



# Installation, Start-Up, and Service Instructions

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**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 or branch for information or assistance. The qualified installer or 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 the National Electrical Code (NEC) for special installation requirements.

Understand the signal words — DANGER, WARNING, and CAUTION. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

Recognize safety information. This is the safety-alert symbol (⚠). When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

**⚠ 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.

**GENERAL**

This Installation and Start-Up Instructions literature is for Aquazone™ water source heat pump systems.

Water source heat pumps (WSHPs) are single-package horizontally and vertically mounted units with electronic controls designed for year-round cooling and heating.

**IMPORTANT:** The installation of 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** — 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. See Tables 1 and 2 for unit physical data.

**HORIZONTAL UNITS (50PCH)** — Horizontal units are designed for indoor installation only. Be sure to allow adequate space around the unit for servicing. See Fig. 1 for overall unit dimensions.

**VERTICAL AND DOWNFLOW UNITS (50PCV, PCD)** — Vertical units are designed for indoor installations. While vertical units are typically installed in a floor-level closet or a small mechanical room, the unit access guidelines for these units are very similar to those described for horizontal units. See Fig. 2 and 3 for overall dimensions.

**⚠ 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.

**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 on both the interior and exterior. 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 15 days of receipt of shipment.

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

1. Be sure that the location chosen for unit installation provides ambient temperatures maintained above freezing.

2. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.
3. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
4. On horizontal units, allow adequate room below the unit for condensate drain trap and do not locate the unit above supply piping.
5. Provide sufficient space for duct connection. Do not allow the weight of the ductwork to rest on the unit.
6. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
7. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils. Removal of the entire unit from the closet should not be necessary.
8. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow return air to freely enter the space.
9. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
10. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.

**STORAGE** — If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the UP arrows on each carton at all times. If unit stacking is required, stack units as follows: vertical units less than 6 tons, no more than two high; horizontal units less than 6 tons, no more than three high. Do not stack units larger than 6 tons.

**PROTECTION** — Once the units are properly positioned on the jobsite, cover them with either a shipping carton, vinyl film, or an equivalent protective covering. Cap open ends of pipes stored on the jobsite. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc. is not yet complete. Foreign material that accumulates within the units can prevent proper start-up and require costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting, and valve, and remove any dirt or foreign material found in or on these components.

**⚠ CAUTION**

**DO NOT** store or install 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.

**INSPECT UNIT** — To prepare the unit for installation, complete the procedures listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Verify that the unit is the correct model for the entering water temperature of the job.
3. Do not remove the packaging until the unit is ready for installation.

4. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
5. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
6. Remove the blower shipping support from underneath the blower.
7. Locate and verify any accessory kit located in compressor section.
8. Remove any shipping brackets from the unit.

**Table 1 — Physical Data — 50PCH,PCV (007-030), 50PCD (015-030) Units**

50PCH,PCV,PCD UNIT	007*		009*		012*		015		018		024		030			
	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi		
<b>COMPRESSOR (1 each)</b>	Rotary						Reciprocating									
<b>Maximum Water Working Pressure (psig)</b>	400															
<b>PSC FAN MOTOR AND BLOWER</b>																
<b>Fan Motor Type/Speeds</b>	PSC/3															
<b>Fan Motor (hp)</b>	<sup>1</sup> / <sub>10</sub>				<sup>1</sup> / <sub>6</sub>		<sup>1</sup> / <sub>4</sub>									
<b>Blower Wheel Size (Dia x W) (in.)</b>	4.5 x 4.5				5.5 x 4.5		9 x 7									
<b>ECM FAN MOTOR AND BLOWER</b>																
<b>Fan Motor Type/Speeds</b>	N/A						C.T. ECM									
<b>Fan Motor (hp)</b>	N/A						<sup>1</sup> / <sub>3</sub>									
<b>Blower Wheel Size (Dia x W) (in.)</b>	N/A						9 x 7									
<b>WATER CONNECTION SIZE</b>																
<b>FPT (in.)</b>	<sup>3</sup> / <sub>4</sub>															
<b>Coaxial Coil Volume (gal)</b>	0.06				0.08		0.09		0.14		0.24					
<b>VERTICAL CABINET</b>																
<b>Refrigeration Charge (oz)</b>	14		15		21		19		17		28		29		37	
<b>Air Coil Dimensions (H x W)</b>	10 x 14						12 X 16.5		16 X 16.5		20 x 16.5					
<b>Std. Filter - 1 in. Throwaway (L x H)</b>	10 x 16						16 x 20				20 x 20					
<b>Opt. Filter - 2 in. MERV 8 or 13 Throwaway (L x H)</b>	10 x 16						16 x 20				20 x 20					
<b>Weight - Operating (lb)</b>	98		103		105		123		173		177		190			
<b>Weight - Shipping (lb)</b>	126		130		132		151		201		205		217			
<b>HORIZONTAL CABINET</b>																
<b>Refrigeration Charge (oz)</b>	16				19				29				35		39	
<b>Air Coil Dimensions (H x W)</b>	10 x 14						12 x 16.5		16 x 16.5		16 x 20.5					
<b>Std. Filter - 1 in. Throwaway (L x H)</b>	10 x 16						16 x 20				16 x 25					
<b>Opt. Filter - 2 in. MERV 8 or 13 Throwaway (L x H)</b>	10 x 16						16 x 20				16 x 25					
<b>Weight - Operating (lb)</b>	96		100		105		136		174		181		190			
<b>Weight - Shipping (lb)</b>	128		132		134		158		208		212		224			

**LEGEND**

- CT** — Constant Torque
- ECM** — Electronically Commutated Motor
- FPT** — Female Pipe Thread
- PSC** — Permanent Split Capacitor

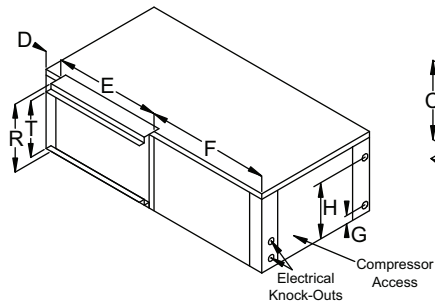
\* Unit sizes not available in 50PCD.

**Table 2 —Physical Data — 50PCH,PCV,PCD Units 036-070**

50PCH,PCV,PCD UNIT	036		041		042		048		060		070		
	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	Cu	CuNi	
<b>COMPRESSOR (1 each)</b>	Reciprocating								Scroll				
Maximum Water Working Pressure (psig)	400												
<b>PSC FAN MOTOR AND BLOWER</b>													
Fan Motor Type/Speeds	PSC/3								N/A	PSC/3			
Fan Motor (hp)	1/2		3/4		1/2		3/4					3/4	
Blower Wheel Size (Dia x W) (in.)	9 x 7				10 x 8					11 x 9			
<b>ECM FAN MOTOR AND BLOWER</b>													
Fan Motor Type/Speeds	C.T. ECM												
Fan Motor (hp)	1/2				3/4							1	
Blower Wheel Size (Dia x W) (in.)	9 x 7				10 x 8				11 x 9				
<b>WATER CONNECTION SIZE</b>													
FPT (in.)	3/4						1						
Coaxial Coil Volume (gal)	0.27						0.49				0.62		
<b>VERTICAL CABINET</b>													
Refrigeration Charge (oz)	48						52		59		73		
Air Coil Dimensions (H x W)	24 x 20.2		20 x 16		24 x 20.2		24 x 26.75				32 x 26.6		
Std. Filter - 1 in. Throwaway (L x H)	24 x 24		20 x 20		24 x 24		24 x 30				16 x 30 (2)		
Opt. Filter - 2 in. MERV 8 or 13 Throwaway (L x H)	24 x 24		20 x 20		24 x 24		24 x 30				16 x 30 (2)		
Weight - Operating (lb)	229		217		239		287		307		336		
Weight - Shipping (lb)	255		243		265		312		331		360		
<b>HORIZONTAL CABINET</b>													
Refrigeration Charge (oz)	46		N/A		43		44		70		61		
Air Coil Dimensions (H x W)	18 x 27.5				18 x 27.5		20 x 32				20 X 42		
Std. Filter - 1 in. Throwaway (L x H)	18 x 30				18 x 30		20 x 34.5				20 x 24 (2)		
Opt. Filter - 2 in. MERV 8 or 13 Throwaway (L x H)	18 x 30				18 x 30		20 x 34.5				20 x 24 (2)		
Weight - Operating (lb)	226				231		274		288		316		
Weight - Shipping (lb)	270		264		299		318		365				

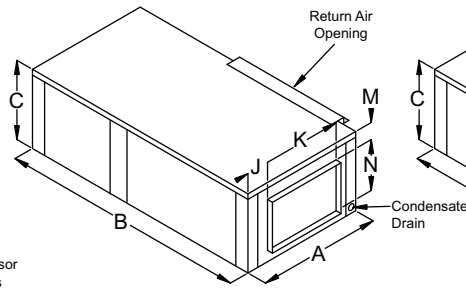
LEGEND

- CT — Constant Torque
- ECM — Electronically Commutated Motor
- FPT — Female Pipe Thread
- PSC — Permanent Split Capacitor

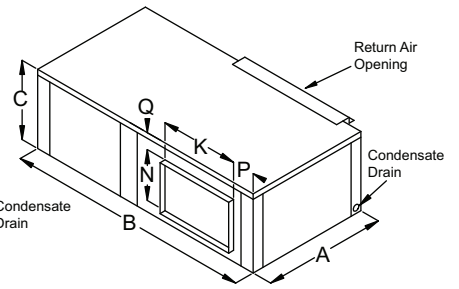


Left Hand Return End Blow (FLE)

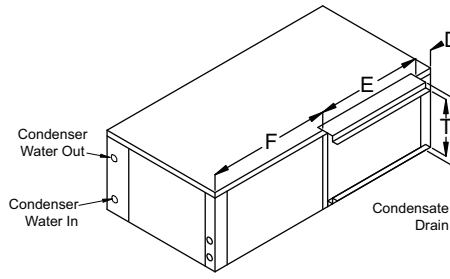
NOTE: Models 048 and 060 Left Hand Return units have condenser water connections on the front right and electrical knockouts on the front left.



Left Hand Return Straight Through (FLS)



Right Hand Return End Blow (FRE)

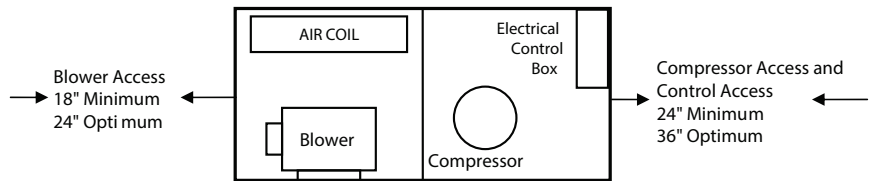


Right Hand Return Straight Through (FRS)

LEGEND

- FLE — Front Water, Left Return, End Supply
- FLS — Front Water, Left Return, Straight Through Supply
- FRE — Front Water, Right Return, End Supply
- FRS — Front Water, Right Return, Straight Through Supply
- R/A — Return Air

Service Clearances

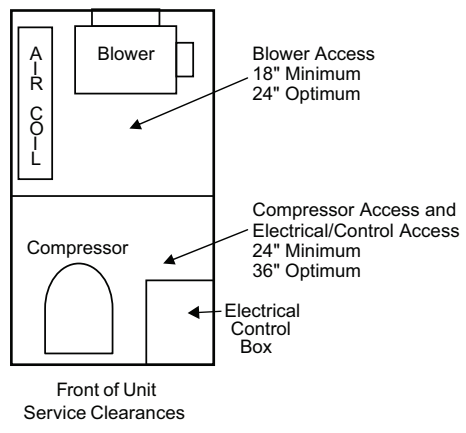
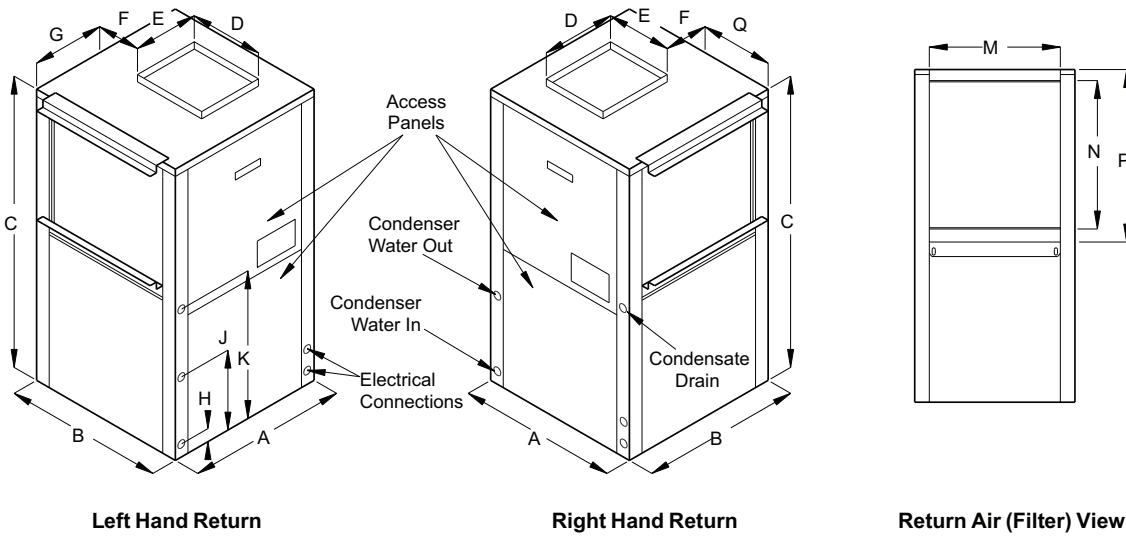


50PCH UNIT SIZE	A	B	C	D	E	F	G	H	J	K	M	N	P	Q	R	T	CONDENSER WATER CONNECTIONS FPT	RECOMMENDED REPLACEMENT NOMINAL FILTER SIZE
	WIDTH	DEPTH	HEIGHT	CAB END TO FILTER RACK	R/A DUCT WIDTH	CAB FRONT TO FILTER RACK	WATER INLET	WATER OUTLET	SIDE TO DISC. WIDTH	DISC. WIDTH	TOP TO DISC. (FLE AND FRS)	DISC. HEIGHT	END TO DISC. (STR)	TOP TO DISC. (FRE AND FLS)	FILTER RACK HEIGHT	R/A DUCT FLANGE HEIGHT		
007	19.0	33.0	11.5	1.5	16.15	15.35	2.38	9.50	5.375	6.30	5.97	4.10	4.875	1.41	11.3	8.6	3/4	10x16x1
009	19.0	33.0	11.5	1.5	16.15	15.35	2.38	9.50	5.375	6.30	5.97	4.10	4.875	1.41	11.3	8.6	3/4	10x16x1
012	19.0	33.0	11.5	1.5	16.15	15.35	2.38	9.50	5.250	6.43	6.31	4.10	4.750	1.14	11.3	8.6	3/4	10x16x1
015	22.0	43.0	17.0	1.5	20.15	21.35	2.86	15.00	8.150	6.43	9.55	4.10	7.650	3.40	16.8	15.0	3/4	16x20x1
018	22.0	43.0	17.0	1.5	20.15	21.35	2.86	14.13	5.420	9.13	6.11	9.65	4.920	1.23	16.8	15.0	3/4	16x20x1
024	22.0	43.0	17.0	1.5	25.00	16.50	2.86	14.13	5.420	9.13	6.11	9.65	4.920	1.23	16.8	15.0	3/4	16x25x1
030	22.0	43.0	17.0	1.5	25.00	16.50	2.47	15.00	5.420	9.13	6.11	9.65	4.920	1.23	16.8	15.0	3/4	16x25x1
036	22.0	54.5	19.0	1.5	30.15	22.85	2.86	16.13	6.470	9.13	7.50	10.28	5.970	1.21	18.8	17.0	3/4	18x30x1
042	22.0	54.5	19.0	1.5	30.15	22.85	2.86	16.13	5.270	10.45	6.46	11.30	4.770	1.22	18.8	17.0	3/4	18x30x1
048	25.0	54.5	21.0	1.5	34.60	18.40	2.86	18.52	7.250	10.45	7.46	11.36	6.750	2.16	20.8	19.0	1	20x34.5x5x1
060	25.0	54.5	21.0	1.5	34.60	18.40	2.86	18.52	6.320	11.76	6.81	12.50	5.820	1.68	20.8	19.0	1	20x34.5x5x1
070	25.0	65.0	21.0	1.5	48.10	15.40	2.86	18.52	6.320	11.76	6.81	12.50	5.820	1.68	20.8	19.0	1	20x24x1 (2)

NOTES:

1. All dimensions are within ± 0.125 inch.
2. All condensate drain connections are 3/4 in. FPT.
3. Unit sizes 015-070 can be field converted between end blow and straight through supply air configurations.
4. Specifications subject to change without notice.
5. The 1-in. filter rack extends 1.23-in. beyond the side of the unit. The 2-in. filter rack extends 2.89-in. beyond the side of the unit. The 2-in. filter rack is 4-sided with a filter access door on one end and can accept either a 1-in. or 2-in. filter.

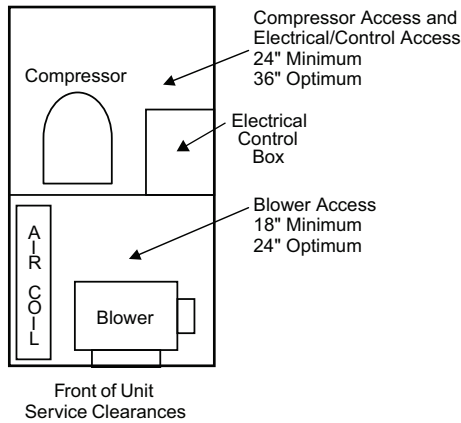
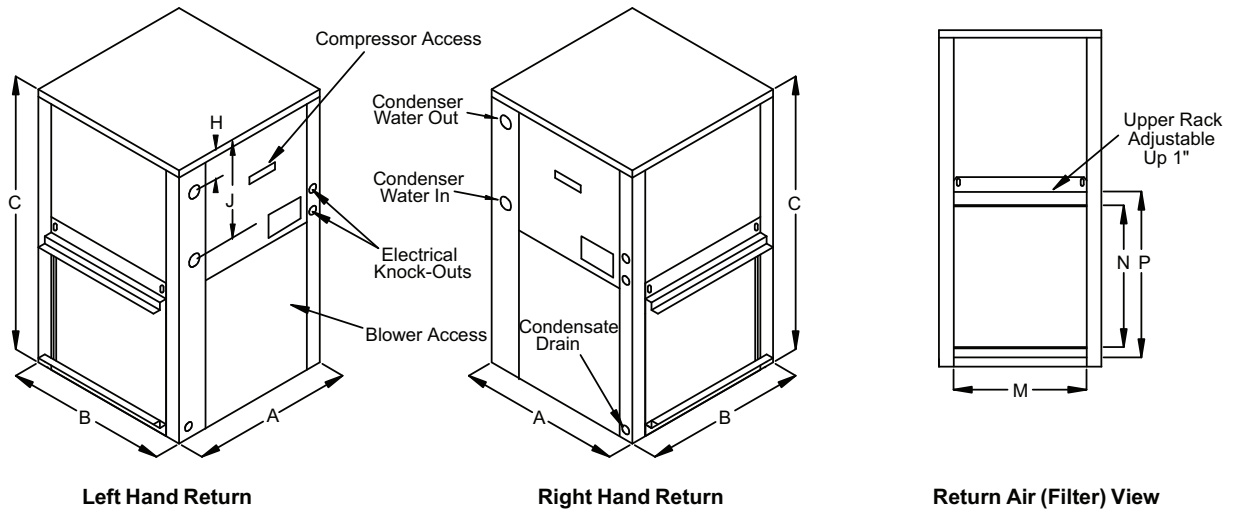
Fig. 1 — 50PCH007-070 Unit Dimensions



50PCV UNIT SIZE	A	B	C	D	E	F	G	H	J	K	M	N	P	Q	CONDENSER WATER CONNECTIONS FPT	RECOMMENDED REPLACEMENT NOMINAL FILTER SIZE
	WIDTH	DEPTH	HEIGHT	DISC. DEPTH	DISC. WIDTH	CABINET EDGE TO DISC.	LEFT SIDE TO DISC.	WATER INLET	WATER OUTLET	CONDENSATE DRAIN	R/A DUCT WIDTH	R/A DUCT FLANGE HEIGHT	FILTER RACK HEIGHT			
007	19.0	19.00	24.25	10.0	8.0	4.5	9.3	2.44	9.68	13.87	16.0	8.0	10.0	5.4	3/4	10x16x1
009	19.0	19.00	24.25	10.0	8.0	4.5	9.3	2.44	9.68	13.87	16.0	8.0	10.0	5.4	3/4	10x16x1
012	19.0	19.00	24.25	10.0	8.0	4.5	9.3	2.44	9.68	13.87	16.0	8.0	10.0	5.4	3/4	10x16x1
015	21.5	21.50	32.25	10.0	8.0	5.8	10.0	2.85	8.45	15.87	20.0	14.0	16.0	3.5	3/4	16x20x1
018	21.5	21.50	32.25	14.0	14.0	3.1	5.2	2.85	8.45	15.87	20.0	14.0	16.0	5.2	3/4	16x20x1
024	21.5	21.50	39.25	14.0	14.0	3.1	5.2	2.80	8.45	18.87	20.0	18.0	20.0	5.2	3/4	20x20x1
030	21.5	21.50	39.25	14.0	14.0	3.1	5.2	2.80	8.45	18.87	20.0	18.0	20.0	5.2	3/4	20x20x1
036	21.5	26.00	43.25	16.0	14.0	4.0	5.0	2.75	10.77	18.87	24.0	22.0	24.0	5.0	3/4	24x24x1
041	21.5	21.50	39.25	16.0	14.0	1.7	4.7	2.80	8.45	18.87	20.0	18.0	20.0	4.7	3/4	20x20x1
042	21.5	26.00	43.25	16.0	14.0	4.0	5.0	2.75	10.77	18.87	24.0	22.0	24.0	5.0	3/4	24x24x1
048	24.0	32.50	45.25	18.0	14.0	7.0	6.2	3.26	13.20	20.87	30.0	22.0	24.0	6.2	1	24x30x1
060	24.0	32.50	45.25	18.0	14.0	7.0	6.2	3.26	13.20	20.87	30.0	22.0	24.0	6.2	1	24x30x1
070	26.0	33.25	58.25	18.0	16.0	7.8	7.2	2.92	13.36	25.87	30.0	30.0	32.0	7.2	1	16x30x1 (2)

- NOTES:
1. All dimensions are within ± 0.125 inch.
  2. All condensate drain connections are 3/4 in. FPT.
  3. Specifications subject to change without notice.
  4. The 1-in. filter rack extends 1.23-in. beyond the side of the unit. The 2-in. filter rack extends 2.89-in. beyond the side of the unit. The 2-in. filter rack is 4 sided with a filter access door on one end and can accept either a 1-in. or 2-in. filter.

