Carrier

Aquazone™
50PSW025-420
Water-to-Water Source Heat Pump
with Puron® Refrigerant (R-454B)

Installation, Start-Up, and Service Instructions

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50PSW START-UP CHECKLIST. CL-1

IMPORTANT: Read the entire instruction manual before starting installation.

SAFETY CONSIDERATIONS

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

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

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

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly an d follow all warnings or cautions attached to the unit. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.

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

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.

⚠WARNING

WARNING: RISK OF FIRE

Flammable Refrigerant Used — To be repaired only by trained service personnel. DO NOT puncture refrigerant tubing.

⚠WARNING

PERSONAL INJURY HAZARD

Do not use means to accelerate the defrosting process or to clean, unless recommended in these instructions.

⚠WARNING

PERSONAL INJURY HAZARD

Do not pierce or burn refrigerant lines. Be aware that refrigerants may not contain an odor.

⚠WARNING

WARNING: RISK OF FIRE

Flammable Refrigerant Used — Dispose of properly in accordance with federal or local regulations.

⚠WARNING

WARNING: RISK OF FIRE

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

⚠CAUTION

PERONAL INJURY HAZARD

Installation of auxiliary electric heaters in connecting ductwork must adhere to Carrier-approved models exclusively. Carrier bears no responsibility for the installation of any alternative auxiliary devices installed in the field.

⚠WARNING

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation and service. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

⚠CAUTION

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

GENERAL

The Aquazone™ 50PSW water source heat pump (WSHP) is a single-package vertically mounted unit with electronic controls designed for year-round cooling and heating.

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

INSTALLATION

Step 1 — Check Jobsite

Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Table 1 for unit physical data. See Fig. 1 for model number nomenclature. Refer to Fig. 2-4 for overall unit dimensions.

Units are designed for indoor installation only. Be sure to allow adequate space around the unit for servicing. See Fig. 5 for service clearances.

These units are not approved for outdoor installation and must be installed indoors in the structure being conditioned. Do not locate in areas where ambient conditions are not maintained within 40 to 100°F.

IMPORTANT: It is the installing contractors responsibility to ensure that all equipment is installed with proper access for services, start-up, installation of accessories, configuration of control and other components, and equipment removal in accordance with Carrier's recommended service clearances and installation instructions. Please refer to the Carrier Commercial WSHP Warranty Statement (document number 04-570008-01) for details on warranty exclusions regarding equipment, access, removal and clearances.

⚠ CAUTION

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

Step 2 — Check Unit

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 jobsite, it should be left in its shipping carton and stored in a clean, dry area between 50 and 95°F. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units a maximum of 3 cartons high. Do not remove any equipment from its shipping package until it is needed for installation.

INSPECT UNIT

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

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Verify that the unit is the correct model for the entering water temperature of the job.
3. Be sure the location chosen for unit installation provides ambient temperatures maintained above freezing. Well water applications are especially susceptible to freezing.
4. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.

   NOTE: A sound control accessory package may be used to help eliminate sound in sensitive spaces.
5. Provide sufficient access to allow maintenance and servicing of the compressor and coils.
6. Wait to remove the packaging until the unit is ready for installation.
7. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
8. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
9. Loosen bolts and remove shipping clamps on compressors equipped with external spring vibration isolators. Compressors are internally spring-mounted.
10. Locate and verify any accessory kit located in compressor section.
11. Remove any access panel screws that may be difficult to remove once unit is installed.

PROTECTION

Once the units are properly positioned on the jobsite, they must be covered with either a shipping carton, vinyl film, or an equivalent protective covering. Open ends of pipes stored on the jobsite must be capped. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc., is not yet complete. Foreign material that is allowed to accumulate within the units can prevent proper start-up and necessitate costly clean-up operations.

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

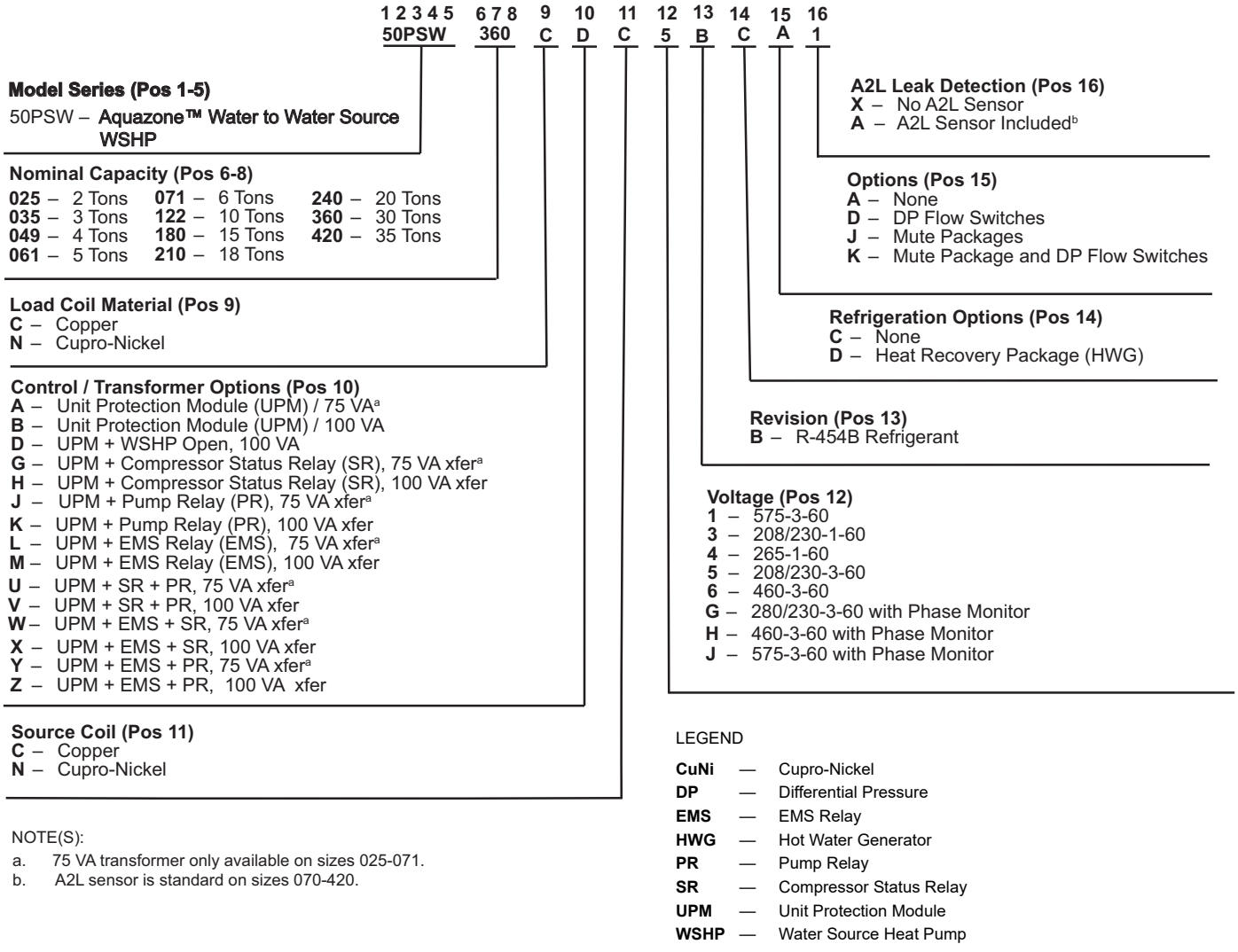
⚠ CAUTION

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

Step 3 — Locate Unit

The following guidelines should be considered when choosing a location for the WSHP:

- Units are for indoor use only.
- Provide sufficient space for water and electrical connections.
- Locate unit in an area that allows for easy access and removal of access panels.
- Allow enough space for service personnel to perform maintenance.



NOTE(S):

a. 75 VA transformer only available on sizes 025-071.
b. A2L sensor is standard on sizes 070-420.

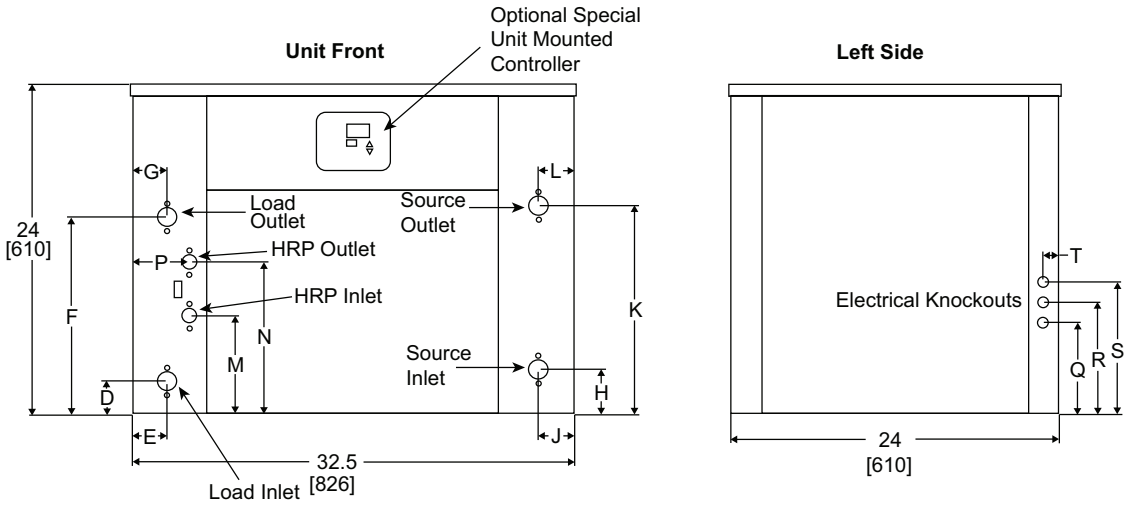
LEGEND

CuNi	—	Cupro-Nickel
DP	—	Differential Pressure
EMS	—	EMS Relay
HWG	—	Hot Water Generator
PR	—	Pump Relay
SR	—	Compressor Status Relay
UPM	—	Unit Protection Module
WSHP	—	Water Source Heat Pump

Fig. 1 — Model Number Nomenclature

Table 1 — 50PSW025-420 Physical Data

50PSW SERIES	025	035	049	061	071	122	180	210	240	360	420
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Compressor Qty (ckts)	1	1	1	1	1	2	1	1	2	2	2
Max Water Working Pressure (psig/kPa)	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100	450/3100
Water Connection Size											
FPT	3/4"	3/4"	1"	1"	1"	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"
Coaxial Coil Volume (gal)	0.49	0.49	0.64	0.77	1.05	1.00	3.31	3.31	1.00	3.31	3.31
Refrigeration Charge (oz/ckt)	49	46	50	60	74	71	238	224	150	236	216
Weight - Operating (lb)	240	250	280	310	430	720	850	890	1230	1550	1700
Weight - Shipping (lb)	260	270	300	330	450	740	870	910	1260	1580	1730



NOTE: Dimensions in inches [mm].

UNIT SIZE	DIMENSIONS (INCHES)[a]															FIELD CONN.[b]	HRP CONN.
	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T		
025	2.20	1.70	13.20	1.70	3.75	1.50	14.25	1.95	7.15	11.00	4.25	6.55	8.05	9.55	1.25	3/4	1/2
035	2.30	2.30	14.30	2.50	3.70	2.55	15.7	2.55	7.15	11.00	4.25	6.55	8.05	9.55	1.25	3/4	1/2
049	2.30	2.10	14.30	2.65	2.75	2.65	14.75	2.65	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2
061	2.80	1.38	14.80	2.63	2.51	2.00	14.38	3.40	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2
071	3.00	2.25	17.25	2.25	3.25	2.25	17.00	2.25	7.15	11.00	4.25	6.55	8.05	9.55	1.25	1	1/2

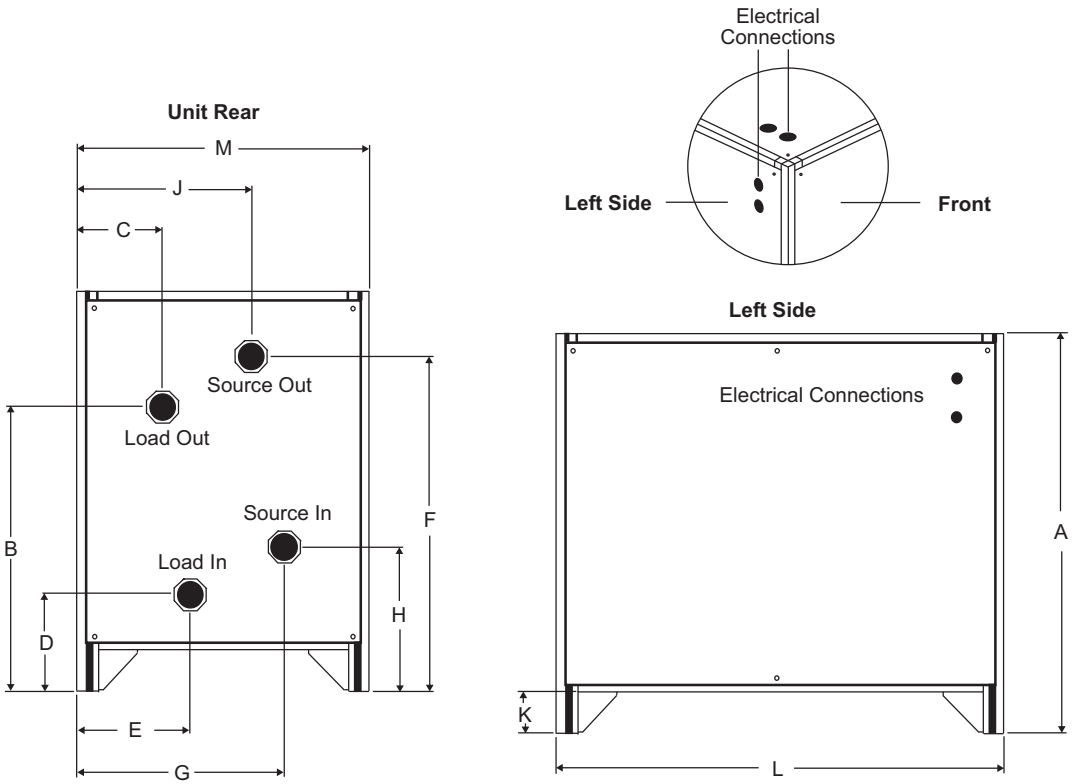
NOTE(S):

a. All dimensions are within ± 0.125 in. Specifications subject to change without notice.
b. Refers to both load and source fluid connections.

LEGEND

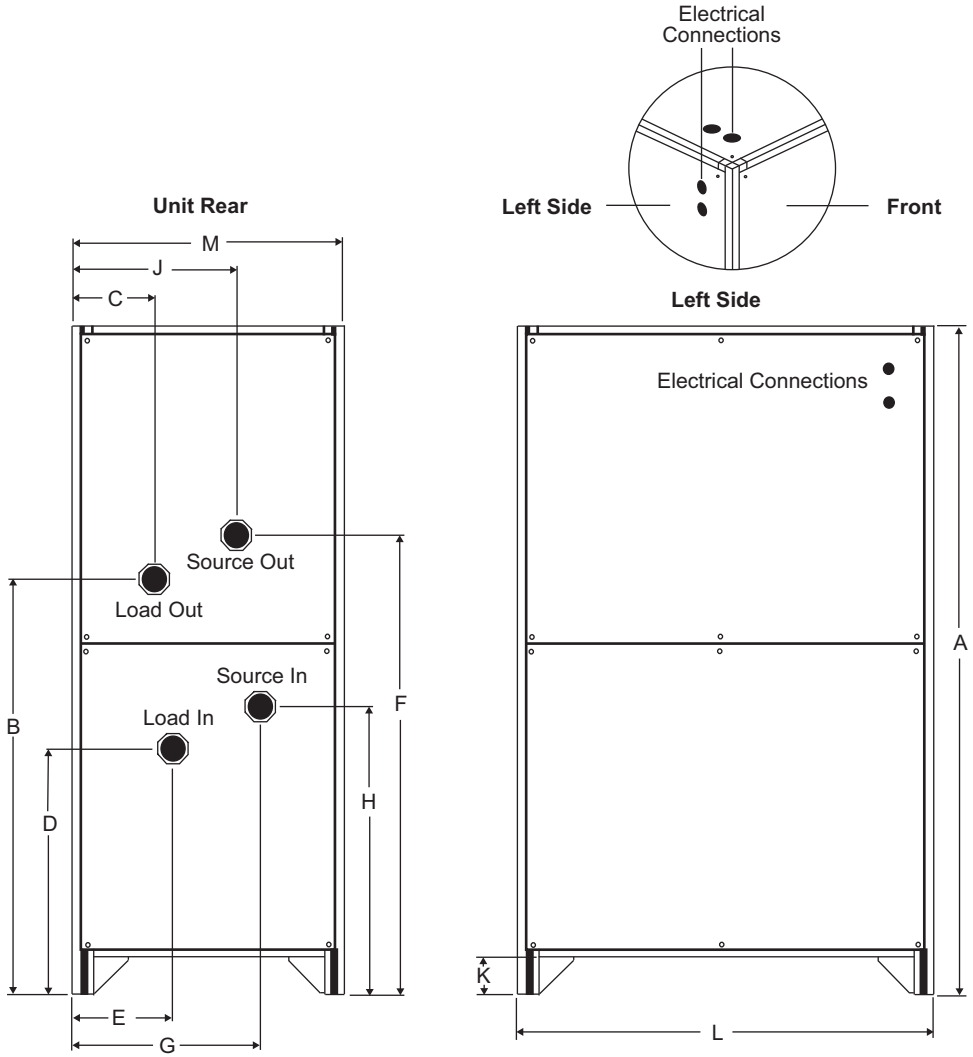
HRP — Heat Recovery Package

Fig. 2 — 50PSW025-071 Unit



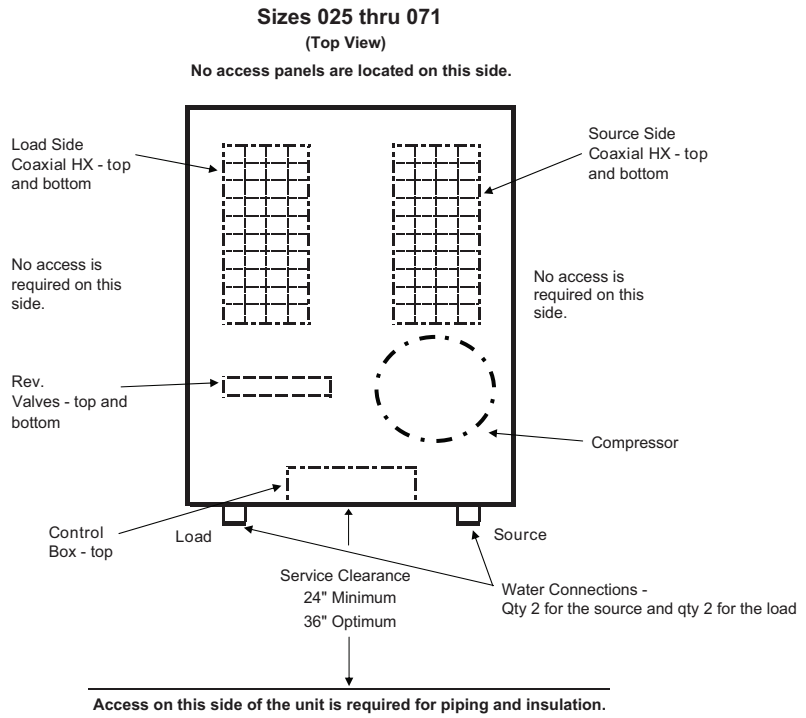
UNIT SIZE	DIMENSIONS (INCHES)												WATER CONN. (FPT)
	A	B	C	D	E	F	G	H	J	K	L	M	
122	37.5	27.62	8.5	8.37	10.5	32.25	19.5	13.5	17.5	3.5	46	28	1-1/4
180	37.5	27.62	4.5	8.37	10.5	32.25	23.5	13.5	17.5	3.5	46	28	1-1/2
210	37.5	27.62	4.5	8.37	10.5	32.25	23.5	13.5	17.5	3.5	46	28	1-1/2

Fig. 3 — 50PSW122-210 Unit

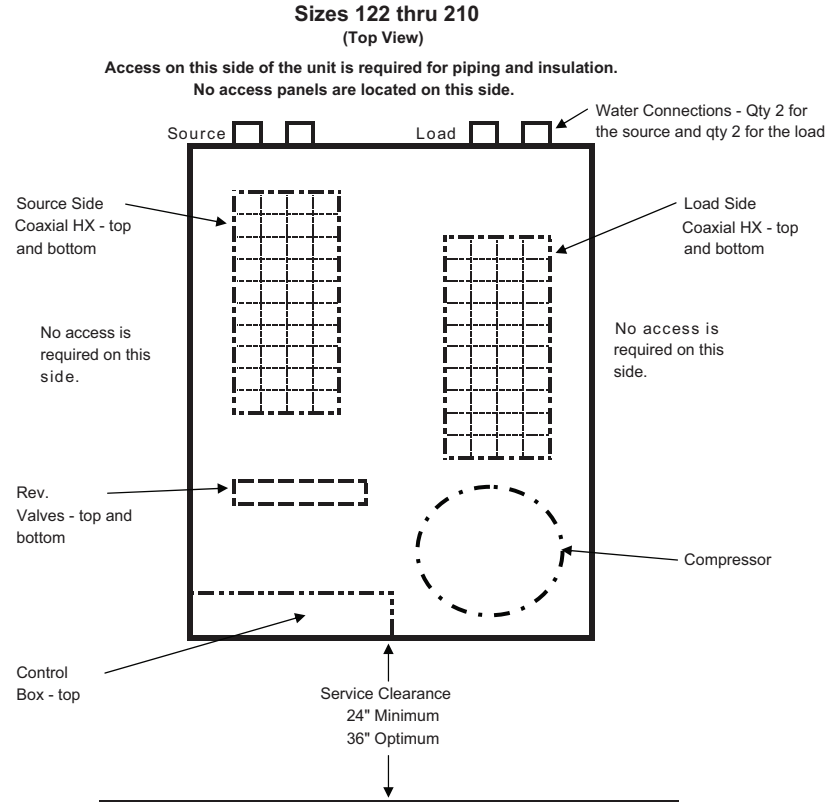


UNIT SIZE	DIMENSIONS (INCHES)												WATER CONN. (FPT)
	A	B	C	D	E	F	G	H	J	K	L	M	
240	70	43.5	8.5	24.5	10.5	48.5	19.5	29.25	17.5	3.5	46	28	2
360	70	43.5	4.5	24.5	10.5	48.5	23.5	29.25	17.5	3.5	46	28	2
420	70	43.5	4.5	24.5	10.5	48.5	23.5	29.25	17.5	3.5	46	28	2

Fig. 4 — 50PSW240-420 Unit



NOTE: Any work required to gain full access to the unit for repair or service is not covered under the scope of the product warranty.



NOTE: Any work required to gain full access to the unit for repair or service is not covered under the scope of the product warranty.

Fig. 5 — Service Clearances

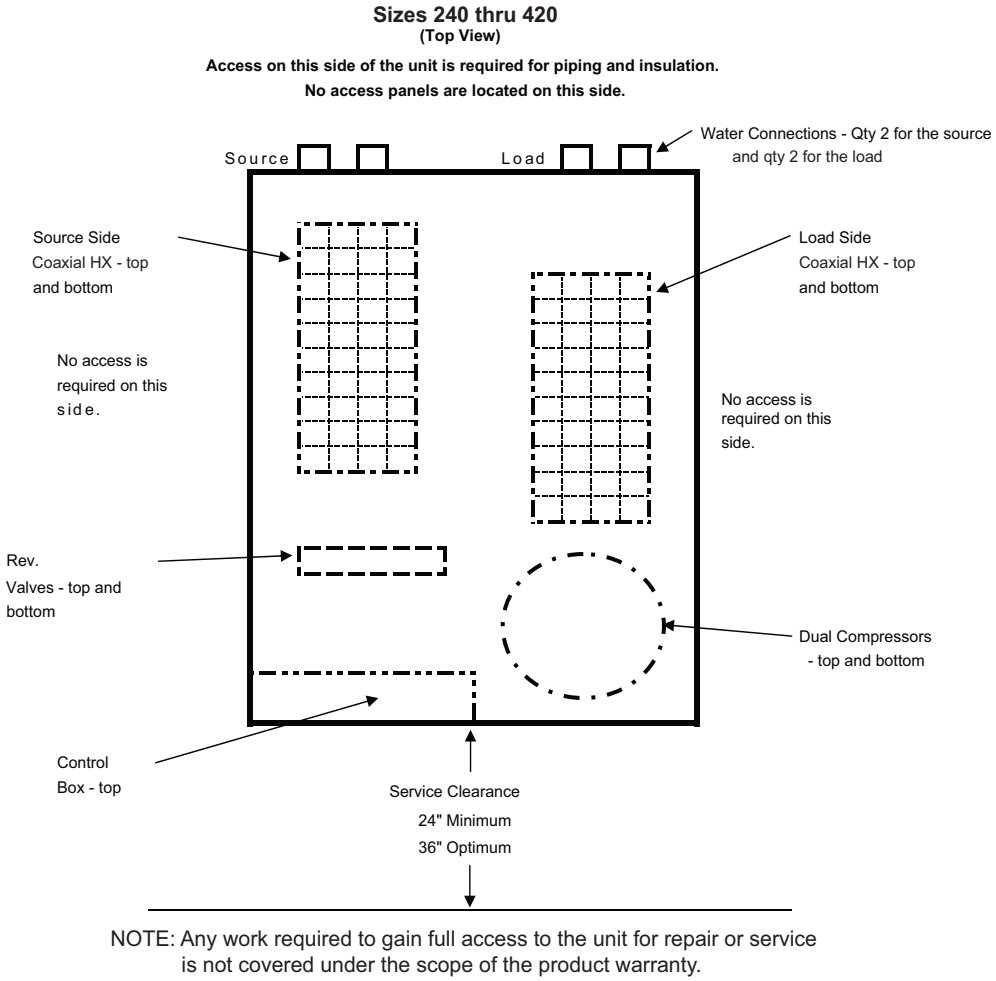


Fig. 5 — Service Clearances (cont)

Step 4 — Mount Unit

The Water-to-Water series 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.

Step 5 — Connect Piping

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. The water-to-water series units are supplied with either a copper or optional cupro-nickel condenser. Should your well driller express concern regarding the quality of the well water available or should any known hazards exist in your area, Carrier recommends 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 cupro-nickel heat exchanger is recommended.

⚠ CAUTION

Galvanized pipe or fittings are not recommended for use with these units due to the possible galvanic corrosion.

Both the supply and discharge water lines will sweat if subject 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.

⚠ CAUTION

Improper heat exchanger fluid flow due to piping, valving or improper pump operation is hazardous to the unit and constitutes abuse which will void the heat exchanger and compressor warranty.

Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult the specification sheets for sizes. Thread sealant should be used when connecting water piping connections to the units to ensure 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 flow balancing.

WATER SUPPLY AND QUALITY

Check water supply. Water supply should be plentiful and of good quality. See Table 2 for water quality guidelines.

