



Enviromax

Vertical Modular Heat Pumps Product Manual

MODEL AVMC36HPWN



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How To Use This Manual

This manual is intended to be a comprehensive guide to the Enviromax line of vertical heat pumps. It contains installation, troubleshooting, maintenance, and application information. The information contained in this manual is to be used by the installer as a guide only. This manual does not supersede or circumvent any applicable national or local codes.

If you are installing the Enviromax 10 heat pump, first read Chapter 1 and scan the entire manual before beginning the installation as described in Chapter 2. Chapter 1 contains general, descriptive information and provides an overview which can speed up the installation process and simplify troubleshooting.

If a malfunction occurs, follow this troubleshooting sequence:

1. Make sure you understand how the Enviromax™ HP works (Chapters 1 & 3).
2. Identify and correct installation errors (Chapter 2).
3. Refer to the troubleshooting information in Chapter 4.

If you are still unable to correct the problem, contact Enviromax for additional assistance.

Please read the following “Important Safety Precautions” before beginning any work.

Important Safety Precautions

1. USE CARE when LIFTING or TRANSPORTING equipment.
2. TRANSPORT the UNIT UPRIGHT. Laying it down on its side may cause oil to leave the compressor, resulting in DAMAGE upon START-UP.
3. TURN ELECTRICAL POWER OFF AT THE breaker or fuse box BEFORE installing or working on the equipment. LINE VOLTAGES ARE HAZARDOUS or LETHAL.
4. OBSERVE and COMPLY with ALL applicable PLUMBING, ELECTRICAL, and BUILDING CODES & ordinances
5. SERVICE may be performed ONLY by QUALIFIED and EXPERIENCED PERSONS.
 - * Wear safety goggles when servicing the refrigeration circuit
 - * Beware of hot surfaces on refrigerant circuit components
 - * Beware of sharp edges on sheet metal components
 - * Use care when recovering or adding refrigerant
6. Use COMMON SENSE - BE SAFETY CONSCIOUS

This is the safety alert symbol . When you see this symbol on the Scholar unit and in the instruction manuals be alert to the potential for personal injury. Understand the signal word DANGER, WARNING and CAUTION. These words are used to identify levels of the seriousness of the hazard.



Failure to comply will result in death or severe personal injury and/or property damage.



Failure to comply could result in death or severe personal injury and/or property damage.



Failure to comply could result in minor personal injury and/or property damage.

IMPORTANT is used to point out helpful suggestions that will result in improved installation, reliability or operation.

Specifications subject to change without notice.

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Description & Specs

1.1 General Description

The Enviromax vertical heat pump system provides heating and cooling in a wide variety of applications from computer rooms to event pavillions.

The Enviromax model is designed for easy installation and service. Major components are accessible for service beneath external panels.

The Enviromax heat pumps feature an exclusive electronic control board. The control board consolidates several of the electrical components and improves the air conditioner's reliability. The control board replaces the blower relay, the lockout relay, the compressor time delay and the timed low pressure bypass found in previous versions. In addition, the control board has LED's to indicate operating status and fault conditions to assist the service technician. A complete description of functions of the control board is below.

All Enviromax 10 heat pumps built in Sept. 2006 and later, include a number of changes to ensure more reliable operation. The date of manufacture of the Enviromax heat pump is contained in the serial number. The last two digits of the serial number are the date code; the first digit indicates the month and the second indicates the year. To determine the month and year of manufacture, please refer to the following table:

Serial Number Date Code

A = January	G = July	S = 2005
B = February	H = August	T = 2006
C = March	J = September	U = 2007
D = April	K = October	V = 2008
E = May	L = November	W = 2009
F = June	M = December	

The changes to the Enviromax 10 heat pump include:

1. The use of a single, larger capacity condensate pump instead of two smaller pumps.
2. The wire harnesses connecting the control board to the internal thermostat and the thermostat to the plug have changed. Note: this harness is not compatible with earlier models.
3. The addition of an electronic control board. A complete description of the operation of this control board is described below.

Defrost Control

The defrost control is designed to control the removal of ice or frost from the outdoor coil of the Enviromax Heat Pump. De-icing is initiated at a 30 minute interval, provided the outdoor coil is below a preset initiation temperature (approximately -2.2°C (28°F)). The de-icing cycle is terminated as soon as the outdoor coil rises to a preset temperature 13.3 °C (56°F) or after a preset length of time. If the outdoor coil cannot reach the desired preset temperature due to weather conditions, or a malfunction, a "time-safe" termination will occur after ten minutes. This termination of the de-ice cycle will restore the heat pump to the normal heat cycle. The defrost will be initiated at the time interval set as noted above, if the outdoor coil temperature is below -2.2°C (28°F) when the timer triggers.

