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ICE AIR
World Class Comfort®

Vertical WSHP Technical Manual

INSTALLATION

Vertical WSHP Technical Manual - INSTALLATION

Note to INSTALLATION PERSONNEL:

Make sure that you are familiar with all of the necessary safety, installation and operating features of the product you are installing *before* commencing installation of this product. This includes thoroughly reading this manual, being aware of all unit operation and control functions and taking all required safety precautions.

Ice-Air LLC is not responsible for the design, execution, and performance of the building mechanical systems or the installation method of the equipment, or any of the accessories items used during installation, including without limitation any:

- Sealing
- Caulking
- Support structures
- Means of attachment
- Electrical connections
- Water connections
- Drain connections
- Grilles and Frames supplied by others
- Controls supplied by others
- Remote controls

Installers Safety Instructions:

This manual is supplied with each Ice Air Vertical Water Source Heat Pump (V-WSHP) unit. It serves to familiarize you, the installer, with the equipment and its proper installation. Additionally, it covers aftermarket servicing of the equipment. Do not begin installation of any Ice Air V-WSHP without thoroughly reading and familiarizing yourself with the V-WSHP model that you are about to install. This includes all safety precautions and related issues relevant to a successful V-WSHP unit installation.

Part of your responsibility in installing an Ice-Air V-WSHP is to be able to **instruct the customer in its safe use.**

This unit is to be installed and serviced by a professionally trained technician. If this unit is improperly installed, adjusted and / or connected, the safety of the unit can be compromised and a hazardous situation may occur.

Note to the CUSTOMER

The following items are the customer's responsibility – *PLEASE READ CAREFULLY:*

- Blocking the air intake or discharge areas (Failure of unit to operate properly due to improper inlet or outlet air supply)
- Damage to the unit due to improper cleaning of the evaporator coil, or the use of the unit in a corrosive environment (such as chemical plants, refineries or salt spray areas) without specifying this type of condition prior to purchase of this unit
- Damage to the unit due to inadequate or interrupted electrical service, use of inadequate electrical protective devices or use of the unit on a power supply other than specified on the unit nameplate.
- Damage due to failure to properly maintain and service unit
- Damage due to improper transportation or handling prior to or during installation
- Damage due to accident or from unauthorized alteration or modification of the equipment, improper installation and or tampering with the unit, the electrical connection and / or the water supply, return or drain systems.
- Improper or inadequate filter cleaning or replacement
- Product misapplication

Safety Note to the Service Professional

Please familiarize yourself with the content of this manual before you attempt to service this unit. The safety precautions listed in this manual should not supersede existing practices but should be considered as additional information for the proper servicing of this unit.

General

To assure trouble free and safely operating equipment, the equipment must be installed, operated and maintained in accordance with installation and operating instructions as contained in this manual. Additionally, please adhere to relevant local building, electrical, plumbing and similar codes and ordinances, or, if these are not available, refer to the National Electrical Code.

Utilities

Dedicated electrical circuitry and power supply is required to properly energize the Ice-Air V-WSHP. Please consult the operating specifications for V-WSHP to verify unit electrical capacity and voltage requirements. Adequate and continuous water flow must also be maintained for proper and safe unit operation.

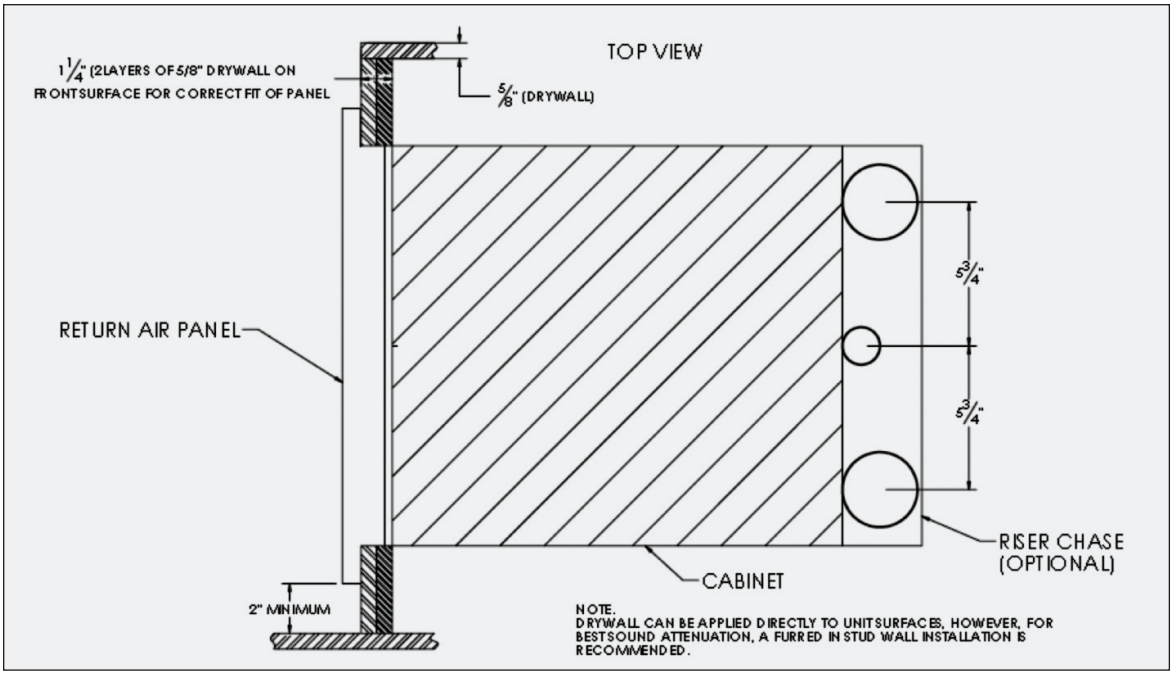
WARNING:

BEFORE INSTALLING, SERVICING, DISCONNECTING OR MAINTAINING THIS UNIT, MAKE SURE THAT ALL ELECTRICAL CONNECTIONS ARE POWERED OFF.

Drywall Installation

All rough in drawings and instructions are designed for 5/8" thick drywall (Figure 1) Rough-in dimensions will be affected if 5/8" drywall is not used. Additionally, the air supply panel will not fit properly to the wall. Poor fit up will affect unit air flow and performance. Install drywall using standard construction practices. Proper mechanical fasteners are required for installation.