IMPORTANT: Failure to comply with the above required water quality and quantity limitations and the closed-system application design requirements may cause damage to the tube-in-tube heat exchanger that is not the responsibility of the manufacturer.

In all applications, the quality of the water circulated through the heat exchanger must fall within the ranges listed in the Water Quality Guidelines table. Consult a local water treatment firm, independent testing facility, or local water authority for specific recommendations to maintain water quality within the published limits.

INSTALLATION OF HOT WATER GENERATOR OPTION (ONLY 025-71 SIZES)

The hot water generator (HWG) or Heat recovery package (HRP) is a factory-installed option capable of providing hot water in the range of 110 to 140°F as a supplemental domestic hot water source. The HWG is a desuperheater that uses recovered heat from the hot discharge gas leaving the compressor. Included with the HWG is a vented, double wall coil, circulating pump, high water temperature limit switch (set at 120°F), discharge gas temperature limit switch, and an ON/OFF switch with built-in circuit breaker. The generator operates independently and is not factory wired to the unit controller.

NOTE: The HWG will reduce the amount of heat available to the load side and it is recommended to deactivate the HWG in heating mode via the ON/OFF switch.

Water Tank Preparation

1. Turn off electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose outdoors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HWG water piping. All hot water piping should be a minimum of 3/8 in. OD copper tube to a maximum distance of fifteen feet. For distances beyond fifteen feet but not exceeding sixty feet use 1/2 in. copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8 in. wall closed cell insulation. Install isolation valves on supply and return to the hot water generator. See Fig. 6.

NOTE: Diagram is for illustration purposes only. Ensure access to heat pump is not restricted. All plumbing and piping connections must comply with local plumbing codes.

TYPICAL HOT WATER GENERATOR INSTALLATION

Water Tank Refill

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HWG by depressing the Schrader valve on the HR unit. Allow all air to bleed out until water appears at the valve.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of heat available from the refrigeration system and to conserve the most energy. On tanks with thermostats and both upper and lower elements, the lower element should be turned down to 100°F, while the upper element should be adjusted to 120°F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat, lower the thermostat setting to 120°F or the "LOW" position. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

Initial Start-Up

1. Turn on the heat pump. The circulating pump should not run if the compressor is not running.
2. Turn HWG switch to the "ON" position. The pump will operate if entering water temperature to HWG is below 120°F.
3. Ensure the temperature difference between the water entering and leaving the heat recovery is 5 to 15°F.
4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump should shut off when the water temperature entering the generator reaches 120°F.

COOLING TOWER/BOILER APPLICATION

To assure adequate cooling and heating performance, the cooling tower and boiler fluid loop temperature should be maintained between 50 and 100°F. In the cooling mode, heat is rejected from the unit into the condenser water loop. A cooling tower provides evaporative cooling to the loop water; 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. (See Fig. 7.)

In the heating mode, heat is absorbed from the condenser water loop to the unit. A boiler can be utilized to maintain the loop within the proper temperature range. In milder climates a "flooded tower" concept is often used. This concept involves adding make-up water to the cooling tower sump to maintain the desired loop temperature. No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove any 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.

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

WELL WATER SYSTEMS

Water quantity should be plentiful, between 1.5 and 2.5 gpm per ton of cooling, and of good quality. To avoid the possibility of freezing the well water should be above 50°F.

Water pressure must always be maintained in the heat exchanger by placing a water control valve on the outlet of the water-to-water unit. A bladder type expansion tank may be used to maintain pressure on the system.

Avoid using low voltage (24 volt) solenoids, using them may overload the unit transformer or interfere with the lock-out circuit.

Line voltage solenoids connected across the load side (T1, T2) of the compressor contactor are preferred.

Pilot operated or slow closing valves are recommended to reduce water hammer.

The discharge water from the water-to-water unit is not contaminated in any manner and can be disposed of in various ways depending on the local codes (i.e. discharge well, dry well, storm sewer, drain field, stream, pond, etc.).

EARTH COUPLED GEOTHERMAL SYSTEMS

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 the Ground Loop Pumping Package (GLP), makes the installation easy. Anti-freeze solutions are utilized when entering loop temperatures drop below 40°F or where piping will be routed through areas subject to freezing. A flow rate between 2.5 to 3.0 gpm per nominal ton of cooling is recommended for this application.

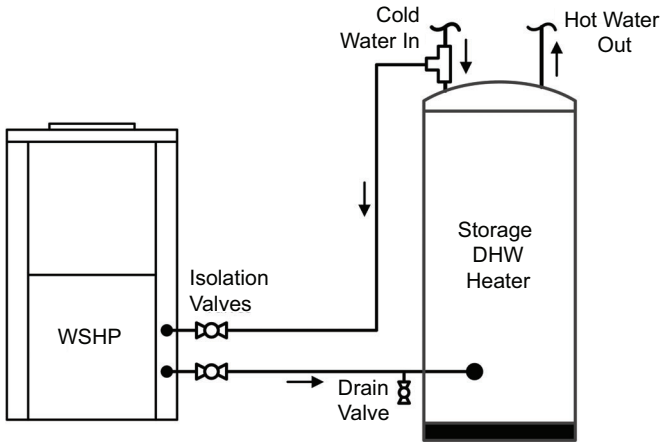
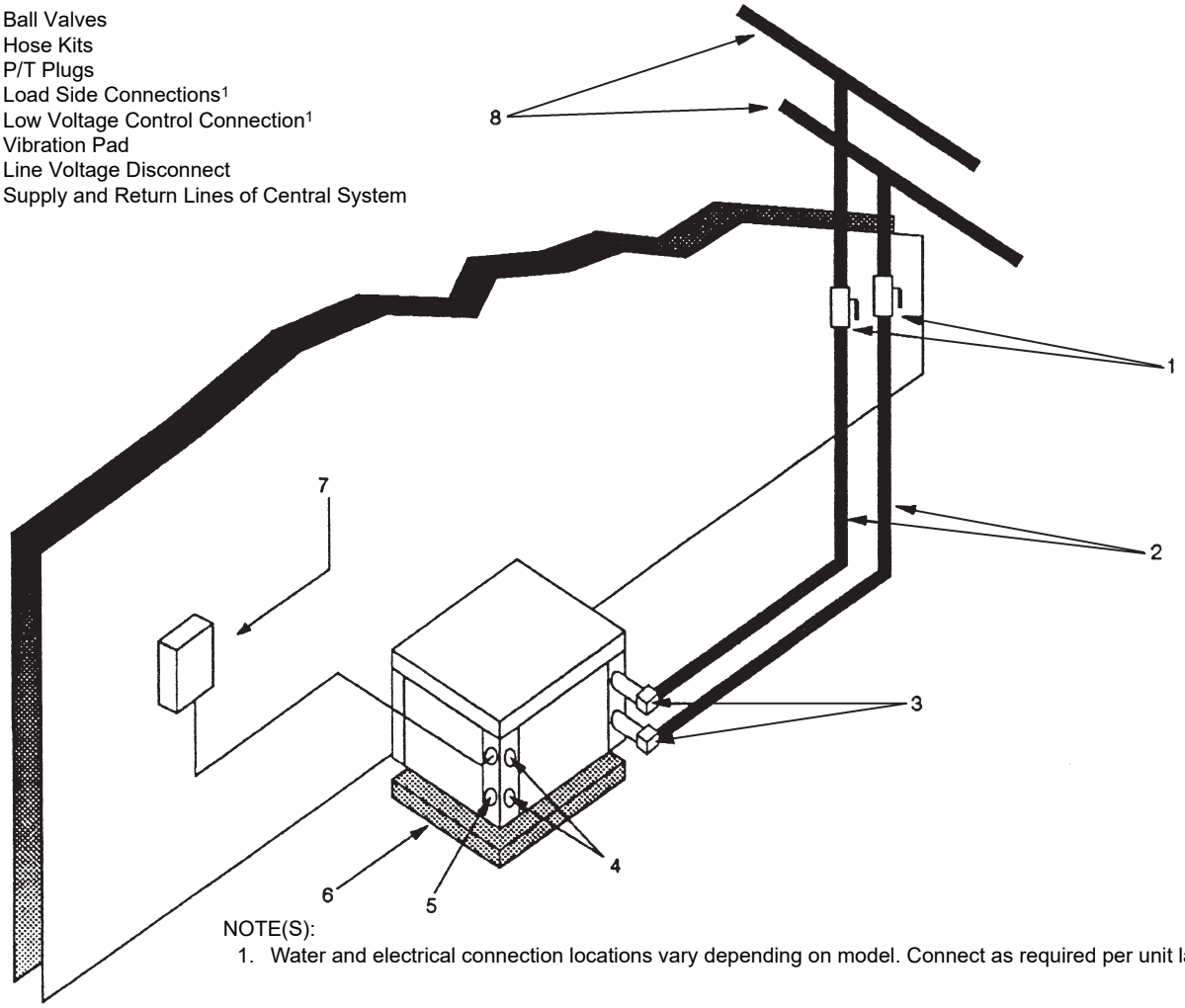


Fig. 6 — Typical Hot Water Generator Installation

1 — Ball Valves
2 — Hose Kits
3 — P/T Plugs
4 — Load Side Connections[1]
5 — Low Voltage Control Connection[1]
6 — Vibration Pad
7 — Line Voltage Disconnect
8 — Supply and Return Lines of Central System



NOTE(S):
1. Water and electrical connection locations vary depending on model. Connect as required per unit labels.

Fig. 7 — Typical Cooling Tower/Boiler Application (Source Side)

Table 2 — Water Quality Guidelines

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

NOTE(S):

a. Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.
b. Closed recirculating system is identified by a closed pressurized piping system.
c. Recirculating open wells should observe the open recirculating design considerations.
d. If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists. Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity can cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water registers a pH of 7.0. To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

LEGEND

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

Step 6 — Wire Field Power Supply

⚠ 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. Install lockout tag.

⚠ CAUTION

Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors. Failure to heed this warning could result in equipment damage.

All field wiring must comply with local and national fire, safety and electrical codes. Power to the unit must be within the operating voltage range indicated on the unit's nameplate. On three phase units, phases must be balanced within 2%.

Properly sized fuse or HACR (heating, air-conditioning, and refrigeration) circuit breakers must be installed for branch circuit protection. See equipment rating plate for maximum size.

The unit is supplied with an opening for attaching conduit. Be certain to connect the ground lead to the ground lug in the control box. Connect the power leads as indicated on the unit wiring diagram. See Table 3 and Fig. 8-18.

Table 3 — 50PSW Electrical Data[a]

50PSW UNIT SIZE	VOLTAGE/HZ/PH	VOLTAGE MIN/MAX	COMPRESSOR			TOTAL FLA	MCA	MOCP
			Quantity	RLA	LRA			
025	208-230/1/60	197/253	1	10.3	62.0	10.3	12.8	20
	265-277/1/60	239/291	1	7.8	52.0	7.8	9.8	15
	208-230/3/60	197/253	1	6.3	56.0	6.3	7.9	15
	460/3/60	414/506	1	3.8	29.0	3.8	4.7	15
035	208-230/1/60	197/253	1	14.6	90.0	14.6	18.2	30
	265-277/1/60	239/291	1	12.5	79.0	12.5	15.6	25
	208-230/3/60	197/253	1	9.9	82.0	9.9	12.3	20
	460/3/60	414/506	1	4.8	44.3	4.8	6.0	15
049	208-230/1/60	197/253	1	18.3	138.0	18.3	22.9	40
	208-230/3/60	197/253	1	11.9	112.0	11.9	14.9	25
	460/3/60	414/506	1	6.8	61.8	6.8	8.5	15
061	208-230/1/60	197/253	1	25.2	147.3	25.2	31.5	50
	208-230/3/60	197/253	1	13.8	161.0	13.8	17.2	30
	460/3/60	414/506	1	6.9	58.0	6.9	8.6	15
071	208-230/1/60	197/253	1	28.0	166.0	28.0	35.0	60
	208-230/3/60	197/253	1	18.9	162.3	18.9	23.6	40
	460/3/60	414/506	1	9.1	70.8	9.1	11.4	20
122	208-230/1/60	197/253	2	27.6	170.0	27.6	62.1	80
	208-230/3/60	197/253	2	19.2	156.5	19.2	43.2	60
	460/3/60	414/506	2	9.0	74.8	9.0	20.3	25
	575/3/60	518/632	2	7.7	47.8	7.7	17.3	25
180	208-230/3/60	197/253	1	40.8	270.0	40.8	51.0	90
	460/3/60	414/506	1	19.4	147.0	19.4	24.3	40
	575/3/60	518/632	1	13.7	109.0	13.7	17.1	30
210	208-230/3/60	197/253	1	49.0	386.3	49.0	61.3	110
	460/3/60	414/506	1	24.0	182.0	24.0	30.0	50
	575/3/60	518/632	1	19.2	131.0	19.2	24.0	40
240	208-230/3/60	197/253	2	33.3	255.0	33.3	74.9	100
	460/3/60	414/506	2	15.4	140.0	15.4	34.7	50
	575/3/60	518/632	2	12.9	107.6	12.9	29.0	40
360	208-230/3/60	197/253	2	40.8	270.0	40.8	91.8	125
	460/3/60	414/506	2	19.4	147.0	19.4	43.7	60
	575/3/60	518/632	2	13.7	109.0	13.7	30.8	40
420	208-230/3/60	197/253	2	49.0	386.3	49.0	110.3	150
	460/3/60	414/506	2	24.0	182.0	24.0	54.0	70
	575/3/60	518/632	2	19.2	131.0	19.2	43.2	60

NOTE(S):

a. Resistance value tolerance ± 7%. All resistance values must be measured with compressor at room temperature.

LEGEND

FLA — Full Load Amps
LRA — Locked Rotor Amp
RLA — Rated Load Amps
MCA — Minimum Circuit Amp
MOCP — Maximum Overcurrent Protection

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	LOAD FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	SOURCE FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GY	GRAY
GN	GREEN
OG	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW

FACTORY WIRE ————————

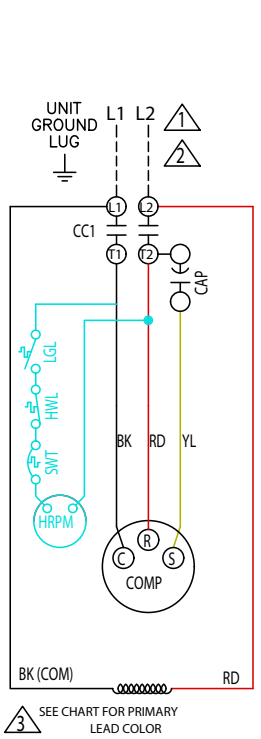
FIELD WIRE — — — —

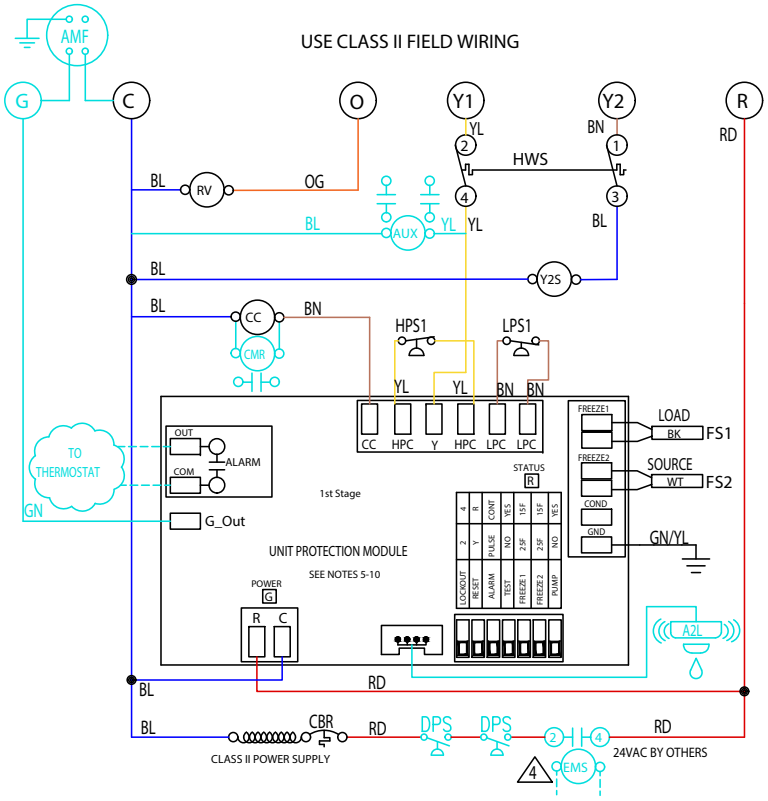
STANDARD COMPONENTS LEGEND:

CAP - COMPRESSOR CAPACITOR
CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:

[ ] A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR
[ ] AMF - A2L MITIGATION FAN
[ ] CMR - COMPRESSOR MONITOR RELAY
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
[ ] EMS - ENERGY MGMT SYSTEM RELAY
[ ] HRP - HEAT RECOVERY PACKAGE
HRPM- HEAT RECOVERY PUMP
LGL - LOW GAS LIMIT
HWL - HOT WATER LIMIT
SWT - ON/OFF SWITCH OVERLOAD PROTECTION





NOTES :

1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY. CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE 240V LEAD AND CONNECT IT TO 208V. CAP ALL UNUSED LEADS.
4. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
5. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
   120 SECOND FREEZE PROTECTION BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
9. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
10. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM THERMOSTAT TERMINAL BLOCK TO ALR-COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.

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Fig. 8 — Unit Sizes 025-071, 1-Phase, 2 Stages, Standard unit

STATUS LED/ALARM BLINK CODES	
1	HIGH PRESSURE FAULT – CKT 1
2	LOW PRESSURE FAULT – CKT 1
3	HIGH PRESSURE FAULT – CKT 2
4	LOW PRESSURE FAULT – CKT 2
5	FREEZE SENSOR 1 FAULT
6	CONDENSATE FAULT
7	BROWN OUT FAULT
8	FREEZE SENSOR 2 FAULT
9	FREEZE SENSOR 3 FAULT
10	FREEZE SENSOR 4 FAULT
11	REFRIGERANT LEAK FAULT
12	2ND STAGE COMMUNICATION FAULT

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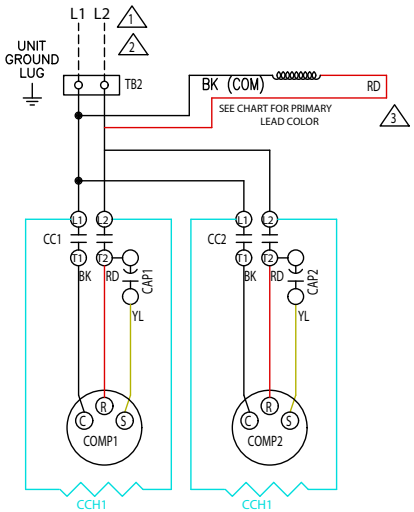

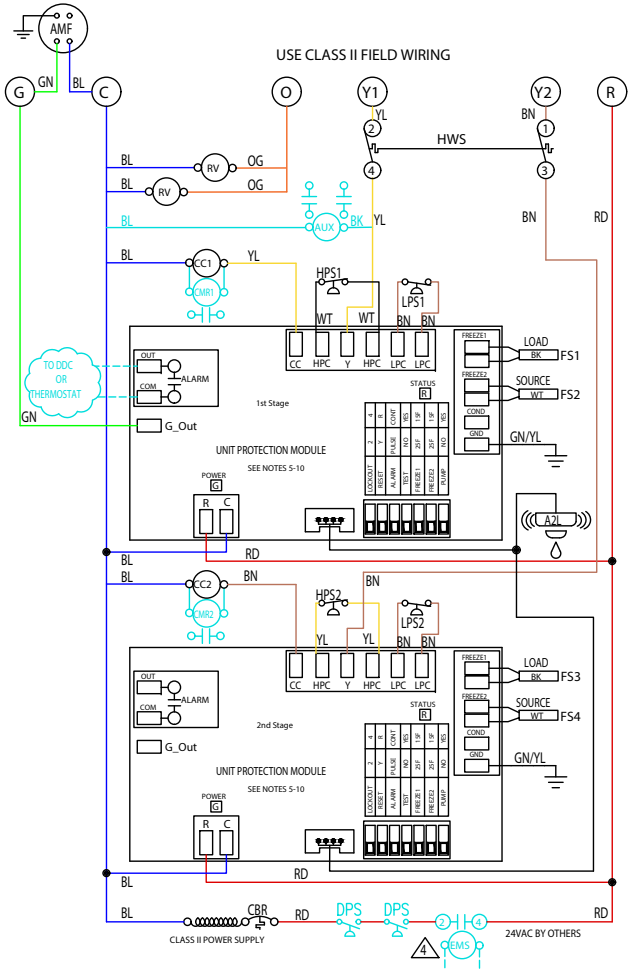

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5. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
   120 SECOND FREEZE PROTECTION BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
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Fig. 9 — Unit Sizes 122, 1-Phase, 2 Stages, Standard Unit

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	LOAD FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	SOURCE FREEZE CONDITION
7	REFRIGERANT LEAKAGE

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LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:

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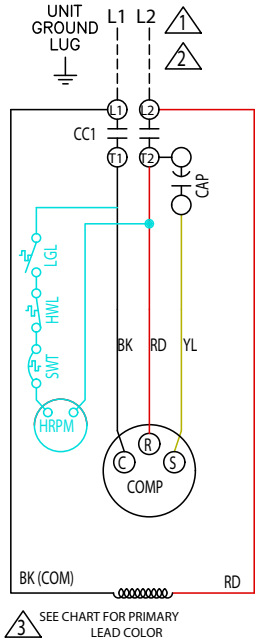

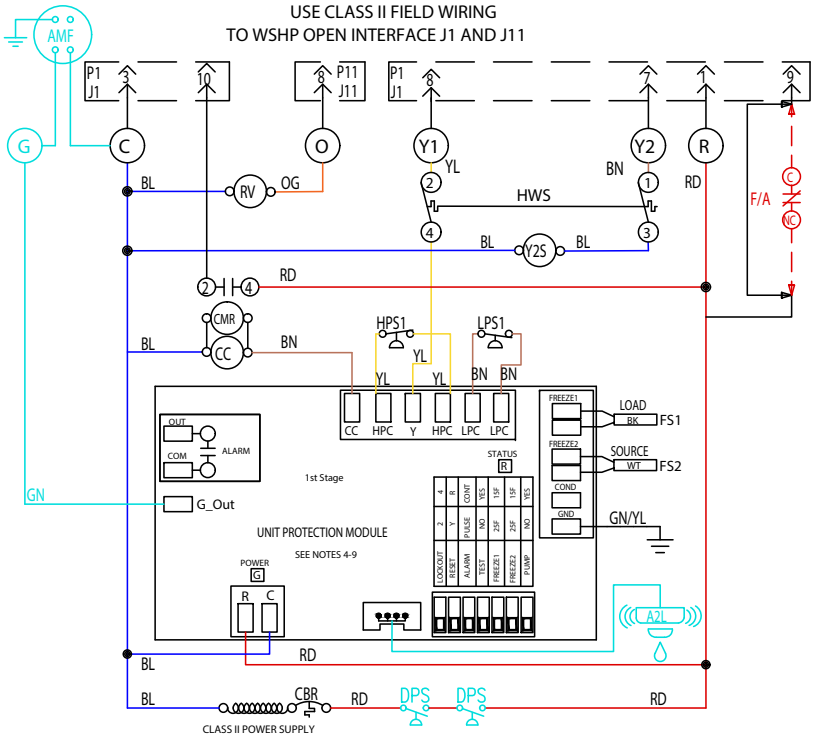

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Fig. 10 — Unit Sizes 025-071, 1-Phase, 2 Stages, W2W Open DDC

STATUS LED/ALARM BLINK CODES	
1	HIGH PRESSURE FAULT – CKT 1
2	LOW PRESSURE FAULT – CKT 1
3	HIGH PRESSURE FAULT – CKT 2
4	LOW PRESSURE FAULT – CKT 2
5	FREEZE SENSOR 1 FAULT
6	CONDENSATE FAULT
7	BROWN OUT FAULT
8	FREEZE SENSOR 2 FAULT
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FACTORY WIRE ————————

FIELD WIRE – — — —

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CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
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FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE

OPTIONAL COMPONENTS LEGEND:

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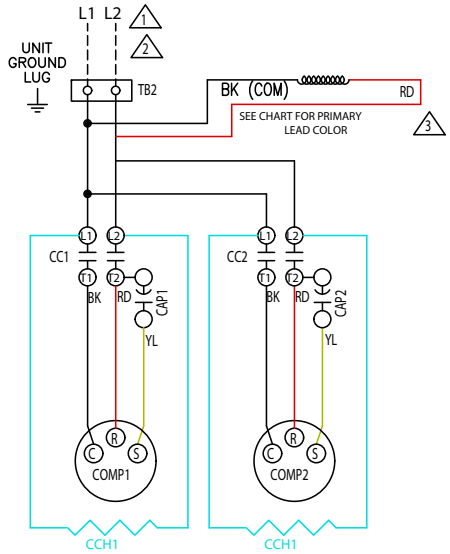

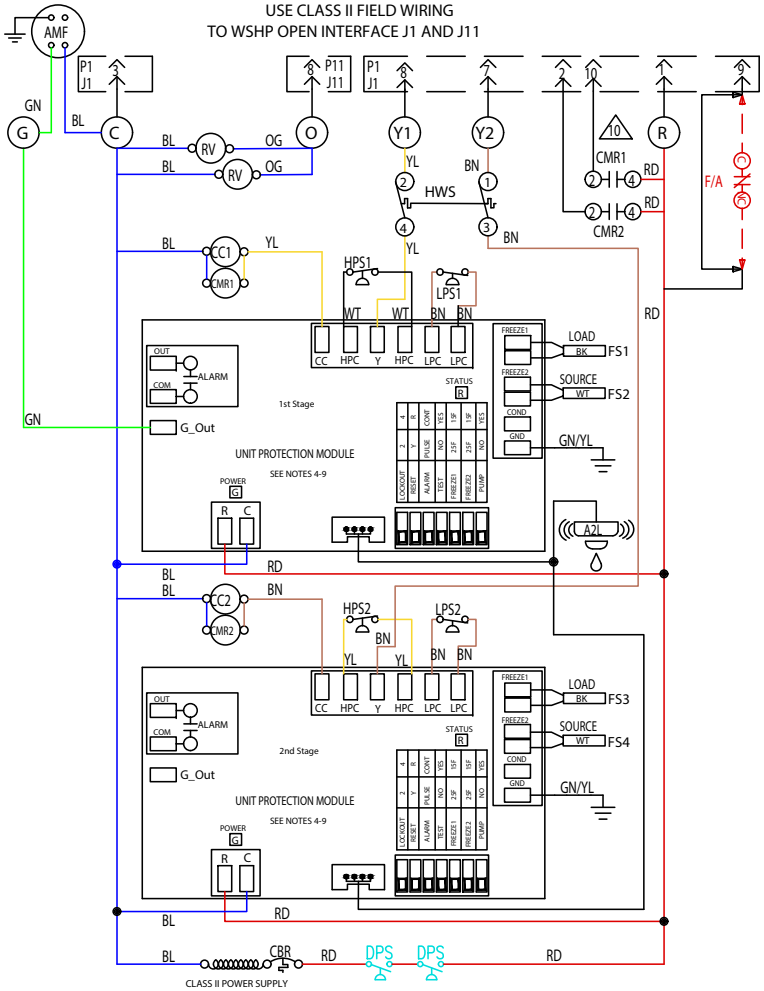

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6. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
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10. COMPRESSOR MONITOR RELAY 2 & 4 CONTACT CONNECTIONS WILL COME FROM WSHP-O DDC.

