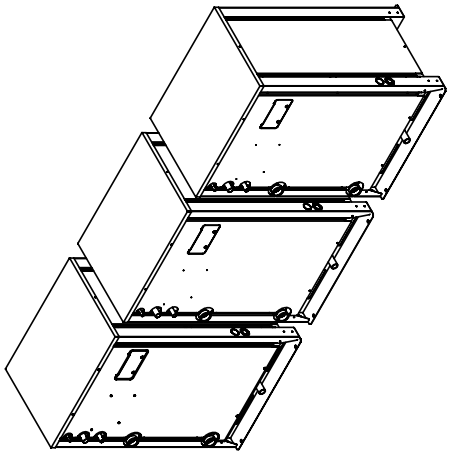


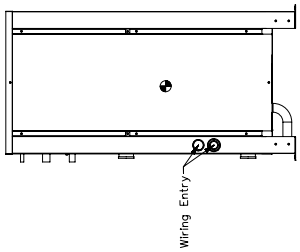


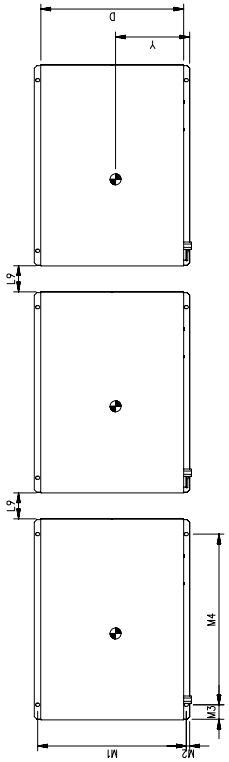
WATER SOURCE UNIT DIMENSIONS

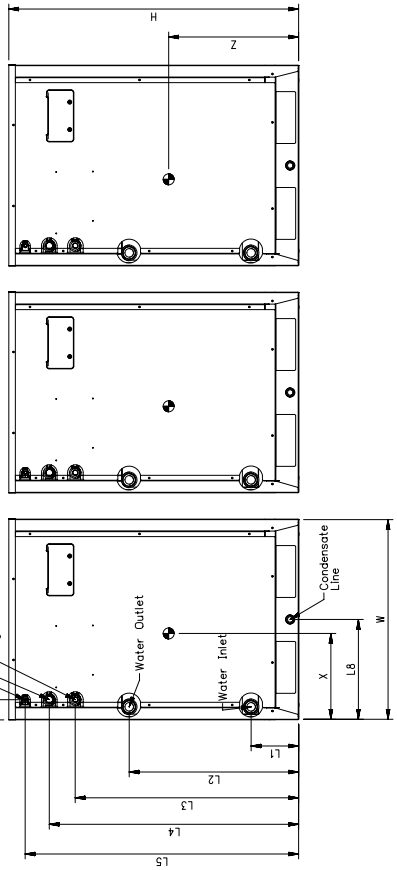
Triple Frame

X	13-1/16"
Y	11-1/4"
Z	19-11/16"
W	30-13/32"
D	21-17/32"
H	44-3/32"
L1	7-3/16"
L2	25-3/4"
L3	33-7/8"
L4	37-7/8"
L5	41-1/2"
L6	3"
L7	1-15/16"
L8	15-3/16"
L9	4"
M1	22-9/16"
M2	1/2"
M3	2-3/16"
M4	25-7/8"



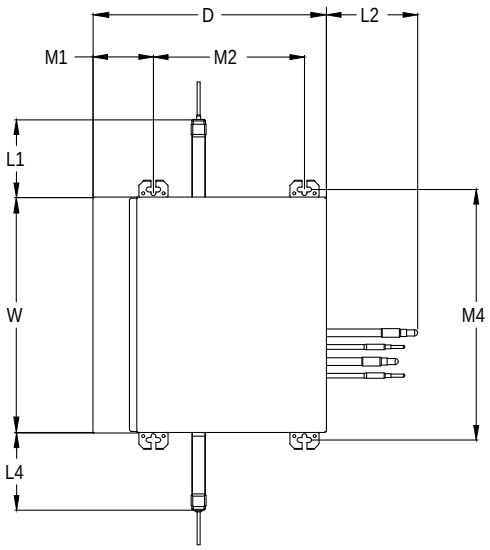


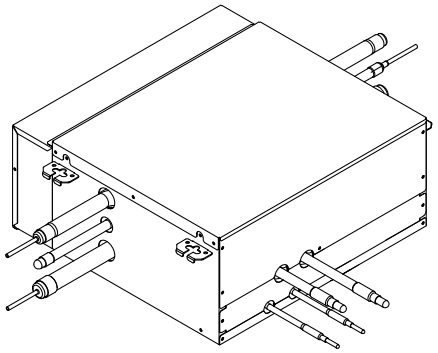




HEAT RECOVERY UNIT DIMENSIONS

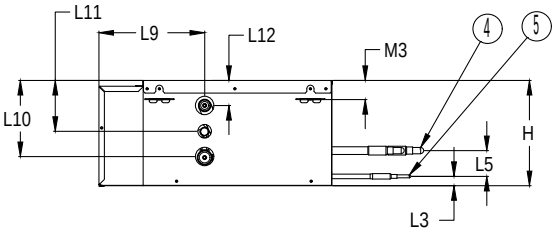
Heat Recovery Unit PRHR023A

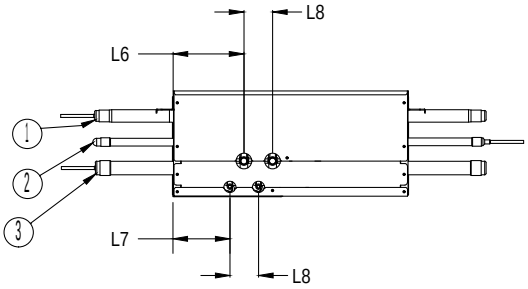




W	19-1/8″
H	8-5/8″
D	18-15/16″
L1	5-15/16″
L2	6-15/16″
L3	3/4″
L4	5-15/16″
L5	2-3/16″
L6	5-3/4″
L7	4-9/16″
L8	2-5/16″
L9	8-9/16″
L10	6-3/16″
L11	3-9/16″
L12	2″
M1	4-15/16″
M2	12-1/4″
M3	1-1/2″
M4	20-3/8″

[Unit: inch]





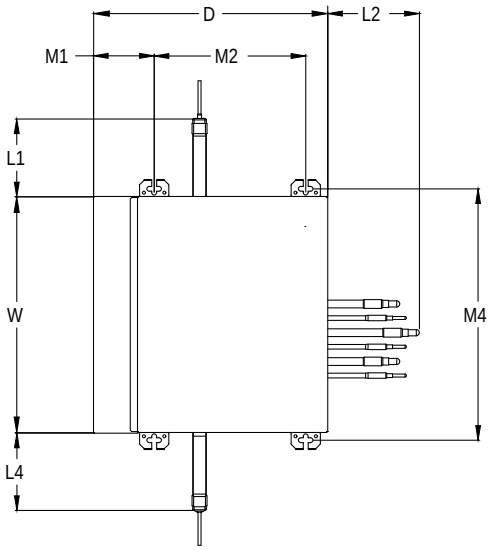
Note:

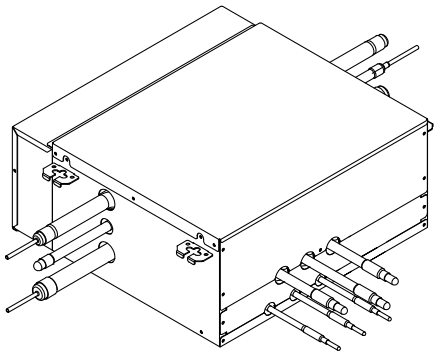
1. Unit should be installed in compliance with the appropriate LG installation manual.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials supplied from the site must comply with the local regulations or national codes.

No.	Part Name
6	Control box
5	Liquid pipe to Indoor unit
4	Gas pipe to Indoor unit
3	Low pressure gas pipe
2	Liquid pipe to Outdoor unit
1	High pressure gas pipe

HEAT RECOVERY UNIT DIMENSIONS

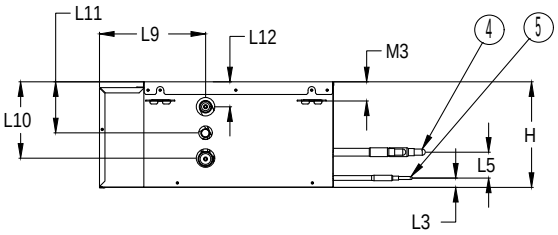
Heat Recovery Unit PRHR033A

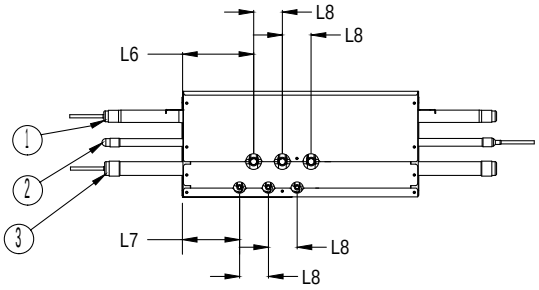




W	19-1/8″
H	8-5/8″
D	18-15/16″
L1	5-15/16″
L2	6-15/16″
L3	3/4″
L4	5-15/16″
L5	2-3/16″
L6	5-3/4″
L7	4-9/16″
L8	2-5/16″
L9	8-9/16″
L10	6-3/16″
L11	3-9/16″
L12	2″
M1	4-15/16″
M2	12-1/4″
M3	1-1/2″
M4	20-3/8″

[Unit: inch]





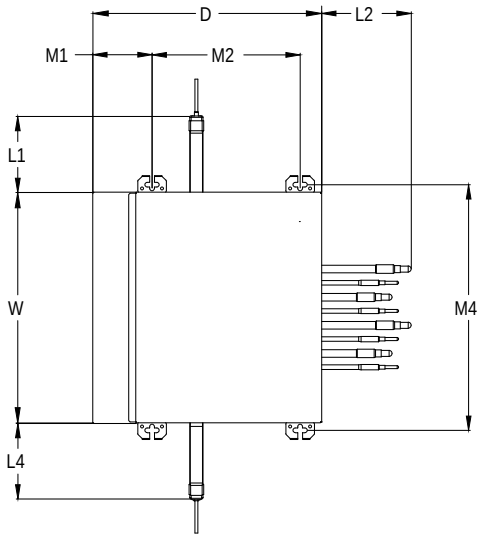
Note:

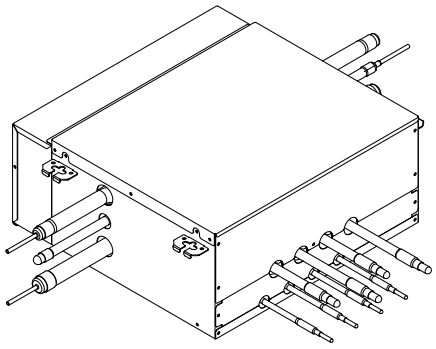
1. Unit should be installed in compliance with the appropriate LG installation manual.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials supplied from the site must comply with the local regulations or national codes.

No.	Part Name
6	Control box
5	Liquid pipe to Indoor unit
4	Gas pipe to Indoor unit
3	Low pressure gas pipe
2	Liquid pipe to Outdoor unit
1	High pressure gas pipe

HEAT RECOVERY UNIT DIMENSIONS

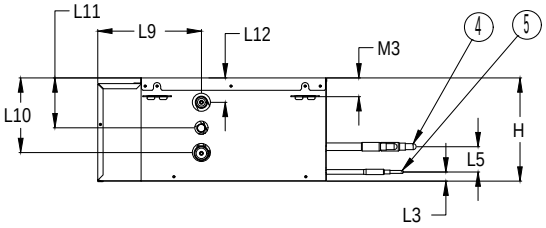
Heat Recovery Unit PRHR043A

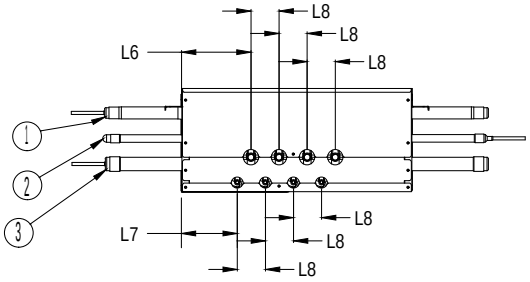




W	19-1/8″
H	8-5/8″
D	18-15/16″
L1	5-15/16″
L2	6-15/16″
L3	3/4″
L4	5-15/16″
L5	2-3/16″
L6	5-3/4″
L7	4-9/16″
L8	2-5/16″
L9	8-9/16″
L10	6-3/16″
L11	3-9/16″
L12	2″
M1	4-15/16″
M2	12-1/4″
M3	1-1/2″
M4	20-3/8″

[Unit: inch]





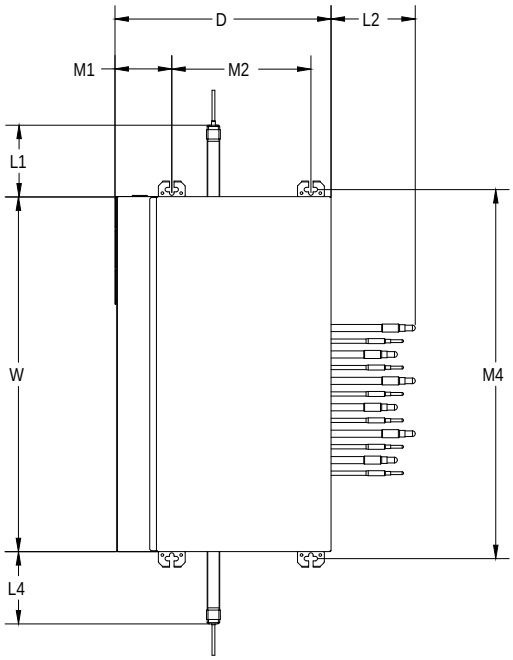
Note:

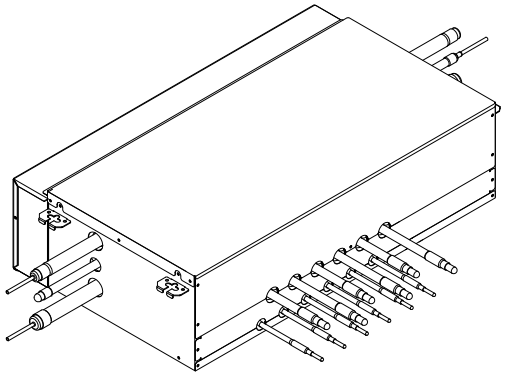
1. Unit should be installed in compliance with the appropriate LG installation manual.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials supplied from the site must comply with the local regulations or national codes.

No.	Part Name
6	Control box
5	Liquid pipe to Indoor unit
4	Gas pipe to Indoor unit
3	Low pressure gas pipe
2	Liquid pipe to Outdoor unit
1	High pressure gas pipe

HEAT RECOVERY UNIT DIMENSIONS

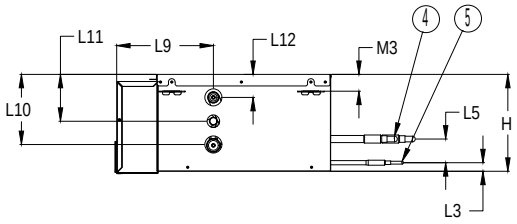
Heat Recovery Unit PRHR063A

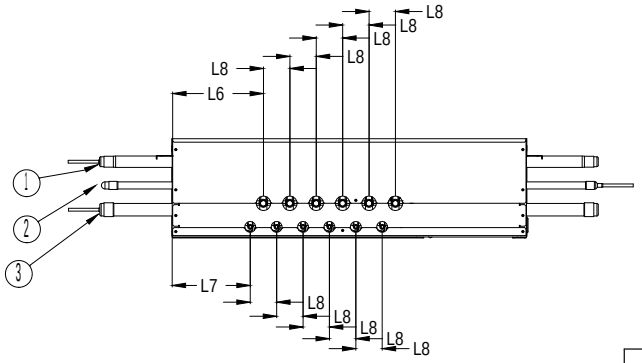




W	31-1/4″
H	8-5/8″
D	18-15/16″
L1	6-5/16″
L2	6-15/16″
L3	3/4″
L4	6-5/16″
L5	2-3/16″
L6	8-1/16″
L7	6-7/8″
L8	2-5/16″
L9	8-9/16″
L10	6-3/16″
L11	3-9/16″
L12	2″
M1	4-15/16″
M2	12-1/4″
M3	1-1/2″
M4	32-1/2″

[Unit: inch]





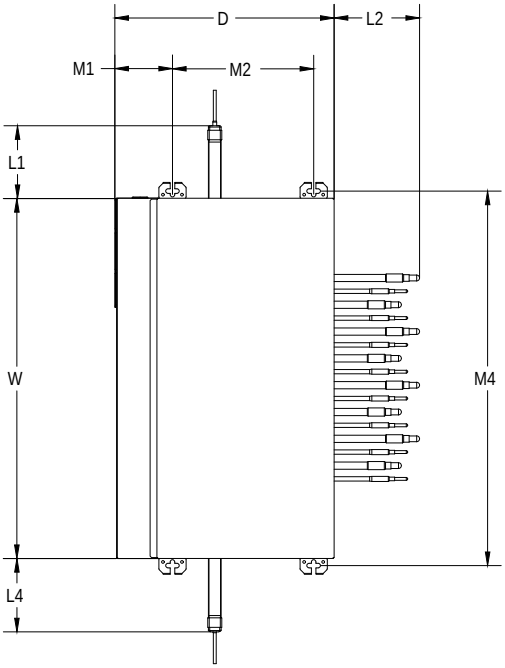
Note:

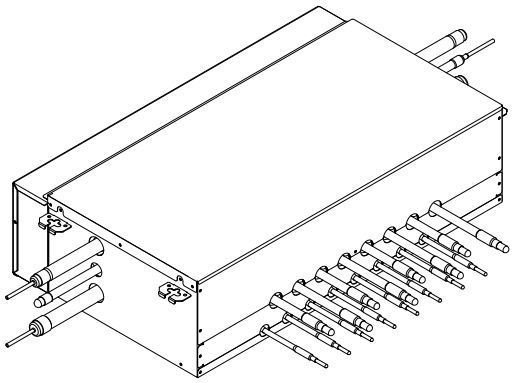
1. Unit should be installed in compliance with the appropriate LG installation manual.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials supplied from the site must comply with the local regulations or national codes.

No.	Part Name
6	Control box
5	Liquid pipe to Indoor unit
4	Gas pipe to Indoor unit
3	Low pressure gas pipe
2	Liquid pipe to Outdoor unit
1	High pressure gas pipe

HEAT RECOVERY UNIT DIMENSIONS

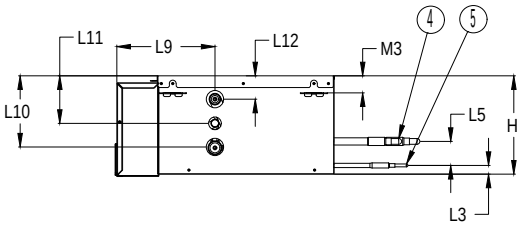
Heat Recovery Unit PRHR083A

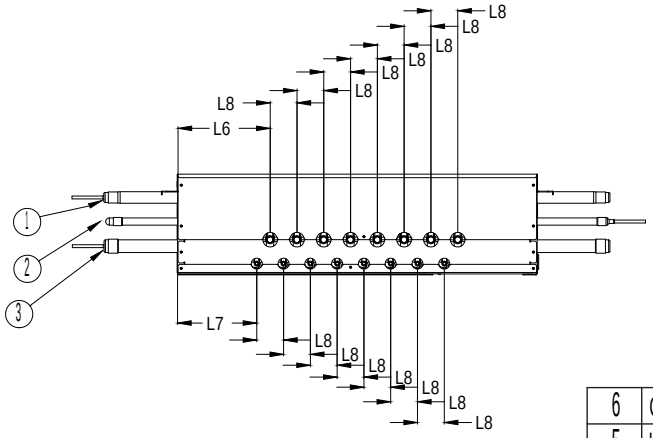




W	31-1/4″
H	8-5/8″
D	18-15/16″
L1	6-5/16″
L2	6-15/16″
L3	3/4″
L4	6-5/16″
L5	2-3/16″
L6	8-1/16″
L7	6-7/8″
L8	2-5/16″
L9	8-9/16″
L10	6-3/16″
L11	3-9/16″
L12	2″
M1	4-15/16″
M2	12-1/4″
M3	1-1/2″
M4	32-1/2″

[Unit: inch]

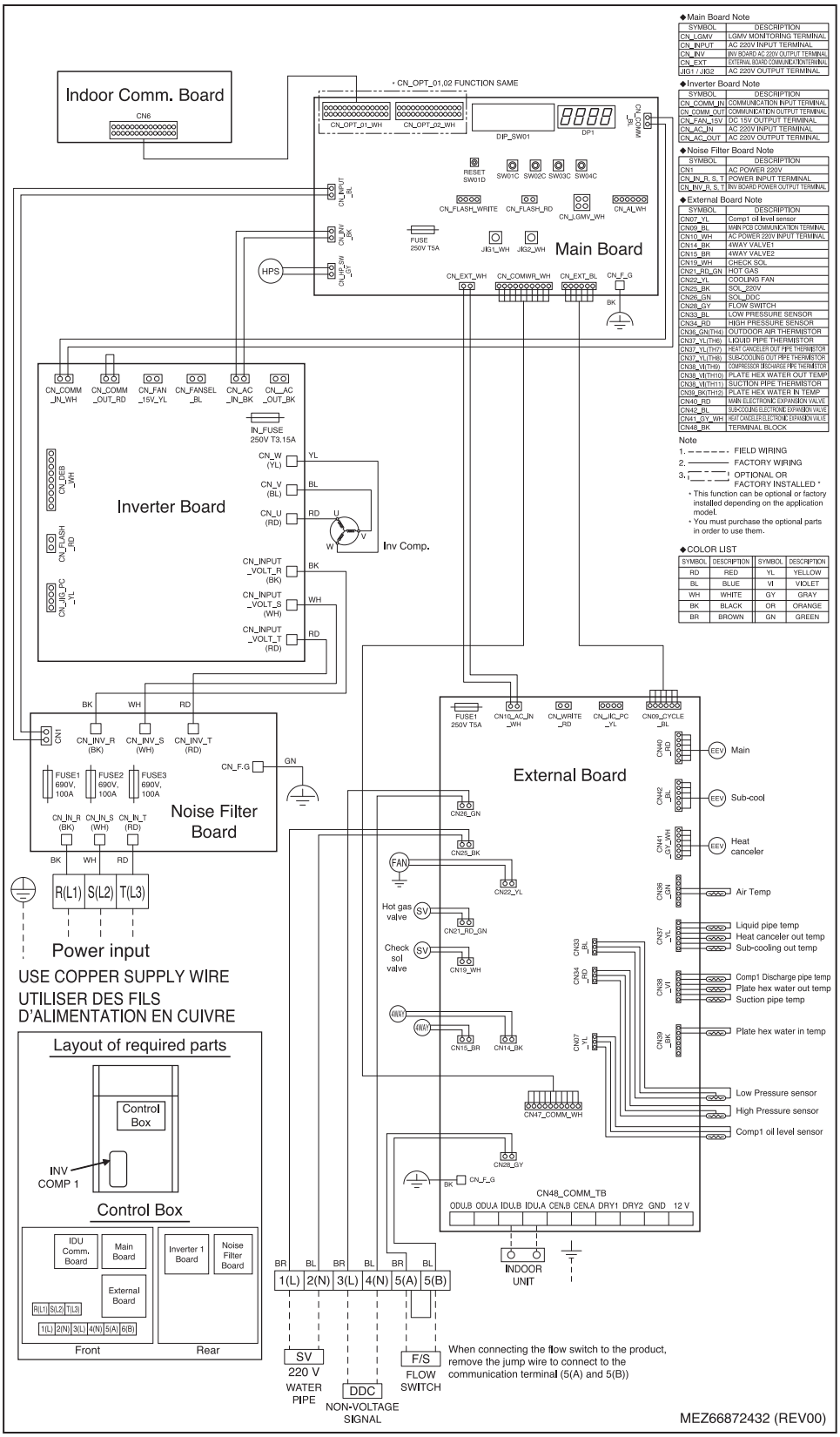




Note:

1. Unit should be installed in compliance with the appropriate LG installation manual.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials supplied from the site must comply with the local regulations or national codes.

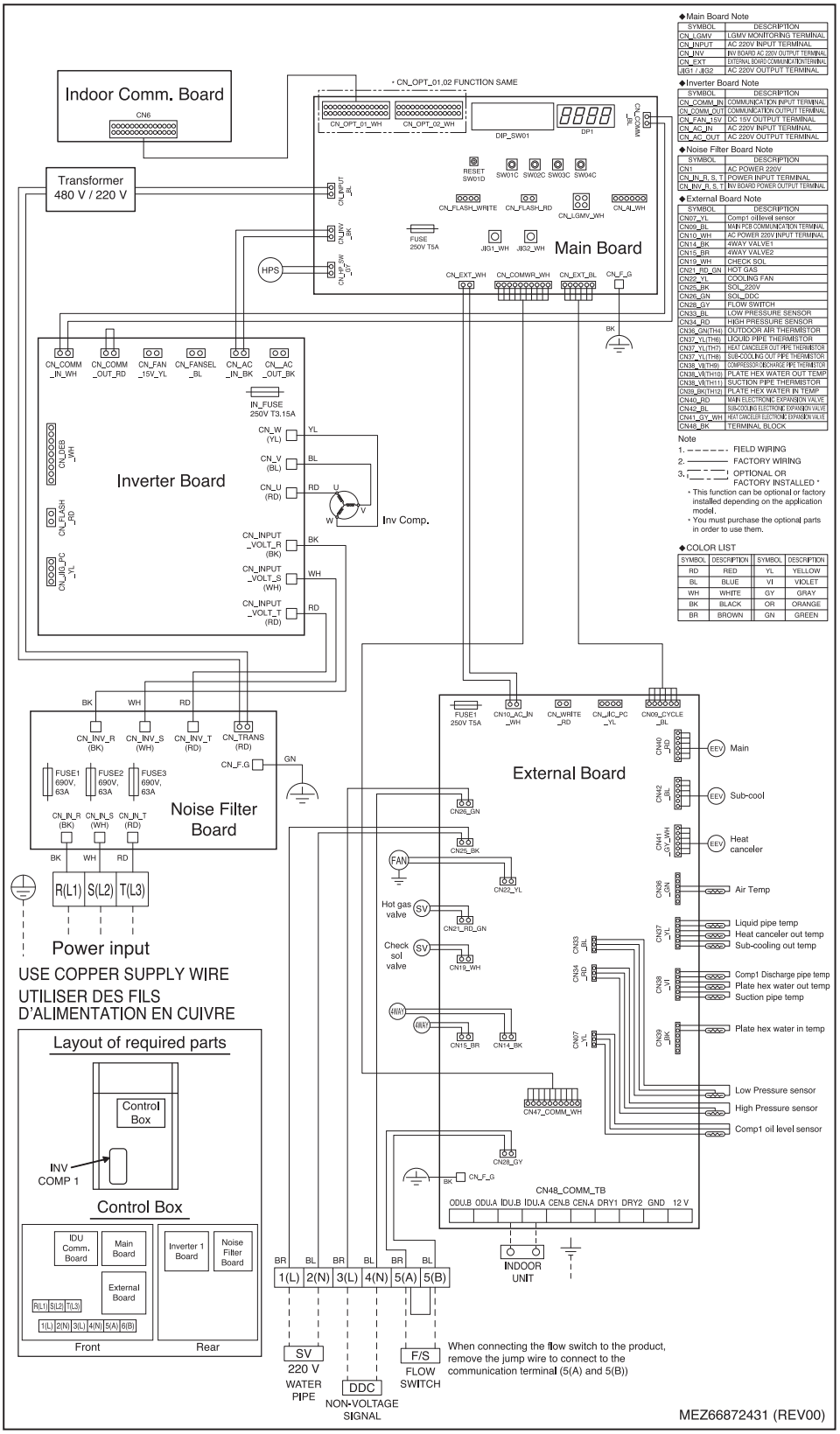
No.	Part Name
6	Control box
5	Liquid pipe to Indoor unit
4	Gas pipe to Indoor unit
3	Low pressure gas pipe
2	Liquid pipe to Outdoor unit
1	High pressure gas pipe



Product Data

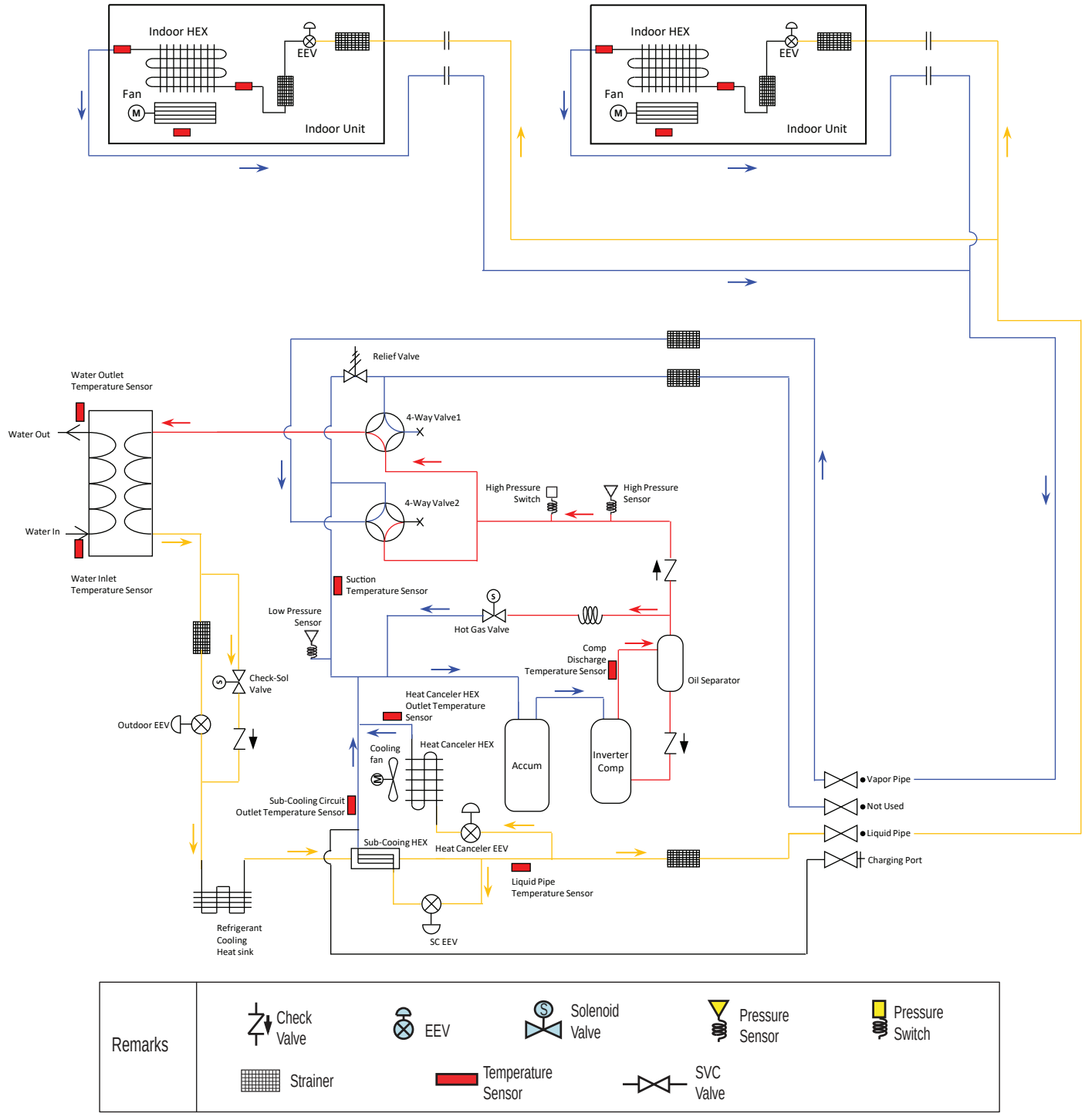
WIRING DIAGRAM

460V Models



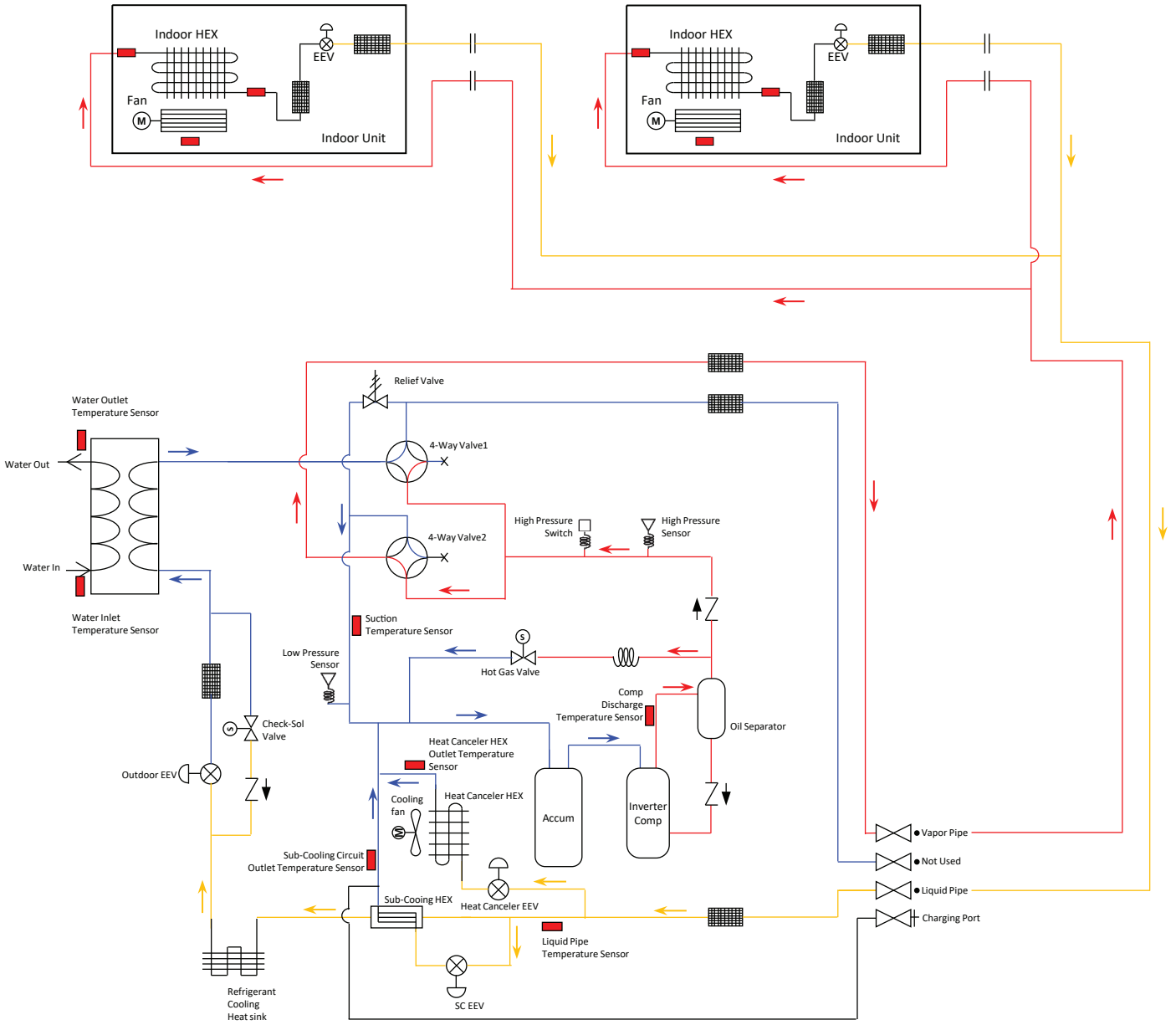
REFRIGERANT FLOW DIAGRAMS

Heat Pump — Cooling Mode

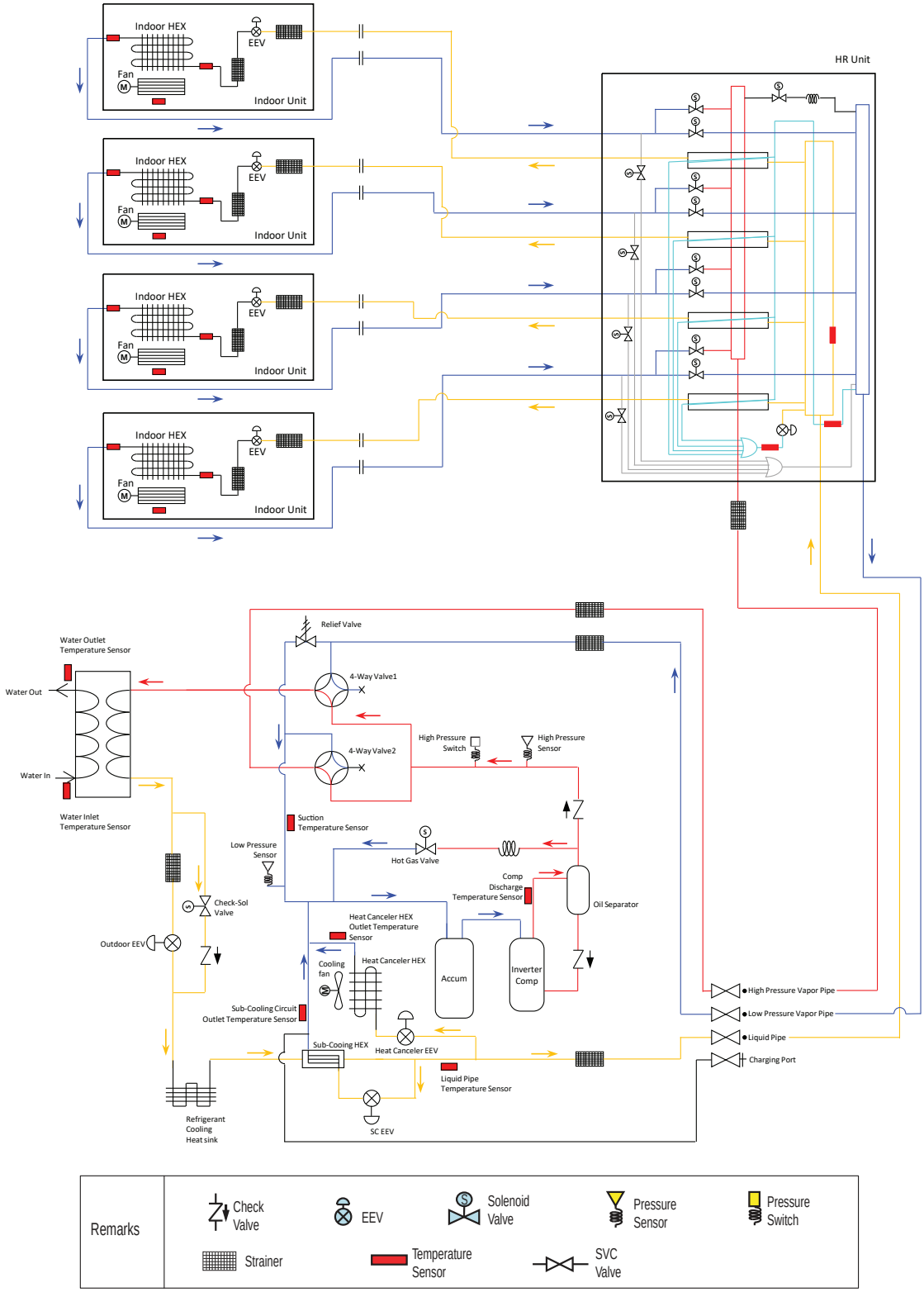


REFRIGERANT FLOW DIAGRAMS

Heat Pump — Heating Mode



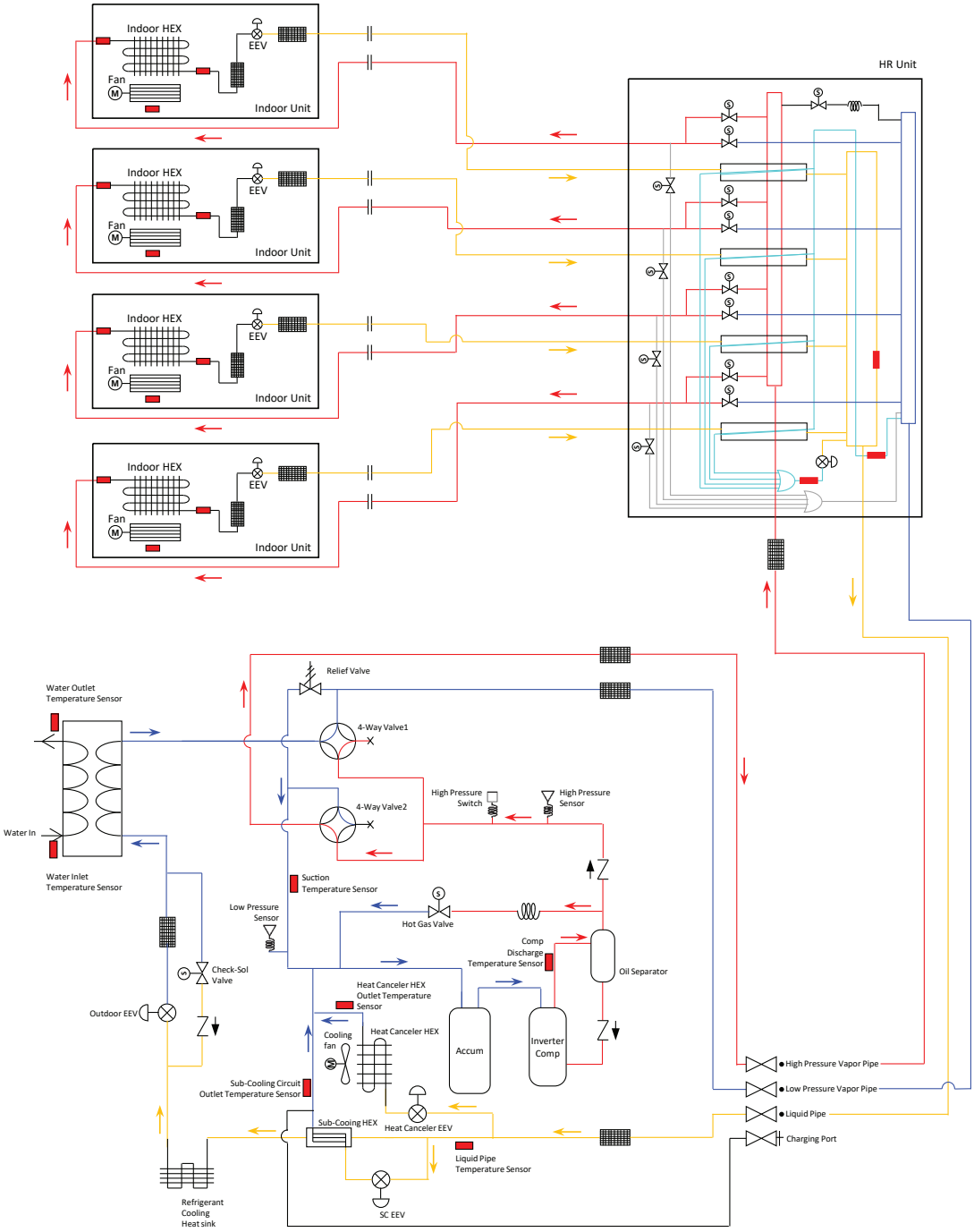
Remarks					
	Check Valve	EEV	Solenoid Valve	Pressure Sensor	Pressure Switch
	Strainer	Temperature Sensor	SVC Valve		

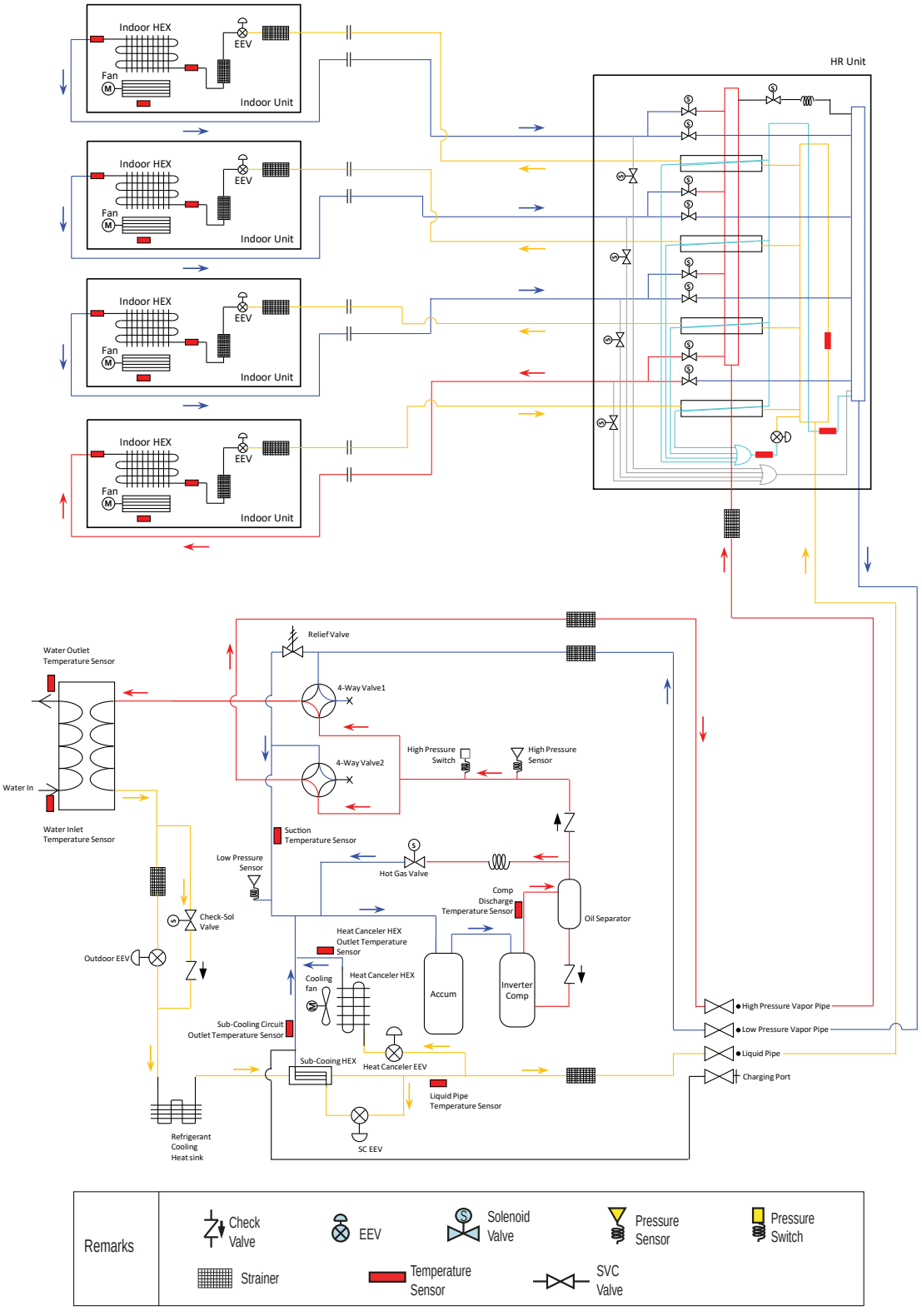


Product Data

REFRIGERANT FLOW DIAGRAMS

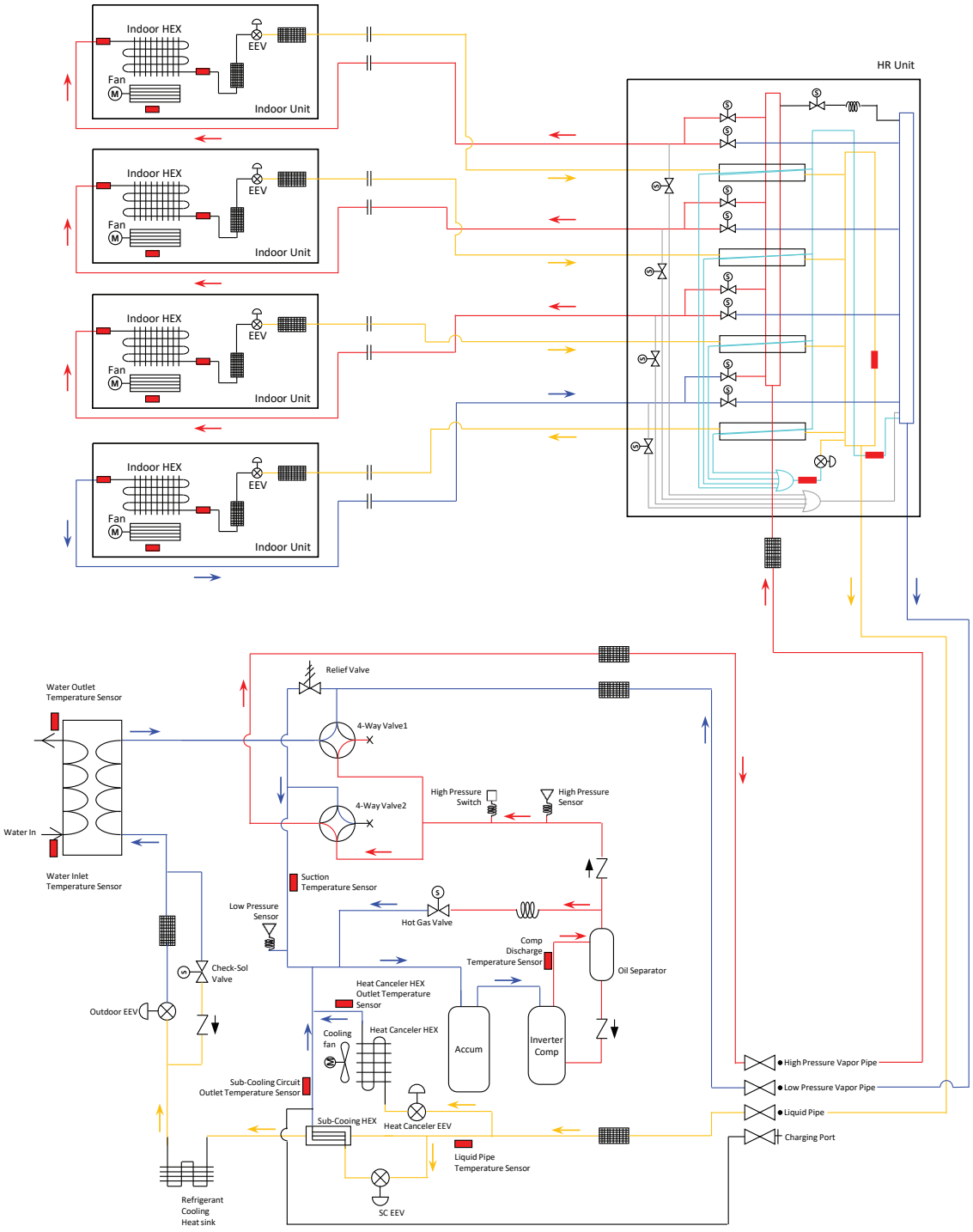
Heat Recovery — Heating Mode

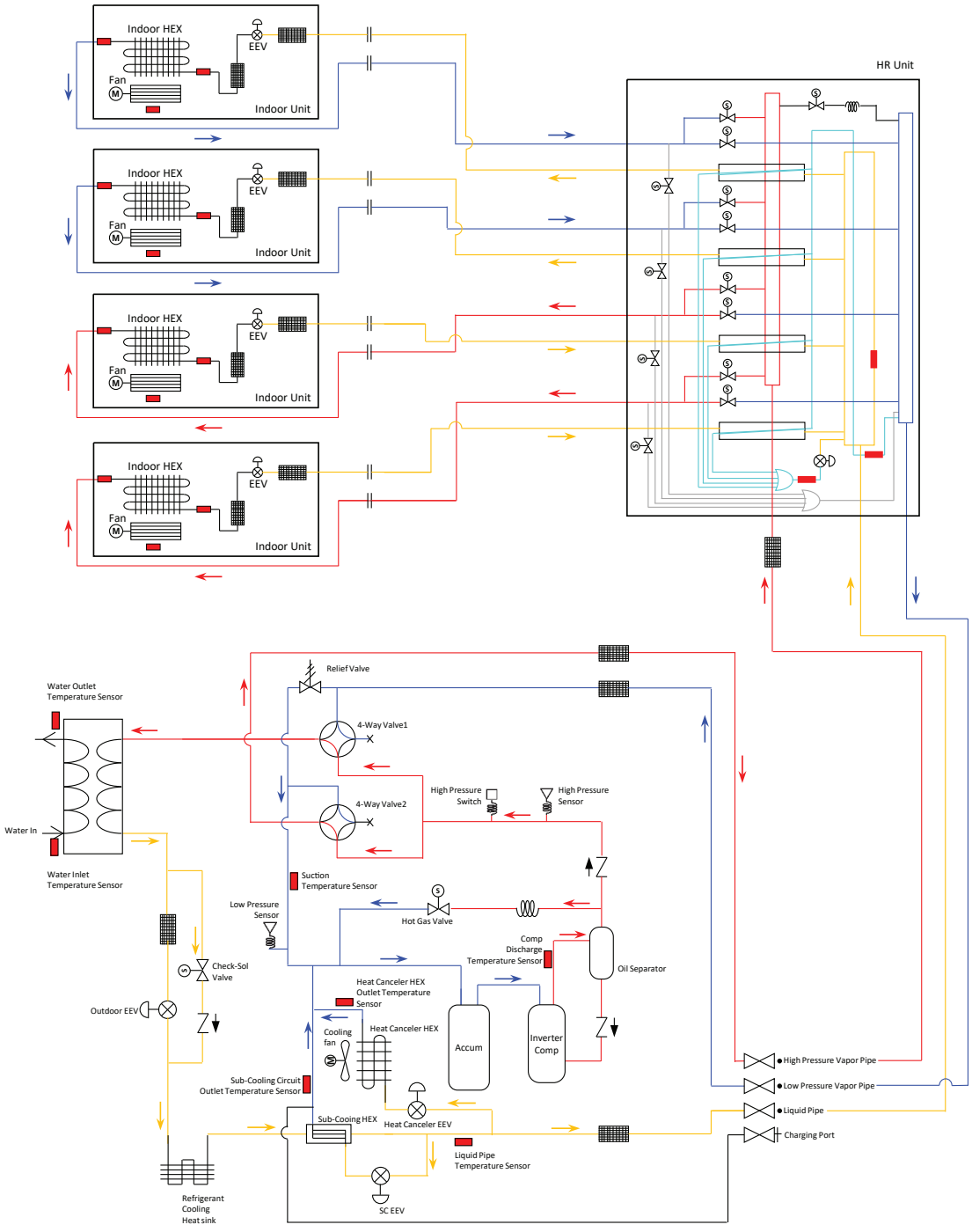




REFRIGERANT FLOW DIAGRAMS

Heat Recovery — Heating based Simultaneous Operation Mode



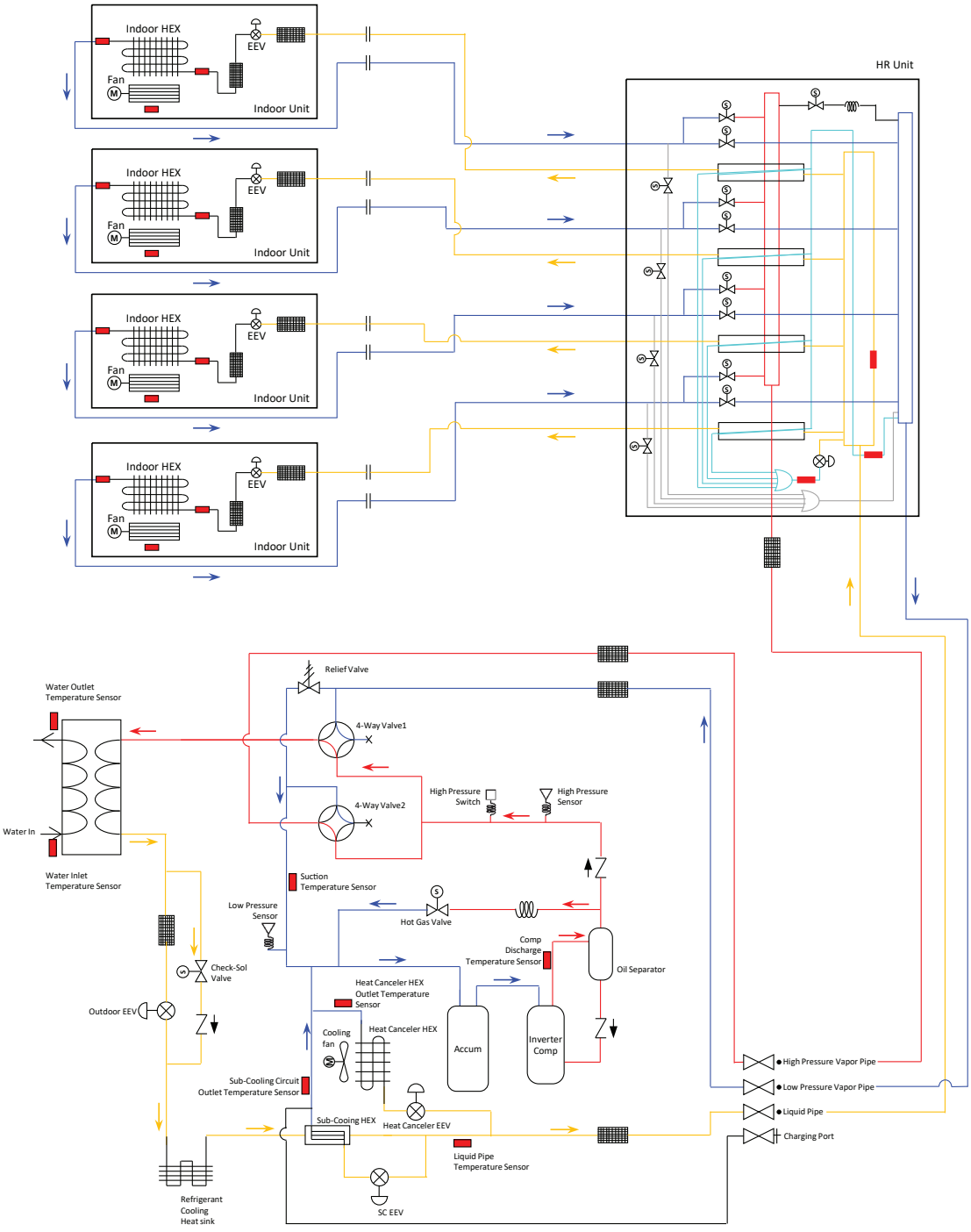


Remarks					
	Check Valve	EEV	Solenoid Valve	Pressure Sensor	Pressure Switch
	Strainer	Temperature Sensor	SVC Valve		

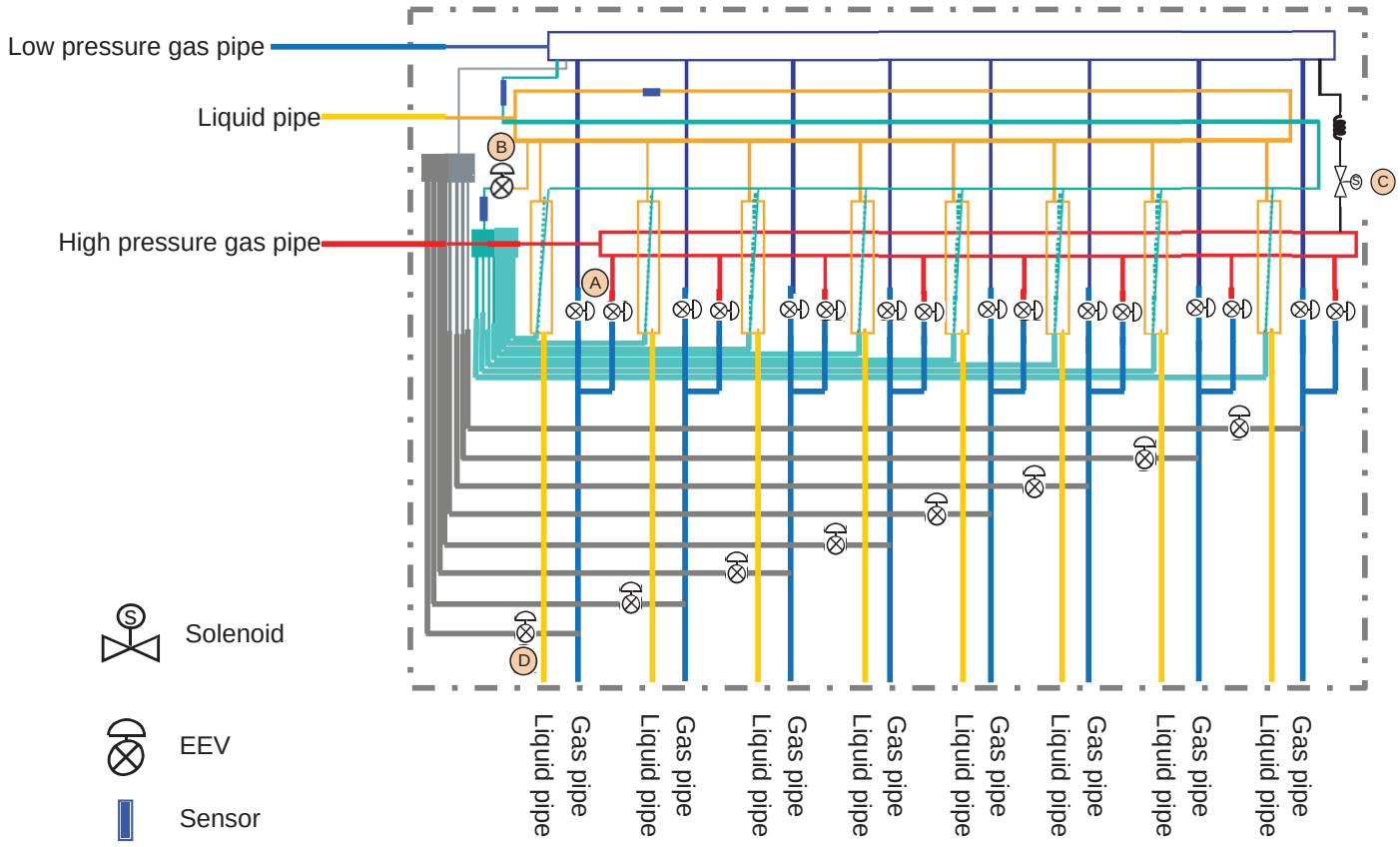
Product Data

REFRIGERANT FLOW DIAGRAMS

Heat Recovery — Oil Return Operation Mode



Remarks					
	Check Valve	EEV	Solenoid Valve	Pressure Sensor	Pressure Switch
	Strainer	Temperature Sensor	SVC Valve		



Ⓐ : Switches operation between cooling and heating by two valves

Ⓑ : Decreases noise according to sub-cooling of inlet and outlet of indoor unit (Simultaneous operation)

Ⓒ : Prevents liquid charging between high pressure gas valve and HR unit in cooling mode

Ⓓ : Controls the pressure between high and low pressure pipe during operation switching

Note:

Refrigerant diagram above represents the PRHR083A model. Appearances may differ depending on model.

CUT SHEETS

Water Source Unit Y-branch Kits for Heat Pump Systems

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

Figure 6: Y-branch Connectors (See Table 14).

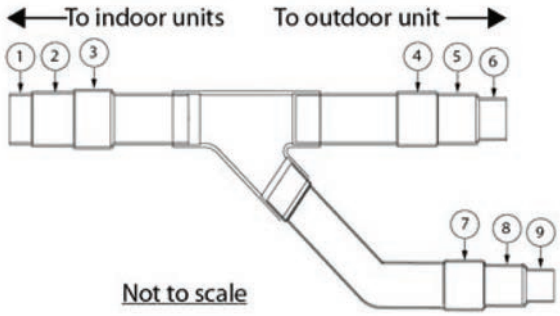


Table 14: Y-branch Connection Diameters (inches, ID).

Y-branch Kit	Y-branch Type	Port Identifier								
		1	2	3	4	5	6	7	8	9
ARCNN21	Liquid AJR67613702	—	3/4	5/8	1/2	5/8	3/8	1/2	5/8	—
	Vapor AJR72963604	1-1/8	1-1/4	1-3/8	7/8	1-1/8	—	1-1/8	—	—
ARCNN31	Liquid AJR67613704	—	7/8	3/4	3/4	—	—	5/8	1/2	—
	Vapor AJR54072908	1-1/2	1-5/8	1-3/8	1-3/8	—	—	1-1/8	—	—

Figure 7: Y-branch dimensions (See Table 15).

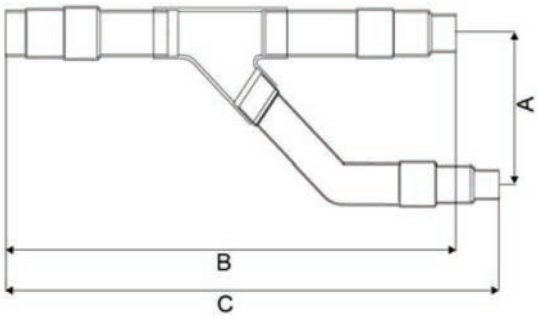


Table 15: Y-branch Dimensions (inches).

Y-branch Kit	Y-branch Type	Dimension		
		A	B	C
ARCNN21	Liquid AJR67613702	3-1/4	12-3/8	13-1/16
	Vapor AJR72963604	4-3/8	16-1/16	16-3/8
ARCNN31	Liquid AJR67613704	3-1/4	11-1/16	13-1/8
	Vapor AJR54072908	4-3/8	13-7/8	16

Figure 8: Reducer Components (See Table 16).

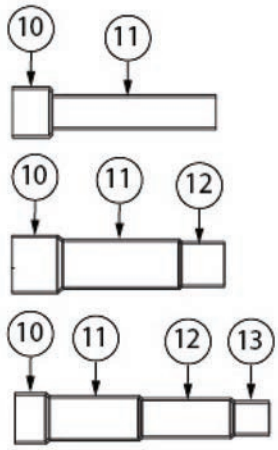


Table 16: Y-branch Reducer Diameters (inches).

Y-branch Kit	Qty/Kit	Reducer Type	Reducer Diameters (in)				
			10	11	12	13	Length
ARCNN21	4	Liquid	7/8 ID	3/8 OD	—	—	2-3/4
			5/8 OD	—	1/2 ID	3/8 ID	4-3/8
		Vapor	1-5/8 ID	1-1/2 ID	—	1-3/8 OD	5-1/8
			1-1/8 OD	—	7/8 ID	3/4 ID	4-3/4
ARCNN31	4	Liquid	3/4 ID	—	5/8 ID	1/2 ID	4-3/8
			1/2 OD	—	3/8 ID	1/4 ID	4-3/8
		Vapor	1-5/8 ID	—	1-3/8 OD	—	4-7/8
			1-1/8 OD	—	7/8 ID	3/4 ID	4-3/4

Table 17: Fitting Properties.

Material	Copper
Design Pressure	550 psig

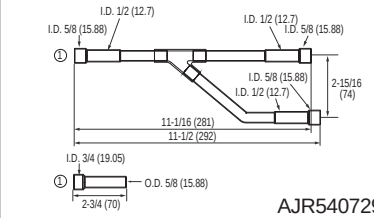
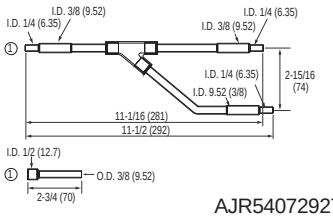
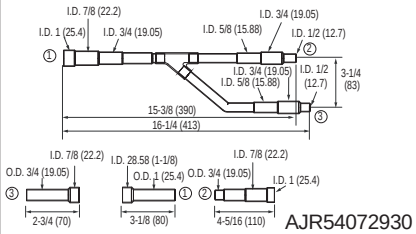
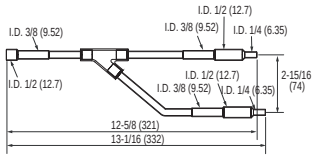
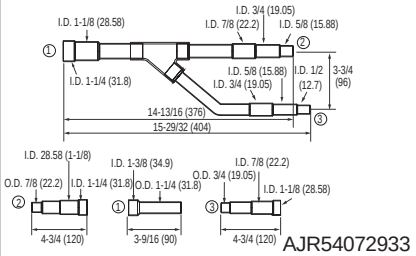
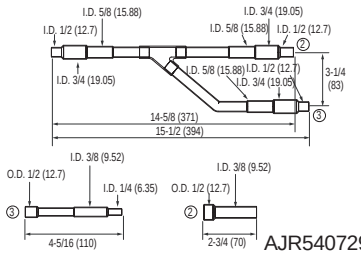
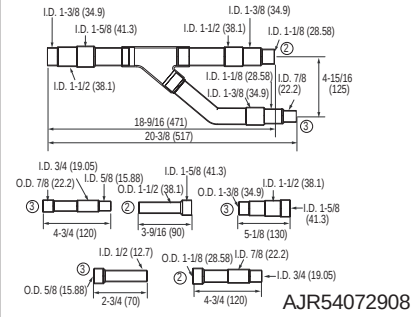
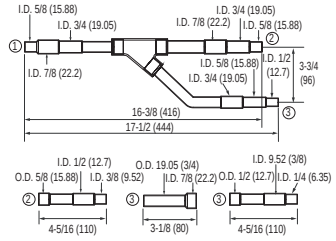
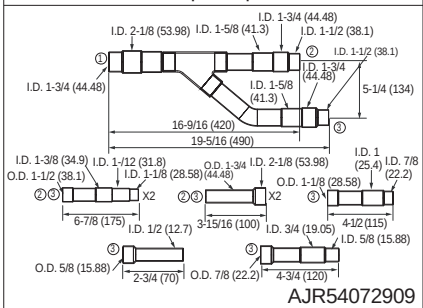
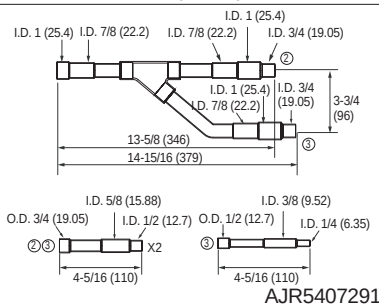
Table 18: Insulation Jacket Properties.