Figure 1

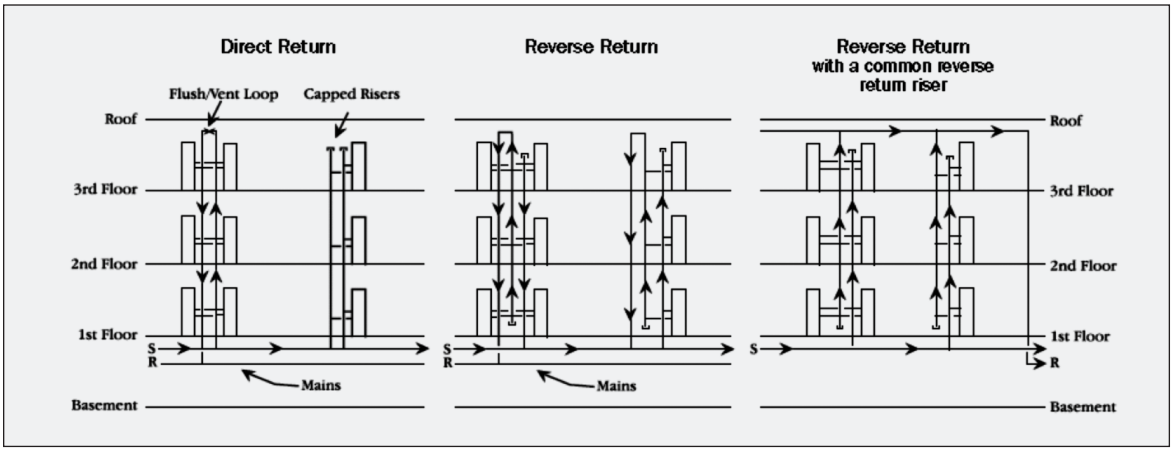


Cutting out supply and return openings through the sheet rock unit surround will create dust and debris. Before operating the unit, clean all drywall dust and construction debris from the unit evaporator coil, drain pans, hoses, air handling system, and blower discharge plenum.
When installation is complete, cover all openings to prevent dirt and debris from entering the unit casing.

Cabinet & Riser Installation

Riser system design is the responsibility of the building mechanical designer and / or the installing contractor. Because it affects the individual unit performance and efficiency, it is important that the system be properly designed, installed and balanced prior to operation of the equipment.

Figure 2
common unit and riser piping configurations.



The first system illustration shows the most common piping arrangement, referred to as "Direct Return". This is the most cost-effective method of piping to install, since the water is supplied and returned to a new riser column at a single location - at the bottom or top of the building. However, this type of system requires additional effort to individually balance water flow to the units. The risers are normally capped at the ends opposite the main supply and return piping and may require field installed flush and vent loops.

Cabinet & Riser Installation (Cont.)

The second system illustration shows a Reverse Return system, which is commonly used to minimize individual unit water flow balancing, and is often referred to as "self balancing". This riser configuration has a natural propensity to balance the flow to each unit in the riser column. However, individual unit balancing may still be required. This piping system is used for 2-pipe systems only, and has an individual return for each riser column.

The third system illustration shows a Reverse Return system with a common reverse return riser, which is installed separately from the individual unit riser columns. This riser configuration allows for more flexibility in individual riser sizing but has the same general characteristics as the reverse return system. It may also be a better fit for the particular structural and architectural requirements of the building.

Regardless of the system being utilized, optimum performance can only be achieved through adjustment to the recommended water flow at each individual unit. (Refer to unit requirements in the following Table #1.)

Table 1

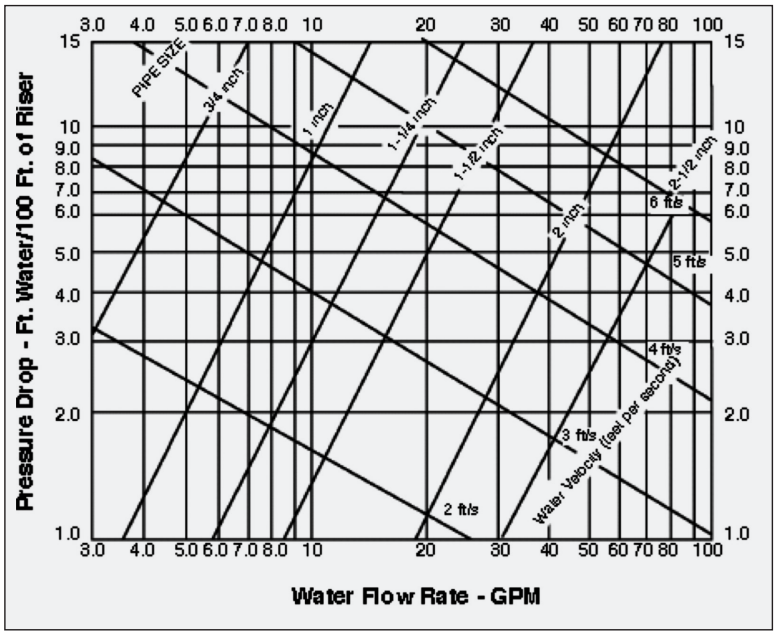
Typical Water Side Data

Model	09	12	15	18	24	30	36
Flow Rate (GPM)	2.3	3.0	3.8	4.5	6.0	7.5	9.0
Water Connection size	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"
Condensate Connection Size	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"

Riser, Sizing & Insulation

Some of the factors affecting riser application and sizing are noise, tube erosion, and economics. Water source heat pumps may be supplied with or without factory installed risers. The riser material, diameter, length and insulation thickness must be determined for each unit based on its positioning within the building, and the overall system requirements. Figure 3 displays riser tube diameter sizes as a function of flow (GPM), friction loss and water velocity. For maximum riser velocity on pressure drop per 100 feet, refer to ASHRAE Fundamentals Handbook for Riser Sizing.

