Instruction Manual

COMMERCIAL ELECTRIC AIR-TO-WATER HEAT PUMP WATER HEATER

820 SW 41st Street
Renton, WA 98057

MODELS AWH-35 to AWH-170
SERIES 100

INSTALLATION - OPERATION - SERVICE
MAINTENANCE - LIMITED WARRANTY

FOR INDOOR INSTALLATION ONLY

Thank you for buying this energy efficient water heater. We appreciate your confidence in our products.

⚠ WARNING

Read and understand this instruction manual and the safety messages herein before installing, operating or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

This manual must remain with the water heater.

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PLACE THESE INSTRUCTIONS ADJACENT TO HEAT PUMP AND NOTIFY OWNER TO KEEP FOR FUTURE REFERENCE.

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SAFE INSTALLATION, USE AND SERVICE

The proper installation, use and servicing of this commercial heat pump water heater is extremely important to your safety and the safety of others.

Many safety-related messages and instructions have been provided in this manual and on your own heat pump water heater to warn you and others of a potential injury hazard. Read and obey all safety messages and instructions throughout this manual. It is very important that the meaning of each safety message is understood by you and others who install, use, or service this heat pump water heater.

	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in injury or death.
⚠ WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in injury or death.
⚠ CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
CAUTION	CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.

All safety messages will generally tell you about the type of hazard, what can happen if you do not follow the safety message, and how to avoid the risk of injury.

The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. This appliance can cause low level exposure to some of the substances listed in the Act.

APPROVALS

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GENERAL SAFETY INFORMATION

PRECAUTIONS

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. Immediately call a qualified service agency to inspect the appliance and to make a determination on what steps should be taken next.

If the unit is exposed to the following, do not operate heater until all corrective steps have been made by a qualified service agency.

1. External fire.
2. Damage.
3. Running without water.

GROUNDING INSTRUCTIONS

This heat pump water heater must be grounded in accordance with the National Electrical Code and/or local codes. These must be followed in all cases. Failure to ground this water heater properly may also cause erratic control system operation.

This heat pump water heater must be connected to a grounded metal, permanent wiring system; or an equipment grounding conductor must be run with the circuit conductors and connected to the equipment grounding terminal or lead on the water heater.

When servicing this unit, verify the power to the unit is turned off prior to opening the control cabinet door.

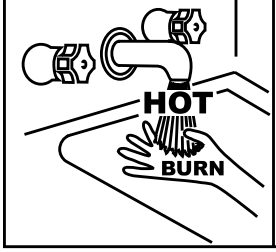
⚠WARNING

CONTAINS REFRIGERANT!

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit rating label for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.

⚠DANGER

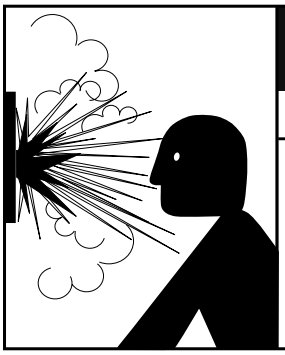


Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting devices such as mixing valves must be installed when required by codes and to ensure safe temperatures at fixtures.



⚠WARNING

Explosion Hazard

- Do not use oxygen to purge or pressurize system for leak test.
- Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.

⚠WARNING

Read and understand this instruction manual and the safety messages herein before installing, operating or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

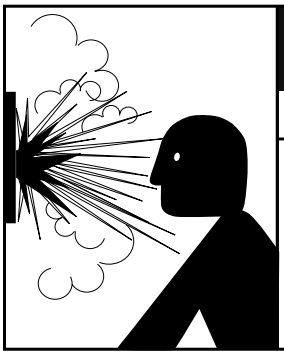
This manual must remain with the water heater.

⚠WARNING

Electrical Shock Hazard

- Turn off power to the water heater before performing any service.
- Label all wires prior to disconnecting when performing service. Wiring errors can cause improper and dangerous operation.
- Verify proper operation after servicing.
- Failure to follow these instructions can result in personal injury or death.

⚠WARNING



Explosion Hazard

- Overheated water can cause water tank explosion.
- Properly sized temperature and pressure relief valve must be installed in the opening provided on connected storage tanks.

INTRODUCTION

Thank You for purchasing this heat pump water heater. Properly installed and maintained, it should give you years of trouble free service.

Abbreviations found In this Instruction Manual include:

- HPWH - Heat Pump Water Heater
- ANSI - American National Standards Institute
- ASME - American Society of Mechanical Engineers
- NEC - National Electrical Code
- NFPA - National Fire Protection Association
- AHRI - Air-conditioning, Heating and Refrigeration Institute

QUALIFICATIONS

QUALIFIED INSTALLER OR SERVICE AGENCY:

Installation and service of this water heater requires ability equivalent to that of a Qualified Agency (as defined by ANSI below) in the field involved. Installation skills such as plumbing, electrical supply are required in addition to electrical testing skills when performing service.

This heat pump water heater contains R-134a refrigerant and is regulated as a stationary refrigeration appliance under Section 608 of the Clean Air Act. Servicing of the refrigeration circuit must only be performed by agencies or individuals possessing Type II or Universal certification as defined in Section 608 of the Clean Air Act.

ANSI Z223.1 2006 Sec. 3.3.83: “Qualified Agency” - “Any individual, firm, corporation or company that either in person or through a representative is engaged in and is responsible for (a) the installation, testing or replacement of gas piping or (b) the connection, installation, testing, repair or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction.”

PREPARING FOR THE INSTALLATION

⚠WARNING

Read and understand this instruction manual and the safety messages herein before installing, operating or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

This manual must remain with the water heater.

1. Read the “General Safety Information” section of this manual first and then the entire manual carefully. If you don’t follow the safety rules, the heat pump water heater may not operate safely. It could cause DEATH, SERIOUS BODILY INJURY AND/OR PROPERTY DAMAGE.

   This manual contains instructions for the installation, operation, and maintenance of the heat pump water heater (HPWH). It also contains warnings throughout the manual that you must read and be aware of. All warnings and all instructions are essential to the proper operation of the HPWH and your safety. **READ THE ENTIRE MANUAL BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS WATER HEATING APPLIANCE.**

   Detailed installation diagrams are in this manual. These diagrams will serve to provide the installer with a reference for the materials and suggested methods of piping. IT IS NECESSARY THAT ALL WATER PIPING AND THE ELECTRICAL WIRING BE INSTALLED AND CONNECTED AS SHOWN IN THE DIAGRAMS.

   Particular attention should be given to the installation of the system (tank) temperature control. See page 19.

⚠WARNING

Electrical Shock Hazard

- Turn off power to the water heater before performing any service.
- Label all wires prior to disconnecting when performing service. Wiring errors can cause improper and dangerous operation.
- Verify proper operation after servicing.
- Failure to follow these instructions can result in personal injury or death.

Be sure to turn off power when working on or near the electrical system of the heat pump. Never touch electrical components with wet hands or when standing in water. When replacing fuses always use the correct size for the circuit. See Unit Wiring Diagrams-Fuse Sizes, pages 32-36.

The principal components of the HPWH are identified in the Features And Components section of this manual on page 8. The rating label on the HPWH also provides useful information. These references should be used to identify the heat pump, its components and optional equipment.

2. The installation must conform with these instructions and the local code authority having jurisdiction and the requirements of the power company. In the absence of local codes, the installation must comply with the latest editions of the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code CSA C22.1. The National Electrical Code may be ordered from: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269. The Canadian Electrical Code is available from the Canadian Standards Association, 8501 East Pleasant Valley Road, Cleveland, OH 44131.
3. If after reading this manual you have any questions or do not understand any portion of the instructions DO NOT proceed with the installation. Call the toll free number listed on the back cover of this manual for technical assistance.
4. In order to expedite your request, please have full model and serial number available for the technician.
5. Carefully consider your intended placement and location for the HPWH. See Locating The Water Heater on page 10
6. Installation and service of this HPWH requires ability equivalent to that of a licensed tradesman or Qualified Agency in the field involved. See Qualifications on page 6.
7. For installation in California the HPWH appliance must be braced or anchored to avoid falling or moving during an earthquake. Instructions may be obtained from California Office of the State Architect, 1102 Q Street, Suite 5100, Sacramento, CA 95811.

8. Ensure the power supply voltage and phase at the job site matches the power requirements on the HPWH rating label before installation begins. Energizing the HPWH with the wrong voltage or phase will cause permanent damage to the unit.

PRINCIPLE OF OPERATION

The appliances covered by this Instruction Manual are commercial air-to-water heat pump water heaters (HPWH).

Operation of the HPWH is similar to that of a package air conditioning system though the HPWH is designed for indoor installation only. The primary difference in operation is that the HPWH unit utilizes the heat removed from the conditioned space to heat water where package air conditioning systems discard this heat outdoors. Recovering and using this waste heat increases the overall energy efficiency of the building.

THE REFRIGERATION CYCLE

Refer to Figure 1 on page 8 for the location of components mentioned in this section.

Refrigerant is circulated through the refrigeration circuit by a *Compressor* (1). The refrigerant is a high temperature high pressure gas when it leaves the compressor. Refrigerant flows from the compressor through the *Hot Gas Line* (2) to the *Condenser* (3).

The condenser is a refrigerant-to-water heat exchanger with two circuits, refrigerant flows through one circuit and water through the other. The high temperature refrigerant gas transfers its heat to the water flowing through the condenser. As the refrigerant gas cools inside the condenser it changes state (condenses) from a gas to a liquid. A *Water Pump* (B) circulates water through the condenser.

Refrigerant leaving the condenser is a medium temperature high pressure liquid. It flows through the *Liquid Line* (4) to the *Thermostatic Expansion Valve* (5). The thermostatic expansion valve (TXV) regulates the flow of refrigerant into the *Evaporator* (6). The evaporator is a tube-and-fin constructed coil. It is an air-to-refrigerant heat exchanger with refrigerant flowing through the tubes and air flowing across the fins.

The *Blower* moves ambient air from the installed space or air ducted to the HPWH from another location across the fins of evaporator coil. The refrigerant absorbs heat from the air in the evaporator. The refrigerant changes state (boils/evaporates) from a liquid state back into a gas (vapor) in the evaporator.

The refrigerant flows out of the evaporator through the *Suction Line* (7) and into the *Accumulator* (8). The accumulator traps any liquid refrigerant the evaporator is unable to vaporize during low temperature operating conditions. The accumulator prevents liquid refrigerant from entering the compressor where it could damage internal components.

Low temperature low pressure refrigerant gas (vapor) is drawn out of the accumulator by the compressor. The compressor increases the pressure and temperature of the refrigerant gas circulating it to the condenser again where the refrigeration cycle starts over or continues.

AIR TEMPERATURE RANGE

The entering air temperature operating range for the HPWH is 50°F to 95°F (10°C to 35°C).

When the HPWH is operating properly the air temperature drop through the evaporator (heat exchanger) will be approximately 12°F to 20°F (7°C to 11°C).

WATER TEMPERATURE RANGE

The inlet (entering) water temperature operating range for the HPWH is 50°F to 140°F (10°C to 60°C).

When the HPWH is operating properly the water temperature rise through the condenser (heat exchanger) will be approximately 8°F to 12°F (4°C to 7°C).

REFRIGERANT CHARGE

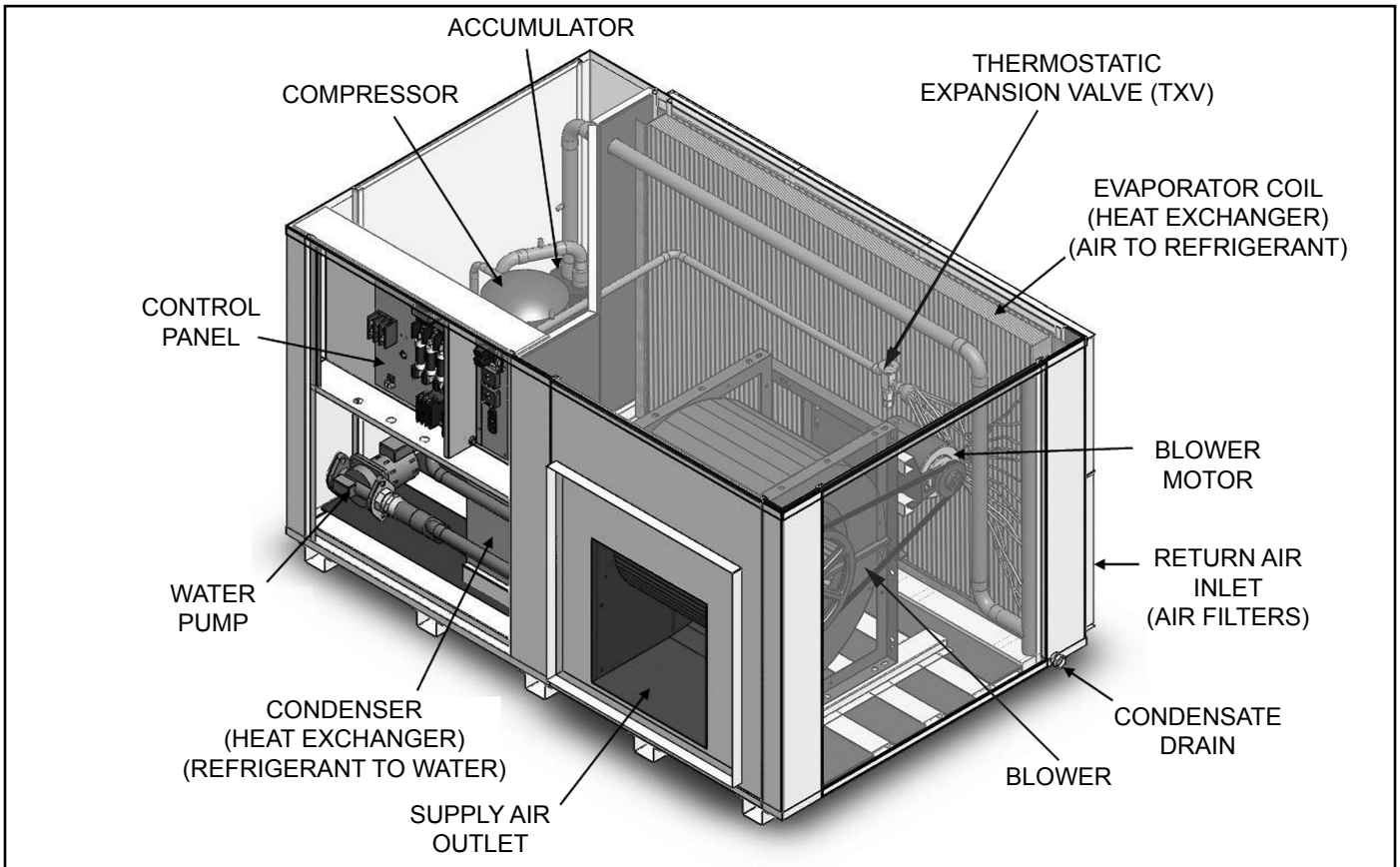
The HPWH is factory-charged with R-134a refrigerant. The refrigerant charge is weighed in at the factory. See Table 9 on page 28. It should not be necessary to add or remove refrigerant during installation or start up.

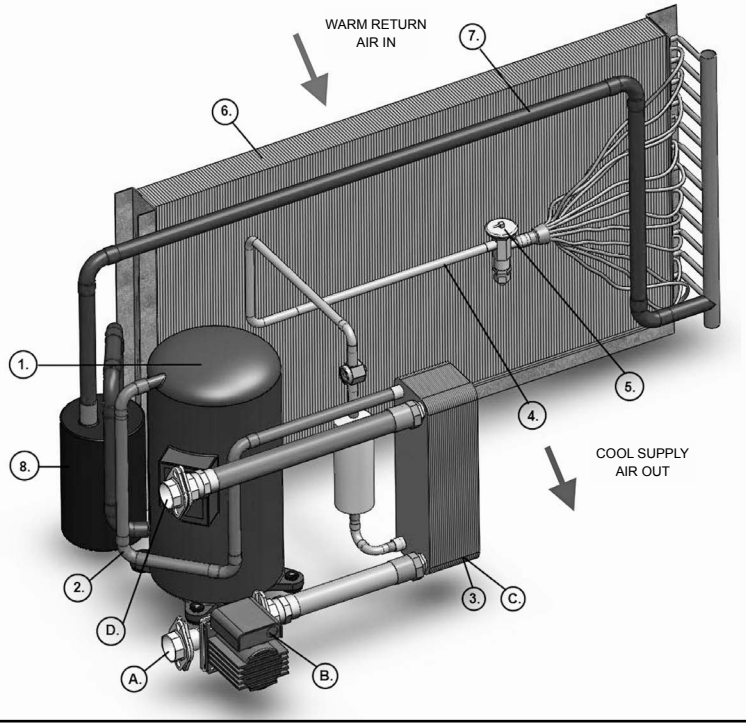
EQUIPMENT DISPOSAL

This heat pump water heater contains R-134a refrigerant and is regulated as a stationary refrigeration appliance under Section 608 of the Clean Air Act. Disposal of this unit must be performed in accordance with the provisions in Section 608 of the Clean Air Act and any state or local regulations that may also apply. See Qualifications on page 6.

FEATURES AND COMPONENTS

PRODUCT ILLUSTRATIONS





COMPONENT REFRIGERATION CIRCUIT	REFRIGERANT STATE
1) COMPRESSOR	GAS
2) HOT GAS LINE	GAS
3) CONDENSER / HEAT EXCHANGER	GAS TO LIQUID
4) LIQUID LINE	LIQUID
5) THERMOSTATIC EXPANSION VALVE (TXV)	LIQUID
6) EVAPORATOR	LIQUID TO GAS
7) SUCTION LINE	GAS
8) ACCUMULATOR	GAS / LIQUID

COMPONENT WATER CIRCUIT

A) WATER INLET
B) WATER PUMP
C) HEAT EXCHANGER / CONDENSER
D) WATER OUTLET

Figure 1

ROUGH IN DIMENSIONS

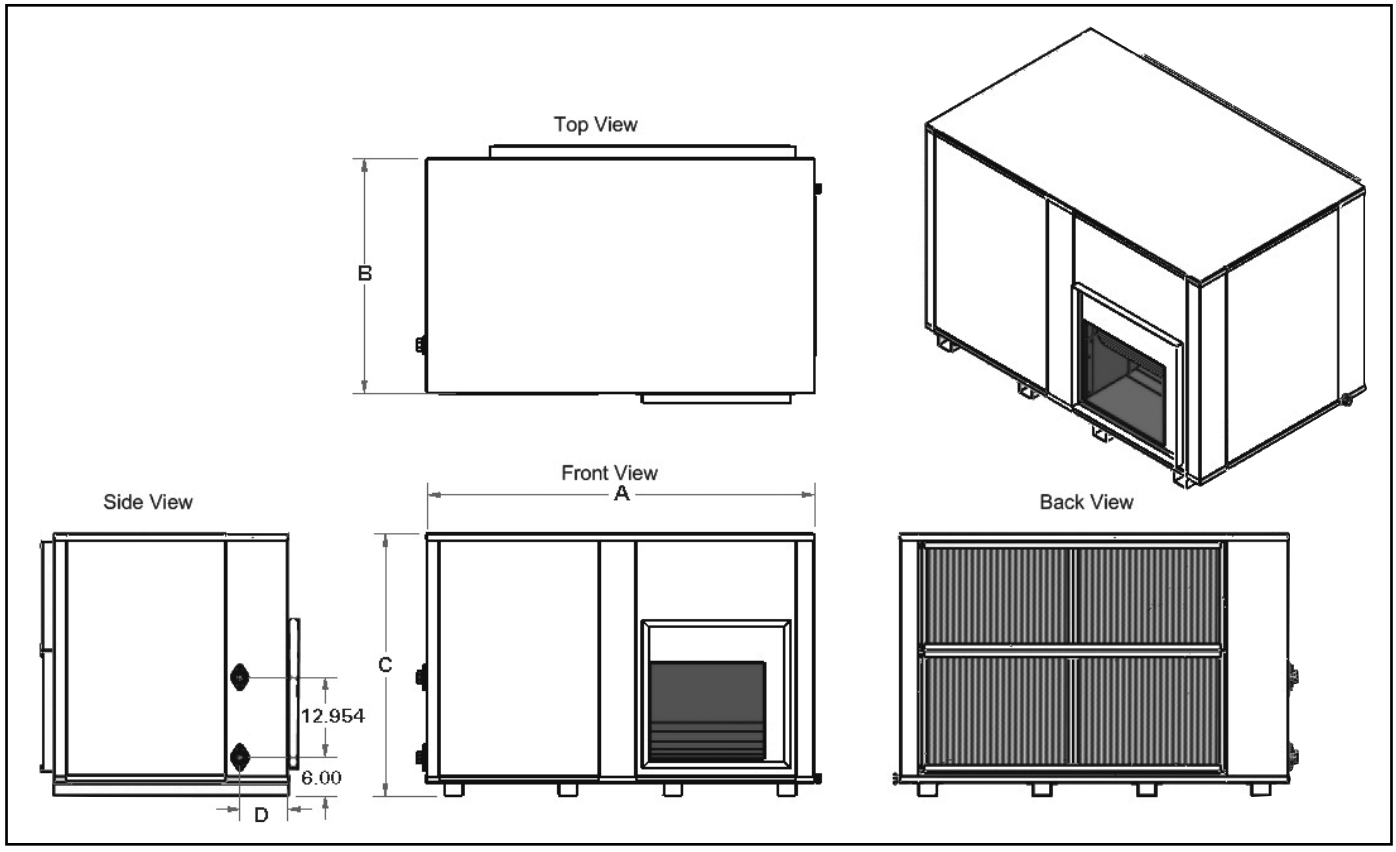


Figure 2

PERFORMANCE SPECIFICATIONS

TABLE 1

MODEL NUMBER	PERFORMANCE					AIR VOLUME (CFM)	WATER FLOW (GPM)	DIMENSIONS					WEIGHT (LBS)
	WATER HEATING CAPACITY		COOLING CAPACITY		COP			INLET OUTLET WATER (FPT)	WIDTH A	DEPTH B	HEIGHT C	D	
	kW	Btu/hr*	Btu/hr	Tons									
AWH-35	10.4	35,500	27,500	2.3	3.9	1040	7	1.0”	40”	26”	24.75”	7"	315
AWH-55	17.0	58,000	45,500	3.8	4.1	1650	11	1.0”	47”	32”	28.5”	7"	405
AWH-75	22.3	76,000	59,000	4.9	3.9	2150	15	1.5”	57”	32”	28.5”	7"	485
AWH-100	28.7	98,000	78,000	6.5	4.2	3200	20	1.5”	63”	38”	42.5”	8"	660
AWH-115	33.1	113,000	89,000	7.4	4.2	3200	23	1.5”	63”	38”	42.5”	8"	665
AWH-140	41.6	142,000	110,000	9.2	3.9	3800	28	2.0”	63”	38”	42.5”	8"	725
AWH-170	50.1	171,000	133,000	11.1	3.9	4900	34	2.0”	75”	46”	42.5”	8"	880

All dimensions are in inches. Weights are approximate shipping weights.