Material	Polyolefin Foam
UL94 Flame Classification	HF-1
Density	1.84 lbs./ft.^{3}
Thermal Conductivity	0.0208 Btu/h/ft. ºF
Thickness	1/2 inch

Indoor Unit Y-Branch Kits

Table 19:Indoor Unit Y-Branch Kit Model Nos.

(Unit: Inch [mm])

Models	Pipe	
	Vapor Pipe	Liquid Pipe
ARBLN01621	 AJR54072929	 AJR54072927
ARBLN03321	 AJR54072930	 AJR54072928
ARBLN07121	 AJR54072933	 AJR54072931
ARBLN14521	 AJR54072908	 AJR54072932
ARBLN23220	 AJR54072909	 AJR54072910

Product Data

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

Figure 9: Y-branch Connectors (See Table 20).

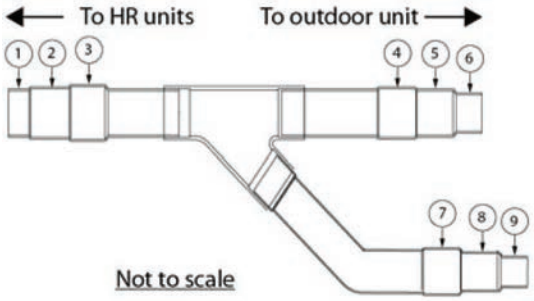


Figure 10: Y-branch Dimensions (See Table 21).

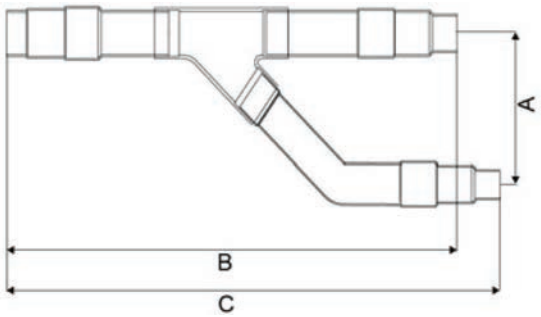


Figure 11: Reducer Components (See Table 22).

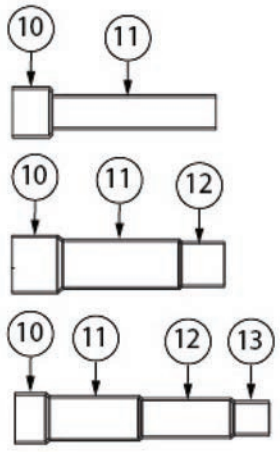


Table 20: Y-branch Connection Diameters (inches, ID)

Y-branch Kit	Y-branch Type	Port Identifier								
		1	2	3	4	5	6	7	8	9
ARCNB21	Liquid AJR67613702	—	3/4	5/8	1/2	5/8	3/8	1/2	5/8	—
	Vapor Line Low AJR67613701	1-1/8	1-1/4	1-3/8	7/8	1-1/8	—	1-1/8	—	—
	Vapor Line High AJR72963604	1-1/8	1-3/8	1-1/4	1-1/8	1-1/4	1	1-1/8	1-1/4	1
ARCNB31	Liquid AJR67613704	—	7/8	3/4	3/4	—	—	5/8	1/2	—
	Vapor Line Low AJR67613703	1-1/2	1-5/8	1-3/8	1-3/8	—	—	1-1/8	—	—
	Vapor Line High AJR72963604	1-3/8	1-1/2	1-5/8	1-1/2	1-3/8	1-1/8	1-3/8	1-1/8	7/8

Table 21: Y-branch Dimensions (inches)

Y-branch Kit	Y-branch Type	A	B	C
ARCNB21	Liquid AJR67613702	3-1/4	12-3/8	13-1/16
	Vapor Line Low AJR67613701	4-3/8	16-1/16	16-3/8
	Vapor Line High AJR72963604	4-3/8	17-7/8	19-5/16
ARCNB31	Liquid AJR67613704	3-1/4	11-1/16	13-1/8
	Vapor Line Low AJR67613703	4-3/8	13-7/8	16
	Vapor Line High AJR72963604	4-15/16	18-9/16	20-3/8

Table 22: Y-branch Reducer Diameters (inches).

Y-branch Kit	Qty/Kit	Reducer Type	Reducer Diameters (inches)				
			10	11	12	13	Length
ARCNB21	7	Liquid	7/8 ID	3/4 OD	—	—	2-3/4
			5/8 OD	—	1/2 ID	3/8 ID	4-3/8
		Vapor Line Low	1-5/8 ID	1-1/2 ID	—	1-3/8 OD	5-1/8
			1-1/8 OD	—	7/8 ID	3/4 ID	4-3/4
		Vapor Line High	1 OD	7/8 ID	—	—	3-1/4
			1 OD	—	7/8 ID	3/4 ID	4-3/4
			3/4 OD	—	5/8 OD	1/2 ID	4-3/8
ARCNB31	6	Liquid	3/4 OD	—	5/8 ID	1/2 ID	4-3/8
			1/2 OD	—	3/8 ID	1/4 ID	4-3/8
		Vapor Line Low	1-5/8 ID	—	1-3/8 OD	—	4-7/8
			1-1/8 OD	—	7/8 ID	3/4 ID	4-3/4
		Vapor Line High	7/8 OD	—	3/4 ID	5/8 ID	4-3/4
			1-1/8 OD	—	7/8 ID	3/4 ID	4-3/4

Table 23: Fitting Properties.

Material	Copper
Design Pressure	550 psig

Table 24: Insulation Jacket Properties.

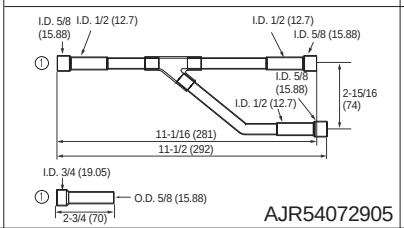
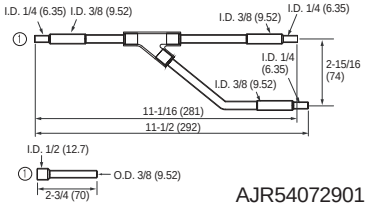
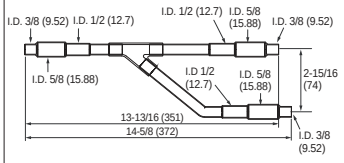
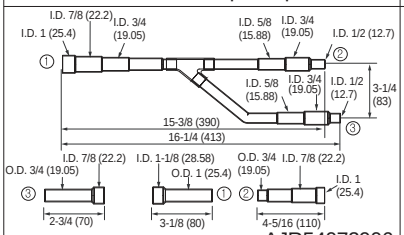
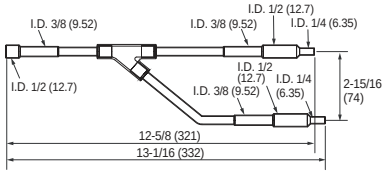
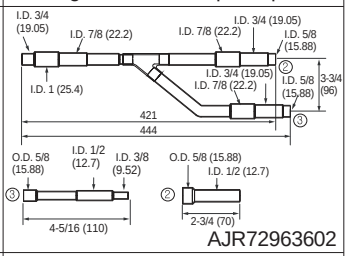
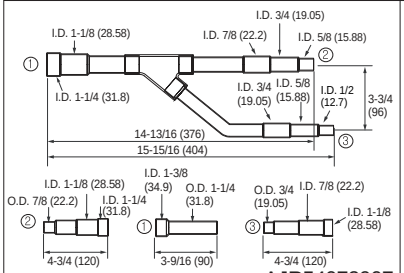
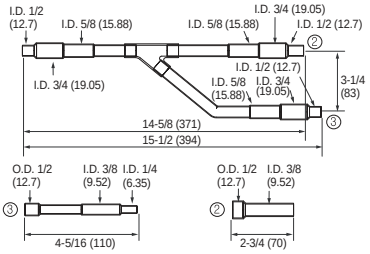
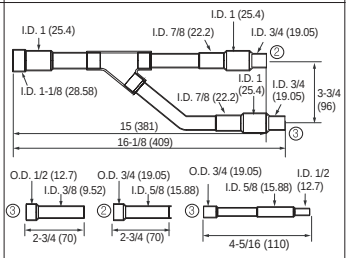
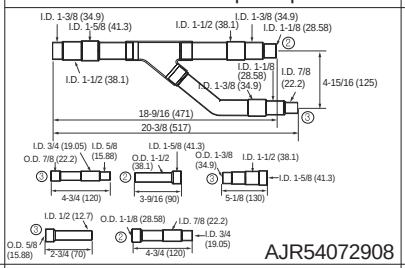
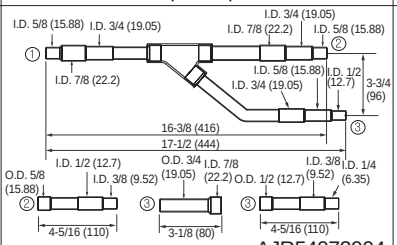
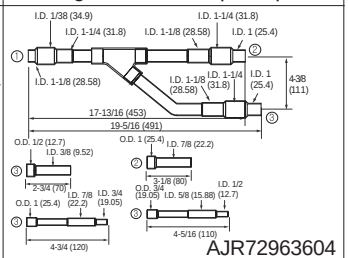
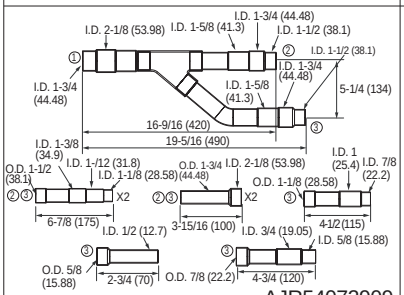
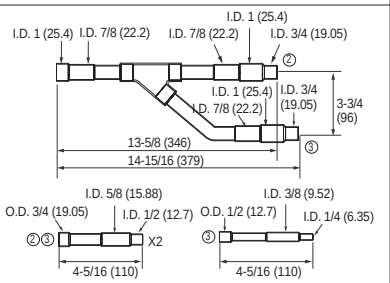
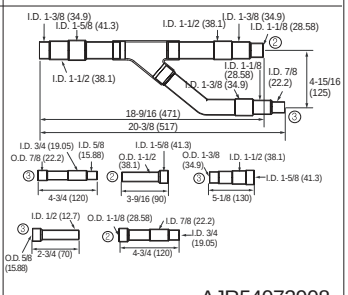
Material	Polyolefin Foam
UL94 Flame Classification	HF-1
Density	1.84 lbs./ft.^{3}
Thermal Conductivity	0.0208 Btu/h/ft. ºF
Thickness	1/2 inch

LG

Indoor Unit Y-Branch Kits

Table 25:Indoor Unit Y-Branch Kit Model Nos.

(Unit: Inch [mm])

Models	Pipe		
	Low-Pressure Vapor Pipe	Liquid Pipe	High-Pressure Vapor Pipe
ARBLB01621	 AJR54072905	 AJR54072901	 AJR72963601
ARBLB03321	 AJR54072906	 AJR54072902	 AJR72963602
ARBLB07121	 AJR54072907	 AJR54072903	 AJR72963603
ARBLB14521	 AJR54072908	 AJR54072904	 AJR72963604
ARBLB23220	 AJR54072909	 AJR54072910	 AJR54072908

Product Data

- LG Headers serve as central connections for multiple runout pipe segments terminating at indoor units.
- Headers must be used with LG systems and be properly installed following the instructions in the applicable LG manual. Field-supplied headers are not permitted.
- Kit components must be kept dry and free of debris before installation.
- All Header Kits include:
  - Insulation jacket (one each for vapor and liquid pipes)
  - Plugging tubes / Insulation for plugging tubes (see Table 27).

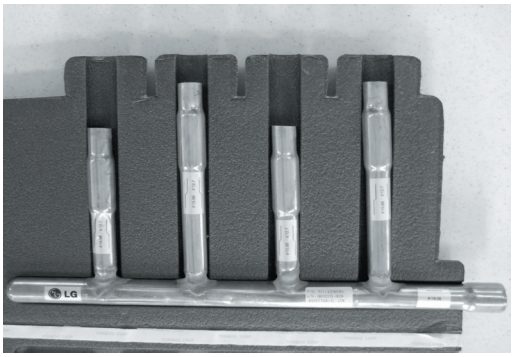


Table 26: Nominal Capacity Range.

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

Table 27: Plugging Tubes and Plugging Tube Insulation Amounts.

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

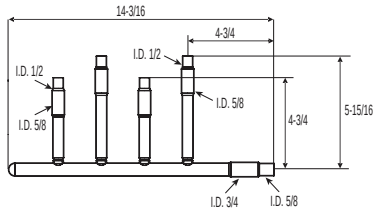
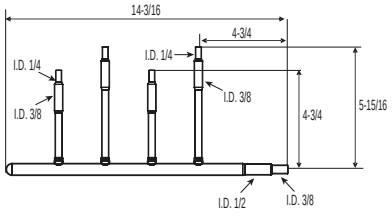
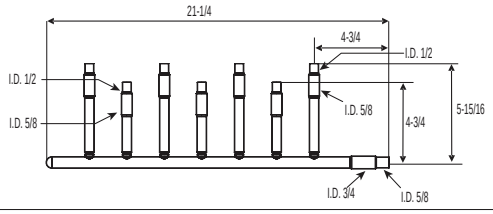
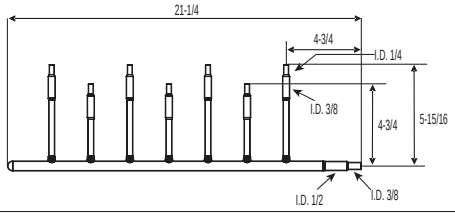
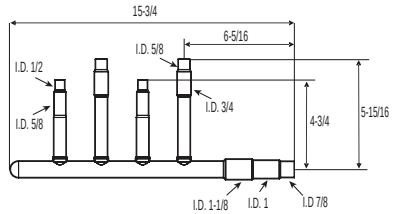
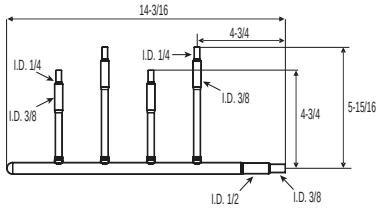
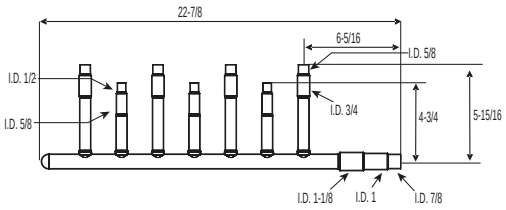
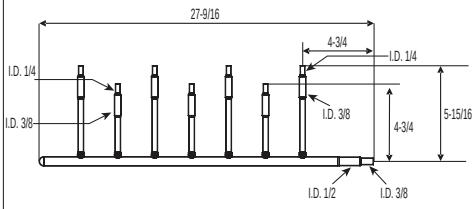
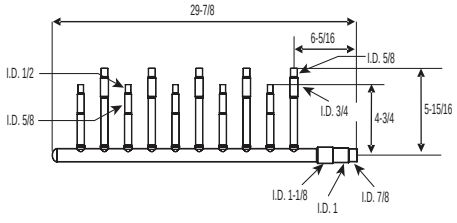
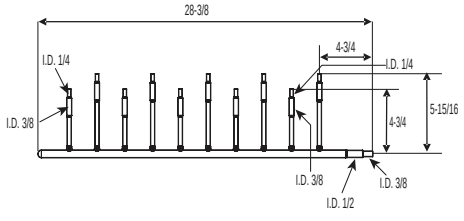
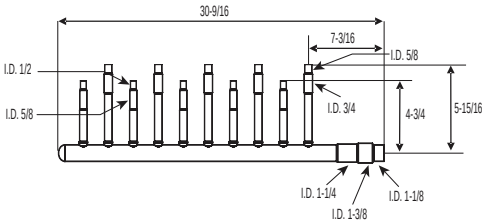
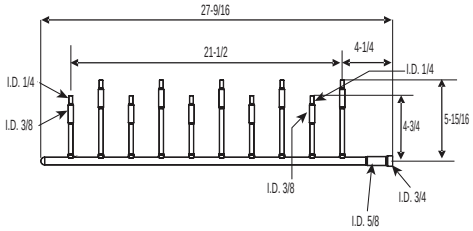
Table 28: Insulation Jacket Properties.

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

Table 29: Fitting Properties.

Material	Copper
Design Pressure	550 psig

Unit: Inch

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

Product Data

Selecting the Best Location

⚠ DANGER

Avoid exposing the water source unit to oil, steam, combustible gases, acidic solutions or sprays, carbon fiber, sulfur, or other corrosive gases. These conditions can cause a fire, resulting in 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.

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. The water source unit will reject heat to the mechanical room.

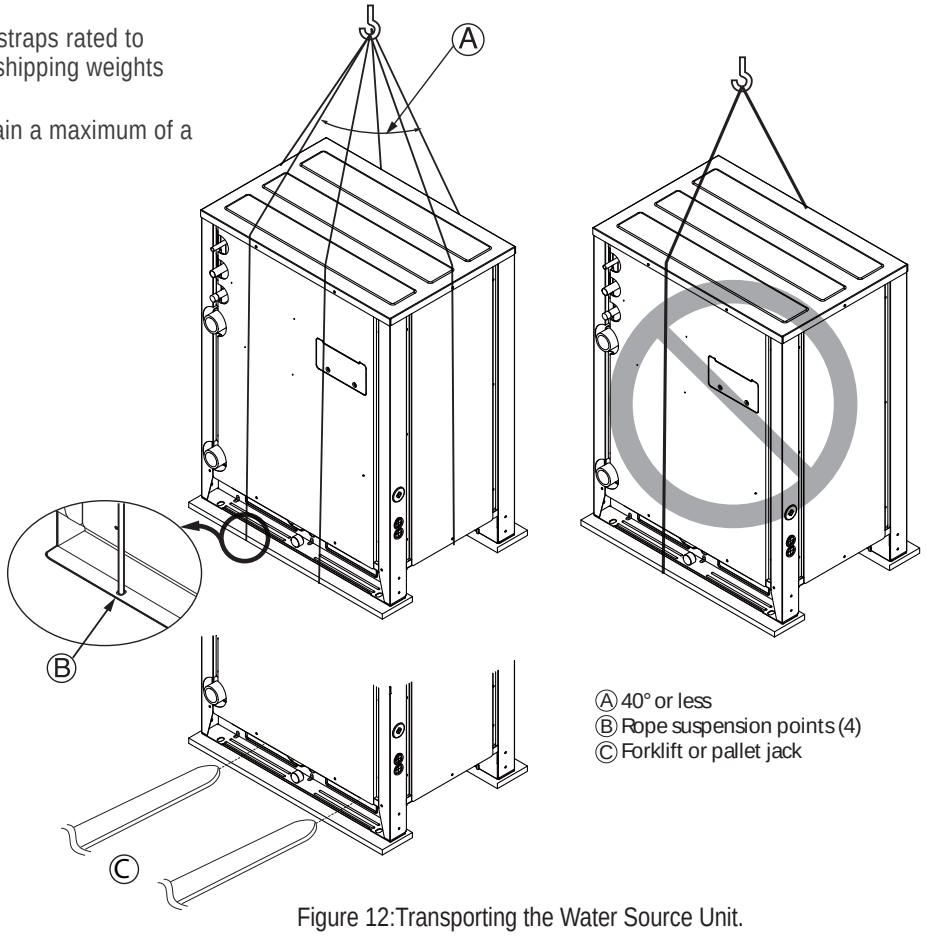
- The water source unit should be strategically located in the building to minimize refrigerant piping materials, labor, and refrigerant. The refrigerant pipe system must be designed within the piping limitations described in the Multi V Water 5 Engineering Manual.
- The underlying structure or foundation 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 Figure 13 through Figure 16 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 should be waterproof. Each water source unit requires a condensate drain to be piped to the nearest floor drain. Periodic flushing of the water heat exchanger is required, and a floor drain installed near the equipment 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 required that an intermediate heat exchanger be installed.
- When piping, towers, or other system components that contain water are exposed to ambient air temperatures below 32°F, an antifreeze solution must be used. Frozen water will damage the plate heat exchanger. A typical antifreeze solution consists of a proper mixture of ethylene glycol, propylene glycol, or methanol mixed with water. The designer should also consider the use of a supplemental boiler/heater to maintain minimum temperatures.

Transporting / Lifting

- When lifting a unit, use lifting straps placed around the unit as shown in Figure 12.
- Always lift a unit using properly sized lifting straps rated to carry the unit weight. Table 30 lists net and shipping weights for each single frame model.
- Ensure the straps are long enough to maintain a maximum of a 40° angle as shown at detail A in Figure 12.

Table 30:Multi V Water 5 Net and Shipping Weights per Frame

Capacity (ton)	Voltage	Net Weight (lbs.)	Shipping Weight (lbs.)
6	208	322	340
8	208	322	340
10	208	322	340
12	208	322	340
6	460	328	346
8	460	328	346
10	460	328	346
12	460	328	346
14	460	348	366
16	460	348	366



Ⓐ 40° or less
Ⓑ Rope suspension points (4)
Ⓒ Forklift or pallet jack

Figure 12:Transporting the Water Source Unit.

⚠WARNING

- *Use caution when using forklift to transport an unpackaged unit. Consider the unit's center of gravity when lifting. There is risk of the unit falling and causing physical injury or death.*
- *Use appropriate moving equipment to safely transport each frame. Ensure moving equipment is capable of supporting the weight of the water source unit frame. Wear protective gloves when handing the moving equipment and frame. There is risk of physical injury or death.*
- *Some products include polypropylene bands around the unit for packaging. Do not use polypropylene bands to lift the unit. There is risk of the unit falling and causing physical injury or death.*
- *Tear apart and throw away plastic packaging bags so that children can not play with them and risk suffocation and death.*
- *Lift the water source unit from the base at specified locations. Support the water source unit at a minimum of six (6) points to avoid slippage from the rigging apparatus. There is risk of the unit falling and causing physical injury or death.*
- ⃠ *Do not drop the unit when carrying it with a forklift. There is risk of physical injury or death.*
- *Use a minimum of three (3) lifting straps. there is risk of the unit falling and causing physical injury or death.*
- *Always know where the center of gravity of the water source unit is before lifting. Hoist the unit with the center of gravity centered among the lifting straps. There is risk of the unit falling and causing physical injury or death.*

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.*

Service Area Requirements

Single Frame Installation

Install a single frame system with the service area requirements shown in Figure 13. If local codes require additional clearance area, comply with local codes.

Note:

- *Job site conditions may require routing refrigerant piping, condensate pipe, and/ or electrical wiring under the unit base. If conditions warrant, consider adding mounting rails under the unit. The unit may need to be elevated above the floor to provide the necessary slope for proper condensate draining on long pipe installations.*
- *Consult with LG Electronics, U.S.A., Inc. if the available space is less than shown.*
- *If water piping passes along the side of a frame, ensure the indicated space is available after considering the space taken by the piping.*

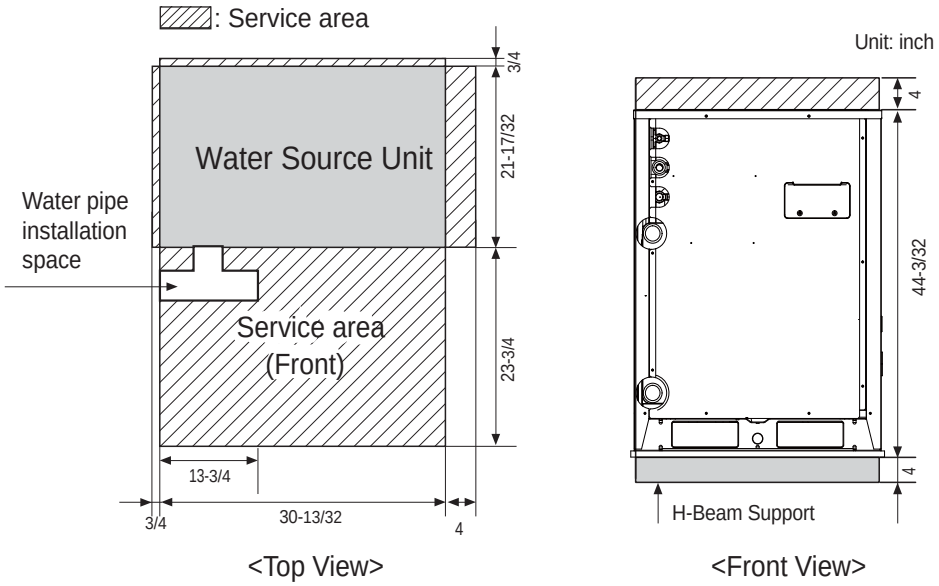


Figure 13: Single Frame Installation.

Dual Frame Installation

Install a single frame system with the service area requirements shown in Figure 14. If local codes require additional clearance area, comply with local codes.

Note:

- *Job site conditions may require routing refrigerant piping, condensate pipe, and/or electrical wiring under the unit base. If conditions warrant, consider adding mounting rails under the units. The units may need to be elevated above the floor to provide the necessary slope for proper condensate draining on long pipe installations.*
- *Consult with LG Electronics, U.S.A., Inc. if the available space is less than shown.*
- *If water piping passes along the side of a frame, ensure the indicated space is available after considering the space taken by the piping.*

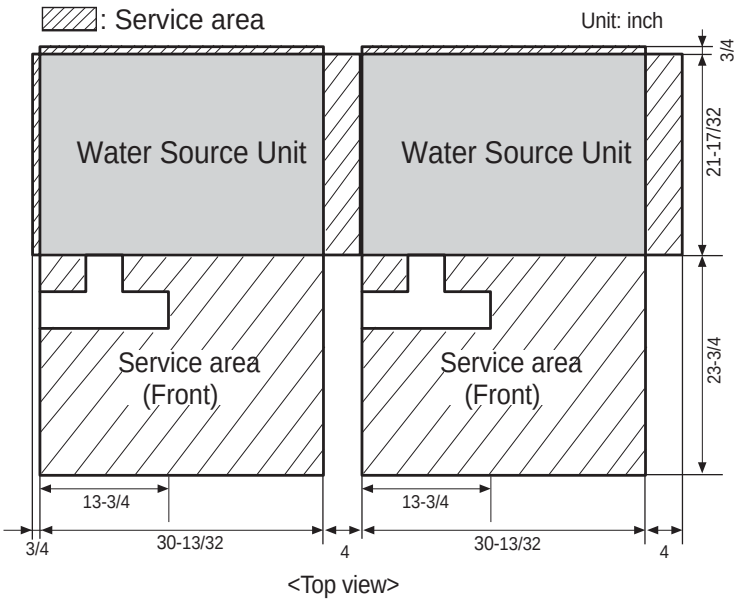


Figure 14: Dual Frame Installation.

Triple Frame Installation

Install a single frame system with the service area requirements shown in Figure 15. If local codes require additional clearance area, comply with local codes.

Note:

- *Job site conditions may require routing refrigerant piping, condensate pipe, and/or electrical wiring under the unit base. If conditions warrant, consider adding mounting rails under the units. The units may need to be elevated above the floor to provide the necessary slope for proper condensate draining on long pipe installations.*
- *Consult with LG Electronics, U.S.A., Inc. if the available space is less than shown.*
- *If water piping passes along the side of a frame, ensure the indicated space is available after considering the space taken by the piping.*

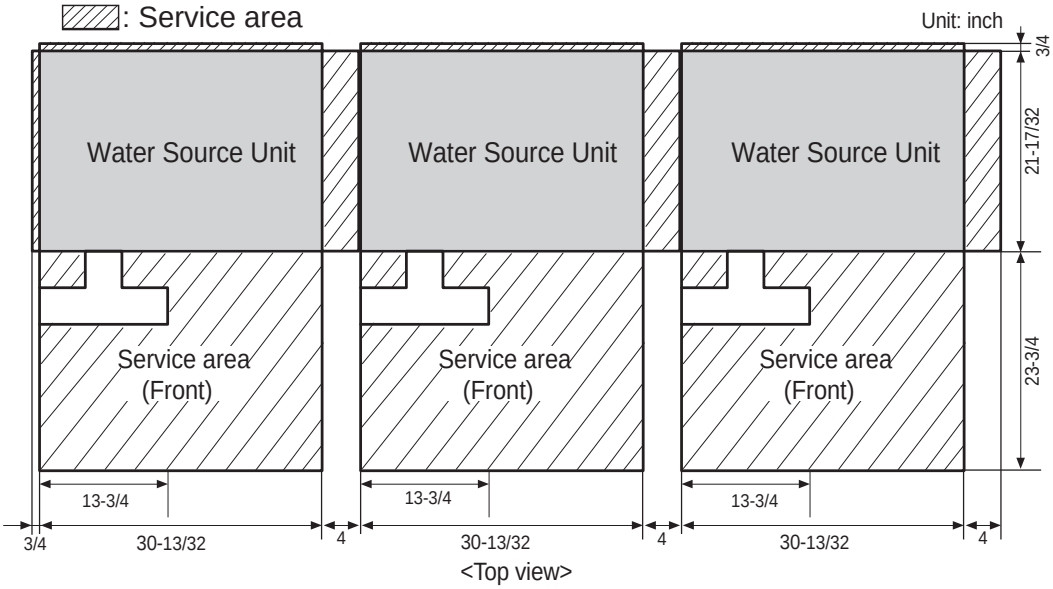


Figure 15: Triple Frame Installation.

Stacked Frame Installation

Install a single frame system only with the service area requirements shown in Figure 16. If local codes require additional clearance area, comply with local codes.

Note:

- *Dual frame systems cannot be stacked.*
- *Job site conditions may require routing refrigerant piping, condensate pipe, and/or electrical wiring under the unit base. If conditions warrant, consider adding mounting rails under the units. The units may need to be elevated above the floor to provide the necessary slope for proper condensate draining on long pipe installations.*
- *Consult with LG Electronics, U.S.A., Inc. if the available space is less than shown.*
- *If water piping passes along the side of a frame, ensure the indicated space is available after considering the space taken by the piping.*

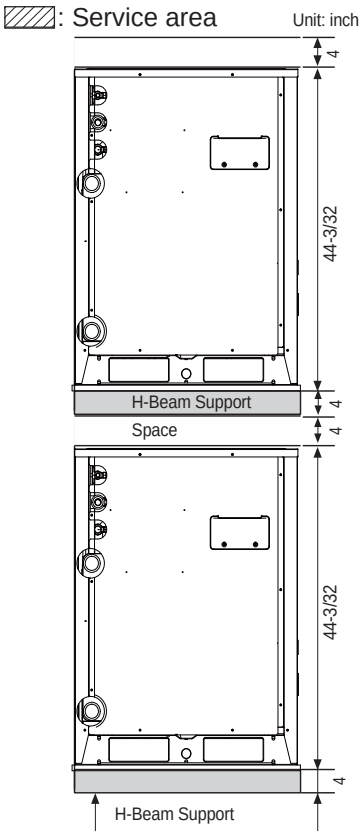


Figure 16: Stacked Frame Installation.

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 the dimensional drawings for single, dual, and triple frame systems on page 24, page 25, and page 26, 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, enough space for pipes and wiring, and sufficient slope for proper drainage between the units, the condensate drain connection, and the floor drain.*
- *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

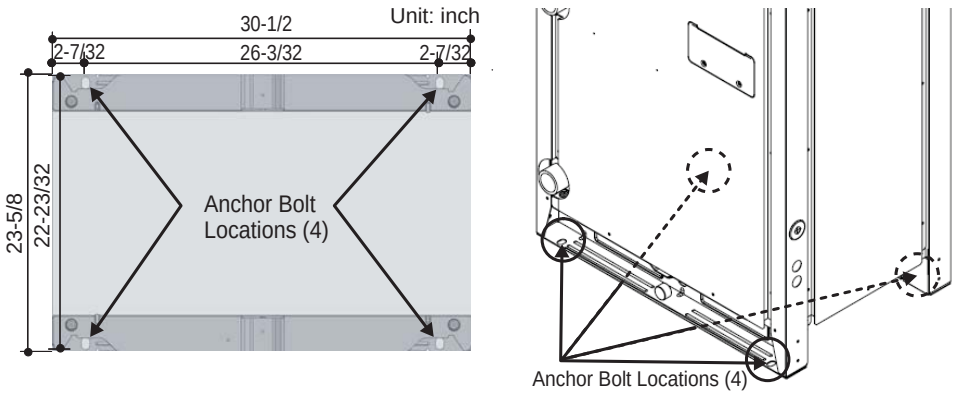


Figure 17: Anchor Bolt Locations.

- Securely fasten all four (4) corners to the supporting base.
- 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.

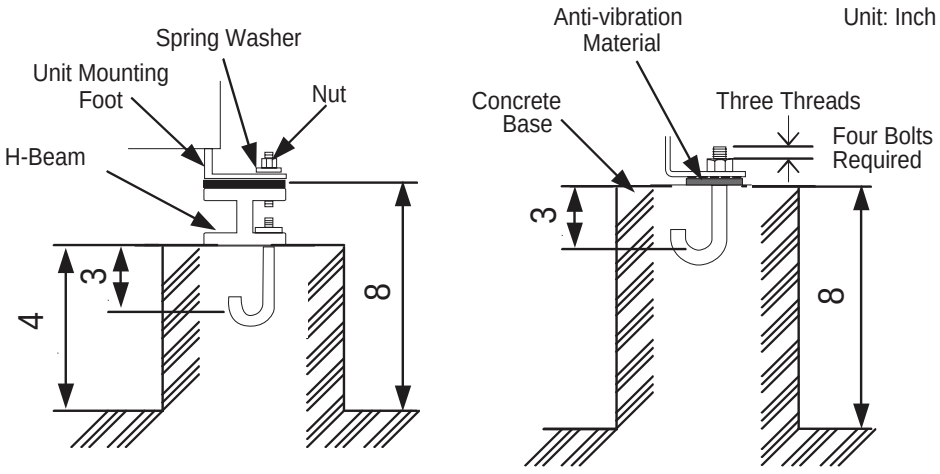


Figure 18: Close up of Anchor Bolts.

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

Figure 19:Corner weights.

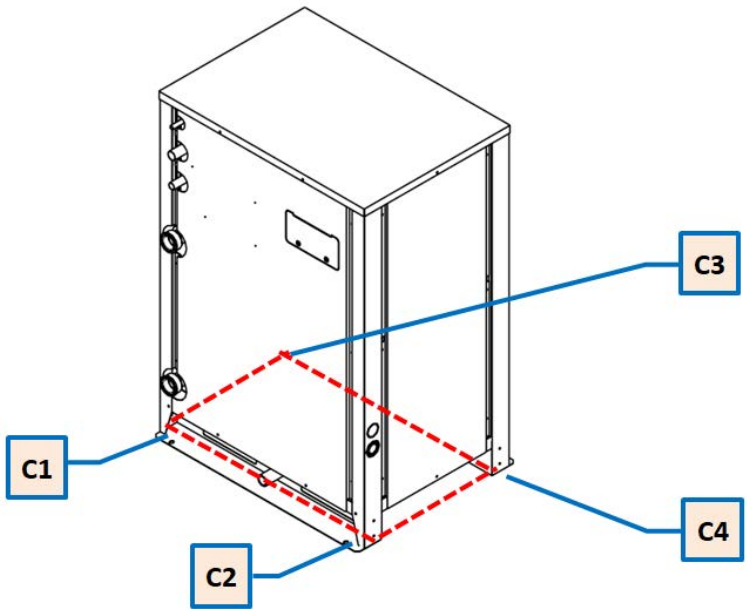


Table 31: Corner Weights.

WSU Model	Frame (Main)	Net Weight (lbs.)	Corner Weight (lbs.)				Frame (B)	Net Weight (lbs.)	Corner Weight (lbs.)				Frame (C)	Net Weight (lbs.)	Corner Weight (lbs.)			
			C1	C2	C3	C4			C1	C2	C3	C4			C1	C2	C3	C4
ARWM072*AS5	ARWM072*AS5	322	121	55	106	40												
ARWM096*AS5	ARWM096*AS5	322	121	55	106	40												
ARWM121*AS5	ARWM121*AS5	322	121	55	106	40												
ARWM144*AS5	ARWM144*AS5	322	121	55	106	40												
ARWM168DAS5	ARWM168DAS5	348	131	60	114	43												
ARWM192DAS5	ARWM192DAS5	348	131	60	114	43												
ARWM191DAS5	ARWM096DAS5	322	121	55	106	40	ARWM096DAS5	322	121	55	106	40						
ARWM192BAS5	ARWM96BAS5	322	121	55	106	40	ARWM96BAS5	322	121	55	106	40						
ARWM168BAS5	ARWM096*AS5	322	121	55	106	40	ARWM072*AS5	322	121	55	106	40						
ARWM216*AS5	ARWM121*AS5	322	121	55	106	40	ARWM096*AS5	322	121	55	106	40						
ARWM240*AS5	ARWM121*AS5	322	121	55	106	40	ARWM121*AS5	322	121	55	106	40						
ARUM264*AS5	ARWM144*AS5	322	121	55	106	40	ARWM121*AS5	322	121	55	106	40						
ARWM288*AS5	ARWM144*AS5	322	121	55	106	40	ARWM144*AS5	322	121	55	106	40						
ARWM360DAS5	ARWM192DAS5	348	131	60	114	43	ARWM168DAS5	348	131	60	114	43						
ARWM360BAS5	ARWM121BAS5	322	121	55	106	40	ARWM121BAS5	322	121	55	106	40	ARWM121BAS5	322	121	55	106	40
ARWM432*AS5	ARWM144*AS5	322	121	55	106	40	ARWM144*AS5	322	121	55	106	40	ARWM144*AS5	322	121	55	106	40
ARWM504DAS5	ARWM192DAS5	348	131	60	114	43	ARWM168DAS5	348	131	60	114	43	ARWM144DAS5	322	121	55	106	40
ARWM576DAS5	ARWM192DAS5	348	131	60	114	43	ARWM192DAS5	348	131	60	114	43	ARWM192DAS5	348	131	60	114	43

Note:

Heat recovery units are used with ARWM-series heat recovery systems only.

Select a heat recovery unit installation space that meets the following conditions:

- Install the heat recovery unit indoors in a level and upright position.
- Ensure there is enough space in the installation area for service access.
- Refrigerant pipes must not exceed lengths specified by LG Electronics, U.S.A., Inc.
- ⃠ Do not install the heat recovery unit in a location where it would be subjected to strong radiated heat from any heat source.
- Avoid an installation environment where oil splattering, vapor spray, or high-frequency electric noise could occur.
- Install the heat recovery unit in a location where any sound it may generate will not disturb occupants in the surrounding rooms.
- Install the refrigerant piping and electrical wiring system in an easily accessible location.
- Condensate drain piping is not required.

Figure 20: 2, 3, and 4 Port Heat Recovery Unit Minimum Service Clearances.

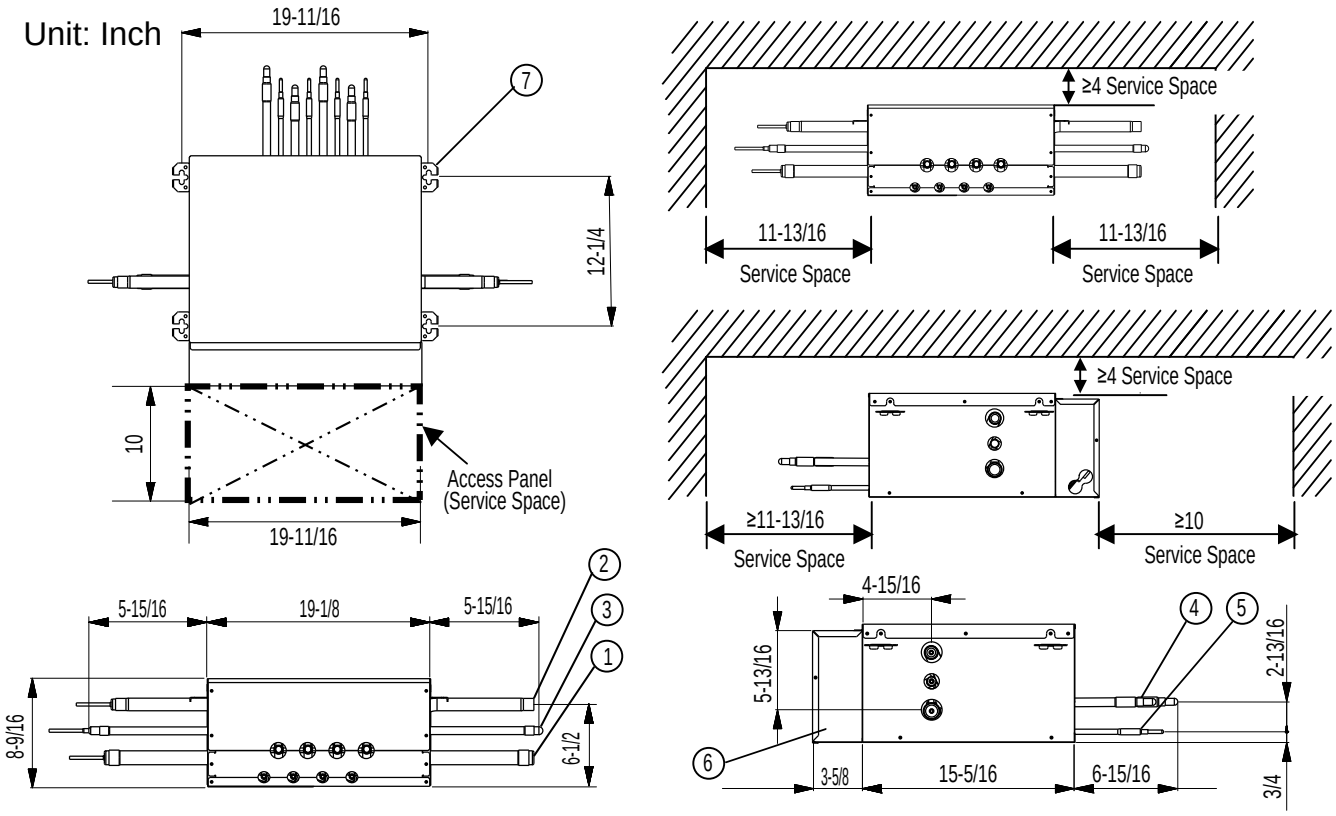
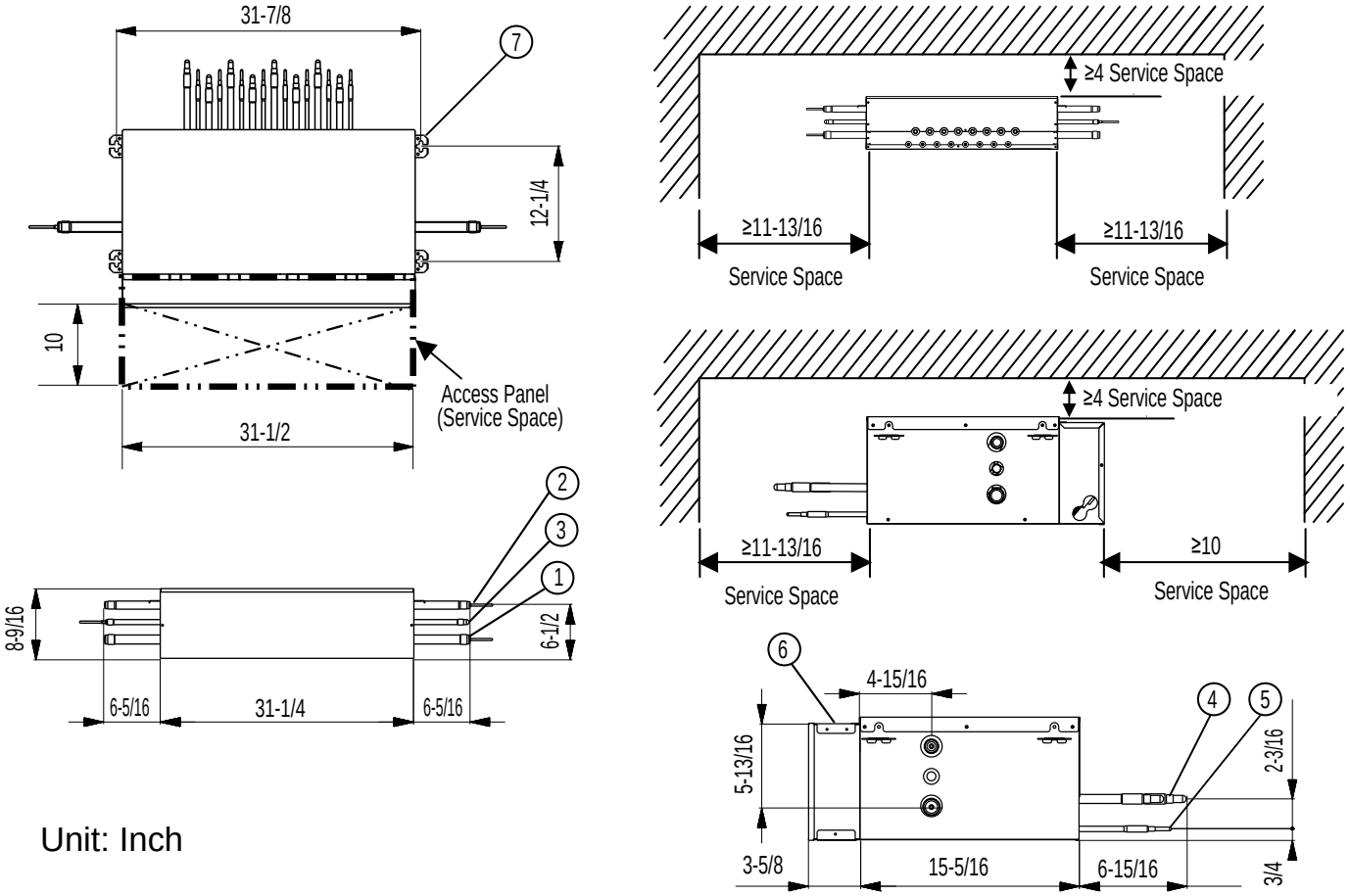


Table 32: 2, 3, and 4 Port Heat Recovery Unit Components.

No.	Component Name	Connection Size (in.) / Type		
		PRHR023A	PRHR033A	PRHR043A
1	Low Pressure Vapor Pipe Connection Port	7/8 Braze	1-1/8 Braze	1-1/8 Braze
2	High Pressure Vapor Pipe Connection Port	3/4 Braze	7/8 Braze	7/8 Braze
3	Liquid Pipe Connection Port	3/8 Braze	1/2 Braze	5/8 Braze
4	Indoor Unit Vapor Pipe Connection Port	5/8 Braze	5/8 Braze	5/8 Braze
5	Indoor Unit Liquid Pipe Connection Port	3/8 Braze	3/8 Braze	3/8 Braze
6	Control Box	–	–	–
7	Metal Hanger Bracket (Field-Supplied Suspension Bolt)	5/16 or 7/16	5/16 or 7/16	5/16 or 7/16

Figure 21: 6 and 8 Port Heat Recovery Unit Minimum Service Clearances.



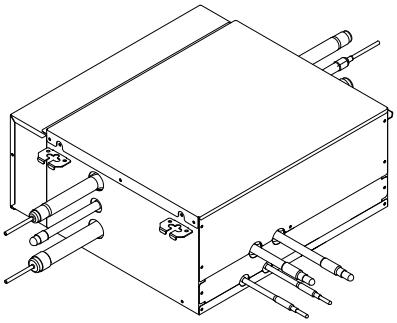
Unit: Inch

Table 33: 6 and 8 Port Heat Recovery Unit Components.

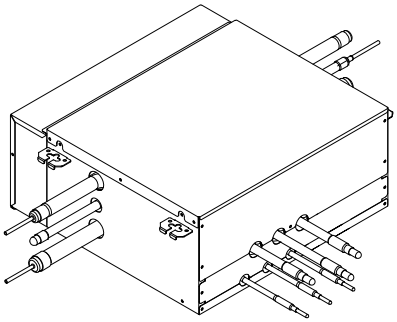
No.	Component Name	Connection Size (in.) / Type	
		PRHR063A	PRHR083A
1	Low Pressure Vapor Pipe Connection Port	1-1/8 Braze	1-1/8 Braze
2	High Pressure Vapor Pipe Connection Port	7/8 Braze	7/8 Braze
3	Liquid Pipe Connection Port	5/8 Braze	5/8 Braze
4	Indoor Unit Vapor Pipe Connection Port	5/8 Braze	5/8 Braze
5	Indoor Unit Liquid Pipe Connection Port	3/8 Braze	3/8 Braze
6	Control Box	–	–
7	Metal Hanger Bracket (Field-Supplied Suspension Bolt)	5/16 or 7/16	5/16 or 7/16

Start IDU connections with port 1 and do not skip ports. The 3A heat recovery units are numbered from right to left (No. 1 port on right side). The maximum capacity of each HRU port is 60 kBtu/h. If an indoor unit exceeds this capacity, two adjacent HRU ports must be connected together with a Y-branch (ARBLB03321) to provide the required capacity.

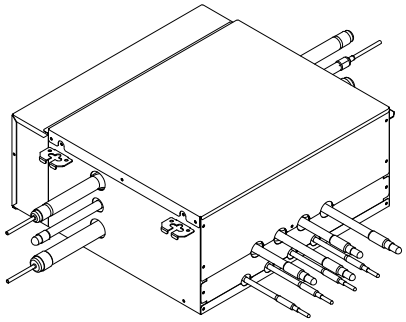
Figure 22: Heat Recovery Unit Models.



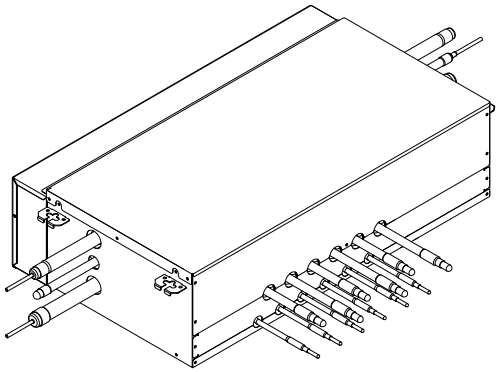
PRHR023A
Two Ports



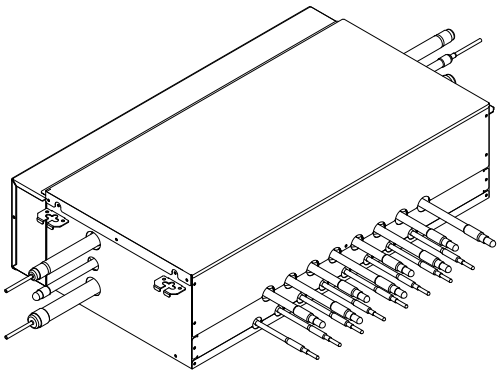
PRHR033A
Three Ports



PRHR043A
Four Ports



PRHR063A
Six Ports



PRHR083A
Eight Ports

1. Each heat recovery unit has a capacity up to 230,000 Btu/h.
2. Heat recovery units connected in series have a total capacity up to 230,000 Btu/h per series string. Series string is defined as heat recovery units piped in series.
3. Elevation difference between heat recovery units connected in series is permitted, but must not exceed 16 feet.
4. Each port on the heat recovery unit has a capacity up to 60,000 Btu/h.
5. Each port can be connected to a maximum of eight (8) indoor units. When multiple indoor units are connected to one port, all indoor units on that port must operate in the same mode (cooling or heating).
6. If an indoor unit larger than 60,000 Btu/h is to be used, two (2) ports must be twinned using a reverse Y-branch.
7. Connect largest indoor unit to the first port(s) of the heat recovery unit. Start indoor unit connections from the first port and do not skip ports. The 3A heat recovery units are numbered from right to left (No. 1 port on right side).
8. Elevation difference between the heat recovery unit and the indoor unit(s) must not exceed 49 feet.
9. All IDUs should start from the first port.
10. Do not skip ports.
11. 6 and 8 ton IDUs should be connected to ports 1 and 2.
12. You can not twin ports 4 and 5.
13. For HRUs in series, 6 and 8 ton IDUs should be connected to the first HRU in series. Additional 6 and 8 ton units can then be connected to other HRUs in series.

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.

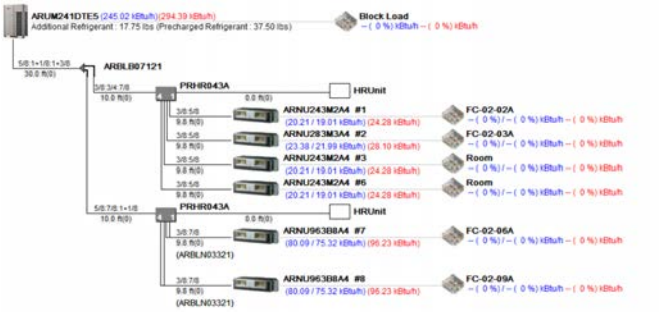
Formats

LATS is available to LG customers in two user interfaces: LATS HVAC and LATS REVIT. Both 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.*

Figure 23:LATS Example.



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.

***Revit® is a registered mark of Autodesk, Inc.*

Features

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

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

The program can also:

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

REFRIGERANT PIPING INSTALLATION

LG Air Conditioner Technical Solution (LATS) Software

LATS Generates a Complete Project Report

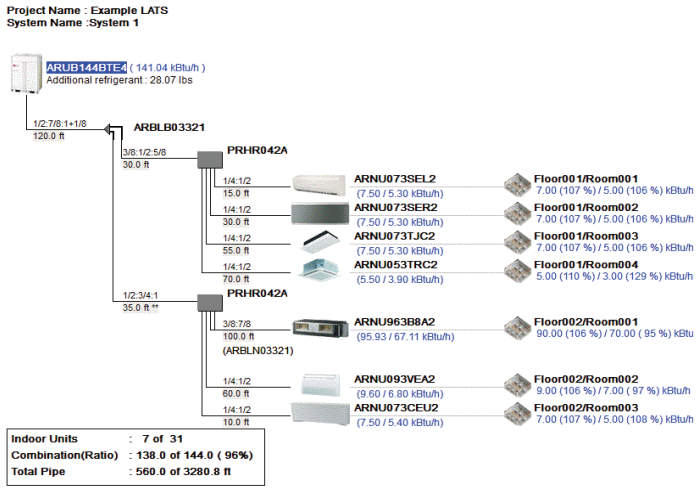
LATS software also generates a report containing project design parameters, cooling and heating design data, system component performance, and capacity data. The report includes system combination ratio and refrigerant charge calculations; and provides detailed bill of material, including outdoor units,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

Proper Design to Install Procedure

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

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

Figure 24:Example of a LATS Tree Diagram.



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 startup 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 startup 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, resizing, 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 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 startup.

Device Connection Limitations

The minimum number of connected and operating indoor units in a Multi V Water Source system is one, taking into consideration the minimum combination ratio. The maximum number of indoor units in a system varies according to model:

Heat Pump / Heat Recovery Models	Nominal Cooling (Btu/h)	Indoor Units		
		Max. Qty.	Sum of Indoor Unit Nominal Cooling Capacities (Btu/h)	
			Min. Capacity (Btu/h) (50%)[1]	Max. Capacity (Btu/h) (130%)[2]
ARWM072BAS5 / ARWM072DAS5	72,000 / 72,000	13/13	36,000 / 36,000	93,600 / 93,600
ARWM096BAS5 / ARWM096DAS5	96,000 / 96,000	16/16	48,000 / 48,000	124,800 / 124,800
ARWM121BAS5 / ARWM121DAS5	119,700 / 119,700	20/20	60,000 / 60,000	156,000 / 156,000
ARWM144BAS5 / ARWM144DAS5	144,000 / 144,000	23/23	72,000 / 72,000	187,200 / 187,200
ARWM168BAS5 / ARWM168DAS5	168,000 / 168,000	29/29	84,000 / 84,000	218,400 / 218,400
ARWM191DAS5	192,000	32	96,000	249,600
ARWM192BAS5 / ARWM192DAS5	192,000 / 192,000	32/32	96,000 / 96,000	249,600 / 249,600
ARWM216BAS5 / ARWM216DAS5	216,000 / 216,000	35/35	108,000 / 108,000	280,800 / 280,000
ARWM240BAS5 / ARWM240DAS5	239,400 / 239,400	39/39	120,000 / 120,000	312,000 / 312,000
ARWM264BAS5 / ARWM264DAS5	264,000/ 264,000	42/42	132,000 / 132,000	343,200 / 343,200
ARWM288BAS5 / ARWM288DAS5	287,700 / 287,700	45/45	144,000 / 144,000	374,400 / 374,400
ARWM360BAS5 / ARWM360DAS5	360,000 / 360,000	58/58	180,000 / 180,000	468,000 / 468,000
ARWM432BAS5 / ARWM432DAS5	430,500 / 430,500	64/64	216,000 / 216,000	561,600 / 561,600
ARWM504DAS5	504,000	64	252,000	655,200
ARWM576DAS5	571,200	64	288,000	748,800

[1] 50% = Minimum Combination Ratio.
[2] 130% = Maximum Combination Ratio.

REFRIGERANT PIPING INSTALLATION

One of the most critical elements of a Multi V Water Source Unit system is the refrigerant piping. Table 34 lists refrigerant pipe length limits that must be followed in system design and installation:

Table 34: Multi V Water Source Unit Liquid Refrigerant Pipe Design Limitations.

Pipe Length (ELF = Equivalent Length of pipe in Feet)	Longest total equivalent piping length	1640 feet
	Longest distance from water source unit to indoor unit	656 feet (Actual); 738 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; (295 ft conditional applications)
Elevation (All Elevation Limitations are Measured in Actual Feet)	Water-source unit above or below indoor unit	≤ 164 feet
	Between any two indoor units (ARWM Series only)	≤ 131 feet
	Between indoor units connected to a heat recovery unit (ARWM Series only)	≤ 49 feet
	Between heat recovery units (ARWM Series only)	≤ 98 feet
	Between indoor units connected to same or series-connected heat recovery units (ARWM Series only)	≤ 49 feet
	Between two indoor units connected to separate Y-branch connected heat recovery units (ARWM Series only)	≤ 131 feet

Table 35: Equivalent Piping Length in Feet for Typical Refrigeration Elbows, Y-Branches, Headers, and Heat Recovery Units.

Component	Elbow 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													
Heat Recovery Unit (ft) (ARWM Series only)	8.2													

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

WSU Capacity Correction Factors

Note:

The LATS software program calculates these correction factors. Use this procedure only when performing manual calculations.

The nominal heating and/or cooling capacities of WSU(s) can be reduced by the design of the refrigerant piping system. Parameters that can reduce nominal capacity are the following:

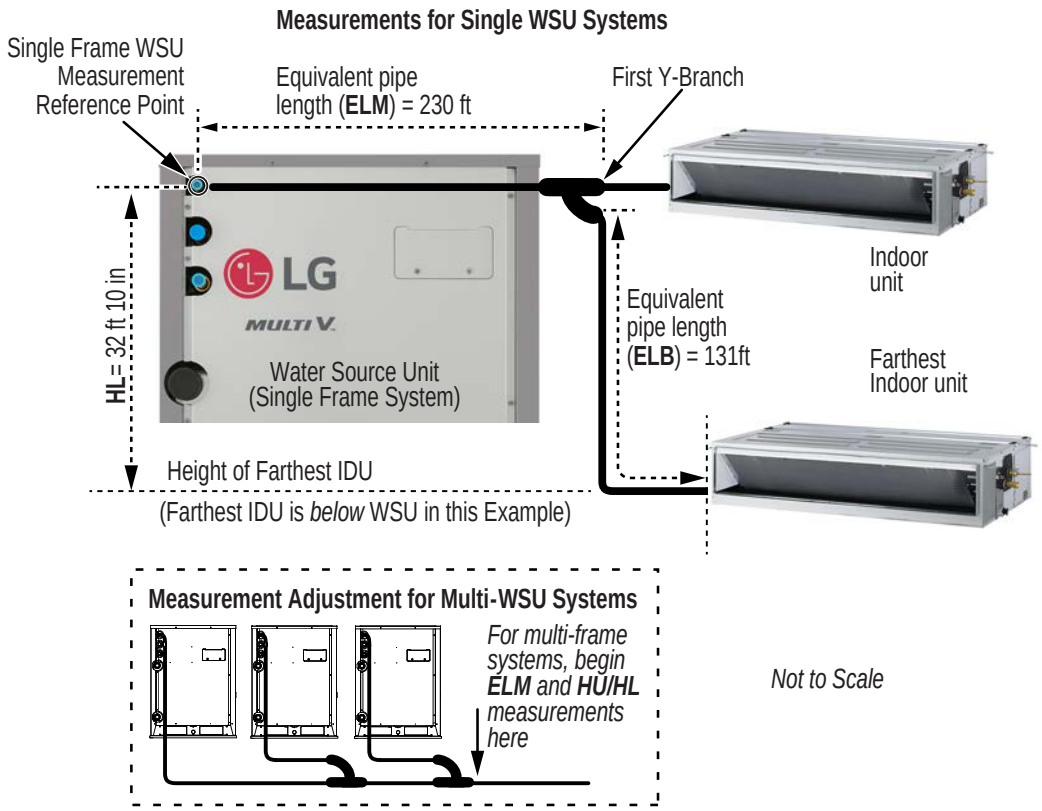
- Length of the liquid refrigerant pipe run to the farthest IDU (vapor pipes do not affect this calculation)
- Number and type of components in this liquid pipe run (elbows, Y-branches, etc.)
- Distance above or below the WSU(s) of the farthest IDU

To determine WSU capacity in your system design, multiply the WSU cooling and heating nominal capacities by the correction factors calculated in this procedure. The correction factor could be 1.0, resulting in no capacity loss, or could be less than 1.0, resulting in a certain amount of capacity loss. If the cooling or heating correction factor causes reduced capacity, the system designer must determine if the reduced capacity is acceptable or if redesign is required.

Two parameters determine WSU cooling and heating correction factors:

1. Height in feet above (HU) or below (HL) the WSU of the IDU farthest away from the WSU. Follow the procedure in the “HU/HL Measurement” on page 59 to find this parameter.
2. Total equivalent length (TEL) in feet of the liquid refrigerant pipe between the WSU and the IDU farthest away from the WSU. Equivalent length considers the effect of pressure drop due to components such as elbows and Y-branches. Equivalent feet will be a larger number than the measured physical distance in feet. Follow the procedure in the "Liquid Pipe Total Equivalent Length Calculation" section to find this parameter.
3. After determining the HU/HL and TEL parameters, follow the procedure in the "WSU Cooling/ Heating Capacity Correction Factor Calculation" section to determine if the proposed refrigerant pipe design and WSU/ IDU locations will reduce WSU capacity.

Figure 25: Equivalent Pipe Length Measurements Example.



HU/HL Measurement

Follow this procedure to determine the value of HU (farthest IDU above WSU) or HL (farthest IDU below WSU). Refer to the figure above .

1. Based on your system's refrigerant pipe design, determine which IDU is the farthest from the WSU.
2. Determine the vertical distance in feet between the WSU and the farthest IDU. For a single WSU system, measure from the WSU liquid pipe connection. For a dual or triple WSU system, measure from the end of the last multi-frame connector. At the IDU end, measure to the IDU's liquid pipe connection.
3. Record the vertical distance measurement in feet, and note if the IDU is above the WSU (HU) or below the WSU (HL).
4. Proceed to the total equivalent pipe length calculation.

Liquid Pipe Total Equivalent Length Calculation

A Multi V system may have many liquid refrigerant pipe runs, each composed of multiple segments, elbows, and other components, but the single pipe run that determines TEL is the run from the WSU(s) through the first Y-branch, to the farthest IDU. The TEL of this pipe run is its physical length plus an amount of "length" added to represent the effect of pressure drop due to elbows, Y-branches, headers, and other pipe system components.

Use this formula to calculate TEL:

TEL = (ELM x CF) + ELB, where:

TEL = total equivalent length of the liquid refrigerant pipe
ELM = equivalent length of the liquid refrigerant pipe to end of first Y-branch
CF = pipe length correction factor
ELB = equivalent length of the liquid refrigerant pipe from end of first Y-branch to farthest IDU

The ELM and ELB parameters will vary according to the system design. CF is a constant and is listed in the table on the next page**.** Determine ELM and ELB and then use the TEL formula to calculate total equivalent length.

Follow these steps to calculate ELM. Refer to the “Equivalent Pipe Length Measurements Example” Figure 25.

1. Determine the beginning measurement reference point at the WSU end of the liquid refrigerant pipe.
   - For a single WSU system, begin the measurement at the WSU's liquid refrigerant pipe connection (smallest diameter pipe, closest to top of unit).
   - For a dual or triple WSU system, begin the measurement at the end of the last multi-frame connector.
2. Locate the first Y-branch in the liquid pipe.
3. Measure the length in feet of this liquid pipe run. Measure along the length of the pipe, following any changes in direction. Record this value.
4. Count the number of elbow connectors in the pipe measured in step 3. Determine the outside diameter (OD) of the elbow connectors. All elbows in this segment should have the same OD.
5. Refer to the table below and find the equivalent length for this size of elbow connector. Multiply the number of elbows by the equivalent length in feet. Record this value.
6. Add the physical measurement found in step 3, the elbow connector value found in step 5, and 1.6 ft. for the first Y-branch. The result is the equivalent length in feet of this section of pipe, and is the **ELM** parameter of the total equivalent length equation.

Follow these steps to calculate **ELB**. Refer to the “Equivalent Pipe Length Measurements Example” Figure 25.

1. Measure the distance in feet from the end of the first liquid pipe Y-branch to the liquid pipe connection of the farthest IDU. Measure along the length of the pipe, following any changes in direction. Record this value.
2. Count the number of elbow connectors in the liquid pipe run measured in step 1. If there is more than one size of elbow connector, count the number of each size. Determine the outside diameter (OD) of each size of elbow connector.
3. Refer to the table below and find the equivalent length for each size of elbow connector. Multiply the number of each size of elbow by its equivalent length. Add these equivalent length values to determine a total equivalent length for elbow connectors. Record this value.
4. Count the number of Y-branches in the liquid pipe run measured in step 1. Multiply the number of Y-branches by 1.6 to determine their equivalent length in feet. Record this value. If there are no Y-branches, the value is zero.

Table 36: Equivalent Piping Length for Elbow Pipe Connectors.

Equivalent Lengths of Elbow Pipe Connectors															
Elbow (90° or 45°)	Size, inches OD	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
	Equivalent Length (ft.)	0.5	0.6	0.7	0.8	1.2	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.5	2.8
Y-branch (ft.)		1.6													
Header (ft.)		3.3													
Heat Recovery Unit (ft.) (For ARWB Heat Recovery Units only)		8.2													

Steps to calculate ELB, continued.

5. Count the number of headers in the liquid pipe run measured in step 1. Multiply the number of headers by 3.3 to determine their equivalent length in feet. Record this value. If there are no headers, the value is zero.

6. Count the number of heat recovery units in the liquid pipe run measured in step 1. Multiply the number of heat recovery units by 8.2 to determine their equivalent length in feet. Record this value. If there are no heat recovery units, the value is zero.

7. Add the physical measurement found in step 1, the elbow connector value found in step 3, the Y-branch value found in step 4, the header value found in step 5 and the heat recovery unit value found in step 6. The result is the equivalent length in feet of this liquid pipe run, and is the **ELB** parameter of the total equivalent length equation.

Follow these steps to calculate **TEL**.

