W2W Series [Water-to-Water]

W2W Models: 36, 52, 72

Geothermal Heat Pumps
Residential Water-to-Water

Installation & Maintenance Manual
Revision: o08

Table of Contents

Safety

Warnings, cautions and notices appear throughout this manual. Read these items carefully before attempting any installation, service or troubleshooting of the equipment.

DANGER: Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury.

DANGER labels on unit access panels must be observed.

WARNING: Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

NOTICE: Notification of installation, operation or maintenance information, which is important, but which is nor hazard-related.

WARNING

All refrigerant discharged from this unit must be recovered. To avoid release of refrigerant into atmosphere, the refrigerant circuit of this unit must only be serviced by technicians who meet all required local and federal qualifications.

CAUTION

Do not use equipment for construction heating or cooling. Doing so will introduce construction dirt and debris, shortening equipment life and voiding motor and/or compressor warranty.

General Information

Inspection
Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all the units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Assure the carrier makes notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. **If not filed within 15 days, the freight company can deny the claim without recourse. Note: It is the responsibility f the purchaser to file all necessary claims with the carrier.** Notify the Traffic Department of all damage within fifteen (15) days of shipment.

Storage
Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times.

Unit Protection
Use shipping cartons, vinyl film, or an alternative form of covering that can adequately protect the unit on the job site. Open ends of piping should always be capped. Avoid causing physical damage to areas where painting, plastering, and/or spraying has not been completed. Take necessary precautions to avoid contamination by foreign materials. Physical damage and contamination may require the equipment to be cleaned or other costly repairs as this can prevent proper start-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or trash found in or on these components.

Pre-Installation
Installation, Operation and Maintenance instructions are provided with each unit. Be sure to completely read and understand these before beginning installation. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and is operation. Check the system thoroughly before operation.
Prepare the units for installation as follows:

1. Compare the electrical data on the unit nameplate with the ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the shipping carton until the installation, plastering, painting, etc. is complete.
3. Check the refrigerant tubing. Ensure it is free of any dents or kinks, and verify that it is not in contact with any other parts in the unit.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Loosen compressor bolts on units equipped with compressor spring vibration isolation until the compressor rides freely on the springs. Remove shipping restraints.

*__NOTICE*__ Failure to remove shipping brackets (if installed) from spring-mounted compressors will cause excessive noise, and could cause failure due to added vibration.

CAUTION
Do not sore or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g. attics, garages, rooftops, etc.). Such conditions can significantly reduce performance, reliability, and service life of equipment.

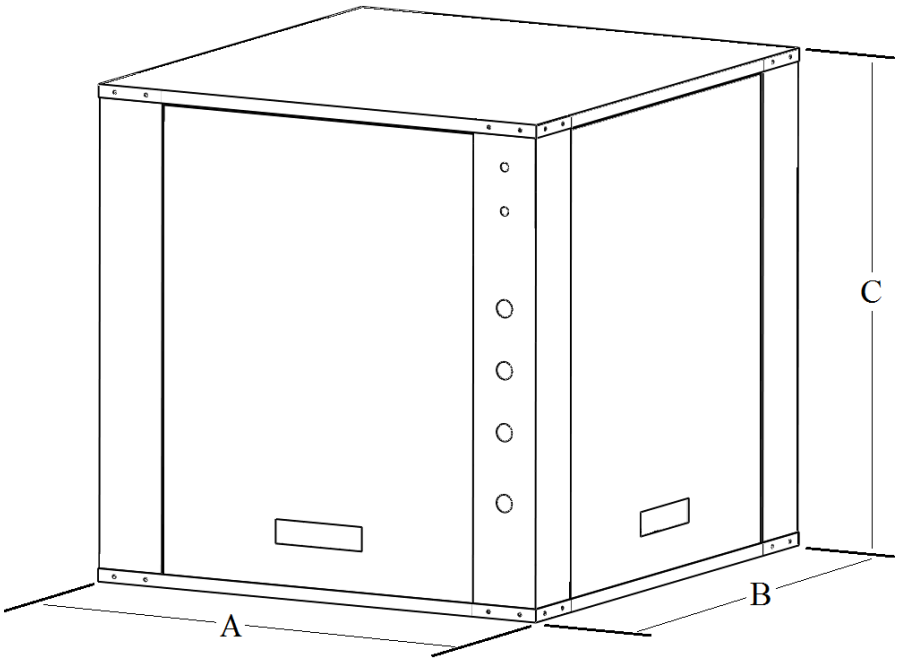
CAUTION
Always move and store units in an upright position. Tilting units on their sides may cause equipment damage.