Fig. 11 — Unit Sizes 122, 1-Phase, 2 Stages, W2W Open DDC

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
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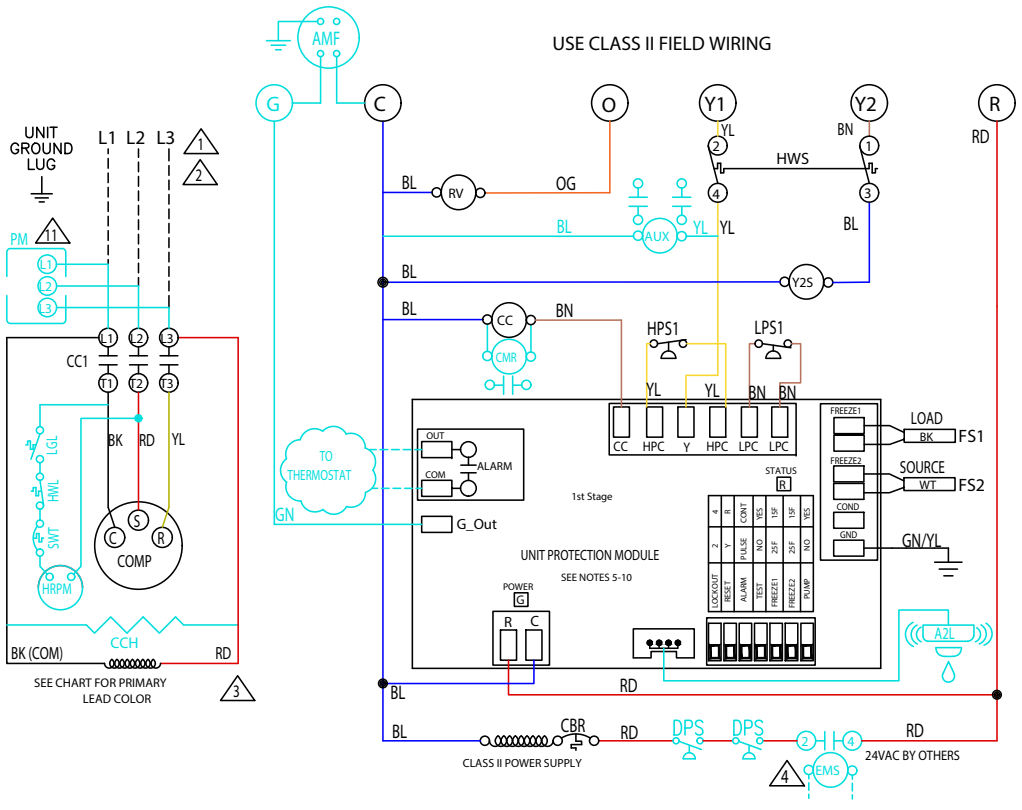
HRPM- HEAT RECOVERY PUMP
LGL - LOW GAS LIMIT
HWL - HOT WATER LIMIT
SWT - ON/OFF SWITCH OVERLOAD PROTECTION
[ ] PM - PHASE MONITOR



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5. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
   120 SECOND FREEZE PROTECTION BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
9. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
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11. CHECK FOR PROPER PHASE ROTATION ON UNITS WITH SCROLL COMPRESSORS. REVERSE ROTATION WILL DAMAGE THE COMPRESSOR AND VOID UNIT WARRANTY.

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Fig. 12 — Unit Sizes 025-071, 3-Phase, 2 stages, Standard Unit

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	LOAD FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	SOURCE FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GY	GRAY
GN	GREEN
OG	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW

FACTORY WIRE ————————

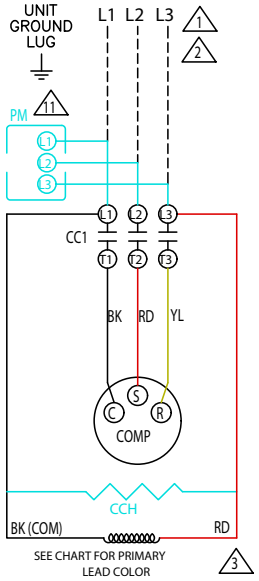
FIELD WIRE — — — —

STANDARD COMPONENTS LEGEND:

A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR
AMF - A2L MITIGATION FAN
CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:

[ ] AUX - AUXILLIARY RELAY (FOR LOOP PUMP, ETC.)
[ ] CCH - CRANKCASE HEATER
[ ] CMR - COMPRESSOR MONITOR RELAY
[ ] CPM - COMPRESSOR PROTECTION MODULE (15 TON COMPRESSORS AND LARGER)
[ ] DS - DISCONNECT SWITCH
[ ] EMS - ENERGY MGMT SYSTEM RELAY
[ ] PM - PHASE MONITOR



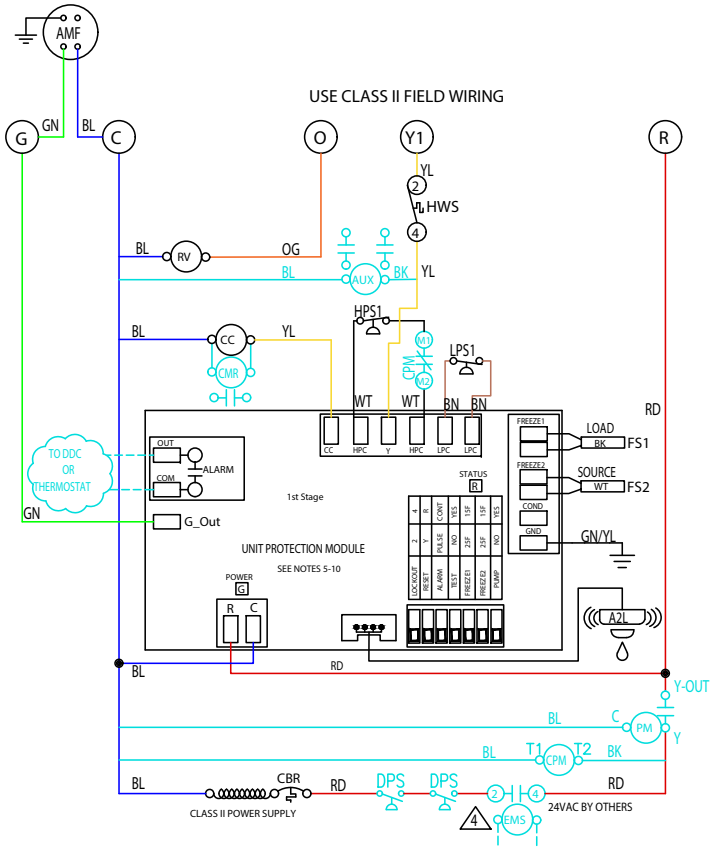


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Fig. 13 — Unit Sizes 180-210, 3-Phase, 1 Stages, Standard Unit

STATUS LED/ALARM BLINK CODES	
1	HIGH PRESSURE FAULT – CKT 1
2	LOW PRESSURE FAULT – CKT 1
3	HIGH PRESSURE FAULT – CKT 2
4	LOW PRESSURE FAULT – CKT 2
5	FREEZE SENSOR 1 FAULT
6	CONDENSATE FAULT
7	BROWN OUT FAULT
8	FREEZE SENSOR 2 FAULT
9	FREEZE SENSOR 3 FAULT
10	FREEZE SENSOR 4 FAULT
11	REFRIGERANT LEAK FAULT
12	2ND STAGE COMMUNICATION FAULT

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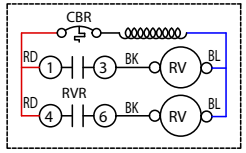


FACTORY WIRE ————————

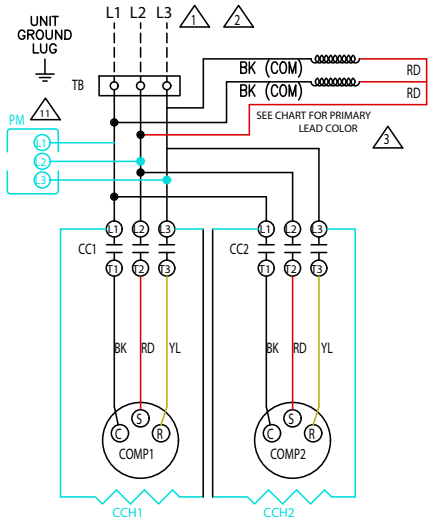
FIELD WIRE – — — —

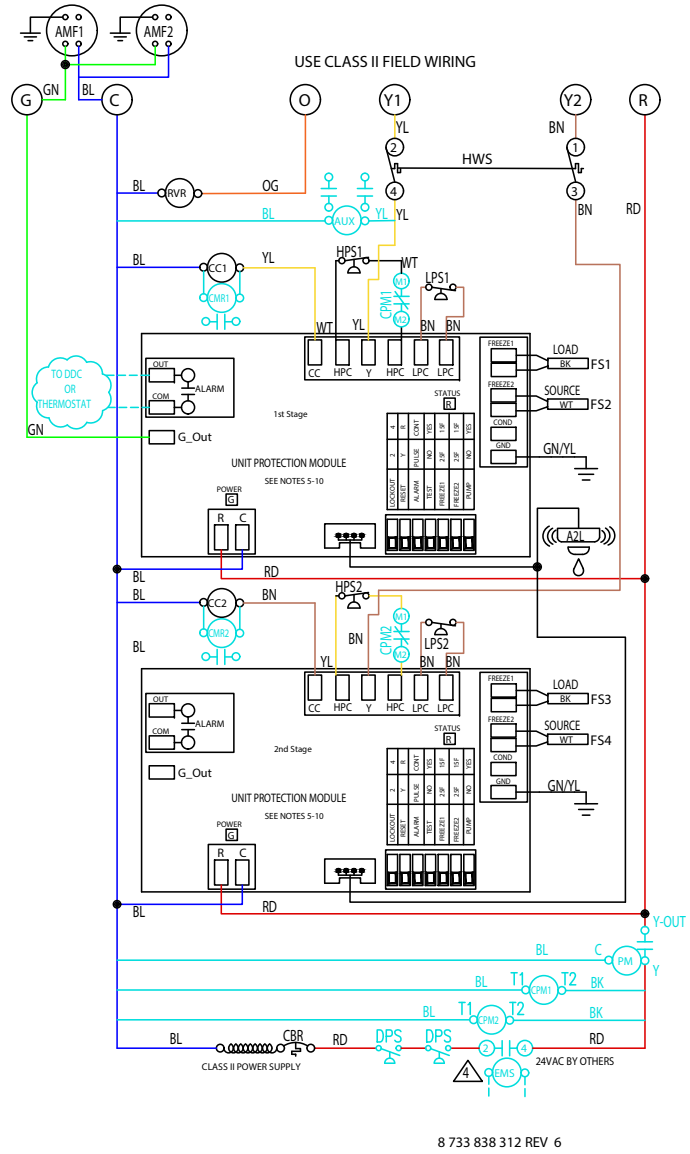
STANDARD COMPONENTS LEGEND:

A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR
AMF - A2L MITIGATION FAN
CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
RVR - REVERSING VALVE
TB - TERMINAL BLOCK (HIGH VOLTAGE)

OPTIONAL COMPONENTS LEGEND:

[ ] AUX - AUXILLIARY RELAY (FOR LOOP PUMP, ETC.)
[ ] CCH - CRANKCASE HEATER
[ ] CMR - COMPRESSOR MONITOR RELAY
[ ] CPM - COMPRESSOR PROTECTION MODULE (15 TON COMPRESSORS AND LARGER)
[ ] EMS - ENERGY MGMT SYSTEM RELAY
[ ] PM - PHASE MONITOR





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   120 SECOND FREEZE PROTECTION BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
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Fig. 14 — Unit Sizes 240-420, 3-Phase, 2 Stages, Standard Unit

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	LOAD FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	SOURCE FREEZE CONDITION
7	REFRIGERANT LEAKAGE

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FACTORY WIRE ————————

FIELD WIRE — — — —

STANDARD COMPONENTS LEGEND:

CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
CMR - COMPRESSOR MONITOR RELAY
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:

[ ] A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR
[ ] AMF - A2L MITIGATION FAN
[ ] CCH - CRANKCASE HEATER
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
[ ] HRP - HEAT RECOVERY PACKAGE
HRPM - HEAT RECOVERY PUMP
LGL - LOW GAS LIMIT
HWL - HOT WATER LIMIT
SWT - ON/OFF SWITCH OVERLOAD PROTECTION
[ ] PM - PHASE MONITOR

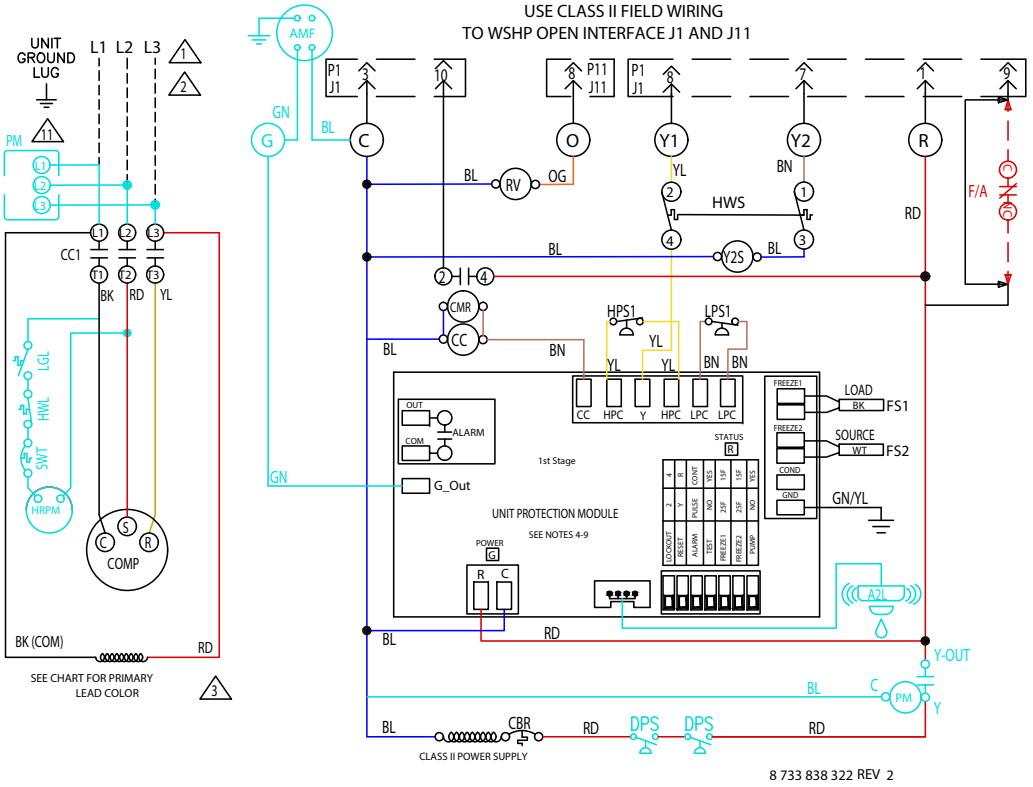

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Fig. 15 — Unit Sizes 025-071, 3-Phase, 2 Stages, Standard Unit, W2W Open DDC

UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
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HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:

[ ] CCH - CRANKCASE HEATER
[ ] CPM - COMPRESSOR PROTECTION MODULE (15 TON COMPRESSORS AND LARGER)
[ ] PM - PHASE MONITOR

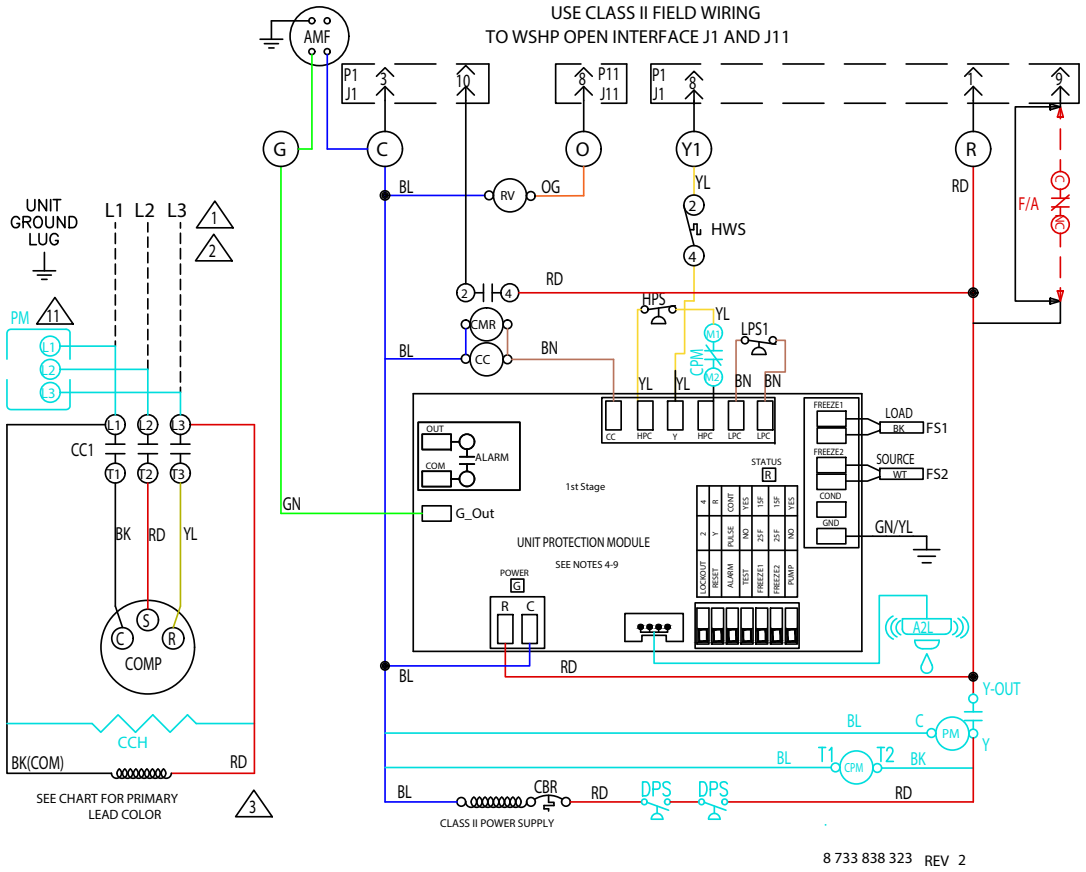

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Fig. 16 — Unit Sizes 180-210, 3-Phase, 1 stages, Standard unit, W2W Open DDC

STATUS LED/ALARM BLINK CODES	
1	HIGH PRESSURE FAULT – CKT 1
2	LOW PRESSURE FAULT – CKT 1
3	HIGH PRESSURE FAULT – CKT 2
4	LOW PRESSURE FAULT – CKT 2
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12	2ND STAGE COMMUNICATION FAULT

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FIELD WIRE – — — —

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HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
RVR - REVERSING VALVE RELAY
TB - TERMINAL BLOCK (HIGH VOLTAGE)

OPTIONAL COMPONENTS LEGEND:

[ ] CCH - CRANKCASE HEATER
[ ] CPM - COMPRESSOR PROTECTION MODULE (15 TON COMPRESSORS AND LARGER)
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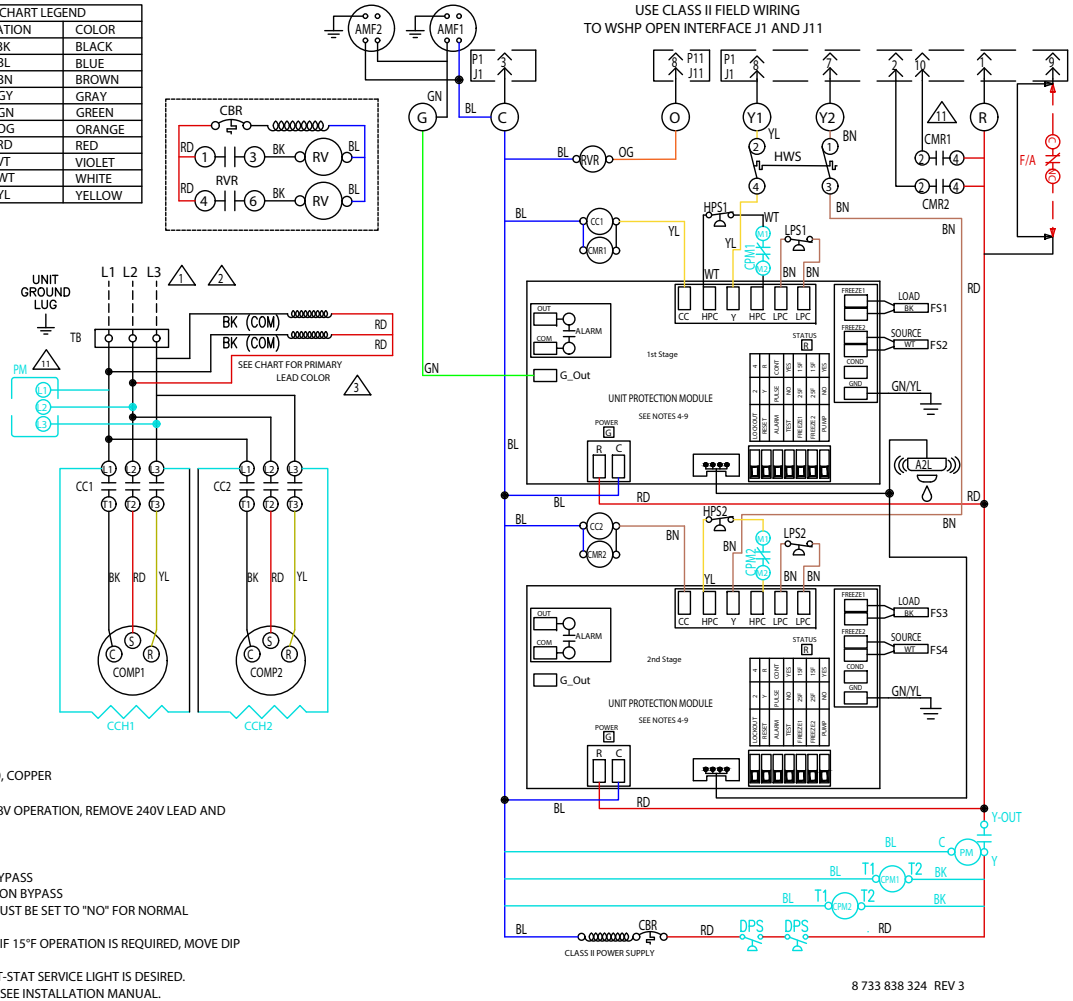

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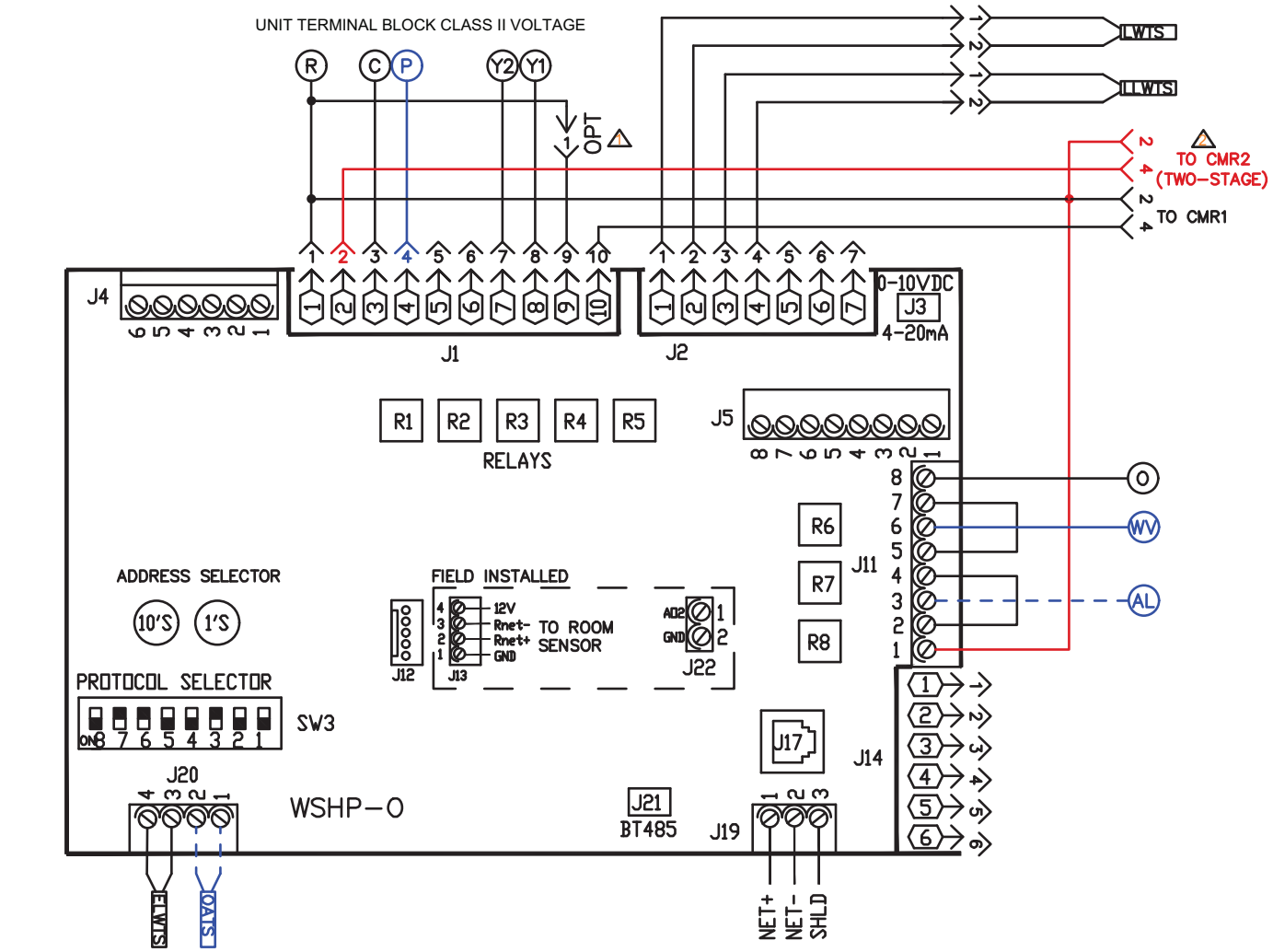
10. CHECK FOR PROPER PHASE ROTATION ON UNITS WITH SCROLL COMPRESSORS. REVERSE ROTATION WILL DAMAGE THE COMPRESSOR AND VOID UNIT WARRANTY.
11. COMPRESSOR MONITOR RELAY 2 & 4 CONTACT CONNECTIONS WILL COME FROM WSHP-O DDC.

