CLIMATEMASTER™

Classic

HIGH EFFICIENCY GEOTHERMAL COMFORT

INSTALLED BY:

Horizontal & Vertical Single Stage Geothermal Heat Pumps

Installation, Operation & Maintenance Instructions

Revision 4/97

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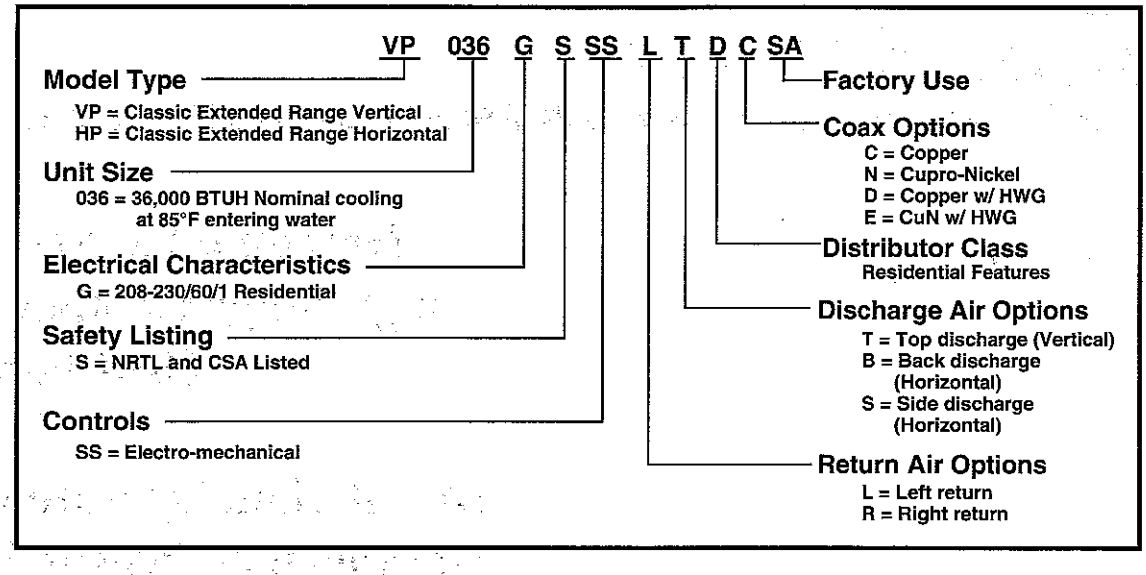
GENERAL INFORMATION

MODEL NOMENCLATURE



Inspection

Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Verify hanger brackets are located inside the fan compartment of horizontal units. Inspect the carton or crating of each unit, and inspect each unit for damage. Assure the carrier makes proper notation of any shortages or damage on all copies of the freight bill and he completes a coomon carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. ***If not filed within 15 days, the freight company can deny the claim without recourse.*** **NOTE: It is the responsibility of the purchaser to file all necessary claims with the carrier.** Notify the ClimateMaster Traffic Department of all damage within fifteen (15) days of shipment.

Introduction

ClimateMaster Classic™ Horizontal Geothermal Heat Pump (HP) units are designed for installation above a false ceiling or in a ceiling plenum. Vertical (VP) units are typically installed in a floor level closet or in a small mechanical room. The installation site chosen for these units must allow adequate clearance for maintenance and servicing of the unit without its removal from the installation location.

Storage

CAUTION: DO NOT store or install Horizontal and Vertical 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.

Equipment should be stored in its shipping carton in a clean, dry area. Store units in an upright position at all times. Stack Horizontal units a maximum of 3 units high. Stack vertical units a maximum of 2 units high. **DO NOT remove equipment from shipping cartons until equipment is required for installation.**

Unit Protection

Cover Horizontal and Vertical units on the job site with either shipping cartons, vinyl film, or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or trash found in or on these components.

Pre-Installation

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 the system before operation.

Prepare Horizontal and Vertical units for installation as follows:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify the correct unit has been shipped.
2. Keep the cabinet covered with the shipping carton until installation is complete and all plastering, painting, etc., is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.

⚠ WARNING

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 will quickly become clogged with construction dirt and debris which may cause system damage.

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

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

If a compressor is removed from this unit, 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.

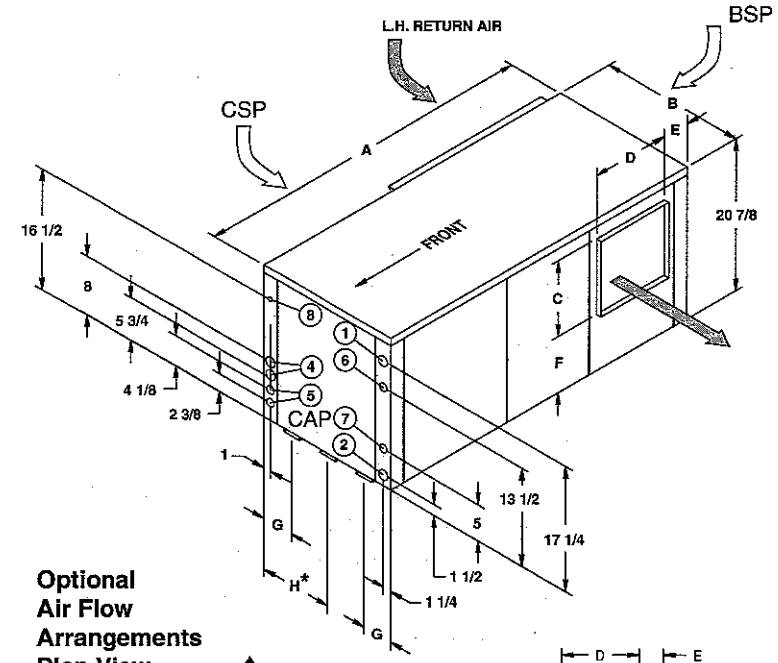
PHYSICAL DATA

Table 1. Physical Data VP/HP "C"

MODEL	VP030	VP036	VP042	VP048	VP060	HP030	HP036	HP042	HP048	HP060
Fan Wheel	9 X 7	9 X 7	10 X 6	10 X 10	11 X 10	9 X 8	9 X 8	10 X 6	10 X 10	11 X 10
PSC Fan Motor HP - # of Speeds	1/4 - 3	1/2 - 3	3/4 - 3	3/4 - 3	1.0 - 3	1/4 - 3	1/2 - 3	3/4 - 3	3/4 - 3	1.0 - 3
Compressor	Recip	Recip	Recip	Recip	Recip	Recip	Recip	Recip	Recip	Recip
R22 (oz.)	44.0	44.0	60.0	60.0	74.0	44.0	44.0	66.0	66.0	72.0
Air Coil Face Area (sq in.)	3.3	3.3	4.2	4.2	4.2	3.3	3.3	5.0	5.0	5.0
Air Coil Cu tube size "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Air Coil Pin Spacing	12	12	14	14	14	14	14	14	14	14
Air Coil # of Rows	3	3	3	3	4	3	3	3	3	4
Air Coil # of Circuits	6	6	6	6	8	6	6	6	6	8
Filter - 1" Throwaway (Std.)	24 x 24	24 x 24	2-14 x 25	2-14 x 25	2-14 x 25	2-14 x 20	2-14 x 20	2-14 x 20	2-14 x 20	2-14 x 20
Weight - Operating	230	230	300	378	388	230	230	315	386	396
Weight - Packaged	240	240	310	388	398	240	240	325	396	406

All units have grommet compressor mounting, TXV expansion device, 20 ga sheet metal, and 7/8" & 7/8" & 1-1/8" electrical knockouts.
All source water connections are 1" FPT swivel and all HWG water connections are 1/2" FPT.

Dimensions — Horizontal Classic Models



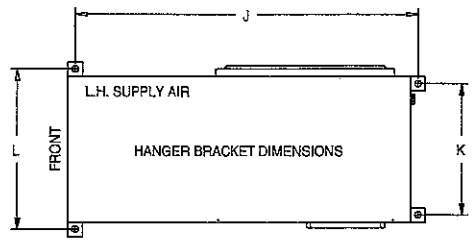
Legend:

1. Water Outlet	1" FPT Swivel Connection
2. Water Inlet	1" FPT Swivel Connection
3. Condensate Drain	3/4" FPT
4. High Voltage Access	7/8" X 1 1/8" K.O.
5. Optional Voltage Access	7/8" X 1 1/8" K.O.
6. HWG Outlet	1/2" FPT
7. HWG Inlet	1/2" FPT
8. Low Voltage Access	7/8" X 1 1/8" K.O.

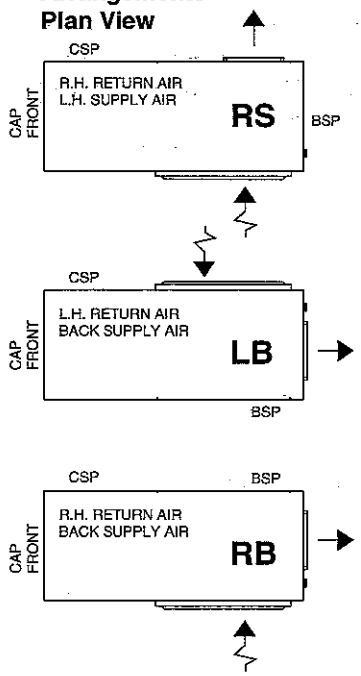
Abbreviations:
CAP - Control Access Panel
BSP - Blower Service Panel
CSP - Compressor Service Panel

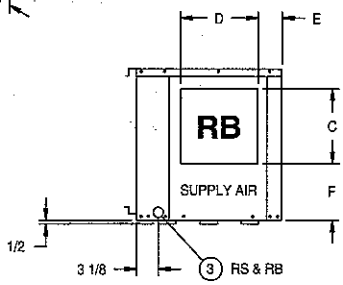
* - There are only (2) support runners on the HP 030/036

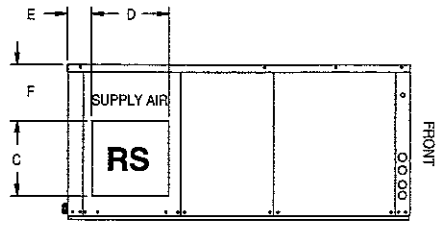
Nominal Filter Size:
HP 030/036 20" X 14" X 1" Qty-2
HP 042/048/060 20" X 20" 1" Qty-2

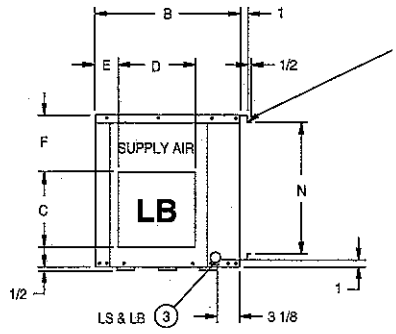


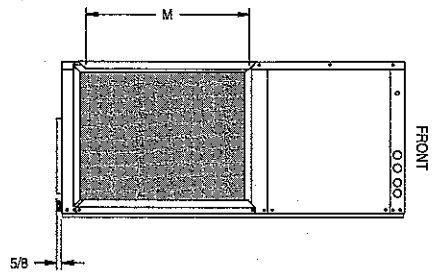
Optional Air Flow Arrangements Plan View







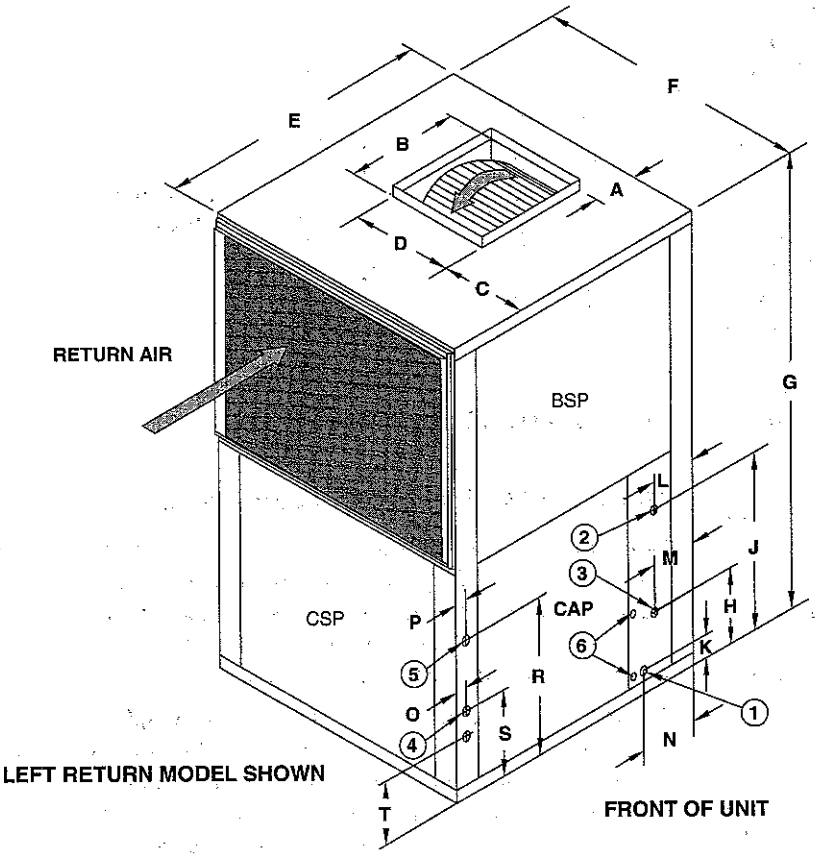




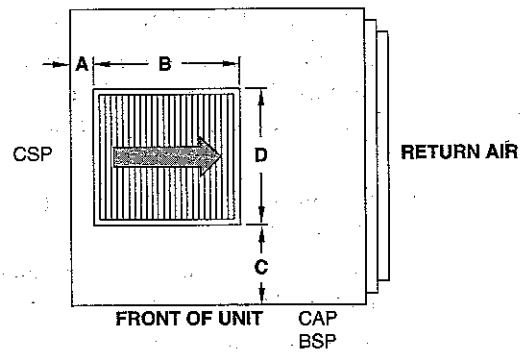
SUPPLY AIR DUCT LOCATIONS (LS SHOWN ON MAIN DRAWINGS)

MODEL	SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N
030	INCHES	47 1/8	20 1/8	10 3/8	10 3/4	3 5/8	7 3/4	7 1/4	N/A	47 1/8	18 1/8	22 1/8	25 5/8	18 3/8
	MM	1197	511	264	273	92	197	184	N/A	1197	460	562	651	467
036	INCHES	47 1/8	20 1/8	10 3/8	10 3/4	3 5/8	7 3/4	7 1/4	14	47 1/8	18 1/8	22 1/8	25 5/8	18 3/8
	MM	1197	511	264	273	92	197	184	356	1197	460	562	651	467
042	INCHES	60	28	11 3/4	8 3/8	8 3/8	7 3/8	4	14	60	26	30	37 1/2	18 3/8
	MM	1524	711	298	213	92	187	102	356	1524	660	762	343	467
048	INCHES	60	28	11 3/4	13 1/2	5 7/8	7 3/8	4	14	60	26	30	37 1/2	18 3/8
	MM	1524	711	298	343	149	187	102	356	1524	660	762	343	467
060	INCHES	60	28	13 7/8	13 1/2	5 7/8	5 3/8	4	14	60	26	30	37 1/2	18 3/8
	MM	1524	711	352	343	149	137	102	356	1524	660	762	343	467

Dimensions — Vertical Classic Models



LEFT RETURN MODEL SHOWN



RIGHT RETURN TOP DISCHARGE PANEL

Legend:

1. Water Inlet	1" FPT Swivel Connection
2. Water Outlet	1" FPT Swivel Connection
3. Condensate Drain	3/4"FPT
4. High Voltage Access	7/8" X 1 1/8" K.O. (22mm X 29mm K.O.)
5. Low Voltage Access	1/2" Dia. (13mm Dia.)
6. HWG Optional	1/2" FPT

HWG Location Dimensions:

Size 030-036

HWG Outlet - 10" from bottom of unit and 1 5/8" to the right of the water inlet.
HWG Inlet - 3 1/8" from bottom of unit and 2 7/8" to the left of water inlet.

Size 042-060

HWG Outlet - 10" from bottom of unit and 6" to the right of the water inlet.
HWG Inlet - 3" from bottom of unit and 4 3/4" to the left of water inlet.