*Performance rating at 75ºF Entering Air Temperature and 55% Relative Humidity, 100ºF Entering Water Temperature.

** Blower design at 0.35” external static pressure.

C. O. P. = Coefficient Of Performance

All models standard 208/230 VAC, 3Ø, 60 Hz

Optional 460 VAC, 3Ø, 60 Hz

Optional 208/230 VAC, 1Ø, 60 Hz available on AWH-35 and AWH-55 only

INSTALLATION REQUIREMENTS

Read all installation requirements in this manual before installation begins. The installation must conform to these instructions and all local and national code authority having jurisdiction.

Costs to diagnose, perform service and repair damage caused by installation errors are not covered under the limited warranty.

Costs to correct installation errors are not covered under the limited warranty.

WATER TEMPERATURE

MAXIMUM SYSTEM TEMPERATURE

The HPWH units covered in this manual are capable of maintaining a maximum system/storage tank temperature of 140°F (60°C). Some commercial water heating applications may require higher temperatures. Install a booster water heater downstream from the storage tank for temperatures above 140°F (60°C). See Figure 8 on page 18.

INLET & OUTLET WATER TEMPERATURE

The inlet (entering) water temperature operating range for the HPWH is 50°F to 140°F (10°C to 60°C). The water temperature rise (Delta T - ΔT) through the condenser (heat exchanger) will be approximately 8°F to 12°F (4°C to 7°C).

Outlet water temperatures up to 152°F (67°C) are possible during normal operation. Exposure to water temperatures this high can cause serious bodily injury or death. See Mixing Valves and Table 5 on page 14.

Service & Installation Notes:

If the inlet (entering) water temperature is outside the operating temperature range for extended periods the control system may lock out on high or low refrigerant pressure switch events/trips.

When the control system locks out on a refrigerant pressure switch event the compressor will stop running, the blower and circulation pump (on models equipped with factory installed pump) will continue to operate. This is a hard lock out condition. The control system is manually reset by cycling power to the HPWH off and then on again.

The tank thermostat must not be set any higher than 140°F (60°C) to prevent control system lock outs.

Ground water temperatures can fall below 50°F (10°C) for extended periods during winter months in many regions. For this reason the cold water supply lines and should not be connected directly to the HPWH inlet or T fitted into the inlet (return) water piping. The cold water supply lines should be connected directly to the storage tank only. See the Piping Diagrams on page 41 in this manual for more information.

AIR TEMPERATURE

ENTERING AIR TEMPERATURE

The return (entering) air temperature range of operation for the unit is 50° - 95°F (10°C to 35°C). The air temperature drop (Delta T - ΔT) through the evaporator (heat exchanger) will be approximately 12°F to 20°F (7°C to 11°C).

If the entering air temperature is outside this operating range the HPWH unit's Ambient Air Limit Thermostat will discontinue heating operation until the entering air temperature returns to this operating range. See Figure 15 on page 37.

High Ambient Air Kits are available that will allow the unit to operate with entering air temperatures up to 120°F (49°C). These accessory kits must be installed if entering air temperatures exceed 95°F (35°C) for extended periods.

Contact your local distributor or call the technical support phone number listed on the back cover of this manual for more information on ordering one of these accessory kits.

Service & Installation Notes:

When the High Ambient Air kit is installed the heating stage set point on the Ambient Air Limit thermostat must be raised to 120°F (49°C) to allow heating operation up to this temperature.

LOCATING THE WATER HEATER

CAUTION

PROPERTY DAMAGE!

- All water heaters eventually leak.
- Do not install without adequate drainage.

INDOOR INSTALLATION ONLY

The HPWH unit is designed for indoor installation only.

Carefully choose a location for the HPWH unit. Placement is a very important consideration for optimal performance and safety.

Locate the HPWH near a floor drain. The unit should be located in an area where leakage from the HPWH unit or the storage tank it is connected to will not result in damage to the area adjacent to the water heater or to lower floors of the structure. See Unit Placement on page 16.

FREEZING TEMPERATURES

The HPWH unit must not be installed in space where freezing temperatures will occur. Exposure to freezing ambient temperatures below 32°F (0°C) may result in severe damage to internal components. Damage caused by exposure to freezing temperatures is not covered under the limited warranty.

COASTAL REGIONS

When the HPWH will be installed within 5 miles of a seacoast the optional Corrosive Duty Package is required. The corrosive duty package includes a 316 stainless steel cabinet and a phenolic coating applied to the evaporator and blower. Damage caused to units not equipped with the corrosive duty package in coastal regions is not covered under the limited warranty.

HEAT SOURCE

The HPWH unit should be located where there is an adequate source of ambient heat and where the cooling benefit can be utilized when possible.

If installation in a space with an adequate heat source is not possible the HPWH unit can be ducted to/from another space such as a boiler room or to the outdoors where sufficient heat is available. See Air Flow and Ducting on page 19.

CONDITIONED SPACE

When installed in a conditioned space ducting supply (outlet) air to an alternate location may be necessary to avoid over-cooling of the space where the HPWH is installed or provide spot cooling in areas for comfort and/or to offset cooling load. See Building Air Pressure, Air Flow and Ducting on page 19.

UNCONDITIONED SPACE

When installed in an unconditioned space ducting return (inlet) air from an alternate location may be necessary to access an adequate or greater source of heat for optimal efficiency. See Building Air Pressure, Air Flow and Ducting on page 19.

CLEARANCES

To ensure optimal performance a minimum of 30 inches clearance is required from the back, left and right sides of the HPWH unit and any wall obstruction. A minimum of 36 inches clearance on the front of the unit for access to the control box. See Figure 3

When installed on an equipment pad the HPWH must be level and elevated at least 6” above floor to avoid dust and debris and permit connection of the condensate line and trap.

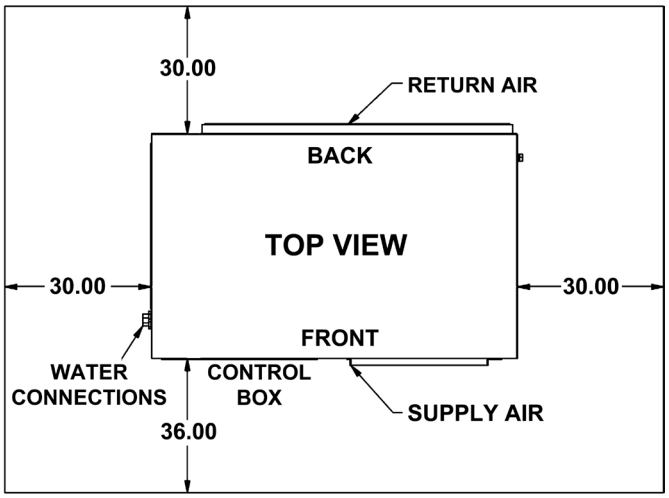


Figure 3

ELECTRICAL REQUIREMENTS

CAUTION

CORRECT POWER SUPPLY!

- Ensure the power supply at the job site matches the voltage and phase listed on the HPWH rating label before connecting power to the HPWH unit.
- Energizing the HPWH with the wrong voltage or phase will cause permanent damage to the HPWH unit.
- Damage caused to the HPWH as the result of applying the wrong voltage or phase is not covered under the limited warranty.

Ensure the power supply voltage and phase at the job site matches the power supply ratings listed on the HPWH rating label BEFORE INSTALLATION BEGINS.

The installation must conform with these instructions and the local code authority having jurisdiction and the requirements of the power company. In the absence of local codes, the installation must comply with the current editions of the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code CSA C22.1.

Voltage applied to the HPWH should not vary more than +5% to -10% of the voltage requirement listed on the HPWH rating label for satisfactory operation.

VOLTAGE & AMPERAGE RATINGS

TABLE 2

MODEL	VOLTS/PHASE/HZ	COMPRESSOR			BLOWER MOTOR		PUMP (230 VAC 1Ø)*		MCA	MFS
		RLA	LRA	MCC	FLA	HP	FLA	HP		
AWH-35	208-230/1/60	18.60	100.00	29.00	3.60	1/2	0.88	1/8	28	45
AWH-35	208-230/3/60	10.90	77.00	17.00	2.40	1/2	0.88	1/8	17	25
AWH-35	460/3/60	5.40	39.00	8.50	1.20	1/2	0.88	1/8	9	12
AWH-55	208-230/1/60	27.90	175.00	43.50	5.30	3/4	0.88	1/8	42	60
AWH-55	208-230/3/60	19.90	115.00	31.00	3.00	3/4	0.88	1/8	29	45
AWH-55	460/3/60	8.70	63.00	13.50	1.50	3/4	0.88	1/8	13	20
AWH-75	208-230/3/60	24.00	196.00	37.50	3.60	1	0.88	1/8	35	50
AWH-75	460/3/60	11.50	100.00	18.00	1.80	1	0.88	1/8	17	25
AWH-100	208-230/3/60	28.20	225.00	44.00	3.60	1	0.88	1/8	40	60
AWH-100	460/3/60	14.10	114.00	22.00	1.80	1	0.88	1/8	20	30
AWH-115	208-230/3/60	35.30	239.00	55.00	3.60	1	1.00	1/6	49	80
AWH-115	460/3/60	17.90	125.00	28.00	1.80	1	1.00	1/6	25	40
AWH-140	208-230/3/60	48.10	300.00	75.00	4.80	1 1/2	2.50	1/2	68	110
AWH-140	460/3/60	21.80	150.00	34.00	2.40	1 1/2	2.50	1/2	31	50
AWH-170	208-230/3/60	52.60	340.00	82.00	6.20	2	2.50	1/2	75	125
AWH-170	460/3/60	25.60	173.00	40.00	3.10	2	2.50	1/2	37	60

*460 VAC models factory-equipped with step down transformer for 230 VAC pump

Abbreviations:

RLA = Running Load Amps; LRA = Locked Rotor Amps; MCC = Maximum Continuous Current;

FLA = Full Load Amps; MCA = Minimum Circuit Ampacity; MFS = Maximum Fuse Size

MINIMUM CIRCUIT AMPACITY & MAXIMUM FUSE SIZE

⚠ WARNING

Electrical Shock Hazard

- Before removing any access panels or servicing the water heater, make sure the electrical supply to the water heater is turned "OFF."
- Failure to do this could result in death, serious bodily injury, or property damage.

Table 2 on page 11 provides the MCA (Minimum Circuit Ampacity) and MFS (Maximum Fuse Size). Use MCA to select the minimum field wires size to power the unit and MFS to select the maximum fuse size for over current protection as follows:

MCA = C x 1.25 + M + P

MFS = C x 2.25 + M + P

Where:

C - Compressor RLA

M - Blower Motor FLA

P - Pump FLA

MINIMUM WIRE SIZE

Allowable Ampacities of Insulated Conductors

Single-phase heat pump water heaters are two wire circuits. Three-phase heaters are three wire circuits. In addition to the foregoing, a grounded conductor is required. Not more than three conductors in raceway, cable, or earth (directly buried), based on ambient temperature of 30°C (86°F)

TABLE 3

Size	Temperature Rating of Conductor								Size
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
AWG MCM	TYPES RUW, T TW, UF	TYPES FEPW, RH, RHW, RUH, THW THWN, XHHW, USE, ZW	TYPES V, MI,	TYPES TA, TBS, SA, AVB, SIS, +FEP, +FEPB, +RHH, +THHN, +XHHW*	TYPES RUW, T TW, UF	TYPES RH, RHW, RUH, THW, THWN, XHHW, USE	TYPES V, MI,	TYPES TA, TBS, SA, AVB, SIS, +RHH, +THHN, +XHHW*	AWG MCM
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM				
18	. . . .	. . . .	. . . .	21	. . . .	. . . .	. . . .	. . . .	. . . .
16	. . . .	. . . .	22	22	. . . .	. . . .	. . . .	. . . .	. . . .
14	15	15	25	25	. . . .	. . . .	. . . .	. . . .	. . . .
12	20	20	30	30	15	15	25	25	12
10	30	30	40	40	25	25	30	30	10
8	40	45	50	50	30	40	40	40	8
6	55	65	70	70	40	50	55	55	6
4	70	85	90	90	55	65	70	70	4
3	80	100	105	105	65	75	80	80	3
2		115	120	120	75	90	95	95	2
1		130	140	140		100	110	110	1
0		150	155	155		120	125	125	0
00		175	185	185		135	145	145	00
000		200	210	210		1155	165	165	000
0000		230	235	285		180	185	185	0000
250		255	270	270		205	215	215	250
300		285	300	300		230	240	240	300
350		310	325	325		250	260	260	350
400		335	360	360		270	290	290	400
500		380	405	405		310	330	330	500
	CORRECTION FACTORS								
Ambient Temp. °C	For ambient temperatures over 30°C, multiply the ampacities shown above by the appropriate correction factor to determine the maximum allowable load current.								Ambient Temp. °F
31-40	.82	.88	.90	.91	.82	.88	.90	.91	86-104
41-50	.58	.75	.80	.82	.58	.75	.80	.82	105-122
51-60	. . . .	.58	.67	.71	. . . .	.58	.67	.71	123-141
61-70	. . . .	.35	.52	.58	. . . .	.35	.52	.58	142-158
71-80	. . . .	. . . .	.30	.41	. . . .	. . . .	.30	.41	159-176

+The load current rating and the overcurrent protection for these conductors shall not exceed 15 amperes for 14 AWG. 20 amperes for 12 AWG and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum.

*For dry locations only. See 75°C column for wet locations.

WATER PIPING

Read all installation requirements in this manual before installation begins.

The water piping installation must conform to these instructions and to all local and national code authority having jurisdiction.

Costs to diagnose, perform service and repair damage caused by installation errors are not covered under the limited warranty.

Costs to correct installation errors are not covered under the limited warranty.

MAXIMUM PIPE LENGTH

Factory installed pumps will provide the specified water flow for up to a total of 50 equivalent feet of water piping between the HPWH and the storage tank. Example: 25 equivalent feet of inlet (return) piping and 25 equivalent feet of outlet (supply) piping.

Exceeding these maximum lengths will cause the unit to malfunction and control system lock outs.

MINIMUM PIPE SIZE

The inlet (return) and outlet (supply) water piping installed between the HPWH unit and the storage tank must not be smaller than the water connection sizes on the HPWH. See Table 4 for water line connection sizes and water flow rates.

Water line sizing is a critical installation requirement. Installing undersized water piping between the storage tank and the HPWH unit will cause insufficient water flow and will have an adverse impact on performance and equipment life.

TABLE 4

WATER CONNECTIONS AND FLOW			
UNIT	GPM	LPM	CONNECTION SIZE (INCH)
AWH-35	7	27	1
AWH-55	11	42	1
AWH-75	15	57	1.5
AWH-100	20	76	1.5
AWH-115	23	87	1.5
AWH-140	28	106	2
AWH-170	34	129	2

PIPE SUPPORT

All water piping must be properly supported per local code requirements.

PIPE INSULATION

All piping installed between the HPWH unit and the storage tank must be insulated.

COLD WATER SUPPLY

Cold water supply lines should not be connected directly to the HPWH inlet or T fitted into the inlet (return) water piping. The cold water supply lines should be connected directly to the storage tank only. See Inlet & Outlet Water Temperature on page 10 and Figure 7 and Figure 8 on page 18.

WATER PRESSURE

System water pressure should be maintained between 40 and 60 PSI. Local code may require, and the manufacturer recommends, installing a pressure reducing valve (PRV) in the cold water supply to the building to maintain consistent water pressure.

CLOSED WATER SYSTEMS

Water supply systems may, because of code requirements or such conditions as high line pressure, among others, have installed devices such as pressure reducing valves, check valves, and back flow preventers. Devices such as these cause the water system to be a closed system.

THERMAL EXPANSION

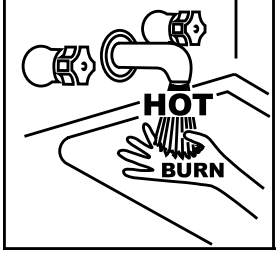
As water is heated, it expands (thermal expansion). In a closed system the volume of water will grow when it is heated. As the volume of water grows there will be a corresponding increase in water pressure due to thermal expansion. Thermal expansion can cause premature failure (leakage) of storage tanks, water heaters and HPWH components such as the condenser. Leakage caused by thermal expansion is not covered under the HPWH limited warranty.

Thermal expansion can also cause intermittent Temperature-Pressure Relief Valve operation: water discharged due to excessive pressure build up. The Temperature-Pressure Relief Valve is not intended for the constant relief of thermal expansion.

A properly sized thermal expansion tank must be installed on all closed systems to control the harmful effects of thermal expansion. Contact a local plumbing service agency to have a thermal expansion tank installed on all closed water systems.

MIXING VALVES

⚠ DANGER



Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting devices such as mixing valves must be installed when required by codes and to ensure safe temperatures at fixtures.

Water heated to a temperature which will satisfy clothes washing, dish washing, and other sanitizing needs can scald and cause permanent injury upon contact. See Table 5.

Some people are more likely to be permanently injured by hot water than others. These include the elderly, children, the infirm and the physically/mentally disabled. The Table below shows the approximate time-to-burn relationship for normal adult skin. If anyone using hot water provided by the water heater being installed fits into one of these groups or if there is a local code or state law requiring a certain water temperature at the point of use, then special precautions must be taken.

In addition to using the lowest possible temperature setting that satisfies the demand of the application a Mixing Valve should be installed upstream from the building fixtures or at the hot water taps to further reduce system water temperature.

Mixing valves are available at plumbing supply stores. Consult a Qualified Installer or Service Agency. Follow the mixing valve manufacturer's instructions for installation of the valves.

TABLE 5

Water Temperature	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
180°F (82°C)	Nearly instantaneous
170°F (77°C)	Nearly instantaneous
160°F (71°C)	About 1/2 second
150°F (66°C)	About 1-1/2 seconds
140°F (60°C)	Less than 5 seconds
130°F (54°C)	About 30 seconds
120°F (49°C)	More than 5 minutes

CONDENSATE REMOVAL

The HPWH unit produces condensate which must be discharged. If there is no drain easily accessible, a condensate lift pump must be installed to discharge the condensate to a remote location. See Condensate Drain Line on page 18 for installation instructions.

CONTAMINATED WATER

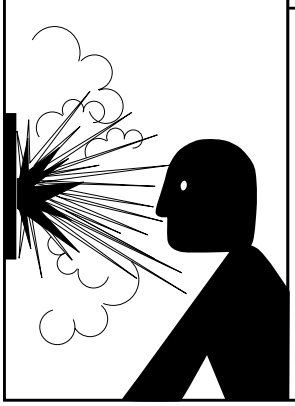
⚠ WARNING

Corrosive Chemical Hazard

- Connecting the heat pump to any system other than a water system may lead to premature corrosion of the unit's heat exchanger and void the unit warranty.

This HPWH unit must not be used to heat any fluid other than water. Corrosive chemicals must not be introduced into the waterways in this HPWH unit.

TEMPERATURE - PRESSURE RELIEF VALVE



⚠ WARNING

Explosion Hazard

- Temperature-Pressure Relief Valve must comply with ANSI Z21.22-CSA 4.4 and ASME code.
- Properly sized temperature-pressure relief valve must be installed in the designated opening in the storage tank.
- Can result in overheating and excessive tank pressure.
- Can cause serious injury or death.

This heat pump water heater should only be connected to a storage tank with a properly rated/sized and certified combination temperature - pressure relief valve. The valve must be certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment of materials as meeting the requirements for Relief Valves for Hot Water Supply Systems, ANSI Z21.22 • CSA 4.4, and the code requirements of ASME.

When the HPWH unit is connected to a storage tank a temperature and pressure relief valve must be installed in the designated opening for the T&P valve per the storage tank manufacturer's requirements. The T&P valve's Btu/hr rating must be equal to or greater than the total heating input rating of all water heaters connected to the storage tank. If more than one water heating appliance is connected to the storage tank the aggregate total of all heating input ratings of all connected appliances must be factored when choosing a T&P valve for the storage tank.

The pressure rating of the T&P valve should always be rated equal to or below the working pressure rating of the storage tank or water heater, whichever rating is lower.

Contact the manufacturer of the storage tank for assistance in sizing of a temperature and pressure relief valve. Follow the storage tank manufacturer's instructions regarding the proper installation of these products.

TANK SELECTION

The HPWH unit is not an instantaneous water heater and must be connected to a storage tank. Storage tank configurations must meet these criteria:

1. The HPWH must not be connected directly to a standard gas or electric water heater.
2. If the HPWH is connected to a used storage tank, the tank should be thoroughly cleaned of scale and sediment before the HPWH is installed.
3. Connection ports used on the storage tank must permit the recommended flow rate through HPWH. The connection ports used on the storage tank must not be smaller than the inlet outlet connection sizes on the HPWH unit. See Table 4 on page 13.
4. Water heated by the HPWH should be returned to the tank at a location that is above the level of the tank's cold water inlet and/or the heat pump's inlet source.
5. The HPWH unit's inlet and outlet lines to the storage tank should be dedicated. Example: no other line (such as a building re-circulating loop or cold water supply) should be connected to the HPWH unit's inlet or outlet water lines.

SOLAR TANKS

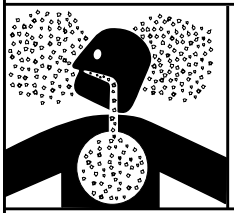
Solar tanks should be used with caution. Some solar tanks with top connections have dip tubes which may significantly reduce the efficiency performance of the HPWH unit.

Before using any solar tank in this application, contact your representative or call the toll free technical support number on the back cover of this manual for further assistance.

CONTAMINATED AIR

⚠ WARNING

Breathing Hazard - Carbon Monoxide Gas



- Do not duct air from a garage or other space where potentially harmful fumes from solvents, chemicals or exhaust from automobiles are present into any other space in the building structure.
- Gas and carbon monoxide detectors are available.

Breathing carbon monoxide can cause brain damage or death. Always read and understand instruction manual.

The supply (outlet) air from a HPWH installed in a garage or a unit drawing return (inlet) air from a garage or any area where solvents or other chemicals that emit potentially harmful fumes are stored or automobiles are located must never be ducted to any other space inside the building structure. This would include all occupied and unoccupied spaces such as attics or basements.

Potentially harmful fumes and vapors could be introduced into occupied spaces. See Unit Placement on page 16.