Fig. 17 — Unit Sizes 240-420, 3-Phase, 2 Stages, Standard Unit, W2W Open DDC



——— FACTORY WIRED COMPONENTS
FIELD WIRED COMPONENTS

STANDARD COMPONENTS:

ELWTS - ENTERING LOAD WATER TEMP SENSOR
LLWTS - LEAVING LOAD WATER TEMP SENSOR
LWTS - LEAVING WATER TEMP SENSOR
CMR1 - COMPRESSOR MONITOR RELAY

OPTIONAL COMPONENTS:

CMR2- COMPRESSOR MONITOR RELAY
(TWO STAGE UNITS)

OPTIONAL FIELD CONTROL COMPONENTS:

AL - ALARM LIGHT
OATS- OUTSIDE AIR TEMPERATURE SENSOR
P - LOAD WATER PUMP
WV - WATER VALVE (SOURCE)

⚠1 J1-9 CAN BE USED TO CONNECT WATER FLOW SWITCH, FIRE ALARM AND/OR PHASE MONITOR OPTIONS

⚠2 CMR 2 CONNECTOR WILL BE INCLUDED ON ALL W2W HARNESSES BUT ONLY NEEDS TO BE CONNECTED TO CMR2 ON TWO STAGE UNITS THAT HAVE 2 CMR'S.

Fig. 18 — WSHP Open - W2W - Wiring Diagram

Additional Installation Requirements

There are certain requirements that must be met to employ the use of units with R-454B Refrigerant (A2L group) depending on the charge amount per UL 60335-2-40.

See Tables 4-7 to determine requirements and options depending on the unit charge amount.

Installation Options

OPTION 1

Install the unit in a room larger than the required minimum room area (Amin).

The equipment must be installed in a room with a minimum floor area greater than or equal to the area listed in Table 4 based on the total refrigerant charge of the system. In this scenario, no additional installation setup required for refrigerant leak mitigation. With this option, Amin can be further reduced if unit is installed on a stand. Tables 6-7 shows the minimum area values at different installation heights.

Table 4 — Additional Installation Requirements

R-454B REFRIGERANT CHARGE	REFRIGERANT LEAK DETECTION SYSTEM	ADDITIONAL INSTALLATION REQUIREMENT
Less than or equal to 62.8 oz	Not required. No further actions needed.	Not required. No further actions needed.
Greater than 62.8 oz	Installed standard from factory.	Required. Refer to the Installation Options section.

Table 5 — Minimum Area Requirement at Different Heights for 50PSW071

50PSW MODEL	CHARGE IN THE SYSTEM (oz)	MINIMUM ROOM AREA (FLOOR/ INSTALL) ft^2 / (m^2)	MINIMUM ROOM (1.2 m)	MINIMUM ROOM AREA (1.5 m)
071	74	254.3	127.1	101.7
		23.6	11.8	9.4

Table 6 — Minimum Requirements at Different Heights for 50PSW122 to 50PSW210

50PSW MODEL	REFRIGERANT CHARGE IN THE SYSTEM oz \ (kg)	MINIMUM ROOM AREA (FLOOR INSTALLATION, h0 = 1 m)	MINIMUM ROOM AREA (1.2 m)	MINIMUM ROOM AREA (1.5 m)
122	142 (4.0)	292.8 (27.2)	244.0 (22.7)	195.2 (18.1)
180	238 (6.7)	490.7 (45.6)	408.9 (38.0)	327.1 (30.4)
210	224 (6.4)	461.9 (42.9)	384.9 (35.8)	307.9 (28.6)

Table 7 — Minimum Requirements at Different Heights for 50PSW240 to 50PSW420

50PSW MODEL	REFRIGERANT CHARGE IN THE SYSTEM oz \ (kg)	MINIMUM ROOM AREA (FLOOR INSTALLATION h0 = 1.8 m)
240	300 (8.5)	347.9 (32.3)
360	472 (13.4)	547.3 (50.9)
420	432 (12.2)	501.0 (46.5)

OPTION 2

If unit is installed in a room with area smaller than Amin, it must be ducted to the outdoors. The duct must not exceed 0.3 in H_2O of static pressure. Refer to Tables 8-9 for cfm requirements, and Table 10 for the mitigation fan ESP/cfm table with the factory installed refrigerant leak detection system.

Table 8 — CFM Requirement for 50PSW 071 (Option 2)

50PSW Model	CHARGE (oz)	Qmin (m^3/h)	Qmin (cfm)
	74	49	29

Table 9 — CFM Requirements per Size for 50PSW122 to 50PSW420 (Option 2)

50PSW MODEL	REFRIGERANT CHARGE PER CIRCUIT (oz)	AIRFLOW REQUIRED ft^3/m (m^3/h)
122	71	28 (47)
180	238	93 (157)
210	224	87 (148)
240	150	58 (99)
360	236	92 (156)
420	216	84 (143)

Table 10 — Airflow Capabilities of Exhaust Fan

EXTERNAL STATIC PRESSURE (in. wc)	CFM
0	100
0.1	90
0.15	78
0.20	63
0.25	30
0.30	20

OPTION 3

Install unit in a machinery room as defined in ANSI/ASHRAE 15 (USA) or CSA B52 (Canada). See Table 11 for altitude adjustments.

When installation location altitude is above 1968 ft (600 m) the minimum room area of the space (Amin) must be corrected by multiplying Amin by the applicable altitude adjustment factor (AF).

Table 11 — Altitude Adjustment

GROUND LEVEL ALTITUDE (halt)		Amln ADJUSTMENT FACTOR (AF)
ft	m	
0	0	—
656	200	1.00
1,312	400	1.00
1,968	600	1.00
2,624	800	1.02
3,280	1,000	1.05
3,937	1,200	1.07
4,593	1,400	1.10
5,249	1,600	1.12
5,905	1,800	1.15
6,561	2,000	1.18

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. Transformer switched to lower voltage tap if necessary.
10. Service/access panels are in place.
11. Control field-selected settings are correct.

Wire Control Connections

All units are offered with additional controls options for use with a field installed thermostat or DDC or a factory installed DDC controller capable of standalone operation (W2W Open).

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

ADDITIONAL CONTROLS OPTIONS WIRING

All control wiring is connected to a terminal block located in the unit electrical box. Refer to the unit wiring diagram for connection details.

⚠ 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.

⚠ WARNING

Do not route control wiring through the same conduit as power supply wiring. Electrical noise and transients from the power wiring can cause communication issues or damage to the control wiring and connected control components.

Units without factory-installed DDC controller are controlled using the included thermostat inputs (R, O, Y1, Y2, C) along with a two-stage thermostat or field installed Direct Digital Controller (DDC). NOTE: The reversing valve on the unit is energized when the unit is in the cooling mode.

PUMP RELAY

Units with selected Pump Relay option can be field wired to enable a field provided loop pump or solenoid valve when there is a call for compressor operation. Represented as AUX relay on Wiring Diagrams (see Fig. 8-25).

ENERGY MANAGEMENT SWITCH

Units with selected energy management switch (EMS) can be field wired to disable unit operation when a 24-v signal is removed from the relay. Removing the 24-v signal causes the relay to open, which cuts 24-v power to the unit control circuit. All unit components will be disabled at when the EMS is deactivated. Represented as EMS relay on Wiring Diagrams (see Fig. 8-18).

PHASE MONITOR

Optionally three-phase units will include a 3-Phase Line Monitor that protects against phase loss, phase reversal, and phase unbalance. Ideally suited to protect your unit's scroll compressor(s) from reverse rotation.

ALARM OUTPUT

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 malfunction output section of Configure Unit Control Components.

W2W OPEN CONTROL

W2W Open is a factory installed DDC controller. W2W Open is not compatible with thermostats or third-party temperature sensors.

All W2W Open wiring is completed at the W2W Open control board. See the applicable wiring diagrams within this document for details. For further instructions on W2W Open, please visit HVACPartners.com or Carrier.com for the W2W Open Integration Guide and Points/Properties Guide.

CONTROL TRANSFORMER

Units 025-071 sizes include a 75 VA transformer, and 122-420 sizes have 100VA as a standard. Optional 100VA transformer for sizes 025-071 is available. The 100 VA capacity of the transformer should be considered when applying low voltage accessories, such as shut off valves, thermostats, or DDC controls.

Configure Unit Control Components

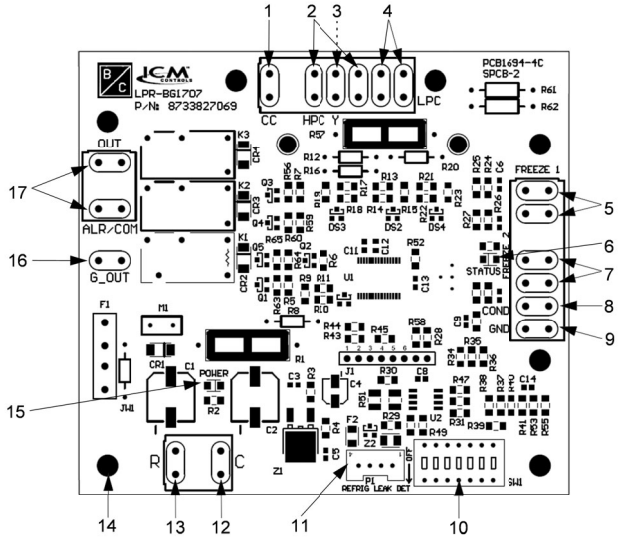
Each unit is provided with a unit protection module (UPM) which controls the compressor and provides the unit safety controls and monitoring. See Fig. 19-21 for the UPM board layout and freeze sensor.

Safety Controls include the following:

1. High Pressure Switch (HPS):
   located in the refrigerant discharge line and set for a high-pressure cutout control of 600 psig. A single HPS is wired across HPC on UPM1 and two HPS are wired across HP1 and HP2 on UPM2.
2. Low Pressure Switch (LPS):
   located in the unit refrigerant suction line and set for a low-pressure cutout of 40 psig. A single LPS is wired across LPC on UPM1 and two LPS are wired across LP1 and LP2 on UPM2.
3. Source Side Freeze Protection (FS Source):
   mounted close to coaxial coil to monitor refrigerant temperature between the coaxial refrigerant to water heat exchanger and the thermal expansion valve and prevent water freezing conditions. Wired Across Freeze 1 terminals on the UPM.
4. Load Side Freeze Protection (FS Load):
   mounted close to coaxial coil to monitor refrigerant temperature between the coaxial refrigerant to water heat exchanger and the thermal expansion valve to prevent water freezing conditions. Wired Across Freeze 2 terminals on the UPM.

The default freeze limit trip for both sensors is 25°F. However, this can be changed to 15°F by flipping DIP switch SW1. (See Fig. 19, Item 10, Fig. 22, and Table 12.) Typically, only the source side freeze protection would be adjusted to account for systems utilizing anti-freeze with low entering water temperatures (<40°F). If the temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut down the compressor and enter a soft lockout condition.

NOTE: Freeze protection will not guard against the loss of water flow. A flow switch is recommended to prevent the unit from running if water flow is lost or insufficient.



NUMBER	ITEM
1	Compressor Contact Output
2	High-Pressure Switch Connection
3	Call for Compressor Input Signal (Y1)
4	Low-Pressure Switch Connection
5	Source Water Coil Freeze Connection (FREEZE 1)
6	UPM Status LED Indicator (Fault Status)
7	Load Coil Freeze Connection (FREEZE 2)
8	Condensate Overflow Sensor Connection (not applicable to water-to-water units)
9	Ground
10	UPM Settings DIP Switch (SW1)
11	A2L Sensor
12	24 Vac Power Common
13	24 Vac Power Input
14	UPM Standoff
15	Power LED
16	Exhaust Fan (fan in the event of an A2L leakage)
17	Dry Contact

Fig. 19 — UPM I Control Board (Single Compressor Units)

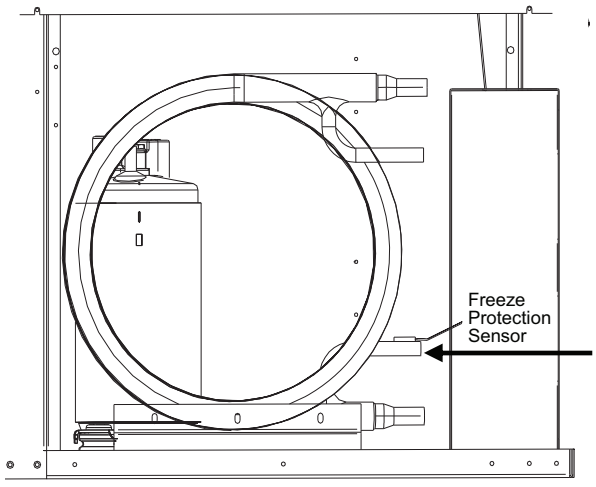
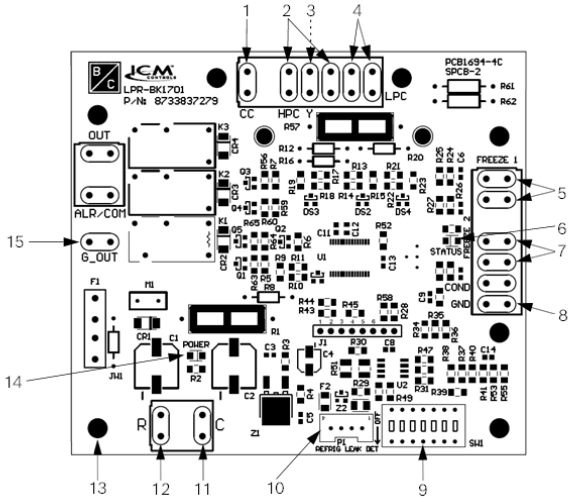


Fig. 20 — Freeze Protection Sensor



NUMBER	ITEM
1	Compressor Contact Output
2	High-Pressure Switch Connection
3	Call for Compressor (Y2)
4	Source Coil Freeze Connection (FREEZE 3)
5	LED Status Indicator (Fault Status)
6	UPM Status LED Indicator (Fault Status)
7	Load Coil Freeze Connection (FREEZE 4)
8	Ground Connection
9	UPM Board Settings DIP Switch
10	A2L Sensor
11	24 Vac Power Common
12	24 Vac Power Input
13	UPM Standoff
14	Power LED
15	Exhaust Fan (Fan in the event of an A2L Leakage)

Fig. 21 — UPM II Control Board (Dual Compressor Units)

UPM CONFIGURATION

Several of the UPM features are configurable via dip switches on the UPM (see Table 12).

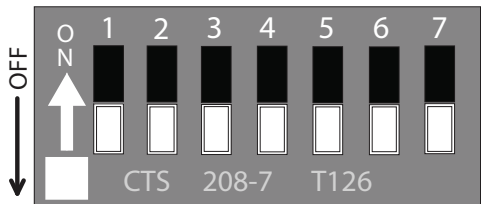


Fig. 22 — UPM Settings DIP Switch (SW1)

Table 12 — UPM DIP Switch Selectable Positions

TOGGLE	FUNCTION	ON	OFF	FACTORY DEFAULT
1	Lockout	4	2	2
2	Reset	R	Y	Y
3	Alarm	Cont	Pulse	Pulse
4	Test	Yes	No	No
5	Freeze 1	15°F	25°F	25°F
6	Freeze 2	15°F	25°F	25°F
7	Pump	ON	OFF	OFF

UPM FEATURES

Anti-Short Cycle Timer

5-minute delay on break timer to prevent compressor short cycling.

Random Start

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

Low Pressure Bypass Timer

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

Brownout/Surge/Power Interruption Protection

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

Malfunction Output

Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for “ALARM”. If it is set to “CONST”, a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to “PULSE”, a pulse signal is produced, and a fault code is detected by a remote device indicating the fault. See LED Fault Indication (For blink code explanations, see Tables 13 and 14). in the trouble shooting section of this document for blink codes. The remote device must have a malfunction detection capability when the UPM board is set to “PULSE”.

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

Test Dip Switch

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

IMPORTANT: 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.

Intelligent Reset

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

Lockout Reset

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

CONSIDERATIONS

1. Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.
2. Long length thermostat and control wiring leads may create voltage drop. Increasing wire gauge or up-size transformers may be required to ensure minimum secondary voltage supply.
3. Carrier recommends the following guidelines for wiring between a thermostat and the unit: 18 GA up to 60 ft, 16 GA up to 100 ft and 14 GA up to 140 ft.
4. Do not apply additional control devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.
5. Check with all code authorities on requirements involving condensate disposal/over flow protection criteria.

Table 13 — UPM I Fault Blink Codes

BLINKS	FAULT	FAULT CRITERIA
None	None	All fault conditions normal.
1	High Pressure	Refrigerant discharge pressure has exceeded 600 psig.
2	Low Pressure	Refrigerant suction pressure has fallen below 40 psig.
3	Source Coil Freeze Condition	Refrigerant temperature to the source coil has fallen below 25°F for 120 seconds.
4	Condensate Overflow	Condensate levels in the unit drain pan are too high.[a]
5	Brown Out	Control voltage has fallen below 18 VAC
6	Load Coil Freeze Condition	Refrigerant temperature to the load coil has fallen below 25°F for 120 seconds.
7	Refrigerant Leak Fault	Refrigerant LFL% is more than 15%.

NOTE(S):

a. This is not applicable to water to water units.

Table 14 — UPM II Fault Codes

BLINKS	FAULT	FAULT CRITERIA
None (Solid)	None	None. Adequate 18-30 vac power is present.
1	High Pressure Sensor #1	Refrigerant discharge pressure has exceeded 600 psig.
2	Low Pressure Sensor #1	Refrigerant suction pressure has fallen below 40 psig.
3	High Pressure Sensor #2	Refrigerant discharge pressure has exceeded 600 psig.
4	Low Pressure Sensor #2	Refrigerant suction pressure has fallen below 40 psig.
5	Freeze Sensor #1 Source Coil Freeze Condition	Refrigerant temperature to the source coil has fallen below 25°F for 30 seconds.
7	Brownout	Control voltage has fallen below 18 vac.
8	Freeze Sensor #2 Load Coil Freeze Condition	Refrigerant temperature to the load coil has fallen below 25°F for 30 seconds.
9	Freeze Sensor #3 Source Coil (circuit 2) Freeze Condition	Refrigerant temperature to the source coil (circuit 2) has fallen below 25°F for 30 seconds.
10	Freeze Sensor #4 Load Coil (circuit 2) Freeze Condition	Refrigerant temperature to the load coil (circuit 2) has fallen below 25°F for 30 seconds
11	Refrigerant Leak	Refrigerant concentration has fallen outside of acceptable range (above 15 percent LFL, refer to leak detection system section.)
12	Second Stage UMP Board Fault	Lost communication with the second stage UPM board.

Refrigerant Leak Detection System (optional)

The refrigerant leak detection system is standard (factory-installed) for units with refrigerant charge amounts exceeding 62.8 oz, and optional for units with refrigerant charge amounts equal to or below 62.8 oz. The refrigerant leak detection system is comprised of three main components: the A2L refrigerant sensor, an exhaust fan and the UPM board. The A2L sensor continually samples the air and if the concentration of refrigerant detected is higher than the preset threshold (15% LFL), it sends a signal to the UPM, which then switches OFF the compressor and turns ON the exhaust fan. The compressor remains OFF until the saturation level is below (15% LFL) and the power is cycled in order to restore normal operations. Once the A2L sensor is connected to the UPM, it must always remain connected. If communication is lost, the UPM enters a refrigerant leak hard lockout fault and energizes the alarm contact.

To test that the communication between the sensor and board is active, the sensor can be disconnected from the UPM, which should simulate a fault. The A2L sensor for the refrigerant leak detection system must only be replaced with the part specified on the spare parts list.

START-UP

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

NOTE: This equipment is designed for indoor installation only.

Unit Start-Up

1. Set the primary controller to the highest setting.
2. Set the primary controller system switch to "COOL." The reversing valve solenoid should energize. The compressor should not run.
3. Reduce the primary controller setting approximately 5 degrees below return fluid temperature.
4. Verify the heat pump is operating in the cooling mode.
5. Check the cooling refrigerant pressures against the values listed in Tables 15-25.
6. Turn the primary controller system switch to the "OFF" position. The unit should stop running and the reversing valve should de-energize.
7. Leave the unit off for approximately (5) minutes to allow for system equalization.
8. Turn the primary controller to the lowest setting.
9. Set the primary controller switch to "HEAT."
10. Increase the primary controller setting approximately 5 degrees above the return fluid temperature.
11. Verify the heat pump is operating in the heating mode.
12. Check the heating refrigerant pressures against the values listed in Tables 15-25.
13. Set the primary controller to maintain the desired return fluid temperature.
14. Check for vibrations, leaks, etc.
15. Instruct the owner on the unit and control operation.

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. (See Table 26.).

POWER SUPPLY

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

NOTE: These operating conditions are not normal or continuous operating conditions. It is assumed that start-up is for the purpose of bringing the building space up to occupancy temperature. (See Table 26.).

⚠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.

Table 15 — 50PSW025 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
025	50	50	4	174-194	78-88	11-13	10-12
			8	161-181	88-98	6-8	5-7
		60	4	182-202	94-104	13-15	12-14
			8	167-187	105-115	7-9	6-8
		70	4	191-211	110-120	15-17	13-15
			8	174-194	125-135	8-10	7-9
		80	4	198-218	123-133	16-18	15-17
			8	182-202	146-156	9-11	9-11
		90	4	212-232	148-158	19-21	18-20
			8	190-210	170-180	10-12	10-12
	70	50	4	235-255	81-91	11-13	9-11
			8	221-241	89-99	5-7	5-7
		60	4	244-264	96-106	12-14	11-13
			8	228-248	107-117	7-9	6-8
		70	4	254-274	112-122	14-16	12-14
			8	236-256	127-137	8-10	7-9
		80	4	268-288	135-145	17-19	15-17
			8	244-264	149-159	9-11	8-10
		90	4	278-298	154-164	18-20	17-19
			8	253-273	174-184	10-12	9-11
	90	50	4	309-329	81-91	10-12	8-10
			8	295-315	89-99	5-7	4-6
		60	4	320-340	97-107	12-14	10-12
			8	302-322	108-118	6-8	5-7
		70	4	332-352	117-127	14-16	11-13
			8	312-332	131-141	7-9	6-8
		80	4	346-366	139-149	16-18	14-16
			8	317-337	145-155	8-10	7-9
		90	4	357-377	158-168	18-20	15-17
			8	328-348	175-185	9-11	8-10
	110	50	4	403-423	87-97	10-12	7-9
			8	388-408	95-105	5-7	4-6
		60	4	414-434	104-114	12-14	9-11
			8	395-415	114-124	6-8	5-7
		70	4	427-447	124-134	14-16	11-13
			8	404-424	134-144	7-9	5-7
		80	4	437-457	141-151	15-17	12-14
			8	413-433	156-166	8-10	6-8
		90	4	453-473	172-182	17-19	14-16
			8	418-438	175-185	9-11	7-9

Table 15 — 50PSW025 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	789K	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
025	30	60	4	188-208	50-60	7-9	8-10
			8	178-198	57-67	3-5	4-6
		80	4	256-276	55-65	6-8	8-10
			8	243-263	59-69	3-5	4-6
		100	4	335-355	56-66	5-7	8-10
			8	323-343	61-71	3-5	4-6
		120	4	436-456	62-72	5-7	8-10
			8	422-442	67-77	2-4	4-6
	50	60	4	205-225	79-89	10-12	12-14
			8	190-210	87-97	5-7	6-8
		80	4	272-292	79-89	9-11	11-13
			8	256-276	87-97	5-7	6-8
		100	4	355-375	83-93	8-10	11-13
			8	338-358	92-102	4-6	5-7
		120	4	457-477	91-101	8-10	11-13
			8	438-458	99-109	4-6	5-7
	70	60	4	225-245	111-121	14-16	16-18
			8	205-225	124-134	8-10	8-10
		80	4	293-313	111-121	12-14	15-17
			8	272-292	125-135	7-9	8-10
		100	4	379-399	118-128	12-14	14-16
			8	357-377	133-143	6-8	8-10
		120	4	483-503	128-138	11-13	14-16
			8	456-476	139-149	6-8	7-9
	90	60	4	246-266	146-156	18-20	19-21
			8	221-241	169-179	10-12	11-13
		80	4	326-346	163-173	18-20	20-22
			8	290-310	176-186	9-11	11-13
		100	4	409-429	169-179	16-18	19-21
			8	374-394	181-191	9-11	10-12
		120	4	504-524	174-184	15-17	18-20
			8	470-490	191-201	8-10	10-12

Table 16 — 50PSW035 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
035	50	50	4.5	194-214	75-85	14-16	12-14
			9.0	178-198	85-95	8-10	7-9
		60	4.5	204-224	89-99	16-18	14-16
			9.0	186-206	102-112	9-11	8-10
		70	4.5	216-236	106-116	19-21	17-19
			9.0	194-214	121-131	10-12	9-11
		80	4.5	228-248	123-133	21-23	19-21
			9.0	199-219	142-152	12-14	11-13
		90	4.5	237-257	142-152	24-26	21-23
			9.0	205-225	164-174	13-15	12-14
	70	50	4.5	258-278	77-87	14-16	11-13
			9.0	242-262	88-98	7-9	6-8
		60	4.5	270-290	92-102	16-18	13-15
			9.0	250-270	105-115	9-11	7-9
		70	4.5	283-303	109-119	18-20	15-17
			9.0	258-278	124-134	10-12	9-11
		80	4.5	294-314	127-137	20-22	18-20
			9.0	262-282	145-155	11-13	10-12
		90	4.5	304-324	146-156	23-25	20-22
			9.0	269-289	168-178	13-15	11-13
	90	50	4.5	337-357	80-90	13-15	10-12
			9.0	321-341	90-100	7-9	5-7
		60	4.5	349-369	95-105	15-17	12-14
			9.0	329-349	107-117	8-10	7-9
		70	4.5	363-383	112-122	17-19	14-16
			9.0	337-357	127-137	9-11	8-10
		80	4.5	375-395	131-141	20-22	16-18
			9.0	341-361	148-158	11-13	9-11
		90	4.5	384-404	149-159	22-24	18-20
			9.0	347-367	172-182	12-14	10-12
	110	50	4.5	432-452	83-93	13-15	9-11
			9.0	417-437	92-102	7-9	5-7
		60	4.5	445-465	98-108	15-17	11-13
			9.0	424-444	109-119	8-10	6-8
		70	4.5	456-476	115-125	17-19	13-15
			9.0	430-450	129-139	9-11	7-9
		80	4.5	467-487	134-144	19-21	15-17
			9.0	436-456	151-161	10-12	8-10
		90	4.5	479-499	154-164	21-23	17-19
			9.0	442-462	175-185	11-13	9-11