Abbreviations:

CAP - Control Access Panel
BSP - Blower Service Panel
CSP - Compressor Service Panel

Return Air Duct Size:

030 - 036	22 1/8" High X 21 3/4" Wide (562mm High X 553mm Wide)
042 - 060	22 7/8" High X 26 3/4" Wide (581mm High X 680mm Wide)

Nominal Filter Size:

VP 030/036 24" X 24" X 1" (610mm X 610mm X 25mm)
VP 042/048/060 14" X 25" X 1" Qty-2 (711mm X 635mm X 25mm)

MODEL		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T
030	INCHES	2	12 9/16	6 13/16	12 15/16	25 5/16	25 5/16	42	7 1/16	16 1/4	1 15/32	3 27/32	7 27/32	5 9/16	1 1/32	1	14 1/2	8	5 3/4
	MM	51	319	173	329	643	643	1067	179	413	37	98	199	141	26	25	368	203	146
036	INCHES	2	12 9/16	6 3/16	12 15/16	25 5/16	25 5/16	42	7 1/16	16 1/4	1 15/32	3 27/32	7 27/32	5 9/16	1 1/32	1	14 1/2	8	5 3/4
	MM	51	319	173	329	643	643	1067	179	413	37	98	199	141	26	25	368	203	146
042	INCHES	2 11/16	14 3/4	7 5/16	15	28	28	43	8 13/16	16 3/4	1 3/8	2 7/8	8 13/16	4 7/8	1 1/32	1	14 1/2	8	5 3/4
	MM	68	325	186	342	711	711	1092	224	425	35	73	224	124	26	25	368	203	146
048	INCHES	2 11/16	14 3/4	7 5/16	15	28	28	43	8 13/16	16 3/4	1 3/8	2 7/8	8 13/16	4 7/8	1 1/32	1	14 1/2	8	5 3/4
	MM	68	325	186	342	711	711	1092	224	425	35	73	224	124	26	25	368	203	146
060	INCHES	2 11/16	14 3/4	7 5/16	15	28	28	43	8 13/16	16 3/4	1 3/8	2 7/8	8 13/16	4 7/8	1 1/32	1	14 1/2	8	5 3/4
	MM	68	325	186	342	711	711	1092	224	425	35	73	224	124	26	25	368	203	146

INSTALLATION

The installation of Horizontal and Vertical Geothermal 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.

General Unit Location

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connection(s). If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping. These units are not approved for outdoor installation and, therefore, must be installed inside the structure being conditioned. Do not locate in areas where ambient conditions are not maintained with 40-100°F and up to 75% relative humidity.

Vertical Units Location and Access

Vertical Units are typically installed in a floor level closet or in a small mechanical room. Install units with adequate clearance to allow maintenance and servicing. Conform to the following guidelines when selecting unit location:

1. Provide adequate clearance for filter replacement and drain pan cleaning. Do not block filter access with piping, conduit or other materials. Refer to the unit catalog for Vertical Unit Dimensions.
2. Provide access for fan and fan motor maintenance and for servicing the compressor and coils without removing the unit.
3. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of the unit, if necessary.
4. Provide access to water valves and fittings and screwdriver access to the unit side panels, discharge collar and all electrical connections.

Setting Vertical Units

Vertical units are available in left or right air return configurations. Vertical units should be mounted level on a vibration absorbing pad or extruding polystryrene slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor (see Figure 1).

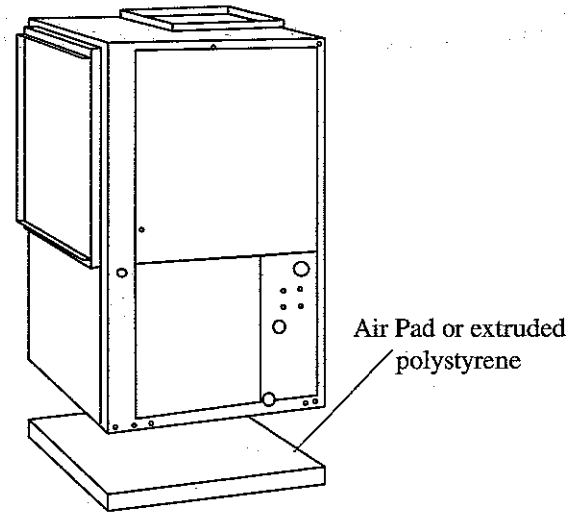


Figure 1. Vertical unit mounting

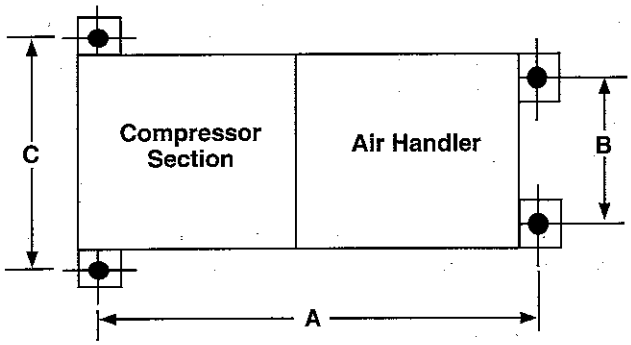
Horizontal Units Location and Access

Horizontal Units are typically installed above a false ceiling or in a ceiling plenum. Install units with adequate clearance to allow maintenance and servicing without removal of the unit from the ceiling. Conform to the following guidelines when selecting unit location:

1. Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-Bar or lay-in ceilings. Refer to the unit catalog for Horizontal Unit Dimensions. Size the access opening to accommodate the service technician during removal and replacement of a compressor and removal and installation of the unit.
2. Provide access to hanger brackets, water valves and fittings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
3. Provide a duct slot for filter replacement, if a return duct is used.
4. Do not obstruct the space beneath the unit with piping, electrical cables and other items.
5. Refer to Figure 2 and 3 for layout and mounting instructions. Use a manual portable jack to lift the unit and to support the weight of the unit during installation and servicing.

Setting Horizontal Units

Some residential applications require an attic floor installation. In this case, the unit is set in a full size secondary drain pan on top of a vibration absorbing mesh. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh.



Model	A	B	C
HP 030 - 036	47	18	22
HP 042-060	60	26	30
All dimensions in inches			

Figure 2. Hanger mounting install

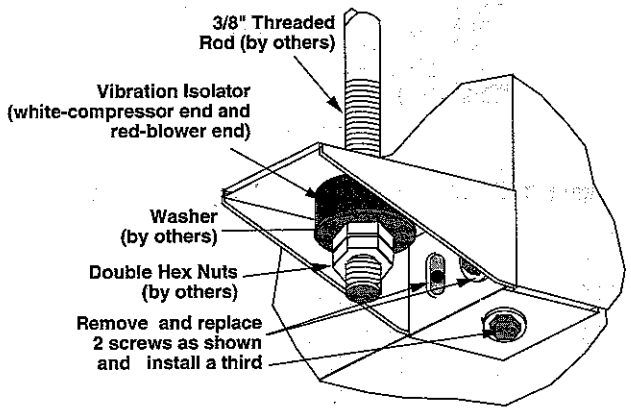


Figure 3. Hanger bracket

Duct System

An air outlet collar is provided on vertical and horizontal units to facilitate duct connection. A flexible connector is recommended for both discharge and return air duct connections on metal duct systems. Uninsulated duct should be insulated with a minimum of one-inch duct insulation. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended as the unit's performance will be adversely affected.

If the unit is connected to existing ductwork, a previous check should have been made to assure the ducts have the capacity to handle the air required for the unit. If ducting is too small, as in the replacement of heating only systems, larger ductwork should be installed. All existing ductwork should be check for leaks and repaired as necessary.

The duct system should be sided to handle the design airflow quietly. To maximize sound attenuation of the unit blower, the supply and return plenums should include internal duct liner of glass fiber or be of ductboard construction for the first few feet. If air noise or excessive air flow is a problem, the blower speed can be changed. See the Blower Performance and Fan Speed sections for further instruction.

Air Coil

To obtain maximum performance, the air coil should be cleaned before start-up. A 10 percent solution of dish-washer detergent and water is recommended for both sides of coil, a thorough water rinse should follow.

Water Connections

The HP/VP Heat Exchanger water connections are swivel piping fittings that accept a 1" Male Pipe Thread (MPT) connector. The swivel connector has a rubber gasket seal similar to a garden hose gasket, which when mated to the flush end of any 1" threaded pipe provides a leak-free seal without the need for thread sealing tape or compound. Check to insure that the rubber seal is in the swivel connector prior to attempting any connection. (The rubber seals are shipped attached the swivel connector.) DO NOT OVERTIGHTEN or leaks may occur.

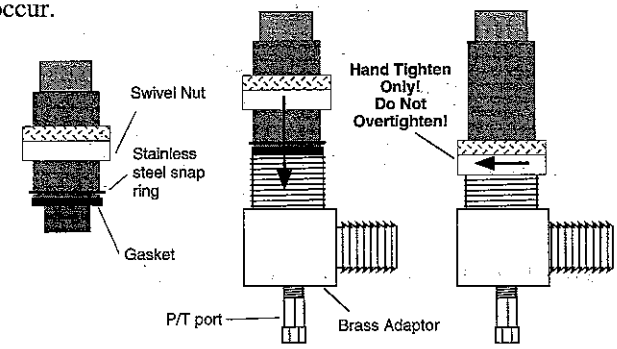


Figure 4. The Female Locking Ring is threaded onto the pipe threads which holds the male pipe end against the gasket, and seals the joint. HAND TIGHTEN ONLY! DO NOT OVERTIGHTEN!

To make the connection to a ground loop system, mate the connection elbow against the rubber gasket in the swivel connector, and thread the female locking ring onto the pipe threads, while maintaining the brass connector in the desired direction (see Figure 4). Tighten the connectors by hand to provide a leak proof joint. When connecting to an open loop (ground water) system, thread any 1" MPT fitting (PVC or copper) into the swivel connector and tighten in the same manner as noted above. The open and closed loop piping system should include pressure/temperature taps for serviceability!

Never use flexible hoses smaller than 1" inside diameter on the unit and limit hose length to 10 ft. per connection. Check carefully for water leaks.

Condensate Drain

On vertical units, Figure 5, a condensate hose is inside all cabinets as a trapping loop, therefore an external trap is not necessary. On horizontal units, an external trap, Figure 6, is required. If a vent is necessary, an open stand pipe may be applied to a tee in the field-installed condensate piping.

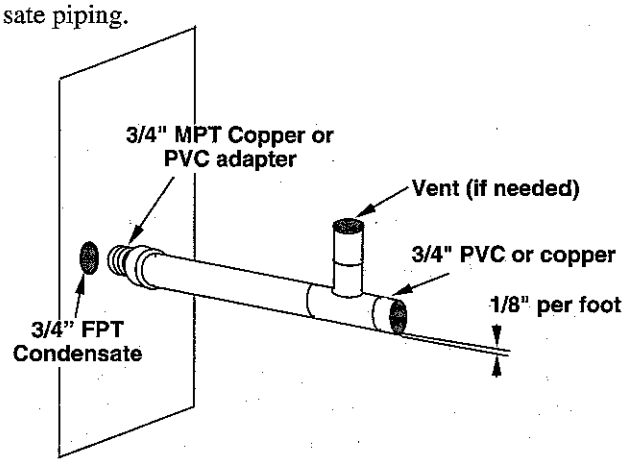


Figure 5. Drain connection for vertical units

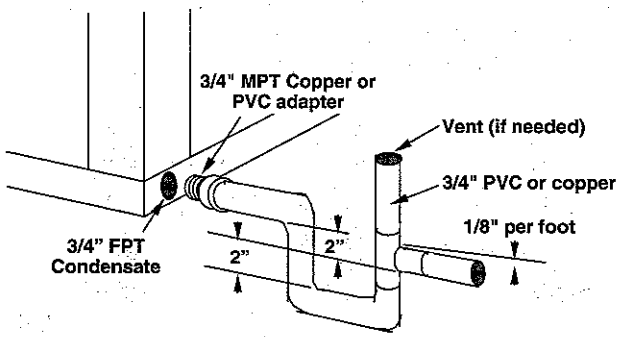


Figure 6. Drain connection for horizontal units

Figure 6 illustrates a typical trap and vent used with HP Heat Pumps. Design the length of the trap (water-seal) based upon the amount of negative pressure on the drain pan. As a rule, 1" of trap is required for each inch of negative pressure on the unit. The unit should be pitched toward the drain Figure 8.

Each unit must be installed with its own individual trap and connection to the condensate line (main). Provide a means to flush or blow-out the condensate drain line. Do not install units with a common trap and/or vent.

Install a vent in the condensate line of any application which may allow dirt or air to collect in the line. Always vent when the application requires a long, horizontal run. When some sagging in the condensate line may be anticipated (as in a long line of plastic pipe) or when "double trapping" may occur. Also vent when large units are working against higher external static pressure that other units connected to the same condensate main since this may cause poor drainage for all units on the line.

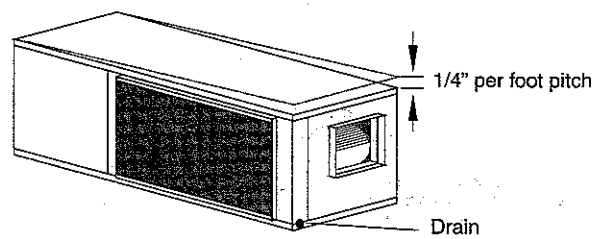


Figure 8. Condensate Pitch for horizontal units

CLOSED LOOP GROUND SOURCE APPLICATIONS

Introduction

CAUTION: The following instructions represent industry accepted installation practices for Closed Loop Earth Coupled Heat Pump Systems. They are provided to assist the contractor in installing trouble-free ground loops. These instructions are recommendations only. State and Local Codes MUST be followed and installations MUST conform to all applicable codes. It is the responsibility of the Installing Contractor to determine and comply with ALL applicable codes and regulations.

Closed Loop Earth Coupled Heat Pump systems are commonly installed in one of three configurations: horizontal, vertical and pond loop. Each configuration provides the benefit of using the moderate temperatures of the earth as a heat source/heat sink. Piping configurations can be either series or parallel.

Series piping configurations typically use 1-1/4 inch, 1-1/2 inch or 2 inch pipe. Parallel piping configurations typically use 3/4 inch or 1 inch pipe for loops and 1-1/4 inch, 1-1/2 inch or 2 inch pipe for headers and service lines. Parallel configurations require headers to be either "closed-coupled" short headers or reverse return design.

Select the installation configuration which provides the most cost effective method of installation after considering all application constraints.

Refer to IGSHPA publication Closed Loop/Ground Source Heat Pump systems Installation Guide (Sections 4-6) for complete ground loop design, materials requirements and joining information.

Pre-Installation

Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

Horizontal Applications

To install Horizontal earth couplings, dig trenches using either a chain-type trenching machine or a backhoe. Dig trenches approximately 5 feet apart. Trenches must be at least 5 feet from existing utility lines, foundations and property lines and at least 10 feet from privies and wells. Trenches may be curved to avoid obstructions and may be turned around corners.

When multiple pipes are laid in a trench, space pipes properly and backfill carefully to avoid disturbing the spacing of the pipes in the trench.

Vertical Applications

To install Vertical earth couplings, drill boreholes using any size drilling equipment. Regulations which govern water well installations also apply to vertical ground lop installations. Vertical applications typically require multiple boreholes. Space boreholes a minimum of 10 feet apart, preferably 15 feet.

The minimum diameter for 3/4 inch or 1 inch U-bend well bores is 4 inches. Larger diameter boreholes may be drilled if convenient, unless local code requires an expensive method of backfilling. Assemble each U-bend assembly, fill with water and pressure test prior to insertion into the borehole.

To add weight and prevent the pipe from curving and digging into the borehole wall during insertion, tape a length of conduit, pipe or reinforcing bar to the U-bend end of the assembly. This technique is particularly useful when inserting the assembly into a borehole filled with water or drilling mud solutions, since a water filled pipe is buoyant under these circumstances. Tape the pipes together approximately every 10 feet to prevent the assembly from separating under downward pressure and bowing out against the borehole wall.

Carefully backfill the boreholes to within 10 feet of the surface. Follow IGSPHA specifications for backfilling unless local codes mandate otherwise.

When all U-bends are installed, dig the header trench 4 to 6 feet deep and as close to the boreholes as possible. Use a spade to break through from ground level to the bottom of the trench. At the bottom of the trench, dig a relief to allow the pipe to bend for proper access to the header.

Building Entry

Seal and protect the entry point of the earth coupling into the building as shown in Figures 9-12.