STORAGE & HANDLING

⚠WARNING

HEAVY OBJECT!

All Heat Pump Water Heaters (HPWHs) covered by this manual are beyond the safe lifting weight for one person. Use proper conveyance equipment to move the unit for storage or during installation. Use OSHA approved safety equipment when moving the unit.

The heat pump water heaters covered in this manual are stationary refrigeration appliances. Careful handling is necessary to prevent internal damage.

- IMPORTANT: Do not remove, cover or deface any permanent instructions, wiring diagrams, labels, or the rating label from the outside cabinet or the inside panels on the HPWH unit.
- Do not tilt the unit beyond 45° at any time. All internal components are braced from the base of unit. Tilting may compromise the refrigeration piping inside unit and cause refrigerant leaks.
- Do not hoist the unit with chains or straps unless spreader bars are furnished and used as depicted in Figure 4 and Figure 5. The side panels and roof of the unit are not constructed to handle significant force from the sides or above.
- The HPWH unit is heaviest on the compressor side (left side when facing the front of the unit). See Figure 4 and Figure 6.
- When using a forklift to raise the HPWH unit ensure the forks are positioned correctly between the runners on the bottom of the HPWH unit. See Figure 6.
- The HPWH unit must be lifted from the front side only when using a forklift to raise the unit. See Figure 6.

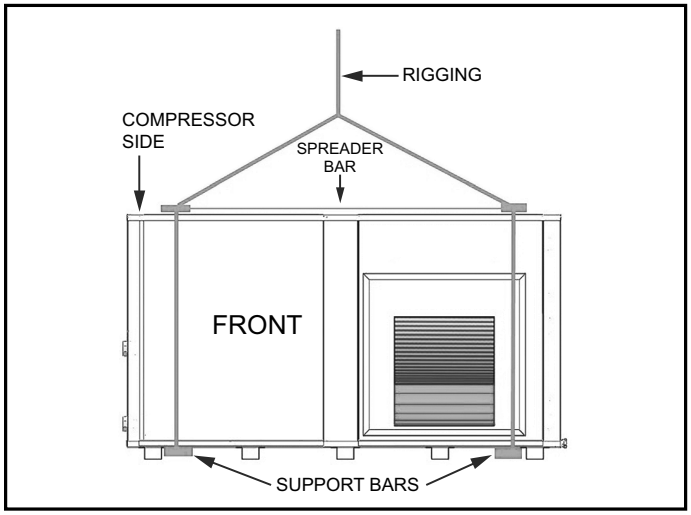


Figure 4

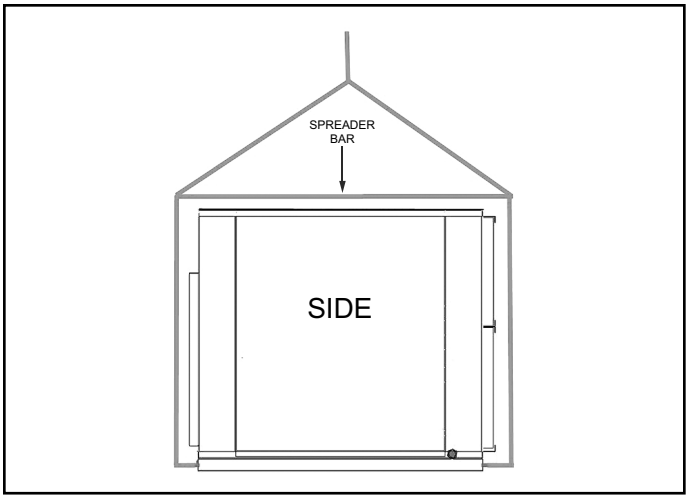


Figure 5

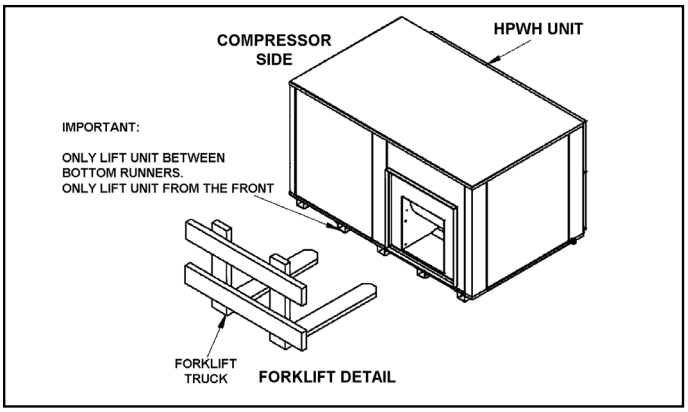


Figure 6

STORAGE RECOMMENDATIONS

The HPWH units should be stored indoors. Do not stack units or stack other construction materials on the units while in storage.

The HPWH units contain electrical/electronic components and should only be stored in conditions between 0ºF to 110°F (-17°C to 43°C) and 5 to 95 percent relative humidity. Electrical components are not moisture-tolerant.

NOTE: The limited warranty does not cover damage to the unit or controls due to negligence during storage.

INSTALLATION

REQUIRED ABILITY

Installation and service of the HPWH unit requires ability equivalent to that of a qualified agency in the field involved. Plumbing, ducting and electrical work are required. See Qualifications on page 6.

GENERAL

The installation must conform with these instructions and the local code authority having jurisdiction. In the absence of local codes, the installation must comply with the latest editions of the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code CSA C22.1. The National Electrical Code may be ordered from: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269. The Canadian Electrical Code is available from the Canadian Standards Association, 8501 East Pleasant Valley Road, Cleveland, OH 44131.

DO NOT start the HPWH unit or test the electrical system before it is connected to the water system, purged of air and filled with water. See Start Up on page 23.

See Features And Components on page 8 to identify the principal components of the HPWH.

REQUIRED TOOLS AND MATERIALS

INSTALLATION & START UP TOOLS

1. All tools common to installation and service of commercial electric water heaters such as hand tools, pipe cutter and torch.
2. Heat transfer compound (paste) such as Honeywell part number 107408 or equivalent.
3. Electrical switch lock out device - used to secure disconnect switches/breaker panels while servicing.
4. Electronic thermometer including:
   - Four (4) thermocouple sensors capable of measuring surface temperatures on water or refrigerant piping up to 2 inch diameter.
   - Two (2) thermocouple sensors capable of measuring ambient air temperature.
   - Temperature range 32°F - 210°F (0°C - 100°C).
5. Volt-Ohm Multi Meter - capable of measuring:
   - AC Voltage up to 600 VAC.
   - DC Voltage up to 24 VDC.
   - Ohms up to 2,000,000 ohms.
   - Continuity.
6. AC amp meter - capable of measuring:
   - AC amperage up to 200 amps.
7. Calculator.

SERVICE TOOLS

See Qualifications on page 6 regarding regulations and certifications required under Section 608 of the Clean Air Act before servicing the refrigeration circuit.

1. Refrigeration manifold gauges.
2. Refrigeration charging scale.
3. Refrigeration vacuum pump.
4. Refrigerant recovery machine.
5. Refrigerant reclamation storage tank.

UNIT PLACEMENT

Whether replacing existing water heating equipment or installing the HPWH in new construction, the following critical points must be observed: The HPWH unit:

1. Must be installed indoors.
2. Should be installed near a floor drain for condensate removal.
3. The HPWH, storage tank and water heater(s) should be located in an area where leakage will not result in damage to adjacent area or to lower floors in the building structure.
4. The HPWH unit must be level for proper condensate drainage. Shim the channel type skid base, pad or floor as necessary if levelling is required.
5. Should be installed close to the point of major hot water usage and power supply.
6. Should be located so that hot water piping and branch circuit wiring will be as short as possible.

CEILING SUSPENSION

Because warm air rises, a drop ceiling or suspended from ceiling configuration is preferred to take advantage of higher ambient temperatures. The HPWH may be suspended from the ceiling using a safe and properly designed support. The sides and top of the cabinet are not designed to support the weight of the unit. Do not attach straps or bars directly to the sides or top of the cabinet. If the HPWH is suspended, it must be supported from underneath.

Mounting Frame

The mounting frame must support the length, width, and weight of the HPWH unit. The weight of the HPWH unit must be evenly dispersed across the footing channels on the bottom of the unit. See Table 1 on page 9 for unit dimensions and weights.

NOTE: A qualified engineer should design and size the structural components of the mounting frame and the appropriate hangers. Structural channels in a field-provided frame should be mounted perpendicular to the unit's footing channels. The following critical points must be observed when the HPWH unit is suspended from the ceiling:

1. Hanging rods must not obstruct access doors.
2. VIBRATION ISOLATORS ARE REQUIRED to prevent transmission of mechanical vibration into the building structure. Selection of suitable isolators should be made by a qualified engineer.
3. Installation must meet local seismic restraint requirements.

PAD MOUNTING

The HPWH may be pad mounted. Vibration isolator mounts MUST BE placed between the unit and the equipment pad to prevent mechanical vibration transmitting into the building structure. Selection of appropriate vibration isolators should be made by a qualified engineer. Unit must be level and elevated at least 6" above floor to avoid dust and debris from entering the unit and permit connection of the condensate trap. See Condensate Drain Line on page 18.

ELECTRICAL CONNECTIONS

CAUTION

CORRECT POWER SUPPLY!

- Ensure the power supply at the job site matches the voltage and phase listed on the HPWH rating label before connecting power to the HPWH unit.
- Energizing the HPWH with the wrong voltage or phase will cause permanent damage to the HPWH unit.
- Damage caused to the HPWH as the result of applying the wrong voltage or phase is not covered under the limited warranty.

CORRECT VOLTAGE AND PHASE

The HPWH units covered by this instruction manual can be ordered with multiple power supply voltage and phase configurations. Ensure the power supply voltage and phase at the job site matches the power supply ratings listed on the HPWH rating label BEFORE INSTALLATION BEGINS.

Voltage applied to the HPWH should not vary more than +5% to -10% of the voltage requirement listed on the HPWH rating label for satisfactory operation.

Energizing the HPWH with the wrong voltage and/or phase may cause permanent damage to HPWH components. Damage resulting from applying the wrong power supply voltage or phase to the HPWH is not covered under the limited warranty.

⚠WARNING

Electrical Shock Hazard

- Before removing any access panels or servicing the water heater, make sure the electrical supply to the water heater is turned “OFF.”
- Failure to do this could result in death, serious bodily injury, or property damage.

BRANCH CIRCUIT DISCONNECT SWITCH

The power supply wiring and equipment grounding must be installed in accordance with local codes or, in the absence of local codes, the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code, CSA C22.1.

Install an adequately fused disconnect switch as close to the unit as possible. See unit rating label for maximum fuse size (MFS).

Run the power supply lines from the disconnect to the control box at the side panel of the unit. Connect the lines to the terminals on input side of power distribution block L1 & L2 for single phase and L1, L2 & L3 for three phases. Connect ground wire to ground lug.

See Minimum Circuit Ampacity & Maximum Fuse Size on page 12 for wire, fuse and breaker sizing information.

TRANSFORMER CONFIGURATION 208 VAC MODELS

The transformer leads must be changed on units connected to a 208 VAC power supply as described below. See Unit Wiring Diagrams-Fuse Sizes on pages 32-36 for component locations.

BEFORE CONNECTING THE THERMOSTAT, turn on power to the HPWH momentarily and measure the voltage to the primary winding of the transformer at the F3 fuse block. If the measured voltage is above 215 VAC no changes are necessary.

If the measured voltage is 215 VAC or less, then the primary leads of the transformer must be changed from the 230 VAC tap to the 208 VAC tap. Do this by disconnecting the orange wire from the transformer primary terminal and replacing with the red wire. Before reapplying power, ensure orange lead is safely isolated with a wire nut and electrical tape.

WATER CONNECTIONS

Water piping must be installed in accordance with the instructions in this manual and all local plumbing codes having jurisdiction. See Figure 7 and Figure 8 on page 18 and the Piping Diagrams on page 41 as a reference for these instructions.

INSTALLATION INSTRUCTIONS

1. This HPWH unit is not designed to supply hot water directly to hot water fixtures. The HPWH unit must be installed with a separate storage tank as shown in the water piping diagrams in this instruction manual.
2. Water lines installed between the storage tank and the HPWH unit MUST NOT be less than the water pipe connection sizes on the unit. See Table 4 on page 13.
3. The HPWH should be plumbed directly to the storage tank.
4. The cold water supply must be connected directly to the storage tank at a low connection port on the storage tank on single tank and two tank preheat piping configurations for optimal efficiency. See Figure 7 and Figure 8 on page 18.
5. The cold water supply MUST NOT be connected the inlet (entering/return) water line to the HPWH unit.
6. The outlet (supply) water from the HPWH unit should connect to a middle or lower port on the storage tank.
7. The inlet (return) water from the HPWH unit should connect to a port on the storage tank lower than the outlet.
8. A heat trap should be installed between the storage tank and the backup water heater on two tank preheat systems. See Piping Diagram on page 41.
9. A T&P valve must be installed in the designated opening on the storage tank per the tank manufacturer’s requirements. See Temperature - Pressure Relief Valve on page 14.
10. Factory installed water pumps can provide the unit specified water flow for up to a total of 50 equivalent feet of piping between the HPWH unit and the storage tank. IE: 25 equivalent feet of inlet piping and 25 equivalent feet of outlet piping. Do not exceed this maximum equivalent feet on models equipped with factory-installed pumps.
11. For optimal performance minimize the equivalent length of water piping between the HPWH and storage tank.
12. Building hot water recirculation loop should be connected to the inlet of the backup water heater on two tank preheat configurations or to the storage tank on single tank configurations. The recirculating pump MUST BE controlled by a field supplied thermostat installed in the building recirculation return line near the storage tank or back up heater. The thermostat should stop pump operation the moment the recirculation line is hot.
13. Use swing-type check valves (not spring-loaded types) on the water outlet lines of all HPWH units plumbed in parallel to prevent hot water short-circuiting.
14. Water lines shared by parallel HPWH units must be large enough to handle combined water flows. Flow rates through the heat pumps and tank(s) must be balanced. See Table 1 on page 9 for HPWH unit flow rates.

15. All components in the hot water supply system must be adequately sized to meet peak water flow requirement
16. When the HPWH unit is installed above the storage tank install a Tee fitting at a high point in the outlet water line leaving the unit. Install a purge valve, or if required by local code, a T&P valve (temperature and pressure relief) in a branch of the Tee fitting that can be used to purge air from the HPWH unit during start up. See Figure 7 and Figure 8.
17. DO NOT install a (T&P) relief valve in the outlet line of the HPWH unit unless required by local code.
18. Dielectric unions should be installed a the inlet and outlet water lines to the HPWH unit.
19. All HPWH water piping must be insulated.

SINGLE TANK CONFIGURATION

The HPWH must be plumbed to storage tank. The maximum stored water temperature the HPWH unit can produce in the storage tank is 140°F (60°C). Figure 7 shows a typical storage tank piping configuration. Tank ports must be large enough to handle the peak water flow rates through the water heating system. See Piping Diagrams on page 41 for detailed piping diagrams.

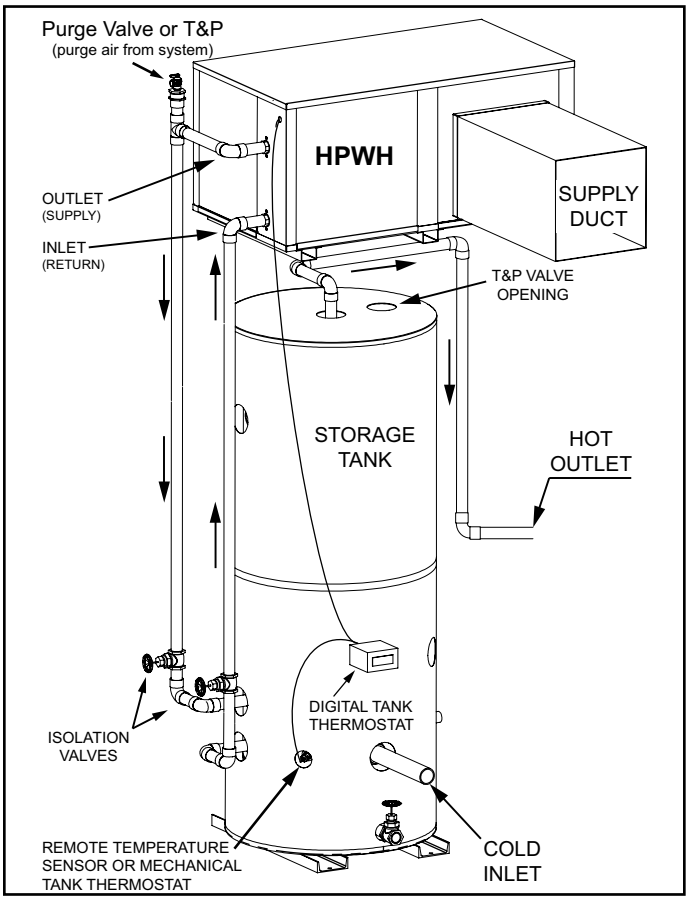


Figure 7

TWO TANK PRE HEAT CONFIGURATION

When water temperatures above 140°F (60°C) are required the HPWH and storage tank are piped in series (upstream) with a backup water heater. See Water Temperature on page 10. The backup water heater will raise the temperature of the preheated water to the final system temperature required. Figure 8 shows a typical preheat piping configuration.

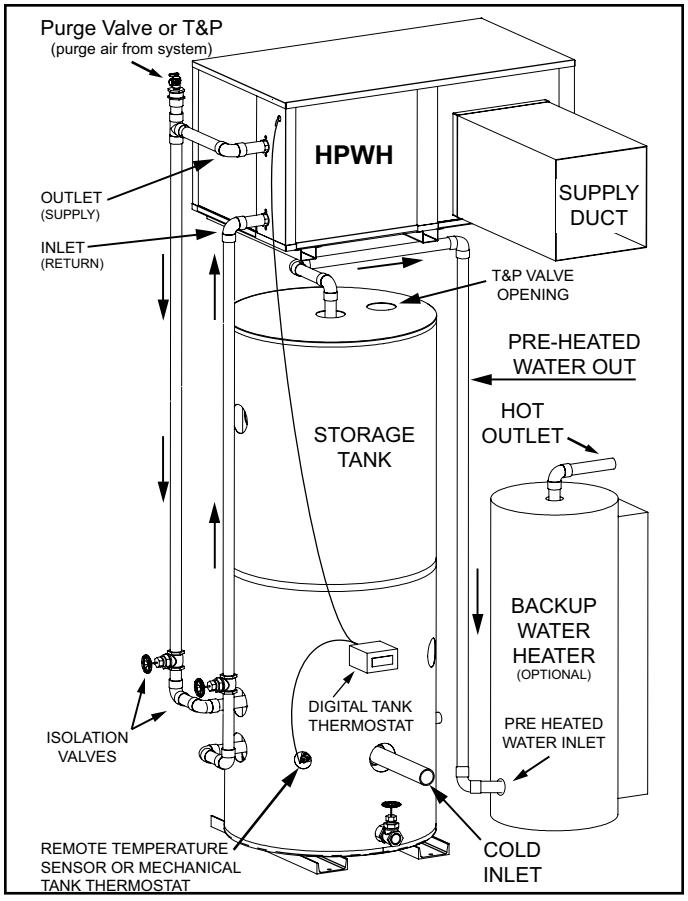


Figure 8

CONDENSATE DRAIN LINE

The HPWH unit must be plumbed to permit condensate drainage. Drain piping connected to the HPWH unit should be a minimum 3/4 inch PVC or equivalent. A condensate trap must be used to overcome the internal vacuum to permit proper drainage. See Figure 9 below for recommended drain trap dimensions.

The condensate must be discharged to a suitable drain. If a drain is inaccessible, use a condensate pump.

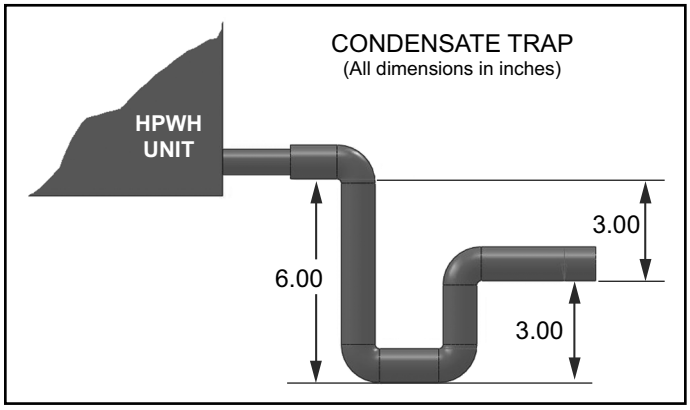


Figure 9

STANDARD TANK THERMOSTAT

Standard tank thermostats (Aquastat) already installed in the storage tank may be used instead of the factory supplied Digital Tank Thermostat if desired. Ensure the standard tank thermostat is installed the lower third of the tank. Wire the existing tank thermostat to the HPWH terminal strip. See Standard Tank Thermostat Wiring on page 38.

DIGITAL TANK THERMOSTAT INSTALLATION

1. Mount the thermostat on the storage tank jacket when or at a suitable location close to the storage tank, see Figure 10.
2. Install three conductor low voltage wiring between the thermostat's terminal strip and the HPWH unit's terminal strip as shown in the Digital Tank Thermostat Wiring on page 37. Use standard 18 AWG thermostat wire or equivalent.

TEMPERATURE SENSOR INSTALLATION

The HPWH unit is shipped from the factory with a Digital Tank Thermostat that includes a Temperature Sensor and a Sensor Well. To install the Sensor Well:

1. Coat the Temperature Sensor and the inside of the Sensor Well with heat transfer compound (paste) such as Honeywell P/N 107408 or equivalent.
2. Secure the Temperature Sensor inside the Sensor Well with the supplied clip or with an appropriate stop.
3. Check the condition of the anode rod(s) on existing storage tanks and replace if depleted.
4. Install the sensor well in the storage tank's designated temperature control opening. Typically a 3/4" female NPT fitting in the lower portion of the storage tank.
5. DO NOT install Sensor Well or temperature sensor in the upper half of the storage tank.
6. Do not install Sensor Well near the cold water supply connection to the storage tank to prevent short cycling.
7. Install two conductor low voltage wiring between the Temperature Sensor and Digital Tank Thermostat terminal strip as shown in the Digital Tank Thermostat Wiring on page 37. Wiring can be installed up to 650 feet using 24 AWG thermostat wire or equivalent.