High Pressure Switch

The high pressure switch is located on the liquid line. It opens at 400 PSIG and closes at 300 PSIG. This protects the Enviromax Heat Pump if airflow is reduced or lost through the heat transfer surface performing the condenser function. See "Lockout" section below for a complete description of the operation of the high pressure switch.

Loss of Charge Switch

The loss of charge switch is located on the liquid line. It opens at 35 PSIG and closes at 60 PSIG. This switch protects the Enviromax Heat Pump if there is a loss of refrigerant. See "Lockout" section below for a complete description of the operation of the loss of charge switch.

Control Board Modes of Operation

Normal:

24 VAC power must be continuously applied to "R" and "C". Upon a call for cooling "Y" and with the high pressure switch (HPS) closed, the compressor will be energized. (Note: See the delay on make feature.) The compressor will remain energized during the 3 minute timed low pressure by-pass cycle, if the loss of charge (LOC) is open the compressor will de-energize.

Lockout:

If either of the fault conditions (LOC or HPS) occurs twice, the control board will enter into and indicate the lockout mode. In the lockout mode, the compressor is turned off. If there is a call for indoor air flow "G", the blower remains energized, the alarm output is energized and the status led will blink to indicate which fault has occurred. When the lockout condition is cleared, the unit will reset if the demand for the thermostat is removed or when the power is reset. With the control board, the user can now have normally closed contacts by moving a wire on the control board. The Enviromax 10 heat pumps are factory wired to be normally open.

Delay on Break:

If the compressor is de-energized due to a loss of a cooling "Y" call or the first fault, the unit re-start will be delayed 3 minutes from the time the contactor is de-energized. (Note: There is no delay on break if the lockout condition is reset.)

Delay on Make:

On initial power up only, the unit will wait 0.03 to 10 minutes from the cooling "Y" call before allowing the contactor to energize.

Low Pressure By-pass Time:

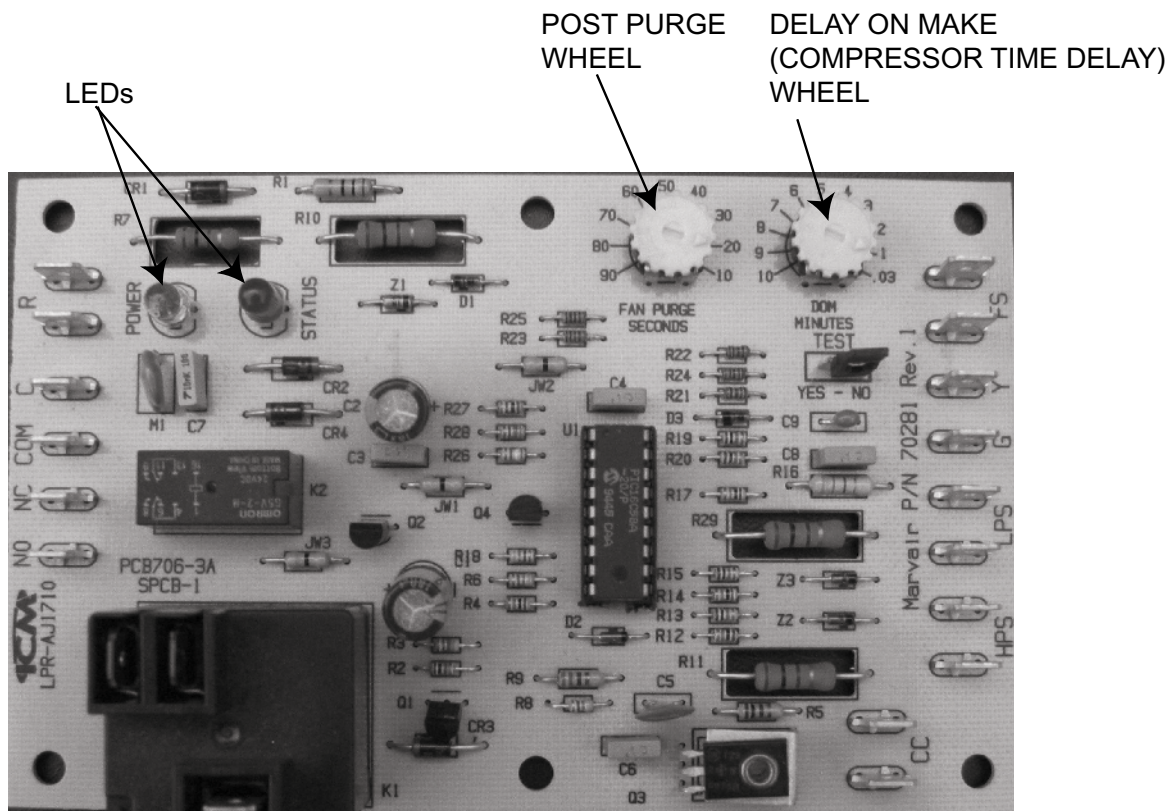
While running or starting, the loss of charge switch (LOC) fault condition will be by-passed for 3 minutes before de-energizing the contactor.