Figure 3



Chilled water and hot water risers are available in Type-M or Type-L copper, with diameters that usually vary from 3/4" – 2-1/2", and typically with either no insulation, 1/2" or 3/4" thick closed foam insulation. Condensate risers are available in Type-M copper or PVC, diameters that vary from 3/4" – 1-1/4", and typically with either no insulation or, 1/2" or 3/4" thick closed cell foam insulation. All factory supplied risers and riser extensions are typically insulated for the full length of the riser, eliminating the need for field insulation. Insulation is not required on loop water piping except where the piping runs through unheated areas, outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient conditions. Insulation is required if loop water temperature drops below the dew point (insulation is required for the ground loop applications in most climates).

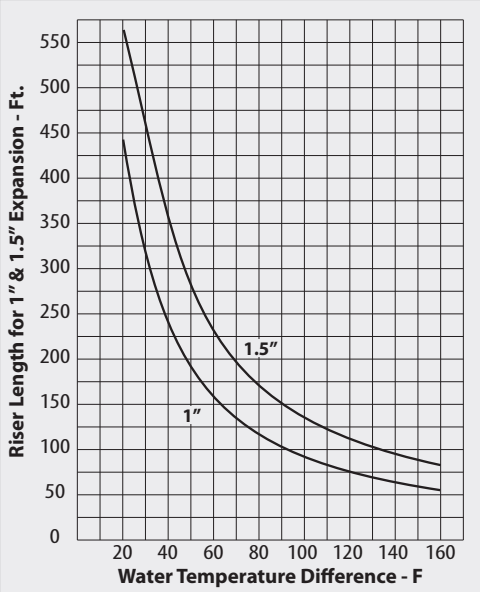
Riser sizing is generally based on the water flow requirements of each unit and will vary depending on unit location within the building (units on higher and lower floors that tie into the same riser column may require different size risers, depending on the piping system chosen). Water piping is often designed at approximately 5 ft/s. With this in mind, risers can be reduced in size as the water flow decreases from floor to floor. For low-rise buildings, riser sizes can be of a single diameter.

The reduced material handling on site will often offset the extra costs associated with the larger risers.

Riser Expansion

Generally, in medium to high-rise buildings, allowances must be made for pipe expansion. In applications supplemented with factory- or field-supplied between floor riser extensions, assemble and install extensions before installing the unit cabinet. NOTES: Riser assemblies are designed to accommodate a maximum of 1-1/8" expansion and contraction up to a total movement of 2-1/4". If the total calculated rise expansion exceeds 2-1/4", expansion devices must be used (Field provided).

Figure 4



All riser modifications necessitated by variations in floor-to-floor dimensions, including cutting off or extending risers, or providing extensions, are the sole responsibility of the installing contractor.

In cases where piping movement is expected to exceed the factory allowances, additional expansion compensation must be made to the riser system in the field. The Graph on the left displays the expansion characteristics of risers compared to water temperature differential. Assuming a minimum water temperature of 20°F and a maximum water temperature of 120°F, the temperature difference of 100°F indicates 90 feet of riser will expand or contract 1". To eliminate stress, a riser system must be anchored at least once to the building structure. Technical information on pipe expansion, contraction and anchoring can be found in the ASHRAE HVAC Systems and Equipment Handbook. Riser expansion and the anchoring of both the riser system and each unit is the responsibility of the design engineer and installing contractor.

Riser Connection

Install Cabinet With Risers As Follows:

a) Move cabinet into position. CAUTION: Keep risers off the floor while moving the cabinet.

b) Be sure that all the copper fittings are clean and free of dirt.

c) Raise the cabinet upright and lower it so the attached risers fit into the risers from the unit previously installed on the floor below. NOTE: The top of each riser is equipped with a 3" deep swaged connection. There is sufficient extension at the bottom to allow insertion of approximately 2" of the riser into the swaged top of the riser below.

d) Center the risers in the pipe chase and shim the unit cabinet to a level position. Plumb the risers in two planes to assure proper unit operation and condensate drainage.

e) Attach the cabinet assembly to the floor and to the building structure on at least two sides using sheet metal angles (field provided). NOTE: A field provided base vibration dampening pad can be used to help eliminate transfer of any vibration from the unit to the building structure. If vibration dampening pads are used, some rough-in dimensional changes will need to be considered before installation due to the type and thickness of the pads. Additional anchorage can be provided by installing brackets at the top of the cabinet (field provided).

f) DO NOT attach drywall studs to the equipment cabinet.

g) When all units on a riser are anchored into place, complete riser joints as follows:

- Verify that all riser joints are vertically aligned and that risers penetrate at least 1" into the swaged joint of the riser below. DO NOT let riser joint bottom out.
- Braze riser joints with a high-temperature alloy using proper Phos-copper or Silfos. Soft solder 50-50, 60-40, 85-15, or 95-5 or low temperature alloys are not suitable riser weld materials.
- Anchor built-in risers to the building structure with at least one contact point. To accommodate vertical expansion and contraction DO NOT fasten risers rigidly within the unit.
- Verify that unit shut-off valves are closed. DO NOT OPEN VALVES until the system has been cleaned and flushed.
- Flush system, Refer to System Cleaning and Flushing Section of this manual for more information.
- Install vents in piping loop as required to bleed the system of air accumulated during installation.

Water-Loop Heat Pump Application

Commercial Water Loop Application

WARNING:

Electrical Shock can cause personal injury or death while installing or servicing system, always turn off main power to system. There may be more than one disconnect switch.

Commercial systems typically include a number of units connected to a common piping system. Any system or unit piping 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 50° F (10°C), 1/2" (13mm) closed cell insulation is required on all piping surfaces to eliminate condensation. Metal to plastic threaded joints should never be used due to their tendency to leak over time.