1. Multiply ELM by in feet to ELB in feet. This value is the equivalent length in feet of this section of refrigerant pipe.
2. Refer to the table below to find the equivalent length correction factor (**CF**) for cooling or heading mode.
3. Use the equation below with the HU/HL, ELB, and CF parameters to calculate total equivalent pipe length. Record this value.

Total Equivalent Length (TEL) in feet = [(ELM in feet) x (CF from Table below)] + (ELB in feet)

Table 37: Equivalent Pipe Length Correction Factors.

If Equivalent Pipe Length (ELM + ELB) is:	
Less than 295 ft, Correction Factor (CF) is:	295 ft or More Correction Factor (CF) is:
1.0 for Cooling	0.5 for Cooling
1.0 for Heating	0.2 for Heating

WSU Cooling/Heating Capacity Correction Factor Calculation

Follow this procedure to determine the system's WSU corrected capacity. You must have the results of the HU/HL Measurement procedure and the Total Equivalent Pipe Length Calculation procedure to accurately calculate the correction factors. If the cooling or heating correction factor causes reduced capacity, the system designer must determine if the reduced capacity is acceptable or if redesign is required.

1. Locate the recorded results of the HU/HL Measurement and the Total Equivalent Pipe Length Calculation.
2. Refer to the Cooling Capacity Correction Factors table. Refer to the HU or HL section of the table, as appropriate for your system.
3. Use the HU/HL measurement and the calculated TEL length to find the cooling correction factor. Record this value.
4. Multiply the nominal WSU cooling capacity by the correction factor found in step 3 to determine the corrected cooling capacity.
5. Refer to the Heating Capacity Correction Factors table. Refer to the HU or HL section of the table, as appropriate for your system.
6. Use the HU/HL measurement and the calculated TEL length to find the heating correction factor. Record this value.
7. Multiply the nominal WSU cooling capacity by the correction factor found in step 6 to determine the corrected heating capacity.
8. If either the cooling or heating corrected capacity is less than the nominal capacity, determine if the corrected capacity is acceptable or if system parameters must change to achieve an acceptable corrected capacity.

WSU Cooling/Heating Capacity Correction Factor Calculation Examples

Examples below use the data in the “Equivalent Pipe Length Measurements” fFigure 25to determine cooling and heating capacity correction factors.

In Figure 25, ELM = 230 ft; ELB = 131 ft; HL = 33 ft

- For the cooling calculation:
  TEL = (230 ft x 0.5) + 131 ft
  TEL = 246 ft.
  Cooling capacity correction factor when TEL is 246 ft and HL is 33 ft is approximately 0.88
  Multiplying the WSU nominal cooling capacity by 0.88 gives the corrected cooling capacity
- For the heating calculation,
  TEL = (230 ft x 0.2) + 131 ft
  TEL = 177 ft.
  Heating capacity correction factor when TEL is 177 ft and HL is 33 ft is approximately 1.0
  Multiplying the WSU nominal heating capacity by 1.0 gives the corrected heating capacity

Cooling and Heating Correction Factor Tables

These tables show the change in capacity of a standard indoor unit system at maximum load under standard conditions. If pipe insulation is insufficient, heat loss will become larger and capacity will decrease.

Note:

The LATS software program calculates these correction factors. To reduce the risk of designing an improper applied system or one that will not operate correctly, designers MUST use LATS when designing LG VRF systems.

Table 38: WSU Capacity Cooling Correction Factors.

Elevation Difference (ft.) Above WSU (HU)	Total Equivalent Length (TEL) in Feet												
	25	33	66	98	131	164	197	230	263	295	328	361	394
	Correction Factor												
0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
33	–	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
66	–	–	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.84	0.83
98	–	–	–	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.85	0.84	0.83
131	–	–	–	–	1.0	1.0	1.0	0.98	0.96	0.95	0.85	0.84	0.83
164	–	–	–	–	–	1.0	1.0	0.98	0.96	0.95	0.85	0.84	0.83
Elevation Difference (ft.) Below WSU (HL)	Total Equivalent Length (TEL) in Feet												
	25	33	66	98	131	164	197	230	263	295	328	361	394
	Correction Factor												
0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
33	–	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
66	–	–	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
98	–	–	–	1.0	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
131	–	–	–	–	1.0	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84
164	–	–	–	–	–	1.0	1.0	0.98	0.96	0.95	0.86	0.85	0.84

Table 39: WSU Capacity Heating Correction Factors.

Elevation Difference (ft.) Above WSU (HU)	Total Equivalent Length (TEL) in Feet									
	25	33	66	98	131	164	197	230	263	295
	Correction Factor									
0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
33	–	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
66	–	–	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
98	–	–	–	1.0	1.0	1.0	1.0	0.98	0.96	0.95
131	–	–	–	–	1.0	1.0	1.0	0.98	0.96	0.95
164	–	–	–	–	–	1.0	1.0	0.98	0.96	0.95
Elevation Difference (ft.) Below WSU (HL)	Total Equivalent Length (TEL) in Feet									
	25	33	66	98	131	164	197	230	263	295
	Correction Factor									
0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
33	–	1.0	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
66	–	–	1.0	1.0	1.0	1.0	1.0	0.98	0.96	0.95
98	–	–	–	1.0	1.0	1.0	1.0	0.98	0.96	0.95
131	–	–	–	–	1.0	1.0	1.0	0.98	0.96	0.95
164	–	–	–	–	–	1.0	1.0	0.98	0.96	0.95

LG

Field-Supplied Copper Tubing

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

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

Tube wall thickness should meet local code requirements and be approved for a maximum operating pressure of 551 psi. When bending tubing, try to keep the number of bends to a minimum, and use the largest radii possible to reduce the equivalent length of installed pipe; also, bending radii greater than ten (10) pipe diameters can minimize pressure drop. Be sure no traps or sags are present when rolling out soft copper tubing coils.

Note:

• Commercially available piping often contains dust and other materials. Always blow piping clean with a dry inert gas.

• Prevent dust, water or other contaminants from entering the piping during installation.

Table 40: ACR Copper Tubing Material.

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

Table 41: Piping Tube Thicknesses.

OD (in)	1/4	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
Material	Rigid or Soft ACR rated for R410A			Rigid or Solid ACR rated for R410A				
Min. Bend Radius (in)	.563	.9375	1.5	2.25	3.0	3.0	3.5	4.0
Min. Wall Thickness (in)	.03	.03	.035	.040	.042	.045	.050	.050

Table 42:ACR Copper Tubing Dimensions and Physical Characteristics[1-4]

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]ACR Tubing is available as hard drawn or annealed (soft) and is suitable for use with R410A refrigerant.

[4]The Copper Tube Handbook, 2010, Copper Development Association Inc., 260 Madison Avenue, New York, NY 10016.

REFRIGERANT PIPING INSTALLATION

Indoor Unit Y-Branch Kits

⃠ No Substitutions on Piping Components

Only LG supplied Y-branches and Headers can be used to join one pipe segment to two or more segments. ⃠ Third-party or field-fabricated components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in the 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 outdoor unit, but a Y-branch cannot be installed between a header and an indoor unit.*
- ⃠ *To avoid the potential of uneven refrigerant distribution through a header fitting, minimize the difference in equivalent pipe length between the header fitting and each connected indoor unit.*

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 are two types of Y-branches used in LG VRF systems: Y-branches that combine two or three outdoor units to make up one large-capacity outdoor unit (also known as multi-frame connectors), or 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 for Heat Recovery Operation Consist of:

- One liquid line, one low pressure vapor line, and one high pressure vapor line (three [3] total).
- Reducer fittings as applicable.
- Molded clam-shell type peel and stick insulation covers.

LG Y-Branch Kits for Heat Pump Operation 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

Install indoor unit Y-branches 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 26:Indoor Unit Y-Branch Horizontal Configuration.

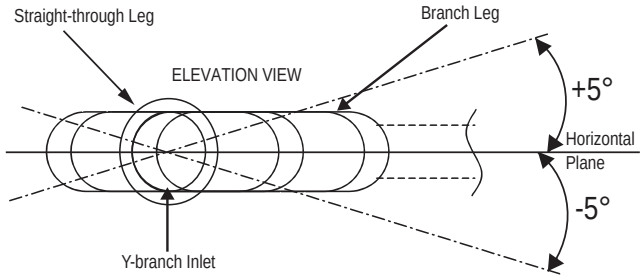


Figure 28:Y-Branch Insulation and Piping Detail.

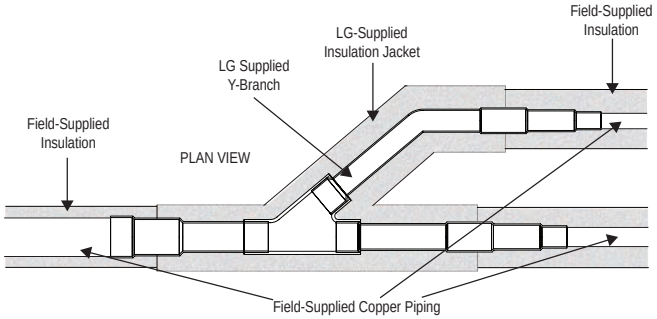
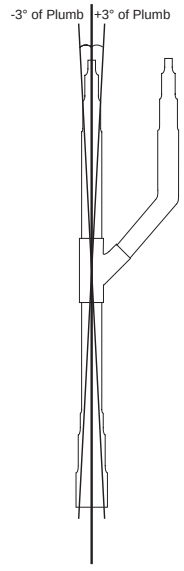
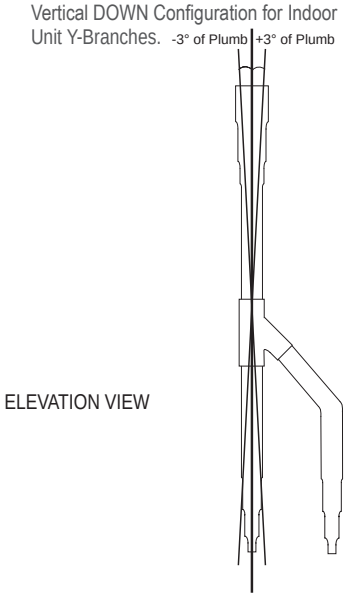


Figure 27:Indoor Unit Y-branch Vertical Installation Alignment Specifications.

Vertical UP Configuration for Indoor Unit Y-Branches.



Vertical DOWN Configuration for Indoor Unit Y-Branches.



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

Outdoor Unit Y-Branches

Outdoor unit Y-branches can only be installed in a horizontal or vertical UP configuration.

⃠ The vertical DOWN configuration is not permitted.

When installed vertically, position the Y-branch at a level lower than the outdoor units it serves, so the straight-through leg is 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.

Outdoor unit Y-branches must always be installed with the two port ends connected to the piping coming from the outdoor units, and the single port end towards the refrigerant piping system supporting the heat recovery unit / indoor unit. Outdoor unit Y-branches are usually installed close to the outdoor unit, leaving enough space for servicing and maintenance.

Figure 29:Outdoor Unit Y-Branch Horizontal Configuration.

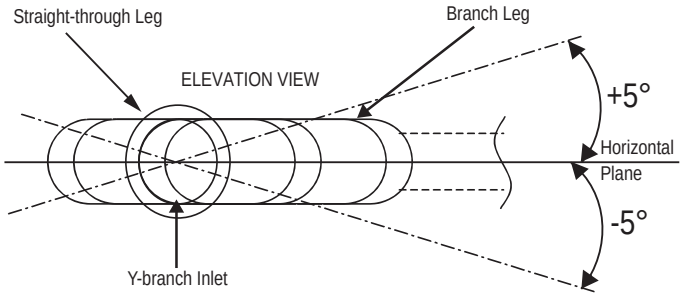
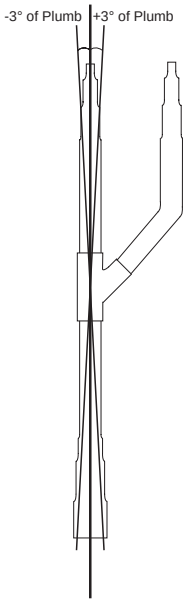


Figure 30:Outdoor Unit Y-branch Vertical Installation Alignment Specifications.

Vertical UP Configuration for Outdoor Unit Y-Branches.



⃠ Vertical DOWN Configuration for Outdoor Unit Y-Branches **NOT PERMITTED**.

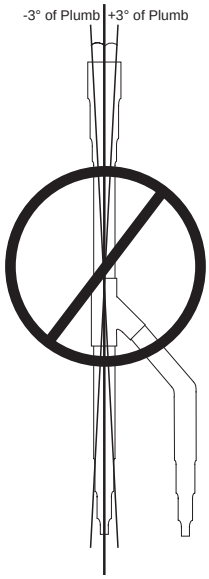


Figure 31:Diagram of an Incorrect Outdoor Unit Y-branch Installation.

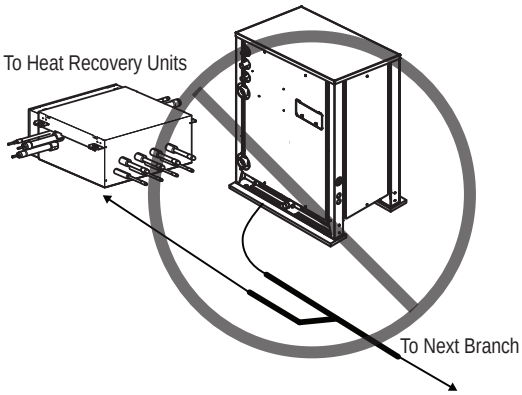
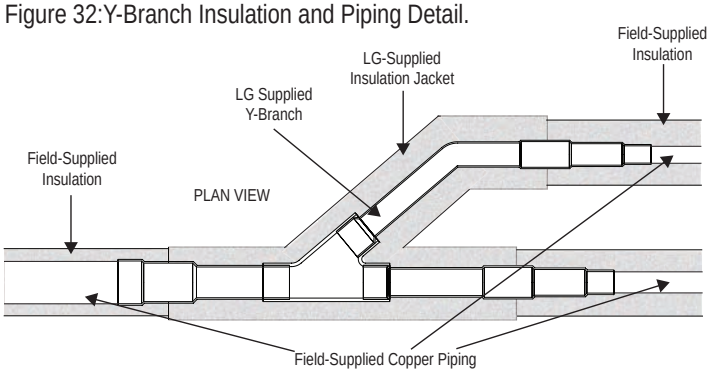


Figure 32:Y-Branch Insulation and Piping Detail.



REFRIGERANT PIPING INSTALLATION

Header Kits

⃠ 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 components such as tee's, Y-fittings, couplings, headers, or other branch fittings are not permitted. The only field-provided fittings allowed in a Multi V 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 outdoor unit, but a Y-branch cannot be installed between a header and an indoor unit.*
- ⃠ *To avoid the potential of uneven refrigerant distribution through a header fitting, minimize the difference in equivalent pipe length between the header fitting and each connected indoor unit.*

Header Kits

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 outdoor 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.

Figure 33: Header Kit—Horizontal Rotation Limit (Ports Must Point to a Horizontal Direction).

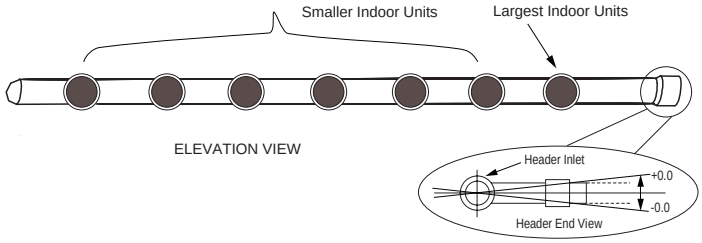


Figure 34: Vertical Header Insulation and Piping Detail (Ports Must Point to an Upright Direction).

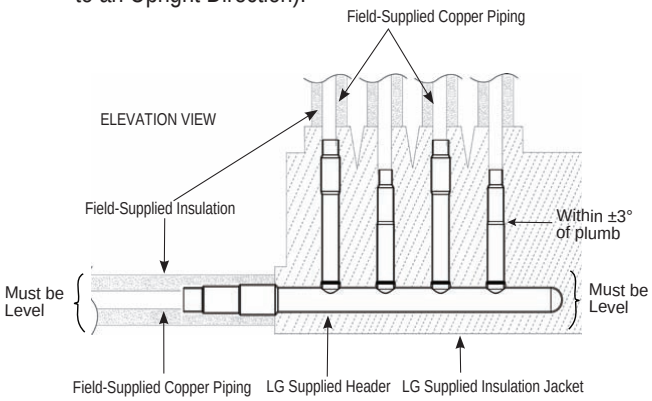


Figure 35:Incorrect Header Configuration.

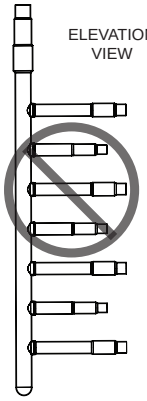
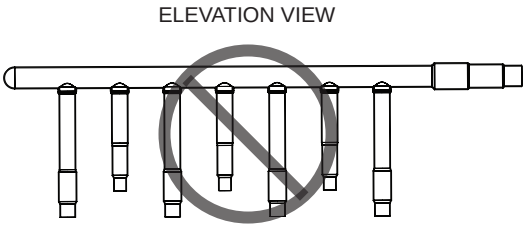


Figure 36:Incorrect Header Configuration (Ports Pointing Downward).

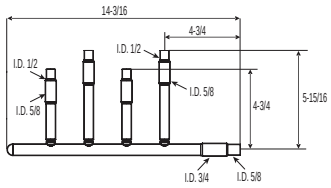
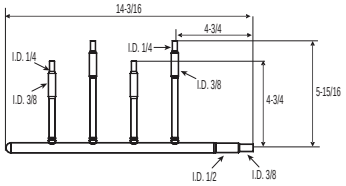
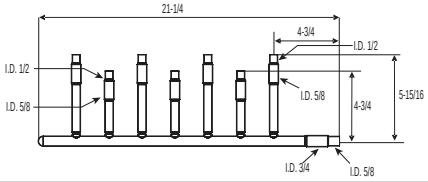
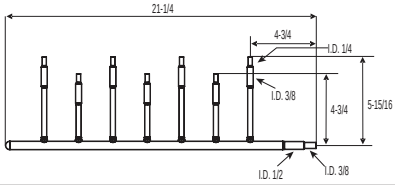
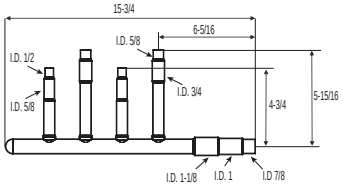
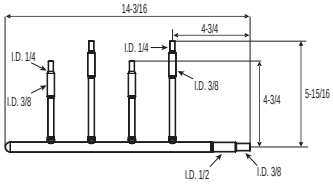
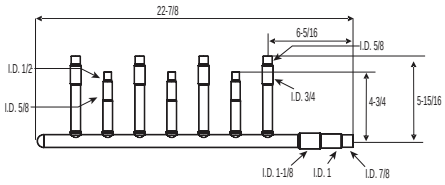
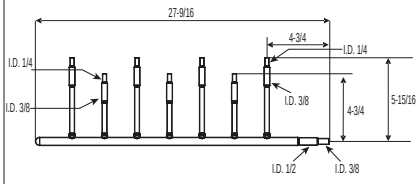
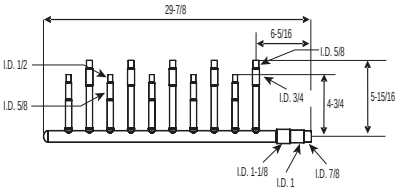
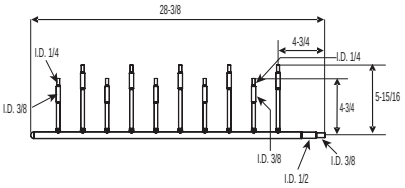
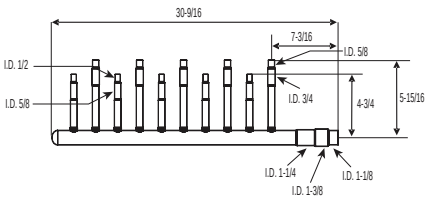
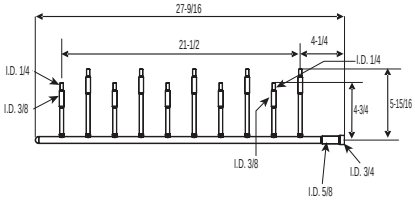


Headers

Table 43:Header Model Nos.

Headers		
Four Branch	Seven Branch	Ten Branch
ARBL054	ARBL057	ARBL1010
ARBL104	ARBL107	ARBL2010

Unit: Inch

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

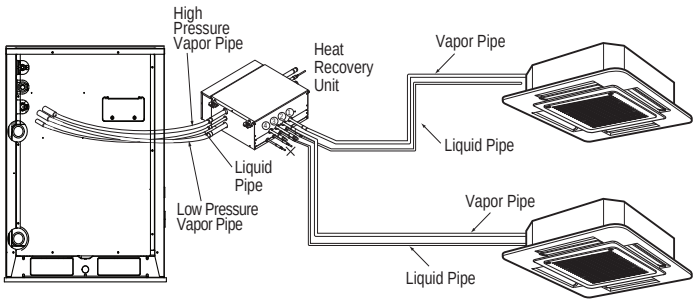
REFRIGERANT PIPING INSTALLATION

Heat Recovery System Piping

Heat Recovery System Piping

Heat recovery systems have three pipes (liquid, high pressure vapor, low pressure vapor) running from the outdoor unit to the heat recovery unit, then two pipes (liquid, vapor) running from the heat recovery unit to the connected indoor units.

Figure 37: Simplified Diagram of Heat Recovery System Piping.

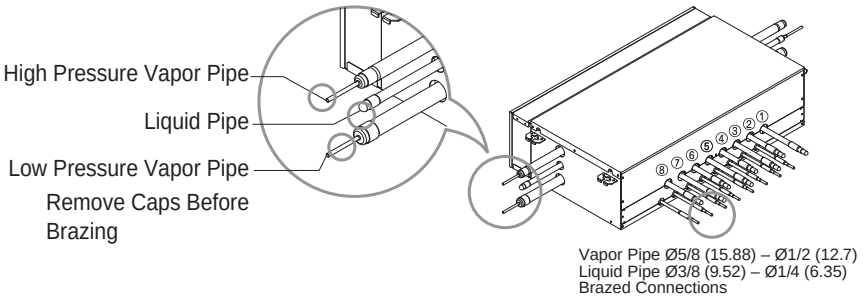


Heat Recovery Unit Connections and Limitations

Note:

1. *Series connection of heat recovery units: Total capacity of indoor units ≤230,000 Btu/h.*
2. *Refer to the heat recovery unit PCB for valve group control setting.*
3. *Maximum capacity of each port is 60,000 Btu/h and eight (8) indoor units.*
4. *⃠ Do not skip ports when connecting indoor units. Start at port 1, then use 2, then use 3, then use 4, etc. (the numbers are displayed on the heat recovery ports from right to left).*

Figure 38:Close Up of the Heat Recovery Unit Connections.



Removing the Caps

Before brazing the field-supplied refrigerant piping to the heat recovery unit connections, the caps MUST be removed from the liquid, high pressure vapor, and low pressure vapor pipe connections.

⚠ WARNING

Removing the caps releases any gas present in the heat recovery unit. If the gas isn't released, physical injury or death will occur from the uncontrolled rapid release of gas, or if the gas comes in contact with a flare during brazing and generates a poisonous gas.

Note:

On whichever port or pipe not used, the factory-provided cap must be removed, and that port / pipe must be recapped and completely insulated.

Figure 39:Preparing Unused Heat Recovery Unit Ports.

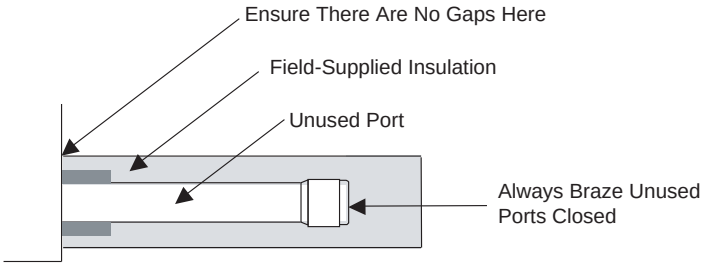


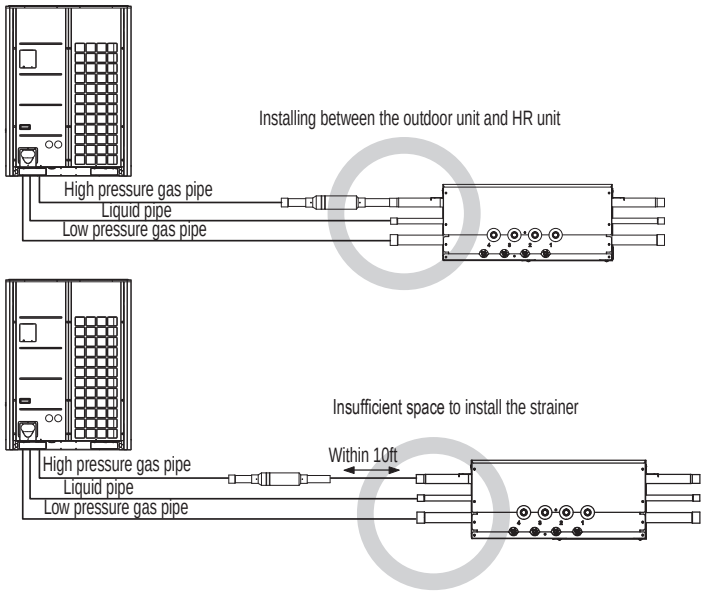
Table 44:Heat Recovery Unit Piping Connection Sizes.

Model			PRHR023A	PRHR033A	PRHR043A	PRHR063A	PRHR083A
Number of Ports			2	3	4	6	8
Connecting Pipes	To Indoor Units	Liquid Pipe (inches)	3/8				
		Vapor Pipe (inches)	5/8				
	To Outdoor Units	Liquid (inches)	3/8	1/2	5/8	5/8	5/8
		Low-pressure Vapor (inches)	7/8	1-1/8	1-1/8	1-1/8	1-1/8
		High-pressure Vapor (inches)	3/4	7/8	7/8	7/8	7/8

Connecting the Strainer

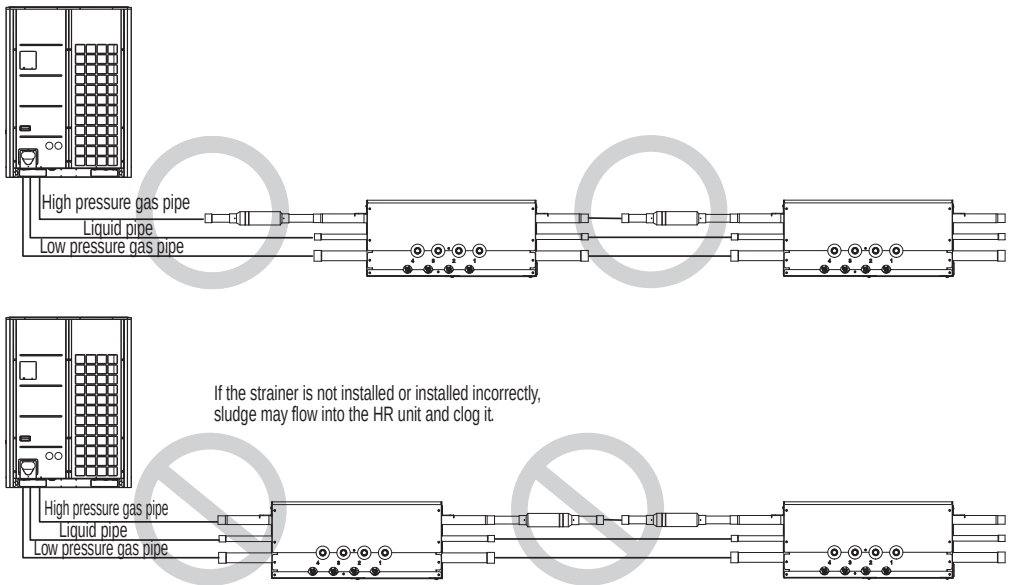
- Connect the strainer directly to the HR unit.
  If there is not enough space to install the strainer, install it between the outdoor unit and the HR unit connection pipe. The distance between the strainer and the HR unit should be within 10ft.

1 Parallel connection with the HR unit (Except PRHR023A)



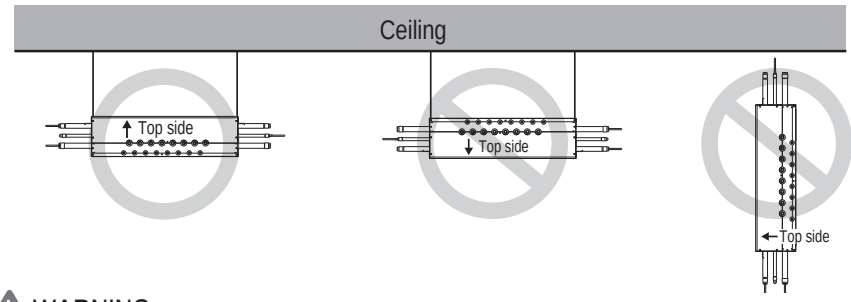
2 Serial connection with the HR unit (Except PRHR023A)

- When connecting the HR unit in a series, the first strainer is mounted between the outdoor unit and the HR unit, and the next strainer is mounted between the previous HR unit and the next HR unit.



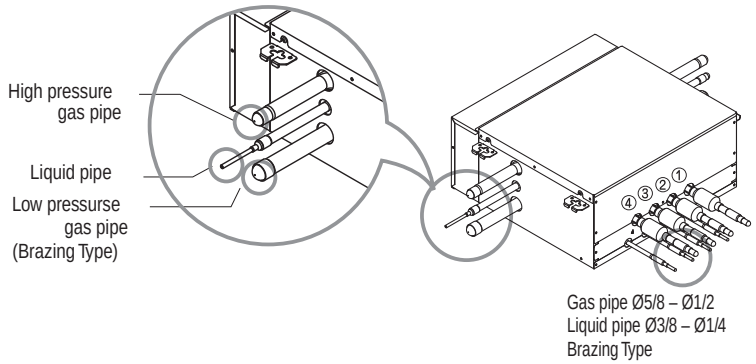
Note

HR Unit should be installed that top side is facing up. If not, it may cause failure of the product.



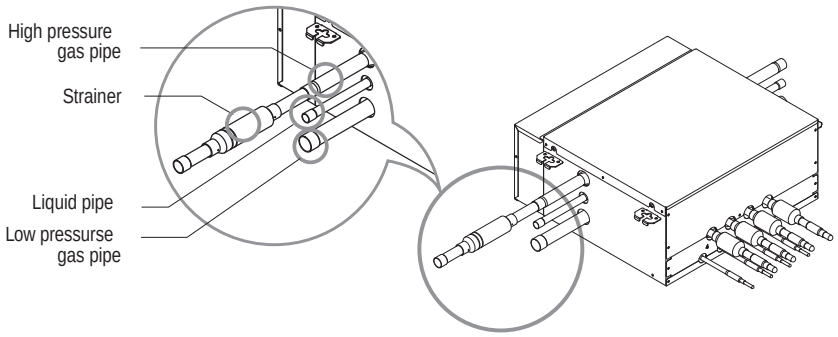
⚠ WARNING

Before brazing work, remove gas in the HR Unit by cutting the three pipes in the small circles on the figure. If not, it may cause injuries. Remove the caps before connecting pipes.

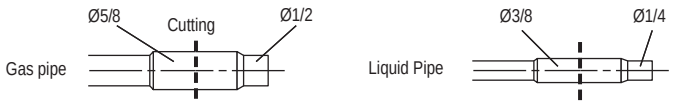


Connect after removing the cap.

Connect the strainer which is provided as an accessory to the HR unit's high pressure gas pipe.



After considering the indoor unit capacity,
determine the pipe sizes and cut the pipes connected to the indoor unit.



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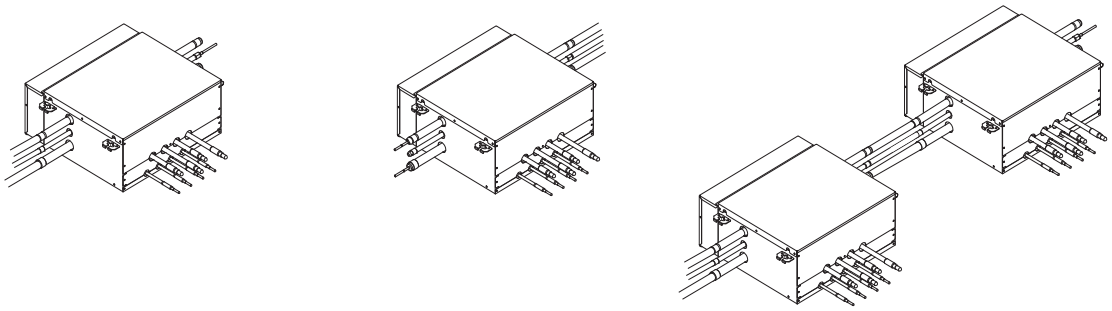
Piping Connection Options

Heat recovery units can connect to the field-supplied refrigerant piping on the left side or on the right side. Heat recovery units can also be installed in series / in parallel using these side connections.

Figure 40:Heat Recovery Unit Piping Connection Options.

Pipe Connection from Left Side | Pipe Connection from Right Side | Series / Parallel Pipe Connection



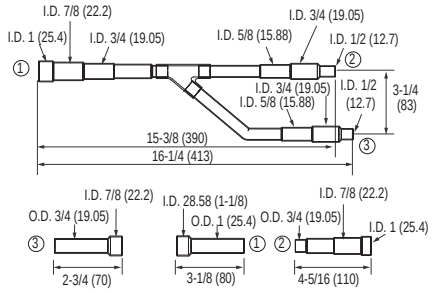
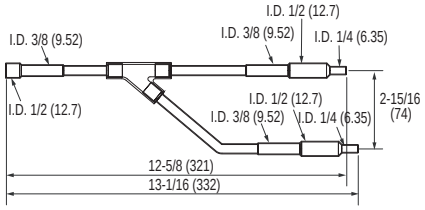
Combining Heat Recovery Ports for Large Indoor Units

It is necessary to combine two ports on a heat recovery unit when installing a single indoor unit with a capacity exceeding 60,000 Btu/h. Two adjacent heat recovery ports are combined using a reverse Y-branch that is then connected to the one large indoor unit.

Note:

If large capacity indoor units (larger than 60,000 Btu/h) are installed, the Y-branch pipe shown in the table below must be used to twin the ports.

Unit: Inch

Kit Model No.	Vapor Pipe Dimensions	Liquid Pipe Dimensions
ARBLN03321		

REFRIGERANT PIPING INSTALLATION

Heat Recovery System Piping

Combining Heat Recovery Ports for Large Indoor Units, continued.

Note:

- *Connect / twin ports that are adjacent. ⃠ Do not connect / twin ports that are not adjacent.*
- *⃠ Do not connect / twin more than two (2) heat recovery unit ports.*
- *⃠ Do not twin ports 4 and 5.*
- *The 96,000 Btu/h and 72,000 Btu/h units MUST be connected / twinned to the first and second ports of the first heat recovery unit. Smaller indoor units (including smaller high static ducted indoor units) can be connected / twinned to any two (2) neighboring ports on one (1) heat recovery unit.*
- *If the rules above are not followed, the system may not operate properly and / or malfunction.*

Reducers

When installing an indoor unit to a heat recovery port, it may be necessary to cut the piping connected to the indoor unit (after considering indoor unit capacity and determining pipe sizes). A reducer can also be installed if the indoor unit piping or outdoor unit piping is too large or too small for the heat recovery unit connections.

Figure 41:Location of Where to Cut Piping on the Indoor Unit.

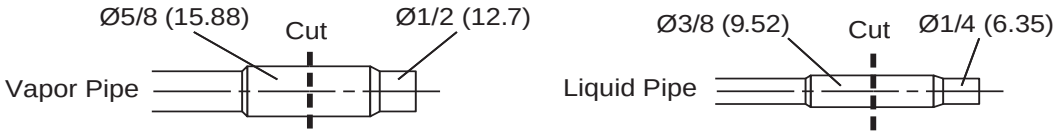


Table 45:Reducers for Heat Recovery Units.

Unit: Inches (mm)

Model		Liquid Piping	Vapor Piping	
			High Pressure	Low Pressure
Heat Recovery Unit Reducer	PRHR023A	O.D. 3/8 (9.52) Ø1/4 (6.35)	O.D. 3/4 (19.05) Ø5/8 (15.88) Ø1/2 (12.7) O.D. 1/2 (12.7) Ø3/8 (9.52)	O.D. 7/8 (22.2) Ø3/4 (19.05) Ø5/8 (15.88) O.D. 5/8 (15.88) Ø1/2 (12.7)
	PRHR033A PRHR043A PRHR063A PRHR083A	O.D. 5/8 (15.88) Ø1/2 (12.7) Ø3/8 (9.52) O.D. 1/2 (12.7) Ø3/8 (9.52)	O.D. 7/8 (22.2) Ø3/4 (19.05) Ø5/8 (15.88) O.D. 5/8 (15.88) Ø1/2 (12.7)	O.D. 1-1/8 (28.58) Ø7/8 (22.2) Ø3/4 (19.05) O.D. 3/4 (19.05) Ø5/8 (15.88)

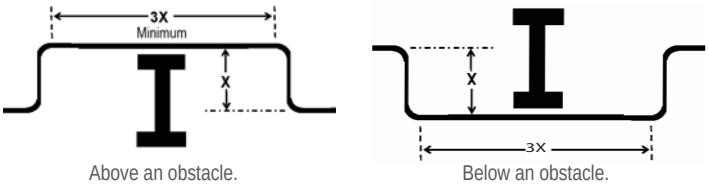
No Pipe Size Substitutions

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

Obstacles

Refer to Figure 42. 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)

Figure 42: Installing Piping Above or Below an Obstacle.



Above an obstacle. Below an obstacle.

times the longest vertical rise (or fall) at either end of the segment.

Copper Expansion and Contraction

Under normal operating conditions, the vapor pipe temperature of a Multi 5 system can vary as much as 160°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. When the refrigerant pipe is mounted underground in a utility duct stacked among other pipes, natural restriction to linear movement is present.

If the pipe is mounted in free air space, no natural restriction to movement is present if mounting clamps are properly spaced and installed.

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 as shown in Figure 43. 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:

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

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

1. In Table 46, find the row corresponding with the actual length of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe. In the column showing the minimum pipe temperature, find the anticipated expansion distance. Do the same for the maximum pipe temperature.
3. Calculate the difference in the two expansion distance values. The result is the anticipated change in pipe length.

Example:

A Multi V system is installed and the design shows that there is a 130 feet straight segment of tubing between a Y-branch and an indoor unit. In heating, this pipe transports hot gas vapor to the indoor units at 120°F. In cooling, the same tube is a suction line returning refrigerant vapor to the water source unit at 40°F. Look up the copper tubing expansion at each temperature and calculate the difference.

Vapor Line

Transporting Hot Vapor: 130 ft. pipe at 120°F = 1.54 in.
Transporting Suction Vapor: 130 ft. pipe at 40°F = 0.52 in.
Anticipated Change in Length: 1.54 in. – 0.52 in. = 1.02 in.

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 height should be a minimum of two times the joint width. Although different types of expansion arrangements are available, the data for correctly sizing an expansion loop is listed in Table 47. 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.

Refer to Table 46 for precalculated anticipated expansion for various pipe sizes and lengths of refrigerant tubing.

To find the anticipated expansion value:

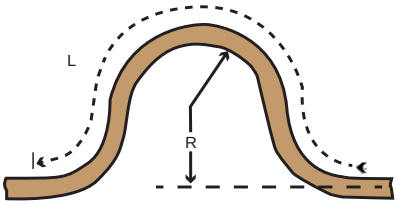
1. In Table 46, find the row corresponding with the actual feet of the straight pipe segment.
2. Estimate the minimum and maximum temperature of the pipe.
3. In the column showing the minimum pipe temperature, look up the anticipated expansion distance corresponding to the segment length. Do the same for the maximum pipe temperature.
4. Calculate the difference in the two expansion distance values. The result is the anticipated change in pipe length.

Table 46: Linear Thermal Expansion of Copper Tubing in Inches.

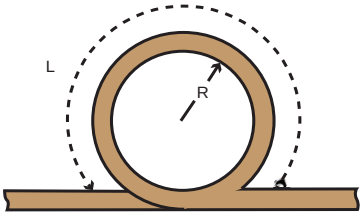
Pipe Length[1]	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19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

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

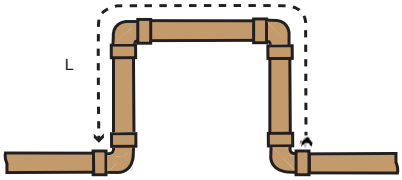
Figure 43: Coiled Expansion Loops and Offsets.



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



Loop



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

Table 47: 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 = Center line Length of Pipe.
[2]L = Center line Minimum Radius (inches).

Pipe Bends

When bending soft copper, use long radius bends. Refer to Table 47 for minimum radius specifications.

In-line Refrigeration Components

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

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 may simplify future maintenance requirements, and, if used, considerations should 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 may 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 may be voided in whole or part should any field supplied accessory fail in any way that causes product failure.

Using Elbows

Field supplied elbows are allowed as long as they are designed for use with R410A refrigerant. The designer and installer, however, should be cautious with the quantity and size of fittings used, and must account for the additional pressure losses in equivalent pipe length calculation for each branch. The equivalent pipe length of each elbow must be added to each pipe segment in the LATS program. See Table 35 for equivalent lengths.

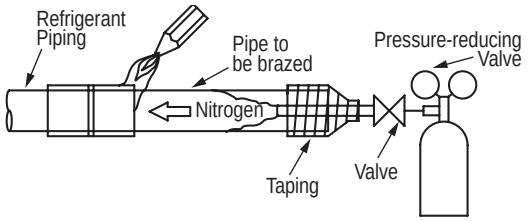
Installation of Refrigerant Piping/Brazing Practice

Note:

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

1. All joints are brazed in the field. Multi V Water Source Unit 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.
   - Store pipe stock in a dry place; keep stored pipe capped and clean.
   - Blow clean all pipe sections with dry nitrogen prior to assembly.
2. Proper system operation depends on the installer using best practices and the utmost care while assembling the piping system.
   - Use adapters to assemble different sizes of pipe.
   - 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 may accumulate and clog or damage the compressors. Flux can harm the copper piping or refrigerant oil.
   - Use a tubing cutter to cut pipe; do not use a saw. De-bur and clean all cuts before assembly.
3. Brazing joints:
   - Use a dry nitrogen purge operating at a minimum pressure of three (3) psig and maintain a steady flow.
   - Use a 15% silver phosphorous copper brazing alloy to produce good flow and avoid overheating.
   - Protect isolation valves, electronic expansion valves, and other heat-sensitive control components from excessive heat with a wet rag or heat barrier spray.

Figure 44:Refrigerant Pipe Brazing.

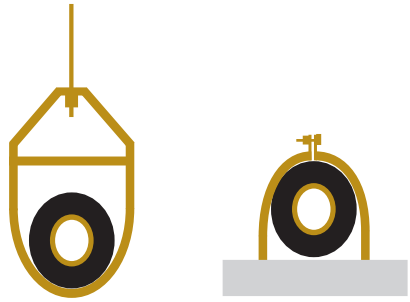


Pipe Supports

A properly installed pipe system includes adequate support to avoid pipe sagging. Sagging pipes become oil traps that lead to equipment malfunction.

Pipe supports should never touch the pipe wall; supports shall be installed outside (around) the primary pipe insulation jacket (see Figure 45). Insulate the pipe first because pipe supports shall be installed outside (around) the primary pipe insulation jacket. Clevis hangers should be used with shields between the hangers and insulation. Field provided pipe supports should be designed to meet local codes. If allowed by code, use fiber straps or split-ring hangers suspended from the ceiling on all-thread rods (fiber straps or split ring hangers can be used as long as they do not compress the pipe insulation). Place a second layer of insulation over the pipe insulation jacket to prevent chafing and compression of the primary insulation within the confines of the support pipe clamp.

Figure 45: Pipe Hanger Details.



A properly installed pipe system will have sufficient support to prevent pipe sagging during the life of the system. As necessary, place supports closer for segments where potential sagging could occur. Maximum spacing of pipe supports shall meet local codes.

If local codes do not specify pipe support spacing, pipe shall be supported:

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

Wherever the pipe changes direction, place a hanger within twelve (12) inches on one side and within twelve to nineteen (12 to 19) inches of the bend on the other side as shown in Figure 46. Support piping at indoor units as shown in Figure 47. Support Y-Branch and Header fittings as shown in Figure 48 and Figure 49.

Figure 46: Typical Pipe Support Location—Change in Pipe Direction.

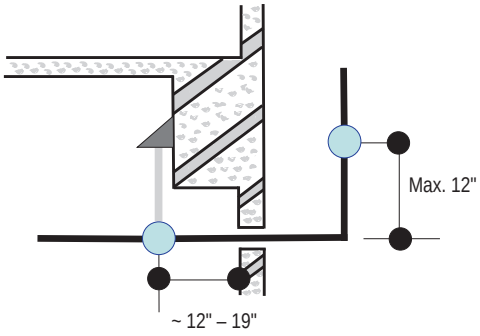


Figure 47: Pipe Support at Indoor Unit.

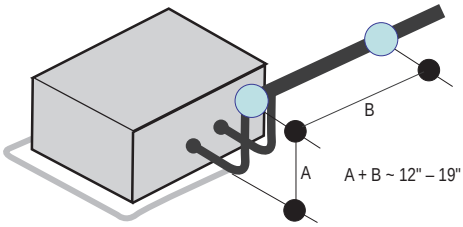


Figure 48: Pipe Support at Y-branch Fitting.

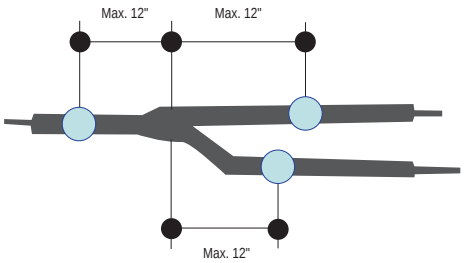
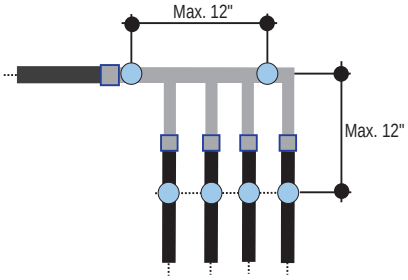


Figure 49: Pipe Support at Header Fitting.



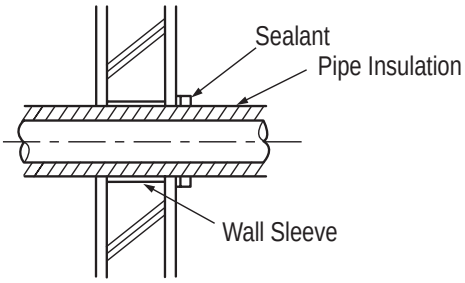
Pipe Slope

The horizontal pipe slope cannot exceed 10° up or down.

Pipe Sleeves and Wall Penetrations

LG recommends that all pipe penetrations through walls and floors be properly insulated and routed through an appropriate wall sleeve of sufficient size to prevent compression of refrigerant pipe insulation and allow free movement of the pipe in the sleeve.

Figure 50:Typical Pipe Penetration.

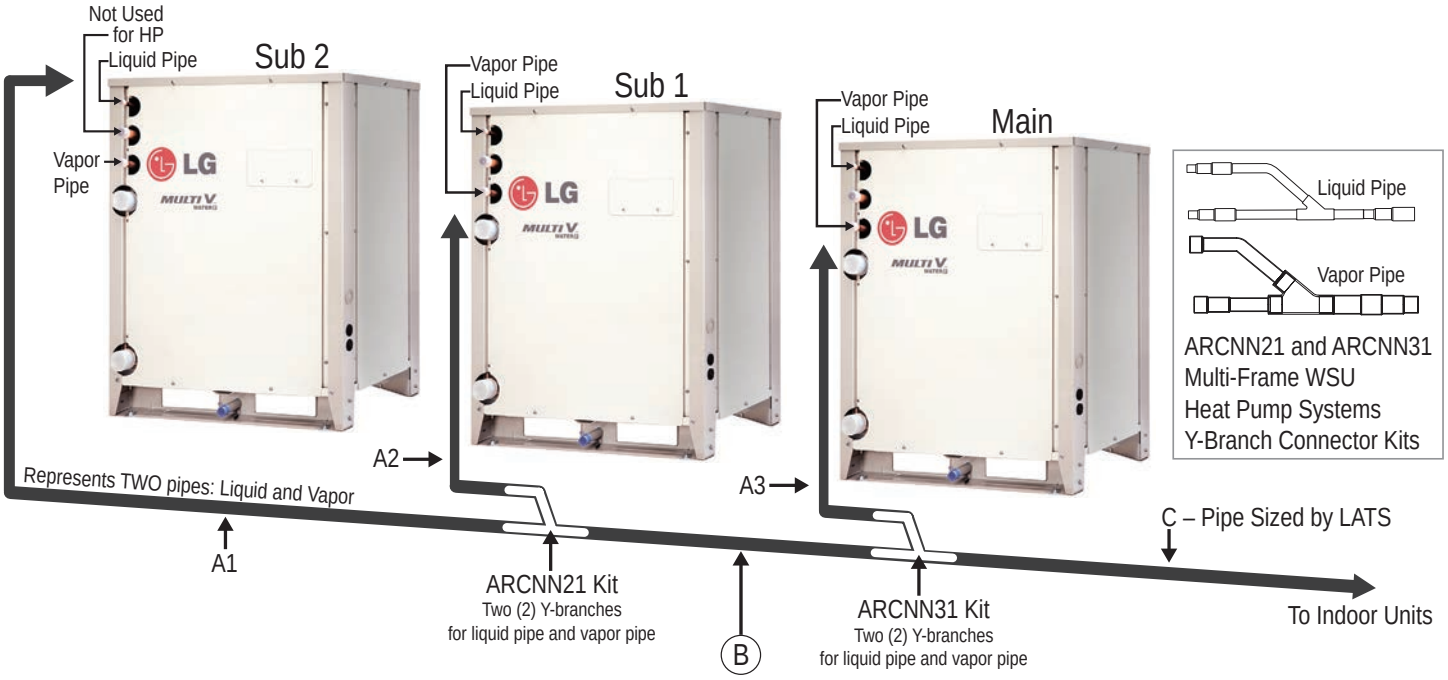


REFRIGERANT PIPING INSTALLATION

Pipe Sizing for ARWM Series Heat Pump Systems

Triple-Frame Heat Pump Water Source Unit Connections

Figure 51: Heat Pump Triple-Frame Refrigerant Pipe Connections.



Refrigerant Pipe Sizes for WSU Connections

- Figure 51 is for reference only, is not to scale, and does not represent required pipe routing.
- Multi-frame Y-branches MUST be installed horizontally as shown in Figure 29.
- A1, A2, and A3 pipe diameters match the water source unit connection diameters.
- Main pipe C diameters are sized by LATS.
- See Table 48 for B pipe diameters.

Table 48: Heat Pump Triple-Frame Connection Pipe Sizes.

Size (tons)	Water Source Unit (WSU)	Voltage	Main Unit	Sub Unit 1	Sub Unit 2	B Pipe			
						Equivalent pipe length from WSU to farthest IDU is <295'		Equivalent pipe length from WSU to farthest IDU is ≥295'	
						Liquid	Vapor	Liquid	Vapor
30	ARWM360BAS5	208-230V	ARWM121BAS5	ARWM121BAS5	ARWM121BAS5	3/4"	1-3/8"	7/8"	1-5/8"
36	ARWM432BAS5	208-230V	ARWM144BAS5	ARWM144BAS5	ARWM144BAS5	3/4"	1-3/8"	7/8"	1-5/8"
36	ARWM432DAS5	460V	ARWM144DAS5	ARWM144DAS5	ARWM144DAS5	3/4"	1-3/8"	7/8"	1-5/8"
42	ARWM504DAS5	460V	ARWM192DAS5	ARWM168DAS5	ARWM144DAS5	3/4"	1-3/8"	7/8"	1-5/8"
48	ARWM576DAS5	460V	ARWM192DAS5	ARWM192DAS5	ARWM192DAS5	3/4"	1-3/8"	7/8"	1-5/8"

Note:

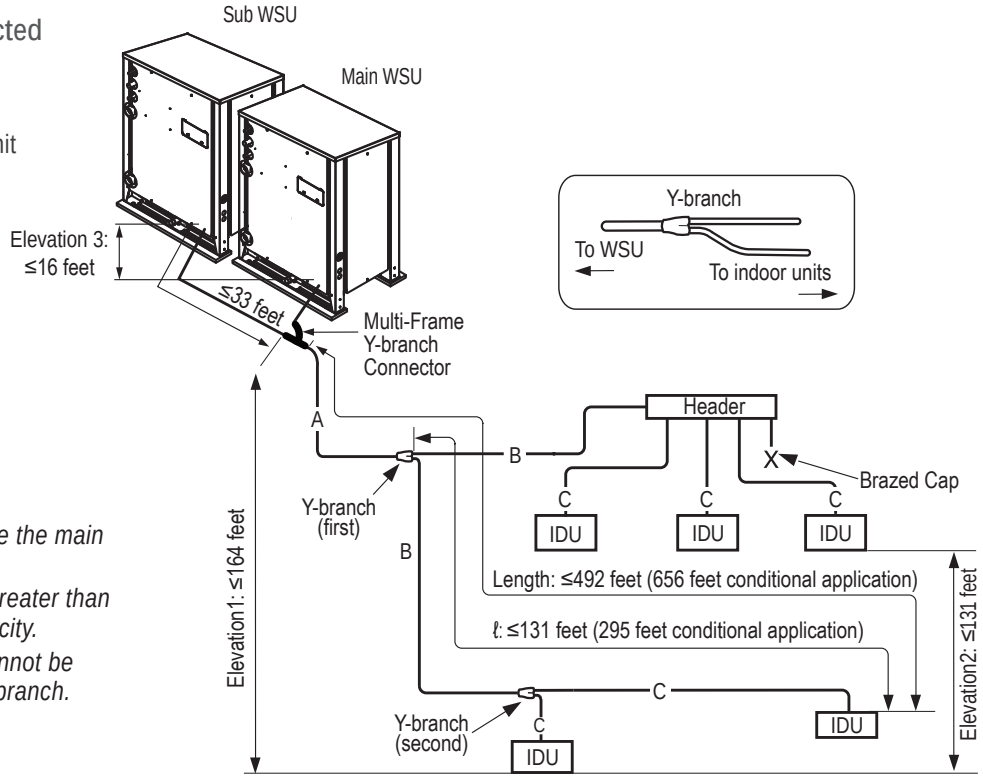
- *Larger-capacity water source units must be the main in a multi-frame system.*
- *Main water source unit capacity must be greater than or equal to the Sub 1 water source unit capacity, and, where applicable, Sub 1 water source unit capacity must be greater than or equal to Sub 2 water source unit capacity.*
- *Be sure to insulate all refrigerant system piping and piping connections.*

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

Combination Y-branch Pipe and Header Pipe Sizing When Installing a Dual-Frame System

Example: Five (5) indoor units connected

- WSU: Water Source Unit.
- IDU: Indoor units.
- A: Main Pipe from Water Source Unit to First Y-branch.
- B: Heat Recovery Unit to Heat Recovery Unit, Y-branch to Heat Recovery Unit, Heat Recovery Unit to Header, or Y-branch to Y-branch.
- C: Heat Recovery Unit or Header to Indoor Unit.



Note:

- *Larger-capacity water source units must be the main in a multi-frame system.*
- *Main water source unit capacity must be greater than or equal to the sub water source unit capacity.*
- *Y-branches and other header branches cannot be installed downstream of the initial header branch.*

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

REFRIGERANT PIPING INSTALLATION

Pipe Sizing for ARWM Series Heat Pump Systems

MULTI V WATER 5

Note:

- *Always reference the LATS Multi V software report.*
- *The largest capacity unit must be the main unit in a multi-frame system.*
- *Main water source unit capacity must be greater than or equal to the sub water source unit capacity.*
- *Connection piping from branch to branch cannot exceed the main pipe diameter (A) used by the water source unit.*
- *Install the header branches 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.*
- ⃠ *Y-branches and other header branches cannot be installed downstream of the initial header branch.*

Table 49: Main Pipe (A) Diameter from Water Source Unit to First Y-branch / Header Branch.

WSU Capacity (tons)	Equivalent pipe length from WSU to farthest IDU is <295 ft.		Equivalent pipe length from WSU to farthest IDU is ≥295 ft.	
	Liquid pipe (inches OD)	High Pressure Vapor pipe (inches OD)	Liquid pipe (inches OD)	High Pressure Vapor pipe (inches OD)
6	3/8	5/8	1/2	3/4
8	3/8	3/4	1/2	7/8
10	1/2	3/4	5/8	7/8
12	1/2	7/8	5/8	1-1/8
14	5/8	7/8	3/4	1-1/8
16	5/8	1-1/8	3/4	1-3/8
18	5/8	1-1/8	3/4	1-3/8
20	5/8	1-1/8	3/4	1-3/8
22	3/4	1-1/8	7/8	1-3/8
24	3/4	1-1/8	7/8	1-3/8
30	3/4	1-1/8	7/8	1-3/8
36	3/4	1-1/8	7/8	1-3/8
42	3/4	1-1/8	7/8	1-3/8
48	3/4	1-3/8	7/8	1-5/8

Table 50: Refrigerant Pipe Diameter (B) from Y-branch to Y-branch /Header.

Downstream Total Capacity of IDUs (Btu/h)[1]	Liquid pipe (inches OD)	Vapor pipe (inches OD)
≤19,100	1/4	1/2
≤54,600	3/8	5/8
≤76,400	3/8	3/4
≤112,600	3/8	7/8
≤160,400	1/2	1-1/8
≤242,300	5/8	1-1/8
≤354,900	3/4	1-3/8
>354,900	3/4	1-5/8

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

Table 51: Indoor Unit Connecting Pipe from Branch (C).

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

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

LG

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

Table 52: Pipe Capabilities.

Length	Total pipe length	Longest actual pipe length	Equivalent pipe length[1]
	A + ΣB + ΣC ≤ 984 ft. (Standard) / 1,640 ft. (Conditional Application)	492 ft. (Standard) / 656 ft. (Conditional Application)	574 ft. (Standard) / 738 ft. (Conditional Applications)
ℓ	Longest pipe length after first branch		
	≤131 feet (295 feet conditional application)		
Elevation1	Elevation differential (Water Source Unit ↔ Indoor Unit)		
	Height ≤164 feet		
Elevation2	Elevation differential (Indoor Unit ↔ Indoor Unit)		
	Height ≤131 feet		
height1	Elevation differential ((Highest Water Source Unit ↔ Lowest Water Source Unit)		
	Height ≤16 feet		
Distance between Water Source Unit to Water Source Unit		≤33 feet	
Distance between fittings and Indoor Unit		≥20 inches	
Distance between fittings and Y-branches / Headers		≥20 inches	
Distance between two Y-branches / Headers		≥20 inches	

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

Note:

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

Conditional Applications

Conditional applications are computed in LATS. See below for an explanation of when pipes are upsized.

If the equivalent length between the first Y-branch to the farthest indoor unit is >131 feet (up to 295 feet maximum):

- Pipe segment diameters between the first Y-branch and the second Y-branch should be sized up by one following the information in Table 42. This applies to both liquid and low pressure vapor pipes. If the next size up is not available, or if the piping segment diameters are the same as main pipe (A) diameters, sizing up is not possible.
- While calculating the entire refrigerant pipe length, pipe lengths for ΣB should be multiplied by two: A+(ΣBx2)+ΣC ≤3,280 feet.
- Length of pipe (C) from each indoor unit to the closest Y-branch or header ≤ 131 ft.
- [Length of pipe from water source unit to farthest indoor unit (A+B+C)] - [Length of pipe from water source unit to closest indoor unit (A+B+C)] ≤131 feet.
- When an indoor unit is directly connected after the 1st branch. When installing the pipe of an Indoor unit directly connected after the 1st branch that is between 131 ft and 295 ft.,
  - Pipe diameter must be sized up by one.
  - This pipe length must be multiplied by two: A+(ΣBx2)+C(1)+ΣC ≤3,280 feet.

If the pipe (B) diameters after the first branch are bigger than the main pipe (A) diameters, pipe (B) should be changed to match main pipe (A) sizes. If one (or both) of the conditions below are met, the main pipe must be upsized.

- The equivalent length between outdoor unit and the farthest indoor unit is 295 ft. or more (liquid and gas pipes are upsized).
- The elevation distance between outdoor unit and indoor unit is 164 ft. or more (only the liquid pipe is upsized).

Refer to “Table 49: Main Pipe (A) Diameter from Water Source Unit to First Y-branch / Header Branch.” on page 80.

Example: When an indoor unit combination ratio of 120% is connected to a 22-ton water source unit:
Water source unit main pipe (A) diameters: 1-3/8Ø inches (vapor) and 5/8Ø inches (liquid).

1. Pipe (B) diameters: 1-3/8Ø (vapor) and 3/4Ø (liquid) (after the first branch, when indoor unit combination ratio is 120% [26 tons]).
2. After the first branch, pipe (B) diameters must be changed to 1-3/8Ø inches (vapor) and 5/8Ø inches (liquid) to match main pipe (A) sizes.

Instead of using the total indoor unit capacity to choose main pipe (A) diameters, use water source unit capacity to choose downstream main pipe (A) diameters. Do not permit connection pipes (B) from branch to branch to exceed main pipe (A) diameters as indicated by water source unit. capacity. Example: When an indoor unit combination ratio of 120% is connected to a 20-ton water source unit (24 tons), and indoor unit with a 7,000 Btu/h capacity is located at the first branch:

1. Main pipe (A) diameters on a 20-ton water source unit: 1-1/8Ø inches (vapor) and 5/8Ø inches (liquid).
2. Pipe diameters between first and second branches, however, are: 1-3/8Ø (vapor) and 3/4Ø (liquid) (connected downstream indoor unit capacity is 20 tons).
3. If main pipe (A) diameters of a 20-ton water source unit are 1-1/8Ø (vapor) and 5/8Ø (liquid), then the pipe diameters between the first and second branches should be changed to match.

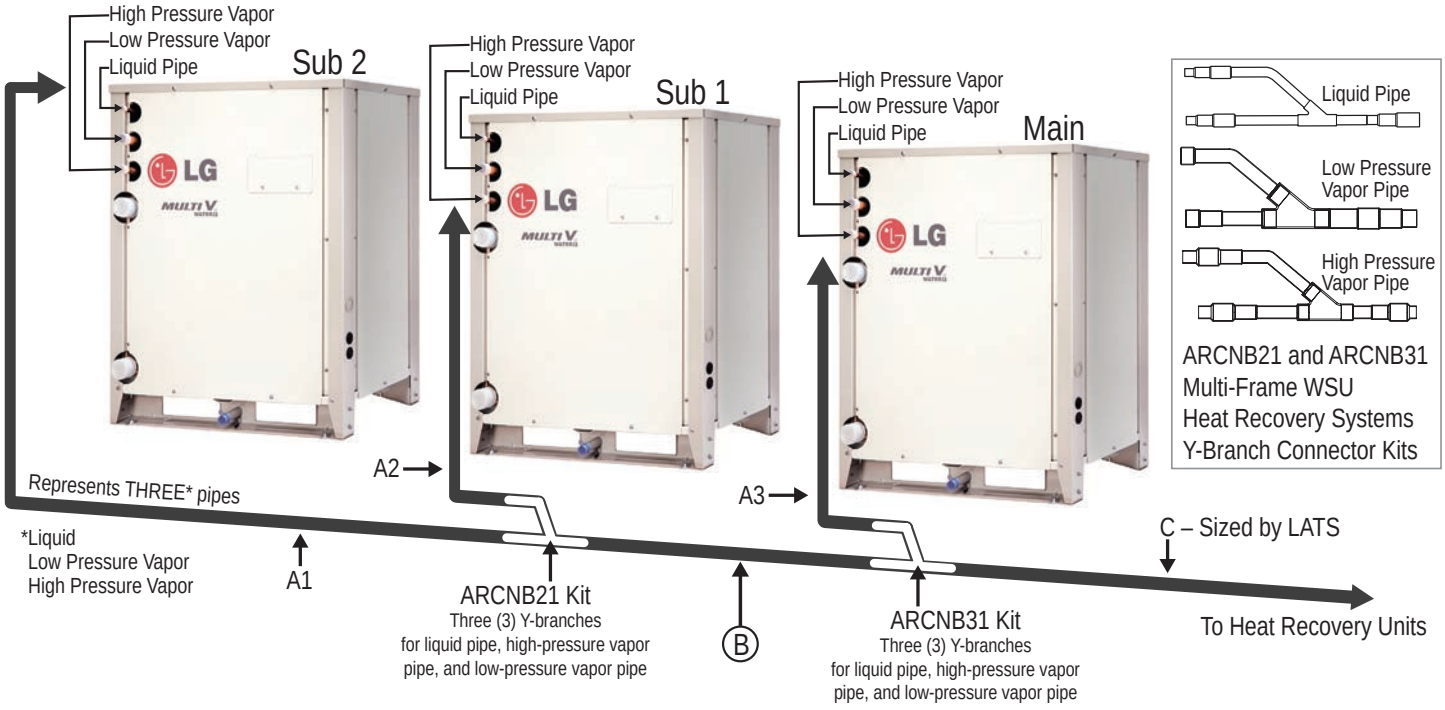
Note that the pipe diameters computed in LATS may not be standard ACR copper tube sizes that are commonly available. In these instances, refer to the table below and use the next commonly available pipe size. Please refer to the Copper Development Association Inc. Publication A4015-14/19: Copper Tube handbook for additional information.

Table 53: LATS Conditional Piping Upsizing.

LATS Conditional Applications Upsized Pipe Diameters	Standard Size Commonly Available ACR Pipe Diameters
1" →	1-1/8"
1-1/4" →	1-3/8"
1-1/2" →	1-5/8"

Triple-Frame Heat Recovery Water Source Unit Connections

Figure 52: Heat Recovery Triple-Frame Refrigerant Pipe Connections.



Refrigerant Pipe Sizes for WSU Connections

- Figure 52 is for reference only, is not to scale, and does not represent required pipe routing.
- Multi-frame Y-branches MUST be installed horizontally as shown in Figure 29.
- A1, A2, and A3 pipe diameters match the water source unit connection diameters.
- Main pipe C diameters are sized by LATS.
- See Table 54 for B pipe diameters.

Table 54: Heat Recovery Triple-Frame Connection Pipe Sizes.

