



Installation, Start-Up, and Service Instructions

CONTENTS

	Page
SAFETY CONSIDERATIONS	1,2
GENERAL	2
INSTALLATION	2-14
Step 1 — Check Jobsite	2
Step 2 — Check Unit	2
• STORAGE	
• PROTECTION	
• INSPECT UNIT	
Step 3 — Location of Unit	3
Step 4 — Mounting the Unit	6
Step 5 — Condensate Drain	6
Step 6 — Piping Connections	6
• WATER LOOP APPLICATIONS	
• GROUND-WATER APPLICATIONS	
• GROUND-LOOP APPLICATIONS	
Step 7 — Electrical Wiring	7
• SUPPLY VOLTAGE	
• 208-VOLT OPERATION	
• BLOWER SELECTION	
Step 8 — Low Voltage Wiring	14
• THERMOSTAT CONNECTIONS	
• WATER FREEZE PROTECTION	
• AIR COIL FREEZE PROTECTION	
• ACCESSORY CONNECTIONS	
• WATER SOLENOID VALVES	
PRE-START-UP	14,15
System Checkout	14
FIELD SELECTABLE INPUTS	15,16
C Control Jumper Settings	15
C Control DIP Switches	15
D Control Jumper Settings	15
D Control DIP Switches	15
D Control Accessory Relay Configurations	16
Water Valve (Slow Opening)	16
Outside Air Damper (OAD)	16
START-UP	16-18
Operating Limits	16
Scroll Compressor Rotation	17
Unit Start-Up Cooling Mode	17
Unit Start-Up Heating Mode	17
Flow Regulation	17
Flushing	17
Antifreeze	18
Cooling Tower/Boiler Systems	18
Ground Coupled, Closed Loop and Plateframe Heat Exchanger Well Systems	18
OPERATION	19
Power Up Mode	19
Units with Aquazone™ Complete C Control	19
Units with Aquazone Deluxe D Control	19
SYSTEM TEST	19,20
Test Mode	19
Retry Mode	20
Aquazone Deluxe D Control LED Indicators	20
SERVICE	20-22
Filters	20
Water Coil	20
Condensate Drain Pans	21
Refrigerant System	21
Condensate Drain Cleaning	21
Air Coil Cleaning	21
Condenser Cleaning	21
Checking System Charge	22
Refrigerant Charging	22
Air Coil Fan Motor Removal	22
TROUBLESHOOTING	22-25
Thermistor	22
Control Sensors	22
START-UP CHECKLIST	CL-1, CL-2

IMPORTANT: Read the entire instruction manual before starting installation.

SAFETY CONSIDERATIONS

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

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

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

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

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

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

⚠ WARNING

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

GENERAL

This Installation and Start-Up Instructions literature is for Aquazone™ Rooftop Water Source Heat Pump systems.

Rooftop Water Source Heat Pumps (WSHP) are single-package outdoor units with electronic controls designed for year-round cooling and heating.

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

INSTALLATION

Step 1 — Check Jobsite — Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Table 1 for unit physical data.

⚠ CAUTION

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

Step 2 — Check Unit — Upon receipt of shipment at the jobsite, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed

damage not discovered during unloading must be reported to the shipping company within 15 days of receipt of shipment.

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

1. Verify unit is correct model for entering water temperature of job.
2. Be sure to provide freeze protection for piping, as required. Well water applications are especially susceptible to freezing.
3. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.
4. Check local codes to be sure a secondary drain pan is not required under the unit.
5. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
6. Provide sufficient space for duct connection.
7. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
8. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils.
9. Provide an unobstructed path to the unit. Space should be sufficient to allow removal of unit if necessary.
10. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
11. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.

STORAGE — If the equipment is not installed immediately upon its arrival at the jobsite, it should be left in its shipping carton and stored in a clean, dry area of the building or in a warehouse. Units must be stored in an upright position at all times. If unit stacking is necessary, stack 50RTG03-10 units a maximum of 2 high. Do not stack units larger than 50RTG10. Do not remove any equipment from its shipping package until it is needed.

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.

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

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Verify that the unit is the correct model for the entering water temperature of the job.
3. Do not remove the packaging until the unit is ready for installation.
4. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
5. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
6. Compressors are internally spring-mounted. Compressors equipped with external spring vibration isolators must have bolts loosened and shipping clamps removed.

7. Remove any blower support cardboard from inlet of the blower if present.
8. Locate and verify any accessory kit located in compressor section.
9. Remove any access panel screws that may be difficult to remove once unit is installed.

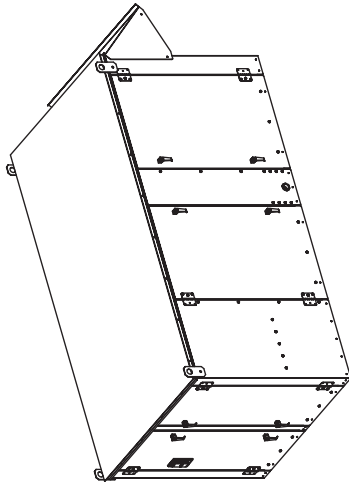
Step 3 — Location of Unit — The following guidelines should be considered when choosing a location for WSHP. Refer to Fig. 1 and 2 for unit dimensional data:

- Provide sufficient space for water, electrical and duct connections
- Locate unit in an area that allows for easy access and removal of filter and access panels
- Allow enough space for service personnel to perform maintenance

Table 1 — Physical Data — Aquazone™ 50RTG03-20 Units

UNIT 50RTG	03	04	05	07	08	10	12	15	20
OPERATING WEIGHT (lb)	735	785	835	880	1080	1125	1175	1770	1960
SHIPPING WEIGHT (lb)	750	800	850	900	1100	1150	1200	1800	2000
REFRIGERANT TO AIR HEAT EXCHANGER									
Face Area (sq ft)	5	5	5	7.5	9.3	9.3	10.5	20	20
Rows Deep	2	3	3	3	3	3	3	4	4
Copper Tube Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
No. Fins per Inch	12	12	12	12	12	12	12	12	12
REFRIGERANT CHARGE R-22/Ckt (oz)	52	68	86	132	68	86	88	141	160
NUMBER OF CIRCUITS	1	1	1	1	2	2	2	2	2
BLOWER DATA									
Diameter (qty-in.)	1-10	1-10	1-10	1-12	1-15	1-15	1-15	2-15	2-15
Width (in.)	6	6	10	11	11	11	11	11	11
FILTER DATA									
Size (in.)	16 x 20	16 x 20	16 x 20	16 x 20	16 x 20	16 x 20	16 x 20	16 x 20	16 x 20
Quantity	4	4	4	4	6	6	6	10	6

50RTG UNITS	DIMENSIONS (in.)						Water In/Out (FPT)
	A	B	C	D	E	F	
03/04	39.52	43.90	81.00	12.32	4.692	6.614	3/4
05	39.52	43.90	81.00	12.32	4.692	6.614	1
07	39.52	43.90	81.00	12.32	4.692	6.614	1 1/4
08	45.40	49.90	91.07	16.48	5.692	6.614	1 1/4
10/12	45.40	49.90	91.07	16.48	5.692	6.614	1 1/2
15/20	50.62	88.00	91.07	16.48	4.543	6.566	2



- NOTES:
1. All dimensions are in inches.
 2. Carrier works continuously to improve its products. As a result, the design and specification of each product at the time of order may be changed without notice.
 3. Assembly tolerances $\pm 1/8$.

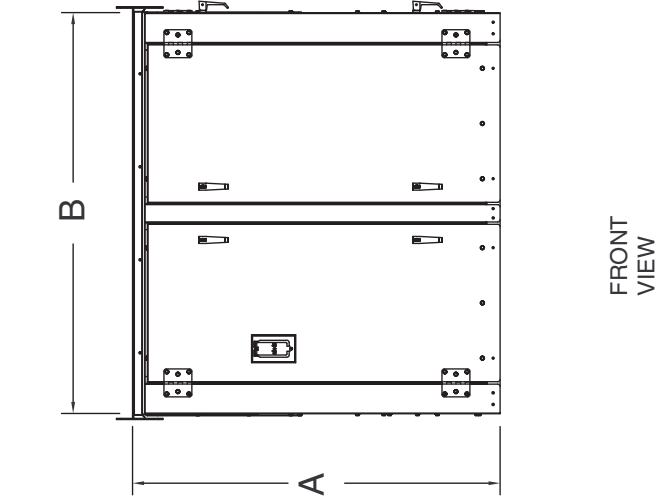
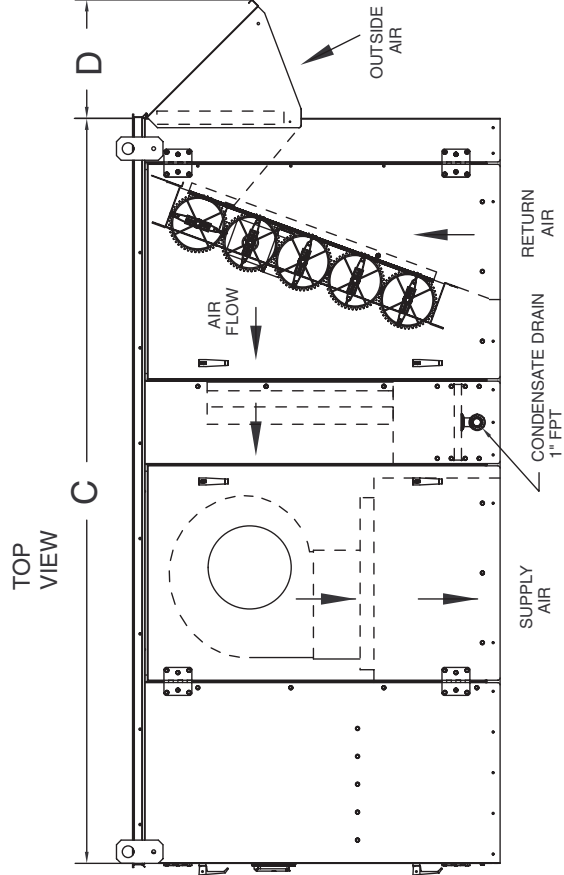
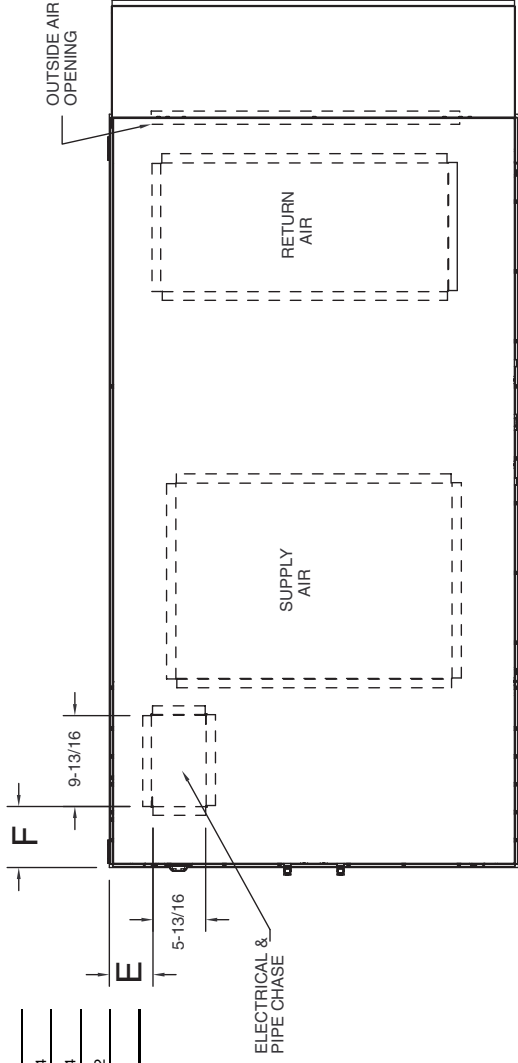
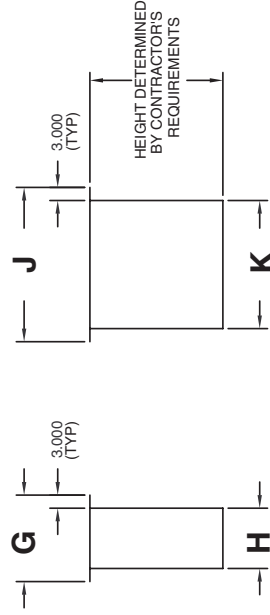
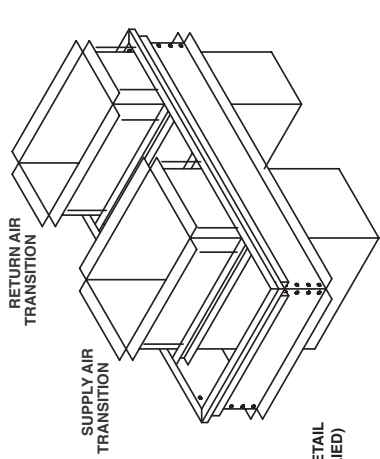
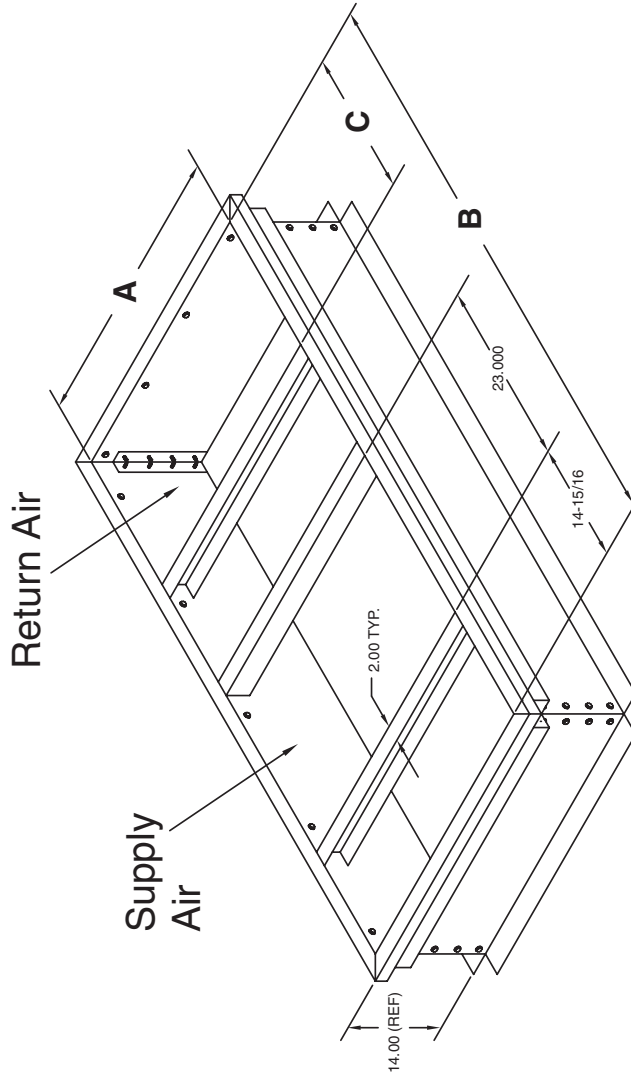