CAUTION
CUT HAZARD! Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses, and gloves when handling parts and servicing heat pumps.

PHYSICAL, CONNECTION and ELECTRICAL DATA

Model	W2W-36	W2W-52	W2W-72
Factory Charge R410A (oz)	45	52	90
LOAD water - copper male sweat (in)	1	1	1 1/4
SOURCE water - copper male sweat (in)	1	1	1 1/4
Desuperheater - copper male sweat (in) [1]	½	½	½
Cabinet Dimensions (A x B x C) (in)	28 x 34 x 24	28 x 34 x 24	28 x 34 x 24
Electrical Voltage /PH	230/60/1	230/60/1	230/60/1
Total Unit FLA	26	34	35
Compressor LRA	82	134	150
MAX fuse size	60	60	80
Min. circuit Ampacity	32.9	42.5	47.5
Weight – Operating, (lbs)	146	180	230
Weight – Packaged, (lbs)	155	195	250

Notes:
(1) Optional item. May not be present.
(2) Balanced Port Expansion Valve (TXV)
(3) Insulated Source and Load Water Coils
(4) Check rating plate for refrigeration type and correct charge



Installation

Unit Location
W2W series units are not designed for outdoor installation. Install the unit in an INDOOR location that allows enough space for service personnel to perform typical maintenance or repairs.

The installation of water source heat pump units and all components, parts and accessories that make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the Installing Contractor to determine and comply with ALL applicable codes and regulations.

Locate the unit in an indoor area that allows easy removal of access panels, and has enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water and electrical connections. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. These units are not approved for the outdoor installation and, therefore, must be installed inside the structure being conditioned. Do not locate in areas where ambient conditions are not maintained within 40-100ºF and up to 75% relative humidity.

PIPING INSTALLATION

Installation of Supply and Return Piping

Follow these piping guidelines.

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shut-off/balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Refer to Table. Do not exceed bend radius for the hose selected. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

Table 1: Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radius
½" [12.7mm]	2½ " [63.5mm]
¾" [19.1mm]	4" [101.6mm]
1" [25.4mm]	5½" [139.7mm]
1 & 1/4" [31.8mm]	6¾" [171.5mm]

Insulation is not required on loop water piping except where the piping runs through unheated areas or outside the building, or when the loop water temperatures is below the minimum expected dew point of the pipe ambient. Insulation is required where loop water temperature may drop below the ambient air dew point.

Note: When anti-freeze is used in the loop, assure that it is compatible with Teflon tape or pipe joint compound employed.

Optional hose assemblies designed specifically for use with W2W-series units area available. Similar hoses can be obtained from alternate suppliers.

Refer to Hose kit instructions for an illustration of a Supply/Return Hose Kit. Male adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check them regularly to avoid system failure and reduced service life.

Load Plumbing Installation

W2W-Series Unit Load Plumbing
The applications are varied and cannot be described in their entirety in this document. However, some basic guidelines will be presented. Much of the discussions on water loop applications would be valid for the load

plumbing discussion as well. All plumbing should conform to local codes and consider the following:

Wide temperature variation applications, such as heating/cooling coils:

- Employ piping materials that are rated for the maximum temperature and pressure combination. This excludes PVC for most heating applications.
- Insure load water flow in high temperature heating applications is at least 3 gpm per ton to improve performance and reduce nuisance high-pressure faults.
- Should NOT employ plastic to metal threaded joints.
- Utilize a pressure tank and air separator vent system to equalize pressure and remove air.

Swimming Pool/Hot tub applications:
Load coax material should always be, at minimum cupro-nickel in chlorine/bromine fluid applications.

Potable Water Applications:
Load coax material should always be vented double walled when used directly in potable water systems. Alternatively, the domestic water can be separated from the load water through a second heat exchanger provided as part of a load manager or other Ecologix geothermal pumping module.
Ensure load water flow in high temperature heating applications is at least 3gpm per ton to improve performance and reduce nuisance high-pressure faults.

Pressure Testing:
Pressure testing of all piping connections is recommended before finishing of interior space or before access to connections is limited. Equipment manufacturer is not responsible for damages from water leaks due to inadequate testing.