**Fig. 2 — 50PCV007-070 Unit Dimensions**



50PCD UNIT SIZE	A	B	C	H	J	M	N	P	CONDENSER WATER CONNECTIONS FPT	RECOMMENDED REPLACEMENT NOMINAL FILTER SIZE
	WIDTH	DEPTH	HEIGHT	WATER INLET	WATER OUTLET	R/A DUCT WIDTH	R/A DUCT FLANGE HEIGHT	FILTER RACK HEIGHT		
015	21.5	21.50	32.25	19.9	25.5	20.0	14.0	16.0	3/4	16x20x1
018	21.5	21.50	32.25	19.9	25.5	20.0	14.0	16.0	3/4	16x20x1
024	21.5	21.50	39.25	23.9	36.0	20.0	18.0	20.0	3/4	20x20x1
030	21.5	21.50	39.25	23.9	36.0	20.0	18.0	20.0	3/4	20x20x1
036	21.5	26.00	43.25	27.8	35.8	24.0	22.0	24.0	3/4	24x24x1
042	21.5	26.00	43.25	27.8	35.8	24.0	22.0	24.0	3/4	24x24x1
048	24.0	32.50	45.25	28.3	38.3	30.0	22.0	24.0	1	24x30x1
060	24.0	32.50	45.25	28.3	38.3	30.0	22.0	24.0	1	24x30x1
070	26.0	33.25	58.25	36.0	46.4	30.0	30.0	32.0	1	16x30x1 (2)

**NOTES:**

1. All dimensions are within  $\pm 0.125$  inch.
2. All condensate drain connections are 3/4 in. FPT.
3. Specifications subject to change without notice.
4. The 1-in. filter rack extends 1.23-in. beyond the side of the unit. The 2-in. filter rack extends 2.89-in. beyond the side of the unit. The 2-in. filter rack is 4 sided with a filter access door on one end and can accept either a 1-in. or 2-in. filter.

**Fig. 3 — 50PCD015-070 Unit Dimensions**

**Step 3 — Locate Unit** — Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, electrical, and duct connection(s). If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space.

Unit condensate drains are not internally trapped. Allow room below the unit base for horizontal and counterflow models for an adequate condensate trap.

These units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned. Do not locate units in areas that are subject to freezing. Units must be installed in conditioned space that is not subject to extremes of temperature or humidity to avoid cabinet sweating and/or equipment damage.

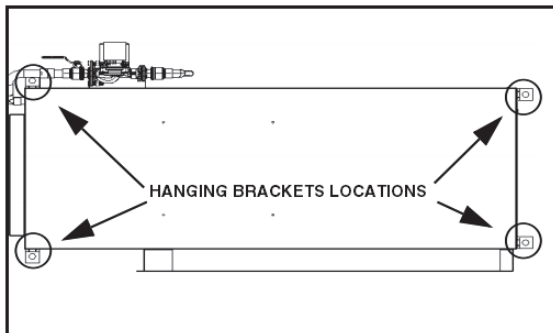
Do not use units for temporary heating, air conditioning or ventilation during construction, especially when plastering, sanding or painting. Care should be taken to avoid introduction of dust, paint or debris into the air coil.

### Step 4 — Mount the Unit

**DUCT FLANGES** — The unit heat pumps feature foldout return and supply air duct flanges. These fold-out flanges allow the heat pumps to more easily fit through doorways and other tight spaces, and also prevent damage in shipping and handling.

It is recommended that all fold-out flanges be folded out once the heat pump is installed to ensure that return and supply airflow is not obstructed. These flanges can be easily folded using standard or duckbill pliers. Once folded out these flanges can be used to support light ductwork loads.

**HORIZONTAL UNITS (50PCH)** — While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. All horizontal units come with a Hanging Bracket Kit to facilitate suspended unit mounting. Hanging brackets are installed as shown in Fig. 4.



**Fig. 4 — Hanging Bracket Locations**

The hanging bracket kit includes the following:

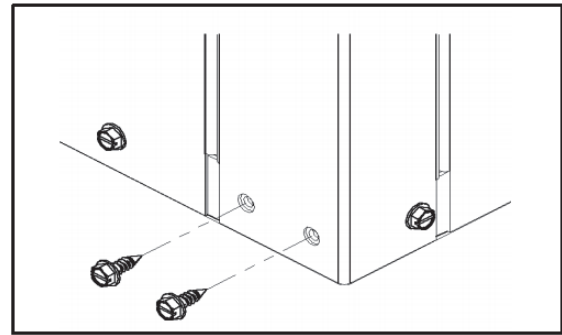
- (5) Brackets
- (5) Rubber vibration isolators
- (8) Screws #10 x 1/2 in.
- (10) Bolts 1/4 — 28 x 1/2 in. hex bolt (not used on this model)

The following additional materials are needed and must be field-supplied:

- Threaded rod (3/8 in. maximum diameter)
- Hex nuts
- Washers (1 3/4 in. minimum O.D.)

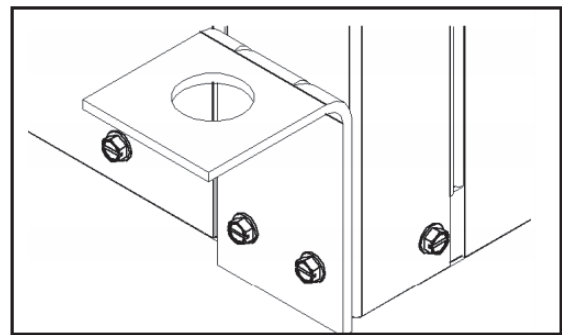
#### Hanging Bracket Installation

1. Remove and discard factory-provided screws from location where hanging brackets will be installed. See Fig. 5.



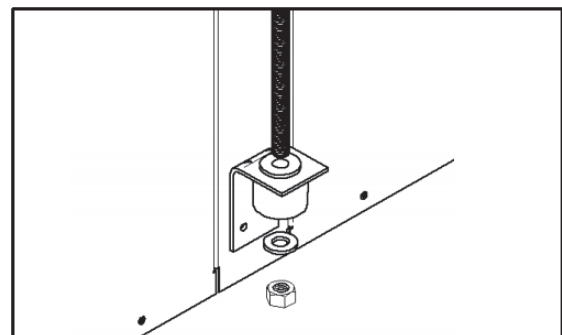
**Fig. 5 — Removing Factory Screws**

2. Mount 4 brackets to unit corner post using the bolts provided in the kit, as shown in Fig. 6. **DO NOT** re-use the screws removed from the unit during Step 1 to mount the hanging brackets on the unit.



**Fig. 6 — Mounting Brackets**

3. Install rubber grommet on the bracket as shown in Fig. 7.
4. Hang the unit and assemble the field-provided threaded rod, nuts, and washers on the brackets as shown in Fig. 7.



**Fig. 7 — Hanging the Unit**

**IMPORTANT:** Units larger than six tons include an integral angle iron frame with mounting holes present.

Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan if required by code, should be at least 4 in. larger than the bottom of the heat pump.

Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc.. Some applications require an attic floor installation of the horizontal unit. In this case the unit should be set in a full size secondary drain pan on top of a vibration absorbing mesh.

The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the

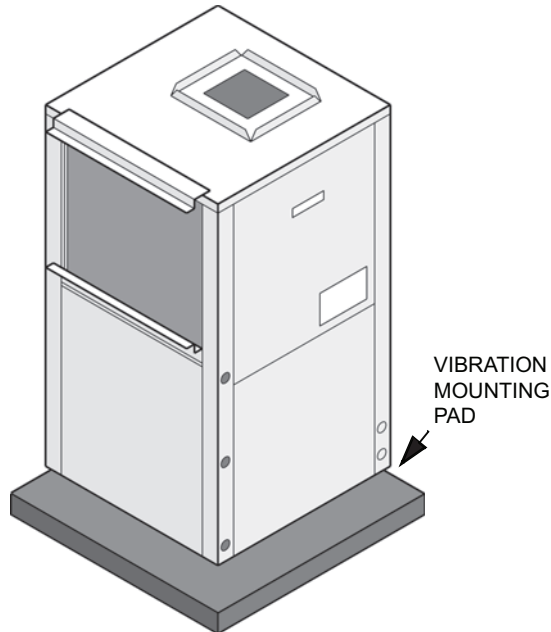


ceiling joists by additional layers of vibration absorbing mesh. In both cases, a 3/4-in. drain connected to this secondary pan should be run to an eave at a location that will be noticeable.

**CAUTION**

If the unit is located in a crawl space, the bottom of the unit must be at least 4-in. above grade to prevent flooding of the electrical parts due to heavy rains.

**VERTICAL AND DOWNFLOW UNITS (50PCV, PCD)** — Vertical and counterflow units should be mounted level on a vibration absorbing pad slightly larger than the unit base in order to minimize vibration transmission from the unit to the building structure. See Fig. 8. It is generally not necessary to anchor the unit unless required by local code.



**Fig. 8 — Mounting Vertical Units**

All major service access for the vertical and counterflow models is from the front side of the unit. When installing the unit in a confined space such as a closet, ensure that the service panel screws are accessible, that the filter can be replaced without damage and that water and electrical connections are accessible. For models with a unit-mounted disconnect switch, make sure the switch can be easily seen and operated.

To reduce sound transmission, units should be installed using flexible electrical conduit and hose kits. Care should be taken to ensure that no part of the unit cabinet is touching part of the building structure. For ducted return applications, a flexible duct connection should be used. Mount the unit on a vibration absorption pad slightly larger than the entire base to minimize vibration transmission. It is not necessary to mount the unit on the floor.

**Step 5 — Check Duct System** — All units are provided with a return air duct flange and supply air duct connections. Refer to unit dimensional drawings (Fig. 1-3) for physical dimensions of the collar and flange.

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of 1 in. duct insulation to avoid heat loss or gain and prevent condensate from forming during the cooling operation. Application of the unit to uninsulated ductwork is not recommended as the unit's performance will be adversely affected.

**CAUTION**

Do not connect discharge ducts directly to the blower outlet. The factory filter rack should be left in place on a free return system.

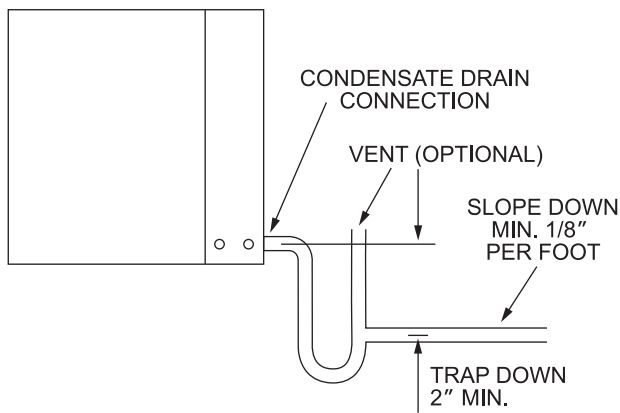
If the unit will be installed in a new installation with new ductwork, the installation should be designed using current ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) procedures for duct sizing. If the unit will be connected to an existing duct system, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application. If the duct system is too small, larger ductwork must be installed. Be certain to check for existing leaks and repair. The duct system and all diffusers should be sized to handle the designed airflow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path through the air grille into the heat pump. The return air inlet to the heat pump must have at least one 90-degree turn away from the space return air grille. If air noise or excessive airflow are a problem, the blower speed can be changed to a lower speed to reduce airflow. (Refer to motor speeds and settings in Tables 3 and 4.)

**HORIZONTAL SUPPLY AIR CONFIGURATION CONVERSION** — The supply air location on horizontal units can be quickly field converted from end blow to straight through or vice-versa. To convert the supply air direction, follow the steps below:

1. If connected to power, shut off the unit and disconnect switch or circuit breaker.
2. Unscrew and remove the blower access panel.
3. Disconnect the wires from the unit electrical box to the blower motor. Note which speed taps are wired for units with PSC or constant torque motors.
4. Unscrew and carefully remove the blower panel with the blower and motor attached. Be careful not to damage the refrigerant coils or any other internal unit components.
5. Remove the blower support brackets from the bottom of the blower housing and relocate them to the top of the blower housing.
6. Turn the blower panel 180 degrees so that the blower support brackets are now at the bottom of the blower.
7. Insert the blower panel with the blower and motor into the desired location. Be careful not to damage the refrigerant coils or any other internal unit components. Screw the panel into place.
8. Replace the wires between the blower motor and electrical box. Make sure to connect wires to the proper speed taps.
9. Replace the blower access panel.
10. Reconnect power to the unit.

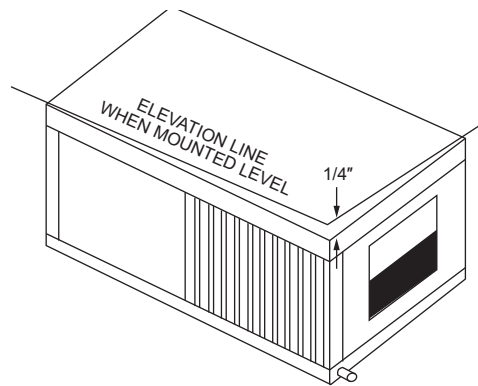
**Step 6 — Install Condensate Drain** — A drain line must be connected to the heat pump and pitched away from the unit a minimum of 1/8-in. per foot to allow the condensate to flow away from the unit.

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to ensure free condensate flow. (Heat pumps are not internally trapped). A vertical air vent is sometimes required to avoid air pockets. See Fig. 9.



**Fig. 9 — Condensate Drain**

The depth of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included. The horizontal unit should be pitched approximately 1/4-in. towards the drain in both directions, to facilitate condensate removal. (See Fig. 10.)



**Fig. 10 — Pitched Unit**

**Table 3 — PSC Motor Selection**

UNIT SIZE	MOTOR HP	TAP 1	TAP 2	TAP 3
007	1/10	LOW	<b>MED</b>	HIGH
009	1/10	LOW	MED	<b>HIGH</b>
012	1/10	LOW	MED	<b>HIGH</b>
015	1/6	LOW	MED	<b>HIGH</b>
018	1/4	LOW	<b>MED</b>	HIGH
024	1/4	LOW	MED	<b>HIGH</b>
030	1/4	LOW	MED	<b>HIGH</b>
036	1/2	LOW	MED	<b>HIGH</b>
041	3/4	LOW	MED	<b>HIGH</b>
042	1/2	LOW	MED	<b>HIGH</b>
048	3/4	LOW	MED	<b>HIGH</b>
060	1	LOW	MED	<b>HIGH</b>
070	1	LOW	MED	<b>HIGH</b>

NOTE: Bold type indicates factory default motor setting.

**Table 4 — Constant Torque ECM Selection**

UNIT SIZE	MOTOR HP	TAP 1	TAP 2	TAP 3	TAP 4	TAP 5
015	1/3	LOW	MED-LOW	<b>MED</b>	MED-HI	HIGH
018	1/3	LOW	<b>MED-LOW</b>	MED	MED-HI	HIGH
024	1/3	LOW	MED-LOW	MED	<b>MED-HI</b>	HIGH
030	1/2	LOW	MED-LOW	MED	MED-HI	<b>HIGH</b>
036	1/2	LOW	MED-LOW	<b>MED</b>	MED-HI	HIGH
041	3/4	LOW	MED-LOW	MED	<b>MED-HI</b>	HIGH
042	3/4	LOW	<b>MED-LOW</b>	MED	MED-HI	HIGH
048	1	LOW	MED-LOW	<b>MED</b>	MED-HI	HIGH
060	1	LOW	MED-LOW	<b>MED</b>	MED-HI	HIGH
070	1	LOW	MED-LOW	<b>MED</b>	MED-HI	HIGH

NOTE: Bold type indicates factory default motor setting.

**Step 7 — Pipe Connections** — Depending on the application, there are 3 types of WSHP piping systems to choose from: water loop, ground-water and ground loop. Refer to Piping Section of Carrier System Design Manual for additional information.

All WSHP units use low temperature soldered female pipe thread fittings for water connections to prevent annealing and out-of-round leak problems which are typically associated with high temperature brazed connections. Refer to Tables 1 and 2 for connection sizes. When making piping connections, consider the following:

- Use a backup wrench when making screw connections to unit to prevent internal damage to piping.
- Insulation may be required on piping to avoid condensation in the case where fluid in loop piping operates at temperatures below dew point of adjacent air.
- Piping systems that contain steel pipes or fittings may be subject to galvanic corrosion. Dielectric fittings may be used to isolate the steel parts of the system to avoid galvanic corrosion.

**WATER LOOP APPLICATIONS** — Water loop applications usually include a number of units plumbed to a common piping system. Maintenance to any of these units can introduce air into the piping system. Therefore, air elimination equipment comprises a major portion of the mechanical room plumbing.

The flow rate is usually set between 2.25 and 3 gpm per ton of cooling capacity. For proper maintenance and servicing, pressure-temperature (P/T) ports are necessary for temperature and flow verification.

In addition to complying with any applicable codes, consider the following for system piping:

- Piping systems using water temperatures below 50°F require 1/2-in. closed cell insulation on all piping surfaces to eliminate condensation.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger.
- Use backup wrench. Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Flush the piping system prior to operation to remove dirt and foreign materials from the system.

