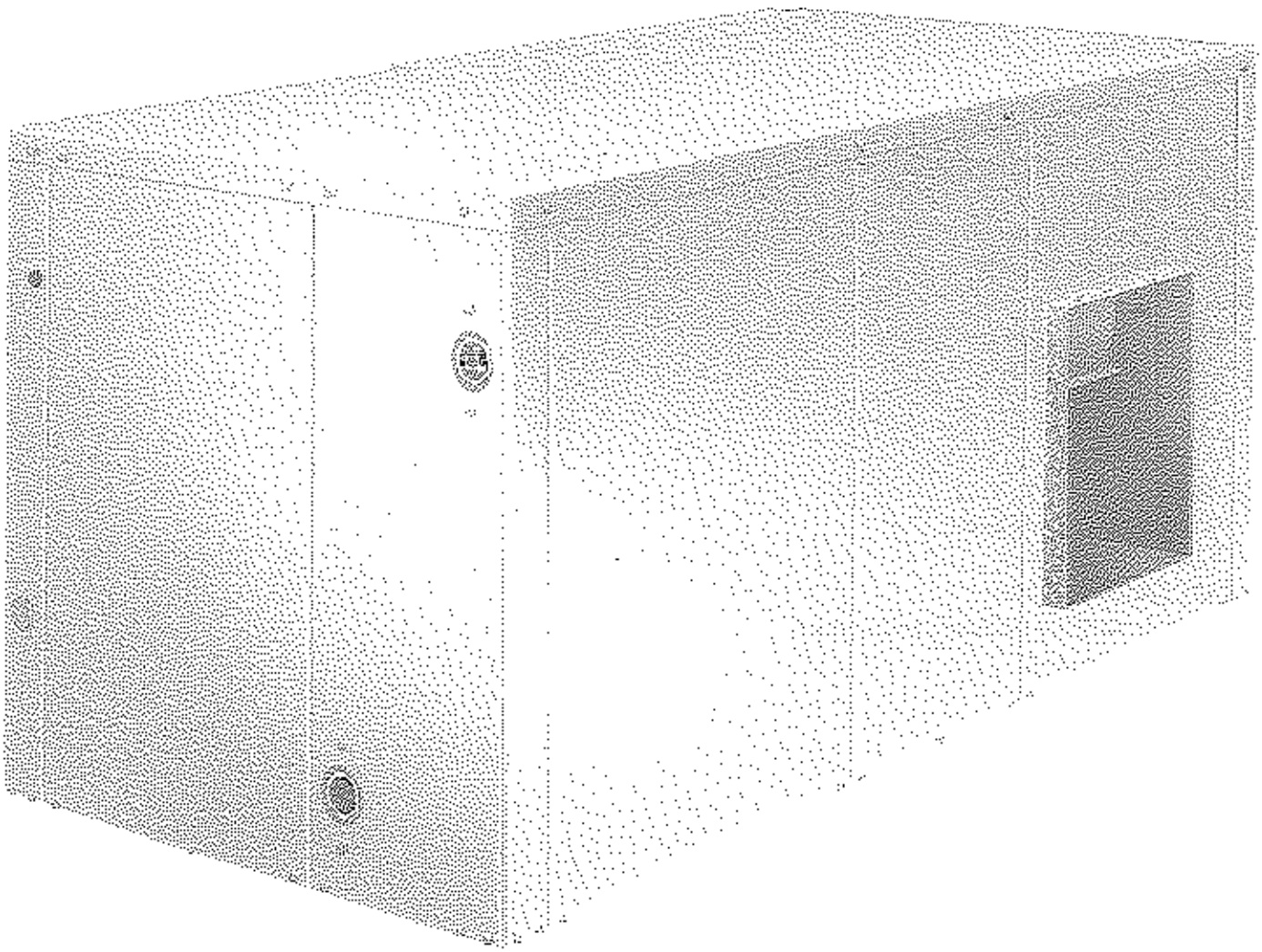
ClimateMaster

Climate Master 814 Series

Installation Operation Maintenance

Water Source Heat Pumps: Horizontal Units



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Initial Inspection

Be sure to inspect the carton or crating housing on each unit as it is received at the job site and before signing the freight bill. Verify that all items have been received and that there is no visible damage; note any shortages or damage on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damage not discovered until after unloading must be reported to the carrier within 15 days of its receipt.

Unit wiring diagrams and installation/operation/maintenance instructions are provided with each unit. Before unit start-up, be sure to read these manuals to become familiar with the unit and its operation.

Notice that an installation checklist is provided at the end of this manual; it should be completed after all the installation procedures described have been accomplished. A periodic maintenance checklist is provided in the "Maintenance" section to outline recommended maintenance schedules. Do not substitute these checklists for the detailed information found in the appropriate sections of this manual.

In addition, a start-up/inspection log has also been included at the end of this manual to encourage thorough unit checkout at initial start-up.

Storage

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area of the building, or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units as follows: Horizontal units, maximum 4 high. Do not remove any equipment from its shipping package until it is needed for installation.

Unit Protection

Once the units are properly positioned on the job site, they must be covered with either a shipping carton, vinyl film, or an equivalent protective covering; open ends of pipes stored on the job site must be capped. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material and the like 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; remove any dirt found on these components.

Do NOT use these units as a source of heat during construction of the building since the units' filters will quickly fill with construction dirt and debris. (Operating a unit with a clogged filter impairs or prevents unit operation, and — as stated earlier — necessitates costly unit clean-up.) It is strongly recommended that an alternative means of providing temporary heat be used.

Preinstallation

To prepare a unit for installation, be sure to complete the inspections and instructions 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. Do not remove the cardboard carton until the unit is ready for installation.
3. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
4. Inspect all electrical connections; connections should be clean and tight at the terminals.

The compressors of all units are internally spring-mounted. **Those equipped with external Spring Vibration Isolators must have bolts loosened and shipping clamps removed.**

Installation

Location and Access

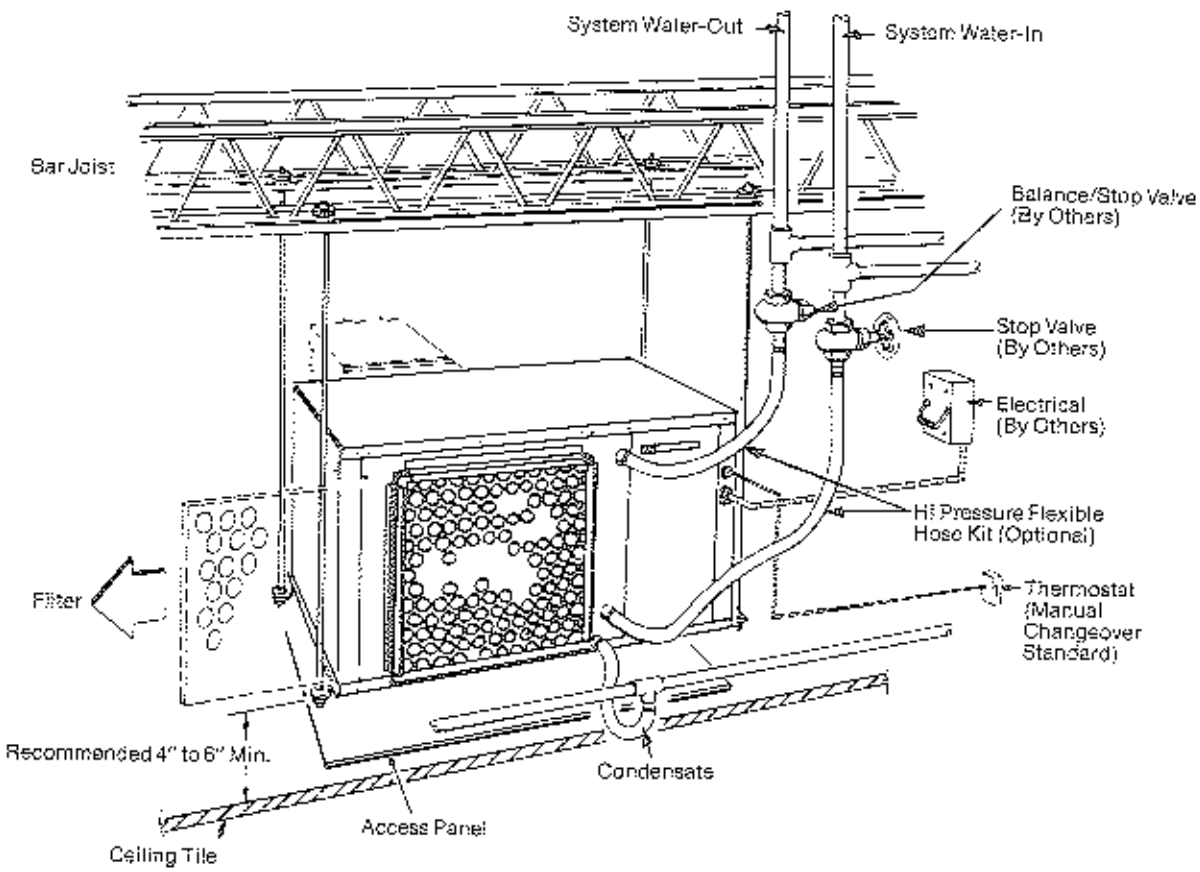
Horizontal Units

Because Horizontal units are designed for installation above a false ceiling or ceiling plenum, access becomes an extremely important consideration. Be sure that the site chosen for unit installation provides enough clearance to allow easy maintenance or servicing of the unit without necessitating its removal from the ceiling. A minimum of 24" is recommended for compressor and blower access.

A number of guidelines to consider when installing a Horizontal unit are listed below; refer to Figure 1 for an illustration of a typical Horizontal installation.

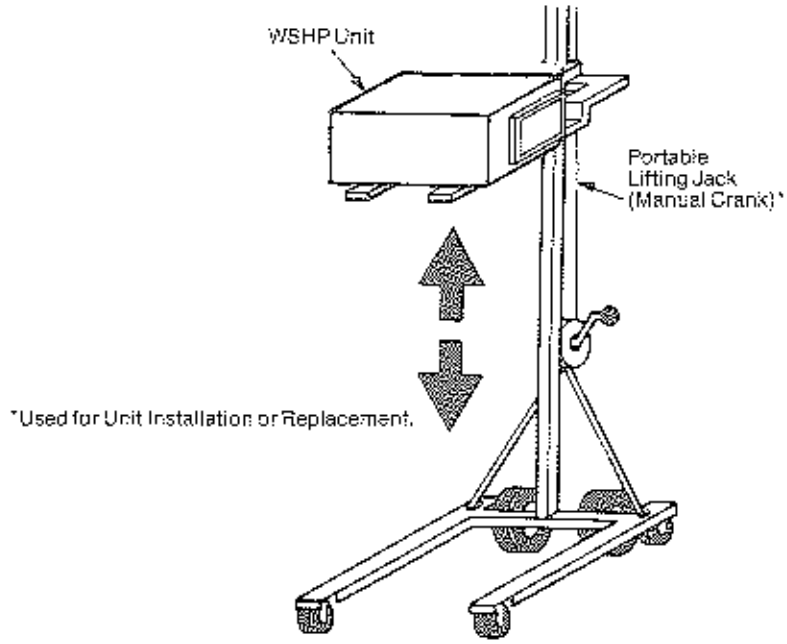
1. Provide a hinged access door (in concealed-spline or plaster ceilings), or removable tiles (in T-bar or lay-in ceilings). The access opening must be large enough to accommodate the service technician as he services the unit (including compressor removal and replacement), and to permit removal of the unit. Refer to Table 4 for overall dimensions of the unit. Maximum access as defined by local codes should be maintained at all time.
2. Provide easy access to hanger brackets, water valves and fittings, and screwdriver clearance to access panels, the discharge collar, and all electrical connections.
3. If a return duct is used, be sure to provide a duct slot for filter replacement.
4. To allow removal of the unit do not run obstructions (e.g., piping, electrical cable, etc.) under the unit.
5. Minimize obstructions in the conditioned space beneath the unit whenever possible. A manual, portable jack can then be used to lift and support the weight of the unit during installation or servicing. See Figure 2.