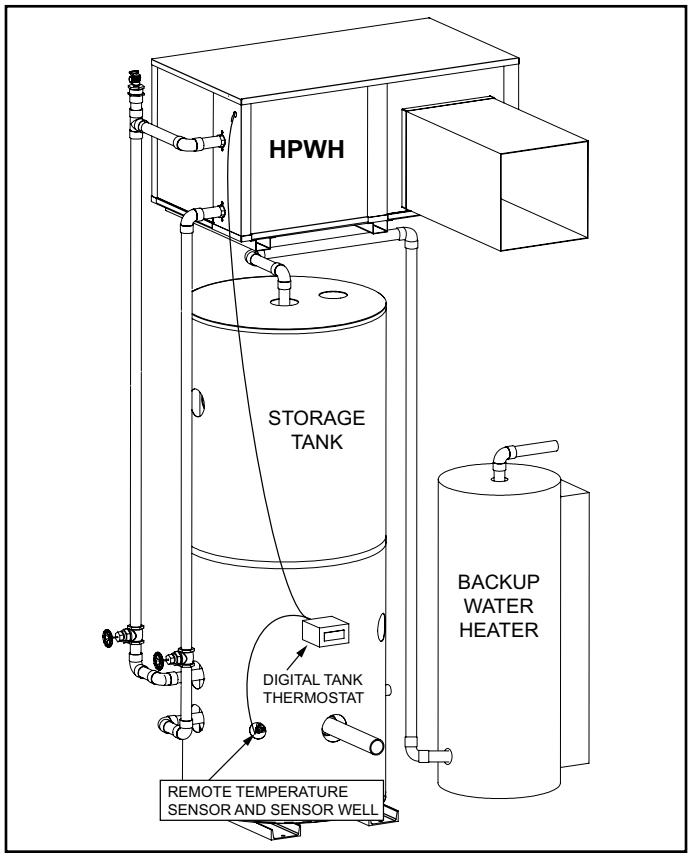


Figure 10

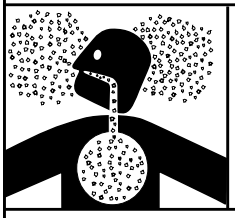
AIR FLOW AND DUCTING

GENERAL GUIDELINES

Review Locating The Water Heater on page 10, and this section prior to connecting ductwork to the HPWH. See Features And Components on page 8 to locate components.

⚠WARNING

Breathing Hazard - Carbon Monoxide Gas



- Do not duct air from a garage or other space where potentially harmful fumes from solvents, chemicals or exhaust from automobiles are present into any other space in the building structure.
- Gas and carbon monoxide detectors are available.

Breathing carbon monoxide can cause brain damage or death. Always read and understand instruction manual.

The supply (outlet) air from a HPWH installed in a garage or a unit drawing return (inlet) air from a garage or any area where solvents or other chemicals that emit potentially harmful fumes are stored or automobiles are located must never be ducted to any other space inside the building structure. This would include all occupied and unoccupied spaces such as attics or basements. Potentially harmful fumes and vapors could be introduced into occupied spaces. See Unit Placement on page 16.

DUCT SIZING

Supply and return air ducting must be sized properly to insure adequate airflow. Table 6, Table 7 and Table 8 on page 21 provide requirements for the total equivalent supply and return duct lengths allowed. These tables are based on the most common duct material options available today. Exceeding those maximum lengths will adversely affect the operation of the heat pump.

DUCT INSULATION

The cooled air from the HPWH may be below room dew point. Insulate the supply duct to prevent dripping from moisture condensing on the duct.

It is not necessary to insulate return ducts unless the air in the return duct is lower than the room air. Also consider insulating all ductwork to reduce blower noise from the unit.

MAKE DUCT CONNECTIONS

Install all ductwork to and from unit in accordance with all applicable codes. Duct construction must allow unit to operate within the limits of the unit external static pressure as in the HPWH unit's performance and specification sheets. See Table 1 on page 9 also.

Use flexible connections to minimize duct-to-duct alignment problems and noise transmission.

Install ductwork, accessory grilles, and plenums so that they do not restrict access to filter and so they prevent dirt, dust, and debris from settling in unit.

BUILDING AIR PRESSURE

When installing ducting to or from an alternate location (other than the installed space) both the supply (outlet) and return (inlet) air may need to be ducted to prevent positive or negative building air pressure conditions within the installed space.

Negative Pressure

Ducting supply air only to an alternate location, such as the outdoors, may cause excessive negative air pressure inside the building envelope.

Excessive negative pressure inside the building structure may result in cold or hot air from outdoors being drawn inside the building and place additional load on space heating and cooling equipment. Negative air pressure in buildings can also cause reverse flow in chimneys and gas vents.

Positive Pressure

Ducting return air only from an alternate location, such as the outdoors, may cause excessive positive air pressure inside the building envelope.

Excessive positive pressure inside the building structure may place additional load on space heating and cooling equipment by interfering with the delivery of conditioned air.

WHEN TO INSTALL DUCTING

HPWH units are often installed in unoccupied spaces or equipment rooms where there is an ample source of ambient heat and no need to redirect the supply air to another location. Ductwork is not necessary in these circumstances. See Heat Source and Conditioned Space on page 10 and Unconditioned Space on page 11.

Typical applications when ducting is installed.

- Duct supply (outlet) air to alternate location for spot cooling or discard supply air not wanted in the installed space.
- Duct return (inlet) air from an alternate location (outdoors, warm equipment room) to optimize efficiency.

SUPPLY AIR DUCTING

Observe and follow these guidelines and instructions when installing supply (outlet) air duct:

⚠ DANGER

Sharp Spinning Blades!

The blower operates at a high RPM that can cause injury. To prevent inadvertent access to the blower opening, supply ducting or other suitable means to prevent access must be provided.

1. When duct work is not field connected to the supply air outlet on the HPWH unit a field supplied safety guard must be installed over the supply air connection. Failure to comply could result in severe injury.
2. All ductwork and plenums shall be field supplied or fabricated.
3. The total equivalent length of all supply and return air ducting must not exceed the maximum equivalent lengths shown in Table 6 or Table 7 on page 21.
4. Cooling output (supply air) from the HPWH is supplemental only and must not be factored into sizing calculations for space cooling equipment. Cooling output is only produced when the HPWH is operating to satisfy a water heating demand. Once the storage tank temperature is satisfied, the HPWH will stop until the next water heating demand is initiated regardless of space cooling needs.
5. Depending on the temperature of the air entering the HPWH unit the supply air may not be suitable for supplemental space cooling purposes.

   The air temperature drops approximately 12°F to 20°F (7°C to 11°C) as it flows through the HPWH unit. If the return air to the HPWH unit is derived from a location that is above 80°F (27°C) the supply air from the HPWH unit will not be suitable for offsetting the building cooling load. This will often be the case when the return air is ducted from a warm equipment room or from the outdoor atmosphere. In these circumstances do not duct supply air to another location for spot cooling.
6. Ducting supply air only to an alternate location, such as the outdoors, may cause excessive negative air pressure inside the building envelope.

   Provision must be made to prevent a negative pressure in the installed space or building envelope. Return air must be supplied to the HPWH from the alternate location through ducting or louvers that communicate with the alternate location where the supply ducting terminates. See the Return Air Ducting section that follows.

RETURN AIR DUCTING

Observe and follow these guidelines and instructions when installing return (inlet) air duct:

1. All ductwork and plenums shall be field supplied or fabricated.
2. The total equivalent length of all supply and return air ducting must not exceed the maximum equivalent lengths shown in Table 6 or Table 7 on page 21.
3. When installing return air duct to the HPWH unit a field supplied/fabricated filter access door must be installed.
4. Ducting return air only from an alternate location, such as the outdoors, may cause excessive positive air pressure inside the building envelope.

   Provision must be made to prevent a positive pressure in the installed space or building envelope. Supply air must be supplied to the HPWH from the alternate location through ducting that communicates with the alternate location from where the return air is derived. See the preceding Supply Air Ducting section.
5. If the alternate location where return air is derived from has temperatures above 95°F (35°C) for extended periods the accessory High Ambient Air Kit should be installed for optimum efficiency. See page 39.

BLOWER ASSEMBLY ADJUSTMENTS

⚠ DANGER

Sharp Spinning Blades!

The blower operates at a high RPM that can cause injury. To prevent inadvertent access to the blower opening, supply ducting or other suitable means to prevent access must be provided.

The HPWH blower is a belt driven assembly. The blower belt and sheaves are factory pre-set and should not require any field adjustment. The blower assembly should be checked to ensure the blower wheel moves freely and that sufficient tension is on the blower belt. If belt looseness is suspected, check the blower maintenance section of the manual for re-set recommendations.

TABLE 6

METAL DUCT											
			DUCT SIZE (INCHES)								
			6	8	10	12	14	16	18	20	22	24
MODEL	CFM	EXT (in WG)	MAXIMUM EQUIVALENT LENGTH (FEET)									
AWH-35	1040	0.35	3	14	41	102	208	417				
AWH-55	1650	0.35		6	17	41	90	173	308			
AWH-75	2150	0.35		3	10	25	52	105	188	313		
AWH-100	3200	0.35			6	14	31	59	107	180	292	
AWH-115	3200	0.35			5	12	26	49	87	148	234	
AWH-140	3800	0.35			4	9	18	35	64	110	170	262
AWH-170	4900	0.35				5	12	22	39	67	107	167
ELBOW SIZE (IN)			6	8	10	12	14	16	18	20	22	24
EQUIVALENT FEET ONE 90° ELBOW			18	23	29	35	41	47	53	58	64	70

Note 1: Gradual rectangular to round transition must be used. Angle not to exceed 30°

Note 2: If elbows are used, equivalent length of elbows must be added to duct length.

TABLE 7

FLEXIBLE DUCT											
			DUCT SIZE (INCHES)								
			6	8	10	12	14	16	18	20	22	24
MODEL	CFM	EXT (in WG)	MAXIMUM EQUIVALENT LENGTH (FEET)									
AWH-35	1040	0.35		6	18	45	93	185				
AWH-55	1650	0.35		3	8	18	40	77	137			
AWH-75	2150	0.35			5	11	23	47	83	139		
AWH-100	3200	0.35			3	6	14	26	48	80	130	
AWH-115	3200	0.35				5	12	22	38	66	104	
AWH-140	3800	0.35				4	8	16	29	49	76	116
AWH-170	4900	0.35				2	5	10	18	30	48	74
ELBOW SIZE (IN)			6	8	10	12	14	16	18	20	22	24
EQUIVALENT FEET ONE 90° ELBOW			18	23	29	35	41	47	53	58	64	70

Note 1: Gradual transition must be used. Angle not to exceed 30°

Note 2: If elbows are used, equivalent length of elbows must be added to duct length.

TABLE 8

DUCT CONNECTION SIZES				
UNIT	SUPPLY		RETURN**	
	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL
AWH-35	14	14	20.25	27
AWH-55	16	16	24	35
AWH-75	18	18	24	47
AWH-100	22	22	38	49.5
AWH-115	22	22	38	49.5
AWH-140	24	24	38	49.5
AWH-170	28	28	38	63.75

**When installing return duct to the unit, a filter access door must be included in the field fabrication.

INSTALLATION CHECKLIST

The list below represents some of the most critical installation requirements that, when overlooked, often result in operational problems, down time and needless parts replacement. This is not a complete list. Before performing any troubleshooting procedures use the list below to check for installation errors. Costs to correct installation errors are not covered under the limited warranty. Ensure all installation requirements and instructions in this manual have been followed.

LOCATION

1. Ensure the HPWH is located where there is a adequate supply of ambient heat for optimal performance or that the HPWH is ducted to such a location.
2. Ensure required clearances are maintained and there is access for servicing. See Clearances on page 11.
3. Ensure the HPWH is properly supported. See Ceiling Suspension and Pad Mounting on page 16.

AIR FLOW & DUCTING

4. Ensure all supply and return ductwork connected to the HPWH is properly sized, does not exceed maximum equivalent length requirements and is installed according to the instructions in this manual. See Air Flow and Ducting on page 19.
5. Ensure all supply duct work is insulated to prevent condensation from forming on the ductwork.
6. Ensure all return air duct is insulated if the return air temperatures are expected to fall below the surrounding room air temperature during normal operation.

WATER PIPING

7. Ensure the outlet (supply) and inlet (return) water piping connected to the HPWH are not less than the connection size on the unit. See Table 1 on page 9.
8. Ensure swing-type check valves (not spring-loaded types) are installed on outlet lines of all heat pumps plumbed in parallel to prevent hot water short-circuiting.
9. When the HPWH is connected to a storage tank ensure the storage tank is equipped with a properly rated and sized Temperature and Pressure (T&P) relief valve. Refer to the storage tank manufacturer's instructions for T&P valve sizing and installation requirements.

   NOTE: This is a critical installation requirement that must not be overlooked. Call the toll free technical support phone number on the back cover of this manual for further assistance.
10. DO NOT install a T&P valve in the outlet (supply) water line of the HPWH unless required by local code.
11. Ensure the maximum lengths of 25 equivalent feet of supply piping and 25 equivalent feet of return piping are not exceeded on HPWH units equipped with a factory installed circulation pump. Exceeding these lengths will cause the unit to malfunction and/or the control system to lock out.
12. Ensure isolation valves are installed on the HPWH supply and return water line at the storage tank for servicing and purging the air from the HPWH during start-up.
13. Ensure the cold water supply is not connected directly to or Tee fitted to the inlet water line on the HPWH. See the Service and Installation Notes for Inlet & Outlet Water Temperature on page 10. See Figure 7 and Figure 8 on page 18.
14. On two tank preheat piping configurations ensure the cold water supply is not connected to the back up water heater.
15. Connect building recirculation loop piping to the backup water heater inlet on two tank preheat piping configurations.
16. Ensure the building recirculation loop pump is controlled by a field supplied line thermostat and that it stops the pump when the recirculation line is hot. See Building Recirculation Pump Wiring Diagram on page 40.
17. When the HPWH unit is installed above the storage tank install a Tee fitting at a high point in the outlet water line with a purge valve to bleed air during start up.
18. Though not required, the manufacturer recommends installing a strainer at the inlet water line on the HPWH to help prevent scale build up in the heat exchanger. Service costs to clear blockages from the HPWH unit's heat exchanger due to debris are not covered under the limited warranty.

CONDENSATE DRAIN

19. Ensure there is a water trap installed in the condensate line at the HPWH. Condensate will not drain without a water trap.
20. Ensure the condensate drain is properly connected to the HPWH and draining freely to a suitable floor drain or condensate lift pump that discharges condensate to a remote location. See Condensate Drain Line on page 18.

ELECTRICAL

21. BEFORE ENERGIZING THE UNIT ensure the power supply voltage and phase matches the requirements on the HPWH rating label. Damage resulting from applying the wrong voltage or phase is not covered under the limited warranty.
22. On HPWH units connected to 208 VAC power supplies ensure the transformer has been properly configured. Damage caused by failure to configure the transformer properly is not covered under the limited warranty. See Transformer Configuration 208 VAC Models on page 17.
23. Ensure the power supply breaker or the fuses disconnect switch are within the requirements for the unit as shown on the HPWH rating label.
24. Ensure the power supply wiring meets the MCA (Minimum Circuit Ampacity) requirements shown in this manual and on the HPWH rating label.
25. Ensure the HPWH is properly grounded according to the instructions in this manual and local code requirements.
26. Ensure the power supply connections to the HPWH are connected properly and securely tightened.
27. Ensure all electrical connections in the HPWH control panel are securely tightened.
28. When the factory supplied Digital Tank Thermostat is used:
    - Insure the thermostat and sensor are installed properly. See Digital Tank Thermostat Installation and Temperature Sensor Installation on page 19.
    - Ensure the Temperature Sensor and supplied Sensor Well have been installed in a designated temperature control opening in the lower part of the storage tank.
    - Ensure the supplied Temperature Sensor is coated with a suitable heat transfer compound (paste).
    - Ensure the Temperature Sensor has been properly wired to the terminal strip of the Digital Tank Thermostat. See Figure 15 on page 37.

START UP

This start-up refers to several tools and test instruments needed to complete the procedure. See Required Tools and Materials on page 16.

⚠ WARNING

Electrical Shock Hazard

- Turn off power to the water heater before performing any service.
- Label all wires prior to disconnecting when performing service. Wiring errors can cause improper and dangerous operation.
- Verify proper operation after servicing.
- Failure to follow these instructions can result in personal injury or death.

1. Ensure the Installation Checklist has been completed.
2. Ensure the HPWH, storage tank and water system has been purged of air and all valves are in the position for normal operation.
3. Turn on power at the circuit breaker or disconnect switch serving the HPWH.

   If the HPWH does not start immediately:

   - Wait 5 minutes in case the anti short cycle timer has halted operation. This control system feature protects the HPWH from rapid short cycling that can cause permanent damage to the unit.
   - Ensure the operating set point on the tank temperature control is adjusted high enough to initiate a call for heat. The recommended setting is 120°F to 140°F (29°C to 60°C).
   - DO NOT set the operating set point on the tank temperature control above 140°F. See Water Temperature Range on page 7.
   - Ensure the Differential Set Point is not set too high. Higher differential settings will cause greater temperature swings in system temperature. Lower differential settings can cause unit short cycling. The recommended setting is 3°F.
   - If the unit does not start after all of the above procedures have been followed. Refer to the troubleshooting section of this manual.
4. Securely attach surface mount thermometers or temperature sensors to the inlet (entering) and outlet (leaving) water lines near the HPWH cabinet. If there are thermometers installed in the inlet and outlet in close proximity to the HPWH water connections they can be used for the following check.

   Ensure the water outlet (supply) and inlet (return) valves are fully open. Start the HPWH and allow it to operate for 5 minutes. With the HPWH operating record the inlet and outlet temperatures.

   During normal operation, the outlet line should be 8°F to 12°F (4°C to 7°C) hotter than the inlet line. This is the temperature rise through the heat exchanger inside the HPWH unit.

   Note: Temperature rise and water flow rate through the heat exchanger inside the HPWH are uniformly linked. As water flow is decreased the temperature rise will increase and as water flow is increased the temperature rise will decrease. Because of this relationship between temperature rise and flow rate this test can be useful to determine if the flow rate through the heat exchanger is adequate. Other factors may also affect water flow rate and temperature rise such as debris or lime scale build up inside heat exchanger or water pump operation.

   If the temperature rise through the HPWH is consistently lower than 8°F the outlet (supply) valve can be throttled slightly closed to reduce the water flow rate. This may be necessary on installations with a minimum of water piping between the HPWH and the water system or tank.

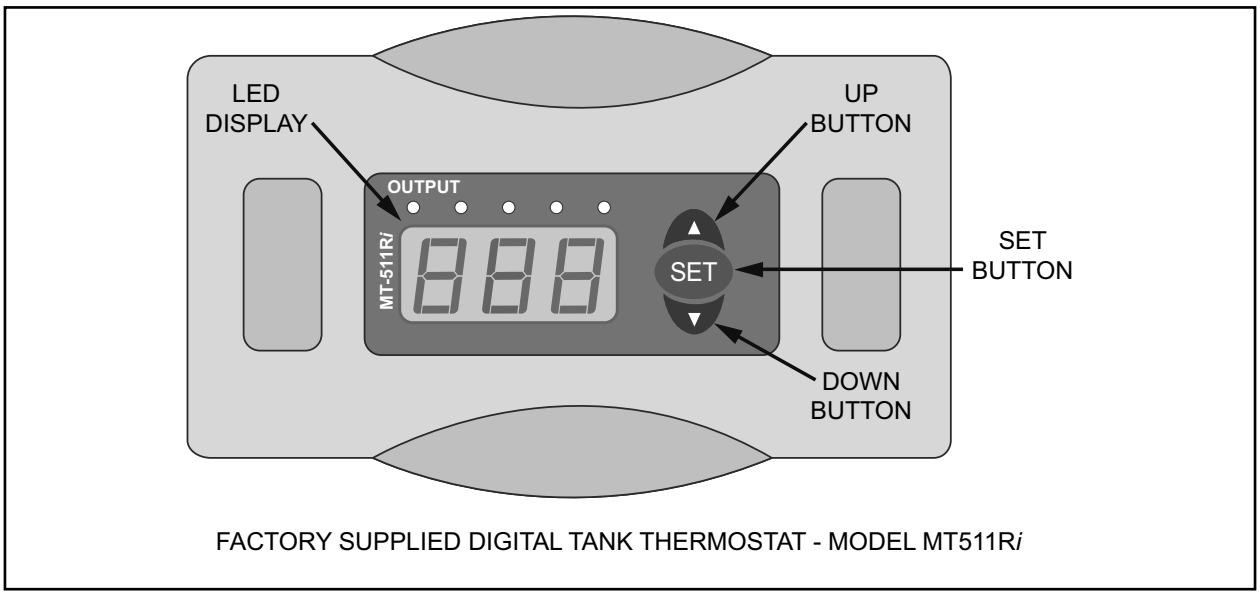
   Throttling should be done in small increments, no more than 1/8 turn of the valve handle at a time. The HPWH must run be allowed to run for approximately 5 minutes between each adjustment before the temperature rise is measured again. If the outlet valve is throttled during start up, mark the valve position and remove the valve handle to ensure it is not accidentally changed.

   If the temperature rise through the HPWH is consistently greater than 12°F the water flow may be restricted. Ensure all water valves between the HPWH and the tank or water system are fully open. Ensure the water pump inside the HPWH is running. If the temperature rise continues to be excessive call the toll free technical support phone number on the back cover of this manual for further assistance.
5. Using thermometers or temperature sensors, measure the temperature of the return (inlet) air to the HPWH and the supply (outlet) air leaving the unit. The outlet air temperature should be 12°F to 20°F (7°C to 11°C) cooler than the inlet air.

   Air temperature and flow rate through the heat pump determines what this temperature difference will be. The higher the flow rate the lower the temperature differential will be. The higher the air temperature, the higher the differential will be.

   If the temperature differential between return and supply air is not within the range stated above ensure the air filters are clean and there is nothing blocking the air flow on either side of the airstream or ductwork attached to the HPWH. Ensure the ductwork is not smaller than the minimum required size and or longer than the maximum length allowed in the Air Flow & Ducting section of this manual. Ensure the evaporator coil is not damaged (fins flattened) or dirty.

   If the temperature differential continues to be outside the range mentioned above call the toll free technical support phone number on the back cover of this manual for further assistance.
6. When all of the above procedures are complete adjust the tank temperature control set point to desired system temperature, not to exceed 140°F (60°C). Remove all test instruments and replace all cabinet doors.



FACTORY SUPPLIED DIGITAL TANK THERMOSTAT - MODEL MT511R*i*

Figure 11

OPERATION

When the water temperature in the storage tank as sensed by the Digital Tank Thermostat's temperature sensor reaches the Tank Temperature Set Point the thermostat will end the heating cycle and HPWH unit will shut down.