**GROUND LOOP APPLICATIONS** — Temperatures between 25 and 110°F and a cooling capacity of 2.25 to 3 gpm of flow per ton are recommended. In addition to complying with any applicable codes, consider the following for system piping:

- Limit piping materials to only polyethylene fusion in the buried sections of the loop.
- Do not use galvanized or steel fittings at any time due to corrosion.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use pressure-temperature (P/T) plugs to measure flow of pressure drop.

**INSTALLING SUPPLY AND RETURN HOSE KIT** —

Follow these piping guidelines:

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shutoff/balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.

5. Do not exceed the minimum bend radius for the hose selected. Refer to Table 5. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

NOTE: Piping must comply with all applicable codes.

**Table 5 — Metal Hose Minimum Bend Radii**

HOSE DIAMETER (in.)	MINIMUM BEND RADII (in.)
1/2	2 1/2
3/4	4
1	5 1/2

Insulation is not required on loop water piping except where the piping runs through unheated areas or outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient. Insulation is required if loop water temperature drops below the dew point.

**IMPORTANT:** Do not bend or kink supply lines or hoses.

Pipe joint compound is not necessary when Teflon\* threaded tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe joint compound is preferred, use compound only in small amounts on the male pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

NOTE: When anti-freeze is used in the loop, assure that it is compatible with Teflon tape or pipe joint compound employed.

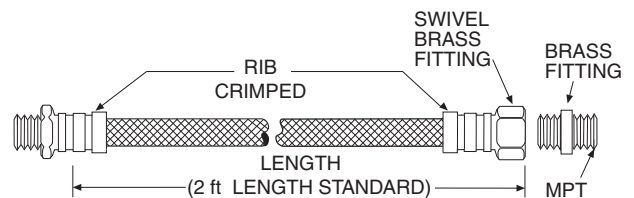
Maximum allowable torque for brass fittings is 30 ft-lb. If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with Carrier units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

**CAUTION**

Backup wrench is required when tightening water connections to prevent water line damage. Failure to use a backup wrench could result in equipment damage.

Male adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check them regularly to avoid system failure and reduced service life. See Fig. 11.



**Fig. 11 — Supply/Return Hose Kit**

\* Registered trademark of DuPont.

**Step 8 — Wire Field Power Supply** — See Fig. 12-18 for typical wiring diagrams. See Tables 6 and 7 for additional electrical data. Please refer to the unit wiring diagram attached to the control panel for field installation.

**⚠ 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**

All power connections must be properly torqued to avoid the risk of overheating.

**HIGH VOLTAGE** — All field-installed wiring must comply with the National Electric Code as well as all applicable local codes. Refer to the unit electrical data on the unit nameplate for wire and branch circuit protection sizing. Supply power voltage and phasing should match the required voltage and phasing shown on the unit nameplate. Operating the unit below the minimum voltage, above the maximum voltage or with incorrect phasing can result in poor system performance or damage to the heat pump. All field wiring should be installed by qualified and trained personnel. Refer to the unit wiring diagram for field connection requirements.

Power wiring to the heat pump should be enclosed in flexible conduit to minimize the transmission of vibration from the unit cabinet to the building.

For heat pumps with unit mounted disconnect switches, field power should be connected to the marked terminals on the disconnect switch. For heat pumps without unit-mounted disconnect switches (except units with dual power supply), power is connected to the line (L) side of the compressor contactor and the ground lug in the unit electrical box.

**Units with Dual Power Supplies** — For models with dual power supplies (special order), one power supply feeds the compressor and a second power supply feeds the unit fan motor and control circuit. The compressor power supply should be connected to the line (L) side of the compressor contactor. The fan motor and control circuit power supply should be connected to a provided terminal block. Care should be taken to ensure that each power supply meets the voltage, amperage and phase requirements of its load. Refer to the unit nameplates for requirements.

**⚠ CAUTION**

The power supply ground wire should never be used as a neutral wire.

**Transformer Settings for 208/230-v Units** — As factory built, all 208/230-v units are wired for 230-v operation unless the wire for 208-v option is ordered. For jobsites with a 208-v power supply, the primary leads on the unit transformer will need to be changed from 240-v to 208-v. Refer to the unit wiring diagram for details.

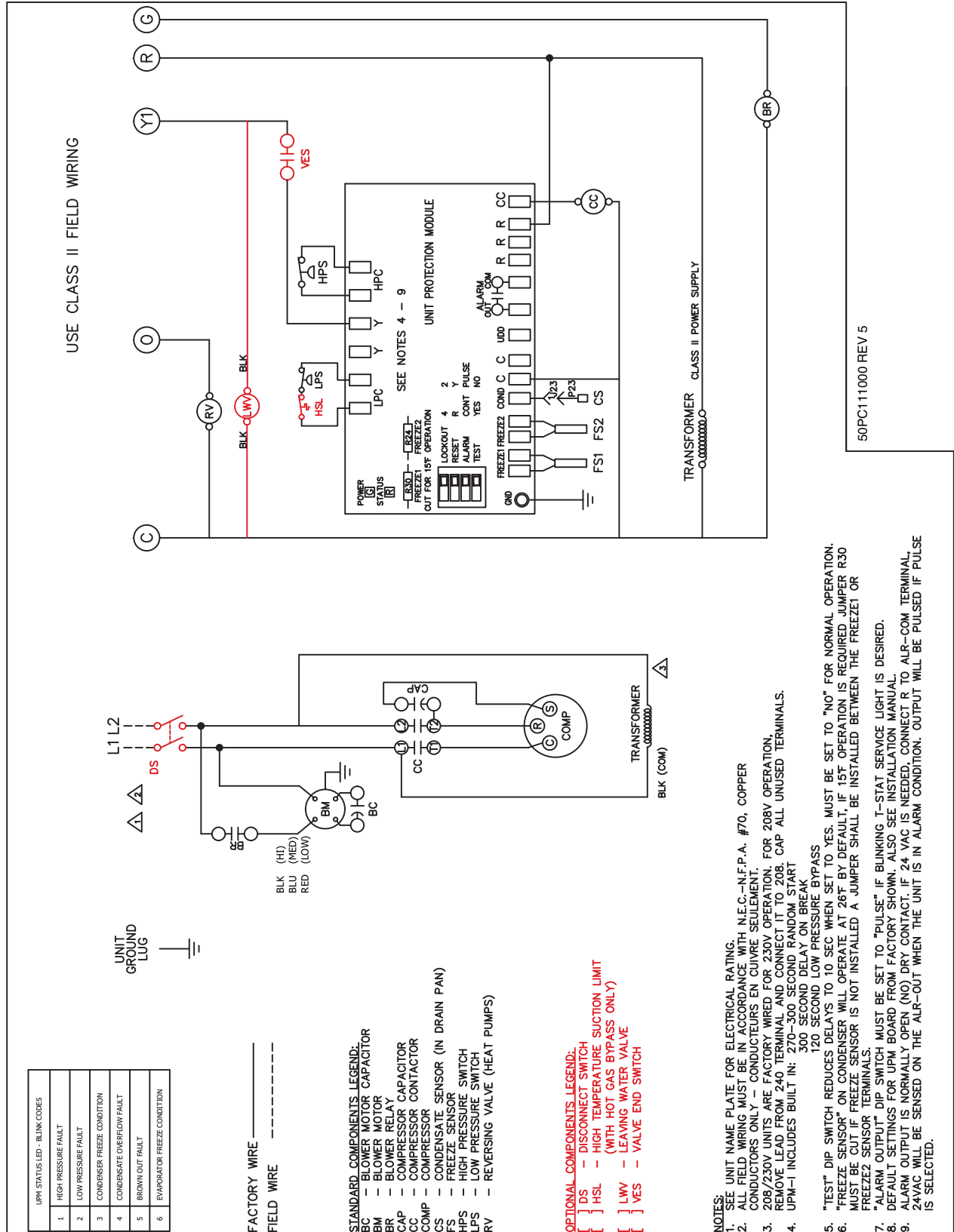


Fig. 12 — PSC Motor, Single Phase/Single Stage, Complete C Control

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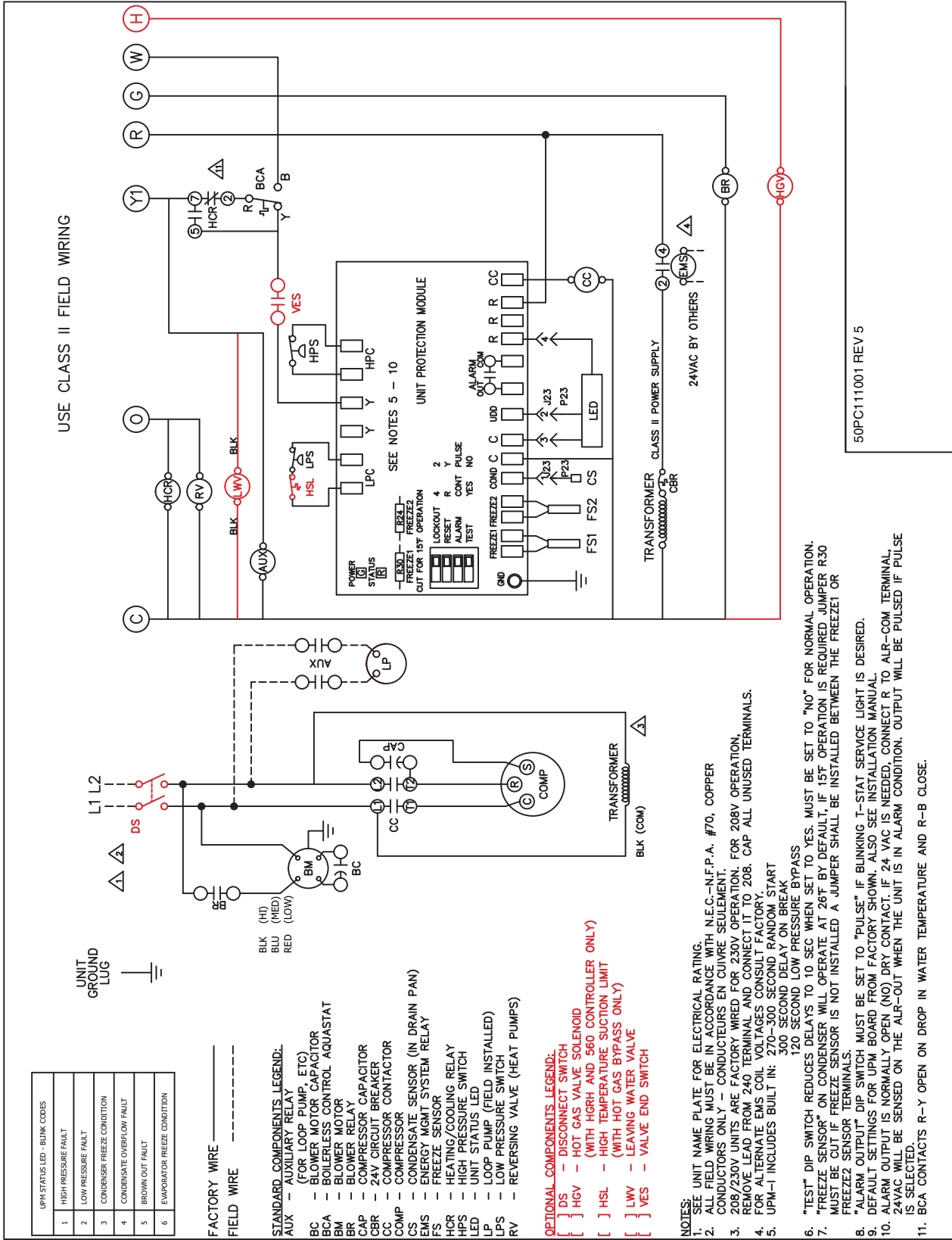


Fig. 13 — PSC Motor, Single Phase/Single Stage, Deluxe D Control

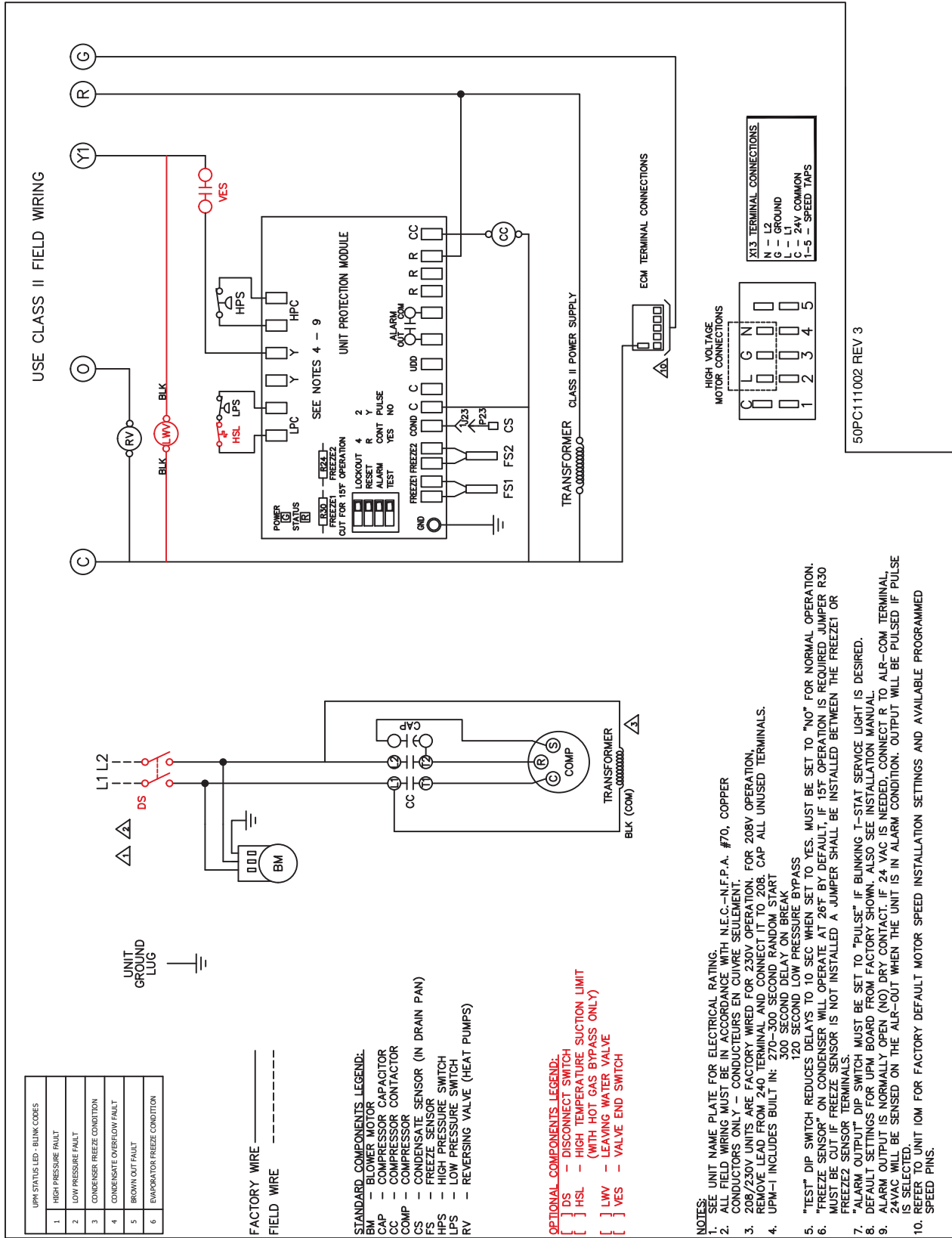
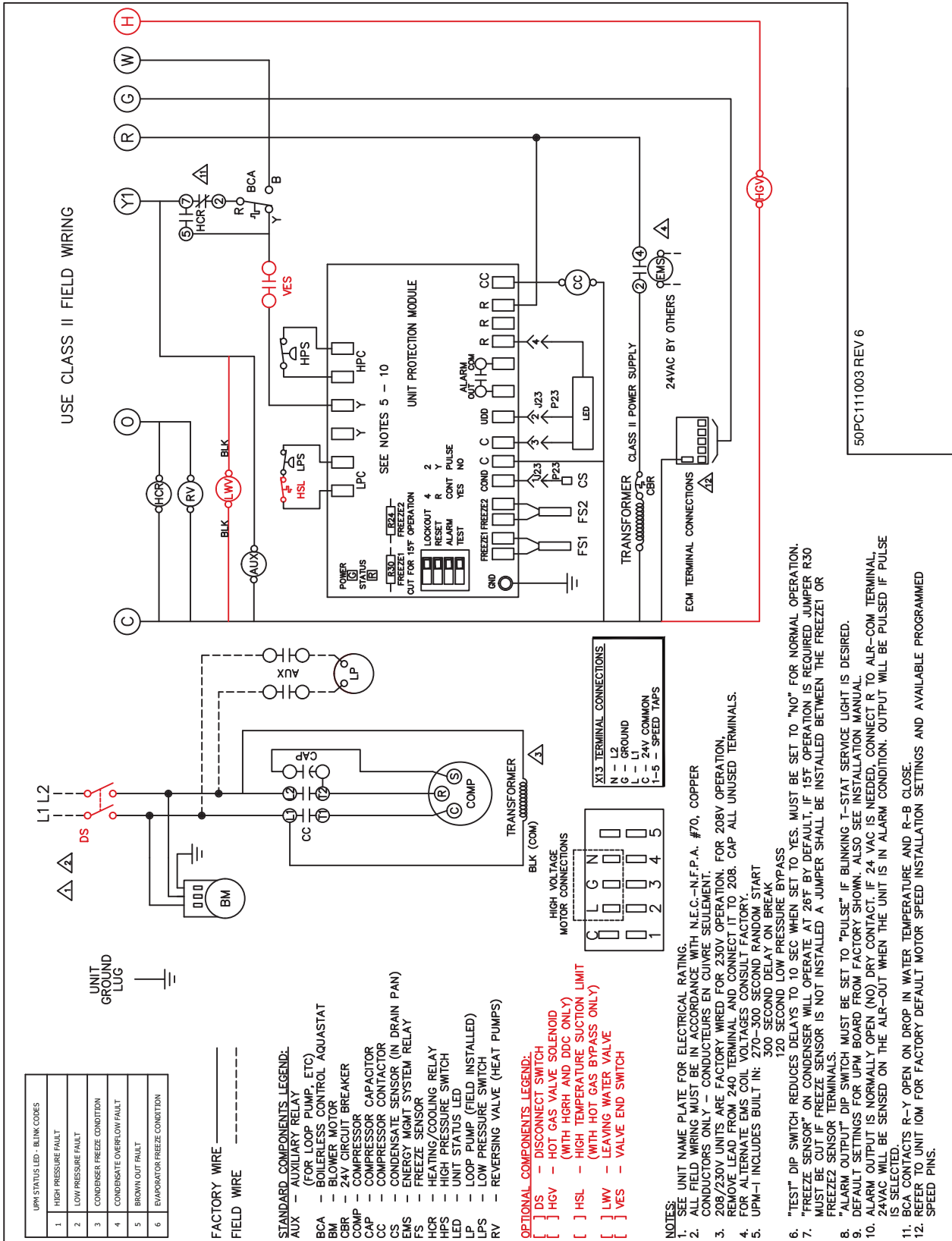


