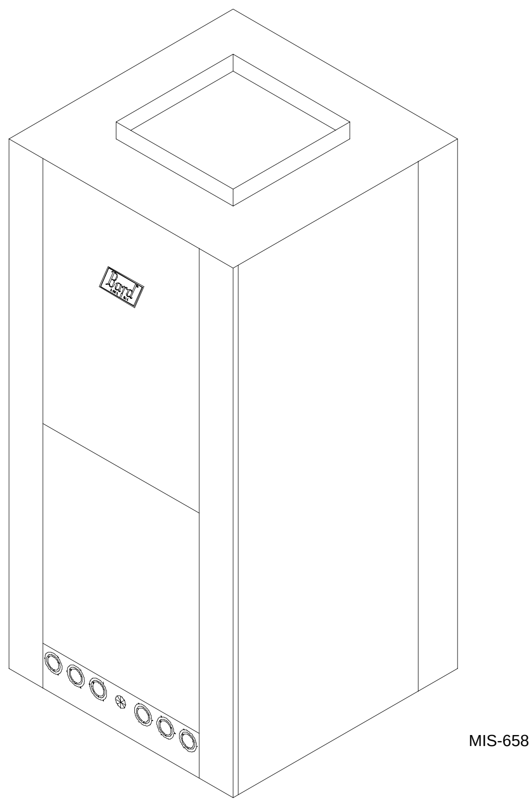
INSTALLATION INSTRUCTIONS

WATER SOURCE HEAT PUMPS

MODELS: WPV24C WPV30C
WPV36C WPV42C
WPV48C WPV60C



Earth Loop Fluid Temperatures 25° - 110°
Ground Water Temperatures 45° - 75°

BARD MANUFACTURING COMPANY
Bryan, Ohio 43506

Since 1914...Moving ahead, just as planned.

Manual: 2100-250 Rev. E
Supersedes: Rev. D
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TABLE 1
SPECIFICATIONS

MODEL	WPV24C	WPV30C	WPV36C	WPV42C	WPV48C	WPV60C
Electrical Rating (60HZ/V/PH)	230/208-1	230/208-1	230/208-1	230/208-1	230/208-1	230/208-1
Operating Voltage Range	253 - 197	253 - 197	253 - 197	253 - 197	253 - 197	253 - 197
Minimum Circuit Ampacity	15.0	14.4	20.5	27.5	34.5	36.0
+ Field Wire Size	#14	#14	#12	#10	#8	#8
++Delay Fuse Max. or Ckt. Bkr.	20	25	35	45	50	60
Total Unit Amps 230/208	8.9/9.4	10.3/11.3	14.8/16.3	19.5/21.2	23.7/27.0	25.9/28.8
COMPRESSOR						
Volts	230/208	230/208	230/208	230/208	230/208	230/208
Rated Load Amps 230/208	7/7.5	8.2/9.2	12.7/14.2	14.8/16.5	19.0/22.3	21.2/24.1
Branch Ckt. Selection Current	9.7	12.2	14.7	18.3	23.7	25.0
Lock Rotor Amps 230/208	50/50	61.7/61.7	82/82	109/109	129/129	169/169
BLOWER MOTOR and EVAPORATOR						
Blower Motor - HP/Spd	1/4 3-spd	1/3 2-spd	1/3 2-spd	1/2 3-spd	1/2 3-spd	1/2 3-spd
Blower Motor - Amps	1.9	2.1	2.1	4.7	4.7	4.7
Face Area Sq. Ft./ Rows/ Fins Per Inch	3.16/3/14	3.16/3/14	3.16/3/14	4.6/3/13	4.6/3/13	4.6/3/13
SHIPPING WEIGHT LBS.	240	240	255	350	370	375

TABLE 2
WATER COIL PRESSURE DROP

Model	WPV24C		WPV30C		WPV36C		WPV42C		WPV48C, WPV60C	
GPM	PSIG	Ft Hd	PSIG	Ft Hd	PSIG	Ft Hd	PSIG	Ft Hd	PSIG	Ft Hd
4	3.00	6.93	2.50	5.78	- - -	- - -	- - -	- - -	- - -	- - -
5	3.50	8.08	3.20	7.39	2.20	5.08	- - -	- - -	- - -	- - -
6	4.10	9.50	5.30	12.24	2.75	6.36	1.00	2.31	1.65	3.82
7	4.70	10.85	6.40	14.78	3.40	7.86	1.49	3.44	2.35	5.43
8	- - -	- - -	9.60	22.18	4.15	9.59	2.02	4.67	3.10	7.16
9	- - -	- - -	- - -	- - -	5.00	11.56	2.60	6.01	3.86	8.92
10	- - -	- - -	- - -	- - -	5.95	13.75	3.22	7.44	4.65	10.75
11	- - -	- - -	- - -	- - -	- - -	- - -	3.90	9.01	5.50	12.71
12	- - -	- - -	- - -	- - -	- - -	- - -	4.60	10.63	6.40	14.79
13	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	7.45	17.22
14	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	8.60	19.88
15	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	9.90	22.89

TABLE 3
INDOOR BLOWER PERFORMANCE
(CFM – Dry Coil with Filter) ①

Model	WPV24C			WPV30C WPV36C		WPV42C, WPV48C, WPV60C Without Optional CW45 Installed			WPV42C, WPV48C, WPV60C With Optional CW45 Installed	
ESP in WC	Motor Speed			Motor Speed		Motor Speed			Motor Speed	
	High	Medium	Low	High	Low	High	Medium	Low	High	Medium
.00	1,033	946	774	1,300	1,190	1,740	1,650	1,530	1,740	1,600
.10	983	904	757	1,275	1,150	1,695	1,607	1,510	1,695	1,550
.20	942	870	742	1,210	1,110	1,650	1,570	1,480	1,650	1,520
.30	903	836	720	1,150	1,060	1,602	1,532	1,443	1,625	1,500
.40	857	794	688	1,080	1,000	1,550	1,490	1,400	1,500	1,460
.50	799	742	648	1,010	960	1,490	1,435	1,348	1,440	1,380
.60	740	681	603	920	875	1,420	1,365	1,290	1,390	1,310

① For wet coil CFM multiply by .96
ESP = External Static Pressure (inches of water)

APPLICATION AND LOCATION

GENERAL

Units are shipped completely assembled and internally wired, requiring only duct connections, thermostat wiring, 230-208 volt AC power wiring, and water piping. The equipment covered in this manual is to be installed by trained, experienced service and installation technicians. Any heat pump is more critical of proper refrigerant charge and an adequate duct system than a cooling only air conditioning unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire heat pump system should be carefully read before beginning the installation. Note particularly any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not in any way supersede any national and/or local codes. Authorities having jurisdiction should be consulted before the installation is made.

SHIPPING DAMAGE

Upon receipt of the equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

APPLICATION

Capacity of the unit for a proposed installation should be based on heat loss calculations made in accordance with methods of the Air Conditioning Contractors of America, formerly National Warm Air Heating and Air Conditioning Association. The air duct system should be sized and installed in accordance with Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other than Residence Type NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B.

LOCATION

The unit may be installed in a basement, closet or utility room provided adequate service access is insured. Ideally, three sides of the unit should have a minimum access clearance of two feet but the unit can be adequately serviced if two or only one side has a minimum two feet of clearance. The unit should be located in the conditioned space to prevent freezing of the water lines.

Clearance to combustible materials is 0 inches for the heat pump. If an optional duct heater is installed, follow the instructions packed with the duct heater for specifications regarding clearance to combustible material.

Before setting the unit, consider ease of piping, drain and electrical connections for the unit. Also, for units which will be used with a field installed heat recovery unit, consider the proximity of the unit to the water heater or storage tank. Place the unit on a solid base, preferably concrete, to minimize undesirable noise and vibration. DO NOT elevate the base pan on rubber or cork vibration eliminator pads as this will permit the unit base to act like a drum, transmitting objectionable noise.

DUCTWORK

If the unit is to be installed in a closet or utility room which does not have a floor drain, a secondary drain pan under the entire unit is highly recommended.

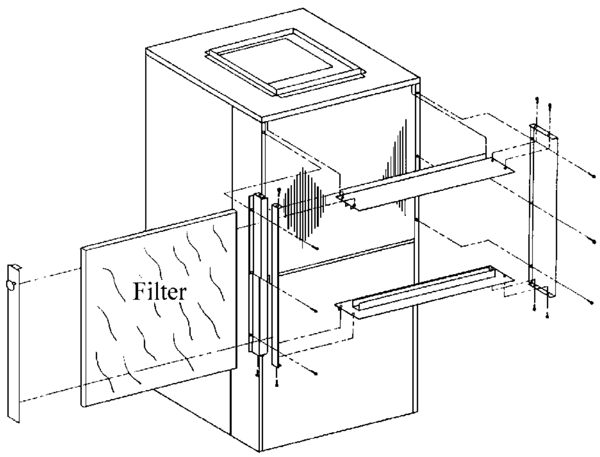
DO NOT install the unit in such a way that a direct path exists between any return grille and the unit. Rather, insure that the air entering the return grille will make at least one turn before entering the unit air coil. This will reduce possible objectionable compressor and air noise from entering the occupied space.

Design the ductwork according to methods given by the Air Conditioning Contractors of America. When duct runs through unconditioned spaces, it should be insulated with vapor barrier. It is recommended that flexible connections be used to connect the ductwork to the unit in order to keep the noise transmission to a minimum.

FILTER

This unit must not be operated without a filter. It comes equipped with a disposable filter which should be checked often and replaced if dirty. Insufficient air flow due to undersized duct systems or dirty filters can result in nuisance tripping of the high or low pressure control. Refer to Table 1 for correct air flow and static pressure requirements. See FIGURE 1.

FIGURE 1



CONDENSATE DRAIN

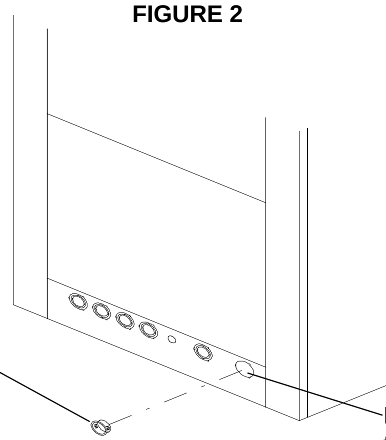
Determine where the drain line will run. This drain line contains cold water and must be insulated to avoid droplets of water from condensing on the pipe and dropping on finished floors or the ceiling under the unit. A trap MUST BE installed in the drain line and the trap filled with water prior to start up. The use of plugged tees in place of elbows to facilitate cleaning is highly recommended.

Drain lines must be installed according to local plumbing codes. It is not recommended that any condensate drain line be connected to a sewer main. The drain line enters the unit through the water access panel, see FIGURE 2, and connects to the FPT coupling under the condensate drain pan.

PIPING ACCESS TO THE UNIT

Water piping to and from the unit enters the unit casing through the water access panel. Piping connections are made directly to the heat exchanger coil and are 3/4" or 1" FPT. The access panel can be installed on the front of the unit (as received) or on the right side of the unit. It is highly recommended that the piping from the water coil to the outside of the casing be installed while the unit is completely accessible and before it is finally set in position. Two 1 3/4" inch plastic bushings are provided (packed with unit installation instructions) to protect piping from sheet metal edges of access panel. See FIGURE 2.

FIGURE 2



All electrical connections are made through the top of the unit. High voltage connections are made with wire nuts to the factory-provided pigtail leads in the junction box. Low voltage connections are made to the terminal strip mounted on the top of the unit. Refer to the wiring diagram for connecting the terminals.

MAIN POWER

Refer to the unit serial plate for wire sizing information and correct protection size. Each unit is marked with a "Minimum Circuit Ampacity." This means that field wiring connections must be sized to carry that amount of current. Each unit and/or wiring diagram is also marked "Use Copper Conductors Only," meaning the leads provided are not suitable for aluminum wiring. Refer to the National Electric Code for complete current-carrying capacity data on the various grades of wiring material.

The unit rating plate lists "Maximum Overcurrent Protective Device" that is to be used with the equipment. This device may be a time delay fuse or HACR type circuit breaker. The correct size overcurrent protective device must be used to provide for proper circuit protection and to avoid nuisance trips due to the momentary high starting current of the compressor motor.

THERMOSTAT LOW-VOLTAGE WIRING

A 24 volt terminal strip is mounted on top of the unit with an optional terminal board cover included with the unit installation instructions. See FIGURE 3. Two types of thermostats are available: 1) single stage heat, single stage cool to operate the heat pump alone--without backup duct style electric heaters. This thermostat is equipped with a signal light to indicate when the unit is "locked out" because of the low temperature or high pressure control. Refer to the wiring diagram 4091-810 for correct connection of the terminals. 2) two stage heat, single cool to operate the heat pump or duct heaters on heating or the heat pump on cooling. This thermostat is also equipped with a signal light to indicate when the unit is "locked out" because of operation of the low temperature or high pressure control. In addition, a second signal light tells when the unit has been placed in Emergency Heat. Refer to the wiring diagram 4091-811 and to the wiring diagram packed with the duct heater for correct connection of the low voltage terminals.

FIGURE 3

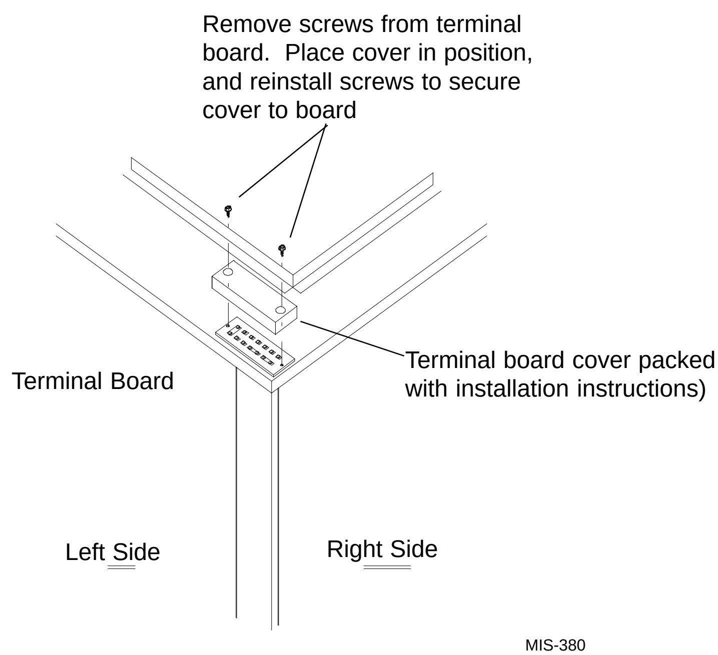
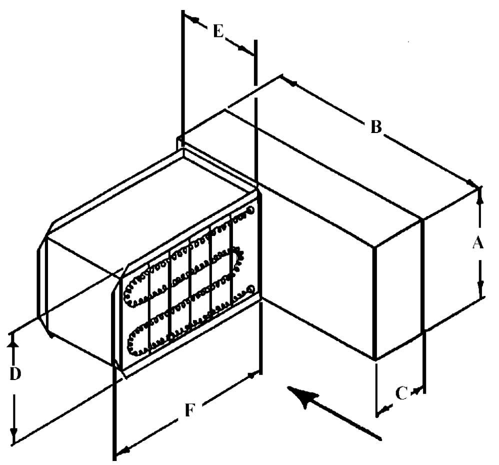


TABLE 4
ACCESSOSRY ITEMS – DUCT HEATER
(See Figure 4)

Part No.	PH	Volts	KW	Minimum Ampacity	Wire Size ①		Maximum Fuse	Dimensions					
					CU	AL		A	B	C	D	E	F
8604-080	1	240	5.0	27	#10	#8	30	8	10	4	7	7	12
8604-081	1	240	9.8	52	#6	#4	55	8	10	4	7	7	16
8604-082 ②	1	240	14.7	78	#4	#1	80	15	18	5	11	9	18
8604-083 ②	1	240	19.2	100	#2	#0	100	15	18	5	11	9	18

① Use wire suitable for at leat 75° C.
② Fused units (over 48 amperers).
NOTE: All duct heaters are supplied with backup protection and internal fusing as required by NEC.