Slab on Grade Construction

New Construction: When possible, position the pipe in the proper location prior to pouring the slab. To prevent wear as the pipe expands and contracts, protect the pipe

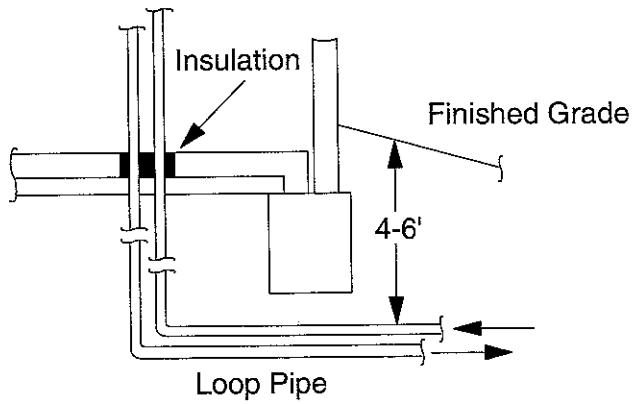


Figure 9. Slab on grade penetration

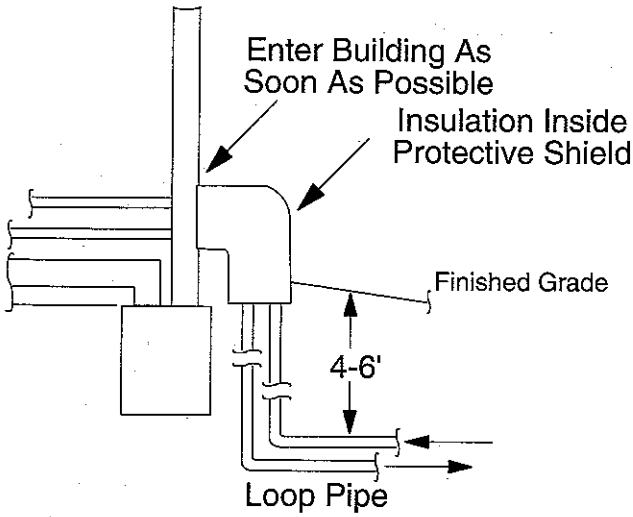


Figure 10. Retrofit Construction

with a layer of insulation as shown in Figure 9. When the slab is poured prior to installation, create a chase through the slab for the service lines with 4 inch PVC street elbows and sleeves. Refer to Section 4 of the IGSHPA for details.

Retrofit Construction

Trench as close as possible to the footing. Bring the loop pipe up along the outside wall of the footing until it is

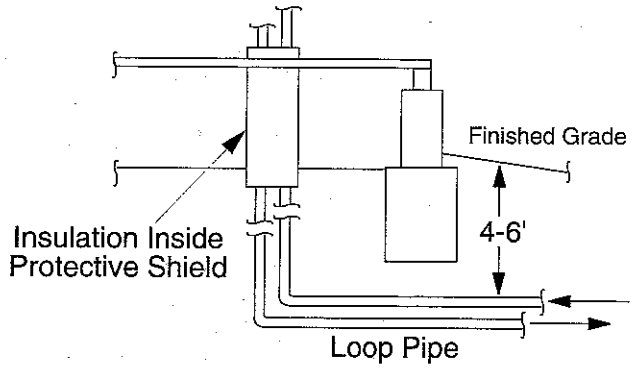


Figure 11. Pier and Beam (Crawl Space)

higher than the slab. Enter the building as close to the slab as the construction allows. Shield and insulate the pipe to protect it from damage and the elements as shown in Figure 10.

Pier and Beam (crawl space)

New and Retrofit Construction: Bury the pipe beneath the footing and between piers to the point that it is directly below the point of entry into the building. Bring the pipe up into the building. Shield and insulate piping as shown in Figure 11 to protect it from damage.

Below Grade Entry

New and Retrofit Construction: Bring the pipe through the wall as shown in Figure 12. For applications in which loop temperature may fall below freezing, insulate pipes at least 4 feet into the trench to prevent ice forming near the wall.

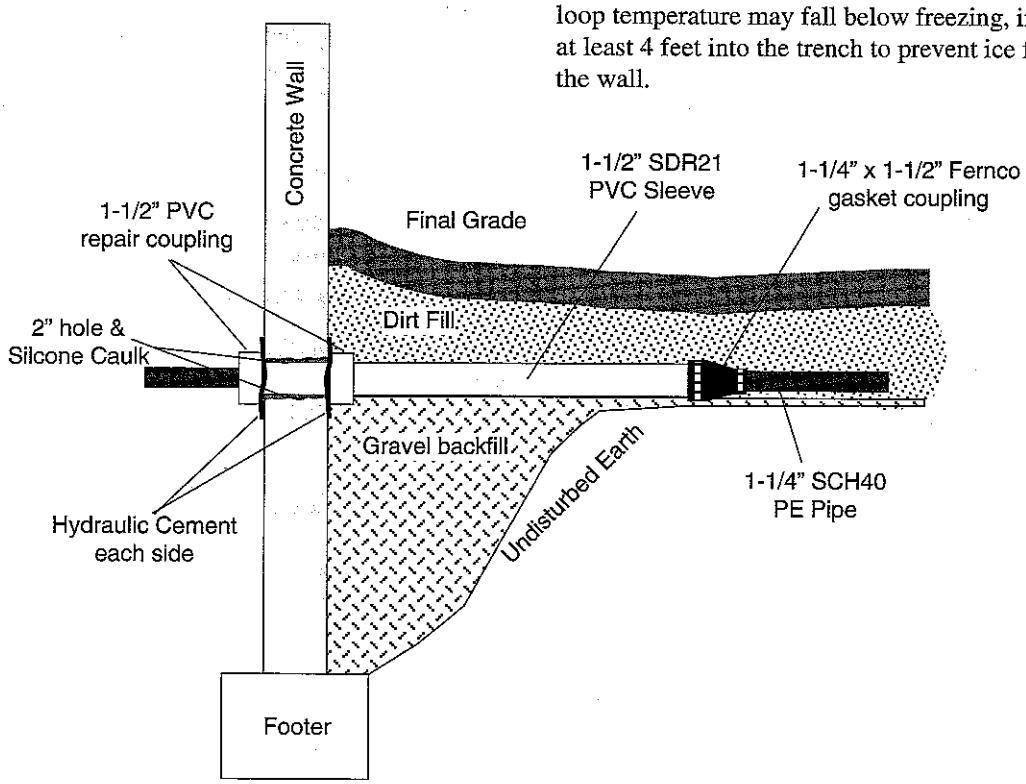


Figure 12. Below grade penetration(basement)

GROUND LOOP INSTALLATION

Upon completion of the ground loop piping, pressure test the loop to assure a leak free system.

Horizontal Systems: Test individual looks as installed. Test entire system when all loops are assembled.

Vertical U-Bends and Pond Loop Systems: Test Vertical U-bends and pond loop assemblies prior to installation with a test pressure of at least 100 psi. Either water or air may be used as the testing medium.

Flushing and Purging

Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air. See Table 2 below for approximate fluid volumes.

Table 2. Approximate Fluid Volume (gal.) per 100' of Pipe

Pipe	Size	Volume
Copper	1"	4.1
	1.25"	6.4
	1.5"	9.2
Rubber Hose	1"	3.9
Polyethylene	3/4" IPS SDR11	2.8
	1" IPS SDR11	4.5
	1 1/4" IPS SDR11	8.0
	1 1/2" IPS SDR11	10.9
	2" IPS SDR11	18.0
	1 1/4" IPS SCH40	8.3
	1 1/2" IPS SCH40	10.9
	2" IPS SCH40	17.0
Unit Heat Exchanger	Typical	1.0
Flush cart tank	10" diam x 3 ft	10.0

Refer to Section 7 of the IGSHPA manual for more information on flushing and purging Closed Loop Earth Coupled Systems.

Add antifreeze if necessary. Refer to Table 3 for the correct type and amount of antifreeze to add.

⚠ WARNING

Do Not use calcium chloride in ClimateMaster units. The use of calcium chloride voids the equipment warranty.

Piping Installation

The typical closed loop ground source system is shown in Figure 13. All earth loop piping materials should be limited to only polyethylene fusion in inground sections of the loop and galvanized or steel fitting should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided as well due to their potential to leak in earth coupled applications and a flanged fitting substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger in lieu of other flow measurement means. Earth loop temperatures can range between 25-110°F and 2.25 to 3 gpm of flow per ton of cooling capacity is recommended in these applications.

Flushing the Earth Loop

Once piping is completed between the unit, Flow Controller and the ground loop (Figure 13), final purging and charging of the loop is needed. A flush cart (at least a 1.5 hp pump) is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop itself. Antifreeze solution is used in most areas to prevent freezing. All air and debris must be removed from the earth loop piping system before operation. Flush the loop with a high volume of water at a high velocity (2 fps in all piping), both directions. The steps below must be followed for proper flushing. Fill loop with water from a garden hose through flush cart before using flush cart pump to ensure an even fill. Once full, do not allow the water level in the flush cart tank to drop below the pump inlet line or air can be pumped back out to the earth loop. Try to maintain a fluid level in the tank above the return tee so that air can not be continuously mixed back into the fluid. 50 psi surges can be used to help purge air pockets by simply shutting off the return valve going into the flush cart reservoir. This 'dead heads' the pump to 50 psi. To dead head the pump until maximum pumping pressure is reached, open the valve back up and a pressure surge will be sent through the loop to help

Table 3. Antifreeze Percentages by Volume

Type	Minimum Temperature for Freeze Protection			
	10°F	15°F	20°F	25°F
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	30%	22%	15%

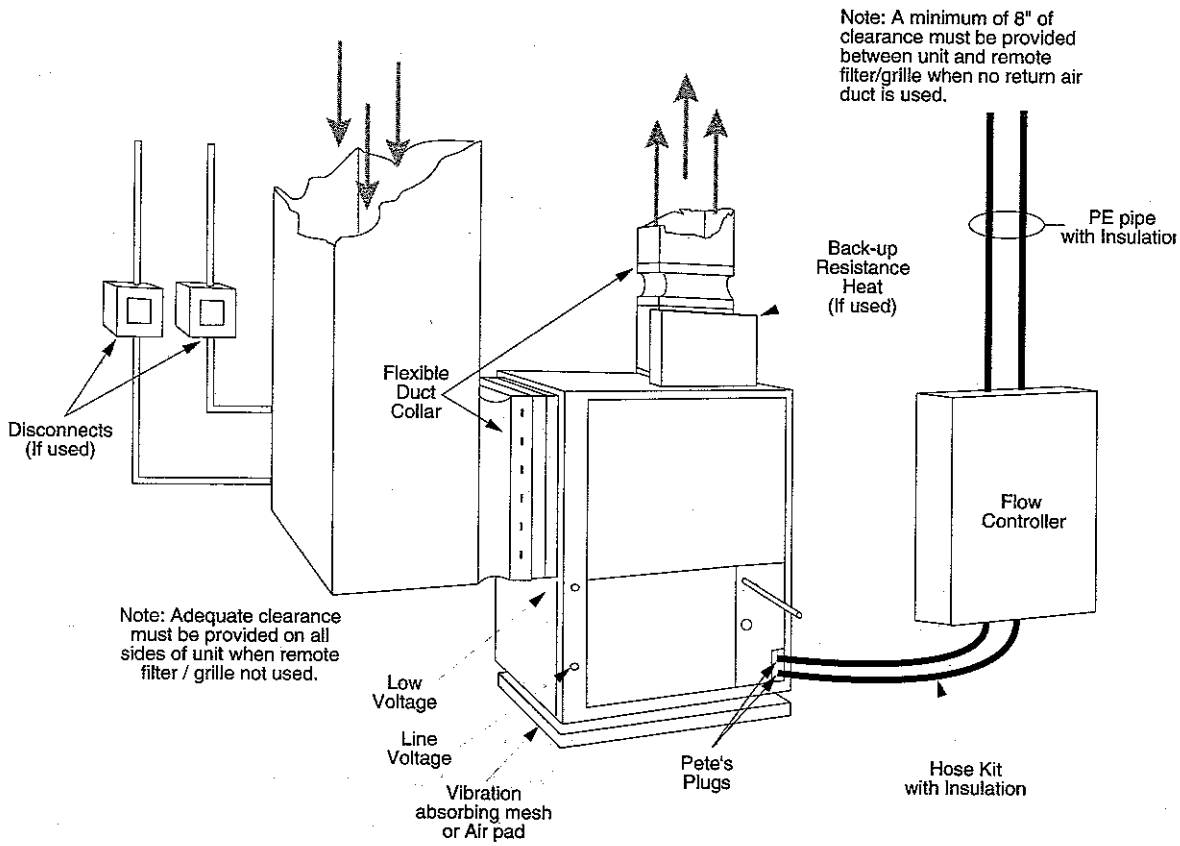


Figure 13. Typical Closed Loop System.

purge air pockets from the piping system. Notice the drop in fluid level in the flush cart tank. **If air is purged from the system, the level will drop only 1-2 inches in a 10" diameter PVC flush tank (about a half gallon) since liquids are incompressible.** If the level drops more than this, flushing should continue since air is still being compressed in the loop fluid. Do this a number of times. When the fluid level is dropping less than 1-2" in a 10" diameter tank the flow can be reversed. Finally the dead head test should be checked again for an indication of air in the loop. **This fluid level drop is your only indication of air in the loop.** Antifreeze may be added before, during or after the flushing procedure. However, depending upon which time is chosen, antifreeze could be wasted when emptying the flush cart tank. Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the cooling season. This fluctuation is normal and should be considered when charging the system initially. Pressurize the loop to a static pressure of 40-50 psi (winter) 15-20 psi (summer).

After pressurization, be sure to remove the plug in the end of the Grundfos loop pump motor(s) to allow trapped air to be discharged and to insure the motor housing has been flooded. This is not required for the Flow Controller which uses Taco circulators. Insure the loop Flow Controller provides adequate flow through the unit by checking pressure drop across the heat exchanger and comparing it to the figures shown in Table 9.

Antifreeze

In areas where minimum entering loop temperatures drop below 40°F or where piping will be routed through areas subject to freezing, anti-freeze is needed. Alcohols and glycols are commonly used as antifreezes, however your local territory manager should be consulted for the antifreeze best suited to your area. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if 30°F is the minimum expected entering loop temperature, the leaving loop temperature would be 25-22°F and freeze protection should be at 15°F (30°F-15°F=15°F). All alcohols should be premixed and pumped from a reservior outside of the building when possible or introduced under water level to prevent fuming. Initially calculate the total volume of fluid in the piping system using Table 2. Then use the percentage by volume shown in Table 3 for the amount of antifreeze. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Freeze Stat Setting

When an antifreeze is selected the freezestat wires should be switched to the activate the low temperature freezestat switch to avoid nuisance faults. See Figure 20.

OPEN LOOP - WELL WATER SYSTEMS

Typical open loop piping is shown in Figure 14. Shut off valves should be included in case of servicing. Boiler drains or other valves should be 'tee'd' in the line to allow acid flushing of just the heat exchanger. Pressure temperature plugs should be used so that flow and temperature can be measured. The water freezestat should be wired. Piping materials should be limited to PVC SCH80 or copper. **Due to the pressure and temperature extremes, PVC SCH40 is not recommended.**

Water Quality

Water should be plentiful and of good quality. Table 4 shows recommended water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Copper is adequate for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating moderate scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. Heat exchanger coils can may over a time lose heat exchange capabilities due to a build up of mineral deposits inside. These can be cleaned only by a qualified service mechanic as acid and special pumping equipment are required. **Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the homeowner should be informed that the heat exchanger may require occasional acid flushing.**

Expansion Tank

Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to handle at least one minute run time of the pump to prevent premature pump failure using its drawdown capacity rating. The pump should be sized to the home's domestic water load (5-9 gpm) plus the heat pump water load. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes, i.e. recharge well, storm sewer, drain field, adjacent stream or pond, etc. Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

Water Control Valve

Note the placement of the water control valve. Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation. Pilot operated or Taco slow closing valve's solenoid valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Insure that the total 'VA' draw of the

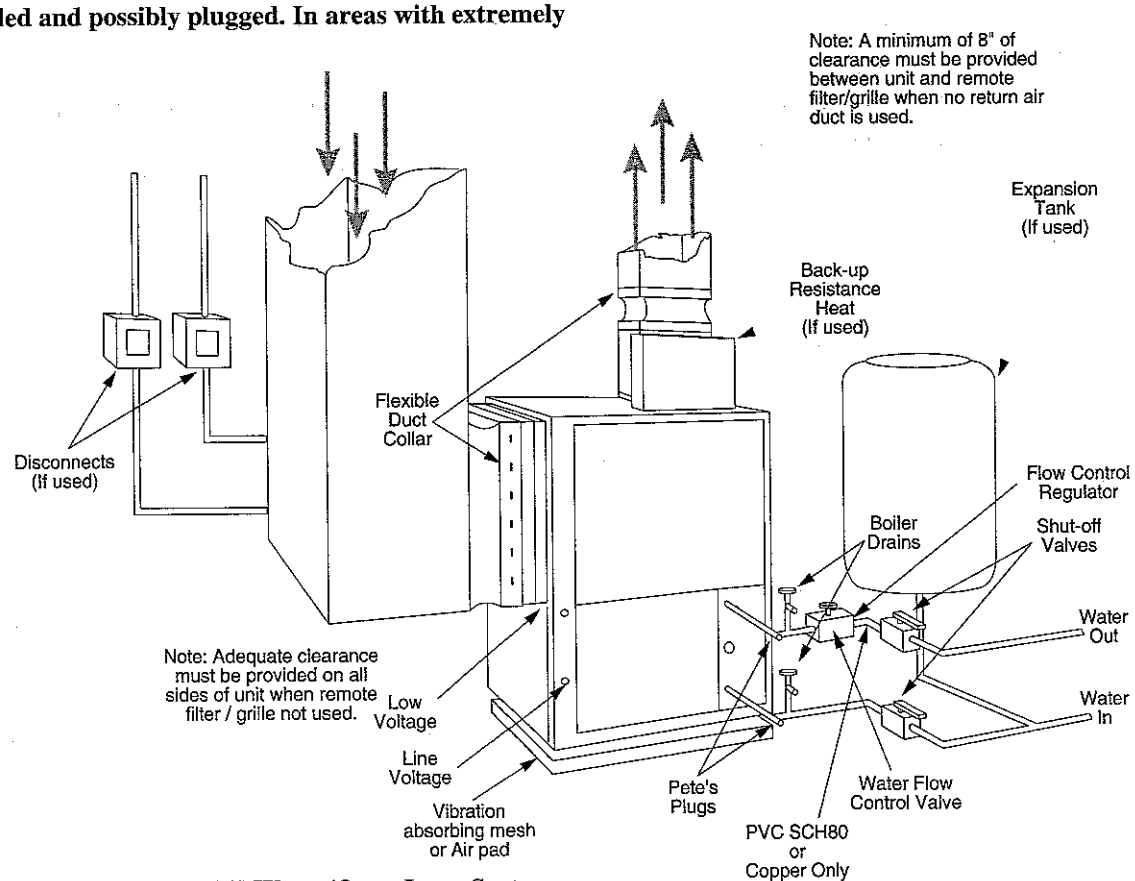


Figure 14. Typical Well Water/Open Loop System

valve can be supplied by the unit transformer. For instance the Taco slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls employed. A typical pilot operated solenoid valve draws approximately 15VA. Note the wiring diagram in Figure 21.

FLOW REGULATION - Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built in. By measuring the pressure drop through the unit heat exchanger flow rate can be determined and compared to Table 9. Since the pressure is constantly varying two pressure gauges might be needed. Simply adjust the water control valve until the desired flow of 1.5 to 2 gpm per ton is achieved. Secondly a flow control device may be installed. The devices are typically an orifice that isdesigned to allow a specified flow rate. These are mounted on the outlet of the water control valve. On occasion these valves can produce a velocity noise that can be reduced by applying some back pressure. This is accomplished by slightly closing the leaving isolation valve of the well water setup.

FREEZESTAT - The high temperature freezestat (water) should be activated. This is shipping positionto avoid freeze damage to the unit. See low voltage wiring section See Figure 20.

Table 4. Water Quality Standards

Acidity pH	7 to 9 range for copper. Cupro-Nickel may be used in the 5 - 10 range.
Total Hardness	Calcium and magnesium carbonate should not exceed 25 grains per gallon (350 ppm)
Iron Oxides	Less than 1 ppm
Iron Bacteria	No level allowable
Corrosiveness	Use Cupro-nickel heat exchangers when concentrations greater than 1 ppm of the following are present: *Ammonia* *Ammonium sulfate* *Ammonium hydroxide* *Chlorine* *Ammonium chloride* *Hydrogen sulfide* *Ammonium nitrate*
Brackish	Use cupro-nickel heat exchanger when concentrations of calcium or sodium chloride greater than 125 ppm are present:

HOT WATER GENERATOR

The HWG (Hot Water Generator) option provides considerable operating cost savings by utilizing excess heat energy from the heat pump to help satisfy domestic hot water requirements. The HWG is active throughout the year, providing virtually free hot water when the heat pump operates in the cooling mode or hot water at the COP of the heat pump during operation in the heating mode. Actual HWG water heating capacities are provided in the appropriate heat pump design guide performance data.

All Climate Master heat pumps equipped with the HWG option include a built-in water to refrigerant heat exchanger to eliminate the need to open and tie into the heat pump's refrigerant circuit in the field. The control circuit is also built in. Depending on heat pump model and size, the circulating pump may be built into the heat pump or shipped loose. Either way, the pump and concentric fitting are included as a portion of the HWG option. Figure 15 is a typical example of HWG water piping connections on a vertical unit with a built-in pump and Figure 16 shows a unit with an external HWG pump.

Using a concentric hot water tank connection fitting eliminates the need to tie into the hot water tank cold water piping.

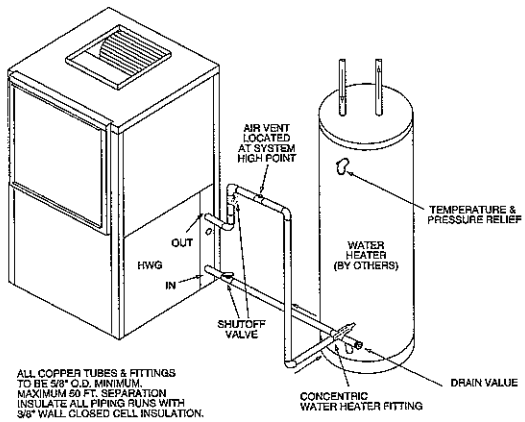


Figure 15. Typical vertical HWG with internal pump.

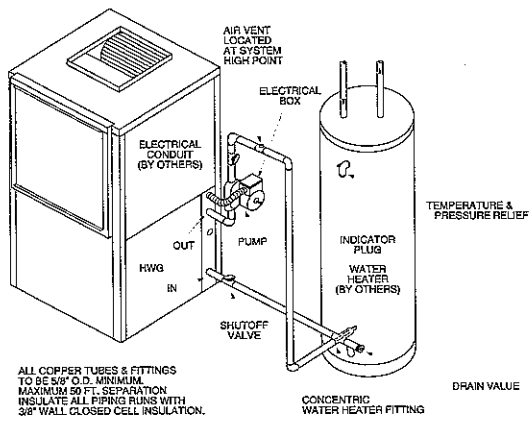


Figure 16. Typical HWG with external pump

If a concentric fitting is not used, Figure 17, presents an arrangement suitable for either circulating pump configuration.

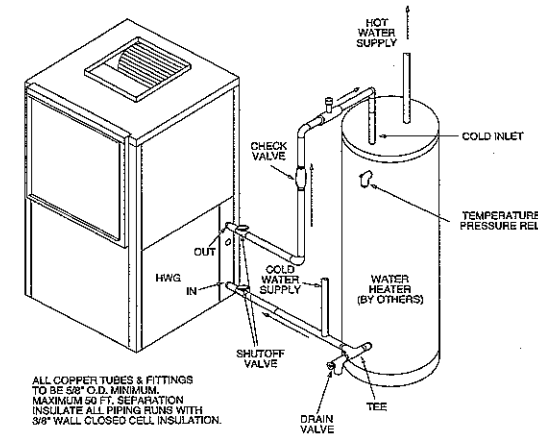


Figure 17. HWG piping without concentric fitting

The installation method illustrated in Figure 17 is very useful if scaling or mineral residue normally creates a problem in hot water tanks in your area. The water flow path illustrated continually cleans the seat of the check valve, "shocks" the heat exchanger to prevent scale build-up, and purges and reprimes the circulator pump.

It discharges to the bottom of the hot water tank so residue at the bottom of the tank is not sucked into the pump and heat exchanger. This mixes the tank to create a full tank of hot water. Regardless of the connection methods used, if scaling or residue problems exist you should add provisions for periodic maintenance. Under extreme conditions, it may be wise to not use the HWG option since the probable cost of frequent maintenance may offset or exceed any savings.

Installation

The "shipped loose" circulating pump should be connected to the "Water IN" port on the heat pump. DO NOT CONNECT POWER TO THE PUMP UNTIL THERE IS WATER IN THE HOT WATER TANK. Locate the hot water tank as close to the heat pump as possible.

The HWG aquastat is set at 125 degrees F and is located on the HWG heat exchanger "Water In" line. If the HWG is connected incorrectly or if circulation is reversed, the aquastat will sense leaving water temperature and prevent HWG operation. UNDER NO CIRCUMSTANCES DISCONNECT OR REMOVE THE HWG AQUASTAT! Full load conditions could drive hot water tank temperatures fare above desirable levels if the aquastat has been disconnected or removed.

The heat pump, water piping, pump and hot water tank should be located where the ambient temperature does not fall below 50 degrees F. Keep water piping lengths at a minimum – DO NOT use a one way length greater than

50 feet. All installations must be made in accordance with local codes. The installer is responsible for knowing the local requirements, and for performing the installation accordingly.

Water Tank Preparation

1. Turn off power or fuel supply to the hot water tank.
2. Connect a hose to the drain valve on the water tank.
3. Shut off the cold water supply to the water tank.
4. Open the drain valve and open the pressure relief valve or a hot water faucet.
5. In an existing tank, once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HWG water piping.

HWG Water Piping

1. If necessary, install the circulating pump. THE PUMP SHAFT MUST BE HORIZONTAL!
2. Using at least 5/8" O.D. copper, route and install the water piping, valves and air vent as shown in Figures 15, 16, or 17. When used, the air vent MUST be at the high point of the HWG water piping.
3. Insulate all HWG water piping with no less than 3/8" wall closed cell installation.
4. Open both shut off valves and make sure the tank drain valve is closed.

Water Tank Refill

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Inspect all work for leaks.
5. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank theremostat(s) to ensure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100 degrees F or lowest setting, while the upper element should be adjusted to 120 degrees F. Depending upon the specific needs of the customer, you may want to adjust the upper element differently. On tanks with a single thermostat, lower the thermostat setting to 120 degrees F or the "LOW" position.
6. Replace access cover(s) and restore power or fuel supply.

Initial Start-Up

1. Make sure all valves in the HWG water circuit are full open.
2. Turn on the heat pump and allow it to run for 10-15 minutes.
3. Turn the heat pump and heat pump power supply "OFF" and CONNECT POWER TO THE REMOTE HWG PUMP as shown in Figure 16.

   On units with the internally mounted pump, connect the pump power lead as instructed on the lead tag.
4. The HWG pump should not run if the compressor is not running.
5. The temperature difference between the water entering and leaving the HWG coil should be approximately 10 degrees F.
6. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly.

ELECTRICAL

⚠ 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 electrical ground, must comply with the National Electrical Code as well as all applicable local codes.

Refer to the unit wiring diagrams for fuse sizes and 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.

All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

Table 5 Electrical Data.

Model	Size	Rated Voltage	Voltage Min/Max	Comp RLA	Comp LRA	Fan Motor (HP)	Fan Motor (FLA)	HWG* Pump (Amp)	Loop† Pump (Amp)	Total Unit (FLA)	Min Crkt Amp	Max Fuse (USA)	Max Fuse (Can)	Wire Min AWG	Wire Max Ft
HP/VP	030	208-230/60/1	197/254	11.2	61	1/4	1.6	0.52	4.0	17.3	20.1	30	30	10	100
HP/VP	036	208-230/60/1	197/254	14.4	82	1/2	3.0	0.52	4.0	21.9	25.5	35	35	10	80
HP/VP	042	208-230/60/1	197/254	17.9	87	3/4	5.6	0.52	4.0	28.1	32.6	40	40	8	90
HP/VP	048	208-230/60/1	197/254	21.8	105	3/4	5.5	0.52	4.0	31.8	37.3	50	50	8	80
HP/VP	060	208-230/60/1	197/254	24.4	135	1	5.8	0.52	4.0	34.7	40.8	60	60	6	120

HACR circuit breaker in USA only. All fuses Class RK-5
Wire length based on one way measurement with 2% voltage drop and wire size based on 60°C copper conductor
*HWG Pump Amps not used in Max Fuse or MCA calculations per UL1995 Section 36.15
†Loop Pump Amps included in Min Ckt Amp and Max Fuse/HACR

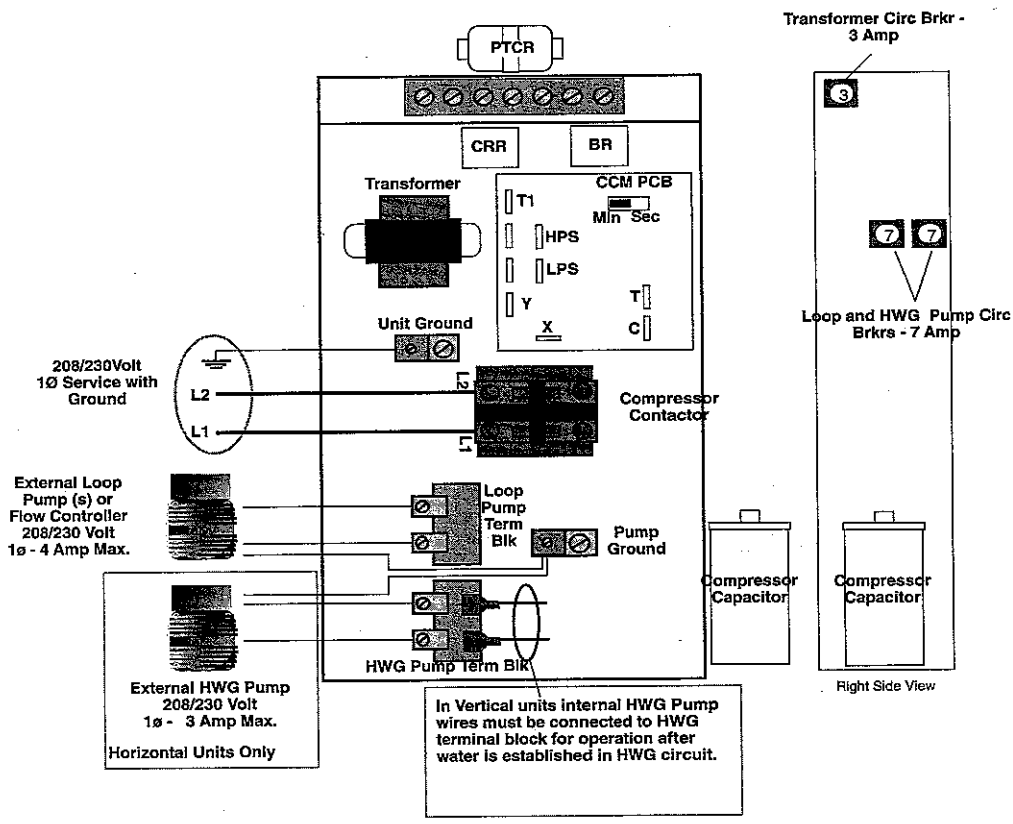


Figure 18 Line Voltage Field Wiring.

General Line Voltage Wiring

Be sure the available power is the same voltage and phase as that shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Unit Power Connection

Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor as shown in Figure 18. Consult Table 5 for correct wire and fuse size.

External Loop Pump Power Connection

If the unit is to be used with an external loop pump or flow controller, the pump(s) will be connected to the loop pump terminals in the unit electrical box as shown in Figure 18. The pumps will automatically be cycled as required by the unit.

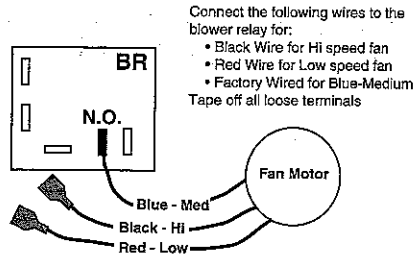


Figure 19. Blower Speed Selection.

208 Volt Operation

All 208-230 volt units are factory wired for 230 volt operation. For 208 volt operation, the red and the blue transformer wires must be switched on terminal strip PS. See the wiring schematic on page ?? for details.

Blower Speed Selection

All blowers are shipped on medium speed. Other speeds may be selected by changing the appropriate jumper Fig 19.

Low Voltage Wiring

Freeze Protection

The freeze protection setting can be changed by switching the freeze sensor wiring Fig 20. The freeze protection sensor for water is factory wired and must be switched for antifreeze operation in closed loop systems. On applications using an open loop/ground water system, leave in the water setting (the factory setting).

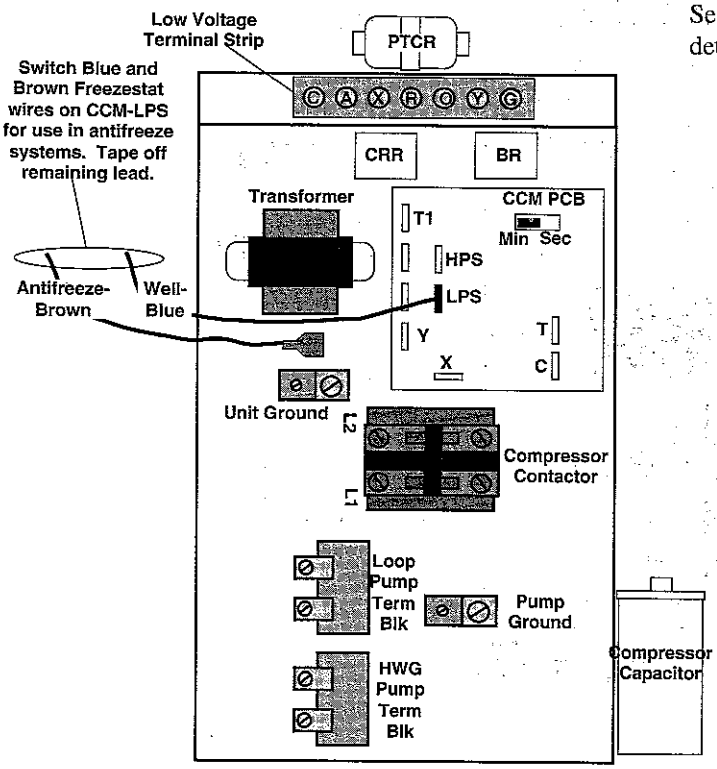


Figure 20. Low Voltage Field Wiring.

Water Solenoid Valve

A set of "dry" contacts has been provided to control accessory devices, such as water solenoid valves on open loop installations, electronic air cleaners, humidifiers, etc. This relay contact should be used only with 24 volt signals and not line voltage signals. The relay is normally open (SPST) and operates with the compressor contactor. See Fig 21 or the wiring schematic on page 18-19 for details.

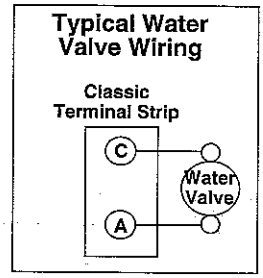


Figure 21. Water Valve Wiring

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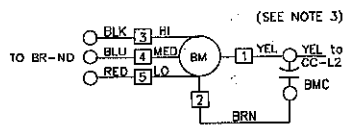
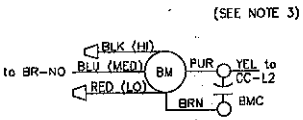
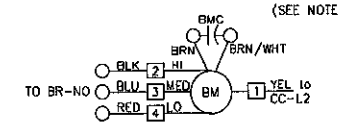


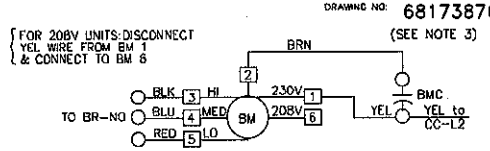
BLOWER WIRING



ALTERNATE BLOWER WIRING



ALTERNATE BLOWER WIRING

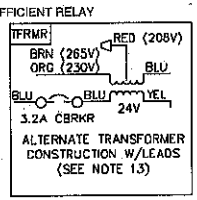


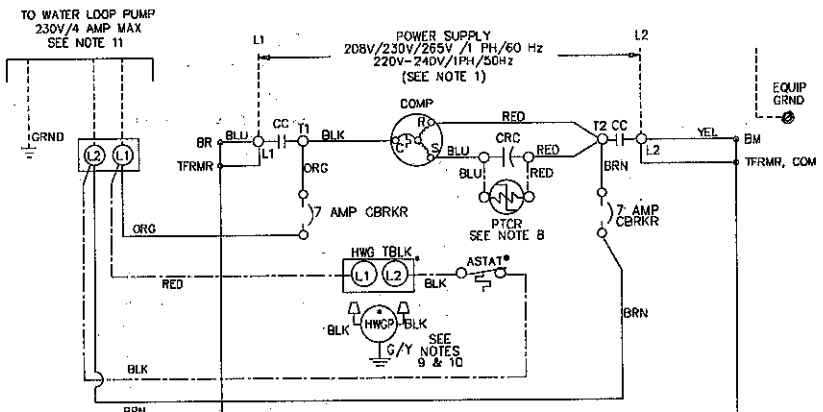
ALTERNATE BLOWER WIRING

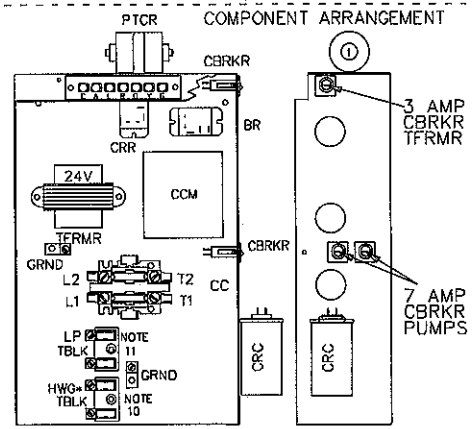
LEGEND:

ACO	AUTO CHANGE OVER
ASTAT	AQUASTAT
BM	BLOWER MOTOR
BMC	BLOWER MOTOR COMPACITOR
BR	BLOWER RELAY
CBRKR	CIRCUIT BREAKER
CC	COMPRESSOR CONTACTOR
CCM	COMPRESSOR CONTROL MODULE
COM	COMMON
COMP	COMPRESSOR
CRC	COMPRESSOR RUN COMPACITOR
CRR	COMPRESSOR RUN RELAY
HPS	HIGH PRESSURE SWITCH
HWGP	HOT WATER GENERATOR PUMP
LP	LOOP PUMP
LPS	LOW PRESSURE SWITCH
LR	LOCKOUT RELAY
LTS	LOW TEMP SWITCH
MCO	MANUAL CHANGE OVER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
PTCR	POSITIVE TEMPERATURE COEFFICIENT RELAY
RVS	REVERSING VALVE SOLENOID
SVS	SERVICE SIGNAL TO TSTAT
TBLK	TERMINAL BLOCK
TFRMR	TRANSFORMER
TSTAT	THERMOSTAT
WV	WATER VALVE

FIELD WIRING
WIRING FOR OPTIONS
COMMON POTENTIAL (NOT A WIRE)

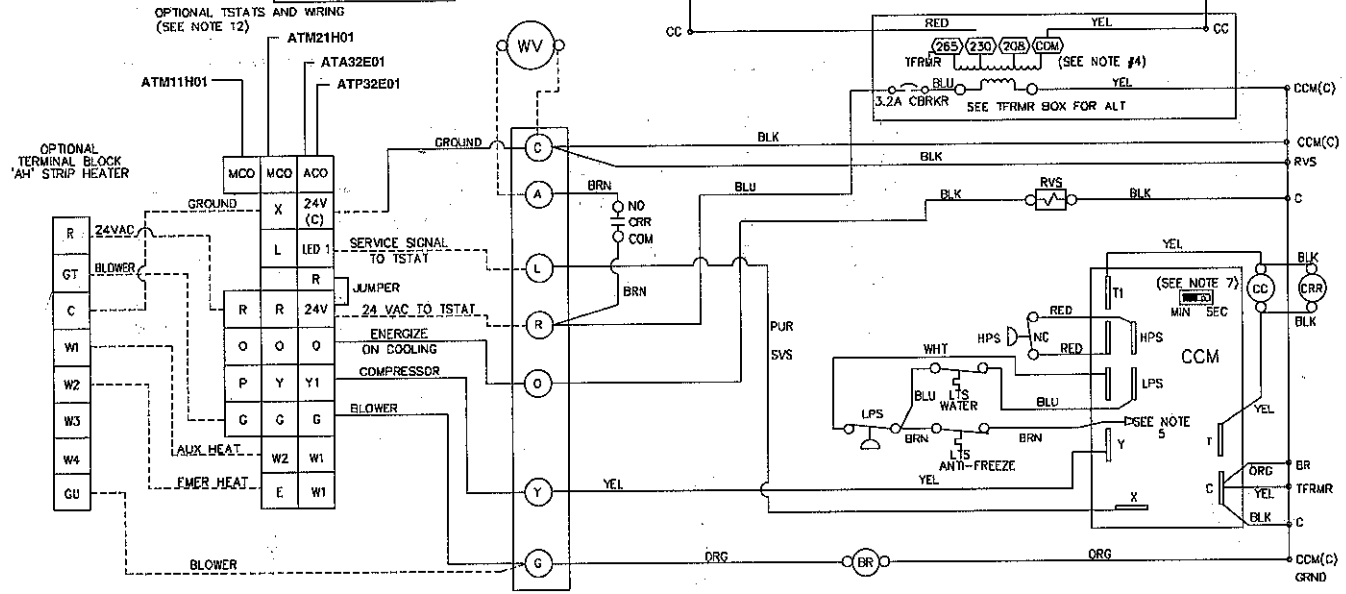






NOTES:
1. TO BE WIRED IN ACCORDANCE WITH NATIONAL ELECTRIC CODE (N.E.C.) & LOCAL CODES. USE COPPER CONDUCTORS ONLY.
2. COMPRESSOR & FAN MOTOR ARE THERMALLY PROTECTED.
3. BLOWER MOTORS WITH THREE SPEEDS ARE FACTORY WIRED TO HIGH SPEED. FOR ALTERNATE SPEEDS MAKE WIRING CHANGES ACCORDING TO APPROPRIATE 'BLOWER WIRING' BLOCK. CAP OFF ALL UNUSED LEADS. SEE BLOWER WIRING BLOCKS FOR ADDITIONAL WIRING INFORMATION.
4. TFRMR IS WIRED TO 230V TAP FOR 230/1/60 UNITS, 230V TAP FOR 220-240/1/50 UNITS, OR 265V TAP FOR 385/1/60. FOR 208V, MOVE WIRE TO 208V TAP.
5. UNIT IS WIRED FOR WATER FREEZE SWITCH, FOR ANTI-FREEZE. FREEZE SWITCH REMOVE BLUE WIRE FROM LPS TERMINAL ON CCM AND REPLACE WITH BROWN WIRE. TAPE OFF ALL LOOSE TERMINALS.
6. MOUNT CCM BOARD AS SHOWN IN WIRING SCHEMATIC.
7. ANTI SHORT CYCLE TIMER SET AT 5 MIN. FOR 5 SEC. MOVE JUMPER TO 5 SEC. PIN. (FOR SERVICE ONLY.).
8. PTCR USE ONLY WHEN APPLICABLE.
9. FOR OPERATION OF INTERNAL HWG CONNECT BLK WIRES TO HWG TBLK 'L1' AND 'L2'. **CAUTION** LINE VOLTAGE. **WARNING DO NOT** OPERATE PUMP UNLESS IT HAS BEEN CONNECTED TO A WATER SOURCE.
10. HWG PUMP INSTALLED IN VERTICAL UNITS ONLY. FOR HORIZONTAL UNITS WIRE PUMP, (3 AMP MAX). TO HWG TBLK, WIRE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE (N.E.C.) AND LOCAL CODES.
11. LOOP PUMP CONNECTIONS (TBLK) ON 230V UNITS ONLY.
12. ATM11H01 IS NOT FOR USE WITH STRIP HEAT
    ATA32E01 IS NOT PROGRAMMABLE
    ATP32E01 IS PROGRAMABLE
13. 208VAC 75VA TFRMR HAS EXTERNAL CBRKR. 265VAC 75VA. TFRMR HAS EXTERNAL CBRKR

CCM BOARD FUNCTIONS
-3 SECOND DELAY ON MAKE OF 'Y'
-90 SECOND LOW PRESSURE BYPASS ON MAKE OF 'Y'
-5 MIN. DELAY ON BREAK OF 'Y' (SEE NOTE 7).
-24 VOLT OUTPUT (X) FOR REMOTE COMPRESSOR LOCKOUT INDICATION



THIS UNIT IS WIRED WITH THE OPTIONAL (*) AS CHECKED BELOW

☐ HWG – HOT WATER GENERATOR

H*/V* 015-060 G/E/V 68173876 E

Thermostat Selection

ATM11H01 - Manual Changeover electromechanical 1 Heat / 1 Cool thermostat

This thermostat, Figure 22, is well suited to heat/cool situations not requiring auxiliary electric heat.

ATM21H01 - Manual Changeover electromechanical 2 Heat / 1 Cool thermostat

This thermostat, Figure 23, is well suited to heat/cool situations that do require auxiliary electric heat.

ATA11E01 - Auto Changeover electronic 2 Heat / 1 Cool thermostat

This electronic thermostat, Figure 24, is well suited to heat/cool situations that requires auxiliary electric heat but not programmability.

ATP32E01 - Auto Changeover programmable electronic 3 Heat / 2 Cool thermostat

This electronic thermostat, Figure 25, is well suited to heat/cool situations that requires auxiliary electric heat and programmability.

Controls Description

The reversing valve is energized in the cooling mode. and accessory relay is activated simultaneously with the compressor contactor.

The Classic also incorporates a solid state compressor control module in place of the traditional lockout relay. In addition to improved reliability the control features:

- Complete lockout function
- 3 second delay on make
- 90 second low pressure and freeze stat bypass delay
- 5 minute anti-short cycle protection
- 'Lockout' output for thermostat indication
- 'Speed up mode' jumper for timings

Lockout conditions possible with standard controls are:

- High Pressure
- Low Pressure
- Freeze Protection

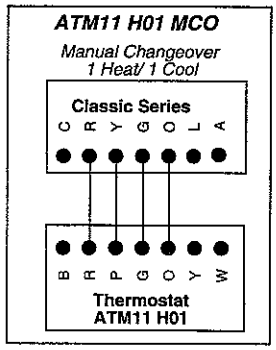


Figure 22.

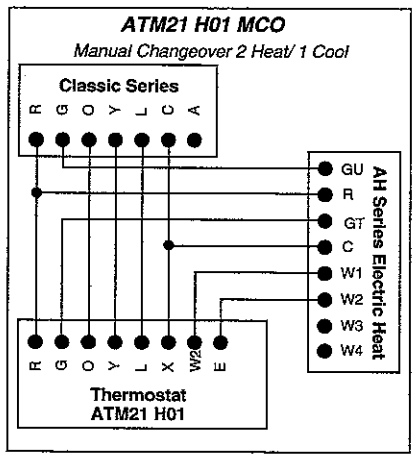


Figure 23.

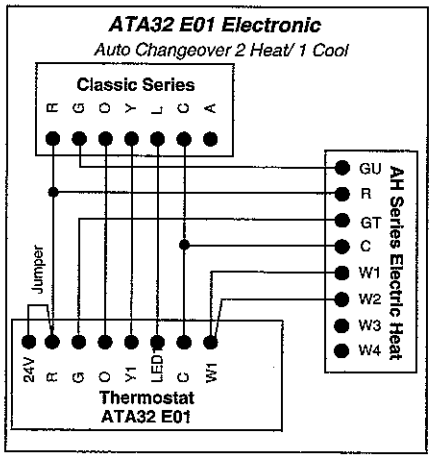


Figure 24.

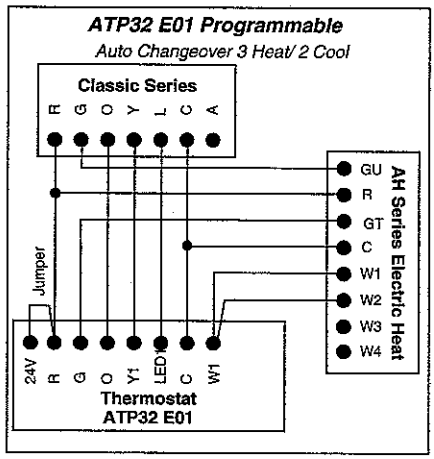


Figure 25.

Blower Performance Data

Horizontal Models HP

High Efficiency

Air flow based on Wet Coil and clean filter

Do not extrapolate
Motor tapped to medium from factory

Model	Size	Air Flow	Speed	Voltage	External Static Pressure (inch H2O) 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
HP	30	LS/RS	Low	208	995	924	838	746	674	596						
HP	30	LS/RS	Med	208	1091	1013	945	829	738	626						
HP	30	LS/RS	High	208	1177	1105	1022	914	809	667						
HP	30	LS/RS	Low	230, 265, 460	1081	984	924	829	738	639						
HP	30	LS/RS	Med	230, 265, 460	1161	1074	974	893	797	667						
HP	30	LS/RS	High	230, 265, 460	1243	1157	1040	944	853	730						
HP	30	LB/RB	Low	208	876	813	737	656	593	524						
HP	30	LB/RB	Med	208	960	891	832	730	649	551						
HP	30	LB/RB	High	208	1036	972	899	804	712	587						
HP	30	LB/RB	Low	230, 265, 460	951	866	813	730	649	562						
HP	30	LB/RB	Med	230, 265, 460	1022	945	857	786	701	587						
HP	30	LB/RB	High	230, 265, 460	1094	1018	915	831	751	642						
HP	36	LS/RS	Low	208	1002	985	965	934	856	717						
HP	36	LS/RS	Med	208	1221	1179	1117	1044	965	821						
HP	36	LS/RS	High	208	1553	1374	1261	1179	1045	966						
HP	36	LS/RS	Low	230, 265, 460	1169	1115	1068	983	905	766						
HP	36	LS/RS	Med	230, 265, 460	1321	1238	1153	1074	973	833						
HP	36	LS/RS	High	230, 265, 460	1582	1449	1341	1193	1063	963						
HP	36	LB/RB	Low	208	882	867	849	822	753	631						
HP	36	LB/RB	Med	208	1074	1038	983	919	849	722						
HP	36	LB/RB	High	208	1367	1209	1110	1038	920	850						
HP	36	LB/RB	Low	230, 265, 460	1029	981	940	865	796	674						
HP	36	LB/RB	Med	230, 265, 460	1162	1089	1015	945	856	733						
HP	36	LB/RB	High	230, 265, 460	1392	1275	1180	1050	935	847						
HP	42	LS/RS	Low	208	1462	1394	1342	1281	1239	1174	1113	1063				
HP	42	LS/RS	Med	208	1625	1570	1490	1423	1353	1307	1237	1172	1115	1060		
HP	42	LS/RS	High	208	1762	1681	1589	1522	1451	1357	1278	1208	1142	1077		
HP	42	LS/RS	Low	230, 265, 460	1587	1519	1454	1385	1320	1259	1199	1144	1086			
HP	42	LS/RS	Med	230, 265, 460	1715	1631	1570	1484	1411	1340	1271	1203	1138	1078		
HP	42	LS/RS	High	230, 265, 460	1801	1716	1621	1527	1462	1395	1330	1267	1206	1141	1078	
HP	42	LB/RB	Low	208	1287	1227	1181	1127	1090	1033	979	935				
HP	42	LB/RB	Med	208	1430	1382	1311	1252	1191	1150	1089	1031	981	933		
HP	42	LB/RB	High	208	1551	1479	1398	1339	1277	1194	1125	1063	1005	948		
HP	42	LB/RB	Low	230, 265, 460	1397	1337	1280	1219	1162	1108	1055	1007	956			
HP	42	LB/RB	Med	230, 265, 460	1509	1435	1382	1306	1242	1179	1118	1059	1001	949		
HP	42	LB/RB	High	230, 265, 460	1585	1510	1426	1344	1287	1228	1170	1115	1061	1004	949	
HP	48	LS/RS	Low	208	2002	1928	1838	1757	1664	1543	1458	1371	1288			
HP	48	LS/RS	Med	208	2214	2130	2037	1920	1803	1692	1575	1468	1357	1241		
HP	48	LS/RS	High	208	2381	2282	2144	1992	1892	1773	1658	1541	1432	1319	1214	
HP	48	LS/RS	Low	230, 265, 460	2170	2101	1977	1850	1728	1611	1491	1378	1277			
HP	48	LS/RS	Med	230, 265, 460	2347	2247	2113	1983	1882	1769	1654	1547	1438	1337	1238	
HP	48	LS/RS	High	230, 265, 460	2441	2339	2206	2088	1974	1874	1763	1662	1564	1463	1364	1270
HP	48	LB/RB	Low	208	1762	1697	1617	1546	1464	1358	1283	1206	1133			
HP	48	LB/RB	Med	208	1948	1874	1793	1690	1587	1489	1386	1292	1194	1092		
HP	48	LB/RB	High	208	2095	2008	1887	1753	1665	1560	1459	1356	1260	1161	1068	
HP	48	LB/RB	Low	230, 265, 460	1895	1800	1700	1593	1509	1425	1336	1251				
HP	48	LB/RB	Med	230, 265, 460	1910	1849	1740	1628	1521	1418	1312	1213	1124			
HP	48	LB/RB	High	230, 265, 460	2148	2058	1941	1837	1737	1649	1551	1463	1376	1287	1200	1118
HP	60	LS/RS	Low	208	1988	1907	1842	1774	1704	1608	1501					
HP	60	LS/RS	Med	208	2129	2041	1956	1886	1807	1695	1580					
HP	60	LS/RS	High	208	2467	2351	2229	2082	1980	1853	1733	1608	1499			
HP	60	LS/RS	Low	230, 265, 460	2256	2163	2076	1974	1879	1759	1648	1543				
HP	60	LS/RS	Med	230, 265, 460	2390	2259	2171	2050	1941	1858	1749	1648	1543			
HP	60	LS/RS	High	230, 265, 460	2571	2490	2370	2232	2092	1960	1833	1707	1586			
HP	60	LB/RB	Low	208	1749	1678	1621	1561	1500	1415	1321					
HP	60	LB/RB	Med	208	1874	1796	1721	1660	1590	1492	1390					
HP	60	LB/RB	High	208	2171	2069	1962	1832	1742	1631	1525	1415	1319			
HP	60	LB/RB	Low	230, 265, 460	1985	1903	1827	1737	1654	1548	1450	1358				
HP	60	LB/RB	Med	230, 265, 460	2103	1988	1910	1804	1708	1635	1539	1450	1358			
HP	60	LB/RB	High	230, 265, 460	2262	2191	2086	1964	1841	1725	1613	1502	1396			

Vertical Models VP

High Efficiency

Air flow based on Wet Coil and clean filter

Do not extrapolate
Motor tapped to medium from factory

Model	Size	Speed	Voltage	External Static Pressure (inch H2O) 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
VP	30	Low	208	995	924	838	746	674	596				
VP	30	Med	208	1091	1013	945	829	738	626				
VP	30	High	208	1177	1105	1022	914	809	667				
VP	30	Low	230, 265, 460	1081	984	924	829	738	639				
VP	30	Med	230, 265, 460	1161	1074	974	893	797	667				
VP	30	High	230, 265, 460	1243	1157	1040	944	853	730				
VP	36	Low	208	1002	985	965	934	856	717				
VP	36	Med	208	1221	1179	1117	1044	965	821				
VP	36	High	208	1553	1374	1261	1179	1045	966				
VP	36	Low	230, 265, 460	1169	1115	1068	983	905	766				
VP	36	Med	230, 265, 460	1321	1238	1153	1074	973	833				
VP	36	High	230, 265, 460	1582	1449	1341	1193	1063	963				
VP	42	Low	208	1330	1268	1211	1136	1072	1004				
VP	42	Med	208	1400	1329	1267	1196	1104	1029				
VP	42	High	208	1455	1368	1301	1232	1158	1079				
VP	42	Low	230, 265, 460	1388	1310	1247	1182	1105	1021				
VP	42	Med	230, 265, 460	1437	1361	1274	1217	1135	1063				
VP	42	High	230, 265, 460	1472	1399	1321	1245	1157	1079				
VP	48	Low	208	1399	1635	1569	1482	1372	1272				
VP	48	Med	208	1321	1701	1627	1567	1451	1344	1269			
VP	48	High	208	1245	1771	1680	1589	1498	1388	1293			
VP	48	Low	230, 265, 460	1157	1707	1612	1545	1427	1325	1231			
VP	48	Med	230, 265, 460	1079	1757	1654	1544	1463	1357	1260			
VP	48	High	230, 265, 460	1895	1800	1700	1593	1509	1425	1336	1251		
VP	60	Low	208	2051	1990	1927	1861	1794	1723	1650	1579		
VP	60	Med	208	2160	2084	2024	1956	1892	1805	1726	1652	1583	
VP	60	High	208	2302	2242	2164	2088	2004	1923	1843	1762	1678	1598
VP	60	Low	230, 265, 460	2210	2136	2048	1987	1911	1825	1742	1663	1578	
VP	60	Med	230, 265, 460	2302	2220	2141	2047	1986	1903	1826	1745	1668	1588
VP	60	High	230, 265, 460	2327	2252	2163	2076	1985	1899	1812	1733	1658	1585

SUPPLEMENTAL HEAT

Climate Master recommends the contractor determine the use of supplemental/back-up heat on each installation by using the CMEA software package.

The Climate Master AH "stab-in" electric heat package, as illustrated in Figure 23, is designed to provide a supplemental/back-up heat source for water to air heat pump applications. These units are designed and tested to be used mounted in the heat pump supply plenum. Installation other than in accordance with these instructions may cause unit malfunction. NOTE: THE AH MUST be installed in accordance with ALL applicable codes.

Application

Refer to Table 7 for the appropriate heat pump/AH combinations. Prior to installation, confirm correct power supply (voltage, frequency and phase) and adequate service capacity (amps). Heater electric data is also provided in Table 7.

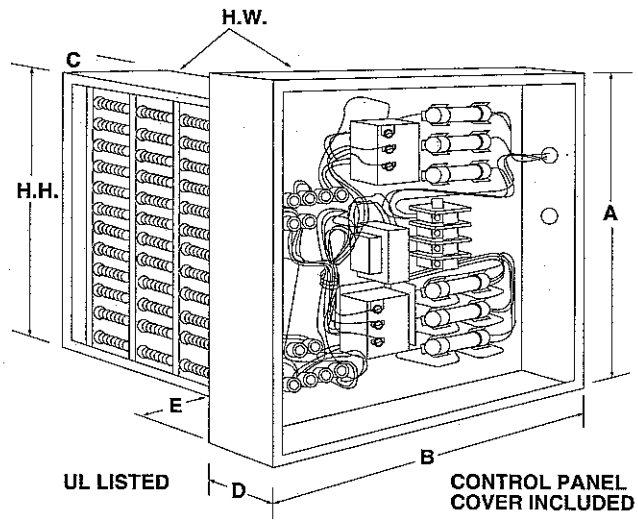


Figure 23. AH Stab-in Electric Heater

ClimateMaster recommends supply duct be constructed of dimensions A & B fastening directly to the top of the cabinet being careful not to puncture any internal components with mounting screws. Then an insertion hole be cut of dimension C & D in which to slide the heater and direct heater conact with duct insulation should be eliminated. Also included with this Tech Bulletin is a corrected Classic Demension Sheet.

Features

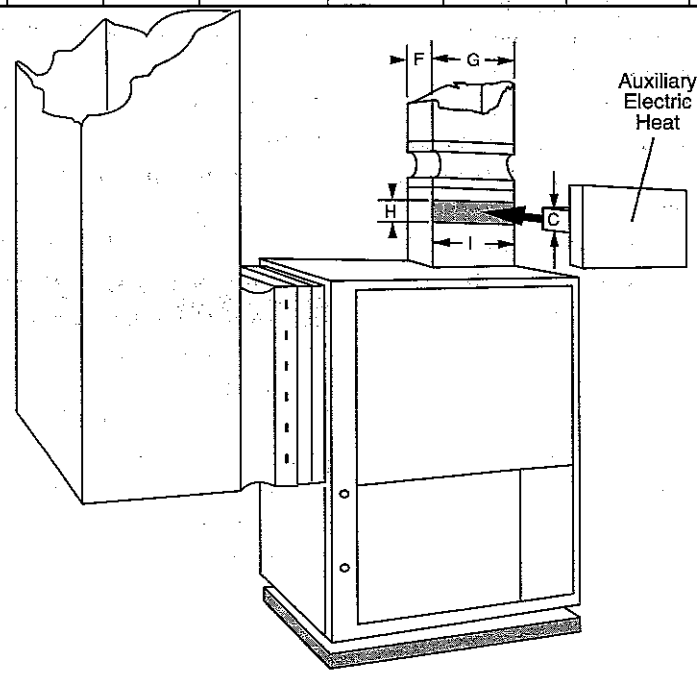
- Heaters are U.L. listed for zero clearance and meet all applicable requirements of the 1981 National Electric Code (N.E.C.).
- Heater frames and boxes are constructed of 20 gauge or heavier galvanized steel.
- Control boxes have a hinged control panel cover.
- A wiring diagram is furnished with every heater.
- All controls are serviceable without removing the heater from the installation.
- All heater control panels contain a U.L. approved grounding lug.

Table 7. Auxiliary Electric Heat Data (*See Figure 23*)

MODEL	KW	VOLTS	PHASE	STEPS	AMPS	DIMENSIONS						
						A	B	C*	D	E	H.W.	H.H.
AH05GS	4.6 3.75	230 208	1	1	20.0 18.1	14	10	6.2	4	2	12	12
AH10GM	9.2 7.5	230 208	1	2	40.0 36.1	16	10	6.2	4	2	13	14
AH10GL	9.2 7.5	230 208	1	2	40.0 36.1	17	17	6.2	4	2	15.5	15
AH15GM	13.8 11.25	230 208	1	2	60.0 54.1	16	17	6.2	4	2	13	14
AH15GL	13.8 11.25	230 208	1	3	60.0 54.1	17	17	6.2	4	2	15.5	15
AH20GL	18.4 15.0	230 208	1	4	80.0 72.1	17	17	6.2	4	2	15.5	15

**Maximum*

UNIT	F	G	H	I	AH10GM	AH15GM	AH10GL	AH15GL	AH20GL
030	15	15	7	14.5	X	X			
036	15	15	7.0	14.5	X	X			
042	17	17	7.0	15.5			X	X	X
048	17	17	7.0	15.5			X	X	X
060	17	17	7.0	15.5			X	X	X
072	17	17	7.0	15.5			X	X	X



Installation

- Before installing the heater, inspect thoroughly for shipping damage. Notify carrier immediately if any damage is found. Check all porcelain insulators for breakage and inspect heater element wire to see that none have been deformed.
- The minimum air velocity as shown on the heater label is required and must be even across the face of the heater.
- Install heater with the air flow in the proper direction as indicated by the arrow.
- Reinforce duct where necessary to support theweight of the heater and prevent sagging.
- Allow sufficient clearance for servicing and removal if necessary.
- Connect heater as shown on heater schematic wiring diagram. All electrical connections, wire sizes and type and conduit sizes shall be in accordance with appropriate electrical, heating, air conditioning and plumbing codes. The local installer is responsible for knowing the code requirements, and for performing the installation accordingly.
- Main power supply, minimum wire sizes, circuits, fusing, etc., are shown on schematic wiring diagram.
- The air duct system should be designed and installed in accordance with the standards of the National Fire Protection Association for the installation of Air-Conditioning and Ventilation Systems (Pamphlet 90A or 90B). Also follow SMACNA guides and recommendations.
- Heaters should be mounted in the duct far enough away from the blower or any change in the direction of air flow to ensure even air flow over the entire face area of the heater. If a heater cannot be mounted at least 48 inches downstream from the blower or a change in direction of air flow, baffles must be installed in the duct ahead of the heater to ensure even air flow across the face of the heater.
- Elbows, transitions, extractors or similar turbulence producing devices must be at least 48 inches from the nearest heating element.
- The heater control circuit is interlocked with the air system via a blower relay. When a blower relay is used (see diagram) the fan motor amperage must not exceed that given on the diagram.
- All heaters are suitable for zero clearance between duct and combustible material.

Check, Test and Start

Before energizing the heater for operation, be sure that all electrical terminal connections, clamps, screws, etc., are tight as these may have become loose in shipment. It is advisable to retighten all electrical connections after the equipment has been in operation and the components have reached operating temperature. In addition to the above, the following tests and procedures should be followed:

A. Clean all dirt, dust and moisture from equipment.

B. Check for loose terminal connections.

C. Check for proper clearances of live parts and to ground and make sure that all required barriers are in place.

D. Check for missing insulation in equipment and on conductors.

E. Check for any modifications, alterations, for the use of unapproved parts.

F. Check that all fuse and circuit breaker short circuit interrupting ratings are adequate.

G. The equipment room or area should be dried of all dampness and moisture accumulations.

H. Conduct a "megger" test of all equipment andwiring.

Any modification or repairs to this equipment without written permission from the factory, will be done at the installer's own risk and expense.

Leaving air thermostats or other devices which may cause short-cycling of the contractors are not recommended for use with this equipment.

Maintenance and Service

These electric duct heaters are constructed in a manner that should require little if any maintenance on parts supplied with your heater.

Always make sure all connections are tight before heater is turned back on.

Be sure heater elements are free of dirt and foreign matter.

- Even though your heater requires no periodic maintenance check, if your heater is not functioning properly, the following are some points to check:

⚠ WARNING

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

Only trained and qualicied service personnel should install, repair or sercice this equipment. Follow all safety codes. Wear saftey glasses and work gloves.

When working on this equipment, always observe precautions described in the literature, tags and labels attached to the unit.

1. Check installation instructions and wiring diagrams to make sure heater was wired and installed properly.
2. Check all connection points and make sure they are all tight.
3. Fuses – One of the most common problems. Check to see they are not blown.
4. Automatic hi-limit or manual reset – temperature may be too high because air flow is insufficient.
5. Air filter may be clogged.
6. Is sufficient air flow "even" over coils?
7. Check for transformer and control voltage.
8. Make sure that the thermostat is operating properly and power is to heater. Check both control and power voltage.
9. Internal insulation may be interfering with safety device.

Wiring Diagrams

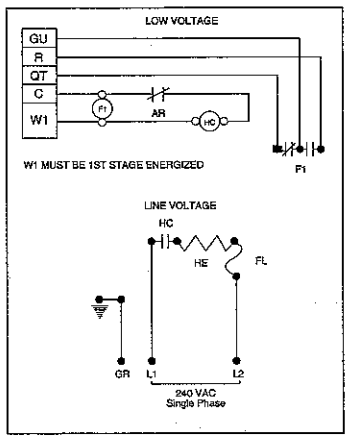


Figure 27. AH Series 5KW Duct Heater

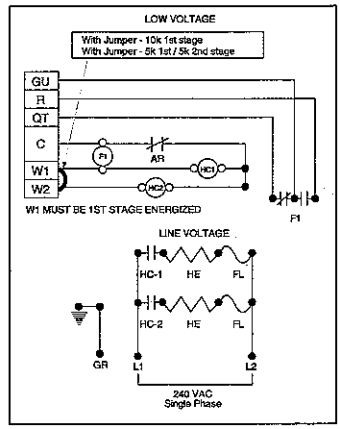


Figure 28. AH Series 10KW Duct Heater

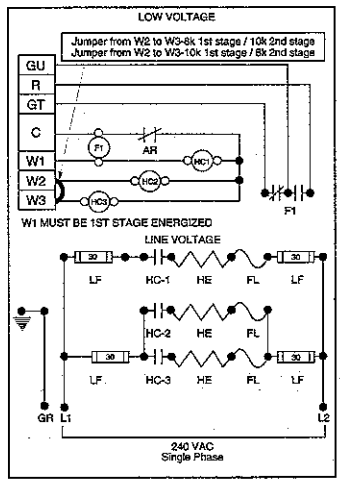


Figure 29. AH Series 15KW Duct Heater

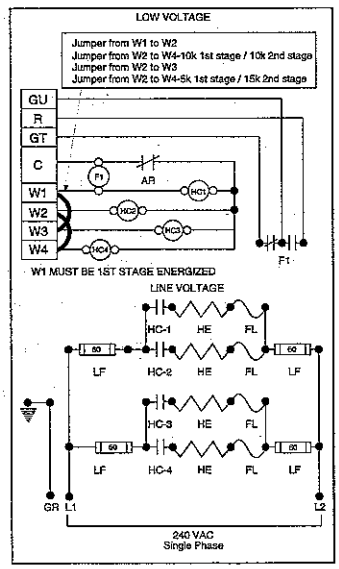


Figure 30. AH Series 20KW Duct Heater

UNIT START UP

Operating Limits

Environment – This unit is designed for indoor installation ONLY.

Power Supply – A voltage variation of +/– 10% of nameplate utilization voltage is acceptable.

Starting Conditions

HP/VP Units – HP/VP Units start and operate in an ambient of 40° F with entering air at 40° F, entering water at 32° F and both air and water at the stated flow rates of ARI 330 for initial winter start-up.

NOTES

1. There are not normal or continuous operating conditions. It is assumed that winter start-up is to bring the building space up to occupancy temperatures.
2. Voltage utilization range complies with ARI Standard 110.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, 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.

Table 7. Operating Limit

Air Limits	HP/VP	
	Cooling	Heating
Min. Ambient Air	40° F	40° F
Rated Ambient Air	80° F	70° F
Max. Ambient Air	100° F	85° 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	40° F	25° F
Normal Entering Water	50-90° F	30-60° F
Max. Entering Water	110° F	90° F

BEFORE POWERING UNIT, check the following:

- ❑ High voltage is correct and matches nameplate
- ❑ Fuses, breakers and wire size correct
- ❑ Low voltage wiring complete
- ❑ Piping completed and water system cleaned and flushed
- ❑ Air is purged from closed loop system
- ❑ Isolation valves are open, water control valves or loop pumps wired
- ❑ Condensate line open and correctly pitched
- ❑ Transformer switched to lower voltage tap if needed
- ❑ HWG pump disconnected unless piping is completed and air has been purged
- ❑ Blower rotates freely – shipping support has been removed
- ❑ Blower speed correct (taps on correct pins)
- ❑ Air filter is clean and in position
- ❑ Service/access panels are in place
- ❑ Return air temperature is between 40-80° F in heating and 50-110° F in cooling
- ❑ Air coil cleaned

Start Up Procedure:

⚠ WARNING

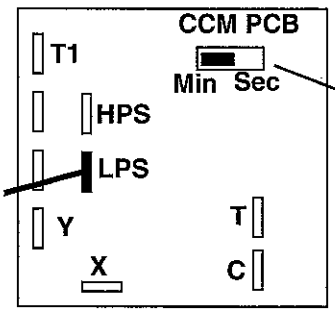
When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

1. Turn thermostat fan position to "ON." Blower should start.
2. Balance air flow at registers.
3. Adjust all valves to their full open position. Turn on the line power to all heat pump units.
4. Operate unit in cooling cycle. Room temperature should be approximately 70° to 75° F DB, and 61° to 65° F WB. Loop water temperature entering the heat pumps should be between 40° F and 110° F.
5. Three factors determine the operating limits of a ClimateMaster Classic™ unit – (a) return air temperature,(b) water temperature, and (c) ambient temperature. When 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. Adjust the unit thermostat to the coolest position. Slowly reduce thermostat setting until the compressor activates.

   b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.

NOTE: Units have a five minute time delay in the control circuit that can be jumpered out on the CCM PCB as shown below in Figure 31. See controls description on page 22 for detailed features of the control



Switch jumper to speed-up timing and delays for troubleshooting

   c. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the Pete's plugs and comparing to Table 9.

   d. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap includes a water seal.

   e. Refer to Table 8. Check the temperature of both supply and discharge water. If temperature is within range, proceed with test. If temperature is outside operating range, check cooling refrigerant pressures in Table 10. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in Table 9. Heat of rejection can be calculatedand compared to specification catalog.

   f. Check air temperature drop across the coil when compressor is operating. Air temperature should drop between 15° F and 25° F.

   g. Turn thermostat to "OFF" position. A hissing noise indicates proper functioning of the reversing valve.

6. Operate the heat pump in the heating cycle immediately after checking cooling cycle operation. Allow five (5) minutes between tests for pressure to equalize or cycle the reversing valve to equalize.

   a. Turn thermostat to lowest setting and set thermostat switch to "HEAT" position.

   b. Slowly turn thermostat to a higher temperature until the compressor activates.

   c. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.

   d. Check the temperature of both supply and discharge water. Refer to Table 8. If temperature is within range, proceed with test. If temperature is outside operating range, check heating refrigerant pressures in Table 10.

   e. Check air temperature rise across the coil when compressor is operating. Air temperature should rise between 20° F and 30° F. Heat of extraction can be calculated and compared to specification catalog.

   f. Check for vibration, noise and water leaks.

7. If unit fails to operate, perform Troubleshooting analysis (page 29-30). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.
9. BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTY REGISTRATION PAPERS TO CLIMATEMASTER.

NOTE: If performance during any mode appears abnormal, refer to the troubleshooting section on page 29-30

Table 8: Water Temperature Change Through Heat Exchanger

Water Flow Rate (GPM)	Rise (Clg)	Drop (Htg)
Closed Loop *	9° F – 12° F	4° F – 8° F
Open Loop **	20° – 26° F	10° F – 17° F

* Earth Coupled or Cooler/Boiler System use 3 GPM/ton

** Open Loop-Well System 1.5 to 2 gpm per ton

NOTE: To obtain maximum performance the air coil should be cleaned before start-up. A 10 percent solution of dishwasher detergent and water is recommended.

Table 9. Water Pressure Drop Table

Unit	GPM	Pressure Drop (psi) 30°F	50°F	70°F	90°F
HP/VP 030	5	1.7	1.6	1.5	1.4
	8	2.8	2.6	2.4	2.3
	10	3.9	3.7	3.4	3.2
HP/VP 036	6	2.3	2.2	2.0	1.9
	9	3.8	3.6	3.3	3.1
	12	5.5	5.1	4.7	4.4
HP/VP 042	7	3.1	2.9	2.7	2.5
	10	5.3	5.0	4.6	4.3
	14	7.7	7.1	6.6	6.2
HP/VP 048	8	4.1	3.8	3.5	3.3
	12	7.3	6.8	6.3	5.9
	16	10.4	9.7	9.0	8.5
HP/VP 060	10	3.5	3.2	3.0	2.8
	15	7.7	7.1	6.6	6.2
	20	11.7	10.9	10.1	9.5

Table 10. Unit operating pressures and temperatures

Entering Water Temp °F	Water Flow GPM/ton	Cooling Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Heating - No HWG Suction Pressure PSIG	Discharge Pressure PSIG	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
30	1.5	61-70	100-117	25-35	15-25	21-24	21-26	34-39	163-183	12-16	4-7	7.6-8.4	14-20
	2.2	62-71	92-109	25-35	15-25	13-16	21-26	37-42	165-185	12-16	4-7	4.8-5.6	16-22
	3.0	62-71	88-104	25-35	15-25	6-11	21-26	38-44	167-186	12-16	4-7	3.4-4.2	16-22
50	1.5	79-85	145-170	10-18	13-18	20-23	20-25	51-58	175-202	13-17	4-7	10.8-11.9	23-29
	2.2	75-83	130-155	10-18	13-18	12-15	20-25	53-62	178-206	13-17	4-7	6.7-8.1	24-30
	3.0	72-82	125-150	10-18	13-18	8-12	20-25	55-65	180-208	13-17	4-7	5.1-5.9	25-31
70	1.5	78-88	180-200	9-14	10-15	19-22	19-24	71-82	215-250	15-19	4-7	14.0-15.2	28-34
	2.2	78-90	169-187	9-14	10-15	11-14	19-24	77-89	203-235	15-19	4-7	9.0-10.2	30-37
	3.0	78-91	160-180	9-14	10-15	7-12	19-24	81-92	200-235	15-19	4-7	6.7-7.9	31-38
90	1.5	79-92	230-272	8-13	10-15	18-21	17-23	-	-	-	-	-	-
	2.2	80-93	215-248	8-13	10-15	10-14	17-23	-	-	-	-	-	-
	3.0	80-93	208-240	8-13	10-15	6-11	17-23	-	-	-	-	-	-

*Based on Nominal 400 cfm per ton airflow and 70°F EAT htg and 80/67°F EAT cooling
**Cooling air and water numbers can vary greatly with changes in humidity

PREVENTIVE MAINTENANCE

Water Coil Maintenance

1) Keep all air out of the water. An open look system should be checked to insure that the well head is not allowing air to infiltrate the water line. Lines should always be airtight.
2) Keep the heat exchanger full of water at all times. It is recommended in open loop systems that an inverted "P" trap be 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 pressure during the summer, 40 PSI during the winter.

NOTE: If the installation is performed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish with the owner a periodic maintenance schedule so the coil can be checked regularly. Should periodic coil cleaning be necessary, use standard coil cleaning procedures which are compatible with either the cupro-nickel or copper water lines. Generally, the more water flowing through the unit the less change for scaling.

Other Maintenance

Filters – Filters must be clean to obtain maximum performance. They should be inspected every month

under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Condensate Drain – In areas where airborne bacteria produce a slime in the drain pan, it may be necessary to treat chemically to minimize the problem. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

Air Coil – The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning. CAUTION: Fin edges are sharp.

Hot Water Generator Coils – See water coil maintenance.

Refrigerant System-To maintain sealed circuit integrity do not install service gauges unless unit operation appears abnormal. Reference the operating charts on the following page.

Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

TROUBLE ANALYSIS

Preliminary Trouble Inspection

⚠ WARNING

HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. Failure to disconnect power before servicing can cause severe personal injury or death.

If operational difficulties are encountered, be sure to perform the preliminary checks before referring to the Troubleshooting Chart.

- Verify that the unit is receiving electrical supply power.
- Make sure the fuses in the fused disconnect switches are intact.

After completing the preliminary checks described above, be sure to inspect for other obvious problems such as leaking connections, broken or disconnected wires, etc.

If everything appears to be in order, but the unit still fails to operate properly, refer to the following Troubleshooting Chart (See Table 5).

Troubleshooting Chart

The Troubleshooting Chart that follows is provided to serve as an aid for identifying malfunctions that may occur. Within the chart are three columns:

1 The Problem column describes what the unit is doing.

2 The Cause column identifies the most likely sources of the problem.

3 The Correction column describes what should be done to correct the problem.

TROUBLE ANALYSIS

Table 11. Troubleshooting Chart

Problem	Heating	Cooling	Cause	Correction
No response to any	X	X	Main power off	Check fuses
thermostat setting	X	X	Defective control transformer	Replace
	X	X	Broken or loose connection	Repair
	X	X	Defective thermostat	Replace
Unit short cycles	X	X	Thermostat or sensor improperly located	Relocate
Blower runs but	X	X	Defective compressor overload	Replace (if external)
compressor does not	X	X	Defective compressor contactor	Replace
	X	X	Supply Voltage too low	Correct
	X	X	Defective compressor capacitor	Replace
	X	X	Defective windings	Replace
	X	X	Limit switches open	Check cause/replace or repair
Insufficient capacity	X	X	Dirty filter	Replace/clean
	X	X	Blower RPM too low (PSC motor only)	Correct
	X	X	Loss of conditioned air due to leaks in ductwork	Repair leaks
		X	Introduction of excessively hot return air	Correct
	X		Introduction of excessively cold return air	Correct
	X	X	Low on refrigerant charge	Locate leak, repair and recharge
	X	X	Restricted metering device	Replace
	X	X	Defective reversing valve	See Touch Test Chart
	X	X	Thermostat improperly located	Relocate
	X	X	Unit undersized	Recalculate heat gains/losses
	X	X	Inadequate water flow	Increase GPM
	X	X	Scaling in chiller	Clean or replace
		X	Water too hot	Decrease temperature
	X		Water too cold	Increase temperature
High pressure		X	Inadequate GPM	Increase
switch open		X	Water too hot	Decrease temperature
	X		Inadequate air flow	Check, clean blower and coil
	X		Dirty filter	Clean/replace
	X	X	Overcharged with refrigerant	Decrease charge
	X	X	Defective pressure switch	Check/replace
High head pressure		X	Trash in chiller	Backflush
		X	Low water flow	Increase GPM
	X	X	Overcharge of refrigerant	Decrease charge
	X	X	Non-condensable in system	Evacuate and recharge
	X	X	Water too hot	Decrease temperature
	X		Dirty filter	Clean/replace
	X		Inadequate air flow	Check, clean blower and coil
Low suction pressure	X	X	Undercharged	Locate leak, repair and recharge
	X	X	Restricted metering device	Repair/replace
		X	Inadequate air flow	Check, clean blower and coil
		X	Dirty filter	Clean/replace
	X		Inadequate GPM	Increase
Low pressure	X		Inadequate GPM	Increase
switch open	X		Water too cold	Increase
		X	Inadequate air flow	Increase
		X	Dirty filter	Clean/replace
	X	X	Undercharged with refrigerant	Increase charge
	X	X	Defective pressure switch	Replace
	X		Heat transfer fluid too cold*	Switch wires from 35 psig to 7 psig
				pressure switch
Freezestat open	X		Inadequate GPM	Increase
	X		Water too cold	Increase
		X	Defective	Replace
	X		Heat transfer fluid too cold*	Replace 35 freezestat w/20 (low
				temp) freezestat

*To change freezestat to 20° F and pressure switch to 7 psig, you must have a heat transfer fluid with protection to 20° F.

LIMITED EXPRESS WARRANTY / LIMATATION OF REMEDIES AND LIABILITY
(WITH EXTENDED DISTRIBUTOR CLASS PRODUCT WARRANTY)

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by ClimateMaster, Inc., a Delaware corporation, ("CM") or its representatives, relating to CM's products, whether oral, written, or contained in any sales literature, catalog or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products. Except as specifically set forth herein, THERE IS NO EXPRESS WARRANTY as to any of CM's products and **CM MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

GRANT OF LIMITED EXPRESS WARRANTY

CM warrants CM products purchased and retained in the United States of America and Canada to be free from defects in material and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating, and/or heat pump units built or sold by CM for 12 months from date of unit start-up or 18 months from date of shipment (from factory), whichever comes first; and, (2) Repair and replacement parts, which are not supplied under warranty, for 90 days from date of shipment (from factory). With respect to complete air conditioning, heating and/or heat pump units built or sold by CM in which the twelfth (12th) digit of the model number for that unit is a "D" (a "Distributor Class Product"), (1) the warranty on the sealed refrigerant circuit parts (which parts only include the compressor, air/air and air/water heat exchangers, reversing valve body, and refrigerant metering device) shall extend for 60 months from the date of shipment (from factory); and, (2) labor incurred for installation of a new or repaired warranty part by CM authorized service personnel within 12 months from date of start up or 18 months from date of unit shipment (from factory), whichever comes first, shall be covered by this warranty only to the extent set forth in the then existing labor rate schedule provided by CM's Warranty Claims Manager; provided, however, actual labor costs are not covered to the extent they exceed the amount allowed under said rate schedule, are not specifically provided for in such rate schedule, or are incurred after the earlier of 12 months from the date of unit start up, or 18 months from the date of unit shipment (from factory) . All parts must be returned to CM's factory in Oklahoma City, Oklahoma, freight prepaid, no later than 60 days after the date of the failure of the part; if CM determines the part to be defective and within CM's Limited Express Warranty, CM shall, when such part has been either replaced or repaired, return such to a factory recognized dealer, contractor or service organization, F.O.B. CM's factory, Oklahoma City, Oklahoma, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

The warranty does not apply to: (1) Air filters, fuses, refrigerant, oil; (2) Products relocated after initial installation; (3) Any portion of the system not supplied by CM; (4) Products on which the unit tags have been removed or defaced; (5) Products on which payment to CM is or has been in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or are caused by accident, misuse or abuse, fire, flood, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures or unauthorized opening of refrigerant circuit; (8) Corrosion or abrasion; (9) Products manufactured or supplied by others; (10) Products which have been subjected to misuse, negligence or accidents; (11) Products which have been operated in a manner contrary to CM's printed instructions; or, (12) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application of CM's products.

CM is not responsible for: (1) the costs of labor, refrigerant, materials or service incurred in removal of the defective part, or in obtaining and replacing the new or repaired part; or, (2) transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, and any implied warranties of fitness for a particular purpose and merchantability shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES

In the event of a breach of the Limited Express Warranty, CM will only be obligated at CM's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma, of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY AGAINST CM FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY

CM shall not be liable for any damages occasioned by any delay in performance or any default caused by war, government restrictions or restraints, strikes, material shortages, acts of God or any other reason beyond the sole control of CM. **CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR NEGLIGENCE OR AS STRICT LIABILITY. CM MAKES NO WARRANTY AGAINST LATENT DEFECTS.**

OBTAINING WARRANTY PERFORMANCE

Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized dealer, contractor or service organization. If assistance is required in obtaining warranty performance, write or call:

ClimateMaster, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma, U.S.A. 73179 • (405) 745-6000 • FAX (405) 745-6058

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or Canadian province to Canadian province.

HP SERIES – SERVICE REPLACEMENT PARTS

SHEET METAL	HP030	HP036	HP042	HP048	HP060
TOP PANEL GZ	S69708706	S69708706	S69708702	S69708702	S69708702
TOP PANEL GN	S69708707	S69708707	S69708703	S69708703	S69708703
BASE PAN ASSY GZ	S69708704	S69708704	S69708700	S69708700	S69708700
BASE PAN ASSY GN	S69708705	S69708705	S69708701	S69708701	S69708701
DRAIN PAN ASSY LH	S69709602	S69709602	S69709600	S69709600	S69709600
DRAIN PAN ASSY RH	S69709603	S69709603	S69709601	S69709601	S69709601
EVAP CRNR POST LH GZ	S69709104	S69709104	S69709104	S69709104	S69709104
EVAP CRNR POST RH GZ	S69709109	S69709108	S69709108	S69709108	S69709108
EVAP CRNR POST LH GN	S69709105	S69709105	S69709105	S69709105	S69709105
EVAP CRNR POST RH GN	S69709109	S69709109	S69709109	S69709109	S69709109
COND CRNR POST GZ	S69709116	S69709116	S69709102	S69709102	S69709102
COND CRNR POST GN	S69709117	S69709117	S69709103	S69709103	S69709103
COND CRNR POST GZ W/HWG	S69709118	S69709118	S69709110	S69709110	S69709110
COND CRNR POST GN W/HWG	S69709119	S69709119	S69709111	S69709111	S69709111
BLWR CRNR POST GZ	S69709106	S69709106	S69709106	S69709106	S69709106
BLWR CRNR POST GN	S69709107	S69709107	S69709107	S69709107	S69709107
ELEC CRNR POST GZ	S69709100	S69709100	S69709100	S69709100	S69709100
ELEC CRNR POST GN	S69709101	S69709101	S69709101	S69709101	S69709101
ELEC ACCESS PANEL GZ	S69709308	S69709308	S69709302	S69709302	S69709302
ELEC ACCESS PANEL GN	S69709309	S69709309	S69709303	S69709303	S69709303
BLWR ACCESS PANEL GZ	S69709306	S69709306	S69709300	S69709300	S69709300
BLWR ACCESS PANEL GN	S69709307	S69709307	S69709301	S69709301	S69709301
BLOWER PANEL GZ	S69710408	S69710410	S69710400	S69710402	S69710404
BLOWER PANEL GN	S69710409	S69710411	S69710401	S69710403	S69710405
COMPR ACCESS PANEL GZ	S69709310	S69709310	S69709304	S69709304	S69709304
COMPR ACCESS PANEL GN	S69709311	S69709311	S69709305	S69709305	S69709305
DIVIDER PANEL ASSY GZ	S69709202	S69709202	S69709200	S69709200	S69709200
DIVIDER PANEL ASST GN	S69709203	S69709203	S69709201	S69709201	S69709201
FILTER RACK TOP 1" GZ	69775800	69775800	69775806	69775806	69775806
FILTER RACK TOP 2" GZ	69775802	69775802	69775808	69755808	69775808
FILTER RACK BOTTOM 1" GZ	69775900	69775900	69775906	69775906	69775906
FILTER RACK BOTTOM 2" GZ	69775902	69775902	69775908	69775908	69775908
FILTER RACK TOP 1" GN	69775801	69775801	69775807	69775807	69775807
FILTER RACK TOP 2" GN	69775803	69775803	69775809	69775809	69775809
FILTER RACK BOTTOM 1" GN	69775901	69775901	69775907	69775907	69775907
FILTER RACK BOTTOM 2" GN	69775903	69775903	69775909	69775909	69775909
CONTROL BOX	69752801	69752801	69752801	69752801	69752801
CONTROL BOX COVER	68366501	68366501	68366501	68366501	68366501
BLOWER WHEEL	68624003	68624018	68624004	68624021	N/A
BLOWER CLIP ASSY	69741400	69741400	69741401	68741401	69741401
BLWR ASSY	S69377300	S69377301	S69377302	S69377303	68536938

HP SERIES – SERVICE REPLACEMENT PARTS

PURCH PARTS / COMPONENTS	VP030	VP036	VP042	VP048	VP060
FILTER 1"	68544445	68544445	68544402	68544402	68544402
FILTER 2"	68544446	68544446	68544430	68544430	68544430
REVERSING VALVE	69173500	69173500	69173500	69172600	69172600
SOLENOID	69170601	69170601	69170601	69170601	69170601
TXV (EXPANSION VALVE)	68266312	68266312	69708444	68708445	69708446
AIR COIL ASSY	S69710204	S59710204	S69710201	S69710201	S69710200
WATER COIL CU	70941601	70941601	70930101	70251402	70251402
WATER COIL CN	70941602	70941602	70930102	70251403	70251403
SWIVEL CONNECTOR	69706000	69706000	69706000	69706000	69706000
COMPRESSOR G VLTG	68832727	68832731	68832710	68832713	68832716
COMPRESSOR E VLTG	68832726	68832730	N/A	N/A	N/A
COMPRESSOR F VLTG	38832729	68832733	68832712	68832715	68832718
COMPRESSOR H VLTG	68832728	68832732	68832711	68832714	68832717
COMPRESSOR N VLTG	N/A	N/A	68832734	68832735	68832736
CONTACTOR G, E, V VLTG	68537800	68537800	68537800	68537811	68537823
CONTACTOR H, F, N VLTG	68537804	68537804	68537804	68537804	68537804
CAPACITOR G VLTG	24280811	24280811	2480812	24280837	24280853
CAPACITOR E, V VLTG	24280821	24280822	N/A	N/A	N/A
L.P. SWITCH	68663903	68663903	68663903	68663903	68663903
H.P. SWITCH	68664002	68664002	68664002	68664002	68664002
COMPR CONTROL MODULE	69243706	69243706	69243706	69243706	69243706
BLWR RELAY G/E/V/H 3/16	68537931	68537931	68537931	68537931	68537931
BLWR RELAY – 1 F/U/N	68537936	68537936	68537936	68537936	68537936
TSTAR 33 DEGREE	69613207	69613207	69613207	69613207	69613207
TSTAT 21 DEGREE	69613206	69613206	69613206	69613206	69613206
TSTAT 125 DEGREE	69186203	69186203	69186203	69186203	69186203
TRFRMR A VLTG 40VA	68538070	68538070	68538070	68538070	68538070
TRFRMR A VLTG 75VA	68538071	68538071	68538071	68538071	68538071
TRFRMR G, H VLTG 40VA	68538072	68538072	68538072	68538072	68538072
TRFRMR G, H VLTG 75VA	68538073	68538073	68538073	68538073	68538073
TRFRMR F, U VLTG 40VA	68538074	68538074	68538074	68538074	68538074
TRFRMR F, U VLTG 75VA	68538075	68538075	68538075	68538075	68538075
TRFRMR E VLTG 40 VA	68538082	68538082	68538082	68538082	68538082
TRFRMR E VLTG 75 VA	68538083	68538083	68538083	68538083	68538083
TRFRMR N VLTG 40 VA	68538084	68538084	68538084	68538084	68538084
TRFRMR N VLTG 75 VA	68538085	68538085	68538085	68538085	68538085
CIRCUIT BREAKER 3 AMP	24316702	24316702	24316702	24316702	24316702
CIRCUIT BREAKER 7 AMP	24316706	24316706	24316706	24316706	24316706
HWG COIL	70931001	70931001	70931001	70931001	70931001
HWG PUMP	69178808	69178808	69178808	69178808	69178808
HWG TANK ADPT TACO	S69619804	S69619804	S69619804	S69619804	S69619804
BLWR MTR G, H TAP	68173412		68173464	68173479	
BLWR MTR E, V TAP	68173413		N/A	N/A	N/A
BLWR MTR F, U TAP	68173414			68173480	
BLWR MTR N TAP	N/A	N/A		68173481	68173406
BLWR MTR G, H LEAD		68173409			68173452
BLWR MTR E, V LEAD		68173423	N/A	N/A	N/A
BLWR MTR F, U LEAD		68173408	68173426		68173428
BLWR MTR N LEAD	N/A	N/A	68173405	N/A	68173406
BLOWER CAPACITOR	24280803	24280803	24280806	24280806	24280806
CMC CONTROL BOARD	69626512	69626512	69626512	69626512	69626512

VP SERIES – SERVICE REPLACEMENT PARTS

PURCHPARTS/COMPONENTS	VP030	VP036	VP042	VP048	VP060
BLOWER TOP	S68222004	S68222002	S69739900	S69739901	S69739902
BASE PAN ASSY	S69740202	S69740202	S69740201	S69740201	S69740201
DRAIN PAN ASSY	S68825600	S68825600	S69739400	S69739400	S69739400
CORNER POST	S68826400	S69779900	S68378800	S68378800	S68378800
ELEC CRNR POST GN	S69709101	S69709101	S69709101	S69709101	S69709101
ELEC ACCESS PANEL	S68222303	S68222303	S69739601	S69739601	S69739601
SIDE PANEL	S68825800	S68825800	S69741301	S69741301	S69741301
BLOWER PANEL	S68826000	S68826000	S69739603	S68397400	S68397400
COMPR SERV PANEL	S68825900	S68825900	S69740901	S69740901	S69740901
COND PANEL GN	S69740706	S69740706	S69740701	S69740701	S69740701
COND PANEL GN W/HWG	S69740704	S69740704	S69740703	S69740703	S69740703
WRAPPER GN	S68826200	S68826200	S69741100	S69741100	S69741100
WRAPPER GN BT	N/A	N/A	S69741103	S69741103	S69741103
FILTER RACK TOP 1"	69775912	69775912	69775915	69775915	69775915
FILTER RACK TOP 2"	69775913	69775913	69775916	69775916	69775916
FILTER RACK BOTTOM 1"	69775912	69775912	69775915	69775916	69775915
FILTER RACK BOTTOM 2"	69775913	69775913	69775916	69775916	69775916
CONTROL BOX	69752801	69752801	69752801	69752801	69752801
CONTROL BOX COVER	68366501	68366501	68366501	68366501	68366501
BLOWER WHEEL	68624003	68624018	68624004	68624021	N/A
BLOWER CLIP ASSY	69741400	69741400	69741401	69741401	69741401
BLWR ASSY	S69377300	S69377301	S69377302	S69377303	68536938
FILTER 1"	68544428	68544428	68544414	68544414	68544414
FILTER 2"	68544431	68544431	68544422	68544422	68544422
REVERSING VALVE	69173500	69173500	69173500	69172600	69172600
SOLENOID	69170601	69170601	69170601	69170601	69170601
TXV (EXPANSION VALVE)	68266312	68266312	68266347	68266348	68266349
AIR COIL ASSY	S69740402	S59740402	S69740400	S69740400	S69740401
WATER COIL CU	70930101	70930101	70930101	70251402	70251402
WATER COIL CN	70930102	70930102	70930102	70251403	70251403
SWIVEL CONNECTOR	69706000	69706000	69706000	69706000	69706000
COMPRESSOR G VLTG	68832727	68832731	68832710	68832713	68832716
COMPRESSOR E VLTG	68832726	68832730	N/A	N/A	N/A
COMPRESSOR H VLTG	68832728	68832732	68832711	68832714	68832717
COMPRESSOR N VLTG	N/A	N/A	68832734	68832735	68832736
CONTACTOR G, E, V VLTG	68537800	68537800	68537800	68537811	68537823
CONTACTOR H, F, N VLTG	68537804	68537804	68537804	68537804	68537804
CAPACITOR G VLTG	24280811	24280811	2480812	24280837	24280853
CAPACITOR E, V VLTG	24280821	24280822	N/A	N/A	N/A
L.P. SWITCH	68663903	68663903	68663903	68663903	68663903
H.P. SWITCH	68664002	68664002	68664002	68664002	68664002
COMPR CONTROL MODULE	69243706	69243706	69243706	69243706	69243706
BLWR RELAY G/E/V/H 3/16	68537931	68537931	68537931	68537931	68537931
BLWR RELAY – 1 F/U/N	68537936	68537936	68537936	68537936	68537936

VP SERIES – SERVICE REPLACEMENT PARTS

SHEET METAL		VP030	VP036	VP042	VP048	VP060
TSTAR 33 DEGREE		69613207	69613207	69613207	69613207	69613207
TSTAT 21 DEGREE		69613206	69613206	69613206	69613206	69613206
TSTAT 125 DEGREE		69186203	69186203	69186203	69186203	69186203
TRFRMR A VLTG 40VA		68538070	68538070	68538070	68538070	68538070
TRFRMR A VLTG 75VA		68538071	68538071	68538071	68538071	68538071
TRFRMR G, H VLTG 40VA		68538072	68538072	68538072	68538072	68538072
TRFRMR G, H VLTG 75VA		68538073	68538073	68538073	68538073	68538073
TRFRMR F, U VLTG 40VA		68538074	68538074	68538074	68538074	68538074
TRFRMR F, U VLTG 75VA		68538075	68538075	68538075	68538075	68538075
TRFRMR E VLTG 40 VA		68538082	68538082	68538082	68538082	68538082
TRFRMR E VLTG 75 VA		68538083	68538083	68538083	68538083	68538083
TRFRMR N VLTG 40 VA		68538084	68538084	68538084	68538084	68538084
TRFRMR N VLTG 75 VA		68538085	68538085	68538085	68538085	68538085
CIRCUIT BREAKER 3 AMP		24316702	24316702	24316702	24316702	24316702
CIRCUIT BREAKER 7 AMP		24316706	24316706	24316706	24316706	24316706
HWG COIL		70931001	70931001	70931001	70931001	70931001
HWG PUMP		69178808	69178808	69178808	69178808	69178808
HWG TANK ADPT TACO		S69619804	S69619804	S69619804	S69619804	S69619804
BLWR MTR G, H	TAP	68173412		68173464	68173479	
BLWR MTR E, V	TAP	68173413		N/A	N/A	N/A
BLWR MTR F, U	TAP	68173414			681734800	
BLWR MTR N	TAP	N/A	N/A		68173481	68173406
BLWR MTR G, H	LEAD		68173409			68173452
BLWR MTR E, V	LEAD		68173423	N/A	N/A	N/A
BLWR MTR F, U	LEAD		68173408	68173426		68173428
BLWR MTR N	LEAD	N/A	N/A	68173405	N/A	68173406
BLOWER CAPACITOR		24280803	24280803	24280806	24280806	24280806
CMC CONTROL BOARD		69626512	69626512	69626512	69626512	69626512

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