Size (tons)	Water Source Unit	Voltage	Main unit	Sub unit 1	Sub unit 2	B Pipe					
						Equivalent pipe length from WSU to farthest IDU is <295'			Equivalent pipe length from WSU to farthest IDU is ≥295'		
						Liquid (in)	Low Pressure Vapor	High Pressure Vapor	Liquid	Low Pressure Vapor	High Pressure Vapor
30	ARWM360BAS5	208-230V	ARWM121BAS5	ARWM121BAS5	ARWM121BAS5	3/4"	1-3/8"	1-1/8"	7/8"	1-5/8"	1-1/8"
36	ARWM432BAS5	208-230V	ARWM144BAS5	ARWM144BAS5	ARWM144BAS5	3/4"	1-3/8"	1-1/8"	7/8"	1-5/8"	1-1/8"
36	ARWM432DAS5	460V	ARWM144DAS5	ARWM144DAS5	ARWM144DAS5	3/4"	1-3/8"	1-1/8"	7/8"	1-5/8"	1-1/8"
40	ARWM504DAS5	460V	ARWM192DAS5	ARWM168DAS5	ARWM144DAS5	3/4"	1-3/8"	1-1/8"	7/8"	1-5/8"	1-1/8"
48	ARWM576DAS5	460V	ARWM192DAS5	ARWM192DAS5	ARWM192DAS5	3/4"	1-3/8	1-1/8	7/8	1-5/8	1-1/8

Note:

- *Larger-capacity water source units must be the main in a multi-frame system.*
- *Main water source unit capacity must be greater than or equal to the Sub 1 water source unit capacity, and, where applicable, Sub 1 water source unit capacity must be greater than or equal to Sub 2 water source unit capacity.*
- *Be sure to insulate all refrigerant system piping and piping connections.*

REFRIGERANT PIPING INSTALLATION

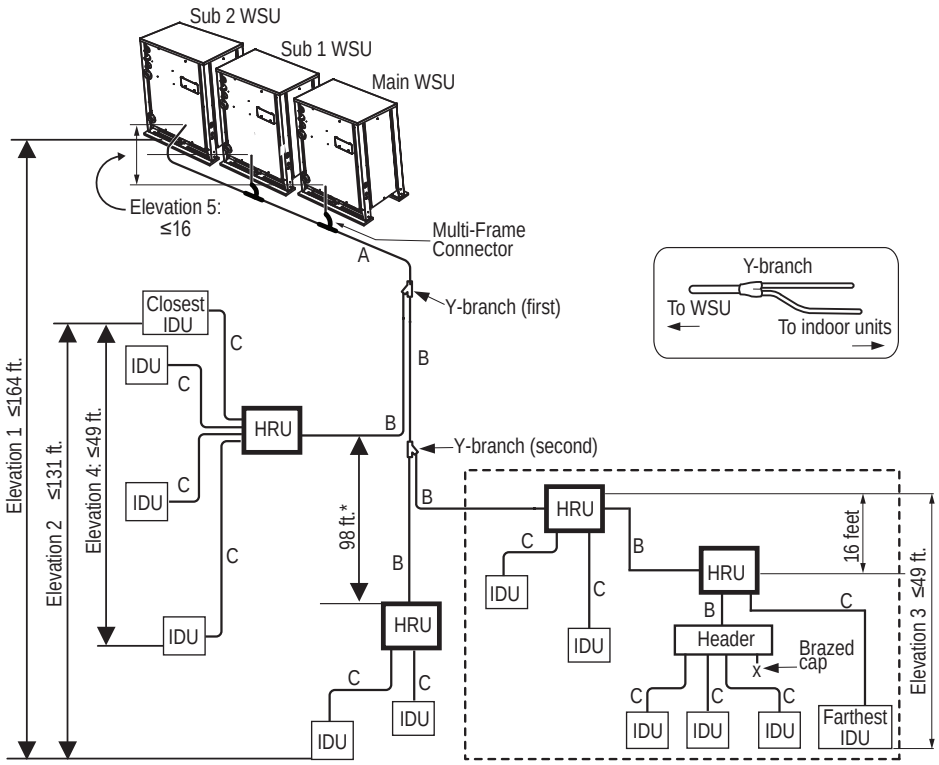
Pipe Sizing for ARWM Series Heat Recovery Systems

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

Pipe Sizing When Installing Heat Recovery Units

Example: Triple-frame system, four (4) heat recovery units, one (1) header, and twelve (12) indoor units connected

WSU: Water Source Units.
HRU: Heat Recovery Units.
IDU: Indoor units.
A: Main Pipe from Water Source Unit to First Y-branch.
B: Heat Recovery Unit to Heat Recovery Unit, Y-branch to Heat Recovery Unit, Heat Recovery Unit to Header, or Y-branch to Y-branch.
C: Heat Recovery Unit or Header to Indoor Unit.



Note:

- *Connection piping from branch to branch cannot exceed main pipe diameter (A) used by WSU.*
- *Install the header branches or heat recovery units so that the pipe distances between the connected indoor units are minimized. Large differences in pipe distances can cause indoor unit performances to fluctuate.*
- *Y-branches and other headers branches cannot be installed downstream of initial header branch.*
- *Total capacity of indoor units in series connection of heat recovery units ≤230,000 Btu/h.*
- *Maximum capacity of a HRU port is 60,000 Btu/h. Two HRU ports can be connected with a Y-branch to support IDUs greater than 60,000 Btu/h.*
- *Always reference the LATS Multi V software report.*
- *Larger-capacity water source units must be the main in a multi-frame system.*
- *Main WSU capacity must be greater than or equal to the sub1 WSU capacity, and, where applicable, sub1 WSU capacity must be greater than or equal to the sub2 WSU capacity.*
- *Refer to refrigerant pipe diameter and pipe length tables for actual lengths.*

Heat Recovery Unit Piping Rules

- *PRHR*2A heat recovery units can be used but system design must follow PRHR*2A piping rules.*
- *Both old PRHR*2A and new PRHR*3A heat recovery units can be installed on the same system, but system design must follow PRHR*2A piping rules.*
- *Use LATS for system design.*

**Up to 131 ft. may be possible with certain applications. Contact LG Engineering for additional information.*

REFRIGERANT PIPING INSTALLATION

Pipe Sizing for ARWM Series Heat Recovery Systems

Table 55: Main Pipe (A) Diameter from Water Source Unit to First Y-branch.

WSU Capacity (ton)	Pipe diameter when equivalent pipe length from WSU to farthest IDU is <295 ft.			Pipe diameter when equivalent pipe length from WSU to farthest IDU is >295 ft.		
	Liquid Pipe (inches OD)	Low Pressure Vapor Pipe (inches OD)	High Pressure Vapor Pipe (inches OD)	Liquid Pipe (inches OD)	Low Pressure Vapor Pipe (inches OD)	High Pressure Vapor Pipe (inches OD)
6	3/8	3/4	5/8	1/2	7/8	3/4
8	3/8	7/8	3/4	1/2	1-1/8	7/8
10	1/2	1-1/8	3/4	5/8	1-3/8	7/8
12	1/2	1-1/8	7/8	5/8	1-3/8	1-1/8
14	5/8	1-1/8	7/8	3/4	1-3/8	1-1/8
16	5/8	1-1/8	1-1/8	3/4	1-3/8	1-3/8
18	5/8	1-1/8	1-1/8	3/4	1-3/8	1-3/8
20	5/8	1-3/8	1-1/8	3/4	1-5/8	1-3/8
22	3/4	1-3/8	1-1/8	7/8	1-5/8	1-3/8
24	3/4	1-3/8	1-1/8	7/8	1-5/8	1-3/8
30	3/4	1-5/8	1-1/8	7/8	1-5/8	1-3/8
36	3/4	1-5/8	1-1/8	7/8	1-5/8	1-3/8
42	3/4	1-5/8	1-1/8	7/8	1-5/8	1-3/8
48	3/4	1-5/8	1-3/8	7/8	1-5/8	1-5/8

Table 56: Refrigerant Pipe (B) Diameter between Y-branches and Y-branches / Heat Recovery Unit / Headers.

Downstream IDU total capacity (Btu/h)	Liquid pipe (inches OD)	Vapor pipe (inches OD)	
		Low pressure	High pressure
≤19,100	1/4	1/2	3/8
<54,600	3/8	5/8	1/2
<76,400	3/8	3/4	5/8
<112,600	3/8	7/8	3/4
<160,400	1/2	1-1/8	7/8
<242,300	5/8	1-1/8	1-1/8
<354,900	3/4	1-3/8	1-1/8
≥354,900	3/4	1-5/8	1-3/8

Table 57: Indoor Unit Connecting Pipe from Branch (C).

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

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

REFRIGERANT PIPING INSTALLATION

Pipe Sizing for Heat Recovery ARWM Series

Table 58:Piping Limitations for Heat Recovery Operation.

Length	Total pipe length A + ΣB + ΣC ≤ 984 ft. (Standard) / 1,640 ft. (Conditional Application)	Longest actual pipe length 492 ft. (Standard) / 656 ft. (Conditional Application)	Equivalent pipe length[1] 574 ft. (Standard) / 738 ft. (Conditional Applications)
ℓ	Longest pipe length after first branch ≤131 feet (295 feet conditional application)		
Elevation 1	Elevation differential (Water Source Unit ↔ Indoor Unit) Height ≤164 feet		
Elevation 2	Elevation differential (Indoor Unit ↔ Indoor Unit) [IDUs connected to separate HRUs which are parallel (Y-branch) connected.] Height ≤131 feet		
Elevation 3	Elevation differential (Indoor Unit ↔ Connected HRU or Series Connected HRU] Height ≤49 feet		
Elevation 4	Elevation differential (Indoor Unit ↔ Indoor Unit [connected to same Heat Recovery Unit]) Height ≤49 feet		
Elevation 5	Elevation differential (Highest WSU ↔ Lowest WSU unit) Height ≤16 feet		
Distance between WSU to WSU			≤33 feet
Distance between fittings and Indoor Unit			≥20 inches
Distance between fittings and Y-branches / Headers			≥20 inches
Distance between two Y-branches / Headers			≥20 inches
Height differential between two Heat Recovery Units if installed with a Y-branch			98 ft.[2]
Height differential between two series-piped Heat Recovery Units			≤16 feet
Maximum number of Heat Recovery Units per system			16

[1] Assume equivalent pipe length of Y-branch is 1.6 feet, and equivalent pipe length of header is 3.3 feet.

[2] Up to 131 ft. may be possible with certain applications. Contact LG Engineering for additional information.

Conditional Applications

Conditional applications are computed in LATS. See below for an explanation of when pipes are upsized.

If the equivalent length between the first Y-branch to the farthest indoor unit is >131 feet (up to 295 feet maximum):

- Pipe segment diameters between the first Y-branch and the second Y-branch should be sized up by one following the information in Table 42. This applies to both liquid and low pressure vapor pipes. If the next size up is not available, or if the piping segment diameters are the same as main pipe (A) diameters, sizing up is not possible.
- While calculating the entire refrigerant pipe length, pipe lengths for ΣB should be multiplied by two: A+(ΣBx2)+ΣC ≤3,280 feet.
- Length of pipe (C) from each indoor unit to the closest Y-branch or header ≤ 131 ft.
- [Length of pipe from water source unit to farthest indoor unit (A+B+C)] - [Length of pipe from water source unit to closest indoor unit (A+B+C)] ≤131 feet.

If the pipe (B) diameters after the first branch are bigger than the main pipe (A) diameters, pipe (B) should be changed to match main pipe (A) sizes. If one (or both) of the conditions below are met, the main pipe must be upsized.

- The equivalent length between outdoor unit and the farthest indoor unit is 295 ft. or more (liquid and gas pipes are upsized).
- The elevation distance between outdoor unit and indoor unit is 164 ft. or more (only the liquid pipe is upsized).

Refer to “Table 55: Main Pipe (A) Diameter from Water Source Unit to First Y-branch.”

Example: When an indoor unit combination ratio of 120% is connected to a 22-ton water source unit:
Water source unit main pipe (A) diameters: 1-3/8Ø inches (vapor) and 5/8Ø inches (liquid).

1. Pipe (B) diameters: 1-3/8Ø (vapor) and 3/4Ø (liquid) (after the first branch, when indoor unit combination ratio is 120% [26 tons]).
2. After the first branch, pipe (B) diameters must be changed to 1-3/8Ø inches (vapor) and 5/8Ø inches (liquid) to match main pipe (A) sizes.

Instead of using the total indoor unit capacity to choose main pipe (A) diameters, use water source unit capacity to choose downstream main pipe (A) diameters. Do not permit connection pipes (B) from branch to branch to exceed main pipe (A) diameters as indicated by water source unit. capacity. Example: When an indoor unit combination ratio of 120% is connected to a 20-ton water source unit (24 tons), and indoor unit with a 7,000 Btu/h capacity is located at the first branch:

1. Main pipe (A) diameters on a 20-ton water source unit: 1-1/8Ø inches (vapor) and 5/8Ø inches (liquid).
2. Pipe diameters between first and second branches, however, are: 1-3/8Ø (vapor) and 3/4Ø (liquid) (connected downstream indoor unit capacity is 20 tons).
3. If main pipe (A) diameters of a 20-ton water source unit are 1-1/8Ø (vapor) and 5/8Ø (liquid), then the pipe diameters between the first and second branches should be changed to match.

Note that the pipe diameters computed in LATS may not be standard ACR copper tube sizes that are commonly available. In these instances, refer to the table below and use the next commonly available pipe size. Please refer to the Copper Development Association Inc. Publication A4015-14/19: Copper Tube handbook for additional information.

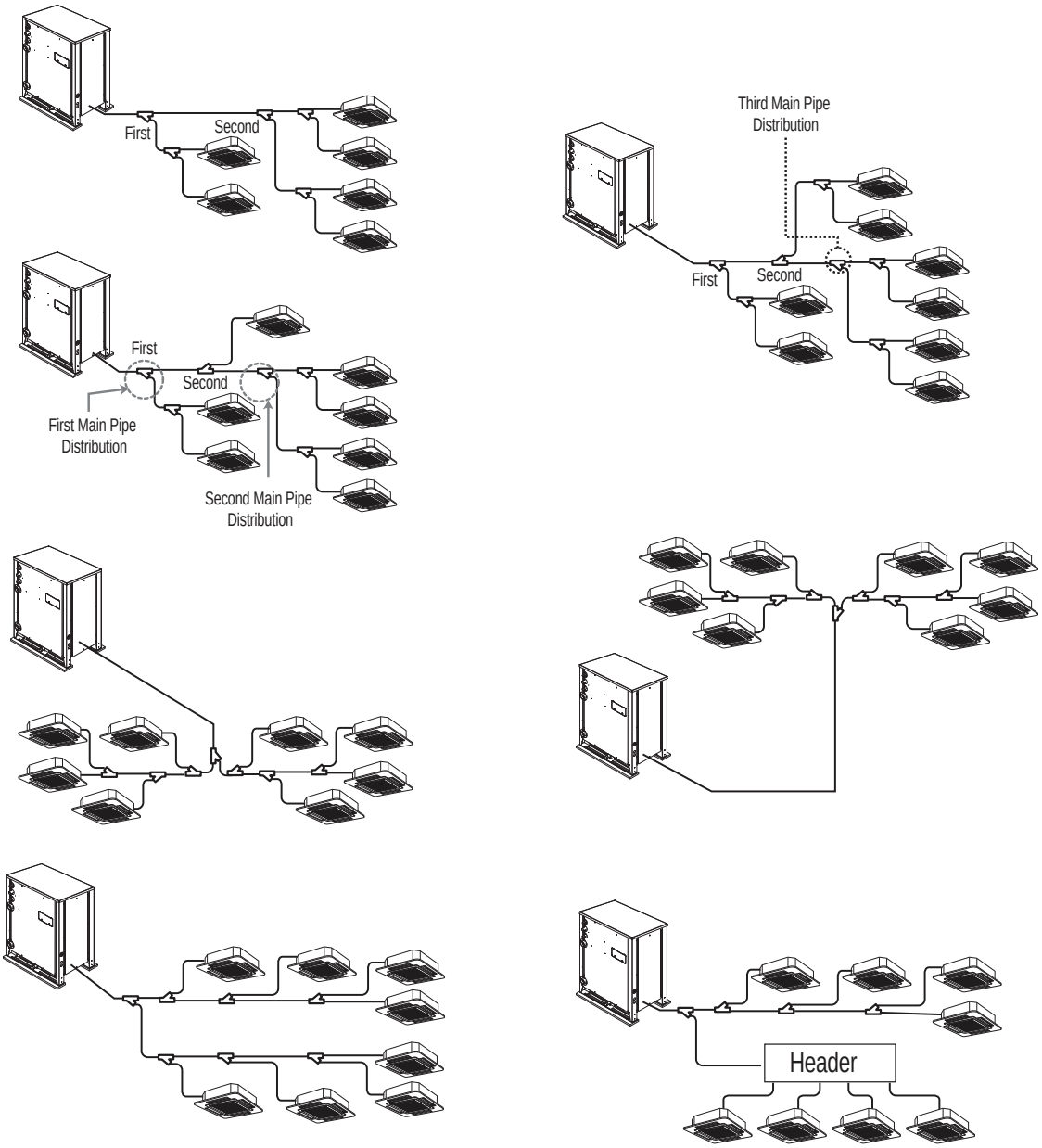
Table 59: LATS Conditional Piping Upsizing.

LATS Conditional Applications Upsized Pipe Diameters	Standard Size Commonly Available ACR Pipe Diameters
1" →	1-1/8"
1-1/4" →	1-3/8"
1-1/2" →	1-5/8"

REFRIGERANT PIPING INSTALLATION

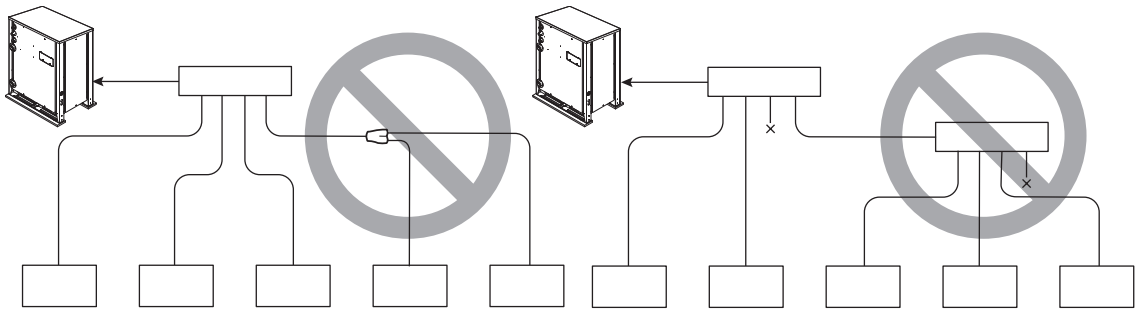
Pipe Layout

Acceptable Layout Examples



Unacceptable Piping System Layouts

A second branch cannot be installed after a header.



Refrigerant Piping for Separated Water Source Units

Dual-frame and triple-frame systems should be installed with all water source units located next to each other. In conditions where the dual-frame or triple-frame water source units need to be separated, the following rules must be followed:

1. Measurements.
All measurements should be made from the union center of the water source unit Y-branch.

2. Maximum pipe length from first water source unit Y-branch to farthest water source unit.
Total pipe length from the first outdoor unit Y-branch to the piping connection at the farthest outdoor unit must not exceed thirty-three (33) feet.

3. Elevation difference between water source units.
The elevation difference between the highest and lowest elevation water source unit must not exceed sixteen (16) feet.

Figure 54: Y-branch Measurement Location.

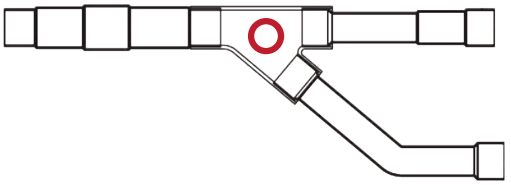


Figure 55: Maximum PIpe Length from First WSU Y-branch to Farthest WSU.

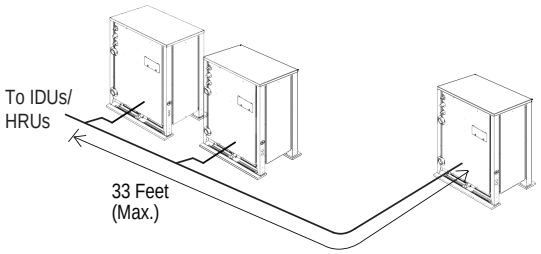
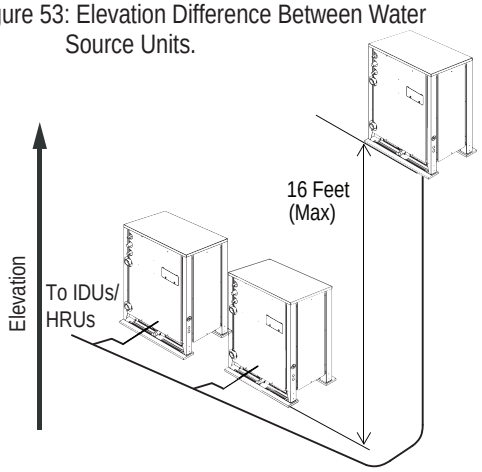


Figure 53: Elevation Difference Between Water Source Units.



Trapping

1. When required, all traps must be inverted type traps ≥8" in the vapor line(s).
   a. Heat pump water source units would be trapped in the suction vapor line, and heat recovery water source units would be trapped in the high AND low pressure vapor lines.

   b. Inverted traps are defined as any piping that is ≥8" in a vertical direction up the horizontal pipe it elevates from.

Figure 56: Traps for Heat Pump and Heat Recovery Units.

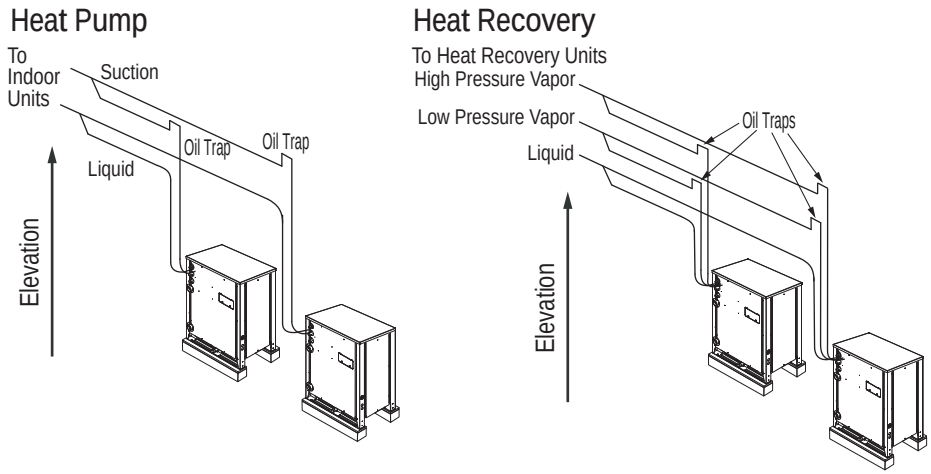
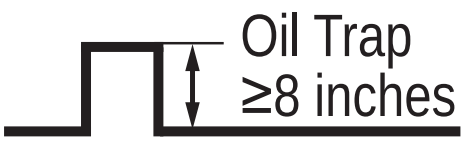


Figure 57: Close Up of An Inverted Oil Trap.



1. Inverted traps are required when:
   a. Piping in a horizontal direction from the outdoor Y-branch towards an outdoor unit or another outdoor unit Y-branch is greater than 6.6'.

   The inverted trap should be installed close to the outdoor unit Y-branch (no more than 6.6' away; 20" is optimum).

   b. Anytime piping turns downward leaving an outdoor unit Y-branch toward an outdoor unit or another outdoor unit Y-branch

   A trap is required for piping within 8" below the unit connection(s) but not required for piping 8" or more below the unit connection(s). The inverted trap should be installed close to the outdoor unit Y-branch (no more than 6.6' away; 20" is optimum), and before the pipe toward the outdoor unit turns downward.

Figure 58: Examples of Inverted Traps.

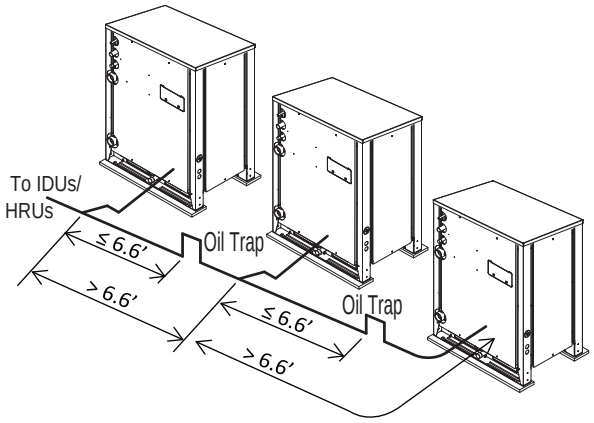
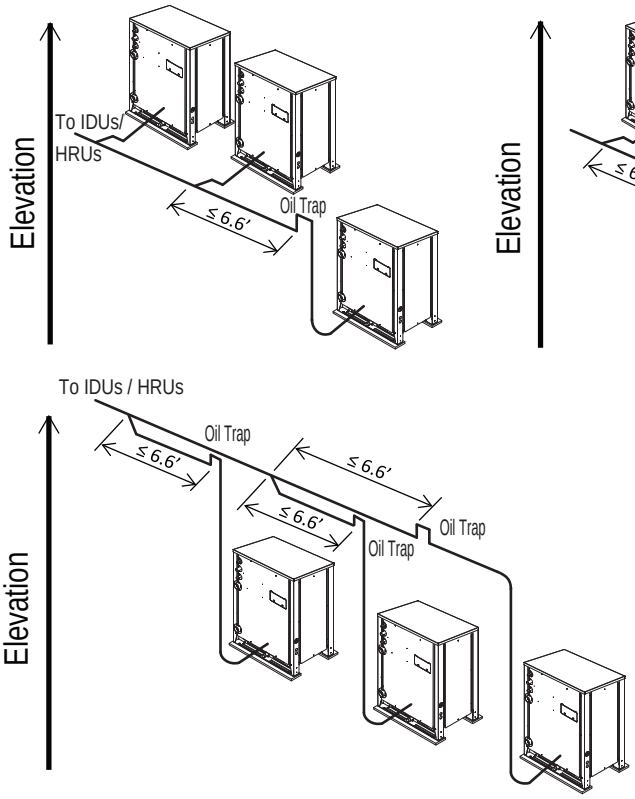


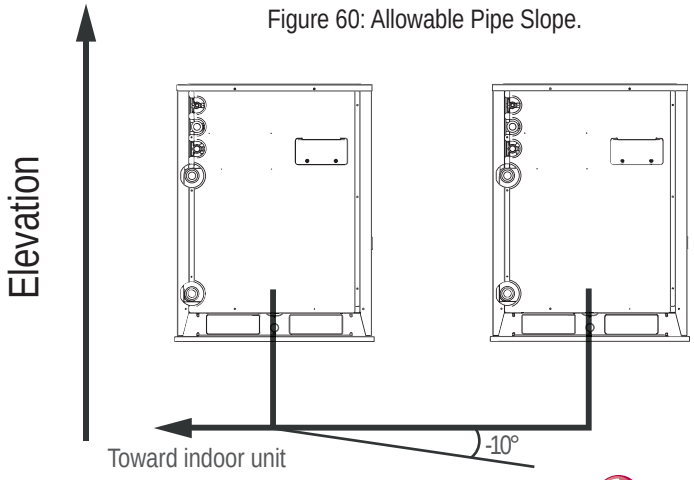
Figure 59: Inverted Trap Applications.



Pipe Slope

Horizontal pipe slope should be level or slightly away from the water source units, otherwise refrigerant and oil will migrate toward the water source units and accumulate in the pipe segment serving the frame that is not running or at the lowest elevation. Piping should never slope more than -10° (see figure) without installing an inverted trap within 6.6' of the water source unit Y-branch and before the pipe slopes downward toward the water source unit.

Figure 60: Allowable Pipe Slope.



Before connecting the piping:

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

Figure 61:Water Source Unit Front Panel.

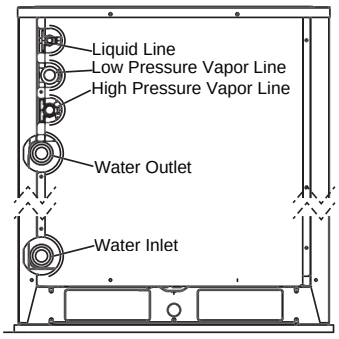


Figure 62: Heat Pump Pipes and Service Ports.

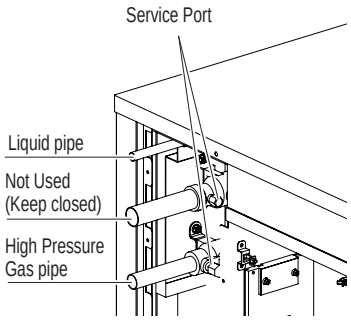
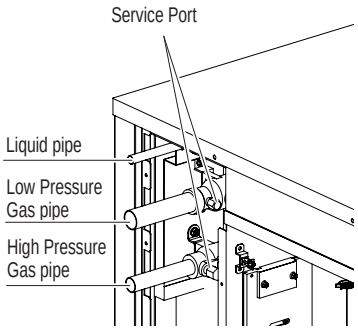


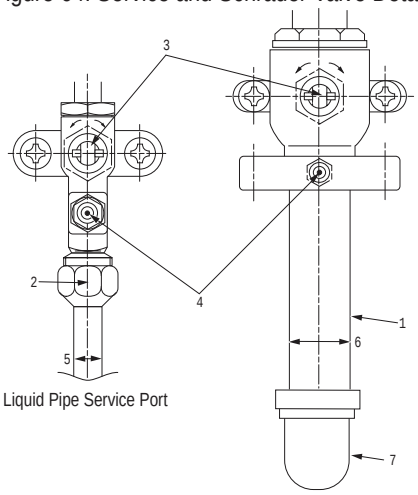
Figure 63: Heat Recovery Pipes and Service Ports.



Water Source Unit Service Valves

1. Field piping.
2. Flare nut.
3. Ball type service valves.
4. Schrader valves.
5. Liquid pipe.
6. Vapor pipe.
7. Field-supplied 90° elbow.

Figure 64: Service and Schrader Valve Detail.



Note:

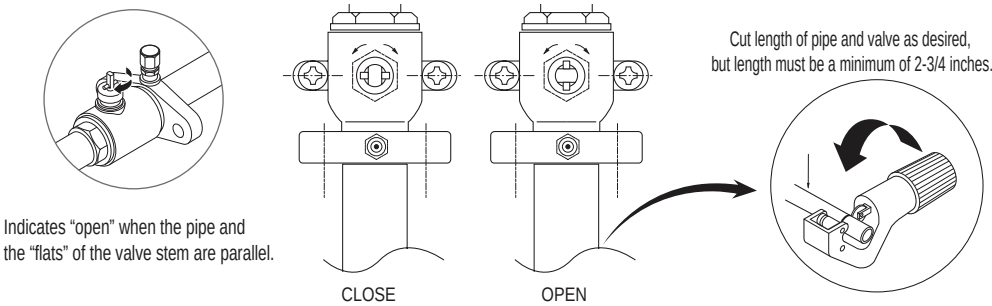
Do not expose the service valves of the water source unit to heat. Protect the service valve with a wet towel during brazing.

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).
3. Evacuate the system, and then charge the refrigerant using the Schrader valve. Reattach the Schrader valve cap after servicing is complete. (Tightening torque of service cap: =10.0 lb-ft).

- The unit ships with a factory charge of refrigerant. When connecting and brazing the vapor line, using a wet rag or cooling gel product to protect the service and Schrader valves from excessive heat.
- After connections are complete, verify that the service ports and caps are securely tightened to prevent leaking refrigerant gas.

Figure 65: Service Valves - Open and Closed Positions.



⚠WARNING

- *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 may break down and generate a poisonous gas. Never braze in a room that is not ventilated. After refrigerant piping work is complete, securely tighten both service and Schrader valves to help prevent refrigerant gas from leaking. Verify the system is free of leaks after refrigerant piping installation is complete.*
- *Do not attempt to remove service valve stem and packing or Schrader valve core. Physical injury or death may occur from uncontrolled rapid release of refrigerant.*

Note:

- *When connecting the refrigerant piping, make sure the service valves of the water source unit are completely closed (factory setting). Do not open the service 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, the system is evacuated, a leak test performed, and the Startup 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, this type of oil will create oil sludge leading to system malfunction.*
- *Use steel wool or comparable material to fill gaps between the unit case and the refrigerant and electrical connections to prevent rodent and animal entry.*

REFRIGERANT PIPING INSTALLATION

Refrigerant Pipe Connections

⚠ WARNING

- *Do not allow the refrigerant to leak during brazing; if the refrigerant combusts, it generates a toxic gas.*
- *Do not braze in an enclosed location*
- *Always test for gas leaks before / after brazing.*

Water Source Unit Pipe Connections

1. Do not use kinked pipe caused by excessive bending in one specific area on its length.
2. Braze the pipes to the service valve pipe stub of the water source unit.
3. After brazing, check for refrigerant gas leaks.
4. 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.

Creating a Flare Fitting

One of the main causes of refrigerant leaks is improper flared connections. Create flared connections using the procedure below.

1. Cut the pipe to length.

- Measure the distance between the indoor unit and the water source 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 and dimensions as detailed in Figure 32.
- If the flare is incorrect, cut it off and re-do procedure.
- If flare looks good, blow the pipe clean with dry nitrogen.

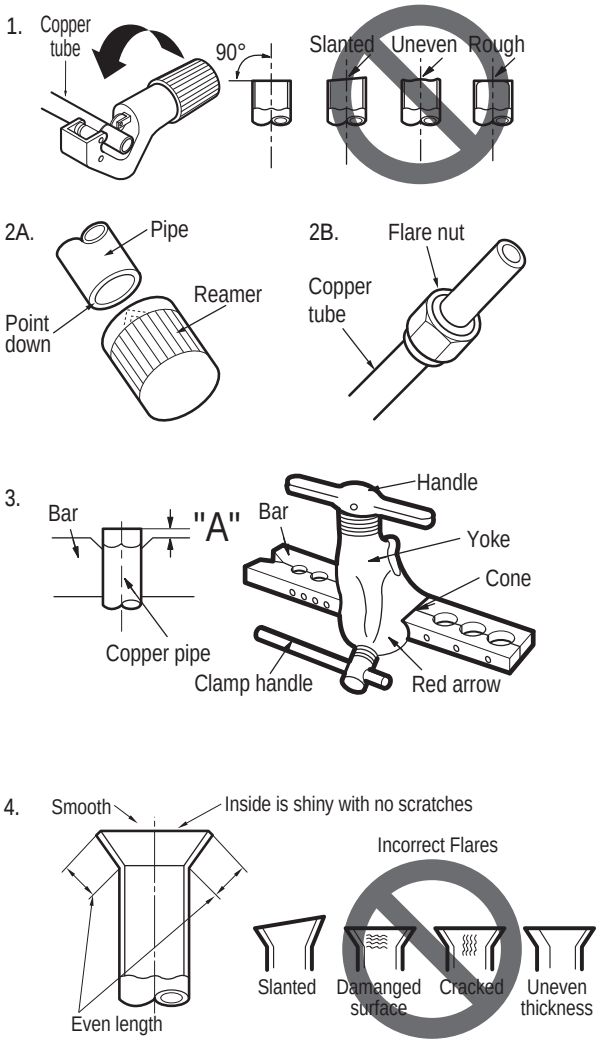


Figure 66:Dimensions of the Flare.

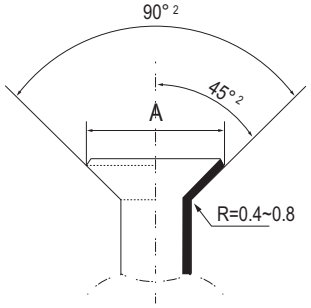


Table 60:Flared Connection Dimensions.

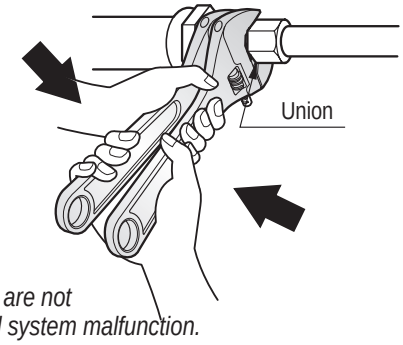
Indoor unit (Btu/h)	Pipe		"A"	
	Vapor (in. O.D.)	Liquid (in. O.D.)	Vapor (in.)	Liquid (in.)
≤19,100	1/2	1/4	5/8 ~ 11/16	7/16 ~ 1/2
<54,600	5/8	3/8	5/8 ~ 11/16	5/8 ~ 11/16
≤76,400	3/4	3/8	3/4 ~ 13/16	5/8 ~ 11/16

Tightening the Flare Nuts

Table 61:Tightening Torque for Flare Nuts.

Pipe size (Inches O.D.)	Tightening torque (ft-lbs)	Width of the flare (A [inches])
3/8Ø	24.1 - 29.4	1/2
1/2Ø	36.5 - 44.5	5/8
5/8Ø	45.5 - 55.6	3/4

Figure 67:Tightening the Flare Nuts.



Note:

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

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

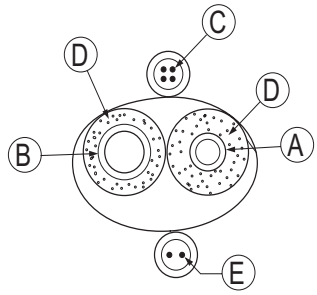
Loosening the Flare Nuts

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

Refrigerant Piping System Insulation

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" thick, and thickness may need to be increased based on ambient conditions and local codes. All refrigerant piping including Y-branch and Header connections, field-provided isolation ball valves, service valves, and elbows must be completely insulated using closed-cell pipe insulation. 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 direct sunlight and deterioration-producing elements must be properly protected with a PVC-aluminum vapor barrier jacket, or alternatively placed in a weather-resistant enclosure such as a pipe rack with a top cover. The design engineer should perform calculations to determine if the factory-supplied insulation jackets have sufficient thickness to meet local codes and to avoid sweating at jobsite conditions. Maximum refrigerant pipe temperature is 170°F; minimum refrigerant pipe temperature is -40°F. Add additional insulation if necessary.

Figure 68:Typical Pipe Insulation, Power Wire and Communications Cable Arrangement.



Ⓐ Liquid Pipe
Ⓑ Gas Pipe
Ⓒ Power Wiring
Ⓓ Insulation
Ⓔ Communication Cables

Figure 69:Typical Insulation Butt-Joint at Indoor Unit Casing.

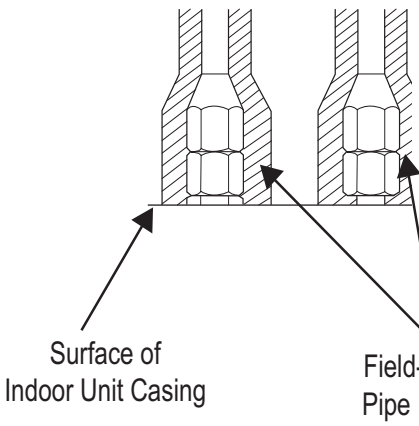
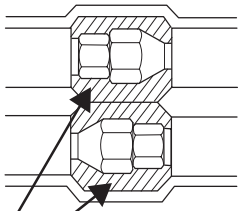


Figure 70:Typical Refrigerant Flare Fitting Insulation Detail.



REFRIGERANT PIPING INSTALLATION

Insulating the Refrigerant Piping

Note:

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.

Note:

Follow locals codes and the designer's instructions when selecting EPDM insulation wall thickness.

Table 62: Minimum Refrigerant Pipe EPDM Insulation Wall Thickness Requirements.[1]

<table>
<tr><th rowspan="2">Classification</th><th rowspan="2">Piping (in. OD)</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="3">Liquid pipe</td><td>1/4</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>3/8</td></tr>
<tr><td>1/2</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>3/8</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>1/2</td></tr>
<tr><td>5/8</td></tr>
<tr><td>3/4</td></tr>
<tr><td>7/8</td></tr>
<tr><td>1</td></tr>
<tr><td>1-1/8</td><td rowspan="5">≥3/4 inches</td></tr>
<tr><td>1-1/4</td><td rowspan="5">≥1 inch</td><td rowspan="5">≥1 inch</td></tr>
<tr><td>1-3/8</td></tr>
<tr><td>1-1/2</td></tr>
<tr><td>1-3/4</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 May 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 ethylene propylene diene methylene (EPDM) insulation that is plenum-rated with a heat-resistance factor of more than 158°F.

Applying Insulation to Y-Branch and Header Fittings

Check the fit of the insulation jacket provided with the LG Y-branch and Header kits after all pipes are brazed to fittings. Mark all pipes at the point where the insulation jacket ends. Remove the 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 clam-shell jacket over the fitting.

Figure 73:Y-Branch Insulation.

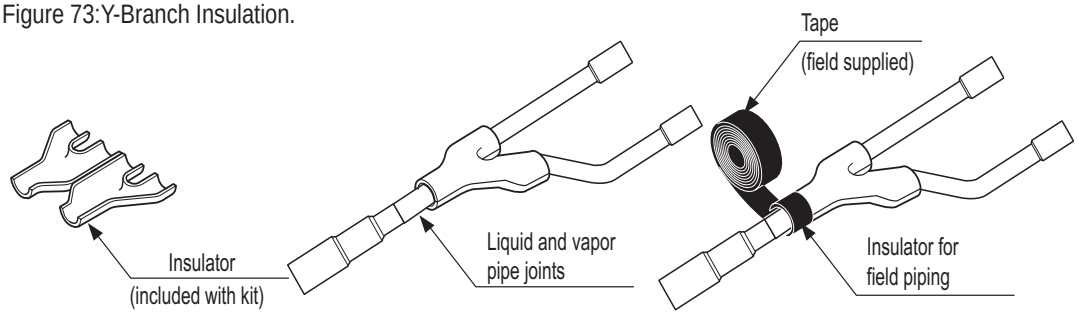


Figure 74:Header Insulation.

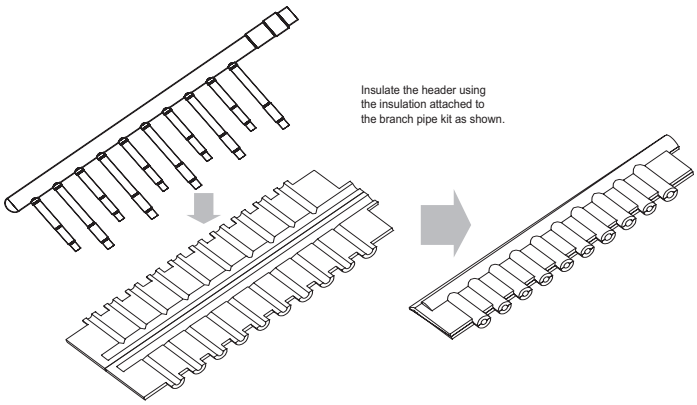


Figure 71:Joints between branch and pipe should be sealed with tape included in each kit.

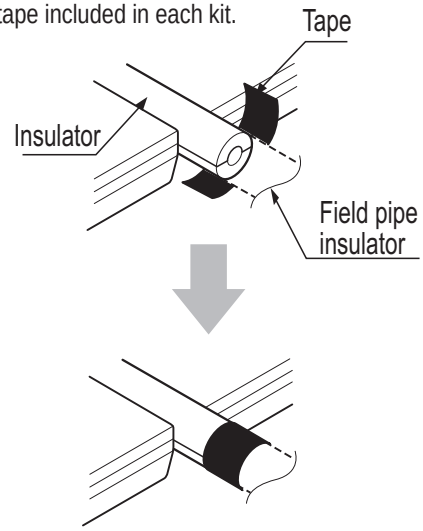
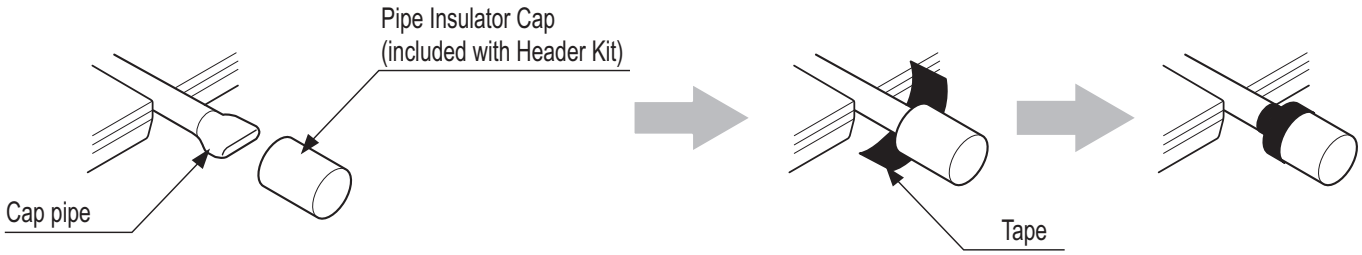


Figure 72:Cap pipes should be insulated using the insulator included in each kit, and then taped as shown.



Note:

Additional Insulation for Y-Branches and Headers May 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.

REFRIGERANT PIPING INSTALLATION

Pressure (Leak) Testing

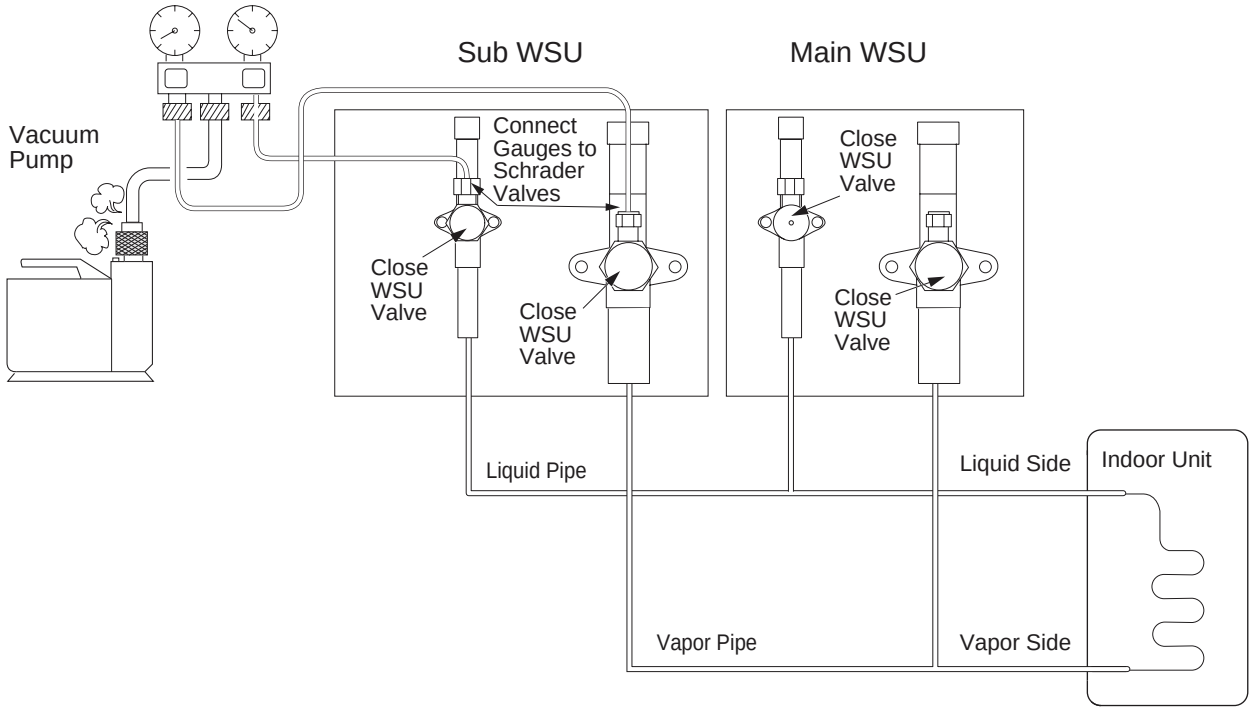
Perform a Pressure (Leak) Test

Note:

Do not apply power during this test. If power has been applied to any device before the pressure test, contact your LG Applied Rep champion or service technician for the procedure to reopen the EEV valves.

1. Upon completion of refrigerant piping system installation, open all isolation ball valves throughout the piping system.
2. DO NOT apply power to the Water Source and Indoor Units. If power is applied, expansion valves close and the pressure test will not be conclusive.
3. DO NOT open the water source unit service valves; the factory refrigerant charge will be released.
4. Use medical grade dry nitrogen and pressure test the refrigerant piping system to a minimum of 550 psi for a period of 24 hours. Pressurize the liquid, low pressure vapor, and high pressure vapor (heat recovery systems only) concurrently.

Heat Pump Pressure Test



⚠WARNING

During pressurization, the nitrogen gas cylinder must be positioned vertically to prevent the nitrogen from entering the refrigeration system in its liquid state. Do not position the nitrogen cylinder on its side.

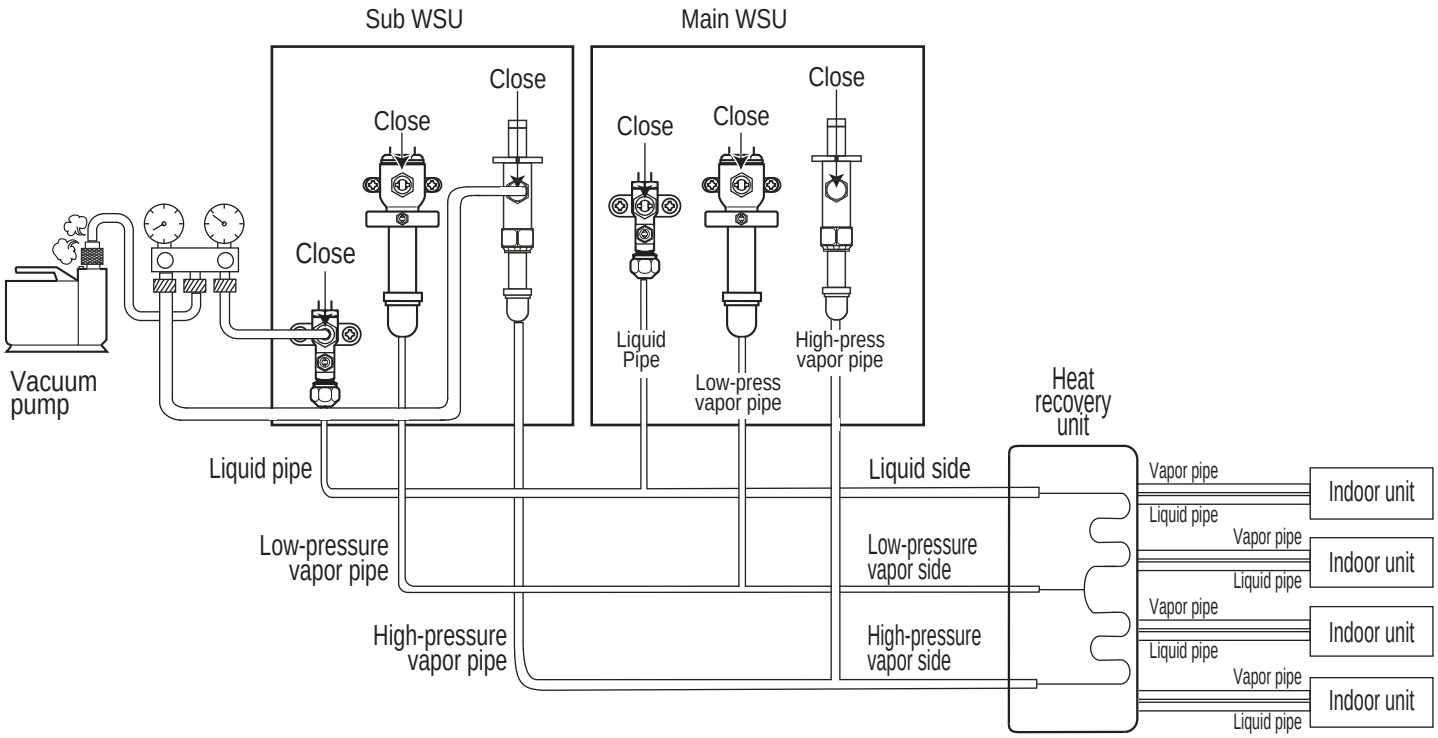
Note:

If the ambient temperature changes between the time when pressure was applied and when the pressure drop is checked, adjust results by factoring in approximately 1.45 psi for each 2°F of temperature difference.

Correction formula = (Temperature when pressure was applied – Temperature when pressure drop is checked) x 0.01.

Example: When pressure (550 psig) was applied, ambient temperature was 80.6°F; 24 hours later when pressure drop (540 psi) was checked, ambient temperature is 68°F. Thus, (80.6 - 68) x 0.01 = 0.126. In this case, the pressure drop of 0.126 is due to temperature difference; therefore, there is no leak in the refrigerant piping system.

Heat Recovery Pressure Test



⚠WARNING

During pressurization, the nitrogen gas cylinder must be positioned vertically to prevent the nitrogen from entering the refrigeration system in its liquid state. Do not position the nitrogen cylinder on its side.

Note:

If the ambient temperature changes between the time when pressure was applied and when the pressure drop is checked, adjust results by factoring in approximately 1.45 psi for each 2°F of temperature difference.

Correction formula = (Temperature when pressure was applied – Temperature when pressure drop is checked) x 0.01.

Example: When pressure (550 psig) was applied, ambient temperature was 80.6°F; 24 hours later when pressure drop (540 psi) is checked, ambient temperature is 68°F. Thus, (80.6 - 68) x 0.01 = 0.126. In this case, the pressure drop of 0.126 is due to temperature difference; therefore, there is no leak in the refrigerant piping system.

Disclaimer: The discussion points provided in this section of the manual are not to be considered a complete or exhaustive design guide. Use this information for concept and general reference only. Use publications available from ASHRAE® for design guidance. Final installed designs must be provided by an experienced licensed professional engineer.

Note: References to third-party devices by make and model are used in this document for illustrative purposes. LG does not warrant any third-party brand or model referenced for any reason including but not limited to quality, merchantability and/or fitness for purpose. LG is NOT responsible for the selection of any third-party product installed using this guide. Refer to the third party product selected for pertinent manufacturers' documentation for, but not limited to, proper sizing, material selection, installation guidance, startup, warranty terms and conditions and post purchase support.

Fluid Loop Pipe Design

Best Practice: Reverse Return Piping

To minimize the differences in pressure drop through the heat exchanger of each frame in a multi-frame installation, best practice would be to employ a reverse return strategy See Figure 78 for a diagram that depicts a reverse return pipe system.

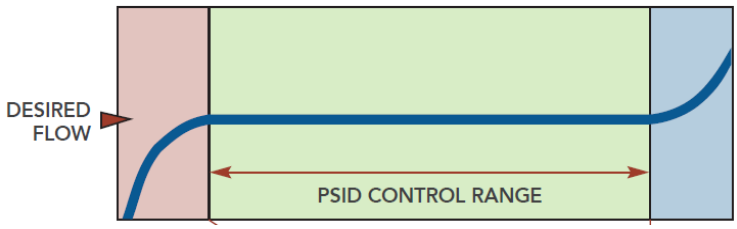
Volume of fluid in circulation must be sufficient to compensate for thermal variations occurring along the distribution piping Think through the dynamics of heat absorbing and heat rejecting devices connected to the fluid loop, loading, unloading, starting and stopping. Add closed cell fluid storage tanks if necessary to increase fluid system volume to dampen the rate of temperature change.

Maintain a Stable Fluid Flow Rate

Know the design allowable pressure drop range of the automatic flow limiting valve or pressure independent control valve selected. The stability of the Multi V Water 5 refrigeration cycle is partially dependent on the stability of the rate of fluid flow through the heat exchanger of the Multi V Water 5 frame. Each frame is designed to operate with a constant volume of fluid passing through the heat exchanger that does not exceed the rated flow. To achieve a stable fluid flow rate while pressure fluctuations occur in the fluid distribution system, specify and install pressure independent self-adjusting balancing valves or control valves.

All manufacturers of pressure independent balancing and control valves publish an acceptable differential pressure range across the device in which the device functions properly. (See Figure 75). The minimum pressure drop through the flow control valve must be larger than the combined pressure drop of the heat exchanger and all components of the pipe system including the strainer up to the entrance of the pressure independent balancing or control valve.

Figure 75: Pressure Independent Flow Limiting and Control Valves Maintain Rated Flow at a Predetermined Differential Pressure.



Pay attention to the minimum acceptable pressure difference through the automatically flow limiting valve or pressure independent control valve when throttling pumps. the minimum pressure drop through the flow limiting valve must be maintained. Typically 5 PSID.

Open Tower Systems Require Intermediary Heat Exchanger

If open cooling towers or loop fluid is exposed to the atmosphere by any other means, an intermediate heat exchanger MUST BE added to protect the water source unit from contaminants and debris in the fluid system and isolate the refrigerant to water heat exchanger from the fluid exposed to atmosphere.

Does Heat Need To Be Purged From The Fluid Loop?

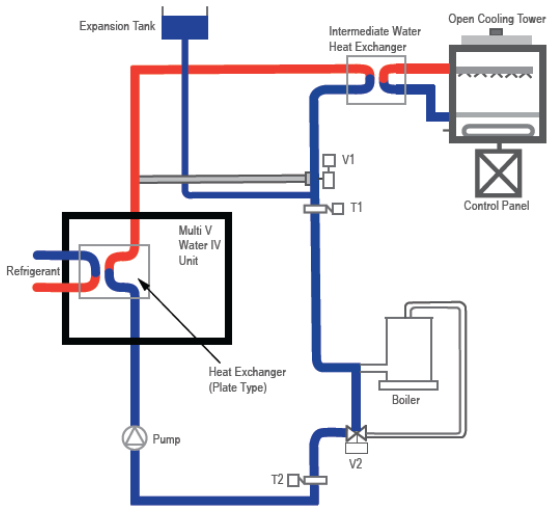
An LG air-cooled heat-pump chiller, cooling tower, dry cooler, or geothermal field may be required to remove heat from the fluid loop during the peak cooling season. Using load calculation software, determine which day/hour of the year has the highest block cooling load. To estimate the heat rejected to the fluid loop by equipment using a refrigeration cycle, calculate the block load of the building and add 22%. This will provide a rough estimate of the total amount of heat that will need to be eliminated by the heat purge equipment.

Does The Project Need Heat Added To The Fluid Loop?

A supplemental heat source, such as an air-cooled heat pump chiller, boiler, or solar water heater may be needed to provide supplemental heat to the fluid loop during heating operation. Calculate the worst case block heating load for all the occupied spaces served by the Multi V

Water 5 VRF units, add to this the calculated value of heat energy consumed by any ancillary heating devices. For example sidewalk and driveway snow melt systems, process equipment, hydronic pre-heat coils or reheat coils in central station air handlers , dedicated outdoor air system (DOAS) equipment, domestic water heating equipment. If any connected devices reject heat to the fluid loop while the Multi V Water 5 units are in heating mode, then add the total heat of rejection from these devices as a credit to this calculation. If the calculation demonstrates additional heat is necessary, plan for it.

Figure 76: Intermediary HEX.



Multi V Water 5 Heat Exchanger Fluid Flow Control

Hydronic Components Required – ALL Installations

The piping components and control instrumentation required at each Multi V Water 5 frame will vary based on; 1) VRF system type (heat pump or heat recovery); 2) system configuration (single or multi frame); 3) the minimum design entering fluid temperature; 4) the desired method of fluid flow control.

PER FRAME Required

1. Two (2) manual or optionally (2) two-position motorized shutoff valves to isolate the frame from the building fluid loop.
2. One (1) properly sized and installed flow switch or differential pressure switch.
3. Two (2) combination pressure/temperature port (or gauges) on the heat exchanger supply and return pipes.
4. One (1) 50 MESH strainer on the supply pipe for each frame (Figure 77, Figure 79, Figure 80) OR, at the installers option, provide (1) upsized 50 MESH strainer to serve all frames of a multi-frame model (Figure 78).
5. One (1) 0-20 PSIG differential pressure gauge (or ports to read differential pressure) across the strainer.
6. Two (2) pressure/temperature ports (or pressure gauges) one mounted either side of the balancing valve or control valve IF the valve installed does not have integral ports.
7. A device that prevents galvanic corrosion, such as a dielectric union, separating each connection between ferrous and non-ferrous sections of pipe.
8. Two (2) unions located near the heat exchanger one each on the fluid inlet and outlet arranged to allow for easy removal of the heat exchanger without the disassembly of any of the pipe system(s) serving the Multi V Water 5 frame.
9. Air vent(s) with plug(s) as necessary on the pipe system, typically at the heat exchanger or at the highest elevation of the pipe segment to allow complete removal of air pockets in pipe system.
10. One (1) drain tee with plug at the heat exchanger or in the pipe segment at the lowest elevation.

Additional Component Requirements are determined by Entering Water Temperature

1. Entering Fluid Temperature ≥ 60˚F
2. Entering Fluid Temperature ≥50˚F and <60˚F
3. Entering Fluid Temperature ≤ 50˚F

Additional component requirements are different for Multi V Water 5 applications and are primarily defined based on the minimum entering fluid temperature to the heat exchanger. Each application defines; 1) required Multi V Water 5 frame function code setting adjustments; 2) anti-freeze requirement 3) additional required components to those included in the list in section *Per Frame Required* items 1-10 above; 4) Multi V Water 5 fluid flow control sequence of operation during thermal on cooling and heating operation 5) piping diagram(s) depicting the placement of the components for each application.

Table 63:Hydronic Accessory Checklist Matrix by Application ID

EFT	Application ID	Flow Switch	#50 Strainer	Isolation valves	Motorized Isolation valves	Strainer PD gauge	Drain cock	Unions on Heat exchanger	Dielectrci Union dissimilar metal	Air Vent	P/T Port HEX Supply	P/T Port HEX Return	Flex Pipes at HEX	Auto Flow Control valve	Variable Water Flow Control Kit	PI 2-Way Control Valve	3-Way Control Valve	Method to measure PD across control valve	Bypass Pump	Pump Bypass Pipe	Hex Bypass Pipe	Pump Discharge Check Valve
≥ 60˚F	1	Yes	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Optional	Yes	Optional	Optional	No	Optional	No	No	No	No
< 60˚F ≥ 50˚F	2	Yes	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Optional	No	Yes	Yes	No	Yes	No	No	No	No
< 50˚F	3	Yes	Yes	Yes	Optional	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Optional	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes

WATER CIRCUIT INSTALLATION

Water Circuit Design

Application 1: Entering Fluid Temperature (EFT) ≥ 60˚F

See Figure 77 and Figure 78. Considering the hydronic system component requirements, a design that maintains a fluid temperature ≥ 60˚F is the most cost effective easiest-to-install and maintain. The fluid flow through each frame's heat exchanger remains constant at rated flow condition throughout the year. If the localized pressure varies in the building fluid loop, the automatic flow limiting valve (balancing valve) at each frame or model regulates the localized flow rate to maintain rated flow condition through each frame's heat exchanger.

Function Code Setting:

- FN40 is Off - Entering Fluid temperature >50F
- FN41 Set to Off - Neither a bypass pump or motorized isolation valves are wired to Terminals 1(L) and 2(N)
- FN42 Set to OFF - VFC Kit not installed
- FNXX: Pump type selection is system pump (Default)

Anti-freeze required: No

Flow Modulation

- Through the heat exchanger : Constant Flow
- From/to the building fluid loop: Constant Flow

Additional required components provided by others with EFT ≥ 60˚F

Heat Pump and Heat Recovery applications

- Single Frame Models: Include an automatic flow limiting pressure independent balancing valve shown in Figure 77.
- Multi-Frame Models: Select #1 or #2.

1. Include an automatic flow limiting pressure independent balancing valve for each frame shown in Figure 78.
2. On each frame, install (1) manual balancing valve set for rated flow condition. Route the piping to the frames in a reverse return configuration. Install (1) an automatic flow limiting pressure independent balancing valve in the common return pipe sized for the combined rated flow of all frames of the multi-frame model shown in Figure 78.

Hydronic fluid control sequence of operation EFT ≥ 60˚F

Cooling cycle operation: Upon a call for a compressor start, terminals 1(L) and 2(N) are energized with 220/60/1 power. 460 volt frames will provide ~220v volt power. These terminals can serve up to a 500 VA load and are provided to power optional two-position motorized isolation valves. If 220-volt motorized isolation valves are installed, they will open allowing heat exchanger fluid flow to begin. Following a delay of 30 seconds after the call for a compressor start, and after the flow switch closes making the circuit between terminals 5(A) and 6(B) proving the flow rate through the hex has achieved a minimum of 90% of rated flow, the compressor will start. When the measured compressor head (high) pressure is above (or below) the target value set by the control algorithm, the onboard logic will modulate the volume of refrigerant

Figure 77: Entering Fluid Temperature ≥ 60°F - Heat Pump and Heat Recovery, Single and Multi-Frame Models

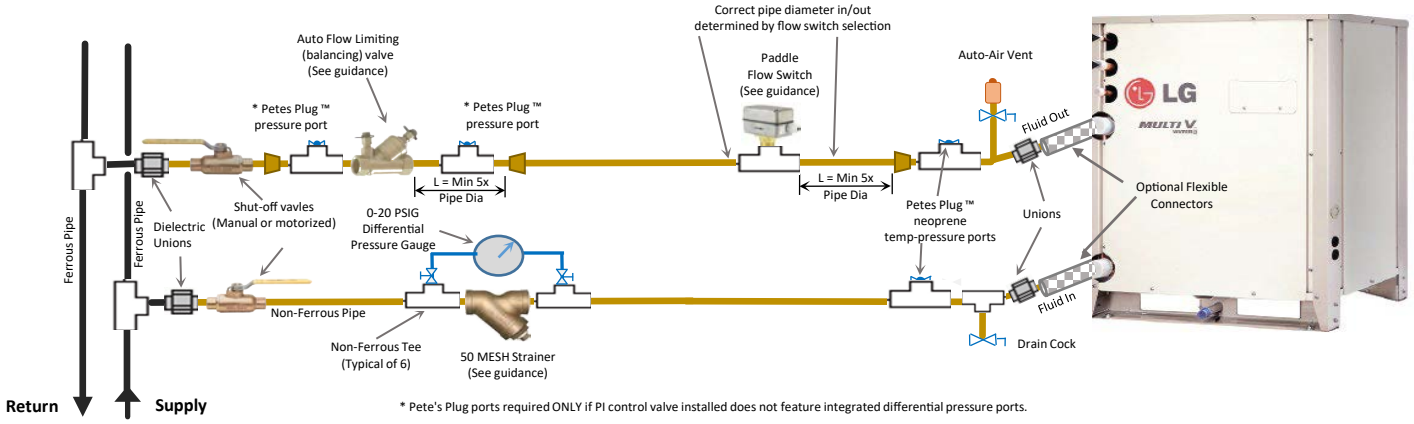
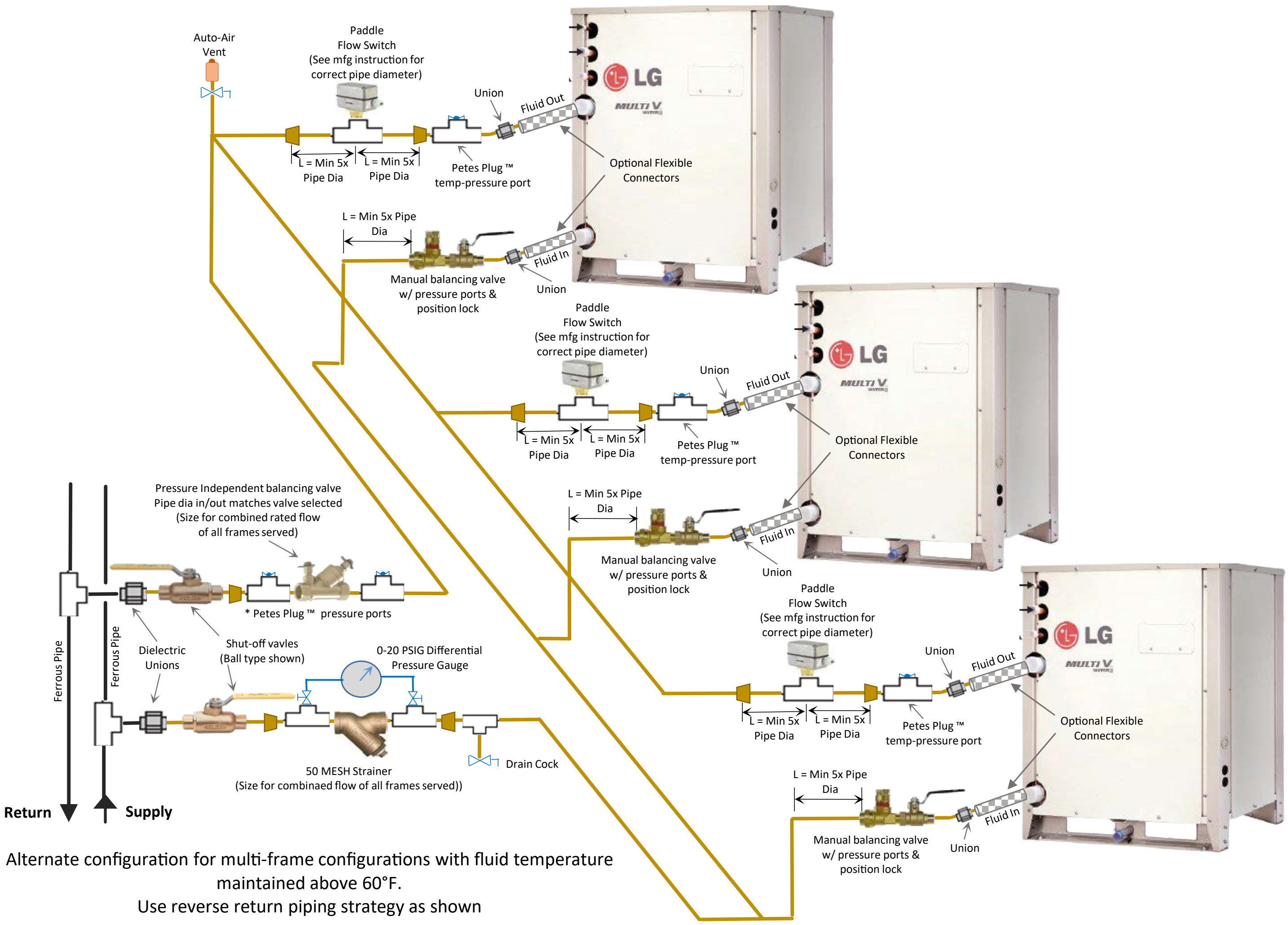


Figure 78: Entering Fluid Temperature ≥ 60°F - Option for Heat Pump Multi-Frame Models



flowing through the heat exchanger, or modify the speed of the compressor, or both. When the load is satisfied the microprocessor will call for the compressor to shut down. Compressor will ramp down speed and shutoff. Once off, the voltage to terminals 1(L) and 2(N) will cease. If motorized fluid flow isolation valves are installed, they will close and stop fluid flow to the heat exchanger. See Figure 77 and Figure 78.