Fig. 14 — Constant Torque Motor, Single Phase/Single Stage, Complete C Control



**Fig. 15 — Constant Torque Motor, Single Phase/Single Stage, Deluxe D Control**



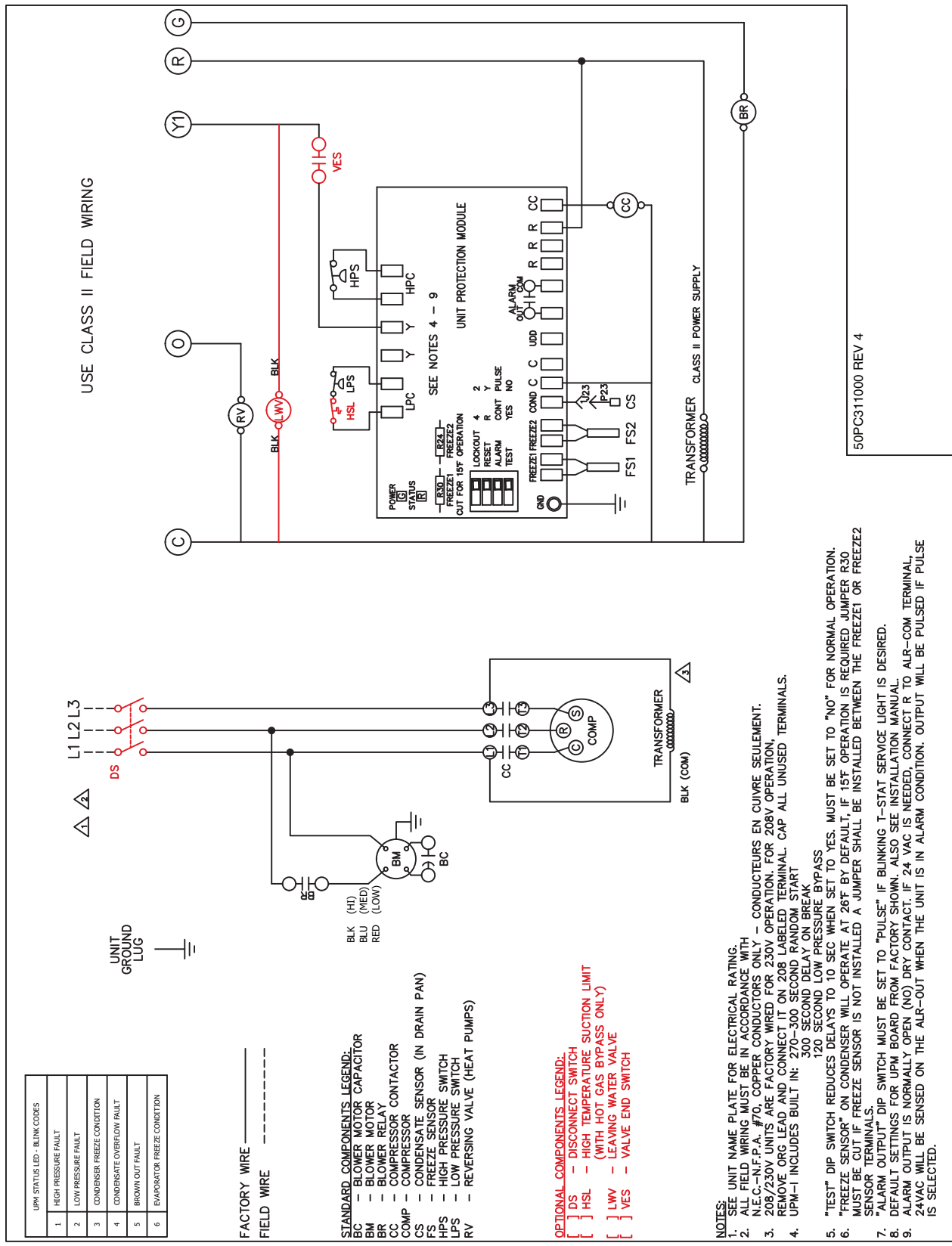


Fig. 16 — PSC Motor, Three Phase/Single Stage, Complete C Control

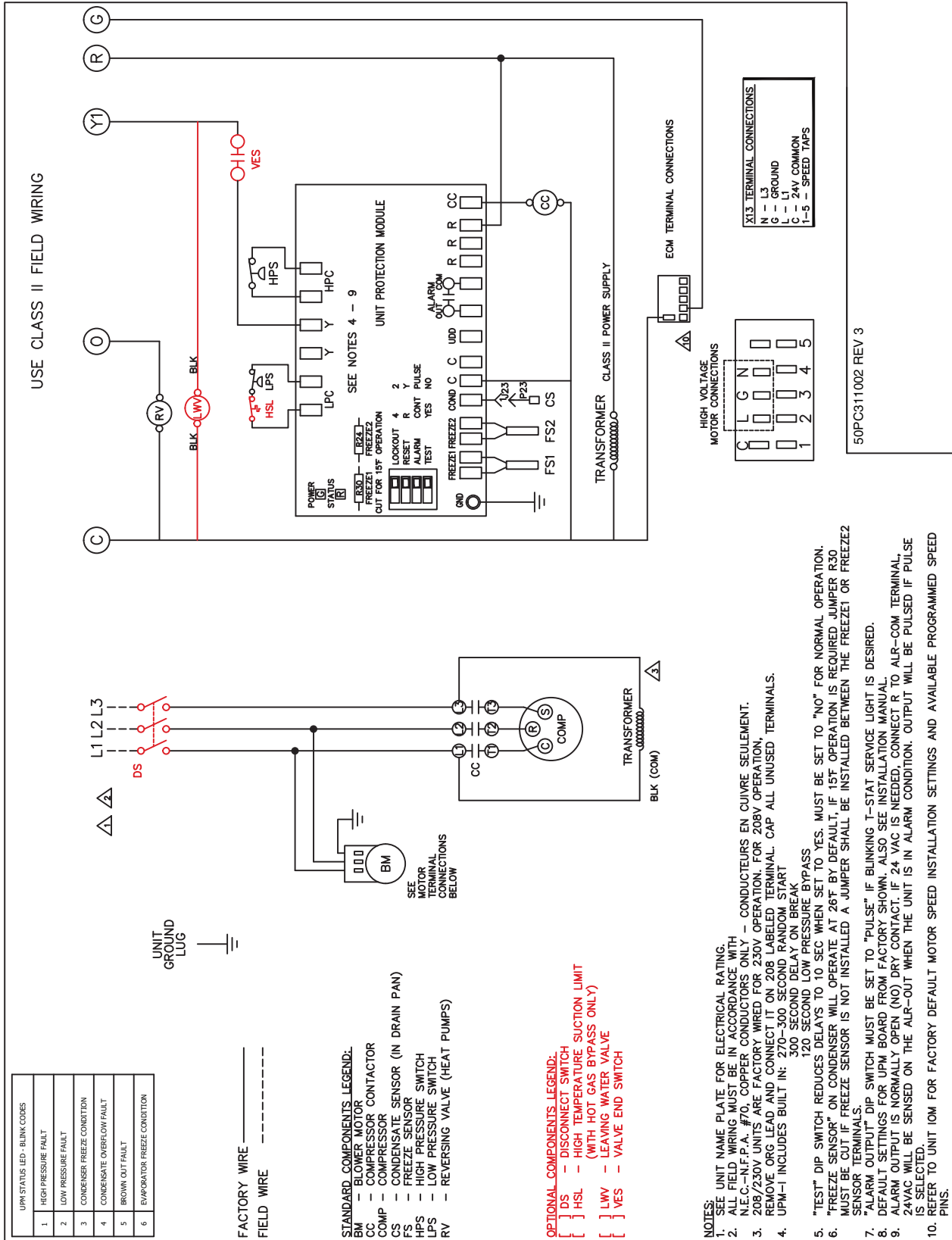
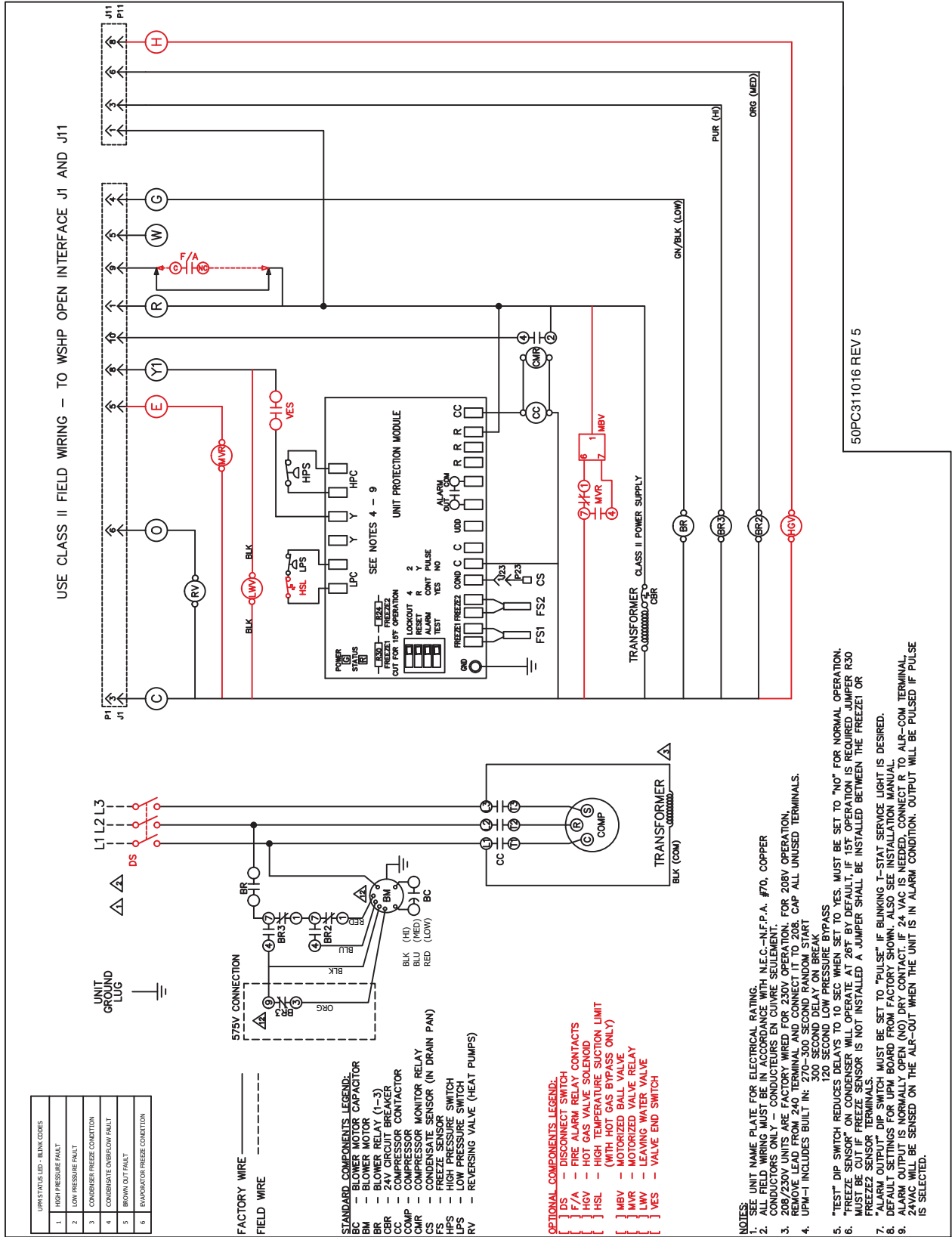


Fig. 17 — Constant Torque Motor, Three Phase/Single Stage, Complete C Control



**Table 6 — 50PC Electrical Data with PSC Blower Motor**

50PC UNIT	VOLTAGE CODE	RATED VOLTAGE V-PH-HZ	VOLTAGE MIN/MAX	COMPRESSOR			BLOWER MOTOR			MIN CIRCUIT AMP	MAX FUSE/HACR
				QTY	RLA	LRA	FLA	HP	FLA		
007	1	208/230-1-60	197/253	1	2.6	17.7	0.96	0.10	3.6	4.2	15
	2	265-1-60	238/292	1	2.6	13.5	0.96	0.10	3.6	4.2	15
009	1	208/230-1-60	197/253	1	3.4	22.2	0.96	0.10	4.4	5.2	15
	2	265-1-60	238/292	1	2.9	18.8	0.85	0.10	3.8	4.5	15
012	0	115-1-60	103/126	1	9.6	58.4	2.20	0.10	11.8	14.2	20
	1	208/230-1-60	197/253	1	4.6	28.0	0.96	0.10	5.6	6.7	15
015	2	265-1-60	238/292	1	3.8	22.2	0.85	0.10	4.7	5.6	15
	1	208/230-1-60	197/253	1	5.6	29.0	1.10	1.17	6.7	8.1	15
018	2	265-1-60	238/292	1	4.6	20.0	0.90	0.17	5.5	6.7	15
	1	208/230-1-60	197/253	1	6.5	43.0	1.80	0.25	8.30	9.9	15
024	2	265-1-60	238/292	1	5.8	46.0	1.60	0.25	7.40	8.9	15
	1	208/230-1-60	197/253	1	7.4	43.0	1.80	0.25	9.20	11.1	15
030	2	265-1-60	238/292	1	6.7	46.0	1.60	0.25	8.30	10.0	15
	3	208/230-3-60	197/253	1	5.9	63.0	1.80	0.25	7.70	9.2	15
	4	460-3-60	414/506	1	2.9	30.0	0.90	0.25	3.80	4.5	15
	1	208/230-1-60	197/253	1	9.9	54.0	1.80	0.25	11.70	14.2	20
036	2	265-1-60	238/292	1	8.5	46.0	1.60	0.25	10.10	12.2	20
	3	208/230-3-60	197/253	1	6.9	63.0	1.80	0.25	8.70	10.4	15
	4	460-3-60	414/506	1	5.4	30.0	0.90	0.25	6.30	7.7	15
	1	208/230-1-60	197/253	1	13.0	74.0	4.40	0.50	17.40	20.7	30
041	2	265-1-60	238/292	1	11.3	67.0	3.30	0.50	14.60	17.4	25
	3	208/230-3-60	197/253	1	7.8	68.0	4.40	0.50	12.20	14.2	20
	4	460-3-60	414/506	1	3.9	34.0	1.80	0.50	5.70	6.7	15
	1	208/230-1-60	197/253	1	13.6	88.0	4.40	0.75	20.1	21.4	35
042	3	208/230-3-60	197/253	1	8.8	68.0	4.40	0.75	15.4	15.4	20
	4	460-3-60	414/506	1	4.4	34.0	2.80	0.75	8.2	8.3	15
	1	208/230-1-60	197/253	1	13.6	88.0	4.40	0.50	18.00	21.4	35
	3	208/230-3-60	197/253	1	8.8	68.0	4.40	0.50	13.20	15.4	20
048	4	460-3-60	414/506	1	4.4	34.0	1.80	0.50	6.20	7.3	15
	1	208/230-1-60	197/253	1	15.7	84.0	4.40	0.75	20.1	24.0	35
	3	208/230-3-60	197/253	1	11.0	88.0	4.40	0.75	15.4	18.2	25
	4	460-3-60	414/506	1	5.4	44.0	2.80	0.75	8.2	9.6	15
060											
070	5	575-3-60	517/633	1	4.4	36.0	2.60	0.75	7.0	8.1	15
	N/A										
	1	208/230-1-60	197/253	1	28.3	178.0	5.50	0.75	33.8	40.9	60
	3	208/230-3-60	197/253	1	19.2	136.0	5.50	0.75	24.7	29.5	45
	4	460-3-60	414/506	1	8.7	66.1	2.80	0.75	11.5	13.7	20
5	575-3-60	517/633	1	6.9	55.3	2.60	0.75	9.5	11.2	15	

**LEGEND**

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

**Table 7 — 50PC Electrical Data with Constant Torque ECM Blower Motor**

50PC UNIT	VOLTAGE CODE	RATED VOLTAGE V-PH-HZ	VOLTAGE MIN/MAX	COMPRESSOR			BLOWER MOTOR			MIN CIRCUIT AMP	MAX FUSE/HACR
				QTY	RLA	LRA	FLA	HP	FLA		
015	1	208/230-1-60	197/253	1	5.6	29	2.8	0.33	8.4	9.8	15
	2	265-1-60	238/292	1	4.6	20	2.6	0.33	7.2	8.4	15
018	1	208/230-1-60	197/253	1	6.5	43	2.8	0.33	9.3	10.9	15
	2	265-1-60	238/292	1	5.8	46	2.6	0.33	8.4	9.9	15
024	1	208/230-1-60	197/253	1	7.4	43	2.8	0.33	10.2	12.1	15
	2	265-1-60	238/292	1	6.7	46	2.6	0.33	9.3	11.0	15
	3	208/230-3-60	197/253	1	5.9	63	2.8	0.33	8.7	10.2	15
	4	460-3-60	414/506	1	2.9	30	2.1	0.50	5.0	5.7	15
030	1	208/230-1-60	197/253	1	9.9	54	2.8	0.33	12.7	15.2	25
	2	265-1-60	238/292	1	8.5	46	2.6	0.33	11.1	13.2	20
	3	208/230-3-60	197/253	1	6.9	63	2.8	0.33	9.7	11.4	15
	4	460-3-60	414/506	1	5.4	30	2.1	0.50	7.5	8.9	15
036	1	208/230-1-60	197/253	1	13.0	74	4.1	0.50	17.1	20.4	30
	2	265-1-60	238/292	1	11.3	67	3.9	0.50	15.2	18.0	25
	3	208/230-3-60	197/253	1	7.8	68	4.1	0.50	11.9	13.9	20
	4	460-3-60	414/506	1	3.9	34	2.1	0.50	6.0	7.0	15
041	1	208/230-1-60	197/253	1	13.6	88	6.0	0.75	19.6	23.0	35
	3	208/230-3-60	197/253	1	8.8	68	6.0	0.75	14.8	17.0	25
	4	460-3-60	414/506	1	4.4	34	4.6	0.75	9.0	10.1	15
042	1	208/230-1-60	197/253	1	13.6	88	6.0	0.75	19.6	23.0	35
	3	208/230-3-60	197/253	1	8.8	68	6.0	0.75	14.8	17.0	25
	4	460-3-60	414/506	1	4.4	34	4.6	0.75	9.0	10.1	15
048	1	208/230-1-60	197/253	1	15.7	84	6.0	0.75	21.7	25.6	40
	3	208/230-3-60	197/253	1	11.0	88	6.0	0.75	17.0	19.8	30
	4	460-3-60	414/506	1	5.4	44	4.6	0.75	10.0	11.4	15
060	1	208/230-1-60	197/253	1	26.3	145.0	7.6	1.00	33.9	40.5	60
	3	208/230-3-60	197/253	1	15.6	123.0	7.6	1.00	23.2	27.1	40
	4	460-3-60	414/506	1	7.8	70.0	4.0	1.00	11.8	13.8	20
070	1	208/230-1-60	197/253	1	28.3	158.0	7.6	1.00	35.9	43.0	70
	3	208/230-3-60	197/253	1	19.2	155.0	7.6	1.00	26.8	31.6	50
	4	460-3-60	414/506	1	8.7	75.0	4.0	1.00	12.7	14.9	20

**LEGEND**

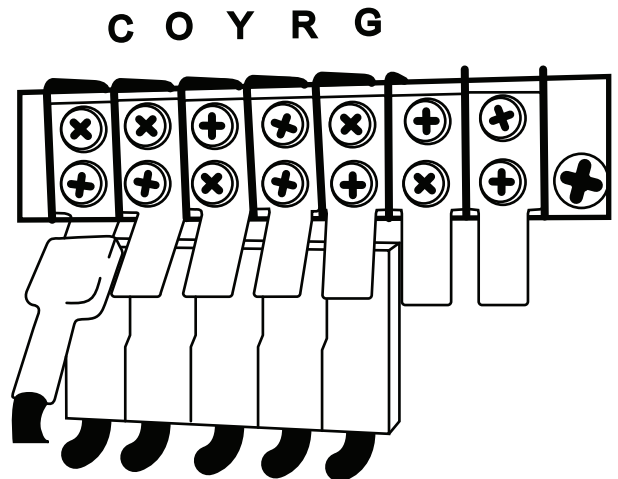
- FLA — Full Load Amps
- HACR — Heating, Air-Conditioning and Refrigeration
- LRA — Locked Rotor Amps
- RLA — Rated Load Amps

**LOW VOLTAGE** — For heat pumps with PSC (Permanent Split Capacitor) or constant torque ECM (electronically commutated motor) fan motors, all thermostat wiring is connected to a terminal block located in the unit electrical box. Refer to the unit wiring diagram for connection details.

**⚠ CAUTION**

Never route control wiring through the same conduit as power supply wiring.

Unless provided with WSHP Open, the WSHP can be controlled using the included thermostat inputs (R, O, Y1, C, G) for single stage heat pump thermostat or field-installed DDC (Direct Digital Controls) controls. Note that the reversing valve on the unit is energized when the unit is in the cooling mode. See Fig. 19 for typical thermostat connections.



