Carrier

Aquazone™ 50PEC09-18 Water Source Heat Pumps Console Unit with Puron® Refrigerant (R-410A)

Installation, Start-Up and Service Instructions

CONTENTS

IMPORTANT: Read the entire instruction manual before starting installation.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor for information or assistance. The qualified installer or service agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and applicable electrical codes for special installation requirements.

⚠ WARNING

Electrical shock can cause personal injury or death. Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable.

⚠ DANGER

DO NOT USE TORCH to remove any component. System contains oil and refrigerant under pressure.

To remove a component, wear protective gloves and goggles and proceed as follows:

a. Shut off electrical power to unit.
b. Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
c. Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.
d. Cut component connection tubing with tubing cutter and remove component from unit. Use a pan to catch any oil that may come out of the lines and as a gage for how much oil to add to the system.
e. Carefully un-sweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Failure to follow these procedures may result in personal injury or death.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

⚠ CAUTION

DO NOT re-use compressor oil or any oil that has been exposed to the atmosphere. Dispose of oil per local codes and regulations. DO NOT leave refrigerant system open to air any longer than the actual time required to service the equipment. Seal circuits being serviced and charge with dry nitrogen to prevent oil contamination when timely repairs cannot be completed. Failure to follow these procedures may result in damage to equipment.

GENERAL

The 50PEC water source heat pump (WSHP) console unit is a decentralized room terminal designed for field connection to a closed-circuit piping loop.

Units are typically installed in perimeter zones, usually under windows. Supply air is discharged directly into the conditioned space through discharge grilles located in the top of the unit.

IMPORTANT: The installation of console water source heat pump units and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

INSTALLATION

Step 1 — Check Jobsite

Units are typically installed along an outside wall of the room. Refer to Fig. 1 for an illustration showing piping locations. Install units with adequate clearance to allow maintenance and servicing. Refer to Table 1. Locate the console unit so that it provides adequate air circulation throughout the room.

Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation.

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep both the chassis and cabinet covered with the shipping carton until all plastering, painting, and finish work is complete and it is time to install the chassis and cabinet.
3. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.

⚠ CAUTION

To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly become clogged with construction dirt and debris which may cause system damage.

⚠ CAUTION

To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians who meet local, regional, and national proficiency requirements.

⚠ CAUTION

All refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry accepted guidelines and all local, regional, and national statutes for the recovery and disposal of refrigerants.

⚠ CAUTION

When a compressor is removed from this unit, system refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, the refrigerant lines of the compressor must be sealed after it is removed.

Step 2 — Check Unit

Upon receipt of shipment at the jobsite, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 5 days of receipt of shipment.

NOTE: It is the responsibility of the purchaser to file all necessary claims with the shipping company.

STORAGE

⚠ CAUTION

DO NOT store or install console units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

Upon the arrival of equipment at the jobsite, immediately store units in their shipping cartons in a clean, dry area.

⚠ CAUTION

DO NOT stack units. Take care when moving the unit. The unit's weight is located on the left (compressor) end. Always store and move unit in an upright position. Take care to protect the unit cabinet and sub-base when moving or storing. Never move or lift unit by its water connections. Units must be moved and stored in an upright position, never lay the unit on it's side.

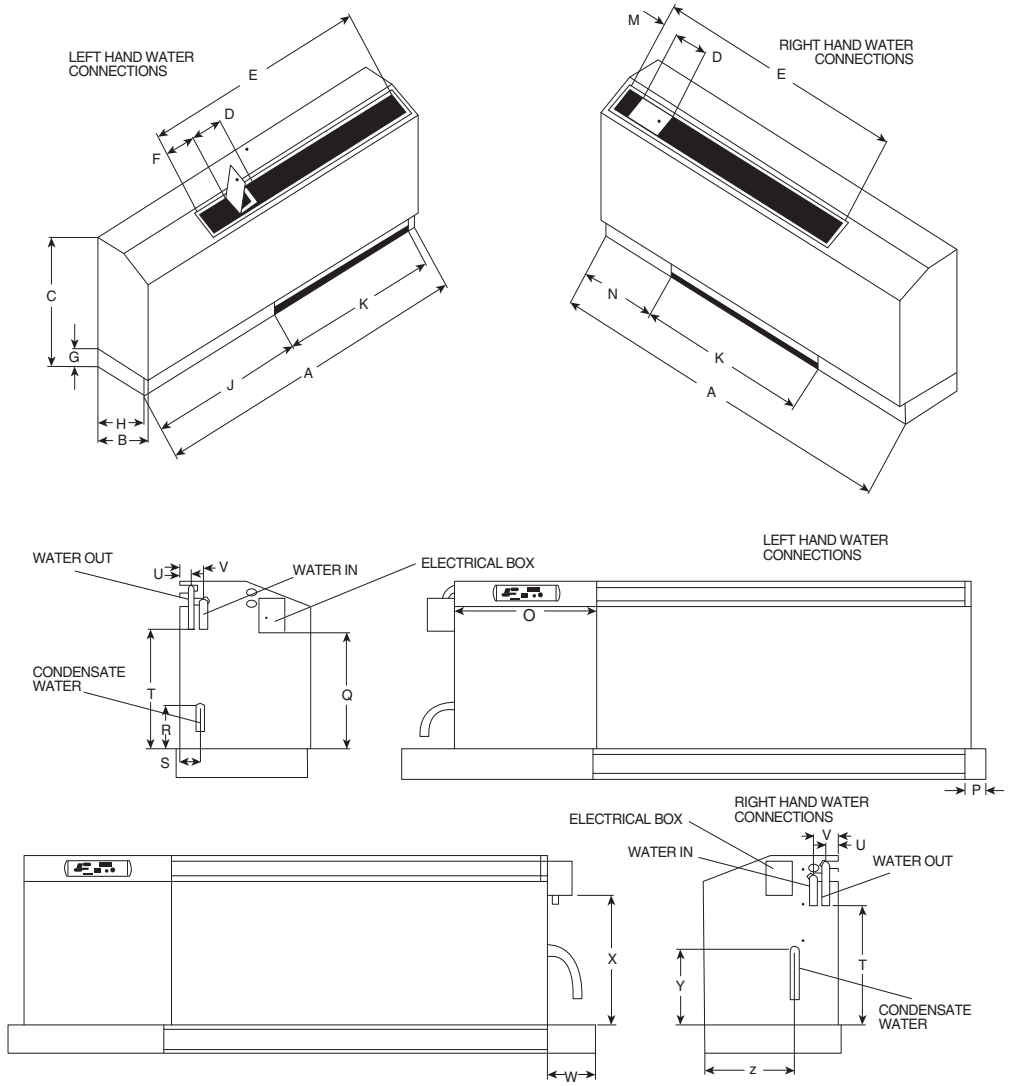
UNIT PROTECTION

Cover console units on the jobsite with either shipping cartons, vinyl film, or an equivalent protective covering. Cap the open ends of pipes stored on the jobsite. In areas where painting, plastering, or the spraying of fireproof material has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

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

⚠ CAUTION

When installing unit in cold air climates, an outside air damper must be provided to prevent possible condenser freeze-up.



UNIT SIZE	A	B	C	D	E	F	G	H	J	K
50PEC09-18	Width	Depth	Height	Control Door Width	Discharge Grille Width	Grilled Edge to Door, Left Hand	Clearance to Unit Bottom	Subbase Depth	Cabinet End to Return Air, Left Hand	Return Air Width
Standard	48.00	12.00	23.88	6.00	45.00	6.12	3.37	11.00	12.87	30.75
Extended Width	63.00								30.87	

UNIT SIZE	M	N	O	P	Q	R	S	T	U	V
50PEC09-18	Grille Edge to Door, Right Hand	Cabinet End to Return Air, Right Hand	Control Panel Width	Return Air to Chassis End, Left Hand	Power Switch Height From Sub-base, Left Hand	Condensate Height from Sub-base, Left Hand	Condensate Depth From Rear, Left Hand	Water Connection Height From Subbase	Water Out Depth from Rear	Water In Depth from Rear
Standard	2.87	12.87	12.00	1.63	13.50	5.00	1.75	13.75	1.00	2.00
Extended Width										

UNIT SIZE	W	X	Y	Z		
50PEC09-18	Return Air to Chassis End, Right Hand	Power Switch Height From Subbase, Right Hand	Condensate Height From Subbase, Right Hand	Condensate Depth From Front, Right Hand	Condensate Water Connections	Permanent Washable Filter Size
Standard	4.00	15.00	8.69	7.31	5/8 tube	30.12 x 7 x 0.37
Extended Width						

NOTE: All dimensions are in inches unless otherwise noted. All dimensions within ±0.125 inch. Specifications subject to change without notice.

Fig. 1 — 50PEC09-18 Unit Dimensions

Table 1 — 50PEC Physical Data

50PEC UNIT	09	12	15	18
COMPRESSOR (qty 1)	Rotary	Rotary	Rotary	Rotary
Maximum Water Working Pressure (psig/kPa)	400/3100	400/3100	400/3100	400/3100
STANDARD FAN MOTOR AND BLOWER				
Fan Motor Type	PSC	PSC	PSC	PSC
Fan Motor (hp)	1/10	1/4	1/4	1/4
Blower Wheel Size (Dia x W) (in.) (qty)	5.5 x 8.0 (X 2)	5.5 x 8.0 (X 2)	5.5 x 8.0 (X 2)	5.5 x 8.0 (X 2)
WATER CONNECTION SIZE (in.)	5/8 in. Sweat (Optional 1/2 in. FPT)			
Coaxial Coil Volume (gal)	0.08	0.11	0.11	0.11
Condensate Connection in.	5/8	5/8	5/8	5/8
VERTICAL CABINET				
Refrigeration Charge (oz)	28	25	31	26
Air Coil Dimensions (H x L)	10 x 27	10 x 27	10 x 27	10 x 27
Standard Filter - 1/2 in. Washable Aluminum (H x L)	7 x 31 1/4 x 3/8	7 x 31 1/4 x 3/8	7 x 31 1/4 x 3/8	7 x 31 1/4 x 3/8
Weight - Operating (lb)	131	138	144	144
Weight - Shipping (lb)	151	158	164	164

LEGEND

FPT — Female Pipe Thread
PSC — Permanent Split Capacitor

Step 3 — Mount Unit

1. Before installing the unit, examine each pipe, fitting and valve; remove any dirt or debris found on or in these components. Use care when installing the system components to avoid damage to the cabinet finish or chassis.
2. After removing the console unit from its packaging remove the cabinet by removing the cabinet screws on either side of the unit and lifting the cabinet off the chassis. Set the cabinet aside and cover it (the console unit's packaging can be used for this purpose).
3. Position the subbase directly on the finished floor. Make sure the subbase is level (use shims if necessary). The sub-base has a frame that supports the cabinet and must be secured to wall or other structure.
4. Position the chassis onto the subbase. Check and align electrical, water and condensate connections and secure to the subbase with 4 screws.
5. Make sure the unit's washable filter is clean and installed in the subbase. Also make sure that the filter clip is in place.
6. Reinstall the unit cabinet via locating pins at the top of the chassis and two screws in the unit subbase.

Step 4 — Make Electrical Connections

⚠ WARNING

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

⚠ CAUTION

Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Field wiring must comply with local and national fire, safety and electrical codes. Power to the unit must be within the operating voltage range indicated on the unit chassis nameplate or the performance data sheet. For electrical data see Table 2. Properly sized fuses or HACR (Heating, Air Conditioning and Refrigeration) breakers must be installed for branch circuit protection. See unit chassis nameplate for maximum size.

Each chassis is supplied with a 2 x 4 junction box for power connection. Inside this box there are 2 pigtail leads for power wiring. The field ground is to be connected to the ground connection on the junction box. On remote thermostat and master/slave units there are also 5-position terminal blocks for low voltage thermostat or slave unit connection. On remote thermostat units, connect the thermostat wires to the low voltage terminal block. On master/slave units connect the thermostat to the "Master" terminal block of the lead unit and the "Slave" terminal block to the "Master" terminal block of the next unit, daisy chaining the units together as required. Note that there is no limit to the number of units that can be connected together in this manner as each unit provides it's own low voltage power supply. For wiring diagrams see Fig. 2-5.