Heating cycle operation: Upon a call for a compressor start, terminals 1(L) and 2(N) are energized with 220/60/1 power. 460 volt frames will provide 220 volt power. These terminals can serve up to a 500 VA load and are provided to power optional two-position 220 volt motorized isolation valves. If 220 volt motorized isolation valves are installed, they will open allowing heat exchanger fluid flow to begin. Following a delay of 30 seconds after the call for a compressor start, and after the flow switch closes making the circuit between terminals 5(A) and 6(B) proving the flow rate through the hex has achieved a minimum of 90% of rated flow, the compressor will start. When the measured compressor head (high) pressure is above (or below) the target value set by the control algorithm, the onboard logic will modulate the volume of refrigerant flowing through the heat exchanger, or modify the speed of the compressor, or both. When the load is satisfied the microprocessor will call for the compressor to shut down. Compressor will ramp down speed and shutoff. Once off, the voltage to terminals 1(L) and 2(N) will cease. If motorized fluid flow isolation valves are installed, they will close and stop fluid flow to the heat exchanger. See Figure 77 and Figure 78.

Application #2: Entering Fluid Temperature ≥50˚F and <60˚F

See Figure 79. When the fluid temperature is less than 60˚F, there is an opportunity to save pumping energy by modulating the fluid flow through the heat exchanger while the refrigerant cycle controls head pressure. LG requires a pressure independent control valve or a pressure dependent control valve in conjunction with an automatic flow control valve (balancing valve) to maintain the maximum flow through the heat exchanger at rated flow condition as localized pressure varies in the building fluid loop.

Function Code settings:

- FN40 is Off - Entering Fluid temperature >50F
- FN41 Set to Off - Neither a bypass pump or motorized isolation valves are wired to Terminals 1(L) and 2(N)
- FN42 Set to ON - Variable Flow Control (VWFC) Kit installed
- FNXX: Pump type selection is system pump (Default)

Anti-freeze required: No

Flow Modulation

- Through the heat exchanger : Variable Flow 100% to 40%
- From/to the building fluid loop: Variable Flow 100% to 40%

Additional required components provided by others with EFT ≥ 50˚F and < 60˚F

For all Heat Recovery and Heat Pump installations, select one of the following and apply to each frame.

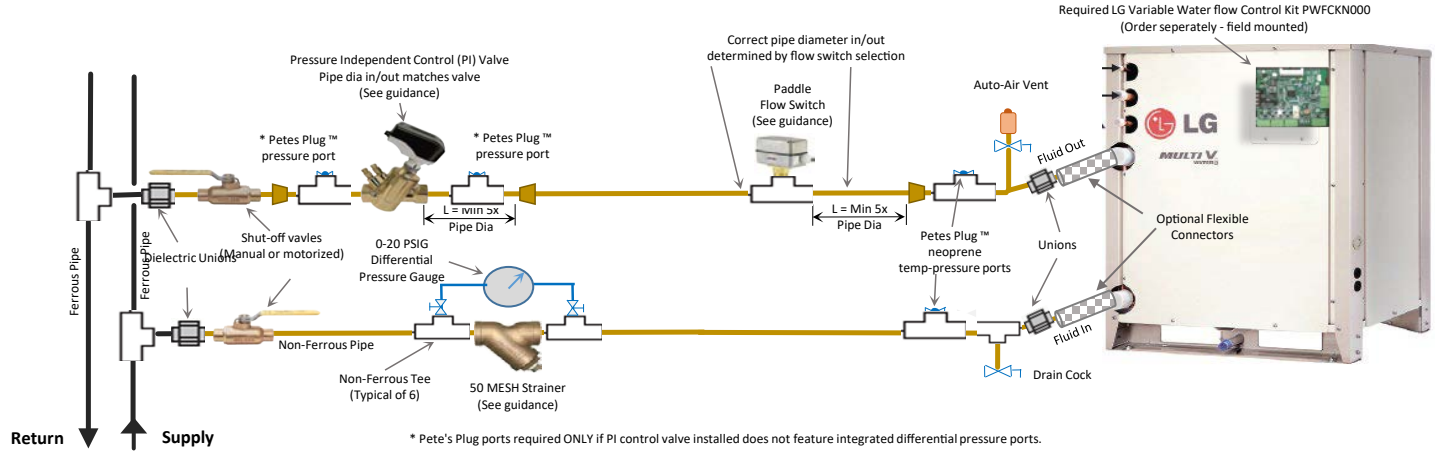
1. (1) LG Variable Water Flow Kit (PN PWFCKN000) with (1) pressure independent two-way control valve shown in Figure 79.
   Note: On applications with an entering fluid temperature ≥ 60˚F, the pressure independent control valve and variable fluid flow control kit is not required but may be applied if desired.
2. (1) LG Variable Water Flow Kit (PN PWFCKN000) with (1) pressure *dependent* two-way control valve in conjunction with an automatic flow limiting balancing valve (not shown).

Hydronic Fluid Control Sequence Of Operation EFT ≥ 50˚F and < 60˚F

Cooling cycle operation: Upon a call for a compressor start, terminals 1(L) and 2(N) are energized with ~220/60/1 power. 460 volt frames will provide ~220 volt power. These terminals can serve up to a 500 VA load and are provided to power optional two-position 220-volt motorized isolation valves. If motorized isolation valves are installed, they will open allowing fluid flow to begin. The VWFC kit will provide 24 volts to power the operator and a variable 2-10 volt control signal initially set at 5 volts to set the valve position at 50% open. Following a delay of 30 seconds after the call for a compressor start, and after the flow switch closes proving flow has reached 48% rated condition the circuit between terminals 5(A) and 6(B) will close and the compressor will start. When the measured compressor head (high) pressure is above (or below) the target value set by the control algorithm, the onboard logic will modulate the position of the control valve. If the control valve is either fully open or at the required minimum 40% flow position and further refrigerant cycle pressure adjustment in necessary, the control logic may vary the volume of refrigerant flowing through the heat exchanger, or modify the speed of the compressor, or both. In the case where the head pressure is above the target, the voltage value to the valve will increase and fluid flow from/to the building fluid circuit will rise. When the head pressure is below target, the voltage value will decrease and fluid flow from/to the building fluid circuit will be reduced. When the load is satisfied the microprocessor will call for the compressor to shut down. Compressor(s) will ramp down speed and eventually shutoff and the VWFC kit will modulate the valve to 40% open. Once off, the VWFC kit will close the two way valve, and the voltage to terminals 1(L) and 2(N) will cease. If 220-volt motorized fluid flow isolation valves are installed, they will close and stop fluid flow to the heat exchanger. See Figure 79.

Heating cycle operation: Upon a call for a compressor start, terminals 1(L) and 2(N) are energized with ~220/60/1 power. 460 volt frames will provide ~220 volt power. These terminals can serve up to a 500 VA load and are provided to power optional two-position 220-volt motorized isolation valves. If motorized isolation valves are installed, they will open allowing fluid flow to begin. The VWFC kit will provide 24 volts to power the operator and a variable 2-10 volt control signal initially set at 5 volts to the control valve actuator moving the valve position to 50% open. Following a delay of 30 seconds after the call for a compressor start, and after the flow switch closes proving flow has reached 48% rated condition the circuit between terminals 5(A) and 6(B) will close and the compressor will start. The VWFC kit will begin monitoring the compressor suction pressure. When the measured compressor suction (low) pressure is above the target, the voltage value to the valve will decrease and fluid flow from/to the building fluid circuit will be reduced. When the compressor suction (low) pressure is below target, the voltage value will increase and fluid flow from/to the building fluid circuit will rise. In applications with the entering fluid temperature less than 60F, the VWFC kit will position the control valve 100% open. When the load is satisfied, the microprocessor will call for the compressor to shut down. Compressor(s) will ramp down speed and eventually shutoff. Once off, the VWFC kit will close the two way valve, and the voltage to terminals 1(L) and 2(N) will cease. If 220-volt motorized fluid flow isolation valves are installed, they will close and stop fluid flow to the heat exchanger. See Figure 79.

Figure 79: EWT ≥ 50F and < 60F (optional for EWT ≥ 60F) - Heat Pump and Heat Recovery, Single and Multi-Frame Models



Application #3: Entering Fluid Temperature < 50˚F

See Figure 80. When the frame is operating in heating mode, following completion of an initial startup (about two-minutes), the variable flow control kit will maintain the control valve position at 100% open. There will not be fluid flow through the bypass.

Note: If the application is HEATING ONLY (cooling operation will be locked out) installation of the bypass pipe and pump is not necessary. Use Figure 1 pipe diagram for installation guidance in HEATING ONLY applications with EWT < 60F.

For all heat pump and heat recovery applications where cooling may be required and the entering fluid temperature is less than 50F, and the cooling load on the system is large enough to require a mode change of the reversing valve to begin cooling operation or a frame start in cooling mode occurs, and the building's cooling load remains low, the rate of heat exchange in the refrigerant-to-water heat exchanger must be reduced to maintain an efficiently operating refrigeration cycle operation. The onboard control logic of the Multi V Water 5 frame will reduce the flow rate through the heat exchanger using the variable water flow control kit down to the minimum required 40% of rated flow. When the entering fluid temperature is excessively low, the minimum required 40% may result in excessive heat transfer. This may occur in single frame installations, but may be more prevalent on larger capacity multi-frame models. To meet this challenge, the LG Multi V Water 5 refrigeration cycle control algorithm allows one or more frames in a multi-frame heat recovery models to operate, when necessary, in the opposite mode of the dominant mode at any given time. The benefit being increased refrigerant cycle operating efficiency, cycle stability, and a significant increase in ability to turn down during lightly loaded (opposite mode) operation. Since Multi V Water 5 heat recovery system frames may be operating in either heating or cooling mode at any given time, every frame must be provided independent fluid flow control apparatus.

Methods that may be employed to warm the entering fluid while operating in cooling mode:

1. The most cost effective, however least efficient, solution would be to install a third party submersible heater in the fluid pipe providing fluid to the Multi V Water 5 frame. Control the heater capacity using an SCR controller connect to a fluid temperature sensor monitoring the entering fluid. Set the control to maintain a target temperature e above 50˚F with an acceptable dead band to minimize unnecessary on/off cycling of the heating device control. Since this option is not energy efficient, it will not be explored further.
2. The most energy efficient option is to provide a pump and a bypass pipe to "recirculate" the warmer fluid leaving the heat exchanger back to the inlet. See Figure 80.

WATER CIRCUIT INSTALLATION

Water Circuit Design

Bypass Fluid Flow Concept

The variable flow control kit (VWFC) modulates the position of a 3-way control valve. Install three-way valves using a diverting configuration. Verify the 100% linear flow is path is to the building return and the reduced flow path is to the bypass pipe referencing the valve manufacturer's literature. When installed using the diverting configuration, at any time the 3-way valve position is less than 100% open, the fluid flow returning to the building is reduced below the rated flow rate, and fluid flow through the bypass will increase. If the valve installed is engineered to provide proportional flow between the common port and the port that is 90 degrees to the direction of flow entering the valve, the flow rate through the heat exchanger could be reduced but should remain at 80% or more at all times.

As the warmed bypass fluid mixes with the supply fluid from the building, the temperature of the fluid entering the heat exchanger will begin to rise. Since the bypass pump maintains the fluid flow rate through the heat exchanger using either bypassed fluid or fluid from the building, this installation strategy allows the flow rate from the building to be modulated down to zero, eliminating the need to maintain a minimum 40% flow rate when the bypass and pump are not present. The actual position of the 3-way valve is set by the variable flow control kit based on refrigerant cycle head pressure. Using the bypass configuration, irrelevant of the of the fluid supplied from the building, the resulting temperature of the fluid entering the heat exchanger will self-adjust over time to a temperature that satisfies the needs of the refrigeration cycle operating in cooling mode. Variable speed pump applications are being researched, but are not ready for general use. Currently LG supports the use of constant speed pump. If another method of flow control is desired, contact LG Applications Engineering team to discuss.

Function Code settings:

- FN40 Set for low fluid temperature operation
- FN41 Set to ON - 220 volt motorized isolation valves and/or bypass pump powered using terminals 1(L) and 2(N)
- FN42 Set to ON - VWFC Kit installed
- FNXX*: Pump type selection is bypass pump*

**NOTE: If the 7-segment display does not offer a function code that allows the choice between pump types, DO NOT Start the product without a firmware upgrade. Contact your LG After Market Technical Specialists.*

Anti-freeze required:

- Yes
- If the design entering fluid temperature is ≥ 35˚F, use a minimum of 35% propylene glycol (by weight.)
- For designs with an entering fluid temperature ≤ 35 ˚F, use a minimum concentration of 40% propylene glycol (by weight.).

Flow Modulation

- Through the heat exchanger : Generally constant at 100% of rated flow, down to 80% acceptable
- From/to the building fluid loop: Variable Flow 0% to 100% of rated flow

Additional required components provided by others with EFT ≤ 50 ˚F

For all Heat Recovery and Heat Pump models, apply all of the following to each frame: (Figure 80)

(1) LG Variable Water Flow Kit.

(1) Pressure dependent three-way control valve

(1) Automatic flow limiting balancing valve.

(1) Heat exchanger bypass pipe.

(1) Constant volume recirculating pump.

(1) Recirculating pump bypass pipe.

(1) 2-position motorized shutoff valve in the pump bypass pipe (voltage selected dependent on pump mfg aux relay options selected).

(1) Check valve - discharge of the bypass pump.

Hydronic fluid control sequence of operation EFT < 50˚F

NOTE: Units manufactured before June 1, 2023 may require a firmware upgrade prior to startup for this sequence to function. Contact your LG Aftermarket Technical Specialists before attempting to operate the Multi V Water 5 without confirming firmware installed is acceptable for this application.

Multi V Water 5 Frame – Three-Way Valve with Constant Speed Pump

Cooling cycle operation: Upon a thermal on request from an IDU, terminals 1(L) and 2(N) are energized with 220v/60/1 power. 460-volt frames will also provide ~220 volt power. These terminals can serve up to 500 VA load and are provided to power optional field provided motorized 220-volt isolation valves and 220-volt recirculation pump if the amperes of the combined connected total is ≤ 500 VA.

Note: This sequence assumes the constant volume, on/off controlled recirculation pump and optional two-way motorized 220-volt isolation valves are powered using Terminal 1(L) and 2(N). The pump start/ stop circuit is controlled using terminals 3(L) and 4(N), The circulating pump is installed in the pipe connecting the heat exchanger outlet to the three-way control valve inlet as shown in Figure 80. If the combination of the pump and control valve operator(s) power draw exceeds 500VA, provide a separate source of power for the bypass pump and a field provided pilot relay connected to terminals (1(L) and 2(N). Provide fusing between the pump and the terminals as well as the optional isolation valves and the terminals. Fuse size for any single connected component cannot exceed 2.2 amperes @ 220v.

If motorized 220-volt two-position isolation valves are installed, the isolation valve operators shall open and fluid flow between the building and the frame will commence. After a delay of approximately 30 seconds following a thermal on request from an IDU, or following the completion of a reversing valve position changeover, Multi V Water 5 closes the circuit between Terminals 3(L) and 4(N) starting the pump. Simultaneously, the variable flow control kit provides 24 volts to power the 3-way valve operator and a variable 2-10 volt control signal initially set at 5-volts, setting the 3-way valve position at 50% of stroke.

The normally open pump bypass valve operator is wired to the pump auxiliary contactor. When the pump starts, the auxiliary contactor on the pump is energized closing the normally open bypass pump valve stopping the flow of fluid through the pump bypass pipe. The bypass valve operator's auxiliary contact (end switch) (or variable 2-10 volt signal) whichever is the case will provide a feedback signal to confirm the valve is closed.

Note: If confirmation from the end switch is not received within 90 seconds (adjust the time delay period for valve operator end to end stroke time) of a pump start, the time delay relay will stop the pump and the pump auxiliary contact will open. The bypass valve operator will be de-energized stroking the valve to the open position. If the valve operator fails, the fail-open spring of the valve operator will return the bypass valve to the open position.

After the pump starts, Multi V Water 5 is seeking flow confirmation by monitoring the circuit between terminals 5(L) and 6(N). When the flow switch closes confirming a minimum of 90% of rated flow is present (see Table 65 for flow switch setting specifications), the circuit between terminal 5(L) and 6(N) is completed. If the flow leaving the heat exchanger falls below 80% of rated flow, the flow switch will open.

Note: when the flow switch opens signaling loss of flow, error code CH189 will be displayed on the Multi V Water 5 seven-segment display.

Upon flow confirmation, the compressor begins a soft-start and ramps up to a warm-up speed of approximately 30 Hz. After approximately two minutes the main controller adjusts the compressor speed and modulates the position of the 3-way valve in response the variable voltage signal provided by the variable flow control kit (VWFC).

The VWFC kit adjusts valve position to maintain compressor head pressure. When the measured compressor head (high) pressure is above the target, the voltage value sent by the VWFC kit to the 3-way valve will increase, fluid flow from/ to the building fluid circuit will rise, and the volume of fluid flowing through the bypass pipe will decrease. When the compressor head (high) pressure is below target, the voltage value from the VWFC kit to the 3-way control valve will decrease, fluid flow from/to the building fluid circuit will be reduced, and the volume of fluid passing through the bypass will increase.

When the building cooling load decreases, the microprocessor instructs the compressor to slow down. When the compressor in the frame has stopped running, the control voltage signal from the VWFC kit will be reduced to zero (0) volts and the valve position will be 100% open between the heat exchanger and the building return with no flow through the bypass. The dry contact closure between Terminals 3(L) and 4(N) will open, opening the pump auxiliary contact de-energizing the pump operation and pump bypass valve operator. Simultaneously, 220-volt power to terminals 1(L), 2(N) will cease, closing the optional 220-volt isolation valves and de-energizing the pump.

Heating Cycle Operation: Upon a thermal on request from an IDU, terminals 1(L) and 2(N) are energized with 220v/60/1 power. 460-volt frames will also provide ~220 volt power. These terminals can serve up to 500 VA load and are provided to power optional field provided 220-volt motorized isolation valves and recirculation pump if the amperes of the connected total is ≤ 500 V A.

Note: This sequence assumes the constant volume, on/off controlled recirculation pump and optional two-way motorized 220-volt isolation valves are powered using Terminal 1(L) and 2(N). The pump start/ stop circuit is controlled using terminals 3(L) and 4(N), The pump is installed in the pipe connecting the heat exchanger outlet to the three-way control valve inlet as shown in Figure 80. If the combination of the pump and control valve operator(s) power draw exceeds 500VA, provide a separate source of power for the bypass pump and a field provided pilot relay connected to terminals (1(L) and 2(N). Provide fusing between the pump and the terminals as well as the optional isolation valves and the terminals. Fuse size for any single connected component cannot exceed 2.2 amperes @ 220v.

If motorized 220-volt two-position isolation valves are installed in lieu of manual shutoff valves the isolation valve operators shall open and fluid flow between the building and the frame will commence.

WATER CIRCUIT INSTALLATION

Water Circuit Design

After a delay of approximately 30 seconds following a thermal on request from an IDU, or following the completion of a reversing valve position changeover, Multi V Water 5 will NOT close the circuit between Terminals 3(L) and 4(N). The pump remains off and the 3-Way control valve remains 100% open between the heat exchanger and the building return providing 100% flow through the pump bypass pipe to the heat exchanger.

Note: If the circulating pump operates while in heating mode shut the system down. Leaving the system operational could result in damaged heat exchanger to to ice formation. Verify the function code settings are correct and that bypass pump has been selected for FNXX. Also confirm the firmware version is valid for use with bypass pump operation. If a firmware change is required contact LG Aftermarket Service.

Multi V Water 5 is seeking flow confirmation by monitoring the circuit between terminals 5(L) and 6(N). When the flow switch closes confirming a minimum of 90% of rated flow is present (see Table 69), the circuit between terminal 5(L) and 6(N) is completed. If the flow leaving the heat exchanger falls below 80% of rated flow, the flow switch will open.

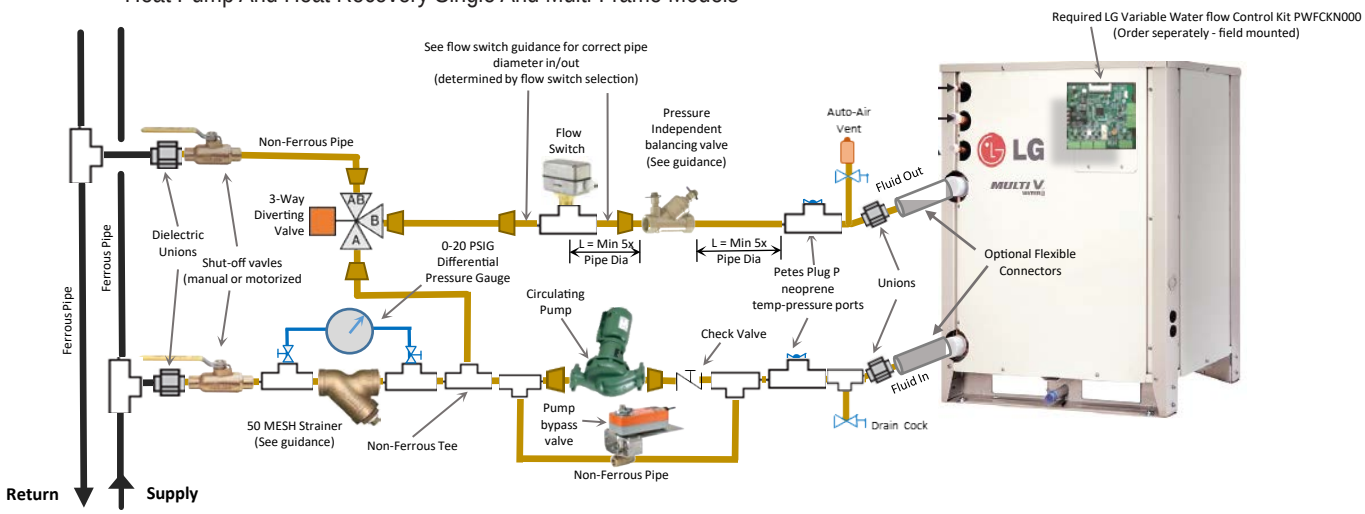
Note: when the flow switch opens signaling loss of flow, error code CH189 will be displayed on the Multi V Water 5 seven-segment display.

Upon flow confirmation, the compressor begins a soft-start and ramps up to a warm-up speed of approximately 30 Hz. After approximately two minutes the main controller adjusts the compressor speed to satisfy the building heating load. The VWFC kit does not modulate with low temperature fluid entering the heat exchanger while operating in heating mode. The voltage signal to the 3-way control valve remains at zero (0) volts.

The microprocessor instructs the compressor to slow down. When the compressor in the frame stops running, the 220-volt power to Terminals 1(L) and 2(N) will cease, closing the optional isolation valves.

Note: For valve malfunction and power loss safety logic see page 117

Figure 80: Entering Fluid Temperature < 50°F, 3-Way Control Valve and Constant Speed Pump
Heat Pump And Heat Recovery Single And Multi-Frame Models



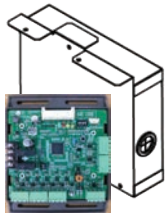
Note: Belimo ball valve orientation depicted. Valve port identification and installation orientation different for other manufacturers and Belimo globe valves.

Component Selection Guidance

Note: This information is not all inclusive and should not be your only source of technical information when engineering the hydronic system. ALWAYS refer to the selected manufacturer's device, engineering, installation, and start-up instructions. DO NOT rely on this information as the manufacturer's data may have changed. The data is provided for training purposes only. If any information presented here conflicts with information in the device manufacturer's published documentation, use the manufacturer's information.

LG Variable Water Control Kit (VWFC)

When the fluid temperature entering the heat exchanger is below 60°F, the LG Variable Water Flow Control (VWFC) Kit is required. The VWFC kit consists of a printed circuit board, and provisions are provided to power a 24-volt third party pressure independent control valve/actuator supplied by others. Reference sequence



of operation discussion elsewhere in this manual for detailed information. Each LG Multi V Water 5 frame in multi-frame models require a separate VWFC kit.

The variable flow control kit purpose is to assist the refrigeration cycle control logic maintain a stable refrigeration cycle while operating in cooling mode with an unusually cold entering fluid temperature. In cooling mode the voltage signal varies comparing target head pressure with actual head pressure. In heating mode the voltage signal varies comparing target low pressure with actual low pressure. When the entering fluid temperature is less than 60˚F, the VWFC kit may reduce the flow rate of fluid to the heat exchanger to maintain stable refrigeration cycle operation. The logic will provide a variable volt analog signal to a field provided linear-response control valve.

Image courtesy of Griswold Controls, Inc.

Note: The programmed logic of the variable flow control kit assumes the fluid flow rate at design conditions is set at rated flow.

Note: For VWFC kit main PCB board DIP switch settings refer to Table 79 on page 135.

Automatic Flow Limiting Valves (Pressure Independent Balancing Valve)

Otherwise known as pressure independent balancing valves are engineered to maintain steady state flow as the local pressure varies in the fluid loop. They are only effective over the manufacturer's specified differential pressure range.

The valve body is engineered to accept a variety of interchangeable cartridges so the same body can be used over a wide range of desired flow conditions. Refer to the instructions provided with the flow limiting valve to guide the installer which cartridge is best considering the fluid differential pressure and rated flow rate at each Multi V Water 5 frame location. Refer to the flow limiting valve manufacturer's instructions how to set the maximum flow rate for the cartridge option installed.

Note: To perform a proper flow limiting valve and cartridge selection, one needs to know the total pressure drop across the heat exchanger, all piping specialties up to and including the flow limiting valve selected. Call your selected flow limiting device manufacturer's rep for assistance selecting the right valve body, cartridge, and setting value to achieve the rated flow rate required.

Rule of Thumb Selecting a Cartridge

For a system with up to 75 feet of pump head, in general select a 2–32 PSID cartridge. If the pump head exceeds 75 feet, some locations may need a 4–57 PSID cartridge.

Selection and ordering notes:

- Before selecting/installing cartridges, consult with the flow limiting valve manufacturer's cartridge selection guidance.
- Review the flow limiting valve manufacturer's product options before ordering.
- If a pressure independent two-way control valve will be installed in conjunction with the LG VWFC Kit, the automatic flow limiting valve should not be installed.

Note: Do not operate the Water 5 unit without first setting the maximum flow rate. Failure to perform this tasks may result in unstable refrigerant cycle operation.

Image courtesy of Griswold Controls, Inc.

Image courtesy of Belimo Holding AG

Pressure Independent (PI) Two-Way Variable Flow Control Valve and Actuator

The pressure independent two-way control valve performs two duties. It maintains steady state maximum flow under varying differential pressure conditions over a specified differential pressure range (Figure 80) and also varies the volume of fluid to the heat exchanger in response to a variable-volt signal originating from the LG variable fluid flow control kit.

When the control valve is wide open, the pressure drop across the PI control valve assembly must be within the valve manufacturer's controllable range (Figure 80). If the differential pressure is outside the published controllable range, the valve will operate as a fixed orifice device and will not maintain steady state flow. Contact the PI control valve manufacturer's representative for further assistance.

If the Belimo valves/actuators, were ordered "off the shelf", a Belimo ZTH US Handheld programming tool will be required to set the prescribed value at the jobsite prior to starting the Water 5 frame.(www.belimo.com).

Selection and ordering notes:

- Specific gravity is an important attribute to of a liquid passing through a Flow Control Valve. The rated specific gravity of fluids at

temperatures other than 60° F are measured comparing the specific gravity of pure water at 60° F. A specific gravity correction factor should be applied to calculations. Contact the valve manufacturer for selection assistance.

- When ordering Belimo valves/actuators, specify the maximum flow rate defined in Table 66 with each valve on the order. If the valve is ordered “off the shelf”, a Belimo ZTH US Handheld programming tool will be required to set the prescribed value at the jobsite prior to startup.(www.belimo.com).

Table 64:Example Pressure Independent Control Valve Body.

Mfg	Series	Valve with Operator Image	Valve Body	Dia (in) Thread	Type	Response	Min flow (GPM)	Max Flow (GPM)	Min pressure drop (PSI)	Max working pressure (psi)	Diff press range (PSI)	Fluid temp range (F)	Fluid type	Multi V Water 5 Single Frame Nom Capacity (tons)	Mfg selection site
Belimo	PI-CV		P2125SU-285	1-1/4 FPT	2-way	Linear	3	28.5	5	200	5-50	14 to 250	up to 60% glycol	6,8	Belimo.com
			P2150SU-396	1-1/2 FPT	2-way	Linear	3	39.6	5	200	5-50	14 to 250		6,8,10,12	Belimo.com
			P2200SU-761	2 FPT	2-way	Linear	3	76.1	5	200	5-50	14 to 250		14, 16	Belimo.com
Griswold Controls	Pinnacle		PNL_BP_	1-1/4 FPT	2-way	Linear	4	20.4	3	360	3-58	-4 to 348	up to 50% glycol	6	GriswoldControls.com
			PNL_BQ_	1-1/2 FPT	2-way	Linear	9	60	3	360	3-58	-4 to 348		6,8,10,12 (All) 14,16 (460v)	GriswoldControls.com

Valve operator listed may or may not be equipped with a position capability. If position feedback is required on the project, verify the valve operator ordered can fulfill requirement. Feedback signal reports actual valve stem position using variable voltage signal. This value not currently used by LG Water 5 variable flow controil kit. Provided for BMS monitoring purposes.

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Table 65: Example Pressure Independent Control Valve Actuators.

Mfg NC=Normally Closed; FO=Fail Open	Series	Valve with operator image	Operator [1]	Maximum stroke time (seconds)	Operator power Vac / Vdc	Power draw (watts)	Feedback signal selection*	Setup*	Manufacturer's Website
Belimo	PI-CV		AKR24-EP2	90	24	4.6	2-10 V	NC/FO	Belimo.com
			AKR24-EP2	90	24	4.6	2-10 V	NC/FO	
			AKR24-EP2	90	24	4.6	2-10 V	NC/FO	
Griswold	Pinnacle		FN.1.2	85	24	3	2-10 V	NC/FO	FlowCon.com
			FH.1	85	24	3	2-10 V	NC/FO	

1 Valve operator model specified is not the only model that will work. Select operator to be fail open via spring return or by electronic means with battery backup.

PI control valve pre-start setup notes:

- Refer to the valve manufacturer’s latest published installation literature for selection, installation, and startup instructions.
- Verify the valve and operator installed is the correct combination for the model listed before applying the setting value specified.
- Set the relationship between the voltage signal and the valve adjustment rate of change to be “linear”.
- Set the end-to-end stroke time to be as fast as possible but no more than 90 seconds.
- Set the valve to modulate in response to be 2-10v (not 0-10v) analog signal. (2 volts = closed, 10 volts 100% open)
- Set the actuator for “direct acting” operation.
- Set the maximum flow rate through the PI control valve (or the flow limiting valve) at the frames rated flow rate when the valve is 100% open. Table 70 provides Belimo and Griswold two-way PI valve setting values for selected models to set the maximum flow rate referencing all Multi V Water 5 frames.

Note: Do not operate the Multi V Water 5 unit without first setting the maximum flow rate. Failure to perform this task may result in unstable refrigerant cycle operation. See Table 66.

The maximum flow rate using a FlowCon Pinnacle valve can be set in the field without requiring a programming tool.

Table 66: Example PI Control Valve Actuator Maximum Flow Settings

Mfg	Series	Valve with operator image	Model	Operator	Dia (in) Thread	LG Model	6.0 Ton ARWM072*AS5	8.0 Ton ARWM096*AS5	10.0 Ton ARWM121*AS5	12.0 Ton ARWM144*AS5	14.0 Ton ARWM168DAS5	16.0 Ton ARWM192DAS5	Mfg selection site
						Rated GPM	20.3	25.4	30.4	35.5	45.7	50.8	
Belimo	PI-CV		P2125SU-285	AKR24-EP2	1-1/4 FPT	max flow % setting	71%	89%					Belimo.com
			P2150SU-396	AKR24-EP2	1-1/2 FPT		51%	64%	77%	88%			Belimo.com
			P2200SU-761	AKR24-EP2	2 FPT						60%	67%	Belimo.com
Griswold Controls	Pinnacle		PNL_BP_	FN.1.2	1-1/4 FPT	max flow setting	5.0						FlowCon.com
			PNL_BQ_	FH.1	1-1/2 FPT		1.8	2.1	2.4	2.7	3.5	3.9	FlowCon.com

Pressure Dependent Three-Way Control Valve and Actuator

Three way valves by nature are not pressure independent. Therefore, to set the maximum flow at rated flow condition through the heat exchanger, the installation will also require installation of an automatic flow limiting valve (pressure independent balancing valve). See Figure 80.

Note: The valve orientation in Figure 5 depicts a Belimo 3-Way ball valve. Port connection locations and identifiers are different between valve designs and valve manufacturers. For example, a Belimo 3-way globe valve port orientation and identifiers are different from their 3-way ball valve. The valve should be installed with the linear response path connecting the heat exchanger outlet with the building return pipe. Follow the selected valve manufacturer's installation and startup procedures.

Figure 81: Ball and Globe Valves

Belimo Ball valve 6-12 ton

Images courtesy of Belimo Holding AG

Belimo Globe valve 14-16 ton

Griswold Ball valve 6-16 ton

Image courtesy of Griswold Controls, Inc.

Table 67: 3-Way Valve Manufacturers' Specifications

Mfg	Series	Valve with Acutator Image	Valve Model	Dia (in)	Type	*Characterized*	Response	Install Config	Port Conn to HEX	BLDG Return Port	Actuator Model	Fail Safe / Ports	Control Voltage	Motor Voltage / Watts	Full Stroke (seconds) [1]
Belimo	3-way (BV)		B320L	3/4	Ball	No	Linear	Diverting	B	AB	LF24-MFT-US	Yes / Spring Return Port B-AB Open	2-10 volt	24 VAC 2.5 Watts	90 sec
Belimo	3-way (BGVL)		G332B-M	1.25	Globe	No	Linear Port B-AB	Diverting	B	AB	SVKB24-MFT or LVKB24-MFT	Yes / Selectable Port B-AB Open	2-10 volt	24 VAC 3 Watts	90 sec
Griswold	3-way (Unimizer)		UR3BF_	3/4	Ball	No	Linear Port AB-A	Diverting	AB	A	KMC MEP-4002	Yes Port AB-A Open	2-10 volt	24 VAC 4 Watts	90 sec
Griswold	3-way (Unimizer)		UR3DC_	1.25	Ball	Yes	Linear Port AB-A	Diverting	AB	A	KMC MEP-4002	Yes Port AB-A Open	2-10 volt	24 VAC 4 Watts	90 sec
Griswold	3-way (Unimizer)		UR3DB_	1.25	Ball	No	Linear Port AB-A	Diverting	AB	A	KMC MEP-4002	Yes Port AB-A Open	2-10 volt	24 VAC 4 Watts	90 sec

(1) Important note: When ordering Belimo ball valve actuators, you must specify a 90 second end to end stroke time (Belimo default stroke time is 150 seconds)

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KMC is a third-party manufacturered valve actuator provided with the Griswold Unimizer valve.

3-Way Valve Flow Data For Pure Water At 60F – Adjust Using Manufacturer's Software For Other Conditions

Table 68: 3-Way Valve Manufacturers' Specifications at LG Operating Parameters

Mfg	Series	Valve with Acutator Image	Valve Model	Nominal Capacity MV Water 5 Model	8.0 Ton ARWM096*AS5	10.0 Ton ARWM121*AS5	12.0 Ton ARWM144*AS5	14.0 Ton ARWM168DAS5	16.0 Ton ARWM192DAS5	Mfg URL Order notes
				Rated Flow (GPM)	25.4	30.4	35.5	45.7	50.8	
Belimo	3-way (BV)		B320L	Valve Cv / Effective Press. Drop PSI	12.8 (3.9)	12.8 (5.6)	12.8 (7.6)			
Belimo	3-way (BGVL)		G332B-M	Valve Cv / Effective Press. Drop PSI				20 / (5.2)	34 / (6.4)	Belimo.com Specify 90 second stroke time (default is 150)
Griswold	3-way (Unimizer)		UR3BF_	Valve Cv / Effective Press. Drop PSI	11.0 / (5.4)	11.0 / (7.1)				Belimo.com
Griswold	3-way (Unimizer)		UR3DC_	Valve Cv / Effective Press. Drop PSI			12.7 / (7.9)			GriswoldControls.com order KMC actuator mounting kit pn 9656-250
Griswold	3-way (Unimizer)		UR3DB_	Valve Cv / Effective Press. Drop PSI				19.4 / (5.6)	19.4 / (6.9)	GriswoldControls.com order KMC actuator mounting kit pn 9656-250

Flow Switch or Differential Pressure Switch

The required diameter of flow switch body and the flow switch actuate/de-actuate set-points is determined by frame capacity and minimum flow requirement. The minimum flow requirement varies based on design entering fluid temperature. For proper unit operation, it is critical to calibrate the flow switch to deactuate (open) if the flow rate through the heat exchanger drops below 40% of rated flow on applications where a variable flow control kit is installed WITHOUT a bypass pump. On applications that do not use the variable flow control kit or use the variable flow control kit WITH a bypass pump, calibrate the flow switch to deactuate (open) if the flow rate through the heat exchanger drops below 80% of rated flow on applications. Use the data provided in Table 69 and Table 70 as a guide to avoid flow switch nuisance trips. Wire flow switches normally open (make on flow). The use of a differential pressure switch in lieu of the paddle type flow switch is a viable alternative. Refer to the differential pressure switch manufacturer's literature for proper selection and installation guidance.

Figure 82: Example Flow Switch/ Differential Pressure Switch

Image courtesy of Kolbold USA, Inc.

Notes: If the field calibrated set value does not satisfy the minimum flow rate defined in Table 69 and Table 70 or if the set value is changed by the user arbitrarily, or the Multi V Water 5 product is operated with the factory jumper wire connecting screw terminals 5(A) and 6(B) not removed (see Figure 90), heat exchanger fouling and/or damage due to freezing is possible which and may result in heat exchanger failure and fluid leakage into the refrigeration system. Compressor failure following a heat exchanger failure is probable and is not covered by the products Limited Warranty.

If the Multi V Water 5 product is operated with an improperly sized flow switch, or at a fluid flow rate that exceeds the maximum flow rating of the switch, or the flow switch is not properly calibrated, or damaged, or stuck closed, expect flow switch related errors that cause excessive compressor cycling to eventually result in compressor failure that is not covered by the product's Limited Warranty.

Flow switch selections provided in Table 69 and Table 70 are example only to assist the designer and installer purchase a properly selected flow switch for use with Multi V Water 5. Verify these sample selections meet all design criteria for the project before selecting. The installer may select any brand and type of flow proving device. Review the selected flow switch manufacturer's most recent product changes before ordering, installing and/or calibrating.

Table 69: Flow Switch Specifications and Calibration : Variable Flow (Application #2)

Mfg	Series	Type	Required Pipe dia (in)	Paddle Length (In)	Mount position	Max Flow Rate (GPM)	Acuate [1]		Deactuate [1]		LG Water 5 Acuate/Deactuate Settings [4]						Mfg Website
							Min	Max	Min	Max	6 ton (072) (ALL)	8 ton (096) (ALL)	10 ton (121) (ALL)	12 ton (144) (ALL)	14 ton (168) (460v)	16 ton (192) (460v)	
Dwyer	FS-2	Paddle	1+1/2	1.3 + 2.2 [2]	Horz Pipe / Top	N/A	7	14.5	4	11.4	9.7 / 8.1	12.2 / 10.2	14.6 / 12.2	N/A	N/A	N/A	Dwyer-Inst.com
Dwyer	FS-2	Paddle	2	1.3 + 2.2 [2]	Horz Pipe / Top	N/A	14.1	31.3	9.7	22.5	N/A	N/A	N/A	17.0 / 14.2	21.9 / 18.3	24.4 / 20.3	
Kobold	FPS-5	Paddle	1+1/2	1.1	Horz or Vert Pipe [3]	39.6	7.5	17.6	4.8	16.3	9.7 / 8.1	12.2 / 10.2	14.6 / 12.2	17.0 / 14.2	N/A	N/A	koboldusa.com
Kobold	FPS-5	Paddle	2	1.1 + 2.1 [2]	Horz or Vert Pipe [3]	66	13.7	26.9	9.7	25.1	N/A	N/A	14.6 / 12.2	17.0 / 14.2	21.9 / 18.3	24.4 / 20.3	

(1) Settings assume pure water. Make at 48% of rated flow, trip at 40% of rated flow

(2) Stack all smaller paddles in the kit with the size specified.

(3) Field adjustable set-screw calibration change required for vertical pipe installation

(4) Actual setting may vary slightly based on pipe archiutecture installed

Table 70: Flow Switch Specifications and Calibration : Constant Flow (Application #1 & #3)

Mfg	Series	Type	Required Pipe dia (in)	Paddle Length (In)	Mount position	Max Flow Rate (GPM)	Acuate [1]		Deactuate [1]		LG Water 5 Acuate/Deactuate Settings [4]						Mfg Website
							Min	Max	Min	Max	6 ton (072) (ALL)	8 ton (096) (ALL)	10 ton (121) (ALL)	12 ton (144) (ALL)	14 ton (168) (460v)	16 ton (192) (460v)	
Dwyer	FS-2	Paddle	2	1.3 + 2.2 [2]	Horz Pipe / Top	N/A	14.1	31.3	9.7	22.5	18.3 / 16.2	22.9 / 20.3	27.4 / 24.3	N/A	N/A	N/A	Dwyer-Inst.com
Dwyer	FS-2	Paddle	2+1/2	1.3 + 2.2 + 3.5 [2]	Horz Pipe / Top	N/A	18.5	35.2	15.4	30.8	N/A	N/A	N/A	32.0 / 28.4	N/A	N/A	
Dwyer	FS-2	Paddle	3	1.3 + 2.2 + 3.5 [2]	Horz Pipe / Top	N/A	27.7	52.8	25.1	46.2	N/A	N/A	N/A	32.0 / 28.4	41.1 / 36.3	45.7 / 40.6	
Kobold	FPS-5	Paddle	2	1.1 + 2.1 [2]	Horz or Vert Pipe [3]	66	13.7	26.9	9.7	25.1	18.3 / 16.2	22.9 / 20.3	N/A	N/A	N/A	N/A	koboldusa.com
Kobold	FPS-5	Paddle	2+1/2	1.1 + 2.1 [2]	Horz or Vert Pipe [3]	105	17.6	30.8	11.9	28.6	18.3 / 16.2	22.9 / 20.3	27.4 / 24.3	32.0 / 28.4	N/A	N/A	
Kobold	FPS-5	Paddle	3	1.1 + 2.1 + 3.3 [2]	Horz or Vert Pipe [3]	105	27.3	50.2	18.9	47.1	N/A	N/A	27.4 / 24.3	32.0 / 28.4	41.1 / 36.3	45.7 / 40.6	

(1) Settings assume pure water. make at 90% of rated flow, trip at 80% of rated flow

(2) Stack all smaller paddles in the kit with the size specified.

(3) Field adjustable set-screw calibration change required for vertical pipe installation

(4) Actual setting may vary due based on pipe archiutecture installed

Paddle type flow switch configuration and installation tips

When installing a paddle/vane type switch it is imperative:

1. There are at least 5 pipe-diameters of straight pipe length upstream of the flow switch mounting position. If flow switch manufacturer's specifications are less stringent, comply with the manufacturer's specification.
2. The correct vane/paddle combination is selected for the pipe's internal diameter. If installation instructions dictate the use of one of the longer flexible paddles shipped with the switch, ALWAYS install the specified paddle back to back with all shorter length flexible paddles included in the kit. This practice ensures stable operation. For guidance on paddle selection, refer to Table 69 and Table 70.
3. Use thread sealing tape and screw the flow switch DIRECTLY into a T-pipe fitting in accordance with DIN 2950. Do not use nipples or extensions; flow switch will not operate properly.
4. Verify the paddle moves freely in the pipeline and that the edges of the paddle do not make contact with the pipe wall before installing the flow switch/pipe tee assembly in the pipe system.
5. Verify the arrow on the body of the flow switch points in the direction of flow.
   Note: For guidance wiring flow switch to the Multi V Water 5 frame see Figure 81, Figure 82, and Figure 83.

Constant Speed Pump Selection Guidance

Reminder: ALWAYS request guidance for the pump selection, the pump control strategy, the installation, application, and startup from the selected pump manufacturer's website and application engineers. Due to 3rd party product vendor's freedom to change specifications and performance at will, LGEUS is not responsible for pump selection, performance, or application using the information provided in this manual.

Figure 83: Example Constant Speed Pump

Image courtesy of Taco, Inc.

Table 71: Circulating Pump Selections - Use Selected Pump Manufacturer's Technical Data For Final Selection And Ordering

MV Water 5 Nom Frame Capacity (tons)	Pump Make	Pump Image	Pump Model	GPM (Hex rated flow)	Pump Head (3) (ft)	Heat exchanger PD (1) (ft-wg)		Flow limit Valve Min PD (2) (ft-wg)		Flange Size (in)	Construction	Impeller Dia (in)	RPM	Hp	Voltage**	Motor FL Amp	Mfg URL
						Water	40% glycol	Water	40% glycol								
6	Taco		132E	20.3	12	3.47	4.79	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com
8	Taco		132E	25.4	12	5.2	7.18	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com
10	Taco		132E	30.4	12	7.23	9.98	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com
12	Taco		132E	35.5	16	9.63	13.29	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com
14	Taco		132E	45.7	14	8.32	11.48	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com
16	Taco		132E	50.7	16	10.08	13.91	7.4	10.21	3.0	Cast Iron SS Fitted	4.9	1725	1/2	Order 115/230/1	1.98	www.TacoComfort.com

1) Hex pressure drop and pump head is calculated at rated flow
2) Flow limiting valve PD data based on Griswold Controls Isolator R series; model IR32S2QTT (1.5" FPT with union 2-32 PSID cartridge)
(3) Pump head is calculated on worse case PD considering the HEX and the flow limiting valve PD plus 10% using 40% propelyene glycol PD values.
This information provided for concept only. ALWAYS contact the selected pump manufacturer's represenatative for proper selection and ordering criteria
(4) If power is provided from terminals 1(L) and 2(N) of the Multi V Water 5 frame, pump voltage = 208-230//60/1. total connected load cannot exceed 500VA.
Provide fuses between pump and Terminals (1) and (2) when using for pump power
Taco® is a registered trademark of Taco, Inc.

Table 72: Variable Flow Control Kit DIP Switch Settings by Application ID

EFT	Application ID	SW01				SW02	
		L1	L2	L3	L4	L1	L2
≥ 60˚F *	1	On	Off	Off	Off	Off	Off
< 60˚F ≥ 50˚F	2	On	Off	Off	Off	Off	Off
< 50˚F	3	On	On	Off	Off	On	On

* VWFC kit is not required. If installed use these settings

Strainer

Three different strainer designs that remove solids in suspension from the fluid loop are available. The wye strainer shown in Figure 5 is the most economical. The basket strainer design (not shown), holds a larger volume of debris compared to the wye strainer and the centrifugal type does an exceptional job removing nearly all particulate. All strainer designs provide a method for cleaning the collector device. Strainer screen/baskets are typically manufactured using 304 stainless steel. Specifying strainer bodies with a blow-down plug makes it easier to clean the screen without disassembly.

Figure 84: Example Strainer

Image courtesy of Watts Water Technologies

Strainers may be installed on a per frame basis or unit (multiple frames) basis. In all installations the strainer must be selected to accommodate the calculated maximum combined fluid flow rate for all frames served. Reference the engineering data provided by the strainer manufacturer to make a proper selection. Each strainer should be provided with a differential pressure gauge to monitor the strainer particulate accumulation.

Figure 85: Wye Strainer

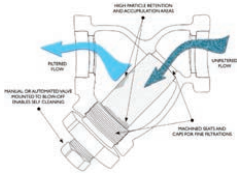


Image courtesy of Titan Flow Control, Inc

Notes: All Multi V Water 5 unit heat exchangers must be protected from debris that may be present in circulating fluid using a strainer with a minimum 50-mesh basket present at all times.

LG recommends using a strainer with a non-ferrous body to avoid the possibility of galvanic corrosion of the strainer body. LG requires fluid flow through the Multi V Water 5 heat exchanger only occurs after passing through an intact, undamaged, and properly seated 50 MESH strainer screen or basket.

Wye And Basket Strainer Ordering Tip

NOTE: Specify 50-MESH screens when ordering. Typically wye strainer manufacturer' supply strainers with a #20 MESH screen used in conjunction with tube-and-shell type heat exchangers found in boilers and chillers. When ordering strainers to protect the Multi V Water 5 heat exchanger, strainers must have a 50 MESH screen.

Specify the strainer provided includes a plug or cap on the strainer blow-down port.

Strainer Screen Maintenance Indicator – Differential Pressure Gauge

The most common cause for maintenance and malfunction of VRF water-cooled equipment refrigeration cycle is a dirty strainer. Provide a method to determine a strainer is obstructed. LG suggests the designer include a differential pressure gauge with ports on either side of every strainer screen/basket to monitor the cleanliness of the strainer screen. Gauge range and accuracy should be selected to read between 0 and 20 PSI in 1 psi increments or smaller.

Note: Catastrophic failure of the strainer screen is commonly referred to as a blowout and must be prevented. If a blowout occurs, the majority of the particulate captured by the strainer screen will be released and most likely get lodged in the heat exchanger. A blowout occurs when the pressure drop across the screen exceeds the tensile strength of the screen material. As the screen collects particulate, the screen openings are clogged reducing the face area of the screen where fluid is allowed to pass. Include a procedure in the strainer maintenance schedule to clean strainers regularly or when the pressure drop is 10 PSI or higher. Heat exchanger failure as a result of debris restricting fluid flow is not covered by the product's Limited Warranty.

A reduction in face area raises the pressure drop across the strainer screen. Figure 85, for example, depicts a strainer profile manufactured by Titan Flow Control, Inc. Titan recommends the strainer screen be cleaned before the differential pressure exceeds 10 psig. Titan Flow Control, Inc. states the risk of strainer screen/basket failure is high if the differential pressure across the screen reaches 20 psig. Table 73 provides the pressure drop data for a Titan model YS55-BZ 1-1/2" wye strainer with a clean #50 mesh screen in a system flowing pure water at rated conditions.

WATER CIRCUIT INSTALLATION

Water Circuit Design

Table 73: Heat Exchanger and Strainer Pressure Drop (Pure Water).

LG Multi V Water 5 Single Frame Models	6.0 Ton ARWM072*AS5	8.0 Ton ARWM096*AS5	10.0 Ton ARWM121*AS5	12.0 Ton ARWM144*AS5	14.0 Ton (460v) ARWM168DAS5	16.0 Ton (460v) ARWM192DAS5
Heat Exchanger Rated Flow (GPM)	20.3	25.4	30.4	35.5	45.7	50.8
Heat Exchanger Pressure Drop at Rated Flow (PSI)	1.5	2.21	3.02	3.96	3.46	4.2
Pressure Drop of Titan Wye Strainer - #50 MESH screen (PSI / FT-WG)	0.3	0.48	0.68	0.93	1.54	1.9

All data presented is for pure water, specific gravity of water assumed to be 1.0
1+1/2" Titan Model YS55-BZ, cast bronze, ANSI class 125, FPT threaded connections
Pressure drop is for a 50-MESH strainer (already corrected from default 20-MESH in manufacturer's data table)
Titan® is a trademark of Titan Flow Control, Inc.

Note: The data provided in Table 73 is an example provided for illustrative purposes. It is imperative that data from the strainer manufacturer selected for a project be used in all pressure drop calculations and the development for strainer maintenance procedures actually employed.

Manual Fluid Isolation Service Valves

To isolate fluid flow through the Multi V Water 5 frame while isolated for maintenance install a two-position non-ferrous full-port, low pressure drop manual valves. Select valve bodies to be non-ferrous to prevent galvanic corrosion and have a very low pressure drop.

Figure 86: Example Manual Fluid Isolation Service Valve

Apollo Valve image courtesy of Aalberts Integrated Piping Systems Americas, Inc.

Motorized Fluid Isolation Valves

⚠ DANGER

High voltage electricity is required to operate these valves. Adhere to the NEC code and valve actuator manufacturer's instructions when wiring.

Improper connections and inadequate grounding can cause accidental injury or death. The voltage on Terminal 1(L) and 2(N) ranges from 208 to 240 volts.

Multi V Water 5 can control the opening and closing of motorized isolation valves. If the designer desires no fluid flow through the frame when the compressor is not operating, specify two-position normally closed fail open 220/60/1 volt motorized valves. Select valve bodies to be non-ferrous to prevent galvanic corrosion. Select valves to be full port and have a very low pressure drop. Power and control motorized isolation valves by connecting to terminals 1(L) and 2(N) on Multi V Water 5. Line voltage power will be provided to Terminal 1(L) when the frame receives a command from an indoor unit for cooling or heating.

Figure 87: 2-Position 220v 3/4" Ball Valve with Operator

Image courtesy of Belimo Holding AG

Install motorized valve and actuator per manufacture's recommendations. Follow all instruction provided in literature shipped with the valve(s).

Note: The total load connected to Terminals 1(L) and 2(N) cannot exceed 500 VA. If the valve actuator is not rated for operation with 208-240v power source and/or the power draw of all devices drawing power from terminals 1(L) and 2(N) exceeds 500 VA, provide a pilot relay between one (or more) connected devices and power these device(s) from a separate source. PCB board failure due to overload condition is not covered by the product's Limited Warranty.

Heat Exchanger Drain

Provide a method to drain the fluid from the heat exchanger if removal is required for maintenance. If it will not be practical to drain the entire fluid loop system, provide a method to isolate the fluid in the interconnecting piping while removing the heat exchanger.

Heat Exchanger Air Vent

Provide a method to assure air is not present in the heat exchanger. Provide air vent/bleed devices in locations necessary to facilitate the removal of air that may be trapped in the heat exchanger before operating the refrigeration cycle.

Provide a Method to Obtain Operating Pressure and Temperature across the Heat Exchanger

Fixed temperature and pressure gauges OR Pete's ports must be provided on the entering and leaving fluid pipes serving the heat exchanger. Suggested locations are shown in Figure 78, Figure 79, and Figure 80.

Interconnecting Pipe Material

Do not use CPVC, PVC or other plastic pipe material. There is a possibility of leaks and pipe deformation at raised operating temperatures.

Flexible Connections and Service Unions at the Frame

Flexible connections at the Multi V Water 5 heat exchanger connections are optional and not required. If flexible connections are installed, verify the installation method used and flexible pipe device installation, orientation, and connection to the pipe system follow the flexible pipe product manufacturer's use and installation instructions.

Provide union fittings between the heat exchanger and the interconnecting pipe system. Place unions in a location that will facilitate the removal of the heat exchanger from the Multi V Water 5 unit. The heat exchanger mount is designed for easy removal from the front panel side of the unit. Refer to installation clearance requirements section of this manual.

Dielectric Unions

Provide di-electric unions at all transitions between ferrous and non-ferrous piping materials. To reduce the quantity of dielectric unions required, LG recommends pipe materials used to interconnect the piping specialties at each frame be non-ferrous. See Figure 77, Figure 78, Figure 79, and Figure 80.

Expansion Tank

All closed loop systems must have a properly selected expansion tank installed. The expansion tank is designed to absorb the room necessary when water expands with a rise in temperature.

Fluid Pipe Support

The fluid pipe must be adequately supported to the structure using materials and methods designed to support the weight of the pipe and remove sheer stress at the pipe connections of the Multi V Water 5 heat exchanger. The supports should be engineered also to absorb any pipe movement related to pipe material temperature changes between seasons and cycling on/off the connected cooling and/or heating equipment.

Fluid Pipe System Insulation Considerations

In most buildings, if the fluid loop temperature (pipe surface temperature) is maintained above the interior building envelope dew-point, then pipe insulation will not be required. If a section of the fluid system has a surface temperature at or below dew point of the surrounding air, and/or is exposed to temperatures at or below freezing, and/or exposed to chemicals that may cause component corrosion, it will need to be protected using insulation or other appropriate coating.

Heat Exchanger Protection

Table 74: Multi V Water 5 Fluid Heat Exchanger Technical Data

ARWM Frame	6.0 Ton	8.0 Ton	10.0 Ton	12.0 Ton	14.0 Ton	16.0 Ton
Heat of rejection at rated condition (MbH)	94.1	125.9	157.9	190.1	220	253.5
Heat of absorption at rated condition (MbH)	74.2	98.6	122.7	146.8	172.8	193.6
Pressure drop at rated flow (PSI)	1.5	2.2	3.0	4.0	3.5	4.2
Rated flow (GPM)	20.3	25.4	30.4	35.5	45.7	50.7
80% Rated flow (GPM)	16.2	20.3	24.3	28.4	36.6	40.6
40% Rated flow (GPM)	8.1	10.2	12.2	14.2	18.3	20.3
Burst pressure (PSI)	640					
Entering Fluid Temp Range (˚F)*	23 - 113					

[1] Operation below 60˚F requires the use of the optional variable flow control kit

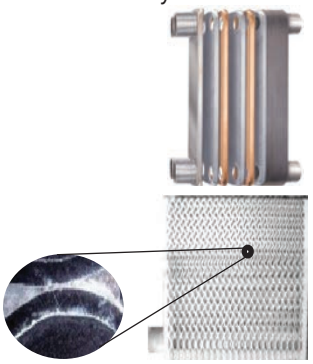
[2] Cooling operation below 50˚F requires the a bypass pipe and pump

Hydronic Fluid Maintenance

DISCLAIMER: The cleanliness of the cooling/heating fluid passing through the heat exchanger directly impacts heat transfer, operating efficiency, and equipment longevity. For a comprehensive resource on the subject of fluid treatment, refer to the 2015 edition, Chapter 49 of the ASHRAE Handbook – HVAC Applications.

Note: Do not use the discussion here as the sole resource. The topics discussed are minimum requirements and the discussion is provided to emphasize importance.

Figure 88: Water 5 Heat Exchanger Cut Away View



General

The high efficiency heat exchanger in the Multi V Water 5 is a sine-wave design with a channel width of 3 mm or 0. 118 inches. Keeping a free and unobstructed fluid flow through these small channels is imperative for maintain operational efficiency and heat exchanger health

The heat exchanger must be protected against flow restrictions caused by;

1. Suspended solids
2. Mineral deposits
3. Rust Formation
4. Freezing

Note: It is imperative that all reasonable measures and maintenance practices be used to protect the Multi V Water 5 refrigerant to fluid heat exchangers from but not limited to fouling, clogging, freezing, over-pressurization, and corrosion. A failure of these heat exchangers will result in an expensive and time consuming clean-up procedure to remove moisture and other contaminants from the refrigerant piping system.

Suspended Solids

Figure 89: Wye Strainer

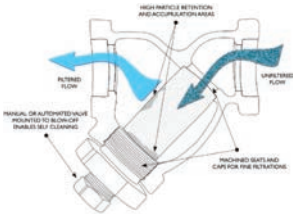


Image courtesy of Titan Flow Control, Inc

Strainers are the primary defense against contamination from solids. The Wye, basket and centrifugal designs are all acceptable. The wye strainer is the most economical, the basket strainer has a higher contaminate storage volume, and the centrifugal type removes nearly all particulate.

The wye and basket strainers must be ordered with a 50 MESH basket. Specifying strainer body with a blow-down port/plug makes it easier to clean the screen without disassembly. More information on strainers is provided in the component selection guidance section.

Mineral Deposits

Strainers will not capture mineral content in suspension from the fluid passing through the strainer. The heating of fluid passing through the Multi V Water 5 heat exchanger while the VRF system is operating in cooling mode may precipitate minerals and other natural impurities in water and may deposit in the heat exchanger channels. Minerals deposited in the heat exchanger over time will, degrade, foul, and restrict flow through the heat exchangers. The quality of the fluid in circulation must meet or exceed the standard set forth in the table below at startup and monitored on a regular basis throughout the life of the building to maintain heat exchanger performance to maintain the Multi V Water 5 product Limited Warranty.

Table 75: Minimum Water Quality Requirements

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

Rust Formation

Rust inhibitors must be used in fluid loops, especially if the fluid temperature exceeds 104°F anytime during the year. Reference the ASHRAE Handbook for complete information and guidance selecting and using rust inhibitors.

Note: LG recommends the building owner employ a local water treatment professional to regularly clean strainers, test and treat the fluid in circulation on a regular basis. Use inhibitors in the water loop, especially if the water temperature is operated above 104°F. Ensure all air is purged from the system. Heat exchanger as a result of mineral, chemical, freezing, and/or sediment deposits is not covered by the product's Limited Warranty.

WATER CIRCUIT INSTALLATION

Water Circuit Design

Freezing

While operating in the heating mode, the heat exchanger is operating as an evaporator and as such the temperature of the heat exchanger surfaces can be near or below freezing. The requirement of anti-freeze solution is dependent upon the minimum design entering fluid temperature. All frames that will be exposed to fluid with an entering temperature below 50 degrees F requires the addition of an antifreeze agent. The concentration requirements are discussed in the Application discussions of this manual.

The addition of anti-freeze chemicals to water will modify the heat transfer characteristic of the heat exchanger using pure water. The concentration of antifreeze determines the amount of heat transfer reduction. Antifreeze agents when mixed with water will make the fluid more viscous and impact the pressure drop through the Hydronic system components.

Multi V Water 5 Performance Correction Factors for Fluids other than Pure Water

Table 76: Antifreeze Capacity Correction Factors

Antifreeze Type	Item	Antifreeze Percentage 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

Adjusting For Fluids Other Than Pure Water

Use the following equation to calculate pressure drop across any device, heat exchanger or through a pipe for fluids other than pure water.

Know the specific gravity of the solution in use or lookup the specific gravity using the charts. Use the formula provided to calculate the corrected maximum flow to configure valve control settings for fluids other than pure water.

$Q=Q1\ \sqrt{SG}$

Where:

Q = Flow rate through the valve if the solution with pure water at 59˚F

Q1 =Rated flow (GPM) of Multi V Water 5 frame

SG= Specific Gravity of the fluid

For example, a fluid with 30% Ethylene glycol is circulated at a minimum leaving water temperature of 45˚F through a Multi V W ater 5 model ARWM096. The rated flow is 25.4 GPM. From the chart in Table 76, the specific gravity for the fluid in circulation is 1.042. To properly select the maximum flow setting on the flow limiting or variable flow control valve to achieve 25.4 GPM through the heat exchanger use the formula to calculate the actual maximum flow control flow rate (Q). Q = Q1*√SG or 25.4 GPM * √1.042; Q= 25.92 GPM. ΔP = G × (Q/Cv)2 × Cr

*Note: * Ice formation temperature values presented are not absolute. They are estimated values for pure water mixed with a typical, pure, commercially available ethylene glycol chemical. Actual ethylene glycol chemical used, rust inhibitors, and other water treatment chemicals that may be present will affect the actual ice crystal formation temperature of the fluid mix. Use the ice formation temperature provided by the ethylene glycol chemical manufacturer, know the specific gravity value of the actual fluid mixture and adjust ethylene glycol concentration accordingly to achieve desired freeze protection. The addition of antifreeze may lower the performance of the water source unit due to reduced heat transfer and added pressure drop. LG's VRF pipe design software, LATS, provides an option to note the concentration level of the antifreeze and the software will calculate the impact on unit performance.*

Freeze Protection Logic

Disclaimer: The freeze protection logic of Multi V Water 5 is designed to reduce the probability of heat exchanger failure due to freezing and provide another layer of protection for the building owner. The freeze protection logic provides limited protection only when the following practices are adhered to throughout the life of the installation.

1. Minimum flow rate defined by the application in use has been maintained at all times.
2. The external flow switch is properly wired, calibrated as specified in Table 69 or Table 70, and operating.
3. There is no jumper wire present between terminals 5 and 6.
4. Antifreeze at the specified minimum concentration levels recommended is provided based on entering fluid temperature application requirement employed.
5. A clean 50 MESH undamaged strainer or centrifugal separator has filtered all fluid passing through the heat exchanger.
6. Minerals contaminants in the circulating fluid have been maintained per requirements in Table 75.
7. This is not an exhaustive list. Consider other design and operating conditions outside the bounds of the design and maintenance guidance set forth in this manual as additional conditions.

Overheating Protection | Control Algorithm (CH24)

Error code CH24 will be raised if the refrigerant pressure is too high.

Low or Loss of Water Flow Protection | Control Algorithm (CH189)

A field provided, normally open flow switch provides the primary defense against heat exchanger damage caused inadequate or complete loss of fluid flow during heating mode operation. This function operation depends on a properly installed, wired, and calibrated external flow detection device connected to terminals 5 and 6. When the external flow switch opens signaling a low or lost flow condition, the Multi V Water 5 onboard logic will raise error code CH189. Compressor operation will cease in an attempt to prevent heat exchanger damage. Calibrate flow switch based on suggested values found in Table 69 and Table 70.

Freeze Protection Logic | Control Algorithm (CH180)

Past generation Multi V logic solely depended on the proper calibration and operation of the third party flow switch in addition to low refrigerant pressure algorithms to halt compressor operation and attempt to prevent heat exchanger damage from freezing.

WATER CIRCUIT INSTALLATION

Water Circuit Design

Multi V Water 5 is provided with additional logic that detects a substandard low flow condition. Multi V Water 5 monitors entering fluid pipe temperature and leaving fluid pipe temperature. When fluid flow is decreased, for example a clogged strainer, or a malfunction of the pump controller, the differential temperature of the fluid passing through the heat exchanger exceeds 12.6˚F (7˚C)* for a period of 30 seconds or longer or momentarily reaches 18˚F, error code CH180 will be displayed on the microprocessor controller and the compressor operation will ceases in an attempt to keep the heat exchanger from being damage.

* Differential temperature trip setting varies slightly by model capacity.

Hydronic Control Valve Malfunction And Power Loss Event Design Precautions to Consider

The 3-way valve is equipped fail safe 100% open between the common port and the building return. The valve manufacturer's fail-safe method to achieve fail safe operation must be battery backup or spring return.

If the valve operator fails and the bypass is open and the entering fluid temperature to the heat exchanger may overheat. If the heat exchanger over heat is extreme, Multi V water 5 control logic will raise error code CH24 and shut down compressor operation.

If the bypass pump logic is operating normally and the circuit between terminals 3(L) and 4(N) is closed the entering fluid temperature will modulate between 45˚F and 60˚F. If at any time the entering fluid temperature approaches 70F, a malfunction of the bypass valve most likely occurred. The control logic provides protection when using the bypass pump control logic. If the entering fluid temperature reaches 70˚F, Multi V Water 5 will open the circuit between terminals 3(L) and 4(N). Bypass pump operation will cease, the 3-way valve operator will be de-energized, and the pump bypass valve will open. 100% flow between the building and the frame will occur.

Note: This logic does not protect against overheating due to fluid temperature from the building loop e4xceeding the frame's specified high temperature limit of 113F.

The two position pump bypass valve is normally open, fail open- spring return. If power is lost to the valve operator, the valve returns to the default (spring return) open position, the auxiliary end switch will open stopping bypass pump operation. 100% flow to/from the building will occur.

If power is lost to the pump, the pump bypass valve will open. 100% flow to/from the building should occur.

Antifreeze Mixtures. Specific Gravity

Figure 90: Ethylene Glycol – Specific Gravity vs. Fluid Temperature.

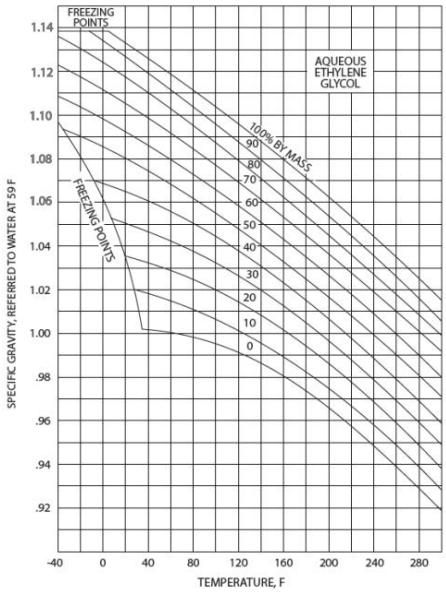
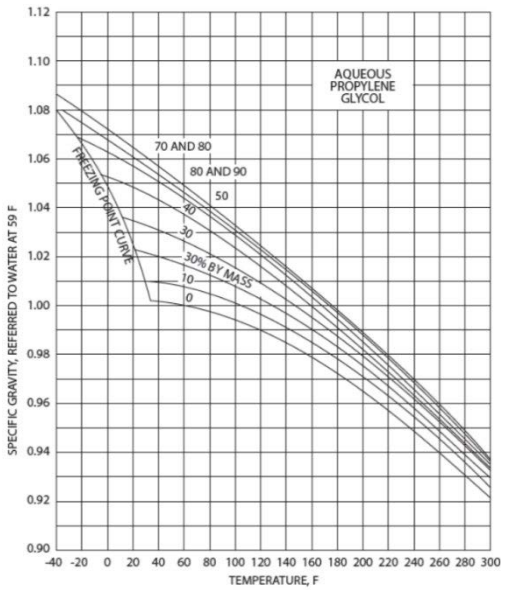


Figure 91: Propylene Glycol – Specific Gravity vs. Fluid Temperature.