A heating cycle will be activated again when the water temperature sensed at the temperature sensor in the storage tank drops below the Tank Temperature Set Point minus the Differential Set Point.

See Figure 11 above as a reference for the instructions that follow.

Notes: The Tank Temperature Set Point must never be set higher than 140°F (60°C). This is the maximum temperature the HPWH can heat the water in the storage tank to. See Maximum System Temperature on page 10.

The factory Differential Set Point is 3°F (1.7°C). This is the recommended setting. The Differential Set Point should never be set lower than the factory setting to ensure the HPWH unit does not short cycle. This Differential Set Point should not be set any higher than 5°F (2.8°C).

TANK TEMPERATURE SETTING

1. Press and hold the **SET** button for 1 second until [**t**] appears on the LED display then release the button.
2. Use the **UP** and **DOWN** buttons to adjust to the desired tank temperature set point.
3. When complete press the **SET** button to save the change.

DIFFERENTIAL SETTING

1. Press and hold the **UP** and **DOWN** buttons simultaneously for 5 seconds until [**dIF**] appears on the LED display then release the buttons.
2. Use the **UP** and **DOWN** buttons to adjust to the desired differential set point.
3. When complete press the **SET** button to save the change.
4. The operating mode of the thermostat will be shown on the LED display next as:

   [**CoL**] for Refrigeration/Cooling mode or

   [**Hot**] for Heating mode.

   Note: the factory for operating mode is [Hot] and should not be changed.

TEMPERATURE UNITS SETTING (°F/°C)

To define the temperature units that thermostat will display:

1. Press and hold the **UP** and **DOWN** buttons simultaneously for 30 seconds until [Uni } appears on the LED display then release the buttons.
2. Use the **UP** and **DOWN** buttons to select [**°F**] or [**°C**].
3. When complete press the **SET** button to save the change.
4. [**FAC**] will appear on the LED display after saving the change and the display will then return to normal operation and display the tank temperature.

   Note: Each time the temperature unit display setting is changed all set points must be re-configured

DISPLAYING MIN/MAX TANK TEMPERATURES

The digital thermostat stores the minimum and maximum tank temperature readings in memory. To display this data:

1. Press the **UP** button.
2. The recorded minimum temperature will be displayed followed by the recorded maximum temperature.
3. Note: to reset the recorded values press and hold the **UP** button while the minimum and maximum values are being displayed.
4. [rSt] will appear confirming that the recorded minimum and maximum temperatures have been cleared.

DISPLAY SIGNALS

During normal operation the LED display will show the actual measured tank temperature from the tank temperature sensor.

The LED light located above the temperature display (Output) indicates that the heat pump, the thermostat output, is on.

If the temperature sensor is detached or the temperature is out of the specified range [**Err**] will be displayed on the LED display.

MAINTENANCE AND SERVICE

ROUTINE MAINTENANCE

Warning: When possible, disconnect all power to the unit and follow the prescribed lock - out/tag - out procedure to prevent accidental electrocution. Should the unit have to be serviced with live electricity, only trained and qualified technicians should carry out the service. Failure to follow all of the safety warnings may result in serious injury or death.

The temperature-pressure relief valve must be manually operated at least once a year. Caution should be taken to ensure that (1) no one is in front of or around the outlet of the temperature-pressure relief valve discharge line, and (2) the water manually discharged will not cause any bodily injury or property damage because the water may be extremely hot. If after manually operating the valve, it fails to completely reset and continues to release water, immediately close the cold water inlet to the heat pump, follow the draining instructions in the storage tank manual, and replace the temperature-pressure relief valve with a properly rated/sized new one.

If you do not understand these instructions or have any questions regarding the temperature-pressure relief valve call the toll free number listed on the back cover of this manual for technical assistance.

AIR FILTERS

Note: If return duct is connected to the unit, be sure to install a filter access door.

Initially, check filters on a monthly basis for dust buildup. Replace throw-away cotton media filters when necessary with new filters. Make sure the arrows on the filter are pointing in the direction of the air flow.

An aluminum mesh filter should be used for applications with significant grease or dust buildup. To clean, wash under a stream of hot water to remove the dirt and lint. To remove grease, apply a grease cutting soap and thoroughly rinse. Allow the filter to dry. Reinstall the filter.

DRAIN PAN

Warning: Read all of the warnings on the bottle of the cleaning products used for drain pan cleaning. Follow all instructions for personal protection and safe application of the products. Before cleaning the drain pan, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

The condensate pan and drain line must be checked for cleanliness, growth and blockage at least every six months.

To clean drain pan, start by disconnecting the power to the unit. Wear the appropriate personal protective equipment prescribed by the cleaning product instructions. Apply the cleaning solution and scour the sides of and bottom of the drain pan. Remove all large solid particles that could potentially clog up the drain line. If algae or mold are found growing in the pan, after cleaning, apply a mild bleach and water solution and brush on the growth areas. Rinse the drain pan thoroughly with water and dry for a final visual inspection.

BLOWER ASSEMBLY

Before performing any maintenance on the blower assembly, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

Inspect and tighten all bearing collar and wheel set screws after the first 50 to 200 hours of operation and there after, at least every six months. During inspection, visually check the drive belt for wear or cracking. Replace as necessary, but do not apply any belt dressing products.

Inspect all set screws on the pulleys, wheel and bearing lock collars. Check the belt for proper tension and alignment.

Clean the blower wheel periodically as material buildup on the blades can cause a wheel imbalance that may lead to wheel or bearing failure.

The pillow block bearings come pre-lubricated from the factory. These bearings should be lubricated at least once per year. The recommended lubricant is Shell Alvania #2 or S3. Caution: overfilling the bearing my rupture the seal and damage the bearing. Apply the grease slowly as the shaft is rotating. Motor grease is not compatible for bearings. Only use grease designated for bearing use.

BLOWER MOTOR

Warning: before performing any maintenance on the blower motor, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

Every six months visually inspect the blower motor. Clean off any dust, grease or oily buildup and vacuum out any cavities in the motor. It may be necessary to periodically disassemble the motor for a more thorough internal cleaning.

Motors are permanently lubricated from the factory. It is not necessary to lubricate the motor upon start-up or lubricate as part of maintenance.

EVAPORATOR COIL

Warning: Read all of the warnings provided for the cleaning products used for refrigeration coil cleaning. Follow all instructions for personal protection and safe application of the products. Before cleaning evaporator, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

Inspect the evaporator coil for dirt buildup or fin crush on at least once per year. If there are signs of fin fold over, use a fin comb to straighten the fins. Should the coils need cleaning, follow the steps listed below:

1. Disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.
2. Wear the prescribed personal protective equipment prescribed from the cleaning product instructions.
3. Install a block-off sheet to prevent splash over into the dry sections of the AWH HPWH.
4. Prepare the cleaning solution as prescribed from the cleaning product instructions and fill the mixture into a high-pressure sprayer.
5. Start spraying both sides of the coil keeping the nozzle perpendicular to the coil at least 6 inches from the coil face. Do not exceed 600 psi.
6. Thoroughly rinse the cleaned coil with cool, clean water.
7. Straighten out any fins displaced during the cleaning using a fin comb.
8. Confirm the drain pan line is not clogged.
9. Replace all panels on the unit and wipe down any standing cleaning solution or water on or around the unit.

CLEANING INTERNAL INSULATION

Inspect the internal insulation on a yearly basis for any microbial growth. The insulation never has to be cleaned unless microbial growth is detected. If microbial growth is detected, follow the removal steps below:

1. Disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.
2. Wear the prescribed personal protective equipment prescribed from the cleaning product instructions.
3. Remove as much dirt and organic material from the insulation using a vacuum device with a HEPA filter (99.97% efficient at 0.3 micron particles). Be careful not to tear the insulation during the cleaning procedure.
4. Apply the microbial cleaning agent as prescribed by the application and usage instructions.
5. Allow the unit to dry thoroughly.
6. If necessary, apply an anti-microbial agent on the insulation per the instructions provided on the product label.
7. Discard collected microbial contaminants as required by local or state codes.

BRAZE PLATE CLEANING INSTRUCTIONS

In some applications the heat exchanger may be subjected to severe fluid conditions, including high temperture hard water conditions, causing accelerated scaling and corrosion rates, and will diminish performance.

It is important to establish regular cleaning schedules, A 5% solution of Phosphoric Acid or Oxalic Acid may be considered. Other types of solutions can be obtained from your local wholesaler. Make sure cleaning solution is applicable for stainless steel and copper and all directions are followed.

Do not heat solution. Be sure to flush heat exchanger with fresh water after cleaning. See Figure 22.

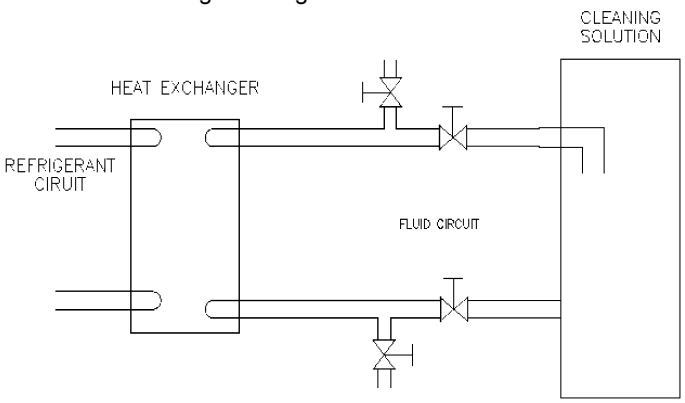


Figure 12

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIONS
Heat pump is too noisy.	1. Sheet metal fasteners are loose. 2. Operating vibration is transferring to floor or building structure. 3. 3. Blower pulley assembly loose or out of alignment.	Tighten fasteners. Place vibration dampeners underneath unit. Tighten or align pulleys.
Water on floor around the heat pump and/or water tank.	1. Tubing, valves, or fittings are leaking. 2. Heat pump is not leveled causing drain pan overflow. 3. Make sure the condensate trap has been properly installed. 4. Drain pan is overflowing. 5. Condensation forming on the bottom of unit (humid environments).	Repair leaks as necessary. Shim unit to level. See installation section. Condensate trap depth must maintain a water column during operation. Use pipe snake or compressed air to remove obstruction. Cover bottom of unit with foam insulation.
Heat pump is not running - electrical issues.	1. Circuit does not have adequate ampacity. 2. Short circuit or loose connection in field wiring. 3. Short circuit or loose connection in unit electrical cabinet. 4. Thermostat failure. 5. Phase Monitor fault (red light on phase monitor lit) 6. Defective anti-short cycle timer. 7. Compressor burn-out.	Refer to nameplate for unit requirements. Check field wiring diagram. Tighten all connections. Check for loose wiring and tighten. Replace thermostat Reset phase monitor Unknown Replace compressor (refer to compressor change-out page)
Heat pump is not running - high pressure fault	1. Thermostat setting too high 2. Room temperature over 95 F 3. Low water flow causes A. unit pump is not operating B. piping between the heat pump and storage tank exceeds 50 equivalent feet C. heat exchanger has scale buildup D. shut off valves are partially closed	Thermostat setting should not exceed 140 F. Keep heat pump off until room temperature is back in operating range Low water flow corrections replace unit pump reduce piping or add booster pump clean heat exchanger with a mild acid wash open all shut off valves
Heat pump is not running - low pressure fault	1. Room temperature below 50 F 2. Blower not operating at nameplate CFM - blower belt is broken or out of alignment filters are dirty 3. Unit does not have adequate clearances obstructing air flow 4. Loss of refrigerant	Keep heat pump off until room temperature is back in operating range Correct air-flow issue i.Replace or realign pulley assembly; tighten belt at the adjustable pulley ii. Replace filtersw iii. Relocate unit to allow for even air flow Find source of leak, repair and recharge
Water is never hot enough.	1. Thermostat setting is too low. 2. Heat pump/storage tank undersized for application. 3. Heat pump is not properly connected to storage tank. 4. Unit cooling coil is overcooling the space.	Set thermostat for storage tank to a higher temperature. Increase size of storage tank or install gas or electric heater to make up for shortfall. Refer to field piping diagrams for recommended piping. If the room air temperature is too cool, a) use back up water heating; b) duct cool air to another space; c) duct warmer air from another space to the installed room.
Cooling coil is icing.	1. Insufficient air flow through the unit 2. Low room temperature 3. Partial refrigerant loss 4. Defective TX valve 5. Clogged filter dryer	Refer to “Heat pump is not running - low pressure fault” section for correction suggestions. If room air temperature is too cool, a) use back up water heating; b) duct cool air to another space; c) duct warmer air from another space to installed room. Find source of leak, repair and recharge Replace TX valve Replace filter dryer

* Reset the heat pump by removing then restoring power to the unit at the breaker or from the manual switch. (There will be a three minute delay before heat pump restarts.) If the heat pump cuts out again on LOW or HIGH PRESSURE, additional troubleshooting is necessary to find the cause DO NOT CONTINUE TO RESET THE HEAT PUMP, AS CONTINUED SHORT-CYCLING MAY STRESS OR DAMAGE INTERNAL COMPONENTS.

CHECKING REFRIGERANT CHARGE

Servicing of the refrigeration circuit must only be performed by agencies or individuals possessing Type II or Universal certification as defined in Section 608 of the Clean Air Act. See Qualifications on page 6.

This HPWH unit is factory charged with 134a refrigerant. See the rating label on the HPWH unit and Table 9 for refrigerant charge by weight. It should not be necessary to add or remove refrigerant during installation or start up. Refrigerant lost during frequent refrigerant pressure testing can cause low refrigerant conditions. Air and water flow should always be checked first to eliminate other potential problems before checking the refrigerant charge.

Check Air Flow

Ensure the air filters are clean. Ensure the evaporator coil is clean. Ensure the blower motor belt is not worn or loose. See Figure 1 on page 8 for component locations. Correct any problems with air flow before checking the refrigerant pressures.

Check Water Temperature Rise

Always check water temperature rise through the HPWH unit's internal heat exchanger before checking the refrigerant charge. See Start Up on page 23 for information on how to measure the water temperature rise.

If the measured water temperature rise during start up was within 8°F to 12°F (4°C to 7°C) checking the charge is not necessary unless other conditions warrant testing.

If the measured temperature rise through the HPWH unit is less than 8°F (4°C) checking the charge is not necessary unless other conditions warrant testing. Short water piping runs between the HPWH and the storage tank will produce lower temperature rises and are not problematic.

If the measured temperature rise through the HPWH unit is more than 12°F (7°C) check for restrictions in the inlet and outlet water piping connected between the HPWH unit and the storage tank. On new installations ensure the maximum equivalent feet of inlet and outlet piping was not exceeded. This is the most common cause of excessive water temperature rise on new installations. See number 11 on page 22.

SUBCOOLING CALCULATION

1. Measure and record the liquid pressure at the liquid line pressure test port inside the unit.
2. Convert the recorded liquid line pressure to saturated temperature using Table 10.
3. Measure the liquid line temperature near the liquid line pressure test port inside the unit.
4. Compare the liquid line temperature to the saturated temperature in Table 10.
5. The difference between saturated temperature and liquid line temperature is the subcooling. Subcooling normal range should be 5°F to 15°F (2.8°C to 8.5°C).

SUPERHEAT CALCULATION

1. Measure and record the suction pressure at the suction line pressure test port inside the unit.
2. Convert the recorded suction pressure to saturated temperature.
3. Measure the suction line temperature near the suction line pressure test port inside the unit.
4. Compare the suction line temperature to the to the saturated temperature in Table 10.
5. The difference between saturated temperature and suction line temperature is the superheat. Superheat normal range should be 8°F to 12°F (4.4°C to 6.7°C).

TABLE 9

MODEL	FACTORY CHARGE R134A
AWH-35	2lbs, 15oz
AWH-55	3lbs, 12oz
AWH-75	6lbs, 5oz
AWH-100	7lbs, 3oz
AWH-115	7lbs, 14oz
AWH-140	10lbs, 15oz
AWH-170	13lbs, 5oz

TABLE 10

R134A SATURATED TEMPERATURE CHART		
SATURATED TEMPERATURE °F	SATURATED TEMPERATURE °C	REFRIGERANT PRESSURE (PSI)
0	-18	7
5	-15	9
10	-12	12
15	-9	15
20	-7	18
25	-4	22
30	-1	26
35	2	30
40	4	35
45	7	40
50	10	45
55	13	51
60	16	57
65	18	64
70	21	71
75	24	79
80	27	87
85	29	95
90	32	104
95	35	114
100	38	124
105	41	135
110	43	146
115	46	158
120	49	171
125	52	185
130	54	199
135	57	214
140	60	229
145	63	246
150	66	263
155	68	281

CONTROL SYSTEM

CONTROL BOARD

The heart of the control system is the Control Board which is a printed circuit board (PCB) installed inside the control box. See Figure 13 below, Figure 14 on page 30 and the Wiring Diagrams on pages 32 to 36.

The Control Board is powered by 24 VAC from the transformer. The F4 fuse on the Control Board protects the secondary winding of the transformer.

The Control Board has four (4) proving circuits that must be closed by either a factor-installed jumper wire or the dry contacts in an external control to enable HPWH operation. The Control Board also has one (1) thermostat circuit that is factory wired to the HPWH Terminal Strip. The factory supplied Digital Tank thermostat (see page 19) or a field supplied standard tank thermostat is wired to this thermostat circuit to regulate water temperature in the storage tank. See Figure 15 on page 37 and Figure 16 on page 38.

SERVICE NOTE: All five (5) of these circuits must be closed circuits or the HPWH will not operate. See items 1-5 in Figure 13 below. If the HPWH unit does not begin a heating cycle within 5 minutes (allowing time for the anti-short-cycle timer) after power is applied ensure the thermostat is calling for heat (closed contacts). is unresponsive when power is applied

PRESSURE SWITCHES

The Control Board monitors two refrigerant pressure switches, a high and a low pressure switch. If the contacts on either switch open during a heating cycle the control system will lockout and the compressor will be disabled. The blower and the pump will continue to operate as long as a call for heat is present. The cause of the pressure switch contacts opening must be corrected and the control system must be reset before the HPWH will resume compressor operation. See Table 11 for pressure switch activation pressures.

Low and High pressure switch LED lights on the Control Board will be energized during this fault condition as a diagnostic aid to indicate which switch has cased the fault condition. See Figure 14 on page 30. The low pressure switch is on a time delay (Time Safety By-Pass) to prevent nuisance lockouts during start up when the return (inlet) water may be below . This delay is set for 300 seconds from the factory.

TABLE 11

MODEL	LOW PRESSURE SWITCH Normally Open - Close On Rise		HIGH PRESSURE SWITCH Normally Closed - Open On Rise	
	Contacts Close	Contacts Open	Contacts Close	Contacts Open
AWH-35 - AWH-170	35 PSI (241 kPa) ± 5%	15 PSI (103 kPa) ± 5%	250 PSI (1,724 kPa) ± 15%	350 PSI (2,413 kPa) ± 15%

CONTROL BOARD

1. Remove the jumper when Phase Monitor is used.
2. Remove the jumper when Push Button Reset (NC contact) is used.
3. Remove the jumper when Compressor Overload Module is used.
4. Remove the jumper when ON/OFF Switch is used.

NOTE: 1-4 are all proving circuits for external control dry contacts. These circuits must be closed to enable operation. If any of these circuits are open HPWH operation will be disabled; compressor, blower and pump will not run. Jumpers must be installed for proving circuits 1-4 when external controls are not in use. Tank Aquastat (thermostat) must be connected to #5.

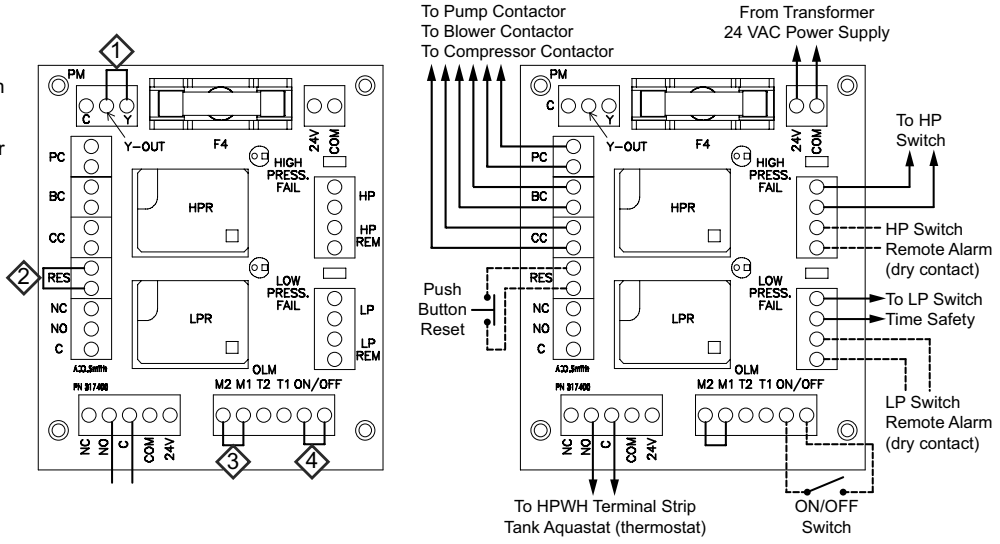


Figure 13

PHASE MONITOR

Some of the higher capacity models are equipped with Phase Monitor and Compressor Overload modules that interface with the Control Board. See Table 12 on page 31.

- If all 3 phases of power are present and in sequence, the normally open contacts (Y/Y-OUT) will close when 24 volts is applied between C and Y terminals. The green LED on the Phase Monitor will be energized.
- If the phases are out of sequence, or if one or more phase is dropped when power to the HPWH unit is turned on, the normally open contacts (Y/Y-OUT) will not close and the control system will lockout. Compressor, blower and pump operation will be disabled until the problem is corrected and the control system is reset. The red LED on the Phase Monitor will be energized.
- If a phase is dropped or becomes out of sequence while the HPWH is energized, the Phase Monitor contacts will open immediately and and the control system will lockout. Compressor, blower and pump operation will be disabled until the problem is corrected and the control system is reset. The red LED on the Phase Monitor will be energized.

COMPRESSOR OVERLOAD MODULE

The solid state sensor protectors provide excellent protection against high motor temperatures resulting from locked rotor, loss of charge, or motor overload. The combination of low voltage sensing and time delay provide positive protection against low voltage conditions which can occur in the pilot circuit in the event of a single phase condition on a three phase circuit.