Figure 1.
Access Guidelines
(Typical Installation Shown)
Horizontal — Sizes 009 thru 031



Note: Provide adequate service clearance on access panel side of unit; minimum recommended clearance is 18"
*Optional is a flow meter which is not shown in the above installation.

Figure 2.
Lifting Unit with
Portable Jack



Hanging or Mounting

While horizontal heat pumps may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling or within a soffit using field-supplied, threaded rods to support their weight.

A mounting kit — which includes four mounting brackets, and vibration issolators — is shipped inside the blower compartment of the unit. Attach the brackets and isolators to the bottom corners of the unit as shown in Figure 3. Then use four field-supplied threaded rods to suspend the unit.

Be sure to follow clearance guidelines described under "Location and Access". Remember that the unit must not be mounted flush with the floor slab above, but should hang clear and be supported only by the mounting bracket assemblies.

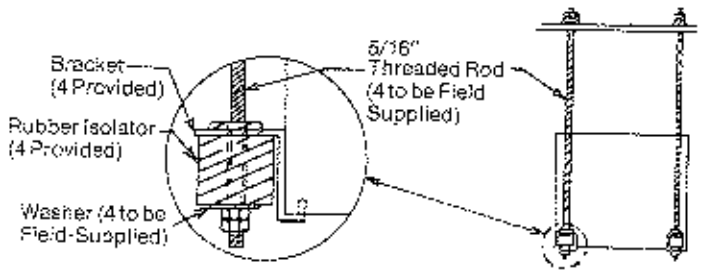
Unit installation within the plenum should provide adequate clearance for filter removal in any one of the four directions possible. On those applications with a return air plenum, a slot for filter removal (i.e., toward the front) must be provided.

Sound Attenuation

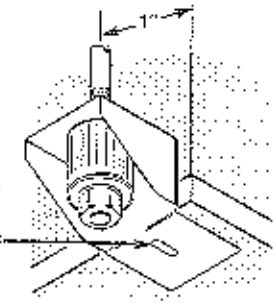
Correct placement of the Horizontal unit can play an important part in minimizing sound problems. Since ductwork is normally applied to these unit, thi enables the unit to be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by the local code if a fire wall is penetrated.

Figure 3.
Hanger and Vibration
Isolation Kits

Horizontal Mounting Brackets
(Used With Horizontal Sizes 009 Through 031)



Notes:
1. Each kit is packaged in a plastic bag with the unit, consisting of 4 hangers, 4 vibration isolators, 4 washers and a set of instructions.
2. Total head space required: Unit height + 1/2 inch + condensate trapping.
3. See unit dimensional drawing for further information.



Slot used only for installation of hangers with 096 and 120 models. (Important: Use screws no longer than 1/2").

Horizontal Mounting Brackets
(Used With Horizontal Sizes 036 Through 120)

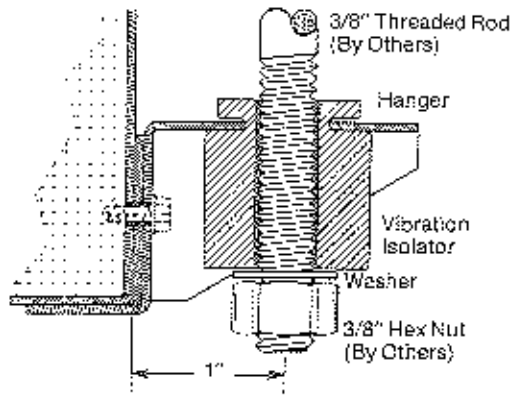
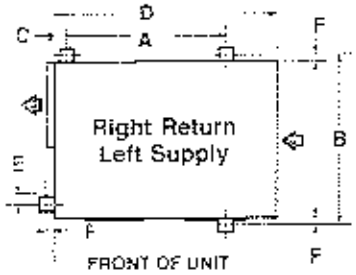
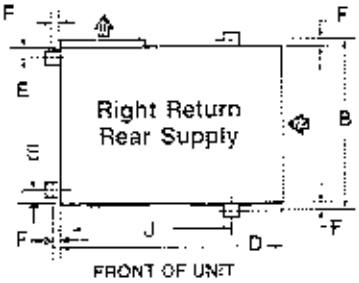
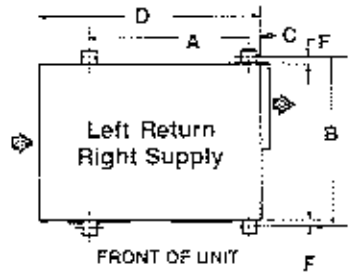


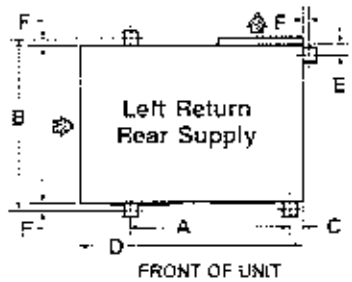
Figure 4.
Hanger Bracket
Dimensions

814-009, 011 and 013





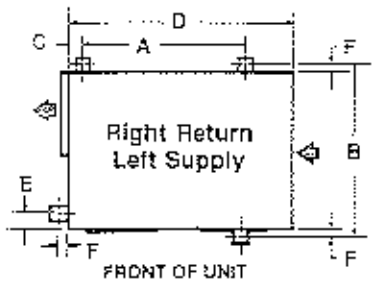


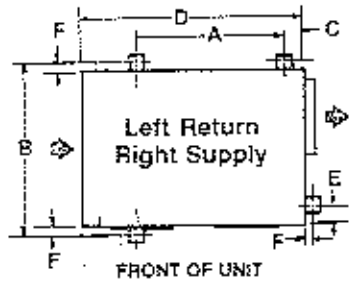


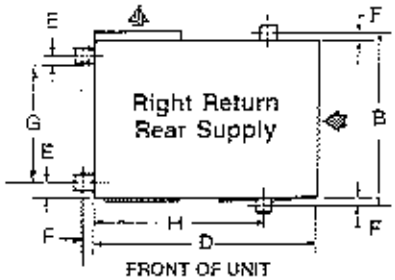
MODEL	DIMENSIONS								
	A	B	C	D	E	F	G	H	J
009, 011 & 013	22 37/64	24	1¾	31½	1⅝	1	—	—	23 49/64

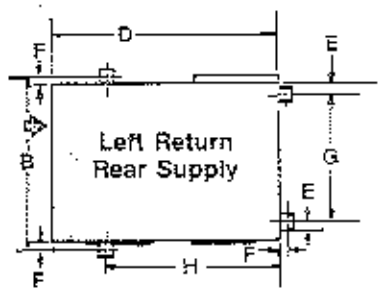
All dimensions in inches

814-019, 023 and 031







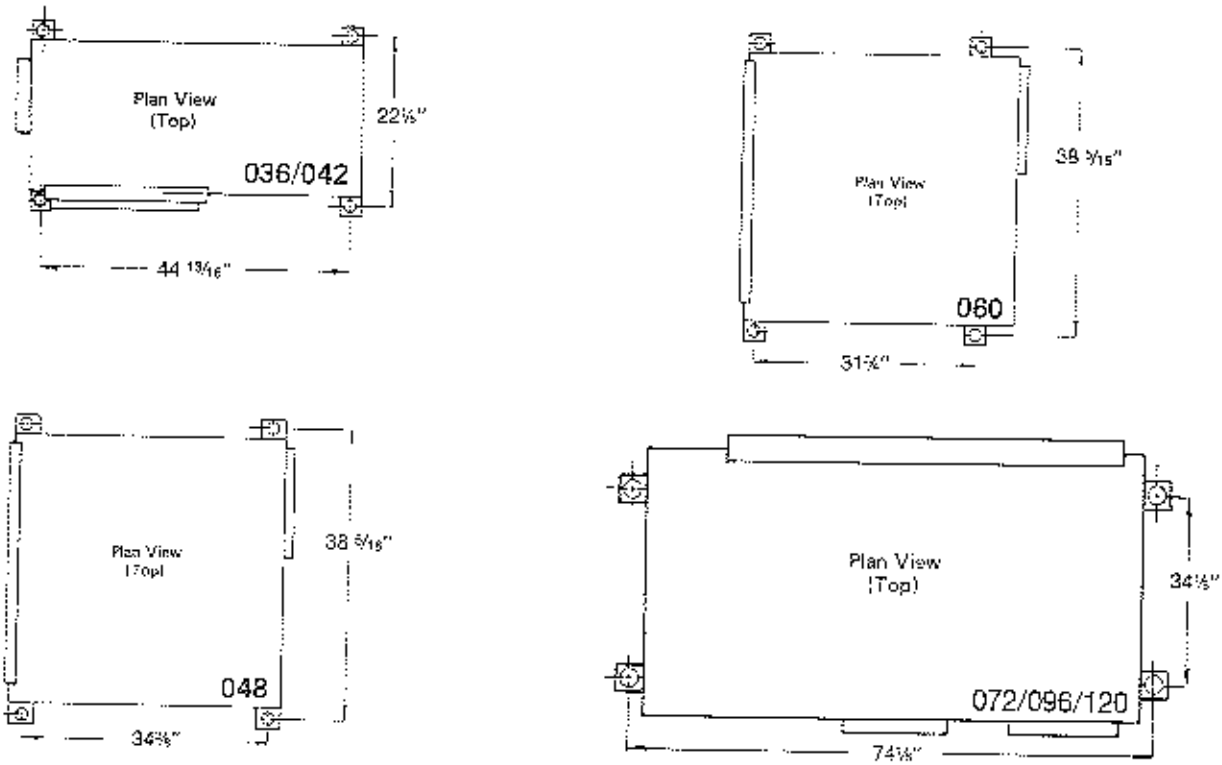


MODEL	DIMENSIONS								
	A	B	C	D	E	F	G	H	J
019, 023 & 031	31 ¾	27	1⅜	41	1 9/16	1	21 27/32	33 9/32	—

All dimensions in inches

Figure 4 Continued.
Hanger Bracket
Dimensions

814-036, 042, 048, 060, 096 and 120



Supply and Return Piping

Besides complying with any applicable codes, system piping should also include the following features:

1. a drain valve at the base of each supply and return riser to enable system flushing at start-up and during routine servicing;
2. shut-off/balancing valves and unions at each unit to permit unit removal for servicing; and,
3. strainers at the inlet of each system circulating pump. (Shut-off/balancing valves, flow indicators, and drain tees in the supply runout and return at each floor facilitate loop balancing and servicing.)

Insulation is not required on the loop water piping except on those sections that run through unheated areas or outside the building. This is because the loop temperature is normally between 60 and 90 F; therefore, the piping will neither sweat nor suffer heat loss.

Condensate Drain

A drain line must be connected to each heat pump and pitched to allow condensate to flow away from the machine.

Condensate Piping

In most system applications, units are positioned directly above each other on successive floors, and the condensate risers are located next to the units. A flexible, nonpressure-rated plastic hose is typically used to connect the unit condensate drain connection to the condensate riser. (This condensate hose must be field supplied and installed.) To ensure an unobstructed flow of condensate from the unit to the riser, this hose must be carefully arranged to avoid kinks.