Desuperheater:
The W2W-series heat pumps are equipped with a desuperheater, which can be used to divert a portion of the delivered heat to a domestic hot water tank. This provides hot water at the heat pump's COP while operating in heating mode, and virtually free hot water while operating in cooling mode. Heat pumps with a desuperheater also include a circulating pump, so that the only necessary plumbing is to connect the desuperheater loop to the domestic tank or preheat tank. For systems with a gas, oil, or propane water heater, or with an electric water heater with only a single center element, a dual tank system is recommended to ensure that water enters the desuperheater at a suitable temperature.

WARNING
Do not connect wiring to the desuperheater pump until the heat pump is ready to commission and the desuperheater loop has been filled and fully purged of air. Running the pump dry can cause pump failure.

Applications

COMMERCIAL WATER –LOOP HEAT PUMP APPLICATIONS

Commercial systems typically include a number of units plumbed to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. In piping systems expected to utilize water temperatures below 50ºF [10ºC], ½" closed cell insulation is required on all piping surfaces to eliminate condensation. Metal to plastic threaded joints should never be employed due to their tendency to leak over time. All non-distributor class units include a low temperature-soldered bracket-supported FTP water connection. Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access.

Hose kits are available in different configurations for connection between the W2W-Series and the piping system. Hose kits can include shut off valves; P/T plugs for performance measurement, high-pressure stainless steel braid hose, "Y" type strainer with blow-down valve, or "J" type swivel connection. Balancing valves to facilitate the balancing of the system, or an external low pressure drop solenoid valve for use in variable speed pumping systems, may also be incorporated into the design of a system and supplied with the equipment.

The piping system should be flushed to remove dirt, piping chips and other foreign material prior to operation. See Piping System Cleaning and Flushing Procedures. The flow rate is usually set between 2.25 and 3gpm per ton of cooling capacity. The manufacturer recommends 2.5gpm per ton for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

Cooling Tower/Boiler Systems typically utilize a common loop maintained at 60-90ºF [15.6-32.2ºC]. The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop in recommended. If an open-type cooling tower is used continuously, chemical treatment and filtering will be necessary.

GROUND WATER HEAT PUMP SYSTEMS

Shut off valves should be included in case of servicing. Boiler drains or other valves should be tee'd into the line to allow acid flushing of just the heat exchanger. Pressure/temperature plugs should be used so that flow and temperature can be measured. Piping materials should be limited to PVC SCH80 or copper. **Due to the pressure and temperature extremes, PVC SCH40 is not recommended**. Water quantity should be plentiful and of good quality. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. Heat exchanger coils may over time lose heat exchange capabilities due to a build up of mineral deposits inside. Only a qualified service mechanic can clean these exchangers. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the homeowner should be informed that the heat exchanger might require occasional acid flushing.

Expansion Tank and Pump

Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to handle at least one minute run time of the pump to prevent premature pump failure using its drawdown capacity rating. The pump should be sized to the home's domestic water load (5-9gpm) plus the heat pump water load. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways depending on local building codes; i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc. Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area. The pump should be sized to handle the home's domestic water load (typically 5-9 gpm [23-41 L/m]) plus the flow rate required for the heat pump. Pump sizing and expansion tank must be chosen as complimentary items. Variable speed pumping applications should be considered for inherent energy savings and smaller expansion tank requirements.

Water Control Valve

Note the placement of the water control valve. Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation. Pilot operated or Taco slow closing solenoid valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the unit transformer can supply the total 'VA' draw of the valve. For instance the Taco slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls employed. A typical pilot operated solenoid valve draws approximately 15VA.

Flow Regulation

Flow regulation can be accomplished by two methods. First, most water control valves have a built in flow adjustment. By measuring the pressure drop through the unit heat exchanger, flow rate can be determined by referring to the table below. Since the pressure is constantly varying, two pressure gauges might be needed. Simply adjust the water control valve until the desired flow of 1.5 to 2gpm per ton is achieved. Secondly, a flow control device may be installed. The devices are typically an orifice of plastic material that is designed to allow a specified flow rate. These are mounted on the outlet of the water control valve. On occasion, these valves can produce a velocity noise that can be reduced by applying some back pressure. This is accomplished by slightly closing the leaving isolation valve of the well water setup. **Note: when EWT is below 50°F (10°C), a minimum of 2 gpm per ton (2.6 L/m per kW) is required.**

Low Temperature Cutout

For units where glycol is not provided, the water low temperature cutout set-point should be set to avoid freeze damage. Depending on model of heat pump a flow switch may be installed in place of the low temperature cut out. Check wiring diagram on door of unit to confirm.