Post Purge:

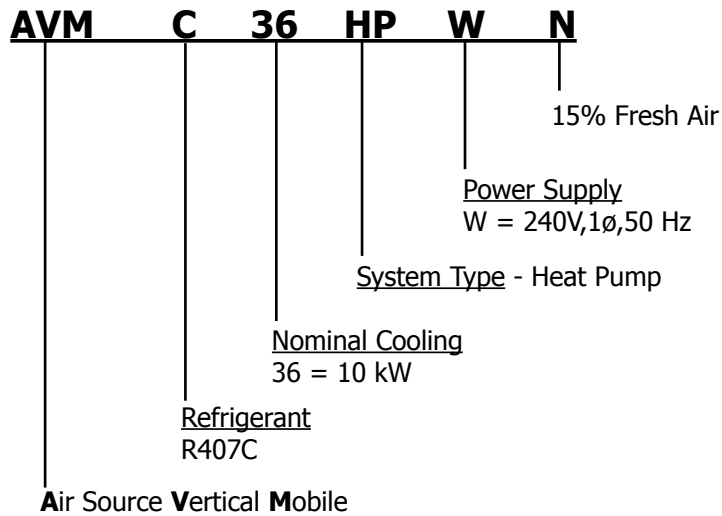
Upon a call for indoor airflow "G" the blower will energize immediately. When in the cooling mode, the blower will remain energized for 10 to 90 seconds (adjustable) after the compressor has been de-energized.

LED Indicator Lights:

COLOR	TYPE	STATUS	DESCRIPTION
GREEN	POWER	CONSTANT ON	24 VAC POWER HAS BEEN APPLIED
RED	STATUS	CONSTANT ON	NORMAL OPERATION
		1 BLINK	HIGH PRESSURE SWITCH HAS OPENED TWICE
		2 BLINKS	LOW PRESSURE SWITCH HAS OPENED TWICE



Model Identification



1.2 Ratings & Specifications

Table 1. m³/hr @ ESP (Wet Coil)

MODEL	0.25 Pa	0.50 Pa	0.75 PA
36	1580	1425	1270

CFM = Cubic Feet per Minute - Indoor Air Flow

ESP = External Static Pressure Pa + m³/hr

Table 2. Filter Size (mm)

MODEL	DESCRIPTION	TYPE
80140	Return Air Filter*, 750 x 395 x 22mm	Spun Filament, Disposable
*Included with return air filter grille.		

Table 3. Ship Weight

MODEL	AVMC36HPWN
SHIP WEIGHT	175 kg

1.3 General Operation

Refrigerant Cycle (Cooling Mode)

The Enviromax™ HP uses R-407C refrigerant in a conventional vapor-compression refrigeration cycle to transfer heat from air in an enclosed space to the outside. A blower assembly blows indoor air across the evaporator. Liquid refrigerant passing through the evaporator is boiled into gas by heat removed from the air. The warmed refrigerant gas enters the compressor where its temperature and pressure are increased. The hot refrigerant gas condenses to liquid as heat is transferred to outdoor air blown across the condenser by the condenser fan. Liquid refrigerant is metered into the evaporator through capillary tubes to repeat the cycle.