Fig. 1 — 50RTG Dimensional Data

ROOF CURB ASSEMBLY DETAILS

ROOF CURB	DIMENSIONS (in.)											
	A	B	C	E	F	G	H	J	K	Supply Air Transition	Return Air Transition	
50RTGACURBAAA	35.25	72.25	18.00	1.50	12.50	22.00	16.00	39.25	33.25	27.00	21.00	39.25
50RTGACURBAAA	41.25	82.25	21.00	1.50	12.50	25.00	19.00	45.25	39.25	27.00	21.00	45.25
50RTGACURBAAA	78.875	82.25	21.00	5.00	9.00	25.00	19.00	82.875	76.875	27.00	21.00	82.875



IMPORTANT NOTE: WHEN INSTALLING CURB, FLASHING MUST CONFORM TO THE NOTED DIMENSIONS. THIS IS TO ALLOW CLEARANCE FOR MOUNTING UNIT TO CURB.

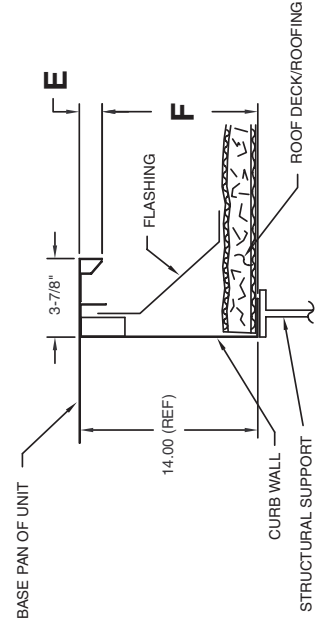


Fig. 2 — 50RTG Roof Curb Dimensional Data

Step 4 — Mounting the Unit — For proper operation, units must be mounted on a roof curb as shown in Fig. 3. Follow these guidelines when installing the roof curb:

1. Set unit on curb.
2. Align unit so that its return and supply air direction match the return and supply air opening in the roof curb frame.
3. Run both the return and supply loop piping, as well as the electrical supply line, through the pipe chase provided in the curb.

Step 5 — Condensate Drain

1. Install a condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection.
2. Design the length of the trap (water seal) based on the amount of positive or negative pressure on the drain pan. As a rule, 1 in. of trap is required for each inch of negative pressure on the unit.

Note that condensate is allowed to drain onto the roof.

Step 6 — Piping Connections — Depending on the application, there are 3 types of WSHP piping systems to choose from: water loop, ground-water and ground loop. Refer to Piping Section of Carrier System Design Manual for additional information.

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

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

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

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

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

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

GROUND-WATER APPLICATIONS — In addition to complying with any applicable codes, consider the following for system piping:

- Install shut-off valves for servicing.
- Install pressure-temperature plugs to measure flow and temperature.
- Boiler drains and other valves should be connected using a “T” connector to allow acid flushing for the heat exchanger.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use PVC SCH80 or copper piping material.

NOTE: PVC SCH40 should *not* be used due to system high pressure and temperature extremes.

Water Supply and Quantity — 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.

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

- Piping materials should be limited to only polyethylene fusion in the buried sections of the loop.
- Galvanized or steel fittings should not be used at any time due to corrosion.
- All plastic to metal threaded fittings should be avoided due to the potential to leak. Use a flange fitted substitute.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Pressure-temperature (P/T) plugs should be used to measure flow of pressure drop.

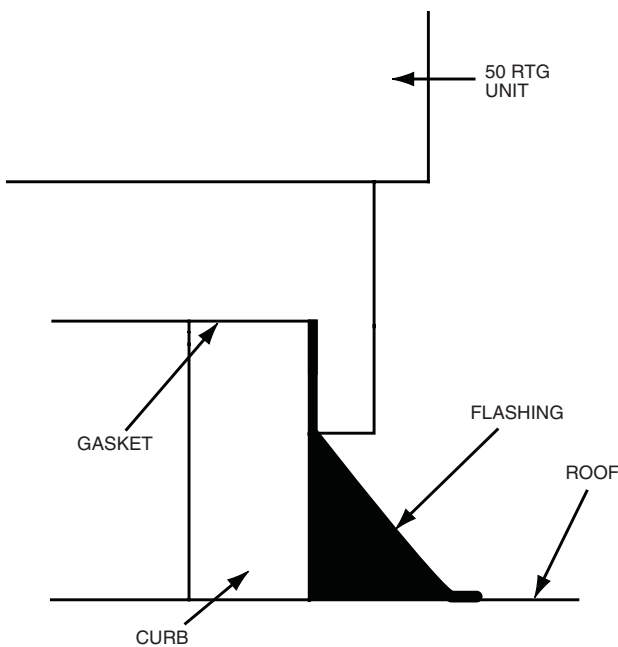


Fig. 3 — 50RTG Curb Installation

Step 7 — Electrical Wiring

⚠ WARNING

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

⚠ CAUTION

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

All field installed wiring, including the electrical ground, MUST comply with the National Electrical Code (NEC) as well as applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in the NEC.

Refer to unit wiring diagram Fig. 4 for a schematic of the field connections which must be made by the installing (or electrical) contractor.

Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. The installing (or electrical) contractor must make the field connections when using field-supplied disconnect.

Operating voltage must be the same voltage and phase as shown in Electrical Data shown in Table 3.

Make all final electrical connections with a length of flexible conduit to minimize vibration and sound transmission to the building.

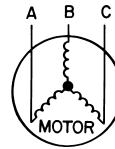
SUPPLY VOLTAGE — Operating voltage to unit must be within voltage range indicated on unit nameplate.

On 3-phase units, voltages under load between phases must be balanced within 2%. Use the following formula to determine the percentage voltage imbalance:

% Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 volts
BC = 464 volts
AC = 455 volts

$$\begin{aligned} \text{Average Voltage} &= \frac{452 + 464 + 455}{3} \\ &= \frac{1371}{3} \\ &= 457 \end{aligned}$$

Determine maximum deviation from average voltage:

(AB) $457 - 452 = 5$ v
(BC) $464 - 457 = 7$ v
(AC) $457 - 455 = 2$ v

Maximum deviation is 7 v.

Determine percent voltage imbalance.

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{7}{457} \\ &= 1.53\% \end{aligned}$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

NOTE: If more than 2% voltage imbalance is present, contact local electric utility.

208-VOLT OPERATION — All 208-230 volt units are factory wired for 208 volts. The transformers may be switched to 230-volt operation (as illustrated on the wiring diagram) by switching the red (208 volt) wire with the orange (230 volt) wire at the L1 terminal.

BLOWER SELECTION — All water source heat pumps are factory set with the appropriate motor and sheave combination to achieve the desired airflow performance. Performance is selected by matching the desired performance with the appropriate region in Tables 4-12. Per the table notes, regions designated by A, B, C and D represent motor drive options.

NOTE: Factory-installed sheaves are field adjustable. Refer to Tables 4-12 for adjustment points.