Though the horizontal run of the condensate hose is usually too short to pose any drainage problems, it is important to remember that horizontal runs of condensate line are typically pitched at least one inch for every 10 feet of run in the direction of flow. Low points and unpitched piping cannot be allowed, since dirt will collect in these areas and cause stoppage and overflow.

To ensure proper condensate flow from the units, the contractor must install a condensate trap at each unit, with the top of the trap positioned below the unit condensate drain connection.

Designing A Functional Trap

One possible cause of malfunction is an incorrectly designed trap. Installing an appropriate trap for the application can result in elimination of the malfunction. The following is a discussion of a systematic approach to designing an effective trap for a draw-through air conditioning unit.

Assess the fan plenum to determine the internal design negative static pressure. It is important to observe that this pressure differs from the fan total pressure, which includes the pressure losses of the supply fan both upstream and downstream. Begin with the inference that the air filters are fully loaded (i.e. "worst case" scenario).

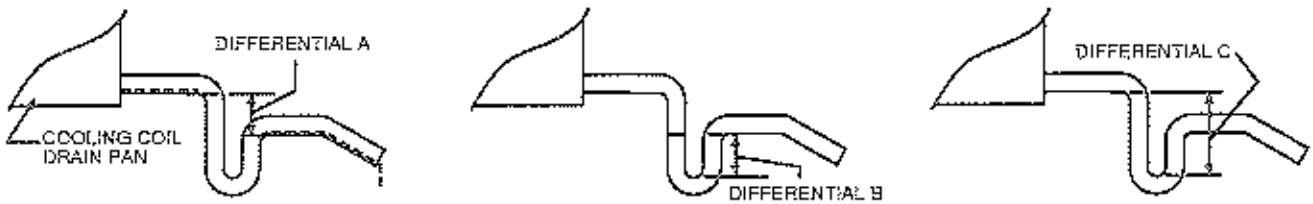
At design operating conditions, Differential A (Fig. 5) must be equal to or larger than the plenum negative static pressure.

Differential B (Fig. 5) must be equal to or larger than 1/2 of the plenum maximum negative static pressure to assure storage of sufficient water to maintain the trap seal.

The maximum negative static pressure in the plenum is equal to Differential C (Fig. 5). It has been determined by testing authentic fan installations that Differential A (the plenum negative static pressure at design operating conditions) and Differential C are virtually the same. It appears that the relationship between the maximum negative static pressure in the plenum to Differential C begins at start-up, before operating pressure is achieved. It can be concluded that the first surge of negative pressure at start-up is not substantially greater than the typical negative pressure within the plenum and is, therefore, not a significant factor.

These data support the conclusion that only Differentials A and B must be defined in order to design a properly functional condensate trap for draw-through air conditioning unit.

Figure 5.
Condensate Drain



(A) Fan running and condensate draining (B) Fan "off" (C) Trap condition when fan starts

Installation of Supply and Return Hoses

Optional pressure-rated hose assemblies designed specifically for use with Climate Master units may be ordered though hoses of a similar type can also be obtained from alternate suppliers in the field. In either case, these hoses will provide long life and trouble-free service if they are properly selected, installed and maintained.

Supply and return hoses are fitted with swivel-joint fittings at one end to prevent the hose from twisting; male adapters are provided to secure the hose assemblies to the unit and risers. Refer to Figure 6 for an illustration of the hoses, and to Table 1 for a listing of the hose kits available. Figure 1 illustrates the supply, return and condensate hoses assembled to a Horizontal unit.

CAUTION: Extremely corrosive system water may require use of special corrosion-resistant fittings and hoses. When this condition is encountered, water treatment is required.

Hose assemblies must be installed properly and checked regularly. Improper installation of hose assemblies may cause failure or reduce service life. Because water leaks can cause severe damage to carpeting, furniture, etc., it is extremely important that the installation guidelines provided below be strictly followed to ensure that water leaks do not occur.

Figure 6.
Supply/ Return
Hose Kit

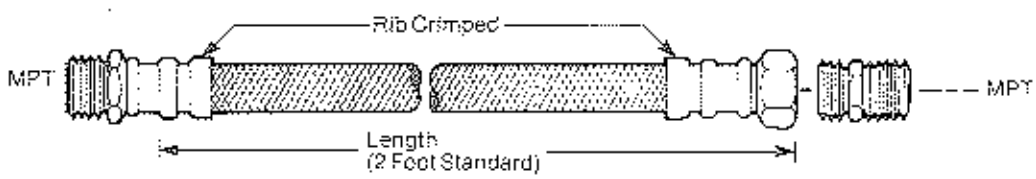


Table 1. Supply and Return Hose Specifications

HOSE SIZE	MIN. OUTSIDE DIAMETER	BEND RADIUS	GALVANIZED BRAID			STAINLESS STEEL BRAID*		
			OPERATING PART NUMBER	WORKING PRESSURE (PSI)	BURSTING PRESSURE (PSI)	OPERATING PART NUMBER	WORKING PRESSURE (PSI)	BURSTING PRESSURE (PSI)
1/2"	23/32"	2-7/8"	AK5042	300	1200	AK5032	375	1500
3/4"	1-1/8"	4-1/2"	AK7542	225	900	AK7532	300	1200
1"	1-3/8"	5-1/2"	AK1042	175	700	AK1032	225	900
1-1/4"	1-11/16"	6-3/4"	AK1212	150	600	AK1222	200	800

*Optional — on order only

To properly select and install the hose assemblies:

1. Select the proper hose length to allow the slack required between connection points. Since the hose may change in length from +2 to - 4 percent under the surge of high pressure, it is necessary to provide sufficient slack for expansion and contraction. See Figure 7.
2. Hoses must also be selected to the proper length to ensure that the minimum bend radius is not exceeded. Exceeding the minimum bend radius can cause the hose to collapse, thus reducing the water flow rate, and/or damaging the hose wall construction. A minimum bend radius specification of four inches means that the shortest distance between sections of bent hose cannot be less than eight inches. Use the following minimum bend radius when selecting metal hoses:

   1/2 Inch Hose = 2-7/8 Inch Minimum Bend Radius

   3/4 Inch Hose = 4-1/2 Inch Minimum Bend Radius

   1 Inch Hose = 5-1/2 Inch Minimum Bend Radius

   1-1/4 Inch Hose = 6-3/4 Inch Minimum Bend Radius

   Where the radius falls below the required minimum, an angle adapter should be used, as shown in Figure 8, to avoid sharp bends in the hose.

Figure 7. Slack Allowance for Hose Installation

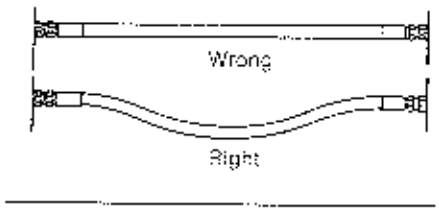
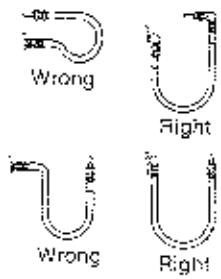


Figure 8. Use of Angle Adapter to Achieve Proper Bend Radius



Note: Bend radius specifications are for hose assemblies stored at temperatures above 40 F (4 C). If hoses have been stored at temperatures below 40 F, the hose will be stiffer than normal. Under these conditions, increase the minimum specified bend radius by 50 percent, and use extreme care to avoid bending the hose.

3. Pipe joint compound is not necessary where Teflon thread tape has been preapplied to hose assemblies, or when flared-end connections are used. In those instances where pipe joint compound is preferred in lieu of tape, use only a small amount on the male pipe threads of the fitting adapters. Be sure to prevent any sealant from reaching the flared surfaces of the joint.
4. Where brass fittings are used, the maximum torque — without damage to the fitting — is 30 foot-pounds. If a torque wrench is not available, use "finger-tight" plus one quarter turn. Tighten steel fittings as necessary.
5. Do not twist hose to avoid damage to the hose wall or rubber compound.
6. Hose connections are completed with the incorporation of combination shut-off/balancing valves at each unit supply and return riser to simplify removal of the unit, as well as proper water flow adjustment.

Installation of Optional Wall-Mounted Thermostat

Two 24-volt thermostat options are available for use with Climate Master units: a single-stage automatic changeover (ACO) thermostat, and a single-stage manual changeover (MCO) thermostat. While more specific installation instructions are provided in the instruction guide which accompanies each thermostat accessory, a field connection diagram (Figure 10) is included here for your convenience. Vendor installation instructions are also shipped with each thermostat.

CAUTION: Zone integrity must be maintained to efficiently control units or groups of units. Unless zones of control are considered and accounted for, adjacent units may operate in heating and cooling modes simultaneously.

In each instance, the low-voltage wiring between the unit terminal block and wall thermostat must be made in compliance with the applicable electrical codes (i.e., NEC and local codes), and completed before the unit is installed. Use of multiple wire, color-coded low-voltage cable is recommended.

Recommended wire sizes and lengths for installing the thermostat are provided in Table 6. The total resistance of these low-voltage wires must not exceed 1 ohm; any resistance in excess of 1 ohm may cause the control to malfunction because of the high voltage drop.

Consult the instructional booklet which accompanies each thermostat to determine the recommended heat anticipator setting for Climate Master units.

Table 6. Recommended Thermostat Wire Sizes

Wire Size	Max. Wire Length*
22-Gauge	30 Feet
20-Gauge	50 Feet
18-Gauge	75 Feet
16-Gauge	125 Feet
14-Gauge	200 Feet

*Length is physical distance from thermostat to unit

Table 2.
General Data

GENERAL DATA CHART

Model Number	Voltages	Phase	Min. CRC Ampacity	Max. Fuse	Comp LRA (ea.)	Comp FLA (ea.)	Blower FLA	Total FLA	Blower Diameter	Blower Width	Blower HP	Type	Ship Wt. Lbs.
814-009	208/230	1	5.5	15	20.0	3.9	0.6	4.5	6.75	6.5	1/12	A	130
	265		4.2		16.0	3.0	0.4	3.4					
814-011	208/230	1	6.7	15	31.0	4.8	0.7	5.5	6.75	6.5	1/12	A	135
	265		5.3		22.9	3.8	0.6	4.4					
814-013	208/230	1	8.0	15	31.0	5.8	0.7	6.5	6.75	6.5	1/12	A	140
	265		6.5		27.0	4.7	0.6	5.3					
814-019	208/230	1	11.5	20	43.3	8.5	0.9	9.4	7.625	7.0	1/8	A	205
	265		9.6	15	36.0	7.1	0.7	7.8					
814-023	208/230	1	14.9	25	48.0	10.6	1.6	12.2	7.625	7.0	1/5	A	220
	265		12.6	20	37.0	9.3	0.9	10.3					
814-031	208/230	1	21.3	35	65.0	15.3	2.2	17.5	9.0	7.0	1/3	A	245
	265	1	19.2	30	55.0	13.9	1.8	15.7					
	208/230	3	15.5	25	60.0	10.6	2.2	12.8					
	460	3	7.6	15	30.7	4.6	1.8	6.4					
814-036	208/230	1	22.6	35	78.0	15.5	3.2	18.7	9.0	7.0	1/2	B	235
	265	1	20.8	30	73.8	14.1	3.2	17.3					
	208/230	3	16.5	25	59.5	10.6	3.2	13.8					
	460	3	7.6	15	30.7	4.6	1.8	6.4					
814-042	208/230	1	25.3	40	88.0	17.7	3.2	20.8	9.0	8.0	1/2	B	240
	208/230	3	17.7	25	65.1	11.6	3.2	14.7					
	460	3	8.2	15	32.8	5.1	1.8	6.9					
814-048	208/230	1	32.3	50	95.4	21.5	5.4	26.9	10	10	3/4	B	300
	208/230	3	22.7	35	82.0	13.8	5.4	19.2					
	460	3	10.9	15	41.0	6.9	2.2	9.1					
	575	3	8.3	15	36.0	5.1	1.4	6.5					
814-060	208/230	1	40.3	60	125.0	27.6	5.8	33.4	12	10	1	B	357
	208/230	3	26.0	40	90.0	16.1	5.8	21.9					
	460	3	12.3	15	45.0	7.7	2.6	10.3					
	575	3	10.3	15	36.0	6.4	2.3	8.7					
814-072	208/230	3	28.9	50	59.5(2)	10.6(2)	5.0	26.2	12.0	11.0	1 1/2	C	635
	460	3	12.9	15	30.7(2)	4.6(2)	2.5	11.7					
	575	3	10.3	15	24.6(2)	3.7(2)	2.0	9.4					
814-096	208/230	3	36.8	50	82.0(2)	13.8(2)	5.7	33.3	10	10	1 1/2	C	665
	460	3	18.6	25	41.0(2)	6.9(2)	2.6	16.4					
	575	3	13.4	15	36.0(2)	5.1(2)	1.9	12.1					
814-120	208/230	3	46.4	80	90.0(2)	16.1(2)	7.5	39.7	(2) 12	(2) 10	2	C	675
	460	3	22.3	25	45.0(2)	7.7(2)	3.4	18.8					
	575	3	16.9	20	36(2)	6.4(2)	2.5	15.3					

A = Direct Drive, 2 Speed Taps
B = Direct Drive, 3 Speed Taps
C = Belt Drive, Variable Pitch Sheaves, 2 Compressors

Table 3.
Blower Performance

Model Number	Fan Speed	CFM at External Static Pressure I.W.G.									Minimum CFM
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
814-009	High	420	340	290							290
	Low	380	305	—							
814-011	High	420	340	290							290
	Low	380	305	—							
814-013	High	475	455	425							395
	Low	415	395	—							
814-019	High	780	750	710	660						640
	Low	700	680	640	—						
814-023	High	920	830	750							660
	Low	800	740	660							
814-031	High	1140	1060	980							930
	Low	1100	1010	930							
814-036	High	1500	1420	1340	1250	1170	1080				900
	Medium	1360	1310	1250	1190	1110	1000				
	Low	1290	1240	1190	1120	1030	—				
814-042	High	1580	1510	1425	1340	1250	1165				1000
	Medium	1490	1415	1335	1255	1170	1085				
	Low	1210	1170	1125	1080	1040	1000				
814-048	High	2130	2050	1960	1860	1760	1630				1400
	Medium	1980	1900	1810	1720	1620	1520				
	Low	1810	1730	1650	1570	1490	1400				
814-060	High	2200	2140	2080	2010	1940	1860				1700
	Medium	2110	2050	2000	1940	1870	1800				
	Low	2060	2000	1940	1880	1820	1760	1700			

The blower performance is based on wet coil and clear filter.
For 208 Volt operation, static pressure is reduced by—.05 (High)
—.10 (Med.)
—.15 (Low)

Reduce CFM by 25% on 814 sizes (009-031) whenever a "back" discharge is used.

CFM Air Flow		EXTERNAL STATIC PRESSURE												
		.3	.4	.5	.6	.7	.8	.9	1	1.1	1.2	1.3	1.4	1.5
Model 814-072														
1800	BHP	—	—	0.59	0.65	0.70	0.75	0.80	0.83	0.90	0.95	0.99	1.03	1.07
	RPM	—	—	798	853	884	914	944	973	1001	1029	1057	1084	1111
	TURNS OUT	—	—	5	4.5	3.5	3	2.5	2	1.5	1	0.5	0	—
2000	BHP	—	0.59	0.66	0.72	0.77	0.82	0.86	0.90	0.96	1.01	1.05	1.09	1.12
	RPM	—	776	830	883	912	941	969	997	1024	1051	1078	1104	1131
	TURNS OUT	—	5	4.5	3.5	3	2.5	2	1.5	1	0.5	0	—	—
2200	BHP	0.58	0.68	0.74	0.81	0.85	0.89	0.94	0.97	1.03	1.08	1.12	1.16	1.19
	RPM	760	812	864	916	943	970	996	1022	1049	1075	1101	1126	1152
	TURNS OUT	5	4	3	2	1.5	1	0.5	0	—	—	—	—	—
2400	BHP	0.68	0.78	0.84	0.90	0.94	0.98	1.02	1.05	1.11	1.16	1.20	1.23	1.26
	RPM	800	850	900	950	975	1000	1025	1050	1075	1100	1125	1150	1175
	TURNS OUT	5	4	3	2	1.5	1	0.5	0	—	—	—	—	—
2600	BHP	0.79	0.89	0.95	1.01	1.04	1.08	1.11	1.14	1.20	1.25	1.29	1.31	1.34
	RPM	842	889	937	986	1009	1032	1055	1079	1103	1127	1151	1175	1199
	TURNS OUT	5	4.5	3.5	2.5	1.5	1	0.5	0	—	—	—	—	—
2800	BHP	0.92	1.02	1.07	1.12	1.15	1.19	1.22	1.24	1.30	1.34	1.38	—	—
	RPM	884	930	976	1023	1044	1065	1087	1110	1132	1155	1178	—	—
	TURNS OUT	5	4	3	2	1	0.5	0	—	—	—	—	—	—
3000	BHP	1.06	1.16	1.21	1.26	1.28	1.31	1.33	1.35	1.41	1.45	—	—	—
	RPM	928	972	1016	1062	1081	1100	1121	1142	1163	1185	—	—	—
	TURNS OUT	5	4.5	3.5	2.5	1.5	0.5	0	—	—	—	—	—	—

Table 3 Continued.
Blower Performance

CFM Air Flow		EXTERNAL STATIC PRESSURE													
		.2	.3	.4	.5	.6	.7	.8	.9	1	1.1	1.2	1.3	1.4	1.5
Model 814-096															
3000	BHP	0.80	0.87	0.94	1.06	1.09	1.16	1.23	1.30	1.37	1.45	1.52	1.42	1.49	1.56
	RPM	980	1023	1064	1105	1144	1183	1220	1256	1292	1327	1362	1365	1399	1433
	TURNS OUT	—	5	4	3.5	2.5	2	1	0.5	0	—	—	—	—	—
3200	BHP	0.94	1.01	1.08	1.21	1.23	1.30	1.37	1.44	1.51	1.59	1.66	1.57	1.56	1.63
	RPM	1034	1074	1114	1153	1191	1228	1264	1299	1334	1368	1402	1403	1437	1470
	TURNS OUT	5	4	3.5	2.5	2	1	0.5	0	—	—	—	—	—	—
3400	BHP	1.09	1.16	1.23	1.29	1.36	1.43	1.49	1.56	1.63	1.70	1.77	1.83	1.90	1.97
	RPM	1094	1133	1172	1209	1246	1282	1317	1351	1386	1419	1452	1484	1515	1548
	TURNS OUT	4	3	2.5	2	1	0.5	0	—	—	—	—	—	—	—
3600	BHP	1.27	1.34	1.41	1.55	1.55	1.62	1.69	1.76	1.83	1.91	1.98	—	—	—
	RPM	1143	1180	1216	1252	1287	1322	1356	1389	1422	1454	1486	—	—	—
	TURNS OUT	3	2.5	1.5	1	0.5	0	—	—	—	—	—	—	—	—
3800	BHP	1.46	1.53	1.60	1.75	1.74	1.80	1.87	1.92	—	—	—	—	—	—
	RPM	1198	1234	1268	1303	1337	1370	1403	1435	—	—	—	—	—	—
	TURNS OUT	2	1.5	1	0	—	—	—	—	—	—	—	—	—	—
4000	BHP	1.68	1.74	1.81	1.96	1.94	—	—	—	—	—	—	—	—	—
	RPM	1254	1288	1321	1354	1387	—	—	—	—	—	—	—	—	—
	TURNS OUT	1	0.5	0	—	—	—	—	—	—	—	—	—	—	—
4200	BHP	1.91	1.97	—	—	—	—	—	—	—	—	—	—	—	—
	RPM	1310	1342	—	—	—	—	—	—	—	—	—	—	—	—
	TURNS OUT	0	—	—	—	—	—	—	—	—	—	—	—	—	—

CFM Air Flow		EXTERNAL STATIC PRESSURE													
		.2	.3	.4	.5	.6	.7	.8	.9	1	1.1	1.2	1.3	1.4	1.5
Model 814-120															
3200	BHP	0.80	0.86	0.91	0.96	1.01	1.06	1.11	1.16	1.21	1.26	1.30	1.36	1.41	1.46
	RPM	978	1009	1040	1070	1098	1126	1153	1180	1207	1232	1258	1282	1306	1329
	TURNS OUT	—	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0	—	—
3400	BHP	0.94	0.99	1.05	1.10	1.15	1.20	1.24	1.29	1.35	1.40	1.44	1.49	1.54	1.59
	RPM	1031	1061	1090	1119	1146	1173	1199	1225	1250	1275	1300	1323	1347	1369
	TURNS OUT	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0	—	—	—
3600	BHP	1.10	1.15	1.20	1.25	1.30	1.35	1.39	1.45	1.50	1.55	1.59	1.64	1.69	1.74
	RPM	1085	1113	1141	1168	1195	1221	1246	1270	1295	1319	1343	1366	1388	1410
	TURNS OUT	4	3.5	3	2.5	2	1.5	1	1	0.5	0	—	—	—	—
3800	BHP	1.27	1.32	1.37	1.42	1.47	1.52	1.56	1.61	1.66	1.71	1.75	1.80	1.85	1.90
	RPM	1139	1166	1193	1219	1244	1269	1293	1317	1341	1364	1387	1409	1431	1452
	TURNS OUT	3	2.5	2	1.5	1	0.5	0	—	—	—	—	—	—	—
4000	BHP	1.46	1.51	1.56	1.61	1.65	1.70	1.74	1.79	1.84	1.89	1.93	1.97	—	—
	RPM	1193	1219	1245	1270	1294	1318	1341	1364	1387	1410	1432	1453	—	—
	TURNS OUT	2	1.5	1.5	1	0.5	0	—	—	—	—	—	—	—	—
4200	BHP	1.67	1.72	1.76	1.81	1.86	1.90	1.94	1.96	—	—	—	—	—	—
	RPM	1248	1272	1297	1321	1344	1368	1390	1412	—	—	—	—	—	—
	TURNS OUT	1.5	1	0.5	0	—	—	—	—	—	—	—	—	—	—
4400	BHP	1.90	1.94	1.99	—	—	—	—	—	—	—	—	—	—	—
	RPM	1303	1326	1350	—	—	—	—	—	—	—	—	—	—	—
	TURNS OUT	0	—	—	—	—	—	—	—	—	—	—	—	—	—

Special sheaves required. RPM above-below RPM range of standard sheaves.
2 hp motor required. BHP required is greater than standard motor.
Special sheaves and 2 hp motor required.

Table 4.
Physical Characteristics

GENERAL 814 SIZES 009-031 UNIT DATA

Physical Characteristics	Model Numbers					
	009	011	013	019	023	031
Blower:						
Motor Horsepower	1/12			1/8	1/5	1/3
Wheel Size (D" x W") In.	6.75 x 6.50			7.65 x 7	7.625 x 7	9 x 7
Filter Size	10 x 22 x 1			16 x 25 x 1		
Unit Weight (Lbs.):						
Shipping	130	135	140	205	220	245
Operating	120	125	130	195	210	235
Ref.-to-Air Heat Exchanger:						
Face Area (Sq. Ft.)	1.33	1.33	1.33	2.26	2.26	2.26
No. of Rows Deep	3	3	3	3	3	3
Copper Tube Size (OD In.)	3/8	3/8	3/8	3/8	3/8	3/8
No. of Fins/Inch	12	12	12	12	12	12
Refrig. Charge (R-22)/CKT. Oz.	16	14	16	27	35	35
No. of Circuits	1	1	1	1	1	1
Unit W" x H" x D"	32-1/4 x 10-7/8 x 22			41-3/4 x 16 x 25		
Water In/Out Size (FPT)	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"
Condensate Size (FPT)	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Hi Voltage Knockout (In.)	7/8	7/8	7/8	7/8	7/8	7/8
Lo Voltage Knockout (In.)	7/8	7/8	7/8	7/8	7/8	7/8
Return Air Collar Dimension: W" x H"	22 x 9-1/8			25 x 14		
Supply Air Collar Dimension: W" x H"	12 x 4-1/8			12-1/2 x 9-3/4		

GENERAL 814 SIZES 036-120 UNIT DATA

Physical Characteristics	Model Numbers						
	036	042	048	060	072	096	120
Blower:							
Motor Horsepower	1/2	1/2	3/4	1	1-1/2	1-1/2	2
Wheel Size (D" x W") In.	9 x 7	9 x 8	10 x 10	10 x 10	12 x 11	10 x 10(2)	12 x 10(2)
Filter Size	20 x 25 x 1		16 x 20 x 1 (2)		20 x 25-1/2 x 1	16 x 20 x 1 (4)	
Unit Weight (Lbs.):							
Shipping	235	240	300	357	635	665	675
Operating	225	230	290	347	615	645	655
Ref.-to-Air Heat Exchanger:							
Face Area (Sq. Ft.)	3.33	3.33	4.17	4.17	6.66	6.33	6.33
No. of Rows Deep	2	3	2	3	2	2	3
Copper Tube Size (OD In.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8
No. of Fins/Inch	14	12	14	14	14	14	14
Refrig. Charge (R-22)/CKT.	36	50	46	82	38	46	82
No. of Circuits	1	1	1	1	2	2	2
Unit W" x H" x D"	47 x 21 x 20		36-1/4 x 21-5/8 x 36-1/4		72-1/4 x 21 x 36-1/4	72-1/4 x 21 x 36-1/4	
Water In/Out Size (FPT)	3/4"	3/4"	1"	1"	1-1/4"	1-1/4"	1-1/4"
Condensate Size (FPT)	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Hi Voltage Knockout (In.)	1-1/8 or 7/8	1-1/8 or 7/8	7/8	7/8	1-3/8	1-3/8	1-3/8
Lo Voltage Knockout (In.)	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Return Air Collar Dimension: W" x H"	23 x 18-1/4		29-3/4 x 18-1/4		53 x 18-1/4	62-3/4 x 18-1/4	
Supply Air Collar Dimension: W" x H"	9-3/8 x 10-3/8	9-3/8 x 10-3/8	15 x 15	15 x 15	16 x 16	15 x 15(2)	15 x 15(2)

Table 5. Cooling and Heating Cycle Optimum Pressures and Superheat

SYSTEM PARAMETERS				COOLING CYCLE			HEATING CYCLE		
UNIT SIZE NOMINAL BTUH	SUPPLY WATER TEMP. °F	WATER FLOW RATE GPM*	AIR FLOW RATE CFM	SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	SUPERHEAT °F	SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	SUPERHEAT °F
9,000	60°	2.4	300	72	160	33	71	239	9
	65°	2.4	300	74	169	30	74	241	16
	70°	2.4	300	75	180	27	77	244	23
	75°	2.4	300	77	191	27	77	244	23
	80°	2.4	300	78	203	16	82	248	32
	85°	2.4	300	80	215	7	84	250	35
12,000	60°	3.3	400	65	150	41	70	250	35
	65°	3.3	400	67	163	38	74	257	2
	70°	3.3	400	70	175	35	77	264	4
	75°	3.3	400	72	187	30	81	270	7
	80°	3.3	400	74	199	23	84	276	11
	85°	3.3	400	76	210	15	87	283	15
15,000	60°	3.9	500	70	150	37	67	225	11
	65°	3.9	500	73	162	33	69	231	16
	70°	3.9	500	76	175	29	73	237	22
	75°	3.9	500	78	191	24	76	241	27
	80°	3.9	500	80	205	18	79	245	32
	85°	3.9	500	82	218	12	81	248	36
19,000	60°	5.0	650	67	153	36	64	215	1
	65°	5.0	650	70	173	33	66	222	2
	70°	5.0	650	72	184	30	70	229	5
	75°	5.0	650	75	196	26	74	235	11
	80°	5.0	650	77	209	21	77	240	17
	85°	5.0	650	79	224	16	80	244	24
24,000	60°	6.4	800	70	150	27	75	255	3
	65°	6.4	800	70	170	23	80	265	7
	70°	6.4	800	73	185	19	85	270	12
	75°	6.4	800	75	195	16	90	275	17
	80°	6.4	800	75	210	14	90	280	21
	85°	6.4	800	75	225	12	90	285	25
30,000	60°	8.0	1000	65	175	38	70	260	0
	65°	8.0	1000	70	180	32	75	260	2
	70°	8.0	1000	73	190	27	80	265	4
	75°	8.0	1000	75	195	21	85	275	6
	80°	8.0	1000	75	210	16	90	280	10
	85°	8.0	1000	80	220	11	90	285	14

Table 5 Continued. Cooling and Heating Cycle Optimum Pressures and Superheat

SYSTEM PARAMETERS				COOLING CYCLE			HEATING CYCLE		
UNIT SIZE NOMINAL BTUH	SUPPLY WATER TEMP. °F	WATER FLOW RATE GPM*	AIR FLOW RATE CFM	SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	SUPERHEAT °F	SUCTION PRESSURE PSIG	DISCHARGE PRESSURE PSIG	SUPERHEAT °F
36,000	60°	9.4	1200	66	150	26	65	217	22
	65°	9.4	1200	68	165	24	67	220	25
	70°	9.4	1200	70	177	21	70	225	28
	75°	9.4	1200	72	188	19	72	230	31
	80°	9.4	1200	74	197	16	74	234	35
	85°	9.4	1200	76	206	13	75	258	38
42,000	60°	10.7	1400	71	85	19	74	231	11
	65°	10.7	1400	73	197	16	76	235	14
	70°	10.7	1400	75	206	13	79	240	17
	75°	10.7	1400	77	215	11	81	245	20
	80°	10.7	1400	79	223	7	83	249	23
	85°	10.7	1400	81	230	5	84	253	26
48,000	60°	12.6	1700	66	180	27	63	225	24
	65°	12.6	1700	68	192	24	65	230	27
	70°	12.6	1700	70	201	21	67	235	30
	75°	12.6	1700	72	210	18	69	240	33
	80°	12.6	1700	74	218	15	71	245	37
	85°	12.6	1700	76	226	12	73	249	40
60,000	60°	16.3	2000	66	172	26	66	235	18
	65°	16.3	2000	68	184	25	68	240	21
	70°	16.3	2000	70	193	22	70	245	24
	75°	16.3	2000	72	202	19	72	250	27
	80°	16.3	2000	74	209	16	74	255	30
	85°	16.3	2000	76	217	13	76	259	33
96,000	60°	25.2	3400	66	180	27	63	225	24
	65°	25.2	3400	68	192	24	65	230	27
	70°	25.2	3400	70	201	21	67	235	30
	75°	25.2	3400	72	210	18	69	240	33
	80°	25.2	3400	74	218	15	71	245	37
	85°	25.2	3400	76	226	12	73	249	40
120,000	60°	32.6	4000	66	172	27	63	235	18
	65°	32.6	4000	68	184	24	65	240	21
	70°	32.6	4000	70	193	21	67	245	24
	75°	32.6	4000	72	202	18	69	250	27
	80°	32.6	4000	74	209	15	71	255	30
	85°	32.6	4000	76	217	12	73	259	33

*Flow Rate Corresponds to Approximately 10° TD on Cooling Cycle & 5 to 6° TD on Heating Cycle

Note: Based upon return air temperature 80°DB/67° WB (Cooling Cycle)
70°DB (Heating Cycle)

Electrical Wiring

WARNING: TO AVOID POSSIBLE INJURY OR DEATH DUE TO ELECTRICAL SHOCK, OPEN SUPPLY POWER DISCONNECT SWITCH AND SECURE IT IN THAT POSITION.

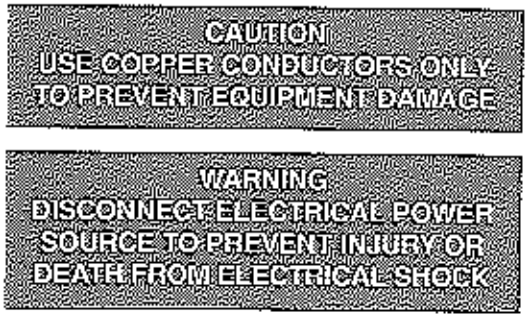
CAUTION: Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

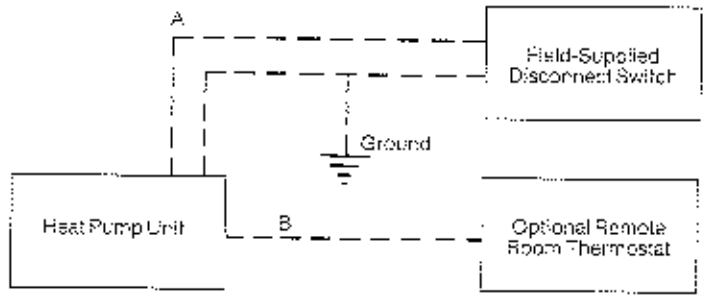
All field-installed wiring — including the electrical ground — must comply with the National Electrical Code, as well as applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in the NEC. Refer to Figure 9 for a schematic of the field connections which must be made by the installing (or electrical) contractor.

To ensure proper electrical hookup, be sure to consult the unit wiring diagram pasted on the inside surface of the electrical access panel. Notice that the 24-volt transformer connection must be modified if the unit nameplate voltage is 208-230 volts, and the actual supply power is 208 volts. Unit electrical data is provided in Table 2.

Note: To minimize vibration and sound transmission to the structure, all final unit electrical connections should be made with a length of flexible, rather than rigid, conduit.