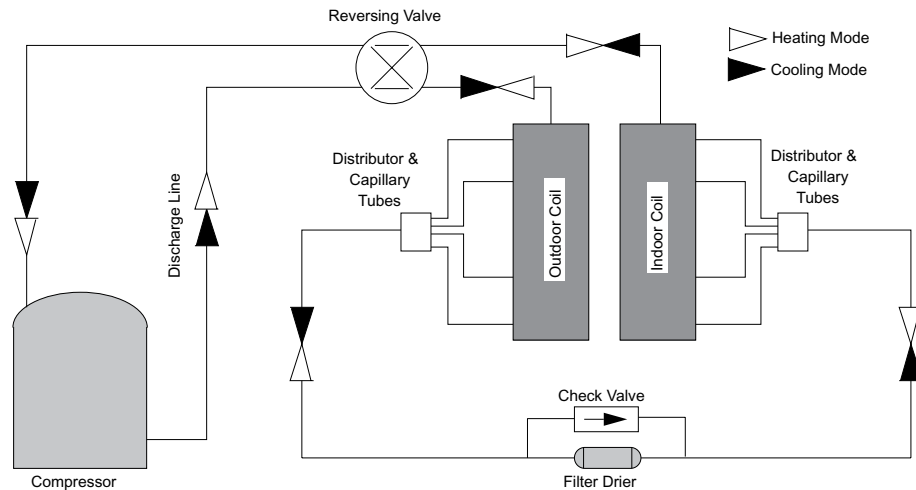


Figure 1. Refrigerant Circuit

Heating Mode

During heating mode a special reversing valve reverses the flow of refrigerant through the system exchanging the roles of the condenser and evaporator. Now the outdoor coil becomes the evaporator and the indoor coil becomes the condenser. The refrigerant then flows through the outdoor coil, picks up heat and becomes vaporized. The vapor then enters the compressor where it is compressed to a higher temperature. Next it is pumped to the indoor coil where the heat will be released into the room. The compressed refrigerant vapor will condense to its liquid state as it gives up heat. Finally, liquid flows through the capillary tube into the evaporator where the cycle will be repeated.

1.4 Electrical Diagrams

The compressor is energized with a contactor controlled by a 24 VAC pilot signal (see Figure 2).