Table 2 — Water Quality Guidelines

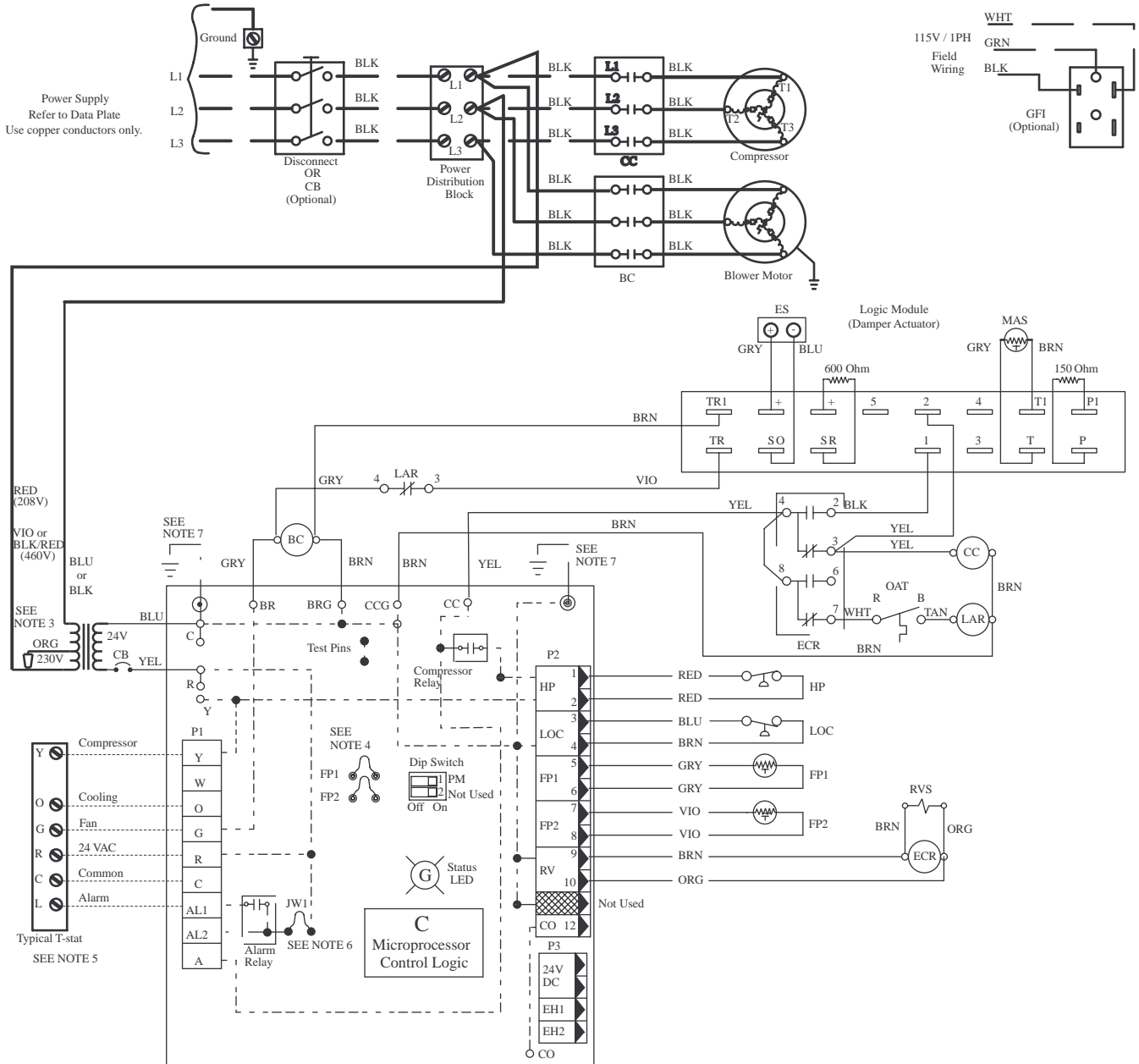
CONDITION	ACCEPTABLE LEVEL		
pH	7 to 9 range for copper. Cupro-nickel may be used in the 5 to 9 range.		
Total Hardness	Calcium and magnesium carbonate should not exceed 20 grains per gallon (350 ppm).		
Iron Oxides	Less than 1 ppm.		
Iron Bacteria	No level allowable.		
Corrosion*	Ammonia, Ammonium Hydroxide	Max Allowable Level	Coaxial Metal
	Ammonium Chloride, Ammonium Nitrate	0.5 ppm	Cu
	Ammonium Sulfate	0.5 ppm	Cu
	Chlorine/Chlorides	0.5 ppm	CuNi
	Hydrogen Sulfide†	None Allowable	—
Brackish	Use Cupro-nickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

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

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

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

50RTG03-07 WITH ECONOMIZER AND COMPLETE C CONTROLLER



LEGEND

- | | |
|---|---|
| AL — Alarm Relay Contacts | PM — Performance Monitor |
| BC — Blower Mtr Contactor | P1 — Field Wiring Terminal Block |
| CB — Circuit Breaker | RVS — Reversing Valve Solenoid |
| CC — Compressor Contactor | Relay Contactor Coil |
| ECR — Economizer Relay | Solenoid Coil |
| EH1 — Auxiliary Heat Stage 1 | Thermistor |
| EH2 — Auxiliary Heat Stage 2 | Ground |
| ES — Enthalpy Sensor | Field Line Voltage Wiring |
| FP1 — Sensor, Water Coil Freeze Protection | Field Low Voltage Wiring |
| FP2 — Sensor, Air Coil Freeze Protection | Printed Circuit Trace |
| HP — High Pressure Switch | |
| JW1 — Jumper, Alarm Mode | |
| LAR — Low Ambient Relay | |
| LOC — Loss-of-Charge Pressure Switch | |
| MAS — Mixed Air Sensor | |
| NEC — National Electrical Code | |
| OAT — Outside Air Thermostat | |

NOTES:

- Compressor and blower motor thermally protected internally.
- All wiring to the unit must comply with NEC and local codes.
- 208/230 v transformers will be connected for 208 v operations. For 230 v operations, disconnect Red lead at L1, and attach Orange lead to L1. Close open end of Red Lead with insulating tape.
- FP1 jumper provides freeze protection for WATER. When using ANTI-FREEZE solutions, cut FP1 jumper.
- Typical thermostat wiring shown. Refer to thermostat Installation Instructions for wiring to the unit.
- 24 v alarm signal shown. For dry alarm contact, cut JW1 jumper and dry contact will be available between AL1 and AL2.
- Transformer secondary ground via Complete C board standoffs and screws to control box. (Ground available from top two standoffs as shown.)

Fig. 4 — Typical Aqazone™ Complete C Control Wiring

Table 3 — 50RTG Electrical Data

UNIT 50RTG	POWER SUPPLY			COMPRESSOR (each)			BLOWER MOTOR			MAX. FUSE OR HACR BREAKER	MINIMUM CIRCUIT AMPACITY
	Voltage	Hz	Ph	RLA	LRA	QTY	HP	FLA	QTY		
03	208/230	60	3	10.7	63.0	1	1	3.6	1	25 Amp 15 Amp	17.0 8.1
	460	60	3	5.0	31.0	1	1	1.8	1		
04	208/230	60	3	13.9	88.0	1	1	3.6	1	30 Amp 15 Amp 15 Amp	21.0 9.8 8.2
	460	60	3	6.4	44.0	1	1	1.8	1		
	575	60	3	5.3	34.0	1	1	1.6	1		
05	208/230	60	3	20.0	123.0	1	1	3.6	1	45 Amp 15 Amp 15 Amp	28.6 11.2 9.6
	460	60	3	7.5	49.5	1	1	1.8	1		
	575	60	3	6.4	40.0	1	1	1.6	1		
07	208/230	60	3	20.7	156.0	1	2	6.2	1	50 Amp 25 Amp 20 Amp	32.1 15.6 12.6
	460	60	3	10.0	70.0	1	2	3.1	1		
	575	60	3	8.2	54.0	1	2	2.3	1		
08	208/230	60	3	13.9	88.0	2	2	6.2	1	50 Amp 20 Amp 15 Amp	37.5 17.5 14.2
	460	60	3	6.4	44.0	2	2	3.1	1		
	575	60	3	5.3	34.0	2	2	2.3	1		
10	208/230	60	3	20.0	123.0	2	2	6.2	1	70 Amp 25 Amp 20 Amp	51.2 20.0 16.7
	460	60	3	7.5	49.5	2	2	3.1	1		
	575	60	3	6.4	40.0	2	2	2.3	1		
12	208/230	60	3	19.3	123.0	2	3	9.2	1	70 Amp 35 Amp 25 Amp	52.6 26.8 21.0
	460	60	3	10.0	62.0	2	3	4.3	1		
	575	60	3	7.8	50.0	2	3	3.4	1		
15	208/230	60	3	20.7	156.0	2	3	9.2	1	70 Amp 35 Amp 30 Amp	55.8 26.8 21.9
	460	60	3	10.0	70.0	2	3	4.3	1		
	575	60	3	8.2	54.0	2	3	3.4	1		
20	208/230	60	3	33.3	232.0	2	5	13.2	1	125 Amp 60 Amp 45 Amp	88.1 44.9 34.4
	460	60	3	17.0	116.0	2	5	6.6	1		
	575	60	3	12.8	97.0	2	5	5.6	1		

LEGEND

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

NOTE: Contact factory for oversize blower motor electrical data.

Table 4 — 50RTG03 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
975	BHP	0.12	0.14	0.17	0.19	0.21	0.23	0.26	0.29	0.31	0.33
	RPM	550	609	667	724	779	833	885	933	980	1024
	Turns Out	5.0	3.5	4.5	3.5	2.5	1.5	1.0	0.0	2.0	1.5
1050	BHP	0.14	0.17	0.19	0.22	0.24	0.26	0.30	0.32	0.35	0.37
	RPM	580	636	691	745	798	849	898	946	991	1035
	Turns Out	4.0	3.0	4.0	3.0	2.5	1.5	0.5	0.0	2.0	1.5
1125	BHP	0.18	0.20	0.23	0.25	0.28	0.31	0.33	0.36	0.39	0.42
	RPM	619	670	721	772	821	870	917	963	1008	1051
	Turns Out	3.5	4.5	3.5	3.0	2.0	1.0	0.5	2.5	2.0	1.0
1200	BHP	0.22	0.24	0.26	0.29	0.32	0.35	0.37	0.41	0.44	0.46
	RPM	658	705	752	799	846	892	937	982	1025	1066
	Turns Out	4.5	4.00	3.00	2.5	1.5	1.0	0.0	2.0	1.5	1.0
1275	BHP	0.26	0.29	0.31	0.33	0.36	0.40	0.42	0.45	0.48	0.52
	RPM	688	732	777	822	867	911	954	997	1038	1079
	Turns Out	4.0	3.5	2.5	2.0	1.5	0.5	2.5	2.0	1.5	1.0
1350	BHP	0.29	0.32	0.35	0.39	0.41	0.44	0.47	0.51	0.54	0.57
	RPM	721	764	807	850	893	935	976	1017	1057	1096
	Turns Out	3.5	3.0	2.5	1.5	1.0	0.0	2.0	1.4	1.0	0.5
1425	BHP	0.4	0.40	0.42	0.44	0.46	0.50	0.53	0.56	0.61	0.64
	RPM	763	803	843	883	923	963	1003	1041	1080	1118
	Turns Out	3.0	2.5	1.5	1.0	0.5	2.5	2.0	1.5	1.0	0.5

LEGEND

- BHP** — Brake Horsepower
- SCFM** — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. For applications requiring higher static pressures, contact your local representative.

Table 5 — 50RTG04 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)										
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
1300	BHP	0.26	0.30	0.33	0.36	0.40	0.42	Operation Not Recommended				
	RPM	633	694	755	812	869	925					
	Turns Out	5	3.5	4.5	3.5	2.5	1.5					
1400	BHP	0.33	0.36	0.40	0.43	0.46	0.50	0.53	Operation Not Recommended			
	RPM	668	725	782	836	890	943	995				
	Turns Out	4	3.0	4.0	3.0	2.0	1.0	0.5				
1500	BHP	0.418	0.45	0.48	0.52	0.55	0.58	0.62	0.65	Operation Not Recommended		
	RPM	712	766	819	871	922	970	1017	1063			
	Turns Out	3.0	4.5	3.5	2.5	1.5	0.5	3.5	3.0			
1600	BHP	0.506	0.54	0.57	0.61	0.64	0.67	0.70	0.75	0.78	0.83	
	RPM	750	801	851	900	948	995	1040	1083	1125	1166	
	Turns Out	4.5	3.5	3.0	2.0	1.0	0.0	3.5	1.5	2.0	1.5	
1700	BHP	0.572	0.62	0.66	0.70	0.74	0.78	0.81	0.86	0.89	0.94	
	RPM	792	840	887	934	979	1024	1068	1110	1152	1194	
	Turns Out	4.0	3.0	2.0	1.5	0.5	3.5	3.0	2.5	1.5	1.0	
1800	BHP	0.671	0.72	0.76	0.80	0.85	0.89	0.94	0.97	1.01	1.06	
	RPM	832	878	923	967	1010	1053	1095	1136	1176	1219	
	Turns Out	3.0	2.5	1.5	1.0	0.0	3.0	2.5	2.0	1.5	1.0	
1900	BHP	0.80	0.85	0.89	0.94	0.98	1.02	1.07	1.11	1.16	1.20	
	RPM	875	919	961	1003	1045	1086	1127	1166	1204	1242	
	Turns Out	2.5	1.5	1.0	0.0	3.0	2.5	2.0	1.5	1.0	0.5	