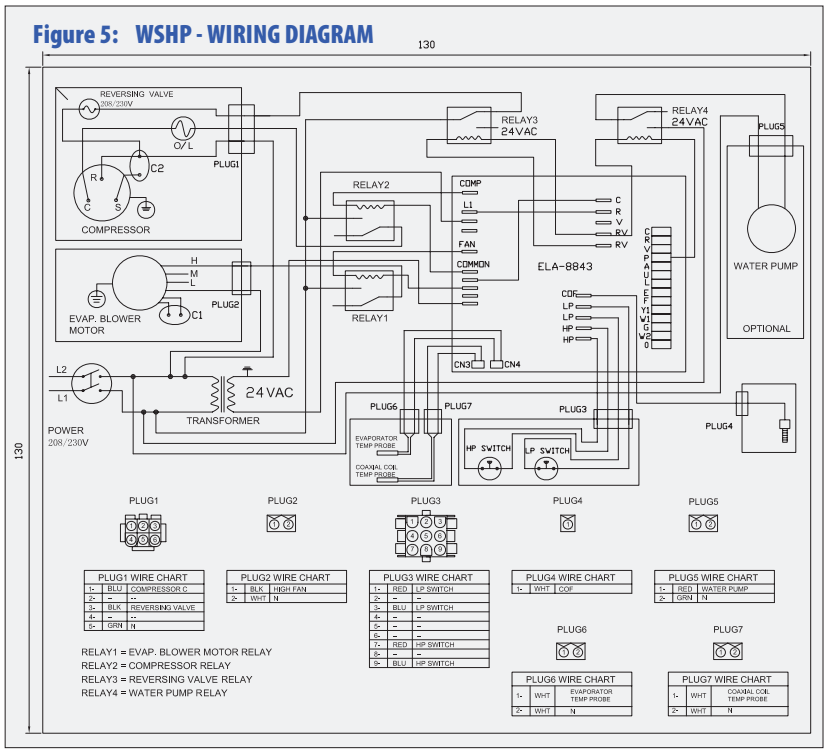
Teflon tape thread sealant is recommended for use in threaded system piping to minimize internal degradation of the heat exchanger. Do not over tighten connections and route piping properly so as not to interfere with service or maintenance access. Hose kits include shut off valves, P/T plugs for performance measurement, high pressure stainless steel braided hose, and hose adaptors.

Balancing valves, flow control valves, motorized solenoid valves and variable speed pumping systems may also be used.

The piping system should be flushed to remove dirt, pipe shavings, chips, and other foreign material prior to operation (refer to System Cleaning and Flushing on page 6.) The flow rate is usually set between 2.25 and 3.5 GPM per ton of cooling (3.9 1/m per kW) for most applications of water loop heat pumps. To insure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

Water loop heat pump (cooling tower/boiler) systems typically utilize a common loop, maintained between 60 - 90 °F (32 °C). The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary.

Figure 5: WSHP - WIRING DIAGRAM



Electrical - Line Voltage

If field installed, wiring, including the electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes below. Consult the wiring diagram on the right for field connections on the right or the electrical diagram located on the back of the unit electrical compartment front panel. All electrical connections must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

Table 2

Electrical Data

Model	Voltage/Hz/Phase	Compressor RLA	Comperssor LRA	Fan Motor FLA	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
8VHPW09	208-230/60-1	3.9	18	0.5	4.4	5.4	15
8VHPW12	208-230/60-1	5.2	25	0.7	5.9	7.2	15
8VHPW15	208-230/60-2	5.8	30	1	6.8	8.3	15
8VHPW18	208-230/60-1	7.7	32	1.2	8.9	10.8	20
8VHPW24	208-230/60-1	13.5	58	1.8	15.3	18.7	30
8VHPW30	208-230/60-1	14.3	64	2.2	16.5	20.1	30
8VHPW36	208-230/60-1	15.7	77	2.5	18.2	22.1	35

General Line Voltage Wiring

Be sure the available power is the same voltage and phase shown on the unit serial number plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code (whichever is applicable).

Power Connection

Units equipped with disconnect: Connect incoming line voltage to the disconnect switch and connect ground wire to the ground lug provided inside tile electrical compartment.

Units without disconnect: Line voltage connection is made by connecting the incoming line voltage wires to the line side(s) of the contactor.

208-230VAC Volt Operation

All commercial 208-230 Volt units are factory wired for 208 Volt single phase operation. For 230 Volt single-phase operation the primary voltage to the transformer must be changed. Remove the red lead from the compressor contactor capping it with a wire nut and connecting the orange 230VAC lead wire from tile transformer to the compressor contactor.

Note: Failure to change the primary voltage lead when using 230VAC line voltage may result in electrical component damage and intermittent system failure.

SYSTEM CLEANING AND FLUSHING

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

a) Verify that electrical power to the unit is off.

b) Verify that supply and return riser service valves are closed at each unit.

c) Fill the system with water, leaving the air vents open. Bleed all air from the system but do not allow the system to over flow. Check the system for leaks and make any required repairs.

d) Adjust the water and air level in the expansion tank.

e) With strainers in place, start the pumps. Systematically check each vent to ensure that all of the air is bled from the system.

f) Verify that make-up water is available and adjusted to properly replace any space remaining when all air is purged. Check the system for leaks and make any additional repairs if needed.

g) Set the boiler to raise the loop temperature to approximately 85°F (29.4°C). Open the drain at the lowest point in the system. Verify that make-up water replacement rate equals rate of bleed. Continue to bleed the system until the water appears clean or for at least three hours, whichever is longer.

h) Completely drain the system.

Flush risers as follows:

a) Close shut-off valves at each unit on the riser except the shut-off valve on the top floor.

b) Flush solution through supply riser. Note: The solution passes through the top floor connection and down the return riser.

c) When the building has more than 10 floors, connect the supply and return run outs on the top two floors to divide the water flow and reduce pressure drop at the pump.

d) Repeat flushing procedure for each set of risers in the building. ,

e) Refill the system and add in a proportion of trisodium phosphate approximately one pound per 150 gallons (0.4kg per 500 liters) of water. Reset the boiler to raise the loop temperature to about 100°F (37.8°C).

f) Circulate the solution for between 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning as needed.

g) Open the supply and return riser service valves at each unit. Refill the system and bleed off all air.

h) Test the system pH with litmus paper. The system water should have a pH of 6 to 8.5. Add chemicals as appropriate to maintain pH levels.

i) When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.

NOTE: DO NOT use "Stop Leak" or similar chemical agent in this system.
Addition of chemicals of this type to the loop water will corrode the heat exchanger and inhibit unit performance.