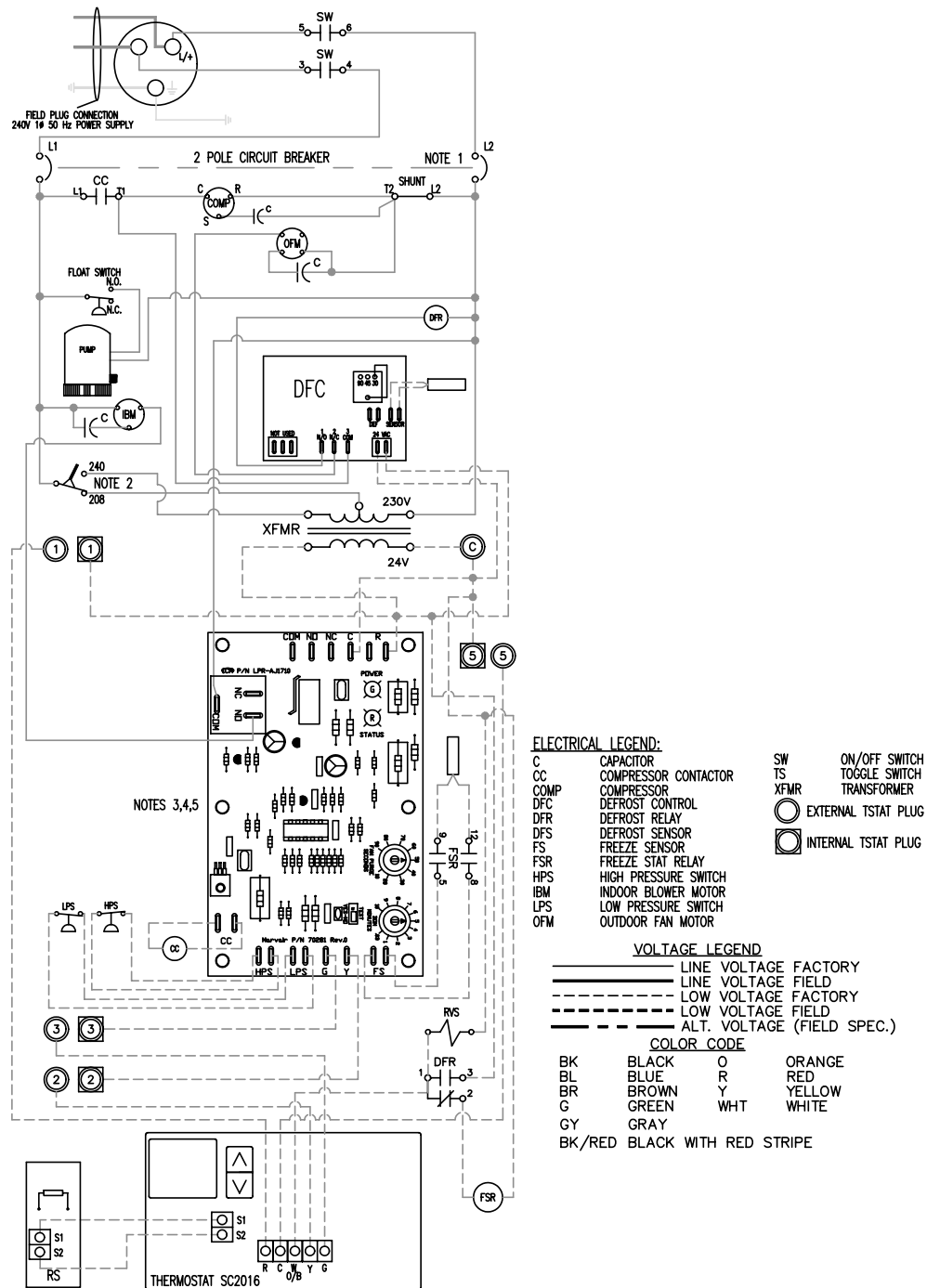


Figure 2. Typical Electric Schematic for Models AVMC36

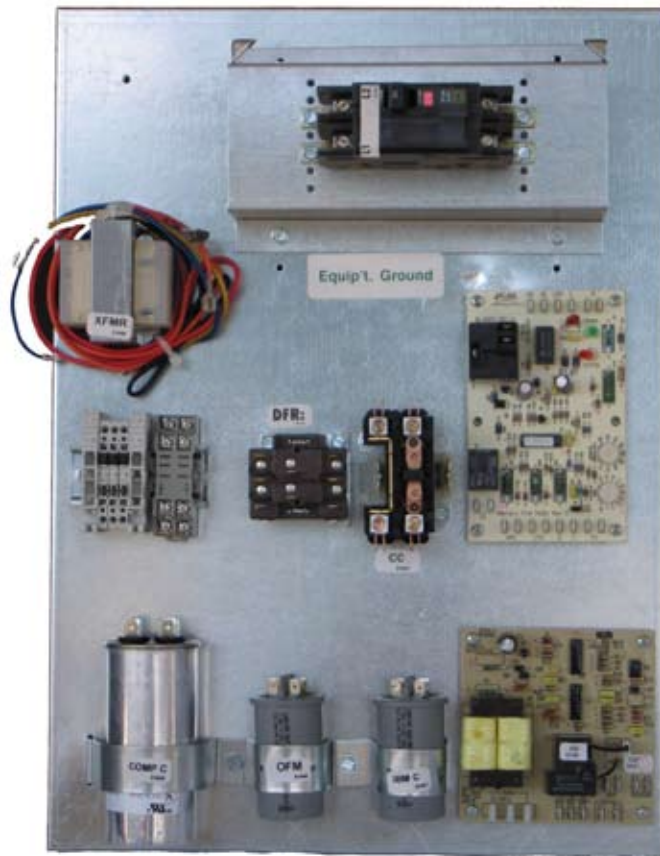


Figure 3. Electrical Box for Models AVMC36

Installation

2.1 Installation Requirements

General

You must consider all of the following when choosing the installation site:

1. **Noise.** Install the unit so that the least amount of noise will be transmitted to inhabited spaces.
2. **Condensate Drainage.** The Enviromax heat pump can produce over 4 litres per hour of condensate during normal operation. This condensate must be disposed of to a suitable location.
3. **Placement.**
 - A) Place the unit in a shaded area, if possible. (For units placed outside a building.)
 - B) Install it above ground for protection against flooding.
 - C) The unit exhausts air. Be sure that the airflow is not impeded by shrubbery or other obstructions.
4. **Airflow Requirements.** Note the minimum air flow requirements (section 2.2). Keep duct lengths as short as possible. Do not obstruct airflow through the unit. If the condenser air discharge is ducted, it must not exceed 5 metres in length. If the supply air is ducted, it must not exceed 20 metres in length.
5. **Clearances.** Airflow entering the outdoor coil from either side and exiting the coil from the front must not be hindered or obstructed. A minimum clearance of 600 mm is recommended from the front of the unit for service. Service access for the condensate pumps is from the left side of the unit when facing the supply and return air openings. Access to the indoor coil is from the top of the unit. In the event that this coil must be replaced or repaired, 600 mm clearance should be provided from the top of the heat pump or the unit must be removed from the structure.
6. **Codes.** Make sure your installation conforms to all applicable electrical, plumbing, building, and municipal codes. Some codes may limit installation to single story structures.
7. **Electrical Supply.** The power supply must have the appropriate voltage, phase, and ampacity for the model selected. Voltage must be maintained above minimum specified values listed below. Refer to the unit data plate for ampacity requirements.

Table 4. Voltage Limitations

Electrical Rating Designations*	W
Nominal Voltage	240
Phase	50
Minimum Voltage	197
Maximum Voltage	253

* Letters refer to model number code designations. Refer to page 5.

2.2 Minimum Airflow Requirements

The duct system must be engineered to assure sufficient air flow through the Enviromax™ HP, even under adverse conditions such as dirty filters, etc. Proper engineering will insure longevity and maximum performance from the Enviromax™ HP.