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 6 — 50RTG05 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
1700	BHP	0.37	0.42	0.45	0.50	0.54	0.58	0.63	0.67	Operation Not Recommended	
	RPM	797	845	892	938	984	1029	1072	1114		
	Turns Out	3.5	2.5	1.5	3.0	2.5	1.5	1.0	0.5		
1800	BHP	0.44	0.48	0.53	0.56	0.61	0.65	0.70	0.75	0.79	Operation Not Recommended
	RPM	836	882	927	971	1015	1057	1099	1140	1180	
	Turns Out	2.5	1.5	3.5	2.5	2.0	1.0	0.5	0.5	0.0	
1900	BHP	0.52	0.56	0.61	0.65	0.69	0.74	0.78	0.84	0.88	0.94
	RPM	880	923	966	1008	1049	1090	1131	1170	1208	1246
	Turns Out	1.5	3.5	3.0	2.0	1.5	0.5	0.5	0.0	3.0	2.5
2000	BHP	0.61	0.65	0.69	0.74	0.78	0.84	0.88	0.94	0.98	1.03
	RPM	926	967	1007	1047	1087	1126	1164	1203	1240	1277
	Turns Out	3.5	3.0	2.0	1.5	1.0	0.5	0.0	3.0	2.5	2.0
2100	BHP	0.69	0.74	0.78	0.84	0.88	0.94	0.98	1.03	1.09	1.14
	RPM	966	1005	1044	1082	1120	1158	1195	1231	1268	1303
	Turns Out	3.0	2.0	1.5	1.0	0.5	0.0	3.0	2.5	2.0	1.5
2200	BHP	0.79	0.84	0.89	0.94	0.99	1.05	1.09	1.14	1.20	1.25
	RPM	1009	1047	1084	1120	1157	1193	1229	1264	1298	1333
	Turns Out	2.0	1.5	1.0	0.5	3.5	3.0	2.5	2.0	1.5	1.0
2300	BHP	0.9	0.96	1.00	1.06	1.11	1.17	1.22	1.28	1.33	1.39
	RPM	1055	1091	1126	1161	1196	1231	1265	1299	1332	1365
	Turns Out	1.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 7 — 50RTG07 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
1950	BHP	0.42	0.46	0.51	0.56	0.62	0.67	0.73	0.78	Operation Not Recommended					
	RPM	620	664	707	750	792	832	870	908						
	Turns Out	4.5	3.5	2.5	4.5	3.5	2.5	2.0	1.5						
2200	BHP	0.56	0.62	0.67	0.73	0.78	0.85	0.90	0.97	1.03	1.10	1.17			
	RPM	675	716	755	793	831	869	905	941	975	1007	1038			
	Turns Out	3	2.0	4.5	3.5	3.0	2.0	1.5	0.5	5.0	3.0	2.5			
2400	BHP	0.70	0.76	0.83	0.88	0.95	1.00	1.07	1.14	1.21	1.28	1.34	1.41		
	RPM	721	758	795	830	865	900	935	969	1002	1034	1066	1097		
	Turns Out	2.0	4.5	3.5	3.0	2.0	1.5	0.5	0.0	4.5	4.0	3.5	3.0		
2600	BHP	0.87	0.94	0.99	1.06	1.12	1.19	1.25	1.33	1.40	1.47	1.55	1.63	1.69	1.77
	RPM	765	800	835	868	901	933	965	997	1029	1060	1090	1120	1149	1178
	Turns Out	4	3.5	3.0	2.0	1.5	0.5	0.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5
2800	BHP	1.07	1.13	1.20	1.27	1.33	1.40	1.47	1.54	1.62	1.69	1.77	1.86	1.94	2.01
	RPM	812	845	877	908	939	970	1000	1030	1059	1089	1118	1147	1175	1203
	Turns Out	3.5	2.5	2.0	1.5	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
3000	BHP	1.28	1.35	1.42	1.50	1.56	1.64	1.72	1.79	1.87	1.95	2.02	2.11	2.20	2.28
	RPM	857	889	919	949	978	1007	1035	1064	1091	1119	1147	1174	1202	1228
	Turns Out	2.5	1.5	1.0	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	1.0
3250	BHP	1.60	1.67	1.75	1.83	1.90	1.98	2.06	2.13	2.22	2.30	2.39	2.48	2.56	2.65
	RPM	915	945	974	1001	1029	1056	1082	1109	1135	1161	1187	1212	1238	1263
	Turns Out	1.0	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.5	2.0	1.5	1.0	1.0	0.5

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 8 — 50RTG08 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2400	BHP	0.40	0.45	0.50	0.55	0.61	0.66	0.72	0.77	0.83	0.87	0.91	0.98	1.03	1.10
	RPM	482	521	559	594	629	661	693	723	751	779	806	832	858	883
	Turns Out	4.5	3.5	2.0	4.5	3.5	2.5	1.5	1.0	0.0	4.5	4.0	3.5	3.0	2.5
2650	BHP	0.51	0.56	0.62	0.67	0.74	0.79	0.86	0.91	0.98	1.05	1.10	1.16	1.21	1.27
	RPM	514	550	585	619	651	683	713	742	770	797	823	848	872	895
	Turns Out	4	2.5	4.5	3.5	3.0	2.0	1.0	0.5	4.5	4.0	3.5	3.0	2.5	2.0
2900	BHP	0.64	0.69	0.76	0.83	0.88	0.95	1.01	1.08	1.14	1.22	1.29	1.35	1.42	1.49
	RPM	549	583	615	647	677	707	736	764	791	818	843	868	894	915
	Turns Out	2.5	4.5	4.0	3.0	2.0	1.5	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0
3200	BHP	0.81	0.88	0.95	1.02	1.09	1.16	1.23	1.30	1.38	1.45	1.52	1.60	1.67	1.74
	RPM	588	619	649	679	707	735	763	789	815	841	865	890	913	936
	Turns Out	5	3.5	3.0	2.0	1.5	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5
3450	BHP	1.00	1.07	1.14	1.21	1.29	1.36	1.44	1.52	1.60	1.67	1.75	1.83	1.90	1.99
	RPM	623	652	681	709	736	763	789	814	839	863	887	911	934	956
	Turns Out	3.5	3.0	2.0	1.5	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
3700	BHP	1.20	1.28	1.35	1.43	1.51	1.60	1.67	1.75	1.84	1.91	2.00	2.08	2.17	2.26
	RPM	657	685	712	739	764	790	815	839	863	886	909	932	954	976
	Turns Out	2.5	2.0	1.0	0.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5
4000	BHP	1.47	1.56	1.64	1.73	1.82	1.89	1.98	2.07	2.16	2.24	2.33	2.42	2.51	2.61
	RPM	699	725	750	775	799	823	847	870	892	915	937	958	980	1001
	Turns Out	1.5	1.0	0.0	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5	0.0

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 9 — 50RTG10 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
3000	BHP	0.69	0.76	0.83	0.89	0.96	1.02	1.09	1.16	1.22	1.29	1.36	1.43	1.50	1.57
	RPM	563	596	628	658	688	718	746	773	800	826	851	876	900	923
	Turns Out	4.5	3.5	2.5	1.5	1.0	4.0	3.5	3.0	2.5	2.0	1.5	0.5	0.0	2.5
3300	BHP	0.89	0.96	1.03	1.10	1.18	1.24	1.32	1.39	1.46	1.54	1.62	1.69	1.77	1.85
	RPM	604	635	664	693	721	748	775	801	827	852	876	900	923	946
	Turns Out	3	2.5	1.5	4.5	4.0	3.5	3.0	2.5	2.0	1.0	0.5	0.0	2.5	2.0
3600	BHP	1.12	1.20	1.28	1.35	1.43	1.51	1.58	1.66	1.75	1.83	1.90	1.99	2.07	2.16
	RPM	647	676	703	730	756	782	807	832	856	880	903	926	949	971
	Turns Out	2.0	1.0	4.5	4.0	3.5	2.5	2.0	1.5	1.0	0.5	0.0	2.5	2.0	1.5
4000	BHP	1.47	1.56	1.64	1.73	1.82	1.89	1.98	2.07	2.16	2.24	2.33	2.42	2.51	2.61
	RPM	699	725	750	775	799	823	847	870	892	915	937	958	980	1001
	Turns Out	4.5	4.0	3.5	3.0	2.5	2.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5
4300	BHP	1.82	1.90	1.99	2.09	2.18	2.27	2.35	2.45	2.54	2.64	2.73	2.83	2.93	
	RPM	746	770	794	817	840	863	885	907	929	950	971	991	1012	
	Turns Out	3.5	3.0	4.5	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	1.0	0.5	
4700	BHP	2.32	2.42	2.52	2.61	2.71	2.81	2.90	Operation Not Recommended						
	RPM	803	825	848	869	891	912	933							
	Turns Out	4.5	4.0	3.5	3.5	3.0	2.5	2.0							
5000	BHP	2.76	2.86	2.96	Operation Not Recommended										
	RPM	847	868	889											
	Turns Out	3.5	3.5	3.0											

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 10 — 50RTG12 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
3600	BHP	1.02	1.10	1.18	1.25	1.33	1.41	1.49	1.56	1.64	1.72	1.80	1.88	1.97	2.05
	RPM	609	639	667	695	722	748	774	800	825	849	873	896	919	942
	Turns Out	5.5	4.5	3.5	2.5	1.5	5.5	4.5	3.5	3.0	2.5	1.5	1.0	4.5	4.0
4000	BHP	1.38	1.45	1.54	1.62	1.71	1.78	1.87	1.96	2.05	2.13	2.22	2.31	2.40	2.49
	RPM	664	691	717	742	767	792	816	839	863	886	908	930	952	973
	Turns Out	4.5	3.0	2.0	5.5	4.5	4.0	3.5	2.5	2.0	1.5	4.5	4.0	3.5	3.0
4400	BHP	1.77	1.86	1.96	2.05	2.13	2.23	2.32	2.41	2.51	2.61	2.70	2.79	2.89	2.98
	RPM	716	741	765	789	812	835	858	879	901	923	944	965	985	1006
	Turns Out	2.0	5.5	4.5	4.0	3.5	3.0	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5
4800	BHP	2.23	2.33	2.43	2.53	2.63	2.73	2.83	2.93	3.03	3.12	3.23	3.33	3.43	3.54
	RPM	765	788	810	833	854	876	897	918	938	959	978	998	1018	1037
	Turns Out	5.5	4.0	3.5	3.0	2.5	1.5	1.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5
5200	BHP	2.82	2.93	3.04	3.14	3.25	3.36	3.47	3.58	3.69	3.78	3.89	4.00	4.11	
	RPM	825	846	867	888	908	928	948	968	987	1006	1025	1044	1062	
	Turns Out	4.5	2.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	2.5	2.0	1.5	1.0	
5600	BHP	3.47	3.58	3.70	3.81	3.93	4.04	4.16	4.27	4.39	4.51	4.62	Operation Not Recommended		
	RPM	879	899	918	938	957	976	995	1013	1031	1050	1067			
	Turns Out	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.5	1.0			
6000	BHP	4.20	4.33	4.46	4.58	4.70	4.82	4.95	Operation Not Recommended						
	RPM	933	952	970	989	1007	1025	1042							
	Turns Out	4.0	3.5	3.0	3.0	2.5	2.0	1.5							

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 11 — 50RTG15 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
4500	BHP	0.68	0.78	0.88	0.98	1.08	1.17	1.28	1.39	1.43	1.54	1.65	1.76	Operation Not Recommended	
	RPM	465	506	545	582	617	650	681	711	740	768	795	821		
	Turns Out	5.0	3.5	2.5	4.5	4.0	3.5	2.5	2.0	1.0	4.0	3.5	3.0		
5000	BHP	0.87	0.98	1.09	1.20	1.31	1.42	1.52	1.65	1.76	1.87	1.94	2.07	2.16	2.31
	RPM	493	531	568	603	636	669	701	732	762	791	819	846	872	897
	Turns Out	4.0	3.0	2.0	4.5	3.5	3.0	2.0	1.0	4.0	3.5	3.0	2.5	1.5	1
5500	BHP	1.10	1.22	1.33	1.45	1.57	1.71	1.83	1.94	2.07	2.20	2.31	2.44	2.51	2.64
	RPM	525	561	595	627	659	690	720	749	777	804	830	855	879	902
	Turns Out	3.0	2.0	4.5	4.0	3.0	2.0	1.5	4.5	4.0	3.0	2.5	2.0	1.5	1
6000	BHP	1.36	1.49	1.62	1.75	1.88	2.01	2.15	2.28	2.42	2.55	2.71	2.84	2.97	3.102
	RPM	556	589	621	652	682	712	740	768	795	821	846	871	895	918
	Turns Out	2.0	4.5	4.0	3.0	2.5	1.5	1.0	4.0	3.5	3.0	2.5	2.0	1.0	0.5
6500	BHP	1.69	1.83	1.97	2.10	2.24	2.39	2.53	2.67	2.83	2.97	3.12	3.26	3.41	3.564
	RPM	593	624	654	683	711	739	766	793	819	844	868	890	913	936
	Turns Out	4.5	4.0	3.0	2.5	1.5	1.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5
7000	BHP	2.05	2.19	2.34	2.49	2.64	2.79	2.95	3.10	3.26	3.41	3.56	3.73	3.88	
	RPM	625	654	683	710	737	764	790	815	840	864	888	911	934	
	Turns Out	4.0	3.0	2.5	2.0	1.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5	
7500	BHP	2.46	2.62	2.77	2.94	3.09	3.26	3.41	3.58	3.74	3.91	4.08	4.25	Operation Not Recommended	
	RPM	660	687	714	740	766	791	816	840	864	887	910	933		
	Turns Out	3.0	2.5	1.5	1.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5		