**Fig. 19 — Typical Thermostat Connections**

Thermostats should be located on an interior wall away from supply ducts. Avoid locations subject to direct sunlight or drafts, or external walls. Thermostat wiring should be 18 AWG (American Wire Gage). Refer to the installation instructions for the thermostat for further details.

**IMPORTANT:** Exceptionally long runs of thermostat wire should be avoided to prevent voltage drops in the control circuit.

**HOT GAS REHEAT CONTROL** — Units with hot gas reheat (HGRH) will include an additional H terminal on the input terminal board for dehumidification control. To enable a call for dehumidification, a 24V signal must be sent to the H terminal with no voltage applied to the Y1 or O terminals. Any call for cooling (Y1 and O) will override the dehumidification call.

Unit heat pumps are supplied with a 50 VA control transformer as standard. Models with WSHP Open, Deluxe D control package, hot gas reheat (HGRH), or waterside economizer options are supplied with a 75VA transformer. The VA capacity of the transformer should be considered when connecting low voltage accessories to the heat pump such as thermostats or solenoid valves. Table shows the VA draw of factory-mounted components in the low voltage heat pump. The total VA draw of the heat pump internal components plus any attached accessories must be lower than the VA capacity of the unit control transformer.

**CAUTION**

Exceeding the transformer capacity can result in low control voltage, erratic unit operation or damage to the heat pump.

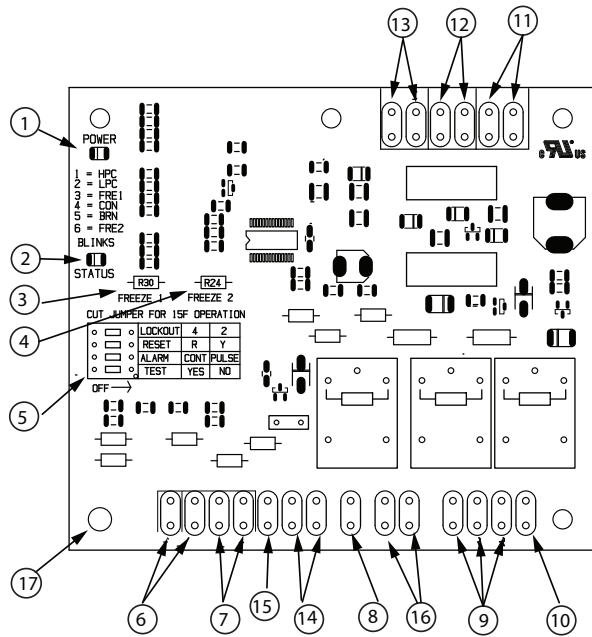
**Step 9 — Wire Field Controls**

**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.

**SAFETY DEVICES AND UNIT PROTECTION MODULE (UPM)** — Each unit is factory provided with a UPM board that controls the compressor operation and monitors the safety. See Fig. 20.

If the unit is being connected to a thermostat with a malfunction light, this connection is made at the unit malfunction output or relay. See Table 9 for UPM board fault blink codes.



1	Board Power Indicator
2	UPM Status LED Indicator
3	Water Coil Freeze Protection Temperature Selection [R30]
4	Air Coil Freeze Protection Temperature Selection
5	UPM Settings
6	Water Coil Freeze Connection
7	Air Coil Freeze Connection
8	LED Status-Diagnostic Connection
9	24VAC Power Input
10	Compressor Contact Output
11	High Pressure Switch Connection
12	Call for Compressor Y1
13	Low Pressure Switch Connection
14	24VAC Power Common
15	Condensate Overflow Sensor
16	Dry Contact
17	UPM Ground Standoff

**Fig. 20 — Unit Protection Module (UPM)**

**Table 8 — Low Voltage VA Draw**

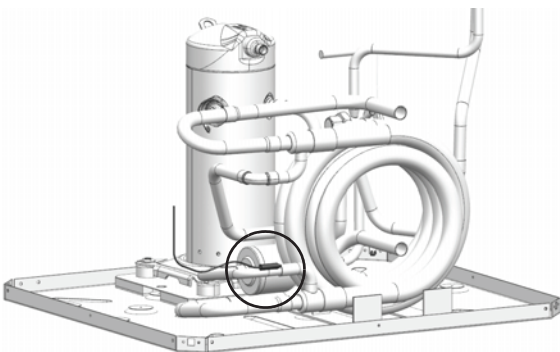
STANDARD CONSTRUCTION		HOT GAS REHEAT OR ECONOMIZER		OPTIONAL COMPONENTS	
Component	VA	Component	VA	Component	VA
Blower Relay (PSC motors only)	6-7	Total from 'Standard'	22-26	Monitor Relay (VA draw per relay)	6-7
Reversing Valve Solenoid	8-9	Additional Control Relays	12-14	Internal 2 Way Motorized Valve	7
Compressor Contactor	6-8	Hot Gas Reheat Solenoid	8-9		
Complete C board	2	—	—		
<b>Total VA draw</b>	<b>22-26</b>	<b>Total VA draw</b>	<b>42-49</b>		

**Table 9 — UPM Board Fault Blink Codes**

LED BLINKS	FAULT	FAULT CRITERIA
0	None	All fault conditions nominal
1	High Pressure	Refrigerant discharge pressure has exceeded 600 psig
2	Low Pressure	Refrigerant suction pressure has fallen below 40 psig
3	Water Coil Freeze Condition	Refrigerant temperature to the water coil has fallen below 30 F for 30 seconds
4	Condensate Overflow	Condensate levels in the unit drain pan are too high
5	Air Coil Freeze Condition	Refrigerant temperature to the air coil has fallen below 30 F for 30 seconds
6	Brown Out	Control voltage has fallen below 18 VAC

Safety controls include the following:

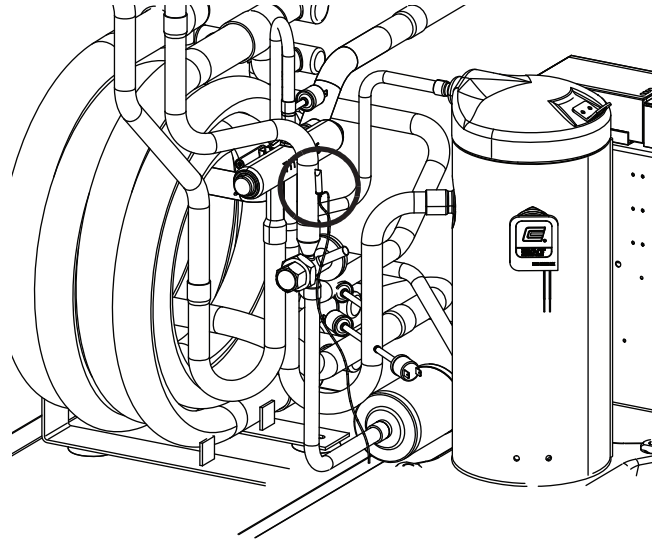
- High-pressure switch located in the refrigerant discharge line and wired across the HPC terminals on the UPM board.
- Low-pressure switch located in the unit refrigerant suction line and wired across terminals LPC1 and LPC2 on the UPM board.
- UPM board dry contacts are normally open (NO).
- Water-side 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 a soft lockout condition. The default freeze limit trip is 30°F, however this can be changed to 15°F by cutting the R30 or Freeze1 resistor located on top of DIP switch SW1. Refer to Fig. 20, Item 3 for resistor location. If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 30°F in order to shut down the unit at the appropriate leaving water temperature and protect heat pump from freezing if a freeze sensor is included.
- Evaporator freeze protection sensor, mounted between the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator 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 30°F. (See Fig. 21 and 22.)
- The condensate overflow protection sensor is located in the drain pan of the unit and connected to the 'COND' terminal on the UPM board.



**Fig. 21 — Water-Side Freeze Protection Sensor**

**WARNING**

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 30°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.



**Fig. 22 — No Freeze Protection Sensor**

The UPM board includes 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 units simultaneously starting at the same time after power up or after a power interruption, thus avoiding creating large inrush current.

**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 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 UPM board will shut does 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.

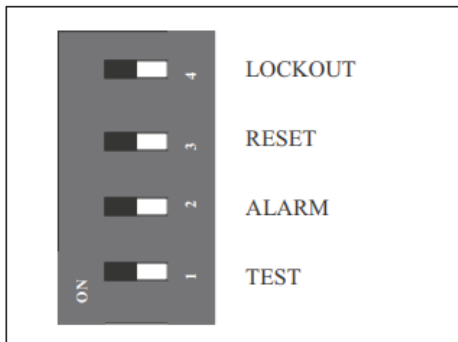
**Malfunction Output** — Alarm output is normally open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the DIP switch setting for ALARM. If it is set to CONST, a constant signal will be produced to indicate a fault has occurred and the unit requires 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. The remote device must have a malfunction detection capability when the UPM board is set to PULSE.

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

**UPM Dip Switch Settings** — The DIP switches are used to configure most of the available features of the UPM as follows:

- Lockout mode: two (2) or four (4) strikes
- Reset mode: Y signal or R signal
- Alarm mode: Constant or Pulse
- Test mode: Normal or Test operation

Figure 23 shows the factory default settings for most heat pump applications. However, the unit wiring diagram is the ultimate guide for factory DIP switch default settings.



**Fig. 23 — Typical DIP Switch Factory Defaults**

Table 10 shows the available options on the UPM board DIP switch banks.

**Table 10 — UPM DIP Switch Options**

SWITCH NUMBER	DIP SWITCH	ON	OFF
4	LOCKOUT	4	2
3	RESET	R	Y
2	ALARM	CONT	PULSE
1	TEST	YES	NO

**CAUTION**

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 default setting for the freeze limit trip is 30°F (sensor number 1); however this can be changed to 15°F by cutting the R30 resistor located on top of the DIP switch SW1. Since freeze sensor 2 is dedicated to monitor the evaporator coil it is recommended to leave the factory default setting

on the board. The UPM board will constantly monitor the refrigerant temperature with the sensor mounted close to the condensing water coil between the thermal expansion valve and water coil. If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash three times the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if DIP switch is set to 4) within an hour the UPM board will enter into a hard lockout condition. It will constantly monitor the refrigerant temperature with the sensor mounted close to the evaporator between the thermal expansion valve and evaporator coil as shown in Fig. 21. If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash three times the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if DIP switch is set to 4) within an hour the controller will enter into a hard lockout condition.

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

**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".

**Selectable Alarm Mode** — The UPM board can be configured to have either a constant or pulse signal. If constant (CONT) is selected the UPM will provide a closed contact at the alarm output until the alarm is cleared. If pulsed (PULSE) is selected the UPM will sequence the alarm contact with the fault LED flashes.

**Test Mode (TEST)** — In test mode the ASC and Random Start time delays are reduced (5 seconds and 10 seconds respectively), and serve no function to the end user equipment. The alarm and display relays also pulse for both soft and hard lockout conditions, and are both cleared through a manual reset.

**UPM Sequence of Operations** — Figure 24 shows the UPM sequence of operations.



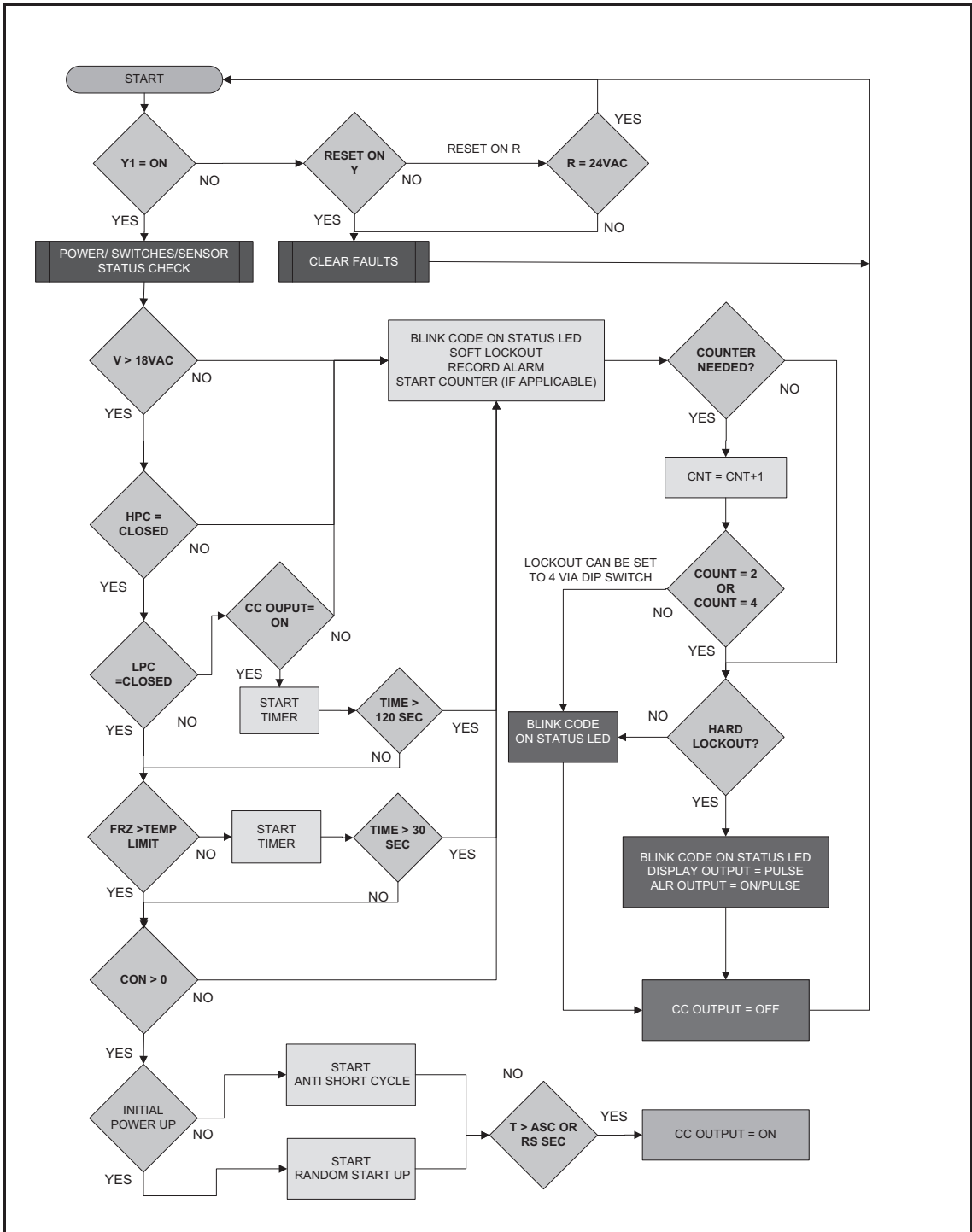


Fig. 24 — UPM Sequence of Operations

## PRE-START-UP

**System Checkout** — After completing the installation, and before energizing the unit, the following system checks should be made prior to initial startup:

1. Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Verify that the control transformer is set to the correct voltage for 208/230V units (factory setting is 230V).
3. Make sure that all electrical connections are tight and secure.
4. Check the electrical fusing and wiring for the correct size.
5. Verify that the low voltage wiring between the thermostat and the unit is correct.
6. Verify that the water piping is complete and correct.
7. Check that the water flow is correct, and adjust if necessary.
8. Check the blower for free rotation, and that it is secured to the shaft.
9. Verify that vibration isolation has been provided.
10. Unit is serviceable. Be certain that all access panels are secured in place.

11. Verify that the blower shipping support has been removed.
12. Verify that ductwork has been properly fastened to supply and return duct collars.
13. Make sure return air filters are positioned correctly in the filter rack if removed during installation.
14. Verify that the unit is not in TEST mode.

**AIR COIL** — To obtain maximum performance, clean the air coil before starting the unit. A ten percent solution of dishwasher detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

**PSC (Permanent Split Capacitor) Blower Speed Selection** — The PSC blower fan speed can be changed by moving the blue wire on the fan motor terminal block to the desired speed. The 50PC units are designed to deliver rated airflow at nominal static (0.15 in. wg) on medium speed (factory setting) and rated airflow at a higher static (0.4 to 0.5 in. wg) on high speed for applications where higher static is required. Low speed will deliver approximately 85% of rated airflow at 0.10 in. wg.

NOTE: Blower performance is shown in Tables 11 and 12.

**Table 11 — 50PCH,PCV (007-070), 50PCD (015-070) PSC Blower Performance**

50PC UNIT	FAN SPEED	RATED AIRFLOW	AIRFLOW (cfm) AT EXTERNAL STATIC PRESSURE (in. wg)											
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
007	Low	300	370	340	295	250	—	—	—	—	—	—	—	—
	Med		390	360	330	300	260	—	—	—	—	—	—	
	High		410	380	350	315	280	210	—	—	—	—	—	
009	Low	350	370	340	295	250	—	—	—	—	—	—	—	
	Med		390	360	330	300	260	—	—	—	—	—	—	
	High		410	380	350	315	280	210	—	—	—	—	—	
012	Low	400	300	290	290	300	—	—	—	—	—	—	—	
	Med		380	380	360	330	290	—	—	—	—	—	—	
	High		420	400	380	360	340	320	—	—	—	—	—	
015	Low	500	500	450	400	—	—	—	—	—	—	—	—	
	Med		560	520	480	430	400	—	—	—	—	—	—	
	High		700	650	600	550	500	450	400	—	—	—	—	
018	Low	650	—	—	—	—	—	—	—	—	—	—	—	
	Med		810	790	760	730	680	590	—	—	—	—	—	
	High		1010	970	920	870	800	680	530	—	—	—	—	
024	Low	850	650	610	570	540	510	—	—	—	—	—	—	
	Med		830	820	800	770	720	620	—	—	—	—	—	
	High		1050	1000	950	910	840	710	570	—	—	—	—	
030	Low	950 (50PCV/D) 865 (50PCH)	740	730	700	660	610	—	—	—	—	—	—	
	Med		830	810	770	730	680	620	—	—	—	—	—	
	High		1000	950	900	830	750	690	630	—	—	—	—	
036	Low	1200	1290	1250	1200	1150	1080	1000	—	—	—	—	—	
	Med		1410	1350	1290	1220	1150	1060	900	—	—	—	—	
	High		1500	1440	1370	1290	1210	1120	1000	900	—	—	—	
041	Low	1300	950	900	840	780	720	700	—	—	—	—	—	
	Med		1200	1140	1080	1010	930	870	820	—	—	—	—	
	High		1490	1400	1320	1240	1160	1080	990	910	—	—	—	
042	Low	1400	1210	1210	1190	1160	1120	1080	—	—	—	—	—	
	Med		1460	1450	1430	1390	1330	1250	1160	—	—	—	—	
	High		1750	1710	1670	1620	1560	1460	1330	1210	1080	—	—	
048	Low	1600	1450	1440	1420	1400	1360	1320	—	—	—	—	—	
	Med		1700	1670	1630	1580	1530	1470	1400	—	—	—	—	
	High		1930	1870	1810	1740	1670	1600	1520	1430	1340	—	—	
060	N/A													
070	Low	2100	1570	1560	1550	1540	1530	1505	1475	1440	1400	—	—	
	Med		1900	1890	1880	1870	1860	1825	1790	1730	1670	1590	1500	
	High		2240	2220	2200	2150	2100	2050	2000	1940	1870	1800	1700	1590

NOTE: 575V models employ 1 speed motors (high only).