There are two major components in the protection system:

1. **The Protector Sensors** are mounted internally in the motor windings. The characteristics of the sensor are such that a change in temperature causes a change in the sensor's electrical resistance, the relation between temperature and resistance remains stable and exact, so that calibration of the protection system can be made on the basis of resistance readings.
2. **The Control Module** is a sealed enclosure containing a relay or triac, transformer, and several electronic components. Leads from the internal motor sensors are connected to the module. As the motor temperature rises or falls, the resistance also rises or falls, triggering the action of the control circuit at predetermined opening and closing settings.

DELAY TIMERS

Time Delay By-Pass (Low Pressure Switch Bypass): When power is applied to the input, regardless of the state of the pressure switch, the load is energized and timing begins. After the timing delay is complete, the pressure switch will control the load. The control is reset by removing power during or after the time delay.

Anti-Short Cycle / Lockout Timer: With application of power, the load is energized. When the thermostat opens or when there is a loss of power, the load is de-energized and the delay period begins. The compressor will not start again during the delay period. The ICM203 provides true thermostat interruption protection, even in the presence of a trickle current.

HOW TO RESET THE CONTROL SYSTEM

Whenever control system has disable heating (locked out) power to HPWH unit must be turned off and on again to reset control system.

OPTIONAL FIELD SUPPLIED CONTROLS

- A field supplied low voltage momentary (reset) switch can be wired to the Control Board to reset the control system when it has been disabled by a fault condition.
- A field supplied low voltage on/off switch can be added to turn the unit off. Note: high voltage would still be present inside the control box,turn off the main disconnect or breaker before performing any maintenance or service on the HPWH unit.
- The Control Board also has provision to activate field supplied external alarms (audible/visual) during a fault condition.

Call the toll free number listed on the back cover of this manual for technical assistance with any of these optional features.

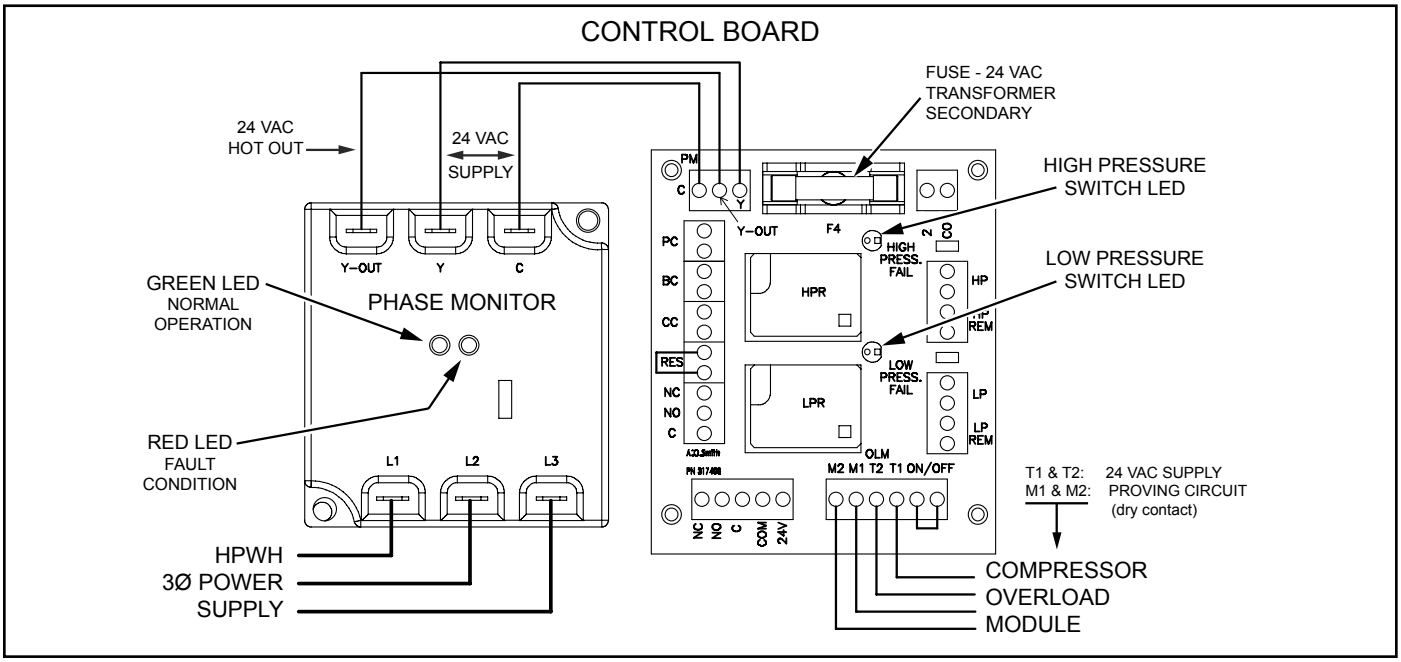


Figure 14

WIRING DIAGRAMS

Not all models are factory equipped with Phase Monitors or Compressor Overload Modules. Table 12 shows which models will include these components from the factory.

TABLE 12

MODEL	PHASE MONITOR	COMPRESSOR OVERLOAD MODULE
AWH-35	No	No
AWH-55	No	No
AWH-75	No	No
AWH-100	Yes	No
AWH-115	Yes	No
AWH-140	Yes	Yes
AWH-170	Yes	Yes

Abbreviations are used in the wiring diagrams in this section. Table 13 defines the wiring diagram abbreviations used in this section and on the wiring diagrams affixed to the HPWH units.

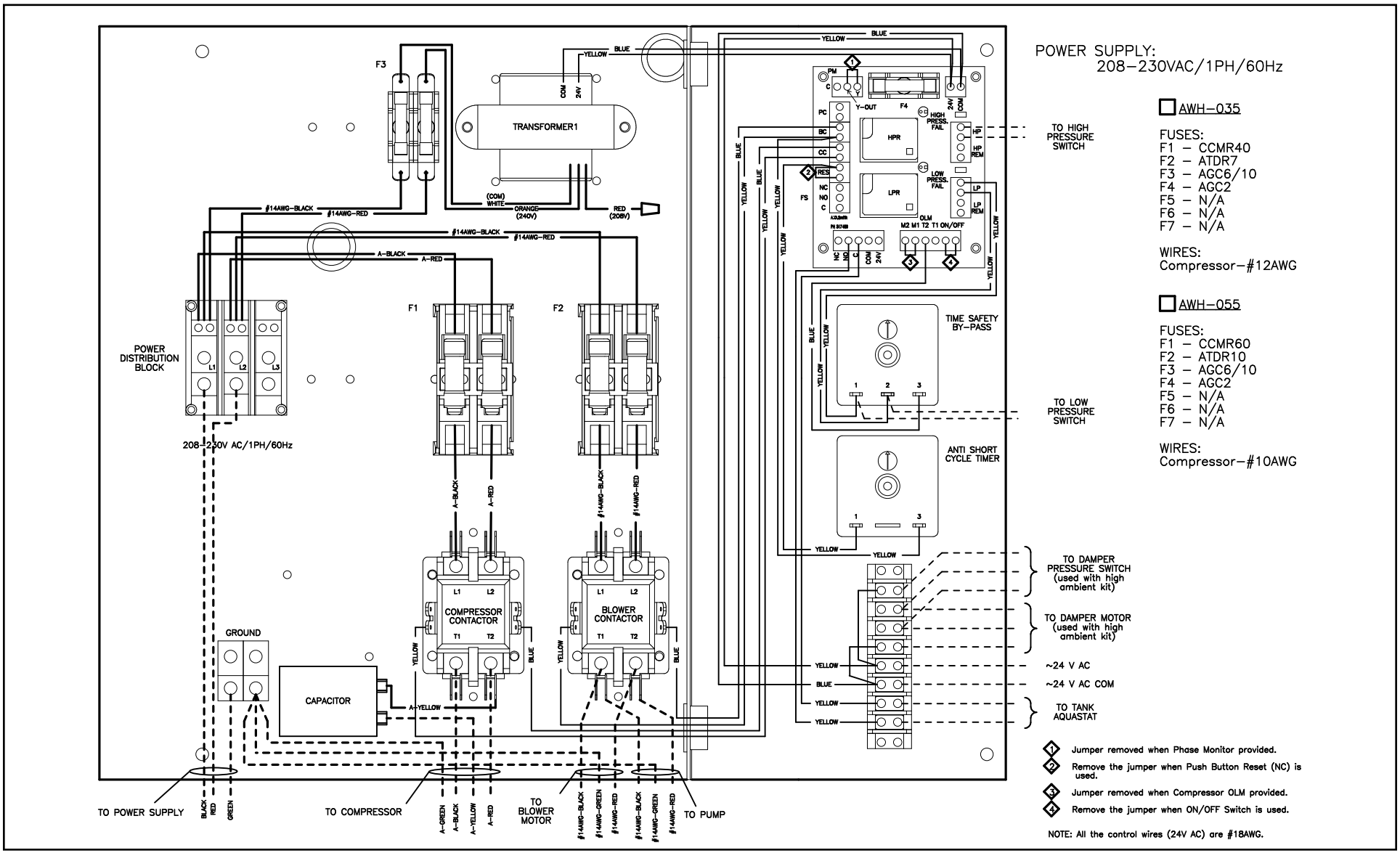
TABLE 13

ABBREVIATION	DESCRIPTION	WIRING	NOTES
PM	Phase Monitor	Factory	If installed
PC	Pump Contactor	Factory	Load pump if installed
BC	Blower Contactor	Factory	
CC	Compressor Contactor	Factory	
HP	High Pressure Switch	Factory	Indicates high pressure fault
REMHP	Remote High Pressure (dry contact)	Field	Remote fault alert
LP	Low Pressure Switch	Factory	Indicates low pressure fault
REMLP	Remote Low Pressure (dry contact)	Field	Remote fault alert
ON/OFF	Remote on/off (dry contact)	Field	Remote unit on/off capability
OLM	Compressor Overload Module	Factory	If installed, powers overload
DT	Terminals for Controller Connection	Factory	Wired up to the 8 pole connector
RES	Remote Reset	Field	Remote reset after fault

UNIT WIRING DIAGRAMS - FUSE SIZES

208/230 VAC - SINGLE PHASE - 60 HZ

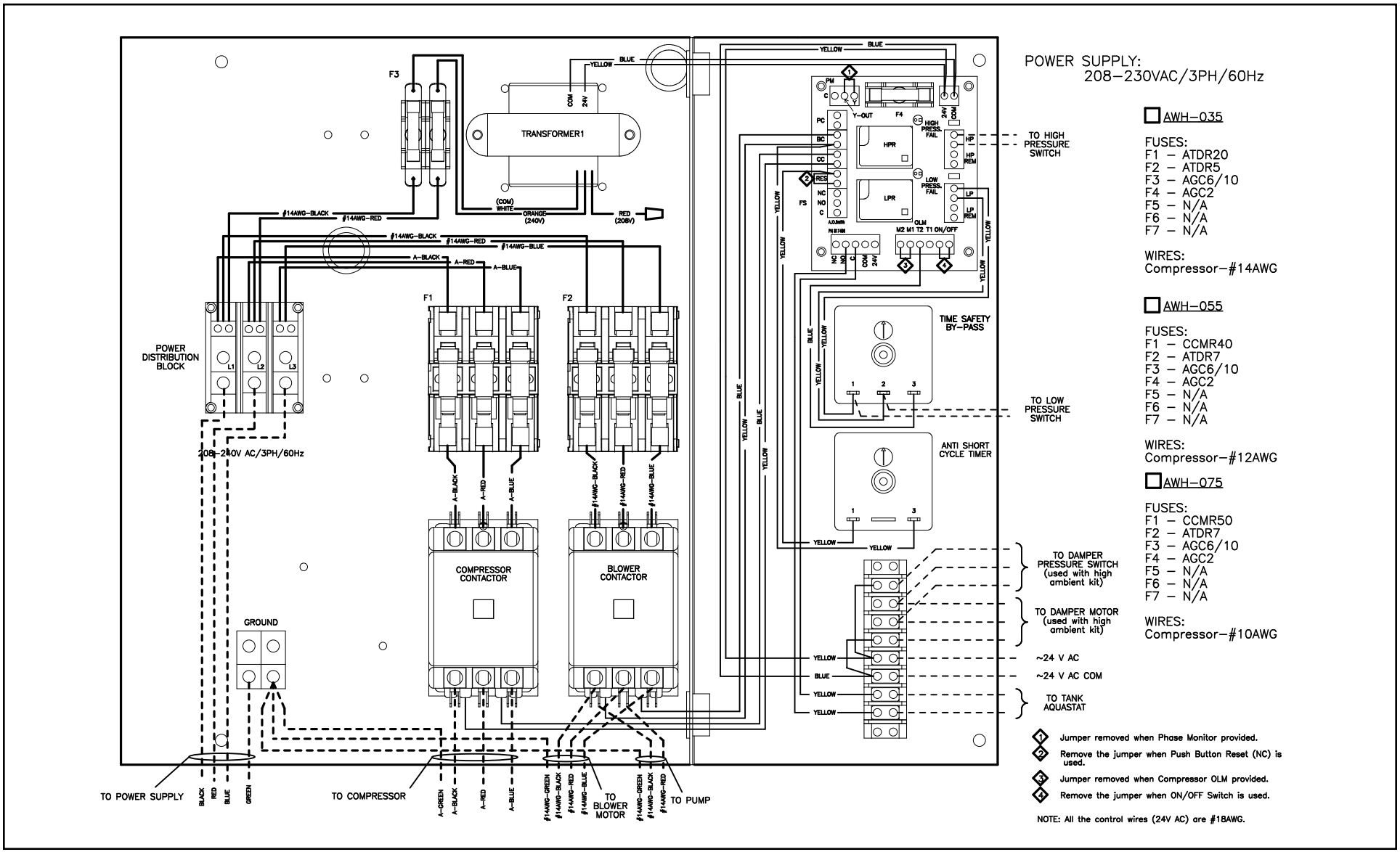
Note: 208/230 VAC, single phase is an optional voltage configuration available for AWH-35 and AWH-55 models only.



UNIT WIRING DIAGRAMS - FUSE SIZES

208/230 VAC - THREE PHASE - 60 HZ

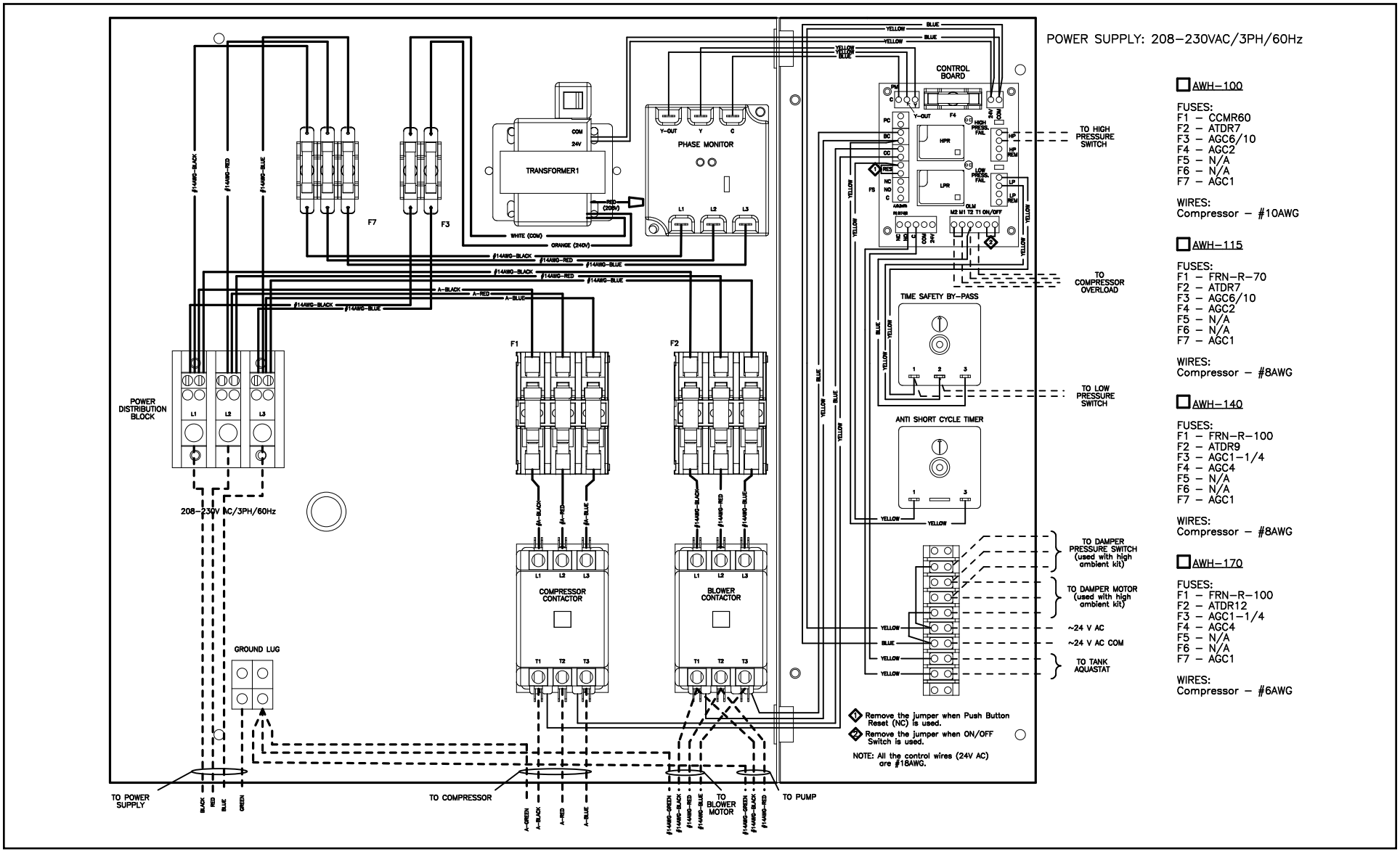
Note: 208/230 VAC, three phase is the standard configuration for all models. The wiring diagram below is for the smaller size models: AWH-35, AWH-55 and AWH-75 only.



UNIT WIRING DIAGRAMS - FUSE SIZES

208/230 VAC - THREE PHASE - 60 HZ

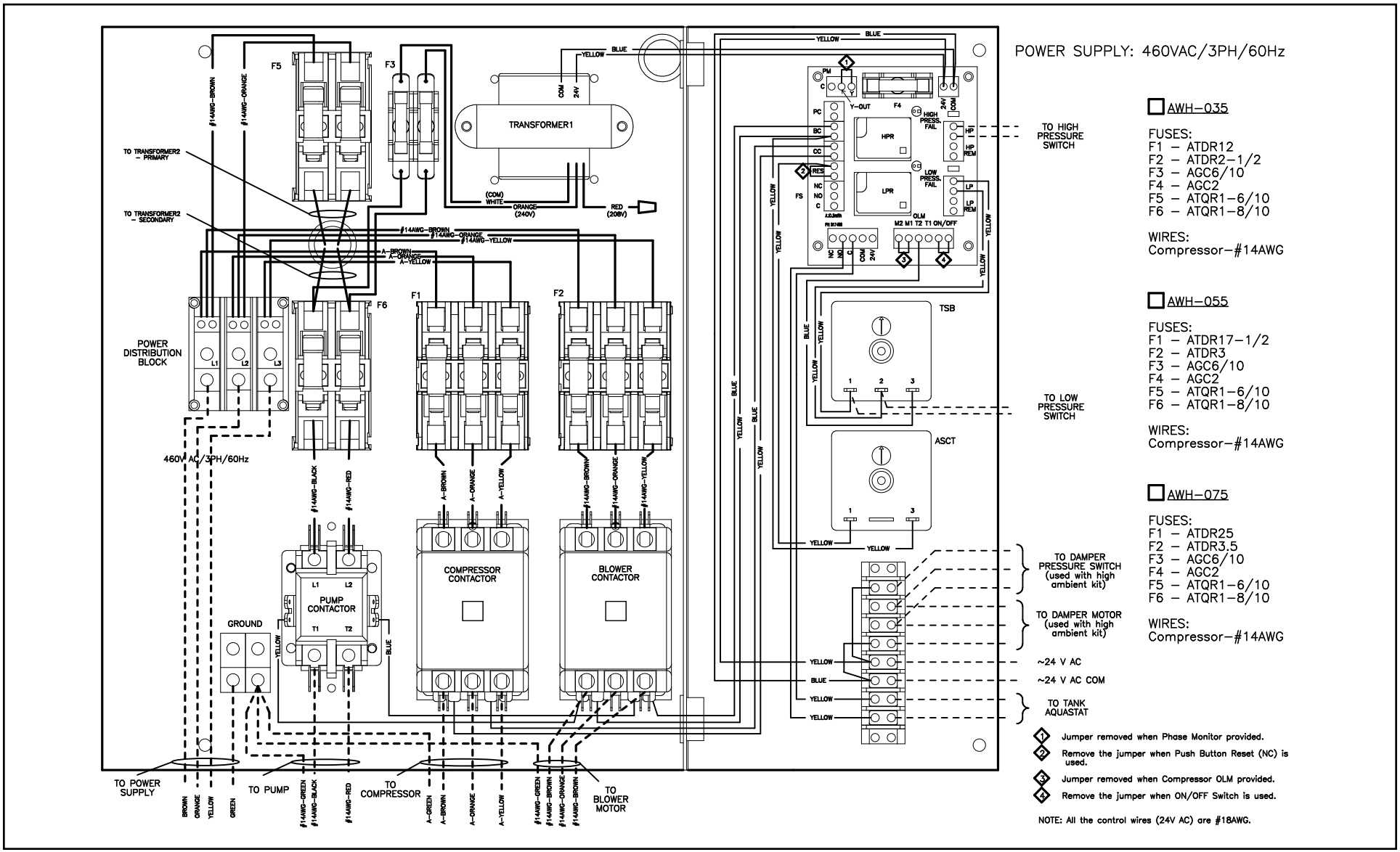
Note: 208/230 VAC, three phase is the standard configuration for all models. The wiring diagram below is for the larger size models; AWH-100, AWH-115, AWH-140 and AWH-170 only.