Table 16 — 50PSW035 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
035	30	60	4.5	205-225	47-57	9-11	11-13
			9.0	205-225	53-63	5-7	6-8
		80	4.5	273-293	49-59	8-10	11-13
			9.0	257-277	52-62	4-6	5-7
		100	4.5	351-371	44-54	6-8	9-11
			9.0	343-363	56-66	4-6	5-7
		120	4.5	456-476	54-64	6-8	10-12
			9.0	446-466	59-69	3-5	5-7
	50	60	4.5	225-245	69-79	12-14	15-17
			9.0	208-228	80-90	7-9	8-10
		80	4.5	296-316	73-83	12-14	15-17
			9.0	277-297	82-92	6-8	8-10
		100	4.5	381-401	75-85	11-13	14-16
			9.0	361-381	84-94	6-8	7-9
		120	4.5	487-507	79-89	9-11	14-16
			9.0	462-482	86-96	5-7	7-9
	70	60	4.5	247-267	95-105	16-18	19-21
			9.0	224-244	114-124	10-12	11-13
		80	4.5	319-339	97-107	15-17	18-20
			9.0	293-313	116-126	9-11	10-12
		100	4.5	408-428	105-115	14-16	18-20
			9.0	377-397	119-129	8-10	10-12
		120	4.5	507-527	108-118	13-15	18-20
			9.0	476-496	122-132	7-9	9-11
	90	60	4.5	271-291	131-141	22-24	24-26
			9.0	234-254	149-159	12-14	14-16
		80	4.5	344-364	137-147	20-22	24-26
			9.0	308-328	160-170	12-14	13-15
		100	4.5	433-453	144-154	19-21	23-25
			9.0	390-410	163-173	11-13	13-15
		120	4.5	534-554	150-160	18-20	22-24
			9.0	491-511	167-177	10-12	12-14

Table 17 — 50PSW049 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
049	50	50	5	206-226	63-73	17-19	14-16
			10	188-208	72-82	9-11	8-10
		60	5	219-239	74-84	19-21	16-18
			10	192-212	86-96	11-13	9-11
		70	5	227-247	86-96	21-23	19-21
			10	199-219	102-112	12-14	11-13
		80	5	238-258	101-111	24-26	22-24
			10	207-227	119-129	14-16	13-15
		90	5	250-270	116-126	27-29	24-26
			10	215-235	138-148	16-18	15-17
	70	50	5	271-291	65-75	16-18	13-15
			10	252-272	74-84	9-11	7-9
		60	5	285-305	77-87	19-21	15-17
			10	256-276	89-99	10-12	9-11
		70	5	294-314	90-100	21-23	18-20
			10	262-282	105-115	12-14	10-12
		80	5	305-325	105-115	24-26	20-22
			10	270-290	122-132	14-16	12-14
		90	5	317-337	120-130	26-28	23-25
			10	279-299	142-152	15-17	14-16
	90	50	5	351-371	67-77	16-18	12-14
			10	330-350	76-86	8-10	6-8
		60	5	365-385	80-90	18-20	14-16
			10	334-354	92-102	10-12	8-10
		70	5	375-395	94-104	21-23	16-18
			10	340-360	108-118	11-13	9-11
		80	5	387-407	109-119	23-25	19-21
			10	348-368	125-135	13-15	11-13
		90	5	400-420	125-135	26-28	21-23
			10	357-377	146-156	15-17	13-15
	110	50	5	447-467	71-81	16-18	11-13
			10	422-442	79-89	8-10	6-8
		60	5	459-479	84-94	18-20	13-15
			10	428-448	94-104	10-12	7-9
		70	5	472-492	98-108	20-22	15-17
			10	435-455	111-121	11-13	8-10
		80	5	483-503	113-123	23-25	17-19
			10	442-462	130-140	13-15	10-12
		90	5	498-518	131-141	25-27	20-22
			10	451-471	149-159	14-16	11-13

Table 17 — 50PSW049 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
049	30	60	5	212-232	43-53	9-11	12-14
			10	198-218	49-59	5-7	6-8
		80	5	282-302	45-55	9-11	12-14
			10	267-287	51-61	5-7	6-8
		100	5	367-387	47-57	8-10	12-14
			10	351-371	52-62	4-6	6-8
		120	5	464-484	49-59	7-9	12-14
			10	449-469	54-64	3-5	6-8
	50	60	5	235-255	63-73	13-15	16-18
			10	216-236	73-83	8-10	9-11
		80	5	308-328	66-76	12-14	16-18
			10	286-306	75-85	7-9	9-11
		100	5	395-415	69-79	11-13	16-18
			10	371-391	78-88	6-8	9-11
		120	5	488-508	72-82	10-12	16-18
			10	473-493	80-90	5-7	8-10
	70	60	5	257-277	87-97	18-20	21-23
			10	227-247	102-112	11-13	12-14
		80	5	331-351	91-101	17-19	21-23
			10	297-317	105-115	10-12	12-14
		100	5	418-438	95-105	16-18	21-23
			10	382-402	108-118	9-11	11-13
		120	5	527-547	99-109	14-16	20-22
			10	485-505	113-123	8-10	11-13
	90	60	5	280-300	116-126	24-26	27-29
			10	244-264	138-148	14-16	16-18
		80	5	355-375	121-131	22-24	26-28
			10	314-334	141-151	13-15	15-17
		100	5	444-464	127-137	21-23	26-28
			10	399-419	147-157	12-14	14-16
		120	5	569-589	133-143	18-20	25-27
			10	502-522	151-161	11-13	14-16

Table 18 — 50PSW061 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
061	50	50	6.5	203-223	45-55	17-19	14-16
			13	182-202	51-61	9-11	8-10
		60	6.5	211-231	54-64	19-21	17-19
			13	188-208	61-71	11-13	9-11
		70	6.5	221-241	65-75	22-24	19-21
			13	195-215	74-84	12-14	11-13
		80	6.5	232-252	76-86	25-27	22-24
			13	203-223	89-99	14-16	13-15
		90	6.5	244-264	88-98	28-30	25-27
			13	213-233	103-113	16-18	15-17
	70	50	6.5	268-288	47-57	16-18	13-15
			13	246-266	54-64	9-11	7-9
		60	6.5	277-297	57-67	19-21	16-18
			13	251-271	65-75	10-12	9-11
		70	6.5	287-307	68-78	21-23	18-20
			13	258-278	77-87	12-14	10-12
		80	6.5	299-319	79-89	24-26	21-23
			13	266-286	91-101	13-15	12-14
		90	6.5	315-335	96-106	28-30	24-26
			13	276-296	108-118	15-17	14-16
	90	50	6.5	347-367	51-61	16-18	12-14
			13	322-342	56-66	9-11	7-9
		60	6.5	356-376	60-70	18-20	14-16
			13	330-350	68-78	10-12	8-10
		70	6.5	367-387	72-82	21-23	17-19
			13	337-357	80-90	11-13	9-11
		80	6.5	380-400	84-94	24-26	19-21
			13	344-364	94-104	13-15	11-13
		90	6.5	395-415	97-107	26-28	22-24
			13	354-374	111-121	15-17	13-15
	110	50	6.5	444-464	54-64	16-18	11-13
			13	425-445	59-69	8-10	6-8
		60	6.5	453-473	64-74	18-20	13-15
			13	423-443	72-82	10-12	7-9
		70	6.5	464-484	76-86	21-23	15-17
			13	433-453	84-94	11-13	8-10
		80	6.5	478-498	89-99	23-25	18-20
			13	441-461	98-108	12-14	10-12
		90	6.5	493-513	102-112	26-28	20-22
			13	450-470	114-124	14-16	11-13

Table 18 — 50PSW061 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
061	30	60	6.5	213-233	27-37	10-12	13-15
			13.0	199-219	31-41	5-7	7-9
		80	6.5	284-304	30-40	9-11	13-15
			13.0	266-286	32-42	4-6	6-8
		100	6.5	368-388	32-42	8-10	13-15
			13.0	351-371	34-44	4-6	6-8
		120	6.5	466-486	35-45	7-9	13-15
			13.0	447-467	37-47	3-5	6-8
	50	60	6.5	231-251	44-54	14-16	17-19
			13.0	208-228	49-59	8-10	9-11
		80	6.5	302-322	47-57	13-15	17-19
			13.0	277-297	52-62	7-9	9-11
		100	6.5	387-407	49-59	12-14	16-18
			13.0	360-380	53-63	6-8	8-10
		120	6.5	488-508	53-63	11-13	16-18
			13.0	462-482	58-68	5-7	8-10
	70	60	6.5	251-271	63-73	19-21	22-24
			13.0	221-241	72-82	11-13	12-14
		80	6.5	323-343	67-77	18-20	21-23
			13.0	289-309	74-84	10-12	12-14
		100	6.5	409-429	70-80	16-18	21-23
			13.0	373-393	77-87	9-11	11-13
		120	6.5	514-534	75-85	15-17	21-23
			13.0	475-495	82-92	8-10	11-13
	90	60	6.5	276-296	86-96	24-26	27-29
			13.0	240-260	99-109	14-16	16-18
		80	6.5	350-370	91-101	23-25	27-29
			13.0	309-329	103-113	13-15	15-17
		100	6.5	438-458	96-106	21-23	26-28
			13.0	393-413	108-118	12-14	15-17
		120	6.5	543-563	101-111	19-21	26-28
			13.0	495-515	113-123	11-13	14-16

Table 19 — 50PSW071 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
071	50	50	7.5	202-222	50-60	17-19	14-16
			15.0	182-202	57-67	9-11	8-10
		60	7.5	210-230	60-70	19-21	16-18
			15.0	188-208	69-79	10-12	9-11
		70	7.5	219-239	71-81	22-24	19-21
			15.0	195-215	83-93	12-14	11-13
		80	7.5	230-250	84-94	24-26	22-24
			15.0	203-223	98-108	14-16	13-15
		90	7.5	242-262	98-108	27-29	24-26
			15.0	212-232	116-126	16-18	14-16
	70	50	7.5	267-287	53-63	16-18	13-15
			15.0	246-266	60-70	9-11	7-9
		60	7.5	275-295	63-73	19-21	15-17
			15.0	251-271	72-82	10-12	8-10
		70	7.5	285-305	75-85	21-23	18-20
			15.0	257-277	86-96	12-14	10-12
		80	7.5	297-317	88-98	24-26	20-22
			15.0	265-285	102-112	13-15	12-14
		90	7.5	309-329	102-112	26-28	23-25
			15.0	274-294	119-129	15-17	13-15
	90	50	7.5	346-366	57-67	16-18	12-14
			15.0	323-343	61-71	8-10	6-8
		60	7.5	355-375	67-77	18-20	14-16
			15.0	329-349	75-85	10-12	8-10
		70	7.5	365-385	79-89	20-22	16-18
			15.0	335-355	89-99	11-13	9-11
		80	7.5	377-397	92-102	23-25	19-21
			15.0	343-363	105-115	13-15	11-13
		90	7.5	391-411	107-117	26-28	22-24
			15.0	352-372	123-133	14-16	12-14
	110	50	7.5	474-494	64-74	16-18	11-13
			15.0	424-444	66-76	8-10	6-8
		60	7.5	451-471	72-82	18-20	13-15
			15.0	423-443	79-89	9-11	7-9
		70	7.5	461-481	83-93	20-22	15-17
			15.0	432-452	93-103	11-13	8-10
		80	7.5	474-494	97-107	23-25	17-19
			15.0	439-459	109-119	12-14	10-12
		90	7.5	489-509	112-122	25-27	20-22
			15.0	447-467	127-137	14-16	11-13

Table 19 — 50PSW071 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
071	30	60	7.5	195-215	42-52	11-13	13-15
			15.0	182-202	44-54	5-7	7-9
		80	7.5	262-282	44-54	10-12	13-15
			15.0	248-268	47-57	5-7	7-9
		100	7.5	344-364	46-56	9-11	13-15
			15.0	328-348	49-59	4-6	6-8
		120	7.5	439-459	49-59	8-10	13-15
			15.0	423-443	51-61	3-5	6-8
	50	60	7.5	211-231	63-73	15-17	18-20
			15.0	192-212	68-78	8-10	9-11
		80	7.5	279-299	66-76	14-16	17-19
			15.0	259-279	71-81	7-9	9-11
		100	7.5	362-382	68-78	12-14	17-19
			15.0	340-360	73-83	6-8	9-11
		120	7.5	463-483	71-81	11-13	16-18
			15.0	435-455	73-83	5-7	8-10
	70	60	7.5	229-249	89-99	20-22	23-25
			15.0	204-224	99-109	11-13	13-15
		80	7.5	299-319	93-103	19-21	22-24
			15.0	268-288	99-109	10-12	12-14
		100	7.5	383-403	97-107	17-19	22-24
			15.0	351-371	106-116	9-11	12-14
		120	7.5	483-503	100-110	15-17	21-23
			15.0	446-466	102-112	8-10	10-12
	90	60	7.5	251-271	122-132	26-28	29-31
			15.0	221-241	141-151	15-17	17-19
		80	7.5	323-343	126-136	24-26	28-30
			15.0	286-306	143-153	14-16	16-18
		100	7.5	409-429	131-141	22-24	27-29
			15.0	368-388	147-157	13-15	15-17
		120	7.5	509-529	135-145	20-22	26-28
			15.0	466-486	149-159	11-13	14-16

Table 20 — 50PSW122 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
122	50	50	17.5	175-195	65-75	7-9	6-8
			35.0	159-179	68-78	3-5	3-5
		60	17.5	180-200	80-90	8-10	7-9
			35.0	189-209	86-96	4-6	3-5
		70	17.5	186-206	96-106	10-12	9-11
			35.0	176-196	102-112	5-7	4-6
		80	17.5	193-213	113-123	11-13	10-12
			35.0	181-201	124-134	6-8	5-7
		90	17.5	201-221	133-143	12-14	12-14
			35.0	188-208	146-156	7-9	6-8
	70	50	17.5	237-257	68-78	7-9	6-8
			35.0	222-242	77-87	3-5	3-5
		60	17.5	241-261	82-92	8-10	7-9
			35.0	245-265	88-98	4-6	3-5
		70	17.5	246-266	98-108	9-11	8-10
			35.0	252-272	107-117	4-6	4-6
		80	17.5	253-273	116-126	10-12	9-11
			35.0	229-249	125-135	5-7	5-7
		90	17.5	261-281	136-146	12-14	11-13
			35.0	245-265	148-158	6-8	5-7
	90	50	17.5	313-333	70-80	6-8	5-7
			35.0	312-332	71-81	3-5	2-4
		60	17.5	318-338	84-94	7-9	6-8
			35.0	297-317	92-102	4-6	3-5
		70	17.5	322-342	101-111	9-11	7-9
			35.0	302-322	107-117	4-6	3-5
		80	17.5	329-349	120-130	10-12	9-11
			35.0	315-335	127-137	5-7	4-6
		90	17.5	336-356	140-150	11-13	10-12
			35.0	321-341	150-160	6-8	5-7
	110	50	17.5	404-424	72-82	6-8	4-6
			35.0	386-406	80-90	3-5	2-4
		60	17.5	411-431	87-97	7-9	5-7
			35.0	405-425	88-98	3-5	2-4
		70	17.5	415-435	104-114	8-10	7-9
			35.0	393-413	114-124	4-6	3-5
		80	17.5	421-441	123-133	9-11	8-10
			35.0	400-420	130-140	5-7	4-6
		90	17.5	429-449	144-154	11-13	9-11
			35.0	404-424	153-163	5-7	4-6

Table 20 — 50PSW122 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
122	30	60	17.5	192-212	33-43	4-6	5-7
			35.0	186-206	35-45	1-3	2-4
		80	17.5	259-279	38-48	4-6	5-7
			35.0	251-271	38-48	1-3	2-4
		100	17.5	338-358	38-48	3-5	4-6
			35.0	331-351	40-50	1-3	2-4
		120	17.5	439-459	43-53	3-5	4-6
			35.0	430-450	43-53	1-3	2-4
	50	60	17.5	201-221	55-65	6-8	7-9
			35.0	191-211	59-69	3-5	3-5
		80	17.5	268-288	57-67	5-7	7-9
			35.0	257-277	60-70	2-4	3-5
		100	17.5	350-370	60-70	5-7	6-8
			35.0	338-358	63-73	2-4	3-5
		120	17.5	449-469	64-74	4-6	6-8
			35.0	436-456	67-77	2-4	3-5
	70	60	17.5	213-233	81-91	8-10	9-11
			35.0	199-219	87-97	4-6	5-7
		80	17.5	279-299	85-95	8-10	9-11
			35.0	265-285	90-100	4-6	5-7
		100	17.5	361-381	87-97	7-9	9-11
			35.0	343-363	90-100	3-5	4-6
		120	17.5	457-477	89-99	6-8	8-10
			35.0	442-462	95-105	3-5	4-6
	90	60	17.5	231-251	114-124	12-14	13-15
			35.0	217-237	124-134	6-8	7-9
		80	17.5	290-310	112-122	10-12	11-13
			35.0	278-298	127-137	5-7	6-8
		100	17.5	377-397	123-133	10-12	11-13
			35.0	357-377	131-141	5-7	6-8
		120	17.5	475-495	128-138	9-11	11-13
			35.0	454-474	134-144	4-6	5-7

Table 21 — 50PSW180 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
180	50	50	25	233-253	42-52	11-13	10-12
			50	213-233	48-58	6-8	5-7
		60	25	241-261	52-62	13-15	11-13
			50	220-240	59-69	7-9	6-8
		70	25	251-271	62-72	15-17	13-15
			50	228-248	71-81	8-10	7-9
		80	25	263-283	73-83	17-19	15-17
			50	240-260	84-94	10-12	8-10
		90	25	277-297	86-96	19-21	17-19
			50	251-271	99-109	11-13	10-12
	70	50	25	300-320	46-56	11-13	9-11
			50	279-299	52-62	6-8	5-7
		60	25	309-329	56-66	13-15	11-13
			50	285-305	63-73	7-9	6-8
		70	25	319-339	66-76	14-16	12-14
			50	293-313	75-85	8-10	7-9
		80	25	331-351	78-88	16-18	14-16
			50	303-323	89-99	9-11	8-10
		90	25	346-366	91-101	19-21	16-18
			50	315-335	104-114	11-13	9-11
	90	50	25	383-403	51-61	11-13	8-10
			50	362-382	56-66	6-8	4-6
		60	25	392-412	60-70	12-14	10-12
			50	366-386	67-77	7-9	5-7
		70	25	402-422	71-81	14-16	12-14
			50	374-394	80-90	8-10	6-8
		80	25	415-435	83-93	16-18	13-15
			50	384-404	94-104	9-11	7-9
		90	25	430-450	97-107	18-20	15-17
			50	396-416	110-120	10-12	9-11
	110	50	25	481-501	55-65	10-12	7-9
			50	460-480	60-70	6-8	4-6
		60	25	494-514	65-75	12-14	9-11
			50	466-486	71-81	6-8	5-7
		70	25	505-525	77-87	14-16	11-13
			50	473-493	85-95	7-9	6-8
		80	25	519-539	89-99	16-18	12-14
			50	484-504	100-110	9-11	7-9
		90	25	535-555	104-114	17-19	14-16
			50	496-516	116-126	10-12	8-10

Table 21 — 50PSW180 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
180	30	60	25	251-271	28-38	6-8	8-10
			50	232-252	32-42	3-5	4-6
		80	25	320-340	33-43	6-8	8-10
			50	306-326	36-46	3-5	4-6
		100	25	402-422	36-46	5-7	8-10
			50	386-406	40-50	2-4	4-6
		120	25	489-509	40-50	4-6	8-10
			50	475-495	43-53	2-4	4-6
	50	60	25	259-279	46-56	9-11	11-13
			50	238-258	52-62	5-7	6-8
		80	25	332-352	50-60	8-10	11-13
			50	309-329	56-66	4-6	6-8
		100	25	421-441	55-65	7-9	10-12
			50	397-417	59-69	4-6	6-8
		120	25	550-570	61-71	6-8	10-12
			50	518-538	65-75	3-5	5-7
	70	60	25	277-297	67-77	12-14	14-16
			50	253-273	76-86	7-9	8-10
		80	25	350-370	71-81	12-14	14-16
			50	322-342	80-90	6-8	8-10
		100	25	439-459	77-87	11-13	14-16
			50	409-429	85-95	6-8	7-9
		120	25	558-578	83-93	9-11	13-15
			50	515-535	90-100	5-7	7-9
	90	60	25	303-323	92-102	16-18	18-20
			50	276-296	104-114	9-11	11-13
		80	25	376-396	98-108	15-17	18-20
			50	345-365	110-120	9-11	10-12
		100	25	467-487	104-114	14-16	17-19
			50	430-450	117-127	8-10	10-12
		120	25	592-612	113-123	13-15	17-19
			50	537-557	124-134	7-9	9-11

Table 22 — 50PSW210 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
210	50	50	25	200-220	56-66	12-14	10-12
			50	190-210	62-72	6-8	5-7
		60	25	209-229	68-78	14-16	12-14
			50	196-216	77-87	7-9	6-8
		70	25	219-239	82-92	16-18	14-16
			50	206-226	92-102	9-11	8-10
		80	25	231-251	97-107	18-20	16-18
			50	218-238	110-120	10-12	9-11
		90	25	244-264	113-123	20-22	18-20
			50	247-267	132-142	11-13	10-12
	70	50	25	262-282	59-69	12-14	10-12
			50	248-268	66-76	6-8	5-7
		60	25	270-290	72-82	14-16	11-13
			50	255-275	80-90	7-9	6-8
		70	25	281-301	85-95	16-18	13-15
			50	263-283	96-106	8-10	7-9
		80	25	293-313	101-111	18-20	15-17
			50	273-293	114-124	9-11	8-10
		90	25	306-326	118-128	20-22	17-19
			50	285-305	134-144	11-13	9-11
	90	50	25	339-359	63-73	12-14	9-11
			50	324-344	69-79	6-8	4-6
		60	25	347-367	76-86	13-15	10-12
			50	331-351	83-93	7-9	5-7
		70	25	358-378	90-100	15-17	12-14
			50	338-358	99-109	8-10	6-8
		80	25	370-390	106-116	17-19	14-16
			50	348-368	118-128	9-11	8-10
		90	25	384-404	123-133	19-21	16-18
			50	359-379	139-149	10-12	9-11
	110	50	25	434-454	67-77	11-13	8-10
			50	412-432	72-82	6-8	4-6
		60	25	442-462	80-90	13-15	9-11
			50	425-445	87-97	7-9	5-7
		70	25	453-473	94-104	15-17	11-13
			50	432-452	103-113	8-10	6-8
		80	25	465-485	111-121	17-19	13-15
			50	442-462	122-132	9-11	7-9
		90	25	479-499	129-139	19-21	15-17
			50	451-471	144-154	10-12	8-10

Table 22 — 50PSW210 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
210	30	60	25	213-233	34-44	7-9	9-11
			50	201-221	37-47	3-5	5-7
		80	25	281-301	38-48	6-8	9-11
			50	268-288	41-51	3-5	5-7
		100	25	364-384	42-52	5-7	9-11
			50	350-370	44-54	2-4	4-6
		120	25	455-475	45-55	5-7	9-11
			50	444-464	48-58	2-4	4-6
	50	60	25	227-247	53-63	10-12	12-14
			50	214-234	59-69	5-7	7-9
		80	25	294-314	57-67	9-11	12-14
			50	278-298	63-73	4-6	6-8
		100	25	377-397	61-71	8-10	12-14
			50	359-379	66-76	4-6	6-8
		120	25	487-507	66-76	7-9	11-13
			50	458-478	70-80	3-5	6-8
	70	60	25	248-268	78-88	14-16	16-18
			50	232-252	87-97	7-9	9-11
		80	25	315-335	82-92	13-15	16-18
			50	296-316	91-101	7-9	9-11
		100	25	398-418	87-97	12-14	15-17
			50	375-395	96-106	6-8	8-10
		120	25	499-519	93-103	10-12	15-17
			50	473-493	100-110	5-7	8-10
	90	60	25	276-296	108-118	18-20	21-23
			50	216-236	113-123	9-11	11-13
		80	25	343-363	113-123	17-19	20-22
			50	322-342	128-138	9-11	11-13
		100	25	425-445	120-130	15-17	19-21
			50	399-419	133-143	8-10	11-13
		120	25	526-546	127-137	14-16	18-20
			50	495-515	140-150	7-9	10-12

Table 23 — 50PSW240 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
240	50	50	36	203-223	58-68	6-8	5-7
			72	191-211	64-74	3-5	2-4
		60	36	208-228	71-81	7-9	6-8
			72	195-215	77-87	4-6	3-5
		70	36	215-235	84-94	8-10	7-9
			72	201-221	92-102	5-7	3-5
		80	36	224-244	99-109	9-11	9-11
			72	209-229	109-119	5-7	4-6
		90	36	234-254	115-125	11-13	10-12
			72	217-237	128-138	6-8	5-7
	70	50	36	269-289	61-71	6-8	5-7
			72	256-276	66-76	3-5	2-4
		60	36	274-294	73-83	7-9	6-8
			72	259-279	80-90	4-6	2-4
		70	36	280-300	87-97	8-10	7-9
			72	265-285	95-105	4-6	3-5
		80	36	289-309	103-113	9-11	8-10
			72	271-291	113-123	5-7	4-6
		90	36	298-318	120-130	10-12	9-11
			72	280-300	132-142	6-8	5-7
	90	50	36	350-370	63-73	5-7	4-6
			72	336-356	68-78	3-5	2-4
		60	36	354-374	77-87	6-8	5-7
			72	340-360	82-92	3-5	2-4
		70	36	361-381	91-101	7-9	6-8
			72	344-364	99-109	4-6	3-5
		80	36	369-389	108-118	9-11	8-10
			72	350-370	117-127	5-7	3-5
		90	36	379-399	125-135	10-12	9-11
			72	358-378	137-147	5-7	4-6
	110	50	36	448-468	66-76	5-7	4-6
			72	433-453	71-81	3-5	1-3
		60	36	452-472	80-90	6-8	5-7
			72	437-457	85-95	3-5	2-4
		70	36	459-479	95-105	7-9	6-8
			72	441-461	103-113	4-6	2-4
		80	36	467-487	113-123	8-10	7-9
			72	447-467	121-131	4-6	3-5
		90	36	477-497	131-141	9-11	8-10
			72	455-475	143-153	5-7	4-6

Table 23 — 50PSW240 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) Source	Entering Fluid Temp (°F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
240	30	60	36	229-249	29-39	4-6	5-7
			72	218-238	33-43	1-3	3-5
		80	36	302-322	31-41	3-5	5-7
			72	289-309	35-45	1-3	3-5
		100	36	384-404	33-43	3-5	4-6
			72	375-395	37-47	1-3	2-4
		120	36	483-503	35-45	3-5	4-6
			72	472-492	40-50	1-3	2-4
	50	60	36	235-255	48-58	5-7	6-8
			72	220-240	53-63	2-4	4-6
		80	36	307-327	50-60	5-7	6-8
			72	292-312	55-65	2-4	3-5
		100	36	393-413	53-63	4-6	6-8
			72	378-398	57-67	2-4	3-5
		120	36	497-517	56-66	4-6	6-8
			72	481-501	60-70	1-3	3-5
	70	60	36	249-269	70-80	8-10	9-11
			72	234-254	77-87	3-5	5-7
		80	36	320-340	74-84	7-9	8-10
			72	302-322	80-90	3-5	5-7
		100	36	406-426	78-88	6-8	8-10
			72	387-407	84-94	3-5	4-6
		120	36	511-531	82-92	6-8	8-10
			72	490-510	88-98	2-4	4-6
	90	60	36	270-290	97-107	10-12	11-13
			72	252-272	107-117	5-7	6-8
		80	36	340-360	103-113	10-12	11-13
			72	319-339	112-122	5-7	6-8
		100	36	427-447	108-118	9-11	11-13
			72	403-423	118-128	4-6	6-8
		120	36	533-553	114-124	8-10	10-12
			72	507-527	124-134	4-6	6-8