NOTE: All 208/230 volt (voltage code -1) units are factory wired to 230 volts unless ordered otherwise. In 208 volt applications the transformer wiring may need to be switched from the 230 volt tap to the 208 volt tap. Cap all unused leads.

Table 2 — Electrical Data — 50PEC Units With or Without Disconnect

50PEC UNIT SIZE	VOLTAGE V-PH-Hz	COMPRESSOR			BLOWER			MIN CIRCUIT AMPS	MAX FUSE/ HACR
		QTY	RLA	LRA	QTY	FLA	HP		
09	115-1-60	1	7.0	45.6	1	2.1	0.10	10.9	15
	208/230-1-60	1	3.4	22.2	1	0.9	0.10	5.2	15
	265-1-60	1	2.9	18.8	1	0.7	0.10	4.3	15
12	115-1-60	1	9.6	58.4	1	1.3	0.25	13.3	20
	208/230-1-60	1	4.6	27.9	1	0.8	0.25	6.6	15
	265-1-60	1	3.8	22.2	1	0.8	0.25	5.6	15
15	208/230-1-60	1	5.6	29.0	1	0.8	0.25	7.8	15
	265-1-60	1	4.6	20.0	1	0.8	0.25	6.6	15
18	208/230-1-60	1	7.4	33.0	1	0.8	0.25	10.1	15
	265-1-60	1	6.0	28.0	1	0.8	0.25	8.3	15

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
RLA — Rated Load Amps

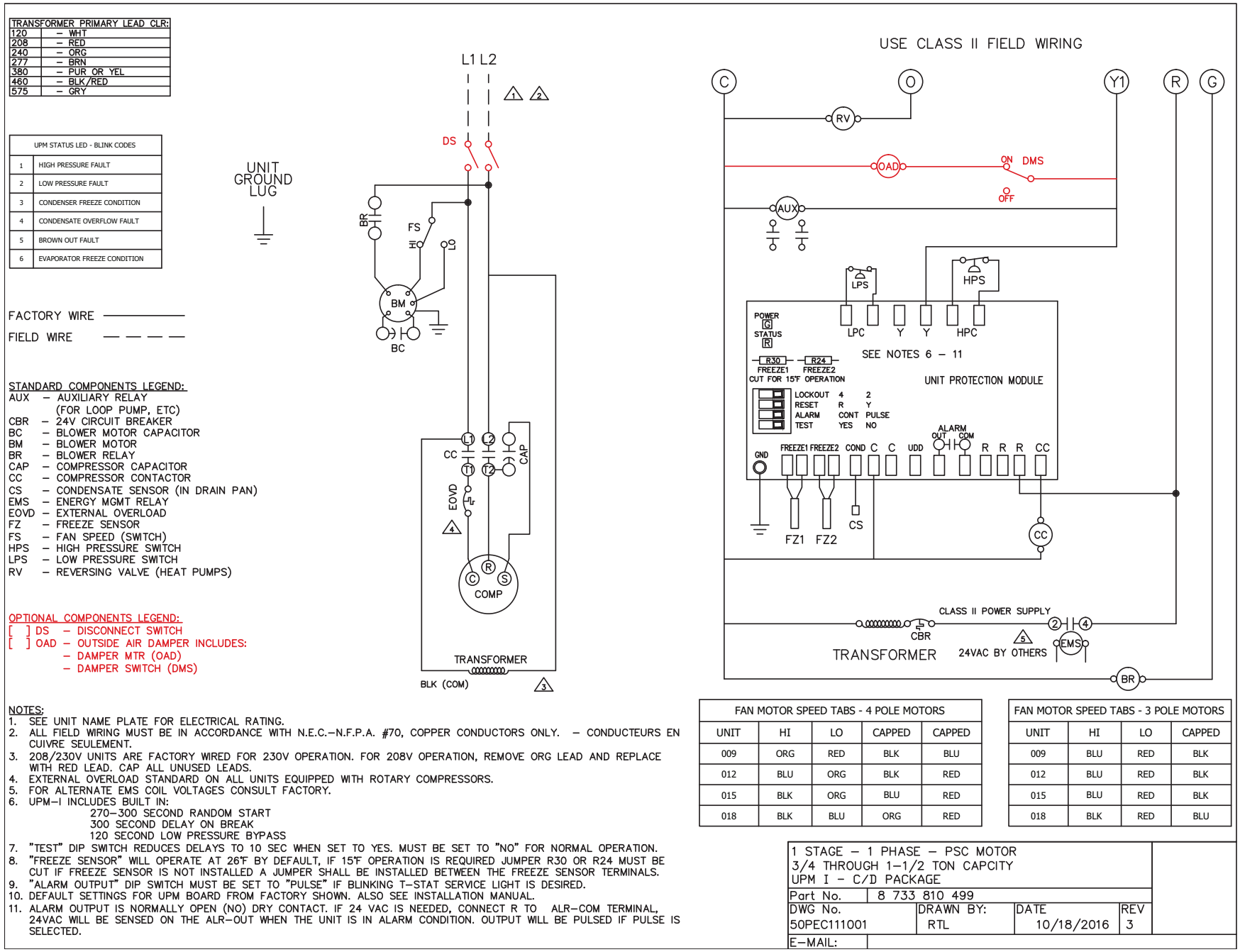


Fig. 2 — PSC Motor, Single Phase/Single Stage, Complete C / Deluxe D

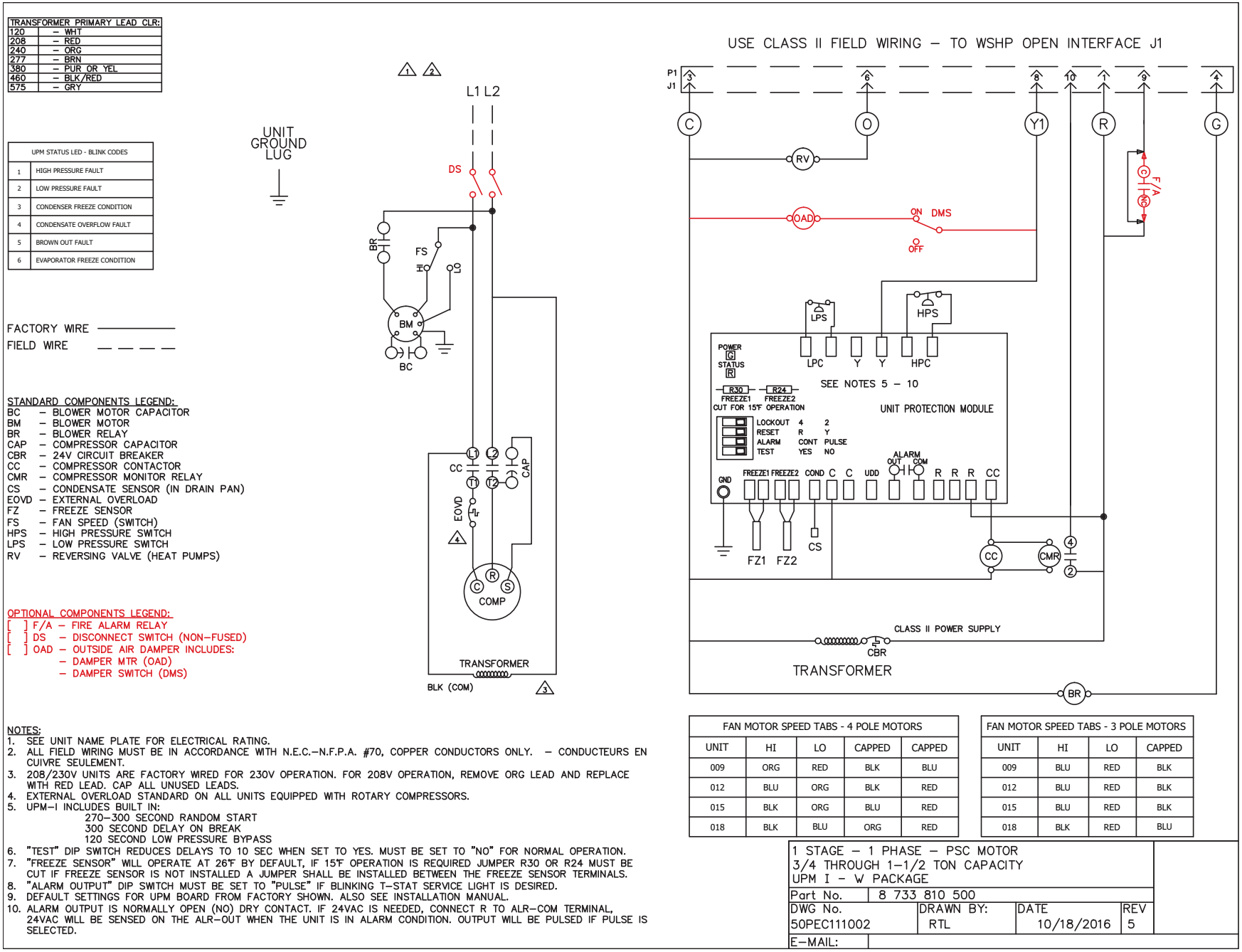
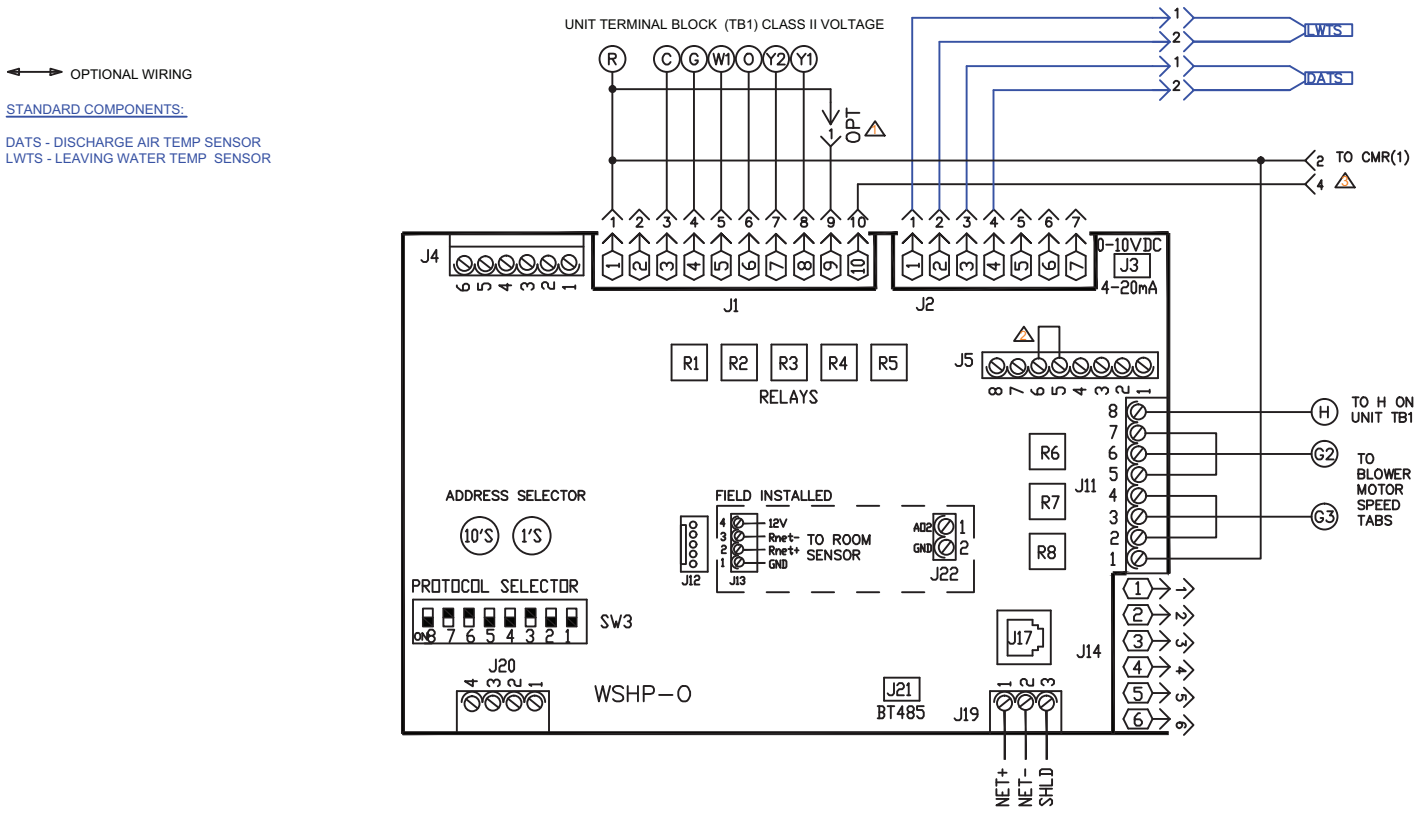


Fig. 3 — PSC Motor, Single Phase/Single Stage, WSHP Open



⚠ J1-9 USED TO CONNECT FIRE ALARM RELAY OR PHASE MONITOR OPTIONS

⚠ FACTORY JUMPER IS INSTALLED ON J5-5 AND J5-6 IF CONDENSATE FLOAT SWITCH (NC) IS NOT PRESENT

⚠ FOR 2-STAGE UNITS, CONNECT CMR CONN ACROSS PINS 4 AND 6 OF CMR1 WITH SIGNAL CMR-4 GOING TO PIN 4 AND SIGNAL CMR-2 GOING TO PIN 6.