GROUND –LOOP HEAT PUMP APPLICATIONS

Closed Loop Applications

A closed loop system re-circulates the same water/antifreeze solution through a closed system of underground high-density polyethylene pipe. As the solution passes through the pipe it collects heat (in the heating mode) that is being transferred from the relatively warm surrounding soil through the pipe and into the relatively cold solution. The solution is circulated back to the heat pump that extracts its heat and then returns to the ground to absorb more heat from the earth.

The W2W-Series heat pumps are designed to operate on either **vertical or horizontal closed loop applications**. Vertical loops are typically installed with a well drilling rig up to 200 feet deep or more. Horizontal systems are typically installed with excavating or trenching equipment approximately six to eight feet deep, depending on geographic location and length of pipe used. Earth loops must be sized properly for each particular geographic area and individual capacity requirements. Contact your local installer for loop sizing requirements in your area.

Loop Pump Selection

Select a loop circulation pump based upon the gpm required and total system pressure drop.

Lake or Pond Loops

Closed loop systems may also be used in lakes or rivers to supply a heat source to the heat pump. Typically a loop consisting of geothermal pipe can be designed and placed in an area not much deeper than 15ft with some water currents present. In any lake or pond, municipal and area by-laws must be observed in regards to a lake or pond loop. The use of an environmentally friendly loop fluid like ethanol should be considered if the loop was ever damaged. Consult an IGSHPA or CGC certified installer for proper lake or pond loop design.

Piping Installation

All earth-loop piping materials should meet CSA-C448. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger in lieu of other flow measurement means. Earth loop temperatures can range between 25-110°F and 2.25 to 3gpm of flow per ton of cooling capacity is recommended in these applications. Upon completion of the ground loop piping, pressure test the loop to assure a leak-free system. Horizontal Systems: test individual loops as installed. Test entire system when all loops are assembled. Vertical U-Bends and Pond Loop Systems: test vertical U-bends and pond loop assemblies with a test pressure of at least 100 psi. Either water or air may be used as the testing medium.

Table 2: Approximate Fluid Volume

Fluid Volume (gal [liters] per 100' [30 meters] Pipe)		
Pipe	Size	Volume (gal) [liters]
Copper	1"	4.1 [15.3]
	1.25"	6.4 [23.8]
	2.5"	9.2 [34.3]
Rubber Hose	1"	3.9 [14.6]
Polyethylene	¾" IPS SDR11	2.8 [10.4]
	1" IPS SDR11	4.5 [16.7]
	1.25" IPS SDR11	8.0 [29.8]
	1.5" IPS SDR11	10.9 [40.7]
	2" IPS SDR11	18.0 [67.0]
	1.25" IPS SCH40	8.3 [30.9]
	1.5 "IPS SCH40	10.9 [40.7]
	2" IPS SCH40	17.0 [63.4]
Unit Heat Exchanger	Typical	1.0 [3.8]
Flush Cart Tank	10" Dia x 3ft tall [254mm x 91.4cm tall]	10 [37.9]

Flushing the Earth Loop

Once piping is completed between the unit, flow center and the ground loop, final purging and charging of the loop is needed. A flush cart (at least a 1.5hp pump) is needed to achieve adequate flow velocity in the loop to purge air

and dirt particles from the loop itself. An antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping system before operation. Flush the loop with a high volume of water at a high velocity (2 fps in all piping) both directions.

The steps below must be followed for proper flushing. Fill loop with water from a garden hose through flush cart before using flush cart pump to ensure an even fill. Once full, do not allow the water level in the flush cart tank to drop below the pump inlet line or air can be pumped back out to the earth loop. Try to maintain a fluid level in the tank above the return tee so that air cannot be continuously mixed back into the fluid. 50 psi surges can be used to help purge air pockets by simply shutting off the return valve going into the flush cart reservoir. This procedure 'dead heads' the pump. To dead head the pump until maximum pumping pressure is reached, open the valve back up and a pressure surge will be sent through the loop to help purge air pockets from the piping system. Notice the drop in fluid level in the flush cart tank. **If air is purged from the system, the level will drop only 1-2 inches in a 10" diameter PVC flush tank (about a half gallon) since liquids are incompressible**. If the level drops more than this, flushing should continue since air is still being compressed in the loop fluid. Do this a number of times.