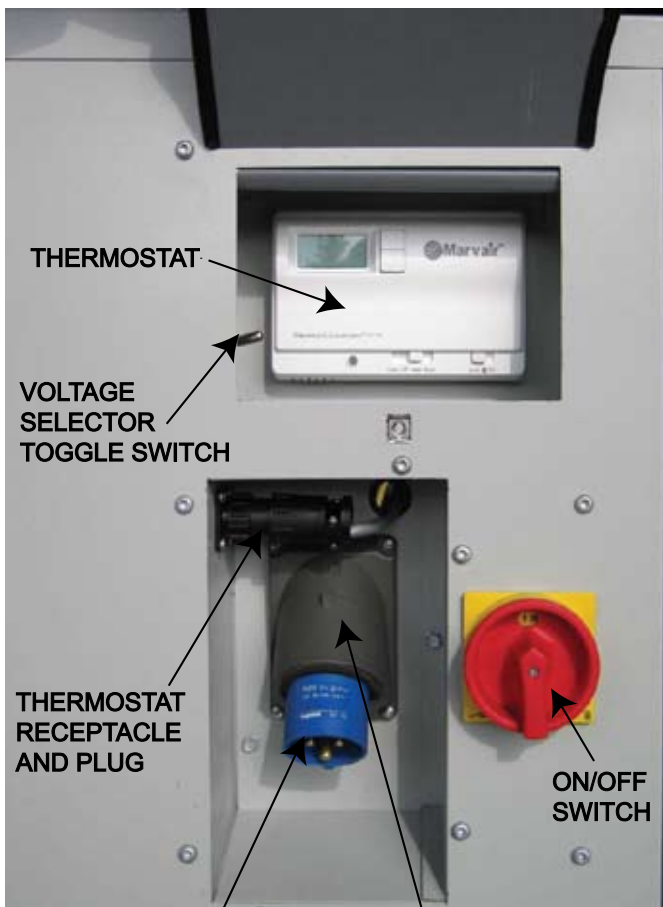
Basic Model	Maximum Total Static - Supply Air	Minimum Filter Area
36	.75 Pa	1935 sq. mm.

Table 5. Maximum Static Pressure

2.3 Electrical Connections

The Enviromax10 units can operate on voltages from 195 volts to 245 volts. They are factory wired for operation on a 221 volt to 245 volt power supply. To determine the voltage at your site, using a voltage meter, carefully measure the voltage at the end of the power receptacle or on the line side of the disconnect switch located in the electrical box located inside the Enviromax 10 heat pump. If the power supply is 225 volts or less, the toggle switch to the left of the thermostat on the side of the unit must be placed in the DOWN position. If the voltage is more than 225V, the toggle switch must be in the UP position. THE INTERNAL TRANSFORMER IS NOT DESIGNED TO POWER OTHER EXTERNAL DEVICES. NOTE: The power must be OFF before moving the toggle switch.

POWER AND THERMOSTAT CONTROL



LINE VOLTAGE PLUG
(POWER CORD NOT SHOWN)

LINE VOLTAGE
RECEPTACLE



IF VOLTAGE IS ABOVE 225V, PLACE TOGGLE IN **UP** POSITION. IF VOLTAGE IS LESS THAN OR EQUAL TO 225V, PLACE TOGGLE IN **DOWN** POSITION
NOTE: THE VOLTAGE SHOULD BE SELEC WITH THE SUPPLY POWER OFF.

2.4 Condensate

The condensate produced during the cooling operation and water produced during the defrost cycle must be disposed of to a suitable location. To dispose of the water, a pump is factory installed in the Enviromax heat pump. The water pump is located beneath the outdoor coil in a sump. Water produced during the defrost cycle collects in the lower pan and flows into the sump. Condensate from the upper pan flows directly into the sump. When the float switch in the pump closes, water is pumped from the sump through tubing to the side of the heat pump. Tubing should be field installed onto the fitting and the tubing routed to a suitable location away from the heat pump.

PUMP ACCESS



PUMP

Important: Double-check all electrical connections before applying power.

3.1 Check Out of Cooling Cycle

Procedure:

1. Set the thermostat "system switch" in the COOL position.
2. Lower the cooling temperature to a setting lower than the room temperature. The compressor, outdoor fan and indoor fan should cycle on after the time delays have cycled.
3. To stop cooling, slowly raise the thermostat set point to a temperature higher than the ambient.

If the unit fails to operate, refer to the troubleshooting information in Chapter 4.

Follow the same procedure for additional units.

3.2 Check Out of Heating Cycle

Procedure:

1. Place the thermostat system switch to "Heat".
2. Raise the heating temperature to a setting which is higher than the room temperature. The fan and compressor should cycle on after time delay has cycled.
3. Move the system switch to the "Off" position. All functions should stop.

Troubleshooting

4.1 Overview

A comprehensive understanding of the operation of the Enviromax™ HP is a prerequisite to troubleshooting. Please read the Chapter 1 for basic information about the unit.

Enviromax™ heat pumps are thoroughly tested before they are shipped from the factory. Of course, it is possible that a defect may escape undetected, or damage may have occurred during transportation. However, the great majority of problems result from installation errors.

If you experience difficulties with the Enviromax™ HP, please review the installation steps in Chapter 2.

Much time can be saved by taking a thoughtful and orderly approach to troubleshooting. Start with a visual check - are there loose wires, crimped tubing, missing parts, etc.? Begin deeper analysis only after making this initial inspection.