Fig. 4 — Open DDC Wiring Diagram

FAN MOTOR SPEED TABS - 3 POLE MOTORS			
UNIT	HI	LO	CAPPED
009	BLU	RED	BLK
012	BLU	RED	BLK
015	BLU	RED	BLK
018	BLK	RED	BLU

FAN MOTOR SPEED TABS - 4 POLE MOTORS				
UNIT	HI	LO	CAPPED	CAPPED
009	ORG	RED	BLK	BLU
012	BLU	ORG	BLK	RED
015	BLK	ORG	BLU	RED
018	BLK	BLU	ORG	RED

FACTORY WIRE _____

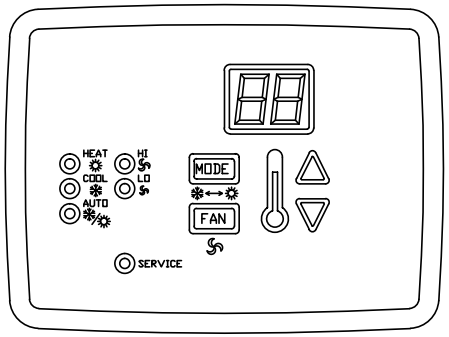
FIELD WIRE — — — — —

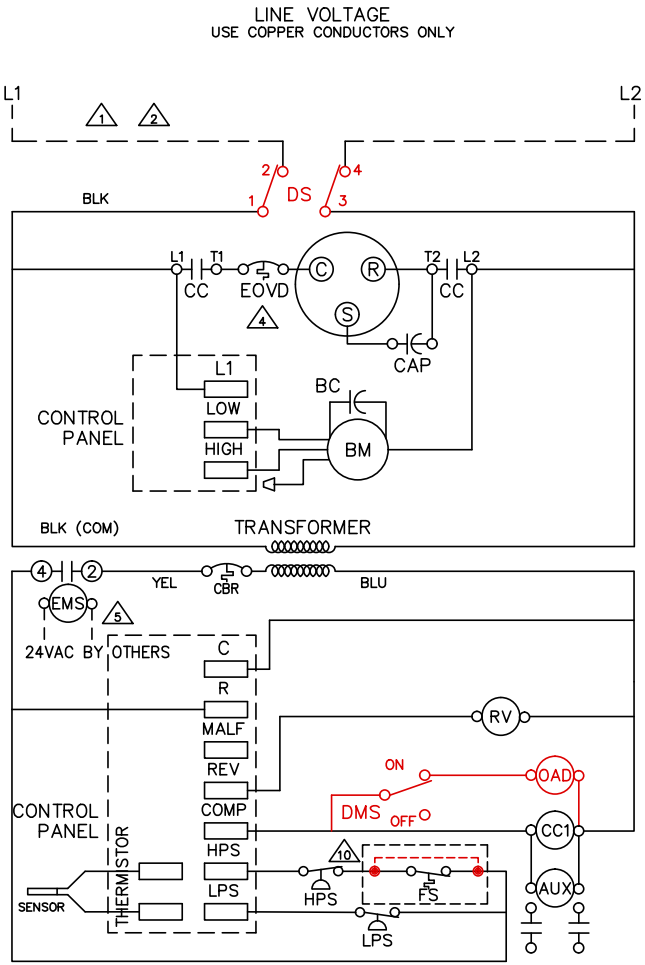
TRANSFORMER PRIMARY LEAD CLR:	
120	– WHT
208	– RED
240	– ORG
277	– BRN
380	– PUR OR YEL
460	– BLK/RED
575	– GRY

STANDARD COMPONENTS LEGEND:
AUX – AUXILIARY RELAY (FOR LOOP PUMP, ETC)
CBR – 24V CIRCUIT BREAKER
BC – BLOWER MOTOR CAPACITOR
BM – BLOWER MOTOR
CAP – COMPRESSOR CAPACITOR
CC – COMPRESSOR CONTACTOR
EMS – ENERGY MGMT SYSTEM RELAY
EOVD – EXTERNAL OVERLOAD
FS – FREEZE STAT (40 DEG F)
HPS – HIGH PRESSURE SWITCH
LPS – LOW PRESSURE SWITCH
RV – REVERSING VALVE (HEAT PUMPS)

OPTIONAL COMPONENTS LEGEND:
[ ] DS – DISCONNECT SWITCH
[ ] OAD – OUTSIDE AIR DAMPER INCLUDES:
– DAMPER MTR (OAD)
– DAMPER SWITCH (DMS)

UNIT GROUND LUG





PROGRAMMING INSTRUCTIONS:
TO PROGRAM THE CONTROLLER'S USER CONFIGURABLE FEATURES PRESS THE TEMPERATURE UP AND DOWN ARROW BUTTONS SIMULTANIOUSLY AND HOLD FOR 5 SECONDS. THIS WILL PUT THE CONTROLLER IN THE CONFIGURATION MODE.

USE THE (MODE) BUTTON TO SELECT THE FEATURE TO BE CONFIGURED: FARENHEIT/CELCIUS (F/C), TEMPERATURE DIFFERENTIAL, TIME DELAY/NO TIME DELAY (dE/nd), CYCLING FAN/CONSTANT FAN (CY/CO).

ONCE THE DESIRED FEATURE IS SELECTED, USE THE ARROW BUTTONS TO ADJUST IT. THE CONTROLLER WILL REVERT TO NORMAL OPERATION AFTER 5 SECONDS OF NO ACTIVITY.

NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE ORG LEAD AND REPLACE WITH RED LEAD. CAP ALL UNUSED LEADS.
4. EXTERNAL OVERLOAD STANDARD ON ALL UNITS EQUIPPED WITH ROTARY COMPRESSORS.
5. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
6. UNIT INCLUDES BUILT IN: 30–60 SECOND RANDOM START
   5 MINUTE DELAY ON BREAK
   90 SECOND LOW PRESSURE BYPASS
7. SERVICE LIGHT WILL BLINK ONCE ON A HIGH PRESSURE LOCKOUT
8. SERVICE LIGHT WILL BLINK TWICE ON A LOW PRESSURE LOCKOUT
9. LOCKOUTS CAN BE RESET BY CYCLING THE CONTROLLER OFF WITH THE (MODE) BUTTON
10. FOR COLD WATER GROUND LOOP APPLICATIONS, INSTALLER IS REQUIRED TO BYPASS THE FREEZE STAT SENSOR TO ALLOW NORMAL UNIT OPERATION.

1 STAGE – 1 PHASE – PSC MOTOR 3/4 THRU 1 – 1/2 TON CAPACITY UMC – C/D PACKAGE			
Part No.	8 733 810 501		
DWG No. 50PEC111000	DRAWN BY: RTL	DATE 10/18/2016	REV 4
E–MAIL:			

Fig. 5 — Wiring Diagram with Unit Mounted Controller

Step 5 — Install Supply and Return Piping

The following items should be adhered to in addition to applicable piping codes.

- A drain valve at the base of each riser to enable proper flushing of the system at startup and during servicing.
- Shutoff/isolation ball valves at the supply and return connections and unions at each unit to permit proper flow balancing and unit servicing.
- Strainers at the inlet of each circulating pump. Use Teflon[1] tape on threaded pipe fittings to eliminate water leaks and ensure against air entering the system.
- Flexible hose connections between the unit and the rigid system to eliminate the possibility of vibration transmission through the piping.
- Insulation is not normally required on supply and return piping for boiler tower installations except in unheated sections or outdoor runs.
- Insulation is required for closed-loop Geothermal installations as loop temperatures may fall below the dew point and can even fall below the freezing point of water during heating season.

Hose Kits

When using optional hose kits follow the manufacturer's recommendations for installation. Never stretch or twist hoses and never use hoses that show external wear or damage or are suspected of having damage. Never exceed the manufacturer's maximum working pressure recommendations.

Step 6 — Install Condensate Piping

Console units are designed with a blow-through configuration in the air-handling section. This means that there is positive pressure at the unit drain pan and thus trapping is not required. Condensate is routed from the drain pan via a $^{5}/_{8}$ in. non-pressure rated vinyl hose that is located below the supply and return water connections.

Though horizontal runs of condensate piping are usually too short to pose problems, horizontal runs should be pitched at least 1 in. for every 10 ft of piping. Avoid low spots or no sloped piping, as these areas can collect sediment and eventually block condensate flow. Always inspect both internal and external condensate piping for kinks that could block condensate flow.

PRE-START-UP

System Cleaning and Flushing

Cleaning and flushing the unit and system is the single most important step to ensure proper start-up and continued efficient operation of the system. See Tables 3 and 4.

⚠ WARNING

To prevent injury or death due to electrical shock or contact with moving parts, open unit disconnect before servicing unit.

⚠ CAUTION

TO AVOID POSSIBLE DAMAGE DO NOT FLUSH SYSTEM THROUGH THE UNIT!

1. Teflon is a registered trademark of Dupont.

Follow the instructions below to properly clean and flush the system:

1. Verify that electrical power to the units is disconnected, and that the circulation pump is deenergized.
2. Connect the supply hose directly to the return riser valve. Use a single length of flexible hose.

NOTE: If the length of hose is too short (i.e., the resulting connection would exceed the minimum bend radius of the hose), substitute two lengths of flexible hose joined together with a field-supplied, standard NPT coupling and the flare-fitting-to-pipe adapters provided with the hose kit.

3. Open all air vents. Fill the system with water. Do not allow system to overflow. Bleed all air from the system. Check the system for leaks and repair appropriately.
4. Check and adjust the water and air level in the expansion tank.
5. Verify all strainers are in place. Start the pumps, and systematically check each vent to ensure all air is bled from the system.
6. Verify make-up water is available. Adjust make-up water appropriately to replace the air that was bled from the system. Pressure test and inspect the system for leaks and make any necessary repairs. Check and adjust the water and air level in the expansion tank.
7. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed. Continue to bleed the system until the water appears clean or for at least three hours, whichever is longest; then, completely drain the system.
8. Refill the system with clean, chemically treated water. Since water varies for each locality, contact a local water treatment company for the correct treatment chemicals to use in the area. See Table 4. Set the boiler to raise the loop temperature to approximately 85°F.

⚠ CAUTION

To avoid possible damage to piping systems constructed of plastic piping DO NOT allow loop temperature to exceed 110°F.

Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning as necessary.

9. When the cleaning process is complete, remove the short-circuited hoses. Connect the hoses to the proper supply and return connections on each unit. Refill the system and bleed off all air.
10. Test the system pH with litmus paper. The system water should be slightly alkaline (pH 7.0 to 8.5). Add chemicals, as appropriate, to maintain acidity levels.

⚠ CAUTION

DO NOT use "Stop-Leak" or any similar chemical agent in this system. Addition of these chemicals to the loop water will foul the system and will inhibit unit operation.

11. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

Table 3 — Air and Water Limits

50PEC UNIT	COOLING (F)	HEATING (F)
Min Ambient Air	50	50
Rated Ambient Air	80	70
Max Ambient Air	100	85
Min Entering Air	50	50
Rated Entering Air, dry bulb/wet bulb	80/67	70
Max Entering Air, dry bulb/wet bulb	100/83	80
Min Entering Water	40	25
Normal Entering Water	85	70
Max Entering Water	110	80

NOTES:
1. Minimum air and water conditions can only be used at nominal flow rates.
2. 50PEC units may have up to two values at maximum or minimum with all other parameters at normal conditions.
3. Operating limits shown are for start-up, not continuous operation. It is assumed that such a start-up is for the purpose of bringing the space to desired occupancy temperature.

System Checkout

After completing the installation, and before energizing the unit, the following system checks should be made:

- Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
- Verify the control transformer is tapped for the correct voltage.
- Make sure that all electrical connections are tight and secure.
- Check the electrical fusing and wiring for the correct size.

⚠ CAUTION

Ensure cabinet and electrical box are properly grounded. Failure to follow these procedures may result in damage to equipment.

- Verify that the low voltage wiring between the thermostat and the unit is correct.
- Verify that the water piping is complete and correct.
- Check that the water flow is correct, and adjust if necessary.
- Check for water leaks and correct as necessary.
- Check the blower for free rotation, and that it is secured to the shaft.
- Verify that the return air filter has been installed and is clean.
- Verify that vibration isolation has been provided.
- Be certain that all access panels are secured in place.

⚠ CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to system water. Condenser coils never fully drain by themselves and will freeze unless winterized with antifreeze.

Table 4 — Water Quality Guidelines

CONDITION	HX MATERIAL*	CLOSED RECIRCULATING†	OPEN LOOP AND RECIRCULATING WELL**		
Scaling Potential — Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below.					
pH/Calcium Hardness Method	All	N/A	**pH < 7.5 and Ca Hardness, <100 ppm**		
Index Limits for Probable Scaling Situations (Operation outside these limits is not recommended.)					
Scaling indexes should be calculated at 150 F for direct use and HWG applications, and at 90 F for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	N/A	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	N/A	**–0.5 to +0.5** If <–0.5 minimize steel pipe use. Based upon 150 F HWG and direct well, 85 F indirect well HX.		
Iron Fouling					
Iron Fe^{2+} (Ferrous) (Bacterial Iron Potential)	All	N/A	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous) >0.2 ppm with pH 6 - 8, O_2<5 ppm check for iron bacteria.		
Iron Fouling	All	N/A	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention††					
pH	All	6 - 8.5 Monitor/treat as needed.	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8.		
Hydrogen Sulfide (H_2S)	All	N/A	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and cupronickel piping or HXs. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are okay to <0.5 ppm.		
Ammonia Ion as Hydroxide, Chloride, Nitrate and Sulfate Compounds	All	N/A	**<0.5 ppm**		
Maximum Chloride Levels			Maximum allowable at maximum water temperature.		
			50 F (10 C)	75 F (24 C)	100 F (38 C)
	Copper	N/A	<20 ppm	NR	NR
	Cupronickel	N/A	<150 ppm	NR	NR
	304 SS	N/A	<400 ppm	<250 ppm	<150 ppm
	316 SS	N/A	<1000 ppm	<550 ppm	<375 ppm
	Titanium	N/A	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size.	<10 ppm (<1 ppm “sandfree” for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components.		
Brackish	All	N/A	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

LEGEND

HWG — Hot Water Generator
HX — Heat Exchanger
N/A — Design Limits Not Applicable Considering Recirculating Potable Water
NR — Application Not Recommended
SS — Stainless Steel

*Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.

†Closed recirculating system is identified by a closed pressurized piping system.

**Recirculating open wells should observe the open recirculating design considerations.

††If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.

Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

START-UP

NOTE: You must use the Start-Up Checklist provided on pages CL-1 and CL-2 of this document when performing unit start-up for the first time. See Tables 5 and 6 for operating data.

1. Use the fan speed selector switch to set the fan to the desired speed (hi or lo).
2. Set the thermostat to the highest setting.
3. Set the thermostat system switch to "COOL" and the fan switch to the "AUTO" position. The reversing valve solenoid should energize. The compressor and fan should not run.
4. Reduce the thermostat setting approximately 5 degrees below the room temperature.
5. Verify the heat pump is operating in the cooling mode.
6. Turn the thermostat system switch to the "OFF" position. The unit should stop running and the reversing valve should de-energize.
7. Leave the unit off for approximately 5 minutes to allow for system equalization.
8. Turn the thermostat to the lowest setting.
9. Set the thermostat switch to "HEAT".
10. Increase the thermostat setting approximately 5 degrees above the room temperature.
11. Verify the heat pump is operating in the heating mode.
12. Set the thermostat to maintain the desired space temperature.
13. Check for vibrations, leaks, etc.

Antifreeze

In areas where entering loop temperatures drop below 50°F or where piping will be routed through areas subject to freezing, antifreeze is needed.

Alcohols and glycols are commonly used as antifreeze agents. Freeze protection should be maintained to 15° F below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is 30°F, the leaving loop temperature would be 22 to 25°F. Therefore, the freeze protection should be at 15°F (30°F –15°F) = 15°F.

IMPORTANT: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent alcohols from fuming.

Calculate the total volume of fluid in the piping system. See Table 7. Use the percentage by volume in Table 8 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

FREEZE PROTECTION SELECTION

The 30°F factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, the JW3 jumper (FP1) should be clipped on the control to select the low temperature (antifreeze 10°F) set point to avoid nuisance faults.

Cooling Tower/Boiler Systems

These systems typically use a common loop maintained at 60 to 90°F. Carrier recommends using a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary.

Ground Coupled, Closed Loop and Plateframe Heat Exchanger Well Systems

These systems allow water temperatures from 30 to 110°F. The external loop field is divided up into 2 in. polyethylene supply and return lines. Each line has valves connected in such a way that upon system start-up, each line can be isolated for flushing using only the system pumps. Air separation should be located in the piping system prior to the fluid re-entering the loop field.

Table 5 — Operating Temperatures and Pressures

UNIT SIZE	EWT (F)	FLOW (GPM)	COOLING				HEATING			
			SUCTION PRESSURE psig	DISCHARGE PRESSURE psig	FLUID TEMP RISE (F)	AIR TEMP DROP (F)	SUCTION PRESSURE psig	DISCHARGE PRESSURE psig	FLUID TEMP RISE (F)	AIR TEMP DROP (F)
09	30	1.5	—	—	—	—	120-125	295-305	4.3-4.7	12.2-13.4
		2.0	—	—	—	—	125-130	300-310	3.3-3.7	12.4-13.8
	40	1.5	—	—	—	—	120-125	300-305	5.2-5.8	14.3-15.8
		2.0	—	—	—	—	125-130	300-310	4.1-4.5	14.6-16.2
	50	1.5	125-130	285-295	12.8-14.2	18.1-20.0	135-140	305-310	6.2-6.8	16.2-18.0
		2.0	126-131	275-285	10.5-11.6	18.1-20.0	130-135	310-320	4.8-5.3	16.7-18.5
	60	1.5	127-132	295-305	12.6-14.0	17.4-19.2	135-140	315-320	7.1-7.9	18.3-20.3
		2.0	125-130	285-295	9.8-10.8	17.6-19.4	140-145	320-330	5.5-6.1	18.8-20.8
	70	1.5	132-137	315-325	12.4-13.8	16.7-18.5	155-165	325-335	8.2-9.0	20.0-22.2
		2.0	130-135	305-315	9.7-10.7	17.0-18.8	160-170	330-340	6.3-6.9	20.9-23.1
	80	1.5	136-141	345-355	12.4-13.7	16.2-17.9	165-175	335-345	9.0-10.0	22.3-24.7
		2.0	135-140	335-345	9.5-10.5	16.3-18.1	170-175	340-350	7.0-7.8	22.9-25.3
	90	1.5	139-144	370-380	12.2-13.4	15.5-17.1	—	—	—	—
		2.0	137-142	360-370	9.4-10.4	15.7-17.3	—	—	—	—
	100	1.5	141-145	415-425	12.1-13.3	14.8-16.4	—	—	—	—
		2.0	139-144	410-420	9.3-10.3	15.1-16.7	—	—	—	—
12	30	2.0	—	—	—	—	110-115	305-315	4.6-5.0	15.3-16.9
		3.0	—	—	—	—	115-120	305-315	3.8-4.2	15.6-17.2
	40	2.0	—	—	—	—	110-115	310-315	5.4-6.0	17.4-19.2
		3.0	—	—	—	—	115-120	310-315	4.5-4.9	17.8-19.6
	50	2.0	140-145	290-300	12.5-13.9	20.0-22.2	115-120	315-320	6.3-6.9	19.5-21.5
		3.0	135-140	270-280	10.3-11.3	20.2-22.4	120-125	320-325	5.1-5.7	19.9-21.9
	60	2.0	142-147	310-320	12.4-13.7	19.4-21.4	125-130	325-330	7.0-7.8	21.5-23.7
		3.0	137-142	300-310	10.2-11.2	19.7-21.7	130-135	330-335	5.8-6.4	21.9-24.2
	70	2.0	145-150	335-345	12.3-13.5	18.9-20.9	145-150	335-240	7.9-8.7	23.5-25.9
		3.0	143-152	325-335	10.1-11.1	19.1-21.1	150-155	340-350	7.4-8.2	23.9-26.5
	80	2.0	152-157	360-370	12.2-13.4	18.3-20.3	155-160	345-350	8.7-9.7	25.6-28.2
		3.0	150-155	350-360	10.0-11.0	18.5-20.5	160-165	350-360	7.1-7.9	26.0-28.8
	90	2.0	154-159	385-395	12.1-13.3	17.8-19.6	—	—	—	—
		3.0	152-158	375-385	9.9-10.9	18.1-20.0	—	—	—	—
	100	2.0	156-160	435-445	12.0-13.2	17.3-19.1	—	—	—	—
		3.0	154-159	425-435	9.8-10.8	17.5-19.3	—	—	—	—
15	30	3.0	—	—	—	—	110-115	280-290	3.6-4.0	13.6-15.0
		4.0	—	—	—	—	110-115	290-295	2.9-3.2	13.9-15.3
	40	3.0	—	—	—	—	115-120	295-300	4.4-4.8	15.8-17.4
		4.0	—	—	—	—	115-120	300-305	3.4-3.8	16.2-17.9
	50	3.0	127-132	275-285	12.4-13.8	21.8-24.0	115-120	305-310	5.2-5.8	18.1-20.1
		4.0	125-130	265-275	9.7-10.7	22.0-24.4	120-125	310-315	4.1-4.5	18.5-20.5
	60	3.0	129-135	310-320	12.2-13.4	20.7-22.9	125-130	315-320	6.1-6.7	20.5-22.7
		4.0	127-132	295-305	9.4-10.4	21.0-23.2	130-135	320-325	4.8-5.3	21.1-23.3
	70	3.0	135-140	330-340	11.8-13.0	19.8-21.8	145-150	325-330	6.9-7.7	23.0-25.4
		4.0	133-138	320-330	9.1-10.1	20.0-22.2	150-155	330-340	5.4-6.0	23.6-26.0
	80	3.0	142-147	355-365	11.5-12.7	18.7-20.7	155-160	335-340	7.8-8.6	25.3-27.9
		4.0	140-145	345-365	8.9- 9.9	19.0-21.0	160-165	345-350	6.0-6.6	25.9-28.7
	90	3.0	144-149	380-390	11.1-12.3	17.7-19.5	—	—	—	—
		4.0	143-148	370-380	8.6- 9.6	18.0-19.8	—	—	—	—
	100	3.0	147-152	430-440	10.8-12.0	16.7-18.5	—	—	—	—
		4.0	145-150	420-430	8.4- 9.2	16.9-18.7	—	—	—	—

LEGEND

EWT — Entering Water Temperature

NOTE: For unit size 18, contact product management.

Table 6 — Water Side Pressure Drop

50PEC UNIT SIZE	GPM	PRESSURE DROP (PSIG)	PRESSURE DROP (ft wg)
09	1.3	0.98	2.25
	1.5	1.26	2.91
	2.0	2.11	4.87
	2.5	3.16	7.29
	3.0	4.39	10.13
12	1.5	1.26	2.91
	2.0	2.11	4.87
	2.5	3.16	7.29
	3.0	4.39	10.10
	4.0	7.36	17.00
15	2.5	1.08	2.50
	3.0	1.50	3.47
	3.5	1.98	4.58
	4.0	2.52	5.82
	5.0	3.77	8.70
18	2.5	1.08	2.50
	3.0	1.50	3.47
	4.0	2.52	5.82
	5.0	3.77	8.70
	6.0	5.24	12.10

Table 7 — Approximate Fluid Volume (gal.) per 100 ft of Pipe

PIPE	DIAMETER (in.)	VOLUME (gal.)
Copper	1	4.1
	1.25	6.4
	1.5	9.2
Rubber Hose	1	3.9
Polyethylene	3/4 IPS SDR11	2.8
	1 IPS SDR11	4.5
	1 1/4 IPS SDR11	8.0
	1/2 IPS SDR11	10.9
	2 IPS SDR11	18.0
	1 1/4 IPS SCH40	8.3
	1 1/2 IPS SCH40	10.9
	2 IPS SCH40	17.0

LEGEND

IPS — Internal Pipe Size
SCH — Schedule
SDR — Standard Dimensional Ratio

NOTE: Volume of heat exchanger is approximately 1.0 gallon.

Table 8 — Antifreeze Percentages by Volume

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (F)			
	10	15	20	25
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15

OPERATION

NOTE: See Fig. 6 for sequence of operations.

Cooling Mode

Energizing the "O" terminal energizes the unit reversing valve in the cooling mode. The fan motor starts when the "G" terminal is energized.

NOTE: The fan motor will take 30 seconds to ramp up to operating speed and will run at fan only rated air flow as long as there is no call for compressor or heater operation.

When the thermostat calls for cooling (Y+O) the loop pump or solenoid valve if present is energized and the capacity starts. The fan ramps up to cooling air flow.

Once the thermostat is satisfied, the compressor shuts down accordingly and the fan ramps down to either fan only mode or off over a span of 30 seconds.

NOTE: A fault condition initiating a lockout will de-energize the compressor irrespective of which stage is engaged.

Heating Mode

The heating (Y) operates in the same manner as cooling, but with the reversing valve de-energized. Once the thermostat is satisfied, the compressor shuts down and the fan ramps down either fan only mode or off.

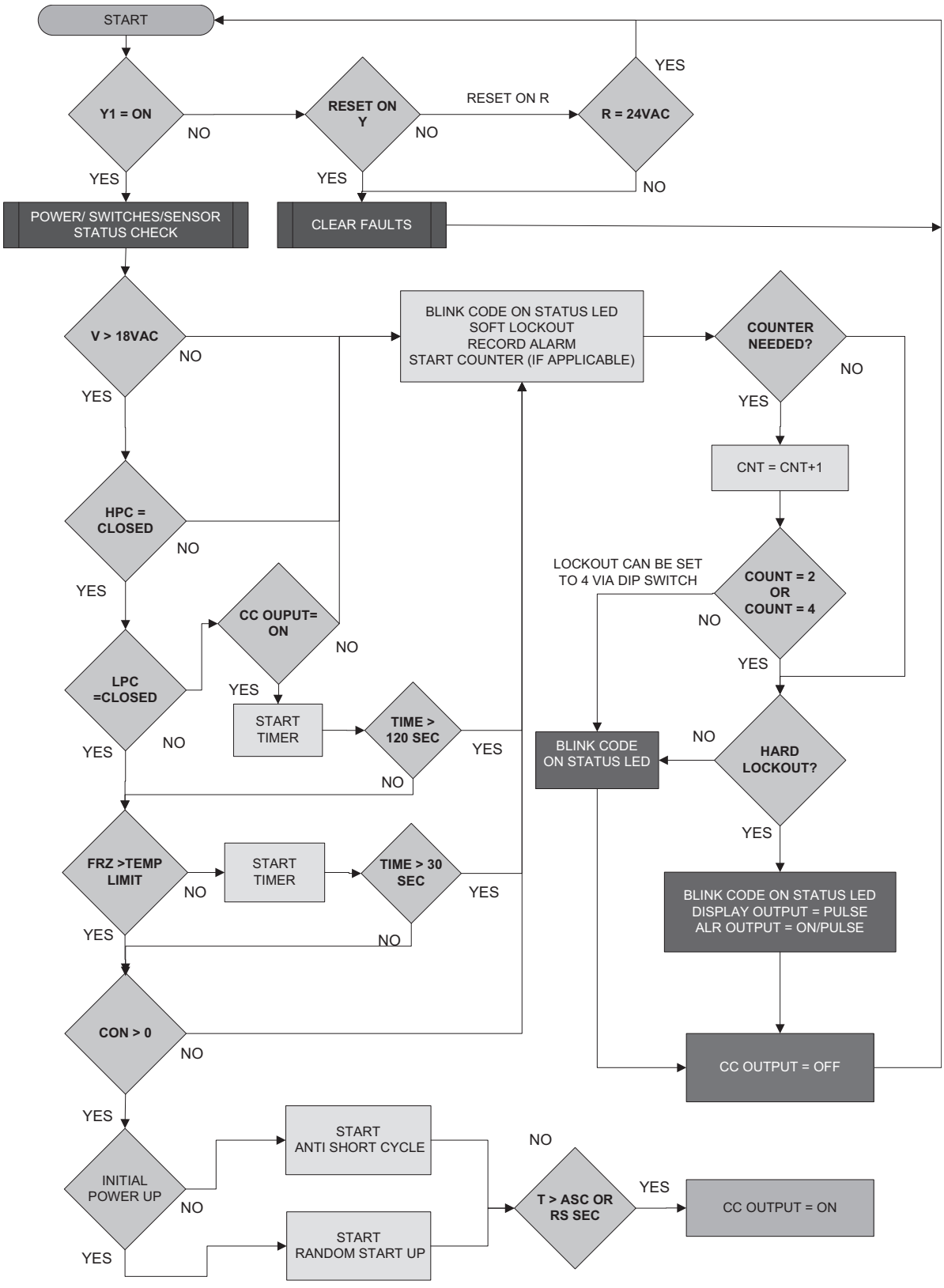


Fig. 6 — Sequence of Operations

SAFETY DEVICES AND THE COMPLETE C AND DELUXE D PACKAGES

Units are provided with a Complete C package that controls the compressor operation and monitors the safety controls that protect the unit (see Fig. 7). Safety controls include the following:

HIGH PRESSURE SWITCH

Located in the refrigerant discharge line and wired across the HPC terminals on the Complete C package.

LOW PRESSURE SWITCH

Located on the refrigerant suction line and wired across the LPC terminals on the Complete C package.

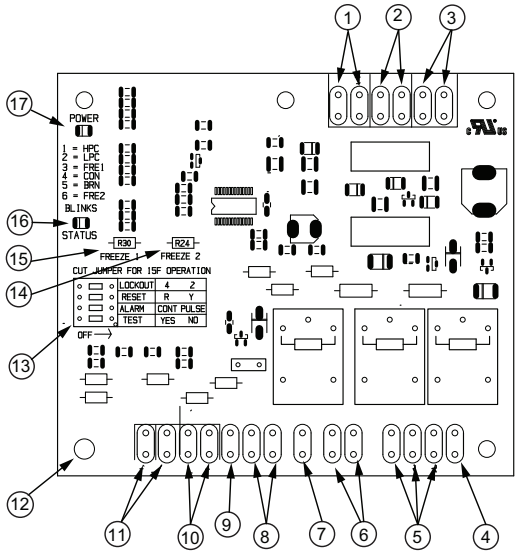
NOTE: The default setting for Complete C package contacts is open (NO).

WATER SIDE FREEZE PROTECTION SENSOR

Mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 26°F, however this can be changed to 15°F by cutting the R24 resistor located on top of DIP switch SW1.

CONDENSATE OVERFLOW PROTECTION SENSOR

Located in the drain pan of the unit and connected to the 'COND' terminal on the Complete C package (Fig. 7).



LEGEND

1 — Low pressure switch connection
2 — Compressor call Y1
3 — High pressure switch connection
4 — Compressor contactor output
5 — 24VAC power input
6 — Dry contact alarm output (ALR)
7 — Unit display connection
8 — 24VAC power common
9 — Condensate overflow sensor connection
10 — Air coil freeze connection
11 — Water coil freeze connection
12 — Complete C package ground stand-off
13 — Complete C package settings
14 — Air coil freeze protection temperature selection (FREEZE 2)
15 — Water coil freeze protection temperature selection (FREEZE 1)
16 — Board power indicator
17 — Status light indicator

Fig. 7 — Complete C Package

Units with Aquazone Complete C Package

Units with Complete C package include the following features:

ANTI-SHORT CYCLE TIMER

A 5-minute delay on break timer prevents compressor short cycling.

RANDOM START

Each controller has an unique random start delay ranging from 270 to 300 seconds on initial power up to reduce the chance of multiple unit simultaneously starting at the same time after power up or after a power interruption, thus avoiding creating large electrical spike.

LOW PRESSURE BYPASS TIMER

If the compressor is running and the low pressure switch opens, the controller will keep the compressor ON for 120 seconds. After 2 minutes if the low pressure switch remains open, the controllers will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low pressure switch closes and the anti-short cycle time delay expires. If the low pressure switch opens 2 to 4 times (depending on 2 or 4 setting for Lockout dip switch) in 1 hour, the unit will enter a hard lockout. In order to exit hard lockout, power to the unit would need to be reset.

BROWNOUT/SURGE/POWER INTERRUPTION PROTECTION

The brownout protection in the Complete C package will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain OFF until the voltage is above 18 VAC and ANTI-SHORT CYCLE TIMER (300 seconds) times out. The unit will not go into a hard lockout and does not need to be reset.

MALFUNCTION OUTPUT

Alarm output is a Normally Open (NO) dry contact. The fault output will depend on the dip switch setting for "ALARM." If it is set to "CONST," a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to "PULSE," a pulse signal is produced and a fault code is detected by a remote device indicating the fault. See Tables 9 and 10 below for LED blink code explanation. The remote device must have a malfunction detection capability when the Complete C package is set to "PULSE."

NOTE: If 24 VAC output is needed R must be wired to ALR-COM terminal; 24 VAC will be available on the ALR-OUT terminal when the unit is in the alarm condition.

Table 9 — Unit-Mounted Controller Fault Codes

BLINKS	DESCRIPTION
1	High Pressure Lockout, Freeze
2	Low Pressure Lockout

Table 10 — C and D package LED Indicators

INDICATOR COLOR	BLINKS	DESCRIPTION
Green	Solid	18-30 VAC Power is Present
Red	1	High Pressure Lockout
Red	2	Low Pressure Lockout
Red	3	Freeze Sensor Lockout
Red	4	Condensate overflow
Red	5	Brownout
Red	6	Evaporator Freeze Condition

DISPLAY OUTPUT

The Display output is a pulse output connected to the Unit Diagnostic Display (UDD) and it pulses 24 VAC when the unit is in an lockout alarm condition.

TEST DIP SWITCH

A test dip switch is provided to reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation.

NOTE: Operation of unit in test mode can lead to accelerated wear and premature failure of components. The "TEST" switch must be set back to "NO" after troubleshooting/servicing.

FREEZE SENSOR

The freeze sensor input is active all the time. If a freeze option is not selected the freeze terminals will need a jumper. There are two (2) configurable freeze points, 26°F and 15°F. The unit will enter a soft lock out until the temperature climbs above the set point and the anti-short cycle time delay has expired. The freeze sensor will shut the compressor output down after 90 seconds of water flow loss and report a freeze condition.

IMPORTANT: It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

NOTE: If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R24 resistor set to 26°F in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

INTELLIGENT RESET

If a fault condition is initiated, the 5-minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.

LOCKOUT RESET

A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R.”

NOTE: The blower motor will remain active during a lockout condition.

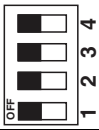
NOTE: Always check incoming line voltage power supply and secondary control voltage for adequacy.

NOTE: See Tables 11 and 12 for default settings.

Table 11 — Complete C Package Factory Default Settings

OPERATION	SETTING
TEMP	26 F
LOCKOUT	2
RESET	Y
ALARM	PULSE
TEST	NO
HOT/DRY ALARM	NO

Table 12 — Complete C DIP Switch Default Position

SWITCH	OPERATION	OFF (Default)	ON
	LOCKOUT	2	4
	RESET	Y	R
	ALARM	Pulse	Cont.
	TEST	No	Yes

Units with Aquazone Deluxe D Package

Units with Deluxe D package include all the functions of the Complete C package as well as the following:

ENERGY MANAGEMENT SWITCH

Enables 24 VAC external signal to control the operation of the WSHP.

PUMP/VALVE RELAY

Provides a signal between an isolation valve and a secondary pump.

Units with WSHP Open Controls with UPM Package

Units with WSHP Open still feature a UPM package for unit operation, so the operation will be similar to the sequence for the Complete C and Deluxe D package. WSHP Open does feature advanced functionality, such as automatic fan speed control and intelligent alarming, which will differ from the Complete C and Deluxe D packages. Below is an overview of the different features for the WSHP Open controls. See Fig. 8. For more details of the WHSP Open operation, please refer to the WSHP Open Integration Guide and the WSHP Points/Properties Manual.

COOLING

The control will operate one or two stages of compression to maintain the desired cooling setpoint. To improve dehumidification and reduce noise, the control operates the fan at the lowest speed possible to satisfy the load conditions. If cooling is active and should the SAT approach the minimum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient and if the SAT falls further (equal to the minimum SAT limit), the fan will be indexed to the maximum speed. If the SAT still continues to falls 5 degrees below the minimum SAT limit, all cooling stages will be disabled.

During Cooling, the reversing valve output will be held in the cooling position (either B or O type as configured) even after the compressor is stopped. The valve will not switch position until the opposite mode is required.

REVERSE CYCLE HEATING

The control will operate one or two stages of compression to maintain the desired heating setpoint. To reduce noise, the control operates the fan at the lowest speed possible. If the heating is active and should the SAT approach the maximum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient, then if the SAT rises further and reaches the Maximum Heating SAT limit, the fan will be indexed to the maximum speed. If the SAT still continues to rise 5°F above the maximum limit, all heating stages will be disabled.

During Heating, the reversing valve output will be held in the heating position (either B or O type as configured) even after the compressor is stopped. The valve will not switch position until the opposite mode is required.

TWO POSITION OA DAMPER

The control can be configured to operate a 2-position ventilation damper to provide the minimum ventilation requirements during occupied periods.

MODULATING OA DAMPER WITH DCV

The control can be configured to operate a modulating ventilation damper during occupied periods that responds to changing CO_2 levels from an optional sensor. The control monitors the CO_2 level and compares it to the configured setpoints and adjusts the ventilation rate as required. The control provides proportional ventilation to meet the requirements of ASHRAE specifications by providing a base ventilation rate and then increasing the rate as the CO_2 level increases. The control has three user adjustable setpoints; start ventilation maximum ventilation and maximum damper position. The control will begin to proportionally increase ventilation when the CO_2 level rises above the start ventilation setpoint and will reach the full ventilation rate (maximum damper position) when the CO_2 level is at or above the maximum setpoint. A user configurable minimum damper position insures that proper base ventilation is delivered when occupants are not present.

AUXILIARY MODULATING HOT WATER / STEAM HEATING REHEAT

The control can modulate a hot water or steam valve connected to a coil on the discharge side of the unit and supplied by a boiler in order to maintain the desired heating setpoint should the compressor capacity be insufficient or a compressor failure occurs. Unless the compressor fails, the valve will only operate to supplement the heat provided by the compressor if the space temperature falls 2°F or more below the desired heating setpoint. The valve will be controlled so the SAT will not exceed the Maximum Heating SAT limit.

2-POSITION HOT WATER / STEAM HEATING REHEAT

The control can operate a two position, NO or NC, hot water or steam valve connected to a coil on the discharge side of the unit and supplied by a boiler in order to maintain the desired heating setpoint should the compressor capacity be insufficient or a compressor failure occurs. Unless the compressor fails, the valve will only open to supplement the heat provided by the compressor if the space temperature falls 2°F or more below the desired heating setpoint. The valve will be controlled so the SAT will not exceed the Maximum Heating SAT limit and subject to a two minute minimum OFF time to prevent excessive valve cycling.

SINGLE STAGE ELECTRIC AUXILIARY HEAT

The control can operate a single stage of electric heat connected to a coil on the discharge side of the unit in order to maintain the desired heating setpoint should the compressor capacity be insufficient or a compressor failure occurs. Unless the compressor fails, the heat stage will only operate to supplement the heat provided by the compressor if the space temperature falls 2°F or more below the desired heating setpoint. The heat stage will be controlled so the SAT will not exceed the Maximum Heating SAT limit and subject to a two minute minimum OFF time to prevent excessive cycling.

AUTOMATIC FAN SPEED CONTROL

The control is capable of controlling up to three fan speeds. The motor will operate at the lowest speed possible to provide quiet and efficient fan operation. The motor will increase speed if additional cooling or heating is required to maintain the desired space temperature setpoint. The control increases the motor's speed by one step for each 2°F above the cooling or below the heating setpoint. Also, the control will increase the fan speed as the Supply Air Temperature approaches the configured minimum or maximum limits. Fan speed for PSC motors is controlled by energizing and de-energizing low, medium and high speed relays. Fan speed for ECMs is controlled by first energizing the low speed tap. If a higher speed is required, the low speed tap remains energized while the medium speed tap is also energized. If high motor speed is required, all three speed taps are energized. If more than one speed tap is energized for an ECM, the ECM will default to the higher speed.

FAN SPEED CONTROL — DURING HEATING

Whenever heat is required and active, the control continuously monitors the supply air temperature to verify it does not rise above the configured Maximum Heating SAT Limit (110°F Default). As the SAT approaches this value, the control will increase the fan speed as required to insure the SAT will remain within the limit. This feature provides the most quiet and efficient operation by operating the fan at the lowest speed possible.

FAN SPEED CONTROL — DURING COOLING

Whenever mechanical cooling is required and active, the control continuously monitors the supply air temperature to verify it does not fall below the configured Minimum Cooling SAT Limit (50°F Default). As the SAT approaches this value, the control will increase the fan speed as required to insure the SAT will remain within the limit.

MODULATING WATER ECONOMIZER CONTROL

The control has the capability to modulate a water valve to control condenser water flowing through a coil on the entering air side of the unit.

COOLING

The purpose is to provide an economizer cooling function by using the water loop when the entering water loop temperature is suitable (at least 5°F below space temperature). If the water loop conditions are suitable, then the valve will modulate open as required to maintain a Supply Air Temperature that meets the load conditions. Should the economizer coil capacity be insufficient for a period greater than 5 minutes, or should a high humidity condition occur, then the compressor will be started to satisfy the load. As the SAT approaches the Minimum Cooling SAT limit, the economizer valve will modulate closed during compressor operation.

HEATING

Additionally, the control will modulate the water valve should the entering water loop temperature be suitable for heating (at least 5°F above space temperature) and heat is required. The valve will be controlled in a similar manner except to satisfy the heating requirement. Should the coil capacity be insufficient to satisfy the space load conditions for more than 5 minutes, then the compressor will be started to satisfy the load. As the SAT approaches the Maximum Heating SAT limit, the economizer valve will modulate closed during compressor operation.

2-POSITION WATER ECONOMIZER CONTROL

The control has the capability to open a NO or NC, two position, water valve to control condenser water flow through a coil on the entering air side of the unit.

COOLING

The purpose is to provide a cooling economizer function directly from the condenser water loop when the entering water loop temperature is suitable (at least 5°F below space temperature). If the optional coil is provided and the water loop conditions are suitable, then the valve will open to provide cooling to the space when required. Should the capacity be insufficient for a period greater than 5 minutes, or should a high humidity condition occur, then the compressor will be started to satisfy the load. Should the SAT reach the Minimum Cooling SAT limit, the economizer valve will close during compressor operation.

HEATING

Additionally, the economizer control will open the water valve should the entering water loop temperature be suitable for heating (at least 5°F above space temperature) and heat is required. The valve will be controlled in a similar manner except to satisfy the heating requirement. Should the coil capacity be insufficient to satisfy the space load for more than 5 minutes, then the compressor will be started to satisfy the load. Should the SAT reach the Maximum Heating SAT limit, the economizer valve will close during compressor operation.

POWER FAIL RESTART DELAY

The control provides a delay when recovering from a power failure in order to insure stable utility power and to prevent excessive demand when many units start simultaneously. Each unit can be user configured for a unique delay between 0 and 600 seconds. The factory programmed default delay is 60 seconds. (Note that the onboard control will not start the compressor on any call for heating, cooling or dehumidification until 5 minutes has elapsed from the power restoration. If a lower restart time delay is configured, only the fan start will be affected as the internal logic packages will prevent compressor operation for more than 300 seconds).

SUPPLY AIR TEMPERATURE MONITORING / CONTROL / ALARM

The control has 2 configurable control limits for supply air temperature. The control will monitor the supply air temperature (SAT) and verify it is within limits. During cooling, the control will increase fan speed and reduce compressor stages should the SAT approach the Maximum Cooling SAT limit. Likewise, during heating, should the SAT approach the Maximum Heating SAT limit, the fan speed will be increased, followed by reducing compressor stages. Auxiliary heating coils are controlled so as not to exceed the Maximum Heating SAT limit. Additionally, a separate High SAT Alarm Limit and Low SAT Alarm Limit are provided so that an alarm can be generated to indicate an abnormal SAT condition should the SAT exceed the alarm limit for more than 1 minute.

DEHUMIDIFICATION

The control can monitor the space relative humidity and if the unit is equipped with the factory installed hot gas reheat, whenever the humidity exceeds the appropriate (occupied or unoccupied) humidity setpoint and if the unit is not heating or cooling, the control will activate cooling (compressor and reversing valve) and the hot gas reheat outputs to start dehumidification. The fan will operate at medium speed if equipped with a three speed fan.

SPACE TEMPERATURE ALARMS

The control provides the ability to generate an alarm whenever the space temperature exceeds the alarm setpoint. A separate occupied hysteresis and unoccupied high and low alarm setpoints are provided. The control provides a 5 minute alarm delay during unoccupied periods. During occupied periods, the control uses the occupied temperature setpoint and applies the hysteresis value to determine the alarm setpoints. Whenever an occupancy transition from unoccupied to occupied occurs or the occupied temperature setpoints are changed causing an alarm condition to occur, the control will automatically calculate an alarm delay (equivalent to the configured delay time in minutes / °F times the temperature error that occurred). This will prevent nuisance alarms whenever an occupancy change occurs and allows time for the unit to correct an alarming temperature condition.

CONDENSER WATER TEMPERATURE MONITORING / CONTROL / ALARM

The control has 4 configurable alarm limits for condenser water temperature. The control will verify that the water temperature is within operating range (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor. Once the compressor is started, the condenser water temperature is further monitored to verify that it is within limits to insure sufficient water is flowing through the coil. Should the leaving water temperature rise above or fall below the appropriate limits, and alarm is generated and the compressors will be shut down if the condition occurs for more than 15 seconds.

HIGH CONDENSATE / OVERFLOW ALARM

The control will monitor a discrete input to determine the state of a condensate level switch. The input can be configured to alarm on either an open or closed switch condition. Should this input be in an alarm state, the control will start a timer and after the timer exceeds a configurable 'Condensate Overflow Alarm Delay' limit (10 seconds default), the control will generate an alarm and the unit will disable the compressor, dehumidification and fan outputs.

FILTER STATUS ALARM

The control provides the ability to generate a dirty filter alarm after the number of fan run hours exceeds a configurable filter alarm timer limit. The control monitors the fan output and if the fan is operating at any speed, it accumulates run time. Should the fan run time hours exceed the configurable limit, an alarm is generated. To reset the alarm timer after the alarm has been generated, a 'Reset Filter Alarm' input is provided. The filter alarm can be disabled by setting the 'Filter Alarm Timer Delay' to zero (factory default).

COMPRESSOR FAULT/LOCKOUT ALARM

The control will monitor a discrete input to determine the compressor state. Should the input state not match the desired compressor operating state for greater than 6 minutes, the control assumes the compressor has been locked-out and will generate an alarm. Also, when this fault occurs and if the unit is equipped with an auxiliary heating coil or a water economizer and the water temperature is suitable for heating, should heating be required, the control will utilize the auxiliary heating source as the primary heating source until the fault condition is corrected.