When the fluid level drops less than 1-2" in a 10" diameter tank the flow can be reversed. Finally the deadhead test should be checked again for an indication of air in the loop. **This fluid level drop is your only indication of air in the loop.**

Flushing & Filling Using 3-Way Valves

Step 1:
Use water and a high volume head circulator pump to flush air and debris and to fill the loop system.
- Refer to recommendations provided by IGSHPA when choosing a pump for the flushing process.
- It is recommended that pump suction be from the bottom of a large volume container. Use a suction line strainer to prevent debris discharged into the container from being recycled to the system.

Step 2:
Pump water into the system by connecting the pump discharge hose to one (not both) of the 1" NPT water connections located on the sides of the 3-way flush valve. Connect a return hose to the opposite side of the valve assembly to discharge debris and air as water is added to the loop.

Step 3:
Rotate the 3-way valves to engage the pump cart.

Step 4:
Start the pump. Add anti-freeze (if used) and water to the container as needed so that no air enters the system. This will push any air out of the loop. If flushing assembly is equipped with valves to reverse flow direction, do so occasionally to help remove trapped air. When bubbles cease in the return hose container, the earth loop has been completely flushed.

Step 5:
Flush the heat pump. To do so, simply rotate the valves while the pump is running. Flush the heat pump using the same procedure as used to flush the earth loop.

Pressurizing the System

Step 6:
After flushing and filling the system, rotate the 3-way valve discharging into the flush container to pressurize the loop. Then turn the valves.

Step 7:
Turn off the flush cart pump. The system should remain pressurized. Release excess pressure by rotating either module valve to allow a small amount of water to pass through and out of the system and into the container. Some initial loss of pressure can be expected and is due to the expansion of the earth loop pipe under pressure. The pressure will stabilize if the system has no leaks.

Step 8:
Flushing, filling and pressurization should be complete. Start the loop pump module circulators.

Step 9:
Troubleshoot. If for some reason the circulators are not operating, power off and diagnose the problem.

Step 10:
Using a single water pressure gauge, measure the pressure drop at the pressure/temperature plugs across the heat pump heat exchanger. Compare the measurement with the flow versus the pressure drop information for your specific model (found in the tables below) and determine the actual flow rate. If the flow rate is low, recheck the selection of the loop pump module model for sufficient capacity. If the model is correct, there is likely trapped air or a restriction in the flow circuit. System pressure should increase rapidly as the flush pump works to force more water into the system. Additional flushing of the loop is needed if the water level in the loop falls. This shows that there is air in the system. System operating pressures should be between 10 to 40PSI.

Table 3: Source/Load Heat Exchanger Water-Side Flow Data

W2W-36	gpm	7	8	9	10	11	12	13
	psi	2.7	3.3	4.0	4.8	5.7	6.7	7.7
W2W-52	gpm	5	7	9	11	13	15	17
	psi	1.3	1.6	2.1	2.8	3.6	4.6	5.8
W2W-72	gpm	12	14	16	18	20	22	24
	psi	2.4	3.1	3.9	4.7	5.7	6.8	8.3

Table 4: Desuperheater Water-Side Flow Data

W2W-36	gpm	0.0	0.5	1.0	1.5	2.0
	psi	0.0	0.3	0.5	1.2	1.9
W2W-52,72	gpm	1.0	1.5	2.0	2.5	3.0
	psi	0.8	1.6	2.7	4.0	5.5

Table 5: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10ºF [-12.2ºC]	15ºF [-9.4ºC]	20ºF [-6.7 ºC]	25ºF [-3.9 ºC]
100% USP Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

***Must be denatured with any petroleum based product**

Antifreeze may be added before, during, or after the flushing procedure. However, depending upon which time is chosen, antifreeze could be wasted when emptying the flush cart tank. See antifreeze section for more details. Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for a number of minutes to condition the loop to a homogenous temperature. This is a good time for tool cleanup, piping insulation etc. Then final flush and pressurize the loop to a static pressure of 40-50 psi (winter) 15-20 psi (summer).

After pressurization, be sure to remove the plug in the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. This is step is only required for Grundfos wet rotor circulators with end plugs. Ensure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures shown in the performance table.

Antifreeze

In areas where minimum entering loop temperatures drop below 40°F or where piping will be routed through areas subject to freezing, antifreeze is needed. Alcohols and glycols are commonly used as antifreeze. However, your local territory manager should be consulted for the antifreeze best suited to your area. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if 30°F is the minimum expected

entering loop temperature, the leaving loop temperature would be 25-22°F and freeze protection should be at 15°F (30°F-15°F=15°F).

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under water level to prevent fuming. Initially calculate the total volume of fluid in the piping system using the Table. Then use the percentage by volume shown in Table 5 for the amount of antifreeze. Antifreeze concentration should be checked from a well-mixed sample using a hydrometer to measure specific gravity.

ELECTRICAL – LINE VOLTAGE

General Line Voltage Wiring
Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electrical Code whichever is applicable.

WARNING
To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

W2W Power Connection
Line voltage connection is made by connecting the incoming line voltage wires to the "Line" side of the contactor or the power block as shown in the wiring diagram located on the electrical panel door of the unit.

Field Wiring
All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes.

Refer to the unit wiring diagrams for fuse sizes and a schematic of the field connections that must be made by the installing (or electrical) contractor.

Consult the unit wiring diagram provided with the equipment or located on the inside of the compressor access panel to ensure proper electrical hookup.

All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

ELECTRICAL – LOW VOLTAGE

Thermostat Connections
The aquastat/thermostat or set point control should be wired directly to the wire connections in the unit. Refer to wiring diagrams provided with the unit or the Ecologix pump module supplied with the unit.

Water Solenoid Valves
When solenoid valves are used, a slow closing valve may be required to prevent water hammer. The valve takes approximately 60 seconds to open (very little water will flow before 45 seconds) and it activates the compressor only after the valve is completely opened (by closing its end switch). Only relay or triac based electronic thermo-stats should be used with the AVM valve. When wired as described above, the valve will operate properly with the following notations.

1-The valve will remain open during a unit lockout.
2-The valve will draw approximately 25-35 VA through the "Y" signal of the thermostat.
Note: This can overheat the anticipators of electromechanical thermostats. Therefore only relay or triac based thermostats should be used when a water solenoid valve is present.