Table 24 — 50PSW360 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) Source	Entering Fluid Temp (°F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
360	50	50	45	211-231	58-68	6-8	5-7
			90	197-217	63-73	4-6	2-4
		60	45	217-237	71-81	7-9	6-8
			90	202-222	77-87	4-6	2-4
		70	45	226-246	84-94	8-10	7-9
			90	210-230	92-102	5-7	3-5
		80	45	237-257	100-110	10-12	8-10
			90	219-239	109-119	6-8	4-6
		90	45	249-269	117-127	11-13	10-12
			90	229-249	128-138	6-8	5-7
	70	50	45	278-298	61-71	6-8	4-6
			90	263-283	66-76	3-5	2-4
		60	45	284-304	74-84	7-9	5-7
			90	267-287	80-90	4-6	2-4
		70	45	293-313	88-98	8-10	6-8
			90	274-294	96-106	5-7	3-5
		80	45	304-324	104-114	9-11	8-10
			90	283-303	113-123	5-7	3-5
		90	45	317-337	122-132	10-12	9-11
			90	293-313	132-142	6-8	4-6
	90	50	45	360-380	65-75	5-7	4-6
			90	343-363	69-79	3-5	1-3
		60	45	366-386	78-88	6-8	5-7
			90	347-367	84-94	4-6	2-4
		70	45	375-395	93-103	7-9	6-8
			90	353-373	100-110	4-6	2-4
		80	45	386-406	109-119	8-10	7-9
			90	362-382	118-128	5-7	3-5
		90	45	400-420	128-138	10-12	8-10
			90	372-392	137-147	6-8	4-6
	110	50	45	454-474	69-79	5-7	4-6
			90	440-460	73-83	3-5	1-3
		60	45	464-484	82-92	6-8	4-6
			90	444-464	88-98	3-5	2-4
		70	45	474-494	97-107	7-9	5-7
			90	451-471	104-114	4-6	2-4
		80	45	485-505	115-125	8-10	6-8
			90	459-479	123-133	5-7	3-5
		90	45	499-519	133-143	9-11	7-9
			90	470-490	143-153	5-7	3-5

Table 24 — 50PSW360 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
360	30	60	45	231-251	32-42	3-5	4-6
			90	221-241	36-46	1-3	3-5
		80	45	302-322	35-45	3-5	4-6
			90	294-314	40-50	1-3	2-4
		100	45	380-400	38-48	2-4	4-6
			90	373-393	43-53	0-2	2-4
		120	45	479-499	42-52	2-4	3-5
			90	469-489	47-57	0-2	2-4
	50	60	45	236-256	51-61	5-7	6-8
			90	224-244	56-66	2-4	3-5
		80	45	305-325	55-65	4-6	6-8
			90	292-312	59-69	2-4	3-5
		100	45	393-413	59-69	4-6	5-7
			90	379-399	63-73	1-3	3-5
		120	45	491-511	62-72	3-5	5-7
			90	480-500	66-76	1-3	3-5
	70	60	45	249-269	75-85	7-9	8-10
			90	237-257	82-92	3-5	5-7
		80	45	319-339	79-89	6-8	8-10
			90	303-323	86-96	3-5	4-6
		100	45	404-424	83-93	6-8	7-9
			90	387-407	90-100	2-4	4-6
		120	45	508-528	88-98	5-7	7-9
			90	489-509	94-104	2-4	4-6
	90	60	45	270-290	103-113	10-12	11-13
			90	256-276	114-124	5-7	6-8
		80	45	338-358	109-119	9-11	10-12
			90	324-344	119-129	4-6	6-8
		100	45	424-444	115-125	8-10	10-12
			90	403-423	125-135	4-6	6-8
		120	45	528-548	121-131	7-9	9-11
			90	505-525	131-141	3-5	5-7

Table 25 — 50PSW420 Typical Unit Operating Pressures and Temperatures

COOLING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise (°F) (Source)	Water Temp Drop (°F) (Load)
420	50	50	45	191-211	64-74	8-10	7-9
			90	163-183	68-78	4-6	3-5
		60	45	198-218	78-88	9-11	8-10
			90	249-269	88-98	5-7	4-6
		70	45	208-228	93-103	11-13	10-12
			90	165-185	99-109	5-7	5-7
		80	45	218-238	111-121	12-14	11-13
			90	348-368	136-146	6-8	5-7
		90	45	230-250	130-140	14-16	13-15
			90	401-421	162-172	7-9	6-8
	70	50	45	251-271	67-77	8-10	6-8
			90	237-257	74-84	4-6	3-5
		60	45	259-279	81-91	9-11	8-10
			90	231-251	86-96	4-6	4-6
		70	45	267-287	97-107	11-13	9-11
			90	303-323	107-117	5-7	4-6
		80	45	278-298	114-124	12-14	10-12
			90	326-346	128-138	6-8	5-7
		90	45	288-308	134-144	14-16	12-14
			90	271-291	150-160	7-9	6-8
	90	50	45	328-348	70-80	8-10	6-8
			90	340-360	76-86	4-6	3-5
		60	45	335-355	84-94	9-11	7-9
			90	323-343	91-101	4-6	3-5
		70	45	343-363	100-110	10-12	8-10
			90	362-382	110-120	5-7	4-6
		80	45	353-373	119-129	12-14	10-12
			90	378-398	131-141	6-8	5-7
		90	45	364-384	139-149	13-15	11-13
			90	349-369	152-162	7-9	6-8
	110	50	45	423-443	74-84	8-10	5-7
			90	430-450	79-89	4-6	2-4
		60	45	429-449	88-98	9-11	6-8
			90	437-457	96-106	4-6	3-5
		70	45	437-457	104-114	10-12	7-9
			90	445-465	113-123	5-7	3-5
		80	45	446-466	123-133	11-13	9-11
			90	458-478	134-144	5-7	4-6
		90	45	457-477	145-155	13-15	10-12
			90	445-465	156-166	6-8	5-7

Table 25 — 50PSW420 Typical Unit Operating Pressures and Temperatures (cont)

HEATING							
Size	Entering Fluid Temp (°F) (Source)	Entering Fluid Temp (°F) (Load)	GPM	Discharge Pressure	Suction Pressure	Water Temp Drop (°F) (Source)	Water Temp Rise (°F) (Load)
420	30	60	45	205-225	38-48	4-6	6-8
			90	197-217	41-51	1-3	4-6
		80	45	272-292	42-52	4-6	6-8
			90	263-283	44-54	1-3	3-5
		100	45	355-375	45-55	3-5	6-8
			90	345-365	47-57	1-3	3-5
		120	45	446-466	49-59	3-5	6-8
			90	439-459	51-61	1-3	3-5
	50	60	45	217-237	60-70	7-9	8-10
			90	209-229	65-75	3-5	5-7
		80	45	282-302	64-74	6-8	8-10
			90	271-291	68-78	2-4	5-7
		100	45	364-384	67-77	5-7	8-10
			90	352-372	71-81	2-4	4-6
		120	45	465-485	71-81	5-7	8-10
			90	451-471	75-85	2-4	4-6
	70	60	45	237-257	88-98	9-11	11-13
			90	346-366	107-117	4-6	6-8
		80	45	301-321	92-102	9-11	11-13
			90	288-308	99-109	4-6	6-8
		100	45	381-401	96-106	8-10	10-12
			90	365-385	103-113	3-5	6-8
		120	45	480-500	101-111	7-9	10-12
			90	463-483	107-117	3-5	6-8
	90	60	45	262-282	122-132	13-15	15-17
			90	198-218	119-129	6-8	8-10
		80	45	326-346	127-137	12-14	14-16
			90	275-295	129-139	5-7	8-10
		100	45	405-425	133-143	11-13	13-15
			90	388-408	144-154	5-7	8-10
		120	45	503-523	140-150	9-11	13-15
			90	482-502	150-160	4-6	7-9

Table 26 — 50PSW Operating Limits

LIMIT[a]			COOLING	HEATING
Minimum Ambient Air			50°F	40°F
Maximum Ambient Air			100°F	85°F
Rated Ambient Air			80°F	68°F
Antifreeze Protection Required LWT / EWT			—	< 40/< 50°F
Source Side	Minimum Water Coil Entering Fluid		50°F	30°F
	Maximum Water Coil Entering Fluid		110°F	90°F
Load Side	Minimum Water Coil Entering Fluid		50°F	60°F
	Maximum Water Coil Entering Fluid		90°F	120°F
Rated Water Coil Entering Fluid	Water Loop Application	Load	53.6°F	104°F
		Source	86°F	68°F
	Ground Loop Application	Load	53.6°F	104°F
		Source	77°F / 68°F (PL)	32°F / 41°F (PL)
	Ground Water Application	Load	53.6°F	104°F
		Source	59°F	50°F
Maximum Operating Water Pressure			450 PSI / 3103 kPa	
Minimum Operating Water Flow Rate			1.5 Gpm per Ton	

NOTE(S):

a. Maximum and minimum operating limits may not be combined. If one value is at either maximum or minimum, the other value(s) must be within normal operating range.

LEGEND

EWT — Entering Water Temperature
LWT — Leaving Water Temperature
GPM — Gallons per Minute
WSHP — Water Source Heat Pump

Scroll Compressor Rotation

It is important to be certain the compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges 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.

⚠ CAUTION

When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling. Damage to compressor will occur if allowed to operate in this manner.

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

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

Cleaning and Flushing

Cleaning and flushing of the piping system is the single most important step to ensure proper start-up and continued efficient operation of the system.

⚠ 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. Install lockout tag.

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

1. Verify electrical power to the unit is disconnected and lockout tag installed.
2. Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
3. Open all air vents. Fill the system with the water. DO NOT allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair appropriately.
4. Verify all strainers are in place. Start the pumps, and systematically check each vent to ensure all air is bled from the system.
5. Verify make-up water is available. Adjust make-up water appropriately to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
6. Raise the loop temperature to approximately 85°F. Open the drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gal. of water (or other equivalent approved cleaning agent).

⚠ CAUTION

To avoid possible damage to a plastic (PVC) piping system, do not allow temperatures to exceed 110°F.

8. Raise the loop temperature to 100°F. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
9. When the cleaning process is complete, remove the short-circuited hose. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
10. Test the system pH with litmus paper. The system water should be slightly alkaline (pH of 7.5 to 8.5). Add chemicals, as appropriate, to maintain acidity levels.
11. When the system is successfully cleaned, flushed, refilled and bled, restore power.
12. Check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

⚠ CAUTION

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

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°F 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 27.) Use the percentage by volume in Table 28 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

FREEZE PROTECTION

The freeze sensor input is active at all the times. There are 2 configurable freeze points, 25°F and 15°F. See "Configure Unit Control Components" on page 27. for more information regarding the freeze sensors. The unit will enter a soft lockout until the temperature climbs above the set point and the anti-short cycle time delay has expired. The freeze sensor will shut the compressor output down after 30 seconds of water flow loss and report a freeze condition. It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

Table 27 — Approximate Fluid Volume (gal.) per 100 Ft of Pipe[a]

PIPE	DIAMETER (in.)	VOLUME (gal.)
Copper	1.00	4.1
	1.25	6.4
	1.50	9.2
Rubber Hose	1.00	3.9

Table 27 — Approximate Fluid Volume (gal.) per 100 Ft of Pipe[a] (cont)

PIPE	DIAMETER (in.)	VOLUME (gal.)
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

NOTE(S):

a. Volume of heat exchanger is approximately 1.0 gallon.

LEGEND

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

Table 28 — Antifreeze Percentages by Volume

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

System Flow

FLOW VERIFICATION

The 50PSW WSHP units do not include a factory flow switch as standard. It is recommend to field install a flow switch or order the unit with a flow switch as factory-installed option to prevent the compressor from operating without loop flow.

FLOW REGULATION

Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. Adjust the water control valve until the desired flow rate is achieved. Since the pressure constantly varies, two pressure gauges may be needed in some applications. See Start-Up Checklist for flow rates based on waterside pressure drop.

An alternate method of flow regulation is to install an automatic flow control valve. These valves feature a removable cartridge that controls the maximum flow through the valve assembly.

Verify that the water flow control cartridge matches the application flow requirement. (See Fig. 23 and 24.)

Cooling Tower/Boiler Systems

These systems typically use a common loop maintained at 60°F 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 a 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.

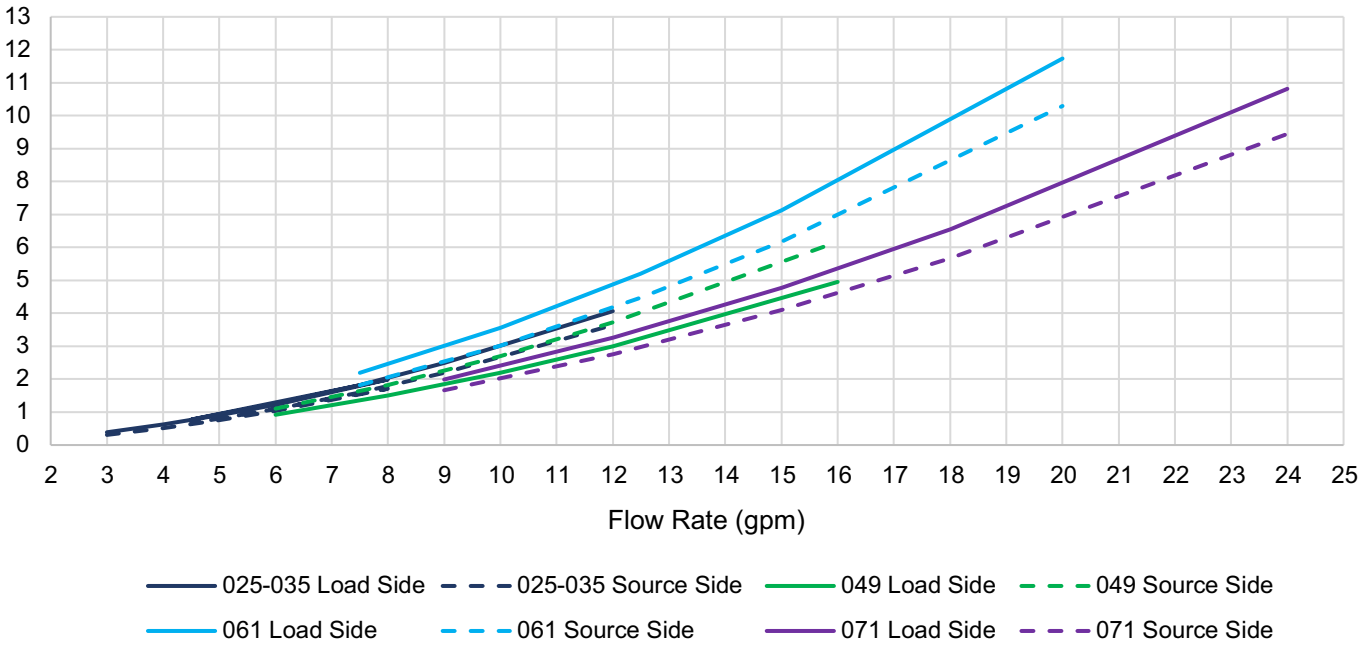


Fig. 23 — Water Pressure Drop Curves (025-071)

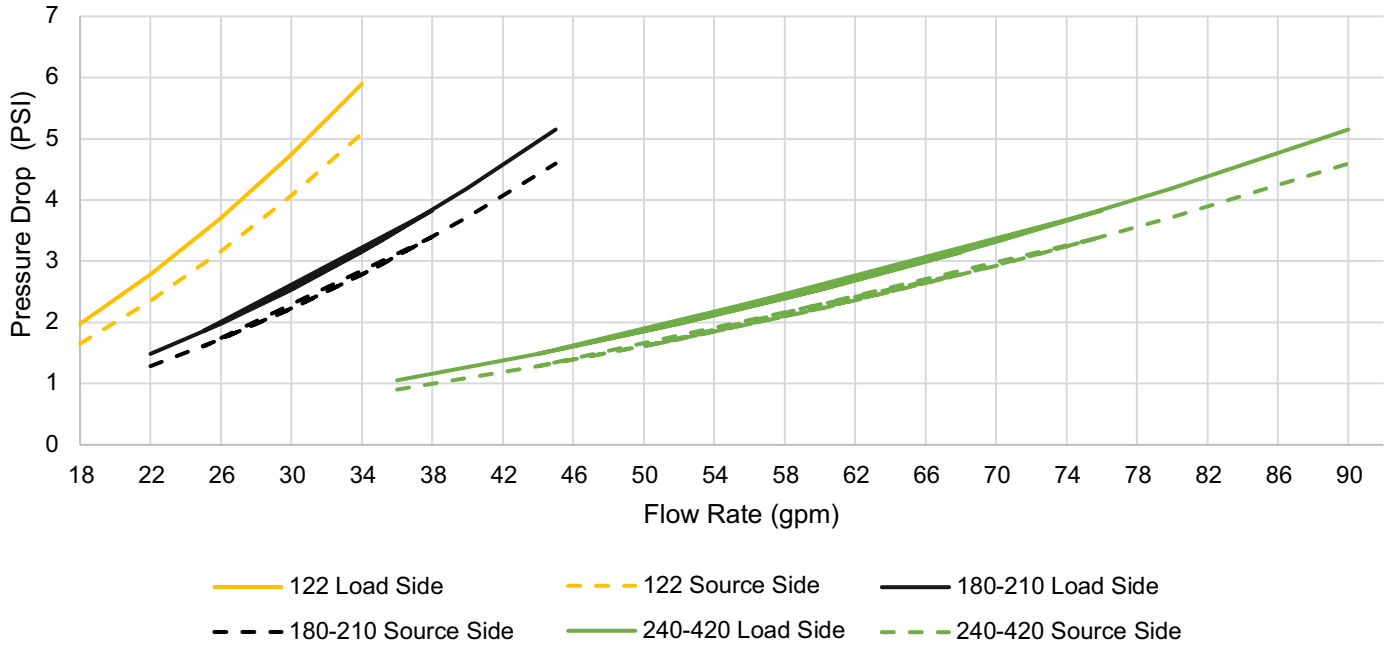


Fig. 24 — Water Pressure Drop (120-420)

OPERATION

Power Up Mode

The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation. (See Fig. 25 and 26.)

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

Unit Protection Model (UPM)

Figure 26 shows the UPM sequence of operation for unit safeties. All 50PSW units are equipped with a UPM.

Units without DDC controller

COOLING MODE

Energizing the "O" terminal energizes the unit reversing valve thus placing the unit into cooling mode. When the thermostat calls for first stage cooling (Y1) the loop pump or solenoid valve if present is energized and the first stage of compressor capacity starts. When the thermostat calls for second stage cooling (Y2) the second stage (or full compressor capacity) is initiated. Once the thermostat is satisfied, the compressor shuts down accordingly.

HEATING MODE

The first two stages of heating (Y1 and Y2) operate in the same manner as cooling, but with the reversing valve de-energized. Once the thermostat is satisfied, the compressor shuts down.

Units with W2W Open Controls

Units with W2W Open still feature a UPM board for unit operation, so the operation will be similar to the sequence for the other control packages. W2W Open features advanced functionality, such as outdoor air reset and intelligent alarming, which will differ from the other control packages. Below is an overview of the different features for the W2W Open controls. For more details of the W2W Open operation, please refer to the W2W Open Integration Guide and the W2W Points/Properties Manual. See Fig. 25 for W2W Open Control Board overview.

SEQUENCE OF OPERATION

WSHP Open W2W

OCCUPANCY

Scheduling

Scheduling is used to start/stop the unit based upon a time period to control the leaving water temperature to specified heating or cooling setpoints. By default, the modules schedule is continuously occupied and will thus be enabled to operate as configured to maintain the leaving water temperature and the water supply setpoint.

Time schedules may be configured with Bacview6, Field Assistant, or i-Vu Open. See the appropriate machine interface User's Guide for specific instructions for setting time schedules. NOTE: The modules' local time and date must be set for these functions to operate properly.

System occupancy

The system occupancy function provides a means for W2W controls installed as part of an i-Vu Open system to have their occupancy determined by another module on the controls network. A Binary Network input (BNI2) object is utilized to read the present value of the Occupancy Status variable of another module. System Occupancy requires Field Assistant, or iVu Open Server for setup.

BAS (BUILDING AUTOMATION SYSTEM) ON/OFF

The BAS On/Off function provides a means for W2W controls installed as part of a Third-party BACnet system to have their occupancy determined by another device on the controls network. A Network Visible, BACnet Multi-state Value object may be written by the third-party device to set the controls occupied state as required. This method of occupancy determination takes precedence over all others. No special configuration is necessary to utilize this function. Object address information is also described in the W2W Integration Guide.

REMOTE OCCUPANCY CONTACT

The W2W has the capability to utilize an external dry contact closure to determine the occupancy status of the unit. The external contact may be normally closed or normally opened. Assuming a normally open contact, the module will be unoccupied when the remote contact is open, and occupied when the contact is closed. A normally closed contact will be unoccupied when the remote contact is closed, and occupied when the remote contact is open.

SHUTDOWN

The W2W includes a unit shutdown function. Shutdown is a software switch that allows an operator to stop unit operation. Shutdown is a BACnet binary value (object name "**shutdown**") and is accessed in the **Status** expander via the **Shutdown** variable. Setting **Shutdown** "**Active**" will immediately stop compressor operation. The pump and valve outputs will remain energized until their respective off delays have expired (see pump and valve section).

The equipment will remain off as long as **Shutdown** is **active**. **Shutdown's** default state is **inactive**. **Shutdown** may be invoked from the UI, or accessed via the network (where the module is part of a BACnet MSTP network).

POWER FAIL RESTART DELAY

The W2W control includes an adjustable Power Fail Restart Delay (PFRD). The PFRD holds off the equipment startup until the configured delay time has expired, and may be utilized to stagger equipment starts after a power outage. The PFRD default value is 60 seconds but may be adjusted between 0 and 600 seconds.

CHANGEOVER TIMEGUARD

The W2W control utilizes a fixed 5 minute **Changeover Timeguard** to protect the equipment in the event of any immediate mode change between heating and cooling. The timeguard stops compressor operation for **5 minutes** to allow water temperatures and refrigerant pressures to normalize before restarting the compressor. The status **(Inactive / Active)** of the **Changeover Timeguard** may be viewed in the module's **Maintenance** expander.

LOAD PUMP

The W2W has a dedicated binary output to control a Load Pump. The load pump output will be energized whenever the unit is occupied.

When power is first applied to the control, or reapplied after a power outage, the pump output will be energized after the Power Fail Restart Delay (described previously) expires.

The pump control includes a configurable Pump Stop Delay. The stop delay defines the time the pump will continue to operate after heating or cooling is stopped, should the unit transition to unoccupied. The Pump Stop Delay default value is 45 seconds and may be adjusted between 0 and 180 seconds. NOTE: On a request for unit shutdown (described previously), the pump will continue to operate until all compression is disabled and then additionally until the configured pump delay expires.

SOURCE WATER ISOLATION VALVE/SOURCE WATER PUMP OUTPUT

The W2W has a dedicated binary output to control a Source Water Isolation Valve or dedicated source water pump. The output will be energized prior to starting any compression stage.

The output includes a configurable close/off delay. The delay defines the time the isolation valve will remain open or the pump will continue to operate after the last stage of compression stops.

The Iso Valve Close Delay default value is 45 seconds and may be adjusted between 0 and 180. NOTE: On a request for unit shutdown (described previously), the valve will remain open until all compression is disabled and then additionally until the configured valve close delay expires.

COOLING (SINGLE MODULE)

When configured for "Single/Secondary Unit" operation, The W2W control will operate up to four stages of compression to maintain the desired chilled water setpoint. The control point can be selected by setting the "Control Type" to either the leaving water temperature sensor (default) or the entering water temperature sensor. While in the cooling mode, the compressor outputs are controlled by the PI (Proportional-integral) cooling loop and cooling stages capacity algorithm. The algorithms calculate the desired number of stages needed to satisfy the load water setpoint by comparing the actual water temperature sensor value to the chilled water setpoint.

Additionally, an independent leaving load water temperature safety check is included to verify that sufficient load water flow is provided. Regardless of the control type, as the leaving load water temperature exceeds the configured "Chilled Water Supply Setpoint", the compressor stages will start to be reduced as required.

The following conditions must be true in order for the cooling algorithm to run:

- Unit is occupied (see Occupancy Section above).
- The lockout temperature (OAT, SPT, or T1) is greater than the Cooling lockout temperature setpoint.
- Cooling mode is set to Enable.
- Heat mode is not active, the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is above the Chilled Water Supply Setpoint.

If all the above conditions are met, the compressor(s) will be energized as required to satisfy the cooling requirements. While cooling, the reversing valve output will be held in the cooling position (either B or O type as configured) even after compression is stopped. The valve will not switch position until the heating mode is required.

During cooling operation, the control employs a 5 minute time delay before each subsequent stage of compression is energized to allow the leaving water temperature (LWT) to achieve a stable temperature and avoid overshoot. Once energized, a stage of compression will have to run for at least 180 seconds before being staged off to avoid short-cycling.

Once a compressor is staged off, it may not be restarted again until a five minute time guard delay period expires.

The module provides three (binary) compressor status inputs to monitor compressor operation. These inputs are monitored to determine if the compressor status matches its commanded state. These inputs are used to determine if a refrigerant safety switch or other safety device has tripped and has caused the compressor to stop operating normally. If this should occur, an alarm will be generated to indicate the faulted compressor condition. The Compressor Status Alarm includes a 6 minute delay to avoid nuisance alarms.

ADDITIONAL COOLING FUNCTIONS

Cooling Setpoint OA Rest

The W2W control may be configured to reset the chilled water setpoint proportionally based upon OAT. The amount of reset and the reset range are both user configurable. This feature can provide energy savings by operating the unit at a higher load water temperature setpoint when the minimum chilled water temperature is not required. It also can be used to better match the chilled water temperature to the cooling load requirements.

The following conditions must be true in order for the Cooling Setpoint OA Reset algorithm to run:

- The preconditions for cooling operation (described previously) have been met.
- The module has a valid Outdoor Air Temperature.
- Cooling Setpoint OA Reset is Enabled.

RH Cooling Setpoint Rest

When the OAT Cooling Setpoint Reset function (described previously) is enabled, The W2W control has the capability to limit the (OAT) chilled water setpoint reset based upon the difference between the High RH setpoint and the measured RH value (Space RH or Outdoor Air RH).

The RH Cooling Setpoint reset override uses a PI function to determine the limit applied to the Cooling Setpoint OA Reset function.

The following conditions must be true in order for the RH Cooling Setpoint Reset algorithm to run:

- The preconditions for cooling operation (described previously) have been met.
- The preconditions for Cooling Setpoint OA Reset operation (described previously) have been met.
- The module has a valid Relative Humidity value.
- RH Cooling Setpoint OA Reset is Enabled.

COOLING CONTROL MODES

The following control modes are available for cooling operation. These modes may be selected by the installing technician, or by an operator of sufficient access privileges using one of the available man machine interfaces (BACview, Field Assistant, or i-Vu Open Server). See the Controls Configuration sections for additional instructions.

Manual Cool

Configuring the Control Mode Selection for Manual Cool places the control in a cooling only configuration and the machine operates as a chiller. The module will operate as described in the Cooling section while configured for Manual Cool. The Outdoor Air and Relative Humidity Cooling setpoint reset functions are available provided their associated preconditions (described previously) are met.

When the Control Mode Selection is set to Manual Cool, the lockout temperature (OAT, SPT, or T1) is overridden, even when the input is available. The control will operate as required to maintain the Chilled Water Supply Temperature setpoint, regardless of the any previously configured lockout temperature.

The following conditions must be true in order for the cooling algorithm to run in the Manual Cool control mode:

- Control Mode Selection is set to Manual Cool.
- Cool Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- Load water temp is above the Chilled Water Supply Setpoint.

OAT

Configuring the Control Mode Selection for OAT sets the control to change modes between heating and cooling automatically based on the Outdoor Air Temperature (OAT). The control will compare the OAT to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. A valid outdoor air temperature reading (hardware or network) is required for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require cooling, the module will operate as described in the Cooling section above. The Outdoor Air and Relative Humidity Cooling setpoint reset functions are available provided their associated preconditions (described previously) are met.

The following conditions must be true in order for the cooling algorithm to run in the OAT control mode:

- A valid Outdoor Air Temperature is present.
- Control Mode Selection is set to OAT.
- Cool Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The OAT is greater than the Cooling lockout temperature setpoint.
- Heat mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is above the Chilled Water Supply Setpoint.

SPT

Configuring the Control Mode Selection for SPT sets the control to change modes between heating and cooling based on the Space Temperature sensor located in the space or return air plenum (SPT). The control will compare the SPT to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. A valid space temperature reading (hardware or network) is required for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require cooling, the module will operate as described in the Cooling section. The Outdoor Air and Relative Humidity Cooling setpoint reset functions are available provided their associated preconditions (described previously) are met.

The following conditions must be true in order for the cooling algorithm to run in the SPT control mode:

- A valid SPT is present.
- Control Mode Selection is set to SPT.
- Cool Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The SPT is greater than the Cooling lockout temperature setpoint.
- Heat mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is above the Chilled Water Supply Setpoint.

System T1 Temp

Configuring the Control Mode Selection for System T1 Temp sets the control to change modes between heating and cooling based on a network temperature. The control will compare the network temperature to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. The System T1 Temperature network input object must be addressed to read the desired temperature and communicating for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require cooling, the module will operate as described in the Cooling section. The Outdoor Air and Relative Humidity Cooling setpoint reset functions are available provided their associated preconditions (described previously) are met.

The following conditions must be true in order for the cooling algorithm to run in the T1 control mode:

- A valid network T1 Temperature is present.
- Control Mode Selection is set to T1.
- Cool Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The T1 Temperature is greater than the Cooling lockout temperature Setpoint.
- Heat mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is above the Chilled Water Supply Setpoint.

HEATING (SINGLE MODULE)

When configured for “Single/Secondary Unit” operation, The W2W control will operate up to four stages of compression to maintain the desired hot water supply setpoint. The control point can be selected by setting the “Control Type” to either the leaving water temperature sensor (default) or the entering water temperature sensor. While in the heating mode, the compressor outputs are controlled by the PI (Proportional-integral) heating loop and heating stages capacity algorithm. The algorithms calculate the desired number of stages needed to satisfy the load water setpoint by comparing the actual water temperature sensor value to the hot water supply setpoint.

Additionally, an independent leaving load water temperature safety check is included to verify that sufficient load water flow is provided. Regardless of the control type, as the leaving load water temperature exceeds the configured “Hot Water Supply Setpoint”, the compressor stages will start to be reduced as required.

The following conditions must be true in order for the heating algorithm to run:

- Unit is occupied (see Occupancy Section above).
- The lockout temperature (OAT, SPT, or T1) is less than the Heating lockout temperature setpoint.
- Heat Enable is set to Enable.
- Cool mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is below the Hot Water Supply Setpoint.

If all the above conditions are met, the compressors will be energized as required to satisfy the heating requirements. While heating, the reversing valve output will be held in the heating position (either B or O type as configured) even after compression is stopped. The valve will not switch position until the cooling mode is required.

During heating operation, the control employs a 5 minute time delay before each subsequent stage of compression to allow the leaving water temperature (LWT) to achieve a stable temperature and avoid overshoot. Once energized, a stage of compression will have to run for at least 180 seconds before being staged off to avoid short-cycling.

Once a compressor is staged off, it may not be restarted again until a five minute time guard delay period expires.

The module provides three (binary) compressor status inputs to monitor compressor operation. These inputs are monitored to determine if the compressor status matches its commanded state. These inputs are used to determine if a refrigerant safety switch or other safety device has tripped and have caused the compressor to stop operating normally. If this should occur, an alarm will be generated to indicate the faulted compressor condition. The Compressor Status Alarms include a 6 minute delay to avoid nuisance alarms.

ADDITIONAL HEATING FUNCTIONS

Heating Setpoint OA Reset

The W2W control may be configured to reset the hot water supply setpoint proportionally based upon OAT. The amount of reset and the reset range are both user configurable. This feature can provide energy savings by operating the unit at a lower load water temperature setpoint when the maximum hot water supply temperature is not required. It also can be used to better match the hot water temperature to the heating load requirements.

The following conditions must be true in order for the Heating Setpoint OA Reset algorithm to run:

- The preconditions for heating operation (described previously) have been met.
- The module has a valid Outdoor Air Temperature.
- Heating Setpoint OA Reset is Enabled.

HEATING CONTROL MODES

The following control modes are available for heating operation. These modes may be selected by the installing technician, or by an operator of sufficient access rights using one of the available man machine interfaces (BACview, Field Assistant, or i-Vu Open Server). See the Controls Configuration sections for additional instructions.

Manual Heat

Configuring the Control Mode Selection for Manual Heat places the control in a heating only configuration. The module will operate as described in the Heating section while configured for Manual Heat. The Heating Setpoint OA Reset function is available provided the associated preconditions (described previously) are met.

When the Control Mode Selection is set to Manual Heat, the lockout temperature (OAT, SPT, or T1) is overridden, even when the input is available. The control will operate as required to maintain the Hot Water Supply Temperature setpoint, regardless of the any previously configured lockout temperature.

The following conditions must be true in order for the heating algorithm to run in the Manual Heat control mode:

- Control Mode Selection is set to Manual Heat.
- Heat Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- Load water temp is below the Hot Water Supply Setpoint.

OAT

Configuring the Control Mode Selection for OAT sets the control to change modes between heating and cooling automatically based on the Outdoor Air Temperature (OAT). The control will compare the OAT to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. A valid outdoor air temperature reading (hardware or network) is required for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require heating, the module will operate as described in the Heating section. The Outdoor Air Hot Water Supply setpoint reset function is available provided its associated preconditions (described previously) are met.

The following conditions must be true in order for the heating algorithm to run in the OAT control mode:

- A valid Outdoor Air Temperature is present.
- Control Mode Selection is set to OAT.
- Heat Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The OAT is less than the Heating lockout temperature setpoint.
- Cool mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is below the Hot Water Supply Setpoint.

SPT

Configuring the Control Mode Selection for SPT sets the control to change modes between heating and cooling based on the Space Temperature sensor located in the space or return air plenum (SPT). The control will compare the SPT to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. A valid space temperature reading (hardware or network) is required for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require heating, the module will operate as described in the Heating section. The Outdoor Air Hot Water Supply setpoint reset function is available provided its associated preconditions (described previously) are met.

The following conditions must be true in order for the heating algorithm to run in the SPT control mode:

- A valid SPT is present.
- Control Mode Selection is set to SPT.
- Heat Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The SPT is less than the Heating lockout temperature setpoint.
- Cool mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is below the Hot Water Supply Setpoint.

System T1 Temp

Configuring the Control Mode Selection for System T1 Temp sets the control to change modes between heating and cooling based on a network temperature. The control will compare the network temperature to the configured lockout temperatures for heating and cooling and select the appropriate operating mode. The System T1 Temperature network input object must be addressed to read the desired temperature and communicating for this mode. Once enabled, equipment control is as described for heating and cooling.

When conditions require heating, the module will operate as described in the Heating section. The Outdoor Air Hot Water Supply setpoint reset function is available provided its associated preconditions (described previously) are met.

The following conditions must be true in order for the heating algorithm to run in the System T1 Temp control mode:

- A valid network T1 Temperature is present.
- Control Mode Selection is set to T1.
- Heat Enable is set to Enable.
- Unit is occupied (see Occupancy Section above).
- The T1 Temperature is less than the Heating lockout temperature setpoint.
- Cool mode is not active and the compressor time guard has expired.
- The Changeover time guard has elapsed.
- Load water temp is below the Hot Water Supply Setpoint.

Demand Limit

The W2W control has the ability to accept a demand limit signal from the network. The demand limit function provides a means for W2W controls installed as part of an i-Vu Open system to have their heating and chilled water setpoints expanded (lowered and raised respectively) to lower the equipments electricity consumption. The amount of setpoint adjustment for each of the three demand levels is user adjustable for both heating and cooling. The configured demand level values are cumulative, as such a level 3 demand limit incorporates the reset values of demand level 1 + demand level 2 + demand level 3.

If both outdoor air setpoint reset and demand level limiting are active simultaneously, the reset value applied will be the greater of the two individual reset functions in effect but NOT the cumulative total of both.

MUTLI-UNIT PRIMARY

On installations having multiple Water to Water Source Heat Pumps serving a common load, the heat pumps may be controlled as a singular heating or cooling source utilizing the Multi-unit MS/TP Operating Mode.

For these installations, the modules are networked together. One of the installed Water to Water Source Heat Pumps operates as a Primary control, with the remaining modules operating as Secondary. Configured thus, the number of stages required to meet load conditions are determined by the Primary control. Secondary modules will receive the number of stages required from the Primary, and will energize their compressor outputs appropriately in sequence.

In this fashion, a Multi-unit MS/TP system can provide for up to eight total stages of control. A Multi-unit MS/TP system will provide coordinated heat pump operation with the same feature set and sequences of operation as that provided by a Single Unit configuration.

In this configuration, an independent leaving load water temperature safety check at each unit is included to verify that sufficient load water flow is provided. Should the leaving load water temperature fall below the configured "Chilled Water Setpoint" in cooling or the "Hot Water Setpoint" in heating, the compressor stages for any unit (primary or secondary) will be reduced as needed without reducing the system staging requirements.

IMPORTANT: Be sure to configure each secondary unit for standalone operation as a fail-safe. Many individual configuration parameters that are not required or used during secondary operation such as the chilled water and hot water setpoints are hidden once the secondary is linked to a primary unit.

EQUIPMENT ALARM

The W2W provides an alarm output that will illuminate an equipment mounted alarm lamp, and generate a generic Equipment Alarm under certain alarm conditions configured by an operator. See the Equipment Alarm configuration section for configuration instructions related to Equipment Alarm.

SERVICE TEST

The W2W provides a built in Service Test function to allow the installing technician a means to test the modules process outputs independently.

1. The Isolation Valve Test energizes the control's Isolation Valve Binary Output.
2. The Water Pump Test energizes the control's Water Pump Binary Output.
3. The Compressor Test energizes the control's Compressor Binary Outputs.
4. The Alarm Indicator Test energizes the control's Alarm Indicator Binary Output.

Invoking the Service Test function will disable normal equipment operation. Service Test will operate in accordance with the control's configuration. For example, initiating the Compressor Test function of Service Test on a two-stage heat pump configured to provide both heating and cooling will energize the stages of compression in sequence; first staging up in Cooling, then changing the reversing valve before staging down in Heating. Although the isolation valve and water pump outputs may be tested independently, they will be automatically energized when the Compressor Test is enabled.

Service Test will time out (disable) automatically after 60 minutes should the technician neglect to disable it after completing the test.

Invoking the Service Test function will disable normal equipment operation. Service Test will operate in accordance with the controls' configuration. For example, initiating the Compressor Test function of Service Test on a two-stage heat pump configured to provide both heating and cooling will energize the stages of compression in sequence; first staging up in Cooling, then changing the reversing valve before staging down in Heating. Although the isolation valve and water pump outputs may be tested independently, they will be automatically energized when the Compressor Test is enabled.

Service Test will time out (disable) automatically after 60 minutes should the technician neglect to disable it after completing the test.

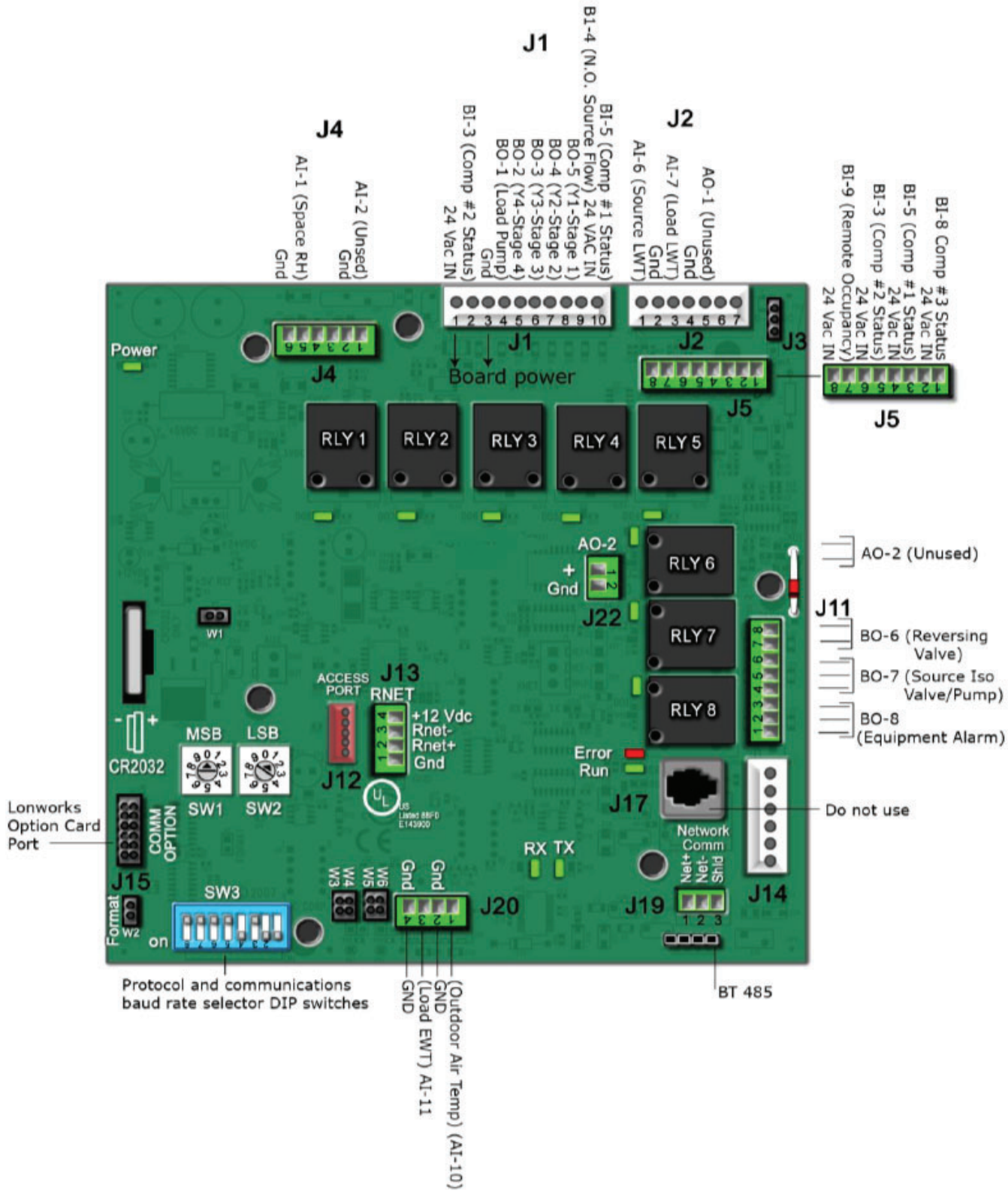


Fig. 25 — W2W Open Control Board

UPM SEQUENCE OF OPERATION

Hot Water Switch

All water-to-water units have a temperature safety switch installed on the load coil. This switch is set to open when it senses that the water temperature in the load coil has reached 145° F. When this occurs, compressor operation will cease, and will not resume until the water has cooled to 115° F. On dual circuit units, there is a single switch that controls both circuits.

Maintenance

⚠ CAUTION

PERSONAL INJURY HAZARD!

Servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

⚠ CAUTION

ELECTRIC SHOCK!

Before performing service or maintenance operations on the system, turn OFF main power to the unit. Electrical shock will cause personal injury or death.

HANDLING PERIODIC LOCKOUTS

Periodic lockouts almost always are caused by water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a mechanic immediately and have them check for:

- water flow problems
- water temperature problems

Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

SERVICING AND REPAIR INFORMATION

Personal Protective Equipment

Ensure that all personal protective equipment is available and being used correctly.

Confined Space Work

Work in confined spaces must be avoided.

Controlled Work Procedure

All work must be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed.

Safety Checks

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. The following precautions must be taken prior to conducting work on the refrigerating system.

Inform Everyone in the General Work Area

All maintenance staff and others working in the local area must be instructed on the nature of work being carried out.

Check for the Presence of Refrigerant

The area must be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with R-454B refrigerant; i.e., non-sparking, adequately sealed, or intrinsically safe.

Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire-extinguishing equipment must be available on hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

Ignition Sources

Ensure the following prior to the work taking place:

1. The area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks.
2. “No Smoking” signs must be posted.
3. All possible ignition sources, including cigarette smoking, must be kept sufficiently far away from the site of installation, repair, removal, or disposal during which refrigerant may possibly be released and exposed to the surrounding area and the ignition sources.
4. Ensure that any person carrying out work in relation to a refrigerating system that involves exposing any pipe work knows that they must NOT use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.

Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. The ventilation must safely disperse all released refrigerant, preferably expelling it externally into the atmosphere. The ventilation must be present during the period that the work is carried out.

Checks to The Refrigerating Equipment

Where electrical components are being changed, they must be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines must be followed. If in doubt, consult Bosch service and support for assistance.

The following checks must be applied to installations using flammable refrigerants:

1. Ensure the actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
2. Ensure that the ventilation machinery and outlets are operating adequately and are not obstructed.
3. Check the secondary circuit for the presence of refrigerant, if an indirect refrigerating circuit is being used.
4. Ensure the markings on the equipment continues to be visible and legible. Markings and signs that are illegible must be corrected.
5. Ensure the refrigerating pipes or components are installed in a position where they are unlikely to be exposed to any substance that may corrode refrigerant containing components, unless the components are constructed of materials that are inherently resistant to being corroded or are suitably protected against being so corroded.

Checks to Electrical Devices

Repair and maintenance to electrical components must include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then electrical supply must NOT be connected to the circuit until the safety fault is satisfactorily corrected. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution must be used. This must be reported to the owner of the equipment, so all parties are advised.

The following are required initial safety checks:

1. Ensure that capacitors are discharged-this must be done in a safe manner to avoid possibility of sparking.
2. Ensure that no live-electrical components and wiring are exposed while charging, recovering, or purging the system.
3. Ensure that there is continuity of earth bonding.

IMPORTANT: REPAIRS TO SEALED COMPONENTS

Sealed-electrical components must be replaced.

IMPORTANT: REPAIR TO INTRINSICALLY SAFE COMPONENTS

Intrinsically safe components must be replaced.

Check Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check must also take into account the effects of aging or continual vibrations from sources such as compressors or fans.

Detection of Flammable Refrigerants

Under NO circumstances may potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) must NOT be used.

The following leak-detection methods are deemed acceptable for all refrigerant systems:

1. Electronic leak detectors may be used to detect refrigerant leaks but in the case of flammable refrigerants, the sensitivity may not be adequate or may need re-calibration. (Detection equipment must be calibrated in a refrigerant-free area.). Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak-detection equipment must be set to a percentage for the Lower-Flammable Limit (LFL) (25% maximum) of the gas that is confirmed.
2. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine must be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work. Examples of leak detection fluids are:

- bubble method
- fluorescent method agents

If a leak is suspected, all naked flames must be removed/ extinguished.

If a leakage of refrigerant is found that requires brazing, all of the refrigerant must be recovered from the system or isolated (by means of shut-off valves) in a part of the system remote from the leak.

Removal and Evacuation

When breaking into the refrigerant circuit to make repairs-or for any other purpose-conventional procedures must be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure must be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas (optional for A2L).
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

The refrigerant charge must be recovered into the correct recovery cylinders if venting is not allowed by local or national codes. For appliances containing flammable refrigerants, the system must be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen must not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerant purging must be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process must be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system must be vented down to atmospheric pressure to enable work to take place.

⚠CAUTION

FIRE HAZARD!

The outlet for the vacuum pump must not be close to any potential ignition sources, and ventilation must be available.

Charging Procedures

In addition to conventional charging procedures, the following requirements must be followed.

1. Ensure that contamination of different refrigerants does not occur when using charging equipment.
2. Ensure hoses or lines are as short as possible to minimize the amount of refrigerant contained in them.
3. Ensure cylinders are kept in an appropriate position according to the instructions.
4. Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
5. Be sure to label the system when charging is complete (if not already).
6. Use extreme care not to overfill the refrigerating system.
7. Ensure the system is pressure-tested with the appropriate purging gas prior to recharging the system.
8. Ensure the system is leak-tested on completion of charging but prior to commissioning. A follow-up leak test must be carried out prior to leaving the site.

Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

Ensure the following:

1. Ensure that only appropriate refrigerant recovery cylinders are employed when transferring refrigerant into cylinders.
2. Ensure that the correct number of cylinders for holding the total system charge are available.
3. Ensure all cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e., special cylinders for the recovery of refrigerant).
4. Ensure all cylinders are complete with a pressure-relief valve and associated shut-off valves that are all in good working order.
5. Ensure empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
6. Ensure the recovery equipment is in good working order.
7. Ensure set of instructions for the recovery equipment is at hand.
8. Ensure the recovery equipment is suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted.

9. Ensure a set of calibrated weighing scales are available and in good working order.
10. Ensure the hoses are complete with leak-free disconnect couplings and are in good condition.
11. Ensure the recovered refrigerant is processed according to local legislations/regulations in the correct recovery cylinder, and the relevant waste transfer note arranged.
12. Ensure there is no mixing of refrigerants in the recovery units and especially not in cylinders.
13. If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body must NOT be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it must be carried out safely.

Decommissioning Information

Only trained and qualified technicians are allowed to decommission and dispose of equipment following the requirements and local codes.

⚠ CAUTION

PERSONAL INJURY HAZARD!

Decommissioning of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, service, or disconnect the equipment.

Protecting the Environment

COMPONENTS

By disposing of this product correctly you will help ensure that the waste undergoes the necessary treatment, recovery, and recycling, thus preventing potentially negative effects on the environment and human health, which could otherwise arise due to inappropriate waste handling.

Many parts in the heat pump can be fully recycled at the end of the product life. Contact your city authorities for information about the disposal of recyclable products.

REFRIGERANT

At the end of the service life of this appliance, and prior to its environmental disposal, a person qualified to work with refrigerant circuits must recover the refrigerant from within the sealed system as per applicable local codes.

HAZARDOUS WASTE

Some components in the Heat Pump may be considered as hazardous waste, such as batteries. For their disposal contact your local household hazardous waste collection site.

Decommissioning Procedure

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail.

It is recommended good practice that all refrigerants are recovered safely. Follow the procedure below.

1. Before attempting the procedure:
   a. Become familiar with the equipment and its operation.
   b. Ensure that electrical power is available for the recovery machine before the task is commenced.
   c. Ensure an oil and refrigerant sample is taken in case analysis is required prior to re-use of recovered refrigerant.
   d. Isolate the system electrically. Lock-Out/Tag-Out recommended.
   e. Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders
   f. Ensure that all personal protective equipment is available and being used correctly.
   g. Ensure that the recovery process is supervised at all times by a competent person
   h. Ensure that the recovery equipment and cylinders conform to the appropriate standards.
2. Pump down refrigerant system, if possible.
3. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
4. Make sure that cylinder is situated on the scales before recovery takes place.
5. Start the recovery machine and operate in accordance with instructions.
6. DO NOT overfill cylinders (no more than 80% volume liquid charge).
7. DO NOT exceed the maximum working pressure of the cylinder, even temporarily.
8. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
9. Recovered refrigerant must NOT be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

Labeling

The following are required:

1. Equipment must be labeled stating that it has been decommissioned and emptied of refrigerant.
2. The label must be dated and signed.
3. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

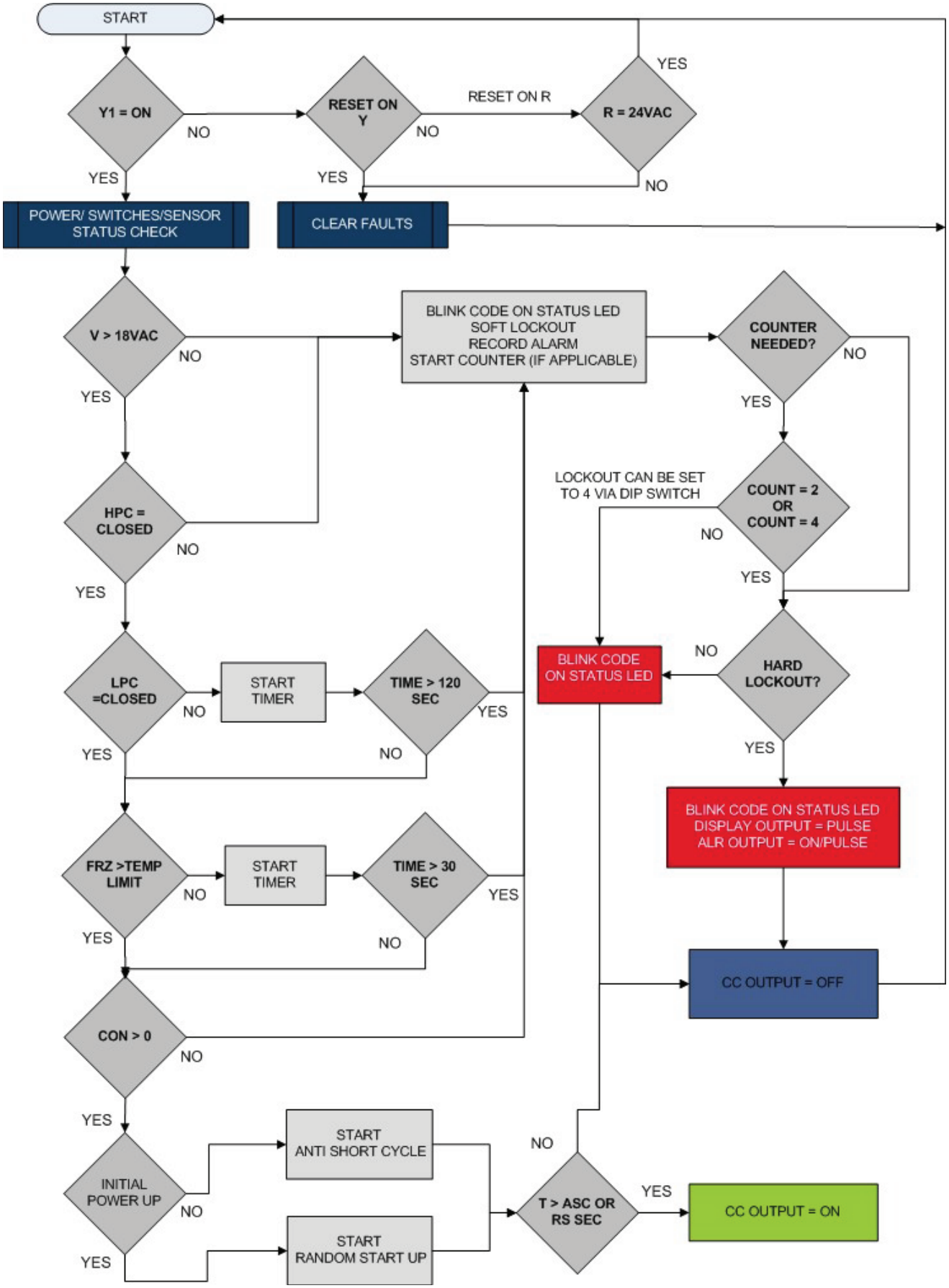


Fig. 26 — Unit Protection Module (UPM) Sequence Of Operation

Configuring Multiple W2W WSHP for MS/TP Operation

On installations having multiple Water-to-Water Source Heat Pumps serving a common load, the heat pumps may be controlled as a singular heating or cooling source utilizing the **Multi-unit MS/TP** Operating Mode.

For these installations, the modules are networked together over the BACnet MS/TP bus. One of the installed Water-to-Water Source Heat Pumps operates as a Primary control, with the remaining modules operating as Secondary. Configured thus, the number of stages required to meet load conditions are determined by the Primary control. Secondary modules will receive the number of stages required from the Primary, and will energize their compressor outputs appropriately in sequence.

In this fashion, a Multi-unit MS/TP system can provide for up to eight total stages of control. A Multi-unit MS/TP system will provide coordinated heat pump operation with the same feature set and sequences of operation as that provided by a Single Unit configuration.

In this configuration, an independent leaving load water temperature safety check at each unit is included to verify that sufficient load water flow is provided. Should the leaving load water temperature fall below the configured "Chilled Water Setpoint" in cooling or the "Hot Water Setpoint" in heating, the compressor stages for any unit (primary or secondary) will be reduced as needed without reducing the system staging requirements.

NOTE: Before configuring the units as a Multi-unit Primary systems, be sure to verify configuration for each secondary unit for standalone operation as a fail-safe. Many individual configuration parameters that are not required or used during secondary operation such as the chilled water and hot water setpoints are hidden (see screen captions below for hidden points) once the secondary is linked to a primary unit. See Fig. 27-29 for visual representations of configuration.

W2W PRIMARY CONFIGURATION PARAMETERS

The following configuration parameters can be accessed in the following figures. (See Fig. 27-29.) Properties→ Control Program→ Configuration→ Service Configuration

Operation Type

Multi-unit MS/TP (default value is Single/Secondary Unit)

Total Controlled Stages

1 - 8 (this variable is the total number of stages of all W2W units to be linked into one single system)

Control Mode Selection

Manual heat, manual cool, SPT, OAT or System T1 Temp

Refrigerant Circuits

Configure for the correct number of refrigerant circuits in the unit.

Compressor Stages

1 - 4 (this variable is how many stages the Primary unit is capable of using) Default value is 2.

W2W SECONDARY CONFIGURATION

The following configuration parameter can be accessed in the following table. Properties →Network Points.

1. **Total Req Sys Comp Stgs** = bacnet://<device instance of primary>/av:88001.

   NOTE: This parameter needs to be configured first because configuration parameters for steps #3, #5, #6 below are hidden until the Secondary and Primary units are linked together through **Total Req Sys Comp Stgs.**

   The following configuration parameters can be accessed in the following table. Properties→Control Program→Configuration→Service Configuration.
2. **Operation Type** - Single/Secondary unit.
3. **System Stage # Assigned to Y1** - This value defines when each secondary unit will start its first stage Y1output of control for system staging.
4. **Compressor Stages** - Total number of compressor stages for each individual unit.
5. **Stage Number of 2nd Compressor -** (Option available when **Compressor Stages** = > 2) - On each unit with **Compressor Stages** set to 2 or more, will be used to identify which output stage (if any) will be used to verify feedback of the second compressor, using the second stage feedback input. This is always a one to one relationship unless unloaders are present.
6. **Stage Number of 3rd Compressor -** (Option available when **Compressor Stages** = > 3) - On each unit with **Compressor Stages** set to 3 or more, used to identify which output stage (if any) will be used to verify feedback of the third compressor, using the third stage feedback input. This is always a one to one relationship unless unloaders are present.

See Fig. 27-29 is an example screen shot of the Service Configuration of a Secondary Unit that has bound to a Primary W2W unit. The Secondary unit has 2 stages of compression and will be the third stage in the system.

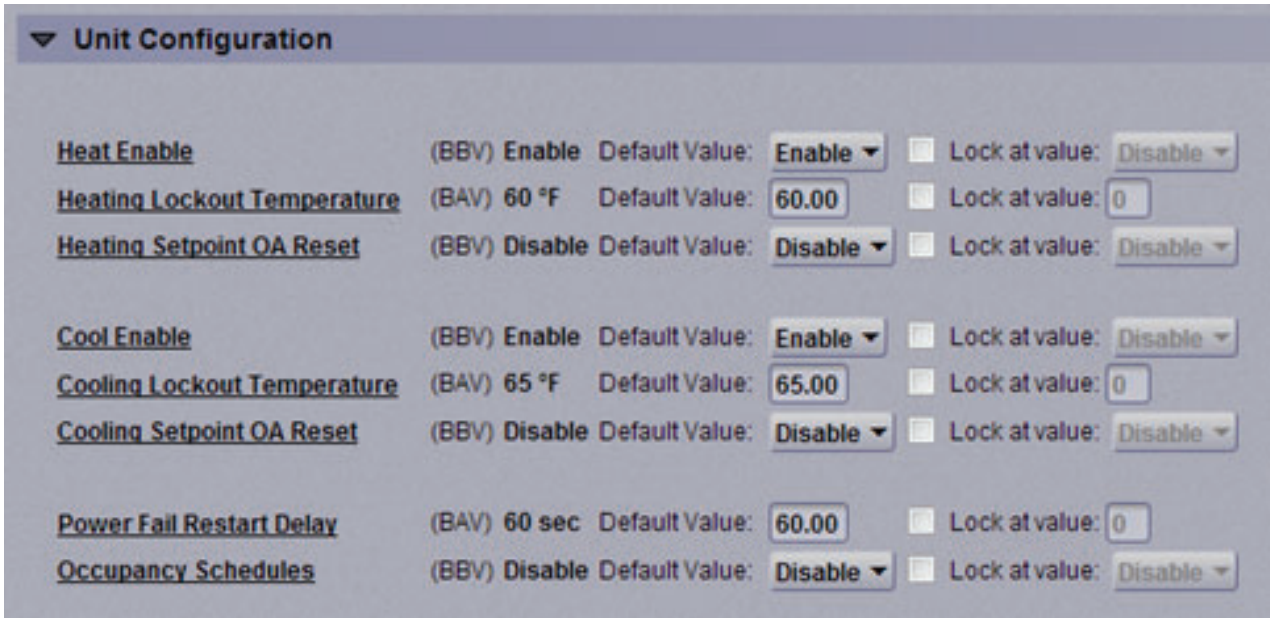


Fig. 27 — W2W Primary Configuration Parameters - Unit Configurations

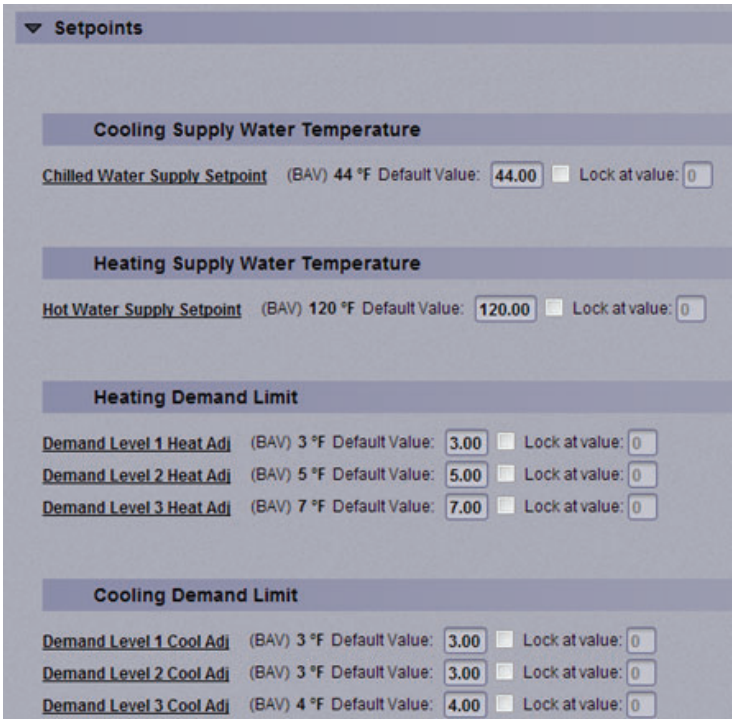


Fig. 28 — W2W Primary Configuration Parameters - Setpoints

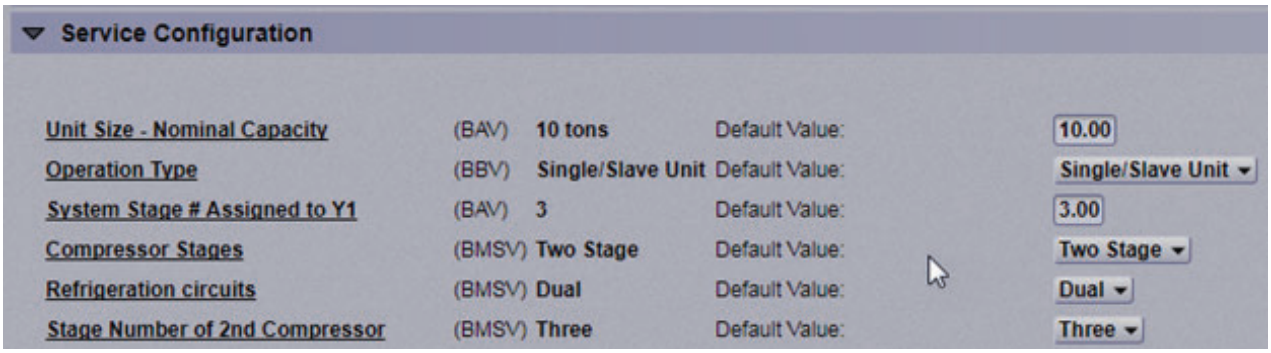


Fig. 29 — W2W Primary Configuration Parameter - Service Configuration

⚠ WARNING

REFRIGERANT SAFETY WARNINGS

The coaxial coil used in this unit is a single-wall heat exchanger not suitable for potable water.

⚠ WARNING

PERSONAL INJURY HAZARD

When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing and place a fire extinguisher close to the work area.

⚠ WARNING

PERSONAL INJURY HAZARD

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

⚠ WARNING

ELECTRIC SHOCK

Before performing service or maintenance operations on the system, turn OFF main power to the unit. Electrical shock will cause personal injury or death.

⚠ WARNING

PERSONAL INJURY HAZARD OR PROPERTY DAMAGE

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

⚠ WARNING

FIRE HAZARD

The appliance must be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater).

⚠ CAUTION

Auxiliary devices that may be ignition sources must NOT be installed in the ductwork, unless the auxiliary devices are approved for use with the specific appliance or declared suitable for the refrigerant.

IMPORTANT: Hot surfaces inside unit may cause burns.

⚠ CAUTION

This appliance is not intended for use by people (including children) with reduced physical, sensory, or mental capabilities, or with lack of experience and knowledge, unless they are supervised or have been given instruction concerning use of the appliance by a person responsible for their safety.

IMPORTANT: Children should be supervised to ensure that they do not play with the appliance.

⚠ WARNING

POISONOUS GAS!

Poisonous gas can be created when refrigerant (R-454B) is exposed to open flames.

IMPORTANT:

Flammable Refrigerant Used—To be repaired only by trained service personnel. DO NOT puncture refrigerant tubing.

Flammable Refrigerant Used—Dispose of properly in accordance with federal or local regulations.
DO NOT pierce or burn refrigerant lines.

Be aware that refrigerants may not contain an odor.

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

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

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

IMPORTANT: The system contains an oversize, protective, earthing (grounding) terminal that must be properly connected, otherwise personal injury or death may result.

Properly-sized fusible safety switches or HACR circuit breakers must be installed for branch circuit protection. See the unit nameplate for maximum fuse or breaker size.

The unit ground wire must never be used as a neutral wire.

All high-voltage connections must be torqued as specified by the component's manufacturer.

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: 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.

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.

⚠ WARNING

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

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.

⚠ CAUTION

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.

Refrigerant System

Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gauges unless unit operation appears abnormal.

Condenser Cleaning

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

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

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

⚠ CAUTION

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

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

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

GRAVITY FLOW METHOD

Do not add solution faster than vent can exhaust the generated gases. When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions. (See Fig. 30.)

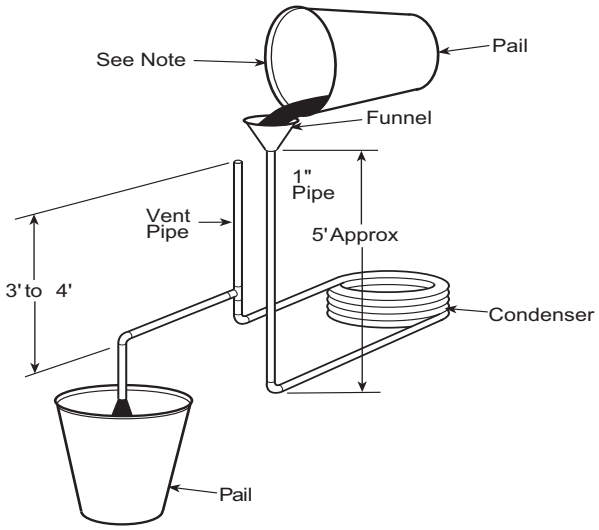


Fig. 30 — Gravity Flow Method

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. 31.) 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.

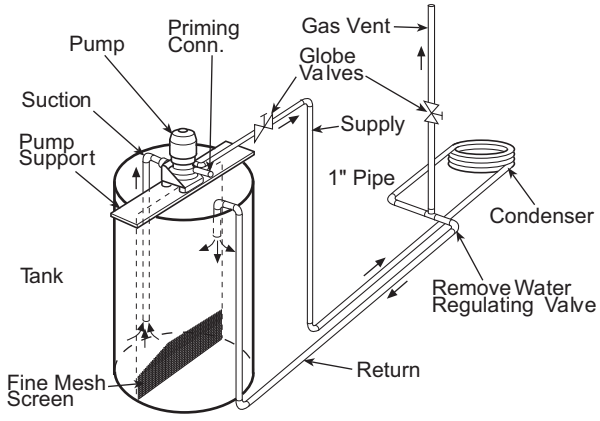


Fig. 31 — Forced Circulation Method

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 gauge.
   NOTE: Operate unit a minimum of 15 minutes before checking charge. From standard field-supplied Pressure-Temperature chart for R-410A, find equivalent saturated condensing temperature.
4. 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.

TROUBLESHOOTING

When troubleshooting problems arise with a WSHP, refer to Table 13 on page 29 for fault codes. See Table 29 for troubleshooting solutions. The UPM on each unit includes an alarm indicator with blink codes to indicate UPM fault. See Fig. 30-31 for single and two-stage UPM fault codes.

Table 29 — Troubleshooting

FAULT	POSSIBLE CAUSE	SOLUTION
COMPRESSOR DOES NOT OPERATE	Power Supply Off	Apply power, close disconnect.
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses.
	Broken or Loose Wires	Replace or tighten the wires. Check for loose or broken wires at compressor, capacitor, or contactor.
	Voltage Supply Low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Controller	Set controller 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 the compressor does not run in all cases, the controller could be miswired or faulty.To ensure miswired or faulty thermostat verify 24 volts is available on the unit section low voltage terminal strip between “R” and “C,” “Y” and “C,” and “O” and “C.” Replace the controller if defective.
	Safety Controls	Reset the controller to “OFF.” After a few minutes turn to “COOL” or “HEAT.” If the compressor runs, unit was off on one of the safety controls. (See problem for possible causes).
	Compressor Overload Open	If the compressor is cool and the overload will not reset, replace compressor.
	Compressor Motor Grounded	Internal winding grounded to the compressor shell. Replace compressor. If compressor burnout, install suction filter drier.
	Compressor Windings Open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor.
UNIT OFF ON HIGH-PRESSURE SWITCH	Discharge Pressure Too High	In “COOLING” mode: SOURCE COIL - Lack of or inadequate water flow. Entering water temperature too warm. Scaled or plugged condenser. In “HEATING” mode: LOAD COIL - Lack of or inadequate water flow. Entering water temperature too warm. Scaled or plugged load coil.
	Refrigerant Charge	The unit is overcharged with refrigerant. Recover refrigerant, evacuate and recharge with factory recommended charge.
	High-pressure Switch	Check for defective or improperly calibrated high-pressure switch.
UNIT OFF ON LOW-PRESSURE SWITCH	Suction Pressure Too Low	In “COOLING” mode: LOAD COIL - Lack of or inadequate fluid flow. Entering water temperature too cold. Scaled or plugged load coil. In “HEATING” mode: SOURCE COIL - Lack of or inadequate fluid flow. Entering water temperature too cold. Scaled or plugged source coil.
	Refrigerant Charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacuate and recharge with factory recommended charge.
	Low-pressure Switch	Check for defective or improperly calibrated low-pressure switch.
UNIT SHORT CYCLES	Unit Oversized	Recalculate heating and or cooling loads.
	Wiring and Controls	Loose connections in the wiring or a defective compressor contactor.
	Fluid Volume	Inadequate load side fluid volume.
INSUFFICIENT COOLING OR HEATING	Unit Undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem. Unit may be short of refrigerant.
	Refrigerant Charge	Unit may be short on refrigerant charge.
	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	Check TXV (thermostatic expansion valve) for possible restriction or defect. Replace if necessary.
	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.

Table 30 — Single Stage UPM Fault Codes

PROBLEM	MODE		CHECK	FAULT	POSSIBLE CAUSE	ACTION
	Cooling	Heating				
Unit Does Not Run	X	X	1 Blink on UPM	High Pressure Fault	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	X				Insufficient or low flow to source water coil.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		X			Insufficient or low flow to load water coil.	
	X	X			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	X				Scaled or plugged source coil.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	X	X	2 Blinks on UPM	Low Pressure Fault	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		X			Insufficient or low flow to source water coil.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	X				Insufficient or low flow to load water coil.	
	X				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
		X			Scaled or plugged load coil.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			Low-pressure switch malfunction	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
		X	3 Blinks on UPM	Freeze 1 (Source)	Insufficient or low flow to source water coil.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	X	X	5 Blinks on UPM	Brownout Fault	Low voltage supply	Check the transformer primary voltage taps. Ensure they are between the limits listed on the unit data plate.
	X	X			Bad thermostat connection	Check control voltage. If below 18 vac, ensure the accessories connected to the unit do not exceed the VA draw shown in Fig. 19 on page 27.
	X	X				Inspect thermostat wiring for damage. Ensure it is the correct gage and length, and that no connections are loose.
	X		6 Blinks on UPM	Freeze 2 (Load)	Insufficient or low flow to load water coil.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	X	X				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	X	X	7 Blinks on UPM	A2L Fault	The A2L sensor has detected a refrigerant leak.	Conduct a thorough inspection of the refrigerant system to identify any leaks.
	X	X			A2L sensor malfunction.	Inspect the sensor and wiring for damage, corrosion, or loose connections.

Table 31 — Two-Stage UPM Fault Codes

PROBLEM	MODE		CHECK	FAULT	POSSIBLE CAUSE	ACTION
	Cooling	Heating				
Unit Does Not Run	X	X	1 Blink on UPM	High Pressure Fault (Circuit 1)	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	X				Insufficient or low flow to source water coil 1.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		X			Insufficient or low flow to load water coil 1.	
	X	X			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	X				Scaled or plugged source coil 1.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	X	X	2 Blinks on UPM	Low Pressure Fault (Circuit 1)	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		X			Insufficient or low flow to source water coil 1.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	X				Insufficient or low flow to load water coil 1.	
	X				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	X				Scaled or plugged load coil 1.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			Low-pressure switch malfunction	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	X	X	3 Blink on UPM	High Pressure Fault (Circuit 2)	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	X				Insufficient or low flow to source water coil 2.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		X			Insufficient or low flow to load water coil 2.	
	X	X			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	X				Scaled or plugged source coil 2.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	X	X	4 Blinks on UPM	Low Pressure Fault (Circuit 2)	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		X			Insufficient or low flow to source water coil 2.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	X				Insufficient or low flow to load water coil 2.	
	X				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	X				Scaled or plugged load coil 2.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	X	X			Low-pressure swith malfunction.	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.

Table 31 — Two-Stage UPM Fault Codes (cont)

PROBLEM	MODE		CHECK	FAULT	POSSIBLE CAUSE	ACTION
	Cooling	Heating				
Unit Does Not Run		X	5 Blinks on UPM	Freeze 1 (Source Coil Circuit 1)	Insufficient or low flow to source water coil 1.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	X	X	6 Blinks on UPM	Condens-ate Fault	Not applicable to water-to-water heat pumps.	
	X	X	7 Blinks on UPM	Brownout Fault	Low voltage supply	Check the transformer primary voltage taps. Ensure they are between the limits listed on the unit data plate.
	X	X			Bad thermostat connection	Check control voltage. If below 18 vac, ensure the accessories connected to the unit do not exceed the va draw shown in Fig. 21 on page 28.
	X	X				Inspect thermostat wiring for damage. Ensure it is the correct gauge and length, and that no connections are loose.
	X		8 Blinks on UPM	Freeze 2 Fault (Load Coil Circuit 1)	Insufficient or low flow to load water coil 1.	Verify the flow rate to load coil is correct and adjust if necessary. Clean the load coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	X	X				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
		X	9 Blinks on UPM	Freeze 3 Fault (Source Coil Circuit 2)	Insufficient or low flow to source water coil 2.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	X		10 Blinks on UPM	Freeze 2 Fault (Load Coil Circuit 2)	Insufficient or low flow to load water coil 2.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	X	X			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	X	X				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	X	X			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	X	X			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	X	X	11 blinks on UPM	A2L Fault	The A2L sensor has detected a refrigerant leak.	Conduct a thorough inspection of the refrigerant system to identify any leaks.
	X	X			A2L sensor malfunction.	Inspect the sensor and wiring for damage, corrosion, or loose connections.
	X	X	12 blinks on UPM	Second-stage Communi cation Fault	Lost communication with the second-stage UPM board	Inspect all electrical wiring and check for loose connections.

50-PSW
START-UP CHECKLIST

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

Customer: _____ Job Name: _____

Model No.: _____ Serial No.:_____Date: _____

Loop Type: _____ Antifreeze Type and %: _____

I. PRE-START-UP

Does the unit voltage correspond with the supply voltage available? (Y/N) _____

Have the power and control wiring connections been made and terminals tight? (Y/N) _____

Have water connections been made and is fluid available at heat exchanger? (Y/N) _____

Has pump been turned on and are isolation valves open? (Y/N) _____

Has condensate connection been made and is a trap installed? (Y/N) _____

Is an air filter installed? (Y/N) _____

II. START-UP

Is fan operating when compressor operates? (Y/N) _____

If 3-phase scroll compressor is present, verify proper rotation per instructions. (Y/N) _____

UNIT VOLTAGE — COOLING OPERATION

Phase AB Volts_____ Phase BC Volts _____ (if 3 phase) Phase CA Volts _____ (if 3 phase)

Phase AB Amps_____ Phase BC Amps _____ (if 3 phase) Phase CA Amps _____ (if 3 phase)

CONTROL VOLTAGE

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

TEMPERATURES

Fill in the analysis chart attached.

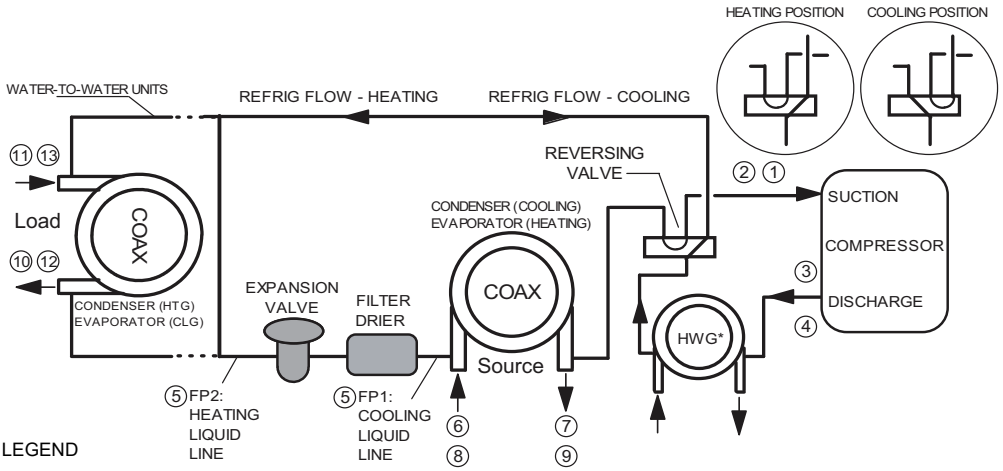
COAXIAL HEAT EXCHANGER COOLING CYCLE: FLUID IN _____ F FLUID OUT _____ F _____ PSI _____ FLOW

HEATING CYCLE:
FLUID IN _____ F FLUID OUT _____ F _____ PSI _____ FLOW

AIR COIL COOLING CYCLE:
AIR IN _____ F AIR OUT _____ F

HEATING CYCLE:
AIR IN _____ F AIR OUT _____ F

HEATING AND COOLING CYCLE ANALYSIS



LEGEND

CLG — Cooling
HTG — Heating

NOTE: Turn off HWG (hot water generator) before troubleshooting.

	DESCRIPTION	HEATING	COOLING	NOTES
	Voltage			
	Compressor Amp			
1	Suction Temperature			
2	Suction Pressure			
2a	Saturation Temperature			
2b	Superheat			
3	Discharge Temperature			
4	Discharge Pressure			
4a	Saturation Temperature			
4b	Subcooling			
5	Liquid Line Temperature			
6	Source Water In Temperature			
7	Source Water Out Temperature			Temperature Difference —
8	Source Water In Pressure			
9	Source Water Out Pressure			
9a	Pressure Drop			
9b	Flow Rate (gpm)			
10	Load Water In Temperature			
11	Load Water Out Temperature			Temperature Difference —
12	Load Water In Pressure			
13	Load Water Out Pressure			
13a	Pressure Drop			
13b	Flow Rate (gpm)			

HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

_____ Flow Rate (GPM) x _____ Temp. Diff. (°F) x _____ Fluid Factor* = _____ (Btu/hr)

SUPERHEAT = Suction Temperature – Suction Saturation Temperature
= ____ (°F)

SUBCOOLING = Discharge Saturation Temperature – Liquid Line Temperature
= ____ (°F)

* Use 500 for water, 485 for antifreeze.

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE