ISO 9001 2000 REGISTERED COMPANY

Scholar III™
Heat Pumps & Air Conditioners
(CSI 15740)

MAINTENANCE & SERVICE

Model VAIA
2, 2.5, 3, 3.5, 4 & 5 Tons

CAUTION!!

Read all instructions before use. Retain this manual for future reference. This equipment should be installed and serviced only by a trained professional HVAC service person.

Due to continuous product improvement, use only the current issue of this manual. The latest version can be downloaded from the Marvair website - www.marvair.com.

Scholar III™

Unitary Air-Conditioners AC
Unitary Air-Source Heat Pumps HP

Manufactured By:

Marvair® Division of AIRXCEL®, Inc.

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SIII M&S 8/09-1

SECTION 15700

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

MAINTENANCE & SERVICE MANUAL

FOR SCHOLAR III™ HEAT PUMP & AIR CONDITIONER, MODEL VAIA (CSI 15740)

TABLE OF CONTENTS

SECTION 15700

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

The purpose of this manual is to provide instructions for maintenance and service for the Marvair® Scholar III™ series of heat pumps and air conditioners. In addition to this manual, there are other pieces of literature available from Marvair. The Engineering and Design Manual details the design and selection of HVAC systems using the Scholar III series. The Installation and Start-Up manual covers the installation of the unit and various accessories and the initial start-up of the unit. An overview of the product line can be found in the Heat Pump and Air Conditioner Product Data Sheets. The current version of this literature can be found and downloaded from the Marvair website at www.marvair.com.

To minimize sound levels within the classroom, certain options should be selected. These options are designated by  throughout the guideline.

1.1 GENERAL OPERATION

A. Scholar III™ heat pumps and air conditioners are designed to provide quiet comfort to the classroom.

   In cooling mode, the compressor will cycle on to provide the cooling required. The system provides cooling, dehumidification and air circulation.

   In heating mode the compressor (heat pump only) will cycle on to provide the heating required. The system provides heating and air circulation. At lower outdoor temperatures, additional heating capacity may be provided by an optional electric resistance heater or a hot water/steam coil.

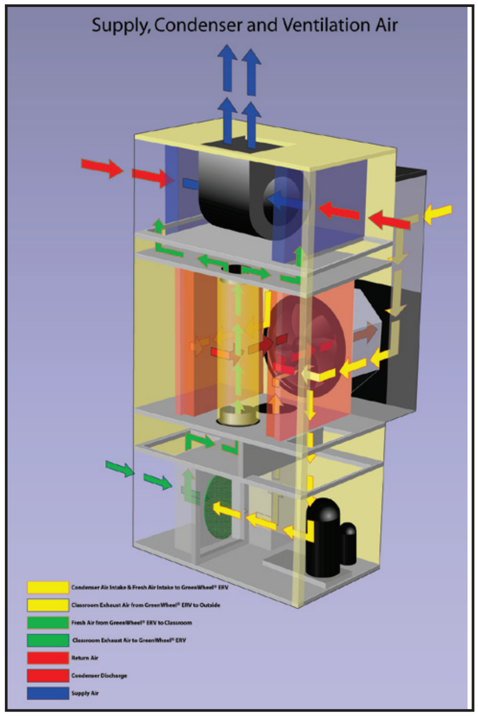
   Ventilation air may be provided by the manual or motorized fresh air vent, power vent or GreenWheel® ERV. These ventilation systems operate when there is a call for cooling or heating or independently to provide fresh air. Note that with the manual, motorized fresh air vent and the power vent options, if the compressor is not operating and the indoor blower is running, unconditioned outside air is being introduced into the classroom. The GreenWheel ERV provides tempered outside air.

   Control systems are either a remote external thermostat, internal thermostat, or a direct digital control interfacing with the building automation system (BAS).

   Hot Gas Reheat (HGR) Dehumidification (Option). To provide on demand dehumidification, the Scholar III™ heat pump or air conditioner can have a factory installed hot gas reheat coil to allow dehumidification through continued cooling with discharge air reheated to avoid over cooling the classroom. The hot gas dehumidification option can be used with electric, steam or hot water heat. The operation of the HGR is controlled by a three-way heat reclaim valve. The HGR coil is sized to provide a heating capacity approximately equal to the sensible capacity of the unit When the demand for cooling is satisfied and the humidity controller calls for dehumidification, hot gas is directed to a reheat coil downstream from the evaporator coil to add heat to the dehumidified, chilled air supplied to the classroom. Hot gas reheat is available with motorized fresh air, PowerVent and GreenWheel® ventilation systems.

Marvair® recommends that for optimum performance, hot gas reheat be used in conjunction with the GreenWheel® heat recovery ventilator. When used with other ventilation options, hot gas reheat may not maintain satisfactory control of the humidity in the classroom over all outdoor conditions.

Figure 1. Conditioned Air Flow and Fresh Air Flow



1.2 MODEL IDENTIFICATION

The Scholar III™ heat pump and air conditioner identification numbering system is shown below. The model identification number is on the data label. The data label is at the bottom of the of left side panel.

VAI S A • • • • • • III

- **VAI** — Vertical Air Indoor Source
- **S** — 2-Stage Compressor
- **A** — Refrigerant: R-410A
- **•** — Nominal Cooling:
  - 24 = 24,000 BTUH
  - 30 = 29,000 BTUH
  - 36 = 35,000 BTUH
  - 40 = 40,500 BTUH
  - 48 = 48,000 BTUH
  - 60 = 59,000 BTUH
- **•** — System Type:
  - HP = Heat Pump
  - AC = Air Conditioner
- **•** — Power Supply:
  - A = 208/230V,1,60Hz
  - C = 208/230V,3,60Hz
  - D = 460V,3,60Hz
- **•** — Heat – kW:
  - 000 - No Heat
  - 050 = 5 kW
  - 075 = 7.5 kW
  - 100 = 10 kW
  - 150 = 15 kW
  - 099 = 99 (Hot Water)
- **•** — Configuration:
  - N = Manual Damper (std)
  - H = GreenWheel® ERV
  - Q = GreenCube™ ERV
  - B = Motorized Damper
  - J = Power Vent with Motorized Damper
- **•** — Special Options:
  - G = Hot Gas Reheat/Dehumidification
- **III** — Configuration:
  - III = Scholar III

IMPORTANT
WHEN SCHOLAR III™ SYSTEMS ARE INSTALLED, MODEL NUMBER AND SERIAL NUMBERS ARE TO BE RECORDED AND MAINTAINED IN A LOCATION FOR IMMEDIATE ACCESS WHEN REQUESTING FURTHER INFORMATION.

2.1 START-UP PROCEDURE

A. This start-up procedure applies to Scholar III™ models equipped with a remote (wall mounted) thermostat and electric supplemental heat.

1. Turn the disconnect in the Scholar III™ unit to "OFF" position and double check all electrical connections before applying power.

2. Check the voltage supply to the disconnect. If voltage readings are appropriate, proceed with start-up. (See Figure 2 for acceptable voltage ranges.) If voltage readings are not appropriate, check the power leads at the disconnect and the main breaker in the mechanical room. Take appropriate corrective action to supply sufficient voltage to the Scholar III™ disconnect.

Figure 2. Voltage Limitations

Electrical Voltage Designations*	A	C	D
Nominal Voltage	208/230	208/230	460
Phase	1	3	3
Minimum Voltage	197	197	414
Maximum Voltage	253	253	506

*Letters refer to model number code designations.

Example: VAIA 36 HP (A) — Voltage

3. Turn the Scholar III™ disconnect to "ON" position.

4. **Cooling**

   a. Set the remote thermostat system switch to "OFF" position. The blower switch should be in "AUTO" position.

   b. At the remote thermostat, raise the cooling set point several degrees above room temperature. Lower the "heating" set point several degrees below room temperature.

   c. Move the blower switch on the remote thermostat from "AUTO" to "ON" position. The indoor blower should come on, as evidenced by sound and air blowing out of the air supply grille.

   d. Move the blower switch on the remote thermostat from "ON" to "AUTO" and the indoor blower will stop 90 seconds later.

   e. Move the system switch on the remote thermostat from "OFF" to "COOL." Slowly lower the cooling set point to just below room temperature and bring on cooling. Check to see that when the heat pump comes on that the air coming out the discharge grille is cooling. Let unit run for five minutes in this mode. If heat pump continues to run and provide cooling, this verifies that the indoor blower, compressor and outdoor blower are all running.

f. Now slowly raise the cooling set point up toward room temperature until the pump compressor and outdoor blower motor turn off. This will be audible. The indoor blower will continue to run and turn off after 90 seconds.

5a. **Heating (heat pump version only)**

a. Put the thermostat system switch to “HEAT” mode. Wait five minutes after testing on cooling, before testing in heating mode.

b. Slowly raise the heating set point above room temperature until the heat pump comes on. The indoor blowers will start and the heat pump will provide warm air from the air supply grille. Let run for five minutes.

c. Slowly lower the set point temperature until the heat pump compressor and outdoor blower turn off. The indoor blower will turn off 90 seconds later.

5b. **Heating (air conditioner version only)**

a. Set the heating set point below room temperature and put the thermostat system switch on “HT.”

b. Raise the set point slowly and the indoor blower and the electric supplemental heat will turn on at the same time.

c. Lowering the set point slowly should turn the electric heat off. The indoor blower will turn off 90 seconds later.

6. **Automatic Changeover**

For an automatic changeover remote thermostat, the proper functioning of the system can be checked for cooling and heating by using the same sequence as detailed above with the thermostat system switch put in “AUTO” position.

7. **Emergency Heat (heat pump version only)**

This setting on a remote thermostat is to provide electric heat in the event the compressor does not function, and heat is required. In emergency heat mode, the compressor is de-energized and electric heat supplies all heating, controlled by the thermostat.

To check this out, set the heating set point below room temperature and put the thermostat system switch on “EM. HT.”

Raise the set point slowly and the indoor blower and the electric supplemental heat will turn on at the same time.

Lowering the set point slowly should turn the electric heat off. The indoor blower will turn off 90 seconds later.

2.2 VENTILATION SYSTEM CALIBRATION

The ventilation system requires calibration to ensure the appropriate amount of fresh air is delivered to the classroom. Refer to the appropriate following ventilation system and use the instructions to calibrate the system for correct air delivery.

A. Manual Fresh Air System. Fresh air ventilation by means of a damper with pressure relief (opening to outside, but no exhaust blower), a ventilation intake blower and a fan speed controller provides up to 450 cfm of outside air. The damper can be manually adjusted at installation to provide the required ventilation airflow.

The fresh air door should be set in accordance with the amount of fresh air flow required, up to a maximum of 450 CFM. Figure 3 illustrates the fresh air door settings and air flow rates.

Follow the directions in Figure 3 to ensure proper air flow rate settings.

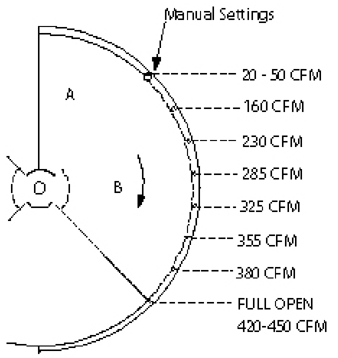
B. Motorized Fresh Air - Configuration B. This ventilation option includes a motorized damper, a fresh air intake blower and motor, and a blower motor speed controller. This ventilation option can provide up to 450 CFM of outside air (but not to exceed 40% of rated airflow) and includes pressure relief (opening to outside, but no exhaust blower). The motorized damper and blowers are controlled by a Programmable Logic Controller (PLC). The PLC will operate the damper and ventilation motors ONLY when the Indoor/Evaporator blower is operating. The PLC is factory wired for this operation by a 24 VAC signal to an input terminal on the PLC. The damper is adjusted after installation for the required rate of ventilation. An optional 24 VAC, 120 VAC or 240 VAC coil relay may be factory installed to control the damper and motor from an external signal, e.g. an EMS or BAS system. A filter on the incoming outside air is standard.

PowerVent - Configuration J (Optional). This ventilation option includes a motorized damper, a fresh air intake blower and motor, an exhaust air blower and motor and one blower motor speed controller. The blower speed controller operates both blowers in tandem. (An optional blower speed control for the exhaust air blower can be factory installed to provide independent control of the exhaust air blower motor and allow pressurization of the classroom).The PowerVent can provide up to 450 CFM of outside air (but not to exceed 40% of rated airflow) and includes active pressure relief. The motorized damper and blowers are controlled by a Programmable Logic Controller (PLC). The PLC will operate the damper and ventilation motors ONLY when the Indoor/Evaporator blower is operating. The PLC is factory wired for this operation by a 24 VAC signal to an input terminal on the PLC. The damper is adjusted after installation for the required rate of ventilation. An optional 24 VAC, 120 VAC or 240 VAC coil relay may be factory installed to control the damper and motor from an external signal, e.g. an EMS or BAS system. A filter on the incoming outside air is standard.

The fresh air door is opened and closed by the motorized drive. Calibration, as shown in Figure 4, will ensure the required amount of air, up to a maximum of 450 CFM, is delivered to the classroom.

Follow the directions in Figure 4 to ensure the proper air flow rate setting. After calibrating the ventilation system, replace the lower front cabinet panel.

Figure 3. Manual Fresh Air System Calibration Procedure



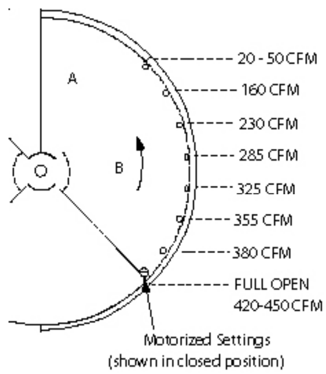
Note: Once calibrated, the manual fresh air system door remains at the set opening at all times.

Inside the lower section, locate the circular calibration plates as noted in the drawing ("A" is fixed, "B" is movable). Remove the screw shown by the arrow from "Manual Settings."

Rotate plate B in a clockwise direction until the hole from which the screw was removed aligns with the hole adjacent to the desired air flow rate, in CFM.

Reinsert the screw into the hole in plate B and firmly drive the screw through the appropriate air flow rate hole, so plate B is securely fastened at the desired opening.

Figure 4. Motorized and PowerVent System Calibration Procedure



Note: Motor drives plate B open to setting when control relay (VMR) is energized. Motor drives plate B to the closed position when control relay (VMR) is deenergized.

Operation is the same for the "Motorized" and "PowerVent" systems.

Inside the lower section, locate the circular calibration plates as noted above in the drawing ("A" is fixed, "B" is movable). Remove the screw shown by the arrow from "motorized settings."

Reinsert the screw into the hole in plate B adjacent to the desired air flow rate, in CFM, and firmly drive the screw in until it bottoms out at the screw head.

C. GreenWheel® ERV. Using best industry standards and practices, measure the fresh air that is being brought into the classroom. For units with one speed controller (std.), adjust the speed of the intake and exhaust blowers by inserting a slotted screw driver into the opening on the controller. The speed controller is located in the control box. Measure the intake air again and adjust the speed of the blowers. Repeat as necessary to meet the fresh air requirements.

For units with the optional variable fan speed controller for the exhaust blower on the GreenWheel® ERV, first measure the air being introduced into the classroom using best industry standards and practices. Adjust the speed of the intake air blower until the required outside air is being brought into the classroom.

Now measure the exhaust air from the classroom. Adjust the speed of the exhaust air blower until the required air is being exhausted from the classroom. The exhaust air controller is in the control box. It is usual practice to pressurize the classroom by exhausting slightly less air than is being brought into the classroom.

3.1 ELECTRICAL

Scholar III heat pumps and air conditioners are built in a wide variety of configurations and options. The illustrations of the control center and the electrical schematics shown here are typical, but probably are not identical to your units. Please refer to the electrical schematic in each unit for the specific construction of that unit.

Figure 5. Typical Control Center Layout for Models VAIA24/30/36/40

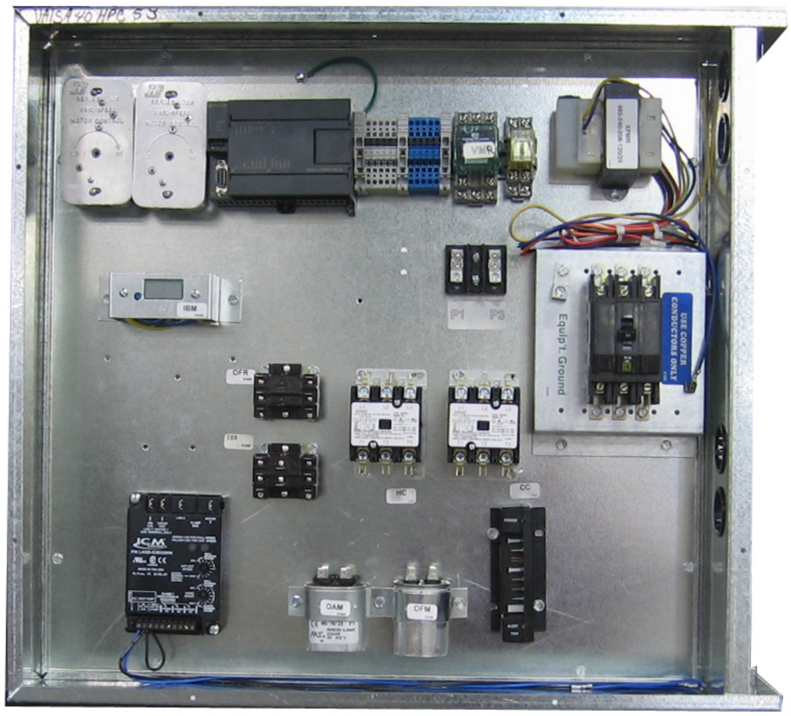
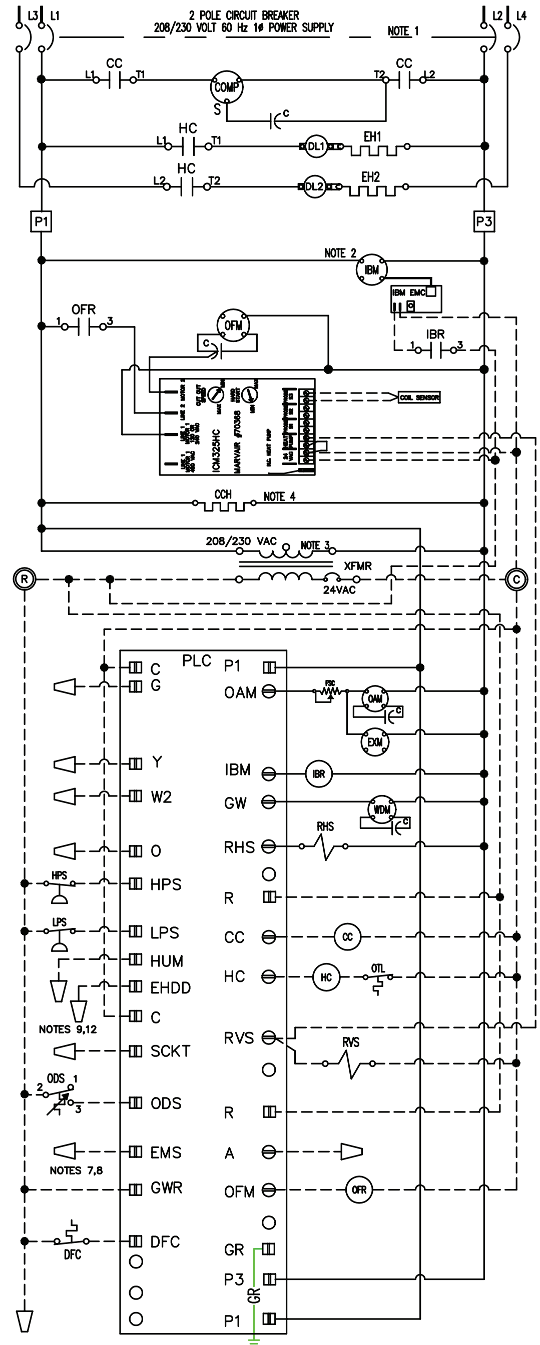


Figure 7a. Typical Wiring Schematic for Heat Pump Model VAIA, Single Phase Power



ELECTRICAL LEGEND:

C	CAPACITOR	OAM	OUTDOOR AIR MOTOR
CC	COMRPESSOR CONTACTOR	OFM	OUTDOOR FAN MOTOR
CCH	CRANKCASE HEATER	OFR	OUTDOOR FAN RELAY
COS	CHANGE-OVER STAT	OTL	ONE TIME LIMIT
COMP	COMPRESSOR	PLC	PROGRAMMABLE LOGIC CONTROLLER
DFC	DEFROST CONTROLLER	RHS	REHEAT SOLENOID
DL	DUAL LIMIT	RVS	REVERSING VALVE SOLENOID
EH	ELECTRIC STRIP HEATER	VM	VENT MOTOR
EXM	EXHAUST MOTOR	WDM	WHEELDRIVE MOTOR
FS	FREEZE STAT	XFMR	TRANSFORMER
FSC	FAN SPEED CONTROL	⊖	Q0 = PLC OUTPUT TERMINAL
HPS	HIGH PRESSURE SWITCH	◫	I0 = PLC INPUT TERMINAL
IBM	INDOOR BLOWER MOTOR		
IBR	INDOOR BLOWER RELAY		
LPS	LOW PRESSURE SWITCH		

VOLTAGE LEGEND

- LINE VOLTAGE FACTORY
- LINE VOLTAGE FIELD
- LOW VOLTAGE FACTORY
- LOW VOLTAGE FIELD
- ALT. VOLTAGE (FIELD SPEC.)

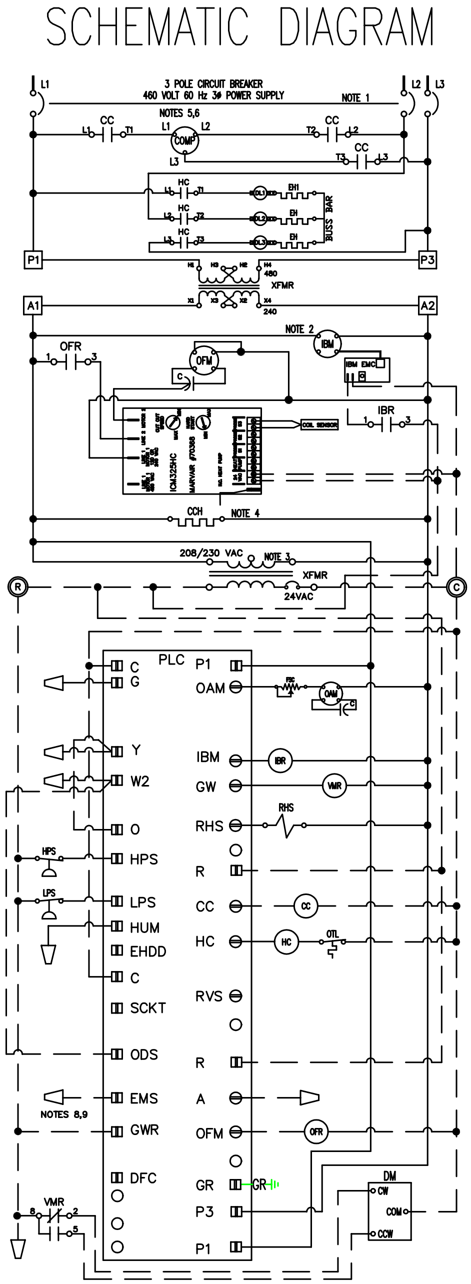
COLOR CODE

BK	BLACK	O	ORANGE
BL	BLUE	R	RED
BR	BROWN	Y	YELLOW
G	GREEN	WHT	WHITE
GY	GRAY		
BK/RED	BLACK WITH RED STRIPE		

GENERAL NOTES:

1. 230 VOLT 60Hz 1ø POWER SUPPLY. SEE DATA PLATE FOR AMPACITY AND FUSE SIZE. OPTIONAL CKT BKR SHOWN.
2. FACTORY PROGRAMMED ECM MOTOR IS CONTINUOUSLY POWERED WITH HIGH VOLTAGE, CONTROL VOLTAGE IS SWITCHED.
3. MULTI-TAP TRANSFORMER HAS CIRCUIT BREAKER ON SECONDARY SIDE. RESET AND CHECK CONTROL CIRCUIT IF OPEN.
4. CRANKCASE HEATER NOT USED ON ALL MODELS.
5. OPTIONAL PAN HEATER, 50 WATTS 240 VOLT.
6. COMPRESSOR IS PROTECTED UNDER SINGLE PHASE FAILURE CONDITIONS.
7. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO OPERATE UPON AN INPUT SIGNAL FROM ANY APPROPRIATE 24 VAC CONTROL THERMOSTAT OR DDC CONTROL SYSTEM. IF UNIT SHUTDOWN IS DESIRED DURING UNOCCUPIED PERIODS OF THE TEMPERATURE CONTROLLED SPACE IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES MARKED EMS AND R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN EMS AND R ARE CLOSED THE SYSTEM WILL SHUT DOWN.
8. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO ENERGIZE THE VENTILATION PACKAGE ANYTIME THE INDOOR FAN/BLOWER IS ENERGIZED. IF ADDITIONAL CONTROL OF THE VENTILATION PACKAGE IS DESIRED, IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST SEPARATE THE FACTORY INSTALLED WIRENUT BETWEEN WIRES MARKED GWR & R THEN PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES GWR & R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN GWR & R ARE CLOSED THE VENTILATION PACKAGE WILL OPERATE WHEN THE INDOOR FAN/BLOWER IS ENERGIZED.
9. WIRES ARE MARKED FOR PROPER THERMOSTAT CONNECTIONS.
   - R = 24VAC
   - Y = COMPRESSOR
   - G = BLOWER
   - O = REVERSING VALVE
   - C = 24VAC COMMON
   - A = ALARM
   - GWR = GREEN WHEEL RELAY
   - EMS = ENERGY MANAGEMENT SYSTEM
   - HUM = HUMIDISTAT
   - W2 = ELECTRIC HEAT
   - SCKT = AMPACITY LIMITING CIRCUIT
   - EHDD = ELECTRIC HEAT DURING DEFROST
10. USE #10 AWG WIRE FOR 10 KW ELECTRIC HEATERS.
11. THE UNIT CONTROL SYSTEM IS FACTORY WIRE TO OPERATE IN NORMAL HEAT PUMP OPERATION. FOR EHDD (ELECTRIC HEAT DURING DEFROST): CONNECT WIRE MARKED EHDD TO WIRE MARKED R. FOR S-CKT (AMPACITY LIMITING CIRCUIT): CONNECT WIRE MARKED S-CKT TO WIRE MARKED R. THIS WILL NOT ALLOW THE HEAT-PUMP AND ELECTRIC HEAT TO OPERATE SIMULTANEOUSLY.
12. CONNECT TO THE YELLOW LEAD (HUM) TO THE YELLOW LEAD ON H600A (REHEAT SIGNAL), LOCATE INSIDE LOW VOLTAGE SHIELD.

Figure 7b. Typical Wiring Schematic for Air Conditioner Model VAIA, Single Phase Power



ELECTRICAL LEGEND:

C	CAPACITOR
CC	COMRPESSOR CONTACTOR
CCH	CRANKCASE HEATER
COMP	COMPRESSOR
EH	ELECTRIC STRIP HEATER
EMC	ELECTRONIC MOTOR CONTROL
DL	DUAL LIMIT
DM	DAMPER MOTOR
FSC	FAN SPEED CONTROL
HC	HEAT CONTACTOR
HPS	HIGH PRESSURE SWITCH
IBM	INDOOR BLOWER MOTOR
IBR	INDOOR BLOWER RELAY
LPS	LOW PRESSURE SWITCH
OAM	OUTDOOR AIR MOTOR
OFM	OUTDOOR FAN MOTOR
OFR	OUTDOOR FAN RELAY
OTL	ONE TIME LIMIT
PLC	PROGRAMMABLE LOGIC CONTROLLER
RHS	REHEAT SOLENOID
VM	VENT MOTOR
VMR	VENT MOTOR RELAY
XFMR	TRANSFORMER
⊖	QO = PLC OUTPUT TERMINAL
◫	IO = PLC INPUT TERMINAL

VOLTAGE LEGEND

- LINE VOLTAGE FACTORY
- LINE VOLTAGE FIELD
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COLOR CODE

BK	BLACK	O	ORANGE
BL	BLUE	R	RED
BR	BROWN	Y	YELLOW
G	GREEN	WHT	WHITE
GY	GRAY		
BK/RED	BLACK WITH RED STRIPE		

GENERAL NOTES:

1. 460 VOLT 60Hz 3ø POWER SUPPLY. SEE DATA PLATE FOR AMPACITY AND FUSE SIZE. OPTIONAL CKT BKR SHOWN.
2. FACTORY PROGRAMMED ECM MOTOR IS CONTINUOUSLY POWERED WITH HIGH VOLTAGE, CONTROL VOLTAGE IS SWITCHED.
3. MULTI-TAP TRANSFORMER HAS CIRCUIT BREAKER ON SECONDARY SIDE. RESET AND CHECK CONTROL CIRCUIT IF OPEN.
4. CRANKCASE HEATER NOT USED ON ALL MODELS. FACTORY PROGRAMMED ECM MOTOR.
5. OPTIONAL PAN HEATER, 50 WATTS 240 VOLT.
6. COMPRESSOR IS PROTECTED UNDER SINGLE PHASE FAILURE CONDITIONS.
7. CHECK LABEL FOR L1, L2 AND L3 ON LEAD END OF THE COMPRESSOR AT THE CONTACTOR. DO NOT REFERENCE MARKINGS ON THE COMPRESSOR TERMINAL COVER FOR BASIS OF WIRE TERMINATION DUE TO CORRECT PHASING REQUIREMENTS FOR 3ø "SCROLL" COMPRESSOR MOTORS.
   IMPORTANT NOTE TO INSTALLER: ALL 3ø COMPONENTS WERE PROPERLY PHASED AT FACTORY RUN-TEST. IF ONE 3ø COMPONENT ROTATES BACKWARDS, ALL SHOULD ROTATE BACKWARDS. INTERCHANGE 2 LEADS OF FIELD POWER SUPPLY TO PROPERLY PHASE ENTIRE UNIT. DO NOT INTERCHANGE LEADS ON INDIVIDUAL COMPONENTS.
8. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO OPERATE UPON AN INPUT SIGNAL FROM ANY APPROPRIATE 24 VAC CONTROL THERMOSTAT OR DDC CONTROL SYSTEM. IF UNIT SHUTDOWN IS DESIRED DURING UNOCCUPIED PERIODS OF THE TEMPERATURE CONTROLLED SPACE IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES MARKED EMS AND R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN EMS AND R ARE CLOSED THE SYSTEM WILL SHUT DOWN.
9. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO ENERGIZE THE VENTILATION PACKAGE ANYTIME THE INDOOR FAN/BLOWER IS ENERGIZED. IF ADDITIONAL CONTROL OF THE VENTILATION PACKAGE IS DESIRED, IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST SEPARATE THE FACTORY INSTALLED WIRENUT BETWEEN WIRES MARKED GWR & R THEN PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES GWR & R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN GWR & R ARE CLOSED THE VENTILATION PACKAGE WILL OPERATE WHEN THE INDOOR FAN/BLOWER IS ENERGIZED.
10. WIRES ARE MARKED FOR PROPER THERMOSTAT CONNECTIONS.
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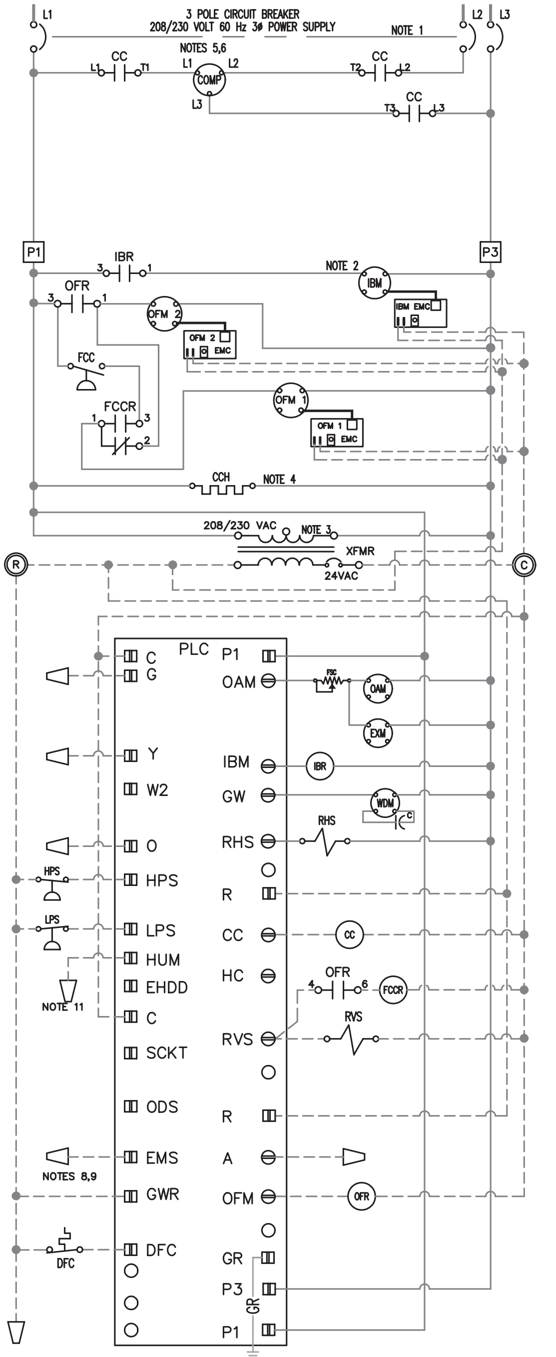
    - HUM = HUMIDISTAT
    - W2 = ELECTRIC HEAT
    - SCKT = AMPACITY LIMITING CIRCUIT
    - EHDD = ELECTRIC HEAT DURING DEFROST
11. USE #10 AWG WIRE FOR 10 KW ELECTRIC HEATERS.
12. CONNECT TO THE YELLOW LEAD (HUM) TO THE YELLOW LEAD ON H600A (REHEAT SIGNAL) , LOCATE INSIDE LOW VOLTAGE SHIELD.

Figure 8a. Typical Wiring Schematic for Heat Pump Model VAIA, Three Phase Power



ELECTRICAL LEGEND:

C	CAPACITOR
CC	COMRPESSOR CONTACTOR
CCH	CRANKCASE HEATER
COMP	COMPRESSOR
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ECM	ELECTRONIC MOTOR CONTROL
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FCCR	FAN CYCLE CONTROL RELAY
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BK - BLACK	O - ORANGE
BL - BLUE	R - RED
BR - BROWN	Y - YELLOW
G - GREEN	WHT-WHITE
BK/RED-BLACK, RED STRIPE	

GENERAL NOTES:

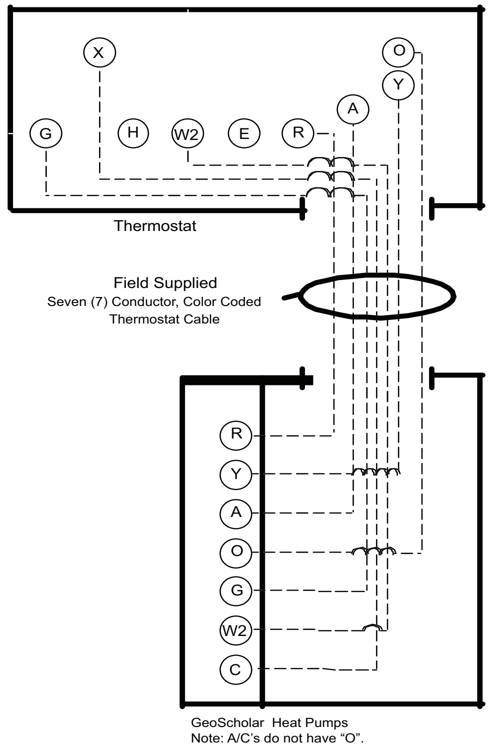
1. 208/230 VOLT 60Hz 3ø POWER SUPPLY. SEE DATA PLATE FOR AMPACITY AND FUSE SIZE.
2. FACTORY PROGRAMMED ECM MOTOR.
3. MULTI-TAP TRANSFORMER HAS CIRCUIT BREAKER ON SECONDARY SIDE. RESET AND CHECK CONTROL CIRCUIT IF OPEN.
4. CRANKCASE HEATER MAY BE REQUIRED.
5. COMPRESSOR IS PROTECTED UNDER SINGLE PHASE FAILURE CONDITIONS.
6. CHECK LABEL FOR L1, L2 AND L3 ON LEAD END OF THE COMPRESSOR AT THE CONTACTOR. DO NOT REFERENCE MARKINGS ON THE COMPRESSOR TERMINAL COVER FOR BASIS OF WIRE TERMINATION DUE TO CORRECT PHASING REQUIREMENTS FOR 3ø "SCROLL" COMPRESSOR MOTORS.
   IMPORTANT NOTE TO INSTALLER: ALL 3ø COMPONENTS WERE PROPERLY PHASED AT FACTORY RUN-TEST. IF ONE 3ø COMPONENT ROTATES BACKWARDS, ALL SHOULD ROTATE BACKWARDS. INTERCHANGE 2 LEADS OF FIELD POWER SUPPLY TO PROPERLY PHASE ENTIRE UNIT. DO NOT INTERCHANGE LEADS ON INDIVIDUAL COMPONENTS.
7. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO OPERATE UPON AN INPUT SIGNAL FROM ANY APPROPRIATE 24 VAC CONTROL THERMOSTAT OR DDC CONTROL SYSTEM. IF UNIT SHUTDOWN IS DESIRED DURING UNOCCUPIED PERIODS OF THE TEMPERATURE CONTROLLED SPACE IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES MARKED EMS AND R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN EMS AND R ARE CLOSED THE SYSTEM WILL SHUT DOWN.
8. THE UNIT CONTROL SYSTEM IS FACTORY WIRED TO ENERGIZE THE VENTILATION PACKAGE ANYTIME THE INDOOR FAN/BLOWER IS ENERGIZED. IF ADDITIONAL CONTROL OF THE VENTILATION PACKAGE IS DESIRED, IT MAY BE ACCOMPLISHED BY THE FOLLOWING: THE CONTROLS CONTRACTOR MUST SEPARATE THE FACTORY INSTALLED WIRENUT BETWEEN WIRES MARKED GWR & R THEN PROVIDE A SET OF CONTACTS (24 VAC PILOT DUTY) BETWEEN WIRES GWR & R. WHEN THE FIELD SUPPLIED CONTACTS BETWEEN GWR & R ARE CLOSED THE VENTILATION PACKAGE WILL OPERATE WHEN THE INDOOR FAN/BLOWER IS ENERGIZED.
9. WIRES ARE MARKED FOR PROPER THERMOSTAT CONNECTIONS.

R = 24VAC	A = ALARM
Y = COMPRESSOR	GWR = GREEN WHEEL RELAY
G = BLOWER	EMS = ENERGY MANAGEMENT SYSTEM
O = REVERSING VALVE	HUM = HUMIDISTAT
C = 24VAC COMMON	W2 = ELECTRIC HEAT

SCKT = AMPACITY LIMITING CIRCUIT
Y2 = SECOND STAGE HIGH CAPACITY COOLING

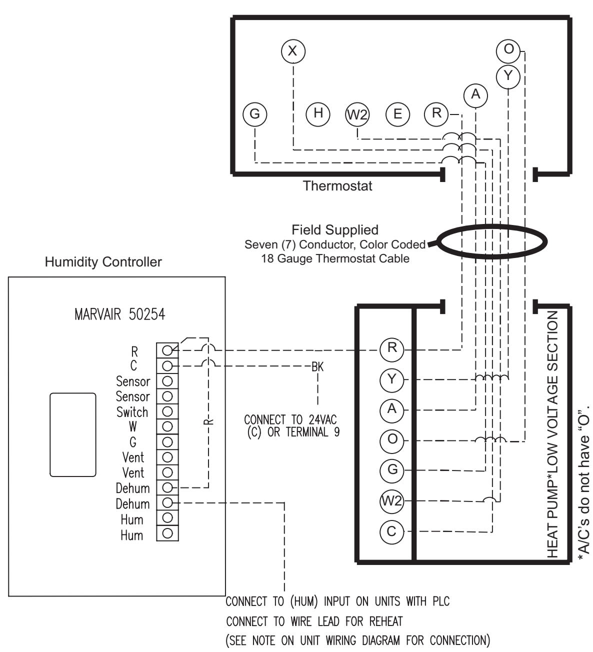
10. CONNECT TO THE YELLOW LEAD ON H600A (REHEAT SIGNAL). LOCATE INSIDE LOW VOLTAGE SHIELD.

Figure 9a. Remote Wall Mounted Thermostat Wiring Detail



THE INTERNAL TRANSFORMER IS NOT DESIGNED TO POWER OTHER EXTERNAL DEVICES.

Figure 9b. Humidity Controller Wiring Detail



4.1 MAINTENANCE

WARNING
BEFORE PERFORMING MAINTENANCE ON THE SCHOLAR III™, SWITCH ELECTRIC POWER OFF AT THE DISCONNECT LOCATED BEHIND THE RIGHT FRONT DOOR. FAILURE TO DO THIS COULD RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

A. **Air filters** on the Scholar III™ model VAIA require scheduled inspection and maintenance. They should be inspected and cleaned or replaced twice a year, as a minimum, before the heating and cooling season.

They should be inspected more often, as necessary.

Please refer to Chapter 7.1 for instructions on accessing the return air filters.

The GreenWheel® Media can be checked visually for excessive dirt build-up. If there is residue build-up on the GreenWheel media, it can be vacuum-cleaned, in place, as necessary. See Chapter 7F for access to the GreenWheel for cleaning. Check it and vacuum clean as necessary. Also check to see that the rubber drive belt is properly engaged on the GreenWheel and drive motor pulley.

B. **Cabinet Panels/Indoor Grilles** may be cleaned with a sponge and warm, soapy water or a mild detergent. Do not use bleach, abrasive chemicals, or harmful solvents.

C. If the **Indoor Coils** 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 off power before cleaning. Be careful not to wet any of the electrical components. Be sure the unit has dried before restarting. See Chapter 7.3 for instructions on cleaning the indoor coils.

D. **Outdoor Coils.** 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. See Chapter 7.4 for information on cleaning the outdoor coils.

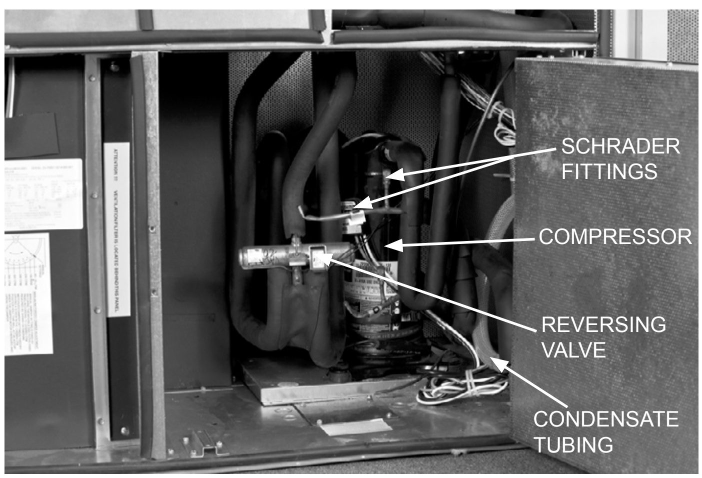
D. **Condensate Lines**. Each Scholar III™ air conditioner or heat pump has one condensate line. The condensate line for the indoor and outdoor drain pans are tied together and the condensate is discharged either through the base of the unit into a floor drain or out of the back of the unit at the bottom of the unit.

5.1 FUNCTION AND DESCRIPTION OF PRIMARY COMPONENTS

A. **Compressor.** All Scholar™ units use a fully hermetic scroll compressor to minimize sound levels and maximize efficiency. Scroll compressors, like several other types of compressors, will only compress in one rotational direction. The direction of rotation is not an issue with single-phase compressors since they will always start and run in the proper direction. However, three phase compressors will rotate in either direction depending upon phasing of power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, it is imperative to confirm that the compressor is rotating in the proper direction at the initial field start-up of the system. Verification of proper rotation is made by observing that the suction pressure drops and the discharge pressure rises when the compressor is energized. An alternate method of verification for self contained system with small critical refrigerant charges, where the installation of gauges may be objectionable, can be made by monitoring the temperature of the refrigerant lines at the compressor. The temperature should rise on the discharge line while the suction line temperature decreases. Reverse rotation also results in a substantially reduced current draw when compared to tabulated values.

There is no negative impact on durability caused by operating three phase compressors in the reversed direction for a short duration of time, usually defined as less than one hour. However, after several minutes of operation the compressor's internal protector will trip. The compressor will then cycle on the protector until the phasing is corrected. Reverse operation for longer than one hour may have a negative impact on the bearings.

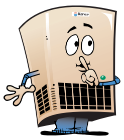
The compressor, reversing valve and coil, and the Schrader fittings are located behind the hinged control box. See figure below.



B. **Indoor Blower and Motor.** All Scholar III air conditioners and heat pumps use an electronically commutated (EC) blower motor and a single blower. The motor speed is controlled by a pulse width modulator located in the electrical box and identified as IBM. The modulators are factory set for proper air flow for design requirements. Should the modulator need adjustment, use the following procedure.

On the face of the modulator, there is an adjustment dial with a slot in the middle.

Using a slotted screw driver, gently turn the dial clockwise to increase the air flow and counterclockwise to decrease the air flow. While rotating the adjuster, a numerical flow index is locked on the display. After adjustment, the display shows fan RPM.



C. **Outdoor Air Mover.** The outdoor air mover is an axial fan with an asynchronous external rotor motor on the 2, 2½, 3, & 3½ heat pumps and all air conditioners. Scholar III heat pumps, models VAIA & VAISA 48 & 60 use two blowers with electronically commutated motors (ECM). One of the blowers operates a full speed anytime the compressor is on. A fan cycle switch on the second blower cycles the blower on & off to maintain proper refrigerant pressures. The switch closes at 400 psig and opens at 245 psig.

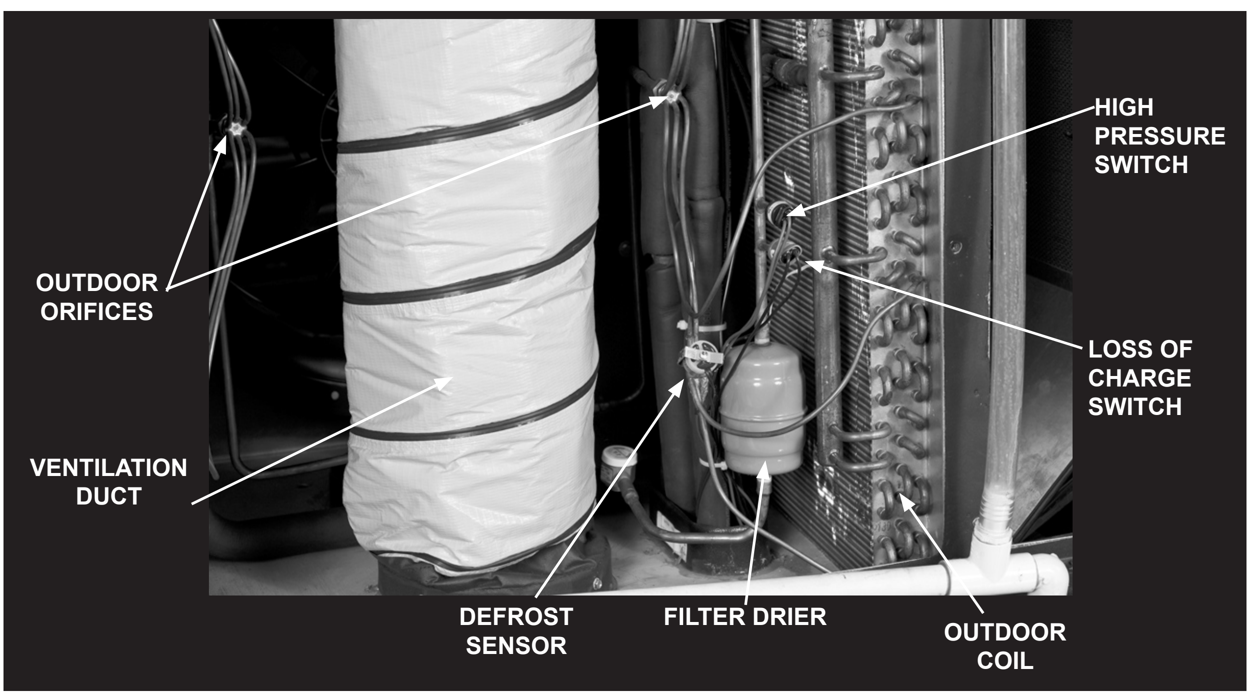
Each blower motor is controlled by a pulse width modulator, identified in the control box by OFM 1 and OFM 2. The modulators are factory set for proper air flow for design requirements. Should the modulator need adjustment, use the following procedure.

1. In the middle of each modulator there is a blue dial with a slot in the middle.

2. Using a slotted screw driver, gently turn the dial clockwise to increase the air flow and counterclockwise to decrease the air flow.

Read the setting by watching the LAMP flashes. The LAMP continuously flashes out the current setting. After a pause, the LAMP flashes out the tens digit, then the units digit of a number (percent) between 1 and 99. If the lamp stays on, the setting is 100%. Long flashes represent the tens digit, and short flashes represent the units digit. A setting of 23% will flash two longs, and three shorts. The LAMP feature can be used to record an air balance setting, or to precisely set the signal to the ECM motor without using a meter.

The outdoor coils, filter drier, high pressure switch, loss of charge switch outdoor orifice, defrost sensor are located behind the middle front door.



D. **Indoor/Outdoor Coils.** The coils are constructed of lanced, aluminum fins mechanically bonded to rifled, seamless copper tubes.

E. **Filter Drier** - The filter drier performs two functions in the refrigerant circuit. First, it removes foreign particulate matter, e.g. dirt, scale, solder particles from the refrigerant to protect the compressor and other components in the refrigerant system with small openings or close tolerances. Second, it absorbs any moisture in the refrigerant with desiccant granules.

F. **High and Low Refrigerant Pressure (Air Conditioner) or Loss of Charge (Heat Pump) Switches & Optional (Heat Pump Only) Indoor Coil Freeze Stat.** These switches render the compressor and outdoor fan motor inoperative whenever the limits of the high or low pressure switches are exceeded or indoor coil freeze up. In the event of high pressure, the Scholar III™ unit will turn off and lockout. The high pressure switch opens at 610 psig and resets at 420 psig.

The system has a High Pressure Switch (HPS) that indicates a high system pressure. When this occurs, the system will run for five seconds then set a High Pressure Lockout. This lockout condition shuts the system off and flashes the "A" indicator on the PLC quickly at a rate of twice per second.

The Low Pressure (air conditioner) or Loss of Charge (heat pump) switches are designed is designed to guard against the operation of the system in the event of a loss of refrigerant. If the Pressure (air conditioner) or Loss of Charge (heat pump) switch opens for more than eight minutes, the system will turn off and a Low Pressure Lockout fault will be indicated by a slow flashing on the "A" LED. The interval for the flash is once per second.

In cold weather the pressure in the refrigerant system is low prior to operation. When the Scholar III™ unit starts in the heat pump mode during cold weather, low pressure could cause the system to lock out. To guard against nuisance lockouts, the Scholar III unit will not shut off if the Low Pressure Switch (LPS) comes on during the first eight minutes of operation and the switch has not cycled more than three times in an hour. In other words, the compressor will start and operate for eight minutes even with the LPS switch open three times before causing a lockout on low pressure.

Both switches open at 40 psig and close at 60 psig.

The high and low pressure switches are resettable at the wall thermostat or by turning power off and then on to the Scholar III™ unit. A fault LED located on the PLC indicates that a lockout has occurred and whether it is due to high or low refrigerant pressure or indoor coil freeze-up. The LED will flash once per second for low pressure or indoor coil freeze up lockout and twice per second for high pressure lockout.

G. **Metering Devices.** The Scholar III uses a thermal expansion valve on the indoor (cooling) circuit and a fixed orifice on the outdoor (heating) circuit.

H. **Reversing Valve.** The reversing valve reverses the refrigerant's direction of flow in a heat pump, allowing the heat pump to switch from cooling to heating or heating to cooling.

I. **Exhaust Air Ventilation Blower** is used to exhaust classroom in the GreenWheel ERV and Power Vent ventilation options. The blower can exhaust up to 450 CFM of air from the classroom. In the standard configuration, both the exhaust and the intake ventilation blowers are controlled by a single speed controller. This speed controller permits the motor speed to be adjusted for the correct cfm of ventilation air. As an option, a second motor controller may be factory installed to allow independent control of the intake and exhaust air blowers. This allows pressurization of the classroom. All ventilation options have an intake air blower.

J. **Intake Ventilation Air Blower** is used to introduce outside air into the classroom. In the standard configuration, both the exhaust (GreenWheel ERV and PowerVent only) and the intake ventilation blowers are controlled by a single speed controller. This speed controller permits the motor speed to be adjusted for the correct cfm of ventilation air. As an option, a second motor controller may be factory installed to allow independent control of the intake and exhaust air blowers. This allows pressurization of the classroom.

K. **Electric Resistance Heat** is installed above the indoor blower outlet. Electric heat is field installed on all Scholar III units. Electric heat can be used with the freeblow plenum or with ducted air distribution options. The heaters are available in nominal kW of 5, 10 & 15 kW for operation on 208/230v. 1Ø, 208/230 v. 3Ø, and 460v, 3Ø. The model number of the heat pump or air conditioner indicates the power supply and kW.

L. **Electric Resistance Heat Controls.** Included with the electric heat assembly are temperature switches designed to turn power off to the heaters if the temperature is too high. There are two types of temperature switches. The first is an auto-reset type that turns power off to the heater if it senses a temperature of 145°F. When the temperature drops to approximately 105°F, power is restored to the heaters. This auto-reset switch is in the low voltage circuit.

The second type of switch is a one time limit switch. If it senses a temperature of 300ºF, power is turned off to the elements. This switch does NOT reset when the temperature drops and must be replaced when it activates.

The number and location of both switches is determined by the power supply and the kW of the heaters.

M. **Hot Water** is installed above the indoor blower outlet as shown in the hot water plenum. A diverter valve is a factory installed option with the hot water coil only. Hot water heat is factory installed in the freeblow or the ducted plenums and is plumbed from the top right side of the plenum. As a standard safety feature, each hot water coil has a protective 24 volt freezestat embedded within it to trigger at 35°F and to turn the unit off.

N. **Programmable Logic Controller (PLC) Microprocessor.** The Scholar III™ heat pump uses a factory installed PLC microprocessor to control the operation, the safety switches and function options. LED's show operational status and provide assistance with diagnosis if troubleshooting is ever required. Various control functions are field selectable. The PLC is also capable of communicating to other Scholar III unit PLC's to allow run time leveling and does not require additional equipment installed in the Scholar III unit. The PLC microprocessor provides improved reliability because of the reduction of components, the components utilized are more durable and the control box wiring has been simplified. Pertinent statistical data about the life of the refrigeration system can be accessed through the PLC.

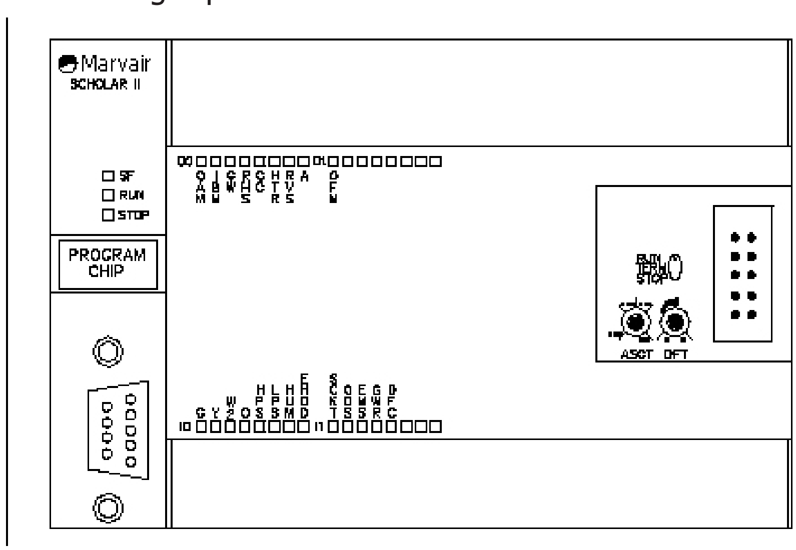
The PLC microprocessor provides for the following control and operation functions:

- **Anti-Short Cycle Timer** - Prevents the compressor from destructive short cycling due to momentary power interruptions. One of three time intervals can be field selected.
- **Defrost Timer (heat pump only)** - Adjustable defrost control that is based upon both time and temperature. The time interval is adjustable from 30 to 90 minutes.
- **BAS Control** - Provides 24 VAC coil to control operation from Building Automation System (BAS). Note - an additional BAS control relay can be added when 120 or 240 VAC coils are required.

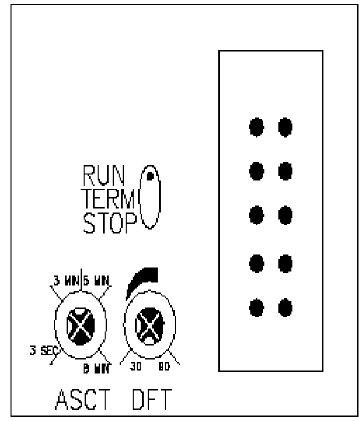
The unit control system is factory wired to operate upon an input signal from any appropriate 24 VAC control thermostat or DDC control system. If unit shutdown is desired during unoccupied periods of the temperature controlled space, it may be accomplished by the following: the controls contractor must provide a set of contacts (24 VAC pilot duty) between terminals E1 and E2. When the field supplied contacts between E1 and E2 are closed the system will shutdown.

Location

The PLC is located in the unit control center. The control center is located behind a panel in the lower right portion of the cabinet.



On the right side of the PLC there is a small door. Behind the door is a three position micro switch and two control adjustments- an anti short cycle timer and a defrost timer. Each control can be adjusted by turning the knob with a small flat head screwdriver. The indicator on the knob is the gap between the two protrusions with the hollow centers on the knob. (See drawing below). For both control timers, turning the knob clockwise increases the time period. NOTE: Scholar III air conditioners do not have the defrost function.



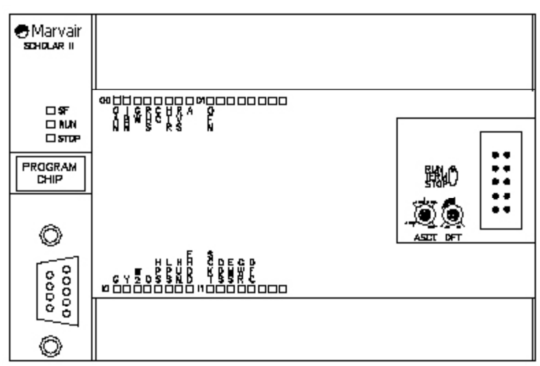
The micro switch has three positions – **RUN, TERM & STOP**. The switch should be in the **RUN** position during normal operation. **Term** is for operation from a remote terminal. **Stop** is no output/ non-operational.

The **Anti-short Cycle Timer (ASCT)** is located to the far left of the switch. The anti-short cycle timer prevents the compressor from destructive short cycling by allowing the compressor to restart only after a selected time interval has passed from compressor shutdown. The timer begins when the compressor turns off. The time interval is frm 3 seconds to eight minutes in one minute increments. The three-second setting is used only for factory testing and should NEVER be used when installed in a classroom. Select the desired time interval by rotating the knob to the desired setting. The Marvair® factory set point is 3 minutes.

The **Defrost Timer (DFT) (heat pump function only)** is located next to the three position micro switch. The defrost control is based upon both time and temperature. The DFT initiates a defrost cycle whenever the outdoor coil temperature is 28°F or below and the selected time interval from the previous defrost cycle has been exceeded. Select the desired time interval by turning the DFT knob. When turned completely to the left (counterclockwise), the time interval between defrost cycles is 30 minutes. When turned completely to the right (clockwise), the time interval is 90 minutes. The knob allows setting the defrost time anywhere between 30 and 90 minutes, i.e., mid-way between the 30 and 90 minutes is 60 minutes. The Marvair® factory set point is 30 minutes.

PLC Inputs & Outputs

The PLC has inputs located along the bottom of the controller and outputs along the top of the controller. An input is a signal to the PLC from either the thermostat, sensors in the Scholar III™ heat pump or air conditioner, or a customer supplied input, e.g., DDC. An output is a signal from the PLC to the heat pump, air conditioner or to the thermostat.



PLC Inputs

The PLC inputs are powered only by 24 VAC. The thermostat inputs are:

- **G** - Blower signal from thermostat
- **Y** - Compressor
- **W2** - Second stage heat (heat pump function only)
- **O** - Reversing valve (energized for cooling) (heat pump function only)

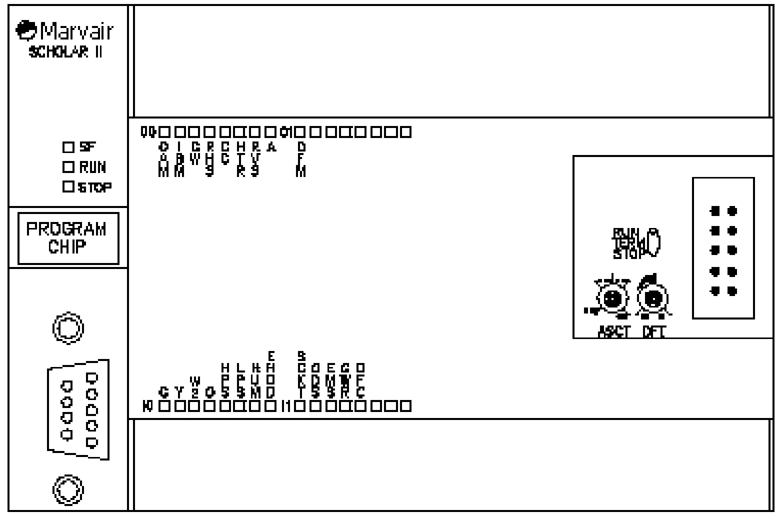
The PLC has indicator LED's that show the status of all thermostat inputs and sensors. For example, if the "G" LED is on, this means that voltage is present from the "G" terminal on the thermostat.

Scholar III™ heat pump and air conditioner sensor or control inputs:

- **HPS** – High Refrigerant Pressure Switch. The HPS is ON during normal operation. No light indicates an open switch. See lockout indicator "A" under Outputs.
- **LPS** – Low Refrigerant Pressure Switch. The LPS is ON during normal operation. No light indicates an open switch. See lockout indicator "A" under Outputs
- **HUM** – Humidity Controller. Used when an external humidity controller operates the Scholar to control the humidity in the classroom.
- **EHDD** – Electric Heat During Defrost. Allows the user to select whether electric heat operates when the heat pump enters into the defrost mode. The units are wired at the factory to prevent the electric heaters from operating during the defrost mode. For operation during defrost, a wire is moved from one terminal to another in the control box. NOTE: for operation of the electric heat during defrost, the electric heat control must be configured to allow simultaneous operation of the electric heat and the compressor. (heat pump only)
- **SCKT** – "S" Circuit. Signal that indicates the electric heat and the compressor can never operate simultaneously. This function is controlled by the electric heat control toggle switch in the control center. The LED should be ON if "Y" is ON, the electric heat is on and the toggle switch is in the S circuit position. (heat pump only)
- **ODS** – Outdoor Thermostat. Determines at what outdoor temperature (factory set at 40°F), the supplemental heat turns on. The LED should be ON if the outdoor temperature is below the ODS set point. (heat pump only)
- **EMS** – Energy Management System. A shutdown input from an external source.
- **GWR** – GreenWheel® ERV Relay. When this LED is lit, the GreenWheel ERV is operating.
- **DFC** – Defrost Control Thermostat. Indicates whether the defrost thermostat is closed. The defrost cycle is based upon both time (see defrost timer) and outdoor coil temperature. (heat pump only)

PLC Outputs

An output is a signal from the PLC to the Scholar III™ heat pump or thermostat. The first four outputs, from left to right, are connected to a 230 VAC supply and thus provide 230 VAC when energized. These outputs are:



- **OAM** - Outdoor Air Motor (Fresh air motor for the GreenWheel® ERV)
- **IBM** – Indoor Blower Motor Relay Note: On early models, this was IFM.
- **GW** - GreenWheel® ERV Drive Motor
- **RHS** - Reheat Solenoid

The next five outputs are 24 VAC. These outputs are:

- **CC** - Compressor Contactor
- **HTR** - Heat Contactor
- **RVS** - Reversing Valve (heat pump only)
- **A** - Lock Out Indicator. A blinking LED indicates that a pressure switch has opened. A flash rate of once per second indicates a low pressure switch lockout. A flash rate of twice per second indicates a high pressure lockout.
- **OFM** - Outdoor Fan Motor Relay

On the left side beneath the Marvair® logo are three LED's that indicate the operational status of the PLC.

- **SF** – System fault indicates an internal fault in the PLC. The fault can be found using the Microwin Programming System and an external PCI cable.
- **Run** – Normal operation. The PLC is on/operational. When the micro switch is in the RUN position, this LED should be lit.
- **Stop** – The PLC is off/non operational. When the micro switch is in the STOP position, this LED should be lit.

Operation Guide

Cooling Mode

During normal operation of the system, the thermostat calls for cooling by turning on the G, Y and O inputs to the system. This request will be indicated on the G, Y and O indicators at the bottom of the unit. If the compressor has been off for a least the amount of time interval set on the ASCT, the Compressor Contactor (CC), Indoor Blower (**IBM**), Reversing Valve (RVS) and the Outdoor Fan Motor (OFM) LED's should be on. This indicates that the controller is sending an output to turn those devices on.

Heating Mode

When the thermostat calls for first stage heating, it turns on the G and Y inputs. The indicators will come on to indicate the thermostat is calling for heat. If the compressor has been powered off for at least the time set on the ASCT, the Compressor Contactor (CC), Indoor Blower Motor (IBM) and Outdoor Fan Motor (OFM) LED's will be on. The LED's indicate that the PLC is sending an output to the devices' controls.

If the thermostat calls for second stage heating (heat pump only), the W2 indicator will be lit. If the W2 LED is on, indicating that the thermostat is calling for second stage heat and the ODS indicator is not and the outside temperature is not below the ODS set point, the second stage heat (HTR) will not come on.

If the W2 indicator is on and the ODS indicator is on then, in addition to the CC, IBM and OFM indicators, the HTR indicator will be on indicating the call for second stage heat.

If the SCKT LED is on indicating that the S Circuit function is selected, the CC and OFM indicators will be off and the HTR indicator will be on. Refer to table below.

G	Y	W2	ODS	SCKT	IBM	CC	OFM	HTR
ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
ON	ON	OFF	OFF	OFF	ON	ON	ON	OFF
ON	ON	ON	OFF	OFF	ON	ON	ON	OFF
ON	ON	ON	ON	OFF	ON	ON	ON	ON
ON	ON	ON	ON	ON	ON	OFF	OFF	ON

Defrost Mode (heat pump only)

When the system has been operating in the heat pump mode for a period of time (set by the Defrost Timer), the system will examine the Defrost Control thermostat Input (DFC). If this input is on (the thermostat is closed), indicated by the LED being on, the system will go into Defrost mode. At this point the Outdoor Fan Motor relay (OFM) is de-energized and the reversing valve is energized. In this mode heat is being applied to the outdoor coil to remove any possible buildup of ice on the coil. The Defrost Control Switch (DFC) comes on at roughly 28°F and goes off at approximately 56°F. During the Defrost Cycle, the unit will continuously examine the DFC input and when it switches off OR the system has been in defrost for 10 minutes, the system will revert back to normal heating mode. By having a maximum time for the Defrost Cycle to operate, the system will not go into Defrost and remain in Defrost mode if a Defrost Switch malfunctions. If the Electric Heat During Defrost (EHDD) function has been selected, the Heat Contactor (HTR) will come on to supply supplemental heat during the Defrost Cycle.

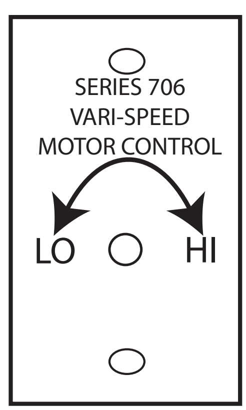
Low Pressure Lockout
The Low Pressure (air conditioner) or Loss of Charge (heat pump) is designed to guard against the operation of the system in the event of a loss of refrigerant. If the Low Pressure Switch stays open for more than eight minutes, the system will turn off and a Low Pressure Lockout fault will be indicated by a slow flashing on the "A" LED. The interval for the flash is once per second. The loss of charge and low pressure switch open at 40 psig and close at 60 psig.

In cold weather the pressure in the refrigerant system is low prior to operation. When the Scholar III™ unit starts in the heat pump mode during cold weather, low pressure could cause the system to lock out. To guard against nuisance lockouts, the Scholar III unit will not shut off if the Loss of Charge Switch (LPS) opens during the first eight minutes of operation and the switch has not cycled more than three times in an hour. In other words, the compressor will start and operate for eight minutes even with the LPS switch open three times before causing a lockout on low pressure.

High Pressure Switch
The system has a High Pressure Switch (HPS) that indicates a high system pressure. When this occurs, the system will run for five seconds then set a High Pressure Lockout. This lockout condition shuts the system off and flashes the "A" indicator quickly at a rate of twice per second. The high pressure switch opens at 610 psig and resets at 420 psig.

O. **Ventilation Blower Fan Speed Control.** The ventilation blower speed control is located in the upper left corner of the electrical control box. Factory setting for the indoor blower speed is full speed. If a lower speed setting is required, the blower motor speed control may be adjusted with a slotted screwdriver rotating the speed control as shown in Figure 12. Reference unit label for minimum required air flow settings for specific unit model.

Figure 12. Ventilation Blower Speed Control Adjustment Instructions



P. **Standard Ventilation Control.** The **motorized fresh air damper with PowerVent and GreenWheel® ERV** ventilation options are equipped with a **fresh air fan speed control**. The fresh air fan speed control operates both the ventilation intake and exhaust blowers together.

Optional Ventilation Controls. The unit control system is factory wired to energize the ventilation package anytime the indoor fan/blower is energized. If additional control of the ventilation package is desired, it may be accomplished by the following: The controls contractor must remove the factory installed jumper between terminals V1 and V2 then provide a set of contacts (24 VAC pilot duty) between terminals V1 and V2. When the field supplied contacts between V1 and V2 are closed, the ventilation package will operate when the indoor fan/blower is energized.

The **motorized fresh air damper with PowerVent and GreenWheel® ERV** ventilation options can be equipped with an exhaust fan air speed control, which controls the ventilation exhaust blower independently of the fresh air intake blower.

Demand Control Ventilation. A field or factory installed carbon dioxide sensor controls the ventilation damper and only opens the damper when CO_2 levels exceed a specified level. Demand control ventilation saves energy and utility costs by ventilating the classroom based upon occupancy.

Note: Not available on manual fresh air damper ("B") configuration.

P. **Outdoor Thermostat.** Factory set at 40°F, this thermostat determines the outdoor temperature at which the supplemental electric heat or wet heat turns on. This may be field adjusted to the desired temperature setting by rotating the adjustment knob in the control box. Please note that when the outdoor thermostat activates wet heat, the compressor does not operate.

The outdoor thermostat is located above the hinged control box, behind the middle front door.

6.1 TROUBLESHOOTING

In diagnosing common faults in the heat pump system, develop a logical thought pattern as used by experienced technicians. The charts which follow are not intended to be an answer to all problems but only to guide the technician's thinking. Through a series of yes and no answers, follow the logical path to a likely conclusion.

A novice technician should use these charts like a road map. Remember that the chart should clarify a logical path to the problem's solutions.

Electrical Checks Flow Chart

<table>
<tr><td colspan="4">Unit Running?</td></tr>
<tr><td colspan="3">NO</td><td>YES</td></tr>
<tr><td colspan="3">Thermostat Problem?</td><td rowspan="14">Go to Mechanical Check for Cooling or Heating</td></tr>
<tr><td colspan="2">YES - Repair and Recheck</td><td>NO</td></tr>
<tr><td colspan="3">Transformer Problem?</td></tr>
<tr><td colspan="2">YES - Repair and Recheck</td><td>NO</td></tr>
<tr><td colspan="3">Voltage on Compressor Side of Contactor?</td></tr>
<tr><td>YES</td><td colspan="2">NO</td></tr>
<tr><td>Run Capacitor</td><td colspan="2">Voltage on Line Side of Contactor?</td></tr>
<tr><td>Compressor Internal Overload Open</td><td>NO</td><td>YES</td></tr>
<tr><td>Compressor Winding Open</td><td>Circuit Breakers or Fuses Open</td><td>Compressor Contactor</td></tr>
<tr><td>Unit Wiring and Connections</td><td>YES</td><td>High Pressure Cut-Out</td></tr>
<tr><td rowspan="4"></td><td>Compressor Winding Grounded</td><td>Low Pressure Cut-Out</td></tr>
<tr><td>Outdoor Fan Motor Grounded</td><td>Compressor Time Delay</td></tr>
<tr><td>Grounded Capacitor</td><td rowspan="2">Unit Wiring and Connections</td></tr>
<tr><td>Replace Fuses or Reset Breakers and Recheck System</td></tr>
</table>

Cooling Mechanical Checks Flow Chart

Unit Running?			
YES			NO
Pressure Problems?			Go to Electrical Checks Flow Chart
High Head Pressure	**Low Head Pressure**	**Low Suction Pressure**	
Dirty Outdoor Coil	Low on Charge	Dirty Filters	
Inoperative Outdoor Fan	Low Ambient Temperature	Dirty Indoor Coil	
Overcharge	Inoperative Compressor Valves	Inadequate Indoor Air Flow	
Recirculation of Outdoor Air	Outdoor Check Valve Closed	Inoperative Indoor Blower	
Non-condensibles	Restricted Indoor Metering Device	Low on Charge	
High Ambient Air Entering Outdoor Coil	Restricted Filter Drier	Restricted Indoor Metering Device	
Wrong Outdoor Fan Rotation	Reversing Valve Failure	Restriction in System	
		Recirculation of Indoor Air	
		Wrong Indoor Blower Rotation	
		Inadequate Ducts	
		Outdoor Check Valve Closed	
		Restricted Filter Drier	

Heating Mechanical Checks Flow Chart

<table>
<tr><th colspan="4">Unit Running?</th></tr>
<tr><td colspan="3">YES</td><td>NO</td></tr>
<tr><td colspan="3">Pressure Problems?</td><td rowspan="11">Go to Electrical Checks Flow Chart</td></tr>
<tr><th>High Head Pressure</th><th>Low Head Pressure</th><th>Low Suction Pressure</th></tr>
<tr><td>Dirty Filters</td><td>Low on Charge</td><td>Dirty Outdoor Coil</td></tr>
<tr><td>Dirty Indoor Coil</td><td>Low Indoor Temperature</td><td>Inadequate Air Flow Over Outdoor Coil</td></tr>
<tr><td>Inoperative Indoor Blower</td><td>Closed Indoor Check Valve</td><td>Inoperative OD Fan</td></tr>
<tr><td>Overcharge</td><td>Inoperative Compressor Valves</td><td>Low on Charge</td></tr>
<tr><td>Inadequate Indoor Air Flow</td><td>Restricted Outdoor Metering Device</td><td>Restricted Outdoor Metering Device</td></tr>
<tr><td>Non-condensibles</td><td>Restricted Filter Drier</td><td>Restriction in System</td></tr>
<tr><td>Wrong Indoor Blower Rotation</td><td rowspan="3">Reversing Valve Failure</td><td>Closed Indoor Check Valve</td></tr>
<tr><td rowspan="2">Inadequate Ducts</td><td>Recirculation of Out-door Air</td></tr>
<tr><td>Restricted Filter Drier</td></tr>
</table>

Defrost Mechanical Checks Flow Chart

<table>
<tr><th colspan="3">Defrost System</th></tr>
<tr><th>No Defrost</th><th>Incomplete Defrost</th><th>Excessive Defrost</th></tr>
<tr><td>Reversing Valve Stuck</td><td>Poor Sensor Location</td><td>Wrong Defrost Control Timer Setting</td></tr>
<tr><td>No Defrost Timer Control Power</td><td>Wrong Defrost Control Timer Setting</td><td>Poor Sensor Location</td></tr>
<tr><td>Failed Defrost Control</td><td>Failed Defrost Relay (doesn’t stop O.D. Fan)</td><td>Low System Charge</td></tr>
<tr><td>Failed Defrost Relay</td><td rowspan="2">Thermostat Satisfies During Defrost</td><td rowspan="2">Wind Affecting in Defrost</td></tr>
<tr><td>Loose Default Sensor</td></tr>
</table>

Subcooling Calculation

1. Measure the liquid pressure at the liquid line service valve.
2. Convert the liquid line pressure to saturated temperature. See tables below.
3. Measure the liquid line temperature at the liquid line service valve.
4. Compare the liquid line temperature to the saturated temperature.
5. The difference between saturated temperature and liquid line temperature is the subcooling. Subcooling normal range 12° to 20°.

Superheat Calculation

1. Measure the suction pressure at the suction line service valve.
2. Convert the suction line pressure to saturated temperature. See tables below.
3. Measure the suction line temperature approximately 6” to 8” from the compressor.
4. Compare the suction line temperature to the saturated temperature.
5. The difference between saturated temperature and suction line temperature is the superheat. Superheat normal range 12° to 18°

Air Conditioning System Troubleshooting Tips

System Problem	Indicators				
	Discharge Pressure	Suction Pressure	Super-heat	Sub-cooling	Compressor Amps
Overcharge	High	High	Low	High	High
Undercharge	Low	Low	High	Low	Low
Liquid Restriction (Drier)	Low	Low	High	High	Low
Low Evaporator Airflow	Low	Low	Low	Lo	Low
Dirty Heat Pump	High	High	Low	Low	High
Low Outside Ambient Temp.	Low	Low	High	High	Low
Inefficient Compressor	Low	High	High	High	Low
TXV Feeler Bulb Charge Lost	Low	Low	High	High	Low
Poorly Insulated Sensing Bulb	High	High	Low	Low	High

Temperature Pressure Chart

Temp. (°F)	R-22 PSIG	R-410A PSIG	Temp. (°F)	R-22 PSIG	R-410A PSIG	Temp. (°F)	R-22 PSIG	R-410A PSIG
-40	0.5	11.0	25	48.7	86.0	90	168.4	273.0
-35	2.6	14.2	30	54.9	95.5	95	181.8	294.1
-30	4.9	17.8	35	61.5	105.7	100	195.9	316.4
-25	7.4	21.8	40	68.5	116.6	105	210.7	339.9
-20	10.1	26.1	45	76.0	128.3	110	226.3	364.6
-15	13.2	30.8	50	84.0	140.8	115	242.7	390.5
-10	16.5	35.9	55	92.5	154.1	120	259.9	417.7
-5	20.0	41.5	60	101.6	168.2	125	277.9	446.3
0	23.9	47.5	65	111.2	183.2	130	296.8	476.3
5	28.2	54.1	70	121.4	199.2	135	316.5	507.6
10	32.8	61.2	75	132.2	216.1	140	337.2	540.5
15	37.7	68.8	80	143.6	234.0	145	258.8	574.8
20	43.0	77.1	85	155.7	253.0	150	381.5	610.6

Troubleshooting Chart

WARNING

DISCONNECT ALL POWER TO UNIT BEFORE SERVICING. CONTACTOR MAY BREAK ONLY ONE SIDE. FAILURE TO SHUT OFF POWER CAN CAUSE ELECTRICAL SHOCK RESULTING IN PERSONAL INJURY OR DEATH.

Problem/Symptom	Likely Cause(s)	Correction
Unit will not run.	1. Power off or loose electrical connection. 2. Thermostat out of calibration - set too high. 3. Defective contactor. 4. Blown fuse/tripped breaker. 5. Transformer defective. 6. High pressure control open. 7. Low pressure control open.	1. Check for correct voltage at unit disconnect. Check for correct voltage at contactor in unit. 2. Reset. 3. Check for 24 volts at contactor coil - replace if contacts are open. 4. Replace fuses/reset breaker. 5. Check wiring - replace transformer. 6. Reset. 7. Reset.
Outdoor fan runs, compressor doesn't.	1. Run capacitor defective 2. Loose connection. 3. Compressor stuck, grounded or open motor winding, open internal overload. 4. Low voltage condition.	1. Replace. 2. Check for correct voltage at compressor - check and tighten all connections. 3. Wait at least 2 hours for overload to reset. If still open, replace the compressor. 4. Add start kit components.
Insufficient cooling.	1. Improperly sized unit. 2. Improper indoor air flow. 3. Incorrect refrigerant charge. 4. Air, non-condensibles or moisture in system.	1. Recalculate load. 2. Check - should be approximately 400 CFM per ton. 3. Charge per procedure. 4. Recover refrigerant, evacuate and recharge, add filter drier.
Compressor short cycles.	1. Incorrect voltage. 2. Defective overload protector. 3. Refrigerant undercharging.	1. At compressor terminals, voltage must be ±10% of nameplate marking when unit is operating. 2. Replace - check for correct voltage. 3. Add refrigerant.
Registers sweat.	1. Low indoor air flow.	1. Increase speed of blower or reduce restriction - replace air filter.
High head - low vapor pressures.	1. Restriction in liquid line, expansion device or filter drier. 2. Flow check piston size too small. 3. Incorrect capillary tubes.	1. Remove or replace defective component. 2. Change to correct size piston. 3. Change assembly coil.
High head - high or normal vapor pressures - cooling mode.	1. Dirty outdoor coil. 2. Refrigerant overcharge. 3. Outdoor fan not running. 4. Air or non-condensibles in system.	1. Clean coil. 2. Correct system charge. 3. Repair or replace. 4. Recover refrigerant, evacuate and recharge.

Troubleshooting Chart (cont'd)

Problem/Symptom	Likely Cause(s)	Correction
Low head - high vapor pressures.	1. Flow check piston size too large. 2. Defective compressor valves. 3. Incorrect capillary tubes.	1. Change to correct size piston. Replace compressor. 2. Replace coil assembly.
Low vapor - cool compressor - iced indoor coil.	1. Low indoor air flow. 2. Operating below 55°F outdoors. 3. Moisture in system.	1. Increase speed of blower or reduce restriction - replace air filter. 2. Add low ambient kit. 3. Recover refrigerant - evacuate and recharge - add filter drier.
High vapor pressure.	1. Excessive load. 2. Defective compressor.	1. Recheck load calculation. 2. Replace.
Fluctuating head and vapor pressures..	1. TXV hunting. 2. Air or non-condensibles in system.	1. Check TXV bulb clamp - check air distribution on coil - replace TXV. 2. Recover refrigerant, evacuate and recharge.
Gurgle or pulsing noise at expansion device or liquid line.	1. Air or non-condensibles in system.	1. Recover refrigerant, evacuate and recharge.

Service Analyzer Charts

Compressor Overheating		
Problem/Symptom	**Likely Cause(s)**	**Correction**
High superheat.	1. Low charge. 2. Faulty metering device. 3. High internal load. 4. Restriction in liquid line. 5. Low head pressure.	1. Check system charge. 2. Restricted cap tube, TXV. Power element superheat adjustment. Foreign matter stopping flow. 3. Hot air (attic) entering room. Heat source on; miswired or faulty control. 4. Drier plugged. Line kinked. 5. Low charge. Operating in low ambient temperatures.
Low voltage.	1. Loose wire connections. 2. Dirty or pitted compressor contactor contacts. 3. Power company problem, transformer. 4. Undersized wire feeding unit.	1. Check wiring. 2. Replace contactor. 3. Have problem corrected before diagnosis continues. 4. Correct and complete diagnosis.
High voltage.	1. Power company problem.	1. Have problem corrected.

Compressor Overheating (cont'd)		
Problem/Symptom	**Likely Cause(s)**	**Correction**
High head pressure.	1. Overcharge. 2. Dirty heat pump coil. 3. Faulty or wrong size heat pump fan motor. 4. Faulty outdoor blower. 5. Recirculation of air. 6. Additional heat source. 7. Non-condensibles	1. Check system charge. 2. Clean coil. 3. Replace fan motor. 4. Replace blower. Replace with correct rotation motor. 5. Correct installation. 6. Check for recirculating from other equipment. 7. Recover refrigerant, evacuate and recharge system.
Short cycling of compressor.	1. Faulty pressure control. 2. Loose wiring. 3. Thermostat. 4. TXV. 5. Capillary Tube. 6. Low charge. 7. Low evaporator air flow. 8. Faulty run capacitor. 9. Faulty internal overload.	1. Replace pressure control. 2. Check unit wiring. 3. Located in supply air stream. Differential setting too close. Customer mis-use. 4. Internal foreign matter. Power element failure. Valve too small. Distributor tube/tubes restricted. 5. Restricted with foreign matter. Kinked. I.D. reduced from previous compressor failure. 6. Check system charge. 7. Dirty coil. Dirty filter. Duct too small or restricted. 8. Replace. 9. Replace compressor.
Faulty compressor valves.	1. Fast equalization/low pressure difference.	1. Replace compressor and examine system to locate reason.
Electrical		
Voltage present on load side of compressor contactor and compressor won't run.	1. Run capacitor. 2. Internal overload. 3. Compressor windings.	1. Check with ohmmeter. 2. Allow time to reset. 3. Check for current ohms.
Voltage present on line side of compressor contactor only.	1. Thermostat. 2. Compressor control circuit.	1. Check for control voltage to compressor-contactor coil. 2. High pressure switch. Low pressure switch. Compressor turned off/on control or interlock.

Electrical (cont'd)		
Problem/Symptom	**Likely Cause(s)**	**Correction**
No voltage on line side of compressor contactor.	1. Blown fuses or tripped circuit breaker. 2. Improper wiring.	1. Check for short in wiring or unit. 2. Recheck wiring diagram.
Improper voltage.	1. High voltage. 2. Low voltage. 3. Single phasing (3 phase).	1. Power supply problem. 2. Power supply problem. Wiring undersized. Loose connections. 3. Check incoming power and fusing.
Contamination		
Moisture.	1. Poor evacuation on installation or during service.	1. In each case, the cure is the same, recover refrigerant. Add filter drier, evacuate and recharge.
High head pressure.	1. Non-condensibles air.	
Unusual head and suction readings.	1. Wrong refrigerant.	
Foreign matter - copper fittings.	1. Copper tubing cuttings.	
Copper oxide.	1. Dirty copper piping.	
Welding scale.	1. Nitrogen not used.	
Soldering flux.	1. Adding flux before seating copper part way.	
Excess soft solder.	1. Wrong solder material.	
Loss of Lubrication		
Low suction pressure.	1. Low charge. 2. Refrigerant leaks.	1. Check system charge. 2. Repair and recharge.
Cold, noisy compressor - slugging.	1. Dilution of oil with refrigerant.	1. Observe piping guidelines.
Noisy compressor.	1. Migration.	1. Check crankcase heater.
Cold, sweating compressor.	1. Flooding.	1. Check system charge.
Low load.	1. Reduced air flow. 2. Thermostat setting.	1. Dirty filter. Dirty coil. Wrong duct size. Restricted duct. 2. Advise customer.
Short cycling of compressor.	1. Faulty pressure control. 2. Loose wiring. 3. Thermostat.	1. Replace control. 2. Check all control wires. 3. In supply air stream, out of calibration. Customer misuse.
Flooding		
Poor system control using a TXV.	1. Loose sensing bulb. 2. Bulb in wrong position. 3. Wrong size TXV. 4. Improper superheater setting.	1. Secure the bulb and insulate. 2. Relocate bulb. 3. Use correct replacement. 4. Adjust, if possible, replace if not.

Flooding (cont'd)		
Problem/Symptom	**Likely Cause(s)**	**Correction**
Poor system control using capillary tubes.	1. Overcharge. 2. High head pressures. 3. Evaporator air flow too low.	1. Check system charge. 2. Dirty heat pump. Restricted air flow. Recirculation of air. 3. Adjust air flow to 400 CFM/Ton.
Thermostatic Expansion Valves		
High superheat, low suction pressure.	1. Moisture freezing and blocking valve. 2. Dirt or foreign material blocking valve. 3. Low refrigerant charge. 4. Vapor bubbles in liquid line. 5. Misapplication of internally equalized valve. 6. Plugged external equalizer line. 7. Undersized TXV. 8. Loss of charge from power head sensing bulb. 9. Charge migration from sensing bulb to power head (warm power head with warm, wet cloth. Does valve operate correctly now?) 10. Improper superheat adjustment (only applicable to TXV with adjustable superheat settings).	1. Recover charge, install filter drier, evacuate system, recharge. 2. Recover charge, install filter-drier, evacuate system, recharge. 3. Correct the charge. 4. Remove restriction in liquid line. Correct the refrigerant charge. Remove non-condensible gases. 5. Use correct TXV. 6. Remove external equalizer line restriction. 7. Replace with correct valve. 8. Replace power head or complete TXV. 9. Ensure TXV is warmer than sensing bulb. 10. Adjust superheat setting counter-clockwise.
Valve feeds too much refrigerant, with low superheat and higher than normal suction pressure.	1. Moisture causing valve to stick open. 2. Dirt or foreign material causing valve to stick open. 3. TXV seat leak (a gurgling or hissing sound is heard at the TXV during the off cycle, if this is the cause). Not applicable to bleed port valves. 4. Oversized TXV. 5. Incorrect sensing bulb location. 6. Low superheat adjustment (only applicable to TXV with adjustable superheat setting). 7. Incorrectly installed or restricted external equalizer line.	1. Recover refrigerant, replace filter drier, evacuate system and then recharge. 2. Recover refrigerant, replace filter drier, evacuate system and recharge. 3. Replace the TXV. 4. Install correct TXV. 5. Install bulb with two mounting straps, in 2:00 or 4:00 position on suction line, with insulation. 6. Turn superheat adjustment clockwise. 7. Remove restriction, or relocate external equalizer.

Thermostatic Expansion Valves (cont'd)		
Problem/Symptom	**Likely Cause(s)**	**Correction**
Compressor flood back upon start-up.	1. Any of the causes listed under symptoms of problem 2.	1. Any of the solutions listed under solutions of problem 2.
Superheat is low to normal with low suction pressure.	1. Unequal evaporator circuit loading. 2. Low load or air flow entering evaporator coil.	1. Ensure air flow is equally distributed through evaporator. Ensure proper piston. Check for blocked distributor tubes. 2. Ensure blower is moving proper air CFM. Remove/correct any air flow restriction.
Superheat and suction pressure fluctuate (valve is hunting)	1. Expansion valve is oversized. 2. Sensing bulb is affected by liquid refrigerant or refrigerant oil flowing through suction line. 3. Unequal refrigerant flow through evaporator circuits. 4. Improper superheat adjustment (only possible with TXV having superheat adjustment. 5. Moisture freezing and partially blocking TXV.	1. Install correct TXV. 2. Relocate sensing bulb in another position around the circumference of the suction line. 3. Ensure proper distributor piston is inserted. Ensure sensing bulb is located properly. Check for block distributor tubes. 4. Replace TXV or adjust superheat. 5. Recover refrigerant, change filter drier, evacuate system and recharge.
Valve does not regulate at all.	1. External equalizer line not connected or line plugged in. 2. Sensing bulb lost its operating charge. 3. Valve body damaged during soldering or by improper installation.	1. Connect equalizer line in proper location, or remove any blockage. 2. Replace TXV. 3. Replace TXV.

7.1 SERVICE

A. Changing the Return Air Filters

Tools Required

- Slotted screw driver or key for opening front doors

There are two return filters in the upper (indoor) section of the unit. A filter is located behind each of the return grilles. To remove the filters, open both doors and slide the filters out as shown below.

B. Changing the Ventilation Air Filters

Tools Required

- Slotted screw driver

The ventilation filter(s) are located in the left section of the bottom compartment behind a panel.

1. Remove the two screws at the top and bottom of each panel to access the filters.

2. Slide the filters out to inspect/replace. After inspecting/replacing of the filters, replace filter access panel.

C. Access to the Indoor Coils for Cleaning

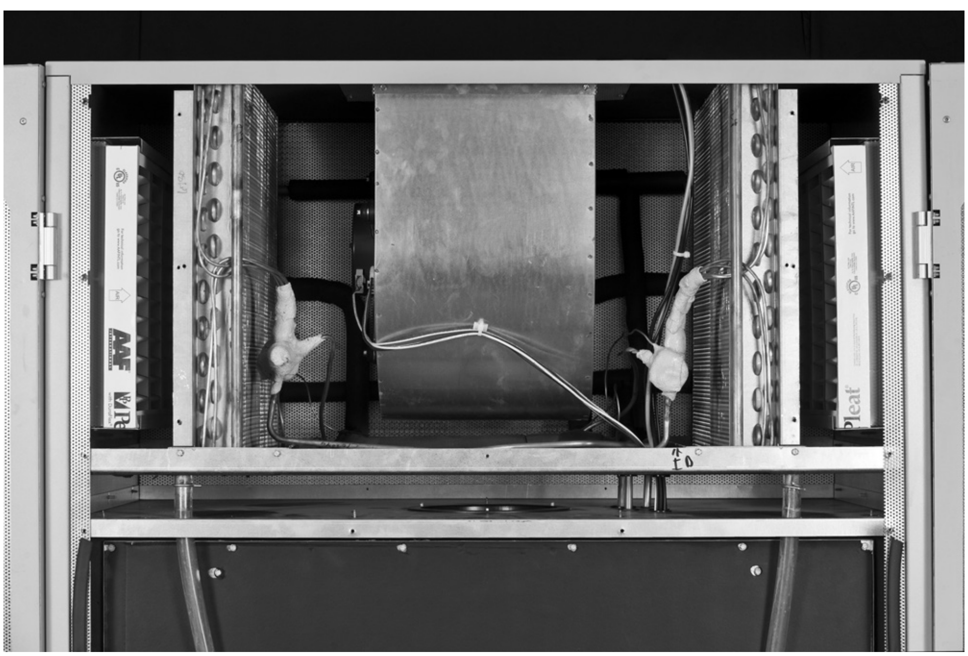
Tools Required

- 5/16” Nut Driver

1. Remove the top cover – fifteen screws.

2. Remove the filters.

3. Carefully spray the coils with the cleaning solution. Use care NOT to spray the electrical connections for the indoor motor.

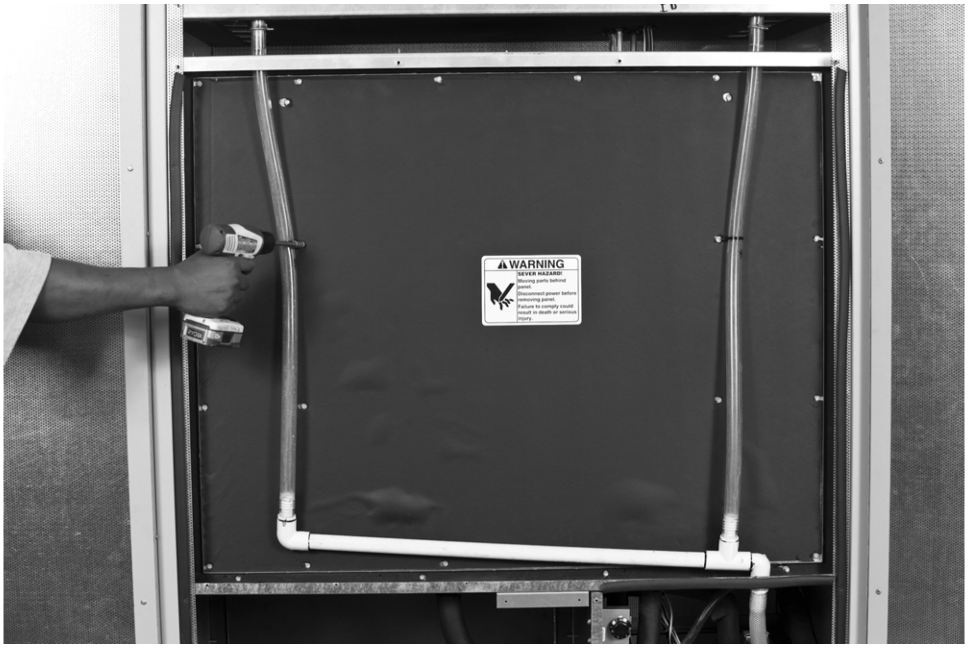


D. Access to Outdoor Coils for Cleaning

Tools Required

- 5/16” Nut Driver

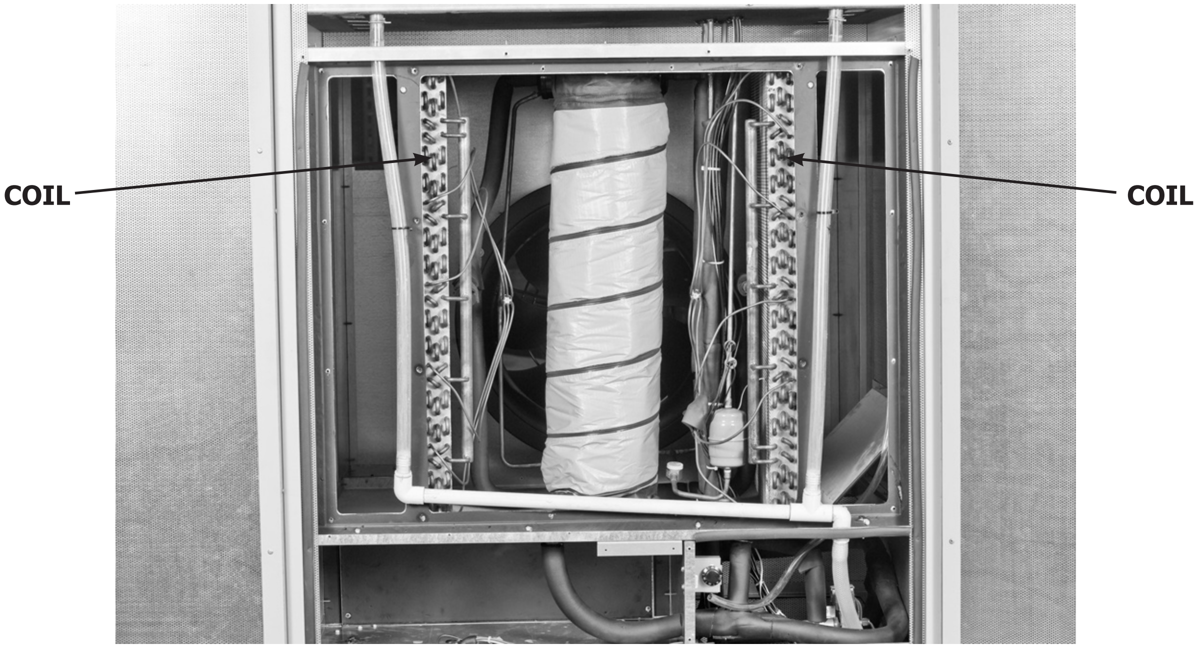
1. Remove the two screws that hold the condensate line to the middle front door. Note: Do not remove or disconnect the condensate tubing.



2. Remove the eighteen screws that hold the door.

3. Carefully remove the door.

4. With the door removed, carefully spray the coils with the cleaning solution.



E. Removal of Fresh Air Intake Blower Motor

Tools Required

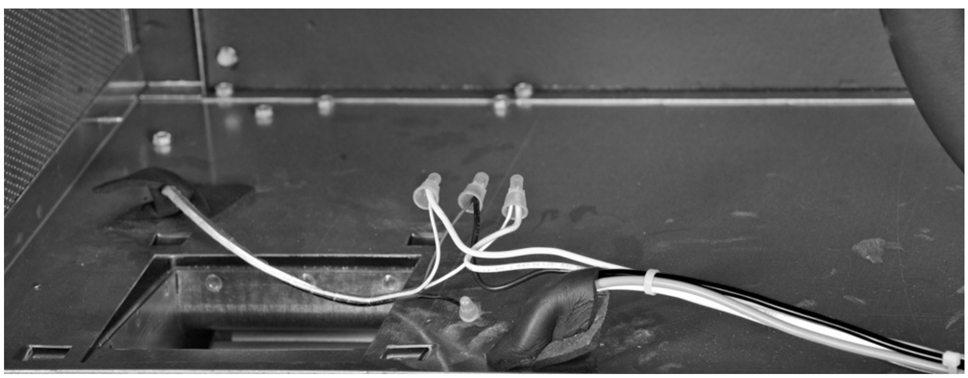
- 5/16” Nut Driver
- Slotted Screw Driver
- Clippers to Cut Wire Tie

1. Remove the two screws that hold the blower in place.

2. Remove the eight screws that hold the lower plenum front cover.

3. Cut tie wrap that hold wires.

4. Disconnect the four wires at the butt splice.



5. Slide the blower motor out.

F. Access to the GreenWheel Drive Motor and the GreenWheel and the Damper Motor for the "B" Ventilation Option, and access to 460v. transformer and to fresh air exhaust motor.

Tools Required

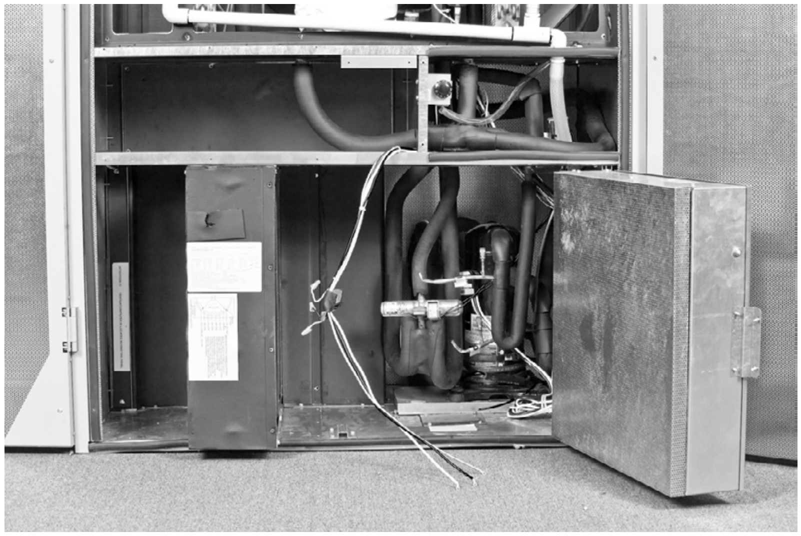
- 5/16" Nut Driver
- 5/16" Socket Wrench or Open End Wrench
- Clippers to Cut Wire Tie

1. Remove ventilation filters.
2. Remove ventilation fresh air intake blower motor. (See instructions for removing this blower/motor.)
3. Remove the filter cover holder – seven screws.

4. Remove the filter rack assembly – thirteen screws.

5. Remove the two GreenWheel dividers – one on the left and one on the right. Each divider has two screws.

6. Disconnect wires to the GreenWheel drive motor or the damper motor.



7. While lifting up on the horizontal divider panel that rests on the ventilation module, pull the ventilation module out of the unit..

Access to 460v. transformer and to fresh air exhaust motor is behind this panel.

G. Removal of the Indoor Blower Motor

Tools Required

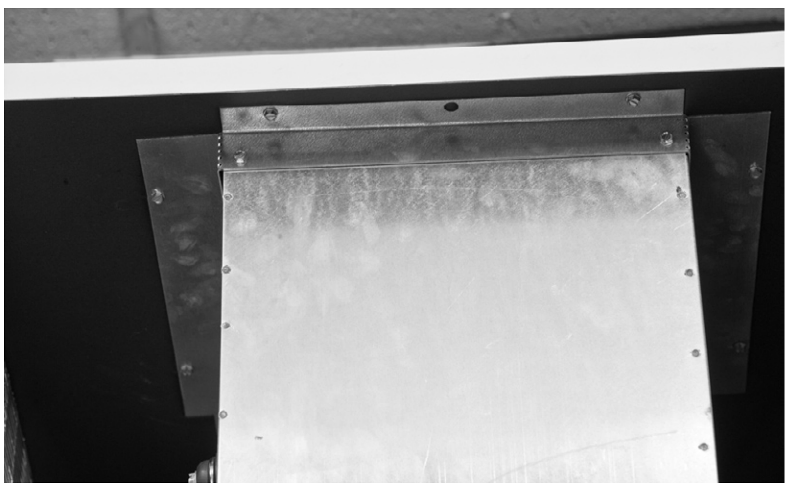
- 5/16” Nut Driver
- Clippers to Cut Wire Tie

1. Remove the top cover – fifteen screws.

2. Disconnect the two electrical harnesses on the blower motor.

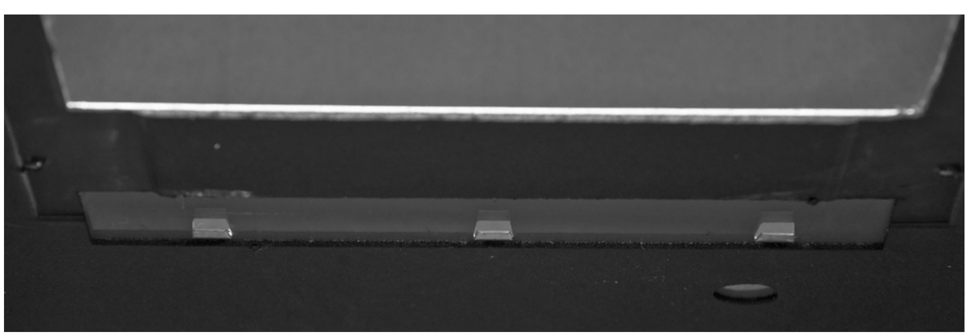
3. Cut the tie wrap that holds the wires to the blower housing.

4. Remove the six screws – two on the left, two in the front and two on the right that hold the blower motor to the top panel. These screws penetrate the blower motor flange vertically into the top panel.



5. Pull forward on the blower. Use caution when removing the blower; it is heavy.

Note: when reinstalling the blower motor, the rear flange of the blower motor must engage the three clips in the top panel. Photo 3343



H. Removal of the Outdoor Fan Motor Assembly (2, 2-1/2, 3 & 3-1/2T Units Only)

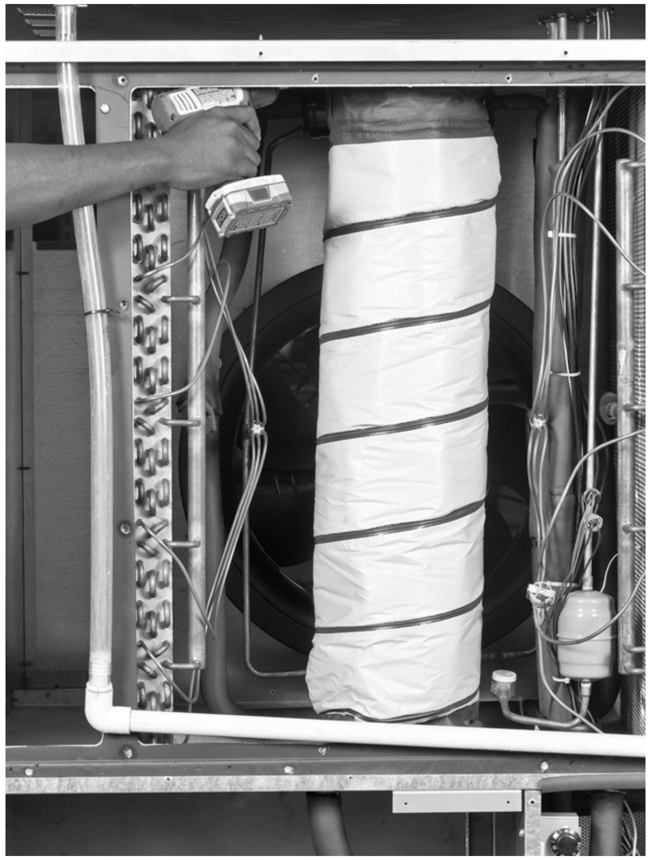
Tools Required

- 7/16” Socket
- 5/16” Nut Driver

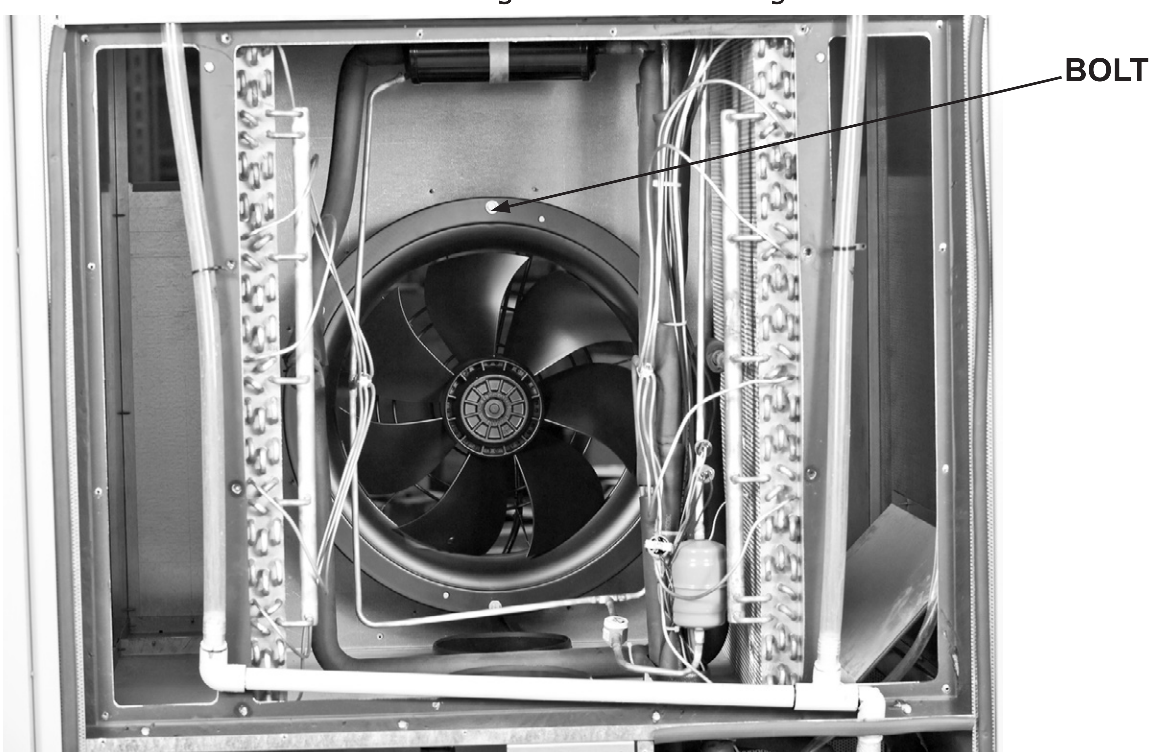
1. Remove the two screws that hold the condensate line to the middle front door. Note: Do not remove or disconnect the condensate tubing.

2. Remove the eighteen screws that hold the door and carefully remove the door.

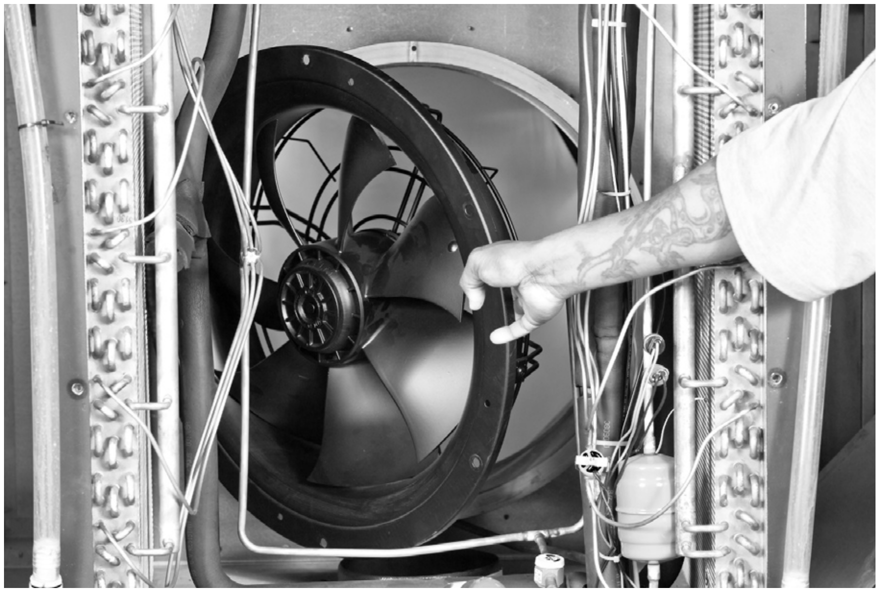
3. Disconnect the flexible duct by removing the screws at the top and bottom of the duct.



4. Remove the six bolts that hold the fan motor assembly. It is necessary to hold the nut on the backside of the flange when unscrewing the bolts.



5. Carefully rotate the fan motor assembly 90° and pull the assembly out of the machine. Use care not to damage the coil or a refrigerant line when removing the fan motor assembly.

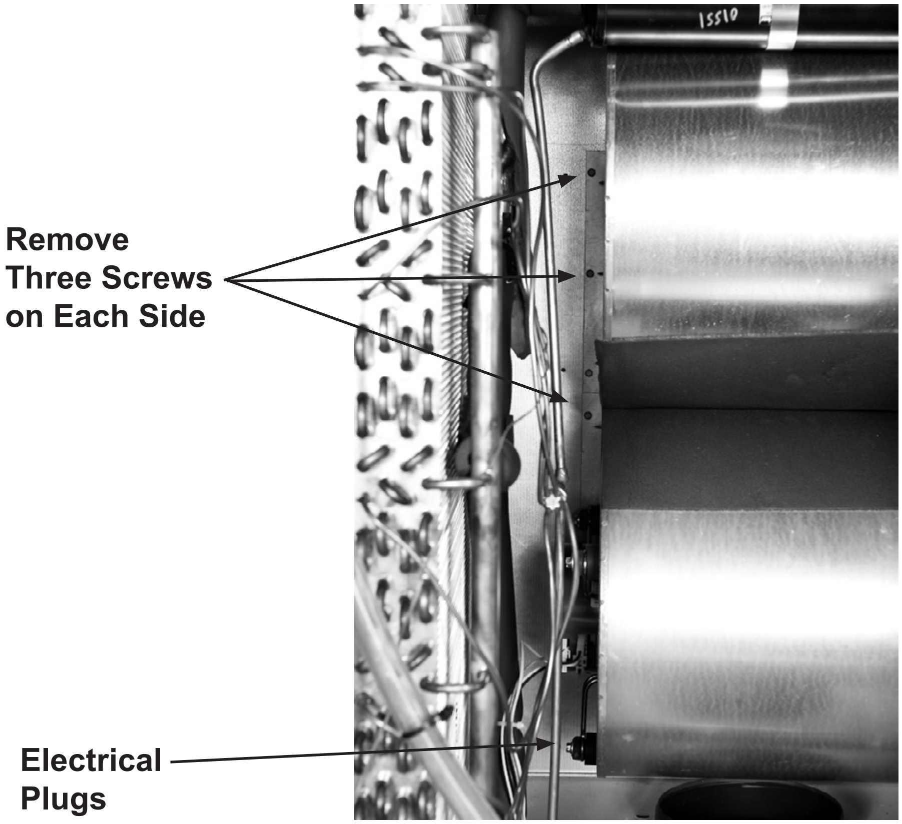


I. Removal of the Outdoor Fan Motor Assembly (4 & 5T Units Only)

Tools Required

- 7/16” socket
- 5/16” nut driver

1. Remove the two screws that hold the condensate line to the middle front door. Note: Do not remove or disconnect the condensate tubing.
2. Remove the eighteen screws that hold the door and carefully remove the door.
3. Disconnect the flexible duct by removing the screws at the top and bottom of the duct.
4. The two blowers can be removed individually. Disconnect the two electrical plugs to the blower assembly(s) that is to be removed.
5. Remove the three screws on each side of the assembly and pull the assembly out of the unit. Use care not to damage the coil or a refrigerant line when removing the fan motor assembly. Note: See photo on following page.

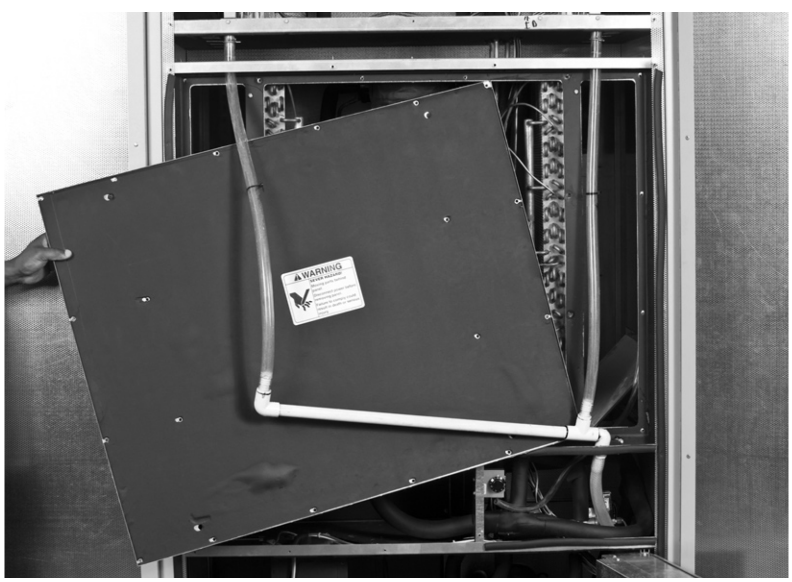


J. Removal of the Fresh Air Exhaust Fan Motor

Tools Required

- 5/16” Nut Driver
- No. 2 Phillips Head Screwdriver

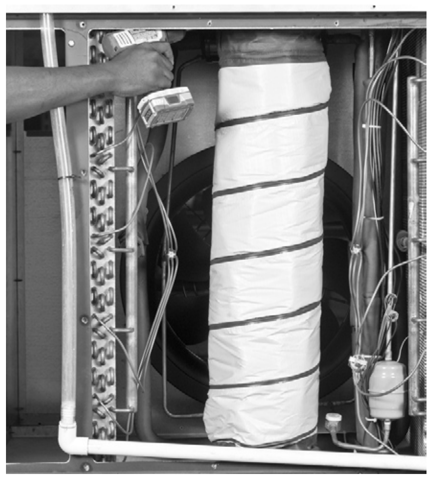
1. Remove the 18 screws that hold the middle door.



2. Remove the lower plenum front cover - eight screws.

3. Remove the lower plenum divider/access door – ten screws.

4. Remove yellow flexible duct.



5. Disconnect wires to the fan motor.

6. Remove fan motor – two Phillips head screws.

K. Access to Electrical Box

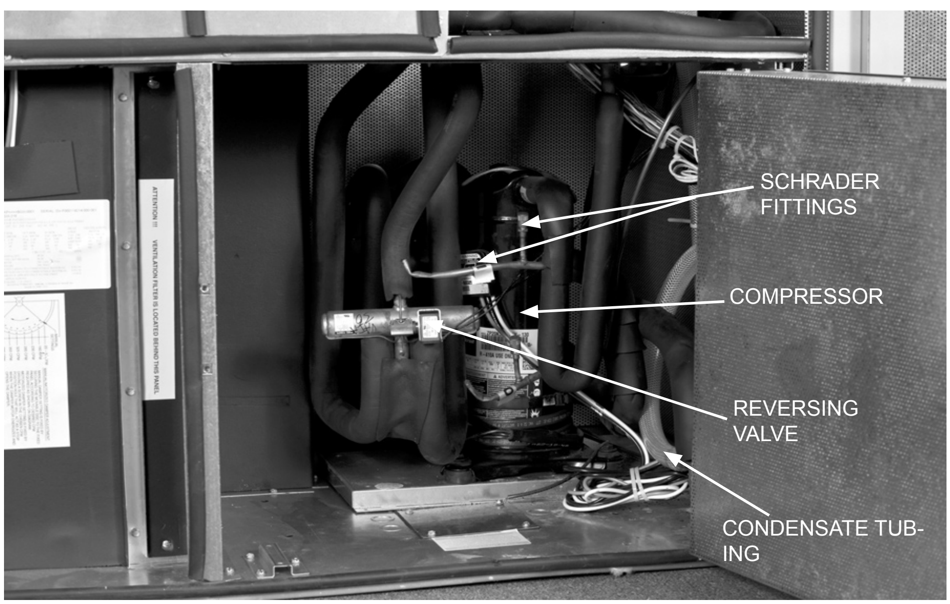
Tools Required

- 5/16” Nut Driver

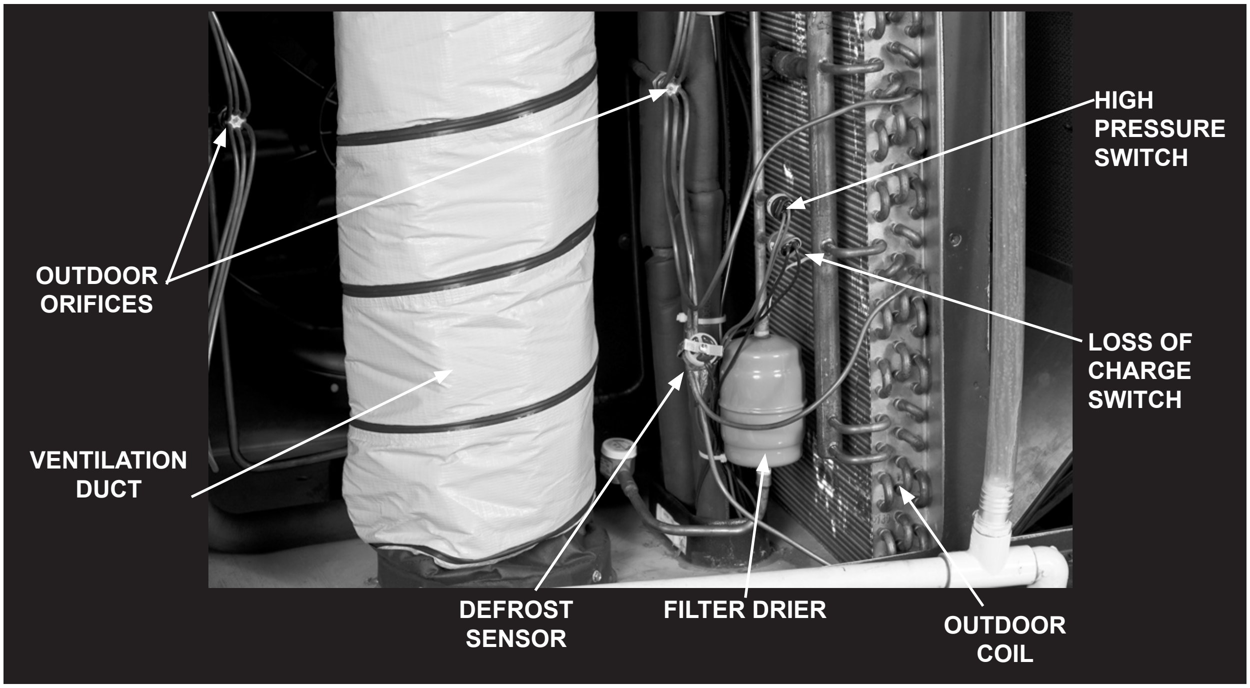
1. Remove the eight screws that hold the control box cover panel.

Location of major components

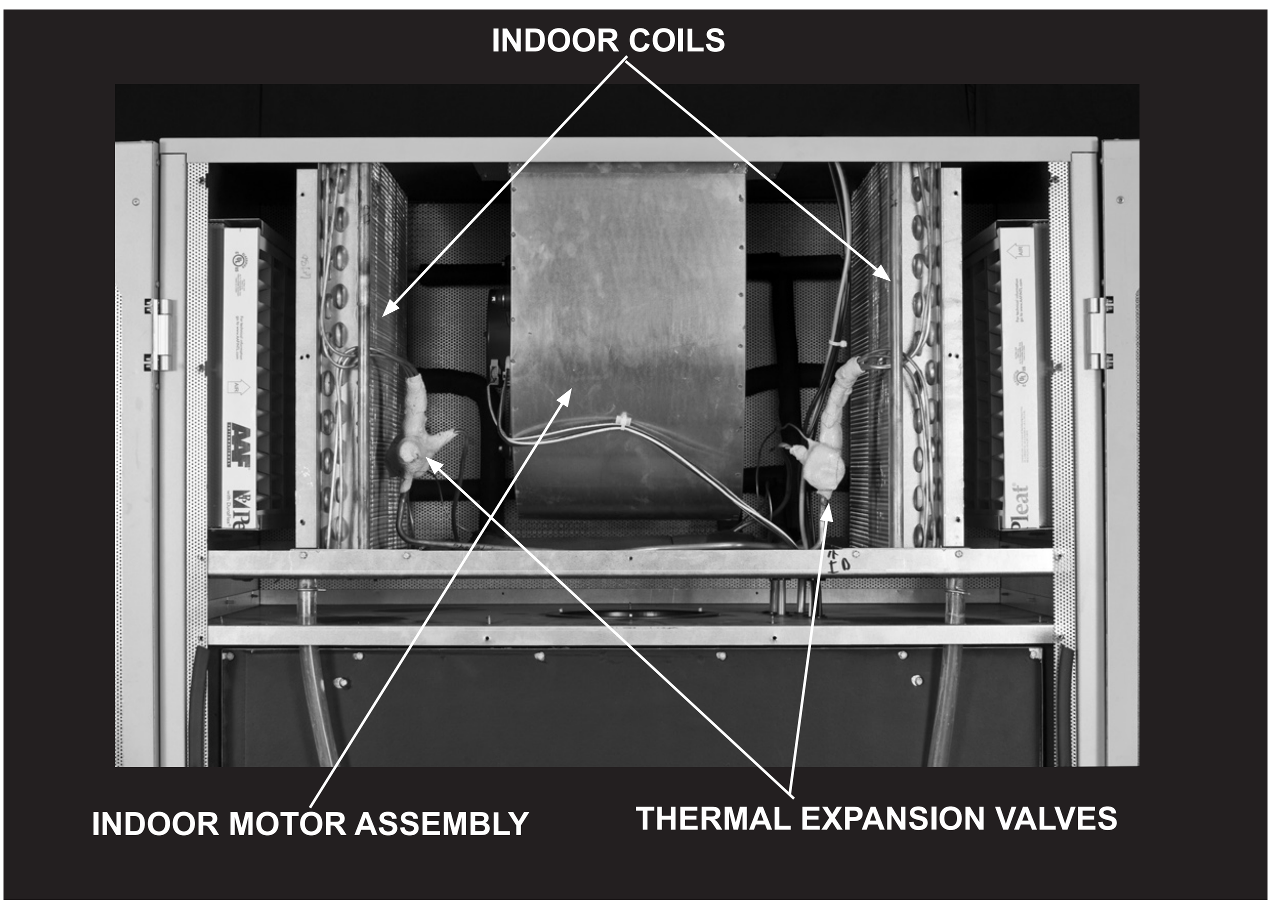
1. Compressor, reversing valve and coil, Schrader fittings and condensate drain hose.



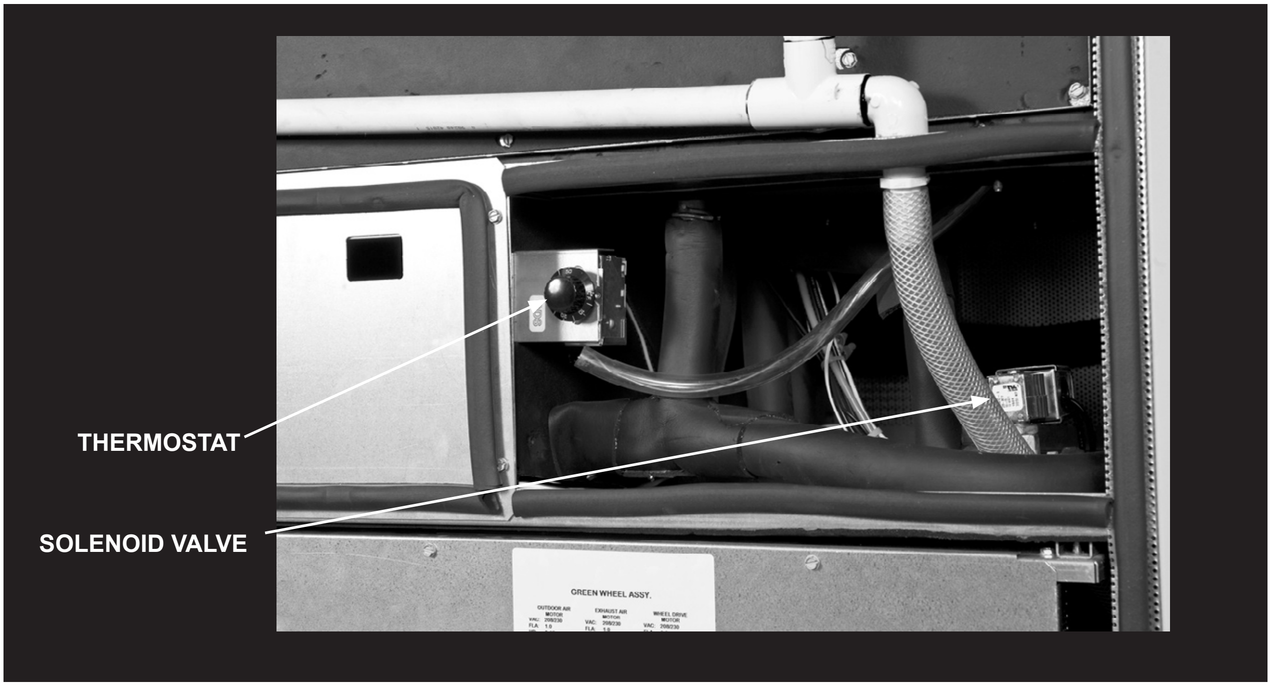
2. Outdoor Coil, Filter drier, High pressure switch, Loss of charge switch, Outdoor orifice, Defrost sensor, Flexible duct for ventilation air.



3. Indoor Coil, Indoor blower motor assembly and Thermal Expansion Valve.



4. Outdoor thermostat, reheat valve and solenoid coil for reheat valve.



8.1 PROCEDURE FOR FILING A WARRANTY CLAIM

156 Seedling Drive • Cordele, GA 31015 • P.O. Box 400 • Cordele, GA 31010-0400
Phone 800-841-7854 • 229-273-3636 • Fax 229-276-1479 • Svc Pager 800-204-8210

MARVAIR SERVICE REQUEST / PURCHASE ORDER FOR SERVICE

DATE RECEIVED	TIME NOTIFIED	DATE DISPATCHED	TIME DISPATCHED	CUSTOMER PO#	MARVAIR SERVICE PO #
		Marvair Use	Marvair Use		Marvair Use

Person requesting service:____

Company requesting service:______________________________________

Phone #:________________________ Fax #:_________________________

Site Information:

Point of Contact:_______________________ Company:__________________________

Phone:______________________________ Alt. Name & Phone:____________________

Site Address:__________________________ Site# / Bldg# / Name:___________________

City:_________________________ ST.______ Zip:____________

Site Access Information:____

Equipment Repair Information:

MODEL #	SERIAL NUMBER	NATURE OF PROBLEM

Marvair Use - Service Company Information:

Service Company:____________________________ Contact:_________________________

Phone #:____________________________________ Fax:_____________________________

Address:____________________________________ Labor Rate:_______________________

City:_________________________ ST.______ Zip:____________

If included here, please review and sign our service centers Warranty Policy Information/Agreement then fax back to 229-273-5154. Invoices will be paid in accordance with Labor Allowance Guidelines included with this PO. Failure to follow these guidelines and labor allowances may result in delayed payment. All over time work must be approved in advance. All times allowed for entry into the refrigerant circuit include evacuation, recharge, refrigerant and drier change. Service centers are required to notify Marvair if site travel will exceed 1 hour each way – additional travel time must be approved in advance. Detailed invoices or service tech call sheet/work orders are required to be submitted with invoices for payment. Service Tech's should document work in detail and include/verify model(s) and serial number(s) of the equipment and include Marvair's PO on all documentation. Marvair will provide contractors with warranty replacement parts for service calls please contact us at 800-841-7854.

9.1 WARRANTY

If any part of your Marvair® Air Conditioner, Heat Pump or Unit Ventilator fails because of a manufacturing defect within fifteen months from the date of original shipment from Marvair or within twelve months from the date of original start-up, whichever is the earlier date, Marvair will furnish without charge, EXW Cordele, Georgia, the required replacement part. Any transportation, related service labor, diagnosis calls, filter, driers, and refrigerant are not included. The owner must provide proof of the date of the original start-up. The owner's registration card filed with Marvair, the contractor's invoice, the certificate of occupancy or similar document are examples of proof of the date of the original start-up.

In addition, if the hermetic compressor fails because of a manufacturing defect within sixty months from the date of original shipment from Marvair®, Marvair will furnish without charge, EXW Cordele, Georgia, the required replacement part. Any related service labor, diagnosis calls, filter, driers and refrigerant are not included. Marvair will pay for non-priority shipping costs of the compressor during the first twelve months of the warranty period. After the first twelve months of the warranty period, all costs of shipment and risk of loss during the shipment of the compressor shall be the responsibility of the owner.

The owner of the product may ship the allegedly defective or malfunctioning product or part to Marvair®, at such owner's expense, and Marvair will diagnose the defect and, if the defect is covered under this warranty, Marvair will honor its warranty and furnish the required replacement part. All costs for shipment and risk of loss during shipment of the product to Marvair and back to the owner shall be the responsibility and liability of the owner. Upon written request by an owner, Marvair may arrange for remote diagnosis of the allegedly defective or malfunctioning product or part but all costs for transportation, lodging and related expenses with regard to such diagnostic services shall be the responsibility and liability of the owner.

An owner requesting performance under this Warranty shall provide reasonable access to the allegedly defective or malfunctioning product or part to Marvair® and its authorized agents and employees.

This warranty applies only to products purchased and retained for use within the U.S.A., Canada, and Mexico. This warranty does not cover damage caused by improper installation, misuse of equipment or negligent servicing.

THIS WARRANTY CONSTITUTES THE EXCLUSIVE REMEDY OF ANY PURCHASER OF A Marvair® HEAT PUMP OR AIR CONDITIONER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE, TO THE FULLEST EXTENT PERMITTED BY LAW. IN NO EVENT SHALL ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE EXCEED THE TERMS OF THE APPLICABLE WARRANTY STATED ABOVE AND Marvair SHALL HAVE NO OTHER OBLIGATION OR LIABILITY. IN NO EVENT SHALL Marvair BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR MONETARY DAMAGES.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE-TO-STATE. Some states do not allow limitations or exclusions, so the above limitations and exclusions may not apply to you.

10.1 PARTS LIST

Scholar III™ Heat Pump Parts List

PARTS		VAIA24HP	VAIA30HP	VAIA36HP	VAIA40HP	VAIA48HP	VAIA60HP
Compressor	HPA[1]	10333 (K5)	10298	10349	10352	10310	10313
	HPC[2]	10327	10299	10350	10353	10311	10314
	HPD[3]	10328	10300	10351	10354	10312	10315
Capacitor, Compressor (ufd/Volts)	HPA	50280	50315	50321	50321	50327	50315 (2)
		35 / 370	40 / 370	45 / 370	45 / 370	70 / 440	40 / 370
Compressor Plug/Cord, 80" Long	HPA	19012	19012	19012	19012	19012	19012
	HPC/HPD	19013	19013	19013	19013	19013	19013
Crankcase Heater, 40 Watt		70044	70044	70044	70044	70044	70044
Sound Blanket, Compressor		20052	20052	20052	20054	20054	20054
Thermal Expansion Valve (Indoor)	P/N	20360 (2)	20360 (2)	20361 (2)	20361 (2)	20362 (2)	20362 (2)
Nozzle and Retainer Clip	P/N	20363 (2)	20363 (2)	20364 (2)	20364 (2)	20365 (2)	20365 (2)
	J Size	1	1	1-1/2	1-1/2	2	2
Indoor Coil with Reheat (G Option4)		60162 (2)	60162 (2)	60162 (2)	60151 (2)	60151 (2)	60151 (2)
Valve, 3-Way Diverting (G Option4)		20257	20257	20257	20257	20257	20257
Coil, Solenoid, 3 Way Diverting (G Option4)		20028	20028	20028	20028	20028	20028
Check Valve, 5/8" Solder (G Option4)		20029	20029	20029	20029	20029	20029
Indoor Coil		60164 (2)	60164 (2)	60164 (2)	60141 (2)	60141 (2)	60141 (2)
Indoor Blower (Wheel / Housing)		30068	30068	30068	30063	30063	30063
Indoor Motor	½ HP	40083	40083	40083	n/a	n/a	n/a
	¾ HP	n/a	n/a	n/a	40089	40089	40089
Mount, Indoor Motor		80455	80455	80455	80455	80455	80455
Digital Control Unit		70363	70363	70363	70363	70363	70363
Manual Control Unit		n/a	n/a	n/a	n/a	70390 (2)	70390 (2)
Cable Assembly		01511	01511	01511	01511	01511 (3)	01511 (3)
Power Cable Assembly		01512	01512	01512	01512	01512 (3)	01512 (3)
Orifice for Outdoor Distributor	P/N	20373 (2)	20374 (2)	20065 (2)	20384 (2)	20103 (2)	20077 (2)
	Size	0.032	0.033	0.036	0.041	0.045	0.051
Outdoor Coil		60163 (2)	60163 (2)	60163 (2)	60142 (2)	60142 (2)	60142 (2)
		2CX1403E-	2CX1403E-	2CX1403-	2CX1404E-	2CX1404E-	2CX1404E-
		36 x 26.5	36 x 26.5	36 x 26.5	36 x 26.5	36 x 26.5	36 x 26.5
Outdoor Axial Fan/Motor, 230 Volt (HP/RPM)		30164	30164	30164	30164	n/a	n/a
Capacitor, Outdoor Motor	P/N	50312	50312	50312	50312	n/a	n/a
	ufd/Volts	8 ufd / 440 v	8 ufd / 440 v	8 ufd / 440 v	8 ufd / 440 v		
Outdoor Blower (Wheel / Housing)		n/a	n/a	n/a	n/a	30069 (2)	30069 (2)
						10-10T DD	10-10T DD
Outdoor Motor	1/2 HP	n/a	n/a	n/a	n/a	40083 (2)	40083 (2)
Mount, Outdoor Motor		n/a	n/a	n/a	n/a	80483 (2)	80483 (2)
Reversing Valve, RV, Alternate		20135B	20135B	20135B	20135B	20220A	20220A
Solenoid Coil, RV, Alternate		50225B	50225B	50225B	50225B	50225A	50225A
Compensator Tank		01549	01549	01549	01551	01551	01551
Accumulator (0.055 Orifice)		70340	70340	70340	70340	70340	70340
Filter Drier (Reversible)		70388	70388	70388	70388	70388	70388
Switch, Fan Cycle (245 Open, 400 Close)		n/a	n/a	n/a	n/a	70384	70384
Switch, High Pressure (610 Open, 420 Close)		70343	70343	70343	70343	70343	70343
Switch, Loss of Charge (40 Open, 60 Close)		70342	70342	70342	70342	70342	70342
Insulation, Quiet Liner		90259	90259	90259	90259	90259	90259
Duct, Flexible,		90260	90260	90260	90260	90260	90260
Hot Water Coil		60165 (2)	60165 (2)	60165 (2)	60165 (2)	60165 (2)	60165 (2)
Valve, Water Zone, Hot Water		20123	20123	20123	20123	20123	20123
Thermostat Outside		70232	70232	70232	70232	70232	70232
Knob, Outside Thermostat		70243	70243	70243	70243	70243	70243
Thermostat Control Mounting Bracket		03163	03163	03163	03163	03163	03163
Actuator, Damper (Ventilation options B, J)		40107	40107	40107	40107	40107	40107
Blower, Supply Air Mover, EBM (OAM)		30072	30072	30072	30072	30072	30072
Capacitor, Blower, Supply Air Mover, 4 ufd/440v		50163	50163	50163	50163	50163	50163

(continued on following page)

PARTS		VAIA24HP	VAIA30HP	VAIA36HP	VAIA40HP	VAIA48HP	VAIA60HP
Tubeaxial Fan, (EXM) (Ventilation options H, J)		30165	30165	30165	30165	30165	30165
Damper, Backdraft		01523	01523	01523	01523	01523	01523
Energy Recovery Wheel (Ventilation option H)		01226	01226	01226	01226	01226	01226
Motor, GreenWheel Drive (Ventilation option H)		40007	40007	40007	40007	40007	40007
Low Voltage Transformer (75 VA)		P/80390	P/80390	P/80390	P/80390	P/80390	P/80390
Fan Speed Controller, 230 Volt (Ventilation options H, Q)		70049	70049	70049	70049	70049	70049
Fan Speed Controller, 460 Volt (Ventilation options H, Q)		70301	70301	70301	70301	70301	70301
Green Cube (Ventilation option Q)		01670	01670	01670	01670	01670	01670
Low Voltage Transformer (75 VA)		50053	50053	50053	50053	50053	50053
Transformer (460 to 230 Volts)		50147	50147	50147	P/50007	P/50008	P/50008
		1.5 KVA	1.5 KVA	1.5 KVA	2 KVA	3 KVA	3 KVA
Contactor, Compressor, 30 Amp	HPA	50020	50020	50020	50020	n/a	n/a
Contactor, Compressor, 40 Amp	HPA	n/a	n/a	n/a	n/a	50030	50030
Contactor, Compressor, 30 Amp	HPC/HPD	50040	50040	50040	50040	50040	50040
Relay, Energy Management (EMS) Sub-Base P/N 50501		50511	50511	50511	50511	50511	50511
Relay, Blower Time (BTR)		50420	50420	50420	50420	50420	50420
Sensor, Open 56° F, Close 28° F		50102	50102	50102	50102	50102	50102
Resistor, 4.7K Ohm, 1/2 Watt, 5% Tolerance		50293	50293	50293	50293	50293	50293
Relay, DPST		50205	50205	50205	50205	50205	50205
Controller, PLC,		70275	70275	70275	70275	70275	70275
Relay, Indoor Blower (IBR) Used with PLC		P/50182	P/50182	P/50182	P/50182	P/50182	P/50182
Contactor, Heat, 2 Pole, 30A	5 kW	50020	50020	50020	50020	50020	50020
Contactor, Heat, 3 Pole, 40A	7.5-10 kW	50030	50030	50030	50030	50030	50030
Contactor, Heat, 3 Pole, 30A	HPC/HPD	50040	50040	50040	50040	50040	50040
Limit Control, Auto Reset (Open 165 F)		70005	70005	70005	70005	70005	70005
Dual Limit Control (145 F Open, 90 F Close)	5 kW HPA	70006	70006	70006	70006	70006	70006
	HPA	70006 (2)	70006 (2)	70006 (2)	70006 (2)	70006 (2)	70006 (2)
	HPC/HPD	70006 (3)	70006 (3)	70006 (3)	70006 (3)	70006 (3)	70006 (3)
Heater, 5 kW, 240 Volts, 20.8A	HPA	70492 (70450 Angled)					
Heater, 7.5 kW, 240 Volts, 31.2A	HPA	70488	70488	70488	70488	70488	70488
Heater, 10 kW, 240 Volts, 41.6A	HPA	70493 (70451 Angled)					
Heater, 5 kW, 240 Volts, 12A	HPC	70489	70489	70489	70489	70489	70489
Heater, 7.5 kW, 240 Volts, 18A	HPC	70484	70484	70484	70484	70484	70484
Heater, 10 kW, 240 Volts, 24A	HPC	70490	70490	70490	70490	70490	70490
Heater, 15 kW, 240 Volts, 36.1A	HPC	70494 (70449 Angled)					
Heater, 5 kW, 480 Volts, 6A	HPD	70485	70485	70485	70485	70485	70485
Heater, 7.5 kW, 480 Volts, 9A	HPD	70486	70486	70486	70486	70486	70486
Heater, 10 kW, 480 Volts, 12A	HPD	70487	70487	70487	70487	70487	70487
Heater, 15 kW, 480 Volts, 18.4A	HPD	70495 (70481 Angled)					
Ring, Condenser Fan Mounting		01566	01566	01566	01566	n/a	n/a
Ring, Round Hose, 8" Diameter		91555 (2)	91555 (2)	91555 (2)	91555 (2)	91555 (2)	91555 (2)
Ring, Flat Oval Hose, 6"		91566	91566	91566	91566	91566	91566
Box, Transition, 20 x 4, with bottom removed		91973 (P/N 91583 Modified)			91973 (P/N 91583 Modified)		
Filter, Return Air (16 x 24 x 2)		91968 (2)	91968 (2)	91968 (2)	91968 (2)	91968 (2)	91968 (2)
Filter, Exhaust (12 x 20 x 1)		80214	80214	80214	80214	80214	80214
Filter, Fresh Air (12 x 20 x 1)		80214	80214	80214	80214	80214	80214
Grille, Plenum (12 x 8 G1V OD Z SA)		91969 (2)	91969 (2)	91969 (2)	91969 (2)	91969 (2)	91969 (2)
Grille, Plenum (14.5 x 12 G1V OD Z SA)		91970 (2)	91970 (2)	91970 (2)	91970 (2)	91970 (2)	91970 (2)
Disconnect		70178 (HPA)		70183 (HPC)		70435 (HPD)	

[1] HPA = 208/230v. 1ø
[2] HPC = 208/230v. 3ø
[3] HPD = 460v. 3ø
[4] G Option = Hot Gas Reheat