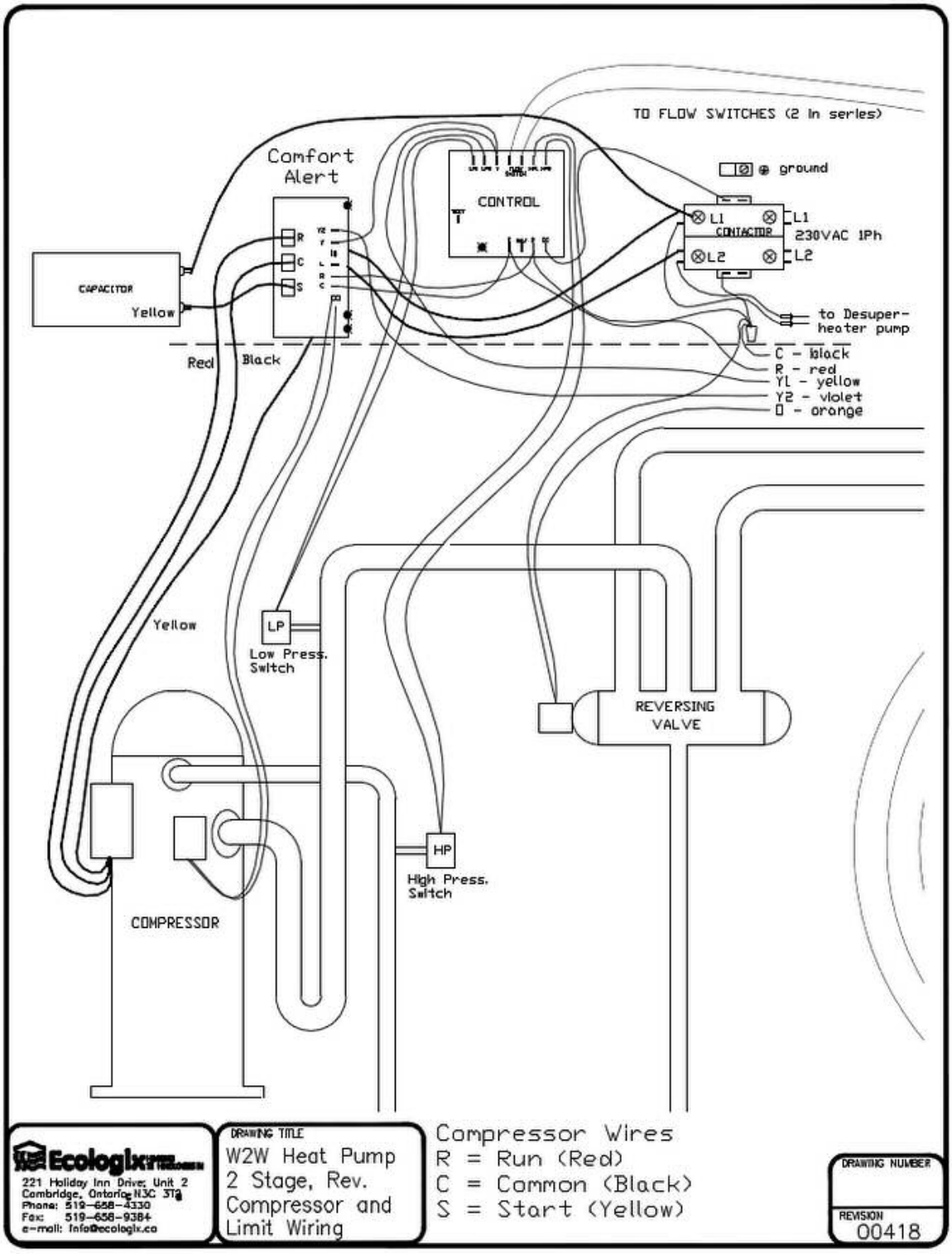


Figure 1: wiring diagram

UNIT STARTING & OPERATING CONDITIONS

Operating Limits

Environment – This unit is designed for indoor installation only.
Power Supply – A voltage variation of +/– 10% of nameplate utilization voltage is acceptable.

Starting Conditions

W Series Units – Units can start and operate in an ambient temperature of 45°F with entering load side at 50°F, entering source side at 30°F, with both at the stated flow rates of 3gpm per ton for initial winter start-up.
Notes:

1. These are not normal or continuous operating conditions. It is assumed that winter start-up is to bring the building space up to occupancy temperatures.
2. Voltage utilization range complies with ARI Standard 110.

Determination of operating limits is dependent primarily upon three factors:
1. Entering load temperature.
2. Entering source temperature
3. Ambient temperature.

When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation.

Extreme variations in temperature and humidity and corrosive water will adversely affect unit performance, reliability, and service life.

Table 6: Operating Limits

Source Side Water Limits	Cooling	Heating
Minimum Entering Water	50ºF [10ºC]	20ºF[-6.6ºC]
Normal Entering Water	85ºF[º29.4C]	60ºF[15.6ºC]
Maximum Entering Water	110ºF[43.3ºC]	70ºF[21.1ºC]
Load Side Water Limits		
Minimum Entering Water	50ºF[10ºC]	60ºF[15.6ºC]
Normal Entering Water	60ºF[15.6ºC]	100ºF[37.8ºC]
Maximum Entering Water	90ºF[32.2ºC]	120ºF[48.9ºC]

PIPING SYSTEM CLEANING & FLUSHING

Cleaning and flushing of the piping system is the single most important step to ensure proper start-up and continued efficient operation of the system. Follow the instruction below to properly clean and flush the system:

1. Verify electrical power to the unit is disconnected.
2. Using a pump cart and the three-way valve connections shown in the installation drawings refill the system with water.
3. Bleed all air from the system as described in the applications section of this manual. Pressurize and check the system for leaks and repair appropriately.
4. Set the back up electric heater or fossil fuel fired boiler system to raise the loop temperature to approximately 85°F. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
5. Drain and refill the system adding tri-sodium phosphate in a proportion of approximately one pound per 150 gallons of water (or other equivalent approved cleaning agent). Reset the heater to raise the loop temperature to about 100°F. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
6. When the cleaning process is complete refill the system and bleed off all air.
7. Test the system pH with litmus paper. The system water should be slightly alkaline (pH

7.5-8.5). Add chemicals, as appropriate, to maintain acidity levels.
8. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

UNIT START-UP PROCEDURE

1. Adjust all valves to their full open position. Turn on the line power to all heat pump units.

2. Operate each unit in the cooling cycle. Loop water temperature entering the heat pumps should be between 70° F and 110° F

3. Operate each heat pump in the heating cycle immediately after checking cooling cycle operation. A time delay will prevent the compressor from re-starting for approximately five (5) minutes.