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Table 12 — 50RTG20 Blower Performance

SCFM AIRFLOW		EXTERNAL STATIC PRESSURE (in. wg)													
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
6,000	BHP	1.38	1.51	1.63	1.76	1.89	2.02	2.16	2.30	2.43	2.57	2.71	2.84	2.99	3.12
	RPM	560	592	624	655	685	715	743	771	797	823	849	874	897	921
	Turns Out	5.5	4.0	3.0	5.5	4.5	3.5	2.5	1.5	1.0	0.0	4.0	3.5	2.5	2.0
6,600	BHP	1.83	1.73	2.10	2.24	2.39	2.53	2.67	2.83	2.97	3.12	3.28	3.34	3.50	3.65
	RPM	614	644	673	702	729	757	783	809	834	859	883	895	919	941
	Turns Out	3.5	2.0	5.0	4.0	3.0	2.0	1.5	0.5	4.5	3.5	3.0	2.5	2.0	1.5
7,200	BHP	2.30	2.44	2.60	2.75	2.90	3.06	3.22	3.38	3.54	3.70	3.86	4.03	4.20	4.27
	RPM	656	684	711	738	764	790	815	839	863	887	910	933	957	966
	Turns Out	5.5	4.5	3.5	3.0	2.0	1.0	0.0	4.5	3.5	3.0	2.5	1.5	1.0	0.5
8,000	BHP	2.94	3.10	3.27	3.44	3.61	3.77	3.95	4.13	4.30	4.47	4.65	4.83	5.01	
	RPM	696	722	747	772	797	821	844	867	890	912	935	956	978	
	Turns Out	4.0	3.5	2.5	1.5	1.0	0.0	4.0	3.5	3.0	2.0	1.5	1.0	0.5	
8,600	BHP	3.71	3.88	4.06	4.25	4.42	4.61	4.79	4.97	5.16	5.35	5.53	Operation Not Recommended		
	RPM	756	780	803	827	849	872	894	916	937	958	979			
	Turns Out	2.0	1.5	0.5	4.5	4.0	3.5	3.0	2.0	1.5	1.0	0.5			
9,300	BHP	4.59	4.77	4.97	5.16	5.36	5.56	5.75	5.95	6.15	Operation Not Recommended				
	RPM	805	828	850	872	893	914	935	955	976					
	Turns Out	0.5	4.5	4.0	3.5	2.5	2.0	1.5	1.0	0.5					
10,000	BHP	5.43	5.63	5.84	6.05	6.26	6.47	6.68	6.89	Operation Not Recommended					
	RPM	838	859	881	901	922	942	962	981						
	Turns Out	4.5	3.5	3.0	2.5	2.0	1.5	0.5	0.0						

LEGEND

BHP — Brake Horsepower
SCFM — Standard Cubic Feet Per Minute

NOTES:

1. Fan BHP includes drive losses.
2. Region "A" is standard drive package.
3. Regions "B" and "C" require optional drive packages.
4. Region "D" represents oversized motor and special sheaves.
5. For applications requiring higher static pressures, contact your local representative.

Step 8 — Low Voltage Wiring

THERMOSTAT CONNECTIONS — The thermostat should be wired directly to the Aquazone™ control board. See Fig. 4 and 5.

WATER FREEZE PROTECTION — The Aquazone control allows the field selection of source fluid freeze protection points through jumpers. The factory setting of jumper JW3 (FP1) is set for water at 30 F. In earth loop applications, jumper JW3 should be clipped to change the setting to 13 F when using antifreeze in colder earth loop applications. See Fig. 6.

AIR COIL FREEZE PROTECTION — The air coil freeze protection jumper JW2 (FP2) is factory set for 30 F and should not need adjusting, unless using anti-freeze.

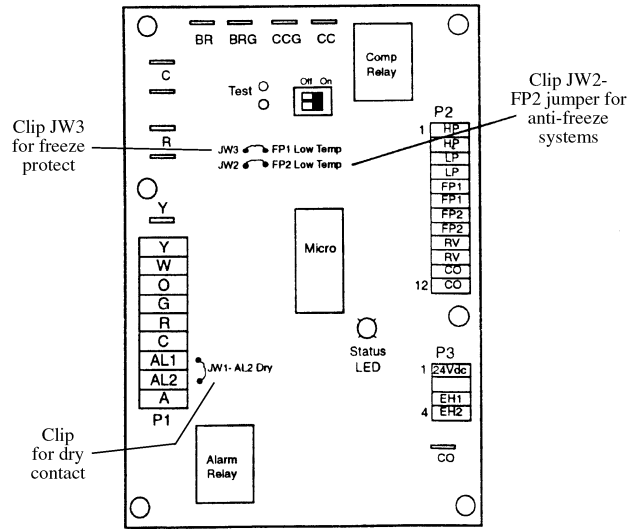
ACCESSORY CONNECTIONS — Terminal labeled A on the control is provided to control accessory devices such as water valves, electronic air cleaners, humidifiers, etc. This signal operates with the compressor terminal. See Fig. 7. Refer to the specific unit wiring schematic for details.

NOTE: The A terminal should *only* be used with 24 volt signals — not line voltage signals.

WATER SOLENOID VALVES — Water solenoid valves may be used on primary secondary pump and ground water installations. A typical well water control valve wiring which can limit waste water in a lockout condition is shown in Fig. 7. A slow closing valve may be required to prevent water hammer. When using a slow closing valve, special wiring conditions need to be considered. The valve takes approximately 60 seconds to open (very little water will flow before 45 seconds) and it activates the compressor only after the valve is completely opened by closing its end switch. When wired as shown, the valve will have the following operating characteristics:

1. Remain open during a lockout.
2. Draw approximately 25 to 35 VA through the “Y” signal of the thermostat.

IMPORTANT: This can overheat the anticipators of electromechanical thermostats. Only use relay based electronic thermostats.



AQUAZONE CONTROL (C Control Shown)

Fig. 6 — Typical Aquazone Control Board Jumper Locations

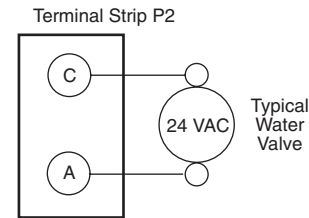
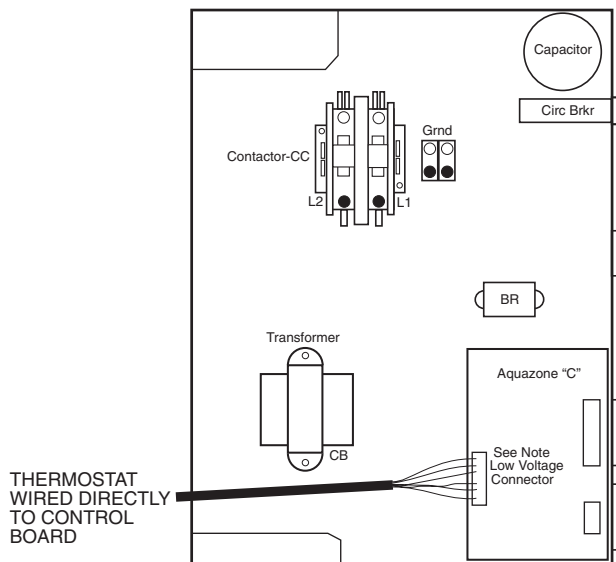


Fig. 7 — Typical D Control Accessory Wiring

PRE-START-UP

System Checkout — When the installation is complete and the system is cleaned and flushed, follow the System Checkout procedure outlined below.

1. **Voltage:** Ensure that the voltage is within the utilization range specifications of the unit compressor and fan motor.
2. **System Water Temperature:** Ensure that the system water temperature is within an acceptable range to facilitate start-up. (When conducting this check, also verify proper heating and cooling set points.)
3. **System Water pH:** Verify system water acidity (pH = 7.5 or 8.5). Proper pH promotes the longevity of hoses and heat exchangers.
4. **System Flushing:** Properly clean and flush the system periodically. Ensure that all supply and return hoses are connected end-to-end to facilitate system flushing and prevent fouling of the heat exchanger by system water. Water used in the system must be potable and should not contain dirt, piping slag, and chemical cleaning agents.
5. **Closed-Type Cooling Tower or Open Tower with Heat Exchanger:** Check equipment for proper temperature set points and operation.
6. Verify Balanced Water Flow Rate to Heat Pump.
7. **Standby Pump:** Verify that the standby pump is properly installed and in operating condition.
8. **Access Panels:** Assure that all access panels in the filter and fan section are securely closed.
9. **Air Dampers:** Assure that all air dampers are properly set.



NOTE: Low voltage connector may be removed for easy installation.

Fig. 5 — Low Voltage Field Wiring

10. **System Controls:** To ensure that no catastrophic system failures occur, verify that system controls are functioning and that the sequencing is correct.
11. **Freeze Protection for Water System:** Verify that freeze protection is provided for the building loop water system when outdoor design conditions require it. Inadequate freeze protection can lead to expensive tower and system piping repairs.
12. **System Water Loop:** Verify that all air is bled from the system. Air in the system impedes unit operation and causes corrosion in the system piping.
13. **Unit Filters:** To avoid system damage, check that the unit filter is clean.
14. **Unit Fans:** Manually rotate fans to assure free rotation. Ensure that fans are properly secured to the fan shaft. Do not oil fan motors on start-up since they are lubricated at the factory.
15. **System Control Center:** Examine the system control and alarm panel for proper installation and operation to ensure control of the temperature set-points for operation of the system's heat rejector and boiler (when used).
16. **Miscellaneous:** Note any questionable aspects of the installation.
17. **Air Coil:** To obtain maximum performance, the air coil should be cleaned before starting the unit. A ten percent solution of dishwasher detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

FIELD SELECTABLE INPUTS

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

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

C Control Jumper Settings (See Fig. 4)

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

ALARM RELAY SETTING — Select jumper 1 (JW1-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

C Control DIP Switches — The C Control has 1 DIP switch block with two switches. See Fig. 4.

PERFORMANCE MONITOR (PM) — DIP switch 1 will enable or disable this feature. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

STAGE 2 — DIP switch 2 will enable or disable compressor delay. Set DIP switch to OFF for stage 2 in which the compressor will have a 3-second delay before energizing.

NOTE: The alarm relay will not cycle during Test mode if switch is set to OFF, stage 2.

D Control Jumper Settings

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of 10 F or 30 F. To select 30 F as the limit, DO NOT clip the jumper. To select 10 F as the limit (for anti-freeze systems), clip the jumper.

ALARM RELAY SETTING — Select jumper 4 (JW4-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

LOW PRESSURE SETTING — The D Control can be configured for Low Pressure Setting (LP). Select jumper 1 (JW1-LP Norm Open) for choosing between low pressure input normally opened or closed. To configure for normally closed operation, do not clip the jumper. To configure for normally open operation, clip the jumper.

D Control DIP Switches — The D Control has 2 DIP switch blocks. Each DIP switch block has 8 switches and is labeled either S1 or S2 on the circuit board.

DIP SWITCH BLOCK 1 (S1) — This set of switches offers the following options for D Control configuration:

Performance Monitor (PM) — Set switch 1 to enable or disable performance monitor. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

Compressor Relay Staging Operation — Switch 2 will enable or disable compressor relay staging operation. The compressor relay can be set to turn on with stage 1 or stage 2 call from the thermostat. This setting is used with dual stage units (units with 2 compressors and 2 D controls) or in master/slave applications. In master/slave applications, each compressor and fan will stage according to its switch 2 setting. If switch is set to stage 2, the compressor will have a 3-second delay before energizing during stage 2 demand.