Specific Gravity figures provided by Griswold Controls, LLC, source publication # F-5573 (3/25)

⚠ WARNING

- *All power wiring and communication cable 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. In case of conflict between local, state, or NEC regulations and the instructions in this manual, follow the local, state, or NEC regulation.*
- *Undersized wiring may lead to unacceptable voltage at the unit and may cause unit malfunction and / or a fire hazard.*
- *Properly ground the water source unit and indoor units. Ground wiring must always be installed by a qualified technician. 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 an NEC approved earth ground can result in equipment malfunction, property damage, electric shock, physical injury or death. Install appropriately sized breakers / fuses / overcurrent protection switches and wiring in accordance with local, state, and NEC regulations related to electrical equipment and wiring, and following the instructions in this manual. Generated overcurrent may include some amount of direct current. Using an oversized breaker or fuse may result in equipment malfunction, property damage, electric shock, physical injury or death.*
- *Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.*

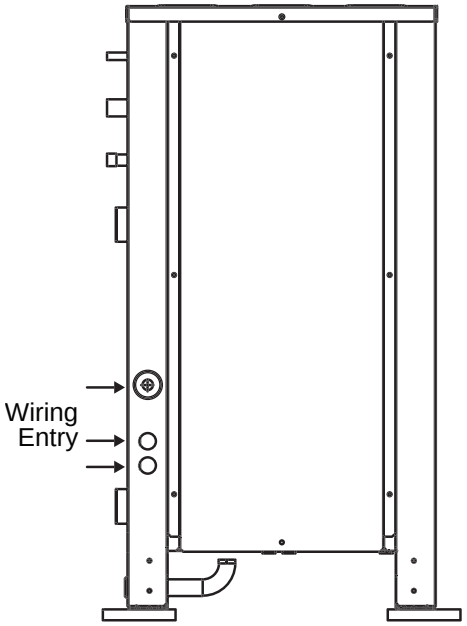


Figure 92:Access Holes for Power Wiring and Communication Cable Connections.

Separating Power Wires and Communication Cables

- Install the power wiring with a minimum of two (2) inches of separation from the communication cables to avoid operation problems caused by electrical interference. Do not run power wiring and communication cables in the same conduit.
- If it is unavoidable to run the power wiring and communication cables alongside each other for long distances, refer to Table 77 below for minimum recommended distances between the cables.

Table 77:Power Wire and Communications Cable Minimum Required Separation Minimum Allowable Distances.

Capacity of Power Supply Wiring (current)		Recommended Minimum Distance[1,2]
100V or more	10A	11-13/16 inches
	50A	19-11/16 inches
	100A	39-3/8 inches
	> 100A	59-1/16 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 interference between the power and communication signals continues, increase the distance until the interference is no longer a problem.

Note:

- *Do not bunch the power wiring and communication cables together.*
- *Do not run the power wiring and the communication cable in the same conduit.*

Power Supply / Power Wiring Specifications

Power Supply

- Power source 3-phase, 3-wire (with ground conductor) 60Hz, 220v (208-230v) and 460v
- Power source voltage cannot fluctuate more than the tolerance listed in the footnotes on Table 12 and Table 13.
- Phase to phase voltage difference cannot exceed 2%.

Note: LG designs this product for use with the most common domestic power source in North America, the three-phase, three wire with a ground conductor Y-configuration. Contact your LG representative for guidance connecting this product to other power source configurations.

Note: If phase-to-phase is above the allowable 2% variance, the electrical components in the product that conduct DC voltage, for example the inverter compressor bridge diodes, will operate at an elevated operating temperature above allowable component design temperature and will fail prematurely.

Power Wiring

Provide electrical conductors that meet the following minimum standard for powering Multi V Water 5 frames.

- Wire type may be stranded or solid copper conductor and must comply with local and NEC code.
- Wire gauge must be selected to comply with local and NEC code.
- Provide a grounding conductor for each frame. Ground all frames per local and NEC code.
- Multi V Water 5 frames and indoor units (IDU) must obtain power from separate breakers.
- Provide each frame with a service disconnect. Avoid mounting disconnect switches to frame panels of the product in a manner that impede service access or the removal of a Multi V Water 5 panel secured by screws.

Figure 93:Multi V Water 5 Power Wiring Terminal Location

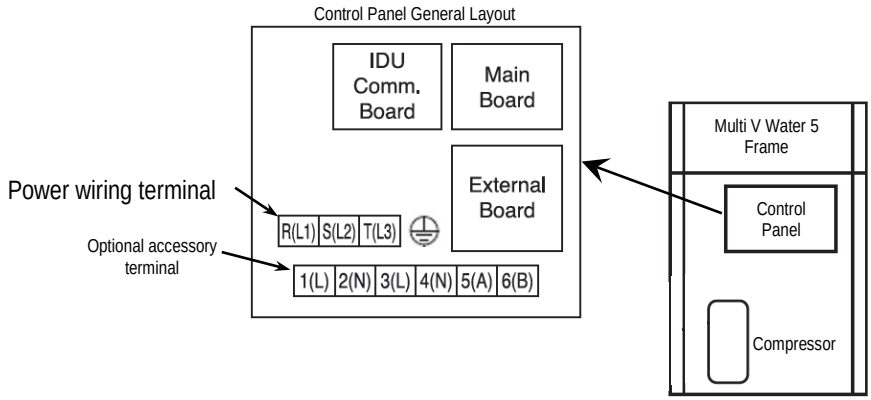
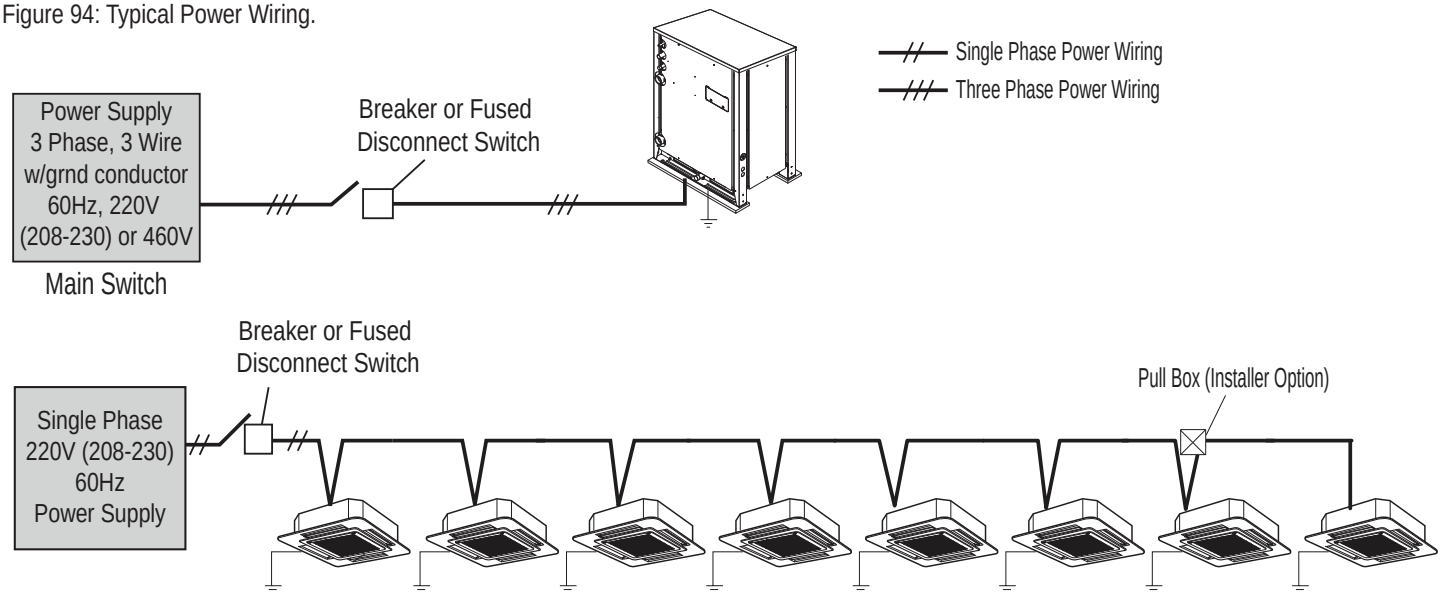


Figure 94: Typical Power Wiring.

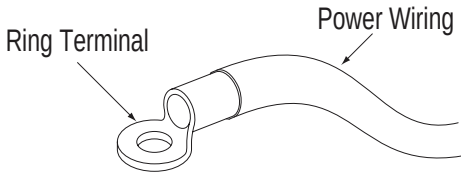


Connecting the Power Wiring

⚠WARNING

- *Multi V Water 5 frame input power is capable of causing severe injury or death. Do not touch bare input power wire or terminals. Ensure input power is OFF before connecting power wiring to the WSU.*
- *If power wires are not properly terminated and firmly attached, there is risk of fire, electric shock, and physical injury or death.*
- *Refer to the installation manual for each model of IDU for details of connecting power to each model of IDU.*

Figure 95:Typical Ring Terminal.



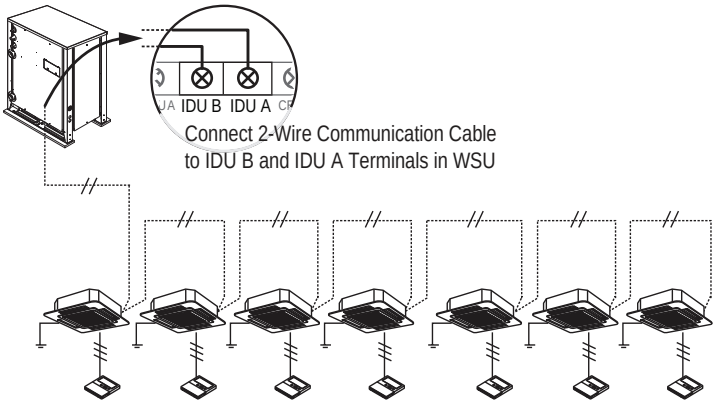
Best practice is to use ring or spade terminals to terminate power wiring at the power terminal block. If ring terminals or spade clips are not available, terminate the wires as follows:

- Firmly attach the wire; secure in a way to prevent external forces from being imparted on the terminal block.
- Use an appropriately sized screwdriver for tightening the terminals.
- Do not overtighten the connections; overtightening may damage the terminals.
- Terminate power wiring on Terminals R (L1), S (L2), T(L3). See Figure 93.

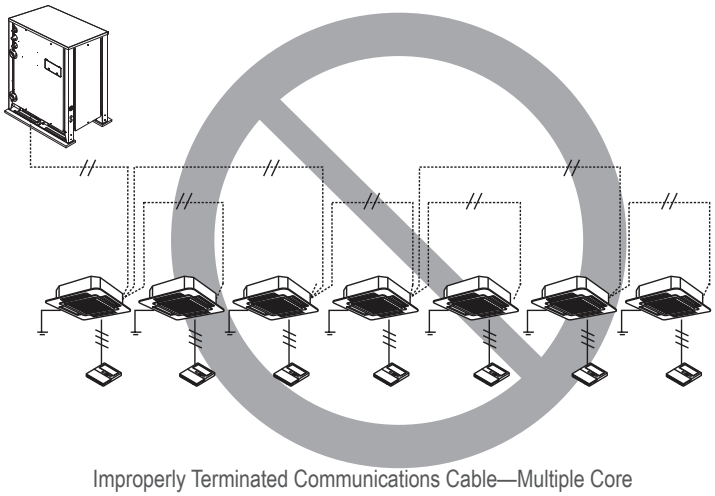
General Communication Cable Specifications

- Use two-conductor, 18 gauge, stranded and shielded cable between the water source unit and the indoor units.
  - Insulation material as required by local code
  - Rated for continuous exposure of temperatures up to 140°F
  - Maximum allowable cable length is 984 ft.
- Use copper-bearing ring or spade terminals to terminate communication cables.
- Firmly attach the cable; provide slack, but secure in a way to prevent strain on the cable and terminal block connections.
- Connect and terminate communications cable connecting the water source unit to indoor unit(s) in a daisy chain (bus) configuration starting at the water source unit.
- Terminate the cable shield to a grounded surface at the water source unit only. Cable shields between connected devices shall be tied together and continuous from the water source unit to the last device connected.
- Refer to the installation manual for the specific model of IDU for detailed communication cable installation instructions.

Figure 96: Water Source Unit Communications Schematic Diagram.



Required Configuration—18 Gauge, Two Conductor, Stranded and Shielded Cable in a Daisy Chain Configuration



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

Note:

- *Ring and spade terminals used to connect communications cables MUST be copper bearing. Do NOT use terminals that are galvanized or nickle plate over steel.*
- *Always verify the communication cable is connected to the proper communications terminals on the WSU(s). Never apply line voltage power to the communication cable connection. Line voltage can damage the circuit boards in the WSU(s) and the IDU(s).*
- *The shield of the communications cable connecting the water source unit to the indoor units should be grounded only to the water source unit frame. Tie the shield of each cable segment together using a wire nut at each indoor unit.*
- *Never ground the shield of the communications cable to the indoor unit frame or any other ground point.*
- *Position the WSU communication cables away from power wiring. Refer to minimum spacing requirements in Table 77.*
- *Never use a common multiple-conductor communications cable. Each communications bus must be a separate cable (i.e., one bus between WSU(s) and indoor units, and one bus between WSU(s) and central controller(s). If communications cables of separate systems are wired using a common multiple-conductor cable, it will result in a poor communications signal and unacceptable system operation.*

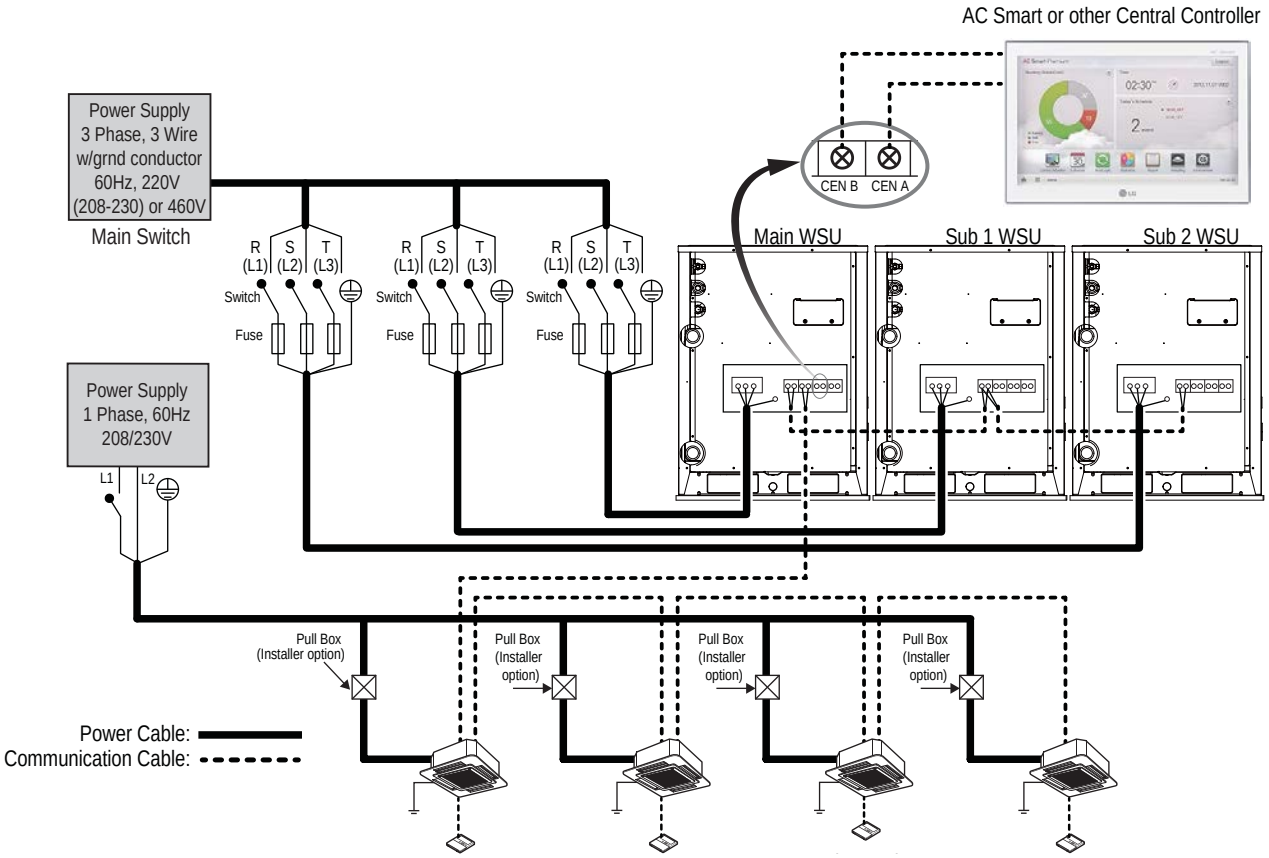
Communication Cable Between the WSU and the Central Control Device

- This communications cable is field provided, 18 gauge, two conductor, stranded and shielded.
- Use cable with insulation material as required by local code.

Connect all central control devices such as AC Smart II, AC Smart Premium, ACP, BACnet and LonWorks gateways, and energy recovery ventilators all on the same cable. 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 CEN A and CEN B. Route the cable as needed between each device. Follow the cable routing parameters described in “Separating Power Wires and Communication Cables” on page 122,

ELECTRICAL CONNECTIONS

ARWN Series Heat Pump Systems (208-230V and 460V)



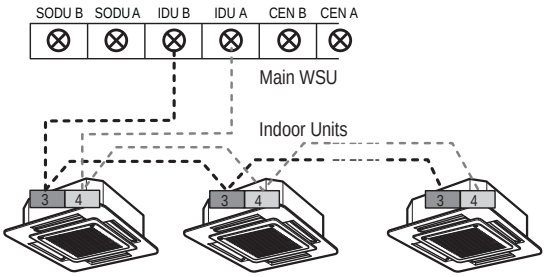
⚠ WARNING

- *Never apply line voltage power to the communications cable terminal block. If contact is made, the system may be damaged.*
- *Always include some allowance in the wiring length when terminating. Provide some slack to facilitate removing the electrical panels while servicing.*
- *Always ground indoor units to help prevent electrical shock accidents or communication signal disruption. Do not connect ground wires to the refrigerant pipes.*
- *Install a main shutoff switch that interrupts all power sources simultaneously.*
- *Operating the system in reversed phase can damage the compressor or other components. If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off during operation, install a field-supplied phase loss protection circuit.*

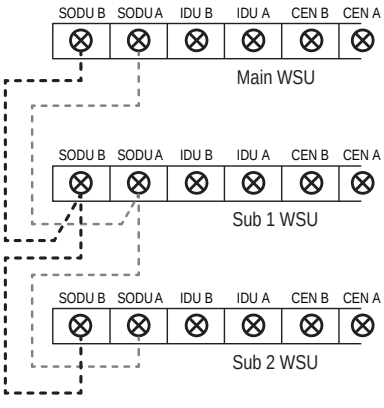
Note:

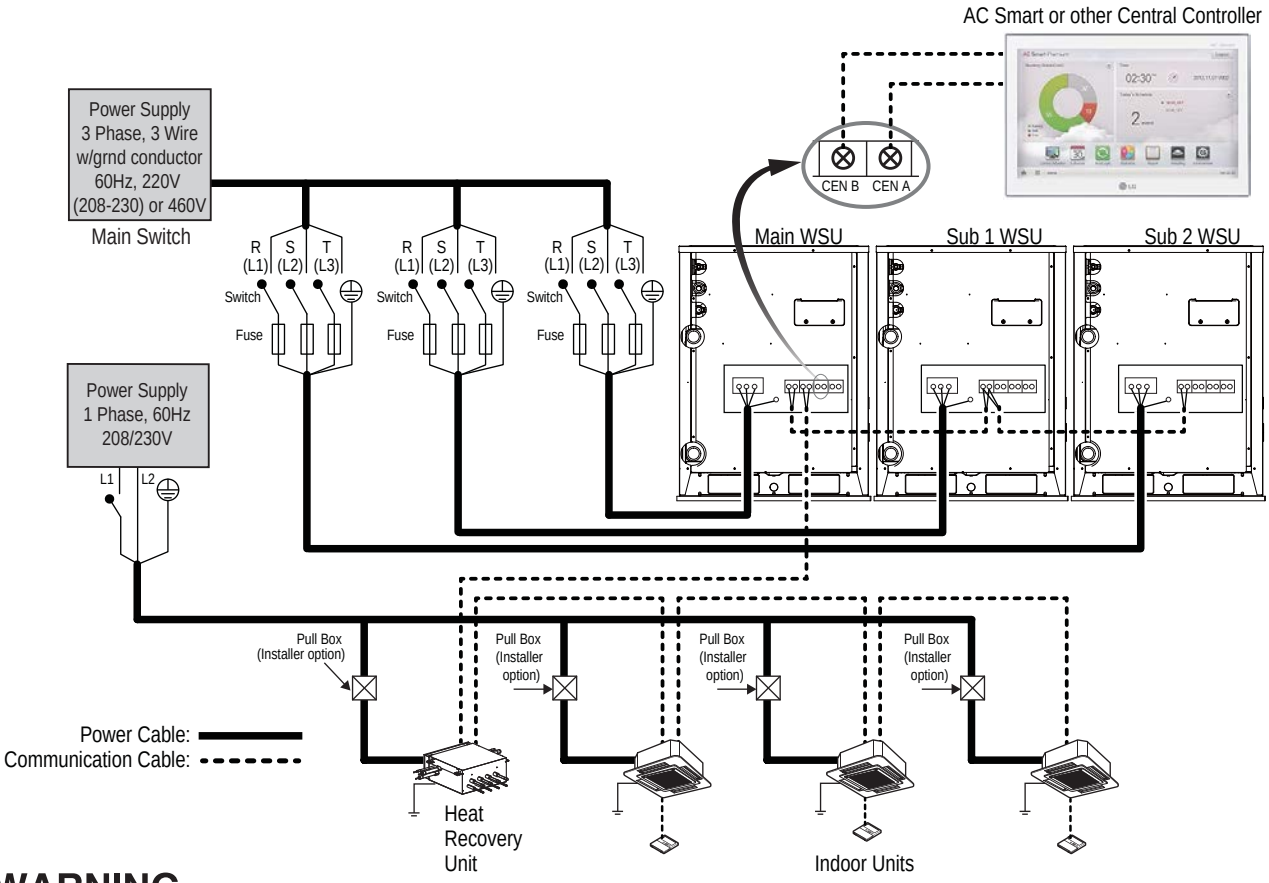
- *The GND terminal at the main circuit board is a negative terminal for a dry contact connection. Do not connect ground wires to this terminal.*
- *Ensure the terminal connections of the main and sub water source unit connections are matched, A terminals to A terminals and B terminals to B terminals.*

Communications Between IDUs and Main WSU



Communications Between WSUs





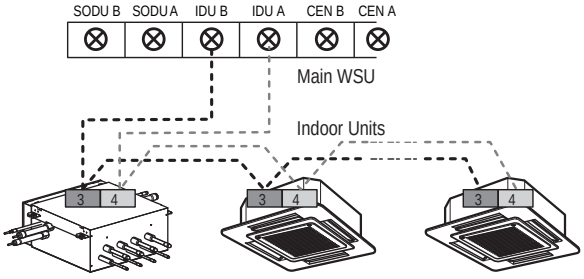
⚠ WARNING

- *Never apply line voltage power to the communications cable terminal block. If contact is made, the system may be damaged.*
- *Always include some allowance in the wiring length when terminating. Provide some slack to facilitate removing the electrical panels while servicing.*
- *Always ground indoor units to help prevent electrical shock accidents or communication signal disruption. Do not connect ground wires to the refrigerant pipes.*
- *Install a main shutoff switch that interrupts all power sources simultaneously.*
- *Operating the system in reversed phase can damage the compressor or other components. If there is a possibility of reversed phase, phase loss, momentary blackout, or the power goes on and off during operation, install a field-supplied phase loss protection circuit.*

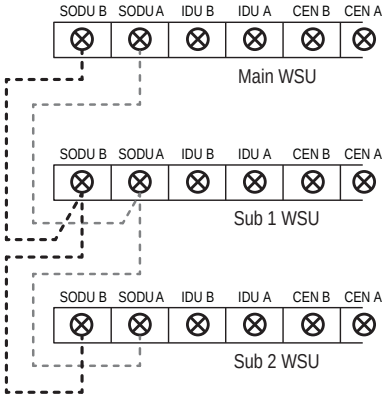
Note:

- *The GND terminal at the main circuit board is a negative terminal for a dry contact connection. Do not connect ground wires to this terminal.*
- *Ensure that the terminal connections of the main and sub water source unit connections are matched, A terminals to A terminals and B terminals to B terminals.*

Communications Between IDUs and Main WSU



Communications Between WSUs



IDU Communication Cable

Refer to Figure 97 and Figure 98. Connect the communication control cables between the main WSU and the IDUs.

Note:

Communications cables must be 18 gauge, stranded, shielded, and grounded at the water source unit(s) only. Maintain polarity throughout the communication network.

Figure 97: Multi V Water 5 ARWN Series Heat Pump System—Daisy-Chain Communications Cable Wiring.

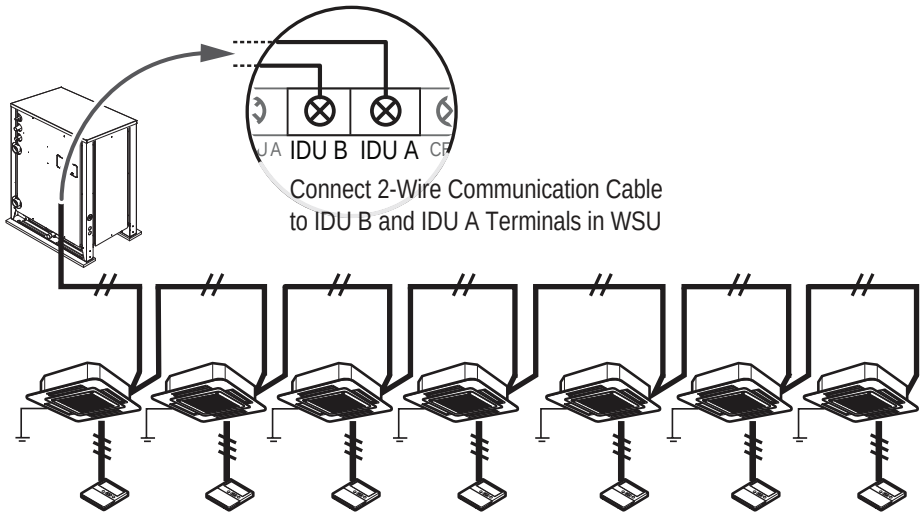
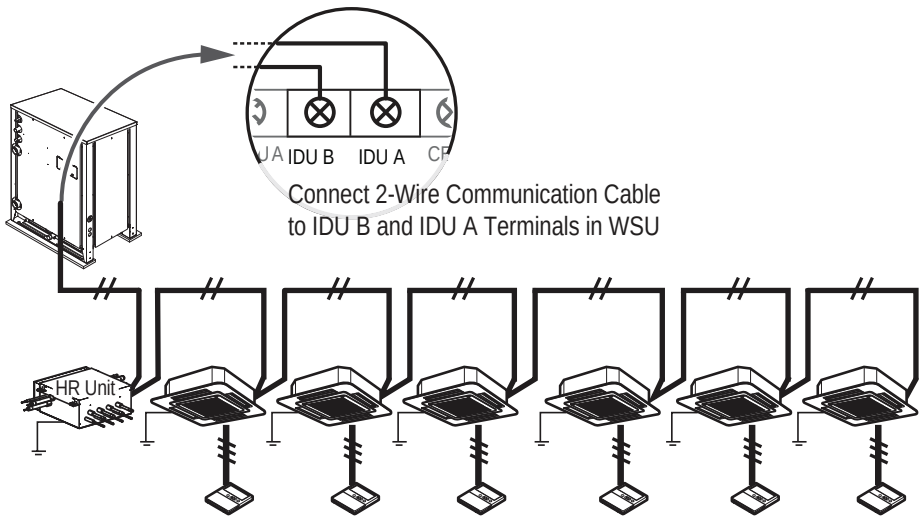


Figure 98: Multi V Water 5 ARWM Series Heat Recovery System—Daisy-Chain Communications Cable Wiring.



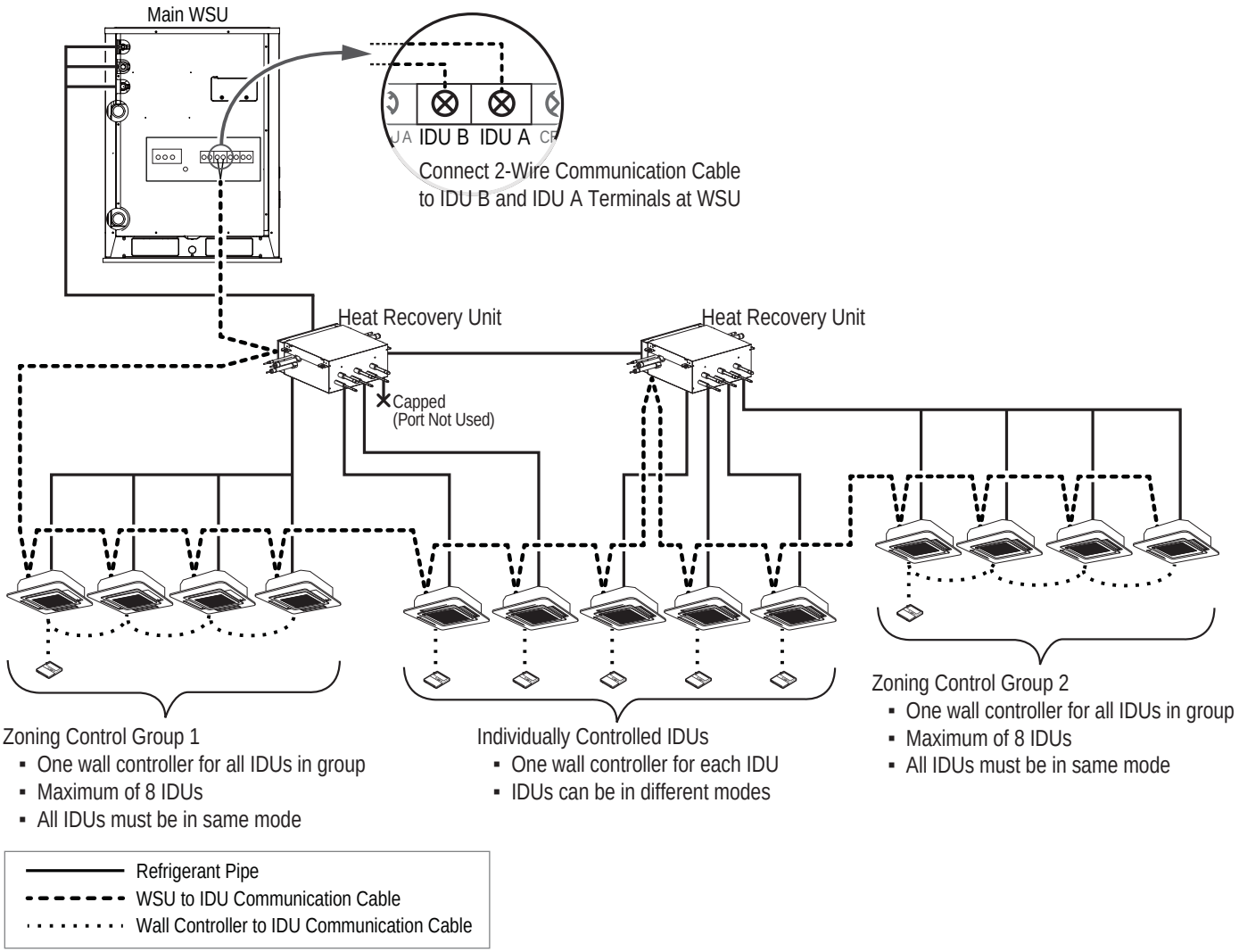
Zone Control Connections

Up to eight indoor units can be connected to one port of a heat recovery unit and can be controlled as a group. Figure 99 shows a typical application with both zone controlled and individually controlled IDUs. The WSU to IDU communications bus must be connected in a daisy chain configuration from IDU to IDU. For zone control of multiple IDUs, the control communications cable from the wall controller must connect first to the main IDU and then is daisy chained to the other IDUs in the zone. Controlling IDUs individually requires one wall controller per IDU.

Note:

- *The capacity of the indoor units on one port of a heat recovery unit (the zone) cannnot exceed 60kBtu/h.*
- *The maximum total capacity of indoor units connected to one PRHR083A Heat Recovery Unit cannot exceed 230kBtu/h.*
- *The maximum number of indoor units connected to one PRHR083A Heat Recovery Unit is 32.*
- *The maximum number of indoor units connected to one port of a PRHR083A Heat Recovery Unit is 8.*
- *All indoor units in a zone must be in the same mode, eitther heating or cooling. Auto Changover and Mode Override functions are not available in zone control.*

Figure 99: Typical IDU Zone Control Connections



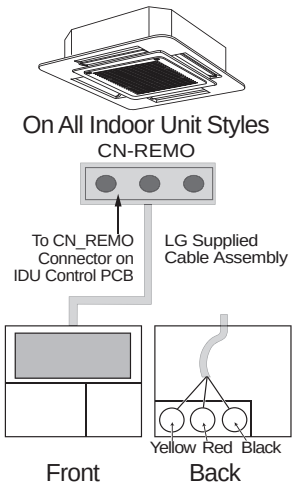
Communication Cable Between the Indoor Units and the Wall-Mounted Zone Controller

- Use field-provided 22 gauge, 3 conductor (22-3) unshielded communications cable between the indoor unit and the wall-mounted zone controller. Maximum length is 164ft.
- Set the indoor unit operating parameters with DIP switches on the indoor unit control PCB or by setting the zone controller. Refer to the indoor unit installation manuals for details.

Note:

Cable connected to Zone Controller is the factory default connection.

Figure 100:Indoor Unit to Zone Controller Connection.



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

- If any indoor units operate as a group, use either:
  - 22-3, stranded, unshielded field-provided wire, or
  - one (or multiple) three-core Group Control Kit (sold separately) containing extension and Y-splitter cables. One (1) group control cable kit is required for each indoor unit in the group except for the last indoor unit.
- Before running cable, decide which indoor unit will be the main indoor unit. The zone controller connects to the main.
- Adjust the appropriate DIP switch at each indoor unit in the group to identify it as the main or a sub. 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.

Note:

Cable connected to Zone Controller is the factory default connection.

Figure 101:Example of Indoor Unit Group to Zone Controller Connections (CN-REMO).

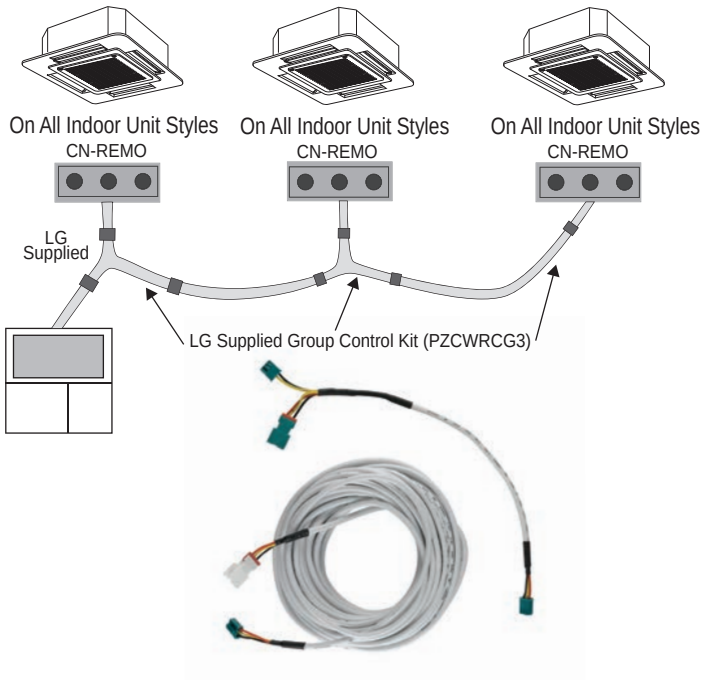
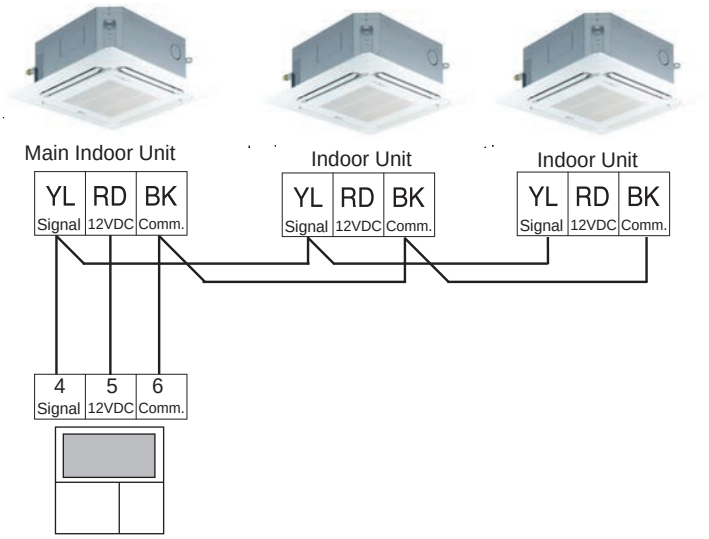


Figure 102:Example of Indoor Unit Group to Zone Controller Connections (Sig-12V-GND [Comm.] Terminal).



LG

Option Settings

Set DIP switch 01 as necessary for your Multi V Water 5 system.

Note: Before setting these options, ensure the input power to all indoor units is OFF. Ensure the water source unit is ON but the compressor is not operating. Restore power to the indoor units after this procedure is complete.

During normal operation, switch 5 of DIP switch SW01 is set to OFF. To enable option configuration, set switch 5 to ON. Use the forward, back, confirm and cancel buttons on the main circuit board to select and set system options. The display above the buttons shows the selected function and its options.

Use forward and back to scroll to the desired function and press confirm to select it. Then use forward and back to scroll between the options for that function and press confirm when the proper option is displayed. Pressing confirm stores the selected option in EEPROM on the circuit board.

Configure Multi V Water 5 Function Codes | Function Code Adjustments

1. Outdoor Unit Addressing (FN5)

If the Multi v Water 5 frame is connected to an LG central control product, or a BMS system, the frame must be assigned a hexadecimal address between 0 and 254. To assign the address follow the procedure outlined in the section Option Settings and values listed in Table 78.

2. Heat/Cool Selector Switch (FN1)

If field provided relays and wiring is installed in the master Multi V Water 5 outdoor unit on the Dry1 and DRY 2 screws with the intention of locking the reversing valve in a particular mode of operation, enable the Heat/Cool Selector switch function. To engage the Heat/Cool Selector Switch, follow the procedure outlined in the section Option Settings and values listed in Table 78.

3. Motorized Fluid Flow Shutoff/Solenoid Valve(s) Installed (FN41)

If the Motorized Fluid Flow Shutoff/Solenoid valve(s) is installed the microprocessor must be informed the accessory is present. Follow the procedure outlined in the section Option Settings and values listed in Table 78.

4. Variable Water Flow Control Kit Installed (FN42)

If the Variable Water Flow Control Kit is installed the microprocessor must be informed the kit is present. Follow the procedure outlined in the section Option Settings and values listed in Table 78.

Figure 103: DIP Switch 01 Operation.

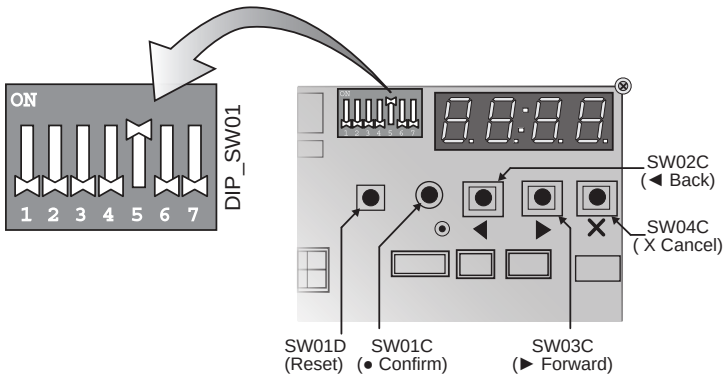


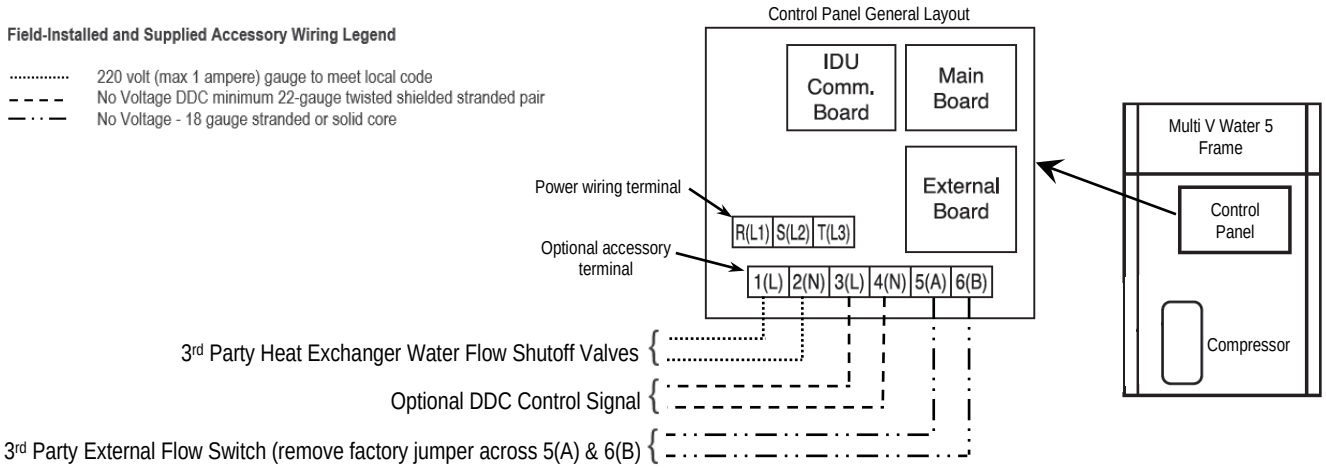
Table 78: DIP Switch 01 Option Settings.

Function		Options
Display	Description	
Fn1	Cool and Heat Selector	OFF / op1–op2
Fn5	WSU Address	0–255
Fn40[1]	Enable for Application #3 when the entering fluid temperature below 50F. (Former GEO-mode)	Enable / Disable
Fn41	Motorized Fluid Flow Shutoff/Solenoid Valve(s) Installed	ON / OFF
Fn42	Variable Water Flow Control Kit Installed	ON / OFF
FnXX	Pump Application	

[1]ENABLE THIS SWITCH ONLY AFTER the specified concentration of antifreeze agent is confirmed present in the circulating fluid.

Field Installed Components Wiring

Figure 104: Multi V Water 5 Field Provided And Installed Instrumentation Wiring Termination Diagram.



Note: For guidance wiring water flow control valves with the variable water flow control kit see Variable Water Flow Control Kit Wiring and Figure 108.

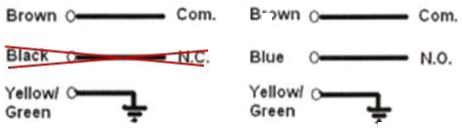
Flow Switch Wiring

Wire the flow switch normally open. Connect all wiring in accordance with local electrical code. Switch action will close the circuit between screw terminals 5(A) and 6(B) when fluid flow increases to the "Actuate" value in Table 65 and Table 66 and will open when the flow rate falls to or below the "Deactuate" value listed in Table 65 and Table 66. Field provide wire in length required to connect the flow switch to the Multi V Water 5 screw terminals.

Dwyer FS-2 Vane Flow Switch

1. Connect the brown common wire to the Multi V Water 5 screw terminal 5(A).
2. Connect the Blue (N.O.) contact wire to the Multi V Water 5 screw terminal 6(B)
3. Connect the Yellow/Green wire to the Multi V Water 5 frame ground screw.

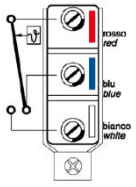
Figure 105: Dwyer.FS-2 Vane Flow Switch



Kobold FPS-5 Vane Flow Switch

1. Provide wire in length required to connect the flow switch to the Multi V Water 5 screw terminals.
2. Connect the Red common terminal to the Multi V Water 5 screw terminal 5(A).
3. Connect the White (N.O.) contact wire to the Multi V Water 5 screw terminal 6(B).

Figure 106: Kobold FPS-5 Vane Flow Switch.



Motorized Isolation Valve Wiring

1. If the valve actuator is not rated for 220 volts, purchase a pilot relay with a coil rated for 220 volt use. The pilot relay contacts should be rated for a current draw of 1 ampere and 220 volts. Find a convenient dry location to mount the pilot relay.
2. Provide field wire between the valve actuator and the pilot relay. The resistance of the leads should not exceed 10 ohms.
3. Terminate the wires at the control valve. Polarity does not matter. Connect one lead to the valve Common (-) terminal and the other to the voltage terminal (+). Connect the other end of the wires from the valve to the pilot relay normally open contact.
4. Connect a field provided wire rated for 220 v between the coil of the pilot relay and the Multi V Water 5 frame. Refer to Figure 9. Polarity does not matter. Terminate one lead to the Multi V Water 5 terminal strip screw tagged 1(L) 220 v. Terminate the other lead to terminal strip screw tagged 2(N). Connect the lead coming from screw 1(L) to one side of the pilot relay coil and the last lead to the other side of the pilot relay coil (See Figure 104).

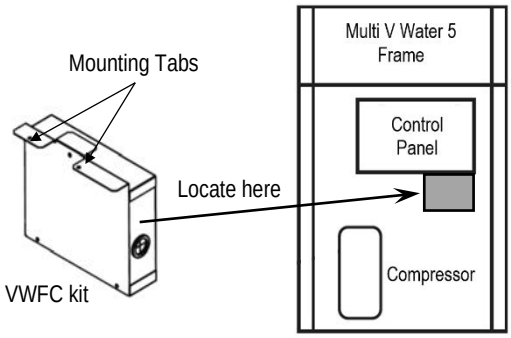
LG PWFKCN000 Variable Water Flow Control Kit Installation

⚠ DANGER

Turn off power to the Multi V Water 5 frame before proceeding.
Electrical shock can cause physical injury or death.

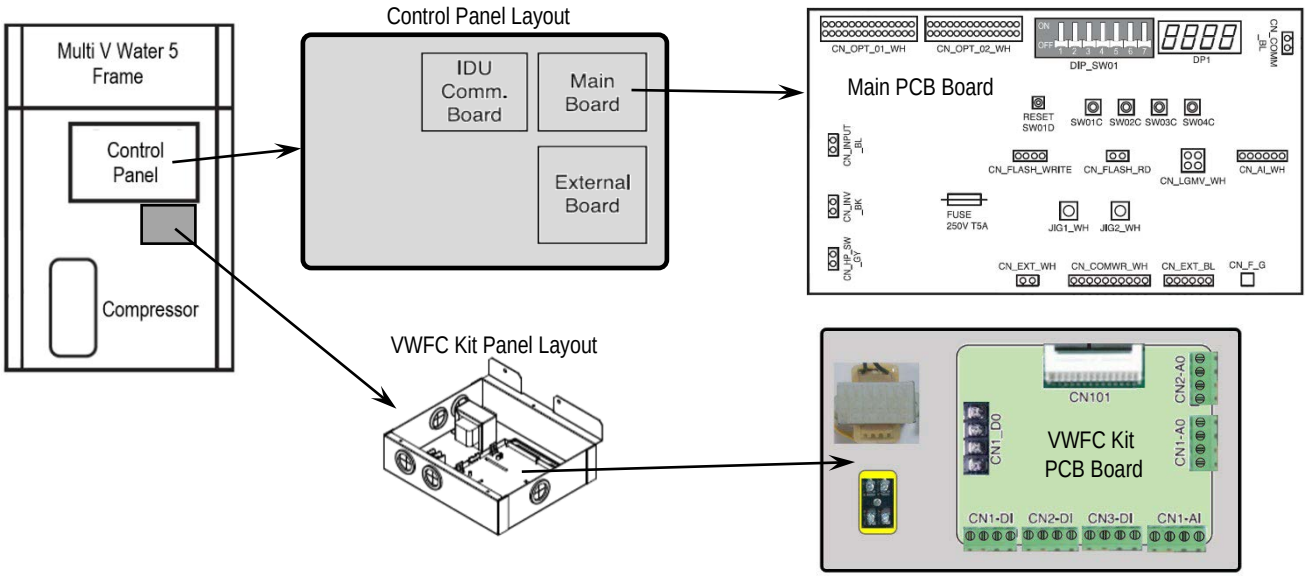
1. Remove the front panel from the Multi V Water 5 frame
2. Remove the front cover of Multi V Water 5 control box.
3. If necessary, unplug the Oil_Level Harness (3-pin yellow Molex plug) from External PCB.
4. Remove the* cover from the VWFC panel.
5. Using the two screws provided with the VWFC kit, mount the VWFC kit assembly. Attach the two tabs to the bottom surface of the Multi V Water 5 control panel.
6. Reinstall the Oil_Level_Harness 3-pin yellow Molex plug if removed in step 3.

Figure 107: Variable Water Flow Control Kit Installation Location.



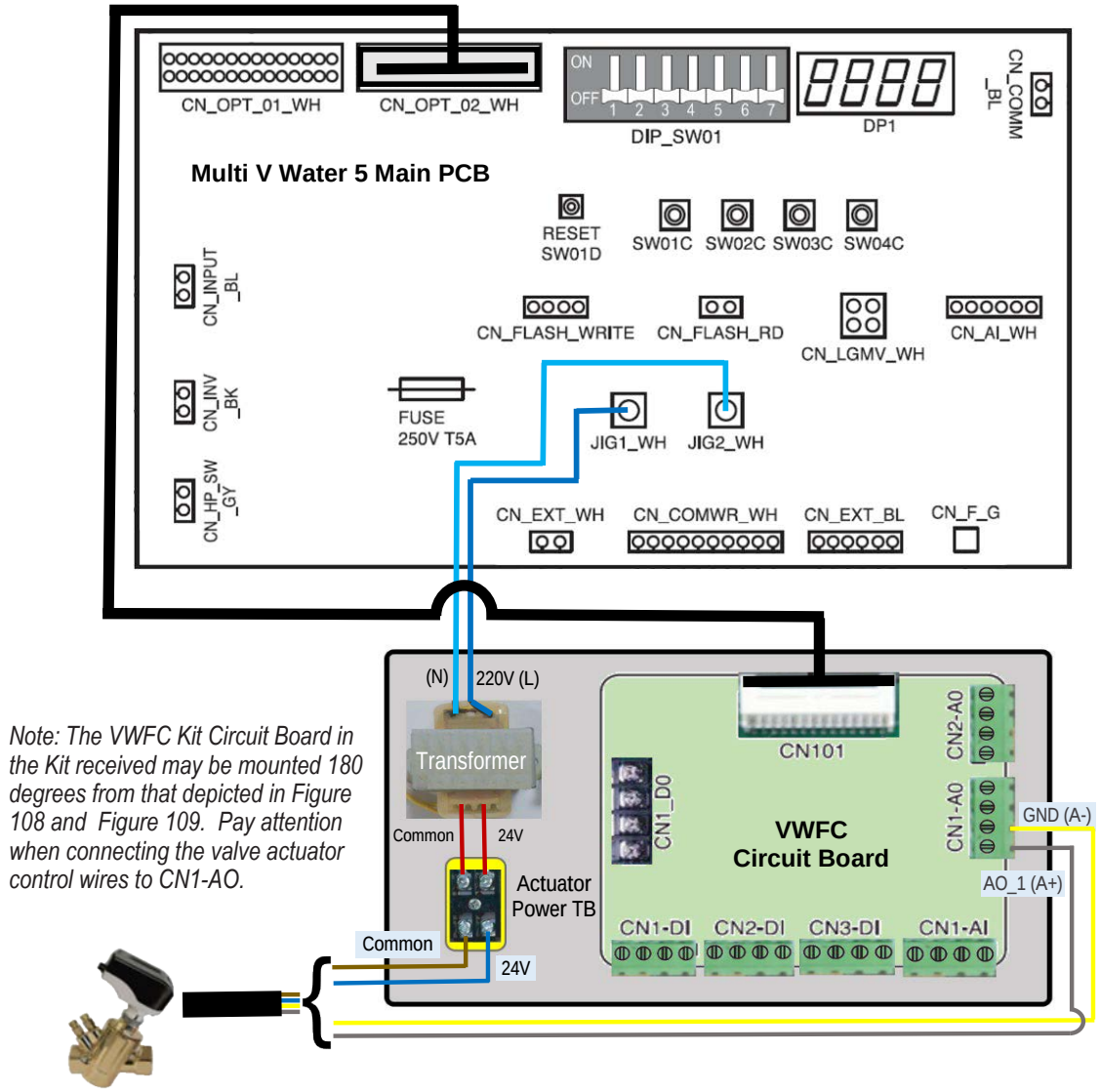
Variable Water Flow Control Kit Wiring

Figure 108: Multi V Water 5 Panel and PCB Board Locations.



Note: For VWFC kit main PCB board DIP switch settings refer to Table 79.

Figure 109: Multi V Water 5 Variable Water Flow Control Kit Field Wiring Schematic.



Note: The VWFC Kit Circuit Board in the Kit received may be mounted 180 degrees from that depicted in Figure 108 and Figure 109. Pay attention when connecting the valve actuator control wires to CN1-AO.

Multi V Water 5 Variable Water Flow Control Kit Wiring Procedure

⚠DANGER

Turn off power to the Multi V Water 5 frame before proceeding.

Electrical shock can cause physical injury or death.

1. Install and terminate the communications cable between the VWFC circuit board and the Multi V Water 5 main circuit board. Route the multi-lead cable with the black wrap provided with the VWFC Kit through the bottom wall center grommet of the VWFC assembly cabinet and up through the bottom grommet of the Multi V Water 5 control panel. Keep this cable away from line voltage wiring. In the VWFC assembly, plug the cable into the white socket tagged CN_101. Plug the opposite end into the socket tagged CN_OPT_02_WH on the Main PCB Board in the control panel.

   Note: The PCB board in the VWC Kit received may be turned 180 degree from that depicted in Figure 101. Therefore, the socket locations may be different than depicted.

2. Install and terminate the VWFC transformer power source wires. Route the two blue wires connected to the transformer in the VWFC Kit through the left grommet hole located on the bottom wall of the VWFC assembly cabinet and up through the grommet located in the bottom wall of the Multi V Water 5 control panel. Connect the two blue wires to the Main PCB Board sockets tagged CN_JIG1_WH (L) and CN_JIG2_WH (N).

LG

3. Install the control valve actuator control/signal cable. Route the PI control valve (or 3-way valve) actuator multi-lead cable through a conduit knock-out of your choosing on the wall of the unit frame. Consider the limited length of the cable when selecting the path. Cable leads must be long enough to reach the terminal block screws “A” and “B” located in the bottom left corner of the VWFC Kit panel and the green terminal block tagged CN 1-AO in Figure 109. LG suggests routing the multi-lead cable through the same grommet hole used for the two blue power wires.
4. Terminate the PI control valve actuator cable. Terminate the actuator Common and 24V leads to the terminal block screws tagged “A” and “B” that connect with the two red wires coming from the transformer. Terminate the control valve signal ground and the 24V 0-10 VDC Input Signal leads to the VWFC kit control board green 4-screw terminal block tagged CN1_AO in Figure 109.
5. Secure the control valve cable, the VFWC power and communications cable leads at the locations shown in Figure 110.
6. Access the Variable Water Flow Control PCB (PWFCKN000). Set the DIP switch positions on DIP SW101 and DIP SW02 as shown in below.

Table 79: Variable Water Flow Control DIP Switch Positions

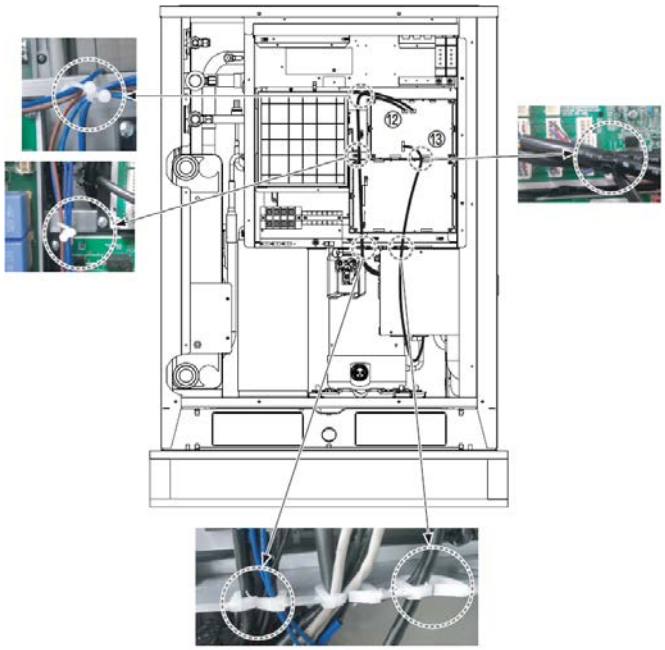
EFT	Application ID	SW01				SW02	
		L1	L2	L3	L4	L1	L2
≥ 60˚F *	1	On	Off	Off	Off	Off	Off
< 60˚F ≥ 50˚F	2	On	Off	Off	Off	Off	Off
< 50˚F	3	On	On	Off	Off	On	On

* VWFC kit is not required. If installed use these settings

7. INFORM the Multi V Water 5 frame the VWFC kit is installed. Set Table 78 function code 42. Set it to ON.
8. Verify the operational settings of each 2-way or 3-way control valve actuator are setup to operate per the specifications set forth in Table 76. Refer to PI control valve actuator set-up procedures on page 140 for applications #2 (optional for application #1).
9. Reinstall the VWFC kit cover plate using screws provided.

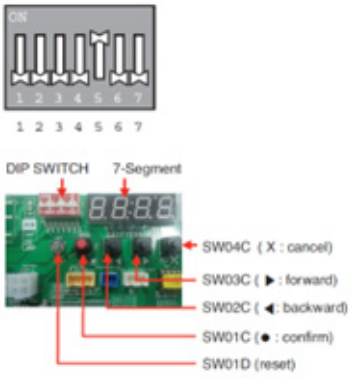
   Note: The resistance value of each lead of the 4-wire cable provided cannot exceed 10 Ohms. The transformer is rated for a maximum load (current draw) by the valve actuator driver-motor of 10VA.

Figure 110: VWFC Installation Suggested Cable Securing Locations.



Procedure:

1. On Multi V Water 5 frame main PCB, turn on DIP switch 5 (up).
2. Select the “Func” mode using the left and right arrow buttons.
3. Press the confirm button.
4. Select the “FN42” for Multi V Water 5 (previous generation products select “FN4”) using the left and right arrow buttons.
5. Press the confirm button.
6. Press the rest button for the new setting to take effect.
7. Turn OFF DIP switch 5 (down).
   NOTE: Press reset button (power cycle) for new switch settings to take effect.



Pressure Independent Control Valve Wiring Terminations

Note: Actuators supplied by valve manufacturer include wiring diagrams and installation manuals with the valve. ALWAYS refer to this paperwork for the most up-to-date wiring diagrams and instructions.

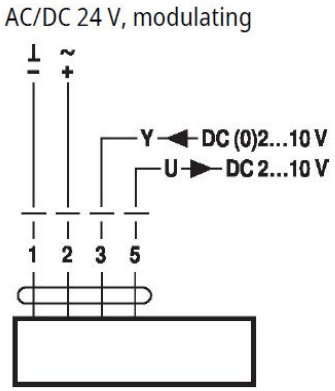
Belimo PI-CV Valve

(last updated 4-20-2022)

Table 80: Belimo PI-CV Valve Information.

Wire Tag / Termination Connection Matrix			
	Belimo AKR24-EP Actuator		LG PWFCKN000
Duty	Lead Color	MFG Diagram Lead Tag	Control Kit Terminal Tag
Actuator Power (common)	Black	Lead #1 [AC/DC 24V (-)]	terminal block Common
Actuator Power (24V)	Red	Lead #2 [AC/DC 24V (+)]	termianl block 24V
Control Signal Input 0-10V	White	Lead #3 [Y-DC (0)2...10V]	CN1-AO_1(A+)
Control Signal (common)	N/A	Jumper to Lead #1	CN1-AO GND (A-)
Control Signal Feedback 0-10V	Orange	Lead #5 [U-DC 2...10V]	Wire cap (not used by LG)

Figure 111: Belimo PI-CV Valve Wiring Diagram



Griswold Controls (FlowCon) Pinnacle Valve

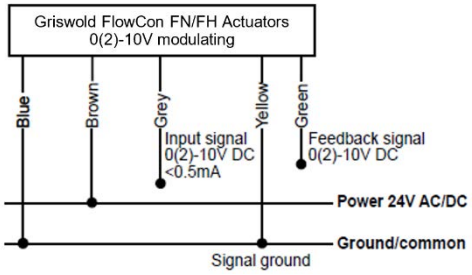
(last updated 4-20-2022)

Table 81: Griswold Controls (FlowCon) Pinnacle Valve Information.

Wire Tag / Termination Connection Matrix			
	*FlowCon FN.1.2 & FH.1 Actuator		LG PWFCKN000
Duty	Lead Color	MFG Diagram Lead Tag	Control Kit Terminal Tag
Actuator Power (common)	Blue	Ground/common	terminal block Common
Actuator Power (24V)	Brown	Power 24V AC/DC	termianl block 24V
Control Signal Input 0-10V	Grey	Input Signal 0(2)-10V DC	CN1-AO_1(A+)
Control Signal (common)	Yellow	Signal ground/common	CN1-AO GND (A-)
Control Signal Feedback 0-10V	Green	Feedback signal 0(2)-10V DC	Wire cap (not used by LG)

*FlowCon division of Griswold Controls

Figure 112: Griswold Controls (FlowCon) Pinnacle Valve Wiring Diagram



Prepare the Electrical System

1. Verify correct, clean, specified power is at the line side of each system component's power disconnect switch.
2. Note if the green LED light on the component PCB board is illuminated.
3. If a zone controller is connected to the component, verify the LCD screen displays current operational characteristics.

Prepare the Fluid Circuit

Before filling the fluid pipe verify the following:

1. Verify the interconnecting pipe used is metallic and NOT a polymer (i.e. PVC, CPVC).
2. Verify that all ferrous to copper/brass connections are connected using die-electric isolating devices.
3. Verify clearance requirements are met for the removal of the heat exchanger and the front panel can be removed without removing refrigerant and/or fluid circulation systems piping.
4. Verify the direction of flow through the heat exchanger is correct. Inlet at the bottom, outlet at the top.
5. Verify the control valve, strainer and flow switch installed with the arrow on the body of each aligned with the direction of flow.
6. Verify flow control provisions (flow limiting valve or PI control valve) are provided for each frame of multi-frame units.
7. Verify ALL Multi V Water 5 frames and associated PI valve controllers are at least eight-(8) pump discharge pipe-diameters or eight (8) feet from the pump discharge whichever is greater.
8. Verify that 5-pipe diameters of straight pipe length are upstream (entering side) of the Flow Limiting or Pressure Independent Control (PIC) valve. Verify at least 5 pipe diameters of straight pipe length are upstream (entering side) of the flow switch.
9. Check manufacturer's requirements for number of pipe diameters of straight pipe length required leaving the valve and verify the installation pipe architecture complies with the specification.
10. Verify the valve stem is mounted within 45 degrees either side of vertical up. If not, verify the installed orientation is authorized by the valve manufacturer's published literature.
11. Verify provision is present to measure fluid flow temperature and pressure drop across the heat exchanger.
12. Verify a method is provided for removing air from the heat exchanger and fluid piping.
13. Verify a method is provided for draining the fluid from and isolating the Multi V Water 5 heat exchanger for service.
14. Verify a method is provided to measure the differential pressure across the strainer.
15. Verify a method is provided to differential pressure across the flow limiting valve or PI control valve.
16. Verify all strainers have a 50 MESH rated screen/basket installed.
17. Verify a flow switch is installed and calibrated for each frame. Flow switch wiring is terminated and the factory jumper wire is removed between terminals 5(A) and 6(B).
18. On frames equipped with a PI control valve verify the valve actuator and the LG Variable Water Flow Control (VWFC) Kit are wired per the schematic in Figure 101.
19. On frames supplied with fluid that will be entering at less than 50˚F, a bypass pump and pipe are installed between the heat exchanger discharges back to the heat exchanger inlet.
20. A check valve is installed on the discharge of the bypass pump.
21. The accessories wired to terminals 1(L) and 2(N) are rated for 220v/60/1.
22. If a bypass pump is installed, the start/stop control is wired to dry contact terminals 3(L) and 4(N) of the Multi V Water 5 frame it serves.
23. Verify the DIP switch settings on the VWFC kit PCB board are set per step 6 of the instructions in "Multi V Water 5 Variable Water Flow Control Kit Wiring Procedure" on page 134 of this manual.

Fill the Pipe System with Fluid

1. Verify the pump and associated variable frequency drive is operating as designed and impeller is spinning in the correct direction.
2. Verify all manual fluid shutoff valves are open.
3. Initiate a pump start.

Note: Do not operate the Multi V Water 5 unit. Leave disconnects OFF

4. Purge all air from the water circuit.
5. Thoroughly flush the fluid circuit. Continually check and clean strainers as necessary. Continue flushing until strainers remain clean.
6. After flushing is complete, add anti-freeze agent and inhibitors BEFORE setting the rated flow rate limits on the flow limiting valve or PI control valve, and triple duty check valve on the bypass pump (if present).
7. Verify the specific gravity rating of the fluid complies with the design (i.e. design engineer's specified freeze protection standard is achieved).
8. Verify the fluid cleanliness meets or exceeds the conditions set forth in Table 71. Acquire a report of a fluid composition test for the fluid in circulation.
9. Verify the piping accessories, pump, and control devices are installed as depicted in Figure 74, Figure 75, Figure 76, and Figure 77 for the pertinent application of the Multi V Water 5 frame.
10. Set the maximum flow through the PI control valve. Table 62 provides guidance for Belimo or Griswold.
11. Balance the fluid circuit flow distribution. The fluid flow balancing contractor must complete their work prior to setup and verifying the fluid flow rate is within project specifications. Excessive or restricted fluid flow may impact the ability of the Setup Agent.

Pressure Independent Control Valve Calibration | Setting the Rated Flow

The method of setting the maximum flow setting variable is manufacturer dependent.

The Table below is provided for sample guidance only. Always refer to the valve manufacturer's installation literature FOR THE VALVE and ACTUATOR model installed to properly calibrate the maximum flow rate.

With the control valve wide open, the pressure drop across the PI control valve assembly must be within the valve manufacturer's controllable flow rate range (see Figure 72 and Table 60). If the differential pressure is outside the published controllable range, the valve will operate as a fixed orifice device and will not operate properly. Contact the PI control valve manufacturer's representative for further assistance.

The data in Table 82 pertains to the valve/operator combinations shown for use with Application 2. Verify the valve and operator installed is the same as those listed in the table before applying the set-up data provided in the table. Find the column in the table below for the Multi V Water 5 unit the valve serves. For Belimo, verify the maximum flow setting is calibrated to the % of maximum flow value provided. For Griswold/FlowCon, set the maxim flow position to the value provided. This will set the maximum flow through the frame to the rated flow condition.

Note: Verify this data has not changed since this publication. Refer to the valve manufacturer's latest published installation literature for the most up-to-date instructions and guidance.

Table 82: Example PI Control Valve Actuator Maximum Flow Settings.

Mfg	Series	Valve with actuator image	Model	Actuator	Dia (in) Thread	LG Model	6.0 Ton ARWM072*AS5	8.0 Ton ARWM096*AS5	10.0 Ton ARWM121*AS5	12.0 Ton ARWM144*AS5	14.0 Ton ARWM168DAS5	16.0 Ton ARWM192DAS5
						Rated GPM	20.3	25.4	30.4	35.5	45.7	50.8
Belimo	PI-CV		P2125SU-285	AKR24-EP2	1-1/4 FPT	max flow % setting	71%	89%				
			P2150SU-396	AKR24-EP2	1-1/2 FPT	max flow % setting	51%	64%	77%	88%		
			P2200SU-761	AKR24-EP2	2 FPT	max flow % setting					60%	67%
Griswold Controls	Pinnacle		PNL_BP_	FN.1.2	1-1/4 FPT	max flow setting	5.0					
			PNL_BQ_	FH.1	1-1/2 FPT	max flow setting	1.8	2.1	2.4	2.7	3.5	3.9

Flow Switch Calibration

Follow guidance for setting the actuate and deactuate settings for the flow switch reference the data provided in Table 65 and Table 66. Note the settings are different for installations with and without a control valve and also with and without a bypass pump. Also read the sequence of operation for cooling mode operation for the installation's entering fluid design temperature (Application #1, #2, or #3) on page 101 though page 109 before selecting to use the calibration data provided in Table 65 and Table 66.