INSUFFICIENT VENTILATION ALARM

The control provides the ability to generate a high CO_2 level alarm during occupied periods whenever the CO_2 sensor value exceeds the user adjustable limit. Whenever an occupancy transition from unoccupied to occupied occurs, or the occupied alarm limit is changed to a value that causes an alarm condition to occur, the control will automatically calculate an alarm delay based on the error from setpoint (15 minutes minimum). This prevents nuisance alarms from occurring when occupancy changes. The IAQ alarm can be disabled by setting 'Occupied High IAQ Alarm Limit' to zero.

RELATIVE HUMIDITY ALARM

The control provides the ability to generate an alarm whenever the space relative humidity exceeds the alarm setpoint. A separate occupied and unoccupied alarm setpoint is provided. The control provides a 5 minute alarm delay during unoccupied periods. During occupied periods, the controller uses the occupied high RH alarm limit Whenever an occupancy transition from unoccupied to occupied occurs or the occupied high alarm limit is lowered causing an alarm condition to occur, the control will automatically calculate an alarm delay (equivalent to the configured delay time in minutes / % RH times the humidity error condition that occurred). This will prevent nuisance alarms whenever an occupancy change occurs and allows time for the unit to correct an alarming humidity condition.

TIME SCHEDULES

The control has an onboard time clock and configurable time schedules to provide occupancy scheduling.

HOLIDAY SCHEDULES

The control has holiday schedules that can be programmed to override the normal occupancy operation and cause the unit to go unoccupied for the duration of the schedule. Each schedule consist of a start date and time and an end date and time so each schedule can span more than a single day duration.

OVERRIDE SCHEDULES

The control has override schedules that can be programmed to override the normal occupancy and holiday operation and cause the unit to go occupied for the duration of the schedule. Each schedule consist of a start date and time and an end date and time so each schedule can span more than a single day duration.

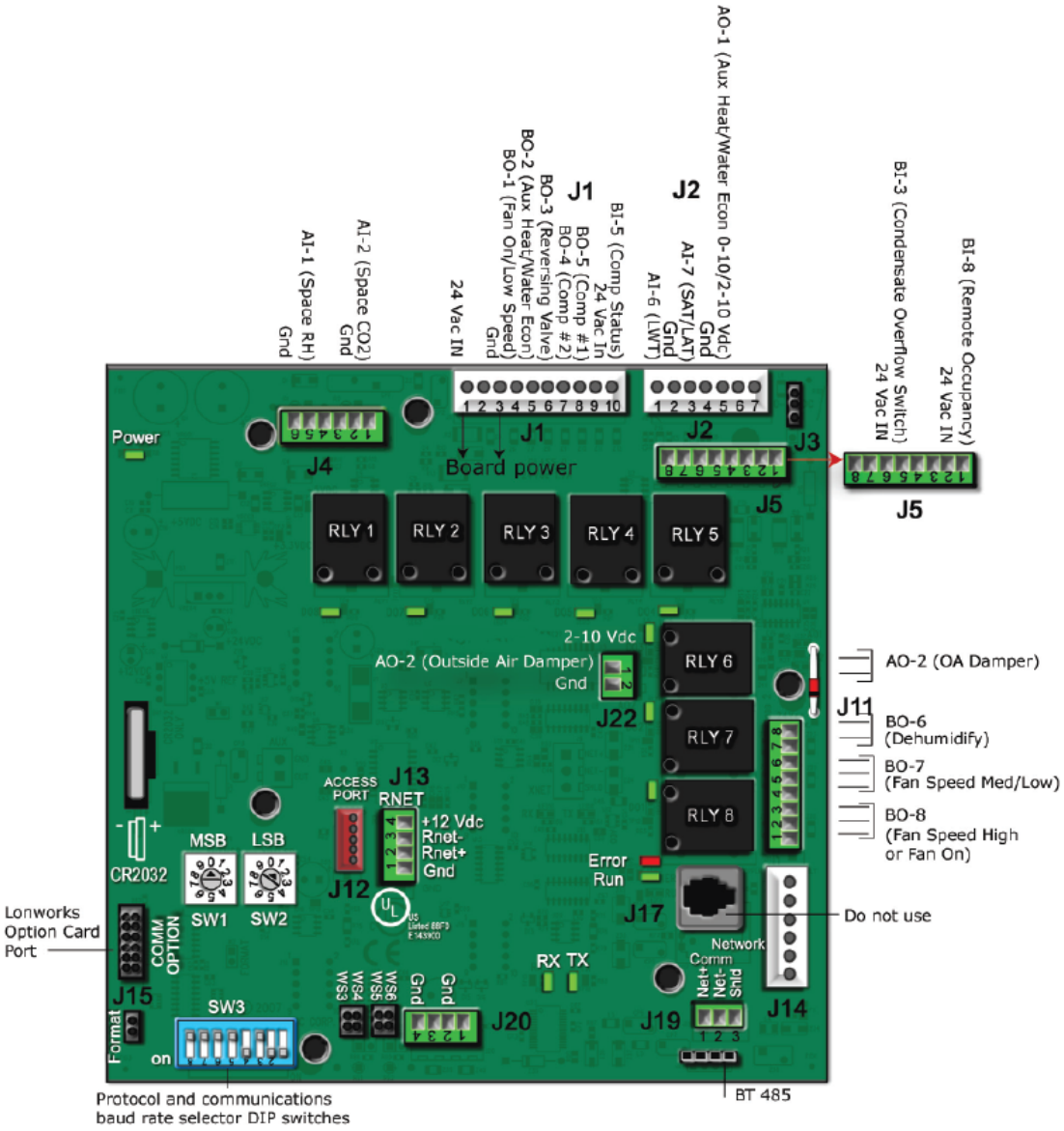


Fig. 8 — WSHP Open Control Package

UNIT-MOUNTED CONTROLLER

Designed to enhance the unit operation with more flexibility, accurate control and operating modes the unit-mounted controller provides an increased level of comfort in the conditioned space together with solid-state reliability and ease of operation. See Fig. 9.

The same functions of the proven Complete C package module are incorporated into the unit-mounted controller for unit protection. unit-mounted controllers are standard on all console units except for remote options.

- Tactile touch pad for temperature, fan and mode adjustment.
- Digital display of temperature in either degrees Fahrenheit or Celsius.
- LED display provides indication for unit operating mode as well as fan speed and fault indication for high or low pressure lockout.
- Adjustable Temperature Set point from 60°F through 80°F (15.5°C through 26.7°C).
- Adjustable Temperature Differential between 1°F and 6°F (0.6°C and 3.3°C).
- Selectable options:
  - Manual/Automatic changeover
  - Fan speed – High or Low
  - Fan operation constant fan or cycling with compressor
- Additional features:
  - 5-minute anti short cycling delay
  - Random start
  - 90-second low pressure bypass timer prevents nuisance lockouts during cold winter start up.
  - Intelligent reset allows the unit to automatically restart after 5 minutes if a fault is no longer active.

NOTE: The 40°F clamp-on water coil freeze sensor is located on the water out piping. If the loop temperature is expected to go below water freezing temperature (see Fig. 10), this sensor should be removed from the safety circuit. The appropriate amount of antifreeze for the specific application must be used to protect the heat pump from freezing.

Refer to the Unit Wiring Diagram located on the unit.

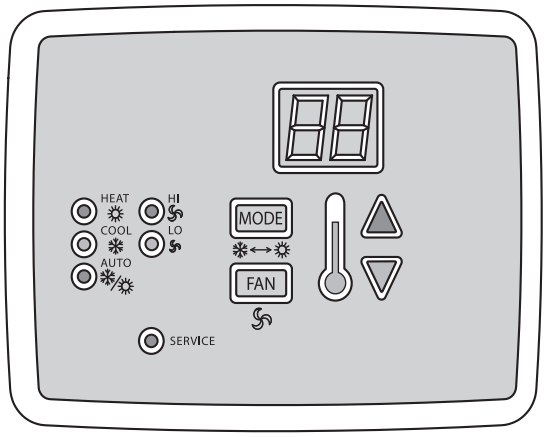


Fig. 9 — Unit Mounted Controller

LOW TEMPERATURE LOOP APPLICATION

In applications where fluid temperatures may fall below 40°F in a ground water or ground loop applications using a console equipped with a unit-mounted controller, the freeze stat will need to be bypassed from the controls circuitry. To accomplish this, follow the instructions below:

1. Locate High Pressure and Freeze Stat mated wires labeled A and B, respectively.
2. Disconnect yellow wire labeled A from black wire labeled B.
3. Locate High Pressure and Freeze Stat mated wires labeled D and C, respectively.
4. Disconnect Yellow wire labeled B from black wire labeled C.
5. Connect yellow wire labeled A to yellow wire labeled D.
6. Leave black wires B and C disconnected from any circuits.
7. This completes the Freeze Stat Bypass Field Rework.

MAINTENANCE

Filter changes or cleaning are required at regular intervals. The time period between filter changes will depend upon the type of environment the equipment is used in. In a single family home that is not under construction, changing or cleaning the filter every 60 days is sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may be need to be as frequent as biweekly.

NOTE: Equipment should never be used during construction due to likelihood of wall board dust accumulation in the air coil of the equipment, which permanently affects the performance and may shorten the life of the equipment.

An annual "checkup" is required by a licensed refrigeration technician. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit's data plate and the data taken at the original start-up of the equipment.

The condensate drain must be checked annually by cleaning and flushing to ensure proper drainage.

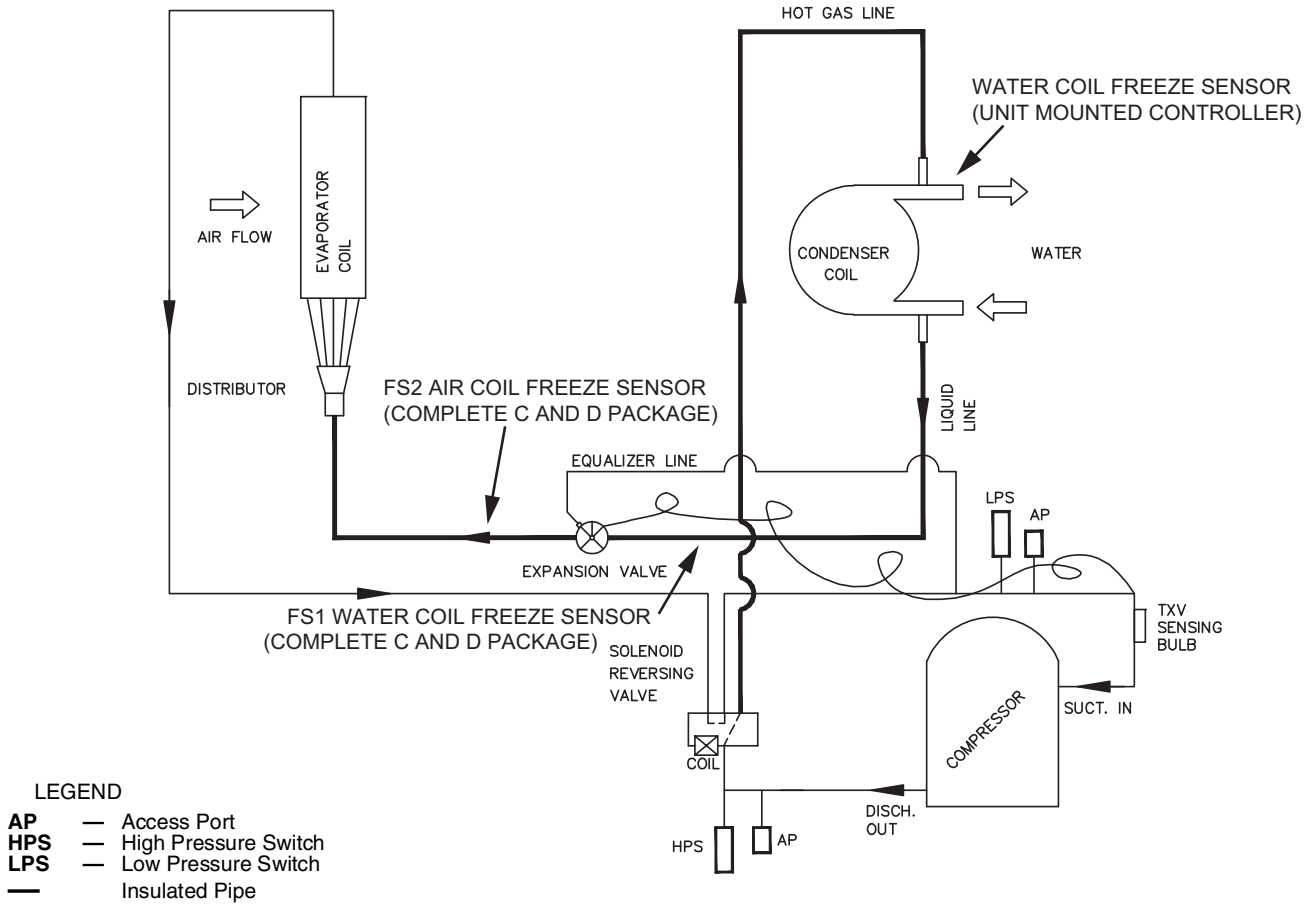


Fig. 10 — Piping and Sensor Schematic

TROUBLESHOOTING

Troubleshooting Checks and Correction column in Table 13 may reflect a possible fault that may be one of, or a combination of causes and solutions. Check each cause and adopt "process of elimination" and/or verification of each before making any conclusion.

Periodic lockouts almost always are caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur, call a technician immediately and have them check for: water flow problems, water temperature problems, air flow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

Table 13 — Troubleshooting

PROBLEM	POSSIBLE CAUSE	CHECKS AND CORRECTION
ENTIRE UNIT DOES NOT RUN	Power Supply Off	Apply power, close disconnect.
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses
	Voltage Supply Low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Thermostat	Set the fan to "ON"; the fan should run. Set thermostat to "COOL" and lowest temperature setting; the unit should run in the cooling mode (reversing valve energized). Set unit to "HEAT" and the highest temperature setting, the unit should run in the heating mode. If neither the blower nor the compressor run in all three cases, the thermostat could be miswired or unit-mounted controller faulty. To ensure miswired or faulty thermostat verify 24 volts is available on the condensing section low voltage terminal strip between "R" and "C," "Y" and "C," and "O" and "C." If the blower does not operate, verify 24 volts between terminals "G" and "C" in the air handler. Replace the thermostat if defective.
BLOWER OPERATES BUT COMPRESSOR DOES NOT.	Thermostat	Check setting, calibration, and wiring.
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor.
	Safety Controls	Check C and D package red default LED for blink code.
	Compressor Overload Open	If the compressor is cool and the overload will not reset, replace compressor.
	Compressor Motor Grounded	Internal winding grounded to the compressor shell. Replace compressor. If compressor burnout, install suction filter drier.
	Compressor Windings Open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor.
UNIT OFF ON HIGH PRESSURE CONTROL	Discharge Pressure Too High	In "COOLING" mode: Lack of or inadequate water flow. Entering water temperature is too warm. Scaled or plugged condenser. In "HEATING" mode: Lack of or inadequate air flow. Blower inoperative, clogged filter or restrictions in duct work.
	Refrigerant Charge	The unit is overcharged with refrigerant. Recover refrigerant, evacuate and recharge with factory recommended charge.
	High Pressure Switch	Check for defective or improperly calibrated high pressure switch.
UNIT OFF ON LOW PRESSURE CONTROL	Suction Pressure Too Low	In "COOLING" mode: Lack of or inadequate air flow. Entering air temperature is too cold. Blower inoperative, clogged filter or restrictions in duct work. In "HEATING" mode: Lack of or inadequate water flow. Entering water temperature is too cold. Scaled or plugged condenser.
	Refrigerant Charge	The unit is low on refrigerant. Check for refrigerant leaks, repair, evacuate and recharge with factory recommended charge.
	Low Pressure Switch	Check for defective or improperly calibrated low pressure switch.
UNIT SHORT CYCLES	Unit Oversized	Recalculate heating and or cooling loads.
	Thermostat	Thermostat installed near a supply air grill; relocate thermostat. Readjust heat anticipator.
	Wiring and Controls	Check for defective or improperly calibrated low pressure switch.
INSUFFICIENT COOLING OR HEATING	Unit Undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem.
	Loss of Conditioned Air By Leakage	Check for leaks in duct work or introduction of ambient air through doors or windows.
	Airflow	Lack of adequate air flow or improper distribution of air. Replace dirty filter.
	Refrigerant Charge	Low on refrigerant charge causing inefficient operation.
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing Valve	Defective reversing valve creating bypass of refrigerant from discharge of suction side of compressor. Replace reversing valve.
	Operating Pressures	Compare unit operation pressures to the pressure/temperature chart for the unit.
	TXV	Check thermostatic expansion valve (TXV) for possible restriction or defect. Replace if necessary.
	Moisture, Non Condensable	The refrigerant system may be contaminated with moisture or non condensable. Recover refrigerant, replace filter dryer, evacuate the refrigerant system, and recharge with factory recommended charge.

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50PEC UNIT
START-UP CHECKLIST

NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Installation, Start-Up and Service document.

CUSTOMER: _____ JOB NAME: _____

MODEL NO.: _____ SERIAL NO.: _____ DATE: _____

I. PRE-START-UP

DOES THE UNIT VOLTAGE CORRESPOND WITH THE SUPPLY VOLTAGE AVAILABLE? (Y/N) _____

HAVE THE POWER AND CONTROL WIRING CONNECTIONS BEEN MADE AND TERMINALS TIGHT? (Y/N) _____

IS THE CONTROL TRANSFORMER SET TO THE CORRECT VOLTAGE? (Y/N) _____

HAVE WATER CONNECTIONS BEEN MADE AND IS FLUID AVAILABLE AT HEAT EXCHANGER? (Y/N) _____

HAS PUMP BEEN TURNED ON AND ARE ISOLATION VALVES OPEN? (Y/N) _____

HAS CONDENSATE CONNECTION BEEN MADE AND IS A TRAP INSTALLED? (Y/N) _____

IS AN AIR FILTER INSTALLED AND CLEANED? (Y/N) _____

HAS THE FAN SPEED SELECTOR SWITCH BEEN SET TO THE DESIRED SETTING? (Y/N) _____

II. START-UP

IS FAN OPERATING WHEN COMPRESSOR OPERATES? (Y/N) _____

UNIT VOLTAGE — COOLING OPERATION

PHASE AB VOLTS_____

PHASE AB AMPS_____

CONTROL VOLTAGE

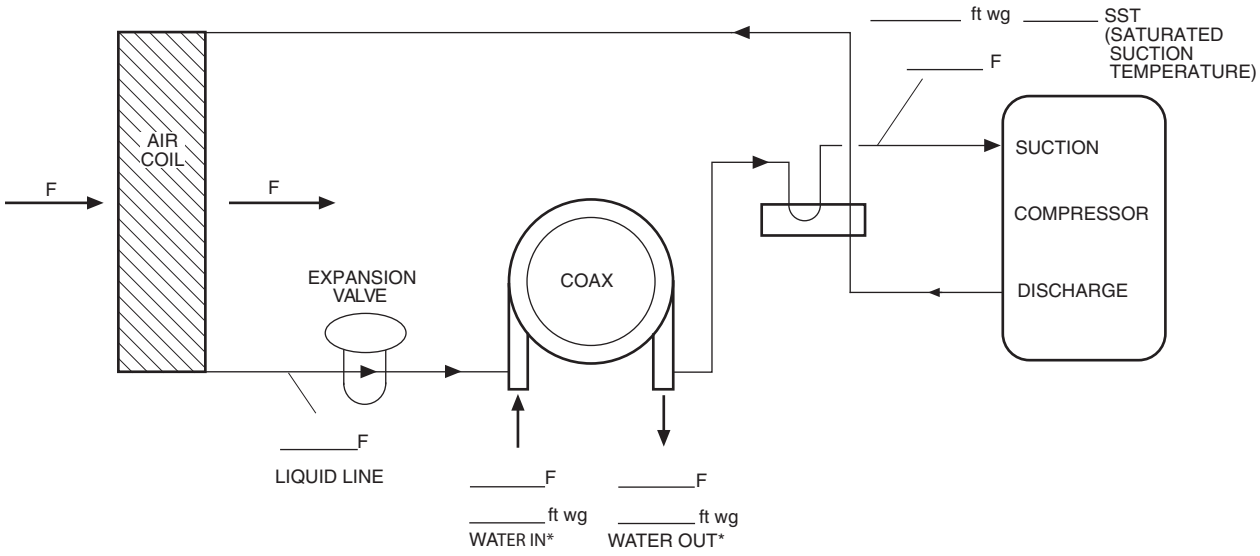
IS CONTROL VOLTAGE ABOVE 21.6 VOLTS? (Y/N) _____.
IF NOT, CHECK FOR PROPER TRANSFORMER CONNECTION.

TEMPERATURES

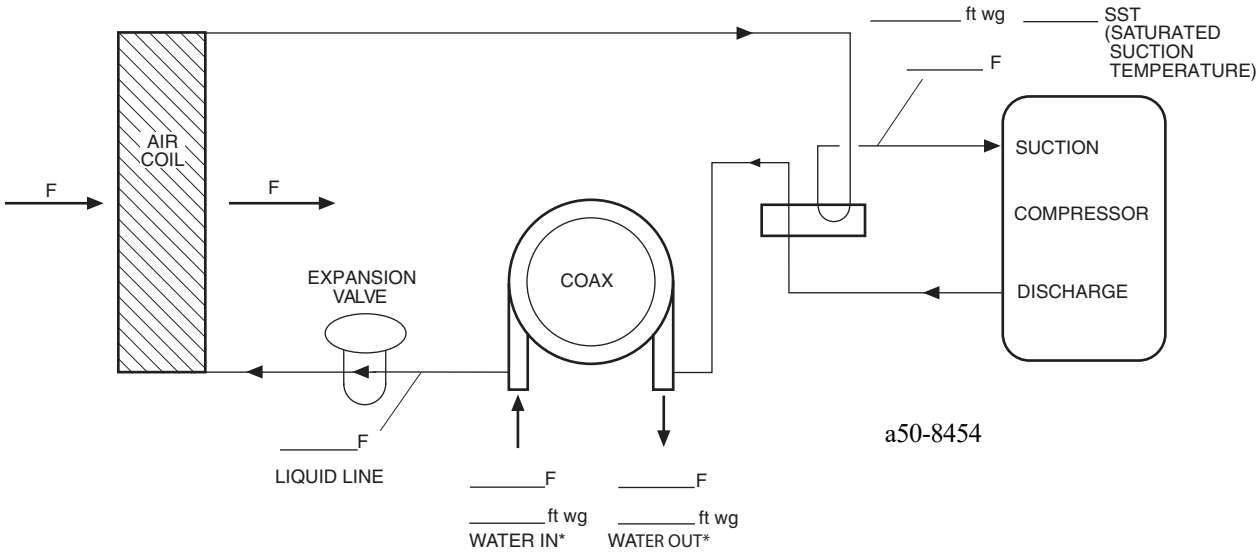
FILL IN THE ANALYSIS CHART ATTACHED.

COAXIAL HEAT EXCHANGER	COOLING CYCLE: WATER IN	_____ F	WATER OUT	_____ F	_____ FT WG	_____ GPM		
	HEATING CYCLE: WATER IN	_____ F	WATER OUT	_____ F	_____ FT WG	_____ GPM		
AIR COIL	COOLING CYCLE: AIR IN	_____ F	AIR OUT	_____ F				
	HEATING CYCLE: AIR IN	_____ F	AIR OUT	_____ F				

HEATING CYCLE ANALYSIS



COOLING CYCLE ANALYSIS



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HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

_____ FLOW RATE (gpm) x _____ TEMP. DIFF. (DEG. F) x _____ FLUID FACTOR† = _____ (Btu/hr)

SUPERHEAT = SUCTION TEMPERATURE – SATURATED SUCTION TEMPERATURE
= ____ (DEG F)

SUBCOOLING = SATURATED CONDENSING TEMPERATURE – LIQUID LINE TEMPERATURE
= ____ (DEG F)

*Look up pressure drop in Table 6 to determine flow rate.
†Use 500 for water, 485 for antifreeze.

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

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