NOTE: If DIP switch is set for stage 2, the alarm relay will not cycle during Test mode.

Heating/Cooling Thermostat Type — Switch 3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. Select OFF for heat/cool thermostats. When in heat/cool mode, Y1 is used for cooling stage 1, Y2 is used for cooling stage 2, W1 is used for heating stage 1 and O/W2 is used for heating stage 2. Select ON for heat pump applications. In heat pump mode, Y1 used is for compressor stage 1, Y2 is used for compressor stage 2, W1 is used for heating stage 3 or emergency heat, and O/W2 is used for RV (heating or cooling) depending upon switch 4 setting.

O/B Thermostat Type — Switch 4 provides selection for heat pump O/B thermostats. O is cooling output. B is heating output. Select ON for heat pumps with O output. Select OFF for heat pumps with B output.

Dehumidification Fan Mode (Not used on 50RTG) — Switch 5 provides selection of normal or dehumidification fan mode. Select OFF for dehumidification mode. The fan speed relay will remain OFF during cooling stage 2. Select ON for normal mode. The fan speed relay will turn on during cooling stage 2 in normal mode.

Switch 6 — Not used.

Boilerless Operation — Switch 7 provides selection of boilerless operation and works in conjunction with switch 8. In boilerless operation mode, only the compressor is used for heating when FP1 is above the boilerless changeover temperature set by switch 8 below. Select ON for normal operation or select OFF for boilerless operation.

Boilerless Changeover Temperature — Switch 8 on S1 provides selection of boilerless changeover temperature set point. Select OFF for set point of 50 F or select ON for set point of 40 F.

If switch 8 is set for 50 F, then the compressor will be used for heating as long as the FP1 is above 50 F. The compressor will not be used for heating when the FP1 is below 50 F and the compressor will operate in emergency heat mode, staging on EH1 and EH2 to provide heat. If a thermal switch is being used instead of the FP1 thermistor, only the compressor will be used for heating mode when the FP1 terminals are closed. If the FP1 terminals are open, the compressor is not used and the control goes into emergency heat mode.

DIP SWITCH BLOCK 2 (S2) — This set of DIP switches is used to configure accessory relay options.

Switches 1 to 3 — These DIP switches provide selection of Accessory 1 relay options. See Table 13 for DIP switch combinations.

Switches 4 to 6 — These DIP switches provide selection of Accessory 2 relay options. See Table 14 for DIP switch combinations.

Table 13 — DIP Switch Block S2 — Accessory 1 Relay Options

ACCESSORY 1 RELAY OPTIONS	DIP SWITCH POSITION		
	1	2	3
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outside Air Damper

NOTE: All other DIP switch combinations are invalid.

Table 14 — DIP Switch Block S2 — Accessory 2 Relay Options

ACCESSORY 2 RELAY OPTIONS	DIP SWITCH POSITION		
	4	5	6
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outside Air Damper

NOTE: All other switch combinations are invalid.

Auto Dehumidification Mode or High Fan Mode (Not used on 50RTG) — Switch 7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification fan mode the fan speed relay will remain off during cooling stage 2 if terminal H is active. In high fan mode, the fan enable and fan speed relays will turn on when terminal H is active. Set the switch to ON for auto dehumidification fan mode or to OFF for high fan mode.

Switch 8 — Not used.

D Control Accessory Relay Configurations —

The following accessory relay settings are applicable for both D controls only:

CYCLE WITH FAN — In this configuration, the relay will be ON any time the Fan Enable relay is on.

CYCLE WITH COMPRESSOR — In this configuration, the relay will be ON any time the Compressor relay is on.

DIGITAL NIGHT SET BACK (NSB) — In this configuration, the relay will be ON if the NSB input is connected to ground C.

NOTE: If there are no relays configured for digital NSB, then the NSB and OVR inputs are automatically configured for mechanical operation.

MECHANICAL NIGHT SET BACK — When NSB input is connected to ground C, all thermostat inputs are ignored. A thermostat set back heating call will then be connected to the OVR input. If OVR input becomes active, then the D control will enter Night Low Limit (NLL) staged heating mode. The NLL staged heating mode will then provide heating during the NSB period.

Water Valve (Slow Opening) — If relay is configured for Water Valve (slow opening), the relay will start 60 seconds prior to starting compressor relay.

Outside Air Damper (OAD) — If relay is configured for OAD, the relay will normally be ON any time the Fan Enable relay is energized. The relay will not start for 30 minutes following a return to normal mode from NSB, when NSB is no longer connected to ground C. After 30 minutes, the relay will start if the Fan Enable is set to ON.

⚠ CAUTION

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

START-UP

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

NOTE: This equipment is designed for indoor installation only.

Operating Limits

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

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

UNIT STARTING CONDITIONS — All units start and operate with entering air at 40 F, entering water at 20 F and with both air and water at the flow rates used.

NOTE: These operating limits are not normal or continuous operating conditions. It is assumed that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 15 for operating limits.

⚠ WARNING

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energized equipment.

1. Restore power to system.
2. Turn thermostat fan position to ON. Blower should start.
3. Balance airflow at registers.
4. Adjust all valves to the full open position and turn on the line power to all heat pump units.
5. Operate unit in the cooling cycle. Room temperature should be approximately 70 to 75 F dry bulb. Loop water temperature entering the heat pumps should be between 60 and 110 F.

NOTE: Three factors determine the operating limits of a unit: (1) entering air temperature, (2) water temperature and (3) ambient temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation. See Table 15.

Table 15 — Operating Limits — 50RTG Units

AIR LIMITS	COOLING	HEATING
Rated Ambient Air	80° F	70° F
Min. Entering Air	50° F	40° F
Rated Entering Air db/wb	80/67° F	70° F
Max. Entering Air db/wb	110/83° F	80° F
WATER LIMITS		
Min. Entering Water	25° F	25° F
Normal Entering Water	85° F	70° F
Max. Entering Water	115° F	115° F

LEGEND

db — Dry Bulb
wb — Wet Bulb

NOTE: Value in heating column is dry bulb only. Any wet bulb reading is acceptable.

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

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

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

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

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

When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

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

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

Unit Start-Up Cooling Mode

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

5. Air temperature drop across the coil should be checked when compressor is operating. Air temperature drop should be between 15 and 25 F.

Unit Start-Up Heating Mode

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

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

Flow Regulation — Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. See Table 16. Adjust the water control valve until the flow of 1.5 to 2 gpm is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications.

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

⚠ WARNING

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

Flushing — Once the piping is complete, final purging and loop charging is needed. A flush cart pump of at least 1.5 hp is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

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

6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

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

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

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

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

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

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Table 16.

Table 16 — 50RTG Coaxial Water Pressure Drop

UNIT 50RTG	GPM	WATER TEMPERATURE (F)			
		30	50	70	90
		Pressure Drop (ft. H ₂ O)			
03	4.0	3.1	2.8	2.8	2.8
	6.0	6.1	5.3	5.3	5.3
	8.0	9.9	8.9	8.9	8.9
	10.0	14.3	12.9	12.9	12.9
04	5.5	4.2	3.4	3.4	3.4
	8.5	8.9	7.8	7.8	7.8
	11.5	14.8	13.2	13.2	13.2
	14.0	20.5	18.6	18.6	18.6
05	7.0	8.1	5.3	5.3	5.3
	11.0	16.9	11.2	11.2	11.2
	15.0	28.5	18.9	18.9	18.9
	18.0	38.8	25.6	25.6	25.6
07	10.0	3.4	2.3	2.3	2.3
	15.0	10.1	6.7	6.7	6.7
	20.0	16.0	10.7	10.7	10.7
	24.0	22.3	14.9	14.9	14.9
08	11.0	4.5	3.5	3.5	3.5
	17.0	9.4	8.1	8.1	8.1
	22.0	14.2	12.7	12.7	12.7
	27.0	20.0	18.2	18.2	18.2
10	14.0	8.3	5.5	5.5	5.5
	22.0	17.6	11.7	11.7	11.7
	30.0	29.4	19.7	19.7	19.7
	36.0	39.9	26.7	26.7	26.7
12	17.0	4.8	3.2	3.2	3.2
	25.0	9.4	6.0	6.0	6.0
	34.0	13.1	10.3	10.3	10.3
	40.0	22.0	13.5	13.5	13.5
15	21.0	5.2	2.9	2.9	2.9
	32.0	10.7	7.4	7.4	7.4
	42.0	17.4	11.6	11.6	11.6
	51.0	24.3	16.5	16.5	16.5
20	31.0	10.6	6.4	6.4	6.4
	47.0	21.2	13.1	13.1	13.1
	62.0	34.2	20.8	20.8	20.8
	74.0	46.2	28.0	28.0	28.0

Antifreeze — In areas where entering loop temperatures drop below 40 F or where piping will be routed through areas subject to freezing, antifreeze is needed.

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

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

Calculate the total volume of fluid in the piping system. See Table 17. Use the percentage by volume in Table 18 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

FREEZE PROTECTION SELECTION — The 30 F FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, the JW3 jumper (FP1) should be clipped on the control to select the low temperature (antifreeze 13 F) set point to avoid nuisance faults.

Table 17 — Approximate Fluid Volume (gal.) per 100 Ft of Pipe

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

LEGEND

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

NOTE: Volume of heat exchanger is approximately 1.0 gallon.

Table 18 — 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

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

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

OPERATION

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

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

Units with Aquazone™ Complete C Control

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

COOLING — Y and O terminals are active in Cooling mode. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

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

HEATING STAGE 1 — Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

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

HEATING STAGE 2 — To enter Stage 2 mode, terminal W is active (Y is already active). Also, the G terminal must be active or the W terminal is disregarded. The compressor relay will remain on and EH1 is immediately turned on. EH2 will turn on after 10 minutes of continual stage 2 demand.

NOTE: EH2 will not turn on (or if on, will turn off) if FP1 temperature is greater than 45 F and FP2 is greater than 110 F.

EMERGENCY HEAT — In emergency heat mode, terminal W is active while terminal Y is not. Terminal G must be active or the W terminal is disregarded. EH1 is immediately turned on. EH2 will turn on after 5 minutes of continual emergency heat demand.

Units with Aquazone Deluxe D Control

STANDBY/FAN ONLY — The compressor will be off. The Fan Enable, Fan Speed, and reversing valve (RV) relays will be on if inputs are present. If there is a Fan 1 demand, the Fan Enable will immediately turn on. If there is a Fan 2 demand, the Fan Enable and Fan Speed will immediately turn on.

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

HEATING STAGE 1 — In Heating Stage 1 mode, the Fan Enable and Compressor relays are turned on immediately. Once the demand is removed, the relays are turned off and the control reverts to Standby mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 2 — In Heating Stage 2 mode, the Fan Enable and Compressor relays remain on. The Fan Speed relay is turned on immediately and turned off immediately once the demand is removed. The control reverts to Heating Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 3 — In Heating Stage 3 mode, the Fan Enable, Fan Speed and Compressor relays remain on. The EH1 output is turned on immediately. With continuing Heat Stage 3 demand, EH2 will turn on after 10 minutes. EH1 and EH2 are turned off immediately when the Heating Stage 3 demand is removed. The control reverts to Heating Stage 2 mode.

Output EH2 will be off if FP1 is greater than 45 F AND FP2 (when shorted) is greater than 110 F during Heating Stage 3 mode. This condition will have a 30-second recognition time. Also, during Heating Stage 3 mode, EH1, EH2, Fan Enable, and Fan Speed will be ON if G input is not active.

EMERGENCY HEAT — In Emergency Heat mode, the Fan Enable and Fan Speed relays are turned on. The EH1 output is turned on immediately. With continuing Emergency Heat demand, EH2 will turn on after 5 minutes. Fan Enable and Fan Speed relays are turned off after a 60-second delay. The control reverts to Standby mode.

Output EH1, EH2, Fan Enable, and Fan Speed will be ON if the G input is not active during Emergency Heat mode.