Calibrate Fluid Flow Control Instrumentation

1. Physically inspect the strainer screen/basket. Verify it is clean.
2. Calibrate the flow limiting or pressure independent (PI) control valve maximum flow rate.
3. Record the inlet and outlet pressure across the control valve with all valves wide open. Does the inlet measurement meet or exceed the minimum pressure drop rating to achieve a linear response of the flow limiting valve or the PI control valve?
4. Verify the strainer differential pressure measurement device is calibrated correctly.
5. Record the clean strainer differential pressure reading with all control and shutoff valves wide open.
6. Verify rated flow for each frame is achieved at each frame with all valves 100% open. Record the measured flow rate for each frame.
7. Calibrate flow switches. Verify the flow switch has been calibrated and the correct actuate and deactuate settings have been set. If flow switch models listed in Table 65 and Table 66 are installed, use the specifications found in Table 65 and Table 66 for calibration.

Additional Settings Pertaining to The Pi Control Valve Actuator and the LG VWFC Kit.

1. Verify the PIC valve actuator is set to provide a linear response.
2. Verify the actuator installed is compatible (has the correct torque rating) with the valve body installed.
3. The actuator motor is rated for use with 24 Vdc power.
4. The valve actuator is programmed to be normally closed. 0 (or 2) volts = closed; 10 volts 100% open.
5. The actuator is programmed to use an Input Signal of 0 (or 2) to 10 VDC signal.
6. The valve actuator is setup for a maximum full stroke time of 90 seconds or less.
7. The power draw of the valve operator does not exceed 6 watts.
8. Verify that upon power loss or valve operator failure, the apparatus installed will drive the control valve to the 100% open position (i.e. valve will be able to fail OPEN).
9. The maximum flow setting is set to limit flow through the wide open valve at the Multi V Water 5 frame's rated flow specification.
10. PI control valve actuator DIP switch settings have been adjusted using valve manufacturer's installation manual guidance to meet the parameters provided in Table 60, Table 61, Table 62, Table 63, Table 64, and Table 82.

Indoor Unit Auto Addressing

⚠WARNING

During this procedure, only a properly-licensed electrician should operate power input disconnect switches. Never look at a disconnect switch when closing. Turn away from the switch when closing. Incorrect wiring could cause the disconnect to explode, resulting in physical injury or death.

⚠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 until directed by the LG-authorized Setup Agent. Major damage to the unit piping and compressors will occur, and there is a risk of explosion, suffocation, physical injury, and / or death.

Note:

⃠ *Do not attempt to start or commission Multi V Water 5 before properly setup the fluid loop. Verify maximum flow rate through the heat exchanger is set at the rated flow specification.*

Note:

During the Pre-setup process for Gen. 4 systems, do not change any DIP switch settings except for SW01 switch number 3 which should be ON to enable Gen. 4 features. All other switches should be left in the OFF position on ODU DIP switch SW01. Refer to "HRU Compatibility and DIP Switch Settings for Generation 4 Equipment" on page 149 for proper setting of DIP switch 3.

Auto Addressing Procedure

Note:

If the Auto Address Procedure is not successful, the compressor(s) will not start when power is applied.

Note:

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

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 main water source unit only.
5. At the water source unit PCB, verify DIP switch SW01 is set as necessary for your system. Refer to "HRU Compatibility and DIP Switch Settings for Generation 4 Equipment" on page 149.
6. If the LED on the main PCB is not observable from the power disconnect switch location, have a second person cycle power on the water source unit. Leave input power disconnect in the ON position.
7. Check the water source unit current configuration code(s). Observe the unit setup codes listed in Table 83 on the LED display on the WSU main PCB. Each code will display for approximately two (2) seconds.

Table 83: Setup Code Display Sequence.

Sequence	Code Displayed	Description
1	See Description	Capacity of Main WSU in horsepower (HP). Refer to Table 15 through Table 18 for HP values.
2	See Description	Capacity of Sub 1 WSU in HP. Refer to Table 15 through Table 18 for HP values.
3	See Description	Capacity of Sub 2 WSU in HP. Refer to Table 15 through Table 18 for HP values.
4	See Description	Total capacity in HP of all WSUs. Refer to Table 15 through Table 18 for HP values.
5	2 or 3	2 = Heat Pump; 3 = Heat Recovery
6	22 or 46	22 = 208-230V system; 46 = 460V system
7	1, 2, or 3	Model type. 1 = General; 2 = Tropical; 3 = Factory

Auto Addressing Procedure, continued

8. Verify how many indoor units and heat recovery units (HR systems only) are connected to the system.
9. Press and hold red Auto Address Button (Figure 113) for about five (5) seconds. Release when “88” appears on the LED. The system begins the auto addressing sequence listed in Table 84. 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. If the auto addressing procedure is successful, this number should match the known number of installed indoor units
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-setup 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. 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. Close the disconnect to reapply power to the water source unit and energize the compressor crankcase heater.
15. Replace the control panel door.

Figure 113:Auto Address Button Location.

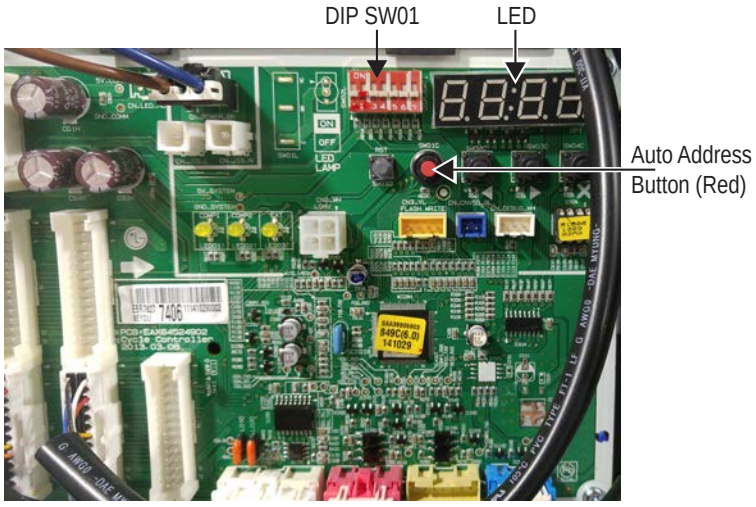
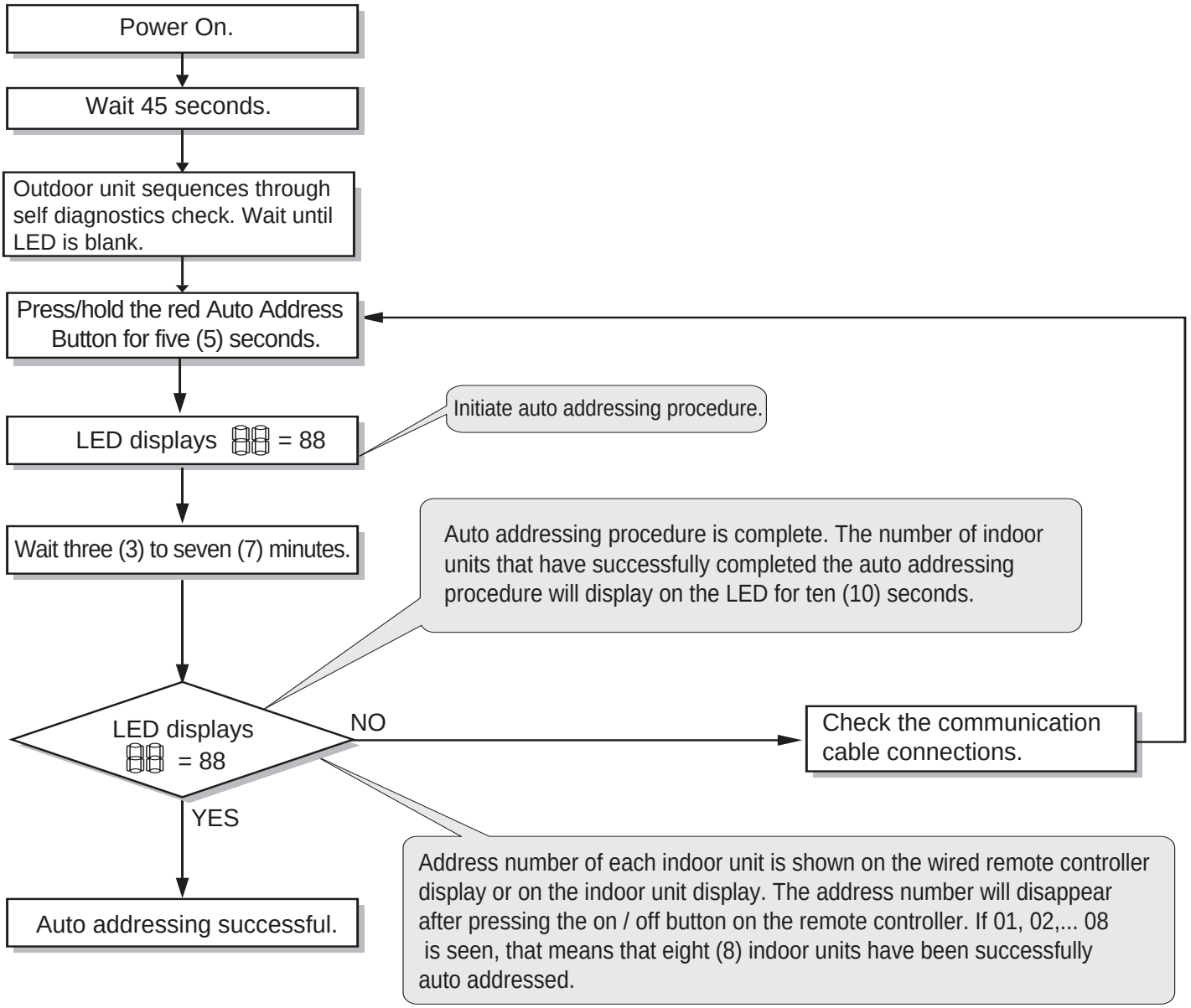


Table 84: IDU Auto Addressing Display Sequence.

Sequence	Code Displayed	Description
1	88	Auto addressing procedure begins
2	88	Auto addressing procedure continues for approximately 3 to 7 minutes (15 minutes maximum)
3	See Description	Number of indoor units found displays
4	See Description	Number of heat recovery units found displays (HR systems only)
5	Blank	Auto addressing procedure is complete

Figure 114: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 “3 (or “5” in the case of cassette frame codes TP, TN, TM) 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 “4” (or “6” in the case of cassette chassis codes TP, TN, TM) 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 number of installed 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-setup 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 Setup 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.

Terminating Group Controlled 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 a group control cable kit consisting of three (3) cables:

- One pigtail cable.
- One Y-cable.
- One extension cable segment.

1. Before proceeding with group control cable terminations, verify power is off at all group 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-setup Device Configuration Worksheet.
3. Termination Procedure:
   - Starting with the Main 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 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.

Plan the Central Control Addresses Assignments

Check with the building’s Chief Engineer for preferences about address assignments. 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.[1]
- 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.[1]

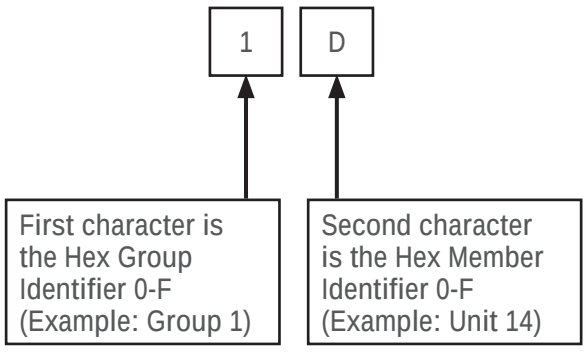
[1]On AC EZ, do not skip addresses. Start with Hex address 0. Buttons have pre-assigned Hex addresses. If an address is skipped, the associated button will do nothing.

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.
- 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.

Figure 115:Central Control Address Nomenclature.



Hex Address Assignment Limitations

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

Central Controller Communications Limitations

Each type of central controller device has a maximum number of indoor units it can communicate with.

The quantity of indoor units that can be connected to a single central control communications cable, therefore, will be defined by the central control device on that cable with the smallest Maximum Indoor Unit Quantity as shown at right.

Table 85:Central Controller Indoor Unit Connection Limitations.

Central Control Device	Maximum Indoor Unit Quantity
AC EZ	32
AC SMART Premium	128
LonWorks Gateway	64
BACnet Gateway	256
Advanced Control Platform	256

Group Number

If the building operator wants to know which indoor units are on each water source 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 may 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 may be necessary.

Member Number

Can be assigned as desired 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-setup 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.

Power Up All Indoor Unit PCBs

Turn the disconnect for each indoor unit to the “ON” position. DO NOT turn the unit ON (on/off button remains off).

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 cable is plugged into CN-REMO socket on the indoor unit PCB.
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

1. Before attempting to assign a central control address to an indoor unit controlled as a group, identify which unit in the group will be identified as the Main indoor unit and which indoor units are going to be identified as Sub units.
2. Go to the Main indoor unit, and access the PCB.
3. Verify a group control pigtail cable is plugged into the CN-REMO socket on the indoor unit PCB. If it is not, do so now by plugging the communications cable pigtail into the CN-REMO socket.
4. If the group control extension cable between the indoor units is plugged into the Y-cable, unplug the extension cable from the Y-cable.
5. If not already present, plug the zone controller communications cable into the pigtail cable.
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 in step 18.
8. If the zone controller and associated communications cable has already been permanently mounted in place, plug the Y-cable back into the pigtail and obtain a loose zone controller with a communications cable to continue programming the Sub indoor units.
9. Go to the first Sub indoor unit and disconnect the Y-cable from the pigtail.
10. Plug the zone controller communications cable into the socket on the pigtail cable. Do not push the ON / OFF button or enable indoor unit operation.
11. 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.
12. Change DIP switch No. 3 on the indoor unit PCB to the "ON" position.
13. Disable power to the indoor unit using the disconnect switch. Wait one (1) minute.
14. While power is off, unplug the zone controller cable from the pigtail socket.
15. Plug the group control Y-cable back into the pigtail.
16. Restore power to that Sub indoor unit, and go to the next Sub indoor unit.
17. Repeat Steps 9 to 16 for each Sub indoor unit except the last one in the group. At the last Sub indoor unit, the process is the same except unplug the group control cable from socket CN-REMO on the indoor unit PCB board and plug the zone controller cable into the same socket.
18. After all Sub indoor units have addresses assigned, go back to the Main indoor unit and restore power.

Indoor Unit Temperature Sensing Location Selection

For each indoor unit connected to a wired zone controller, select a zone temperature sensing option. Assign one of three methods for the indoor unit to sense the zone temperature. Skip this step for indoor units controlled from a handheld (wireless) controller. Record the sensing for each indoor unit on the Pre-setup Device Configuration Worksheet. There are three possible strategies:

1. Use the unit-mounted return air sensor (or the optional remote wall-mounted sensor). When outdoor air is ducted to an indoor unit, the return air sensor cannot be used to control the indoor unit. Use a wall-mounted thermostat or remote temperature sensor instead of the unit-mounted return air sensor.
2. Use the sensor mounted in the zone controller.
3. Sense the temperature at the unit-mounted return air sensor (or the optional remote wall-mounted sensor) and sensor mounted in the zone controller, then control based on the temperature reading using the sensor that is farthest from set-point.

PRHR*3 Heat Recovery Units

The PRHR*3(A) series of heat recovery units were released in June 2018, and are not automatically backwards compatible with all LG manufactured VRF air / water source units.

These HRUs will be compatible with many LG manufactured air / water source units if its “Starting Production Date,” the “Production Starting Serial No.,” and / or the “Upgrade Software Service” dates fall after the dates shown below (see table).

The dates indicate a software upgrade. The old 2A HRU series and the new 3A HRU series will work together if the software has been upgraded. If a system includes both the old and the new models together, however, system constraints will follow the parameters of the old 2A HRU series. For more information, contact your local LG sales representative.

Note:

PRHR*2A heat recovery units can be used with Multi V Water 5 WSUs, but system design must follow PRHR*2A piping rules.

Both old PRHR*2A and new PRHR*3A heat recovery units can be installed on the same system, but system design must follow PRHR*2A piping rules.

Table 86:PRHR*3 Heat Recovery Unit to Air / Water Source Unit Compatibility.

	Model	Starting Production Date	Production Starting Serial No.	Upgrade Software Service
Multi V 5 with LGRED*	ARUM****TE5	February 1, 2019	1902xxx	N/A
Multi V 5	ARUM****TE5	February 1, 2018	1802xxx	September 28, 2018
Multi V S	ARUB060GSS4	October 1, 2018	1810xxx	September 28, 2018
Multi V Water IV	ARWB****AS4	October 1, 2018	1810xxx	September 28, 2018
Multi V IV	ARUB****TE4	N/A	N/A	October 31, 2018
Multi V II and III	ARUB****TE2, ARUB****TE3	N/A	N/A	N/A
Multi V Water II	ARWB****A2	N/A	N/A	N/A

*Low ambient performance with LGRED° heat technology is included in Multi V 5 air source units produced after February 2019.

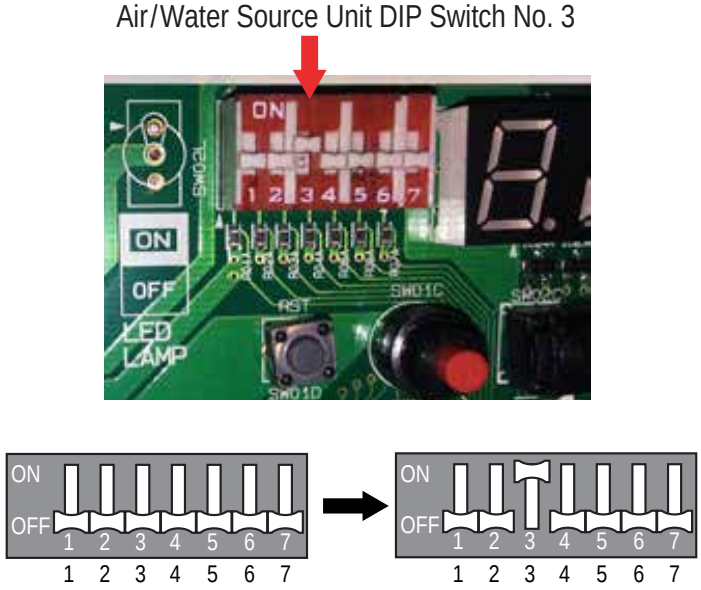
Generation 4 Indoor Units

LG’s indoor units are designated Generation 4 (Gen 4). For Gen 4 indoor units to operate with Gen 4 indoor unit features, the air conditioning system must meet the following requirements:

- All indoor units, heat recovery units, and air / water source units must be Gen 4 or higher.
- All air / water source units must have Gen 4 or higher software factory or field installed.
- Air / water source units DIP switch 3 must be set to ON (factory default setting is OFF).
- All controllers must support Gen 4 indoor unit features.

The figure at right shows the outdoor unit DIP switch. All air and water source units, indoor units, heat recovery units, and controllers in a system must be Gen 4 compatible or the system will not operate with Gen 4 indoor unit features.

Figure 116:Location and Setting of Outdoor Unit DIP Switch 3.



Addressing with 3A Series Heat Recovery Units (For Heat Recovery Systems Only)

General

Each heat recovery unit will have a unique address assign so the outdoor unit will be able distinguish it from other heat recovery units.
Upon completion of the heat recovery unit address, set the heat recovery unit operating parameters by adjusting the positions of the DIP switches on SW02E and SW01E of the main PCB. The main and sub PCBs are identical. The sub PCB is installed on the 6 and 8 port units only.

Procedure

Before beginning the physical process of assigning heat recovery addresses, map out the address assignments using a copy of the LATS tree mode diagram. Set the heat recovery unit switches as required for the system.

Guidelines

1. Addresses must be sequential and cannot be skipped.

2. Assign the lowest address to the heat recovery unit that has the largest capacity indoor unit connected to port number 1. If the capacity of all indoor units connected to port number 1 of each heat recovery unit is the same, assign address “0” to the heat recovery unit farthest away from the outdoor unit. Assign the next address to the next farthest away and so on until all heat recovery units have an address. The heat recovery unit with the highest address must be the one closest to the outdoor unit. Up to 16 heat recovery units can be on a single system. Possible settings in order of lowest to highest are: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E ,F.

Figure 117:Heat Recovery Unit PCB Locations.

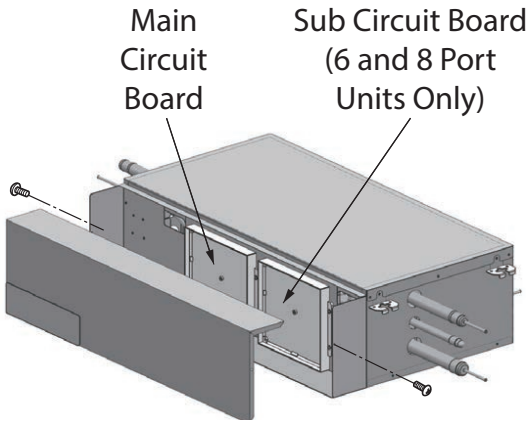
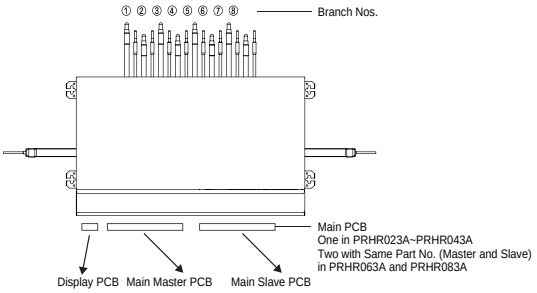


Figure 118:Heat Recovery Unit PCB Locations, Top View.



3. Record the address assigned to each heat recovery unit in the appropriate column on the Pre-setup Device Configuration Worksheet.

Note:

Addressing must be performed following the detailed steps above because port number 1 on the heat recovery unit addressed “0” will remain open during the auto pipe detect procedure. If the indoor unit capacity connected to the port is relatively small compared with other units on the system, the outdoor unit high head pressure safety will trip and shut down the unit during the procedure.

LG

Figure 120:Heat Recovery Unit Main PCB (All Models).

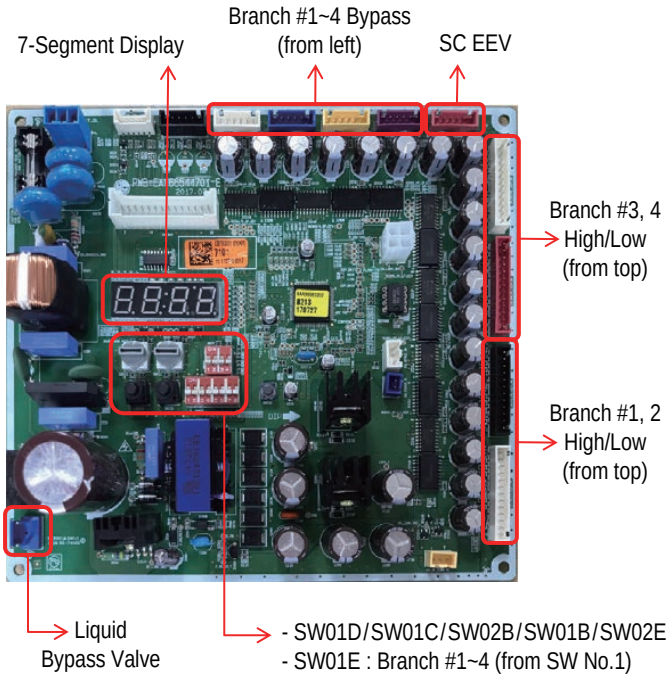


Figure 119:Heat Recovery Unit Sub PCB (PRHR063A and PRHR083A Only).

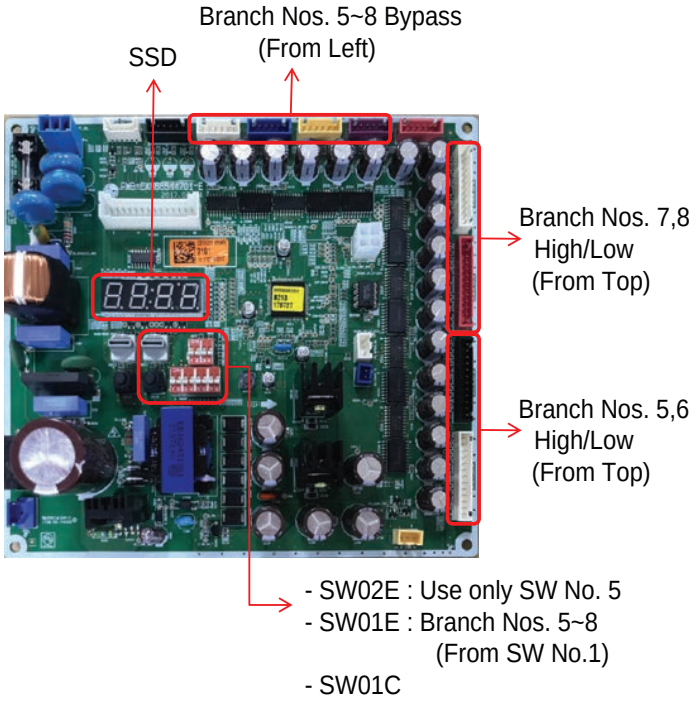
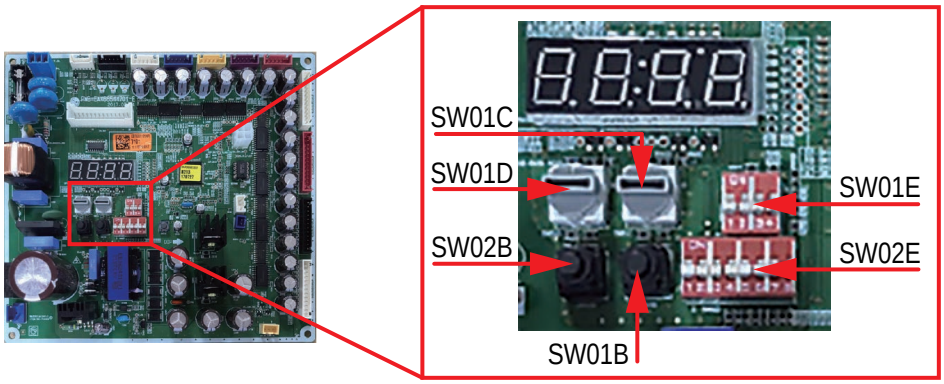


Figure 121:Heat Recovery Unit Main PCB Switches and Rotary Dials.



Note:

The Main and Sub PCBs are identical. Only the six (6) and eight (8) port heat recovery units have a Sub PCB. The only DIP switch setting to make on a Sub PCB is to verify DIP switch No. 5 on SW02E is set to ON. DIP switch No. 5 of SW02E on a Main PCB must be set to OFF.

Figure 122:Heat Recovery Unit Display PCB.

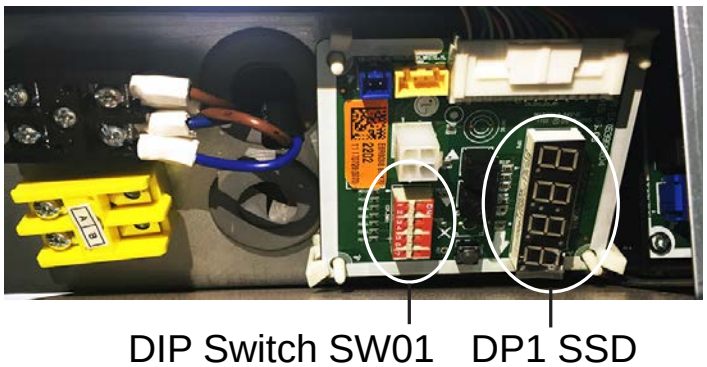
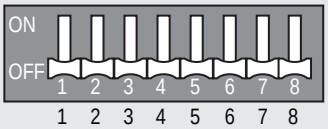
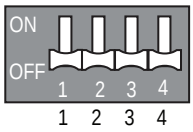
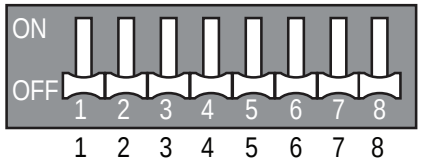


Table 87:DIP Switch, Rotary Dial, and Tact Switch Descriptions.

Switches / Dials	PRHR*2A HRU Series (Old)	PRHR*3A HRU Series (New)	Function
	SW02M	SW02E	For Both PRHR*3A (New) and PRHR*2A (Old) HRU Series: • Auto or Manual Pipe (Valve) Detection Method Selection • Number of Connected Branches / Ports Selection • Zone Control Settings
			For PRHR*3A HRU Series (New) Only: • Main / Sub PCB Selection
			For PRHR*2A HRU Series (Old) Only: • Valve Group Control Selection (If Indoor Unit Capacity is >54,000 Btu/h)
	SW01M	SW01E	Valve (Port) Selection • Selects which valve (port) to address during Manual Valve (Port) Detection and Zone Control
	-	SW01D (Left)	For PRHR*3A HRU Series (New) Only: • Branch / Port Group Control Selection (If Indoor Unit Capacity is >60,000 Btu/h)
	SW05M	SW01C (Right)	• Addresses Heat Recovery Units (From 0 to F) • For Manually Addressing Zoned Indoor Units
	SW03M	SW02B (Left)	Increases the Valve Address by Ten (10) when Central Control Addressing Indoor Units
	SW04M	SW01B (Right)	Increases the Valve Address by One (1) when Central Control Addressing Indoor Units

SW02E DIP Switch Settings

Table 88:DIP Switch SW02E Description.

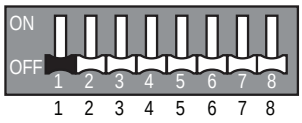
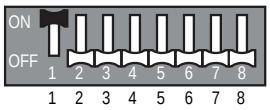


ON S/W	Selection
No. 1	Selects Auto or Manual Pipe (Valve) Detection Method for Heat Recovery Units
No. 2	Selects Number of Connected Branches / Ports on the Heat Recovery Unit
No. 3	
No. 4	
No. 5	Setting Main PCB to Main or Sub Mode
No. 6	EEPROM Factory Initialization (4, 5, 6)
No. 7	For Normal Control (OFF) or Zone Control (ON) Settings; Factory Preset to OFF
No. 8	

Selecting Auto or Manual Valve (Port) Detection Method on SW02E

Select Auto or Manual Valve (Port) Detection for a heat recovery unit by setting No. 1 on DIP switch bank SW02E. If installing a six (6) or eight (8) port heat recovery units, apply this setting only to the Main PCB.

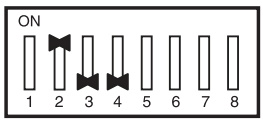
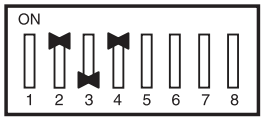
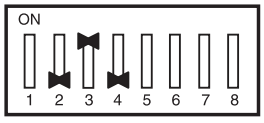
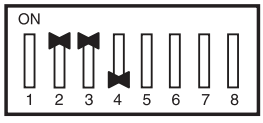
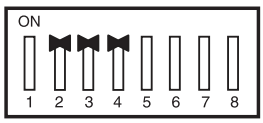
Table 90:Setting Auto or Manual Pipe Detection.

Auto	Manual
SW02E DIP Switch No. 1 OFF 	SW02E DIP Switch No. 1 ON 

Selecting the Number of Connected Branches / Ports on SW02E

DIP Switch Nos. 2, 3, and 4 of SW02E are factory set to correspond to the number of branches / ports on the heat recovery unit. If the system requires using fewer than all of the branches / ports on an heat recovery unit, set the switches to correspond to the number of used branches / ports. Ensure all unused branches / ports are capped and brazed closed. Example: If PRHR083A will only use four (4) branches / ports (branches / ports 1 through 4), cap and braze closed branches / ports 5 through 8, and then set the heat recovery DIP switches for four branches / ports

Table 89:DIP Switch SW02E Number of Connected Branches / Ports Selection.

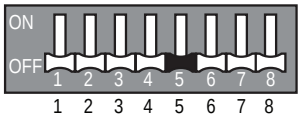
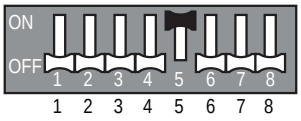
1 branch Connected		5 branches Connected	
2 branches Connected		6 branches Connected	
3 branches Connected		7 branches Connected	
4 branches Connected		8 branches Connected	

The factory setting of switches 2, 3, and 4 corresponds to the number of ports on the unit.

Selecting Main / Sub PCB on SW02E

Ensure No. 5 of DIP switch bank SW02E is set to OFF for Main PCB, and ON for Sub PCB. For Sub PCBs, set only No. 5 of DIP switch bank SW02E to ON. All other switches on SW02E must be set to OFF.

Table 91:Setting Main and Sub PCB.

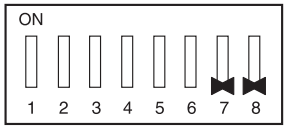
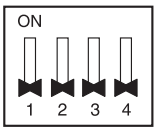
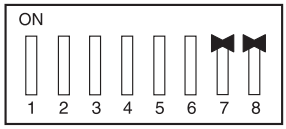
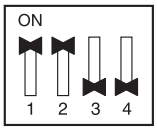
Main	Sub
SW02E DIP Switch No. 5 OFF	SW02E DIP Switch No. 5 ON
	

Selecting Normal or Zone Control on SW02E and SW01E

Use both DIP switch banks SW02E and SW01E to select Normal or Zone Control for both Auto and Manual Valve Detection procedures. Zone Control features two (2) or more indoor units connected to one (1) valve / port of the heat recovery unit. Indoor units set for Zone Control collectively operate in cooling or heating mode.

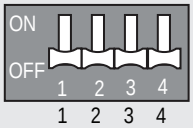
- For Normal Control, on the Main PCB only, set DIP switch Nos. 7 and 8 on SW02E to OFF, and set all DIP switches on SW01E to OFF.
- For Zone Control, on the Main PCB only, set DIP switch Nos. 7 and 8 on SW02E to ON, and set the DIP switches on SW01E as appropriate for the system to perform zone control for each port. See the table for SW01E settings, and how to set the address for each port.
- For Zone Control on the larger 6 and 8 port heat recovery units, use the Main (Sub) PCB for ports 5 through 8.

Table 92:Setting Normal and Zone Control.

	SW02E setting	SW01E setting
Normal control	Main* 	 SW01E
Zoning control	Main* 	Main  SW01E Turn the DIP switch of the zoning branch on. EX) Branch 1,2 are zoning control.

* Main Only

Table 93:DIP Switch SW01E Description.

PCB Component	DIP Switch No.	Settings
SW01E 	No. 1	Valve No. 1 (Main PCB) / Valve No. 5 (Main Sub PCB)
	No. 2	Valve No. 2 (Main PCB) / Valve No. 6 (Main Sub PCB)
	No. 3	Valve No. 3 (Main PCB) / Valve No. 7 (Main Sub PCB)
	No. 4	Valve No. 4 (Main PCB) / Valve No. 8 (Main Sub PCB)

SW01D Rotary Dial Settings

Branch / Port Group Control

The maximum capacity of each 3A Heat Recovery Unit 60,000 Btu/h. If an indoor unit exceeds this capacity (indoor units >60,000 Btu/h), two adjacent heat recovery unit ports must be connected together with an inverted Y-branch (ARBLB03321) to provide the required capacity. If two ports are connected together, address the ports as shown below using the SW01D rotary dial on the Main (Main) PCB only.

Note:

- *Ports are numbered right-to-left on PRHR*3A heat recovery units.*
- *Ports are numbered left-to-right on the old PRHR*2A heat recovery units.*

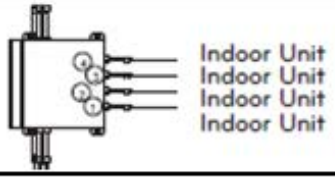
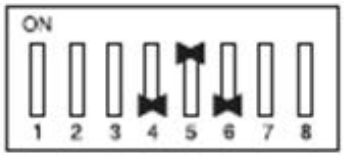
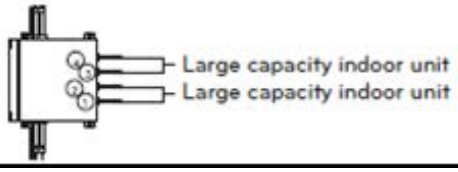
Table 94:Main PCB SW01D Branch / Port Group Control Settings for PRHR*3A Heat Recovery Units.

Branch / Port Group Control	Main (Main) PCB SW01D Setting	Branch / Port Group	Main (Main) PCB SW01D Setting
No Grouping	0	Group Control Branches / Ports 5,6 and 7,8	8
Group Control Branches / Ports 1 and 2	1	Group Control Branches / Ports 1,2 and 5,6	9
Group Control Branches / Ports 2 and 3	2	Group Control Branches / Ports 1,2 and 7,8	A
Group Control Branches / Ports 3 and 4	3	Group Control Branches / Ports 3,4 and 5,6	B
Group Control Branches / Ports 5 and 6	4	Group Control Branches / Ports 3,4 and 7,8	C
Group Control Branches / Ports 6 and 7	5	Group Control Branches / Ports 1,2 and 3,4 and 5,6	D
Group Control Branches / Ports 7 and 8	6	Group Control Branches / Ports 1,2 and 3,4 and 6,7	E
Group Control Branches / Ports 1,2 and 3,4	7	Group Control Branches / Ports 1,2 and 3,4 and 7,8	F

Note:

*In the old PRHR*2A Heat Recovery Unit series, DIP Switch bank SW02M DIP Switch Nos. 4, 5, and 6 were used to set the branch / port control. The SW01D rotary dial is new for PRHR*3A Heat Recovery Units, and was introduced because there are more models with ports varying from 2 to 8 ports (more branch / port combinations than the three SW02M DIP Switches on the old PRHR*2A can control). See below for PRHR*2A Heat Recovery Unit Branch / Port Group Control Settings for comparison.*

Figure 123:Example of Grouping Heat Recovery Unit Branches / Ports for the old PRHR*2A Heat Recovery Unit Series.

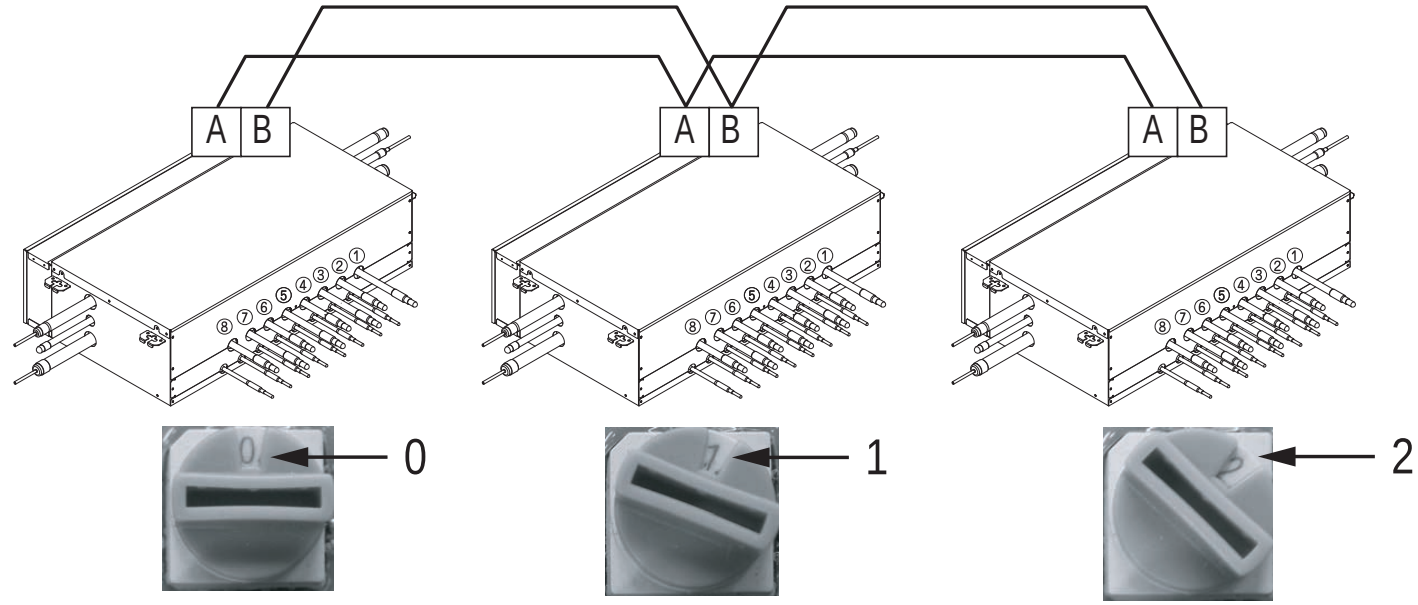
	Dip S/W Setting	Example
No Grouping		
Grouping Valves 1, 2		
Grouping Valves 2,3		
Grouping Valves 1,2 and valves 3,4		

SW01C Rotary Dial Settings

Use rotary switch SW01C to set the heat recovery unit addresses. There can be up to sixteen (16) heat recovery units per system. Possible settings in order of lowest to highest are: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F. The addresses must be set sequentially. For example, if there are three (3) heat recovery units in a system, use addresses 0, 1, and 2. Set the heat recovery unit addresses as required for each system.

If there is only one (1) heat recovery unit in a system, its address must be set to 0.

Figure 124:Example of Manual Addressing with Three (3) Units Heat Recovery Units on a System.



SW01E / SW02B / SW01B / SW01C (DIP Switch / Tact Switch / Rotary Dial) Settings

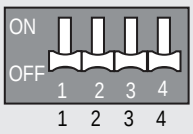
The DIP switch, tact switches, and rotary dial listed are used in the Manual Valve (Port) Detection procedure, which sets the heat recovery unit valves / ports to the central control address(es) of the connected indoor unit(s).

Note:

Before performing manual pipe detection, input a different central control address to every indoor unit through either a wired or a wireless controller (depending on indoor unit type).

- SW01E DIP Switch: Selects the heat recovery unit valve / port that is to be addressed. Use SW01E on the Main PCB for Valves 1 through 4; on six (6) and eight (8) port heat recovery units, use SW01E on the Main Sub PCB for Valve 5 through 8.
- SW02B Tact Switch: Inputs the central control addresses of the indoor units connected to the heat recovery unit valve / port. Increases the address by ten (10). Use SW02B on the Main PCB for Valves 1 through 4; on six (6) and eight (8) port heat recovery units, use SW02B on the Main Sub PCB for Valves 5 through 8.
- SW01B Tact Switch: Inputs the central control addresses of the indoor units connected to the heat recovery unit valve / port. Increases the address by one (1). Use SW01B on the Main PCB for Valves 1 through 4; on six (6) and eight (8) port heat recovery units, use SW01B on the Main Sub PCB for Valves 5 through 8.
- SW01C Rotary Dial: Sets Zone Control during the Manual Valve (Port) Detection procedure when two (2) or more indoor units are connected to one (1) valve / port of the heat recovery unit. Indoor units set for Zone Control collectively operate in cooling or heating mode.

Table 95:DIP Switch SW01E, Tact Switches SW02B and SW01B, and Rotary Dial SW01C Descriptions.

PCB Component	DIP Switch No.	Settings
SW01E 	No. 1	For Valve No. 1 (Main PCB) / Valve No. 5 (Main Sub PCB)
	No. 2	For Valve No. 2 (Main PCB) / Valve No. 6 (Main Sub PCB)
	No. 3	For Valve No. 3 (Main PCB) / Valve No. 7 (Main Sub PCB)
	No. 4	For Valve No. 4 (Main PCB) / Valve No. 8 (Main Sub PCB)
SW02B 	SW02B	Increases the Valve Address by Ten (10) when Central Control Addressing Indoor Units
SW01B 	SW01B	Increases the Valve Address by One (1) when Central Control Addressing Indoor Units
SW01C 	SW01C	• Addresses Heat Recovery Units (From 0 to F; see previous page) • For Manually Addressing Zoned Indoor Units

Auto Valve (Port) Detection

Auto valve (port) detection sets the connection relationship automatically between the indoor units and the heat recovery units.

1. Verify No.1 of SW02E on the heat recovery unit Main PCB is set to OFF.
2. Confirm that the settings of Nos. 2, 3, and 4 of SW02E correspond with the number ports (valves) used.
3. Reset the power of heat recovery unit PCB.
4. Turn main outdoor unit PCB No. 5 DIP switch to ON.
5. Select the “Idu” mode using ► and ◄, then push the ● button.
6. Select the “Id 5” “Ath” or “Atc” function using ► and ◄, then push the ● button. If outdoor temperature is >59°F, use “Ath”. If that does not work, use “Atc.”If outdoor temperature is <59°F, use “Atc”. If that does not work, use “Ath.”

Note:

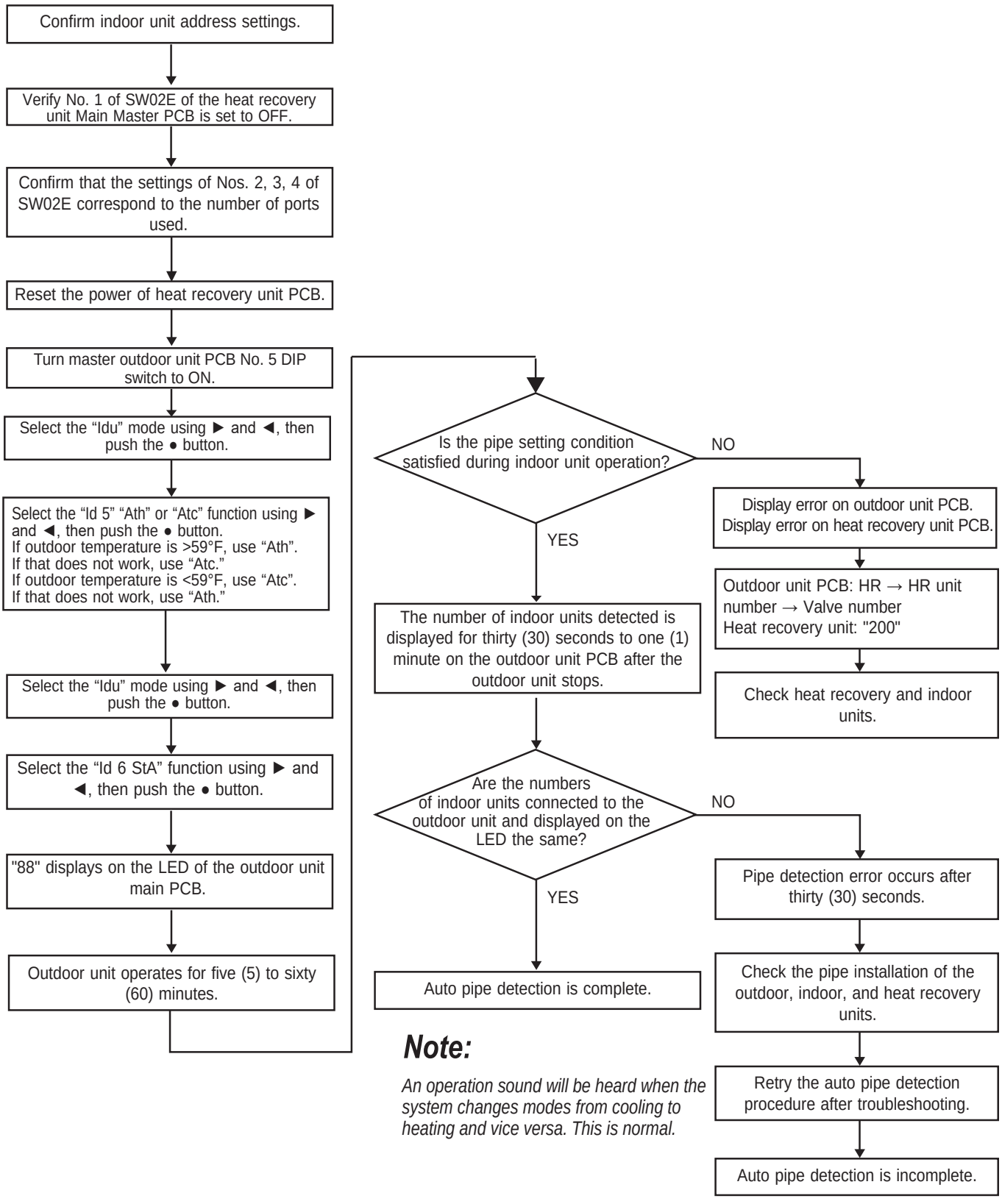
Atc = “At-cold outside”, and Ath = “At-hot outside”. Select accordingly.

7. Select the “Idu” mode using ► and ◄, then push the ● button.
8. Select the “Id 6 StA” function using ► and ◄, then push the ● button.
9. The number “88” displays on the SSD of the outdoor unit main PCB.
10. The automatic pipe detection procedure starts.
11. The procedure could run from five (5) to sixty (60) minutes, depending on the number of connected indoor units, and the ambient outdoor temperature.
12. The number of indoor units detected is displayed for thirty (30) seconds to one (1) minute on the outdoor unit PCB after the outdoor unit stops.
    - The number of indoor units connected to each heat recovery unit will be displayed.
    - If there is an auto pipe detection error, “200” will be displayed.
    - If there are no auto pipe detection errors, the number “88” displays on the SSD of the outdoor unit main PCB. After “88” disappears, the auto detection error is complete.

Note:

- *Run the auto addressing and auto pipe detection procedures again whenever an indoor unit PCB and / or and heat recovery unit PCB are replaced. Apply power to the indoor units and heat recovery units after the repair is complete, otherwise operation error will occur.*
- *Error No. 200 occurs if the number of actual connected indoor units and the number of detected indoor units are different.*
- *If the auto pipe detection procedure fails, perform the manual pipe detection procedure. (If the auto pipe detection procedure is successful, the manual pipe detection procedure is not required.)*
- *The auto pipe detection procedure can be run again after a failed auto pipe detection procedure attempt; just reset the outdoor unit first.*
- ⃠ *Do not turn off the main unit PCB for at least five (5) minutes after the auto pipe detection procedure is complete; allow time for the outdoor unit to automatically save auto pipe detection results.*

Figure 125:Auto Valve (Port) Detection Procedure Flowchart.



Note:

An operation sound will be heard when the system changes modes from cooling to heating and vice versa. This is normal.

Manual Valve (Port) Detection

Note:

Before performing manual valve (port) detection, input a different central control address to every indoor unit through either a wired or a wireless controller (depending on indoor unit type).

1. Enter the central control address into each indoor unit.
2. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to ON.
3. Reset the power of the heat recovery unit PCB.
4. Use the Main PCB DIP Switch SW01E bank to select which valve / port (No. 1 through 4) to central control address. For six (6) and eight (8) port heat recovery units, use Main Sub PCB DIP Switch SW01E bank to choose valve / port Nos. 5 through 8.
5. If indoor units are to be zone controlled, on the Main Sub PCB, use Rotary Dial SW01C to choose the address of the each zone controlled indoor unit (From 0 to F). Repeat Step 5 to input the central control addresses for each zoned indoor unit.
6. On the Main PCB (Main or Sub, depending on the valve / port being addressed), use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the indoor unit connected to that heat recovery unit valve / port.
   - SW02B (Left) increases the valve / port address by ten (10). Digit increases with the number of times the tact switch is pressed, shown on the SSD.
   - SW01B (Right) increases the valve / port address by one (1). Digit increases with the number of times the tact switch is pressed, shown on the SSD.
7. If indoor units are to be zoned controlled, after all zoned indoor units are manually addressed, change Rotary Dial SW01C setting to 0.
8. On the Main PCB (Main or Sub, depending on the valve / port being addressed), turn the DIP Switch to OFF to save the address, and complete the manual valve (port) detection procedure for that valve / port.
9. Reset the power to the outdoor unit PCB.
10. Repeat Steps 4 to 9 until all valves / ports are addressed. If zone control indoor units are NOT to be included in the system, skip Steps 5 and 7.
11. The number of the indoor unit installed will appear after about five (5) minutes. (Example: Heat Recovery Unit to the Number of the Indoor Unit.)
12. Reset the power of the outdoor unit PCB and the heat recovery unit(s).
13. Manual valve / port detection is complete. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to OFF to finish the Manual Valve (Port) Detection procedure.

Note:

1. If a central controller is not installed yet, leave the address data alone until the installer adds the central controller and sets the central control address as desired.

2. If a central controller is already installed, use the wired remote controller of the indoor units to set the central control addresses. (In this case, manually set the heat recovery unit pipe address following the central control address of the indoor unit.)

3. Central controller addresses must be set manually at each individual controller.

4. ⃠ Do not set a central control address of 0xFF to any indoor unit. If an address is 0xFF, manual valve / port detection will not be completed properly.

5. The heat recovery unit valve address and the central control address of its corresponding indoor unit must be set using the same number (in manual addressing).

6. A heat recovery unit valve / port that does not have an indoor unit connected to it must be set with a different address than one that does have an indoor unit connected to it. (If addresses are the same, the valves will not operate.)

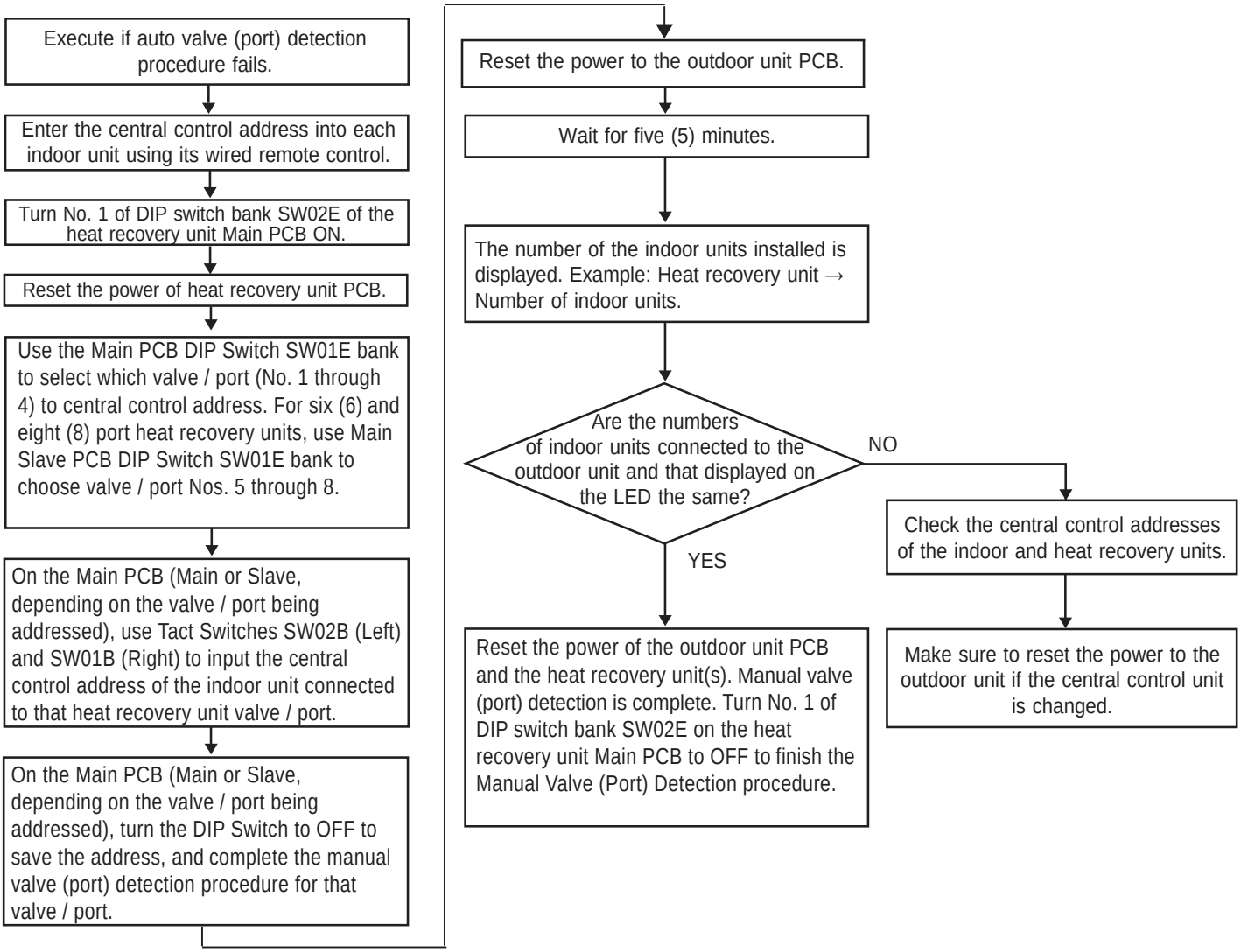
7. Change the manual pipe settings using the heat recovery unit PCB.

8. An error indicates that the manual pipe detection procedure was not completed properly.

9. To save the pipe detection procedure results automatically, ⃠ do not turn off the main outdoor unit PCB for five (5) minutes after the procedure has finished.

Manual Valve (Port) Detection, continued.

Figure 126:Manual Valve (Port) Addressing Flowchart.



Manual Valve (Port) Detection Example (Normal, Non-Zone Setting)

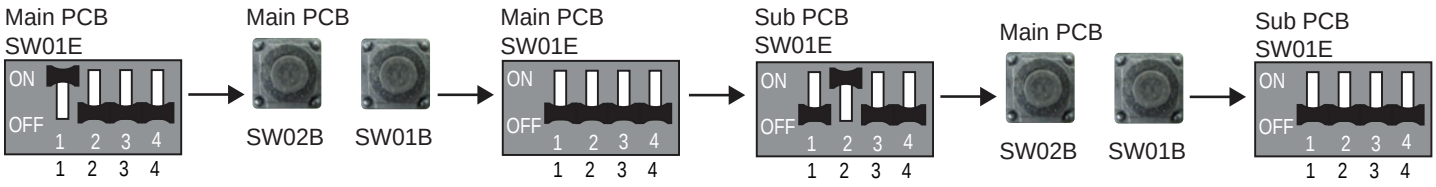
Note:

Before performing manual pipe detection, input a different central control address to every indoor unit through either a wired or a wireless controller (depending on indoor unit type).

Example: Manual Valve (Port) Detection (Normal, Non-Zone Setting) of Valve Nos. 1 and 6 (Six [6] or Eight [8] Port Heat Recovery Unit).

1. Enter the central control address into each indoor unit.
2. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to ON.
3. Reset the power of the heat recovery unit PCB.
4. On Main PCB DIP Switch SW01E, turn No. 1 to ON. This selects Valve / Port No. 1. (Any existing value saved in EEPROM is displayed on the SSD.)
5. On the Main PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the indoor unit connected to heat recovery unit Valve / Port No. 1.
   - SW02B (Left) increases the valve / port address by ten (10). Digit increases with the number of times the tact switch is pressed, shown on the SSD.
   - SW01B (Right) increases the valve / port address by one (1). Digit increases with the number of times the tact switch is pressed, shown on the SSD.
6. On Main PCB DIP Switch SW01E, turn No. 1 to OFF to save the address for Valve No. 1, and complete the manual pipe detection procedure for that valve.
7. On Main Sub PCB DIP Switch SW01E, turn No. 2 to ON. This selects Valve / Port No. 6. (Any existing value saved in EEPROM is displayed on the SSD.)
8. On the Main Sub PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the indoor unit connected to heat recovery unit Valve / Port No. 6.
9. On Main Sub PCB DIP Switch SW01E, turn No. 2 to OFF to save the address for Valve No. 6, and complete the manual pipe detection procedure for that valve.
10. Reset the power to the outdoor unit PCB.
11. The number of the indoor unit installed will appear after about five (5) minutes. (Example: Heat Recovery Unit to the Number of the Indoor Unit.)
12. Reset the power of the outdoor unit PCB and heat recovery unit. Manual valve / port detection is complete. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to OFF to finish the Manual Valve (Port) Detection procedure.

Figure 127:Manual Pipe Detection (Normal, Non-Zone Setting) Example.



Note:

- *The procedure described above must be performed for all heat recovery unit valves / ports.*
- *Valves that do not have indoor units connected to them must be addressed with a number that has not been used. (Valves will not work if the address numbers are the same.)*

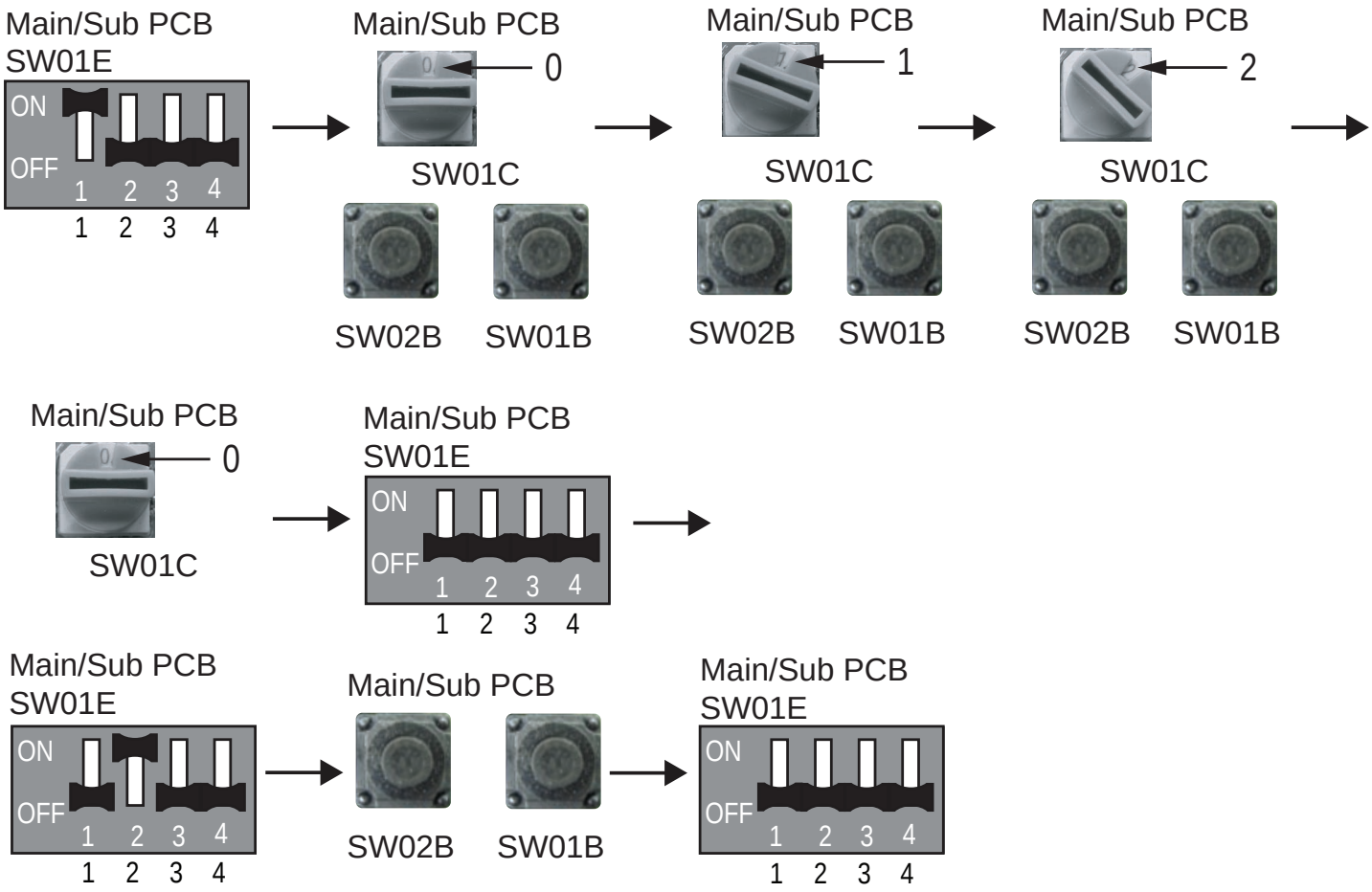
Manual Valve (Port) Detection Example (Zone Control Setting)

Zone Control features two (2) or more indoor units connected to one (1) valve / port of the heat recovery unit. Indoor units set for Zone Control collectively operate in cooling or heating mode. Before performing manual valve (port) detection, input a different central control address to every indoor unit through either a wired or a wireless controller (depending on indoor unit type).

Example: Manual Valve (Port) Detection (Zone Control Setting) of Valve No. 5 (with Three [3] Zone Controlled Indoor Units) and 6 (one [1] Indoor Unit without Zone Control) (Six [6] or Eight [8] Port Heat Recovery Unit).

1. Enter the central control address into each indoor unit.
2. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to ON.
3. Reset the power of the heat recovery unit PCB.
4. On Main Sub PCB DIP Switch SW01E, turn No. 1 to ON. This selects Valve / Port No. 5. (Any existing value saved in EEPROM is displayed on the SSD.)
5. On the Main Sub PCB, use Rotary Dial SW01C to choose the address of the first zone controlled indoor unit (From 0 to F; this example: 0).
6. On the Main Sub PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the first indoor unit connected to heat recovery unit Valve / Port No. 5.
   - SW02B (Left) increases the valve / port address by ten (10). Digit increases with the number of times the tact switch is pressed, shown on the SSD.
   - SW01B (Right) increases the valve / port address by one (1). Digit increases with the number of times the tack switch is pressed, shown on the SSD.
7. On the Main Sub PCB, use Rotary Dial SW01C to choose the manual address of the second zone controlled indoor unit (From 0 to F; this example: 1).
8. On the Main Sub PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the second indoor unit connected to heat recovery unit Valve / Port No. 5.
9. On the Main Sub PCB, use Rotary Dial SW01C to choose the manual address of the third zone controlled indoor unit (From 0 to F; this example: 2).
10. On the Main Sub PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the third indoor unit connected to heat recovery unit Valve / Port No. 5.
11. After all zoned indoor units are manually addressed, change Rotary Dial SW01C setting to 0.
12. On Main Sub PCB DIP Switch SW01E, turn No. 1 to OFF to save the addresses for Valve No. 5, and complete the manual pipe detection procedure for that valve / port.
13. On Main Sub PCB DIP Switch SW01E, turn No. 2 to ON. This selects Valve / Port No. 6. (Any existing value saved in EEPROM is displayed on the SSD.)
14. On the Main Sub PCB, use Tact Switches SW02B (Left) and SW01B (Right) to input the central control address of the indoor unit connected to heat recovery unit Valve / Port No. 6.
15. On Main Sub PCB DIP Switch SW01E, turn No. 2 to OFF to save the address for Valve No. 6, and complete the manual pipe detection procedure for that valve / port.
16. Reset the power to the outdoor unit PCB.
17. The number of installed indoor units displays after about five (5) minutes.
18. Reset the power of the outdoor unit PCB and heat recovery unit. Manual valve / port detection is complete. Turn No. 1 of DIP switch bank SW02E on the heat recovery unit Main PCB to OFF to finish the Manual Valve (Port) Detection procedure.

Figure 128:Manual Valve (Port) Detection (Zone Control Setting) Example.



Note:

- *The procedure described above must be performed for all heat recovery unit valves / ports*
- *Valves / ports that do not have connected indoor units must be addressed with a number that has not been used. (Valves / ports will not work if the address numbers are the same.)*
- *One heat recovery unit valve / port can support up to eight (8) indoor units (rotary dial settings 0~7). An error will display if more than eight (8) indoor units per heat recovery valve / ports are set with the rotary dial.*
- *Return the rotary dial SW01C to its original setting (0) after all settings are complete.*

Conduct an Air Balance for Ducted Indoor Units

For each ducted model indoor unit, confirm that the Test and Balance contractor adjusted the fan speed setting values. Recorded the actual fan setting value used to deliver cataloged CFMs at the jobsite static pressure conditions in the appropriate column on the Pre-setup Device Configuration Worksheet. If the fan setting value was left at the factory default insert “00” in the blank.

Note:

It is always best if the air balance is completed prior to a request for a setup agent. If the air balancing contractor has not completed the work before setup, the Setup Agent is not responsible for setting the indoor unit air flow rates, fan speed, or insure the air volume delivered at each indoor unit is per project specifications, only to spot check. Excessive or restricted airflow may impact the ability of the Setup Agent to successfully complete system setup. If problem exists, 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.

Using the Display PCB

DIP switch bank SW01 on the Display PCB can be set to display valve status and the heat recovery unit address.

Table 96:Display PCB SW01 Settings.