The troubleshooting information in this manual is basic. The troubleshooting section contains problem / solution charts for general problems, followed by a compressor section.

Not every problem can be anticipated. If you discover a problem that is not covered in this manual, we would be very grateful if you would bring it to the attention of our service department for incorporation in future revisions.

As always, please exercise caution and good judgement when servicing the Enviromax™ unit. Use only safe and proven service techniques. Use safety goggles when servicing the refrigeration circuit.

The refrigerant circuit has hot surfaces, and the electrical voltages inside of the unit may be hazardous or lethal. **SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED AND EXPERIENCED PERSONS.**

4.2 Failure Symptoms Guide

PROBLEM/SYMPTOM	LIKELY CAUSE(S)	CORRECTION
A. Unit does not run.	1. Power supply problem. 2. Blown fuse or breaker. 3. Shut off by external thermostat or thermostat is defective. 4. Internal component or connection failure.	1. Check power supply for adequate phase and voltage. Check wiring to unit and external breakers or fuses. 2. Check circuit protection devices for continuity. 3. Check operation of thermostat. 4. Check for loose wiring. Check components for failure.
B. Unit runs for long periods or continuously; cooling is insufficient.	1. Unit undersized for job. 2. Loss of refrigerant. 3. Component failure. 4. Dirty filter or reduced airflow.	1. Add additional units for greater capacity. 2. Check for proper charge and possible leak. 3. Check internal components, especially compressor for proper operation. 4. Check air filter(s). Check blower operation. Remove airflow restriction.
C. Unit cycles on Compressor Overload	1. Loss or restriction of airflow. 2. Restriction in refrigerant circuit. 3. Refrigerant overcharge (following field service)	1. Check blower assembly for proper operation. Look for airflow restrictions, e.g., the air filter. Check blower motor and condenser fan. 2. Check for blockage or restriction, especially filter drier and capillary tube assembly. 3. Evacuate and recharge to factory specifications.
D. Unit blows fuses or trips circuit breaker.	1. Inadequate circuit ampacity. 2. Short, loose, or improper connection in field wiring. 3. Internal short circuit. Loose or improper connection(s) in unit. 4. Excessively high or low supply voltage..	1. Note electrical requirements in Chapter 2 and correct as necessary. 2. Check field wiring for errors. 3. Check wiring in unit. See wiring and schematic diagrams. Test components (especially the compressor) for shorts. 4. Note voltage range limitations specific to the compressor troubleshooting section.
E. Water on floor near unit or leaking from cabinet.	1. Obstruction in condensate line. 2. Obstruction or leak in condensate pan. 3. Unit is not level. 4. Defective condensate pump.	1. Check for clog or restriction. 2. Check pan for leak or blockage. 3. Level unit. 4. Replace or repair pump.

4.3 Compressor Troubleshooting

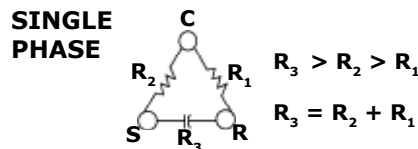
NOTE: It is important to rule out other component failures before condemning the compressor.

The following electrical tests will aid diagnosis:

1. **Start-Up Voltage:** Measure the voltage at the compressor terminals during start-up. The voltage must exceed the minimum shown in Table 4, section 2.2, or compressor failure is likely. A low voltage condition must be corrected.
2. **Running Amperage:** Connect a clamp-on type ammeter to the (common) lead to the compressor. Turn on the supply voltage and energize the unit. The compressor will initially draw high amperage; it should soon drop to the RLA value or less. If the amperage stays high, check the motor winding resistances.

NOTE: Feel the top of the compressor to see if it has overheated. If it is hot, the internal overload may be open. You may have to wait several hours for it to reset.

3. **Motor Winding Resistances:** Using a digital volt-ohm meter (VOM), measure the resistance across the compressor windings as shown below.



Resistance can be measured as shown above. Any deviation from above values could indicate a defective compressor.

4. **High Voltage/Insulation Test:** Test internal leakage with a megohmmeter. Attach one lead to the compressor case on a bare metal tube and to each compressor terminal to test the motor windings. A short circuit at high voltages indicates a motor defect. Do not do this test under vacuum.
5. On single phase models, check the capacitor by substitution.

Maintenance

5.1 Scheduled Maintenance

Marvair® strongly recommends that the heat pump be serviced a minimum of once a year. At this time the filter, evaporator coil, condenser coil, the cabinet, and condensate drains should be serviced as described below. Also at this time, the heat pump should be operated in the cooling and heating cycles as described in Chapter 3, Start-Up. In addition to this seasonal check-out, the Enviromax™ HP should be maintained as follows:

Air Filter

Replace the air filter whenever it is visibly dirty.

Evaporator

If the evaporator becomes clogged or dirty, it may be cleaned by careful vacuuming or with a commercial evaporator cleaning spray. DO NOT use a solvent containing bleach, acetone, or flammable substances. Turn power off before cleaning. Be careful not to wet any of the electrical components. Be sure the unit has dried before restarting.

Condenser

Periodically inspect the outdoor condenser coil and the cabinet air reliefs for dirt or obstructions. Remove foreign objects such as leaves, paper, etc.

If the condenser coil is dirty, it may be washed off with a commercial solvent intended for this purpose. TURN OFF POWER BEFORE CLEANING! Be sure that all electrical components are thoroughly dry before restoring power.

Cabinet

The cabinet may be cleaned with a sponge and warm, soapy water or a mild detergent. Do not use bleach, abrasive chemicals or harmful solvents.

Drains

Regularly check the drain, the upper condensate pan the lower drain pan and the sump. The condensate produced during the cooling cycle collects in the upper pan and flows through tubing into a sump located beneath the lower coil. In the heating mode, water produced during the defrost cycle flows directly into the sump. A pump, located in the sump, pumps the water out of sump, through tubing to the side of the Enviromax heat pump. Check to see that all drain pans, interconnecting tubing are free of any debris and water flows freely. If a commercial drain solvent is used, flush out the drain pan and system with plenty of fresh water to prevent corrosion..

5.2 Winter Storage

If the Enviromax heat pump is to be stored in a site where temperatures can drop to 0°C or lower, water in the sump may freeze and damage the pump. To prevent damage to the pump, remove the drain plug located at the bottom of the sump and allow the water to drain from the sump. Replace the drain plug after all water is removed from the sump.

Parts List

6.1 Parts List

Recommended Spare Parts	AVMC36HP (N)
Compressor, Scroll	10293
Capacitor, Compressor (50 ufd / 370 Volts) 50 Hz.	50310
Distributor - Indoor	20092 (6)
Orifice - Cooling	81222 (.068)
Indoor Coil (6 Circuits, 3CY1202D-28 x 34)	60076
Distributor - Outdoor	20121 (4)
Orifice - Heating	20083 (.055)
Outdoor Coil (4 Circuits, 3CY1202D-28 x 34)	60140
Blower Assembly, Indoor	30043A
Motor, Indoor (1/4 HP, 825 cfm)	40079
Capacitor, Indoor (7.5 ufd / 370 Volts)	50238
Motor Mount, Indoor	80455
Motor, Outdoor (1/4HP 825cfm)	40079
Capacitor, Outdoor (7.5 ufd / 370 Volts)	50238
Motor Mount, Outdoor	80420
Fan Blade, Outdoor	30153
Loss of Charge Switch	70050
High Pressure Switch (400 psig)	51726
Sensor, Freeze Stat	70369
Filter Drier (Reversible)	70388
Reversing Valve, RV, V6-412080	20135B
Solenoid Coil, RV	50225B
Contactor, Compressor, 1 Pole, 30 Amps	50077
Low Voltage Transformer (40 VA)	50141
Circuit Breaker, 30 Amp	70171
Thermostat, internal & external	50186
Internal Sensor for thermostat	50189
Filter (750mm x 395mm x 25mm)	80136
Compressor Jacket (Optional)	20044
Switch, Toggle, DPDT for selecting voltage	70027
Block, Terminal, Light Gray	80520 (Three)
Link, Siemens, 500 MM Long Strip	80522
Plug, Siemens, 1 Pin	80523 (Three)
Retainer End, Siemens	80524 (Two)
Din Rail (1.75")	50503
Socket for P/N 50511 24 VAC DPDT Relay	50501
Relay, DPDT, 24 VAC	50511
Control Board	70281
Defrost Control	70378
Defrost Control relay	50200
Line Voltage Receptacle	80539
Unit On/Off Switch	80542
Harness, Control Box to Thermostat Plug	01521
Harness, Thermostat Plug to Thermostat	01520
Harness, 10 Meter Thermostat Extension (Accessory)	01522
Outdoor Drain Pan Pump	50417
Switch, Float, On/Off	70355
Thumb Screw	90987
Sheet Metal & Side Grilles	
Top Panel (above outdoor coil)	M/04609-GY
Side Panel (side for pump access)	M/06076-GY
Top Panel	M/05062-GY
Painted Panel with Supply & Return Openings. Slides down from top.	M/05884-GY
Side Panel (side with electrical connections)	M/05950-GY
Thermostat Cover	M/05952-GY
Side Grille for pump access	MC/06043
Side Grille	MC-05049
Grilles	
Supply Grille	80676
Return Filter Grille	80673
Mounting box/flange for supply grille	M/05886-GY
Mounting box/flange for return filter grille	M/05887-GY