4. Establish a permanent operating record by logging the unit operating conditions at initial start-up for each unit.

If a unit fails to operate, conduct the following checks:

A. Check the voltage and current. They should comply with the electrical specifications described on the unit nameplate.

B. Look for wiring errors. Check for loose terminal screws where wire connections have been made on both the line and low-voltage terminal boards.

C. Check the supply and return piping. They must be properly connected to the inlet and outlet connections on the unit.

D. If the checks described above fail to reveal the problem and the unit still will not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment

WARNING
Ensure all water valves and controls are set correctly to allow water to flow through the load and source side of the unit prior to engaging the compressor. Failure to do so can lead to freezing of the heat exchangers or water lines, which can permanently damage the heat pump.

WARNING
Do not leave system filled in a building without heat during the winter unless antifreeze is used. Heat exchanger coils never fully drain by themselves and will freeze unless properly winterized.

Note: Units have a five-minute time delay in the control circuit that can be eliminated on the ICM PCB. See wiring diagram on unit for wiring details. Jumper is marked "test"

Table 7: Water Temperature Change Through heat Exchanger

Water Flow, gpm	Rise, Cooling ºF	Drop, Heating ºF
For Closed Loop: Ground source or Closed Loop Systems at 3gpm per ton	9 – 12	4 – 8
For Open Loop: Ground Water Systems at 1.5gpm per ton	20 – 25	10 – 17

Unit & System Checklist

****Before powering the system, please check the following****

Item	Description	Done
	UNIT Checklist	
1	Ensure Voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Check low voltage wiring is complete	☐
2	Ensure transformer has properly selected control voltage tap. 208-230V units are factory wired for 230V operation unless specified otherwise.	☐
3	Ensure entering water temperatures are within operating limits of Performance Table.	☐
4	Verify low water temperature cut-out is properly set. Check flow switch is operating	☐
5	Verify inlet and outlet water temperatures on both Load and source are recorded for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flows that can erode heat exchangers.	☐
	SYSTEM Checklist	
1	Check load and source water temperature for proper range and also verify heating and cooling set points for proper operation.	☐
2	System water pH is 7.5 - 8.5. Proper pH promotes longevity of hoses and fittings.	☐
3	Verify all hoses are connected end to end when flushing to ensure debris bypasses unit heat exchanger and water valves etc. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify all air is purged from the system. Air in the system can cause poor operation or system corrosion.	☐
4	Verify all hoses are connected end to end when flushing to ensure debris bypasses unit heat exchanger and water valves etc. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify all air is purged from the system. Air in the system can cause poor operation or system corrosion.	☐
5	Cooling Tower/Boiler: Check equipment for proper set-points and operation.	☐
6	Verify the standby pump is properly installed and in operating condition.	☐
7	Verify system controls function and operate in the proper sequence.	☐

Preventative Maintenance

Water Coil Maintenance for attached forced air heating systems: (Direct Ground Water Applications Only)
If the installation is performed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly.

If periodic coil cleaning is necessary, use standard coil cleaning procedures that are compatible with either the heat exchanger material or copper water lines.

Generally, the more water flowing through the unit the less chance for scaling therefore 1.5gpm per ton is recommended as a minimum flow.

Compressor:
Water Coil Maintenance for attached forced air heating systems: (All Other Water Loop Applications)
Generally water coil maintenance is not needed; however, if the installation is located in a system with a known high dirt or debris content, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly. These dirty installations are a result of the deterioration of iron or galvanized piping or components in the system or open cooling towers requiring heavy chemical treatment and mineral buildup through water use. If periodic coil cleaning be necessary, use standard coil cleaning procedures which are compatible with both the heat exchanger material and copper water lines. Generally, more water flowing through the unit lowers the chance for scaling. However, flow rates over 3gpm per ton can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Conduct annual amperage checks to ensure amp draw is no more than 10% greater than that indicated by serial plate data.

Cabinet:
Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. Generally all cabinets are set up from the floor a few inches on an isolation pad for sound control. The cabinet can be cleaned using a mild detergent.

Refrigerant System:
To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating chart for pressure and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.