FIGURE 4



The following is a verbal description of the proper procedure for connecting the low voltage hookups for the duct heater. (Refer to wiring diagram 4091-811).

1. Black wire from duct heater to C on the 24 volt terminal block.

2. Green wire from duct heater to green wire from thermostat. These wires must be wire nutted and isolated from the terminal block. Failure to do so will result in improper heater operation.

3. Connect green with tracer from heater to the G terminal on the 24 volt terminal block.

4. Connect the white wire from the heater to W2 on 24 volt terminal block.

   A. For the 15 and 20KW duct heaters, connect the white and white with black tracer wires to W2.

ADD-ON HEAT RECOVERY HOT WATER HEATER

NOTE: This section applies only if a water heating recovery device is added.

GENERAL

This high efficiency water source heat pump series was designed for easy field installation of a heat recovery device for hot water heating commonly known as a desuperheater water heater. The amount of annual hot water supplied and thus additional energy cost savings will depend on the amount of hot water your family uses and the number of hours your heat pump operates. We recommended that a UL recognized heat recovery device be used. This device must be suitable for potable water.

INSTALLATION

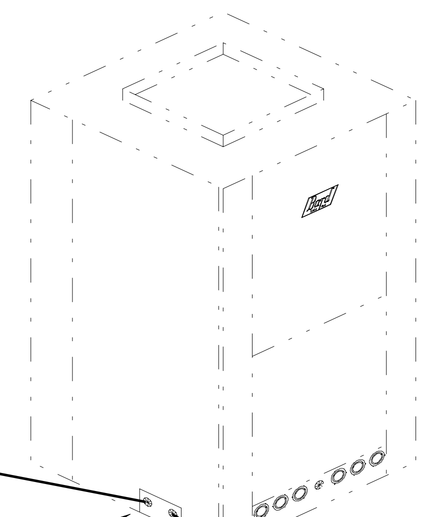
1. Follow all local, state and national codes applicable to the installation of heat recovery devices.

2. Follow the installation procedures you receive with the heat recovery device.

3. Connect the refrigerant lines between the heat recovery device and the heat recovery valves in the heat pump using the inlet and exit panel on the lower left side of the unit as shown in FIGURE 5. Keep dirt and moisture out of the interconnecting tubing using good refrigeration service procedures. See FIGURE 5. Use refrigeration grade (type L) copper tubing. The tube diameter should be the same as the valve for lengths up to 15 feet each way. For lengths between 15 and 25 feet, increase the diameter 1/8". Avoid placing the heat recovery device over 25 feet from the heat pump.

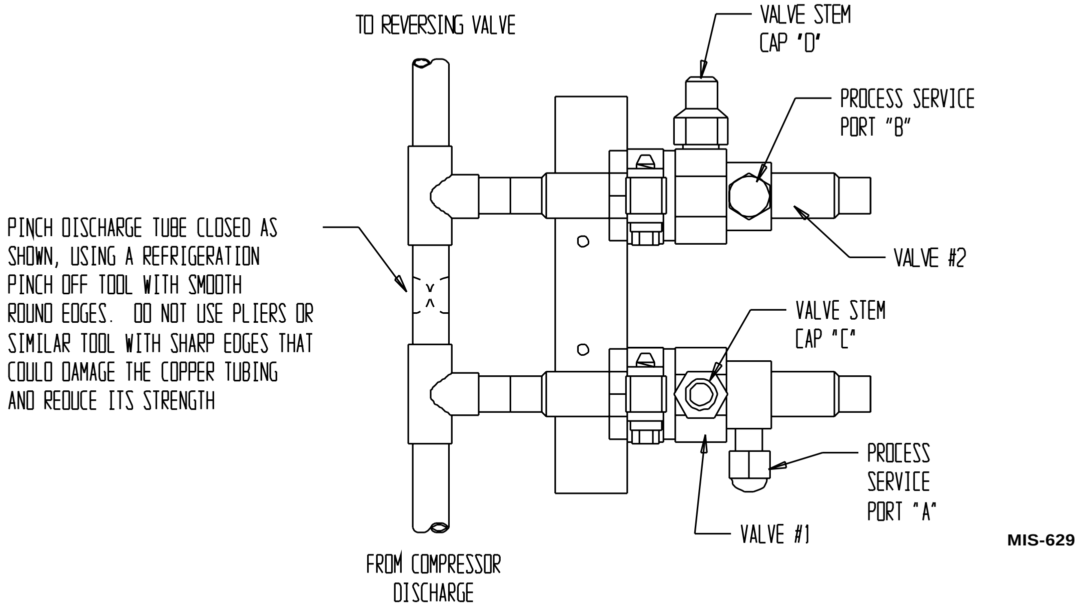
   This tubing should be insulated with Armaflex insulation. Tubing should be protected from abrasion and damage.

FIGURE 5



4. Evacuate the heat recovery device interconnecting tubing and heat exchanger through the process service ports A or B shown in FIGURE 6 and pressurize with Refrigerant 22 and perform a leak check. Release the charge used for pressurization, leak check and re-evacuate. Add 1 ounce of refrigerant for each 10 feet of additional interconnecting tubing to the total system charge. Replace the caps and tighten.

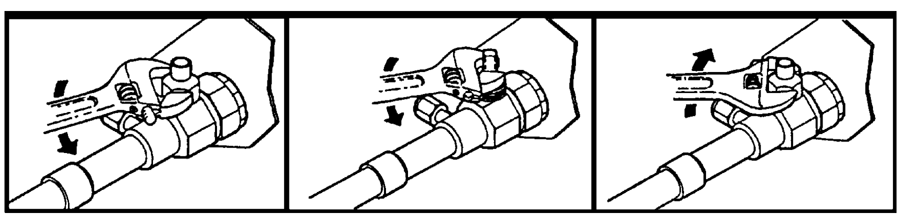
FIGURE 6



UNITS WITH BALL VALVES

5. Remove valve stem caps "C" and "D" shown in FUGURES 6 & 7. Turn the valve stems one-quarter turn counter-clock-wise. See FIGURE 7. This now perrmits the discharge refrigerant from the compressor to flow through valve No. 1 to the heat recovery coil heat exchanger and back through valve No. 2 and then to the condenser inlet. Replace the valve stem cap and finger tighten. Then tighten an additional 1/4 turn. A metal to metal seal is now complete. See FIGURE 7.

FIGURE 7



6. Wire the heat recovery device er the diagram supplied with the heat recovery unit. Turn power to the air conditioner prior to wiring the heat recovery unit. DO NOT in sny esy alter any factory or safety circuits on the air conditioner.

START-UP, CHECKOUT MAINTENANCE

Follow the procedures supplied iwth the heat recovery unit.

HEAT PUMP SERVICE

Wile performing any heat pump service analysis, turn water pump switch to off as it could affect the refrigerant and be misleding.

CLOSED LOOP
(Earth Coupled Ground Loop Applications)

NOTE: Low temperature thermostat must be reset from factory setting to 15º for closed loop applications.

This unit is designed to work on earth coupled ground loop systems, however, these systems operate at entering water (without antifreeze) temperature well below the temperature normally experienced in water well system.

For information on earth coupled loop design, piping connections to heat pump and installation refer to manual 2100-099, "Earth Coupled Loop System Design Manual," available from your distributor.

THE CIRCULATION SYSTEM DESIGN

Equipment room piping design is based on years of experience with earth coupled heat pump systems. The design eliminates most causes of system failure.

Surprisingly, the heat pump itself is rarely the cause. Most problems occur because designers and installers forget that a closed loop earth coupled heat pump system is NOT like a household plumbing system.

Most household water systems have more than enough water pressure either from the well pump or the municipal water system to overcome the pressure or head loss in 1/2 inch or 3/4 inch household plumbing. A closed loop earth coupled heat pump system, however, is separated from the pressure of the household supply and relies on a small, low wattage pump to circulate the water and antifreeze solution through the earth coupling, heat pump and equipment room components.

The small circulator keeps the operating costs of the system to a minimum. However, the performance of the circulator MUST be closely matched with the pressure or head loss of the entire system in order to provide the required flow through the heat pump. Insufficient flow through the heat exchanger is one of the most common causes of system failure. Proper system piping design and circulator selection will eliminate this problem.

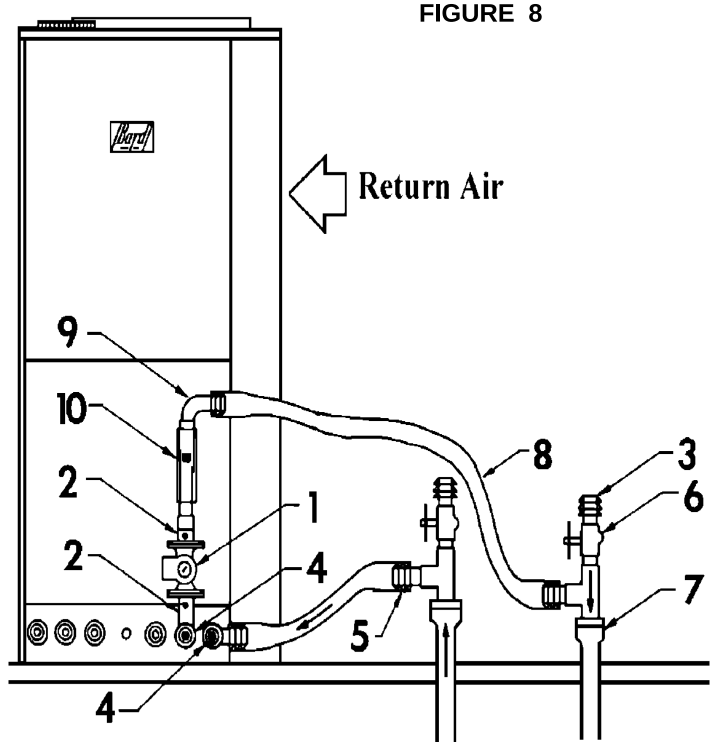
Bard supplies a worksheet to simplify head loss calculations and circulator selection. Refer to "Circulating Pump Worksheet" section in manual 2100-099.

Two general methods are used to pipe the water circuit in the equipment room. The first and easiest to use is to install a pump module. This module comes complete with connecting hose and heat pump adapters available from Bard. A second method is to "site build" the piping at the installation.

To move the transfer fluid (water or antifreeze and water solution) through the earth loop system and the water source heat pump, some type of circulation system is required. Design of circulation system must include provisions for the following. See FIGURE 8.

1. Selection of a circulation pump or pumps for total system.
2. Providing air bleed off before start-up running.
3. Providing for flow monitoring.
4. Positive pressure control and limiting.
5. Antifreeze charging capability.

FIGURE 8



NOTE: The expansion and contraction of earth loop piping may cause a 50 to 60 psig water pressure charge in system between summer to winter.

The components for a circulation system are, See Figure 8:

1. Circulating pump systems are engineered for each individual system to provide the correct water flow and overcome the friction loss of the system piping. Isolation flanges or ball valves are used to insulate pump from system piping. You need to be able to remove the pump from piping without losing the transfer fluid for repairs if ever required.

   *Determining pressure drop and selecting a circulation pump or pumps. It is very important in selecting the circulating pump that a very accurate pressure drop calculation be made because final pressure drop at the selected pump must pump against will to determine the actual flow rate (GPM) that is delivered to the water source heat pump, the pumping cost and efficiency of the entire system.

2. Ball valve and flange

3. Barb X MIP brass adapter

4. Brass test plugs--in order to start up and troubleshoot a closed loop system properly, water in and water out temperatures at the heat pump must be monitored. A test plug is installed on one leg of each connection line. A probe thermostat can be temporarily inserted, the temperature monitored and the thermometer removed. Use one thermometer to monitor these temperatures. Using two different thermometers to measure the temperature differential can introduce large measurement errors. They are also used to measure pressure drop to determine coil flow rate.

5. Bard X insert brass adapter

6. Two boiler drains are located on both sides of the circulator for final filling, air purging and antifreeze addition.

The top drain should be the highest point in the equipment room piping. This will help purge air out of the system during final filling at start up.

7. PE or PB pipe to fit transition

8. One inch reinforced flexible hose

9. 90º street ell (brass)

10. Flow meter (Bard part No. 8603-017)--or equivalent side to monitor water flow is recommended.

HEAT PUMP CONNECTIONS WITHOUT PUMP KIT

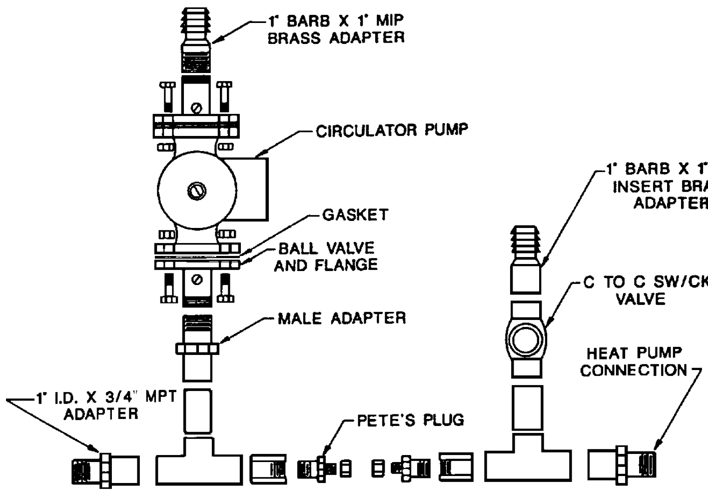
The units have various female connections inside on water coil. To keep losses small, all piping and components in the heat pump should be one inch copper or plastic. The transition to one inch pipe should be made at the exterior of the heat pump if 3/4 inch piping is used in small heat pump models.

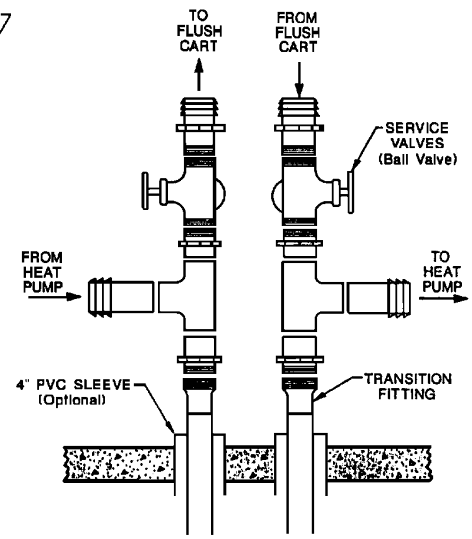
Be sure to use a backup wrench when installing the adapters to the heat pump.