HOSE KIT INSTALLATION

a) Refer to the hose kit installation detail drawing on the right for an illustration of a typical supply/return hose kit assembly.

b) Unpack and examine hose kit. Remove all shipping and/or packing material such as rubber bands, plastic caps, and Styrofoam. Hose kit should contain (2) hoses

c) Attach the hoses to the shut off valves supplied with risers. Always use a back-up wrench when tightening the hose to the valve.

d) Attach flex hoses. Let the universal ends of the hoses hang inside the cabinet. Note: When valves and P/T ports are used, be sure the valve handles and P/T ports are in a position that enables them to be opened and closed and used for system readings after hose installation. Check the swivel ends of the hoses. Gaskets must be in the hose for proper seal.

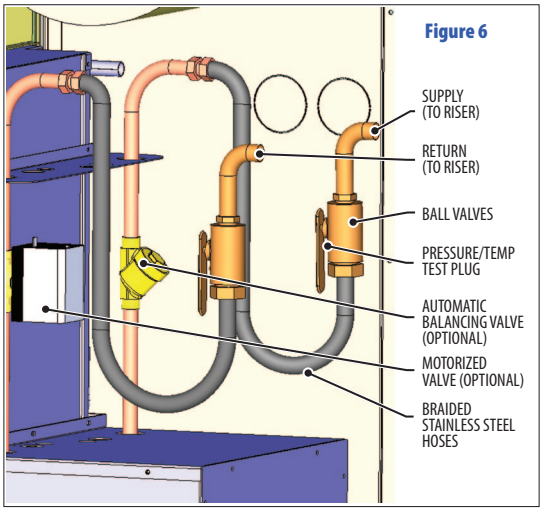


Figure 6

f) Slide the chassis partially into the cabinet. Match the SUPPLY hose to the SUPPLY tube on the chassis and the RETURN hose to the RETURN tube. Tighten the swivel connections, keeping the unit copper tubes parallel to the sides of the chassis, and then tighten the hoses to the copper tubes, making sure the hose hangs straight without twisting or turning.

Note: Always use back-up wrench on the fittings being tightened.

g) With the hoses properly installed, you can proceed to slide the chassis into place in the cabinet.

INSTALLING THE CHASSIS INTO THE CABINET

a) Open the unit water valves and check piping for leaks.

b) Complete the electrical connections between the unit cabinet and the chassis by mating the quick-connect plugs on the chassis cables to the plugs located in the bottom surface of the blower deck, directly under the control box, within the unit cabinet.

c) Before installing the chassis, perform the following checks:

- Ensure that fan wheel rotates freely and does not rub against housing. If rough handling during shipping has caused fan wheel to shift, adjust as necessary.
- Verify that water piping connections to the chassis are complete and that unit service valves, which were closed during system piping flushing, have been re-opened.
- Verify that power between the cabinet and chassis is properly connected.
- Re-attach the upper electrical access panel. Do not start the unit with access panel removed, as this is an electric shock hazard and system lockout and possible equipment damage can occur.

Note: After the system has been filled and system pump is started, all connections should be re-checked for water leaks. Proper installation and checking of the piping system is the responsibility of the installing contractor and Ice Air WILL NOT be responsible or liable for any damage caused by any water leaks from field installed water connection(s).

INSTALLING THE RETURN PANEL

a) Install the provided adhesive backed gasket material on the outer perimeter of the cabinet to seal the return panel to the cabinet.

b) Install the return cabinet panel. Refer to the diagram on the right for exact details.

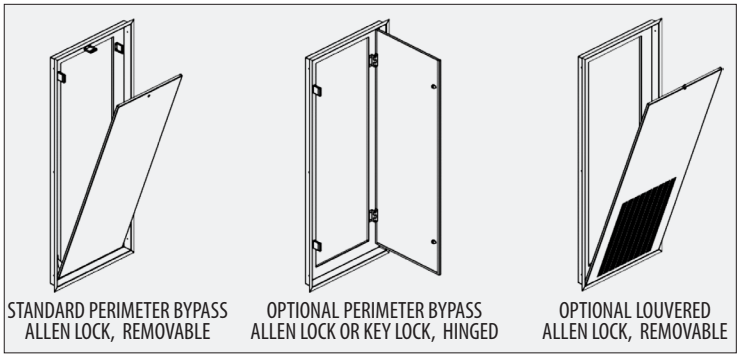


Figure 7

STANDARD 24VAC THERMOSTAT INSTALLATION

Thermostat Connections : The thermostat should be wired directly to the microprocessor board terminals labeled P1 to the corresponding terminals (R,C,Y,W,G)

Installation of Optional Wall-Mounted Thermostat: The unit can be controlled with a remote 24-volt surface mounted thermostat. Typical Thermostat Connections and Color Codes:

Rc	Power (Red)	**C**	24 VAC Common (White)
R	R+ Rc joined by factory jumper wire (Red)	**W**	Heating (Orange)
Y	Cooling (Yellow)	**G**	Fan Relay (Green)

NOTE: *Low-voltage wiring between the unit and the wall thermostat must comply with all applicable electrical codes (i.e., NEC and local codes), and be completed before the unit is installed. Use of six-wire, color-coded, low-voltage cable is recommended.*

The table on the right lists recommended wire sizes and lengths to install the thermostat. The total resistance of low voltage wiring must not exceed 1 ohm. Any resistance in excess of 1 ohm may cause the control to malfunction because of voltage drop.

Table 3

Recommended Wire Gauge
(Low Voltage Thermostat)

Wire Size	Maximum Run (Unit to Thermostat
22 ga.	30′
20 ga.	50′
18 ga.	75′
16 ga.	125′
14 ga.	200′

UNIT AND SYSTEM CHECKOUT

BEFORE POWERING UP THE SYSTEM, CHECK THE FOLLOWING:

a) Balancing/shutoff valves: Insure that all isolation valves are open and motorized water-control valve are properly wired.

b) Line voltage and wiring: Verify that voltage is within an acceptable range for the unit and wiring and fuses and/or circuit breakers are properly sized. Verify that low voltage wiring is complete.

c) Entering water and air: Insure that entering water and air temperatures are within operating limits of the Table on the next 2 pages (page 9 and page 10) and that there are no intake or discharge air blockages.

d) Unit fan: Manually rotate fan to verify free range of motion and insure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if supplied. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory. Check unit fan speed selection and compare to design requirements.

e) Condensate line: Verify that condensate line is open and properly connected and pitched toward drain.

f) Water flow balancing: Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip-outs and high velocity water flow that could erode heat exchangers.

g) Unit controls: Verify that the microprocessor dip-switches are set for proper operation and system configuration.

System Checkout

a) System water temperature: Check water temperature for proper range and verify heating and cooling set points for proper operation.

b) System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings.

c) System flushing: Verify that all hoses are connected end to end when flushing to insure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be of initial potable quality and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.

d) Cooling tower/boiler: Check equipment for proper set points and operation.

e) Standby pumps: Verify that the standby pump is properly installed and in operating condition.

f) System controls: Verify that system controls function and operate in the proper sequence.

g) Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.

h) System control center: Verify that the control center and alarm panel have appropriate set points and are operating as designed.

PERFORMANCE TABLES

8VHPW09

EWT		60			70			80			85			90			100			110		
GPM		1.1	1.7	2.3	1.1	1.7	2.3	1.1	1.7	2.3	1.1	1.7	2.3	1.1	1.7	2.3	1.1	1.7	2.3	1.1	1.7	2.3
Water dP (Ft)		1.1	3.4	6.6	1.1	3.3	6.3	1.0	3.2	6.1	1.0	3.2	6.1	1.0	3.1	6.0	1.0	3.0	5.9	0.9	3.0	5.8
Cooling	Total	10.4	10.9	11.0	9.9	10.3	10.5	9.3	9.7	9.9	8.9	9.4	9.6	8.5	9.0	9.3	7.5	8.2	8.5	6.5	7.1	7.4
	Sensible	7.2	7.3	7.3	7.1	7.2	7.2	6.8	7.0	7.1	6.7	6.9	7.0	6.5	6.7	6.8	6.0	6.3	6.5	5.4	5.8	6.0
	Power (KW)	0.6	0.6	0.5	0.7	0.6	0.6	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.8	0.7	0.9	0.9	0.8	1.0	0.9	0.9
	Heat Rejection	12.5	12.7	12.7	12.2	12.4	12.5	11.8	12.1	12.2	11.6	11.9	12.0	11.3	11.7	11.8	10.7	11.1	11.3	9.9	10.3	10.7
	EER	17.4	19.4	20.4	14.8	16.6	17.6	12.4	14.0	14.9	11.4	12.9	13.7	10.3	11.7	12.4	8.3	9.5	10.2	6.6	7.6	8.2
Heating	Total	10.4	11.1	11.5	11.7	12.5	12.9	13.0	13.8	14.2	13.6	14.4	14.8	14.1	14.9	15.4	Operation Not Recommended					
	Power (KW)	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8						
	Heat Extraction	8.0	8.6	8.9	9.2	9.9	10.3	10.4	11.1	11.5	11.0	11.7	12.1	11.5	12.2	12.6						
	COP	4.1	4.4	4.5	4.6	4.8	4.9	4.9	5.2	5.3	5.1	5.4	5.5	5.3	5.5	5.6						

8VHPW12

EWT		60			70			80			85			90			100			110		
GPM		1.5	2.3	3.0	1.5	2.3	3.0	1.5	2.3	3.0	1.5	2.3	3.0	1.5	2.3	3.0	1.5	2.3	3.0	1.5	2.3	3.0
Water dP (Ft)		2.8	6.6	12.1	2.6	6.1	11.5	2.5	5.8	10.9	2.4	5.7	10.7	2.3	5.6	10.5	2.3	5.5	10.3	2.2	5.3	10.0
Cooling	Total	14.4	15.0	15.3	13.6	14.2	14.4	12.5	13.3	13.6	12.0	12.7	13.0	11.4	12.2	12.5	10.3	11.0	11.3	9.2	9.8	10.1
	Sensible	9.4	9.6	9.7	8.9	9.3	9.4	8.5	8.8	8.9	8.3	8.6	8.7	8.1	8.4	8.5	7.7	7.9	8.1	7.1	7.4	7.5
	Power (KW)	0.8	0.7	0.7	0.9	0.8	0.8	1.0	0.9	0.9	1.0	1.0	0.9	1.1	1.0	1.0	1.2	1.1	1.1	1.3	1.2	1.2
	Heat Rejection	17.1	17.5	17.7	16.6	17.0	17.1	15.8	16.4	16.6	15.5	16.0	16.2	15.1	15.6	15.8	14.3	14.9	15.1	13.6	14.0	14.2
	EER	18.1	20.3	21.6	15.2	17.1	18.2	12.7	14.3	15.2	11.6	13.1	13.9	10.6	11.9	12.6	8.7	9.8	10.4	7.1	8.0	8.5
Heating	Total	12.8	13.6	14.0	14.3	15.1	15.6	15.8	16.6	17.1	16.4	17.3	17.8	17.1	18.0	18.4	Operation Not Recommended					
	Power (KW)	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0						
	Heat Extraction	9.7	10.4	10.8	11.1	11.9	12.3	12.5	13.3	13.7	13.1	14.0	14.3	13.8	14.5	14.9						
	COP	4.1	4.3	4.4	4.5	4.6	4.7	4.8	5.0	5.1	4.9	5.1	5.2	5.1	5.2	5.3						

8VHPW15

EWT		60			70			80			85			90			100			110		
GPM		1.9	2.8	3.8	1.9	2.8	0.8	1.9	2.8	3.8	1.9	2.8	3.8	1.9	2.8	3.8	1.9	2.8	3.8	1.9	2.8	3.8
Water dP (Ft)		0.6	1.1	3.3	0.5	1.0	3.0	0.5	1.0	2.9	0.5	1.0	2.8	0.5	0.9	2.8	0.5	0.9	2.7	0.5	0.8	2.5
Cooling	Total	16.3	17.1	17.5	15.2	16.0	16.3	13.9	14.7	15.1	13.3	14.1	14.5	12.7	13.4	13.8	11.4	12.1	12.5	10.1	10.8	11.1
	Sensible	11.2	11.5	11.7	10.6	11.0	11.2	10.1	10.4	10.6	9.8	10.1	10.3	9.5	9.8	10.0	9.0	9.3	9.4	8.5	8.7	8.9
	Power (KW)	0.9	0.8	0.8	1.0	0.9	0.9	1.1	1.0	1.0	1.2	1.1	1.1	1.2	1.2	1.1	1.3	1.3	1.2	1.5	1.4	1.4
	Heat Rejection	19.3	19.9	20.1	18.5	19.1	19.3	17.7	18.2	18.5	17.2	17.8	18.1	16.8	17.3	17.6	15.9	16.4	16.7	15.1	15.5	15.8
	EER	18.2	20.5	21.8	15.2	17.1	18.2	12.6	14.2	15.1	11.5	12.9	13.7	10.3	11.6	12.4	8.5	9.5	10.1	6.9	7.7	8.2
Heating	Total	14.9	15.8	16.3	16.7	17.7	18.3	18.5	19.6	20.2	19.4	20.6	21.2	20.3	21.5	22.2	Operation Not Recommended					
	Power (KW)	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1						
	Heat Extraction	11.5	12.2	12.7	13.1	14.0	14.6	14.9	15.9	16.4	15.7	16.7	17.4	16.5	17.6	18.2						
	COP	4.3	4.4	4.6	4.7	4.9	5.0	5.0	5.2	5.3	5.2	5.4	5.5	5.4	5.6	5.7						

8VHPW18

EWT		60			70			80			85			90			100			110		
GPM		2.3	3.4	4.5	2.3	3.4	4.5	2.3	3.4	4.5	2.3	3.4	4.5	2.3	3.4	4.5	2.3	3.4	4.5	2.3	3.4	4.5
Water dP (Ft)		1.2	3.6	6.8	1.2	3.2	6.3	1.2	3.2	6.0	1.1	2.9	5.7	1.0	2.9	5.6	1.0	2.9	5.4	1.0	2.8	5.3
Cooling	Total	20.9	21.8	22.1	19.7	20.6	21.0	18.3	19.2	19.6	17.5	18.4	18.8	16.8	17.7	18.2	15.3	16.1	16.7	13.8	14.6	15.1
	Sensible	14.8	15.2	15.4	14.2	14.6	14.8	13.5	14.0	14.2	13.2	13.6	13.9	12.9	13.3	13.5	12.1	12.6	12.8	11.5	11.9	12.1
	Power (KW)	1.2	1.1	1.0	1.3	1.2	1.2	1.5	1.4	1.3	1.5	1.4	1.4	1.6	1.5	1.5	1.8	1.7	1.6	1.9	1.8	1.8
	Heat Rejection	24.8	25.3	25.6	24.0	24.6	24.8	23.2	23.7	24.0	22.7	23.3	23.5	22.2	22.9	23.1	21.3	21.9	22.1	20.4	20.9	21.2
	EER	18.1	20.3	21.5	15.2	17.0	18.1	12.6	14.2	15.1	11.5	13.0	13.8	10.5	11.8	12.5	8.6	9.7	10.3	7.1	8.0	8.4
Heating	Total	20.4	21.5	22.1	22.8	24.1	24.7	25.2	26.4	27.2	26.2	27.5	28.3	27.3	28.7	29.3	Operation Not Recommended					
	Power (KW)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5						
	Heat Extraction	15.7	16.8	17.3	18.0	19.1	19.8	20.2	21.5	22.1	21.3	22.6	23.2	22.4	23.5	24.2						
	COP	4.3	4.5	4.6	4.7	4.9	5.0	5.1	5.3	5.4	5.2	5.4	5.6	5.4	5.6	5.7						

PERFORMANCE TABLES

8VHPW24

EWT		60			70			80			85			90			100			110		
GPM		3.0	4.5	6.0	3.0	4.5	6.0	3.0	4.5	6.0	3.0	4.5	6.0	3.0	4.5	6.0	3.0	4.5	6.0	3.0	4.5	6.0
Water dP (Ft)		2.9	4.9	9.8	2.8	4.8	9.5	2.6	4.5	8.8	2.5	4.4	8.7	2.5	4.3	8.6	2.4	4.1	7.9	2.3	4.0	7.9
Cooling	Total	30.2	31.3	31.7	28.4	29.6	30.3	26.2	27.7	28.4	25.0	26.5	27.2	23.9	25.4	26.1	21.6	23.0	23.7	19.4	20.7	21.4
	Sensible	22.1	22.6	22.8	21.1	21.8	22.1	20.1	20.8	21.1	19.5	20.2	20.6	19.0	19.6	20.0	17.9	18.6	18.8	17.1	17.6	17.8
	Power (KW)	1.6	1.5	1.5	1.8	1.7	1.6	2.0	1.9	1.8	2.2	2.0	1.9	2.3	2.1	2.0	2.6	2.4	2.3	2.9	2.7	2.6
	Heat Rejection	35.7	36.4	36.7	34.5	35.4	35.7	33.1	34.0	34.5	32.4	33.3	33.8	31.7	32.5	33.0	30.3	31.1	31.6	29.4	29.9	30.2
	EER	18.5	20.5	21.6	15.6	17.5	18.5	12.9	14.6	15.5	11.7	13.3	14.2	10.5	12.0	12.8	8.4	9.6	10.3	6.7	7.6	8.2
Heating	Total	26.4	28.0	28.8	29.8	31.6	32.6	33.2	35.2	36.3	34.9	36.9	38.1	36.5	38.7	39.9	Operation Not Recommended					
	Power (KW)	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2						
	Heat Extraction	20.2	21.6	22.3	23.3	24.9	25.9	26.4	28.2	29.3	27.9	29.8	30.9	29.5	31.4	32.5						
	COP	4.2	4.4	4.5	4.5	4.7	4.8	4.9	5.0	5.1	5.0	5.1	5.2	5.1	5.3	5.4						

8VHPW30

EWT		60			70			80			85			90			100			110		
GPM		3.8	5.6	7.5	3.8	5.6	7.5	3.8	5.6	7.5	3.8	5.6	7.5	3.8	5.6	7.5	3.8	5.6	7.5	3.8	5.6	7.5
Water dP (Ft)		2.1	6.4	12.1	2.1	6.2	11.7	1.7	5.4	10.2	1.6	5.3	9.9	1.6	5.2	9.7	1.6	4.9	9.3	1.6	4.7	9.3
Cooling	Total	37.3	37.9	38.1	36.0	36.9	37.3	34.1	35.3	35.9	32.9	34.3	34.9	31.8	33.3	34.0	28.9	30.6	31.4	25.7	27.5	28.4
	Sensible	24.2	24.3	24.3	23.9	24.2	24.2	23.4	23.8	23.9	22.9	23.4	23.6	22.3	23.0	23.3	20.9	21.9	22.2	19.0	20.1	20.7
	Power (KW)	2.0	1.9	1.8	2.2	2.0	2.0	2.4	2.3	2.2	2.5	2.4	2.3	2.7	2.5	2.4	3.0	2.8	2.7	3.3	3.1	3.0
	Heat Rejection	42.0	42.1	42.1	41.3	41.8	42.0	40.4	41.1	41.3	39.7	40.5	40.7	39.0	39.9	40.3	37.4	38.4	38.9	35.7	36.7	37.2
	EER	17.8	19.1	19.8	15.7	17.0	17.7	13.4	14.8	15.5	12.4	13.7	14.4	11.3	12.6	13.3	9.2	10.4	11.0	7.3	8.3	8.9
Heating	Total	31.0	32.3	33.0	34.0	35.3	35.9	36.6	37.5	37.8	37.3	38.1	38.3	38.2	38.6	38.6	Operation Not Recommended					
	Power (KW)	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2						
	Heat Extraction	23.8	25.1	25.9	26.7	28.0	28.5	29.2	30.0	30.5	29.9	30.6	30.8	30.7	31.0	31.1						
	COP	4.3	4.5	4.5	4.7	4.8	4.9	4.9	5.0	5.0	5.0	5.1	5.1	5.1	5.1	5.1						

8VHPW36

EWT		60			70			80			85			90			100			110		
GPM		4.5	6.8	9.0	4.5	6.8	9.0	4.5	6.8	9.0	4.5	6.8	9.0	4.5	6.8	9.0	4.5	6.8	9.0	4.5	6.8	9.0
Water dP (Ft)		5.2	10.7	17.9	5.1	10.5	17.5	4.7	9.7	16.2	4.6	10.0	15.9	4.6	10.4	15.5	4.3	9.0	15.1	4.3	8.8	14.8
Cooling	Total	42.1	43.4	43.9	39.8	41.3	42.0	37.3	38.9	39.7	36.1	37.7	38.3	34.7	36.3	37.1	31.9	33.5	34.3	29.4	30.8	31.6
	Sensible	28.3	28.8	29.0	27.2	27.8	28.2	26.0	26.7	27.0	25.3	26.1	26.5	24.8	25.4	25.8	23.7	24.3	24.6	23.0	23.4	23.6
	Power (KW)	2.3	2.2	2.1	2.6	2.4	2.3	2.9	2.7	2.6	3.0	2.8	2.7	3.2	3.0	2.9	3.6	3.3	3.2	4.0	3.8	3.6
	Heat Rejection	50.0	50.7	51.0	48.5	49.4	49.9	47.0	47.9	48.4	46.2	47.1	47.7	45.5	46.3	46.9	44.2	44.8	45.3	43.1	43.7	43.9
	EER	18.0	19.7	20.6	15.5	17.1	17.9	13.1	14.5	15.3	12.0	13.3	14.1	10.9	12.1	12.8	8.9	10.0	10.6	7.3	8.2	8.7
Heating	Total	35.5	37.2	38.1	39.4	41.3	42.3	43.3	45.2	46.2	45.1	47.0	47.9	46.9	48.7	49.6	Operation Not Recommended					
	Power (KW)	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.6	2.7	2.7						
	Heat Extraction	27.3	28.8	29.8	31.0	32.8	33.7	34.6	36.4	37.3	36.3	38.0	38.9	37.9	39.7	40.5						
	COP	4.3	4.4	4.5	4.6	4.8	4.9	4.9	5.1	5.2	5.1	5.2	5.3	5.2	5.3	5.4						

COP — Coefficient of Performance
EER — Energy Efficiency Ratio
EWT — Entering Water Temperature
GPM — Gallons Per Minute
dP — Pressure Drop

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.
All capacities are in 1000 BTUh
All temperatures are in F

UNIT START-UP

Unit Start-up Procedure

a) Turn on the line power to all heat pumps.

b) Turn the thermostat fan position to "ON" - Blower should start.

c) Balance air flow at registers.

d) Adjust all valves to their full open positions. Room temperature should be within the minimum-maximum ranges of the Performance Tables on pages 9, 10. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].

e) Two factors determine the operating limits of Ice Air VWSHP Series Heat Pumps: Supply water temperature and the return air temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at a normal level to insure proper unit operation.

- Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the "COOL:' position. Slowly reduce thermostat setting until the compressor activates.
- Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.
- Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.
- Refer to the Performance Tables on pages 9,10. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check unit refrigerant pressures.
- Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F (8°C and 14°C).
- Turn thermostat to "OFF" position.
- Allow five (5) minutes before beginning heating test for internal refrigerant pressure to equalize.
- Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
- Slowly raise the thermostat to a higher temperature until the compressor activates.
- Check for warm air delivery within a few minutes after the unit has begun to operate.
- Refer to the Performance Tables on pages 9,10. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures.
- Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F (11°C and 17C).
- Check for vibration, noise, and water leaks.

f) If unit fails to operate, perform troubleshooting analysis (see troubleshooting table on the right.) If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to insure proper diagnosis and repair of the equipment.

g) When testing is complete, set system to maintain desired comfort level.

Board Troubleshooting Table Table 4

Fault Description	Board LED Code Yellow	Green	Red
Normal	OFF	ON	OFF
High Pressure Lockout	OFF	OFF	FLASH
Low Pressure Lockout	FLASH	OFF	OFF
Air Side Freeze-up Protection	FLASH	OFF	FLASH
Waterside Freeze-up Protection	OFF	FLASH	OFF
High Water Temperature Protection	FLASH	OFF	ON
Over/Under Voltage Protection	OFF	OFF	ON
Condensate Overflow Protection	ON	OFF	OFF
Low Water Temperature Protection	ON	OFF	FLASH

h) BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTYREGISTRATION PAPERS TO Ice Air.

Note: If performance during any mode appears abnormal refer to the troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before start-up. Use a coil cleaner for use on indoor evaporator refrigeration equipment.