SW01 DIP Switch No.	Settings
No. 1	Displays the Valve Status for the Main PCB
No. 2	Displays the Valve Status for the Sub PCB
No. 3	Displays the Degree of Subcooling
No. 4	Displays the Heat Recovery Unit Address
No. 5	Displays the Number of Connected Heat Recovery Units
No. 6	Displays the Version of the Heat Recovery Unit Software
No. 7	Not Used

Figure 129:Display PCB DIP Switch SW01 and SSD Locations.

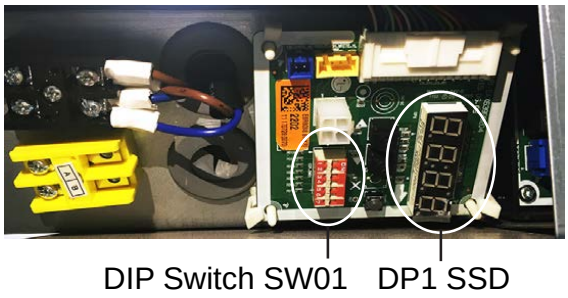
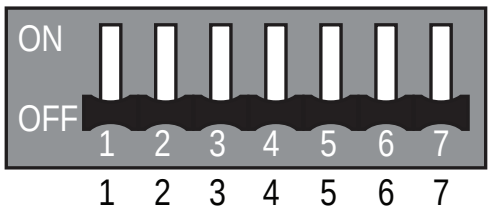
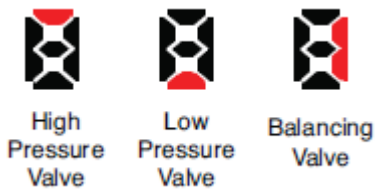


Figure 130:Display PCB DIP Switch SW01.



Displaying the Valve Status (For Main / Sub PCBs)

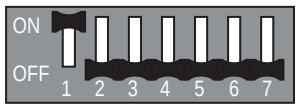
When the high pressure, low pressure, and balancing valves are open, the SSD shows:



Where:

Main	1	2	3	4
Sub	5	6	7	8

Table 97:SW01 DIP Switch No. Valve Status Settings.

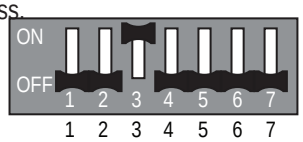
SW01 DIP Switch No. Settings	
Main PCB Valves (Valve Nos. 1 through 4)	Main PCB Valves (Valve Nos. 5 through 8)
	

Displaying the Heat Recovery Unit Address

When DIP switch No. 3 on SW01 is ON, the heat recovery unit address appears on the SSD as:

Displayed No. = 1 + No. of the Value of SW01C on the Main PCB

Figure 131:SW01 DIP Switch Setting for Displaying the Heat Recovery Unit Address.



Troubleshooting Heat Recovery Unit Error Code CH200

Error No.	Description	Details	Causes
2001	Auto pipe search failure.	After auto operation, the number of the indoor units detected is different from the number of communicating indoor units.	1. Power wiring or the communications cable to the heat recovery unit is malfunctioning. 2. After auto addressing, indoor unit has the wrong address (malfunctioning indoor unit PCB and / or power wiring / communications cable). 3. Heat recovery unit rotary or DIP switch setting(s) is (are) wrong. 4. Heat recovery unit PCB is not working.

1. See if the green communication LED of the heat recovery unit is blinking.
2. If the green communication LED of the heat recovery unit is consistently blinking:
   - Check the input power of the heat recovery unit.
   - Reset power to the outdoor unit and heat recovery unit, wait for ≥thirty (30) minutes so the piping temperature will cool down, and then perform the auto addressing procedure.
   - While the power to the heat recovery unit is on, check if error code “CH05” is displayed (see troubleshooting instructions for Error No. CH05).
3. If the green communication LED of the heat recovery unit is still consistently blinking, check the rotary switch and DIP switch settings. Reset power to the outdoor unit and heat recovery unit, wait for ≥thirty (30) minutes so the piping temperature will cool down, and then perform the auto addressing procedure.
4. If the number of indoor units is different than what is actually installed and what number is displayed after the auto addressing procedure is finished, check the piping installation. Outdoor unit ↔ Heat Recovery unit ↔ Indoor unit.
5. If an indoor unit has not been connected to the first port (No. 1 Valve) of the heat recovery unit, set the heat recovery unit piping manually.

Note:

During initial system setup (or re-setup) Error No. CH200: Pipe Detection Error – failure to find indoor unit”, by default, calls for an immediate shutdown without first performing any auto restart attempts. For more information on CH200, see also Service Function SE14 in the Outdoor Unit Functions section.

Troubleshooting Heat Recovery Unit Error Code CH204

Error No.	Description	Details	Causes
204 C+ No. (#) of Heat Recovery Unit	Communication error between outdoor unit and heat recovery unit.	Outdoor unit does not receive signal from heat recovery unit.	1. Heat recovery unit power wiring and / or communication cable connections are incorrect or damaged. 2. Heat recovery unit rotary or DIP switch setting(s) is (are) wrong. 3. Malfunctioning heat recovery unit communications PCB (sub PCB). 4. Malfunctioning heat recovery unit main PCB. 5. Incompatible outdoor unit software.

1. If Error No. 59 is displayed on the heat recovery unit, and Error No. 204 is displayed on the outdoor unit, these indicate that the outdoor unit software has NOT been upgraded to support heat recovery unit 3A models. Contact your LG representative for information.
2. Check power wiring and communication cable connections. Check if the green communication LED on the heat recovery unit PCB is blinking.
3. If the green communication LED is blinking normally, check the rotary and DIP switch settings on the heat recovery unit (See Error No. 200). Reset the power to the outdoor and heat recovery units. (If there is a heat recovery unit communication error, it can't be released until the power to the outdoor unit is reset.)
4. If the green communication LED of the heat recovery unit PCB is not blinking (on continuously), check if the communication of the total indoor units is normal (See Error No. 05). If the green communication LED of the heat recovery unit PCB is not blinking (on continuously), and even if communication to the indoor unit is functioning, replace the heat recovery unit PCB.

⚠DANGER

- *High voltage electricity is required to operate this system. Adhere to the NEC code and these instructions when wiring. Improper connections and inadequate grounding can cause accidental injury or death.*
- *Turn the power off before servicing the equipment. Electrical shock can cause physical injury or death.*
- ⃠ *Do not operate the disconnect switch with wet hands. There is risk of fire, electric shock, physical injury or death.*

⚠WARNING

- *Disconnects must only be performed by a properly licensed electrician. Incorrect wiring could cause the disconnect to explode, leading to physical injury or death.*
- ⃠ *Do not operate the unit with the panel(s) or protective cover(s) removed. The 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.*

Note:

- *If the power wiring and communication cables on the heat recovery unit(s) and indoor unit(s) are not properly connected (connections switched), the communication components will burn out.*
- ⃠ *Do not supply power to the unit until all electrical wiring and controls wiring are completed.*

Troubleshooting Heat Recovery Unit Error Codes CH207 and CH208

Error No.	Description	Details	Causes
207 C+ No. (#) of Heat Recovery Unit	Communication error between the heat recovery unit main and sub main PCBs.	Communication between the heat recovery unit main and sub main PCBs is not occurring.	1. Incorrect or damaged wiring between heat recovery unit main and sub main PCBs. 2. Malfunctioning heat recovery unit main PCB. 3. Malfunctioning heat recovery unit sub PCB.

1. Check if DIP Switch No. 5 of SW02E on heat recovery unit sub main PCB is ON.
2. Check if the communication wiring between the heat recovery unit main and sub main PCB is connected properly. Reconnect or replace connections if necessary.
3. Replace main PCB of heat recovery unit.

Error No.	Description	Details	Causes
208 C+ No. (#) of Heat Recovery Unit	Communication error of heat recovery unit EEPROM.	Heat recovery unit EEPROM is not communicating with the main PCB.	1. Incorrect or damaged wiring between EEPROM and main PCB of heat recovery unit. 2. EEPROM incorrect or damaged wiring / wrong wiring type. 3. Malfunctioning heat recovery unit main PCB.

1. Check if the wiring between the heat recovery unit EEPROM and main PCB is connected properly. Reconnect or replace connections if necessary.
2. Replace main PCB of heat recovery unit.

⚠ DANGER

- *High voltage electricity is required to operate this system. Adhere to the NEC code and these instructions when wiring. Improper connections and inadequate grounding can cause accidental injury or death.*
- *Turn the power off before servicing the equipment. Electrical shock can cause physical injury or death.*
- ⃠ *Do not operate the disconnect switch with wet hands. There is risk of fire, electric shock, physical injury or death.*

⚠ WARNING

- *Disconnects must only be performed by a properly licensed electrician. Incorrect wiring could cause the disconnect to explode, leading to physical injury or death.*
- ⃠ *Do not operate the unit with the panel(s) or protective cover(s) removed. The 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.*

Note:

- *If the power wiring and communication cables on the heat recovery unit(s) and indoor unit(s) are not properly connected (connections switched), the communication components will burn out.*
- ⃠ *Do not supply power to the unit until all electrical wiring and controls wiring are completed.*

LG

Pressure (Leak) Test

Verify a pressure (leak) test has been performed and passed. If not, perform one now. Use medical grade dry nitrogen and pressure test the refrigerant piping system to a minimum of 550 psi for a period of 24 hours.

Evacuate the Refrigerant Piping System

Note:

The water source unit may be put in "vacuum mode." Generally, using the vacuum mode feature does assist with the vacuum process and is not necessary if a vacuum pump is connected to all charging ports at the water source unit simultaneously as suggested herein. See the Technical Service Manual for this product for more information.

Note:

DO NOT apply power to any Multi V system device prior to performing a system evacuation. There is a possibility that EEV valves may close and isolate sections of the pipe system, Contact your LG Applied Rep champion or service technician for the procedure to reopen the EEV valves before evacuation.

1. Release the Pressure Test dry nitrogen charge from all refrigerant pipes.
2. Verify ALL field installed isolation ball valves are OPEN (including those that are capped for future use).
3. Remove and discard the Schrader valve cores at the water source unit charging ports. This ipreventive step ensures that valves used after charging the system have not been subjected to the high pressure used during the Pressure Test.
4. Attach a 5/16" core removal tool equipped with ball valve and a fresh core to each charging port on the water source unit.
5. Check the vacuum pump(s) you intend to use and verify the oil in the sump is fresh and not contaminated.
6. Attach the vacuum pump(s) to each charging port simultaneously using high quality refrigerant vacuum hoses.
7. Perform a triple evacuation.
8. Achieve a micron gauge reading of less than 500 microns.
9. At 500 microns, valve off the charging port by closing the core removal tool ball valves.
10. Remove the vacuum hoses and pumps.
11. Leave the refrigerant piping system in a vacuum until the setup agent arrives and is satisfied with the micron gauge reading.

Note:

- *There is no danger in leaving the refrigerant piping system in a vacuum as all piping and equipment are dry and have never had oil in them.*
- *The system must be left in a vacuum until the Setup Agent arrives and verifies the quality of the evacuation process. If the evacuation procedure was not conducted properly, the system will likely malfunction and operate erratically. Significant costs may be incurred including but not limited to refrigerant reclaim, recycle, and replacement.*
- *Do not open the water source unit service valves and release the factory refrigerant charge until the setup agent authorizes to do so.*

Vacuum for Water Source Systems

Vacuum the refrigerant piping system by connecting the vacuum pump to the service ports on the water source unit as shown in Figure 132 for heat pump systems and Figure 133 for heat recovery systems. Use a vacuum pump with a gauge that can evacuate to 500 microns, and vacuum with the service port valve closed. Never air purge with refrigerant.

1. Evacuate the system for two (2) hours, bringing the system up to 500 microns. After maintaining the system to 500 microns for more than one (1) hour, confirm that pressure has risen. If not, there may be moisture or a leak somewhere in the refrigerant piping system.
2. If the system has been evacuated for more than two (2) hours and it is suspected that moisture may be present (rainwater may have entered the piping if installation look a long time to complete, or if work occurred during a rainy season), pressurize to 14 psi (vacuum break) with nitrogen gas, and then vacuum again for one (1) hour to 500 microns. If the system cannot be evacuated to 500 microns within two (2) hours, repeat vacuum break. After maintaining the system in vacuum for one (1) hour, check the vacuum gauge to see if pressure has risen.

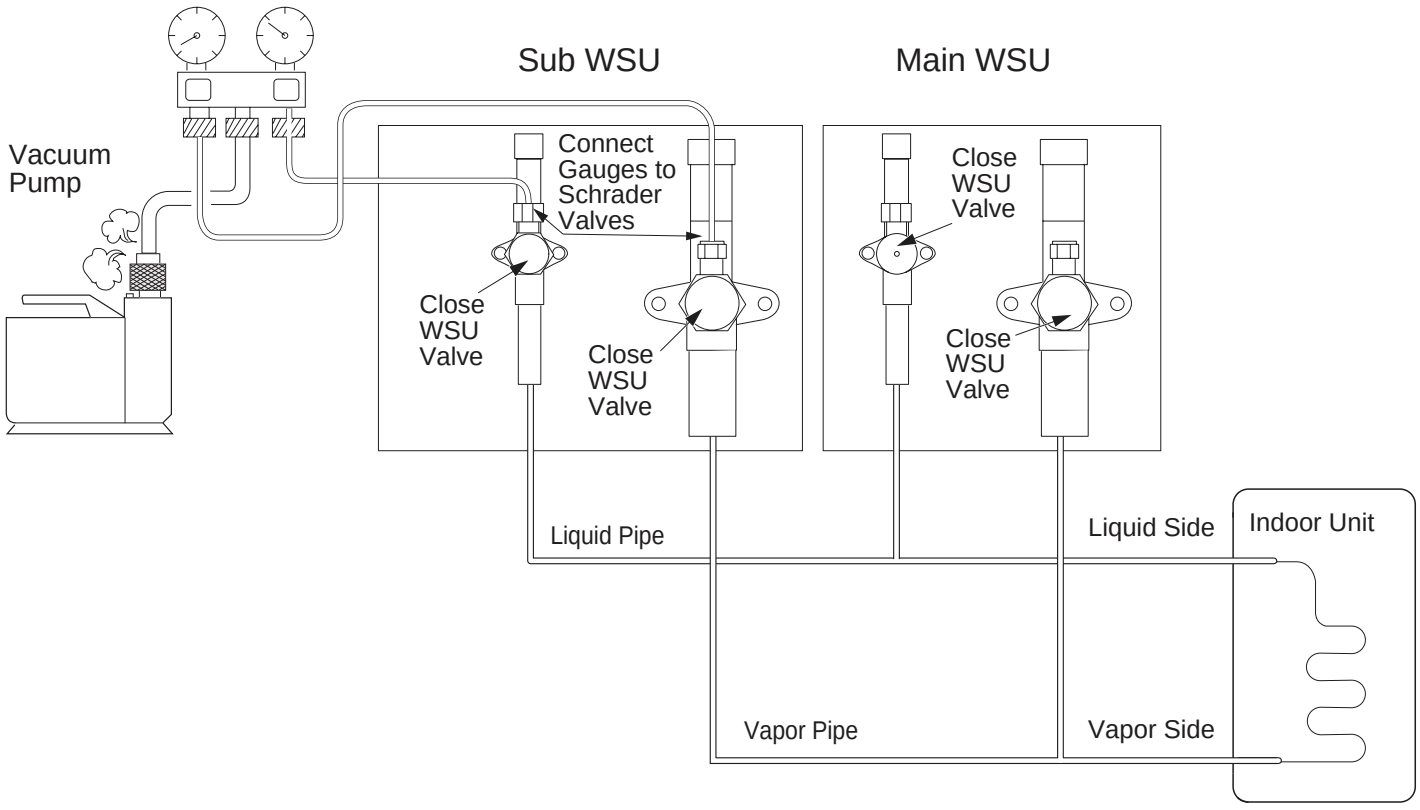


Figure 132: Heat Pump System Vacuum Configuration

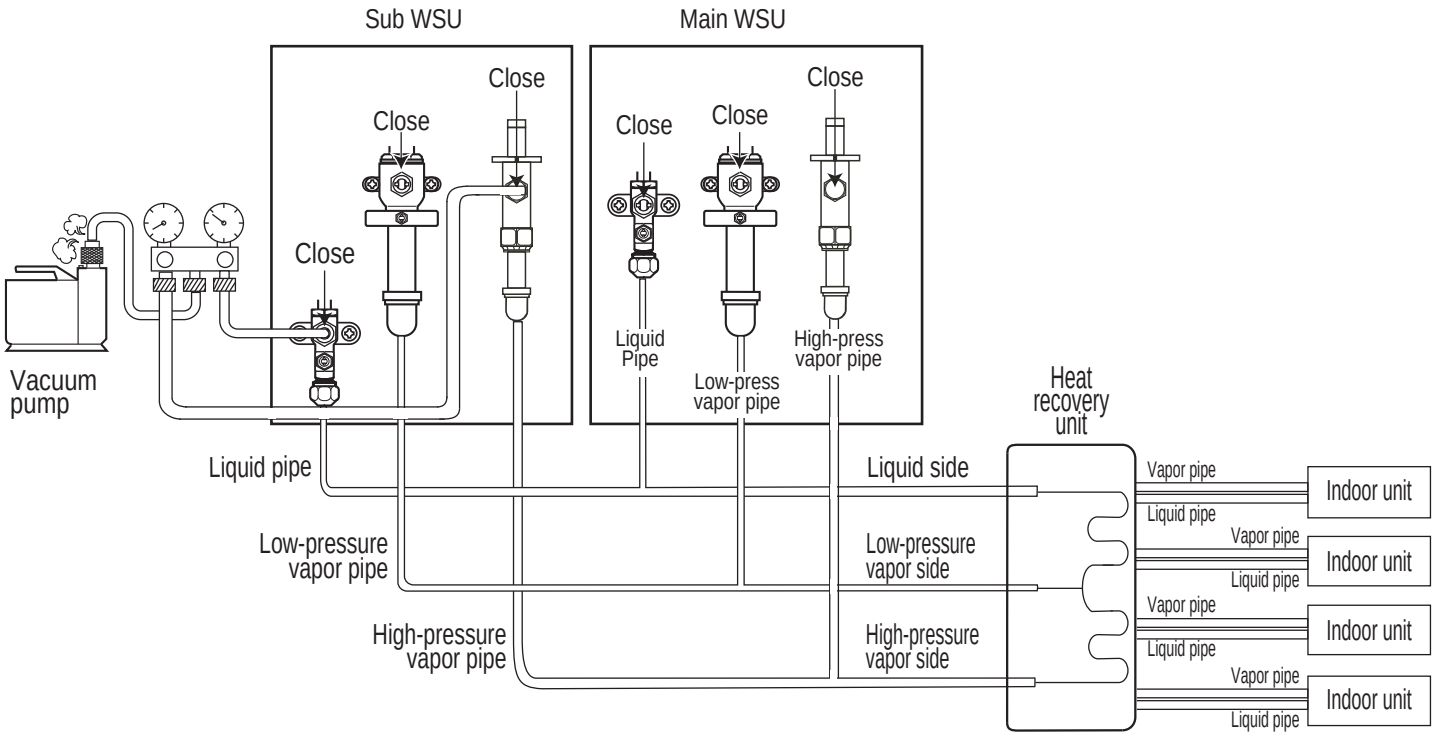


Figure 133: Heat Recovery System Vacuum Configuration

PRE-SETUP

Prepare Pre-setup Package Documents / Initiate a Request

Pre-setup Package Documents

Collect these documents before setup and have them available to the setup agent.

1. A copy of the refrigerant piping system(s) shop drawing(s) generated by LATS Multi V 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 Multi V Project file (*.mtv) that includes all changes noted by the pipe fitter(s) in item 2 of this list. Notes should include changes to the line lengths and # elbows 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 needing attention before continuing.
5. A copy of the water circuit control sequence of operation.
6. A water circuit flow balancing report.
7. A completed Pre-setup Device Configuration Worksheet.
8. A completed copy of the Pre-setup Checklist.
9. If an AC Smart Central Controller is provided and it is to be connected to the building network, record the IP Address on the Pre-setup Device Configuration Worksheet.

Optional, but Highly Recommended

It is always best if the air balance is completed prior to a request for a setup agent to insure the air volume delivered at each indoor unit is per project specifications. The setup agent is not responsible for setting the indoor unit fan speed or ensure the air volume delivered at each indoor unit is per project specifications. Excessive or restricted airflow may impact the ability of the setup agent to successfully complete system setup. Upon completion of the air balance, the report should include the adjusted indoor unit's fan speed (i.e., fan setting value) set by the Test and Balance technician to deliver cataloged air volume (CFM) at jobsite static pressure conditions.

Initiate a Request for System Setup

Contact your LG Applied Representative's Project Manager or your account representative and request a Water Source System Setup. Provide all the documents listed in the "Pre-setup Package Documents" section above.

After Setup Has Been Requested

The setup agent may 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 setup agent's allotted time at your project DOES NOT include owner training. It is understood that the contractor is to request for a setup agent 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 setup agent due to lack of readiness at the jobsite including but not limited to airfare, travel costs, transportation, shipping, labor, and tool costs.

The setup agent's schedule is usually very rigid, and may have no flexibility regarding duration. It also involves advance travel arrangements that may 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	Your LG Manufacturer Representative
Installation, Startup, and Setup Technical Assistance	Your LG Manufacturer Representative

To prevent heat exchanger damage and decreased system performance from scaling, the heat exchanger should be inspected once (1) per year or more often 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 every five (5) years or more often if local conditions require.

Yearly Inspection

Inspect the plate heat exchanger once (1) a year, including:

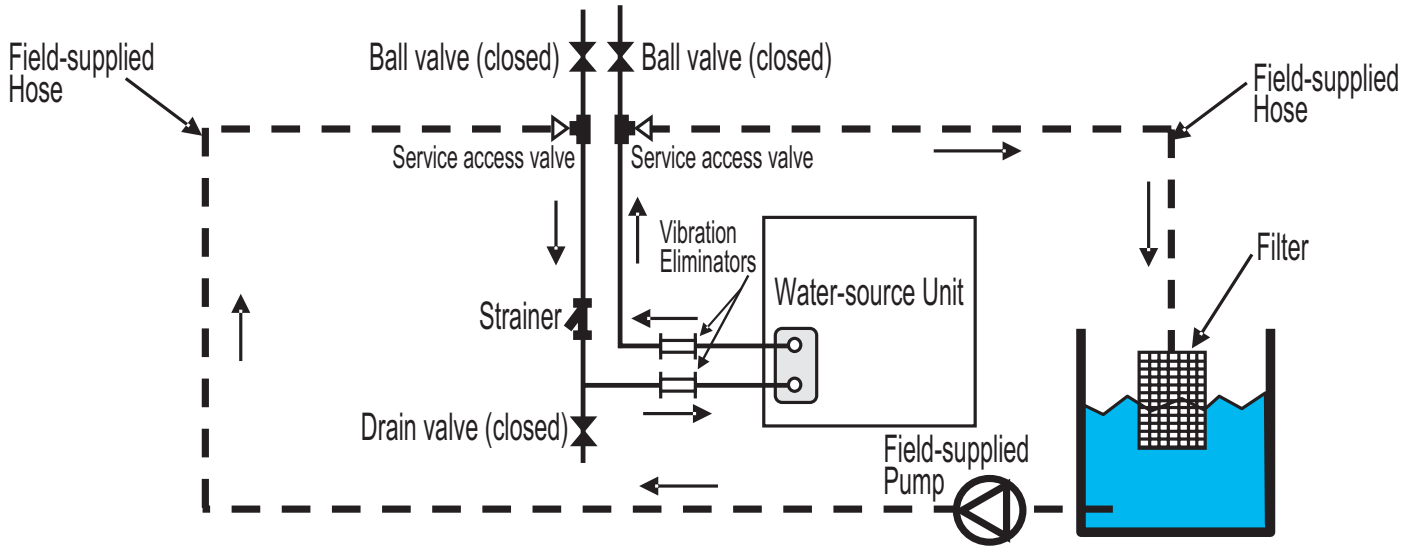
- Water should be tested to see if it is within quality levels listed in the water circuit installation section of this manual.
- Strainer should be cleaned.
- Water flow rate should be checked.
- Water pressure, flow, and inlet / outlet water temperatures should also be checked.

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 heat exchanger 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 to 122°F–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 134: 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 or 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 Table 98 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 98: Minimum Water Quality Requirements.

Basic Item	Closed Type System		Effect	
	Circulating Water	Supplemented Water	Corrosion[1]	Scale[1]
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	Closed Type System		Effect	
	Circulating Water	Supplemented Water	Corrosion[1]	Scale[1]
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.

2. Flow Rate Control

- The heat exchanger may freeze if 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 cease 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.

Table 99: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:

- *This maintenance schedule is based on minimum requirements. Maintenance may need to be increased depending on operating conditions 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, replace the water and purge the air from all air vents 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.*

LG MONITORING VIEW (LGMV) DIAGNOSTIC SOFTWARE

MULTI V WATER 5

LG Monitoring View (LGMV) software allows real-time monitoring of Multi V Water 5 system operating parameters. An industry-standard personal computer (PC) running LGMV connects to the main printed circuit board (PCB) of the water source unit through an LG interface cable. Two versions of LGMV are available: the Low version, which displays real-time parameters, and the High version, which displays the real-time parameters and the parameter targets. This software can be used to both commission new systems and troubleshoot existing systems. LGMV data can be recorded to a .csv file and emailed to an LG representative to assist with diagnostic evaluations. For detailed LGMV software information, contact your LG representative.

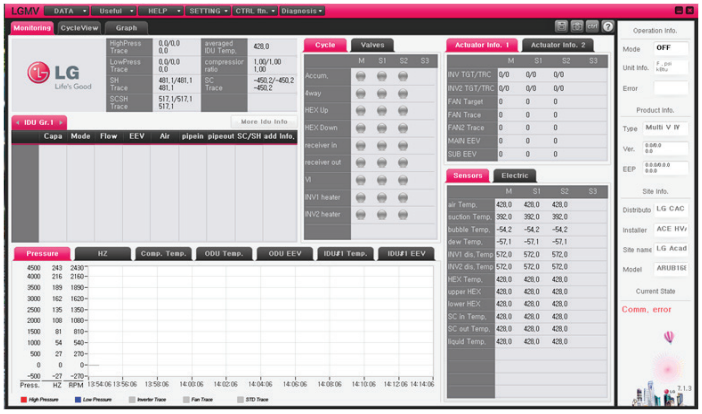
Note:

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

Recommended Minimum PC Configuration:

- CPU: Pentium® IV 1.6 GHz
- Main Memory: 1G
- Operating System: Windows® XP/Vista/7
  32 bit (recommended), 64 bit
- Hard Disk: 600 MB when operating
- MS Office 2003, 2007 (recommended) for select reporting functions

Figure 135: LGMV Real-time Data Screen.



LGMV Data Display

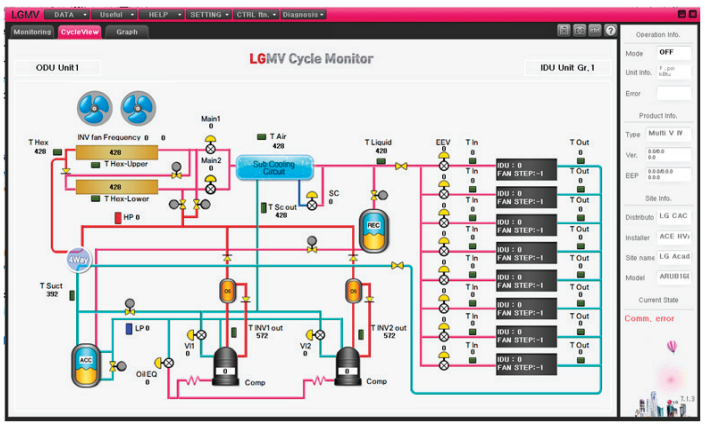
LGMV displays the following real-time data:

- Actual inverter compressor speed
- Target inverter compressor speed
- Actual superheat
- Target superheat (High version)
- Actual subcooler circuit superheat
- Target subcooler circuit superheat (High version)
- 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
- Upper outdoor coil pipe temperature
- Lower outdoor coil pipe temperature
- Liquid line pipe temperature
- Subcooler inlet temperature
- Subcooler outlet temperature
- 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 (High version)
- Target low pressure (High version)
- PCB (printed circuit board) version
- Software version
- Installer name
- Model number
- Site name
- Total number of connected IDUs
- Communication indicator
- IDU capacity
- IDU operating mode
- IDU fan speed
- IDU EEV position
- IDU room temperature
- IDU inlet pipe temperature
- IDU outlet pipe temperature
- IDU error code

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

1. Cycleview: Graphic of internal components including:
   - Compressors showing actual speeds
   - EEVs
   - IDUs
   - Temperature and pressure sensors
   - Four-way reversing valve
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 FTN: Enables user to turn on IDUs in 1.8°F increments.

Figure 136: LGMV Cycleview.



Note:

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

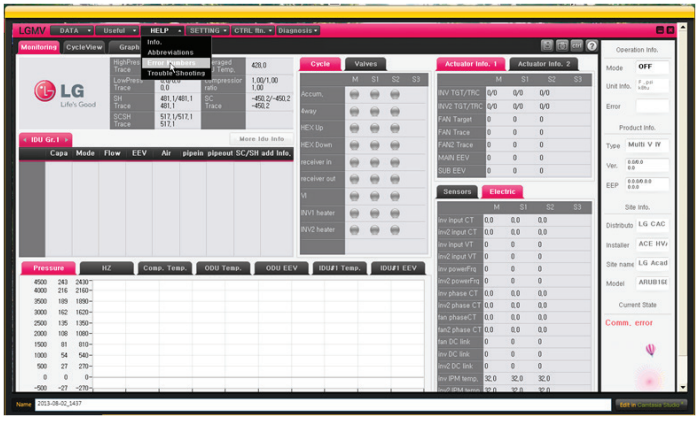
4. Useful Tab
   - Unit Conversion: Converts metric values to imperial values.
5. Data
   - Data Saving Start: Recording of real time data to a separate file created to be stored on the user's computer.
   - Data Loading Start: Recorded data from a saved .csv file can be loaded to create an LGMV session.
6. Monitoring
   - Electrical: The lower half of main screen is changed to show Inverter Compressor Amps, Volts, Power Hz, Inverter control board fan Hz.

Figure 137: LGMV Control Indoor Units Screen.

Error Codes

LGMV software helps the service technician or startup agent to troubleshoot system operation issues by displaying error codes. These error codes are displayed on the upper right area of the LGMV main screen. For an overview of IDU error codes, refer to Table 100. For an overview of WSU error codes, refer to Table 101. For more detailed troubleshooting information, refer to the Multi V Water 5 Service Manual.

Figure 138: Error Code Screen.



ERROR CODE TABLES

Error Codes

- Error codes are displayed on the LED of indoor units, wired remote controllers, LED on the water source unit control board, and LG Monitoring View (LGMV) Diagnostic Software.
- Indicate different types of unit failures, assists in self-diagnosis and to track the frequency of occurrence.
- If two or more errors occur simultaneously, the lower error code number is displayed first.
- After error is resolved, the error code does not display.

Indoor Unit Error Codes

Refer to Table 100 for a list of IDU error codes, descriptions of the codes, and possible causes. IDU error codes are two-digit numbers.

Water Source Unit Error Code Display

Refer to Table 101 for a list of WSU error codes, descriptions of the codes, and possible causes. WSU error codes are three or four digit numbers. Figure 139 is an example of a WSU error code display.

Note:

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

The first two or three numbers identify the error code. The fourth digit identifies the WSU frame that has the error. The fourth digit will be 1, 2, or 3 to identify which WSU unit has the error:

1 = Main WSU (or the only WSU in a single-frame system)

2 = Sub 1 WSU (in a two or three frame system)

3 = Sub 2 WSU (in a three frame system)

Example: ***26–2*** is error 26 on the sub 1 WSU. The dash indicates no digit displayed in the third LED position.

Error Code Nomenclature Definitions

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

Figure 139:Example of an Error Code.

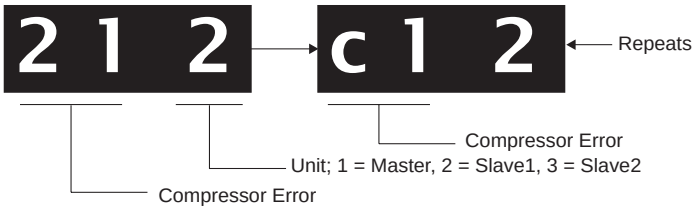


Table 100: Indoor Unit Error Codes.

Error Code				Description	Possible Cause
0	1	–	–	Indoor unit air temperature sensor error	Indoor unit air temperature sensor disconnection or short circuit
0	2	–	–	Inlet pipe temperature sensor of indoor unit	Indoor unit pipe inlet temperature sensor disconnection or short circuit
0	3	–	–	Communication error between wired remote controller and indoor unit	Occurs when indoor unit communication signal is not received from the wired remote controller
0	4	–	–	Indoor unit drain error	Drain pump and float switch error
0	5	–	–	Communication error between WSU and indoor unit	When the indoor unit does not receive the outside communication signal continuously for 5 minutes or more
0	6	–	–	Indoor unit pipe outlet temperature sensor error	Indoor unit pipe outlet temperature sensor disconnection or short circuit
0	8	–	–	Hot water tank temperature sensor error	Hot water tank temperature sensor disconnection or short circuit
0	9	–	–	Indoor unit EEPROM error	Communication error between MICOM and EEPROM or when there is no indoor unit EEPROM data
1	0	–	–	Indoor unit BLDC motor feedback signal error	When motor connector is removed or malfunctioning
1	4	–	–	Hydro kit water flow switch error	Hydro kit water flow switch detect error
1	5	–	–	Hot water tank over temperature error	Hot water tank temperature sensor error or over temperature water detect
1	6	–	–	Hydro kit water pipe temperature sensor error	Hydro kit water pipe temperature sensor disconnection or short circuit
1	7	–	–	Hydro kit water pipe inlet temperature sensor error	Hydro kit water pipe temperature sensor disconnection or short circuit
1	8	–	–	Hydro kit water pipe outlet temperature sensor error	Hydro kit water pipe temperature sensor disconnection or short circuit

Table 101: Water Source Unit Error Codes.

Error Code				Description	Possible Cause
Number			WSU Frame		
1	8	0	1	Freeze protection logic	Decrease in fluid flow, clogged strainer, or malfunction of the pump controller
1	8	9	1	Low flow protection	Low or complete loss of fluid flow during heating operation
2	0	0	1	Searching pipe error	Automatic valve addressing failure
2	1	–	1	Main WSU inverter compressor Intelligent Power Module (IPM) error	Main WSU inverter compressor drive IPM fault
2	1	–	2	Sub 1 WSU inverter compressor IPM fault	Sub 1 WSU inverter compressor drive IPM fault
2	1	–	3	Sub 2 WSU inverter compressor IPM fault	Sub 2 WSU inverter compressor drive IPM fault
2	2	–	1	Main WSU inverter board input over current (RMS)	Main WSU inverter board input current too high (RMS)
2	2	–	2	Sub 1 WSU inverter board input over current (RMS)	Sub 1 WSU inverter board input current too high (RMS)
2	2	–	3	Sub 2 WSU inverter board input over current (RMS)	Sub 2 WSU inverter board input current too high (RMS)
2	3	–	1	Main WSU inverter compressor DC link under-voltage	Main WSU DC voltage is not charged after Main WSU operating relay is turned on
2	3	–	2	Sub 1 WSU inverter compressor DC link under-voltage	Sub 1 WSU DC voltage is not charged after Sub 1 WSU operating relay is turned on
2	3	–	3	Sub 2 WSU inverter compressor DC link under-voltage	Sub 2 WSU DC voltage is not charged after Sub 2 WSU operating relay is turned on
2	4	–	1	High pressure switch	• Compressor maintenance by Main WSU high pressure switch • Flow rate insufficient or Main WSU flow switch failure
2	4	–	2	High pressure switch	• Compressor maintenance by Sub 1 WSU high pressure switch • Flow rate insufficient or Sub 1 WSU flow switch failure
2	4	–	3	High pressure switch	• Compressor maintenance by Main WSU high pressure switch • Flow rate insufficient or Sub 2 WSU flow switch failure
2	5	–	1	Main WSU input power voltage level high/low	Main WSU input power over or under voltage
2	5	–	2	Sub 1 WSU input power voltage level high/low	Sub 1 WSU input power over or under voltage
2	5	–	3	Sub 2 WSU input power voltage level high/low	Sub 2 WSU input power over or under voltage
2	6	–	1	Main WSU inverter compressor operation failure	Initial operation failure due to Main WSU inverter compressor error
2	6	–	2	Sub 1 WSU inverter compressor operation failure	Initial operation failure due to Sub 1 WSU inverter compressor error
2	6	–	3	Sub 2 WSU inverter compressor operation failure	Initial operation failure due to Sub 2 WSU inverter compressor error
2	8	–	1	Main WSU inverter DC link over voltage error	Inverter compressor off due to Main WSU inverter DC voltage too high
2	8	–	2	Sub 1 WSU inverter DC link over voltage error	Inverter compressor off due to Sub 1 WSU inverter DC voltage too high
2	8	–	3	Sub 2 WSU inverter DC link over voltage error	Inverter compressor off due to Sub 2 WSU inverter DC voltage too high
2	9	–	1	Main WSU inverter compressor over-current	Main WSU inverter compressor error or operating component (IPM) error operation
2	9	–	2	Sub 1 WSU inverter compressor over-current	Sub 1 WSU inverter compressor error or operating component (IPM) error operation
2	9	–	3	Sub 2 WSU inverter compressor over-current	Sub 2 WSU inverter compressor error or operating component (IPM) error operation

Table 101: Water Source Unit Error Codes - continued

Error Code				Description	Possible Cause
3	2	–	1	Main WSU inverter compressor discharge temperature high	• Compressor turned off due to Main WSU inverter compressor discharge temperature too high • Main WSU flow rate insufficient or flow switch error
3	2	–	2	Sub 1 WSU inverter compressor discharge temperature too high	• Compressor turned off due to Sub 1 WSU inverter compressor discharge temperature too high • Main WSU flow rate insufficient or flow switch error
3	2	–	3	Sub 2 WSU inverter compressor discharge temperature too high	• Compressor turned off due to Sub 2 WSU inverter compressor discharge temperature too high • Sub 2 WSU flow rate insufficient or flow switch error
3	4	–	1	Main WSU high pressure too high	• Compressor turned off due to Main WSU high pressure too high • Main WSU flow rate insufficient or flow switch error
3	4	–	2	Sub 1 WSU high pressure too high	• Compressor turned off due to Sub 1 WSU high pressure too high • Sub 1 WSU flow rate insufficient or flow switch error
3	4	–	3	Sub 2 WSU high pressure too high	• Compressor turned off due to Sub 2 WSU high pressure too high • Sub 2 WSU flow rate insufficient or flow switch error
3	5	–	1	Main WSU low pressure too low	Compressor turned off due to Main WSU low pressure too low
3	5	–	2	Sub 1 WSU low pressure too low	Compressor turned off due to Sub 1 WSU low pressure too low
3	5	–	3	Sub 2 WSU low pressure too low	Compressor turned off due to Sub 2 WSU low pressure too low
3	6	–	1	Main WSU low pressure ratio	Main WSU pressure ratio is under limit
3	6	–	2	Sub 1 WSU low pressure ratio	Sub 1 WSU pressure ratio is under limit
3	6	–	3	Sub 2 WSU low pressure ratio	Sub 2 WSU pressure ratio is under limit
4	0	–	1	Main WSU inverter compressor CT sensor error	Main WSU inverter compressor current detection (CT) sensor disconnection or short circuit
4	0	–	2	Sub 1 WSU inverter compressor CT sensor error	Sub 1 WSU inverter compressor current detection (CT) sensor disconnection or short circuit
4	0	–	3	Sub 2 WSU inverter compressor CT sensor error	Sub 2 WSU inverter compressor current detection (CT) sensor disconnection or short circuit
4	1	–	1	Main WSU inverter compressor discharge temperature sensor error	Main WSU inverter compressor discharge temperature sensor disconnection or short circuit
4	1	–	2	Sub 1 WSU inverter compressor discharge temperature sensor error	Sub 1 WSU inverter compressor discharge temperature sensor disconnection or short circuit
4	1	–	3	Sub 2 WSU inverter compressor discharge temperature sensor error	Sub 2 WSU inverter compressor discharge temperature sensor disconnection or short circuit
4	2	–	1	Main WSU under-voltage sensor error	Main WSU under-voltage sensor disconnection or short circuit
4	2	–	2	Sub 1 WSU under-voltage sensor error	Sub 1 WSU under-voltage sensor disconnection or short circuit
4	2	–	3	Sub 2 WSU under-voltage sensor error	Sub 2 WSU under-voltage sensor disconnection or short circuit
4	3	–	1	Main WSU over-voltage sensor error	Main WSU over-voltage sensor disconnection or short circuit
4	3	–	2	Sub 1 WSU over-voltage sensor error	Sub 1 WSU over-voltage sensor disconnection or short circuit

Table 101: Water Source Unit Error Codes - continued

Error Code				Description	Possible Cause
4	3	–	3	Sub 2 WSU over-voltage sensor error	Sub 2 WSU over-voltage sensor disconnection or short circuit
4	4	–	1	Main WSU air temperature sensor error	Main WSU air temperature sensor disconnection or short circuit
4	4	–	2	Sub 1 WSU air temperature sensor error	Sub 1 WSU air temperature sensor disconnection or short circuit
4	4	–	3	Sub 2 WSU air temperature sensor error	Sub 2 WSU air temperature sensor disconnection or short circuit
4	5	–	1	Main WSU heat exchanger temperature sensor (A) fault	Main WSU heat exchanger temperature sensor (A) open or short
4	5	–	2	Sub 1 WSU heat exchanger temperature sensor (A) fault	Sub 1 WSU heat exchanger temperature sensor (A) open or short
4	5	–	3	Sub 2 WSU heat exchanger temperature sensor (A) fault	Sub 2 WSU heat exchanger temperature sensor (A) open or short
4	6	–	1	Main WSU suction temperature sensor error	Main WSU suction temperature sensor disconnection or short circuit
4	6	–	2	Sub 1 WSU suction temperature sensor error	Sub 1 WSU suction temperature sensor disconnection or short circuit
4	6	–	3	Sub 2 WSU suction temperature sensor error	Sub 2 WSU suction temperature sensor disconnection or short circuit
4	9	–	1	Main WSU IPM temperature sensor error	Main WSU IPM temperature sensor disconnection or short circuit
4	9	–	2	Sub 1 WSU IPM temperature sensor error	Sub 1 WSU IPM temperature sensor disconnection or short circuit
4	9	–	3	Sub 2 WSU IPM temperature sensor error	Sub 2 WSU IPM temperature sensor disconnection or short circuit
5	0	–	1	Main WSU input power phase loss	Main WSU has lost one of the phases of the three-phase power input
5	0	–	2	Sub 1 WSU input power phase loss	Sub 1 WSU has lost one of the phases of the three-phase power input
5	0	–	3	Sub 2 WSU input power phase loss	Sub 2 WSU has lost one of the phases of the three-phase power input
5	1	–	1	Over-capacity (Indoor unit capacity sum is excessive) connection	Excessive connection of indoor unit connection (combination ratio is exceeded)
5	2	–	1	Main WSU inverter controller communication error	Inverter controller signal is not received from the Main WSU inverter controller
5	2	–	2	Sub 1 WSU inverter controller communication error	Inverter controller signal is not received from the Sub 1 WSU inverter controller
5	2	–	3	Sub 2 WSU inverter controller communication error	Inverter controller signal is not received from the Sub 2 WSU inverter controller
5	3	–	1	Communication error between WSU controller and indoor unit	Indoor unit control signal is not received from the WSU inverter controller
5	7	–	1	Main WSU inverter controller communication error	Inverter controller signal not received by Main WSU controller
5	7	–	2	Sub 1 WSU inverter controller communication error	Inverter controller signal not received by Sub 1 WSU controller
5	7	–	3	Sub 2 WSU inverter controller communication error	Inverter controller signal not received by Sub 2 WSU controller
5	9	–	1	Series connection error	Connection error between WSUs
6	0	–	1	Main WSU inverter PCB EEPROM error	Main WSU inverter PCB EEPROM ACCESS error
6	0	–	2	Sub 1 WSU inverter PCB EEPROM error	Sub 1 WSU inverter PCB EEPROM ACCESS error
6	0	–	3	Sub 2 WSU inverter PCB EEPROM error	Sub 2 WSU inverter PCB EEPROM ACCESS error

Table 101: Water Source Unit Error Codes - continued

Error Code				Description	Possible Cause
6	2	–	1	Main WSU inverter Insulated Gate Bipolar Transistor (IGBT) high temp error	Main WSU inverter IGBT temperature above 194°F
6	2	–	2	Sub 1 WSU inverter IGBT high temp error	Sub 1 WSU inverter IGBT temperature above 194°F
6	2	–	3	Sub 2 WSU inverter IGBT high temp error	Sub 2 WSU inverter IGBT temperature above 194°F
6	5	–	1	Main WSU inverter IGBT temperature sensor error	Main WSU inverter IGBT temperature sensor disconnection or short circuit
6	5	–	2	Sub 1 WSU inverter IGBT temperature sensor error	Sub 1 WSU inverter IGBT temperature sensor disconnection or short circuit
6	5	–	3	Sub 2 WSU inverter IGBT temperature sensor error	Sub 2 WSU inverter IGBT temperature sensor disconnection or short circuit
7	1	–	1	Main WSU PFC CT sensor error	Main WSU PFC CT sensor open or short
7	1	–	2	Sub 1 WSU PFC CT sensor error	Sub 1 WSU PFC CT sensor open or short
7	1	–	3	Sub 2 WSU PFC CT sensor error	Sub 2 WSU PFC CT sensor open or short
8	6	–	1	Main WSU EEPROM error	Communication error between Main WSU MICOM and EEPROM or EEPROM failure
8	6	–	2	Sub 1 WSU EEPROM error	Communication error between Sub 1 WSU MICOM and EEPROM or EEPROM failure
8	6	–	3	Sub 2 WSU EEPROM error	Communication error between Sub 2 WSU MICOM and EEPROM or EEPROM failure
8	8	–	1	Main WSU PFC PCB EEPROM error	Communication error between Main WSU main PFC and EEPROM or EEPROM failure
8	8	–	2	Sub 1 WSU PFC PCB EEPROM error	Communication error between Sub 1 WSU main PFC and EEPROM or EEPROM failure
8	8	–	3	Sub 2 WSU PFC PCB EEPROM error	Communication error between Sub 2 WSU main PFC and EEPROM or EEPROM failure
1	0	4	1	Sub WSU to Main WSU communication error	Main WSU does not receive communication signal from Sub WSU
1	0	4	2	Main WSU to Sub 1 WSU communication error	Main WSU communication signal not received by Sub 1 WSU
1	0	4	3	Main WSU to Sub 2 WSU communication error	Main WSU communication signal not received by Sub 2 WSU
1	1	3	1	Main WSU liquid pipe temperature sensor error	Main WSU liquid pipe temperature sensor disconnection or short circuit
1	1	3	2	Sub 1 WSU liquid pipe temperature sensor error	Sub 1 WSU liquid pipe temperature sensor disconnection or short circuit
1	1	3	3	Sub 2 WSU liquid pipe temperature sensor error	Sub 2 WSU liquid pipe temperature sensor disconnection or short circuit
1	1	4	1	Main WSU sub cool inlet temperature sensor error	Main WSU Sub cool inlet temperature sensor disconnection or short circuit
1	1	4	2	Sub 1 WSU sub cool inlet temperature sensor error	Sub 1 WSU Sub cool inlet temperature sensor disconnection or short circuit
1	1	4	3	Sub 2 WSU sub cool inlet temperature sensor error	Sub 2 WSU Sub cool inlet temperature sensor disconnection or short circuit

Table 101: Water Source Unit Error Codes - continued

Error Code				Description	Possible Cause
1	1	5	1	Main WSU sub cool outlet temperature sensor error	Main WSU Sub cool outlet temperature sensor disconnection or short circuit
1	1	5	2	Sub 1 WSU sub cool outlet temperature sensor error	Sub 1 WSU Sub cool outlet temperature sensor disconnection or short circuit
1	1	5	3	Sub 2 WSU sub cool outlet temperature sensor error	Sub 2 WSU sub cool outlet temperature sensor disconnection or short circuit
1	1	6	1	Main WSU oil sensor error	Main WSU oil sensor disconnection or short circuit
1	1	6	2	Sub 1 WSU oil sensor error	Sub 1 WSU oil sensor disconnection or short circuit
1	1	6	3	Sub 2 WSU oil sensor error	Sub 2 WSU oil sensor disconnection or short circuit
1	4	5	1	Main WSU main board to external board communication error	Main WSU main board communication signal is not received from the external board
1	4	5	2	Sub 1 WSU main board to external board communication error	Sub 1 main board communication signal is not received from the external board
1	4	5	3	Sub 2 WSU main board to external board communication error	Sub 2 main board communication signal is not received from the external board
1	5	1	1	WSU 4 way valve switch failure	WSU 4 way valve switch error
1	8	1	1	Main WSU water temperature sensor error	Main WSU water temperature sensor open/short
1	8	1	2	Sub 1 WSU water temperature sensor error	Sub 1 WSU water temperature sensor open/short
1	8	1	3	Sub 2 WSU water temperature sensor error	Sub 2 WSU water temperature sensor open/short
1	8	2	1	Main WSU communication error between external board MICOMs	Communication error between Main WSU external board main MICOM and sub MICOM
1	8	2	2	Sub 1 WSU communication error between external board MICOMs	Communication error between Sub 1 WSU external board main MICOM and sub MICOM
1	8	2	3	Sub 2 WSU communication error between external board MICOMs	Communication error between Sub 2 WSU external board main MICOM and sub MICOM

Table 102: Heat Recovery Unit Error Codes.

Error Code					Description	Details
Heat Recovery Unit	-	5	1	C + No. of HR Unit	Capacity of indoor units connected to the heat recovery unit exceeds allowable limits.	The amount of nominal cooling capacity of indoor units connected to a heat recovery unit, or a heat recovery unit port, or grouped heat recovery unit port is excessive. After auto-pipe detection is complete, wait 5 minutes, then verify connected capacity. System will display error if: • The heat recovery unit port addresses are all unique, then >54 Mbh single indoor unit connected; >54 Mbh total of multiple indoor units connected. • If 2 heat recovery unit port addresses are the same and the ports are twinned; >108 Mbh total of multiple indoor units are connected. • If 3 heat recovery unit port addresses are the same and the ports are all connected, >162 Mbh total of multiple indoor units connected. • If the total connected indoor unit nominal capacity exceeds 192 Mbh for a single heat recovery unit. • Error code displays on the outdoor unit SSD, the heat recovery unit SSD, or in LGMV.
	2	0	0	1	Auto pipe search failure.	Auto piping procedure did not complete properly.
	2	0	1	C + No. of HR Unit	Heat recovery unit liquid sensor error. (C = Heat recovery unit + Heat recovery unit number).	Disconnection or short circuit of heat recovery unit liquid pipe sensor.
	2	0	2		Heat recovery unit subcooling pipe inlet sensor error. (C = Heat recovery unit + Heat recovery unit number)	Disconnection or short circuit of heat recovery unit subcooling pipe inlet sensor.
	2	0	3		Heat recovery unit subcooling pipe outlet sensor error. (C = Heat recovery unit + Heat recovery unit number)	Disconnection or short circuit of heat recovery unit subcooling pipe outlet sensor.
	2	0	4		Communication error between outdoor unit and heat recovery unit. (C = Heat recovery unit + Heat recovery unit number)	• Outdoor unit does not receive signal from heat recovery unit. • Incompatible outdoor unit software.
	2	0	5		Communication error between heat recovery unit (2A Series) and the 485 modem. The 2A Series heat recovery unit applies only to heat recovery systems communicating at a baud rate of 9,600 bps. • The 485 modem is the communications style on the bus that is an outdoor unit to many indoor units.	• Communication problem occurred between the heat recovery unit PCB and the connection to the communications bus (the heat recovery unit 485 modem). • Error displays if the outdoor unit signal is not received for three (3) minutes. The error clears after the signal is received from the modem. (2A Series Heat Recovery Units.)
	2	0	6		Duplicate address error of the heat recovery unit (2A Series). • The 2A Series heat recovery unit applies only to heat recovery systems communicating at a baud rate of 9,600 bps. • The 485 modem is the communications style on the bus that is an outdoor unit to many indoor units.	• A heat recovery unit address is duplicated for 485 communication. • There are two heat recovery units with one or more HEX addresses that are the same. • Adjust the hex address dial found on the heat recovery units.
	2	0	7		Communication error between the heat recovery unit main and sub main PCBs.	• Incorrect or damaged wiring between heat recovery unit main and sub main PCBs. • Malfunctioning heat recovery unit main PCB. • Malfunctioning heat recovery unit sub PCB.
	2	0	8		Communication error of heat recovery unit EEPROM.	• Incorrect or damaged wiring between EEPROM and main PCB of heat recovery unit. • EEPROM incorrect or damaged wiring / wrong wiring type. • Malfunctioning heat recovery unit main PCB.
Network	2	4	2	*	Network error of central controller.	Inability of the central controller to receive information from the outdoor unit.

LG Multi V Pre-Startup 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:** _____

IDUs:

Unit Tag	Building Floor	Room ID	Type	Model	Serial #	Adjusted Fan Setting Value			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)
						Low	Medium	High					

INSTALLATION CHECKLIST

MULTI V WATER 5

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).	
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.	

Refrigerant Piping and Insulation

Description	Check
All refrigerant piping is copper	
Over 5/8 inches—Rigid ACR only.	
5/8 inches and under—Can use soft ACR.	
15% silver brazing material only.	
All refrigerant pipes and valves are insulated separately. Insulation butts up against the walls of the indoor units. No gaps or cracks. Insulation was not compressed at clamps and hangers.	
LG Y-branch fittings or headers were used as per LATS Multi V report.	
(Optional) Full port ball valves for all indoor units. (Schrader between the valve body and the indoor units.)	

Brazing Practices

Description	Check
Use medical grade (there are 4 available) dry nitrogen for purging during brazing (constant 3 psi while brazing).	
Minimum 3/4", maximum 1" condensate piping installed on indoor units–material used is acceptable under local code. Insulated as necessary to prevent condensation.	

Installation

(For more information on any procedure, refer to the detail provided in the Water Source and Indoor Unit Installation Manuals.)

Refrigerant Piping

Description	Check
You must have in your possession a copy of the "As-Designed" LATS Multi V 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 MULTI V 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.	
All long runs of straight pipe were provided with expansion loops.	
Insure Y-branch fittings are installed within no more than ±10° of horizontal.	
Insure Y-branch fittings are installed within no more than ±3° of vertical.	
Insure all Header fittings are installed horizontal at an elevation above all connected indoor units.	
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 LG factory-supplied flare nuts only.	
All pipe segments were properly supported and all wall penetrations were sleeved.	
All pipe insulation is not compressed at any point.	
Y-branch and headers fittings were properly supported per details provided in the Water Source Unit Installation Manual.	
Insure Y-branch fittings are installed in the correct direction. Flow is always from the single end to the double end.	
No oil traps, solenoid valves, sight glasses, filter driers, leak detection dye or any other unauthorized refrigerant specialities are present	
(Optional) High quality R410A rated full port ball valves with a Schrader port were used at all indoor units and at will in the refrigerant piping network. (Recommended for serviceability.)	
Best practice—a minimum of 20" of straight pipe was installed between each elbow, and Y-branch or header fitting, and between two Y-branch fittings.	

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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 27-1/2" from the bottom of the indoor unit.	
Indoor units with condensate pumps were leveled. Units with gravity drains were leveled or slightly canted toward the drain connection and are properly supported.	
Pumped condensate drain lines were properly connected (do not have traps, and connect to the top surface of the main drain line).	

Power Wire and Communications Cables

Description	Check
Appropriate crimping tool used to attach ring or spade terminals at all power wiring and control cable terminations.	
Verify all ring and spade terminals are copper bearing in all communications daisy chains. Galvanized or nickel plated steel connectors were not used.	
Correct input voltage (208-230V or 460V as specified on water source unit nameplate) was connected to proper power input terminals of water source unit	
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(s) was installed per all local electrical code requirements.	
Power wiring to each indoor unit was installed per all local electrical code 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.	
LG-supplied cable was used between each indoor unit and its zone controller. No cables were spliced and no wire caps are present.	
Communication type RS-485–BUS type. Communication cables are connected in a daisy chain configuration from unit to unit.	
All communications cables are a minimum of 18-Gauge, two conductor, stranded and shielded with insulation material per local code. Cable segment shields were tied together. Cable shield is grounded at the water source unit only.	
All power and control wires were properly separated using the recommended distance provided in the product installation manual.	
Only LG-supplied Y-cables and extension cables were used between indoor units.	
Flow switch communications cable has been properly terminated at the switch and the water source unit.	

PRE-STARTUP CHECKLIST

MULTI V WATER 5

Job Name / Location _____ Tag # _____

Date: _____

Address: _____

_____

Refrigerant Circuit Preparation

Description	Check
Using a copy of the LATS Multi V pipe design diagram, verify the sum of the indoor units nominal capacities connected to the piping system is between 50% 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 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.	
Insure all field-installed full-port ball valves are open.	
The piping system held a constant 550 psig pressure for a minimum of 24 hours with all isolation valves open.	
A triple system evacuation has been performed. Micron gauge reading held at a minimum of 500 for 1 hour with all isolation valves open and without the vacuum pump connected.	
Power was energized to the water source unit at _____(time) on _____day to power the compressor crankcase heater(s). (Must be at least 6 hours before startup.)	
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 startup. (If the valves were opened, the factory refrigerant charge has been released.)	

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.	

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Interconnecting Piping

Description	Check
Verify the interconnecting pipe used is NOT a polymer (i.e. PVC, CPVC).	
Verify that all ferrous to copper/brass connections are connected using die-electric isolating devices.	
Verify a method is provided for removing air from the heat exchanger.	
Verify a method is provided for draining the fluid from and isolating the Multi V Water 5 heat exchanger for service.	
Verify clearance requirements are met for the removal of the heat exchanger without extensive hydronic and refrigerant pipe system disassembly.	
Verify the Multi V water 5 front panel can be removed for service without pipe system disassembly activity.	
Is the control valve, strainer and flow switch installed with the arrow on the body of each aligned with the direction of flow?	
Is the direction of flow through the heat exchanger correct? Inlet at the bottom, outlet at the top.	
Verify shutoff valves are open.	
For variable water flow control installations, is a PIC control valve & VWFC kit installed for each frame?	
For all frames except those with variable water flow control, is a pressure independent flow limiting device installed on each frame?	

Pump and Fluid Flow

Description	Check
Verify the pump and associated variable frequency drive is operating as designed.	
Verify the shutoff valves are open.	
Acquire a certified copy of a fluid composition test for the fluid in circulation.	
Verify the specific gravity rating of the fluid complies with the design (i.e. freeze protection standard is achieved).	
Verify the fluid quality meets or exceeds the conditions set forth in Table ??	
Verify the system has been thoroughly flushed and all strainer screens/baskets have been removed cleaned an re-installed.	
Verify all strainers are 50 MESH rated.	
Verify the flow switch calibration is correct actuate and deactuate settings are correct per the specifications found in Table ??	
Is a method provided to read differential pressure across the strainer?	
Is a method provided to differential pressure across the flow limiting valve or pic control valve?	
Verify rated flow rate is achieved at each frame with all valves 100% open. Record the measured flow rate for each frame.	
Verify the water supplied to the Multi v Water 5 is at least 50˚F.	
Verify the leaving water temperature leaving the Multi V Water 5 heat exchanger while operating under full load in heating mode is not less than 45˚F.	
Verify the strainer differential pressure measurement device is calibrated correctly.	
Physically inspect the strainer screen/basket. Verify it is clean.	
Record the clean strainer differential pressure reading with all control and shutoff valves wide open.	
Record the pressure drop across the strainer basket at rated flow condition. It cannot exceed 10 psig.	
Record the inlet and outlet pressure across the control valve with all valves wide open. Does the inlet measurement meet or exceed the minimum pressure drop rating to achieve a linear response of the flow limiting valve (or the PIC control valve).	

Pressure Independent Control Valve Actuator | Field Selectable Setting Selection And Visual Inspection

Description	Check
The valve actuator, the LG variable water flow control kit are wired per the schematic in Figure 101.	
Verify the valve body is made of a non-ferrous material and is connected to piping that is non-ferrous. If ferrous material is present verify proper dielectric isolation is provided for the materials used.	
Verify that 5-pipe diameters of straight pipe length are upstream of the PIC valve.	
Verify ALL Multi V Water 5 frames and associated PIC valve controllers are at least eight-(8) pump discharge pipe-diameters or eight (8) feet from the pump discharge whichever is greater.	
Check manufacturer's requirements for number of pipe diameters of straight pipe length required leaving the valve and verify the installation pipe architecture complies with the specification.	
Verify the valve orientation as installed matches the flow direction of the valve manufacturer.	
Verify the control stem of the valve is mounted vertical up. If not, verify the installed orientation is authorized by the valve manufacturer's published literature.	
Verify the actuator installed is compatible (has the correct torque rating) with the valve body installed.	
The valve actuator is programmed to be normally closed. 0 (or 2) volts = closed; 10 volts 100% open.	
The actuator motor is rated for use with 24 Vdc power.	
The actuator is programmed to use an Input Signal of 0 (or 2) to 10 VDC signal.	
The valve actuator is setup for a maximum full stroke time of 90 seconds or less.	
The power draw of the valve driver-motor does not exceed 10 VA.	
Verify that upon power loss or valve operator failure, the apparatus installed will drive the control valve to the 100% open position (i.e. valve will be able to fail OPEN).	
The maximum flow setting is set to limit flow through the wide open valve to the rated flow of the Multi V Water 5 frame (see Pressure Independent Control Valve | Setting the rated flow section of this document.	
PIC valve actuator DIP switch settings have been adjusted using valve manufacturer's installation manual guidance to meet the parameters set forth in Tables ?? and ??.	

Prepare Pre-startup Package Documents

Include	Check
1. A copy of the refrigerant piping system(s) shop drawing(s) generated by LATS Multi V 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 Multi V 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 items needing attention before requesting startup..	
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-startup Device Configuration Worksheet.	
9. A completed copy of the Pre-startup Checklist (this checklist).	
10. If available, a list of IP addresses obtained from the building owner's IT department for each ACP, BacNet, LonWorks, AC Smart II, or AC Smart Premium devices.	

Initiate a Startup Request

Description	Check
Verify this checklist and requirements herein have been met. Complete this checklist in its entirety BEFORE requesting Startup.	
Send all Pre-startup 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.

Notes for the Startup Agent

Notes for the Startup Agent

REFRIGERANT CHARGE WORKSHEET

MULTI V WATER 5

Note:

The system will stop operation due to excessive or insufficient refrigerant; therefore, always charge the unit properly. When servicing, always refer to any notes about system piping length and additional refrigerant amounts.

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		TA	7k to 48k		1.5	
19	Mid Static Ducted		M1	7k to 24k		0.57	
20	High Static Ducted		M2	7k to 24k		0.77	
21	Mid Static Ducted		M2	28k to 42k		1.15	
22	Mid / High Static Ducted		M3	28k to 54k		1.35	
23	High Static Ducted		B8	36k to 96k		2.20	
24	Low Static Ducted, Low Static Ducted Bottom Return		L1	5k to 9k		0.31	
25	Low Static Ducted, Low Static Ducted Bottom Return		L2	12k to 18k		0.42	
26	Low Static Ducted, Low Static Ducted Bottom Return		L3	21k to 24k		0.55	
27	Vertical / Horizontal Air Handling Unit		NJ	12k to 30k		1.04	
28	Vertical / Horizontal Air Handling Unit		NJ	36k		1.57	
29	Vertical / Horizontal Air Handling Unit		NK	42k to 54k		2.00	
30	Floor Standing		CE (U)	7k to 15k		0.37	
31	Floor Standing		CF (U)	18k to 24k		0.82	
32	HRU: PRHR022A/023A, 032A/033A, 042A/043A		—	—		1.1	
33	HRU: PRHR063A, 083A		—	—		2.2	
34	ADDITIONAL Refrigerant Charge Required (Sum of lines 1 – 33)						
35	Water-Source Unit Factory Refrigerant Charge	ARWM072BAS5, ARWM096BAS5, ARWM121BAS5, ARWM144BAS5				7.7	
		ARWM072DAS5, ARWM096DAS5, ARWM121DAS5, ARWM144DAS5				7.7	
		ARWM168DAS5, ARWM192DAS5				9.9	
36	Total WSU FACTORY Refrigerant Charge (Sum of factory refrigerant charges for all WSUs in the system)						
37	TOTAL SYSTEM CHARGE Sum of Additional Refrigerant Charge Required (line 34) and Total WSU Factory Refrigerant Charge (line 36)						

[1]CF (Ref.) = Correction Factor for Refrigerant Charge. [2]For refrigerant charge purposes, consider only the liquid line; ignore the vapor line(s).

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

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

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WSU FACTORY REFRIGERANT CHARGE

Table 103:Total Water Source Unit (208-230V) Refrigerant Charge

Nominal Tons	Combination Model Numbers	Individual Component Model Numbers			Refrigerant Charge			
					Frame 1	Frame 2	Frame 3	Total
6.0	ARWM072BAS5	ARWM072BAS5	—	—	7.7	—	—	7.7
8.0	ARWM096BAS5	ARWM096BAS5	—	—	7.7	—	—	7.7
10.0	ARWM121BAS5	ARWM121BAS5	—	—	7.7	—	—	7.7
12.0	ARWM144BAS5	ARWM144BAS5	—	—	7.7	—	—	7.7
14.0	ARWM168BAS5	ARWM096BAS5	ARWM072BAS5	—	7.7	7.7	—	15.4
16.0	ARWM192BAS5	ARWM096BAS5	ARWM096BAS5	—	7.7	7.7	—	15.4
18.0	ARWM216BAS5	ARWM121BAS5	ARWM096BAS5	—	7.7	7.7	—	15.4
20.0	ARWM240BAS5	ARWM121BAS5	ARWM121BAS5	—	7.7	7.7	—	15.4
22.0	ARWM264BAS5	ARWM144BAS5	ARWM121BAS5	—	7.7	7.7	—	15.4
24.0	ARWM288BAS5	ARWM144BAS5	ARWM144BAS5	—	7.7	7.7	—	15.4
30.0	ARWM360BAS5	ARWM121BAS5	ARWM121BAS5	ARWM121BAS5	7.7	7.7	7.7	23.1
36.0	ARWM432BAS5	ARWM144BAS5	ARWM144BAS5	ARWM144BAS5	7.7	7.7	7.7	23.1

Table 104:Total Water Source Unit (460V) Refrigerant Charge

Nominal Tons	Combination Model Numbers	Individual Component Model Numbers			Refrigerant Charge			
					Frame 1	Frame 2	Frame 3	Total
6.0	ARWM072DAS5	ARWM072DAS5	—	—	7.7	—	—	7.7
8.0	ARWM096DAS5	ARWM096DAS5	—	—	7.7	—	—	7.7
10.0	ARWM121DAS5	ARWM121DAS5	—	—	7.7	—	—	7.7
12.0	ARWM144DAS5	ARWM144DAS5	—	—	7.7	—	—	7.7
14.0	ARWM168DAS5	ARWM168DAS5	—	—	9.9	—	—	9.9
16.0	ARWM192DAS5	ARWM192DAS5	—	—	9.9	—	—	9.9
16.0	ARWM191DAS5	ARWM096DAS5	ARWM096DAS5	—	7.7	7.7	—	15.4
18.0	ARWM216DAS5	ARWM121DAS5	ARWM096DAS5	—	7.7	7.7	—	15.4
20.0	ARWM240DAS5	ARWM121DAS5	ARWM121DAS5	—	7.7	7.7	—	15.4
22.0	ARWM264DAS5	ARWM144DAS5	ARWM121DAS5	—	7.7	7.7	—	15.4
24.0	ARWM289DAS5	ARWM144DAS5	ARWM144DAS5	—	7.7	7.7	—	15.4
30.0	ARWM360DAS5	ARWM192DAS5	ARWM168DAS5	—	9.9	9.9	—	19.8
32.0	ARWM384DAS5	ARWM192DAS5	ARWM192DAS5	—	9.9	9.9	—	19.8
36.0	ARWM432DAS5	ARWM144DAS5	ARWM144DAS5	ARWM144DAS5	7.7	7.7	7.7	23.1
42.0	ARWM504DAS5	ARWM192DAS5	ARWM168DAS5	ARWM144DAS5	9.9	9.9	7.7	27.5
48.0	ARWM576DAS5	ARWM192DAS5	ARWM192DAS5	ARWM192DAS5	9.9	9.9	9.9	29.7

For additional technical materials such as submittals, engineering manuals, service manuals, and catalogs, visit www.lghvac.com.

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