UNIT WIRING DIAGRAMS - FUSE SIZES

460 VAC - THREE PHASE - 60 HZ

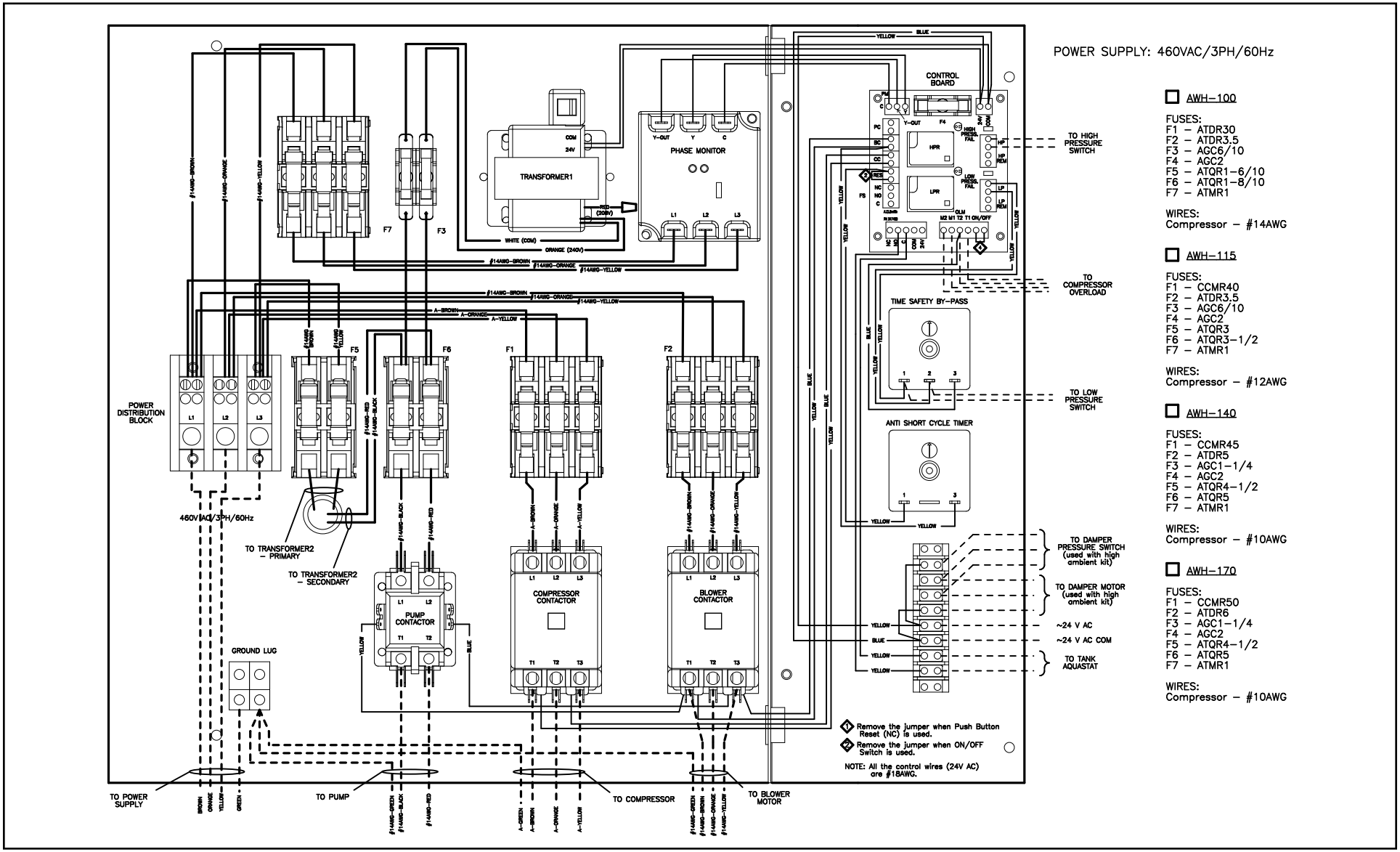
Note: 460 VAC, three phase is and optional voltage configuration for all models. The wiring diagram below is for the smaller size models; AWH-35, AWH-55 and AWH-75 only.



UNIT WIRING DIAGRAMS - FUSE SIZES

460 VAC - THREE PHASE - 60 HZ

Note: 460 VAC, three phase is an optional voltage configuration for all models. The wiring diagram below is for the larger size models; AWH-100, AWH-115, AWH-140 and AWH-170 only.



THERMOSTAT AND ACCESSORY WIRING DIAGRAMS

DIGITAL TANK THERMOSTAT WIRING

This Ambient Air Limit Thermostat temporarily disables compressor operation when the return (entering) air temperature is above or below the normal operating temperature range. The return (entering) air temperature operating range for the HPWH is 50°F to 95°F (10°C to 35°C).

This is a two stage thermostat and is factory configured as shown below. The cooling stage set point is factory set at 50°F (10°C). The heating stage set point is factor set at 95°F (35°C).

When the High Ambient Kit accessory is installed to allow operation at return (entering) air temperatures above 95°F

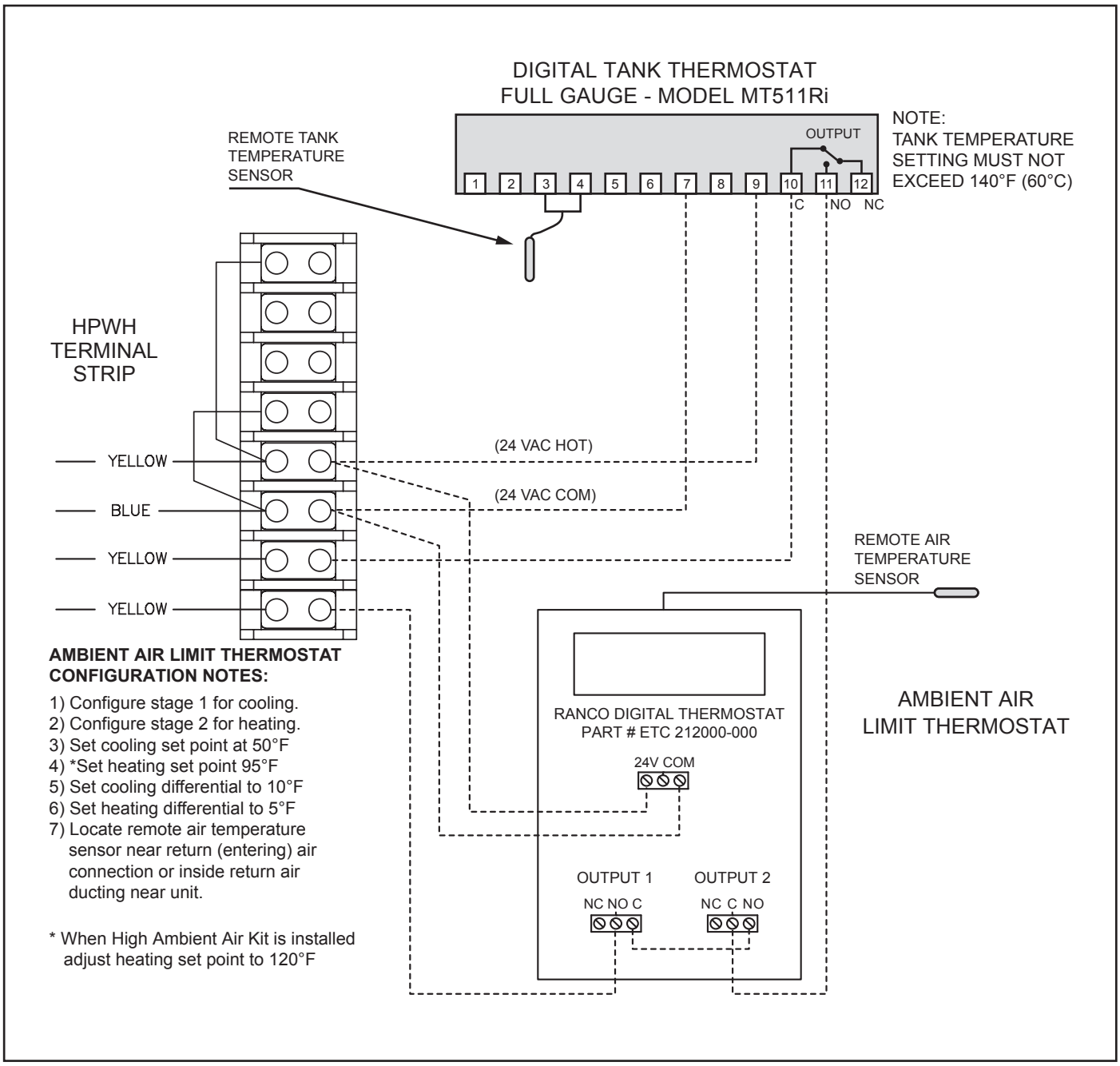


Figure 15

STANDARD TANK THERMOSTAT WIRING

Note: Existing or field supplied mechanical storage tank thermostats (aquastat) should be wired to the HPWH unit as shown.

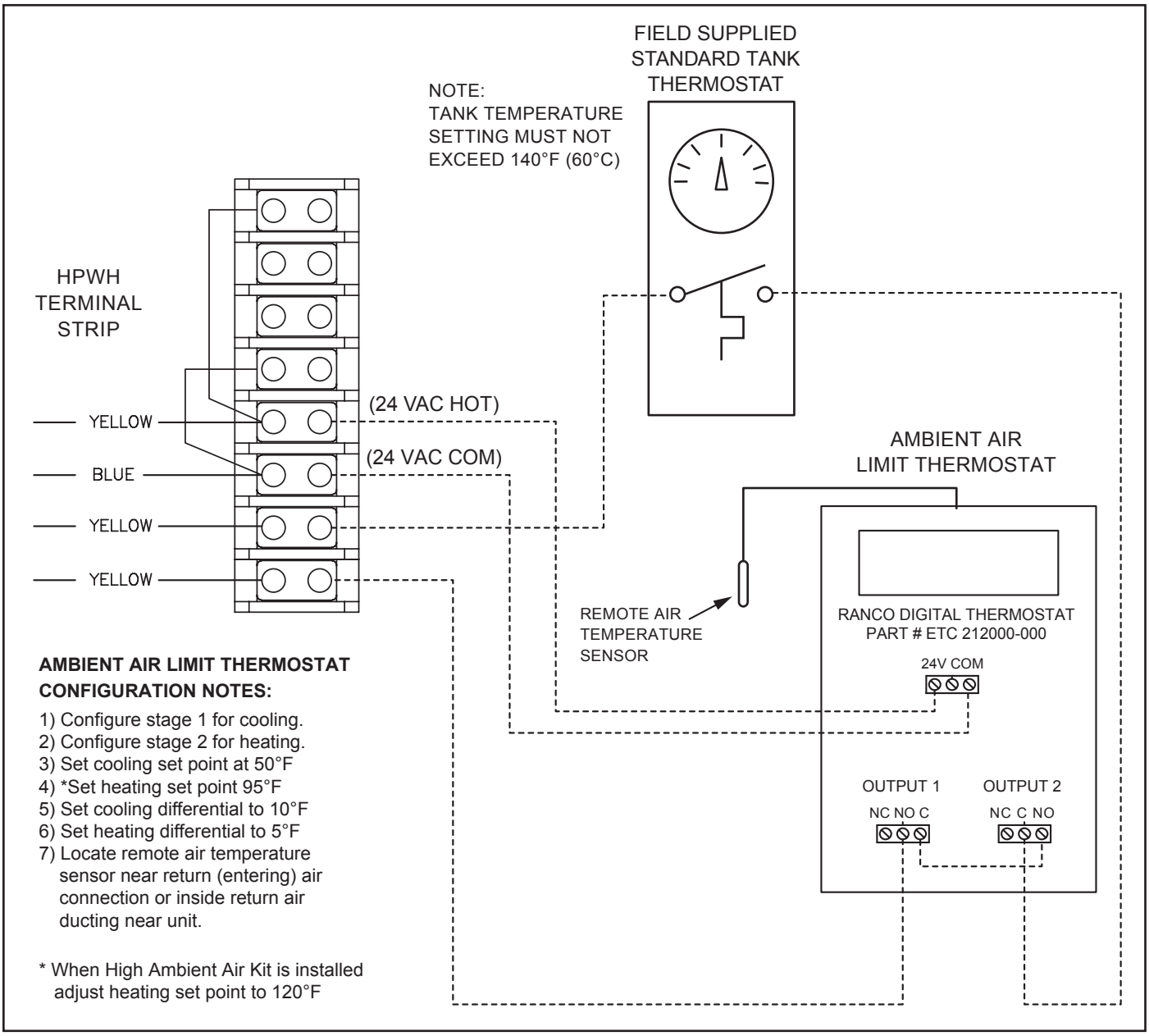


Figure 16

HIGH AMBIENT AIR KIT WIRING

Note: To purchase High Ambient Air Kit contact your sales representative, distributor or call the toll free technical support number on the back cover of this manual for further assistance. See Table 14 on page 40 for the part number needed.

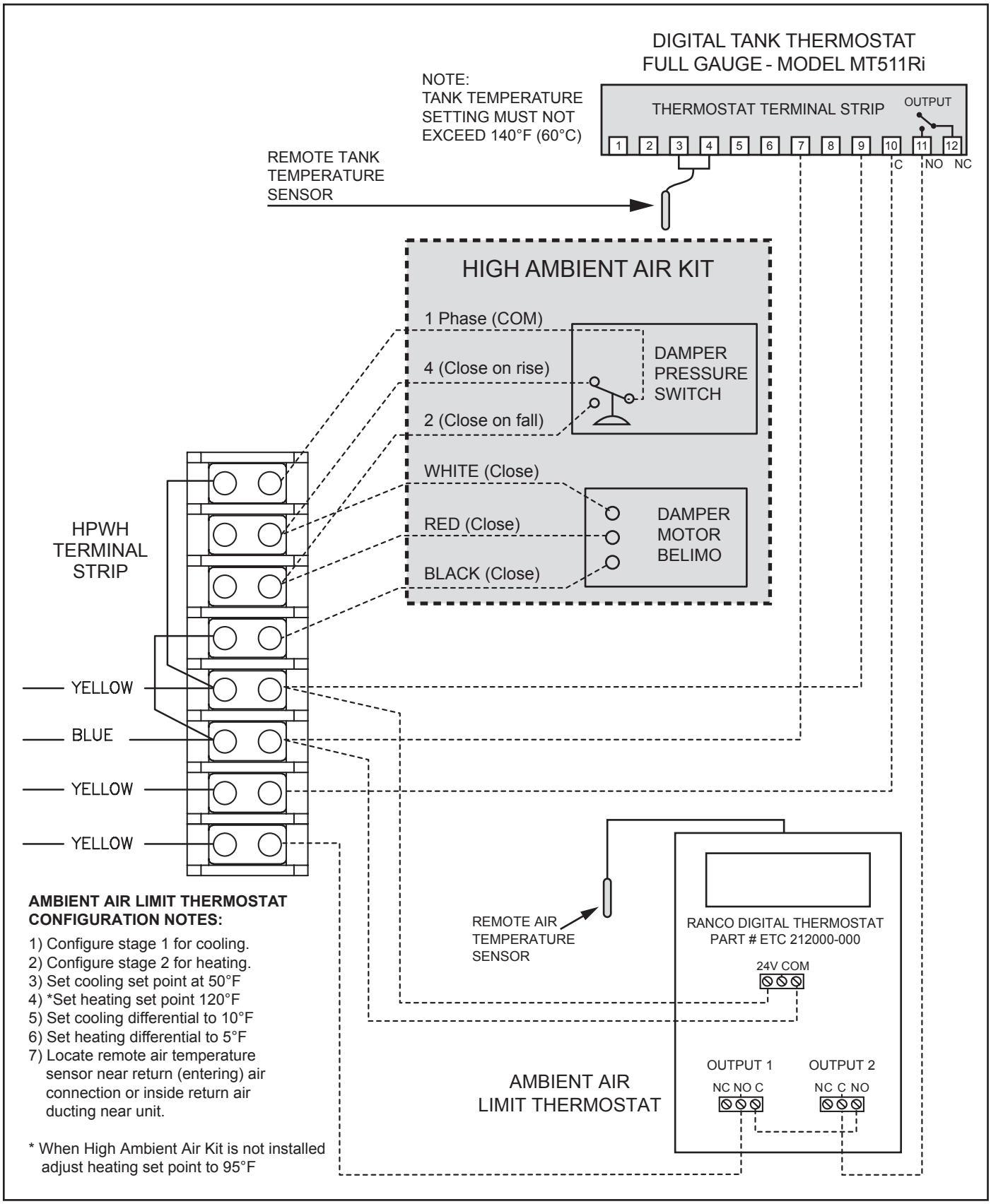


Figure 17

HIGH AMBIENT AIR KITS

TABLE 14

AWH-35	9500012730
AWH-55	9500012731
AWH-75	9500012732
AWH-100	9500012733
AWH-115	
AWH-140	9500012734
AWH-170	9500012735

THERMOSTAT AND ACCESSORY WIRING DIAGRAMS

BUILDING RECIRCULATION PUMP WIRING DIAGRAM

CIRCULATING PUMP WIRING DIAGRAM
FOR BUILDING RECIRCULATION TO STORAGE TANK

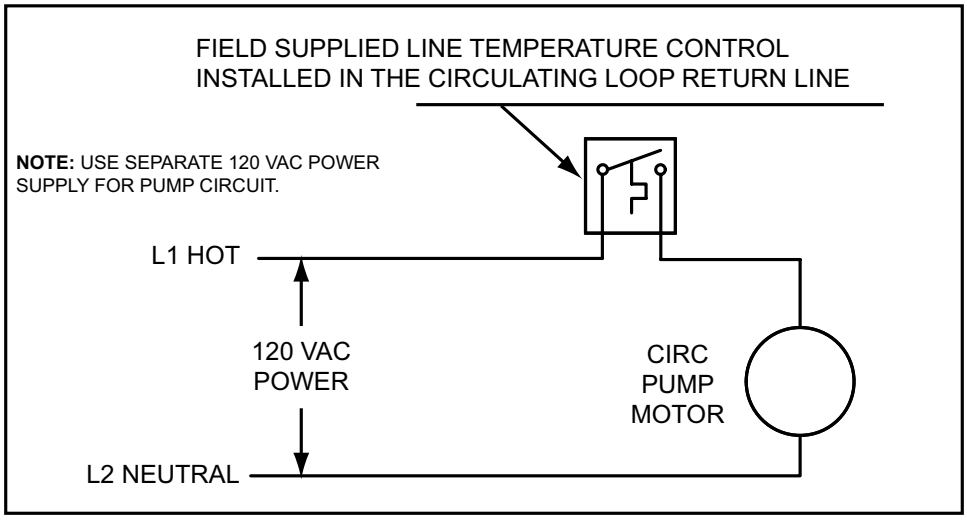


Figure 18

WATER PIPING DIAGRAMS

Before installation of water piping review the following:

1. See Mixing Valves on page 13.
2. See Water Temperature on page 10.
3. See Temperature - Pressure Relief Valve on page 14.
4. See Closed Systems and Thermal Expansion on page 13
5. See Water Connections on page 17.
6. If a building recirculation loop is present the circulation pump must be controlled by a thermostat. See Figure 18 on page 40 for wiring.

ONE AIR TO WATER HEAT PUMP, SINGLE TEMPERATURE, PREHEAT SYSTEM WITH VERTICAL STORAGE TANK AND BACKUP WATER HEATER WITH FORCED BUILDING RECIRCULATION

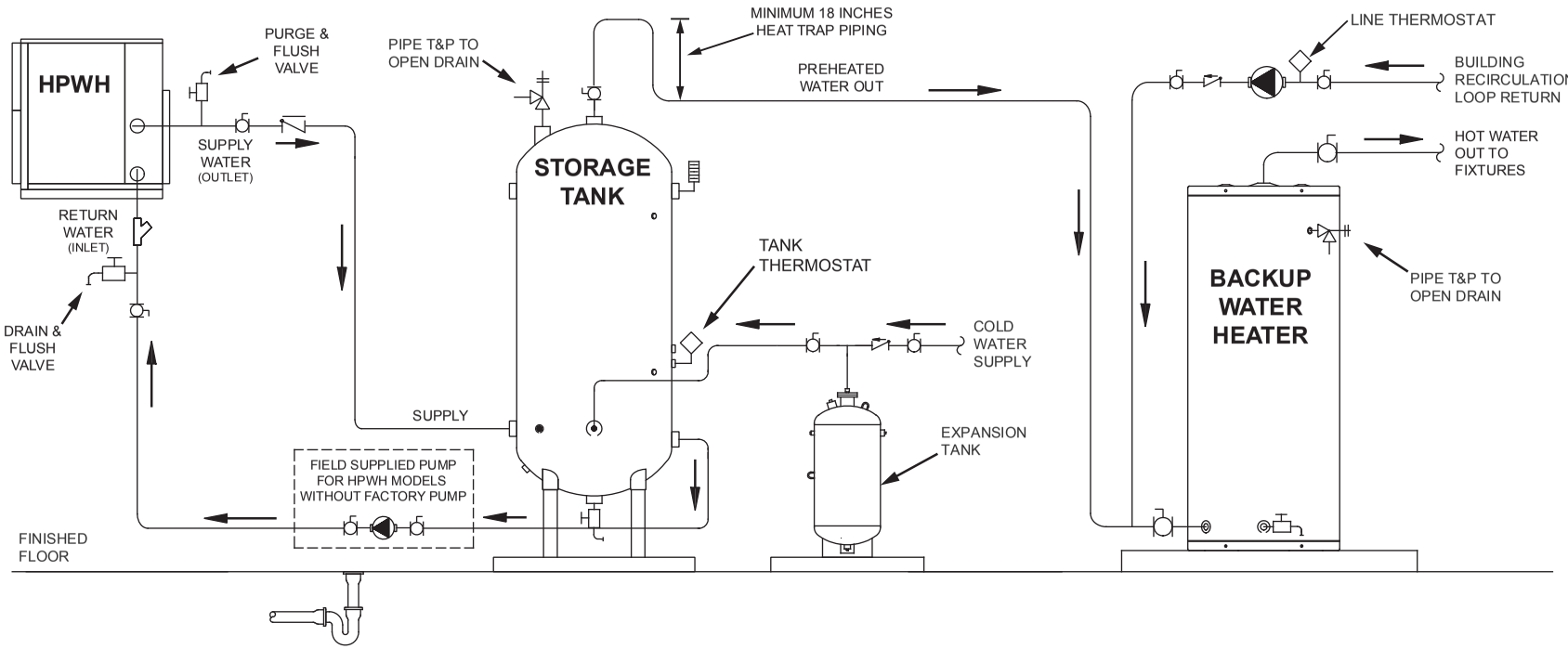
WARNING: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.

IMPORTANT INSTALLATION NOTES:

1. COLD WATER SUPPLY MUST CONNECT TO THE STORAGE TANK ON PREHEAT SYSTEMS
2. BUILDING RECIRCULATION LOOP RETURN LINE MUST CONNECT TO THE INLET OF THE BACKUP WATER HEATER ON PREHEAT SYSTEMS.