**Table 12 — 50PCH,PCV,PCD (015-070) Constant Torque ECM Motor Blower Performance**

50PCH, PCV, PCD	TAP #	RATED AIRFLOW	AIRFLOW (cfm) AT EXTERNAL STATIC PRESSURE (in. wg)											
			0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
015	1	500	480	440	410	370	340	—	—	—	—	—	—	—
	2		530	490	450	420	380	340	—	—	—	—	—	
	3		600	560	510	470	440	410	370	—	—	—	—	
	4		650	600	560	520	500	480	440	380	—	—	—	
	5		710	660	620	580	550	520	490	470	—	—	—	
018	1	650	630	590	560	530	490	—	—	—	—	—	—	
	2		720	700	670	630	600	560	—	—	—	—		
	3		790	770	750	710	670	620	560	—	—	—		
	4		910	890	850	810	740	670	590	520	—	—		
	5		1010	970	920	860	810	750	660	530	—	—		
024	1	850	650	610	580	560	520	—	—	—	—	—	—	
	2		740	720	690	660	620	570	—	—	—	—		
	3		850	830	800	770	730	690	630	—	—	—		
	4		950	920	890	870	840	820	770	650	—	—		
	5		1160	1110	1050	990	920	800	670	560	—	—		
030	1	950	620	600	570	540	490	—	—	—	—	—	—	
	2		730	710	670	640	610	550	—	—	—	—		
	3		820	790	760	740	710	670	630	—	—	—		
	4		940	910	880	850	800	740	660	—	—	—		
	5		1070	1010	950	900	840	760	670	—	—	—		
036	1	1200	1120	1090	1055	1030	1000	—	—	—	—	—	—	
	2		1260	1230	1200	1170	1140	1080	—	—	—	—		
	3		1330	1290	1250	1210	1170	1100	1030	—	—	—		
	4		1400	1360	1310	1250	1190	1120	1040	960	—	—		
	5		1470	1420	1360	1290	1220	1140	1050	970	890	—		
041	1	1300	840	770	700	620	—	—	—	—	—	—	—	
	2		1220	1150	1080	1010	950	—	—	—	—	—		
	3		1430	1360	1280	1200	1130	1080	—	—	—	—		
	4		1540	1460	1380	1300	1220	1140	1060	—	—	—		
	5		1620	1550	1470	1370	1260	1180	1090	1000	—	—		
042	1	1400	1270	1250	1230	1210	—	—	—	—	—	—	—	
	2		1440	1420	1410	1410	1400	1380	1340	—	—	—		
	3		1540	1530	1510	1500	1490	1470	1430	1350	—	—		
	4		1650	1630	1610	1600	1580	1530	1460	1360	1240	—		
	5		1730	1720	1700	1670	1620	1570	1490	1380	1260	1100		
048	1	1600	1390	1370	1350	1320	—	—	—	—	—	—	—	
	2		1600	1580	1550	1530	1510	—	—	—	—	—		
	3		1730	1700	1670	1650	1630	1600	1580	1540	—	—		
	4		1830	1810	1780	1760	1740	1710	1670	1600	1520	—		
	5		1930	1910	1880	1860	1830	1780	1720	1640	1540	1420		
060	1	2000	1900	1880	1860	1820	—	—	—	—	—	—	—	
	2		2000	1970	1950	1920	1890	1860	—	—	—	—		
	3		2110	2090	2060	2030	2010	1970	1940	1910	1880	—		
	4		2220	2200	2170	2140	2110	2080	2050	2060	2050	2000		
	5		2340	2320	2290	2260	2230	2210	2180	2150	2110	2070		
070	1	2100	2050	2010	1970	1930	—	—	—	—	—	—	—	
	2		2150	2120	2080	2030	1990	1960	—	—	—	—		
	3		2270	2230	2200	2160	2120	2080	2040	2010	1980	—		
	4		2390	2350	2320	2280	2250	2200	2160	2130	2100	2070		
	5		2520	2480	2450	2420	2380	2330	2290	2260	2220	2170		

**START-UP**

Use the procedure outlined below to initiate proper unit start-up.

**Operating Limits**

**ENVIRONMENT** — This equipment is designed for indoor installation only. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

**POWER SUPPLY** — A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

**UNIT STARTING CONDITIONS** — Depending on the model, units should start and operate with entering water temperature temperatures between 20 to 110°F and entering air temperatures between 45 and 95°F. Water flow rates should be between 1.5 and 3.5 GPM/nominal cooling ton.

**NOTE:** These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 13 for operating limits.

**⚠ WARNING**

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energized equipment. Failure to heed this warning could lead to personal injury.

1. Restore power to system.
2. Turn thermostat fan position to ON. Blower should start.
3. Balance airflow at registers.
4. Adjust all valves to the full open position and turn on the line power to all heat pump units.

- Operate unit in the cooling cycle first, then the heating cycle. Refer to Table 13 for unit operating limits. Allow 15 minutes between cooling and heating tests for pressure to equalize.

NOTE: Two factors determine the operating limits of a unit: entering-air temperature and water temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation. See Tables 14-25.

**Table 13 — Operating Limits**

AIR LIMITS	STANDARD UNIT	EXTENDED RANGE OPTION
<b>COOLING</b>		
Minimum cooling entering air db/wb F	68/57	68/57
Maximum cooling entering air db/wb F	95/85	98/85
Minimum cooling entering fluid temperature F	50	50
Water loop typical coil entering fluid range temperature F	70/90	70/90
Maximum cooling entering fluid temperature F	100	110
<b>HEATING</b>		
Minimum heating entering air db F	50	50
Maximum heating entering air db F	80	80
Normal water coil entering fluid range F	50-80	25-80*
Minimum water coil entering Fluid F	50	20*

**LEGEND**

db — Dry Bulb  
wb — Wet Bulb

\*Antifreeze solution is required at these fluid temperatures.

**Scroll Compressor Rotation** — It is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

- Connect service gages to suction and discharge pressure fittings.
- Energize the compressor.

- The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

- Turn off power to the unit. Install disconnect tag.
- Reverse any two of the unit power leads.
- Reapply power to the unit and verify pressures are correct.

The suction and discharge pressure levels should now move to their normal start-up levels.

When the compressor is rotating in the wrong direction, the unit makes more noise and does not provide cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, thus activating the unit lockout. This requires a manual reset. To reset, turn the thermostat on and then off.

NOTE: There is a 5-minute time delay before the compressor will start.

**Unit Start-Up Cooling Mode**

- Adjust the unit thermostat to the warmest position. Slowly reduce the thermostat position until the compressor activates.
- Check for cool air delivery at unit grille a few minutes after the unit has begun to operate.
- Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line. Be sure the condensate trap includes a water seal.
- Check the temperature of both supply and discharge water. Compare to Tables 14-25. If temperature is within range, proceed. If temperature is outside the range, check the cooling refrigerant pressures in Tables 14-25.
- Check air temperature drop across the coil when compressor is operating. Air temperature drop should be between 15 and 25°F.

**Table 14 — 50PC007 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	1.4	—	—	—	—	65-80	282-344	6-7	14-17
	1.9	—	—	—	—	73-89	294-359	3-4	15-18
40	1.4	106-129	146-178	17-21	18-22	80-98	299-365	7-9	16-20
	1.9	102-124	133-162	10-13	19-23	89-108	311-380	4-5	17-21
50	1.4	115-141	180-220	17-20	17-21	95-116	315-385	9-11	19-23
	1.9	111-135	163-200	10-12	18-23	105-128	329-402	5-7	20-24
60	1.4	124-152	213-261	16-19	17-21	109-133	332-406	11-13	21-26
	1.9	120-146	194-237	10-12	18-22	121-148	346-423	6-8	22-27
70	1.4	134-163	247-302	15-19	17-20	124-151	349-427	12-15	23-28
	1.9	128-157	225-275	9-11	18-21	138-168	364-444	7-9	25-30
80	1.4	143-175	281-343	14-18	16-20	138-169	366-447	14-17	26-31
	1.9	137-168	255-312	9-11	17-21	154-188	381-466	8-10	27-33
90	1.4	152-186	315-385	14-17	16-19	153-187	383-468	16-19	28-34
	1.9	146-179	286-350	8-10	17-20	170-208	399-487	9-12	29-36
100	1.4	161-197	349-426	13-16	15-19	—	—	—	—
	1.9	155-190	317-387	8-10	16-20	—	—	—	—

**LEGEND**

DB — Dry Bulb  
— — No Operation in This Temperature Range

**Table 15 — 50PC009 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	1.8	—	—	—	—	91-111	251-307	5-6	21-25
	2.4	—	—	—	—	95-116	256-313	3-4	22-26
40	1.8	112-137	144-176	14-17	22-27	107-130	267-327	6-7	24-29
	2.4	106-130	137-167	10-12	23-28	112-137	273-333	4-5	25-30
50	1.8	116-142	177-217	13-16	21-26	123-150	284-347	7-9	27-33
	2.4	111-135	169-206	9-12	22-27	129-158	289-353	5-6	28-34
60	1.8	121-148	211-258	13-16	21-26	139-170	300-366	8-10	30-37
	2.4	115-140	200-245	9-11	22-27	146-179	306-374	6-7	32-39
70	1.8	126-154	245-299	13-15	20-25	156-190	316-386	9-12	33-41
	2.4	119-146	232-284	9-11	21-26	163-200	322-394	7-8	35-43
80	1.8	130-159	278-340	12-15	20-24	172-210	332-406	11-13	36-44
	2.4	124-151	264-323	9-11	21-26	180-220	339-414	8-9	38-47
90	1.8	135-165	312-381	12-15	19-24	188-230	349-426	12-15	39-48
	2.4	128-157	296-362	9-10	20-25	197-241	355-434	8-10	41-51
100	1.8	140-171	345-422	12-14	19-23	—	—	—	—
	2.4	133-162	328-401	8-10	20-24	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 16 — 50PC012 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	2.6	—	—	—	—	73-89	266-325	5-6	15-18
	3.0	—	—	—	—	77-94	272-333	3-4	16-19
40	2.6	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21
	3.0	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22
50	2.6	126-154	221-270	14-17	18-21	162-198	293-358	7-8	20-24
	3.0	121-148	207-253	8-9	19-23	170-208	300-366	5-6	21-25
60	2.6	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
	3.0	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29
70	2.6	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
	3.0	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32
80	2.6	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
	3.0	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35
90	2.6	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36
	3.0	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38
100	2.6	149-182	405-495	13-15	15-19	—	—	—	—
	3.0	143-174	381-465	7-9	16-20	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 17 — 50PC015 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	2.8	—	—	—	—	74-90	244-299	3-4	13-15
	3.8	—	—	—	—	78-95	251-306	2-3	13-16
40	2.8	122-149	183-224	14-18	19-23	87-106	257-314	4-5	15-18
	3.8	117-143	172-210	8-10	20-24	91-111	263-322	3-3	16-19
50	2.8	131-160	214-261	14-18	18-22	164-201	269-329	5-6	17-20
	3.8	126-154	201-245	8-10	19-24	173-211	276-337	3-4	18-22
60	2.8	136-166	244-298	14-17	18-22	111-136	282-344	6-7	19-23
	3.8	131-160	230-281	8-10	19-23	117-143	289-353	4-5	20-24
70	2.8	141-172	275-336	14-17	17-21	124-152	294-360	7-8	21-25
	3.8	135-165	258-316	8-10	18-22	131-160	302-369	5-6	22-27
80	2.8	145-178	310-378	14-17	17-20	136-166	307-375	8-9	23-28
	3.8	140-171	291-356	8-10	18-22	143-175	314-384	5-6	24-30
90	2.8	150-183	349-426	14-17	16-20	149-182	319-390	8-10	25-30
	3.8	144-176	328-401	8-9	17-21	156-191	327-400	6-7	26-32
100	2.8	155-189	392-480	13-16	16-19	—	—	—	—
	3.8	149-182	369-451	8-9	17-21	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 18 — 50PC018 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	3.0	—	—	—	—	65-80	282-344	6-7	14-17
	5.0	—	—	—	—	73-89	294-359	3-4	15-18
40	3.0	121-148	184-225	17-21	18-22	80-98	299-365	7-9	16-20
	5.0	117-143	167-204	10-13	19-23	89-108	311-380	4-5	17-21
50	3.0	123-151	222-271	17-20	17-21	95-116	315-385	9-11	19-23
	5.0	119-145	202-247	10-12	18-23	105-128	329-402	5-7	20-24
60	3.0	125-153	260-318	16-19	17-21	109-133	332-406	11-13	21-26
	5.0	120-147	237-289	10-12	18-22	121-148	346-423	6-8	22-27
70	3.0	127-155	298-365	15-19	17-20	124-151	349-427	12-15	23-28
	5.0	122-149	271-331	9-11	18-21	138-168	364-444	7-9	25-30
80	3.0	129-158	336-411	14-18	16-20	138-169	366-447	14-17	26-31
	5.0	124-152	306-374	9-11	17-21	154-188	381-466	8-10	27-33
90	3.0	131-160	374-458	14-17	16-19	153-187	383-468	16-16	28-34
	5.0	126-154	340-416	8-10	17-20	170-208	399-487	9-12	29-36
100	3.0	133-162	413-504	13-16	15-19	—	—	—	—
	5.0	128-156	375-458	8-10	16-20	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 19 — 50PC024 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	5.0	—	—	—	—	72-87	296-361	5-6	21-25
	7.0	—	—	—	—	75-92	301-368	3-4	22-26
40	5.0	114-139	155-190	14-17	22-27	88-107	314-384	6-7	24-29
	7.0	108-132	147-180	10-12	23-28	92-112	321-392	4-5	25-30
50	5.0	116-142	192-234	13-16	21-26	104-127	333-407	7-9	27-33
	7.0	111-135	182-222	9-12	22-27	109-133	340-415	5-6	28-34
60	5.0	119-146	228-279	13-16	21-26	120-146	352-430	8-10	30-37
	7.0	113-138	217-265	9-11	22-27	125-153	359-439	6-7	32-39
70	5.0	122-149	264-323	13-15	20-25	136-166	371-453	9-12	33-41
	7.0	116-142	251-307	9-11	21-26	142-174	378-462	7-8	35-43
80	5.0	125-152	301-368	12-15	20-24	152-185	389-476	11-13	36-44
	7.0	118-145	286-349	9-11	21-26	159-194	397-485	8-9	38-47
90	5.0	127-156	337-412	12-15	19-24	168-205	408-499	12-15	39-48
	7.0	121-148	320-392	9-10	20-25	176-215	416-509	8-10	41-51
100	5.0	130-159	374-457	12-14	19-23	—	—	—	—
	7.0	124-151	355-434	8-10	20-24	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 20 — 50PC030 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	3.5	—	—	—	—	73-89	266-325	5-6	15-18
	7.5	—	—	—	—	77-94	272-333	3-4	16-19
40	3.5	117-143	189-231	14-17	18-22	86-105	279-341	6-7	17-21
	7.5	112-137	178-217	8-9	19-24	90-110	286-350	4-5	18-22
50	3.5	126-154	221-270	14-17	18-21	162-198	293-358	7-8	20-24
	7.5	121-148	207-253	8-9	19-23	170-208	300-366	5-6	21-25
60	3.5	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
	7.5	125-153	237-290	8-9	18-22	115-141	314-383	6-7	23-29
70	3.5	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
	7.5	130-158	266-326	7-9	18-22	129-157	327-400	6-8	26-32
80	3.5	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
	7.5	134-164	300-367	7-9	17-21	141-172	341-417	7-9	28-35
90	3.5	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36
	7.5	138-169	338-414	7-9	17-21	154-188	355-434	8-10	31-38
100	3.5	149-182	405-495	13-15	15-19	—	—	—	—
	7.5	143-174	381-465	7-9	16-20	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 21 — 50PC036 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	4.5	—	—	—	—	74-90	244-299	3-4	13-15
	9.0	—	—	—	—	78-95	251-306	2-3	13-16
40	4.5	122-149	183-224	14-18	19-23	87-106	257-314	4-5	15-18
	9.0	117-143	172-210	8-10	20-24	91-111	263-322	3-3	16-19
50	4.5	131-160	214-261	14-18	18-22	164-201	269-329	5-6	17-20
	9.0	126-154	201-245	8-10	19-24	173-211	276-337	3-4	18-22
60	4.5	136-166	244-298	14-17	18-22	111-136	282-344	6-7	19-23
	9.0	131-160	230-281	8-10	19-23	117-143	289-353	4-5	20-24
70	4.5	141-172	275-336	14-17	17-21	124-152	294-360	7-8	21-25
	9.0	135-165	258-316	8-10	18-22	131-160	302-369	5-6	22-27
80	4.5	145-178	310-378	14-17	17-20	136-166	307-375	8-9	23-28
	9.0	140-171	291-356	8-10	18-22	143-175	314-384	5-6	24-30
90	4.5	150-183	349-426	14-17	16-20	149-182	319-390	8-10	25-30
	9.0	144-176	328-401	8-9	17-21	156-191	327-400	6-7	26-32
100	4.5	155-189	392-480	13-16	16-19	—	—	—	—
	9.0	149-182	369-451	8-9	17-21	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 22 — 50PC041, 042 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	6.0	—	—	—	—	64-78	248-303	5-6	15-18
	10.0	—	—	—	—	67-82	254-311	3-4	16-19
40	6.0	109-134	183-224	18-22	19-23	75-91	261-319	6-8	17-21
	10.0	105-128	172-210	10-12	20-25	79-96	267-327	4-5	18-23
50	6.0	118-144	214-261	18-22	19-23	142-173	273-334	8-10	20-24
	10.0	113-138	201-245	10-12	20-24	149-182	280-342	5-7	21-26
60	6.0	122-149	244-298	17-21	18-22	96-117	286-349	9-11	22-27
	10.0	117-143	230-281	10-12	19-24	101-123	293-358	6-8	24-29
70	6.0	126-154	275-336	17-21	18-22	107-131	299-365	11-13	25-30
	10.0	121-148	258-316	10-12	19-23	113-138	306-374	7-9	26-32
80	6.0	130-159	310-378	17-21	17-21	117-143	311-380	12-15	27-33
	10.0	125-153	291-356	10-12	18-22	123-151	319-390	8-10	29-35
90	6.0	134-164	349-426	17-20	17-20	128-157	324-396	13-16	29-36
	10.0	129-158	328-401	9-12	18-22	135-165	332-406	9-11	31-38
100	6.0	139-170	392-480	16-20	16-20	—	—	—	—
	10.0	133-163	369-451	9-11	17-21	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range



**Table 23 — 50PC048 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	6.0	—	—	—	—	71-87	277-339	6-7	15-19
	10.0	—	—	—	—	75-92	284-347	4-5	16-20
40	6.0	118-144	194-237	21-25	19-23	84-102	291-356	7-9	18-22
	10.0	113-138	182-223	12-14	20-24	88-108	299-365	5-6	19-23
50	6.0	127-155	226-276	21-25	18-22	159-194	305-373	9-11	20-25
	10.0	122-149	213-260	12-14	19-24	167-204	313-383	6-7	21-26
60	6.0	131-160	259-316	21-25	18-22	108-132	320-391	10-13	23-28
	10.0	126-154	243-297	12-14	19-23	113-138	328-400	7-9	24-29
70	6.0	136-166	291-355	20-25	17-21	120-147	334-408	12-15	25-31
	10.0	130-159	273-334	12-14	18-22	126-154	342-418	8-10	27-32
80	6.0	140-171	328-401	20-24	17-20	131-161	348-425	14-17	27-34
	10.0	135-165	308-377	11-14	18-22	138-169	356-436	9-11	29-36
90	6.0	145-177	369-451	20-24	16-20	144-176	362-442	15-18	30-37
	10.0	139-170	347-424	11-14	17-21	151-185	371-453	10-12	32-39
100	6.0	149-183	415-508	19-24	16-19	—	—	—	—
	10.0	143-175	391-477	11-14	17-21	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 24 — 50PC060 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	8.0	—	—	—	—	68-84	256-313	5-7	19-23
	12.0	—	—	—	—	73-89	261-319	4-5	20-25
40	8.0	113-138	173-212	18-22	19-23	81-99	277-339	7-8	22-26
	12.0	110-134	162-198	12-14	20-24	86-105	283-346	5-6	23-28
50	8.0	116-142	207-253	17-21	19-23	93-114	299-365	8-9	24-29
	12.0	112-137	193-236	12-14	19-24	99-121	305-373	6-7	25-31
60	8.0	118-145	240-293	17-21	18-23	106-129	321-392	9-11	26-32
	12.0	115-140	224-274	11-14	19-23	113-138	327-400	7-8	28-34
70	8.0	121-148	273-334	17-21	18-22	118-145	342-418	10-12	29-35
	12.0	117-143	255-312	11-14	19-23	126-154	349-427	8-9	30-37
80	8.0	123-151	307-375	16-20	18-22	131-160	364-444	11-14	31-38
	12.0	120-146	287-350	11-13	19-23	139-170	371-454	8-10	33-40
90	8.0	126-154	340-416	16-20	18-22	143-175	385-471	12-15	33-41
	12.0	122-149	318-388	11-13	18-22	152-186	393-480	9-11	35-43
100	8.0	128-157	373-456	16-19	17-21	—	—	—	—
	12.0	125-152	349-426	11-13	18-22	—	—	—	—

LEGEND

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Table 25 — 50PC070 Typical Unit Operating Pressures and Temperatures**

ENTERING WATER TEMP (°F)	WATER FLOW (GPM/TON)	COOLING				HEATING			
		SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP RISE (°F)	AIR TEMP DROP (°F) DB	SUCTION PRESSURE (PSIG)	DISCHARGE PRESSURE (PSIG)	WATER TEMP DROP (°F)	AIR TEMP RISE (°F)
30	12.0	—	—	—	—	68-84	256-313	5-7	19-23
	16.0	—	—	—	—	73-89	261-319	4-5	20-25
40	12.0	117-143	182-222	15-19	21-26	81-99	277-339	7-8	22-26
	16.0	114-139	170-208	11-14	22-27	86-105	283-346	5-6	23-28
50	12.0	120-147	215-263	15-18	20-25	93-114	299-365	8-9	24-29
	16.0	117-143	201-246	11-14	21-26	99-121	305-373	6-7	25-31
60	12.0	123-150	248-304	14-17	20-24	106-129	321-392	9-11	26-32
	16.0	119-146	232-284	11-13	21-25	113-138	327-400	7-8	28-34
70	12.0	126-154	282-344	14-17	19-24	118-145	342-418	10-12	29-35
	16.0	122-149	263-322	10-13	20-25	126-154	349-427	8-9	30-37
80	12.0	129-157	315-385	13-16	19-23	131-160	364-444	11-14	31-38
	16.0	125-153	294-360	10-12	19-24	139-170	371-454	8-10	33-40
90	12.0	132-161	348-426	13-16	18-22	143-175	385-471	12-15	33-41
	16.0	128-156	326-398	10-12	19-23	152-186	393-480	9-11	35-43
100	12.0	134-164	382-466	12-15	17-21	—	—	—	—
	16.0	131-160	357-436	9-11	18-22	—	—	—	—

**LEGEND**

DB — Dry Bulb  
 — — No Operation in This Temperature Range

**Unit Start-Up Heating Mode**

NOTE: Operate the unit in heating cycle after checking the cooling cycle. Allow 5 minutes between tests for the pressure or reversing valve to equalize.

1. Turn thermostat to lowest setting and set thermostat switch to HEAT position.
2. Slowly turn the thermostat to a higher temperature until the compressor activates.
3. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.
4. Check the temperature of both supply and discharge water. Compare to Tables 14-25. If temperature is within range, proceed. If temperature is outside the range, check the heating refrigerant pressures in Tables 14-25.
5. Once the unit has begun to run, check for warm air delivery at the unit grille.
6. Check air temperature rise across the coil when compressor is operating. Air temperature rise should be between 20 and 30°F after 15 minutes at load.
7. Check for vibration, noise and water leaks.

**Flow Regulation** — Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. Adjust the water control valve until the desired flow rate is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications.

An alternate method of flow regulation is to install an automatic flow control valve. These valves feature a removable cartridge that controls the maximum flow through the valve assembly. Automatic flow control valves should be sized for the specific flow for each application.

**⚠ WARNING**

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

**Flushing** — Once the piping is complete, units require final purging and loop charging. A flush cart pump of at least 1.5 hp is needed to achieve adequate flow velocity in the loop to purge

air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.
3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 50 psig surges to help purge air pockets. This maintains the pump at 50 psig.
5. To purge, keep the pump at 50 psig until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

NOTE: If air is purged from the system while using a 10 in. PVC flush tank, the level drop will only be 1 to 2 in. since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 1 to 2 in., reverse the flow.

8. Repeat this procedure until all air is purged.
9. Restore power.

Antifreeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the Antifreeze section on page 35 for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogenous temperature.

When complete, perform a final flush and pressurize the loop to a static pressure of 40 to 50 psig for winter months or 15 to 20 psig for summer months.

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be

discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Table 26.

**Table 26 — Waterside Pressure Drop**

50PC UNIT SIZE	WATER FLOW RATE (gpm)	WATERSIDE PRESSURE DROP (psi)	WATERSIDE PRESSURE DROP WITH 2-WAY FLOW CONTROL VALVE (psi)
007	1.0	0.3	0.5
	2.0	1.1	1.8
	3.0	2.3	3.8
009	1.0	0.5	0.6
	2.0	1.7	2.3
	3.0	3.5	5.0
012	1.5	1.0	1.4
	2.5	2.6	3.6
	3.5	4.8	6.7
015	2.0	1.9	2.5
	3.0	3.9	5.3
	4.0	6.5	9.1
018	2.5	1.1	2.1
	4.0	2.7	5.2
	5.0	4.0	8.0
024	3.0	1.7	2.0
	4.0	2.8	3.4
	6.0	5.8	7.2
030	4.0	2.0	2.6
	6.0	4.2	5.6
	8.0	7.0	9.6
036	4.5	1.6	2.4
	6.0	2.6	4.0
	9.0	5.4	8.6
041	5.0	2.0	3.0
	8.0	4.6	7.2
	11.0	8.2	13.1
042	5.0	2.0	3.0
	8.0	4.6	7.2
	11.0	8.2	13.0
048	6.0	0.8	1.4
	8.0	1.4	2.5
	12.0	2.8	5.4
060	7.5	1.4	2.4
	10.0	2.3	4.1
	15.0	4.8	8.8
070	9.0	2.0	3.4
	12.0	3.4	5.9
	18.0	7.0	12.7

**Antifreeze** — In areas where entering loop temperatures drop below 40°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 fuming.

Calculate the total volume of fluid in the piping system. See Table 27. Use the percentage by volume in Table 28 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 FP1 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 13°F) set point to avoid nuisance faults.

**Cooling Tower/Boiler Systems** — These systems typically use a common loop temperature 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.

**Table 27 — 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 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 28 — 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
Ethanol (%)	29	25	20	14

**OPERATION**

**Power Up Mode** — The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation.

NOTE: The compressor will have a 5-minute anti-short cycle upon power up.

**Units with Complete C or Deluxe D Controls**

**STANDBY** — Y and W terminals are not active in Standby mode; however, the O and G terminals may be active, depending on the application. The compressor will be off.

**COOLING** — Y and O terminals are active in Cooling mode. After power up, the first call to the compressor will initiate a 270 to 300 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

**HEATING STAGE 1** — Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 270 to 300 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

**HOT GAS REHEAT (Optional)** — Terminal H is active in dehumidification mode with hot gas reheat. After a call for H, the reversing valve (O), compressor (Y), and fan (G) are also enabled.

**NOTE:** Any call for cooling (Y), heating (Y or W), or reversing valve (O) will override dehumidification mode (H).

**WATERSIDE ECONOMIZER (Optional)** — Y and O terminals are active in Cooling mode. When the entering water temperature drops below the entering water temperature set point on the waterside economizer aquastat, the compressor and reversing valve are disabled and the waterside economizer is enabled. The waterside economizer three way control valve will divert water to the economizer coil for free cooling. When the entering water temperature rises above the aquastat set point, the waterside economizer is disabled and the compressor and reversing valve are enabled.

**TWO WAY WATER FLOW CONTROL VALVE (Optional)** — The two way water flow control valve is enabled anytime there is a call for cooling (Y), heating (Y), or dehumidification (H) and allows water to flow through the unit. When there is no call for cooling, heating, or dehumidification, the water flow control valve is disabled, stopping flow through the unit.

**BOILERLESS HEAT (Deluxe D Only)** — When the entering water temperature is below the boilerless heat aquastat entering water temperature set point and there is a call for heating (Y), the compressor is disabled and the auxiliary heat output is enabled. When the entering water temperature is above the aquastat set point, the auxiliary heat output is disabled and the compressor is enabled.

**PUMP/VALVE RELAY (Deluxe D Only)** — The pump/valve relay is enabled anytime there is a call for cooling (Y), heating (Y), or dehumidification (H) and can be used to enable/disable field installed flow control valves or circulator pumps. When there is no call for cooling, heating, or dehumidification, pump/valve relay is disabled.

**Units with WSHP Open Controls with UPM Board** — Units with WSHP Open still feature a UPM board 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. For WSHP Open operation, please refer to the WSHP Open Integration Guide and the WSHP Points/Properties Manual.

## SERVICE

Perform the procedures outlined below periodically, as indicated.

An annual “checkup” is recommended by a licensed refrigeration mechanic. 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.

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 mechanic immediately and have them check for: water flow problems, water temperature problems, airflow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

**IMPORTANT:** 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.

### ⚠ WARNING

To avoid injury and the discharge of refrigerant into the environment, all refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry accepted guidelines and all local, state and federal statutes for the recovery and disposal of refrigerants.

### ⚠ WARNING

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

### ⚠ WARNING

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

**Filters** — Filter changes or cleanings are required at regular intervals. The time period between filter changes will depend upon 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 may be sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may be needed to be as frequent as biweekly. See Fig. 1-3 for replacement filter sizes. Note that horizontal units containing two filters are taped together at the factory to facilitate removal. This should be done by end user as new filters are installed.

**IMPORTANT:** Units should never be operated without a filter.

### ⚠ CAUTION

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.

**Condensate Drain Pans** — The condensate drain should be checked annually by cleaning and flushing to ensure proper drainage.

**Refrigerant System** — Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gages unless unit operation appears abnormal. Check to see that unit is within the superheat and subcooling temperature ranges shown in Tables 14-25. If the unit is not within these ranges, recover and reweigh in refrigerant charge.

**Compressor** — Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

**Fan Motors** — All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is NOT recommended as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

**Condensate Drain Cleaning** — Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled to maintain an air seal.

**Air Coil Cleaning** — Remove dirt and debris from evaporator coil as required by condition of the coil. A 10% solution of dishwasher detergent and water is recommended for cleaning both sides of the coil, followed by a thorough water rinse. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

**Condenser Cleaning** — Water-cooled condensers may require cleaning of scale (water deposits) due to improperly maintained closed-loop water systems. Sludge build-up may need to be cleaned in an open water tower system due to induced contaminants.

Local water conditions may cause excessive fouling or pitting of tubes. Condenser tubes should therefore be cleaned at least once a year, or more often if the water is contaminated.

Proper water treatment can minimize tube fouling and pitting. If such conditions are anticipated, water treatment analysis is recommended. Refer to the Carrier System Design Manual, Part 5, for general water conditioning information.

**CAUTION**

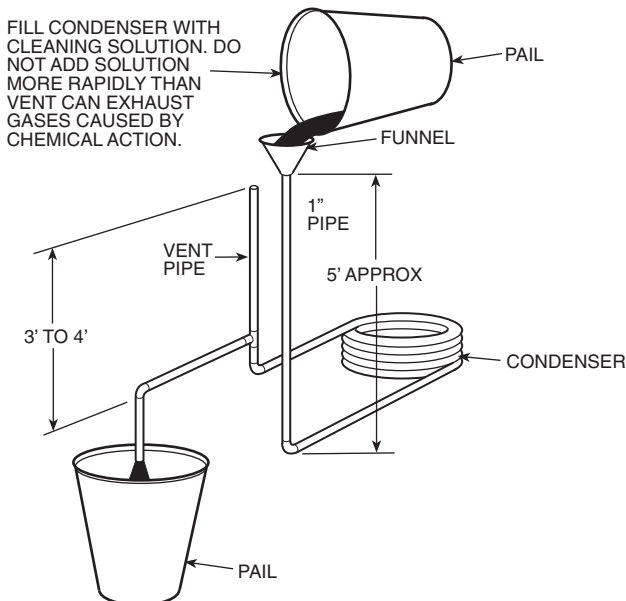
Follow all safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution. Observe and follow acid manufacturer's instructions.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, damage concrete, and, without inhibitor, damage steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

**GRAVITY FLOW METHOD** — Do not add solution faster than vent can exhaust the generated gases.

When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions. See Fig. 25.

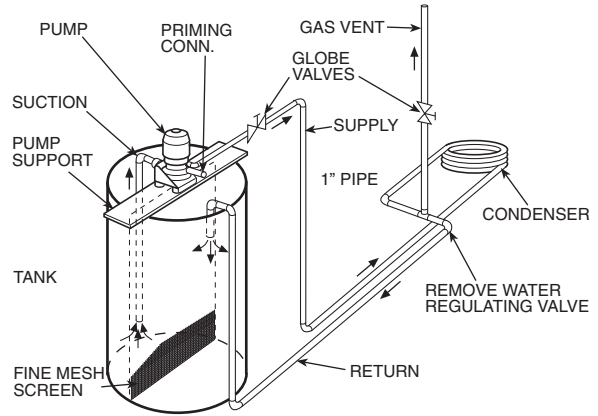


**Fig. 25 — Gravity Flow Method**

**FORCED CIRCULATION METHOD** — Fully open vent pipe when filling condenser. The vent may be closed when condenser is full and pump is operating. See Fig. 26.

Regulate flow to condenser with a supply line valve. If pump is a nonoverloading type, the valve may be fully closed while pump is running.

For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours. Drain condenser and flush with clean water. Follow acid manufacturer's instructions.



**Fig. 26 — Forced Circulation Method**

**Checking System Charge** — Units are shipped with full operating charge. If recharging is necessary:

1. Insert thermometer bulb in insulating rubber sleeve on liquid line near filter drier. Use a digital thermometer for all temperature measurements. DO NOT use a mercury or dial-type thermometer.
2. Connect pressure gage to discharge line near compressor.
3. After unit conditions have stabilized, read head pressure on discharge line gage.

NOTE: Operate unit a minimum of 15 minutes before checking charge.

4. From standard field-supplied Pressure-Temperature chart for R-410A, find equivalent saturated condensing temperature.
5. Read liquid line temperature on thermometer; then subtract from saturated condensing temperature. The difference equals subcooling temperature.
6. Compare the subcooling temperature with the normal temperature listed in Tables 14-25. If the measured liquid line temperature does not agree with the required liquid line temperature, ADD refrigerant to raise the temperature or REMOVE refrigerant (using standard practices) to lower the temperature (allow a tolerance of  $\pm 3^\circ \text{F}$ ).

**Refrigerant Charging**

**WARNING**

To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system — this can cause compressor flooding.

NOTE: Do not vent or depressurize unit refrigerant to atmosphere. Remove and recover refrigerant following accepted practices.

## Air Coil Fan Motor Removal

### ⚠ CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

Disconnect motor power wires from motor terminals before motor is removed from unit.

1. Shut off unit main power supply.
2. Loosen bolts on mounting bracket so that fan belt can be removed.
3. Loosen and remove the 2 motor mounting bracket bolts on left side of bracket.
4. Slide motor/bracket assembly to extreme right and lift out through space between fan scroll and side frame. Rest motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

## TROUBLESHOOTING

When troubleshooting problems with a WSHP, consider the following.

**Thermistor** — A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage.

**Control Sensors** — The control system employs 2 nominal 10,000 ohm thermistors (FP1 and FP2) that are used for freeze protection. Be sure FP1 is located in the discharge fluid and FP2 is located in the air discharge. See Fig. 27.

**Thermostatic Expansion Valves** — Thermostatic expansion valves (TXV) are used as a means of metering the refrigerant through the evaporator to achieve a preset superheat at the TXV sensing bulb. Correct superheat of the refrigerant is important for the most efficient operation of the unit and for the life of the compressor.

Packaged heat pumps typically use one bi-flow TXV to meter refrigerant in both modes of operation. When diagnosing possible TXV problems it may be helpful to reverse the refrigerant flow to assist with the diagnosis.

Geothermal and water source heat pumps are designed to operate through a wide range of entering-water temperatures that will have a direct effect on the unit refrigerant

operating pressures. Therefore, diagnosing TXV problems can be difficult.

**TXV FAILURE** — The most common failure mode of a TXV is when the valve fails while closed. Typically, a TXV uses spring pressure to close the valve and an opposing pressure, usually from a diaphragm, to open the valve. The amount of pressure exerted by the diaphragm will vary, depending on the pressure inside of the sensing bulb. As the temperature of and pressure within the bulb decreases, the valve will modulate closed and restrict the refrigerant flow through the valve. The result is less refrigerant in the evaporator and an increase in the superheat. As the temperature at the bulb increases the diaphragm pressure will increase, which opens the valve and allows more refrigerant flow and a reduction in the superheat.

If the sensing bulb, connecting capillary, or diaphragm assembly are damaged, pressure is lost and the spring will force the valve to a closed position. Often, the TXV will not close completely so some refrigerant flow will remain, even if there is inadequate flow for the heat pump to operate.

The TXV sensing bulb must be properly located, secured, and insulated as it will attempt to control the temperature of the line to which it is connected. The sensing bulb must be located on a dedicated suction line close to the compressor. On a packaged heat pump, the bulb may be located almost any place on the tube running from the compressor suction inlet to the reversing valve. If the bulb is located on a horizontal section, it should be placed in the 10:00 or 2:00 position for optimal performance.

### ⚠ CAUTION

Use caution when tightening the strap. The strap must be tight enough to hold the bulb securely but caution must be taken not to over-tighten the strap, which could dent, bend, collapse or otherwise damage the bulb.

The bulb must be secured to the pipe using a copper strap. The use of heat transfer paste between the bulb and the pipe will also help ensure optimum performance.

The bulb must also be properly insulated to eliminate any influence on valve operation by the surrounding conditions. Cork tape is the recommended insulation as it can be molded tight to the bulb to prevent air infiltration.

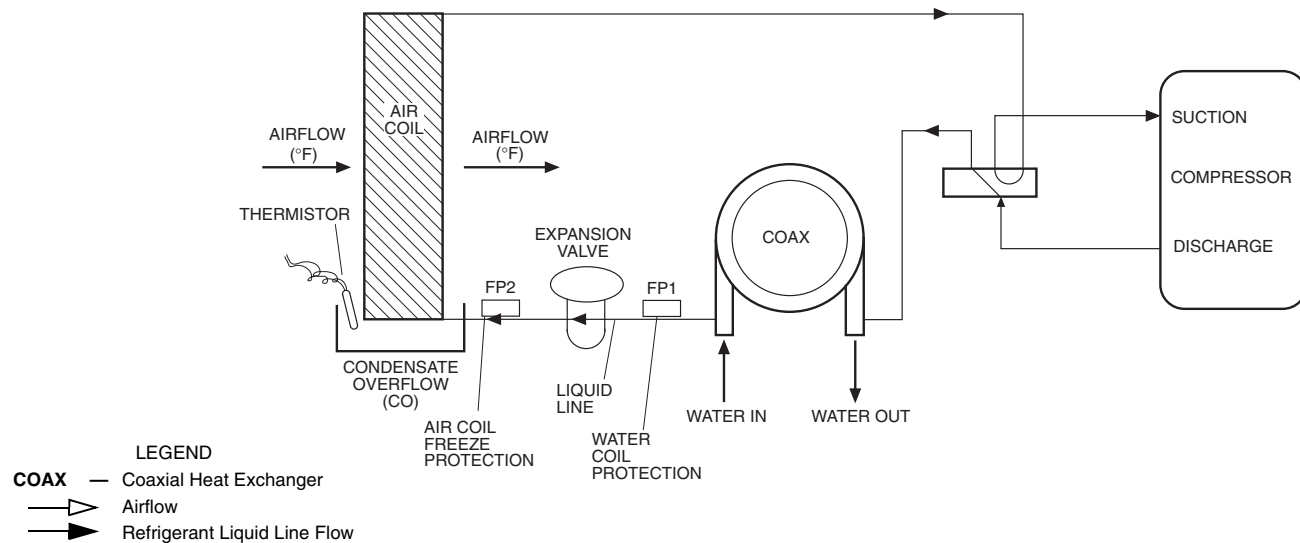


Fig. 27 — FP1 and FP2 Thermistor Location

**Causes of TXV Failure** — The most common causes of TXV failure are:

1. A cracked, broken, or damaged sensing bulb or capillary can be caused by excessive vibration of the capillary during shipping or unit operation.  
If the sensing bulb is damaged or if the capillary is cracked or broken, the valve will be considered failed and must be replaced. Replacement of the TXV “power head” or sensing bulb, capillary, diaphragm assembly is possible on some TXVs. The power head assembly screws onto most valves, but not all are intended to be replaceable. If the assembly is not replaceable, replace the entire valve.
2. Particulate debris within the system can be caused by several sources including contaminated components, tubing, and service tools, or improper techniques used during brazing operations and component replacement.  
Problems associated with particulate debris can be compounded by refrigerant systems that use POE (polyol ester oil). POE oil has solvent-like properties that will clean the interior surfaces of tubing and components. Particulates can be released from interior surfaces and may migrate to the TXV strainer, which can lead to plugging of the strainer.
3. Corrosive debris within the system may happen after a failure, such as a compressor burn out, if system was not properly cleaned.
4. Noncondensables may be present in the system. Noncondensables includes any substance other than the refrigerant or oil such as air, nitrogen, or water. Contamination can be the result of improper service techniques, use of contaminated components, and/or improper evacuation of the system.

