



Installation, Start-Up, and Service Instructions

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IMPORTANT: Read the entire instruction manual before start-up 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.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to 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.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

WARNING

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

DANGER

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

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

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

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

CAUTION

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

GENERAL

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

Water source heat pumps (WSHPs) are single-package vertically or horizontally mounted units with a reversible refrigeration cycle 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.

PRE-INSTALLATION

INSPECTION

Upon receipt of shipment, 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 5 days of receipt of shipment.

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

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 between 50°F and 95°F. Units must only be stored or moved in the normal upright position as indicated by the UP arrows on each carton at all times. **DO NOT STACK UNITS.**

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 Table 1 for unit physical data.

HORIZONTAL UNITS (50HQP)

Horizontal units are designed for indoor installation only, using hanging brackets. See Fig. 1 for the field-installed VFD shipping location. See Fig. 2 and 3 for overall unit dimensions. Be sure to allow adequate space around the unit for installation and servicing. See Fig. 7 for service clearance requirements.

VERTICAL UNITS (50VQP)

Vertical units are designed for indoor installations only. Vertical units are typically installed in a floor-level mechanical room or in the occupied space. See Fig 4-6 for unit dimensions. Be sure to allow adequate space around the unit for installation and servicing. See Fig. 7 for service clearance requirements.

INSTALLATION GUIDELINES (ALL UNITS)

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 blower and blower motor, compressor and coils. Removal of the entire unit from the installation area 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.
11. For units with dual supply fan outlets, ensure the installation area has sufficient clearance for a pair of pants duct discharge.
12. 50HQP only - for units with SAV™ or supply fan VFD option, select installation location for the VFD. If VFD location results in motor wiring that exceeds 10 ft., consider use of shaft grounding rings (field provided).

⚠ 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. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 5 days of receipt of shipment.

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

INSPECT UNIT

To prepare the unit for installation, complete the procedures listed below:

1. Verify that the correct unit has been received. Check the unit capacity (tonnage), voltage, orientation, and configuration.
2. Compare the electrical data on the unit nameplate with to verify the jobsite power feed (voltage, amperage, MCA) and power protection (MOCP).
3. Verify that the unit is the correct model for the entering water temperature of the job (standard or extended range)
4. Remove the unit packaging, keeping the unit attached to the shipping pallet. Do not destroy packaging. Save for re-installation on the unit if the unit will not be fully installed.
5. Open a unit access panel. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
6. Check the water piping and piping connections to make sure they are free from defects, kinks, dents, and appear to be water tight. Verify system operating water pressure.
7. Inspect the blower assembly. Verify that the blower has not come lose during shipping. Verify clearance between the blower wheel and the blower housing. Verify free blower rotation.

8. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
9. Check unit controls. If Complete C, or Deluxe D, verify field provided thermostat or DDC control is available. If WSHP Open, verify proper sensor has been provided and a commissioning interface will be available.
10. 50HQP Only - Locate the hanging bracket kit located in the compressor compartment.
11. 50HQP Only - For units with the SAV™ or single speed VFD option, locate the VFD (ships in control box section or on the pallet with the unit). See Fig. 1 for VFD shipping box location. If VFD is not found, contact your Carrier sales representative.

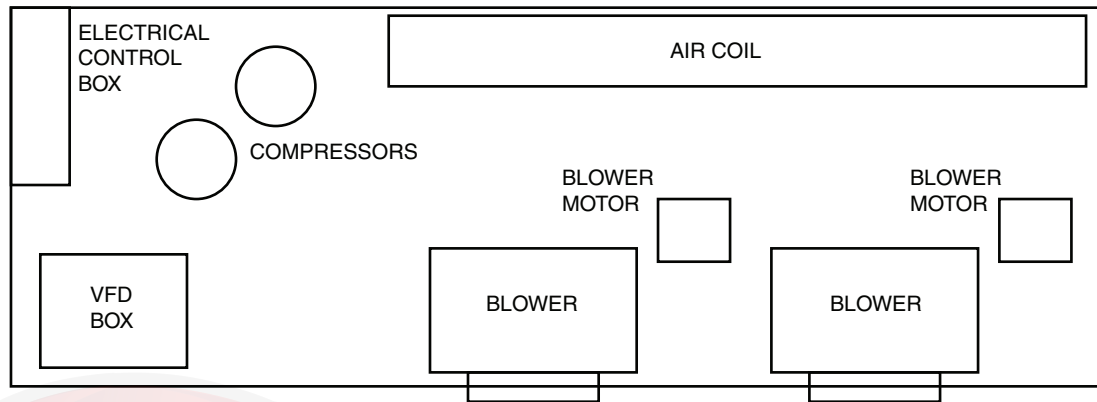


Fig. 1 — Field Installed VFD Shipping Location, 50HQP Units

Table 1 — 50HQP,VQP Unit Physical Data

50HQP,VQP UNIT SIZE		072	096	120	150	151	180
Compressor Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity		2	2	2	2	2	2
Total Refrigerant Charge (lb) Vert/Horiz		9.88/9.13	10/11.25	12.38	14	13.38	15.88
Air Coil Dimensions (in.) H x L (Qty)		20 x 32.5 (2)	20 x 32.5 (2)	20 x 32.5 (2)	24 x 65 (1)	24 x 43 (2)	24 x 65 (1)
Rows		3	3	3	3	3	3
Horizontal Filter Size (in.) (Nominal) (Qty)		20 x 34 ¹ / ₂ x 1 (2)	20 x 34 ¹ / ₂ x 1 (2)	20 x 34 ¹ / ₂ x 1 (2)	24 x 34 x 1 (2)	NA	24 x 34 x 1 (2)
Vertical Filter Size (in.) (Nominal) (Qty)		20 x 34 ¹ / ₂ x 1 (2)	20 x 34 ¹ / ₂ x 1 (2)	20 x 34 ¹ / ₂ x 1 (2)	NA	24 x 24 x 1 (4)	NA
Blower Wheel Size (in.) (Dia. x W) (Qty)		12 x 12 (1)	12 x 12 (1)	H: 12 x 9 (2) V: 15 x 15 (1)	15 x 15 (1)	15 x 15 (1)	12 x 12 (2)
Motor HP (Qty)	Horizontal	1 (1)	2 (1)	3 (1)	3 (1)	NA	2 (2)
	Vertical	1 (1)	1 ¹ / ₂ (1)	2 (1)	NA	3 (1)	NA
Type		Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing
Horizontal Water Connections (in.) FPT		1	1	1 ¹ / ₄	1 ¹ / ₂	NA	1 ¹ / ₂
Vertical Water Connections (in.) FPT		1	1	1 ¹ / ₂	NA	1 ¹ / ₂	NA
Rated Water Flow Rate (gpm)		14.0	18.0	24.0	30.0	30.0	32.0
Water Pressure Drop at Rated Flow (psig) and (FOH) Water Loop Cooling		4.8/11.0	5.1/11.7	4.3/10.0	3.0/7.0	3.0/7.0	3.4/7.9
Horizontal Condensate Connection (in.) FPT		3/4	3/4	3/4	3/4	NA	1 ¹ / ₄
Vertical Condensate Connection (in.) FPT		3/4	3/4	3/4	NA	3/4	NA
Unit Ship Weight (Vert/Horiz) (lb)		715/715	752/752	980/980	NA/1150	1140/NA	NA/1620
Unit Operating Weight (Vert/Horiz) (lb)		670/670	702/702	935/935	NA/1060	1050/NA	NA/1530

50HQP,VQP UNIT SIZE		181	210	240	242	300	360
Compressor Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity		2	2	2	2	2	2
Total Refrigerant Charge (lb)		15.25	16.25	18.13	18.13	18.13	36.00
Air Coil Dimensions (in.) H x L (Qty)		24 x 43 (2)	20 x 32.5 (4)	20 x 32.5 (4)	34 x 65 (1)	20 x 32.5 (4)	30 x 32.5 (2)
Rows		3	3	3	3	3	3
Horizontal Filter Size (in.) (Nominal) (Qty)		NA	NA	NA	17 ¹ / ₄ x 34 ¹ / ₂ x 1 (4)	NA	NA
Vertical Filter Size (in.) (Nominal) (Qty)		24 x 24 x 1 (4)	20 x 34 ¹ / ₂ x 1 (4)	20 x 34 ¹ / ₂ x 1 (4)	NA	20 x 34 ¹ / ₂ x 1 (4)	30 x 34 ¹ / ₂ x 1 (4)
Blower Wheel Size (in.) (Dia. x W) (Qty)		15 x 15 (1)	15 x 15 (2)	15 x 15 (2)	15 x 15 (2)	15 x 15 (2)	15 x 15 (2)
Motor HP (Qty)	Horizontal	NA	NA	NA	2 (2)	NA	NA
	Vertical	5 (1)	1 ¹ / ₂ (2)	2 (2)	NA	3 (2)	5 (2)
Type		Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing	Ball Bearing
Horizontal Water Connections (in.) FPT		NA	NA	NA	2	NA	NA
Vertical Water Connections (in.) FPT		1 ¹ / ₂	2	2	NA	2	2
Rated Water Flow Rate (gpm)		32.0	50.0	50.0	50.0	60.0	80.0
Water Pressure Drop at Rated Flow (psig) and (FOH) Water Loop Cooling		3.4/7.9	6.4/14.8	4.0/9.3	4.0/9.3	5.5/12.8	8.6/19.8
Condensate Connection (in.) FPT		3/4	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄	1 ¹ / ₄
Unit Ship Weight (Vert/Horiz) (lb)		1180/NA	1180/NA	1400/NA	NA/1755	1630/NA	1750/NA
Unit Operating Weight (Vert/Horiz) (lb)		1090/NA	1090/NA	1310/NA	NA/1655	1530/NA	1650/NA

LEGEND

FOH — Feet of Heat
NA — Not Applicable

50HQP UNIT SIZE	HEIGHT	WIDTH	DEPTH*	RETURN AIR			CONDENSER WATER CONNECTIONS					SUPPLY AIR (Blower Outlets)			REPLACEMENT FILTER SIZE (NOMINAL)
				A	B	C	E	F	G	H	DIAMETER (FPT)	J	K	L	
072	21.50	38.00	78.00	2.00	20.50	18.50	28.00	2.75	28.00	14.50	1	15.50	13.50	10.50	20 x 34 1/2 x 1 (2 per unit)
096	21.50	38.00	78.00	2.00	20.50	18.50	26.25	3.50	28.00	19.25	1	15.50	13.50	10.50	
120	21.50	38.00	78.00	2.00	20.50	18.50	27.50	3.38	28.00	16.75	1.25	12.50	13.50	5.25	24 x 34 x 1 (2 per unit)
150	25.50	42.00	82.00	2.00	20.50	18.50	24.00	2.75	24.00	17.75	1.50	18.50	16.00	14.00	

* When WSHP Open controller is installed increase depth by 3.00 inches.

NOTE: All dimensions in inches unless otherwise noted. All dimensions within ± 0.125 -in. Specifications subject to change without notice. Condensate connections are 0.75 in. FPT on sizes 072-150.

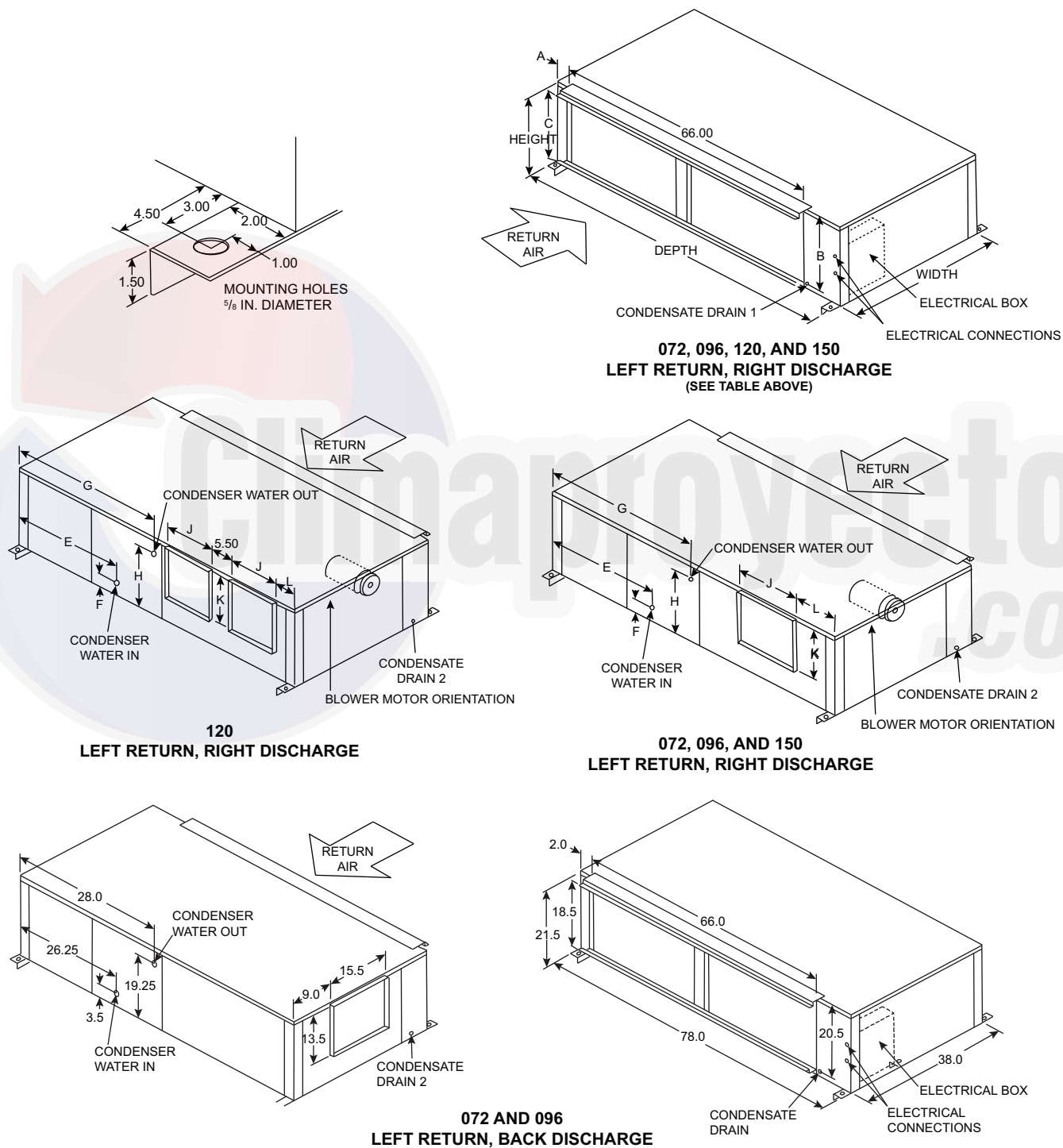
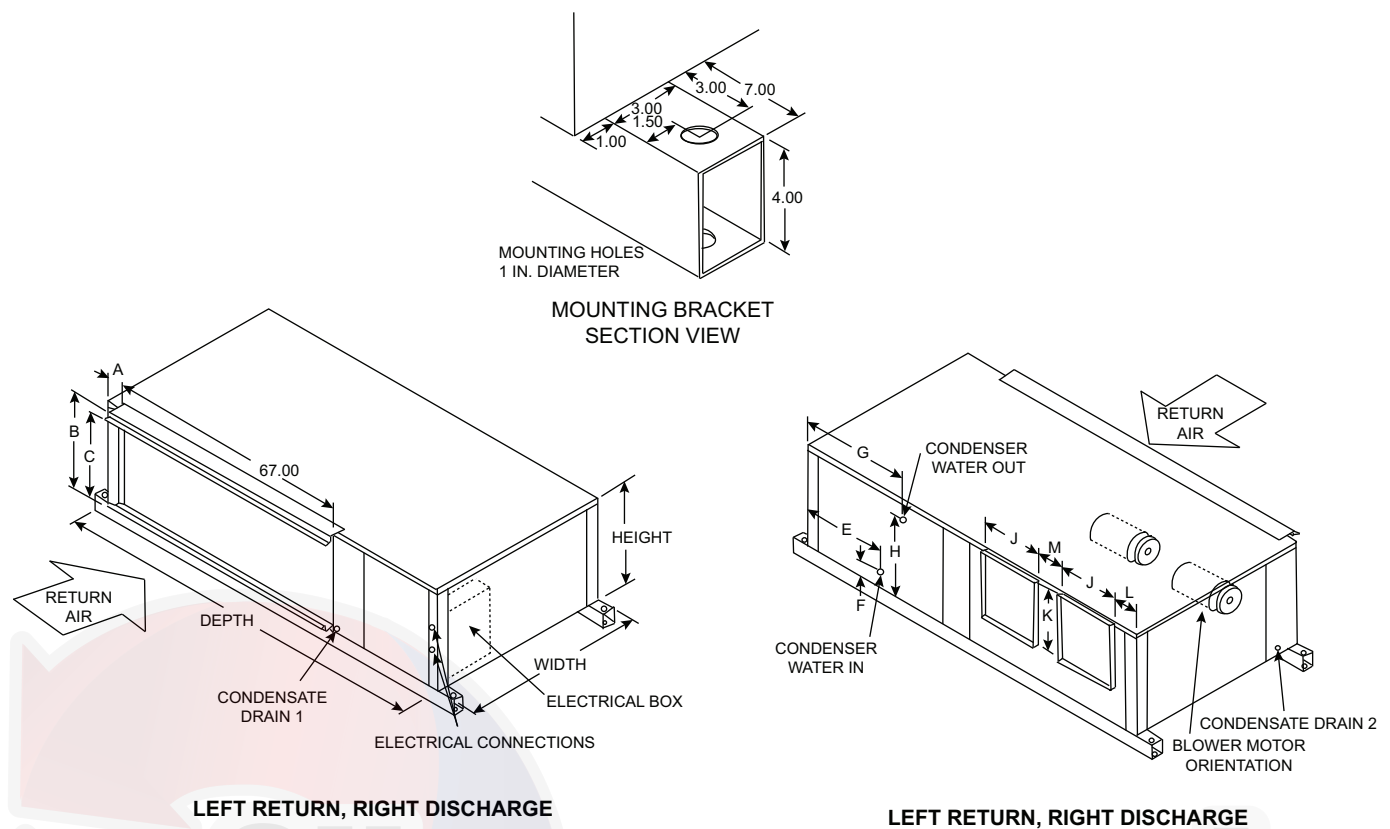