LEGEND

- TEMPERATURE & PRESSURE RELIEF VALVE
- PRESSURE RELIEF VALVE
- CIRCULATING PUMP
- TANK OR LINE TEMPERATURE CONTROL
- WYE STRAINER
- FULL PORT BALL VALVE
- CHECK VALVE
- TEMPERATURE GAGE
- DRAIN



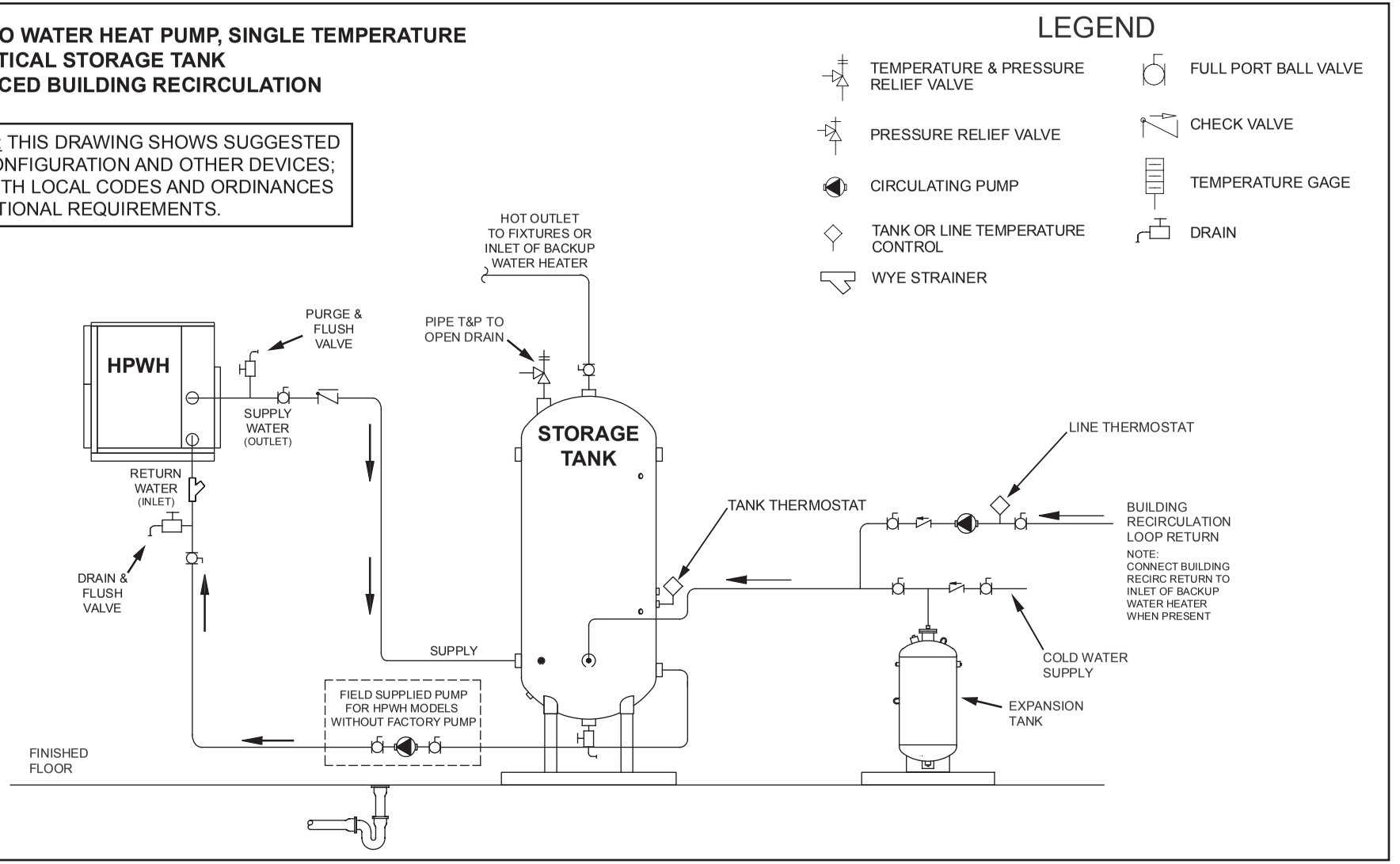
WATER PIPING DIAGRAMS

Before installation of water piping review the following:

1. See Mixing Valves on page 13.
2. See Water Temperature on page 10.
3. See Temperature - Pressure Relief Valve on page 14.
4. See Closed Systems and Thermal Expansion on page 13
5. See Water Connections on page 17.
6. If a building recirculation loop is present the circulation pump must be controlled by a thermostat. See Figure 18 on page 40 for wiring.

ONE AIR TO WATER HEAT PUMP, SINGLE TEMPERATURE WITH VERTICAL STORAGE TANK WITH FORCED BUILDING RECIRCULATION

WARNING: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.



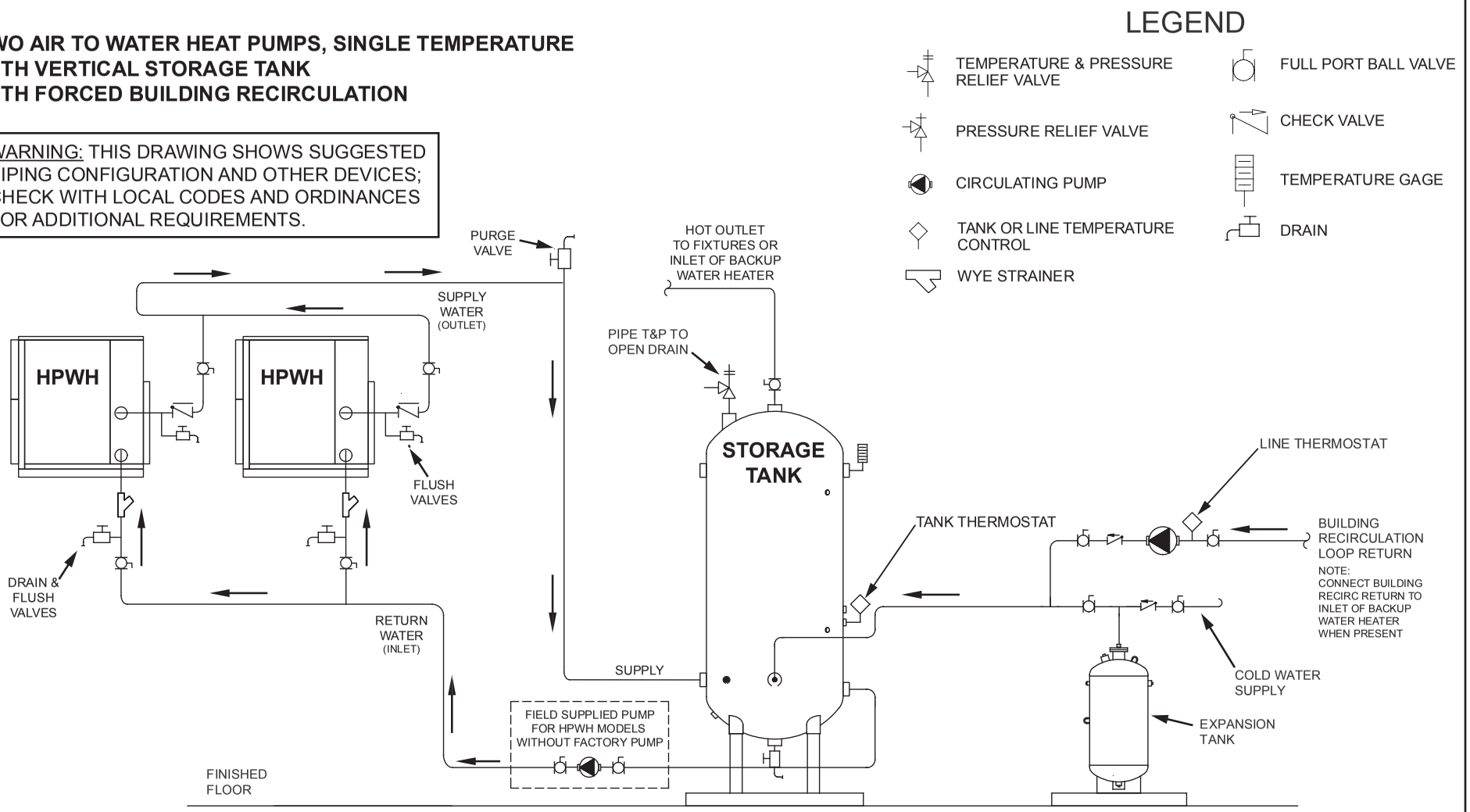
WATER PIPING DIAGRAMS

Before installation of water piping review the following:

1. See Mixing Valves on page 13.
2. See Water Temperature on page 10.
3. See Temperature - Pressure Relief Valve on page 14.
4. See Closed Systems and Thermal Expansion on page 13
5. See Water Connections on page 17.
6. If a building recirculation loop is present the circulation pump must be controlled by a thermostat. See Figure 18 on page 40 for wiring.

TWO AIR TO WATER HEAT PUMPS, SINGLE TEMPERATURE
WITH VERTICAL STORAGE TANK
WITH FORCED BUILDING RECIRCULATION

WARNING: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.



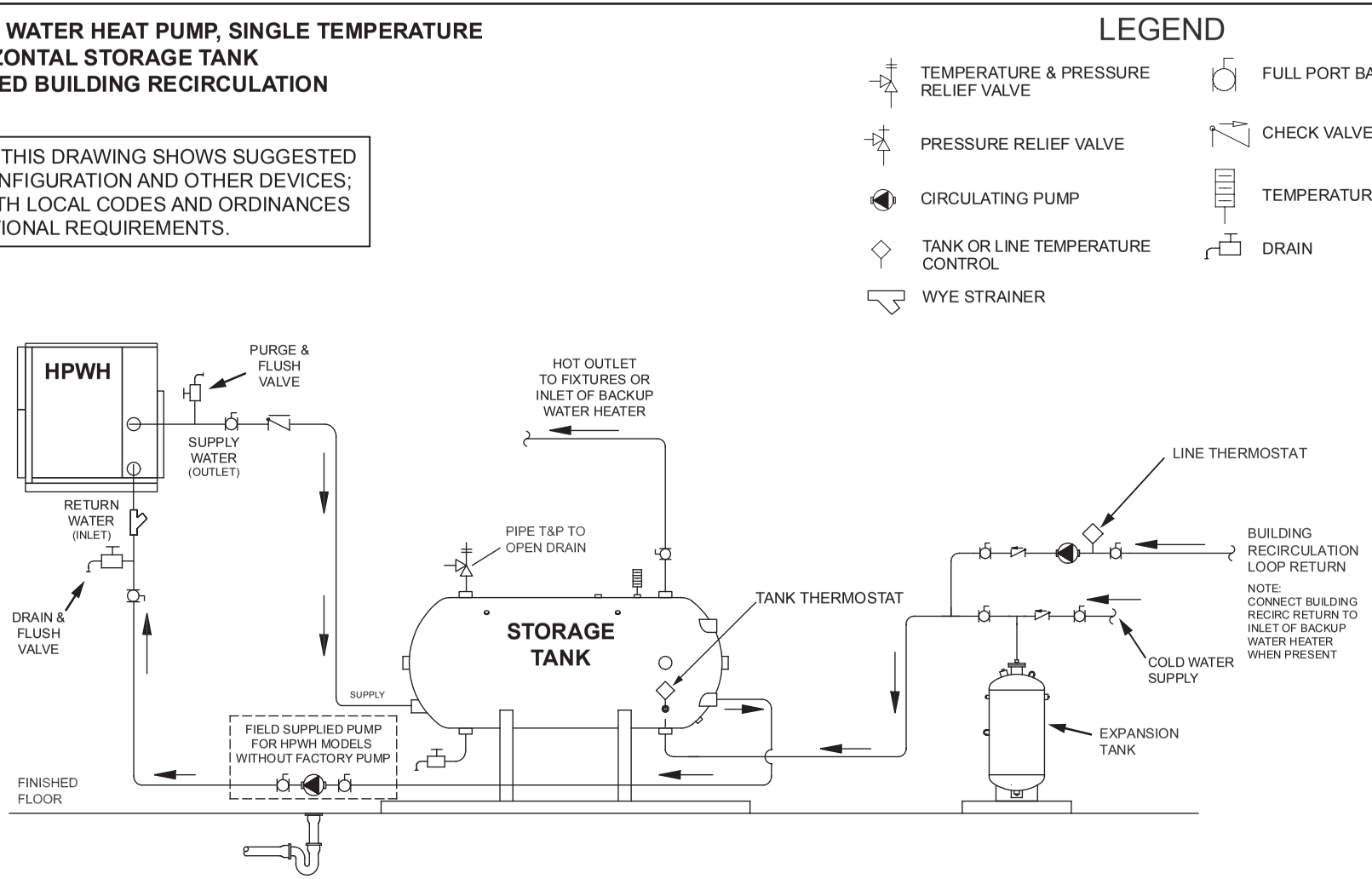
WATER PIPING DIAGRAMS

Before installation of water piping review the following:

1. See Mixing Valves on page 13.
2. See Water Temperature on page 10.
3. See Temperature - Pressure Relief Valve on page 14.
4. See Closed Systems and Thermal Expansion on page 13
5. See Water Connections on page 17.
6. If a building recirculation loop is present the circulation pump must be controlled by a thermostat. See Figure 18 on page 40 for wiring.

ONE AIR TO WATER HEAT PUMP, SINGLE TEMPERATURE WITH HORIZONTAL STORAGE TANK WITH FORCED BUILDING RECIRCULATION

WARNING: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.



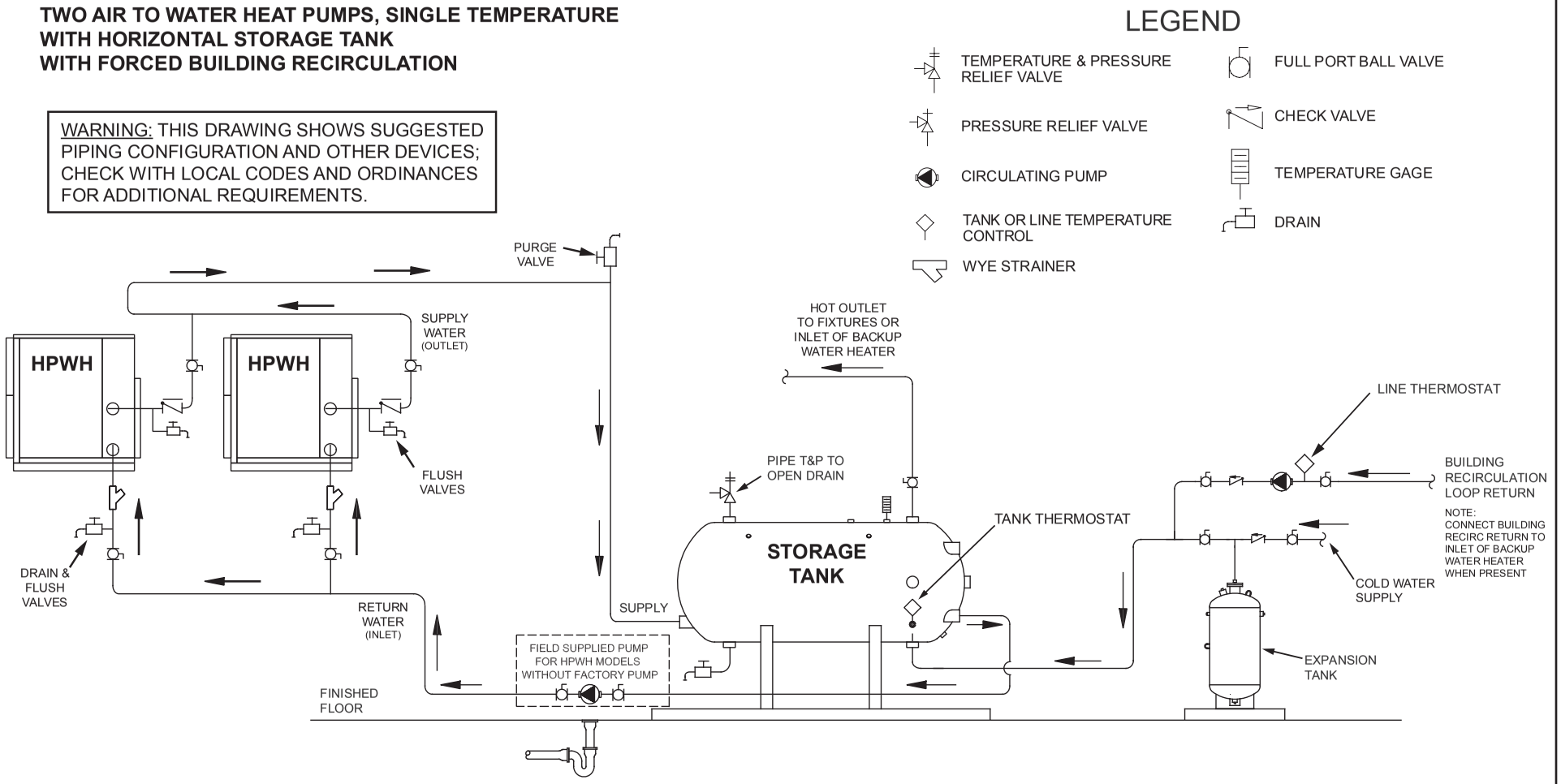
WATER PIPING DIAGRAMS

Before installation of water piping review the following:

1. See Mixing Valves on page 13.
2. See Water Temperature on page 10.
3. See Temperature - Pressure Relief Valve on page 14.
4. See Closed Systems and Thermal Expansion on page 13
5. See Water Connections on page 17.
6. If a building recirculation loop is present the circulation pump must be controlled by a thermostat. See Figure 18 on page 40 for wiring.

TWO AIR TO WATER HEAT PUMPS, SINGLE TEMPERATURE WITH HORIZONTAL STORAGE TANK WITH FORCED BUILDING RECIRCULATION

WARNING: THIS DRAWING SHOWS SUGGESTED PIPING CONFIGURATION AND OTHER DEVICES; CHECK WITH LOCAL CODES AND ORDINANCES FOR ADDITIONAL REQUIREMENTS.



LIMITED WARRANTY

MODELS AWH, WH, WW, CPH COMMERCIAL HEAT PUMP WATER HEATERS

A. O. Smith Corporation, the warrantor, extends the following LIMITED WARRANTY to the owner of this commercial heat pump water heater subject to the terms, conditions and disclaimers stated below:

1. **COMPRESSOR**

If within FIVE (5) years after initial installation of this heat pump water heater the compressor shall prove upon examination by the warrantor to be defective, the warrantor will provide a replacement compressor.

2. **ALL OTHER PARTS**

If within ONE (1) year after initial installation of this heat pump water heater any other part or portion shall prove upon examination by the warrantor to be defective in material or workmanship, the warrantor will repair or replace such part or portion at its option. This warranty also extends to any factory supplied accessories.

3. **CONDITIONS AND EXCEPTIONS**

Refrigerant, filters, refrigerant driers, and fan belts are not covered under this limited warranty. The warranty on all replacement parts, including the compressor, will be limited to the unexpired term of the original warranty. This warranty shall apply only when the heat pump water heater is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices.

a. This warranty shall apply only when the unit is:

(1) used at temperatures not exceeding the maximum system temperatures printed in the instructions provided;

(2) filled with potable water, free to circulate at all times and free of damaging water sediment or scale deposits;

(3) used in a non-corrosive and not contaminated atmosphere;

(4) in its original installation location,

(5) in the United States, its territories or possessions, and Canada;

(6) sized in accordance with proper sizing techniques for commercial heat pump water heaters;

(7) bearing the original rating label which has not been altered, defaced or removed, except as required by the warrantor;

(8) used in an open water system or in a closed system with a properly sized and installed thermal expansion tank;

(9) energized at the proper voltage and phase as stated on the rating label;

(10) maintained in accordance with the instructions printed in the manual included with the heat pump water heater;

b. Any accident to the water heater, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form, will void this warranty.

4. **SERVICE REPAIR AND EXPENSE**

Under this limited warranty the warrantor will provide only a replacement heat pump water heater or part thereof. The owner is responsible for all other costs. Such costs may include but are not limited to:

a. Labor charges for service, removal, repair, or reinstallation of the water heater or any component part;

b. Shipping, delivery, handling, and administrative charges for forwarding the new heater or replacement part from the nearest distributor and returning the claimed defective heater or part to such distributor;

c. All cost necessary or incidental for any materials and/or permits required for installation of the replacement heater or part.

5. **LIMITATIONS ON IMPLIED WARRANTIES**

Implied warranties, including any warranty of merchantability imposed on the sale of this heater under state law are limited to one (1) year duration for the heater or any of its parts. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

6. **CLAIM PROCEDURE**

Any claim under this warranty should be initiated with the dealer who sold the heater, or with any other dealer handling the warrantor's products. If this is not practicable, the owner should contact:

U.S. Customers
A. O. Smith Water Products Company
500 Tennessee Waltz Parkway
Ashland City, TN 37015
Telephone: 1-800-323-2636

Canadian Customers
A. O. Smith Enterprises, Ltd.
P. O. Box 310- 768 Erie Street
Stratford, Ontario N5A 6T3
Telephone: 1-800-265-8520

a. The warrantor will only honor replacement with identical or similar water heater or parts thereof which are manufacture or distributed by the warrantor.

b. Dealer replacements are made subject to in-warranty validation by warrantor.

7. **DISCLAIMERS**

NO OTHER EXPRESS WARRANTY HAS BEEN OR WILL BE MADE IN BEHALF OF THE WARRANTOR WITH RESPECT TO THE MERCHANTABILITY OF THE HEATER OR THE INSTALLATION, OPERATION, REPAIR, OR REPLACEMENT OF THE HEATER. THE WARRANTOR SHALL NOT BE RESPONSIBLE FOR WATER DAMAGE, LOSS OF USE OF THE UNIT, INCONVENIENCE, LOSS OR DAMAGE TO PERSONAL PROPERTY, OR OTHER CONSEQUENTIAL DAMAGE. THE WARRANTOR SHALL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR DAMAGE TO ANY PERSONS OR PROPERTY, WHETHER DIRECT OR INDIRECT, AND WHETHER ARISING IN CONTRACT OR IN TORT.

a. Some states do not allow the exclusion or limitation of the incidental or consequential damage, so the above limitation or exclusion may not apply to you.

b. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Fill in the following for your own reference. Keep it. Registration is not a condition of warranty. The model and serial number are found on the heater's rating label.

Model No. _____ Serial No. _____ Date Installed _____

Dealer's Name _____

Dealer's Address _____ Phone No. _____

City and State _____ Zip _____

500 Tennessee Waltz Parkway, Ashland City, TN 37015
Technical Support: 800-527-1953 • Parts: 800-433-2545 • Fax: 800-644-9306
www.hotwater.com