COOLING STAGE 1 — In Cooling Stage 1 mode, the Fan Enable, compressor and RV relays are turned on immediately. If configured as stage 2 (DIP switch set to OFF) then the compressor and fan will not turn on until there is a stage 2 demand. The fan Enable and compressor relays are turned off immediately when the Cooling Stage 1 demand is removed. The control reverts to Standby mode. The RV relay remains on until there is a heating demand. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

COOLING STAGE 2 — In Cooling Stage 2 mode, the Fan Enable, compressor and RV relays remain on. The Fan Speed relay is turned on immediately and turned off immediately once the Cooling Stage 2 demand is removed. The control reverts to Cooling Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

NIGHT LOW LIMIT (NLL) STAGED HEATING — In NLL staged Heating mode, the override (OVR) input becomes active and is recognized as a call for heating and the control will immediately go into a Heating Stage 1 mode. With an additional 30 minutes of NLL demand, the control will go into Heating Stage 2 mode. With another additional 30 minutes of NLL demand, the control will go into Heating Stage 3 mode.

SYSTEM TEST

System testing provides the ability to check the control operation. The control enters a 20-minute Test mode by momentarily shorting the test pins. All time delays are increased 15 times. See Fig. 4.

Test Mode — To enter Test mode on C or D controls, cycle the power 3 times within 60 seconds. The LED (light-emitting diode) will flash a code representing the last fault when entering the Test mode. The alarm relay will also power on and off during Test mode. See Tables 19 and 20. To exit Test mode, short the terminals for 3 seconds or cycle the power 3 times within 60 seconds.

NOTE: Deluxe D Control has a flashing code and alarm relay cycling code that will both have the same numerical label. For example, flashing code 1 will have an alarm relay cycling code 1. Code 1 indicates the control has not faulted since the last power off to power on sequence.

Table 19 — C Control Current LED Status and Alarm Relay Operations

LED STATUS	DESCRIPTION OF OPERATION	ALARM RELAY
On	Normal Mode	Open
	Normal Mode with PM Warning	Cycle (closed 5 sec., Open 25 sec.)
Off	C Control is non-functional	Open
Slow Flash	Fault Retry	Open
Fast Flash	Lockout	Closed
Slow Flash	Over/Under Voltage Shutdown	Open (Closed after 15 minutes)
Flashing Code 1	Test Mode — No fault in memory	Cycling Code 1
Flashing Code 2	Test Mode — HP Fault in memory	Cycling Code 2
Flashing Code 3	Test Mode — LP Fault in memory	Cycling Code 3
Flashing Code 4	Test Mode — FP1 Fault in memory	Cycling Code 4
Flashing Code 5	Test Mode — FP2 Fault in memory	Cycling Code 5
Flashing Code 6	Test Mode — CO Fault in memory	Cycling Code 6
Flashing Code 7	Test Mode — Over/Under shutdown in memory	Cycling Code 7
Flashing Code 8	Test Mode — PM in memory	Cycling Code 8
Flashing Code 9	Test Mode — Test Mode — FP1/FP2 Swapped Fault in memory	Cycling Code 9

LEGEND

- CO — Condensate Overflow
- FP — Freeze Protection
- HP — High Pressure
- LED — Light-Emitting Diode
- LP — Low Pressure
- PM — Performance Monitor

NOTES:

1. Slow flash is 1 flash every 2 seconds.
2. Fast flash is 2 flashes every 1 second.
3. EXAMPLE: "Flashing Code 2" is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

Table 20 — C Control LED Code and Fault Descriptions

LED CODE	FAULT	DESCRIPTION
1	No fault in memory	There has been no fault since the last power-down to power-up sequence
2	High-Pressure Switch	HP Open Instantly
3	Low-Pressure Switch	LP open for 30 continuous seconds before or during a call (bypassed for first 60 seconds)
4	Freeze Protection Coax — FP1	FP1 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
5	Freeze Protection Air Coil — FP2	FP2 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
6	Condensate overflow	Sense overflow (grounded) for 30 continuous seconds
7 (Autoreset)	Over/Under Voltage Shutdown	"R" power supply is <19VAC or >30VAC
8	PM Warning	Performance Monitor Warning has occurred.
9	FP1 and FP2 Thermistors are Swapped	FP1 temperature is higher than FP2 in heating/test mode, or FP2 temperature is higher than FP1 in cooling/test mode.

LEGEND

- FP — Freeze Protection
- HP — High Pressure
- LED — Light-Emitting Diode
- LP — Low Pressure
- PM — Performance Monitor

Retry Mode — In Retry mode, the status LED will start to flash slowly to signal that the control is trying to recover from an input fault. The control will stage off the outputs and try to

again satisfy the thermostat used to terminal Y. Once the thermostat input calls are satisfied, the control will continue normal operation.

NOTE: If 3 consecutive faults occur without satisfying the thermostat input call to terminal Y, the control will go into lockout mode. The last fault causing the lockout is stored in memory and can be viewed by entering Test mode.

Aquazone™ Deluxe D Control LED Indicators — There are 3 LED indicators on the D Control:

STATUS LED — Status LED indicates the current status or mode of the D control. The Status LED light is green.

TEST LED — Test LED will be activated any time the D control is in test mode. The Test LED light is yellow.

FAULT LED — Fault LED light is red. The fault LED will always flash a code representing the last fault in memory. If there is no fault in memory, the fault LED will flash code 1 on and appear as 1 fast flash alternating with a 10-second pause. See Table 21.

SERVICE

Perform the procedures outlined below periodically, as indicated.

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

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

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

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

IMPORTANT: Units should never be operated without a filter.

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

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

Check P trap frequently for proper operation.

Table 21 — Aquazone D Control Current LED Status and Alarm Relay Operations

DESCRIPTION	STATUS LED (Green)	TEST LED (Yellow)	FAULT LED (Red)	ALARM RELAY
Normal Mode	On	Off	Flash Last Fault Code in Memory	Open
Normal Mode with PM	On	Off	Flashing Code 8	Cycle (closed 5 sec, open 25 sec, ...)
D Control is non-functional	Off	Off	Off	Open
Test Mode	—	On	Flash Last Fault Code in Memory	Cycling Appropriate Code
Night Setback	Flashing Code 2	—	Flash Last Fault Code in Memory	—
ESD	Flashing Code 3	—	Flash Last Fault Code in Memory	—
Invalid T-stat Inputs	Flashing Code 4	—	Flash Last Fault Code in Memory	—
No Fault in Memory	On	Off	Flashing Code 1	Open
HP Fault	Slow Flash	Off	Flashing Code 2	Open
LP Fault	Slow Flash	Off	Flashing Code 3	Open
FP1 Fault	Slow Flash	Off	Flashing Code 4	Open
FP2 Fault	Slow Flash	Off	Flashing Code 5	Open
CO Fault	Slow Flash	Off	Flashing Code 6	Open
Over/Under Voltage	Slow Flash	Off	Flashing Code 7	Open (closed after 15 minutes)
HP Lockout	Fast Flash	Off	Flashing Code 2	Closed
LP Lockout	Fast Flash	Off	Flashing Code 3	Closed
FP1 Lockout	Fast Flash	Off	Flashing Code 4	Closed
FP2 Lockout	Fast Flash	Off	Flashing Code 5	Closed
CO Lockout	Fast Flash	Off	Flashing Code 6	Closed

LEGEND

- CO — Condensate Overflow
- ESD — Emergency Shutdown
- FP — Freeze Protection
- HP — High Pressure
- LP — Low Pressure
- PM — Performance Monitor

NOTES:

1. If there is no fault in memory, the Fault LED will flash code 1.
2. Codes will be displayed with a 10-second Fault LED pause.
3. Slow flash is 1 flash every 2 seconds.
4. Fast flash is 2 flashes every 1 second.
5. EXAMPLE: "Flashing Code 2" is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

▲ 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.

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

Refrigerant System — Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gauges unless unit operation appears abnormal. Check to see that unit is within the superheat and subcooling ranges.

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

Air Coil Cleaning — Remove dirt and debris from evaporator coil as required by condition of the coil. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

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

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

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

▲ CAUTION

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

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. 8.

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. 9.

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

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

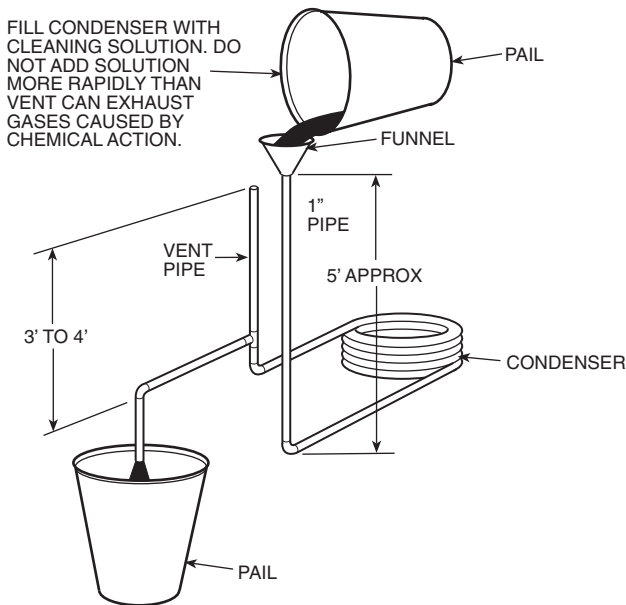


Fig. 8 — Gravity Flow Method

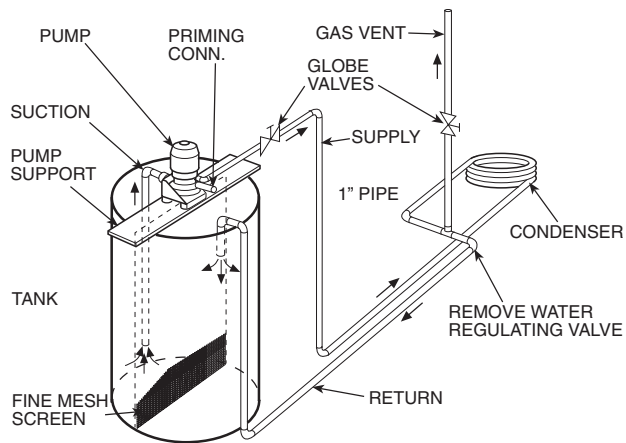


Fig. 9 — Forced Circulation Method

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 reclaim refrigerant following accepted practices.

Air Coil Fan Motor Removal

⚠ CAUTION

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

Motor power wires need to be disconnected from motor terminals before motor is removed from unit.

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

TROUBLESHOOTING (Fig. 10 and 11, and Table 22)

When troubleshooting problems with a WSHP, consider the following.

Thermistor — A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage. See Fig. 10 for thermistor nominal resistance.

Control Sensors — The control system employs 2 nominal 10,000 ohm thermistors (FP1 and FP2) that are used for freeze protection. Be sure FP1 is located in the discharge fluid and FP2 is located in the air discharge. See Fig. 11.