Fig. 2 — 50HQP072-150 Unit Dimensions



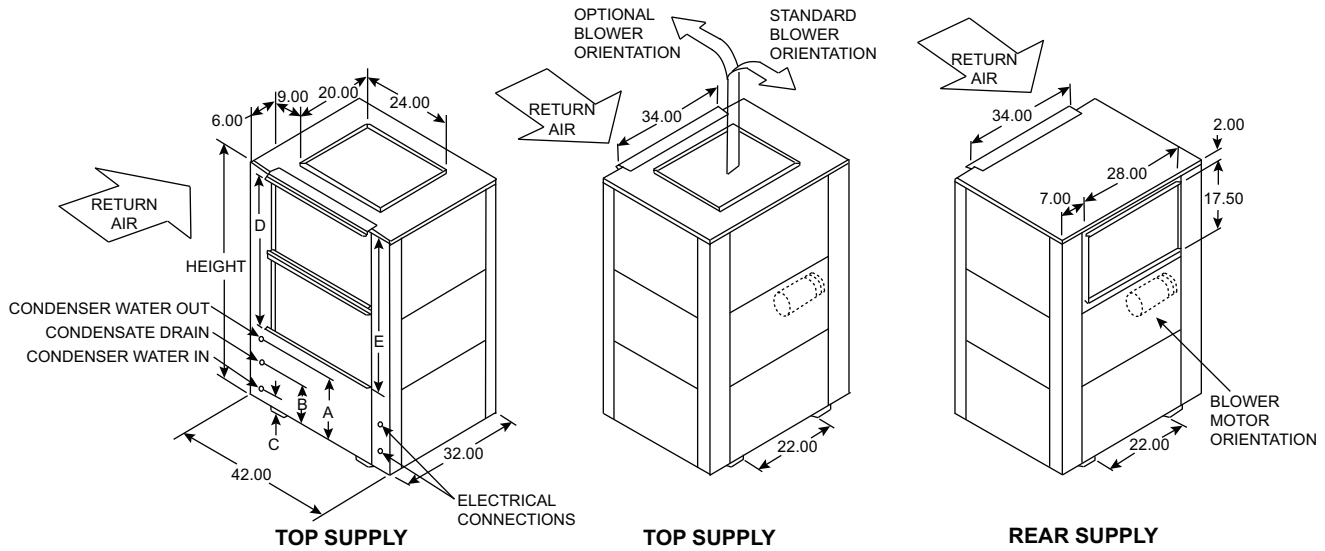
50HQP UNIT SIZE	HEIGHT	WIDTH	DEPTH*	RETURN AIR			CONDENSER WATER CONNECTIONS					SUPPLY AIR (Blower Outlets)				REPLACEMENT FILTER SIZE (NOMINAL)
				A	B	C	E	F	G	H	DIAMETER (FPT)	J	K	L	M	
180	25.25	60.25	106.50	2.00	24.00	22.00	22.00	6.25	22.00	16.00	1.5	27.75	17.25	5.00	4.00	24 x 34 x 1 (2 per unit)
242	36.00	60.25	106.50	2.00	34.75	32.75	24.50	7.25	24.50	19.62	2.0	23.75	19.75	7.75	9.75	17 ¹ / ₄ x 34 ¹ / ₂ x 1 (4 per unit)

* When WSHP Open controller is installed increase depth by 3.00 inches.

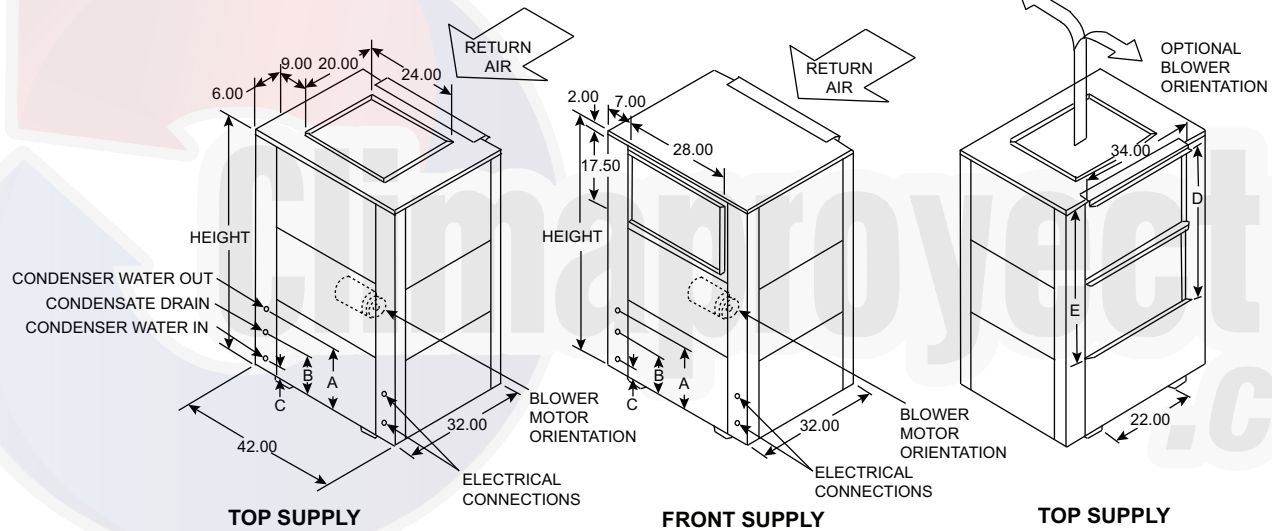
NOTE: All dimensions in inches unless otherwise noted. All dimensions within ± 0.125 -in. Specifications subject to change without notice. Condensate connections are 1.25 in. FPT on sizes 180 and 242.

Fig. 3 — 50HQP180,242 Unit Dimensions

FRONT RETURN



REAR RETURN



50VQP UNIT SIZE	HEIGHT	WIDTH	DEPTH*	CONDENSER WATER CONNECTIONS				DUCT FLANGE D	FILTER RACK E	REPLACEMENT FILTER SIZE (NOMINAL)
				A	B	C	Diameter (FPT)			
072	62.00	42.00	32.00	14.75	8.50	2.75	1	38.00	40.00	20 x 34½ x 1 (2)
096	62.00	42.00	32.00	14.75	8.50	2.75	1			
120	62.00	42.00	32.00	15.00	9.00	3.00	1.25			

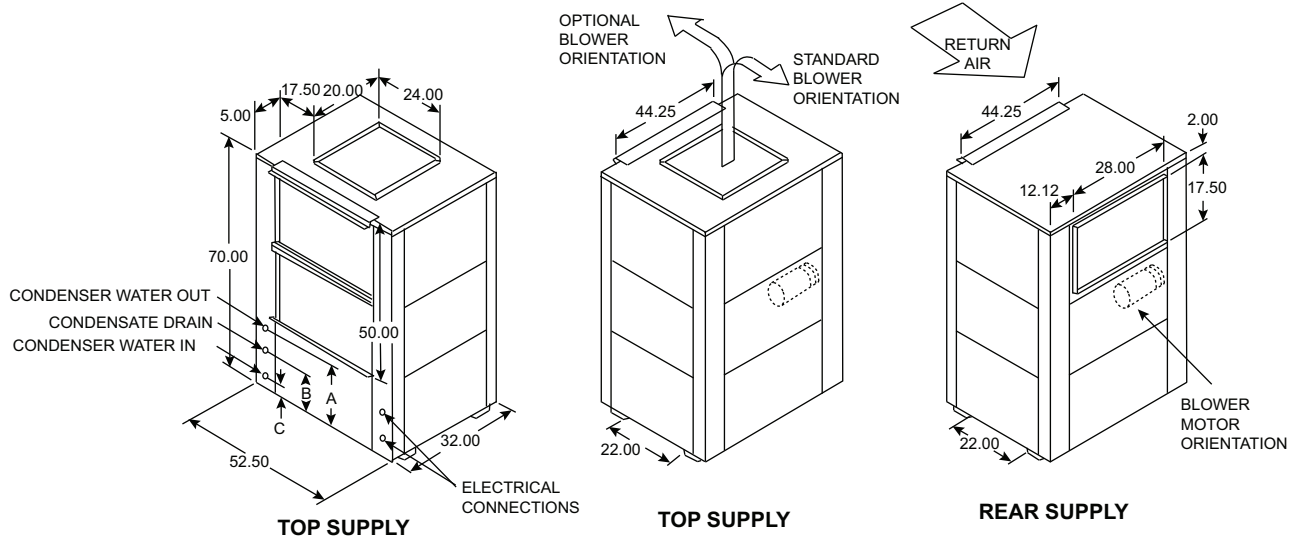
* When WSHP Open controller is installed increase depth by 3.00 inches.

NOTES:

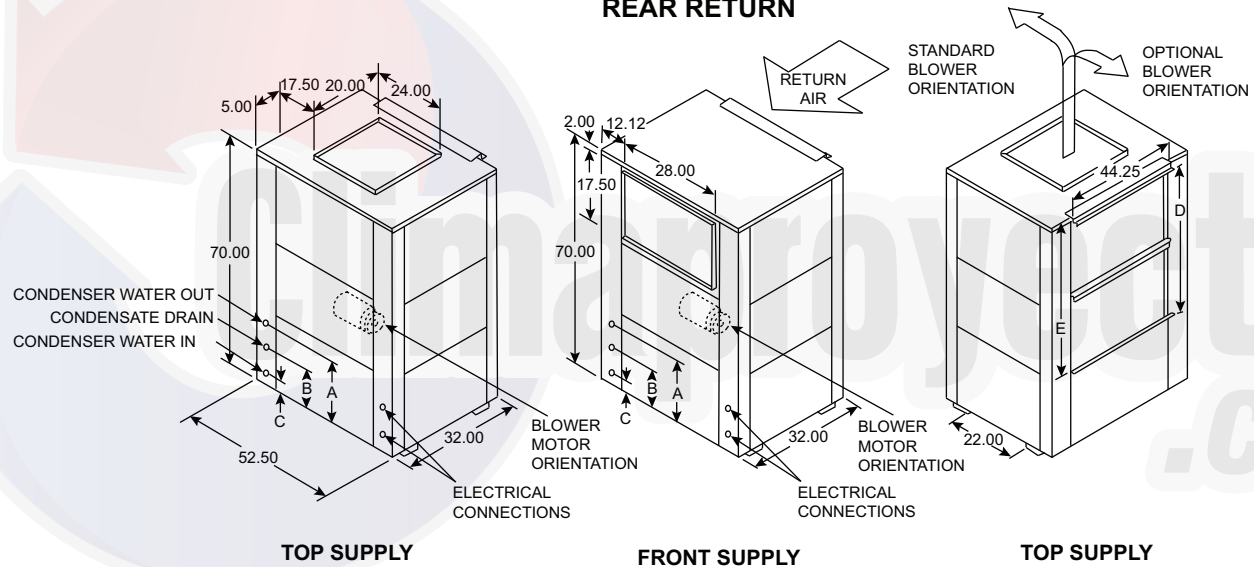
1. All dimensions in inches unless otherwise noted. All dimensions within ± 0.125 -in. Specifications subject to change without notice. Condensate connections are 0.75 in. FPT on sizes 072-120.
2. Front of unit is side with water and electrical connections.

Fig. 4 — 50VQP072-120 Units

FRONT RETURN



REAR RETURN



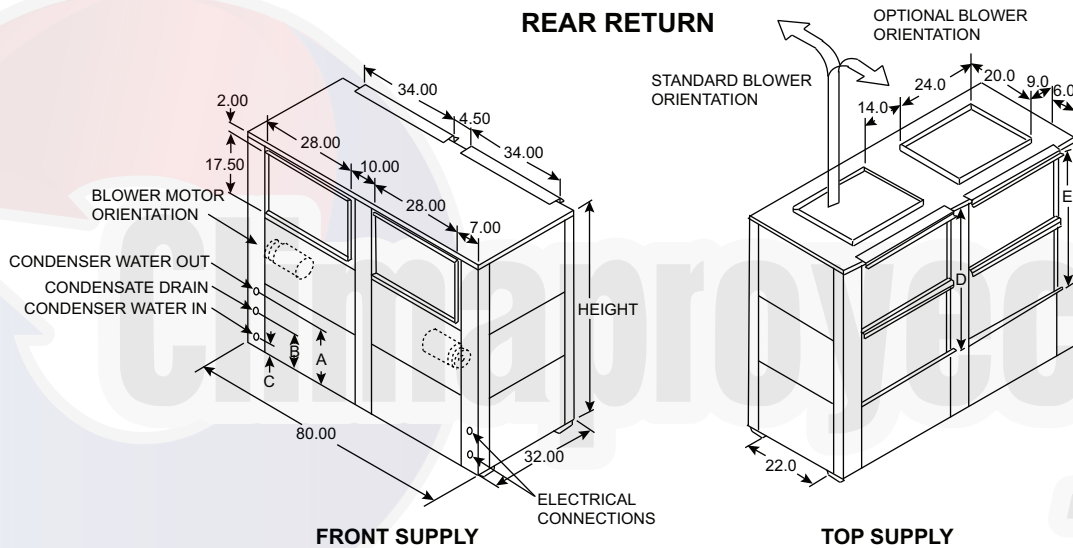
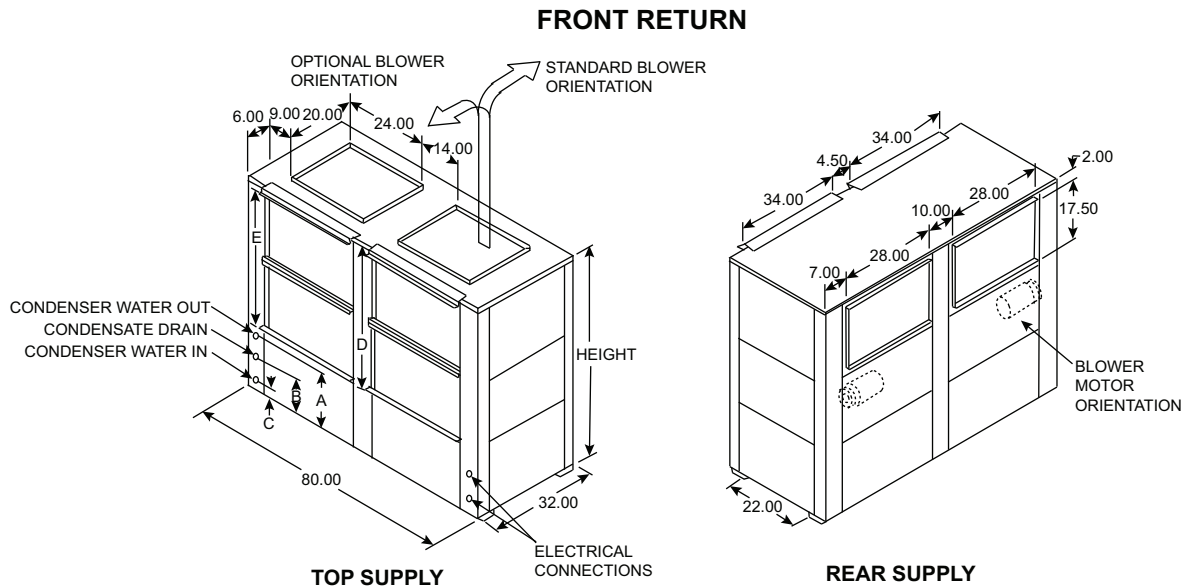
50VQP UNIT SIZE	HEIGHT	WIDTH	DEPTH*	CONDENSER WATER CONNECTIONS				DUCT FLANGE D	FILTER RACK E	REPLACEMENT FILTER SIZE (NOMINAL)
				A	B	C	Diameter (FPT)			
151	70.00	52.50	32.00	17.00	10.50	3.00	1 1/2	48.00	50.00	24 x 24 x 1 (4 per unit)
181	70.00	52.50	32.00	17.00	10.50	3.00	1 1/2			

* When WSHP Open controller is installed increase depth by 3.00 inches.

NOTES:

1. All dimensions in inches unless otherwise noted. All dimensions within ± 0.125 -in. Specifications subject to change without notice. Condensate connections are 0.75 in. FPT on sizes 151 and 181.
2. Front of unit is side with water and electrical connections.

Fig. 5 — 50VQP151,181 Unit Dimensions



50VQP UNIT SIZE	HEIGHT	WIDTH	DEPTH*	CONDENSER WATER CONNECTIONS				DUCT FLANGE D	FILTER RACK E	REPLACEMENT FILTER SIZE (NOMINAL)
				A	B	C	Diameter (FPT)			
210	62.00	80.00	32.00	18.00	8.75	2.75	2	40.00	38.00	20 x 34½ x 1 (4 per unit)
240	66.50	80.00	32.00	18.00	8.75	2.75	2	40.00	38.00	
300	66.50	80.00	32.00	18.00	8.75	2.75	2	40.00	38.00	
360	86.50	80.00	32.00	17.00	9.00	3.50	2	60.00	58.00	30 x 34½ x 1 (4 per unit, size 360 only)

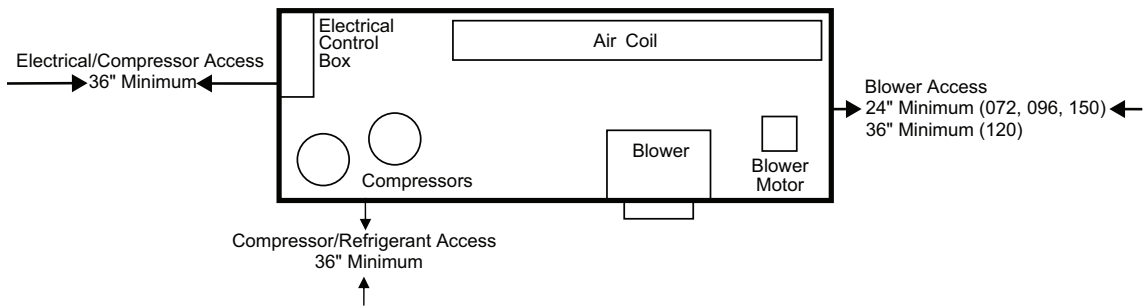
* When WSHP Open controller is installed increase depth by 3.00 inches.

NOTES:

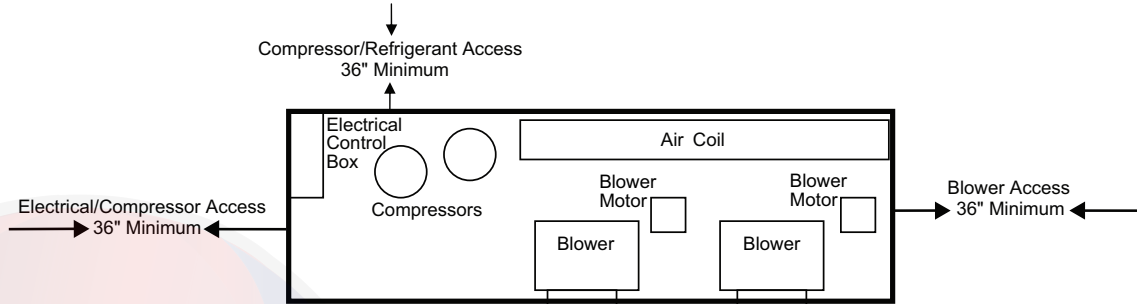
1. All dimensions in inches unless otherwise noted. All dimensions within ± 0.125 -in. Specifications subject to change without notice.
Condensate connections are 1.25 in. FPT on sizes 210-360.
2. Front of unit is side with water and electrical connections.

Fig. 6 — 50VQP210-360 Unit Dimensions

50HQP072-150 UNITS SERVICE CLEARANCES

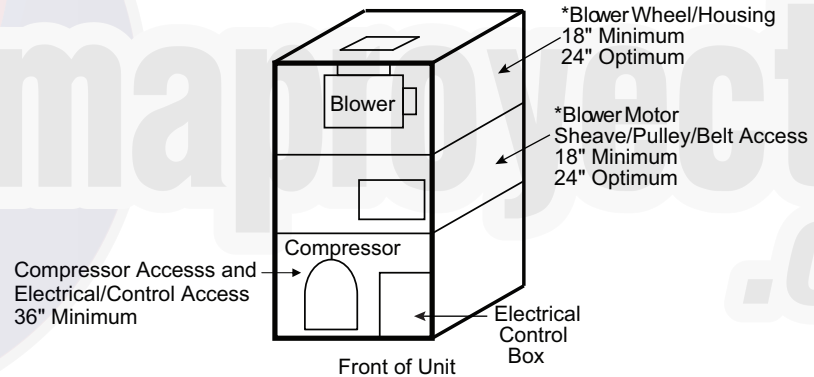


50HQP180-242 UNITS SERVICE CLEARANCES



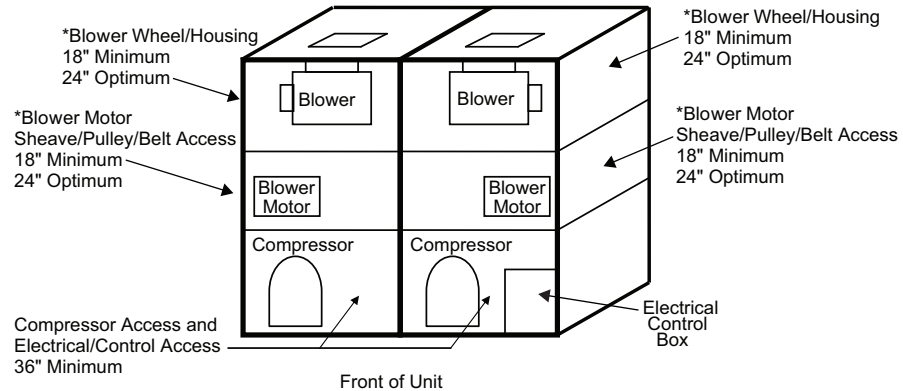
NOTE: The local electric codes may require 36" or more clearance at all electrical control boxes.

50VQP072-181 UNITS SERVICE CLEARANCES



* Blower motor and blower housing access is required on BOTH SIDES of the unit.

50VQP210-360 UNITS SERVICE CLEARANCES



* Blower motor and blower housing access is required on BOTH SIDES of the unit.

Fig. 7 — Service Clearances

⚠ 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.

⚠ CAUTION

Failure to remove shipping brackets from spring-mounted compressors will cause excessive noise and could cause component failure due to added vibration.

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 models for an adequate condensate trap.
- Horizontal units include two condensate drain connections to allow flexibility in unit sloping for proper drainage. Only one connection needs to be used. The unused connection must be plugged.
- 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 or remodeling, especially when plastering, sanding or painting or when replacing carpet or flooring. Dust and debris can clog the coil and blower. Chemical vapors can lead to formicary corrosion and damage the coil. Ensure adequate ventilation and debris collection during construction or remodeling.

IMPORTANT: Care must be taken to prevent the introduction of dust, paint, debris, or chemicals into the unit, which can cause damage to the unit, delay start-up, and may impact unit longevity.

Step 4 — Mount the Unit

⚠ CAUTION

Remove all shipping blocks under blower housing. Loosen compressor mounting bolts. Failure to do so could result in equipment damage.

MOUNTING VERTICAL UNITS

Vertical units are available in front or rear return configurations. Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. It is not necessary to anchor the unit to the floor. See Fig. 8.

All 50VQP units should be vibration isolated according to the design engineers' specifications.

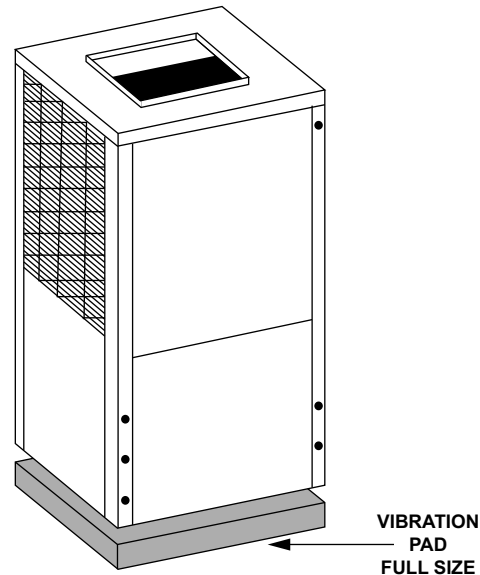


Fig. 8 — Vertical Unit on Vibration Pad

MOUNTING HORIZONTAL UNITS

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. The rods are usually attached to the unit corners by hanger bracket kits. (See Fig. 9.) The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions (Included with the unit) for details. All 50HQP units include an integral angle iron frame with mounting holes present. (See unit horizontal detail drawing.) Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan if required by code, should be at least four inches 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.

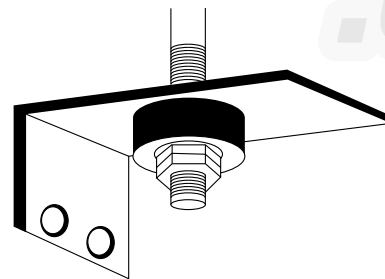


Fig. 9 — Typical Horizontal Unit Hanging Bracket

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 $\frac{3}{4}$ -in. drain connected to this secondary pan should be run to an eave at a location that will be noticeable. 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.

Step 5 — Check Duct System

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections. Fold the duct flange outwards along the perforated line. Refer to Fig. 2-6 for physical dimensions of the collar and flange.

NOTE: All dual fan units (50HQP 120 and 180-242, 50VQP 210-360) must use a “pair of pants” duct configuration as shown in Fig. 10. Failure to follow these guidelines can result in fan system failure.

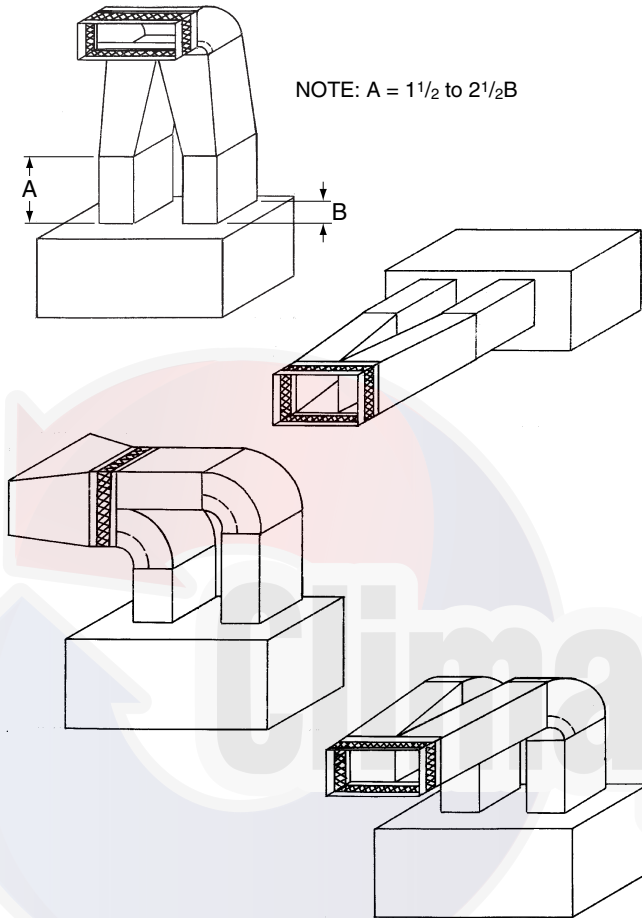


Fig. 10 — Typical Fan Discharge Connections for Multiple Fan Units

Refer to the Carrier System Design Manual or ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards for the recommended duct connection to unit with 2 fans. An adequate straight length of ducting from the unit should be allowed before elbows are installed. Elbows should turn in the direction of fan rotation, if possible. Abrupt turns will generate air turbulence and excessive noise. Turning vanes should be used in all short radius bends. Ensure that ducting does not obstruct access to the unit for routine servicing.

A flexible connector is recommended for supply and return air connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate forming during the cooling operation. Application of the unit to uninsulated duct work is not recommended as the unit's performance will be adversely affected. Do not connect discharge ducts directly to the blower outlet. The factory provided air filter must be removed when using a filter back return air grille. The factory filter 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 return-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.

Step 6 — Install Condensate Drain

⚠ CAUTION

Verify condensate switch is installed in the lowest part of the drain pan, based on unit pitch. Condensate switch may need to be relocated from factory position.

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. 50VQP Vertical units include one condensate drain. 50HQP horizontal units include two condensate drain connections to allow for field pitching based on installation requirements. Only one condensate drain connection should be used. Cap and seal the unused drain connection.

Units with waterside economizer include an additional condensate pan and drain as part of the economizer assembly. This drain must also be piped to a condensate line following the guidance above. NOTE: the waterside economizer condensate pan is not protected by a condensate overflow switch from the factory.

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to ensure free condensate flow. (Units are not internally trapped.) A vertical air vent is sometimes required to avoid air pockets. (See Fig. 11.) The length of the trap depends on the amount of positive or negative pressure on the drain pan.

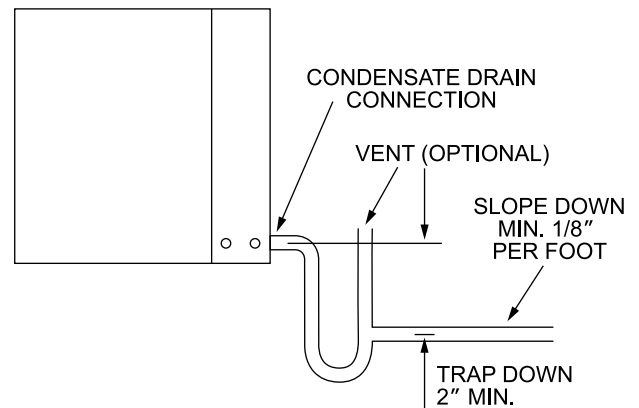


Fig. 11 — Condensate Trapping

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. 12.)

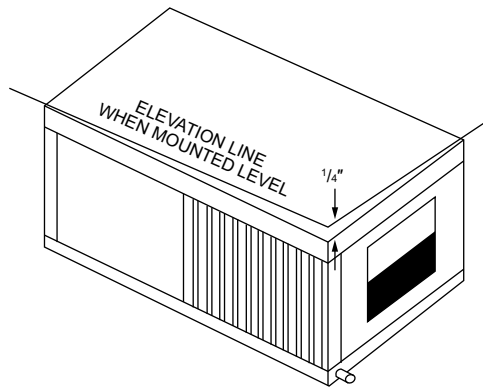


Fig. 12 — Sloped Horizontal Unit Installation

Step 7 — Pipe Connections

Supply and return piping must be as large as the unit connections on the heat pump (larger on long runs). Never use flexible hoses of a smaller inside diameter than that of the water connections on the unit. Units are supplied with either a copper or optional cupronickel condenser. Copper is adequate for ground water that is not high in mineral content. Should your well driller express concern regarding the quality of the well water available or should any known hazards exist in your area, we recommend proper testing to assure the well water quality is suitable for use with water source equipment. In conditions anticipating moderate scale formation or in brackish water a cupronickel heat exchanger is recommended.

Both the supply and discharge water lines will sweat if subjected to low water temperature. These lines should be insulated to prevent damage from condensation.

All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics. Never exceed the recommended water flow rates. Serious damage or erosion of the water to refrigerant heat exchanger could occur.

Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult the specification sheets for sizes. Teflon¹ tape sealer should be used when connecting water piping connections to the units to insure against leaks and possible heat exchanger fouling. Do not

overtighten the connections. Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing.

Pressure/temperature ports are recommended in both the supply and return lines for system flow balancing. The water flow can be accurately set by measuring the water-to-refrigerant heat exchangers water side pressure drop. See the unit specification sheets for the water flow and pressure drop information.

UNITS WITH WATERSIDE ECONOMIZER OR BOILERLESS HEAT CONTROL

Units with Complete C or Deluxe D controls and waterside economizer or units with Boilerless Heat Control (all Deluxe D) include an aquastat with remote sensing bulb that must be field-installed on the incoming water piping. The remote sensing bulb must be installed on a straight section of uninsulated pipe that provides a good measurement of the entering water temperature. It is recommended to insulate the sensing bulb after installation for better water temperature sensing.

⚠ CAUTION

Water piping exposed to extreme, low ambient temperatures is subject to freezing.

WELL WATER SYSTEMS (50°F EWT [ENTERING WATER TEMPERATURE] MINIMUM)

When a water well is used exclusively for supplying water to the heat pump, the pump should operate only when the heat pump operates. A 24 volt, double-pole single-throw contactor can be used to operate the well pump with the heat pump.

When two or more units are supplied from one well, the pump can be wired to operate independently from either unit. Two 24-volt double-pole single-throw relays wired in parallel are required. An upsized VA transformer may be required in either case.

The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local codes (e.g., discharge well, dry well, storm sewer, drain field, stream, pond, etc.). See Fig. 13.

1. Teflon is a registered trademark of Dupont.

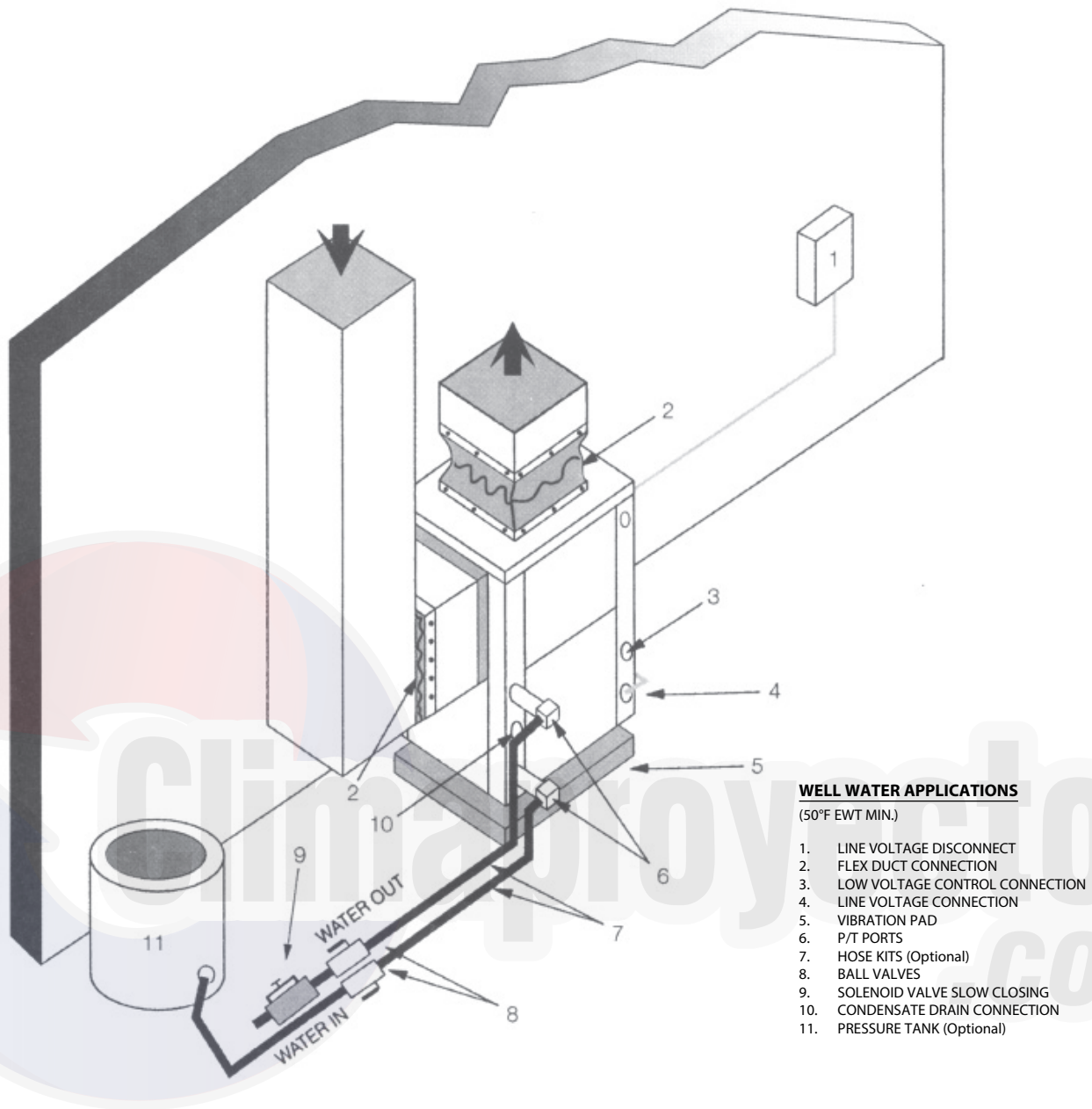


Fig. 13 — Well Water Applications

COOLING TOWER/BOILER APPLICATION

To ensure adequate cooling and heating performance, the cooling tower and boiler water loop temperature should be maintained between 50°F and 80°F in the heating mode and 70°F and 110°F in the cooling mode. In the cooling mode, heat is rejected from the unit into the water loop. A cooling tower provides evaporative cooling to the loop fluid, thus maintaining a constant supply temperature to the unit. When utilizing an open cooling tower, chemical water treatment is mandatory to ensure the water is free of corrosive materials.

A secondary heat exchanger (plate frame between the unit and the open cooling tower) may also be used. It is imperative that all air

is eliminated from the closed loop side of the heat exchanger to prevent condenser fouling. In the heating mode, heat is absorbed from the water loop to the unit. A boiler can be utilized to maintain the loop within the proper temperature range.

No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove dirt, piping chips or other foreign material. Supply and return hoses should be connected together during this process to ensure the entire system is properly flushed. After the cleaning and flushing has taken place the unit may be connected to the water loop and should have all valves wide open. See Fig. 14.

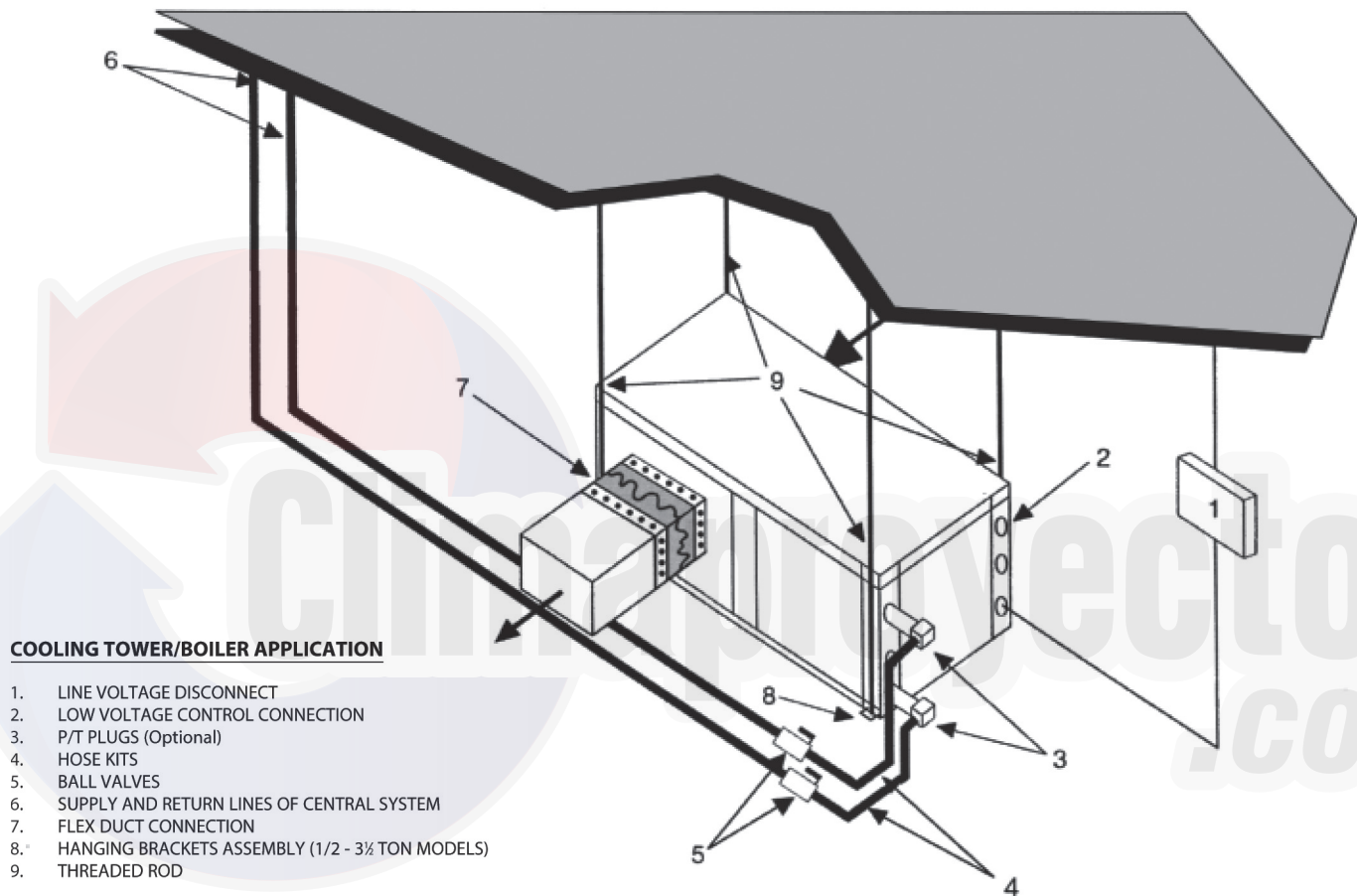


Fig. 14 — Cooling Tower/Boiler Application

EARTH COUPLED SYSTEMS

Operation of a unit on a closed loop application requires the extended range option. See Fig. 15.

NOTE: Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training.

Utilizing Ground Loop Pumping Package (GLP) makes the installation easy. Anti-freeze solutions must be utilized when low evaporating conditions are expected to occur. Refer to the installation manuals for more specific instructions.

Step 8 — Wire Field Power Supply

See Tables 2 and 3 for electrical data.

See Fig. 2-5 for cabinet electrical wiring points. See Fig. 18-28 for typical wiring diagrams. Unit will ship with wiring diagram affixed to the inside of the unit control panel.

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.

CONTROL TRANSFORMER SETTING FOR 208V UNITS

As factory built, all 208/230-v units are wired for 230-v operation. For job sites with a 208-v power supply, the primary leads on the unit transformer will need to be changed from 230-v to 208-v. Refer to the unit wiring diagram for details.

50HQP WITH SUPPLY FAN VFD

Units with the SAV™ or single speed VFD option include a VFD that ships inside the unit control enclosure for field installation. See Fig. 17 for field power wiring for VFD. Use the following guidance for VFD installation:

NOTE: Installation must adhere to local codes and requirements.

1. Remove the VFD from the unit shipping storage location (on the pallet or inside the unit, see Fig. 1).
2. Remove the VFD from the cardboard shipping box and locate the ABB ACH550 VFD Installation, Operation, and Maintenance Manual.
3. Follow the instructions for VFD installation in the ABB ACH550 manual for VFD mounting.
4. Disconnect unit power and remove the electrical control box and compressor access panel. See Fig. 16. Make field wiring connections between VFD input terminals (U1, V1, and W1) and Terminal Block 3 (TB3) located in the electrical control box. See Fig. 17.
5. Make field wiring connections between VFD output terminals (U2, V2, and W2) and Terminal Block 4 (TB4) located in the electrical control box. See Fig. 17.

NOTE: All remote VFD field wiring must be installed per local codes and requirements.

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.

CAUTION

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

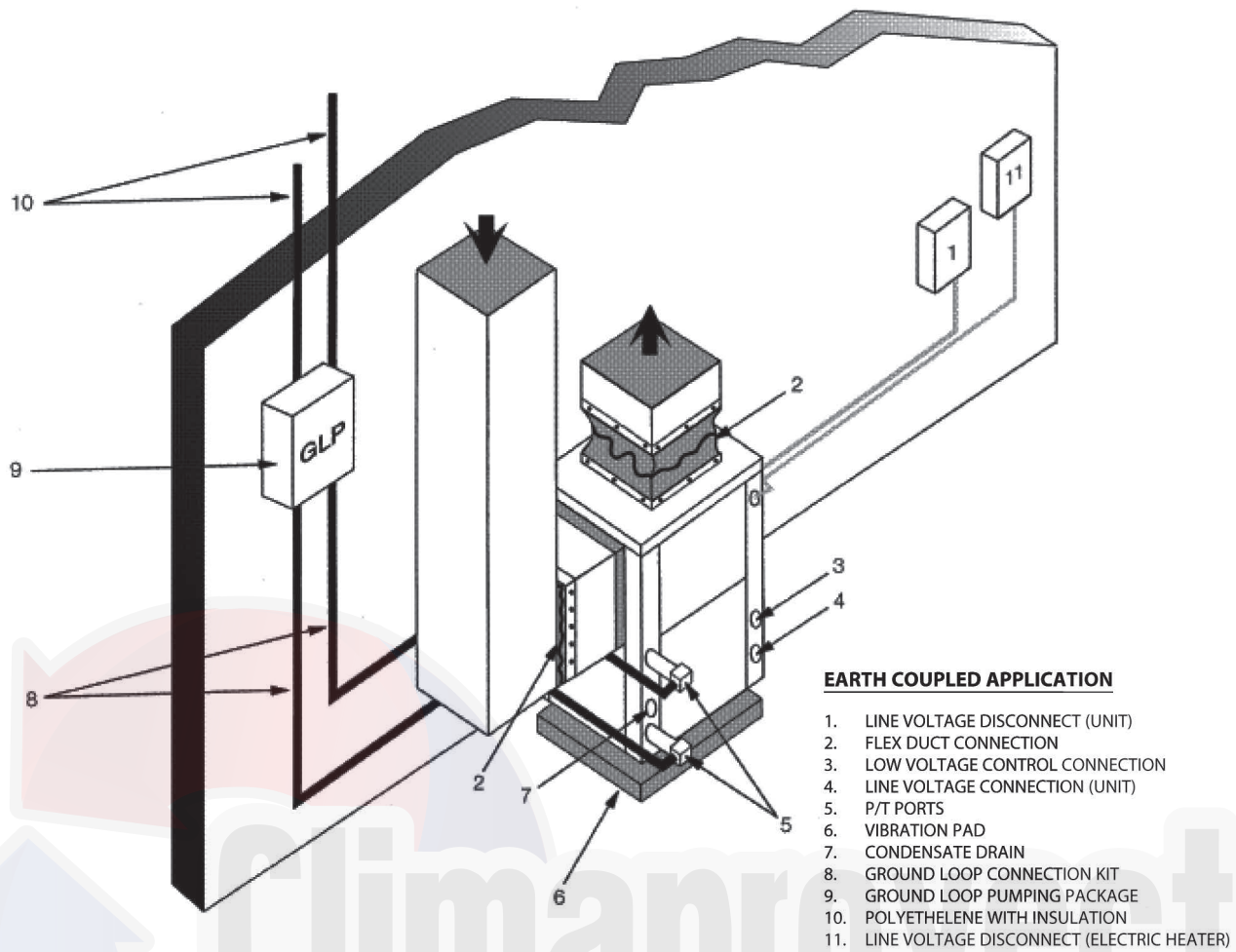


Fig. 15 — Earth Coupled Applications

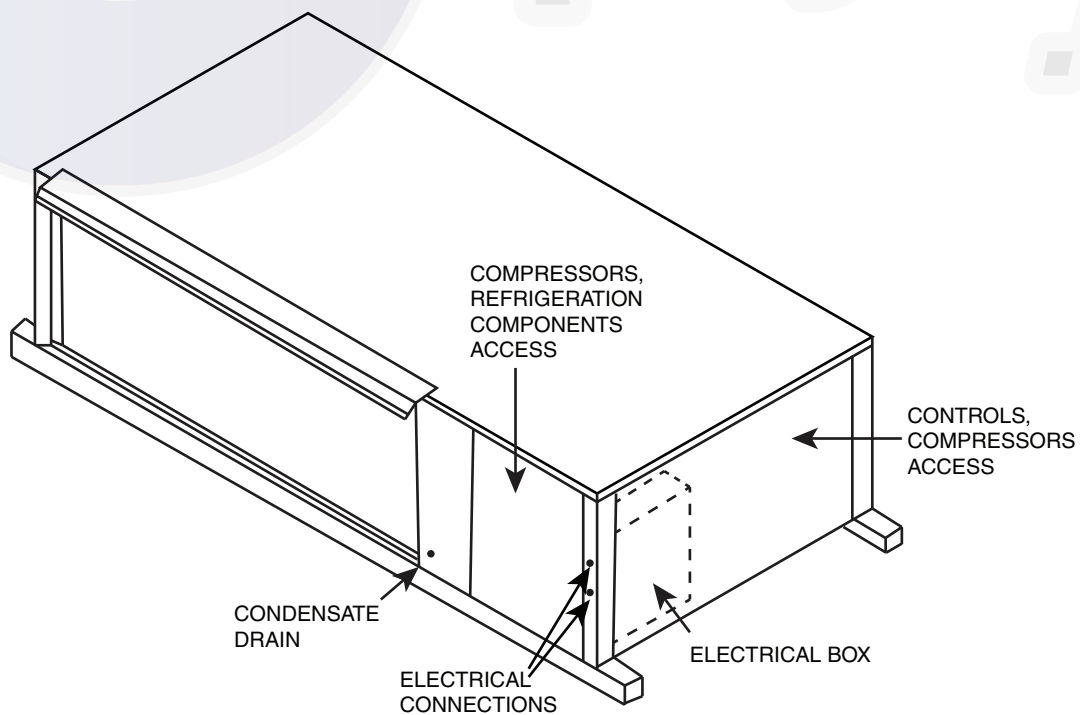


Fig. 16 — Electrical Control Box Location, 50HQP Units

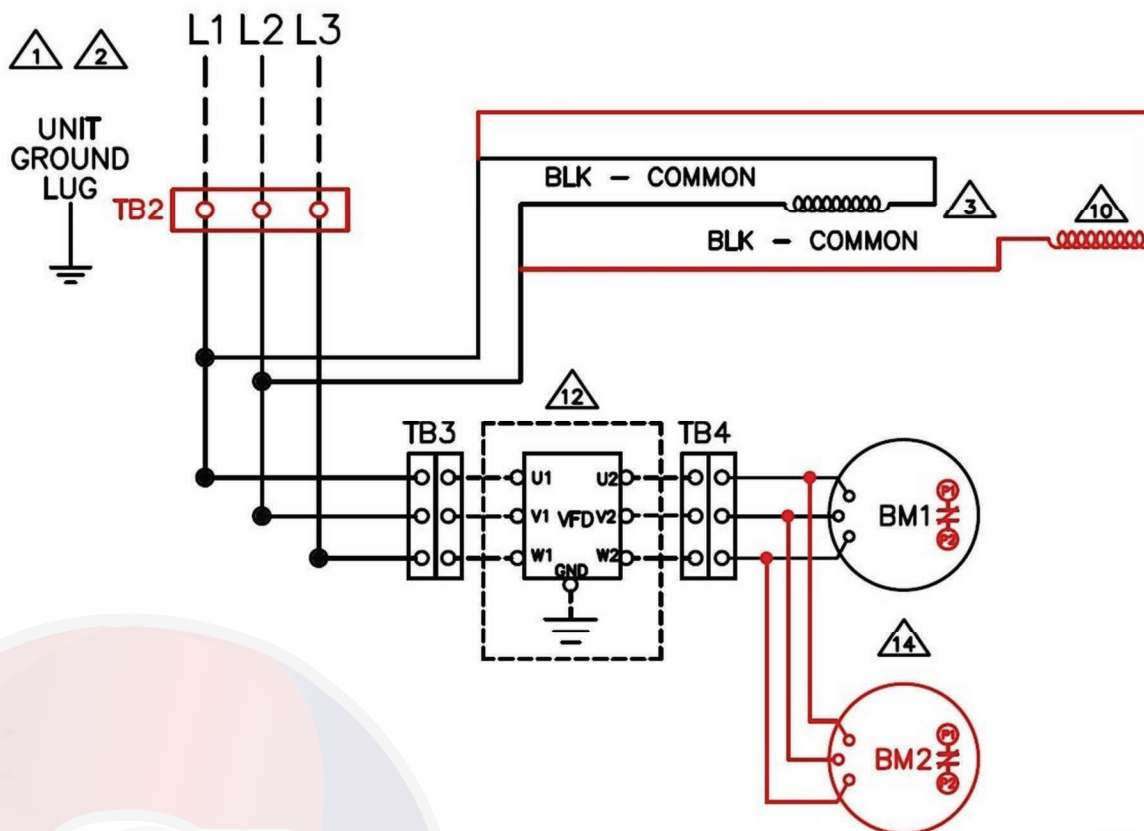


Fig. 17 — VFD Input and Output Power Connections, 50HQP Units

Table 2 — 50HQP072-242 Electrical Data

50HQP UNIT SIZE	VOLTAGE (V-Ph-Hz)	COMPRESSOR (x2)		BLOWER MOTOR			MIN CIRCUIT AMPS	MAX FUSE/HACR
		RLA	LRA	QTY	FLA	HP		
072	208/230-1-60	16.7	79.0	1	7.0	1	44.6	60
	208/230-3-60	10.4	73.0	1	3.6	1	27.0	35
	460-3-60	5.8	38.0	1	1.8	1	14.9	20
096	208/230-1-60	19.6	130.0	1	9.8	2	53.9	70
	208/230-3-60	13.7	83.0	1	6.2	2	37.0	50
	460-3-60	6.2	41.0	1	3.1	2	17.1	20
	575-3-60	4.8	33.0	1	2.6	2	13.4	15
120	208/230-1-60	26.3	134.0	1	9.8	2	69.0	90
	208/230-3-60	15.6	110.0	1	8.0	3	43.1	50
	460-3-60	7.8	52.0	1	3.9	3	21.5	25
	575-3-60	5.8	38.9	1	3.7	3	16.8	20
150	208/230-3-60	19.2	136.0	1	9.2	3	52.4	70
	460-3-60	8.7	66.1	1	4.3	3	23.9	30
	575-3-60	6.9	55.3	1	3.7	3	19.2	25
	208/230-3-60	22.4	149.0	2	6.2	2	62.8	80
180	460-3-60	10.6	75.0	2	3.1	2	30.1	40
	575-3-60	7.7	54.0	2	2.6	2	22.5	30
	208/230-3-60	30.1	225.0	2	3.9	2	75.5	100
242	460-3-60	16.7	114.0	2	3.1	2	43.8	60
	575-3-60	12.2	80.0	2	2.6	2	32.7	40

Table 3 — 50VQP072-360 Electrical Data

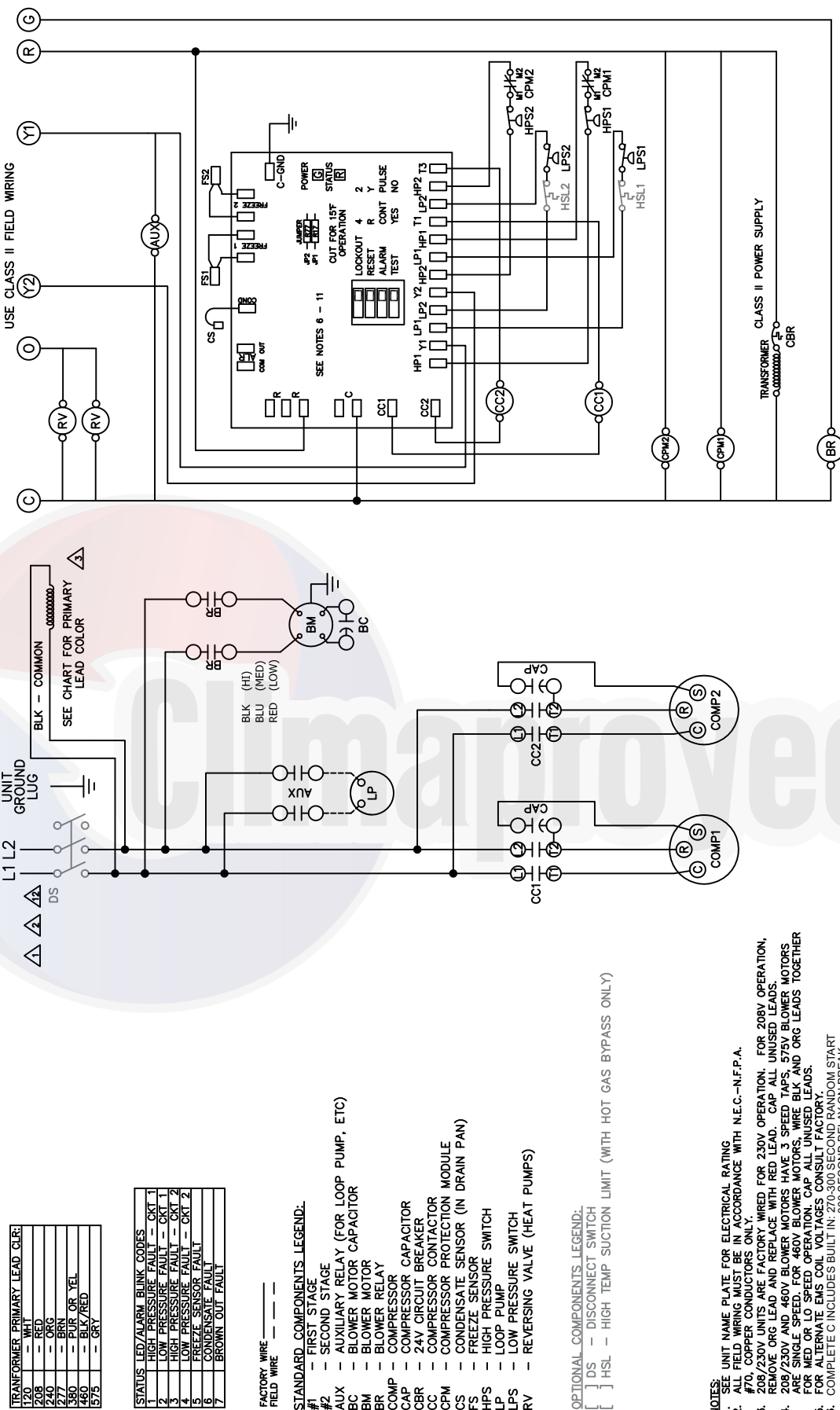
50VQP UNIT SIZE	VOLTAGE (V-Ph-Hz)	COMPRESSOR (x2)		BLOWER MOTOR			MIN CIRCUIT AMPS	MAX FUSE/ HACR
		RLA	LRA	QTY	FLA	HP		
072	208/230-1-60	16.7	79.0	1	7.0	1	44.6	60
	208/230-3-60	10.4	73.0	1	3.6	1	27.0	35
	460-3-60	5.8	38.0	1	1.8	1	14.9	20
096	208/230-1-60	19.6	130.0	1	8.5	1½	52.6	70
	208/230-3-60	13.7	83.1	1	4.8	1½	35.6	45
	460-3-60	6.2	41.0	1	2.4	1½	16.4	20
	575-3-60	4.8	33.0	1	2.0	1½	12.8	15
120	208/230-1-60	26.3	134.0	1	9.8	2	69.0	90
	208/230-3-60	15.6	110.0	1	6.2	2	41.3	50
	460-3-60	7.8	52.0	1	3.1	2	20.7	25
	575-3-60	5.8	38.9	1	2.6	2	15.7	20
151	208/230-3-60	19.2	136.0	1	8.0	3	51.2	70
	460-3-60	8.7	66.1	1	3.9	3	23.5	30
	575-3-60	6.9	55.3	1	3.7	3	19.2	25
181	208/230-3-60	22.4	149.0	1	13.4	5	63.8	80
	460-3-60	10.6	75.0	1	6.6	5	30.5	40
	575-3-60	7.7	54.0	1	5.4	5	22.7	30
210	208/230-3-60	29.5	195.0	2	4.8	1½	76.0	100
	460-3-60	14.7	95.0	2	2.4	1½	37.9	50
	575-3-60	12.2	80.0	2	2.0	1½	31.5	40
240	208/230-3-60	30.1	225.0	2	6.2	2	80.1	110
	460-3-60	16.7	114.0	2	3.1	2	43.8	60
	575-3-60	12.2	80.0	2	2.6	2	32.7	40
300	208/230-3-60	48.1	245.0	2	8.0	3	124.2	150
	460-3-60	18.6	125.0	2	3.9	3	49.7	60
	575-3-60	14.7	100.0	2	3.7	3	40.5	50
360	208/230-3-60	55.8	340.0	2	13.4	5	152.4	200
	460-3-60	26.9	173.0	2	6.6	5	73.7	100
	575-3-60	23.7	132.0	2	5.4	5	64.1	80

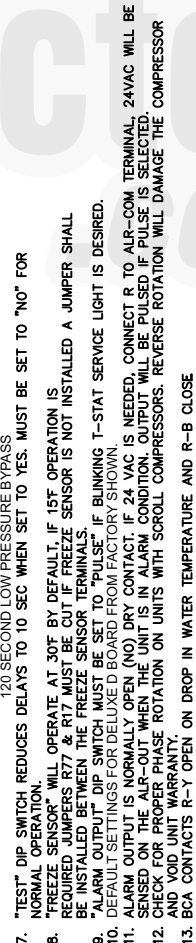
LEGEND

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

NOTES:

1. HACR circuit breaker in U.S.A. only.
2. A voltage variation of ± 10% of nameplate rating is acceptable. Phase imbalance shall not exceed 2%.
3. See WSHP Builder for electrical data for configurations not listed above.





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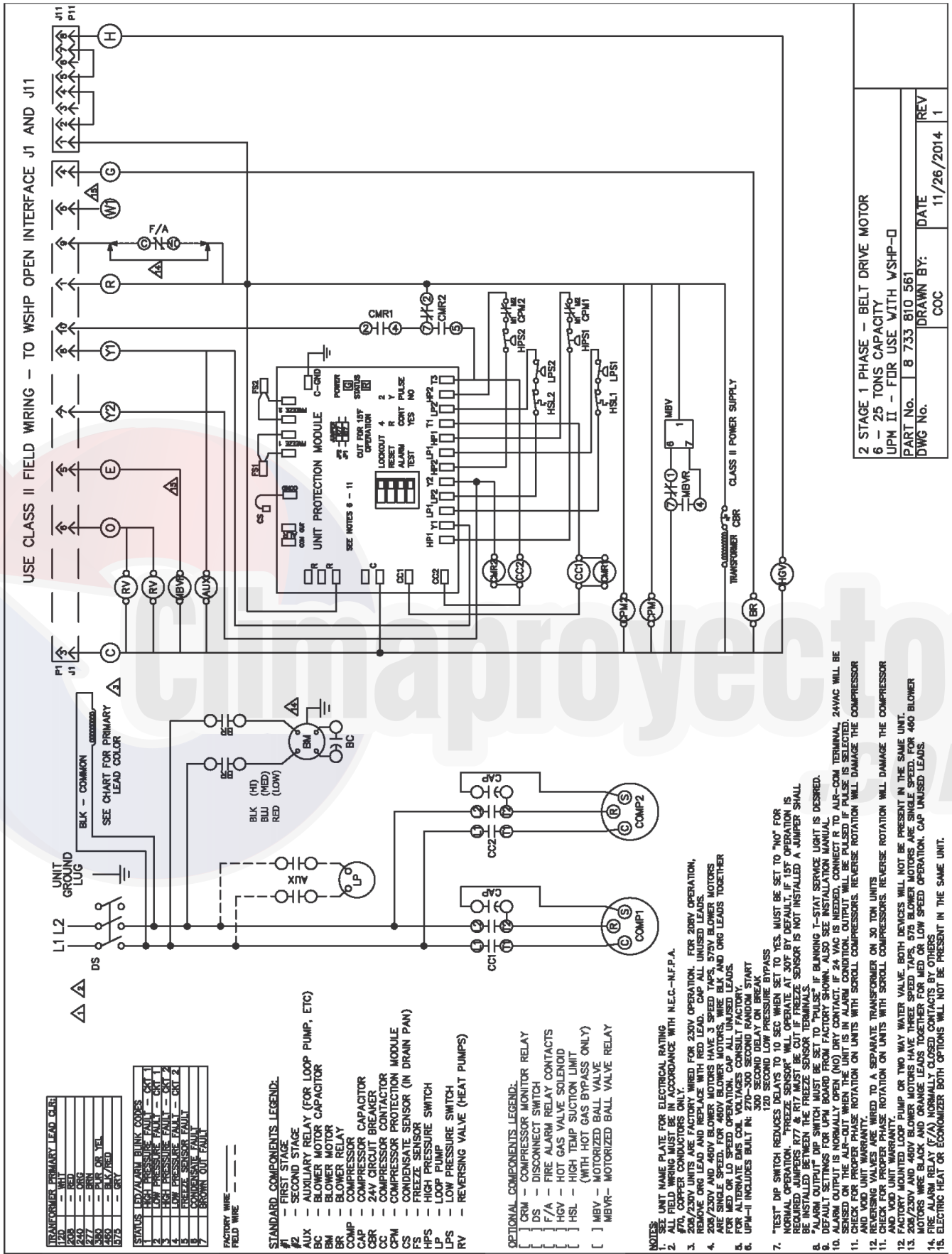
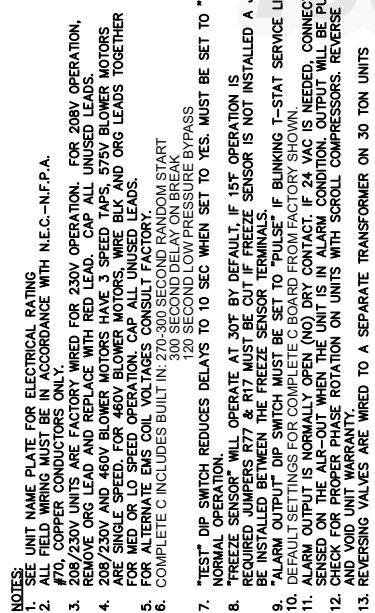


Fig. 20 — Single-Phase with WSHP Open



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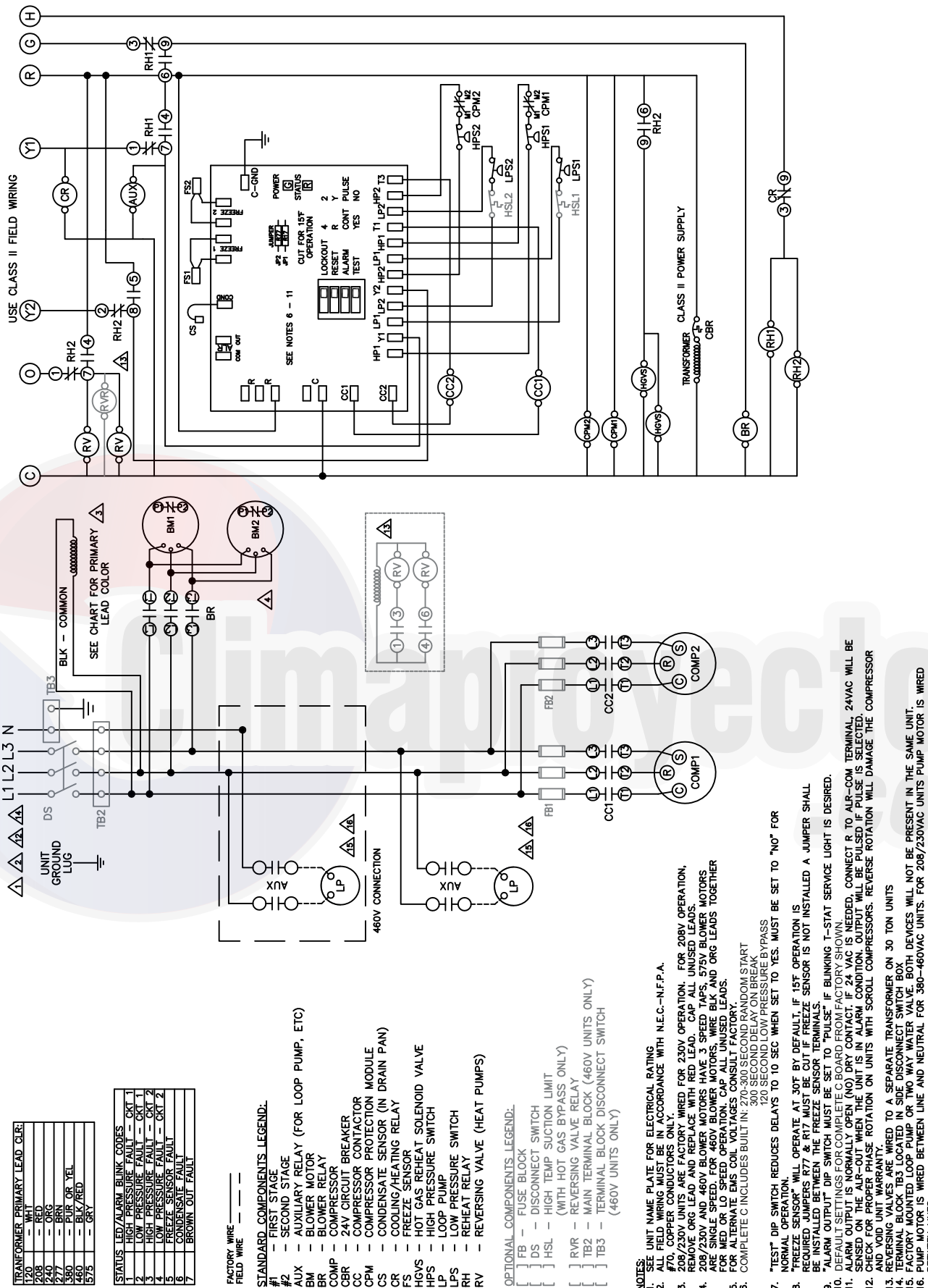


Fig. 24 — 3-Phase Complete C Control Package with Hot Gas Reheat

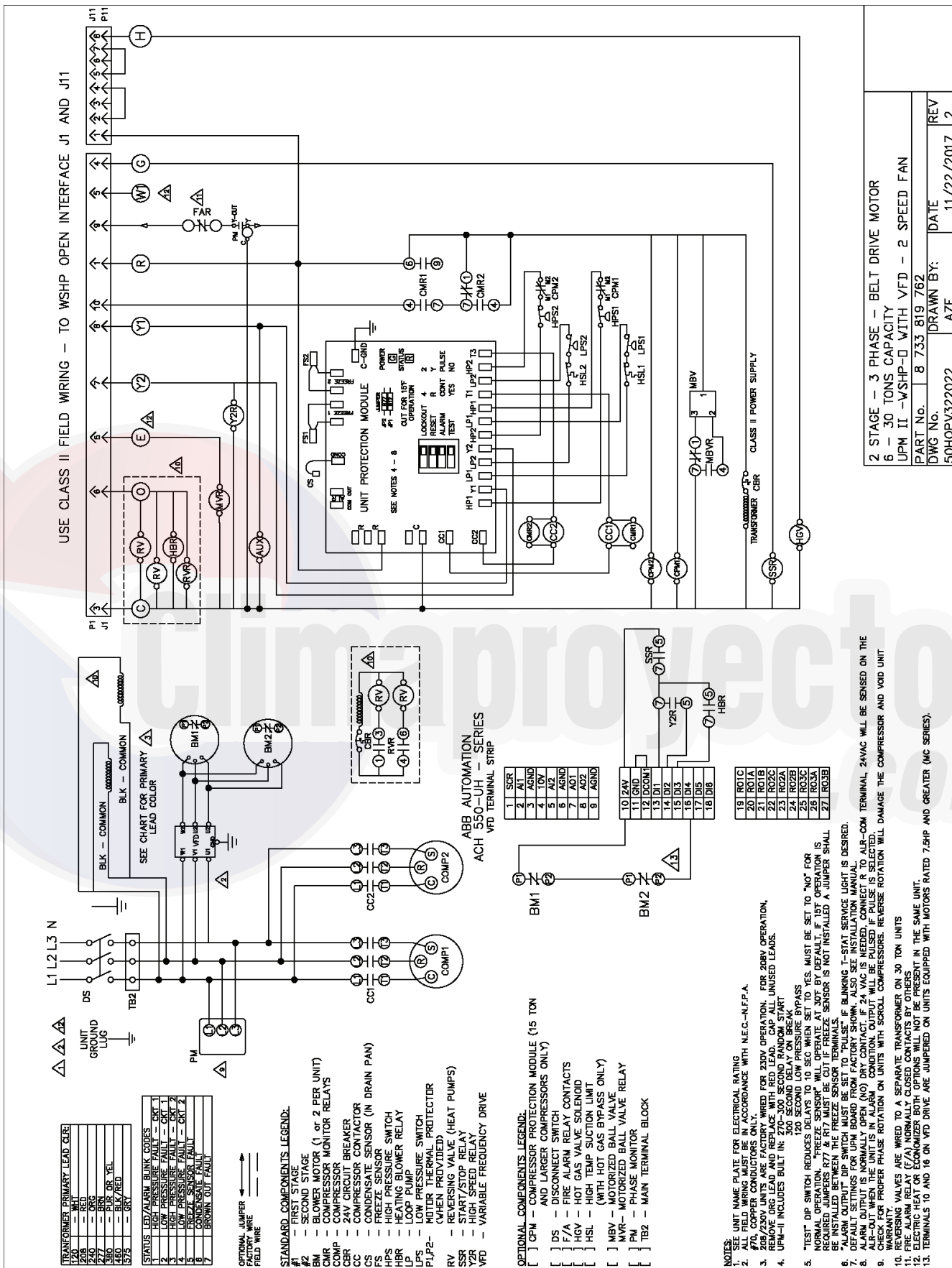


Fig. 26 — 3-Phase with WSHP Open, Hot Gas Reheat, Water Economizer, and SAV™

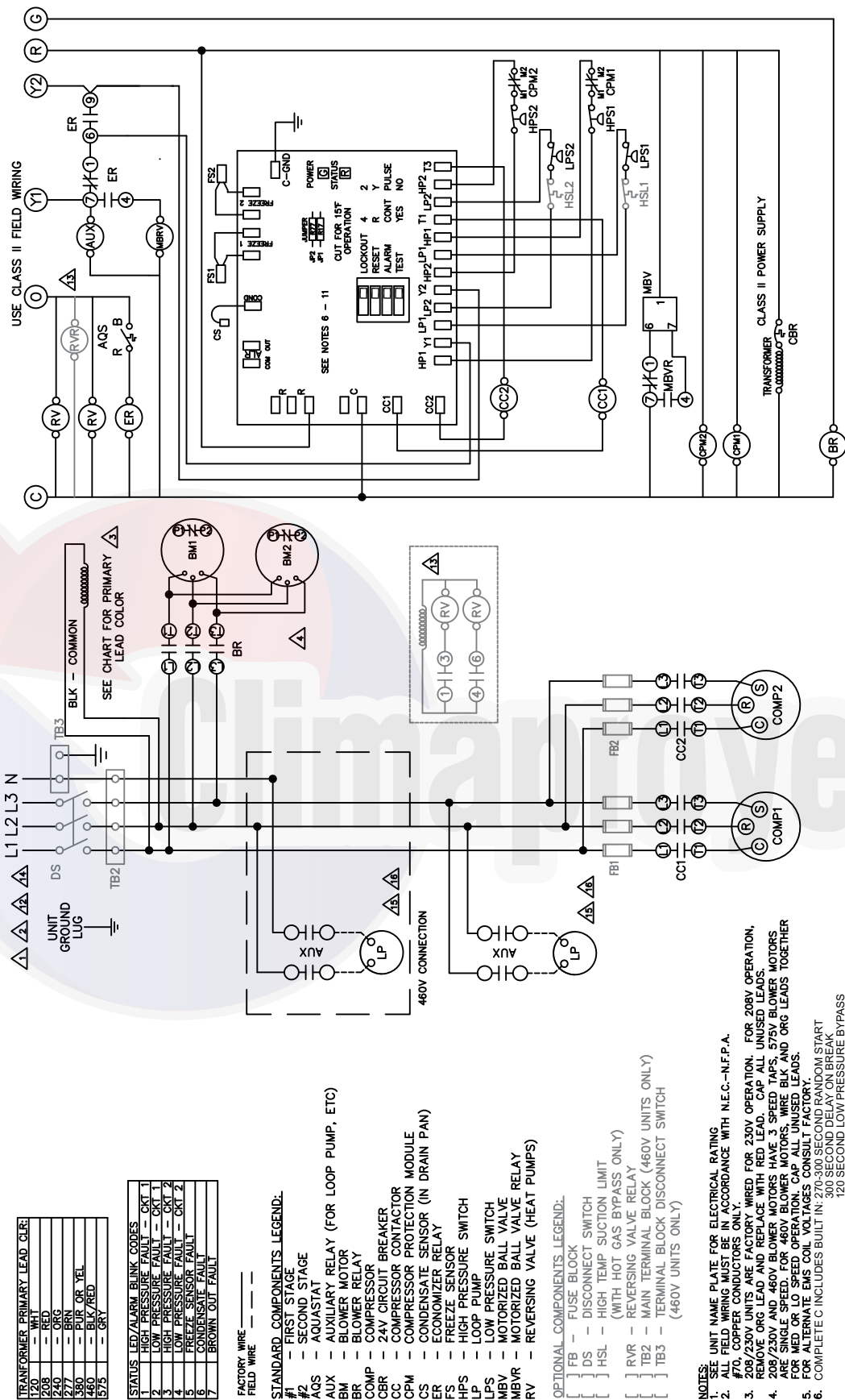


Fig. 27 — 3-Phase Complete C Board with Water Economizer

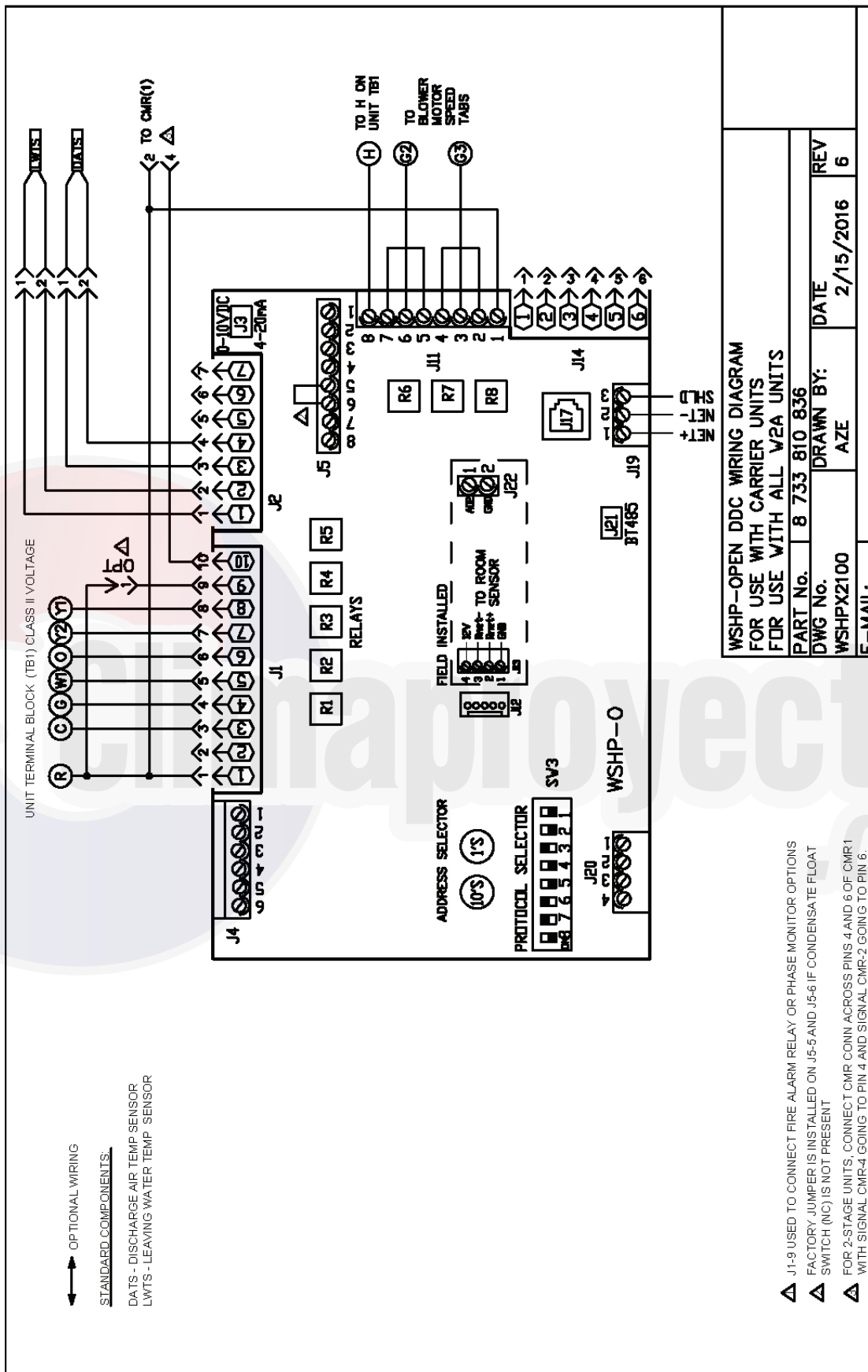


Fig. 28 — WSHP Open W2A Wiring Diagram

Step 9 — Wire Control Connections

COMPLETE C, AND DELUXE D CONTROL

All control wiring is connected to a terminal block located in the unit electrical box. Refer to the unit wiring diagrams in Fig. 18-27 for connection details.

Units with the Complete C or Deluxe D control package can be controlled using the included thermostat inputs (R, O, Y1, Y2, C, G) for two 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. 29 for typical thermostat connections.

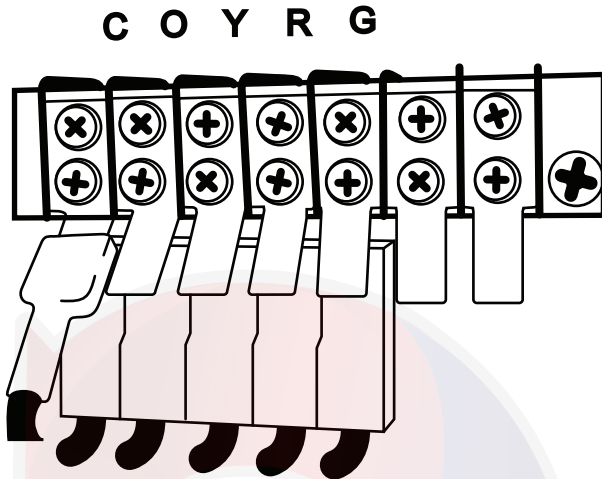


Fig. 29 — Typical Thermostat Connections

THERMOSTAT AND DDC SENSORS

Thermostats or DDC space sensors 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 Gauge). 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, Y2, or O terminals. Any call for cooling (Y1 and O) will override the dehumidification call.

AUXILIARY RELAY (DELUXE D ONLY)

All units with Deluxe D control include an auxiliary relay that can be field wired to enable a field provided loop pump or solenoid valve when there is a call for compressor operation.

ENERGY MANAGEMENT SWITCH (DELUXE D ONLY)

All units with Deluxe D control include an energy management switch (EMS) relay that can be field wired to disable unit operation when a 24V signal is removed from the relay. Removing the 24V signal causes the relay to open, which cuts 24V power to the unit control circuit. All unit components will be disabled at when the EMS is deactivated. See Fig. 19.

BOILERLESS HEAT CONTROL (DELUXE D ONLY)

All units with Deluxe D control include a boilerless heat relay that can be field wired to enable an external heat source when the water loop temperature drops below the boilerless heat control set point.

ALARM OUTPUT (ALL UNITS)

If the unit is being connected to a thermostat or DDC control with an alarm indicator, this connection is made at the unit malfunction output on the Unit Protection Module (UPM). See the Unit Protection Module heading in the Set Up Unit Controls section for further details.

WSHP OPEN CONTROL

WSHP Open is a factory installed DDC control that requires the use of Carrier ZS or WS sensors or the Carrier Equipment Touch or System Touch for space temperature sensing. WSHP Open is not compatible with thermostats or third party temperature sensors. All WSHP Open wiring is completed at the WSHP Open control board. For further instructions on WSHP Open, please visit HVACPartners.com or Carrier.com for the WSHP Open V4 Integration Guide and Points/Properties Guide.

CONTROL TRANSFORMER

Units with Complete C but without HGRH or waterside economizer include a 75VA transformer. Units with Deluxe D, WSHP Open, HGRH, or waterside economizer include a 100VA transformer. Consider the VA draw of any accessories that will be powered by the unit control transformer.

Step 10 — Configure Unit Control Components

UNIT PROTECTION MODULE (UPM)

All units are factory provided with a unit protection module (UPM) controls the compressor and has built safeties. See Fig. 30.

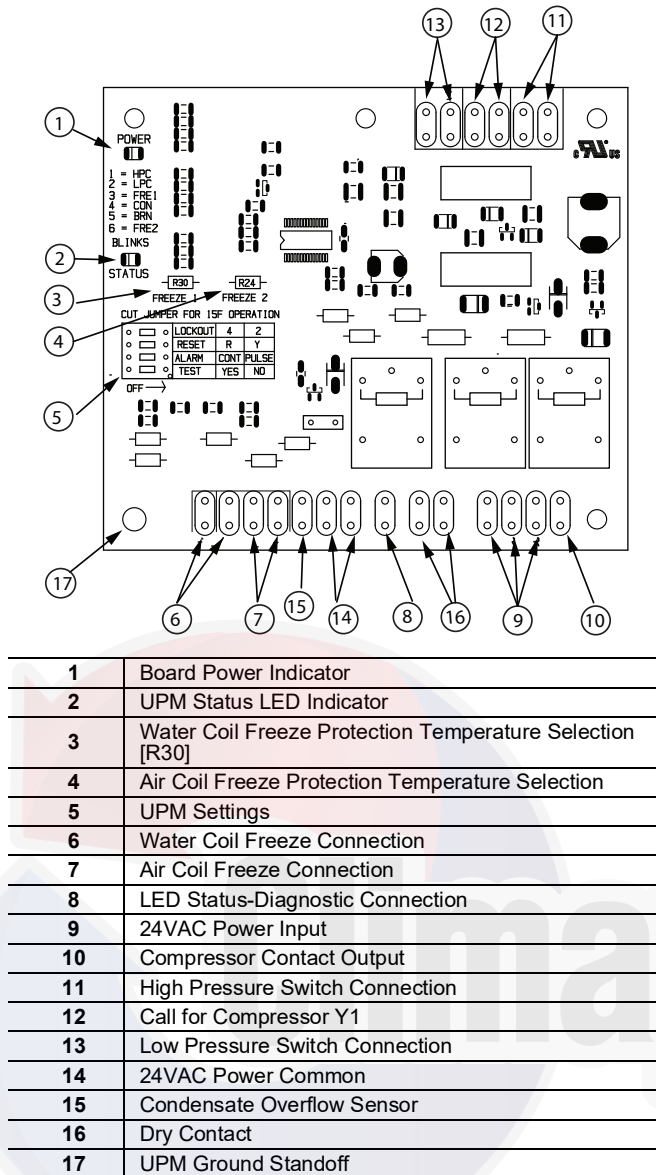


Fig. 30 — Unit Protection Module (UPM)

FREEZE SENSOR

The default setting for the freeze limit trip is 30°F for applications without anti-freeze. This can be changed to 15°F for applications with anti-freeze by cutting the R30 resistor located on top of the DIP switch SW1.

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 31 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. See the Unit Protection Module section in the Troubleshooting section for further details.

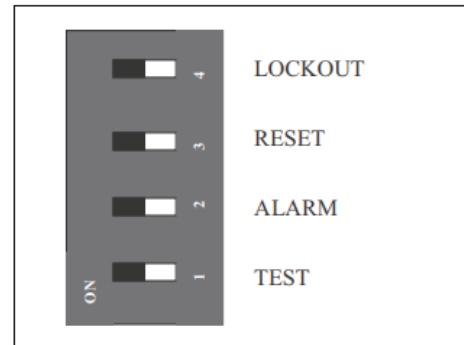


Fig. 31 — Typical DIP Switch Factory Defaults

Table 4 below shows the available options on the UPM board DIP switch banks.

Table 4 — 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.

PRE-START-UP

System Checkout

When the installation is complete, follow the system checkout procedure outlined below before starting up the system. Be sure:

1. Voltage is within the utilization range specifications of the unit compressor and fan motor and voltage is balanced for 3-phase units.
2. Fuses, breakers and wire are correct size.
3. Low voltage wiring is complete.
4. Piping and system flushing is complete.
5. Air is purged from closed loop system.
6. System is balanced as required. Monitor if necessary.
7. Isolation valves are open.
8. Water control valves or loop pumps are wired.
9. Condensate lines are open and correctly pitched.
10. Transformer switched to lower voltage tap (208V) if necessary.
11. Blower rotates freely — shipping support is removed.
12. Blower speed is on correct setting.
13. Air filter is clean and in position.
14. Service/access panels are in place.
15. Return-air temperature is 50 to 95°F for heating and 68 to 95°F for cooling.
16. Air coil is clean.
17. Control field-selected settings are correct.
18. Unused drain connection (50HQP only) is capped and sealed.
19. A pair of pants duct connection (all dual blower units) exists.

AIR COIL

To obtain maximum performance, the air coil should be cleaned before starting the unit. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

FIELD SELECTABLE INPUTS

Jumpers and DIP (dual in-line package) switches on the control board are used to customize unit operation and can be configured in the field.

IMPORTANT: Jumpers and DIP switches should only be clipped when power to control board has been turned off.

⚠ CAUTION

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

START-UP

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

NOTE: This equipment is designed for indoor installation only.

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 $\pm 10\%$ of nameplate utilization voltage is acceptable.

UNIT STARTING CONDITIONS

All units start and operate in an ambient of 45°F with entering air at 40°F, entering water at 20°F and with both air and water at the flow rates used.

NOTE: These operating conditions are not normal or continuous operating conditions. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature.

⚠ 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. Electrical shock can cause personal injury or death.

Start Up System

1. Set the thermostat to the highest setting.
2. Set the thermostat system switch to "COOL," and the fan switch to the "AUTO" position. The reversing valve solenoid should energize. The compressor and fan should not run.
3. Reduce the thermostat setting approximately 5 degrees below the room temperature.
4. Verify the heat pump is operating in the cooling mode.
5. Turn the thermostat system switch to the "OFF" position. The unit should stop running and the reversing valve should de-energize.

6. Leave the unit off for approximately (5) minutes to allow for system equalization.
7. Turn the thermostat to the lowest setting.
8. Set the thermostat switch to "HEAT."
9. Increase the thermostat setting approximately 5 degrees above the room temperature.
10. Verify the heat pump is operating in the heating mode.
11. Set the thermostat to maintain the desired space temperature.
12. Check for vibrations, leaks, etc.
13. Instruct the owner on the unit and thermostat operation.

NOTE: Three factors determine the operating limits of a unit: (1) entering-air temperature, (2) water temperature and (3) ambient 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 Table 5.

Table 5 — 50HQP,VQP Unit Operating Limits

CONDITION	STANDARD RANGE UNIT (F)	EXTENDED RANGE UNIT (F)
Cooling Minimum Entering Air Temperature (db/wb)	68/57	68/57
Cooling Minimum Entering Water Temperature	50	50
Cooling Maximum Entering Air Temperature (db/wb)	95/85	95/85
Cooling Maximum Entering Water Temperature	110	110
Heating Minimum Entering Air Temperature	50	50
Heating Minimum Entering Water Temperature	50	20*
Heating Maximum Entering Air Temperature	80	80
Normal Water Coil Entering Fluid Range	50-80	25-80

LEGEND

db — Dry Bulb
wb — Wet Bulb

*With antifreeze, optional extended range insulation and low temperature cutoff jumper clipped for antifreeze.

Scroll Compressor Rotation

It is important to be certain compressor is rotating in the proper direction. To determine whether compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. 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:

1. Turn off power to the unit. Install disconnect tag.
2. Reverse any two of the unit power leads.
3. 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. See Table 6.

When the compressor is rotating in the wrong direction, the unit makes an elevated level of 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 lock-out. 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.

Table 6 — 50HQP,VQP Typical Unit Operating Pressures and Temperatures

50HQP, 50VQP UNIT SIZE	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) DB
072	30	10.0	—	—	—	—	65- 80	282-344	6- 7	14-17
		16.0	—	—	—	—	73- 89	294-359	3- 4	15-18
	40	10.0	121-148	184-225	17-21	18-22	80- 98	299-365	7- 9	16-20
		16.0	117-143	167-204	10-13	19-23	89-108	311-380	4- 5	17-21
	50	10.0	123-151	222-271	17-20	17-21	95-116	315-385	9-11	19-23
		16.0	119-145	202-247	10-12	18-23	105-128	329-402	5- 7	20-24
	60	10.0	125-153	260-318	16-19	17-21	109-133	332-406	11-13	21-26
		16.0	120-147	237-289	10-12	18-22	121-148	346-423	6- 8	22-27
	70	10.0	127-155	298-365	15-19	17-20	124-151	349-427	12-15	23-28
		16.0	122-149	271-331	9-11	18-21	138-168	364-444	7- 9	25-30
	80	10.0	129-158	336-411	14-18	16-20	138-169	366-447	14-17	26-31
		16.0	124-152	306-374	9-11	17-21	154-188	381-466	8-10	27-33
	90	10.0	131-160	374-458	14-17	16-19	153-187	383-468	16-19	28-34
		16.0	126-154	340-416	8-10	17-20	170-208	399-487	9-12	29-36
	100	10.0	133-162	413-504	13-16	15-19	—	—	—	—
		16.0	128-156	375-458	8-10	16-20	—	—	—	—
096	30	13.0	—	—	—	—	72- 87	296-361	5- 6	21-25
		22.0	—	—	—	—	75- 92	301-368	3- 4	22-26
	40	13.0	114-139	155-190	14-17	22-27	88-107	314-384	6- 7	24-29
		22.0	108-132	147-180	10-12	23-28	92-112	321-392	4- 5	25-30
	50	13.0	116-142	192-234	13-16	21-26	104-127	333-407	7- 9	27-33
		22.0	111-135	182-222	9-12	22-27	109-133	340-415	5- 6	28-34
	60	13.0	119-146	228-279	13-16	21-26	120-146	352-430	8-10	30-37
		22.0	113-138	217-265	9-11	22-27	125-153	359-439	6- 7	32-39
	70	13.0	122-149	264-323	13-15	20-25	136-166	371-453	9-12	33-41
		22.0	116-142	251-307	9-11	21-26	142-174	378-462	7- 8	35-43
	80	13.0	125-152	301-368	12-15	20-24	152-185	389-476	11-13	36-44
		22.0	118-145	286-349	9-11	21-26	159-194	397-485	8- 9	38-47
	90	13.0	127-156	337-412	12-15	19-24	168-205	408-499	12-15	39-48
		22.0	121-148	320-392	9-10	20-25	176-215	416-509	8-10	41-51
	100	13.0	130-159	374-457	12-14	19-23	—	—	—	—
		22.0	124-151	355-434	8-10	20-24	—	—	—	—
120	30	16.0	—	—	—	—	73- 89	266-325	5- 6	15-18
		32.0	—	—	—	—	77- 94	272-333	3- 4	16-19
	40	16.0	117-143	189-231	14-17	18-22	86-105	279-341	6- 7	17-21
		32.0	112-137	178-217	8- 9	19-24	90-110	286-350	4- 5	18-22
	50	16.0	126-154	221-270	14-17	18-21	162-198	293-358	7- 8	20-24
		32.0	121-148	207-253	8- 9	19-23	170-208	300-366	5- 6	21-25
	60	16.0	131-160	252-308	13-16	17-21	110-134	306-374	8-10	22-27
		32.0	125-153	237-290	8- 9	18-22	115-141	314-383	6- 7	23-29
	70	16.0	135-165	284-347	13-16	17-20	122-150	320-391	9-11	24-30
		32.0	130-158	266-326	7- 9	18-22	129-157	327-400	6- 8	26-32
	80	16.0	140-171	320-391	13-16	16-20	134-164	333-407	11-13	27-33
		32.0	134-164	300-367	7- 9	17-21	141-172	341-417	7- 9	28-35
	90	16.0	144-176	360-440	13-16	16-19	147-179	347-424	12-14	29-36
		32.0	138-169	338-414	7- 9	17-21	154-188	355-434	8-10	31-38
	100	16.0	149-182	405-495	13-15	15-19	—	—	—	—
		32.0	143-174	381-465	7- 9	16-20	—	—	—	—

LEGEND

DB — Dry Bulb

Table 6 — 50HQP,VQP Typical Unit Operating Pressures and Temperatures (cont)

50HQP, 50VQP UNIT SIZE	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) DB
150/151	30	22.0	—	—	—	—	74- 90	244-299	3- 4	13-15
		38.0	—	—	—	—	78- 95	251-306	2- 3	13-16
	40	22.0	122-149	183-224	14-18	19-23	87-106	257-314	4- 5	15-18
		38.0	117-143	172-210	8-10	20-24	91-111	263-322	3- 3	16-19
	50	22.0	131-160	214-261	14-18	18-22	164-201	269-329	5- 6	17-20
		38.0	126-154	201-245	8-10	19-24	173-211	276-337	3- 4	18-22
	60	22.0	136-166	244-298	14-17	18-22	111-136	282-344	6- 7	19-23
		38.0	131-160	230-281	8-10	19-23	117-143	289-353	4- 5	20-24
	70	22.0	141-172	275-336	14-17	17-21	124-152	294-360	7- 8	21-25
		38.0	136-165	258-316	8-10	18-22	131-160	302-369	5- 6	22-27
	80	22.0	145-178	310-378	14-17	17-20	136-166	307-375	8- 9	23-28
		38.0	140-171	291-356	8-10	18-22	143-175	314-384	5- 6	24-30
	90	22.0	150-183	349-426	14-17	16-19	149-182	319-390	8-10	25-30
		38.0	144-176	328-401	8- 9	17-21	156-191	327-400	6- 7	26-32
	100	22.0	155-189	392-480	13-16	16-19	—	—	—	—
		38.0	149-182	369-451	8- 9	17-21	—	—	—	—
180/181	30	25.0	—	—	—	—	64- 78	248-303	5- 6	15-18
		45.0	—	—	—	—	67- 82	254-311	3- 4	16-19
	40	25.0	109-134	183-224	18-22	19-23	75- 91	261-319	6- 8	17-21
		45.0	105-128	172-210	10-12	20-25	79- 96	267-327	4- 5	18-23
	50	25.0	118-144	214-261	18-22	19-23	142-173	273-334	8-10	20-24
		45.0	113-138	201-245	10-12	20-24	149-182	280-342	5- 7	21-26
	60	25.0	122-149	244-298	17-21	18-22	96-117	286-349	9-11	22-27
		45.0	117-143	230-281	10-12	19-24	101-123	293-358	6- 8	24-29
	70	25.0	126-154	275-336	17-21	18-22	107-131	299-365	11-13	25-30
		45.0	121-148	258-316	10-12	19-23	113-138	306-374	7- 9	26-32
	80	25.0	130-159	310-378	17-21	17-21	117-143	311-380	12-15	27-33
		45.0	125-153	291-356	10-12	18-22	123-151	319-390	8-10	29-35
	90	25.0	134-164	349-426	17-20	17-20	128-157	324-396	13-16	29-36
		45.0	129-158	328-401	9-12	18-22	135-165	332-406	9-11	31-38
	100	25.0	139-170	392-480	16-20	16-20	—	—	—	—
		45.0	133-163	369-451	9-11	17-21	—	—	—	—
210	30	28.0	—	—	—	—	71- 87	277-339	6- 7	15-19
		52.0	—	—	—	—	75- 92	284-347	4- 5	16-20
	40	28.0	118-144	194-237	21-25	19-23	84-102	291-356	7- 9	18-22
		52.0	113-138	182-223	12-14	20-24	88-108	299-365	5- 6	19-23
	50	28.0	127-155	226-276	21-25	18-22	159-194	305-373	9-11	20-25
		52.0	122-149	213-260	12-14	19-24	167-204	313-383	6- 7	21-26
	60	28.0	131-160	259-316	21-25	18-22	108-132	320-391	10-13	23-28
		52.0	126-154	243-297	12-14	19-23	113-138	328-400	7- 9	24-29
	70	28.0	136-166	291-355	20-25	17-21	120-147	334-408	12-15	25-31
		52.0	130-159	273-334	12-14	18-22	126-154	342-418	8-10	27-32
	80	28.0	140-171	328-401	20-24	17-20	131-161	348-425	14-17	27-34
		52.0	135-165	308-377	11-14	18-22	138-169	356-436	9-11	29-36
	90	28.0	145-177	369-451	20-24	16-20	144-176	362-442	15-18	30-37
		52.0	139-170	347-424	11-14	17-21	151-185	371-453	10-12	32-39
	100	28.0	149-183	415-508	19-24	16-19	—	—	—	—
		52.0	143-175	391-477	11-14	17-21	—	—	—	—
240/242	30	32.0	—	—	—	—	68- 84	256-313	5- 7	19-23
		64.0	—	—	—	—	73- 89	261-319	4- 5	20-25
	40	32.0	113-138	172-210	18-22	19-23	81- 99	277-339	7- 8	22-26
		64.0	110-134	161-196	12-14	20-24	86-105	283-346	5- 6	23-28
	50	32.0	116-142	206-252	17-21	19-23	93-114	299-365	8- 9	24-29
		64.0	112-137	193-236	12-14	19-24	99-121	305-373	6- 7	25-31
	60	32.0	118-145	241-294	17-21	18-23	106-129	321-392	9-11	26-32
		64.0	115-140	225-275	11-14	19-23	113-138	327-400	7- 8	28-34
	70	32.0	121-148	275-336	17-21	18-22	118-145	342-418	10-12	29-35
		64.0	117-143	257-314	11-14	19-23	126-154	349-427	8- 9	30-37
	80	32.0	123-151	309-378	16-20	18-22	131-160	364-444	11-14	31-38
		64.0	120-146	289-353	11-13	19-23	139-170	371-454	8-10	33-40
	90	32.0	126-154	344-420	16-20	18-22	143-175	385-471	12-15	33-41
		64.0	122-149	321-392	11-13	18-22	152-186	393-480	9-11	35-43
	100	32.0	128-157	378-462	16-19	17-21	—	—	—	—
		64.0	125-152	353-432	11-13	18-22	—	—	—	—

Table 6 — 50HQP,VQP Typical Unit Operating Pressures and Temperatures (cont)

50HQP, 50VQP UNIT SIZE	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) DB
300	30	45.0	—	—	—	—	68- 84	256-313	5- 7	19-23
		75.0	—	—	—	—	73- 89	261-319	4- 5	20-25
	40	45.0	117-143	210-256	15-19	21-26	81- 99	277-339	7- 8	22-26
		75.0	114-139	196-239	11-14	22-27	86-105	283-346	5- 6	23-28
	50	45.0	120-147	243-297	15-18	20-25	93-114	299-365	8- 9	24-29
		75.0	117-143	227-277	11-14	21-26	99-121	305-373	6- 7	25-31
	60	45.0	123-150	276-337	14-17	20-24	106-129	321-392	9-11	26-32
		75.0	119-146	258-315	11-13	21-25	113-138	327-400	7- 8	28-34
	70	45.0	126-154	309-378	14-17	19-24	118-145	342-418	10-12	29-35
		75.0	122-149	289-353	10-13	20-25	126-154	349-427	8- 9	30-37
	80	45.0	129-157	343-419	13-16	19-23	131-160	364-444	11-14	31-38
		75.0	125-153	320-391	10-12	19-24	139-170	371-454	8-10	33-40
	90	45.0	132-161	376-459	13-16	18-22	143-175	385-471	12-15	33-41
		75.0	128-156	351-429	10-12	19-23	152-186	393-480	9-11	35-43
	100	45.0	134-164	409-500	12-15	17-21	—	—	—	—
		75.0	131-160	382-467	9-11	18-22	—	—	—	—
360	30	50.0	—	—	—	—	65- 80	282-344	6- 7	14-17
		90.0	—	—	—	—	73- 89	294-359	3- 4	15-18
	40	50.0	121-148	184-225	17-21	18-22	80- 98	299-365	7- 9	16-20
		90.0	117-143	167-204	10-13	19-23	89-108	311-380	4- 5	17-21
	50	50.0	123-151	222-271	17-20	17-21	95-116	315-385	9-11	19-23
		90.0	119-145	202-247	10-12	18-23	105-128	329-402	5- 7	20-24
	60	50.0	125-153	260-318	16-19	17-21	109-133	332-406	11-13	21-26
		90.0	120-147	237-289	10-12	18-22	121-148	346-423	6- 8	22-27
	70	50.0	127-155	298-365	15-19	17-20	124-151	349-427	12-15	23-28
		90.0	122-149	271-331	9-11	18-21	138-168	364-444	7- 9	25-30
	80	50.0	129-158	336-411	14-18	16-20	138-169	366-447	14-17	26-31
		90.0	124-152	306-374	9-11	17-21	154-188	381-466	8-10	27-33
	90	50.0	131-160	374-458	14-17	16-19	153-187	383-468	16-19	28-34
		90.0	126-154	340-416	8-10	17-20	170-208	399-487	9-12	29-36
	100	50.0	133-162	413-504	13-16	15-19	—	—	—	—
		90.0	128-156	375-458	8-10	16-20	—	—	—	—

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 flow of 1.5 to 2 gpm is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications.

An alternative method is to install a flow control device. These devices are typically an orifice of plastic material designed to allow a specified flow rate that are mounted on the outlet of the water control valve. Occasionally these valves produce a velocity noise that can be reduced by applying some back pressure. To accomplish this, slightly close the leaving isolation valve of the well water setup.

⚠ 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, final purging and loop charging is needed. 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, only a 1 to 2 in. level drop will be noticed 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.

1. Repeat this procedure until all air is purged.
2. 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 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.

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 alcohols from fuming.

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

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

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

LEGEND

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

NOTE: Volume of heat exchanger is approximately 1.0 gallon.

Table 8 — Antifreeze Percentages by Volume

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (F)			
	10	15	20	25
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15
Ethanol (%)	29	25	20	14

Cooling Tower/Boiler Systems

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

Ground Coupled, Closed Loop and Plateframe Heat Exchanger Well Systems

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

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 Aquazone™ Complete C Control

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.

HEATING STAGE 2

To enter Stage 2 mode (units equipped with 2 step compressor or with two compressors only), terminal Y2 is active (Y is already active). Also, the G terminal must be active or the W terminal is disregarded. The compressor relay will remain on and EH1 is immediately turned on. EH2 will turn on after 10 minutes of continual stage 2 demand.

LOCKOUT MODE

The status LED will flash fast in Lockout mode and the compressor relay will be turned off immediately. Lockout mode can be “soft” reset via the Y input or can be reset via the disconnect depending on the DIP switch settings. The last fault causing the lockout is stored in memory and can be viewed by entering test mode.

LOCKOUT WITH EMERGENCY HEAT

While in Lock-out mode, if W becomes active, then Emergency Heat mode will occur.

EMERGENCY HEAT

In Emergency Heat mode, terminal W is active while terminal Y is not. Terminal G must be active in the 50HQP,VQP units; the fan will be run if W is energized. EH1 is immediately turned on. EH2 will turn on.

Units with Aquazone Deluxe D Control

STANDBY/FAN ONLY

The compressor will be off. The Fan Enable, Fan Speed, and reversing valve (RV) relays will be on if inputs are present.

NOTE: DIP switch 5 on S1 does not have an effect upon Fan 1 and Fan 2 outputs.

HEATING STAGE 1

In Heating Stage 1 mode, the Fan Enable and Compressor relays are turned on immediately. Once the demand is removed, the relays are turned off and the control reverts to Standby mode.

EMERGENCY HEAT

In Emergency Heat mode, the Fan Enable and Fan Speed relays are turned on. The EH1 output is turned on immediately.

COOLING STAGE 2

In Cooling Stage 2 mode, the Fan Enable, compressor and RV relays remain on. The Fan Speed relay is turned on immediately and turned off immediately once the Cooling Stage 2 demand is removed. The control reverts to Cooling Stage 1 when the thermostat removes all Y2 call.

Retry Mode

In Retry mode, the status LED will flash the code for the corresponding fault. If the fault clears and the thermostat call (Y) is still present the Complete C or Deluxe D control will run the compressor once the ASC (anti-short cycle) timer has expired and will try to satisfy the call. If the call is satisfied, the unit will resume its normal operation.

If 2 or 4 consecutive faults occur (depending on the DIP switch setting) within 1 hour, the controller will lock the compressor operation out and will flash the alarm code on the status LED as well as alarm dry contact output. When the Complete C or Deluxe D control enters lockout mode, the alarm will also be shown on the panel mounted LED.

Units with WSHP Open Controls with UPM Board

Units with WSHP Open still feature a UPM board (see Fig. 32) for unit operation, so the operation will be similar to the sequence for the Complete C and Deluxe D package. WSHP Open does feature advanced functionality, such as automatic fan speed control and intelligent alarming, which will differ from the Complete C and Deluxe D packages. Below is an overview of the different features for the WSHP Open controls. For more details of the WSHP Open operation, please refer to the WSHP Open Integration Guide and the WSHP Points/Properties Manual.

COOLING

The control will operate 1 or 2 stages of compression to maintain the desired cooling setpoint. To improve dehumidification and reduce noise, the control operates the fan at the lowest speed possible to satisfy the load conditions. If cooling is active and should the SAT approach the minimum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient and if the SAT falls further (equal to the minimum SAT limit), the fan will be indexed to the maximum speed. If the SAT still continues to fall 5 degrees below the minimum SAT limit, all cooling stages will be disabled.

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

REVERSE CYCLE HEATING

The control will operate 1 or 2 stages of compression to maintain the desired heating setpoint. To reduce noise, the control operates the fan at the lowest speed possible. If the heating is active and should the SAT approach the maximum SAT limit, the fan will be indexed to the next higher speed. Should this be insufficient, then if the SAT rises further and reaches the Maximum Heating SAT limit, the fan will be indexed to the maximum speed. If the SAT still continues to rise 5°F above the maximum limit, all heating stages will be disabled.

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

TWO POSITION OA DAMPER

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

MODULATING OA DAMPER WITH DCV

The control can be configured to operate a modulating ventilation damper during occupied periods that responds to changing CO₂ levels from an optional sensor. The control monitors the CO₂ level and compares it to the configured setpoints and adjusts the ventilation rate as required. The control provides proportional ventilation to meet the requirements of ASHRAE specifications by providing a base ventilation rate and then increasing the rate as the CO₂ level increases. The control has 3 user adjustable setpoints; start ventilation, maximum ventilation, and maximum damper position. The control will begin to proportionally increase ventilation when the CO₂ level rises above the start ventilation setpoint and will reach the full ventilation rate (maximum damper position) when the CO₂ level is at or above the maximum setpoint. A user configurable minimum damper position insures that proper base ventilation is delivered when occupants are not present.

AUXILIARY MODULATING HOT WATER / STEAM HEATING REHEAT

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

TWO-POSITION HOT WATER/STEAM HEATING REHEAT

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

SINGLE STAGE ELECTRIC AUXILIARY HEAT

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

AUTOMATIC FAN SPEED CONTROL

The control is capable of controlling up to 3 fan speeds. The motor will operate at the lowest speed possible to provide quiet and efficient fan operation. The motor will increase speed if additional cooling or heating is required to maintain the desired space temperature setpoint. The control increases the motor's speed by one step for each 2°F above the cooling or below the heating setpoint. Also, the control will increase the fan speed as the Supply Air Temperature approaches the configured minimum or maximum limits. Fan speed for PSC motors is controlled by energizing and de-energizing low, medium and high speed relays. Fan speed for ECMs is controlled by first energizing the low speed tap. If a higher speed is required, the low speed tap remains energized while the medium speed tap is also energized. If high motor speed is required, all 3 speed taps are energized. If more than one speed tap is energized for an ECM, the ECM will default to the higher speed.

FAN SPEED CONTROL - DURING HEATING

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

FAN SPEED CONTROL - DURING COOLING

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

MODULATING WATER ECONOMIZER CONTROL

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

COOLING

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

HEATING

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

TWO-POSITION WATER ECONOMIZER CONTROL

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

COOLING

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

HEATING

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

POWER FAIL RESTART DELAY

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

SUPPLY AIR TEMPERATURE MONITORING/CONTROL/ALARM

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

DEHUMIDIFICATION

The control can monitor the space relative humidity and if the unit is equipped with the factory installed hot gas reheat, whenever the humidity exceeds the appropriate (occupied or unoccupied) humidity setpoint and if the unit is not heating or cooling, the control will activate cooling (compressor and reversing valve) and the hot gas reheat outputs to start dehumidification. The fan will operate at medium speed if equipped with a 3-speed fan.

SPACE TEMPERATURE ALARMS

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

CONDENSER WATER TEMPERATURE MONITORING/CONTROL/ALARM

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

HIGH CONDENSATE / OVERFLOW ALARM

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

FILTER STATUS ALARM

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

COMPRESSOR FAULT/LOCKOUT ALARM

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

INSUFFICIENT VENTILATION ALARM

The control provides the ability to generate a high CO₂ level alarm during occupied periods whenever the CO₂ sensor value exceeds the user adjustable limit. Whenever an occupancy transition from unoccupied to occupied occurs, or the occupied alarm limit is changed to a value that causes an alarm condition to occur, the control will automatically calculate an alarm delay based on the error from setpoint (15 minutes minimum). This prevents nuisance alarms from occurring when occupancy changes. The IAQ alarm can be disabled by setting 'Occupied High IAQ Alarm Limit' to zero.

RELATIVE HUMIDITY ALARM

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

TIME SCHEDULES

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

HOLIDAY SCHEDULES

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

OVERRIDE SCHEDULES

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

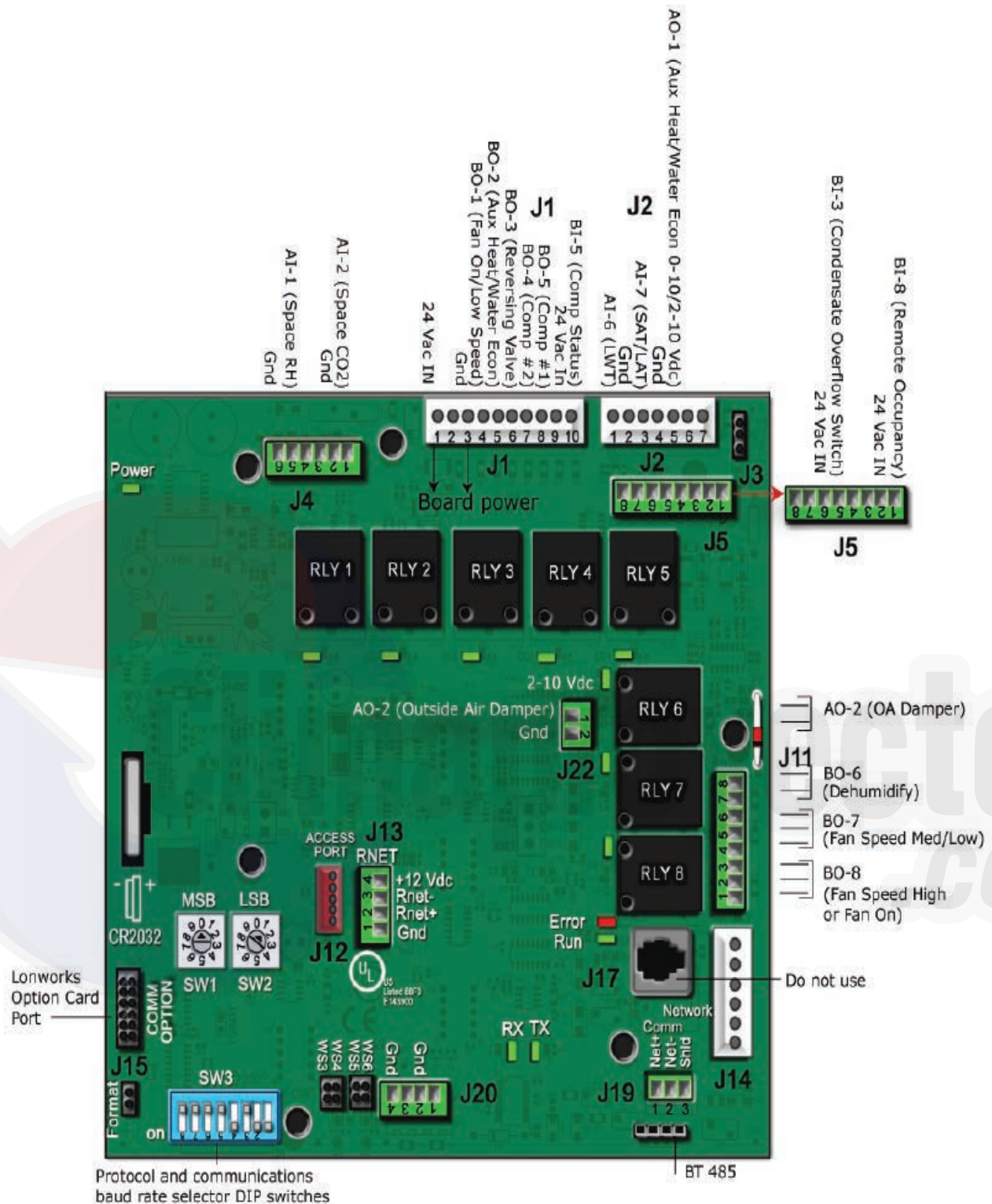


Fig. 32 — WSHP Open Controls with UPM Board

SERVICE

Perform the procedures outlined below periodically, as indicated.

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.

IMPORTANT: 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.

⚠ CAUTION

To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians which 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

Filters must be clean for maximum performance. Inspect filters every month under normal operating conditions. replace when necessary.

IMPORTANT: Units should never be operated without a filter.

Water Coil

Keep all air out of the water coil. Check open loop systems to be sure the well head is not allowing air to infiltrate the water line. Always keep lines airtight.

Inspect heat exchangers regularly, and clean more frequently if the unit is located in a "dirty" environment. The heat exchanger should be kept full of water at all times. Open loop systems should have an inverted P trap placed in the discharge line to keep water in the heat exchanger during off cycles. Closed loop systems must have a minimum of 15 psig during the summer and 40 psig during the winter.

Check P trap frequently for proper operation.

IMPORTANT: To avoid fouled machinery and extensive unit clean-up, DO NOT operate units without filters in place. DO NOT use equipment as a temporary heat source during construction.

Condensate Drain Pans

Check condensate drain pans for algae growth twice a year. If algae growth is apparent, consult a water treatment specialist for proper chemical treatment. The application of an algicide every 3 months will typically eliminate algae problems in most locations.

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.

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. 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. Failure to follow these safety precautions could result in personal injury or equipment or property damage.

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. 33.

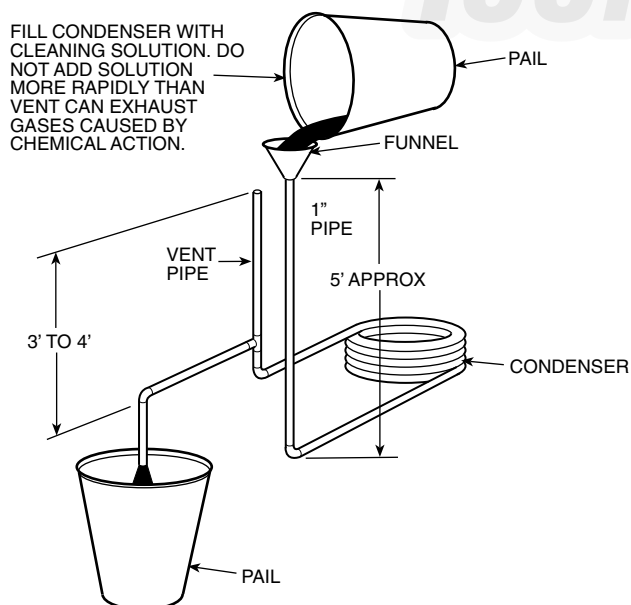


Fig. 33 — Gravity Flow Method

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. 34. Regulate flow to condenser with a supply line valve. If pump is a non-overloading 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.

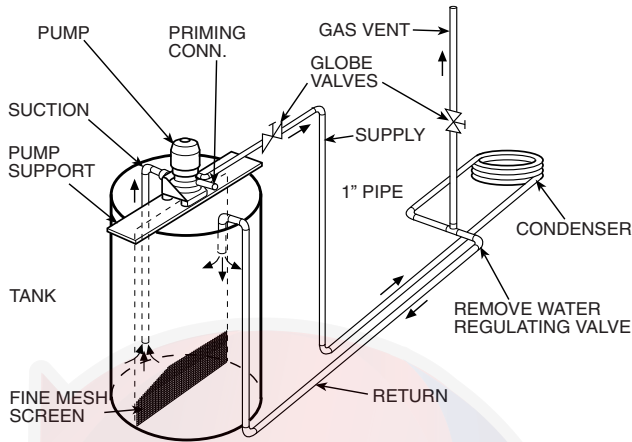


Fig. 34 — Forced Circulation Method

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.

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.

Motor power wires need to be disconnected 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 and see Table 9:

Thermistor

A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage. See Fig. 35 for thermistor nominal resistance.

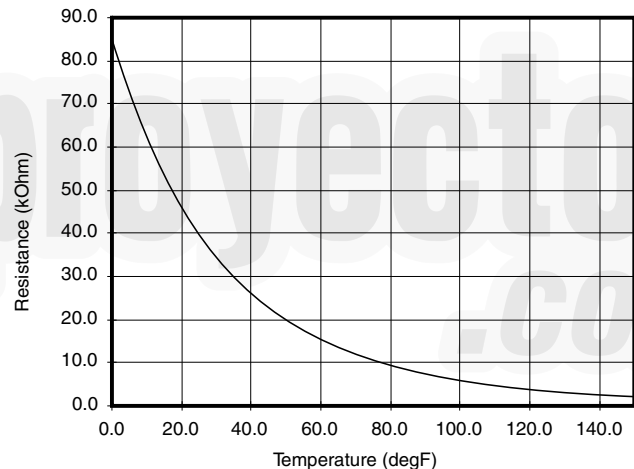


Fig. 35 — Thermistor Nominal Resistance

Table 9 — Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
ENTIRE UNIT DOES NOT RUN	Power supply off	Apply power, close disconnect
	Blown fuse	Replace fuse or reset circuit breaker. Check for correct fuses.
	Voltage supply low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Thermostat	Set the fan to "ON", the fan should run. Set thermostat to "COOL" and lowest temperature setting, the unit should run in the cooling mode (reversing valve energized). Set unit to "HEAT" and the highest temperature setting, the unit should run in the heating mode. If neither the blower or compressor run in all three cases, the thermostat could be mis-wired or faulty. To ensure mis-wired or faulty thermostat verify 24 volts is available on the condensing section low voltage terminal strip between "R" and "C", "Y" and "C", and "O" and "C". If the blower does not operate, verify 24 volts between terminals "G" and "C" in the air handler. Replace the thermostat if defective.
BLOWER OPERATES BUT COMPRESSOR DOES NOT	Thermostat	Check setting, calibration, and wiring.
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor.
	Safety controls	Check Complete C/Deluxe D board red default LED for Blink Code
	Compressor overload open	If the compressor is cool and the overload will not reset, replace compressor.
	Compressor motor grounded	Internal winding grounded to the compressor shell. Replace compressor. If compressor burnout, install suction filter drier.
UNIT OFF ON HIGH PRESSURE CONTROL	Compressor windings open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor.
	Discharge pressure too high	In "COOLING" mode: Lack of or inadequate water flow. Entering water temperature too warm. Scaled or plugged condenser. In "HEATING" mode: Lack of or inadequate airflow. Blower inoperative, clogged filter or restrictions in ductwork.
	Refrigerant charge	The unit is overcharged with refrigerant. Recover refrigerant, evacuate and recharge with factory recommended charge.
UNIT OFF ON LOW PRESSURE CONTROL	High pressure	Check for defective or improperly calibrated high pressure switch.
	Suction pressure too low	In "COOLING" mode: Lack of or inadequate air flow. Entering air temperature too cold. Blower inoperative, clogged filter, or restrictions in ductwork. In "HEATING" mode: Lack of or inadequate water flow. Entering water temperature too cold. Scaled or plugged condenser.
	Refrigerant charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacuate and recharge with factory recommended charge.
UNIT SHORT CYCLES	Low pressure switch	Check for defective or improperly calibrated low-pressure switch.
	Unit oversized	Recalculate heating and or cooling loads.
	Thermostat	Thermostat installed near a supply air grille, relocate thermostat. Readjust heat anticipator.
INSUFFICIENT COOLING OR HEATING	Wiring and controls	Loose connections in the wiring or a defective compressor contactor.
	Unit undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem.
	Loss of conditioned air by leaks	Check for leaks in ductwork or introduction of ambient air through doors or windows.
	Airflow	Lack of adequate airflow or improper distribution of air. Replace dirty filter.
	Refrigerant charge	Low on refrigerant charge causing inefficient operation.
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing valve	Defective reversing valve creating bypass of refrigerant from discharge to suction side of compressor. Replace reversing valve.
	Operating pressures	Compare unit operating pressures to the pressure / temperature chart for the unit.
	TXV/Capillary Tube	Check for possible restriction or defect. Replace if necessary.
LEGEND	Moisture, noncondensables	The refrigerant system may be contaminated with moisture or noncondensables. Recover refrigerant, evacuate and recharge with factory recommended charge. Note: a liquid line drier may be required.

LEGEND

LED — Light Emitting Diode
TXV — Thermostatic Expansion Valve



**50HQP,VQP
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 Instructions.

I. PRELIMINARY INFORMATION

CUSTOMER: _____
JOB NAME: _____
MODEL NO.: _____
SERIAL NO.: _____
DATE: _____

II. 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) _____

III. 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

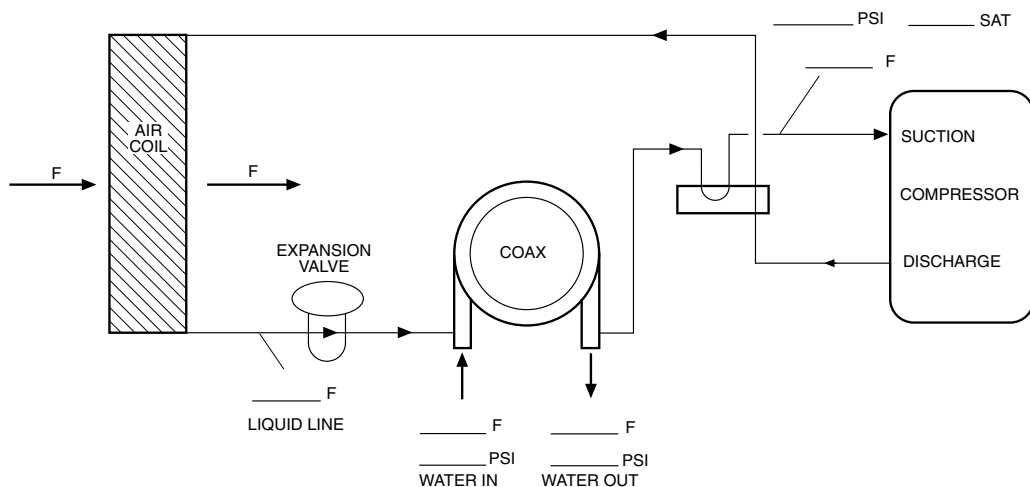
IS CONTROL VOLTAGE ABOVE 21.6 VOLTS? (Y/N) _____.
IF NOT, CHECK FOR PROPER TRANSFORMER CONNECTION.

TEMPERATURES

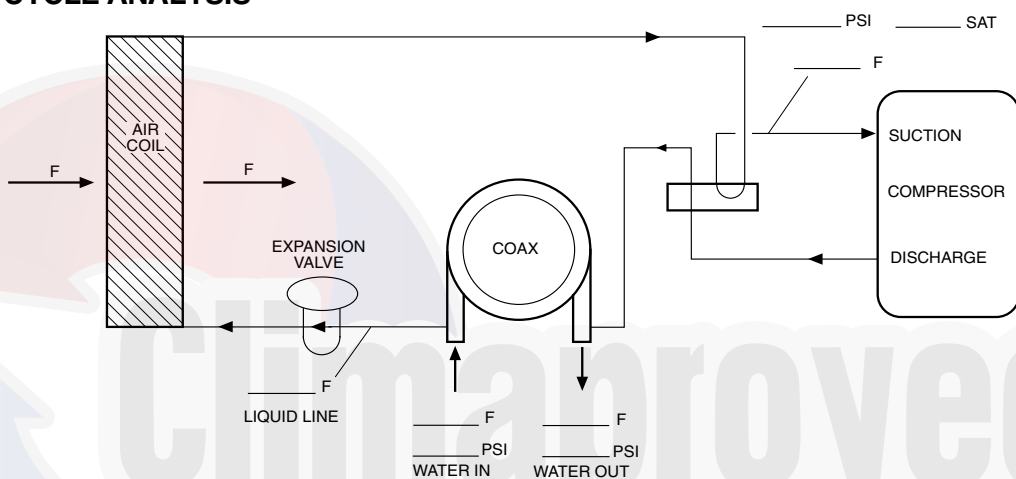
FILL IN THE ANALYSIS CHART ATTACHED.

COAXIAL HEAT EXCHANGER	COOLING CYCLE:	_____ F	FLUID OUT	_____ F	_____ PSI	_____ FLOW
	FLUID IN					
AIR COIL	HEATING CYCLE:					
	FLUID IN	_____ F	FLUID OUT	_____ F	_____ PSI	_____ FLOW
	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