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Water Source Heat Pump 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 Console Water Source Heat Pump (HPW) 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 HPW without thoroughly reading and familiarizing yourself with the HPW model that you are about to install. This includes all safety precautions and related issues relevant to a successful HPW unit installation.

Part of your responsibility in installing an Ice-Air HPW 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 HPW. Please consult the operating specifications for HPW to verify unit electrical capacity and voltage requirements. Adequate and continuous water flow must also be maintained for proper and safe unit operation.

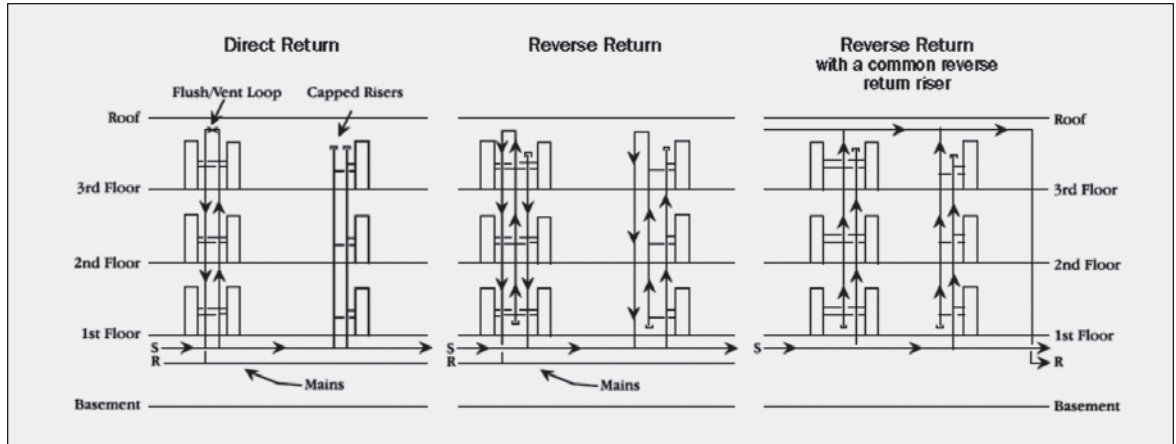
WARNING:

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

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 1
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.

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	16	19
Flow Rate (GPM)	2.3	3.0	3.8	4.5
Water Connection size	1/2"	1/2"	1/2"	1/2"
Condensate Connection Size	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 2 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.

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.

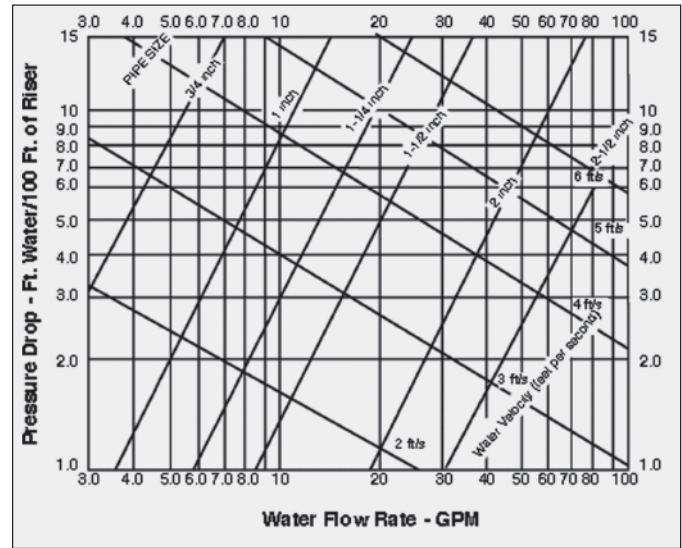


Figure 2

Water-Loop Heat Pump Application

Commercial Water Loop Application

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 60°, 1/2" 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.

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 5.) The flow rate is usually set between 2.25 and 3.5 GPM per ton of cooling 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 . 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.

Inspection

Upon receipt of the equipment, carefully check the shipment against the Bill of Lading. Make sure all units have been received. Inspect the packaging for any damage. Insure that any damage is noted on the delivering Carriers Bill of Lading.

Note: It is the responsibility of the purchaser to file all necessary claims with the delivering carrier in a timely fashion. Many carriers have a 15 day notice period from receipt of delivery to file any and all claims.

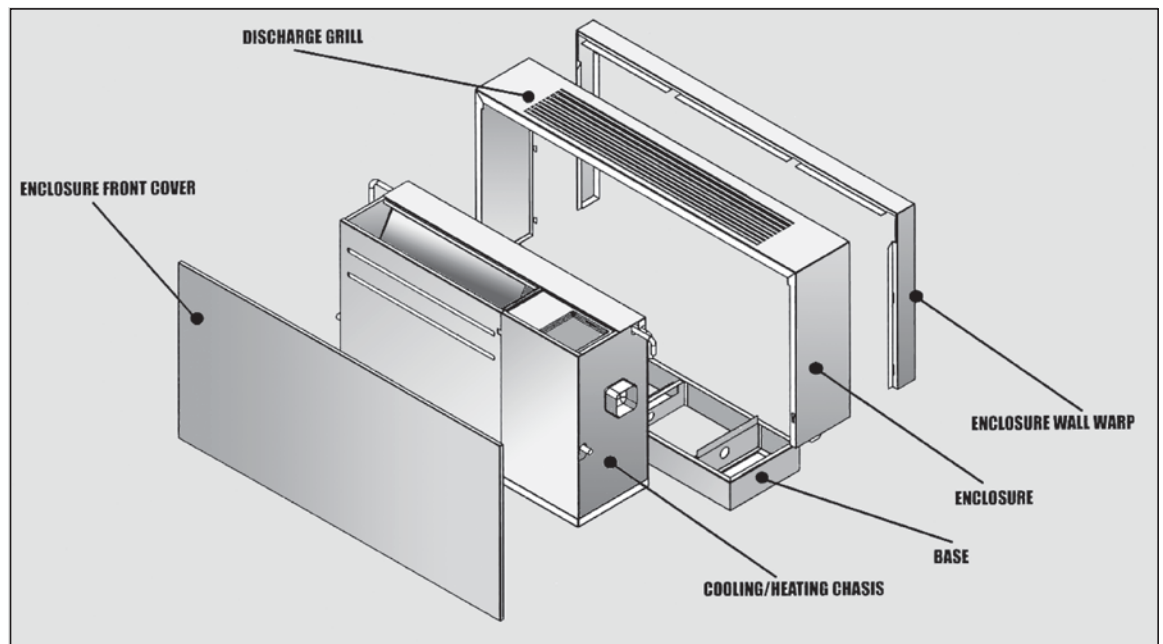
Installation

1. Compare the individual unit data on the nameplate with order and shipping information to verify that the correct unit has been shipped. Check the building floor plans to ensure that the proper unit capacities and voltages are being installed at each location .
2. Unpack the console unit from the shipping carton. Remove the Enclosure front panel by lifting up and away from the Enclosure (Refer to Figure 4.)
3. Remove the Enclosure from the Wall Wrap by pulling up and then away from the Wall Wrap.
4. Place the console unit into place and ensure the unit is square and level. Use shims to level the unit , if necessary to ensure proper installation.
5. Select the proper fasteners to connect the wall wrap securely to wall
6. Fasten the wall wrap onto the wall through the screw holes located on the back flange . Proper fasteners, connected to wall studs or other means of anchoring the unit, must be used.
7. Secure the Sub-base into place.
8. Make all the necessary electrical connections per the electrical connection section of this manual (Page 6.)
9. Follow the following steps to connect supply, return and condensate lines to the water loop system.

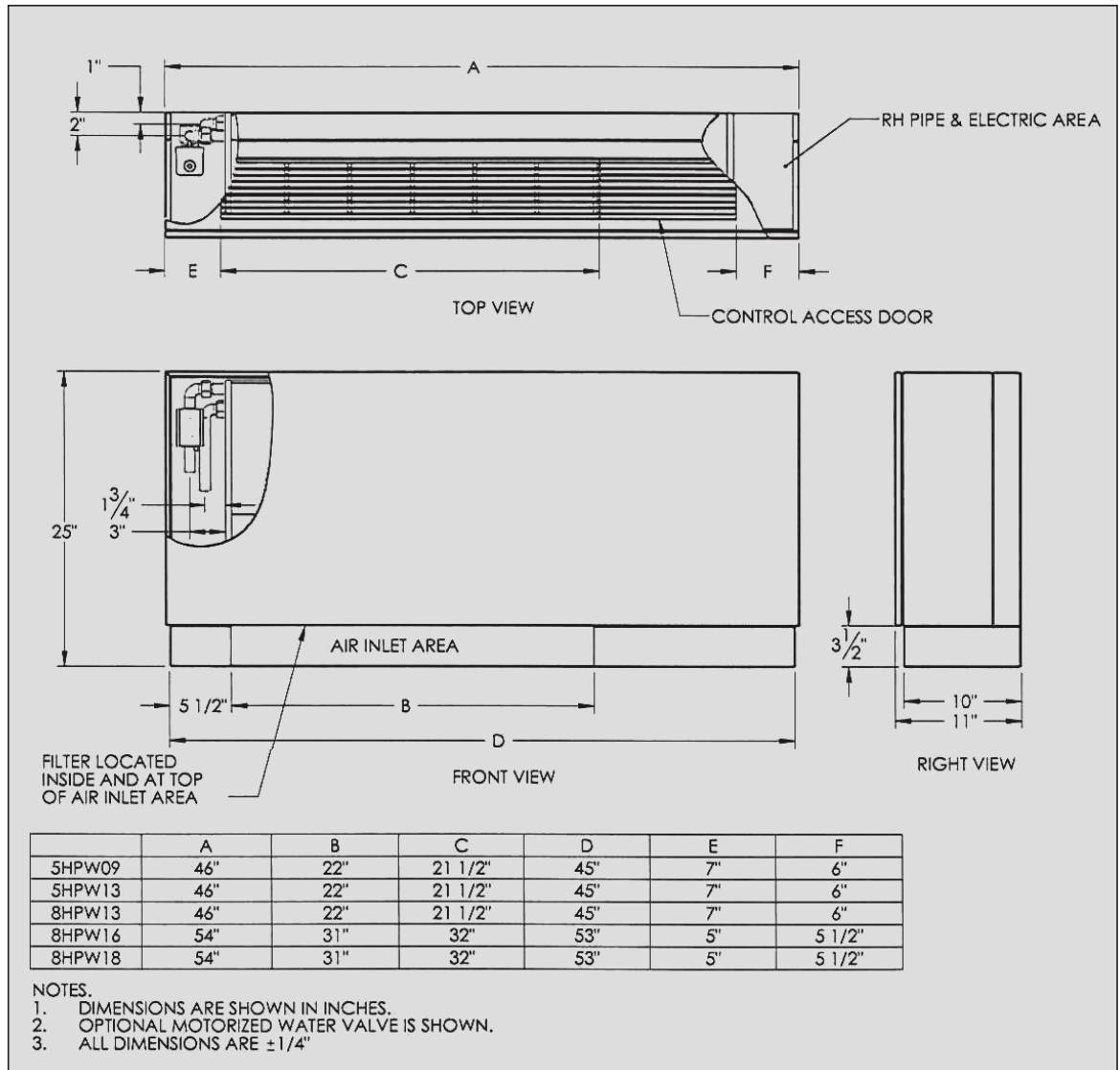
System Instructions:

- a. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
 - b. Install shut-off valves at each unit to permit unit removal for servicing.
 - c. Place strainers at the inlet of each system circulating pump.
 - d. The unit is supplied with a 1/2" clear condensate drain hose. Connect this hose to the building drain. Avoid making kinks in the hose to ensure an unobstructed flow of condensate from the unit to the drain . Do not twist, pull hose out or push excess hose into unit. If hose will not connect to the building drain , add or cut hose to size and use hard plastic or copper elbow fittings for tight radii . Keep hose positioned within cover sub-base area so hose does not interfere with enclosure or front cover. Clamp all joints water tight and check for leaks.
10. Before making the final water connection, flush the system per the "System Flushing" section of this manual on Page 7.
 11. After start up reinstall the enclosure and front cover over the chassis.

Figure 4:
Unit components
(Front exploded view)



**Figure 5 -
Console Water Source
Heat Pump
dimensional drawing**



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.

Electrical - Line Voltage

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 below (figure 3) 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.

Figure 3

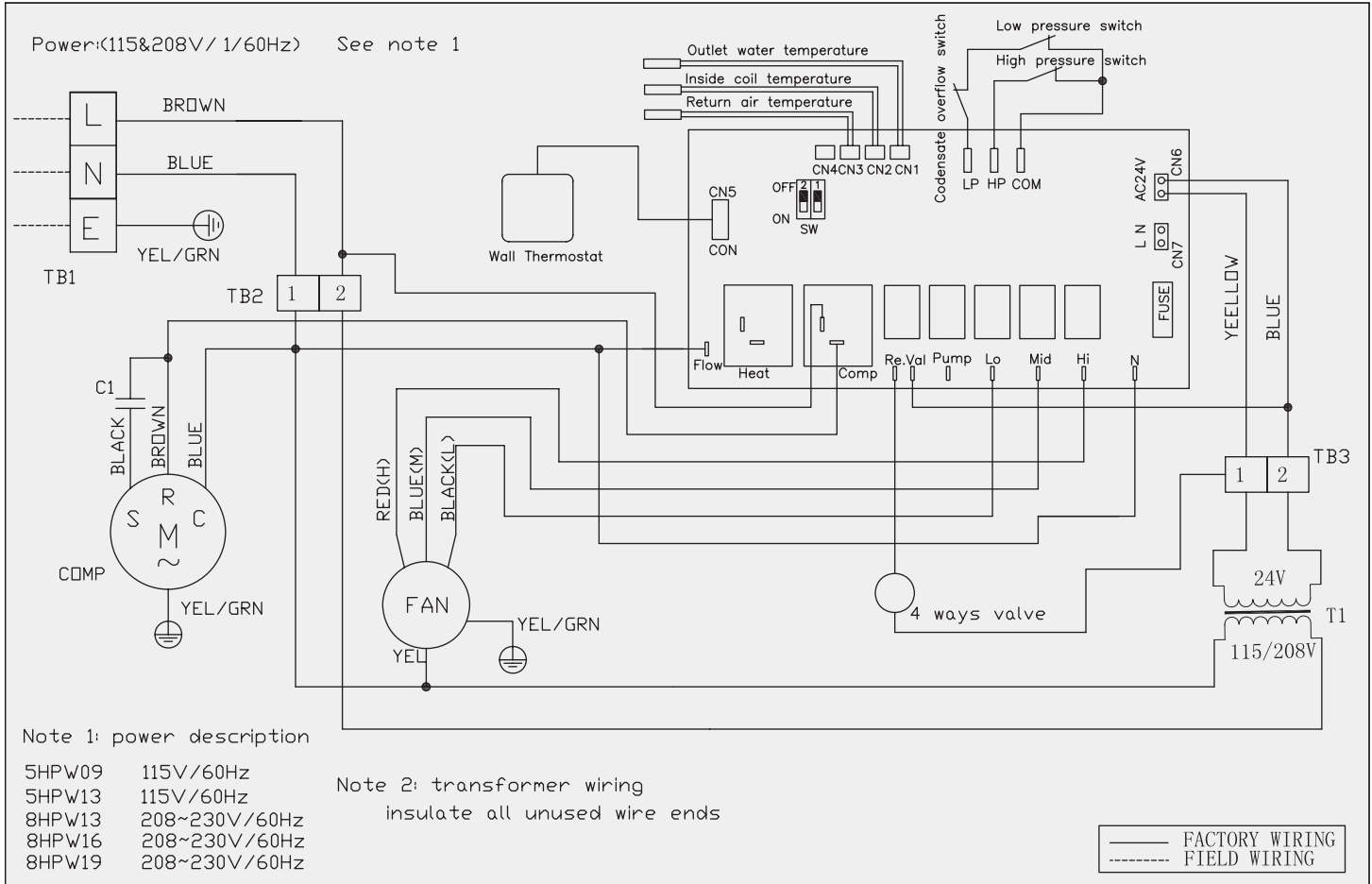


Table 2

Electrical Data

Model	Voltage/Hz/Phase	Total Unit FLA	Min Circuit Amps	Max Fuse/HACR
5HPW09	115/60-1	7.4	10.5	20
5HPW13	115/60-1	9.5	14.5	20
8HPW13	208-230/60-1	5.2	7.8	15
8HPW16	208-230/60-1	5.5	9.5	15
8HPW18	208-230/60-1	6.9	11.4	15

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 the electrical compartment.

Units without disconnect: Line voltage connection is made by connecting the incoming line voltage wires to the terminal block.

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.





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

STANDARD 24VAC THERMOSTAT INSTALLATION

Thermostat Connections : If optional wall mounted thermostat is used it 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:

	R 24 VAC Power (Red)
	Y Cooling (Yellow)
	C 24 VAC Common (White)
	W Heating (Orange)
	G Fan Relay (Blue)

Recommended Wire Gauge (Low Voltage Thermostat)

Table 3

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

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.

Table 3 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.

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:

- Verify that electrical power to the unit is off.
- Verify that supply and return riser service valves are closed at each unit.
- 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.
- Adjust the water and air level in the expansion tank.
- With strainers in place, start the pumps. Systematically check each vent to ensure that all of the air is bled from the system.
- 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.
- 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.
- 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.

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 Performance Tables (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

5HPW09

EWT		60			70			80			85			90			100			110		
GPM		1.1	1.6	2.2	1.1	1.6	2.2	1.1	1.6	2.2	1.1	1.6	2.2	1.1	1.6	2.2	1.1	1.6	2.2	1.1	1.6	2.2
Water dP (Ft)		2.9	5.6	9.7	2.6	5.2	9.2	2.6	5.0	8.4	2.5	5.0	8.2	2.4	5.0	7.9	2.4	4.8	7.6	2.4	4.8	7.6
Cooling	Total	10.7	10.8	10.8	10.3	10.6	10.7	9.7	10.0	10.3	9.2	9.7	10.0	8.9	9.3	9.7	7.9	8.4	8.8	6.6	7.3	7.6
	Sensible	8.1	8.0	8.0	8.1	8.1	8.1	8.0	8.1	8.1	7.9	8.0	8.0	7.6	7.9	8.0	7.2	7.5	7.6	6.4	6.8	7.1
	Power (KW)	0.7	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.7	0.9	0.8	0.8	0.9	0.8	0.8	1.0	0.9	0.9	1.1	1.1	1.0
	Heat Rejection	12.9	12.9	12.8	12.8	12.9	12.9	12.4	12.7	12.8	12.1	12.4	12.5	11.9	12.2	12.4	11.2	11.6	11.9	10.4	10.8	11.1
	EER	16.4	17.5	18.2	14.2	15.7	16.4	12.0	13.2	14.2	10.8	12.2	13.0	9.9	11.1	12.0	7.8	8.9	9.6	5.9	6.9	7.5
Heating	Total	10.7	11.1	11.4	11.8	12.2	12.5	12.7	13.2	13.5	13.2	13.6	13.9	13.6	14.0	14.2	Operation Not Recommended					
	Power (KW)	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9						
	Heat Extraction	8.0	8.5	8.7	9.0	9.4	9.7	9.8	10.3	10.6	10.3	10.7	10.9	10.7	11.0	11.2						
	COP	3.8	3.9	4.0	4.1	4.1	4.3	4.3	4.4	4.4	4.4	4.4	4.5	4.4	4.5	4.5						

5HPW13

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)		4.6	10.1	14.3	4.2	9.6	13.4	3.8	8.8	13.2	3.7	8.6	12.7	3.6	8.2	12.4	3.6	8.0	11.8	3.3	8.0	11.5
Cooling	Total	14.4	14.8	14.9	13.8	14.3	14.4	13.1	13.6	13.8	12.7	13.2	13.4	12.4	12.9	13.1	11.5	12.0	12.3	10.7	11.2	11.4
	Sensible	10.7	10.5	10.4	10.9	10.8	10.7	10.9	10.9	10.9	10.8	10.9	10.9	10.8	10.9	10.9	10.4	10.7	10.7	9.8	10.1	10.4
	Power (KW)	0.9	0.8	0.8	0.9	0.9	0.9	1.0	1.0	0.9	1.1	1.0	1.0	1.1	1.1	1.0	1.3	1.2	1.2	1.4	1.3	1.3
	Heat Rejection	17.4	17.5	17.6	17.1	17.3	17.4	16.8	17.0	17.1	16.5	16.8	16.9	16.3	16.5	16.8	15.9	16.2	16.3	15.6	15.8	15.9
	EER	16.8	18.2	18.9	14.7	16.0	16.8	12.5	13.9	14.5	11.7	12.8	13.5	10.8	11.9	12.5	9.1	10.1	10.6	7.6	8.4	8.9
Heating	Total	14.4	15.2	15.6	16.0	16.9	17.2	17.5	18.3	18.6	18.2	18.9	19.2	18.8	19.5	19.7	Operation Not Recommended					
	Power (KW)	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2						
	Heat Extraction	11.0	11.7	12.0	12.5	13.2	13.7	13.9	14.6	15.0	14.5	15.2	15.5	15.1	15.7	16.0						
	COP	3.8	4.0	4.0	4.2	4.3	4.4	4.4	4.6	4.7	4.6	4.7	4.8	4.7	4.8	4.9						

8HPW13

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)		4.6	10.1	14.3	4.2	9.6	13.4	3.8	8.8	13.2	3.7	8.6	12.7	3.6	8.2	12.4	3.6	8.0	11.8	3.3	8.0	11.5
Cooling	Total	14.4	14.8	14.9	13.8	14.3	14.4	13.1	13.6	13.8	12.7	13.2	13.4	12.4	12.9	13.1	11.5	12.0	12.3	10.7	11.2	11.4
	Sensible	10.7	10.5	10.4	10.9	10.8	10.7	10.9	10.9	10.9	10.8	10.9	10.9	10.8	10.9	10.9	10.4	10.7	10.7	9.8	10.1	10.4
	Power (KW)	0.9	0.8	0.8	0.9	0.9	0.9	1.0	1.0	0.9	1.1	1.0	1.0	1.1	1.1	1.0	1.3	1.2	1.2	1.4	1.3	1.3
	Heat Rejection	17.4	17.5	17.6	17.1	17.3	17.4	16.8	17.0	17.1	16.5	16.8	16.9	16.3	16.5	16.8	15.9	16.2	16.3	15.6	15.8	15.9
	EER	16.8	18.2	18.9	14.7	16.0	16.8	12.5	13.9	14.5	11.7	12.8	13.5	10.8	11.9	12.5	9.1	10.1	10.6	7.6	8.4	8.9
Heating	Total	14.4	15.2	15.6	16.0	16.9	17.2	17.5	18.3	18.6	18.2	18.9	19.2	18.8	19.5	19.7	Operation Not Recommended					
	Power (KW)	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2						
	Heat Extraction	11.0	11.7	12.0	12.5	13.2	13.7	13.9	14.6	15.0	14.5	15.2	15.5	15.1	15.7	16.0						
	COP	3.8	4.0	4.0	4.2	4.3	4.4	4.4	4.6	4.7	4.6	4.7	4.8	4.7	4.8	4.9						

8HPW16

EWT		60			70			80			85			90			100			110		
GPM		1.9	2.8	3.7	1.9	2.8	3.7	1.9	2.8	3.7	1.9	2.8	3.7	1.9	2.8	3.7	1.9	2.8	3.7	1.9	2.8	3.7
Water dP (Ft)		2.5	5.7	9.5	2.5	5.4	8.9	2.5	4.9	8.4	2.3	4.7	8.1	2.1	4.6	7.8	2.1	4.3	7.6	2.1	4.3	7.3
Cooling	Total	18.6	19.2	19.4	17.6	18.3	18.6	16.4	17.1	17.6	15.7	16.5	16.8	15.1	15.8	16.3	13.7	14.5	14.9	12.4	13.1	13.5
	Sensible	13.2	13.3	13.5	12.8	13.1	13.2	12.3	12.6	12.8	12.1	12.3	12.5	11.7	12.1	12.3	11.2	11.5	11.7	10.8	11.0	11.1
	Power (KW)	1.0	0.9	0.9	1.1	1.0	1.0	1.2	1.2	1.1	1.3	1.2	1.2	1.4	1.3	1.3	1.5	1.4	1.4	1.7	1.6	1.5
	Heat Rejection	22.1	22.5	22.6	21.5	22.0	22.1	20.8	21.3	21.5	20.4	20.8	21.1	19.9	20.5	20.7	19.1	19.5	19.9	18.4	18.7	19.0
	EER	18.5	20.7	21.8	15.7	17.6	18.5	13.2	14.7	15.6	12.0	13.4	14.2	11.0	12.2	13.0	9.0	10.1	10.7	7.4	8.3	8.7
Heating	Total	15.5	16.3	16.7	17.2	18.2	18.6	18.9	19.8	20.2	19.6	20.5	20.9	20.4	21.2	21.6	Operation Not Recommended					
	Power (KW)	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3						
	Heat Extraction	11.9	12.6	13.1	13.6	14.4	14.8	15.1	15.9	16.4	15.8	16.6	17.0	16.5	17.3	17.6						
	COP	3.8	3.9	4.0	4.1	4.3	4.4	4.4	4.6	4.7	4.5	4.7	4.8	4.7	4.8	4.9						

8HPW18

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)		4.5	10.1	15.7	4.3	9.6	14.6	3.9	9.0	14.2	3.8	8.7	13.8	3.7	8.4	13.5	3.7	8.2	12.9	3.4	7.9	12.7
Cooling	Total	22.4	23.1	23.3	21.0	21.8	22.2	19.4	20.4	20.7	18.7	19.5	20.0	17.8	18.7	19.2	16.5	17.2	17.6	15.6	16.0	16.2
	Sensible	16.2	16.3	16.5	15.6	16.0	16.2	14.8	15.4	15.5	14.3	14.9	15.1	13.8	14.4	14.6	12.8	13.3	13.5	12.0	12.3	12.6
	Power (KW)	1.1	1.1	1.0	1.3	1.2	1.2	1.4	1.3	1.3	1.5	1.4	1.4	1.6	1.5	1.4	1.7	1.7	1.6	1.9	1.8	1.8
	Heat Rejection	26.6	27.0	27.1	25.7	26.2	26.5	24.6	25.3	25.6	24.2	24.8	25.1	23.7	24.2	24.5	22.9	23.3	23.4	22.6	22.7	22.8
	EER	19.6	21.7	22.6	16.4	18.2	19.2	13.7	15.2	16.1	12.5	13.8	14.6	11.3	12.5	13.2	9.5	10.4	10.9	8.3	8.8	9.2
Heating	Total	20.7	21.1	21.2	22.0	22.5	22.8	23.9	24.9	25.4	25.3	26.6	27.4	26.8	28.4	29.3	Operation Not Recommended					
	Power (KW)	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.5	1.6	1.6						
	Heat Extraction	15.7	16.0	16.2	16.9	17.3	17.7	18.7	19.5	20.1	20.1	21.2	21.9	21.3	22.8	23.7						
	COP	4.3	4.3	4.3	4.5	4.5	4.6	4.8	4.9	4.9	4.9	5.1	5.2	5.1	5.3	5.4						

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 to "ON"
- c) 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 and 95°F.
- d) Two factors determine the operating limits of Ice Air HPW 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).
 - Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the "HEAT" position.
 - Allow five (5) minutes before beginning heating test for internal refrigerant pressure to equalize.
 - 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.
 - Check for vibration, noise, and water leaks.

UNIT START-UP (Cont.)

- e) If unit fails to operate, perform troubleshooting analysis. If the checklist 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.
- f) When testing is complete, set system to maintain desired comfort level.
- g) BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTY / REGISTRATION PAPERS TO **ICE AIR**.

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

TROUBLE SHOOTING ERROR CODE MENU

CODE NO.	CODE DESCRIPTION	ERROR CAUSE	MACHINE OPERATION SYMPTOMS	HOW TO REPAIR
E11	Ambient Temperature Sensor Fail	Loose Wire Loose Connector Sensor failure	Machine will cycle for 50 minutes and shuts down	Trace Ambient sensor wiring Check for loose connections Replace Ambient Sensor
E12	Evaporator Sensor Failure	Loose Wire Loose Connector Sensor failure	Machine shuts down Low pressure sensor and freezestat failed	Trace Evaporator sensor wiring Check for loose connections Replace Evaporator Coil Sensor
E19	Low Temperature Low Pressure sensor	Dirty Air Filter Return Air Obstruction Protecting Compressor	Compressor Shut Down Low Refrigerant	Remove Filter Check bottom intake of machine Check Refrigerant charge
E29 COOLING	Exiting Water temperature too High over 140F Entering Water temperature too High	Abnormal water temperature	Machine enters safe mode Compressor stops Exiting Water Temperature must be bellow 120F	Check Chiller water temperature and water flow Check entering water temperature
E29 HEATING	Low EWT less than 42.8F	Check EWT	Compressor will not start unless the Exiting Water temperature is above 50F	Check water temperature Check water flow
E14	Water temperature sensor located on the coaxial coil failure	Loose wire connection Temp sensor failure	Machine will shut off immediately Low pressure sensor and freezestat not functioning	Replace sensor
E18	The high pressure limit has been exceeded.	Entering water temp too high. Poor air flow	Compressor shuts down while the blower fan will operate to cool down the evaporator coil no heat	Check water temperature Check water flow Check/replace filter
E02	Communication Error	Loose connection	Machine will stop operating	Check wiring from control pad to board Replace board / Replace Pad

To restart machine after error resolution cycle the power OFF and ON; normal operation will resume.