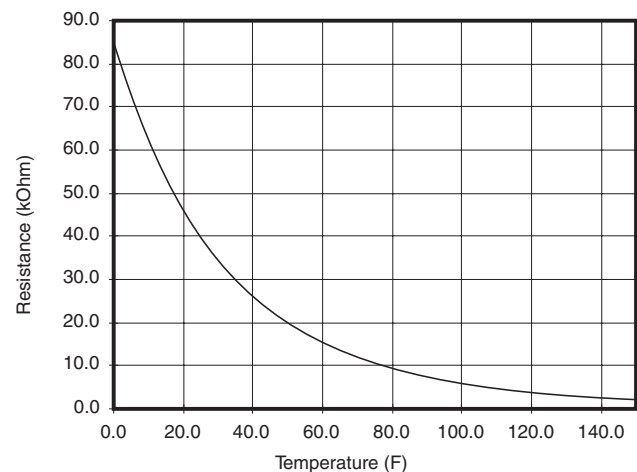


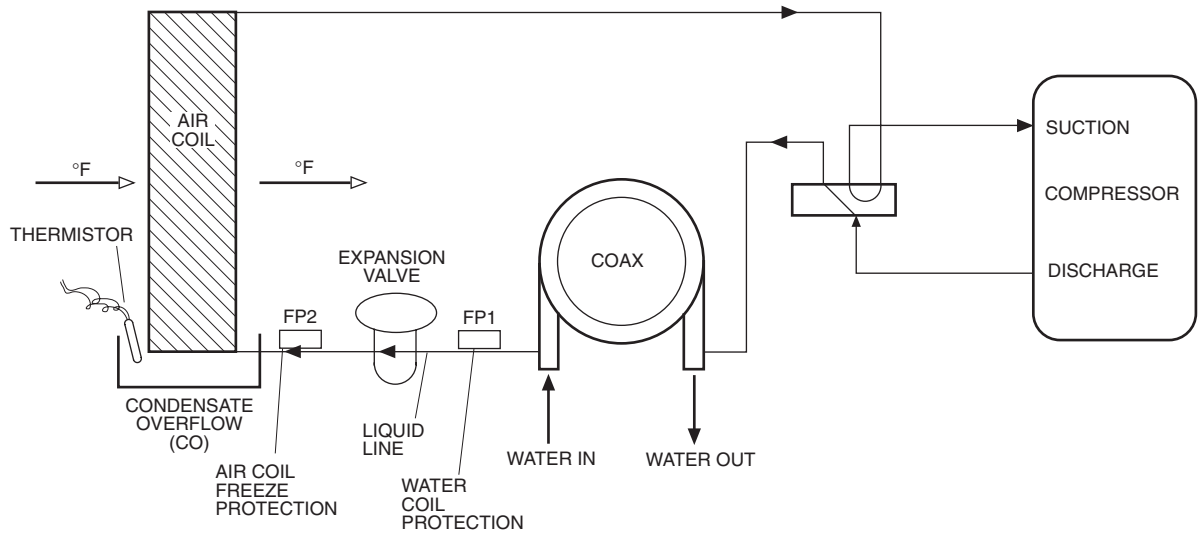
Fig. 10 — Thermistor Nominal Resistance

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

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

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

4. From standard field-supplied Pressure-Temperature chart for R-22, find equivalent saturated condensing temperature.
5. Read liquid line temperature on thermometer; then subtract from saturated condensing temperature. The difference equals subcooling temperature.
6. ADD refrigerant to raise the temperature or REMOVE refrigerant (using standard practices) to lower the temperature (allow a tolerance of $\pm 3^\circ$ F), as required.





LEGEND
COAX — Coaxial Heat Exchanger
 Airflow
 Refrigerant Liquid Line Flow

Fig. 11 — FP1 and FP2 Thermistor Location

Table 22 — Troubleshooting

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Main Power Problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24 VAC between R and C on controller.
				Check primary/secondary voltage on transformer.
HP Fault — Code 2 High Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting. Check water flow adjust to proper flow rate.
		X	Water temperature out of range in cooling	Bring water temperature within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. Dirty air coil — construction dust etc. External static too high. Check Tables 4-12.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition.
	X	X	Bad HP switch	Check switch continuity and operation. Replace.
LP/LOC Fault — Code 3 Low Pressure/Loss of Charge	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at start-up	Check charge and start-up water flow.
FP1 Fault — Code 4 Water Freeze Protection	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting. Plugged strainer or filter. Clean or replace. Check water flow adjust to proper flow rate.
		X	Inadequate antifreeze level	Check antifreeze density with hydrometer.
		X	Improper freeze protect setting (30 F vs 10 F)	Clip JW2 jumper for antifreeze (10 F) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
	X	X	Bad thermistor	Check temperature and impedance correlation.
	FP2 Fault — Code 5 Air Coil Freeze Protection		X	Reduced or no airflow in cooling
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
		X	Improper freeze protect setting (30 F vs 10 F)	Normal airside applications will require 30°F only.
X		X	Bad thermistor	Check temperature and impedance correlation.
Condensate Fault — Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit. Check slope of unit toward outlet. Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
Over/Under Voltage — Code 7 (Auto Resetting)	X	X	Under voltage	Check power supply and 24 VAC voltage before and during operation. Check power supply wire size. Check compressor starting. Check 24 VAC and unit transformer tap for correct power supply voltage.
			Over voltage	Check power supply voltage and 24 VAC before and during operation. Check 24 VAC and unit transformer tap for correct power supply voltage.
Performance Monitor — Code 8	X		Heating mode FP2>125 F	Check for poor airflow or overcharged unit.
		X	Cooling mode FP1>125 F OR FP2< 40 F	Check for poor water flow or airflow.
FP1 and FP2 Thermistors — Code 9	X		FP1 temperature is higher than FP2 temperature	Swap FP1 and FP2 thermistors.
		X	FP2 temperature is higher than FP1 temperature	Swap FP1 and FP2 thermistors.
No Fault Code Shown	X	X	No compressor operation	See scroll compressor rotation section.
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in 'Test Mode'	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in Test mode.

LEGEND

RV — Reversing Valve

Table 22 — Troubleshooting (cont)

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts. Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Unit Does Not Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24 VAC on RV coil and at control. If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'Click'.
Insufficient capacity/ Not cooling or heating properly	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Tables 4-12.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Tables 4-12.
	X	X	Leaky ductwork	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling .
	X	X	Restricted metering device	Check superheat and subcooling. Replace metering device.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind thermostat.
	X	X	Unit undersized	Recheck loads and sizing check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
	High Head Pressure	X		Reduced or no airflow in heating
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting. Check water flow and adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
X			Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform Scaling check and clean if necessary.
X		X	Unit overcharged	Check superheat and subcooling. Reweigh in charge.
X		X	Non-condensables in system	Vacuum system and reweigh in charge.
X		X	Restricted metering device	Check superheat and subcooling. Replace metering device.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting. Plugged strainer or filter. Clean or replace. Check water flow adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Tables 4-12.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low discharge air temperature in heating	X		Airflow too high	Check blower Tables 4-12.
	X		Poor performance	See 'Insufficient Capacity'.
High humidity		X	Airflow too high	Check blower Tables 4-12.
		X	Unit oversized	Recheck loads and sizing check sensible cooling load and heat pump capacity.

LEGEND

RV — Reversing Valve

**50RTG
START-UP CHECKLIST**

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

I. PRE-START-UP

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

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

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

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

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

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

II. START-UP

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

IF 3-PHASE SCROLL COMPRESSOR IS PRESENT, VERIFY PROPER ROTATION PER INSTRUCTIONS. (Y/N) _____

UNIT VOLTAGE — COOLING OPERATION

PHASE AB VOLTS _____ PHASE BC VOLTS _____ PHASE CA VOLTS _____
(if 3 phase) (if 3 phase)

PHASE AB AMPS _____ PHASE BC AMPS _____ PHASE CA AMPS _____
(if 3 phase) (if 3 phase)

CONTROL VOLTAGE

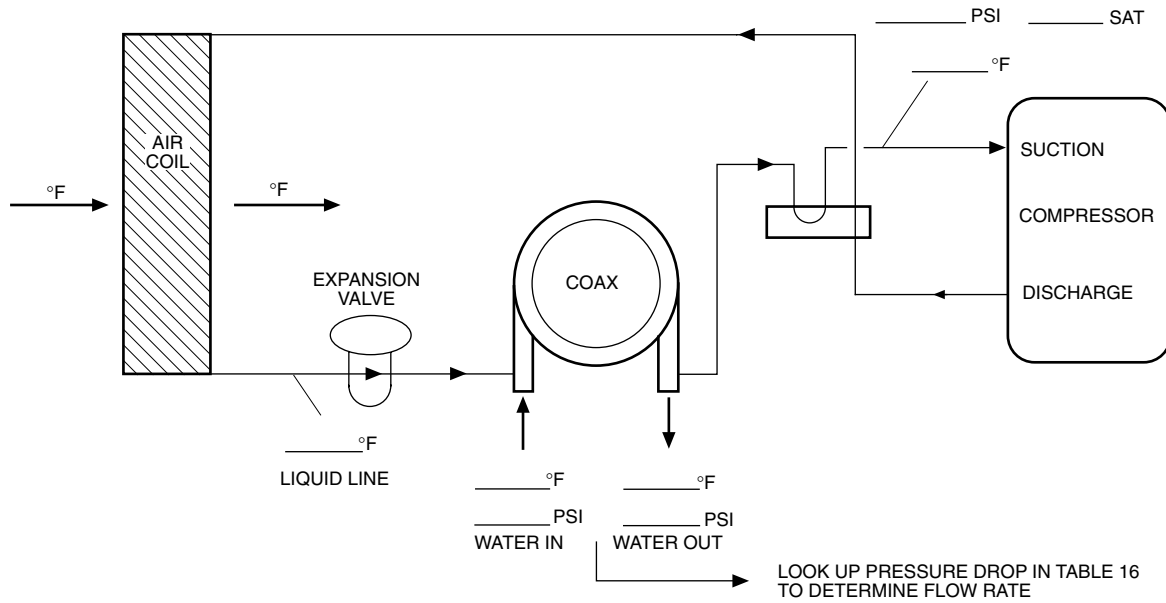
IS CONTROL VOLTAGE ABOVE 21.6 VOLTS? (Y/N) _____.
IF NOT, CHECK FOR PROPER TRANSFORMER CONNECTION.

TEMPERATURES

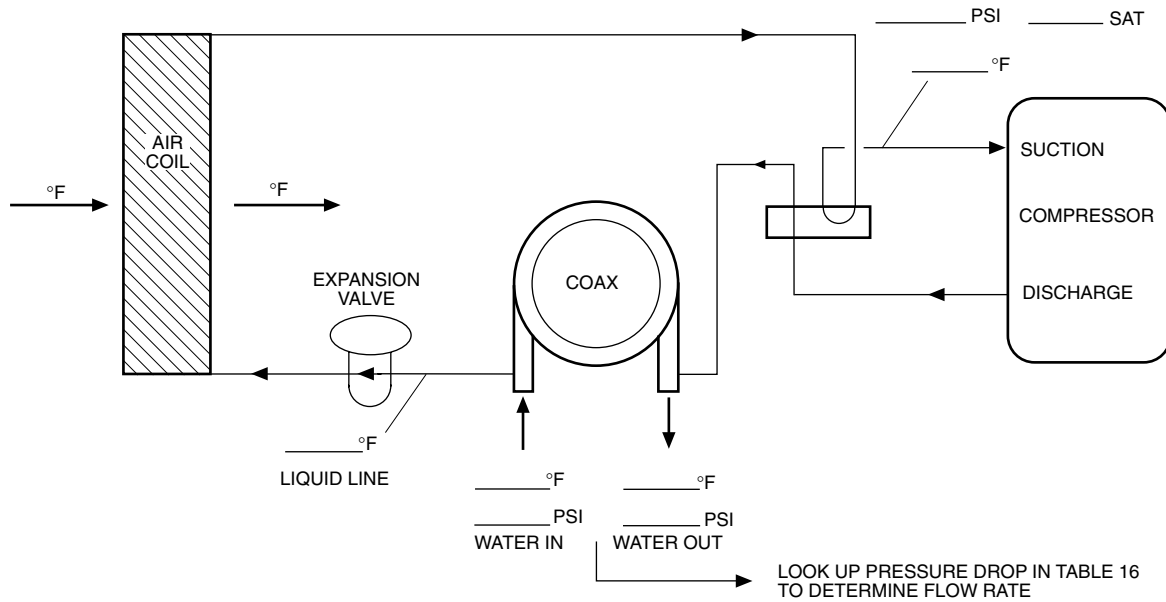
FILL IN THE ANALYSIS CHART ATTACHED.

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

HEATING CYCLE ANALYSIS



COOLING CYCLE ANALYSIS



HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

$$\text{_____ FLOW RATE (GPM)} \times \text{_____ TEMP. DIFF. (DEG. F)} \times \text{_____ FLUID FACTOR*} = \text{_____ (Btu/hr)}$$

$$\text{SUPERHEAT} = \text{SUCTION TEMPERATURE} - \text{SUCTION SATURATION TEMPERATURE}$$

$$= \text{_____ (DEG F)}$$

$$\text{SUBCOOLING} = \text{DISCHARGE SATURATION TEMPERATURE} - \text{LIQUID LINE TEMPERATURE}$$

$$= \text{_____ (DEG F)}$$

*Use 500 for water, 485 for antifreeze.



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CUT ALONG DOTTED LINE