Figure 9.
Field Installed Wiring

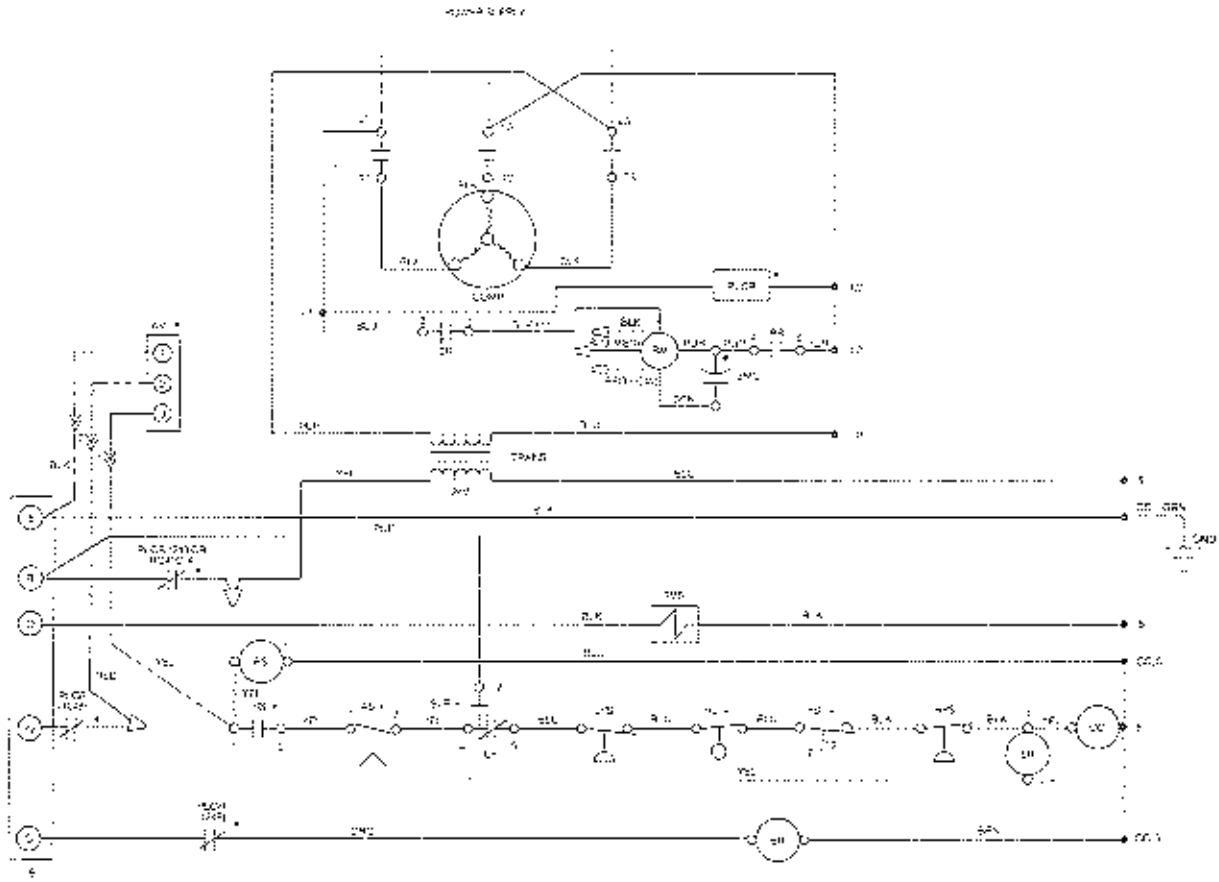




A = Two power wires on single-phase units; three power wires on three-phase units.
B = 1 H/C manual changeover or auto changeover — 4 wires.
For multiple compressor units and/or other thermostats, see Unit Wiring Diagram.

Note: All customer-supplied wiring to be copper only, and must conform to NEC and local electrical codes. Wiring shown with dashed lines must be field-supplied and field-installed.

Figure 10.
Typical Wiring Diagram



LEGEND

ACO	=	Automatic Changeover Relay
AS	=	Anti-Short Cycle Relay
BM	=	Blower Motor
BMC	=	Blower Motor Capacitor
BR	=	Blower Relay
CC	=	Compressor Contactor
CCH	=	Crankcase Heater
COMP	=	Compressor
CPC	=	Compressor Capacitor
CR	=	Control Relay
DL	=	Demand Limit Relay
FS	=	Freezestat
HL	=	High Level Condensate Switch
HP	=	High Pressure Switch
HT	=	High Temperature Switch
LP	=	Low Pressure Switch
LR	=	Lockout Relay
OL	=	Overload
PLCR	=	Power Line Carrier Receiver
PR	=	Program Relay
RS	=	Random Start Relay
RVR	=	Reversing Valve Relay
RVS	=	Reversing Valve Solenoid
SD	=	Shutdown Relay
SLR	=	Special Lockout Relay
SSM	=	Safety Shutdown Module
TB	=	24-Volt Terminal Block
TD	=	Time Delay Relay
TR	=	Timer Relay
TRANS	=	Line Voltage to 24-Volt Transformer
NOTE	=	*(Denotes available as option)

Start-Up

Preparation for Start-Up System

Cleaning and Flushing

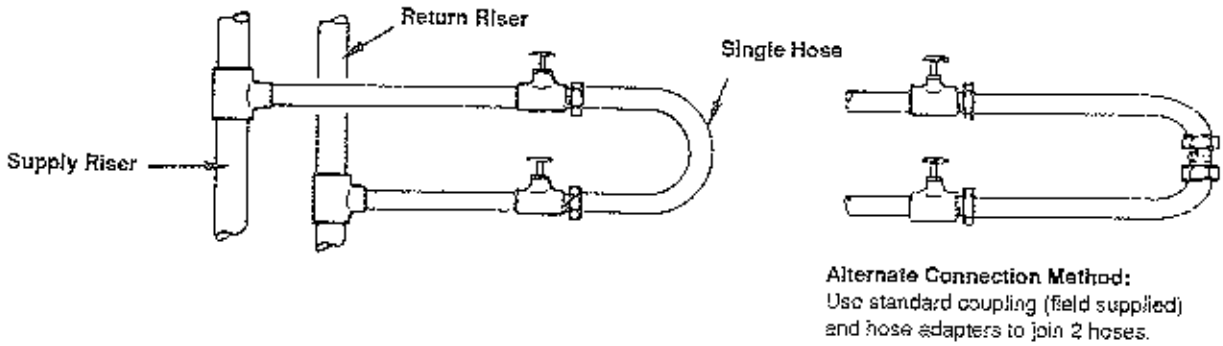
Cleaning and flushing the Water Source Heat Pump System — when correctly done — is the single most important step to ensuring proper start-up and the continued efficient operation of the system.

Carefully follow the instructions provided below to properly clean and flush the system:

WARNING: BEFORE SERVICING THE UNIT, OPEN A UNIT DISCONNECT TO PREVENT INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

1. Install the system with the supply hose connected directly to the return riser valve; this can be accomplished with a single length of flexible hose, as illustrated in Figure 11. **Note:** Substitute two lengths of flexible hose joined together with a field-supplied, standard NPT coupling and the flare-fitting-to-pipe adapters provided with the hose kit (Figure 11) whenever one length of hose is too short (i.e., the resulting connection would exceed the minimum bend radius of the hose).
2. Verify that electrical power to the units is disconnected, and that the heat rejector is de-energized.
3. Fill the system with water, leaving the air vents open. Watch to see that all of the air is bled from the system; at the same time, prevent any overflow of water. Check the system for leaks and repair appropriately.
4. Check, and adjust the water/air level in the expansion tank.
5. Start the pumps — with the strainers in place — and systematically check each vent to ensure that all of the air is bled from the system. Verify that make-up water is available and adjusted properly to replace the space taken up by the air. In addition, make sure that the pumps are adequately bolted down and aligned to prevent damage to the seals and couplings. Again, check for system leaks and repair any that are apparent before proceeding.
6. Set the boiler to raise the loop temperature to approximately 85 F. Open a drain at the lowest point in the system; make sure that the make-up water replacement rate equals the rate of bleed. Continue to bleed the system until the water appears clean — or for at least three hours — whichever is longest; then, completely drain the system.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons of water. Reset the boiler to raise the loop temperature to about 100 F. **CAUTION:** To avoid possible damage to piping systems constructed of plastic piping, do NOT allow loop temperature to exceed 110 F. Circulate the solution for a minimum of eight to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat if necessary. (Many contractors repeat this operation — i.e., filling and dumping — as many as eight times to ensure system water cleanliness.)
8. Remove the short-circuited hoses, and reconnect them to the proper supply and return connections on each of the units. Then, refill the system and remove all of the air. Test the system pH with litmus paper, and leave the system water slightly alkaline (i.e., pH 7.5 to 8.5). If the system continues to be acidic, appropriate chemicals must be added. **CAUTION:** At no time should "Stop-Leak" or any similar chemical agent be used in this system. Addition of such chemicals to the loop water will foul the system and inhibit unit operation.
9. After the system is successfully cleaned and flushed, set up the controls to properly maintain loop temperatures; then, check the main system panels, safety cutouts, and alarms.

Figure 11.
Temporary Connection for Flushing System Piping



System Checkout

After completing the installation (including system cleaning and flushing) of the Water Source Heat Pump System, a series of system checks and recordings of system parameters must be made. An outline of these system checks is provided below, and covers only the most essential aspects of the system. A much more complete checklist is provided in the "Water Source Heat Pump System Start-Up and Inspection Sheet" found near the end of this manual. The installing contractor should use this form to ensure that the system check out and start-up inspections are conducted properly.

In addition, the installing contractor should also complete the abbreviated "Installation Checklist" at the back of this booklet and return it to the local Sales Office.

❑ 1. **Voltage Check:** Ensure that voltage is within the utilization range specifications of the unit compressor and fan motor.

❑ 2. **System Water Temperature:** Ensure that it is within an acceptable range to facilitate start-up; see Table 7. (When conducting this check, be sure to verify the proper heating and cooling setpoints as well.)

❑ 3. **System Water pH:** Verify that system water exhibits an approximately neutral balance (i.e., a pH of 7.5 or 8.5); this will contribute to the longevity of the hoses and heat exchangers.

❑ 4. **System Flushing:** Proper system cleaning and flushing is the most important aspect of the start-up procedure for water source heat pump installations. Make sure that the system has been flushed properly, with all supply and return hoses connected end-to-end as illustrated in Figure 11 (This particular method not only facilitates system flushing, but also prevents fouling of the unit heat exchangers by system water.) Water used in the system must be clear city water with no visible dirt, piping sag, or chemical cleaning agents apparent.

❑ 5. **Closed-Type Cooling Tower (or Open Tower w/Heat Exchanger):** Required to ensure continued cleanliness of the system water, while providing the means for removing excess heat from the building. Be sure to check equipment for proper temperature set points and operation.

❑ 6. **Balanced Water Flow Rate to Heat Pump:** Make sure that — as each heat pump unit is installed — the inlet and outlet water temperatures are recorded; refer to the "Heat Pump Start-Up/Inspection Sheet." This check will eliminate nuisance unit trip-outs resulting from water velocities that are either too low or too high; it can also prevent the occurrence of erosive water flow rates.

❑ 7. **Standby Pump Installed:** Each system must have a standby pump for proper sequencing and operation.

❑ 8. **System Controls Operational:** Verify that the system controls are functioning and providing the proper sequencing; this check is necessary to ensure that no catastrophic system failures occur (e.g., frozen cooling towers or heat exchangers, nuisance system shutdowns, etc.).

❑ 9. **Freeze Protection for Water System:** Be sure that freeze protection is provided for the outdoor portion of the loop water system. Inadequate freeze protection can lead to extremely expensive tower and system piping repairs. **Note:** A problem commonly associated with this type of system occurs when it is filled — during construction — for the purpose of cleaning, flushing and testing. After testing is complete and the system is drained, the building is often left without heat during winter conditions. Since the condenser coils never fully drain by themselves, they will freeze unless glycol is added to the system. Be sure to avoid this practice whenever winter conditions prevail.

❑ 10. **System Water Loop Free of Air:** Verify that all air is removed from the system. (Air in the system will impair unit operation and cause corrosion in the system piping.)

❑ 11. **Unit Filters Clean:** Check to ensure that unit filter is clean; this will contribute to the proper operation of the unit by ensuring adequate airflow across the coil. Climate Master recommends that the contractor install a new filter in each unit before attempting start-up. In addition, use a vacuum to remove any debris or dirt lodged in or on the units.

❑ 12. **Check Unit Fans for Free Rotation:** Manually rotate fans to make sure that they rotate freely, and that they are secured properly to the fan shaft. Do not oil fan motors on start-up; they were lubricated at the factory.

❑ 13. **System Control Center Installed:** A system control and alarm panel is a necessity to ensure control of the temperature setpoints for operation of the system's heat rejector and boiler. Ideally, the panel should also contain condition signals, both audio and visual, to indicate abnormal loop water temperatures or lack of water flow. Indicator lights for the primary and standby loop circulator pumps should also be provided.

❑ 14. **Miscellaneous:** Note any questionable aspects of the installation.

Table 7. Operating Limits [3]

Constraint	Minimum	Normal	Maximum
Power Supply Voltage: [1]			
208/60/1	197	208	218
230/60/1	216	230	252
265/60/1	240	265	290
208/60/3	187	208	218
230/60/3	216	230	252
460/60/3	432	460	504
Entering Air Temperature: [2]			
Wet Bulb (Cooling)	57 F	61-67 F	75 F
Dry Bulb (Heating)	50 F	65-75 F	80 F
Entering Water Temperature:			
Cooling	60 F	80-90 F	95 F
Heating	60 F	65-75 F	95 F
Surrounding Ambient	40 F DB	65 F DB 67 F WB	70 F WB
Water Pressure (Excluding Hose Kits)	—	—	350 psig

Notes:

1. Voltage utilization range complies with ARI Standard 110.
2. When using 100 percent outside air as a source of ventilation, a 40 F DB minimum and a 80 F WB are acceptable, but the cabinet may sweat during hot weather.
3. Determination of operating limits is dependent primarily upon 3 factors: (1) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any one of these factors is at a minimum or maximum level, the other two factors should be at normal levels to ensure proper unit operation.

   Extreme variations in temperature and humidity, and corrosive water or air will adversely affect unit performance, reliability and service life.

Unit Start-Up

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

1. Adjust all valves to the full open position, and turn on the line power to all heat pump units. **WARNING: HIGH VOLTAGE IS PRESENT IN SOME AREAS OF THE ELCTRICAL PANELS WITH THE DISCONNECT SWITCH(ES) CLOSED. BE SURE TO EXERCISE CAUTION WHEN WORKING WITH ENERGIZED EQUIPMENT.**

2. Operate each unit first in the cooling cycle. Room temperature should be in the normal range (i.e., approximately 61 to 67 F, wet bulb). Loop water temperature entering the heat pump should normally be at least 60 F, but not in excess of 95 F. Refer to Table 7 for more specific information on the operating parameters. **Note:** Three factors determine the operating limits of a unit: (1) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any one of these factors is at a minimum or maximum level, the other two factors must be at normal levels to ensure proper unit operation.

   a. For heat pumps equipped with an optional, accessory MCO thermostat, adjust the thermostat temperature. For heat pumps equipped with an optional, accessory ACO thermostat, set the thermostat temperature indicators to the far left position, and the selector switch to AUTO. At this time both the fan and the compressor should run.

   b. Check for cool air delivery at the registers or unit grille a few minutes after the units have begun to operate. List the identification number of any machines that do not function at this time.

   c. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line.

3. Operate each heat pump in the heating cycle immediately after checking cooling cycle operation. **Note:** Horizontal heat pumps are designed to start heating at a minimum return air temperature of 50 F with a normal water flow rate and ambient temperature.

   a. If the unit is equipped with an optional, accessory MCO thermostat, adjust the thermostat temperature indicator to the highest setting and set the selector switch to HEAT; both the fan and the compressor should run. If the unit is equipped with an optional, accessory ACO thermostat, set the thermostat temperature indicator levers to the far right position with the selector switch still set on AUTO; both the fan and compressor should run.

   b. Once the unit has begun to run, check for warm air delivery at the registers or unit grille. Again, the installing contractor must list the room identification of any machines that do not function.

4. If the unit fails to operate, conduct the following checks:

   a. Check the voltage and current; it should be in accordance with the electrical specifications described on the unit nameplate.

   b. Look for wiring errors; check for loose terminal screws where wire connections have been made on both the line and low-voltage terminal boards.

   c. Check for dirty filters; a clogged filter will cause the unit's safety cutouts to stop unit operation.

   d. Verify that the supply and return piping is properly connected to the inlet and outlet connections on the unit.

   e. If the fan fails to operate, check to see that the fan wheel turns freely and that it is secured to the shaft. Also, determine whether the fan operates during both the heating and cooling modes.

   f. If the checks described above fail to reveal the problem and the unit still will not operate, be sure to contact a trained service technician to ensure proper diagnosis and repair of the equipment.

Maintenance

Maintenance Procedures

Perform the maintenance procedures outlined below at the intervals indicated.

WARNING: BEFORE SERVICING UNIT, OPEN UNIT DISCONNECT SWITCH TO PREVENT INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

- ❑ **Inspect filters every three months.** A regular maintenance schedule is recommended, and the frequency of filter changeouts depends upon the type of occupancy (e.g. hotel, office, school). **CAUTION:** To avoid fouled machinery and extensive unit clean-up, do not operate units without filters in place or use as a temporary heat source during construction.

  To remove the filter from a unit, simply slide the filter out of its frame. When installing a new filter, be sure to use the slide-in rails to guide the filter into the proper position. Verify that the airflow arrow found on the top of each filter points toward the unit.

  Refer to Table 4 to determine the proper filter type and size for each unit.

- ❑ **Check condensate drain pans for algae growth at three-month intervals.** When algae growth is apparent, consult a water treatment specialist for proper chemical treatment. Typically, the application of an algacide every three months will eliminate algae problems in most locations.

- ❑ **Visually inspect the unit at least once each year.** When inspecting each unit, give special attention to the hose assemblies; note any signs of deterioration or cracking, and repair any leaks immediately.

- ❑ **Conduct an amperage check annually on the compressor and fan motor.** Amperage draw on this equipment should not exceed normal full load or rated load amps by more than 10 percent of the values noted on the unit nameplate. Record the values obtained in this check in a log book so that a deteriorating condition in a fan motor or compressor can be detected prior to component failure.

- ❑ **Clean the refrigerant coil at least once each year (or more frequently if the unit is located in a "dirty" environment) to help maintain proper unit operating efficiency.**

Safety Control Reset

All heat pumps are furnished with high-pressure and/or low-temperature or low pressure safety switches to prevent the unit from operating at abnormal conditions of temperature or water flow. The high-pressure control used on Horizontal units is designed to open its contacts at 380 psig and automatically reclose them at 300 psig, while the contacts of the low pressure switch opens at 35 psi and reclose at 50 psig. Reset is accomplished by opening and closing the circuit breaker switch, regardless of the position of the control lever(s) on the thermostat.

Note: If the unit must be reset more than twice at normal entering air temperature, be sure to check it for a dirty filter, abnormal entering water temperature, inadequate or excessive water flow, and internal malfunctions.

Trouble Shooting Guide

Trouble	Cause	Cure
Suspected insufficient water flow through condenser.	Hand valves in water lines closed, or partially closed.	Open valves.
	Air in water lines.	Bleed system at highest point. Loosen return fitting at offending unit to check for air.
	Obstruction in piping due to insufficient initial flushing.	Check in and out water temperature at unit on heating and cooling for normal fall or rise in temperature.
	Water circulating pump not operating.	Repair or replace.
	Plugged strainer in system piping.	Clean strainer.
Blower inoperative.	No power.	Check supply line fuses, circuit breakers, and be sure the power is on at the conditioner. Voltage to the equipment must be within plus ten or minus five percent of voltage given on data plate, whenever conditioner is running.
	Faulty thermostat or sub-base.	Short unit low voltage terminals R to G confirm if fan runs, repair or replace thermostat sub-base.
	Blower wheel will not turn.	Make sure shipping block under blower wheel has been removed and wheel turns freely.
	Faulty capacitor (PSC motors only).	Replace capacitor.
	Loose connections at thermostat or sub-base.	Tighten.
	Loose wire in fan motor wiring.	Tighten.
	Faulty fan relay.	Replace.
	Blower motor failure.	Check for open, short or grounded wiring. If confirmed replace motor.
Equipment gives Electrical shock.	Grounded electrical circuit.	Kill the power to the unit and locate with continuity checker, then eliminate.
Circuit breaker trips (or fuses blow) repeatedly.	Grounded electrical circuit.	Disconnect blower motor leads and compressor motor leads. Check each motor for grounds by placing one probe of continuity checker on motor frame and other on each lead in turn. Replace motor if continuity shown with any lead. If motor checks no ground, locate ground in wiring or other devices, and repair or replace defective part.

Trouble	Cause	Cure
Insufficient heating capacity.	Loss of refrigerant charge.	Locate leak, repair and recharge or replace conditioner.
	Defective refrigerant reversing valve solenoid.	Replace solenoid.
	Water temperature too high.	Check water supply (should be between 60°& 95°)
	Insufficient air flow through room side coil due to:	
	a) Dirty room side coil.	Clean the coil.
	b) Ice on room side coil.	Turn equipment off to let ice melt (see last two items of "Entire unit does not run").
	c) Dirty air filter.	Clean or replace.
	d) Obstructed duct or discharge grilles.	Remove obstruction.
	e) Blower Motor not running.	Check as in "Blower inoperative".
	f) Blower Motor not up to speed.	Check for correct voltage.
	g) Blower slipping on motor shaft.	Oil motor if necessary. Adjust Blower Wheel position and tighten set screw.
Insufficient cooling capacity.	Accessory electric heat equipment such as duct heating or draft barrier energized due to improper control setting.	Check controls and determine proper setting.
	Window and doors in room are open.	Close them.
	Water temperature too high or flow too low.	Check for reason and correct.
	Compressor not pumping indicated by:	
	a) Low amperage.	Replace conditioner.*
	b) Condenser not warm, evaporator only partially cool, or not at all.	Replace conditioner.*
	Insufficient charge of refrigerant indicated by:	
	a) Low amperage	Replace conditioner.*
	b) Condenser not warm.	
	c) Compressor locks out on low pressure switch.	Replace conditioner.*
Water drips from conditioner.	Condensate drain plugged.	Remove obstructions to water flow.
	Condensate drain runs up hill.	Correct piping.
	Dirty filters.	Clean or replace filter.
	No trap provided at unit outlet.	Install 1" trap leaving unit.
	Blower motor not up to speed.	Check for correct voltage. Oil motor, if necessary.
	Blower loose or incorrectly positioned.	Adjust.

Trouble	Cause	Cure
Equipment is is noisy.**	Blower rubbing against enclosure.	Adjust fan position on motor shaft or reposition fan motor bracket assembly.
	Blower Motor bearings are dry.	Lubricate with SAE No. 10 oil or replace motor.
	Loose blower hold-down nuts on motor-bracket assembly.	Align blower assembly and tighten nuts.
	Faulty compressor (broken internal mounting springs).	Replace conditioner.*
	Refrigerant absorbed in compressor oil after extended shut down.	Noise will disappear after equipment runs a while.
	Buzzing relay.	Replace relay.
	Equipment improperly installed.	Make necessary adjustments to components.
	Loose terminal box cover on side of compressor.	Tighten.
	Loose electrical components.	Fasten securely.
	Copper tubing vibrating.	Adjust by bending or applying tape.
	Loose sheet metal parts.	Tighten.
Unit vibrates or rattles.	Discharge or suction tube hitting metal surface.	Bend and adjust for clearance where hitting.
	Loose or bent blower.	Tighten or replace blower.
	Blower motor out of alignment, bent shaft or loose on mounting.	Check alignment and tighten mounting. Replace motor if shaft is bent.
Evaporator ices over.	Clogged air filter.	Check filter. Clean or replace if found too dirty.
	Evaporator blower motor tripping off on overload.	Check for overheated evaporator blower motor and tripped overload. Replace motor if necessary.
	Unit operating at too low room temperature	If room temperature drops below 55° F the evaporator may ice over.
	Unit operating at too low water temperature.	When unit operates when water is too cold it may ice over.

Trouble	Cause	Cure
Entire unit does not run.	Blown fuse.	Replace fuse or reset circuit breaker. (Check for correct fuse.)
	Broken or loose wires.	Replace or tighten the wires.
	Voltage supply low	If voltage is below minimum voltage specified on dataplate, contact local power company.
	Low voltage circuit.	Check 24 volt transformer for burnout or voltage less than 18 volts.
	Thermostat	Set thermostat on "COOL" and lowest temperature setting, unit should run. Set thermostat on "HEAT" and highest temperature setting, unit does run. Set fan on "RUN," fan should run. If unit should not run in all three cases, the thermostat could be wired incorrectly or faulty. To ensure faulty or miswired thermostat, disconnect thermostat wires at unit and jumper between "R," "Y," "G," and W terminals and units should run. Replace T-stat with correct T-stat only. A substitute may not work properly.
Blower operates but compressor does not.	Compressor overload open.	In all cases an "external" or "internal" temperature sensitive compressor overload is used. If the compressor dome is too hot to touch, the overload will not reset until the compressor cools down. If the compressor is cool and the overload does not reset, there may be a defective or open overload. If the overload is external, replace the overload, otherwise replace the compressor.
	Compressor motor grounded.	Internal winding grounded to the compressor shell. Replace the compressor. If compressor burnout, install filter dryer at suction line.
	Compressor windings open.	Check continuity of the compressor windings with an ohmmeter. If the windings are open, replace the compressor.
Blower runs but compressor does not.	Voltage Supply low.	If voltage is below minimum voltage specified on the dataplate, contact local power company.
	Thermostat	Check setting, calibration and wiring.
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor.
	High or low pressure controls.	The unit could be off on the high or low pressure cut out control. Reset the thermostat to "OFF." After a few minutes turn to "COOL." If the compressor runs, unit was off on high or low pressure (see trouble for possible causes). If the unit still fails to run, check for faulty pressure switch by jumping the high and low pressure controls individually.
	Defective lockout relay.	Stuck open, does not reset when power is turned off.
	Defective capacitor.	Check capacitor; if defective, remove, replace and rewire correctly.
	Seized compressor.	Try an auxiliary capacitor in parallel with the run capacitor momentarily. If the compressor starts but the problem recurs on starting, install an auxiliary start kit. The hard-start kit is comprised of a recommended start relay and correctly sized capacitor. If the compressor still does not start, replace the compressor.

Trouble	Cause	Cure
Unit off on high pressure cut-out control.	Discharge pressure too high.	On COOLING Cycle: Lack of, or inadequate, water flow. Entering water too warm. Scaled or plugged condenser. On HEATING Cycle: Lack of, or inadequate, air flow. Entering air too hot, Blower inoperative, clogged filter or coil, restrictions in ductwork.
	Refrigerant charge.	The unit is overcharged with refrigerant. Bleed off some charge or evacuate and recharge with specified amount of R-22.
	Defective high pressure switch.	Stuck open, does not reset, or has defective calibration. A replacement switch is available that attaches to the service port. When it is necessary to replace either of the pressure switches or reversing valve, wrap them with a wet cloth and direct the heat away. Excessive heat can damage them.
Unit off on low pressure cut-out control.	Suction pressure too low.	On COOLING Cycle: Lack of, or inadequate, air flow. Entering air too cold. Blower inoperative, clogged filter or coil, restrictions in ductwork. On HEATING Cycle: Lack of, or inadequate, water flow. Entering water too cold. Scaled or plugged condenser. When installed in an unconditioned space, (such as a garage) the unit may not start in cool weather, (approximately 50° F). In this case, it may be necessary to start the unit on cooling in cool weather for three to five minutes, then shut off and turn to heat, after one minute shut down. (It may be necessary to repeat this procedure several times, especially when a crankcase heater is not used.)
Unit off on high pressure cut-out control.	Discharge pressure too high.	On COOLING Cycle: Lack of, or inadequate, water flow. Entering water too warm. Scaled or plugged condenser. On HEATING Cycle: Lack of, or inadequate, air flow. Entering air too hot, blower inoperative, clogged filter or coil, restrictions in ductwork.
	Refrigerant charge.	The unit is overcharged with refrigerant. Bleed off some charge or evacuate and recharge with specified amount of R-22.
	Defective high pressure switch.	Stuck open, does not reset, or has defective calibration. A replacement switch is available that attaches to the service port. When it is necessary to replace either of the pressure switches or reversing valve, wrap them with a wet cloth and direct the heat away. Excessive heat can damage them.

Trouble	Cause	Cure
Unit off on low pressure cut-out control.	Suction pressure too low.	On COOLING Cycle: Lack of, or inadequate, air flow. Entering air too cold. Blower inoperative, clogged filter or coil, restrictions in ductwork. On HEATING Cycle: Lack of, or inadequate, water flow. Entering water too cold. Scaled or plugged condenser. When installed in an unconditioned space, (such as a garage) the unit may not start in cool weather (approximately 50° F). In this case, it may be necessary to start the unit on cooling in cool weather for three to five minutes, then shut off and turn to heat, after one minute shut down. (It may be necessary to repeat this procedure several times, especially when a crankcase heater is not used.)
Unit off on low pressure cut-out control.	Refrigerant charge.	The unit is low in charge of refrigerant. Locate leaks, repair, evacuate and recharge with specified amount of R-22.
	Defective low pressure switch.	Stuck open, does not reset or has defective calibration. A replacement switch is available that attaches to the service port. When it is necessary to replace the pressure switch, wrap it with a wet cloth and direct the heat away (excessive heat can damage the pressure switch).
Unit short cycles.	Thermostat	The differential is set too close in the thermostat. Readjust heat anticipator.
	Wiring and controls.	Loose connections in the wiring, or control contactors defective.
	Compressor overload.	Defective compressor overload, check and replace if necessary. If the compressor runs too hot it may be due to a deficient refrigerant charge.
	Thermostat	Improperly located thermostat (eg. near kitchen, sensing inaccurately the comfort level in living areas).
Water leak.	Plugged condensate drain or machine out of level.	Condensate drains pick up dirt or algae which can grow, causing the drain outlet to clog and condensate to overflow. Inspect and clean. Check level of the unit and adjust.
Unit heats only.	Reversing valve does not shift.	The solenoid valve is energized due to miswiring at the unit or the thermostat. The valve is stuck. The thermostat is in the cool position.

* Where the cure is to replace the conditioner: disconnect power supply, thermostat leads, air discharge connection, condensate connection, close water valves, and disconnect water in and out connections. Replace with spare conditioner and reconnect. Open water valves and check operation.

**Note: Before trying to correct the noise, determine its cause — blower or compressor. Operate the blower only. If this doesn't cause the noise, the compressor is the source.

WSHP System Start-Up/Inspection Sheet

Installing Contractor: Use this form to thoroughly check out the system and units before and during start-up.

Job Name _____ Job Location _____

Sales Order No. _____

Sales Engineer _____ Installing Contractor _____

Sales Office _____ Bldg. Maintenance Mgr. _____

Telephone No. _____ Engineer _____

In order to minimize troubleshooting and costly unit and system failures, complete the following checks and data entries before the system is put into full operation:

Loop Water Circuit

- ❑ Cleaning/Flushing Completed per Specification
  Date: _____
  Company: _____
- ❑ Balanced per Specification
  Date: _____
  Company: _____
- ❑ Chemical Treatment per Specification
  Date: _____
  Company: _____

Loop Temperature Control Method

- ❑ System Panel Installed
  Panel Type: _____

Checked for proper operation of

- ❑ High Temperature Alarm
- ❑ Low Temperature Alarm
- ❑ No Flow Alarm
- ❑ Pump Sequencing Device
- ❑ Pump Lead/Lag Feature
- ❑ Cooling Tower
- ❑ Boiler

Heat Rejector

- ❑ Closed-Loop Cooling Tower
  Tower Make/Model No.: _____
  _____
- ❑ Full Loop Water Flow thru Tower

Checked for proper operation of:

- ❑ Closure Dampers
- ❑ Spray Pump
- ❑ Fan Motors
- ❑ Sump Float Valve
- ❑ Sump Heater
- ❑ Heat Tape (on Exposed Piping)
- ❑ Exposed Piping Properly Insulated
- ❑ Open Tower with Heat Exchanger
  Tower Make/Model No.: _____
  _____
  Heat Exchanger Make/Model No.: _____
  _____
- ❑ Tower Operates Properly
- ❑ Loop Water Inlet Temperature: _____ F
- ❑ Loop Water Outlet Temperature: _____ F
- ❑ Tower Water Inlet Temperature: _____ F
- ❑ Tower Water Outlet Temperature: _____ F
- ❑ Tower Loop Pumps Quantity: _____
- ❑ Automatic Sequencing
- ❑ Alarms

Boiler

Boiler Type: _____
Boiler Model No.: _____

- ❑ Operating Control Setpoint: _____ F
  (Should be 60 to 70 F)
- ❑ Hi-Limit Cutout Setpoint: _____ F
  (Should be 80 F)
- ❑ Steps of Heating Checked in Sequence
- ❑ Checked Line Current To Each Heater Element
  (Electric Only)

System Main Circulating Pumps

Pump Make/Model No.: _____
_____
Quantity: _____

- ❑ Automatic Pump Sequencing
- ❑ No Flow Alarm
- ❑ Discharge Pressure: _____ psig
- ❑ Suction Pressure: _____ psig
- ❑ Flow Rate: _____ GPM

Vibration Isolation:

- ❑ From Floor
- ❑ From Piping System

System Piping

- ❑ Closed Loop
  Piping Materials: _____
- ❑ Thermometer/Aquastats Installed in Loop
- ❑ Correct Level in Expansion Tank

Air Vents

- ❑ Installed at Proper Points in System

System Make-Up Water

- ❑ Automatic
- ❑ Manual
- ❑ Chemically Treated

Make-Up Air System

- ❑ Installed per Specification

(over)

Individual Heat Pump Check

Complete this inspection for each unit:

Unit Location: _____

Unit Model No.: _____

Unit Serial No.: _____

- ❑ Clean Filter
- ❑ Clean Drain Pan
- ❑ Condensate Trap Installed

Unit Started in:

- ❑ Heating Mode
- ❑ Cooling Mode
- ❑ Entering Air Temperature: _____ F
- ❑ Leaving Air Temperature: _____ F
- ❑ Entering WaterTemperature: _____ F
- ❑ Leaving Water Temperature: _____ F
- ❑ Volts (Under Load): _____ V
- ❑ Fan Amps: _____
- ❑ Compressor Amps: _____

Comments _____

Installation Checklist

The following form Should be filled out by the installing contractor and returned to the local Sales Office.

(To avoid disassembling this manual, simply make a photocopy of the completed form and send it to the sales office.)

Job Name _____
Sales Order No. _____
Sales Engineer _____
Sales Office _____
Telephone No. _____

Job Location _____
_____
Installing Contractor _____
Bldg. Maintenance Mgr. _____
Engineer _____

Essential Items Checkout

- ❑ Voltage: _____
- ❑ System Water pH: _____
- ❑ Loop Temp. Cooling Setpoint: _____ F
- ❑ Loop Temp. Heating Setpoint: _____ F
- ❑ Loop Water Flushed Clean
- ❑ Closed-Type Cooling Tower
- ❑ Water Flow Rate to Heat Pump(s) Balanced
- ❑ Standby Pump Installed
- ❑ System Controls Functioning Properly
- ❑ Outdoor Portion of Water System Protected from Freeze-Up
- ❑ Loop System Free of Air
- ❑ Filters Clean
- ❑ Condensate Traps Installed
- ❑ Other Conditions Found: _____

_____
_____
_____
_____
_____
_____
_____

NOTES

NOTES

ClimateMaster

Continuing engineering research results in steady improvements. Therefore, these specifications are subject to change without notice.

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