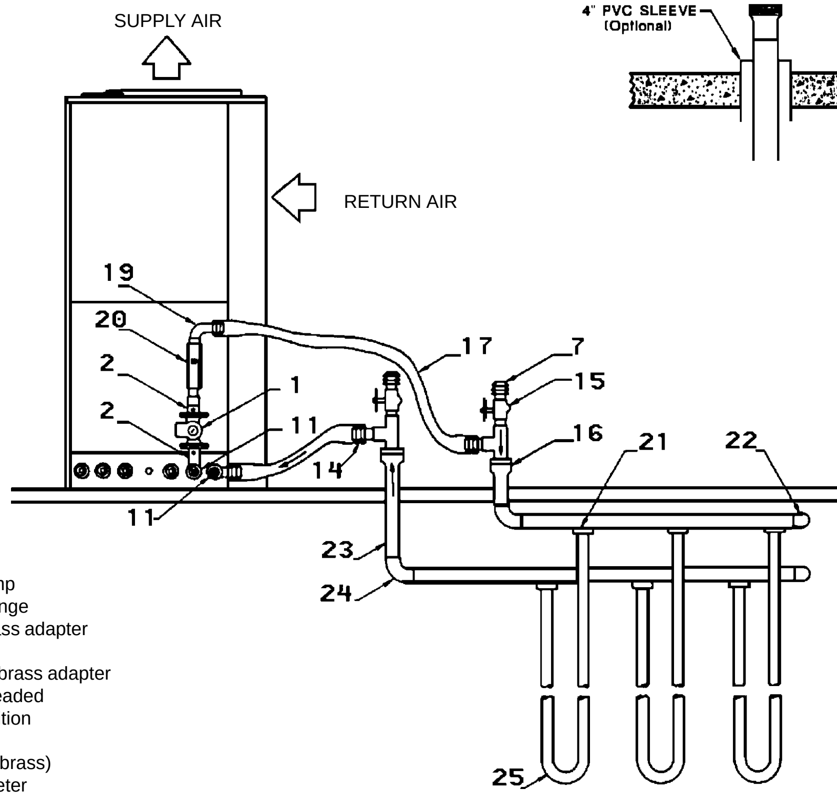
PIPING CONNECTIONS

Up to 12 feet of reinforced flexible hose is used. Cut hoses to the desired lengths and install with as few bends as possible. Close bends increase pipe head loss so any bends should be as wide as possible. Use the clamps to secure hoses in position.

FIGURE 9







DETAIL C

Legend
1 - Circulation pump
2 - Ball valve & flange
7 - Barb X MIP brass adapter
11 - Petes plug
14 - Barb X insert brass adapter
15 - Ball valve threaded
16 - PE to fit transition
17 - Flexible hose
19 - 90º street ell (brass)
20 - Visual flow meter
21 - Saddle fusion fitting
22 - End cap
23 - PE 3408 pipe
24 - 90º PE 3408
25 - U-bend PE 3408

Drawings courtesy of Oklahoma State University

Polybutylene may also be used in place of Polyethylene pipe shown on drawings.

FIGURE 12

PUMP MODULE HOOKUP
GPM-1 WITHOUT CABINET SHOWN

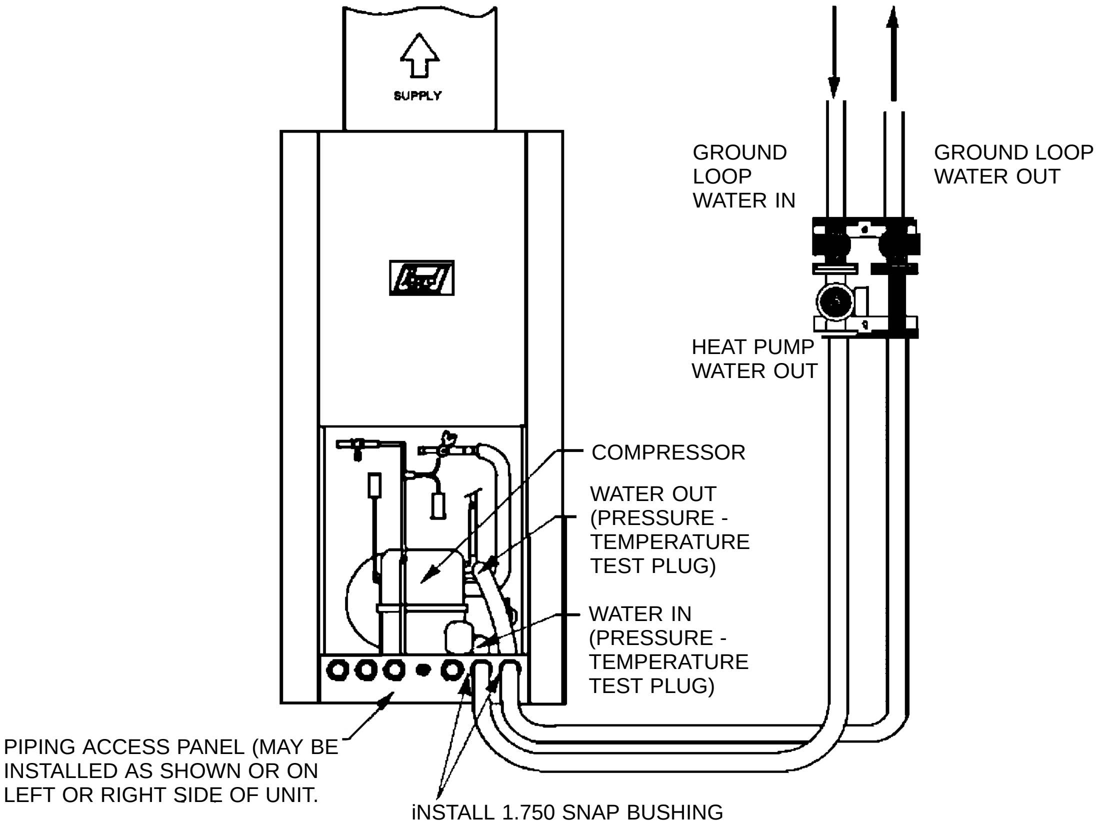
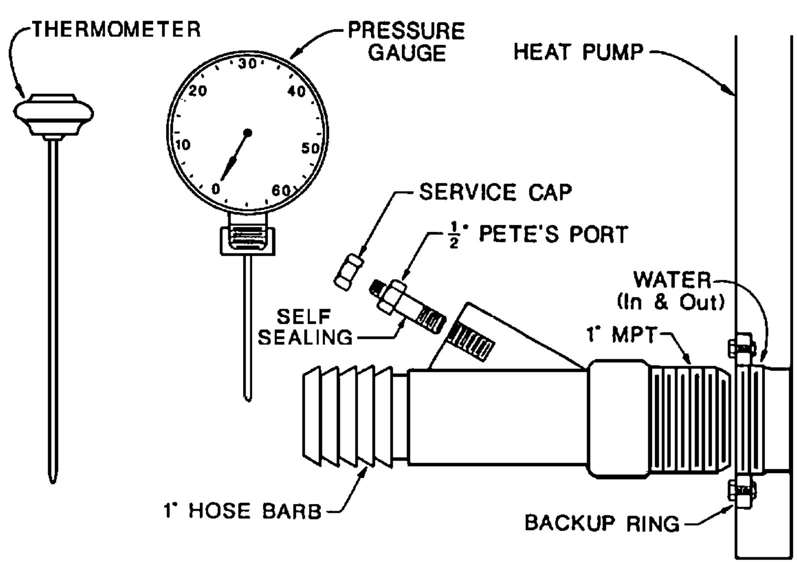


FIGURE 13



Drawing courtesy of Oklahoma State University.

FIGURE 14
PUMP MODULE HOOKUP

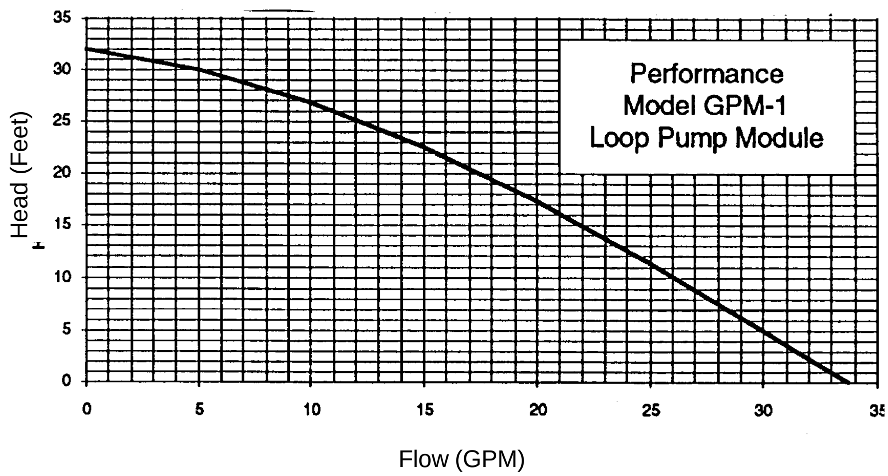
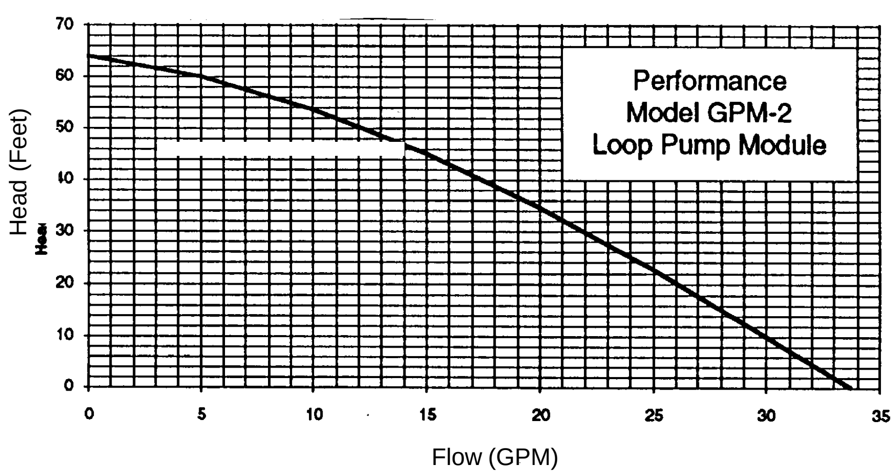


FIGURE 15
PRESSURE AND TEMPERATURE SENSING ADAPTER AND COMPONENTS



SYSTEM START UP PROCEDURE

1. Be sure main power to the unit is OFF at disconnect.

2. Set thermostat system switch to OFF, fan switch to AUTO.

3. Move main power disconnect to ON. Except as required for safety while servicing, DO NOT OPEN THE UNIT DISCONNECT SWITCH.

4. Check system air flow for obstructions.
   A. Move thermostat fan switch to ON. Blower runs.
   B. Be sure all registers and grilles are open.
   C. Move thermostat fan switch to AUTO. Blower should stop.

5. Flush, fill and pressurize the closed loop system as outlined in manual 2100-099.

6. Fully open the manual inlet and outlet valves. Start the loop pump module circulator(s) and check for proper operation. If circulator(s) are not operating, turn off power and diagnose the problem.

7. Check fluid flow using a direct reading flow meter or a single water pressure gauge, measure the pressure drop at the pressure-temperature plugs across the water coil. Compare the measurement with flow versus pressure drop table to determine the actual flow rate. If the flow rate is too low, recheck the selection of the loop pump module model for sufficient capacity. If the module selection is correct, there is probably trapped air or a restriction in the piping circuit.

8. Start the unit in cooling mode. By moving the thermostat switch to cool, fan should be set for AUTO.

9. Check the system refrigerant pressures against the cooling refrigerant pressure table in the installation manual for rated water flow and entering water temperatures. If the refrigerant pressures do not match, check for air flow problem then refrigeration system problem.

10. Switch the unit to the heating mode. By moving the thermostat switch to heat, fan should be set for AUTO.

11. Check the refrigerant system pressures against the heating refrigerant pressure table in installation manual. Once again, if they do not match, check for air flow problems and then refrigeration system problems.

    NOTE: If a charge problem is determined (high or low):

    A. Check for possible refrigerant leaks.
    B. Recover all remaining refrigerant from unit and repair leak.
    C. Evacuate unit down to 29 inches of vacuum.
    D. Recharge the unit with refrigerant by weight. This is the only way to insure a proper charge.

OPEN LOOP (Well System Applications)

***NOTE: Low temperature thermostat factory set to 25º for open loop applications*.**

WATER CONNECTIONS

It is very important that an adequate supply of clean, noncorrosive water at the proper pressure be provided before the installation is made. Insufficient water, in the heating mode for example, will cause the low temperature control to trip, shutting down the heat pump. In assessing the capacity of the water system, it is advisable that the complete water system be evaluated to prevent possible lack of water or water pressure at various household fixtures whenever the heat pump turns on. All plumbing to and from the unit is to be installed in accordance with local plumbing codes. The use of plastic pipe, where permissible, is recommended to prevent electrolytic corrosion of the water pipe. Because of the relatively cold temperatures encountered with well water, it is strongly recommended that the water lines connecting the unit be insulated to prevent water droplets from condensing on the pipe surface.

Refer to piping, FIGURE 16. Slow closing Solenoid Valve (6) with a 24V coil provides on/off control of the water flow to the unit. Refer to the wiring diagram for correct hookup of the valve solenoid coil.

Constant Flow Valve (7) provides correct flow of water to the unit regardless of variations in water pressure. Observe the water flow direction indicated by the arrow on the side of the valve body. Following is a table showing which valve is to be installed with which heat pump.

CONSTANT FLOW VALVES

Part No.	Min. Available Pressure PSIG	Flow Rate GPM
8603-007	15 (1)	6
8603-008	15 (1)	8
8603-010	15 (1)	4
8603-011	15 (1)	5

(1)The pressure drop through the constant flow valve will vary depending on the available pressure ahead of the valve. Unless a minimum of 15 psig is available immediately ahead of the valve, no water will flow.

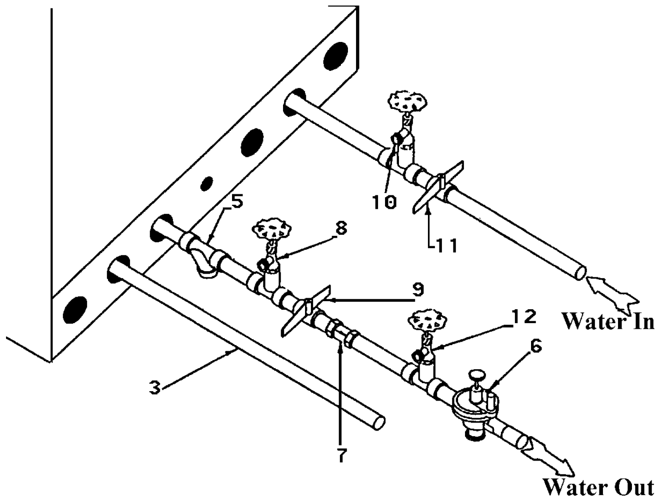
Strainer (5) installed upstream of constant flow valve (7) to collect foreign material which would clog the flow valve orifice.

The figure shows the use of shut-off valves (9) and (11), on the in and out water lines to permit isolation of the unit from the plumbing system should future service work require this. Globe valves should not be used as shutoff valves because of the excessive pressure drop inherent in the valve design. Instead use gate or ball valves as shut-offs so as to minimize pressure drop.

Drain cock (8) and (10), and tees have been included to permit acid cleaning the refrigerant-to-water coil should such cleaning be required. See WATER CORROSION.

Drain Cock (12) provides access to the system to check water flow through the constant flow valve to insure adequate water flow through the unit. A water meter 1-10 GPM (8603-013) is used to check the water flow rate.

FIGURE 16



WELL PUMP SIZING

Strictly speaking, sizing the well pump is the responsibility of the well drilling contractor. It is important, however, that the HVAC contractor be familiar with the factors that determine what size pump will be required. Rule of thumb estimates will invariably lead to under or oversized well pumps. Undersizing the pump will result in inadequate water to the whole plumbing system but with especially bad results to the heat pump--NO HEAT/NO COOL calls will result. Oversized pumps will short cycle and could cause premature pump motor or switch failures.

The well pump must be capable of supplying enough water and at an adequate pressure to meet competing demands of water fixtures. The well pump must be sized in such a way that three requirements are met:

1. Adequate flow rate in GPM
2. Adequate pressure at the fixture.
3. Able to meet the abobe from the depth of the well-feet of lift.

The pressure requirements put on the pump are directly affected by the diameter of pipe being used, as well as, by the water flow rate through the pipe. The worksheet included in manual 2100-078 should guarantee that the well pump has enough capacity. It should also ensure that the piping is not undersized which would create too much pressure due to friction loss. High pressure losses due to undersized pipe will reduce efficiency and require larger pumps and could also create water noise problems.

SYSTEM START UP PROCEDURE

1. Be sure main power to the unit is OFF at disconnect.
2. Set thermostat system switch to OFF, fan switch to AUTO.
3. Move main power disconnect to ON. Except as required for safety while servicing -- DO NOT OPEN THE UNIt DISCONNECT SWITCH.
4. Check system air flow for obstructions.
   A. Move thermostat fan switch to ON. Blower runs.
   B. Be sure all registers and grilles are open.
   C. Move thermostat fan switch to AUTO. Blower should stop.
5. Fully open the manual inlet and outlet valves.
6. Check water flow.

A. Connect a water flow meter to the drain cock between the constant flow valve and the solenoid valve. Run a hose from the flow meter to a drain or sink. Open the drain cock.

B. Check the water flow rate through constant flow valve to be sure it is the same as the unit is rated for. (Example 4 GPM for a WPV30).

C. When water flow is okay, close drain cock and remove the water flow meter. The unit is now ready to start.

7. Start the unit in cooling mode. By moving the thermostat switch to cool, fan should be set for AUTO.

   A. Check to see the solenoid valve opened.

8. Check the system refrigerant pressures against the cooling refrigerant pressure table in the installation manual for rated water flow and entering water temperatures. If the refrigerant pressures do not match, check for air flow problem then refrigeration system problem.

9. Switch the unit to the heat mode. By moving the thermostat switch to heat, fan should be set for AUTO.

   A. Check to see the solenoid valve opened again.

10. Check the refrigerant system pressures against the heating refrigerant pressure table in installation manual. Once again, if they do not match, check for air flow problems and then refrigeration system problems.

    NOTE: If a charge problem is determined (high or low):

    A. Check for possible refrigerant loss.

    B. Discharge all remaining refrigerant from unit.

    C. Evacuate unit down to 29 inches of vacuum.

    D. Recharge the unit with refrigerant by weight. This is the only way to insure a proper charge.

WATER CORROSION

Two concerns will immediately come to light when considering a water source heat pump, whether for ground water or for a closed loop application: Will there be enough water? And, how will the water quality affect the system?

Water quantity is an important consideration and one which is easily determined. The well driller must perform a pump down test on the well according to methods described by the National Well Water Association. This test, if performed correctly, will provide information on the rate of flow and on the capacity of the well. It is important to consider the overall capacity of the well when thinking about a water source heat pump because the heat pump may be required to run for extended periods of time.

The second concern, about water quality, is equally important. Generally speaking, if the water is not offensive for drinking purposes, it should pose no problem for the heat pump. The well driller or local water softening company can perform tests which will determine the chemical properties of the well water.

Water quality problems will show up in the heat pump in one or more of the following ways:

1. Decrease in water flow through the unit.
2. Decreased heat transfer of the water coil (entering to leaving water temperature difference is less).

There are four main water quality problems associated with ground water. These are:

1. <u>Biological Growth.</u> This is the growth of microscopic organisms in the water and will show up as a slimy deposit through out the water system. Shock treatment of the well is usually required and this is best left up to the well driller. The treatment consists of injecting chlorine into the well casing and flushing the system until all growth is removed.
2. <u>Suspended Particles in the Water.</u> Filtering will usually remove most suspended particles (fine sand, small gravel) from the water. The problem with suspended particles in the water is that it will erode metal parts, pumps, heat transfer coils, etc. So long as the filter is cleaned and periodically maintained, suspended particles should pose no serious problem. Consult with your well driller.

3. Corrosion of Metal. Corrosion of metal parts results from either highly corrosive water (acid water, generally not the case with ground water) or galvanic reaction between dissimilar metals in the presence of water. By using plastic plumbing or dielectric unions galvanic reaction is eliminated. The use of corrosion resistant materials (such as the Cupro Nickel coil) through the water system will reduce corrosion problems significantly.

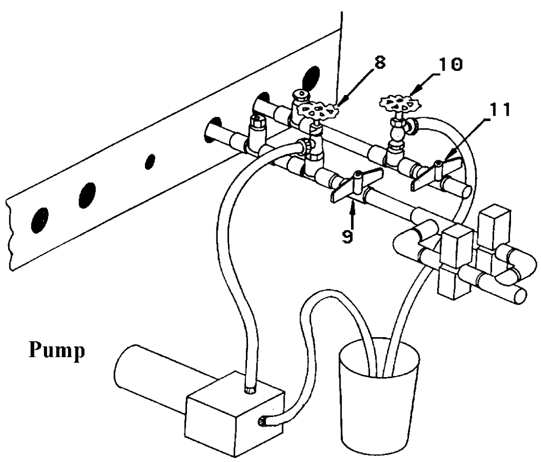
4. Scale Formation. Of all the water problems, the formation of scale by ground water is by far the most common. Usually this scale is due to the formation of calcium carbonate by magnesium carbonate or calcium sulfate may also be present. Carbon dioxide gas (CO_2), the carbonate of calcium and magnesium carbonate, is very soluble in water. It will remain dissolved in the water until some outside factor upsets the balance. This outside influence may be a large change in water temperature or pressure. When this happens, enough carbon dioxide gas combines with dissolved calcium or magnesium in the water and falls out of solution until a new balance is reached. The change in temperature that this heat pump produces is usually not high enough to cause the dissolved gas to fall out of solution. Likewise, if pressure drops are kept to a reasonable level, no precipitation of carbon dioxide should occur.

REMEDIES OF WATER PROBLEMS

Water Treatment. Water treatment can usually be economically justified for closed loop systems. However, because of the large amounts of water involved with a ground water heat pump, water treatment is generally too expensive.

Acid Cleaning the Water Coil or Heat Pump Recovery Unit. If scaling of the coil is strongly suspected, the coil can be cleaned up with a solution of Phosphoric Acid (food grade acid). Follow the manufacturer's directions for mixing, use, etc. Refer to the "Cleaning Water Coil," FIGURE 17. The acid solution can be introduced into the heat pump coil through the hose bib (part 8 of FIGURE 17). Be sure the isolation valves (parts 9 and 11 of FIGURE 17) are closed to prevent contamination of the rest of the system by the coil. The acid should be pumped from a bucket into the hose bib (part 8 of FIGURE 17) and returned to the bucket through the other hose bib (part 10 of FIGURE 5). Follow the manufacturer's directions for the product used as to how long the solution is to be circulated, but it is usually circulated for a period of several hours.

FIGURE 17



LAKE AND POND INSTALLATIONS

Lakes and ponds can provide a low cost source of water for heating and cooling with a ground water heat pump. Direct usage of the water without some filtration is not recommended as algae and turbid water can foul the water to freon heat exchanger. Instead, there have been very good results using a dry well dug next to the water line or edge. Normal procedure in installing a dry well is to backhoe a 15 to 20 foot hole adjacent to the body of water (set backhoe as close to the water's edge as possible). Once excavated, a perforated plastic casing should be installed with gravel backfill placed around the casing. The gravel bed should provide adequate filtration of the water to allow good performance of the ground water heat pump.

The following is a list of recommendations to following when installing this type of system:

A. A lake or pond should be at least 1 acre (40,000 square feet) in surface area for each 50,000 BTUs of ground water heat pump capacity or have 2 times the cubic feet size of the dwelling that you are trying to heat (includes basement if heated).

B. The average water depth should be at least 5 feet and there should be an area where the water depth is at least 12 to 15 feet deep.

C. If possible, use a submersible pump suspended in the dry well casing. Jet pumps and other types of suction pumps normally consume more electrical energy than similarly sized submersible pumps. Pipe the unit the same as a water well system.

D. Size the pump to provide necessary GPM for the ground water heat pump. A 12 GPM or greater water flow rate is required on all modes when used on this type system.

E. A pressure tank should be installed in dwelling to be heated adjacent to the ground water heat pump. A pressure switch should be installed at the tank for pump control.

F. All plumbing should be carefully sized to compensate for friction losses, etc., particularly if the pond or lake is over 200 feet from the dwelling to be heated or cooled.

G. Keep all water lines below low water level and below the frost line.

H. Most installers use 4 inch field tile (rigid plastic or corrugated) for water return to the lake or pond.

I. The drain line discharge should be located at least 100 feet from the dry well location.

J. The drain line should be installed with a slope of 2 inches per 10 feet of run to provide complete drainage of the line when the ground water heat pump is not operating. This gradient should also help prevent freezing of the discharge where the pipe terminates above the frost line.

K. Locate the discharge high enough above high water level so the water will not back up and freeze inside the drain pipe.

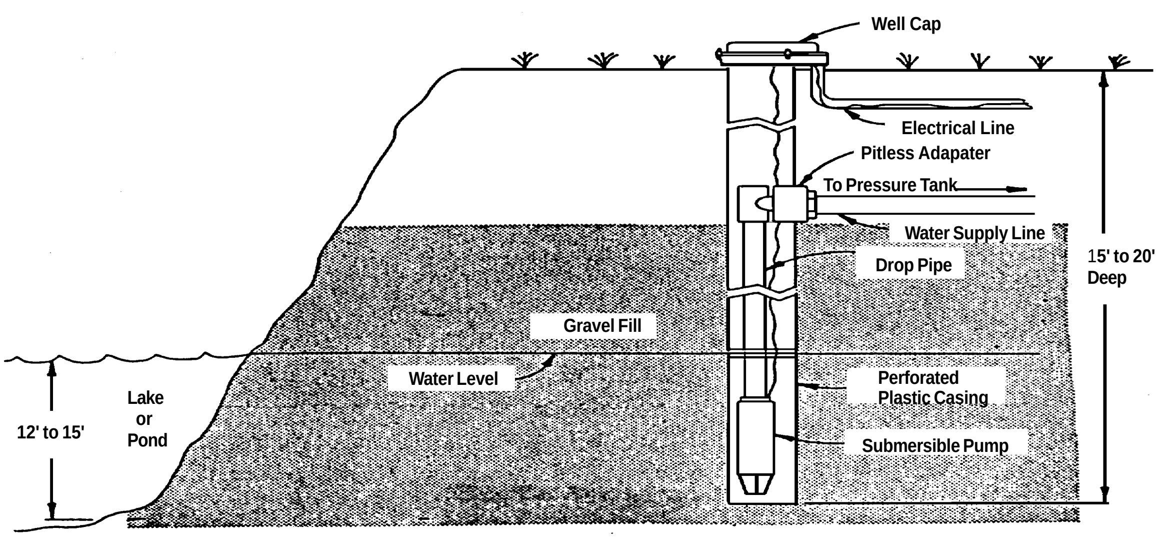
L. Where the local conditions prevent the use of a gravity drainage system to a lake or pond, you can instead run standard plastic piping out into the pond below the frost and low water level.

⚠ WARNING

Thin ice may result in the vicinity of the discharge line.

For complete information on water well systems and lake and pond applications, refer to Manual 2100-078 available from your distributor.

FIGURE 18



SEQUENCE OF OPERATION

1. COOLING WITH OR WITHOUT DUCT HEATERS

Whenever the system lever is moved to COOL, thermostat system switch completes a circuit R to O, energizing the reversing valve solenoid. On a call for cooling, the cooling bulb completes a circuit from R to G, energizing the blower relay coil. The blower relay contacts complete a 230 volt circuit to the blower motor and the blower operates. R to Y circuit is completed at the same time as the fan circuit and current flows from Y to terminal 4 at the lockout relay. Terminal 4 of the lockout relay provides two paths for current flow.

1. Through the lockout relay coil which offers the resistance of the lockout relay coil.
2. Through the normally closed contacts of the lockout relay to terminal 5 of the lockout relay and then through the high and low pressure switches to the compressor contactor coil.

If the high pressure and low temperature switches remain closed (refrigerant pressure and temperature remains normal), the path of least resistance is through these safety controls to the compressor contactor coil. The contacts of the compressor contactor complete a 230 volt circuit to the compressor and the compressor runs. If discharge pressure reaches the set point of the high pressure control, the normally closed contacts of the high pressure control open and current no longer flows to the compressor contact coil--the coil drops out. Current now can take the path of least resistance through the lockout relay coil, energizing the lockout relay coil and opening terminals 4 and 5 of the lockout relay. The lockout relay will remain energized as long as a circuit is completed between R and Y at the thermostat. In the meantime, since the compressor is operating, refrigerant pressure will equalize and the high pressure switch will automatically reset. However, the circuit to the compressor contact will not be complete until the lockout relay is de-energized by moving the thermostat system switch to OFF, breaking the circuit from R to Y dropping out the lockout relay coil and permitting terminals 4 and 5 to make. When the high pressure switch closes, a circuit is complete to L at the thermostat, energizing the signal light to indicate a malfunction. When the system switch is moved from OFF to COOL, the cycle is repeated.

2. SINGLE STAGE HEAT WITHOUT DUCT HEATERS

Compressor circuit R to Y including lockout relay and pressure controls is the same as cooling. Blower circuit R to G is the same as cooling. With system switch set to HEAT, no circuit is completed between R and O and reversing valve solenoid is not energized.

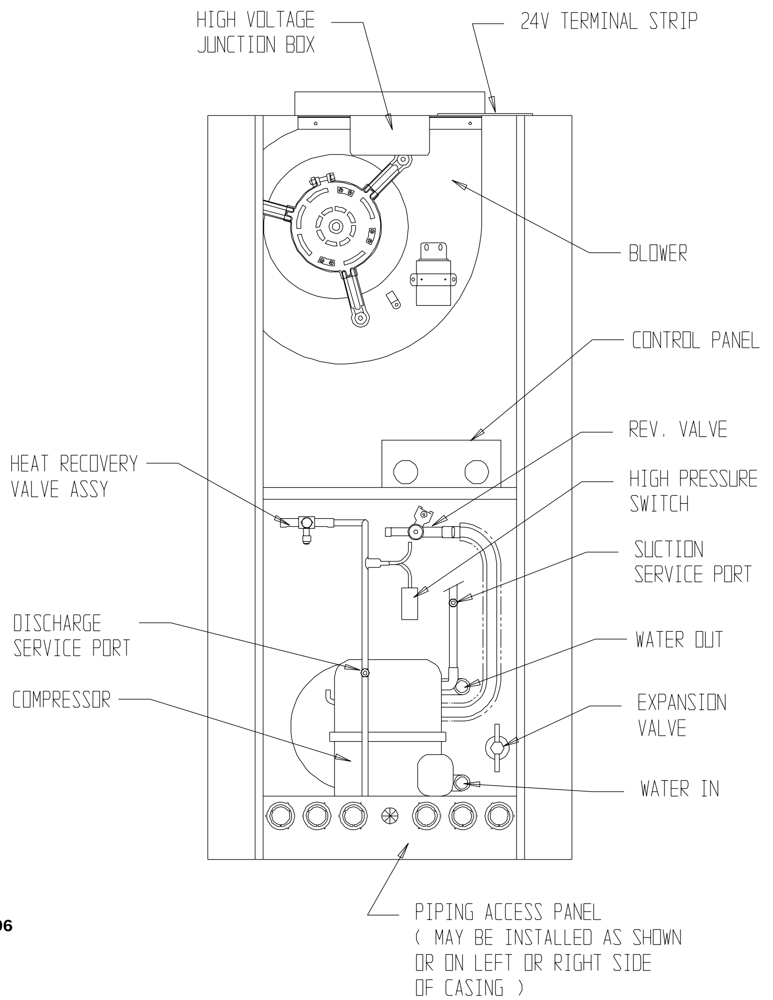
3. TWO STAGE HEAT WITH DUCT HEATERS

First stage heat is the same as single heating without duct heater. When the second stage thermostat bulb makes, a circuit is completed from C to W2, energizing the duct heater heat contactor, through the heating element and manual reset limit. C to W2 also simultaneously energizes the 24 volt coil on the interlock relay, closing the contacts, which in turn energize the low voltage coil on the blower relay to close the high voltage contacts and power the blower motor. The elements and blower remain energized as long as C to W2 are made.

4. EMERGENCY HEAT

When the system switch is moved to EMER, the compressor circuit R to Y is disconnected. Control of the electric heaters is from C to W2 and W3 through the thermostat second stage heating bulb. Blower operation is controlled by the second stage heating bulb. Operation is the same as above, "Two Stage Heat with Duct Heaters."

FIGURE 19



MIS-096

NOTE: IF NO RETURN AIR DUCT IS USED, APPLICABLE INSTALLATION CODES MAY LIMIT THIS CABINET TO INSTALLATION ONLY IN A SINGLE STORY STRUCTURE.

FIGURE 20

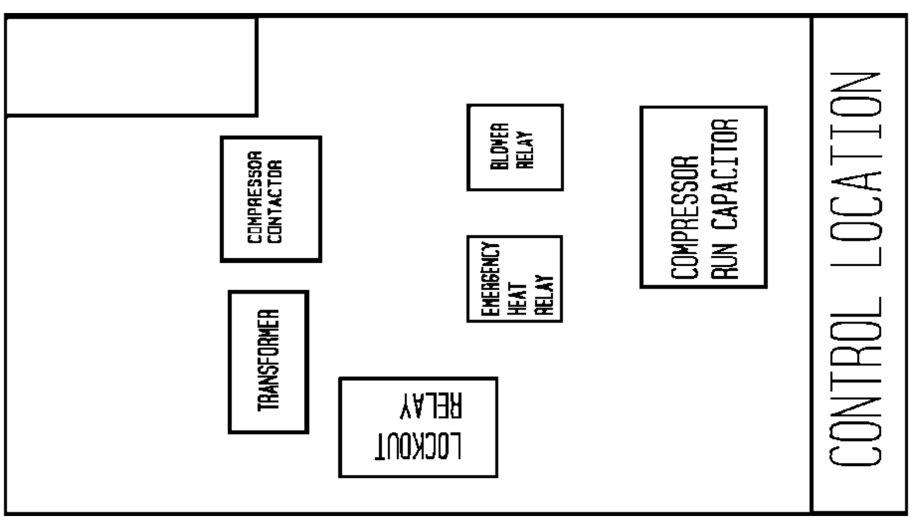


FIGURE 21
WATER SOURCE HEAT PUMP
COOLING CYCLE

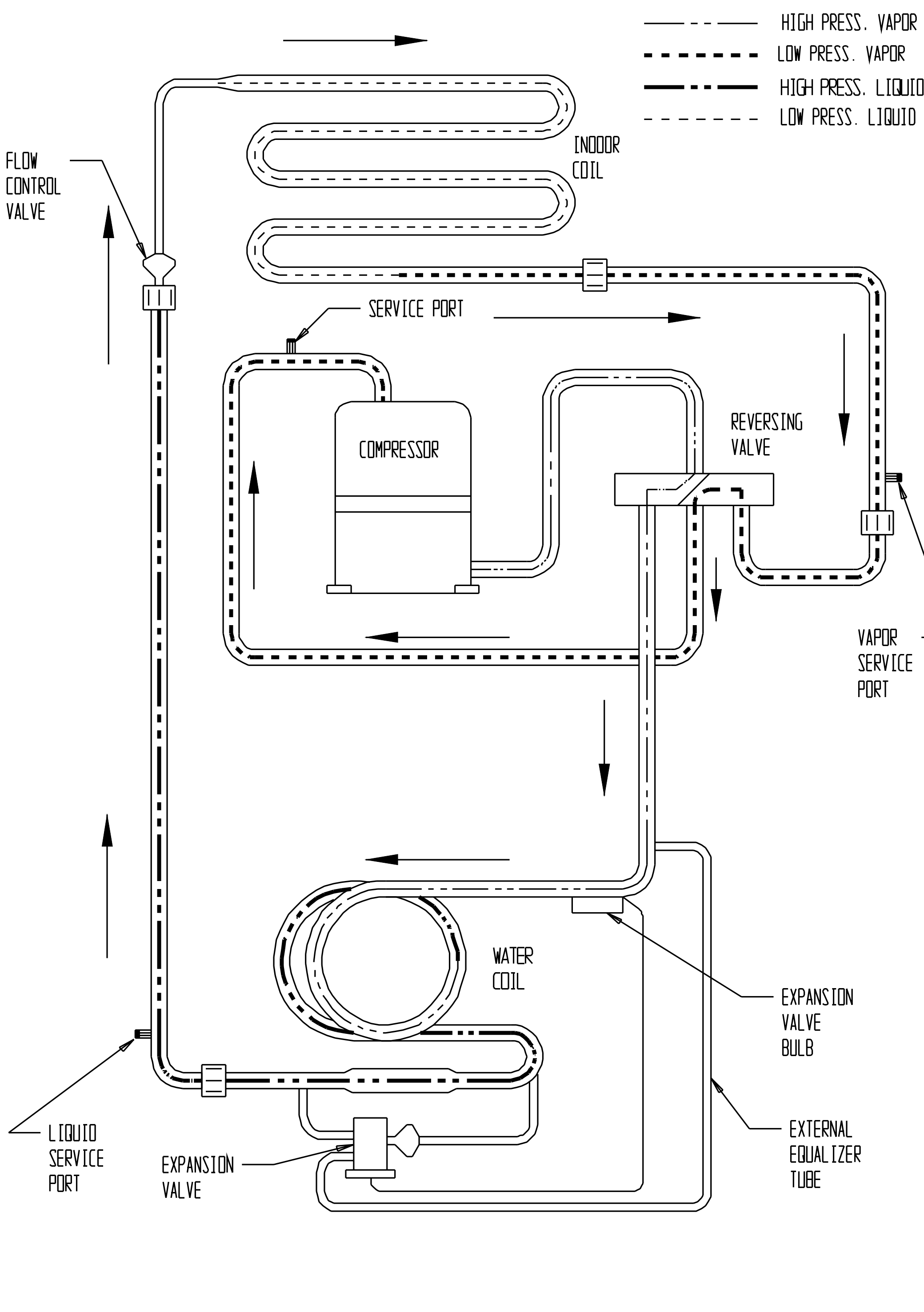


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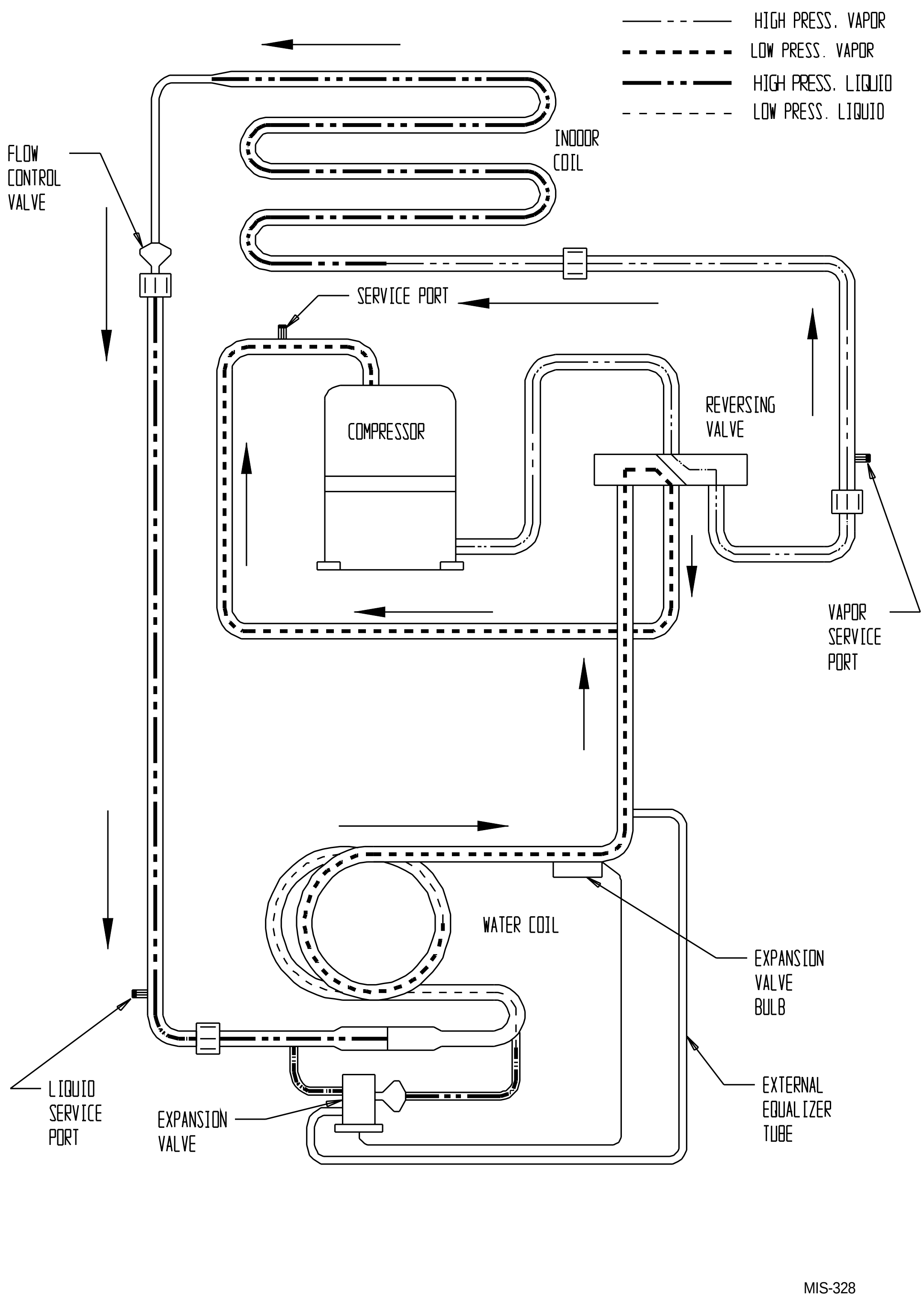
FIGURE 22
WATER SOURCE HEAT PUMP
HEATING CYCLE



CAPACITY AND EFFICIENCY APPLICATION RATINGS BASED ON 15% SODIUM CHLORIDE

TABLES 5A – 5F

MODEL WPV24C
800 CFM
5 GPM

Table 5A

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	23,400	22,750	22,090	21,428	20,767	20,100	19,444	18,782	18,121
	Sensible Cooling	17,700	17,100	16,700	16,200	15,700	15,200	14,600	14,100	13,600
	Total Heat of Rejection	27,500	26,600	25,700	24,800	23,900	23,000	22,100	21,200	20,300
	EER ①	23.50	21.31	19.09	16.86	14.60	12.40	10.15	7.90	5.75
80 / 67	Total Cooling	24,900	24,203	23,500	22,796	22,000	21,380	20,685	19,981	19,277
	Sensible Cooling	18,200	17,700	17,200	16,600	16,200	15,600	15,100	14,600	14,000
	Total Heat of Rejection	29,300	28,300	27,400	26,400	25,400	24,500	23,500	22,500	21,600
	EER ①	24.30	21.99	19.70	17.40	15.10	12.80	10.50	8.20	5.90
85 / 72	Total Cooling	27,400	26,624	25,850	25,075	24,300	23,527	22,753	21,979	21,205
	Sensible Cooling	19,100	18,600	18,000	17,500	16,900	16,400	15,800	15,300	14,800
	Total Heat of Rejection	32,200	31,200	30,100	29,000	28,000	26,900	25,900	24,800	23,700
	EER ①	25.90	23.50	21.00	18.60	16.10	13.70	11.20	8.70	6.30

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F						
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**
70	Total Heating	14,400	15,100	17,200	19,400	27,700	30,500	33,300
	Total Heat of Absorption	10,900	11,700	13,500	15,300	21,400	23,900	26,400
		3.20	3.26	3.53	3.80	4.2	4.5	4.90

MODEL WPV30C
1,000 CFM
6 GPM

Table 5B

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	31,600	30,300	28,900	27,600	26,300	25,000	23,600	22,300	21,000
	Sensible Cooling	23,300	22,700	22,000	21,300	20,600	19,900	19,300	18,600	17,900
	Total Heat of Rejection	36,700	35,500	34,300	33,100	2,000	30,700	29,600	28,400	27,200
	EER ①	25.30	22.90	20.50	18.10	15.70	13.30	10.90	8.50	6.10
80 / 67	Total Cooling	33,600	32,200	30,800	29,400	27,900	26,500	25,100	23,700	22,300
	Sensible Cooling	24,100	23,400	22,700	22,000	21,300	20,600	19,800	19,100	18,400
	Total Heat of Rejection	39,100	37,700	36,500	35,200	34,000	32,700	31,400	30,200	28,900
	EER ①	26.10	23.60	21.20	18.70	16.20	13.70	11.20	8.80	6.30
85 / 72	Total Cooling	36,900	35,400	33,800	32,300	30,700	29,200	27,600	26,100	24,600
	Sensible Cooling	25,300	24,500	23,800	23,000	22,300	21,600	20,800	20,100	19,400
	Total Heat of Rejection	42,900	41,500	40,100	38,700	37,400	36,000	34,600	33,200	31,800
	EER ①	27.90	25.30	22.60	20.00	17.30	14.60	12.00	9.40	6.70

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F						
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**
70	Total Heating	16,666	18,333	21,666	25,000	27,700	30,500	33,300
	Total Heat of Absorption	12,600	13,900	16,400	18,900	21,400	23,900	26,400
	COP ①	3.00	3.20	3.50	3.90	4.20	4.50	4.90

MODEL WPV36C 1,150 CFM 7 GPM

Table 5C

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	37,200	35,700	34,200	32,600	31,100	29,600	28,000	26,500	25,000
	Sensible Cooling	26,900	26,200	25,400	24,600	23,800	23,000	22,200	21,400	20,600
	Total Heat of Rejection	41,200	40,400	39,600	38,800	38,000	37,200	36,400	35,600	34,800
	EER ①	24.00	21.60	19.20	16.90	14.50	12.10	9.70	7.30	5.00
80 / 67	Total Cooling	39,600	38,000	36,400	34,700	33,100	31,500	29,800	28,200	26,600
	Sensible Cooling	27,800	27,000	26,200	25,400	24,500	23,700	22,900	22,100	21,300
	Total Heat of Rejection	43,900	43,000	42,200	41,300	40,500	39,600	38,800	37,900	37,000
	EER ①	24.80	22.30	19.90	17.40	15.00	12.50	10.00	7.60	5.10
85 / 72	Total Cooling	43,600	41,800	40,000	38,200	36,400	34,600	32,800	31,000	29,200
	Sensible Cooling	29,200	28,300	27,500	26,600	25,800	24,900	24,000	23,200	22,300
	Total Heat of Rejection	48,300	47,300	46,400	45,400	44,500	43,600	42,600	41,700	40,700
	EER ①	26.50	23.90	21.20	18.60	16.00	13.30	10.70	8.10	5.40

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F						
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**
70	Total Heating	23,400	25,200	29,000	32,700	36,400	40,100	43,800
	Total Heat of Absorption	16,400	18,100	21,500	25,000	28,400	31,900	35,300
	COP ①	2.90	3.00	3.40	3.70	4.00	4.30	4.60

MODEL WPV42C 1,550 CFM 9 GPM

Table 5D

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	53,500	50,700	47,900	45,100	42,300	39,500	36,800	34,000	31,200
	Sensible Cooling	38,700	37,100-	35,600	34,000	32,400	30,800	29,200	27,700	26,100
	Total Heat of Rejection	61,500	,59,500	57,400	55,400	53,300	51,200	49,200	47,100	45,100
	EER ①	23.30	21.00	18.60	16.20	13.80	11.50	9.10	6.70	4.40
80 / 67	Total Cooling	57,000	53,900	51,000	48,000	45,000	41,500	39,100	36,100	33,200
	Sensible Cooling	40,000	38,300	36,700	35,000	33,400	31,800	30,100	28,500	26,900
	Total Heat of Rejection	65,500	63,200	61,100	58,900	56,700	54,500	52,300	50,100	47,900
	EER ①	24.00	21.60	19.20	16.70	14.30	11.90	9.40	7.00	4.50
85 / 72	Total Cooling	62,600	59,300	56,100	52,800	49,500	46,300	43,000	39,800	36,500
	Sensible Cooling	42,000	40,200	38,500	36,800	35,100	33,400	31,600	30,000	28,200
	Total Heat of Rejection	72,000	69,600	67,200	64,800	62,400	60,000	57,600	55,100	42,700
	EER ①	25.70	23.10	20.50	17.90	15.30	12.70	10.00	7.50	4.84

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F						
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**
70	Total Heating	29,800	32,800	38,800	45,000	51,100	57,200	63,300
	Total Heat of Absorption	19,300	22,100	27,800	33,500	39,100	44,800	50,500
	COP ①	2.75	3.00	3.30	3.80	4.20	4.60	5.00

MODEL WPV48C
1,550 CFM
9 GPM

Table 5E

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	54,467	82,378	50,290	48,201	46,112	44,023	41,934	39,845	37,756
	Sensible Cooling	37,675	36,346	35,017	33,687	32,358	31,029	29,699	28,370	27,041
	Total Heat of Rejection	62,530	61,486	60,442	59,397	58,353	57,308	56,264	55,219	54,175
	EER ①	18.97	17.43	15.89	14.34	12.80	11.26	9.71	8.17	6.63
80 / 67	Total Cooling	57,944	55,722	53,500	51,277	49,055	46,833	44,611	42,388	40,166
	Sensible Cooling	38,840	37,470	36,100	34,729	33,359	31,988	30,618	29,248	27,877
	Total Heat of Rejection	66,522	65,411	64,300	63,188	62,077	60,966	59,855	58,744	57,633
	EER ①	19.58	17.99	16.40	14.80	13.21	11.62	10.02	8.43	6.84
85 / 72	Total Cooling	63,738	61,294	58,850	56,405	53,961	51,516	49,072	46,627	44,183
	Sensible Cooling	40,782	39,343	37,905	36,466	35,027	33,588	32,149	30,710	29,271
	Total Heat of Rejection	73,174	71,952	70,730	69,507	68,285	67,063	65,841	64,618	63,396
	EER ①	20.91	19.21	17.51	15.81	14.11	12,41	10.71	9.01	7.30

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F							
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**	**90**
70	Total Heating	32,500	35,000	40,000	45,000	50,000	55,000	60,000	65,000
	Total Heat of Absorption	21,516	23,933	28,766	33,600	38,433	43,266	18,100	52,933
	COP ①	2.76	2,90	3.12	3.35	3.57	3.79	4.01	4.233

MODEL WPV60C
1,570 CFM
11 GPM

Table 5F

Dry Bulb/ Wet Bulb	Cooling Capacity	Fluid Temperature Entering Water Coil Degrees F								
		30 ②	**40 ②**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
75 / 62	Total Cooling	58,777	57,071	55,366	53,660	51,954	50,248	48,542	46,836	45,130
	Sensible Cooling	44,972	42,759	40,546	38,332	36,119	33,906	31,693	29,480	27,267
	Total Heat of Rejection	65,511	65,232	64,954	64,675	64,396	64,118	63,839	63,561	63,282
	EER ①	19.61	18.04	16.47	14.90	13.33	11.76	10.20	8.63	7.06
80 / 67	Total Cooling	62,529	60,714	58,900	57,085	55,270	53,455	51,640	49,825	48,011
	Sensible Cooling	46,362	44,081	41,800	39,518	37,237	34,935	32,674	30,392	28,111
	Total Heat of Rejection	69,692	69,396	69,100	68,803	68,507	68,211	67,914	67,618	67,322
	EER ①	20.23	18.61	17.00	15.38	13.76	12.14	10.52	8.90	7.28
85 / 72	Total Cooling	63,738	61,294	58,850	56,405	53,961	51,516	49,072	46,627	44,183
	Sensible Cooling	40,782	39,343	37,905	36,466	35,027	33,588	32,149	30,710	29,271
	Total Heat of Rejection	73,174	71,952	70,730	69,507	68,285	67,063	65,841	64,618	63,396
	EER ①	20.91	19.21	17.51	15.81	14.11	12.41	10.71	9.01	7.30

Dry Bulb	Heating Capacity	Fluid Temperature Entering Water Coil Degrees F							
		25 ②	**30 ②**	**40 ②**	**50**	**60**	**70**	**80**	**90**
70	Total Heating	32,500	35,000	40,000	45,000	50,000	55,000	60,000	65,000
	Total Heat of Absorption	21,516	23,933	28,766	33,600	38,433	43,266	48,100	52,933
	COP ①	2.79	2.90	3.12	3.35	3.57	3.79	4.01	4.21

TABLE 6
CAPACITY MULTIPLIER FACTORS

% of Rated Air Flow	-10	Rated	10
Total Btuh	0.975	1.00	1.02
Sensible Btuh	0.950	1.00	1.05

TABLE 7
CORRECTION FACOTRS FOR PERFORMANCE AT OTHER WATER FLOWS

Rated Flow Plus - GPM	Heating		Cooling	
	Btuh	Watts	Btuh	Watts
2	1.00	98	1.01	1.00
4	1.01	97	1.03	1.01
6	1.02	96	1.05	1.02
8	1.02	95	1.06	1.02

TABLE 8
PRESSURE TABLE – COOLING

COOLING

Fluid Temperature Entering Water Coil °F

Model	Room Air Temperature	Pressure	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	100°
WPV24C	75 DB	Low Side	70	71	72	73	74	75	76	77	78	79	81	82	83	84	85	86	87
Rated Flow	62 WB	High Side	142	149	156	162	169	176	183	189	196	203	209	216	233	229	236	243	249
Rated GPM*	80 DB	Low Side	75	76	77	78	80	81	82	83	84	85	86	87	88	90	91	92	93
Rated CFM 800	67 WB	High Side	146	153	160	167	174	180	187	194	201	208	215	221	228	235	242	249	256
	85 DB	Low Side	81	82	83	84	86	87	88	89	90	91	93	94	95	96	97	99	100
	72 WB	High Side	151	158	165	172	180	187	194	201	208	215	222	229	236	243	251	258	265
WPV30C	75 DB	Low Side	66	67	68	69	70	70	71	72	73	74	75	76	77	77	78	79	80
Rated Flow	62 WB	High Side	96	107	118	129	140	151	162	173	184	195	206	217	228	239	250	261	272
Rated GPM*	80 DB	Low Side	71	72	73	74	75	75	76	77	78	79	80	81	82	83	84	85	86
Rated CFM 1000	67 WB	High Side	98	110	121	132	144	155	166	177	189	200	211	223	234	245	256	268	279
	85 DB	Low Side	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
	72 WB	High Side	102	113	125	137	149	160	172	184	195	207	219	230	242	254	265	277	289
WPV36C	75 DB	Low Side	57	58	59	60	61	62	63	64	65	66	67	68	70	71	72	73	74
Rated Flow	62 WB	High Side	91	102	113	124	135	146	157	168	179	190	201	212	223	234	245	256	267
Rated GPM*	80 DB	Low Side	61	62	63	64	66	67	68	69	70	71	72	73	74	76	77	78	79
Rated CFM 1500	67 WB	High Side	93	105	116	127	139	150	161	172	184	195	206	218	229	240	251	263	274
	85 DB	Low Side	66	67	68	69	70	72	73	74	75	76	78	79	80	81	82	84	85
	72 WB	High Side	97	108	120	132	143	155	167	178	190	202	214	225	237	249	260	272	284
WPV42C	75 DB	Low Side	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	75	76
Rated Flow	62 WB	High Side	101	112	123	134	145	156	167	178	189	200	211	222	233	244	255	266	277
Rated GPM*	80 DB	Low Side	63	64	65	66	68	69	70	71	72	73	74	75	76	78	79	80	81
Rated CFM 1550	67 WB	High Side	103	115	126	137	149	160	171	182	194	205	216	228	239	250	261	273	284
	85 DB	Low Side	68	69	70	71	73	74	75	76	77	79	80	81	82	83	85	86	87
	72 WB	High Side	107	119	130	142	154	165	177	189	200	212	224	236	247	259	271	282	294
WPV48C	75 DB	Low Side	68	67	67	66	66	65	65	65	64	64	63	63	63	62	62	61	61
Rated Flow	62 WB	High Side	111	121	132	142	153	163	174	184	195	205	215	225	235	246	256	267	277
Rated GPM*	80 DB	Low Side	73	72	72	71	71	70	70	70	69	69	68	68	68	67	67	66	66
Rated CFM	67 WB	High Side	114	125	136	146	157	167	178	189	200	211	221	232	243	254	264	275	286
	85 DB	Low Side	79	78	78	77	77	76	76	75	75	74	73	73	73	72	72	71	71
	72 WB	High Side	118	129	140	151	162	173	184	195	206	217	229	240	250	262	273	284	295
WPV60C	75 DB	Low Side	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	75	76
Rated Flow	62 WB	High Side	90	101	112	123	134	145	156	167	178	189	200	211	222	233	244	255	266
Rated GpM*	80 DB	Low Side	63	64	65	66	68	69	70	71	72	73	74	75	76	78	79	80	81
Rated CFM 1570	67 WB	High Side	92	104	115	126	138	149	160	171	183	194	205	217	228	239	250	262	273
	85 DB	Low Side	68	69	70	71	73	74	75	76	77	79	80	81	82	83	85	86	87
	72 WB	High Side	96	107	119	131	142	154	166	177	189	201	212	224	236	248	259	271	283

See notes regarding Tables 8 and 9 after Table 9 on Page 29.

TABLE 9
PRESSURE TALBLE – HEATING

HEATING **Fluid Temperature Entering Water Coil °F**

Model	Room Air Temp.	Pressure	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°
WPV24C Rated Flow Rated GPM* Rated CFM 800	70° DB	Low Side High Side	35 148	40 177	44 181	49 186	54 190	59 195	63 199	68 203	73 208	77 212	82 217	87 221
WPV30C Rated Flow Rated GPM* Rated CFM 1000	70° DB	Low Side High Side	30 179	34 183	68 187	42 191	46 195	51 200	55 204	59 208	63 212	67 216	71 220	86 225
WPV36C Rated Flow Rated GPM* Rated CFM 1500	70° DB	Low Side High Side	30 190	37 195	41 201	45 206	49 212	54 218	58 223	62 229	66 234	70 240	74 245	79 251
WPV42C Rated Flow RatedU GPM* Rated CFM 155	70° DB	Low Side High Side	32 173	36 178	40 184	44 189	48 195	53 201	57 206	61 212	65 217	69 223	73 228	78 234
WPV48C Rated Flow Rated GPM* Rated CFM	70° DB	Low Side High Side	28 184	32 189	36 195	40 200	43 206	47 212	51 217	54 223	57 228	61 234	65 239	69 245
WPV60C Rated Flow Rated GpM* Rated CFM 1570	70° DB	Low Side High Side	31 214	35 219	39 225	43 230	47 236	52 242	56 247	60 253	64 258	68 264	72 269	77 275

Low side pressure ± 2 PSIG
High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow) across the evaporator coil and rated fluid flow rate through the water coil. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated and recharged to serial plate specifications.

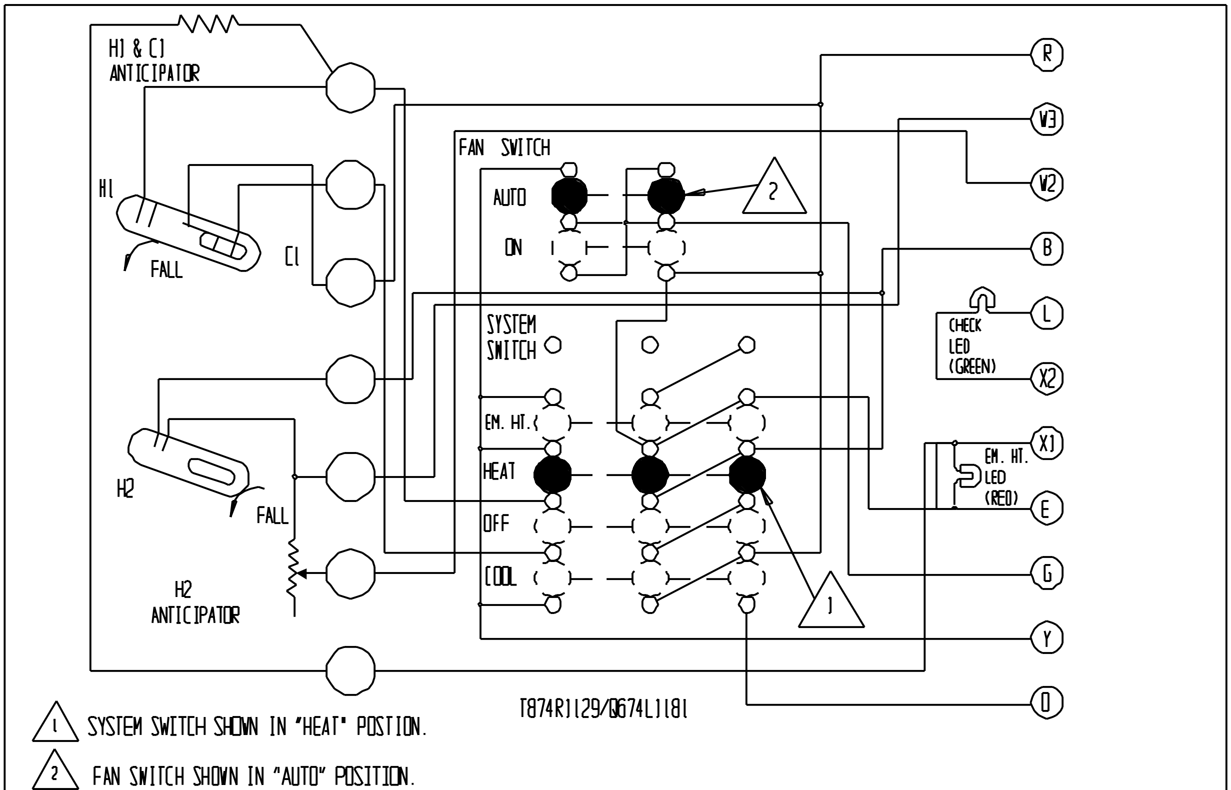
* Flow Rates for Various Fluids	WPV24C	WPV30C	WPV36C	WPV42C WPV48C	WPV60C
Flow rate required GPM fresh water	4	4	5	6	8
Flow rate required GPM 15% sodium chloride	5	6	7	9	11
Flow rate required GPM 25%GS4	5	6	7	9	11

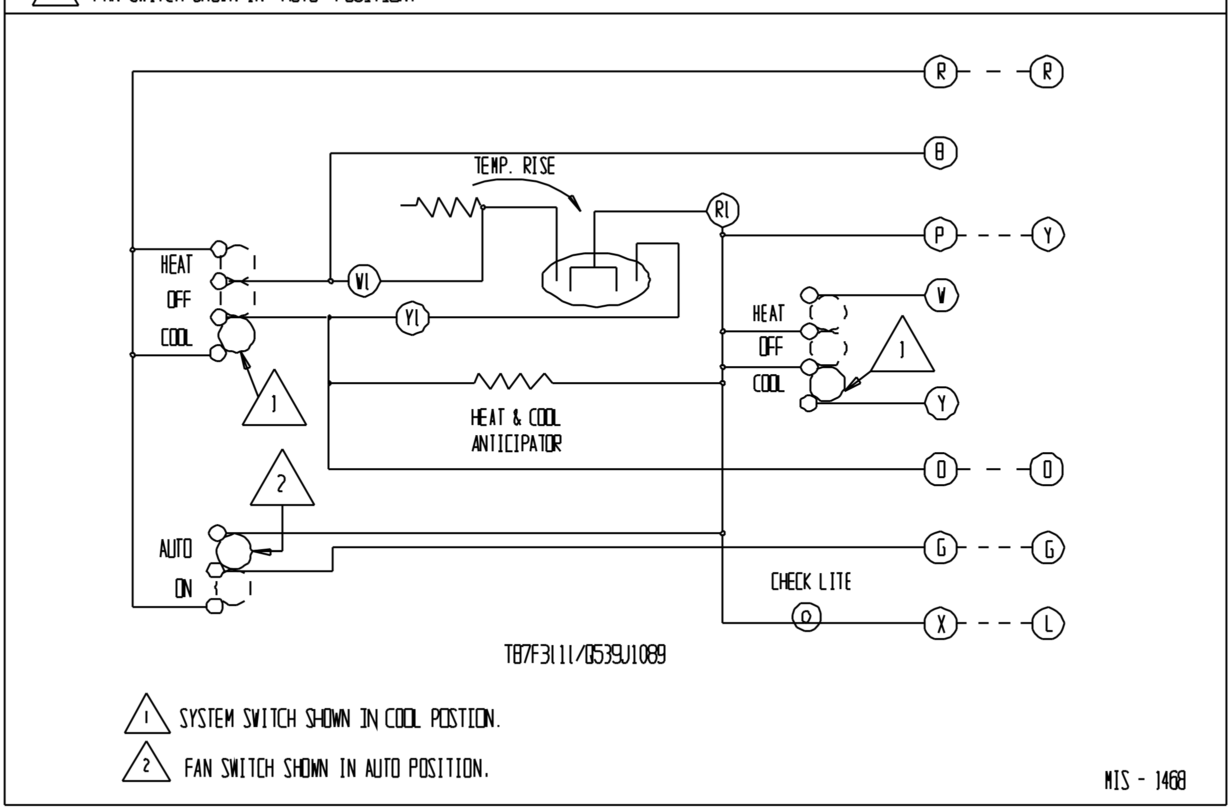
● DENOTES COMMON CAUSE

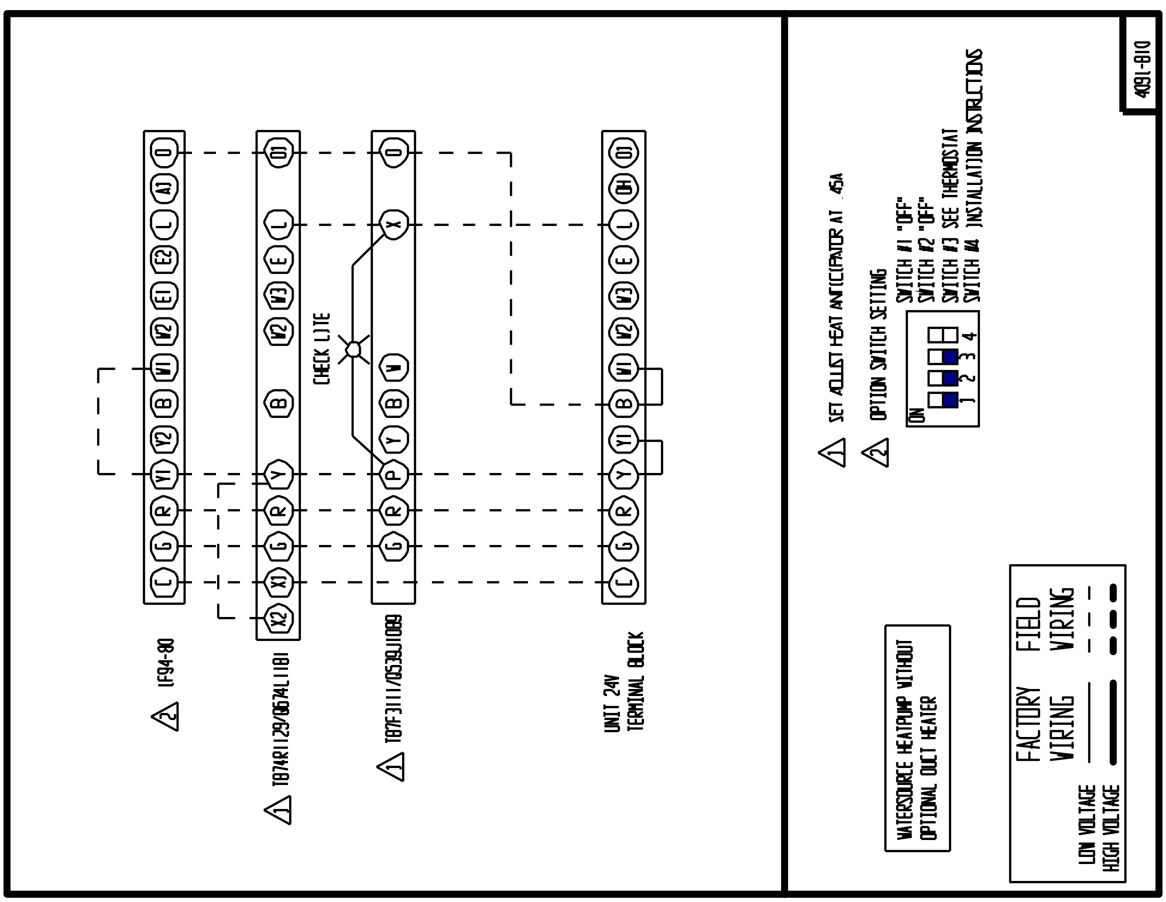
✕ DENOTES OCCASIONAL CAUSE

		POWER SUPPLY																		WATER COIL SECTION																													INDOOR SECTION				
		Line Voltage										Control Circuit								Compressor					Refrigerant System								Water Solenoid			Rev. Valve		Water Coil						Indoor Blower Motor and Coil				
		Power Failure	Blown Fuse or Tripped Breaker	Faulty Wiring	Loose Terminals	Low Voltage	Defective Contacts in Contactor	Compressor Overload	Potential Relay	Run Capacitor	Start Capacitor	Faulty Wiring	Loose Terminals	Control Transformer	Low Voltage	Thermostat	Contactor Coil	Pressure Controls (High or Low)	Indoor Blower Relay	Discharge Line Hitting Inside of Shell	Bearings Defective	Seized	Valve Defective	Motor Wingings Defective	Refrigerant Charge Low	Refrigerant Overcharge	High Head Pressure	Low Head Pressure	High Suction Pressure	Low Suction Pressure	Non-Condensables	Unequalized Pressures	Solenoid Valve Stuck Closed (Htg)	Solenoid Valve Stuck Closed (Clg)	Solenoid Valve Stuck Open (Htg or Clg)	Leaking	Defective Valve or Coil	Plugged or Restricted Metering Device (Htg)	Scaled or Plugged Coil (Htg)	Scaled or Plugged Coil (CLg)	Water Volume Low (Htg)	Water Volume Low (Clg)	Low Water Temperature (Htg)	Plugged or Restricted Metering Device (Clg)	Fins Dirty or Plugged	Motor Winding Defective	Air Volume Low	Air Filters Dirty
Heating or Cooling Cycles	Compressor Will Not Run No Power at Contactor	●	●	●	●		+	+				●	●	●	+	+	●	●																														
Heating or Cooling Cycles	Compressor Will Not Run Power at Contactor			●	●	●		●	●	●	●										+	●		●								●																
Heating or Cooling Cycles	Compressor "Hums" But Will Not Start			●	●	●	+		●	●	●										●	●		●								●																
Heating or Cooling Cycles	Compressor Cycles on Overload			●	●	●	+	●	●	●	●										+		+	+	●	●	+		+		●					+			+	+	+	+			+	+	+	●
Heating or Cooling Cycles	Thermostat Check Light Lite-Lockout Relay																	●																														
Heating or Cooling Cycles	Compressor Off on High Pressure Control																	+	●							●					●			●				+		+		●		+	●	●	●	●
Heating or Cooling Cycles	Compressor Off on Low Pressure Control																		+						●			●		●			●						+		●		+	●				
Heating or Cooling Cycles	Compressor Noisy																			+	+	●																										
Heating or Cooling Cycles	Head Pressure Too High																									●					●			●			+	+		●		●		+	+	+	●	●
Heating or Cooling Cycles	Head Pressure Too Low																						●		●					●			+			+			●		●		●					
Heating or Cooling Cycles	Suction Pressure Too High																						●			●	●									+												
Heating or Cooling Cycles	Suction Pressure Too Low																								●			+					●					+	●		●		+	+	●	+	●	●
Heating or Cooling Cycles	I.D. Blower Will Not Start	●	●	●	●							●	●	●	+	+			●																													
Heating or Cooling Cycles	I.D. Coil Frosting or Icing																								●					●														+	●	●	●	●
Heating or Cooling Cycles	High Compressor Amps					●				●											●	●		+		●	●		●		●							+		●		●		+	●	●	●	●
Heating or Cooling Cycles	Excessive Water Usage																																		●				+	+								
Cooling Cycle	Compressor Runs Continuously – No Cooling																						●		●					●										+		+		+	●	●	●	●
Cooling Cycle	Liquid Refrigerant Flooding Back To Compressor																									●	●																		●	●	●	●
Heating Cycle	Compressor Runs Continuously – No Heating																						●		●					●			●			+		+	●		●		+					
Heating Cycle	Reversing Valve Does Not Shift			●	●																				+			+									●											
Heating Cycle	Liquid Refrigerant Flooding Back To Compressor																									●	●						●			+	+		●		●		●					
Heating Cycle	Aux. Heat on I.D. Blower Off			●	●							●	●			+			●																											●		
Heating Cycle	Excessive Operation Costs			+	+											+									●	●							+	+		●	●		+	+	+				+	+	+	
Heating Cycle	Ice in Water Coil			+	+																				●								●				●		+		●							

THERMOSTAT DIAGRAMS



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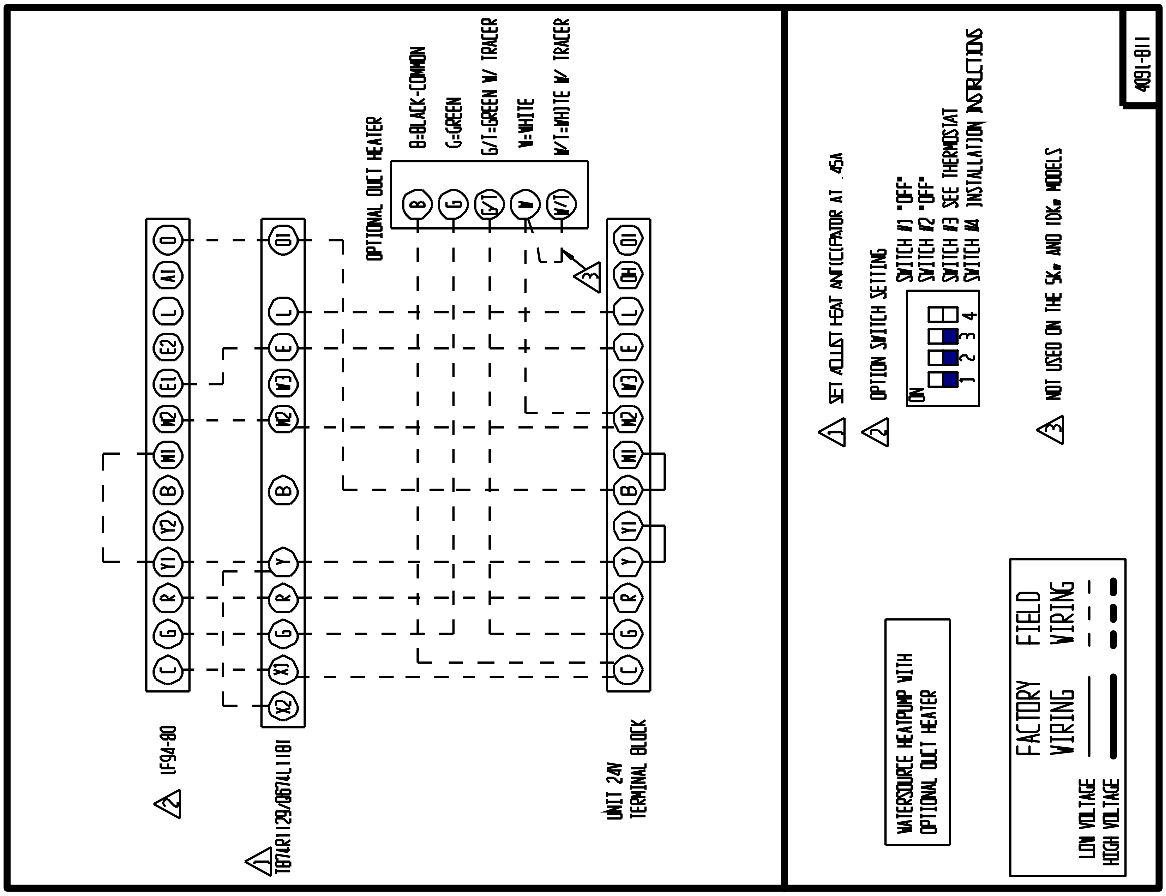
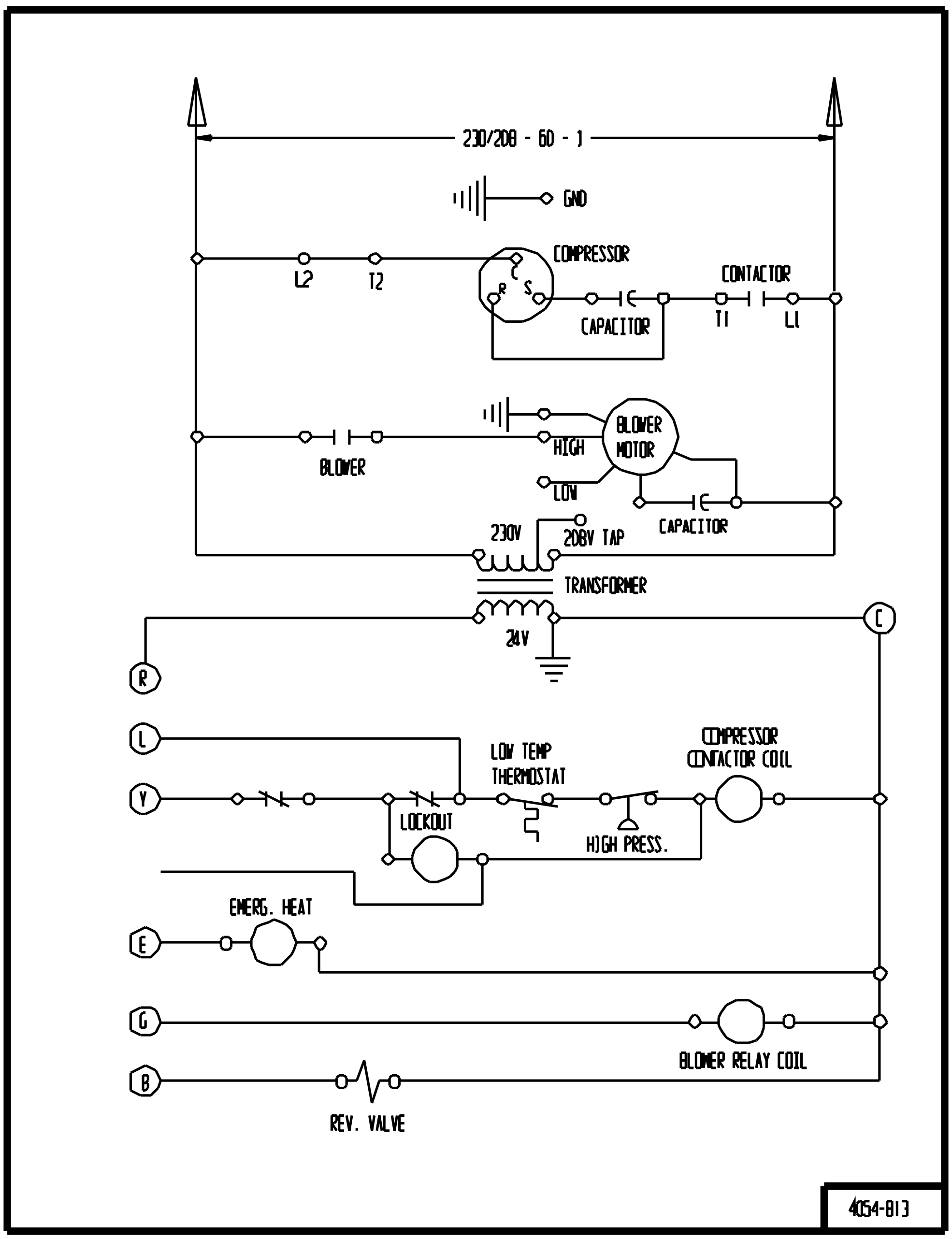
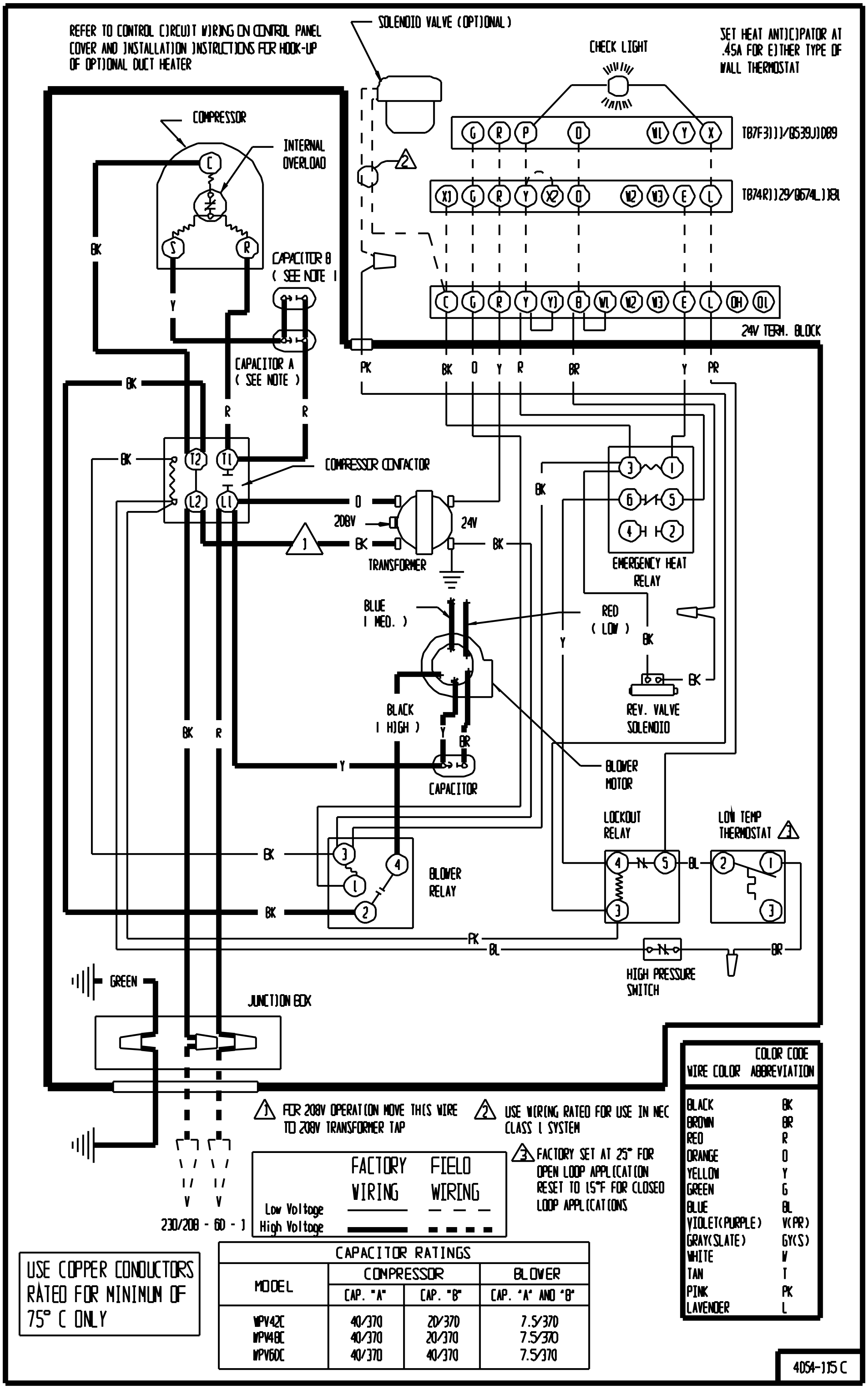
1F94-80
T874R1129/B674L1181
T87F3111/Q539J1089
CHECK LITE
UNIT 24V TERMINAL BLOCK
SET ADJUST HEAT ANTICIPATOR AT .45A
OPTION SWITCH SETTING
SWITCH #1 "OFF"
SWITCH #2 "OFF"
SWITCH #3 SEE THERMOSTAT
SWITCH #4 INSTALLATION INSTRUCTIONS
FACTORY WIRING
FIELD WIRING
LOW VOLTAGE
HIGH VOLTAGE
4091-810


WATERSOURCE HEATPUMP WITH OPTIONAL DUCT HEATER
1F94-80
T874R1129/B674L1181
UNIT 24V TERMINAL BLOCK
OPTIONAL DUCT HEATER
B=BLACK-COMMON
G=GREEN
G/T=GREEN W/ TRACER
W=WHITE
W/T=WHITE W/ TRACER
SET ADJUST HEAT ANTICIPATOR AT .45A
OPTION SWITCH SETTING
SWITCH #1 "OFF"
SWITCH #2 "OFF"
SWITCH #3 SEE THERMOSTAT
SWITCH #4 INSTALLATION INSTRUCTIONS
NOT USED ON THE 5Kw AND 10Kw MODELS
FACTORY WIRING
FIELD WIRING
LOW VOLTAGE
HIGH VOLTAGE
4091-811


230/208 - 60 - 1
GND
COMPRESSOR
C
R
S
L2
T2
CAPACITOR
CONTACTOR
T1
L1
BLOWER MOTOR
HIGH
LOW
BLOWER
CAPACITOR
230V
208V TAP
TRANSFORMER
24V
C
R
L
Y
LOW TEMP THERMOSTAT
COMPRESSOR CONTACTOR COIL
LOCKOUT
HIGH PRESS.
EMERG. HEAT
E
G
BLOWER RELAY COIL
B
REV. VALVE
4054-813



CAPACITOR RATINGS			
MODEL	COMPRESSOR		BLOWER
	CAP. "A"	CAP. "B"	CAP. "A" AND "B"
WPV42C	40/370	20/370	7.5/370
WPV48C	40/370	20/370	7.5/370
WPV60C	40/370	40/370	7.5/370

COLOR CODE	
WIRE COLOR	ABBREVIATION
BLACK	BK
BROWN	BR
RED	R
ORANGE	O
YELLOW	Y
GREEN	G
BLUE	BL
VIOLET(PURPLE)	V(PR)
GRAY(SLATE)	GY(S)
WHITE	W
TAN	T
PINK	PK
LAVENDER	L

GROUND SOURCE HEAT PUMP PERFORMANCE REPORT

This performance check report should be filled out by installer and retained with unit.

DATE: ________________________ TAKEN BY:

1. OUTDOOR UNIT:
   Mfgr. ____________________ Model No. ____________ S/N

   INDOOR UNIT (Split System):
   Mfgr. ____________________ Model No. ____________ S/N

2. Person Reporting ____

3. Company Reporting ____

4. Installed By _______________ Date Installed _________

5. User's (Owner's) Name ____
   Address ____
   ____

6. Unit Location ____

WATER SYSTEM INFORMATION

7. Open Loop System (Water Well) ____________ Closed Loop System _________
   A. If Open Loop where is water discharged?

8. The following questions are for closed loop systems only!

   A. Closed loop system designed by: _____________________________________

   B. Type of antifreeze used ___ % Solution ____________________________
   C. System type: Series ________________ Parallel ________________
   D. Pipe material: _________ Nominal Size ______________________________
   E. Pipe installed:
      1. Horizontal ________________ Total length of pipe ________________ ft.
         No. pipes in trench ________ Depth bottom pipe ________________ ft.
      2. Vertical __________________ Total length of bore hole ____________ ft.

THE FOLLOWING INFORMATION IS NEEDED TO CHECK PERFORMANCE OF UNIT.

FLUID SIDE DATA		Cooling	Heating	
9.	Entering fluid temperature	______	______	F
10.	Leaving fluid temperature	______	______	F
11.	Entering fluid pressure	______	______	PSIG
12.	Leaving fluid pressure	______	______	PSIG
13.	Pressure drop thru coil	______	______	PSIG
14.	Gallons per minute through the water coil	______	______	GPM
15.	Liquid or discharge line pressure	______	______	PSIG
16.	Suction line pressure	______	______	PSIG
17.	Voltage at compressor (unit running)	______	______	V
18.	Amperage draw at line side of contactor	______	______	A
19.	Amperage at compressor common terminal	______	______	A
20.	*Suction line temperature 6" from compressor	______	______	F
21.	*Superheat at compressor	______	______	F
22.	*Liquid line temperature at metering device	______	______	F
23.	*Coil subcooling	______	______	F

INDOOR SIDE DATA		Cooling	Heating	
24.	Dry bulb temperature at air entering indoor coil	______	______	F
25.	Web bulb temperature of air entering indoor coil	______	______	F
26.	Dry bulb temperature of air leaving indoor coil	______	______	F
27.	Wet bulb temperature of air leaving indoor coil	______	______	F
28.	Indoor fan motor operating voltage (split system only)	______	______	V
29.	Indoor fan motor operating amperage	______	______	A
30.	*Static pressure drop across indoor coil (split system only)	______	______	WC
31.	*Supply air static pressure (packaged unit)	______	______	WC
32.	*Return air static pressure (packaged unit)	______	______	WC

*Items that are optional.

30. Other information about installation

____

____

____

____

____

____

____

____

____