**Symptoms** — The symptoms of a failed TXV can be varied and will include one or more of the following:

- Low refrigerant suction pressure
- High refrigerant superheat
- High refrigerant subcooling
- TXV and/or low pressure tubing frosting
- Equalizer line condensing and at a lower temperature than the suction line or the equalizer line frosting
- FP1 faults in the heating mode in combination with any of the symptoms listed above
- FP2 faults in the cooling mode in combination with any of the symptoms listed above. Some symptoms can mimic a failed TXV but may actually be caused by another problem.

Before conducting an analysis for a failed TXV the following must be verified:

- Confirm that there is proper water flow and water temperature in the heating mode.
- Confirm that there is proper airflow and temperature in the cooling mode.
- Ensure coaxial water coil is clean on the inside; this applies to the heating mode and may require a scale check.
- Refrigerant may be undercharged. To verify, subcooling and superheat calculations may be required.

**Diagnostics**—Several tests may be required to determine if a TXV has failed. The following tools may be required for testing:

1. Refrigerant gage manifold compatible with the refrigerant in the system.
2. Digital thermometer, preferably insulated, with wire leads that can be connected directly to the tubing.
3. Refrigerant pressure-temperature chart for the refrigerant used.

To determine that a TXV has failed, verify the following:

- The suction pressure is low and the valve is non-responsive.  
The TXV sensing bulb can be removed from the suction line and warmed by holding the bulb in your hand. This action should result in an increase in the suction pressure while the compressor is operating. The sensing bulb can also be chilled by immersion in ice water, which should result in a decrease in the suction pressure while the compressor is operating. No change in the suction pressure would indicate a nonresponsive valve.
- Simultaneous LOW suction pressure, HIGH refrigerant subcooling and HIGH superheat.
- LOW suction pressure, LOW subcooling and HIGH superheat may indicate an undercharge of refrigerant. HIGH subcooling and LOW superheat may indicate an overcharge of refrigerant. The suction pressure will usually be normal or high if there is an overcharge of refrigerant.
- LOW suction pressure and frosting of the valve and/or equalizer line may indicate a failed valve. However, these symptoms may also indicate an undercharge of refrigerant. Calculate the subcooling and superheat to verify a failed valve or refrigerant charge issue.

#### Repair

##### **WARNING**

Puron® refrigerant (R-410A) operates at higher pressure than R-22, which is found in other WSHPs. Tools such as manifold gages must be rated to withstand the higher pressures. Failure to use approved tools may result in a failure of tools, which can lead to severe damage to the unit, injury or death.

##### **WARNING**

Most TXVs are designed for a fixed superheat setting and are therefore considered non-adjustable. Removal of the bottom cap will not provide access for adjustment and can lead to damage to the valve or equipment, unintended venting of refrigerant, personal injury, or possibly death.

##### **CAUTION**

Always recover the refrigerant from the system with suitable approved tools, recovery equipment, and practices prior to attempting to remove or repair any TXV.

##### **CAUTION**

Use caution when tightening the strap. The strap must be tight enough to hold the bulb securely but caution must be taken not to over-tighten the strap, which could dent, bend, collapse or otherwise damage the bulb.

##### **CAUTION**

Puron® refrigerant (R-410A) requires the use of synthetic lubricant (POE oil). Do not use common tools on systems that contain R-22 refrigerants or mineral oil. Contamination and failure of this equipment may result.

**IMPORTANT:** Due to the hygroscopic nature of the POE oil in Puron refrigerant (R-410A) and other environmentally balanced refrigerants, any component replacement must be conducted in a timely manner using caution and proper service procedure for these types of refrigerants. A complete installation instruction will be included with each replacement TXV/filter drier assembly. It is of critical importance these instructions are thoroughly understood and carefully followed. Failure to follow these instructions can result in a system that is contaminated with moisture to the extent that several filter drier replacements may be required to properly dry the system.

**IMPORTANT:** Repair of any sealed refrigerant system requires training in the use of refrigeration tools and procedures. Repair should only be attempted by a qualified service technician. A universal refrigerant handling certificate will be required. Local and/or state license or certificate may also be required.

See Table 29 for additional troubleshooting information.

**⚠ CAUTION**

Disconnect power from unit before removing or replacing connectors, or servicing motor. Wait 5 minutes after disconnecting power before opening motor.



**Table 29 — Troubleshooting**

FAULT	COOLING	HEATING	CHECK	POSSIBLE CAUSE	SOLUTION	
<b>No Compressor Operation but Fan Runs</b>	X		Is fault LED Blinking 1 time?	High Pressure fault - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.	
				High Pressure fault - high water temperature	Check water temperature - is it in range?	
				High Pressure fault - fouled or scaled water coil	Check for proper flow rate and water temperature, but low water side temp rise in cooling.	
				High Pressure fault - no or low airflow	Check fan motor for proper operation.	
			X		Check air filter.	Inspect air coil for dirt/debris.
					Check ductwork - are dampers closed or blocked?	
	X		Is fault LED Blinking 2 times?	Low Pressure fault - no or low airflow	Check fan motor for proper operation.	
					Check air filter	
					Inspect air coil for dirt/debris	
					Check ductwork - are dampers closed or blocked?	
			X		Check refrigerant pressure with gage set	
			Is fault LED Blinking 3 times?	Freeze fault, water coil - no or low water flow	Check water valves and/or pumps for proper operation. Check for water coil blockage.	
				Freeze fault - low water temperature	Check water temperature - is it below 40°F entering? If heat pump is connected to a closed loop with anti-freeze check that the "FREEZE 1" resistor on the Complete C board has been cut to set the unit to anti-freeze mode.	
				Freeze fault - low refrigerant	Check refrigerant pressure with gage set	
	X		Is fault LED Blinking 4 times?	Condensate fault - poor drainage	Check condensate pan for high water level. Check drain line for blockages, double trapping or inadequate trapping.	
				Condensate fault - blocked return air	Check condensate pan for high water level. Check air filter and return air ductwork for blockage. Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.	
	X	X	Is fault LED Blinking 5 times?	Brown out fault - low supply voltage	Check primary voltage - ensure it is within the limits listed on the unit data plate.	
				Brown out fault - overloaded control circuit	Check control voltage - if it is below 18 V check accessories connected to the unit and insure that they do not exceed the VA draw shown on page 21.	
				Brown out fault - bad thermostat connection	Check that thermostat wiring is proper gage and length, that it is not damaged and that all connections at the thermostat and heat pump are secure.	
	X		Is fault LED Blinking 6 times?	Freeze fault, air coil - no or low airflow	Check fan motor for proper operation.	
					Check air filter	
					Inspect air coil for dirt/debris	
					Check ductwork - are dampers closed or blocked?	
				Freeze fault, air coil - blocked return air	Check that there is adequate space between the return air opening and walls or other obstructions on free return applications.	
			Freeze fault, air coil - low refrigerant	Check refrigerant pressure with gage set.		
X	X	No fault LED - contactor not energized	Thermostat not calling for compressor operation	Ensure that the thermostat is on and calling for "Y" .		
			Bad thermostat connection	Check "Y" connection from thermostat. Ensure that there is 24 VAC between "Y" and "C" .		
			Loose wire to contactor coil	Check wiring - insure that there is 24 VAC across the contactor coil.		
			Burned out contactor coil	Test contactor with 24VAC (between "R" and "C" ). Ohm contactor coil - an open circuit indicates a burned coil.		
X	X	No fault LED - contactor energized	Open compressor overload	Check for supply voltage at the load side of the contactor. For 3 phase models check phase rotation and voltage at all 3 phases.		
			Poor wiring connections	Look for signs of heat on the wiring insulation. Check that all wiring connections are secure and properly torqued.		
			Burned out compressor	Does compressor hum when power is applied? If not check the resistance of the compressor windings using the values shown in the compressor characteristics chart. Note that the compressor must be cool (70°F) when checking the windings.		

**Table 29 — Troubleshooting (cont)**

FAULT	COOLING	HEATING	CHECK	POSSIBLE CAUSE	SOLUTION
No compressor or fan operation	X	X	Power LED on	Bad thermostat connection / faulty thermostat	Check thermostat and wiring. Check unit terminal block for 24 VAC between "Y" and "C" and "G" and "C".
			Power LED off	Low or no supply power	Ensure that the supply voltage to the unit is within the range shown on the unit data plate.
				Faulty control transformer	Check for 24 VAC between "R" and "C" on the unit terminal block. For 75 and 100 VA transformers, check that the transformer circuit breaker has not tripped. Check low voltage circuit for overload conditions or short circuits before replacing the transformer.
No fan operation - PSC motor	X	X	Fan relay energized	Faulty motor	Check supply voltage from the fan relay to the motor. Check that all motor wires are secure. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.
			Fan relay not energized	No fan operation signal	Check for 24 VAC across the fan relay coil. Check all wiring connections.
				Bad fan relay	If the relay coil is energized but the relay does not pull in, check the resistance across the relay coil - an open circuit is an indicator of a faulty relay.
No fan operation - constant torque motor	X	X	No fan operation signal	Check for 24 VAC between "G" and "C". Check all wiring connections.	
			Loose wiring	Check all wiring connections at motor and control box.	
			Faulty motor	Check supply voltage to the motor. Check that all motor wires are secure. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.	
No fan operation - constant airflow motor	X	X	No fan operation signal	Check for 24 VAC between "G" and "C". Check all wiring connections. Make sure that the thermostat connection plug is securely connected.	
			Loose wiring	Check all wiring connections at motor and control box. Check that power and control harnesses are securely connected.	
			Interface board problems	Make sure that the interface board is not damaged and that all DIP switches are in the proper configuration (refer to the blower performance tables).	
			Faulty motor	Check supply voltage to the motor. Check that all motor wires are secure. Move the "TEST" DIP switch to "ON" and the other switches to "OFF" on the "ADJUST" switch block on the interface board - the motor should run at 70% torque when "G" is called. With power off spin the motor shaft - noise, resistance or uneven motion can be signs of motor failure.	
Unit not shifting into cooling	X		Reversing valve solenoid energized	Faulty solenoid	Check that the reversing valve solenoid is receiving 24 VAC. If so, check the resistance of the solenoid - an open circuit may indicate a burned out solenoid.
			Reversing valve solenoid not energized	Miswired/faulty thermostat	Check that the reversing valve thermostat wire is connected to the "O" terminal of the thermostat. Check for a contact closure between "O" and "R".
				Loose wire on "O" terminal	Check that the wires from the thermostat to the unit are securely connected and that the wires from the electrical box to the reversing valve are connected.
Excessively cold supply air temperature in cooling or excessively hot supply air temperature in heating	X	X	Reduced airflow	Dirty Filter	Replace filter.
				Fan speed too low	Consult blower performance table and increase fan speed if possible.
				Excessive duct pressure drop	Consult blower performance table and increase fan speed if possible.
Excessively warm supply air temperature in cooling and/or excessively cool air in heating	X	X	Airflow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			High or low water temperature	Inlet water temperature out of range	Check unit capacity vs. water temperature.
			Air leakage	Leaky ductwork	Inspect ductwork.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gage set.
High humidity	X		Airflow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gage set.
			Short cycling	Unit oversized	Check unit performance against building load calculations.
				Poor thermostat location	Make sure that thermostat is not located by a supply-air duct.

**Table 29 — Troubleshooting (cont)**

FAULT	COOLING	HEATING	CHECK	POSSIBLE CAUSE	SOLUTION
High humidity	X		Airflow too high	Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Loss of refrigeration capacity	Low refrigerant	Check refrigerant pressures with gage set.
			Short cycling	Unit oversized	Check unit performance against building load calculations.
				Poor thermostat location	Make sure that thermostat is not located by a supply-air duct.
Objectionable noise levels	X	X	Air noise	Poor ductwork/grille design	Ensure ductwork and grilles are properly sized for unit airflow.
				Fan speed setting too high	Consult blower performance table and reduce fan speed if possible.
			Structure borne noise	Unit not mounted on full vibration pad	Mount unit on a vibration pad.
				Unit not connected with flexible conduit, water lines and/or ductwork	Install unit in accordance with instructions.
				Unit cabinet touching wall or other building component	Adjust unit location to avoid unit touching structure.
			X		Compressor noise
	Scaled or fouled water coil elevating heat pressure	Clean/descale water coil.			
		X		Low airflow elevating head pressure	Check filter. Increase fan speed.
	X	X	Water hammer	Fast closing valves installed	Change valves to slow-close type.



**50PCH,PCV,PCD  
START-UP CHECKLIST  
(Remove and use for job file.)**

**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 Instruction 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) \_\_\_\_\_
- 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? (Y/N) \_\_\_\_\_

**II. START-UP**

- IS FAN OPERATING WHEN COMPRESSOR OPERATES? (Y/N) \_\_\_\_\_
- IF 3-PHASE SCROLL COMPRESSOR IS PRESENT, VERIFY PROPER ROTATION PER INSTRUCTIONS. (Y/N) \_\_\_\_\_

**UNIT VOLTAGE — COOLING OPERATION**

PHASE AB VOLTS \_\_\_\_\_ PHASE BC VOLTS \_\_\_\_\_ PHASE CA VOLTS \_\_\_\_\_  
(if 3 phase) (if 3 phase)

PHASE AB AMPS \_\_\_\_\_ PHASE BC AMPS \_\_\_\_\_ PHASE CA AMPS \_\_\_\_\_  
(if 3 phase) (if 3 phase)

**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.

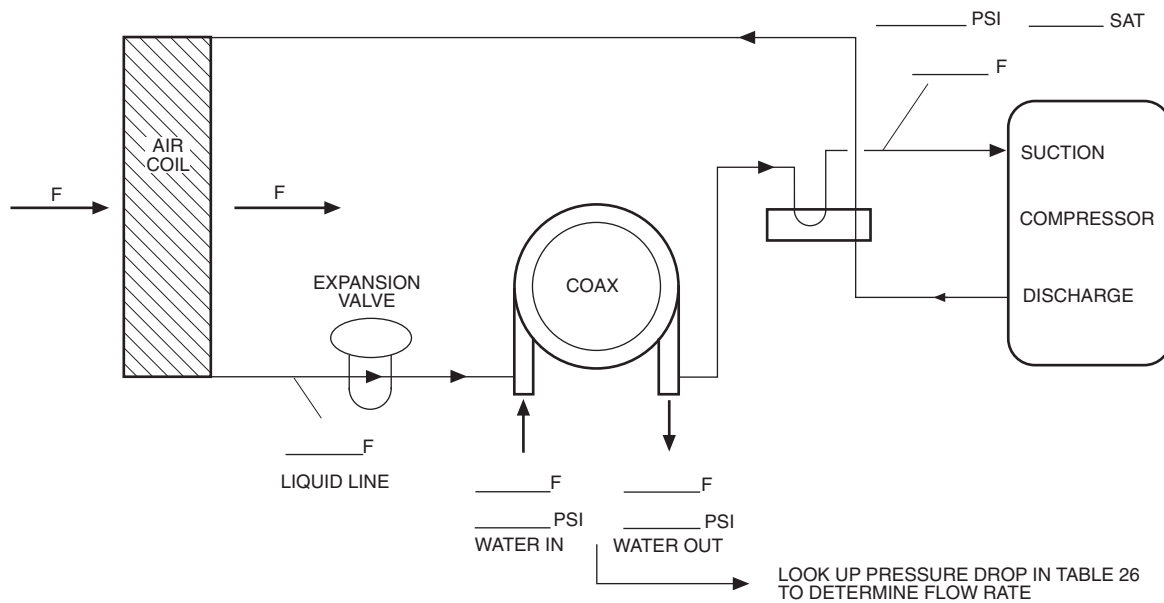
COAXIAL HEAT EXCHANGER COOLING CYCLE:  
 FLUID IN \_\_\_\_\_ F FLUID OUT \_\_\_\_\_ F \_\_\_\_\_ PSI \_\_\_\_\_ FLOW

HEATING CYCLE:  
 FLUID IN \_\_\_\_\_ F FLUID OUT \_\_\_\_\_ F \_\_\_\_\_ PSI \_\_\_\_\_ FLOW

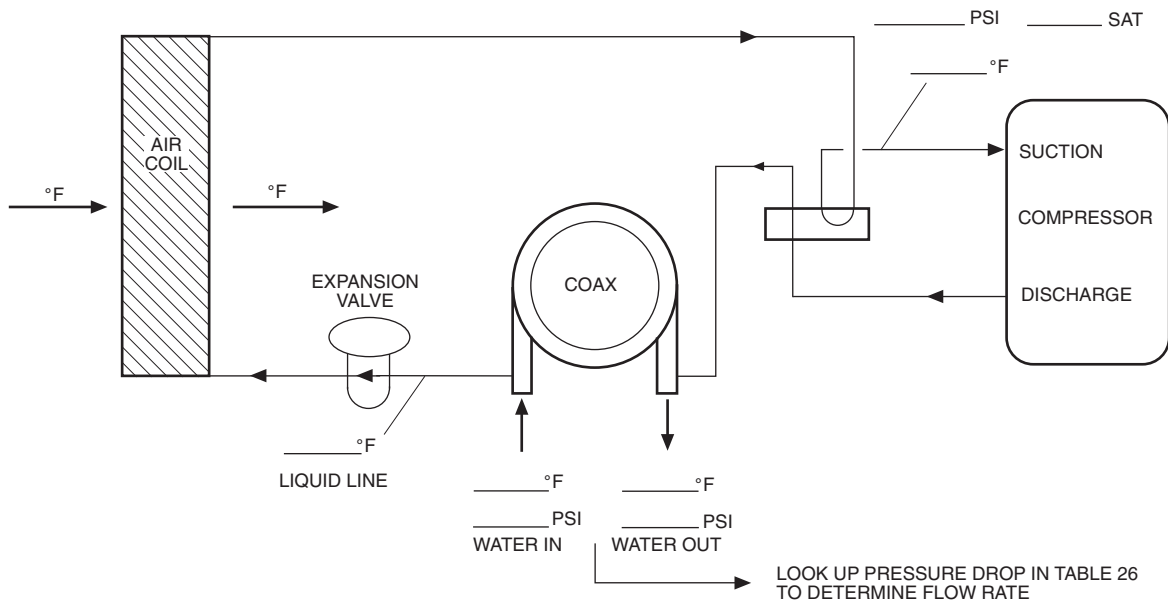
AIR COIL COOLING CYCLE:  
 AIR IN \_\_\_\_\_ F AIR OUT \_\_\_\_\_ F

HEATING CYCLE:  
 AIR IN \_\_\_\_\_ F AIR OUT \_\_\_\_\_ F

**HEATING CYCLE ANALYSIS**



**COOLING CYCLE ANALYSIS**



**HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =**

\_\_\_\_\_ FLOW RATE (GPM) x \_\_\_\_\_ TEMP. DIFF. (DEG. F) x \_\_\_\_\_ FLUID FACTOR\* = \_\_\_\_\_  
(Btu/hr)

**SUPERHEAT** = SUCTION TEMPERATURE – SUCTION SATURATION TEMPERATURE  
= \_\_\_\_\_ (DEG F)

**SUBCOOLING** = DISCHARGE SATURATION TEMPERATURE – LIQUID LINE TEMPERATURE  
= \_\_\_\_\_ (DEG F)

\*Use 500 for water, 485 for antifreeze.

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE