Marvair®
AIRXCEL®, Inc.
ISO 9001 2000 REGISTERED COMPANY

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

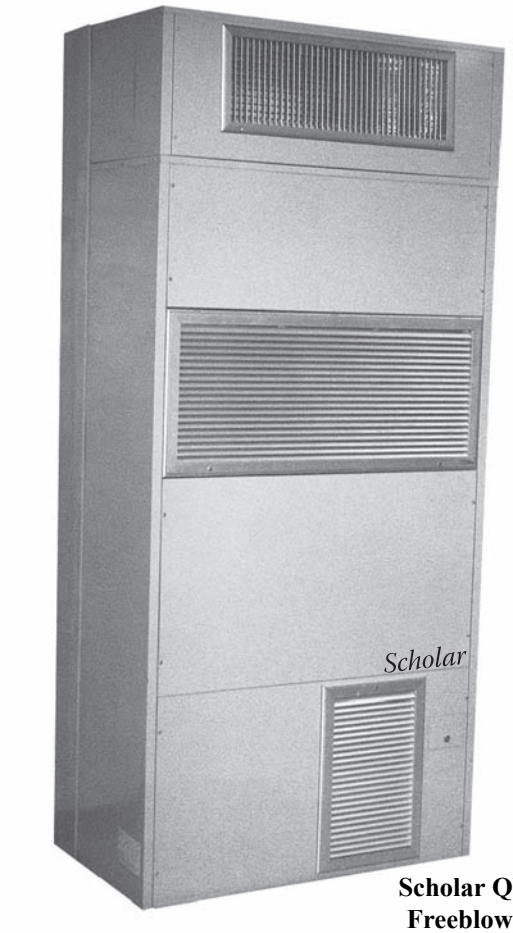
MAINTENANCE & SERVICE

Model VAI
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 to specify the Marvair® Scholar QV™ Heat Pump or Air Conditioner.



Scholar QV™ with Freeblow Plenum

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

Manufactured By:
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SECTION 15700

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

MAINTENANCE & SERVICE MANUAL

FOR SCHOLAR QV™ HEAT PUMP & AIR CONDITIONER, MODEL VAI (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 QV™ 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 QV 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.

1.01 GENERAL OPERATION

A. Scholar QV™ 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.

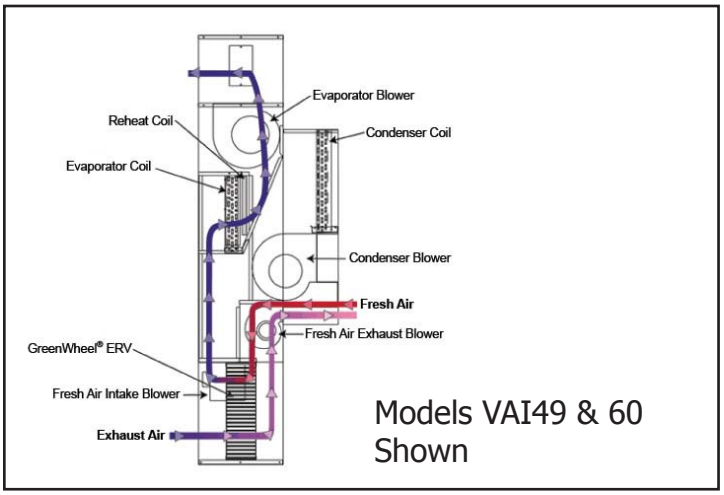
Control systems are either a remote external thermostat, internal thermostat, or a direct digital control interfacing with the building automation system (BAS).

Hot Gas Reheat (HGR) Dehumidification (Option). To provide on demand dehumidification, the Scholar QV™ 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 (p/n 50057) 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



1.02 MODEL IDENTIFICATION

The Scholar QV™ heat pump and air conditioner identification numbering system is shown below. The model identification number is found on the left cabinet panel near the bottom front cover.

Certain models of Scholar QV™ heat pumps and air conditioners are available with a backward curved motorized impeller for the condenser air mover. The motorized impeller reduces the sound of the condenser air and reduces the sound level in the classroom. Scholar QV heat pumps and air conditioners with the motorized impeller are designated by "QV" at the end of the model number.

Model Identification

VAI • • • • • • • QV

- VAI: Vertical Air Indoor Source
- Nominal Cooling: 24 = 23,500 BTUH; 30 = 30,000 BTUH; 36 = 35,000 BTUH; 40 = 39,000 BTUH; 49 = 47,000 BTUH; 60 = 56,500 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: 00, 05, 7.5, 10, 15, 98 (Steam), 99 (Hot Water)
- Configuration: N = Manual Damper (std); H = GreenWheel® ERV; B = Motorized Damper; J = Power Vent with Motorized Damper
- Special Options: G = Hot Gas Reheat/Dehumidification; GG = Two Stage Hot Gas Reheat
- Configuration: QV = Quiet Version, Scholar Heat Pump

IMPORTANT

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

1.03 START-UP PROCEDURE

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

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

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

3. 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 QV™ 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: VAI 36 HP(A) — Voltage

4. Turn the Scholar QV™ heat pump disconnect to "ON" position.

5. **Cooling**

a. At the remote thermostat, move the cooling set point several degrees above room temperature. Move the "heating" set point several degrees below room temperature.

b. Put the thermostat system switch in "COOL" mode.

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.

6a. **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.

6b. **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.

7. **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.

8. **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.

1.04 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. This ventilation module is standard with the Scholar QV™ heat pump and air conditioner. Fresh air ventilation by means of a damper with pressure relief 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. After calibrating the ventilation system, replace the lower front cabinet panel.

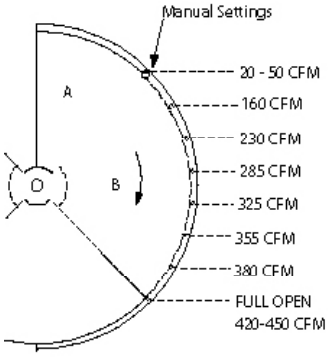
B. Motorized Fresh Air - Configuration B (Optional). This ventilation option includes a motorized damper, a fresh air intake blower and motor, and a blower motor speed controller. This ventilation option can provide up to 450 CFM of outside air (but not to exceed 40% of rated airflow) and includes pressure relief. 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. Filters on both the incoming and exhaust air are 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 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. Filters on both the incoming and exhaust air are 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



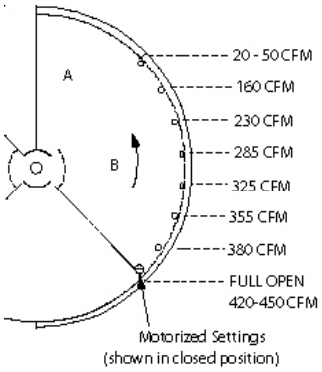
Note: Once calibrated, the manual fresh air system door remains at the set opening at all times.

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 (WMR) is energized. Motor drives plate B to the closed position when control relay (WMR) 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.

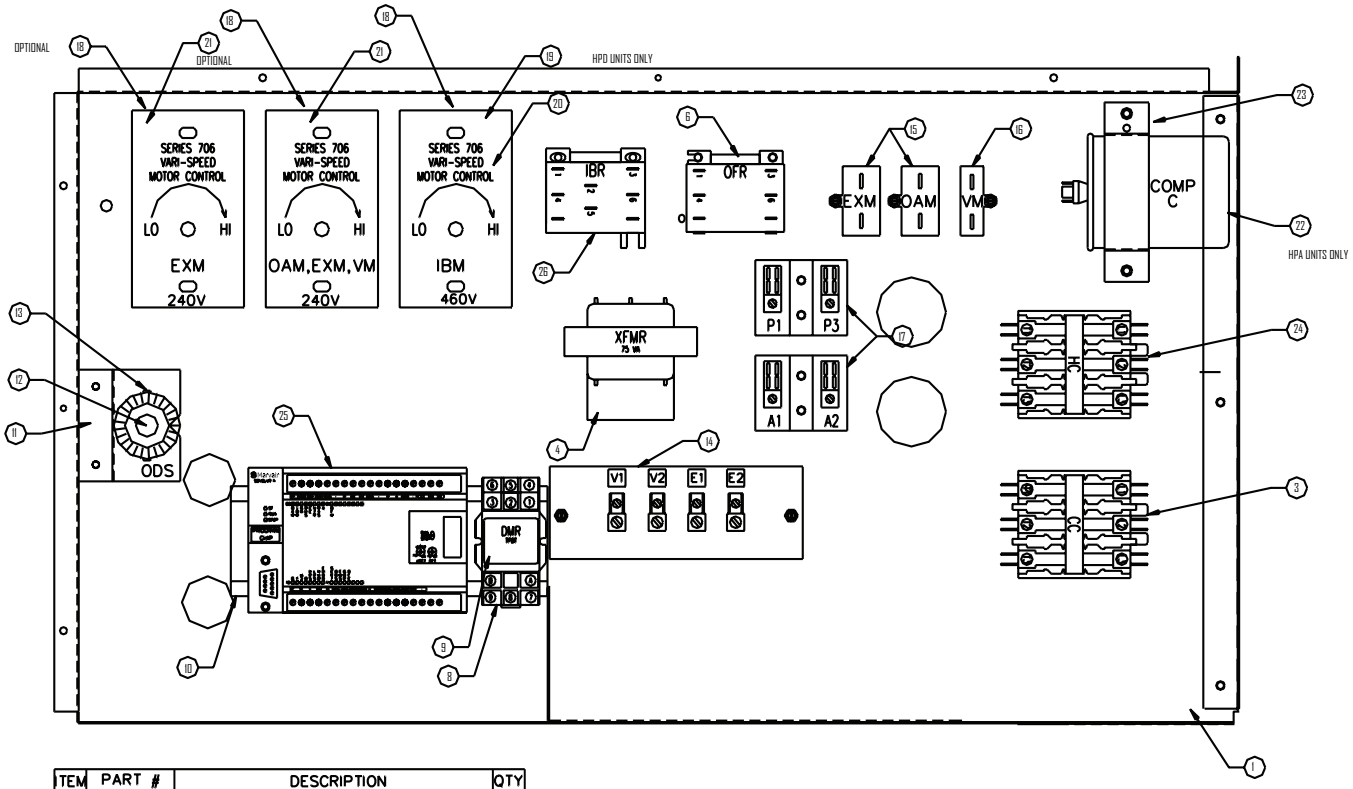
C. GreenWheel® ERV. Using best industry standards and practices, measure the fresh air that is being brought into the classroom. For units with one speed controller (std.), adjust the speed of the intake and exhaust blowers by inserting a slotted screw driver into the opening on the controller. The speed 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.

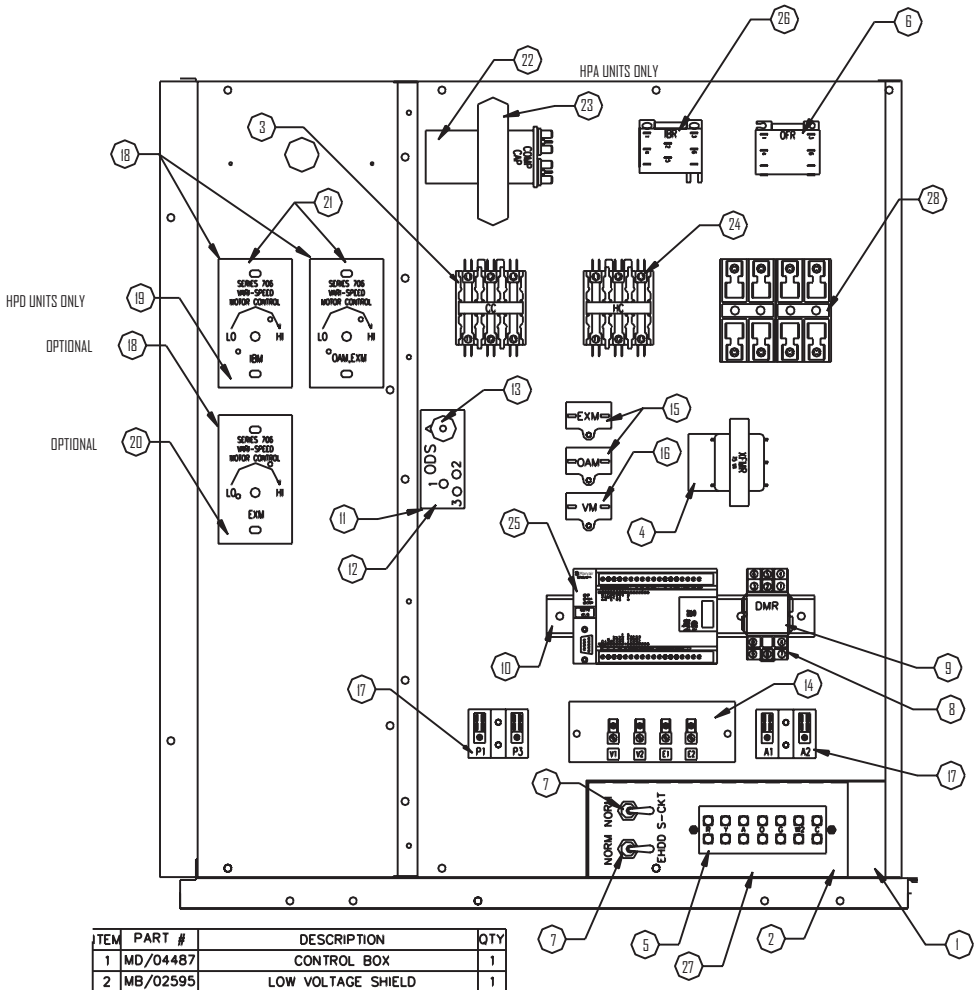
1.05 ELECTRICAL

Figure 5. Typical Control Center Layout for Models VAI24/30/36/40



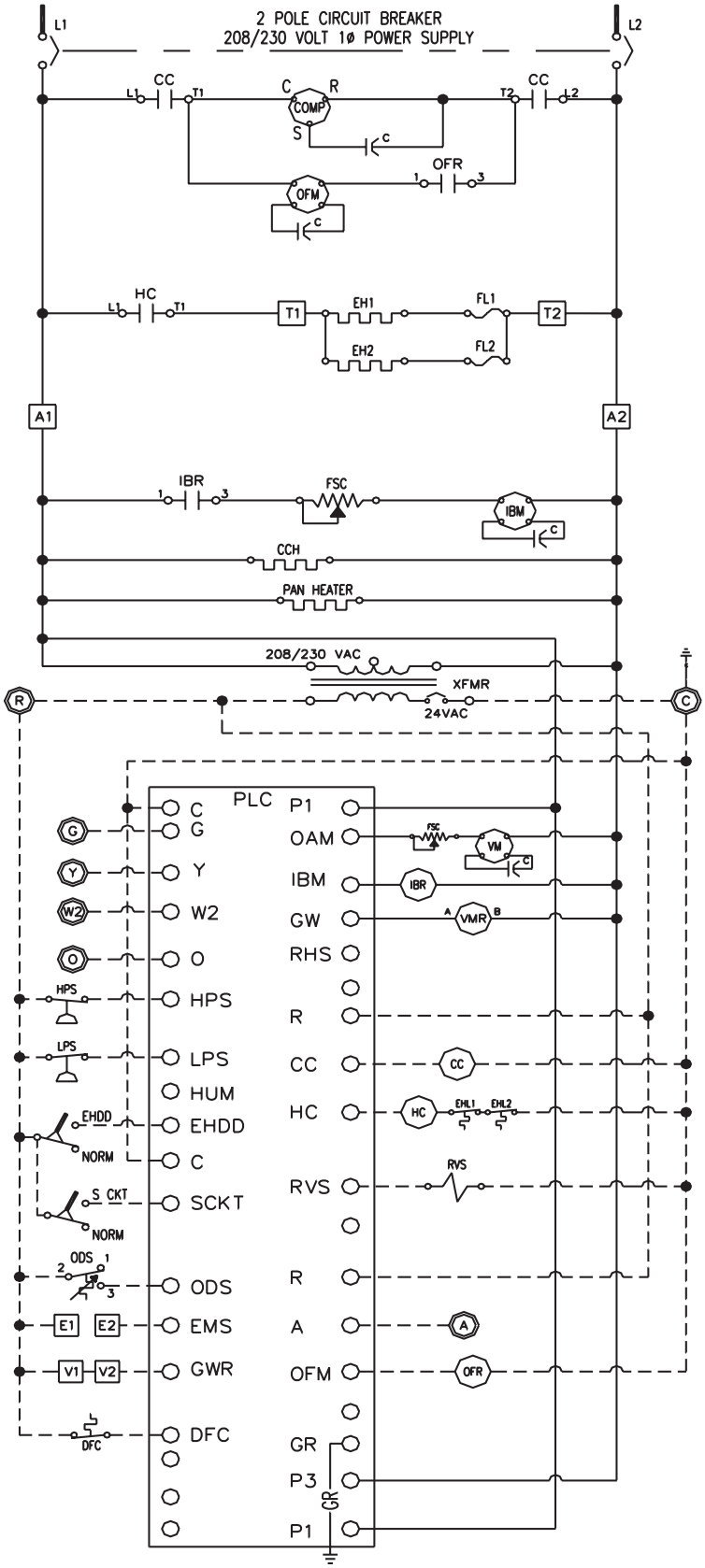
ITEM	PART #	DESCRIPTION	QTY
1	MD/04402	CONTROL BOX	1
3	50040	CONTACTOR, 30 AMP 3 POLE(HPC,HPD)	1
	50030	CONTACTOR, 30 AMP 2 POLE(HPA)	1
4	50053	XFMR PRI-208/240/480-SEC .24/75	1
6	50205	RELAY, -D.P.S.T. -24V VAC	1
8	50519	IDEC SOCKET	1
9	50019	RELAY - MIDTEX - 3PDT-240V COIL	1
10	50503	DIN RAIL	1
11	91253	ODS BRACKET	1
12	70232	ODS - OUTDOOR THERMOSTAT	1
13	70243	KNOB - FOR ODS 70232 T'STAT	1
14	80798	BOARD - TERMINAL 4 POLE	1
15	50256	CAPACITOR - 4@370 V	2
16	50326	CAPACITOR - 2@370 V	1
17	80812	BLOCK-TERMINAL 2P	1
18	80611	J BOX- 2 X 4	3
19	70301	FAN SPEED CONT-460V 1PH-5AMP	1
20	70049	FAN SPEED CONT-230V 1 PH	1
21	70049	FAN SPEED CONT-230V 1 PH	2
22	50320	CAPACITOR - 40@440 V	1
	50310	CAPACITOR - 50@370 V	1
	50321	CAPACITOR - 45@370 V	1
	50315	CAPACITOR - 40@370 V	1
23	MA/01958	CAPACITOR STRAP	1
	MA/04006	CAPACITOR STRAP	1
24	50040	CONTACTOR, 30 AMP 3 POLE(HPC,HPD)	1
	50030	CONTACTOR, 30 AMP 2 POLE(HPA)	1
25	70275	PLC CONTROLLER-S7-200	1
26	P/50182	RELAY-D.P.S.T.-208/240V COIL	1

Figure 6. Typical Control Center Layout for Models VAI49/60



ITEM	PART #	DESCRIPTION	QTY
1	MD/04487	CONTROL BOX	1
2	MB/02595	LOW VOLTAGE SHIELD	1
3	50040	CONTACTOR, 30 AMP 3 POLE(HPC,HPD)	1
	50030	CONTACTOR, 30 AMP 2 POLE(HPA)	1
4	50053	XFMR PRI-208/240/480-SEC .24/75	1
5	80795	BOARD - TERMINAL	1
6	50205	RELAY, -D.P.S.T. -24V VAC	1
7	70027	TOGGLE SWITCH - D.P.D.T.	2
8	50519	IDEC SOCKET	1
9	50019	RELAY - MIDTEX - 3PDT-240V COIL	1
10	50503	DIN RAIL	1
11	91253	ODS BRACKET	1
12	70232	ODS - OUTDOOR THERMOSTAT	1
13	70243	KNOB - FOR ODS 70232 T'STAT	1
14	80798	BOARD - TERMINAL 4 POLE	1
15	50256	CAPACITOR - 4@370 V	2
16	50326	CAPACITOR - 2@370 V	1
17	80812	BLOCK-TERMINAL 2P	1
18	80611	J BOX- 2 X 4	3
19	70301	FAN SPEED CONT-460V 1PH-5AMP	1
20	70049	FAN SPEED CONT-230V 1 PH	1
21	70049	FAN SPEED CONT-230V 1 PH	2
22	50320	CAPACITOR - 40@440 V	1
	50310	CAPACITOR - 50@370 V	1
	50321	CAPACITOR - 45@370 V	1
	50315	CAPACITOR - 40@370 V	1
23	MA/01958	CAPACITOR STRAP	1
	MA/04006	CAPACITOR STRAP	1
24	50040	CONTACTOR, 30 AMP 3 POLE(HPC,HPD)	1
	50030	CONTACTOR, 30 AMP 2 POLE(HPA)	1
25	70275	PLC CONTROLLER-S7-200	1
26	P/50182	RELAY-D.P.S.T.-208/240V COIL	1
27	M/04086	LOW VOLTAGE SHIELD BRACKET	1
28	70123	FUSE BLOCK	1
	70124	FUSE BLOCK	1

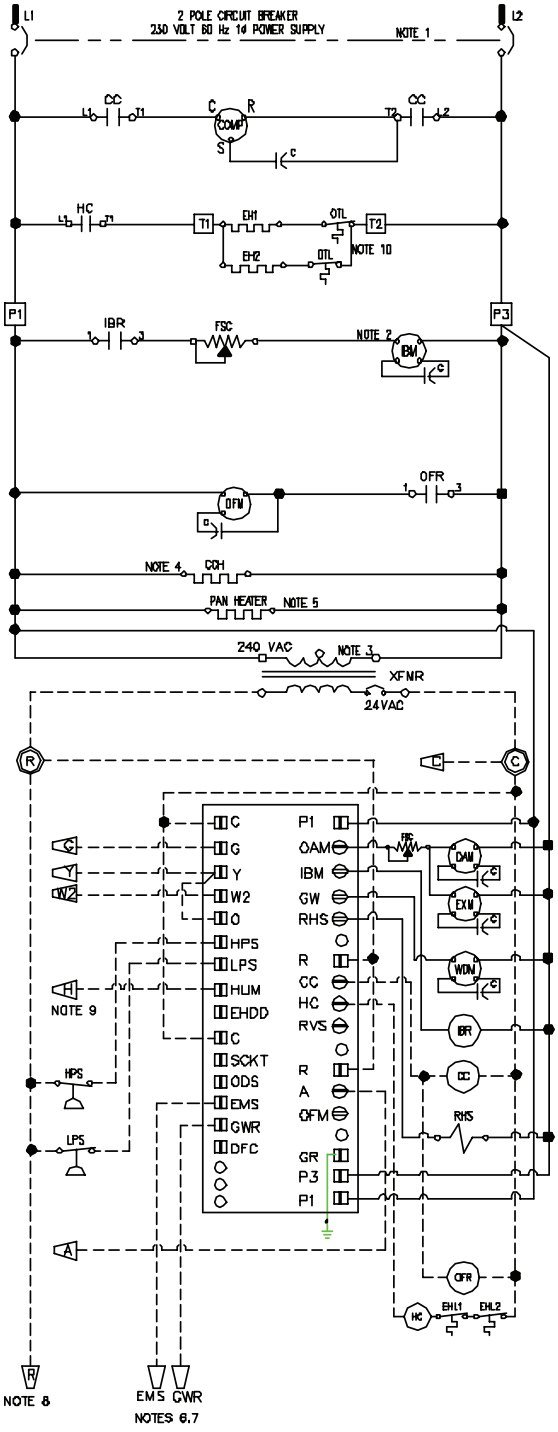
Figure 7a. Typical Wiring Schematic for Heat Pump Model VAI, Single Phase Power



ELECTRICAL LEGEND:

C	CAPACITOR
CC	COMRPESSOR CONTACTOR
CCH	CRANKCASE HEATER
COMP	COMPRESSOR
DFC	DEFROST CONTROLLER
EH	ELECTRIC STRIP HEATER
EHL	ELECTRIC HEAT LIMIT
HC	HEAT CONTACTOR
HPS	HIGH PRESSURE SWITCH
IBM	INDOOR BLOWER MOTOR
IBR	INDOOR BLOWER RELAY
LPS	LOW PRESSURE SWITCH
OFM	OUTDOOR FAN MOTOR
OFR	OUTDOOR FAN RELAY
PLC	PROGRAMMABLE LOGIC CONTROLLER
RVS	REVERSING VALVE SOLENOID
VM	VENT MOTOR
XFMR	TRANSFORMER

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



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

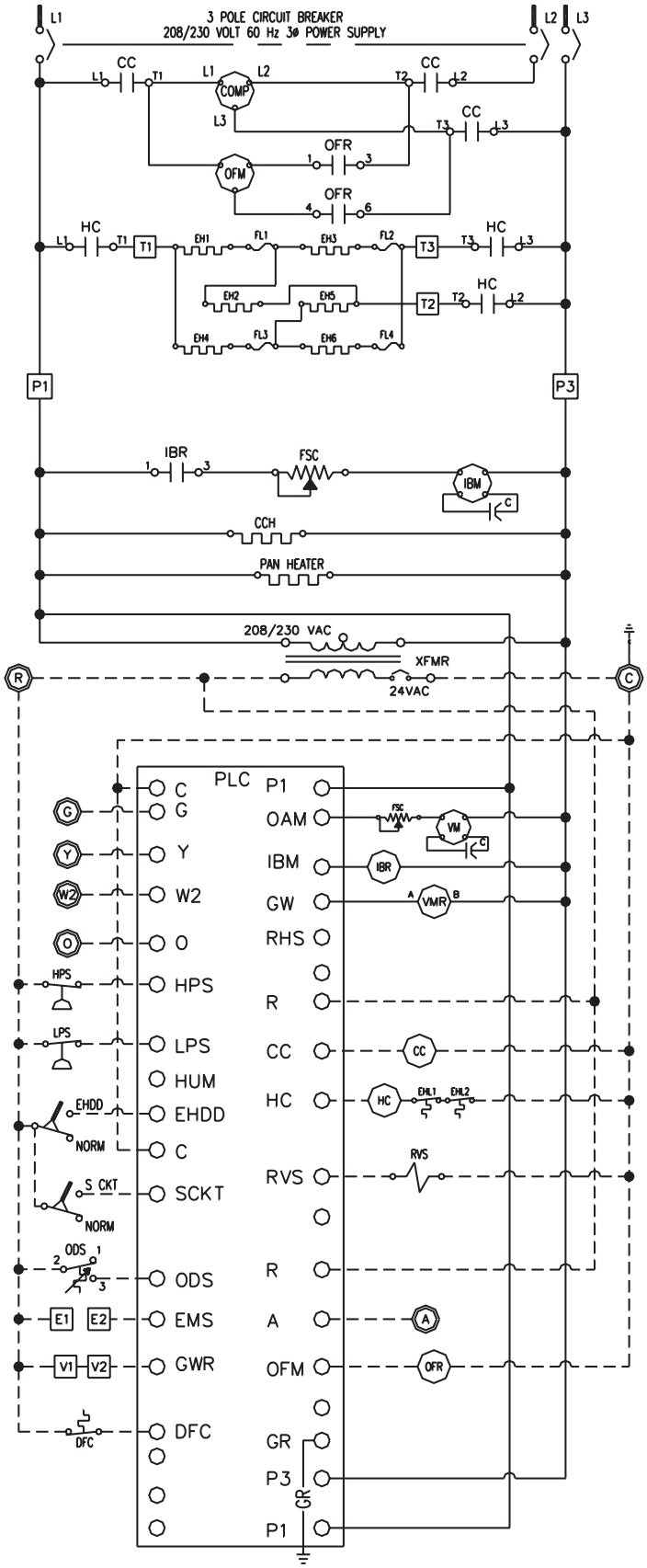
ELECTRICAL LEGEND:

C	CAPACITOR	OAM	OUTDOOR AIR MOTOR
CC	COMPRESSOR CONTACTOR	OFM	OUTDOOR FAN MOTOR
CCH	CRANKCASE HEATER	OFR	OUTDOOR FAN RELAY
COMP	COMPRESSOR	OTL	ONE TIME LIMIT
DFC	DEFROST CONTROLLER	PLC	PROGRAMMABLE LOGIC CONTROLLER
EH	ELECTRIC STRIP HEATER	PLC	REHEAT SOLENOID
EHL	ELECTRIC HEAT LIMIT	RVS	REVERSING VALVE SOLENOID
EXM	EXHAUST MOTOR	WDM	WHEELDRIVE MOTOR
FSC	FAN SPEED CONTROL	XFMR	TRANSFORMER
HC	HEAT CONTACTOR	⊖	QO = PLC OUTPUT TERMINAL
HPS	HIGH PRESSURE SWITCH	⊡	IO = PLC INPUT TERMINAL
IBM	INDOOR BLOWER MOTOR		
IBR	INDOOR BLOWER RELAY		
LPS	LOW PRESSURE SWITCH		

GENERAL NOTES:

1. 240 VOLT 60Hz 1Φ POWER SUPPLY. SEE DATA PLATE FOR AMPACITY AND FUSE SIZE. OPTIONAL CKT BKR SHOWN.
2. SPEED TAP - SEE MOTOR NAMEPLATE FOR WIRE COLORS.
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. 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.
7. 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.
8. 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
9. CONNECT TO THE YELLOW LEAD ON H60KA (REHEAT SIGNAL). LOCATE INSIDE LOW VOLTAGE SHIELD.
10. USE #10 AWG WIRE FOR 10 KW ELECTRIC HEATERS.

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



ELECTRICAL LEGEND:

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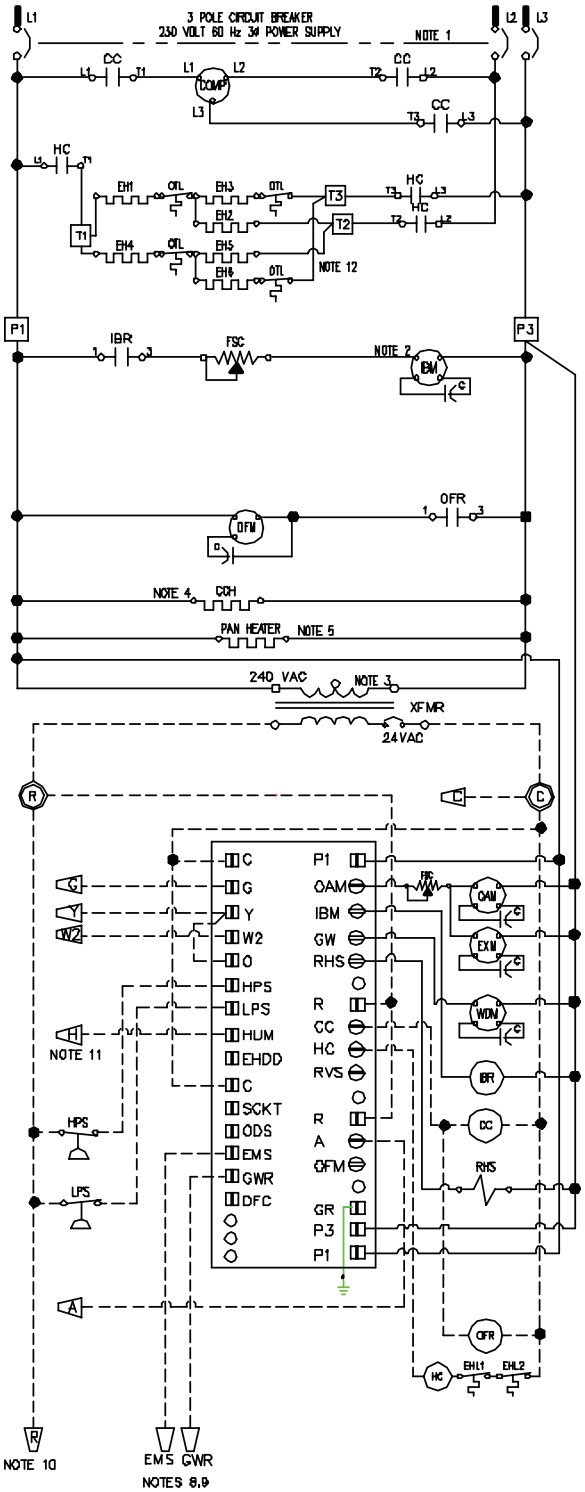
RVS	REVERSING VALVE SOLENOID
VM	VENT MOTOR
XFMR	TRANSFORMER

Figure 8b. Typical Wiring Schematic for Air Conditioner Model VAI, Three Phase Power



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BL	BLUE	R	RED
BR	BROWN	Y	YELLOW
G	GREEN	WHT	WHITE
GY	GRAY		

BK/RED BLACK WITH RED STRIPE

ELECTRICAL LEGEND:

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CC	COMPRESSOR CONTACTOR	OFM	OUTDOOR FAN MOTOR
CCH	CRANKCASE HEATER	OFR	OUTDOOR FAN RELAY
COMP	COMPRESSOR	OTL	ONE TIME LIMIT
DFC	DEFROST CONTROLLER	PLC	PROGRAMMABLE LOGIC CONTROLLER
EH	ELECTRIC STRIP HEATER	RHS	REHEAT SOLENOID
EHL	ELECTRIC HEAT LIMIT	RVS	REVERSING VALVE SOLENOID
EXM	EXHAUST MOTOR	WDM	WHEELDRIVE MOTOR
FSC	FAN SPEED CONTROL	XFMR	TRANSFORMER
HC	HEAT CONTACTOR	⊖	DO = PLC OUTPUT TERMINAL
HPS	HIGH PRESSURE SWITCH	▯▯	IO = PLC INPUT TERMINAL
IBM	INDOOR BLOWER MOTOR		
IBR	INDOOR BLOWER RELAY		
LPS	LOW PRESSURE SWITCH		

GENERAL NOTES:

1. 240 VOLT 60Hz 3ø POWER SUPPLY. SEE DATA PLATE FOR AMPACITY AND FUSE SIZE. OPTIONAL CKT BKR SHOWN.
2. 5PEED TAP – SEE MOTOR NAMEPLATE FOR WIRE COLOR5.
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. 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.
    - 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
11. CONNECT TO THE YELLOW LEAD ON H600A (REHEAT SIGNAL). LOCATE INSIDE LOW VOLTAGE SHIELD.
12. USE #10 AWG WIRE FOR 10 KW ELECTRIC HEATERS.

Figure 9a. Remote Wall Mounted Thermostat Wiring Detail

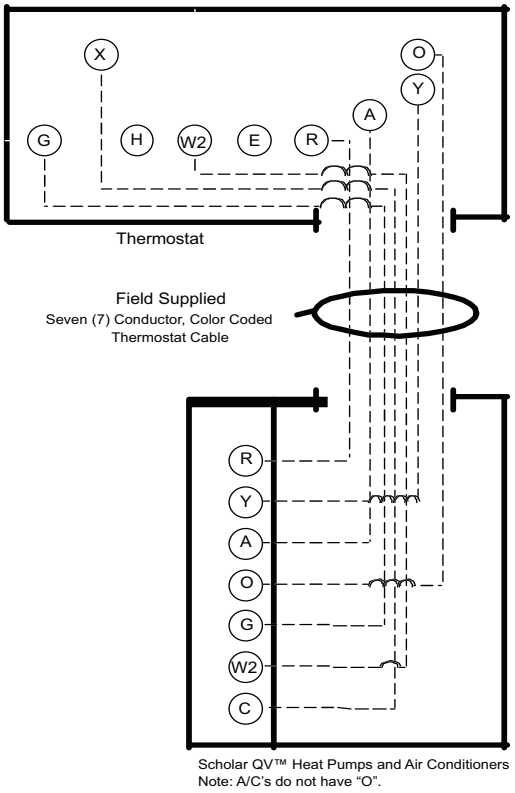
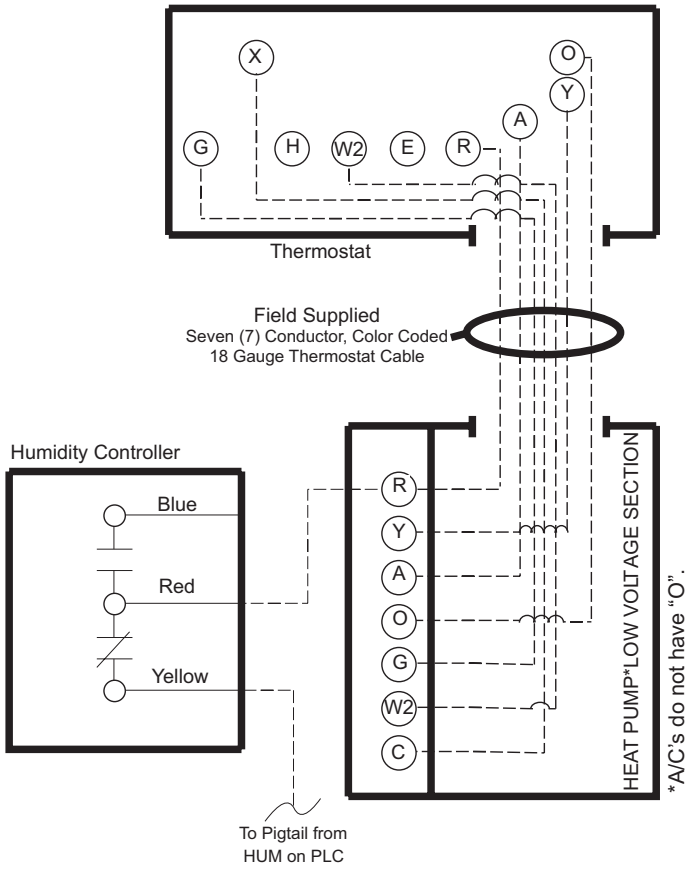


Figure 9b. Humidity Controller Wiring Detail



1.06 MAINTENANCE

WARNING

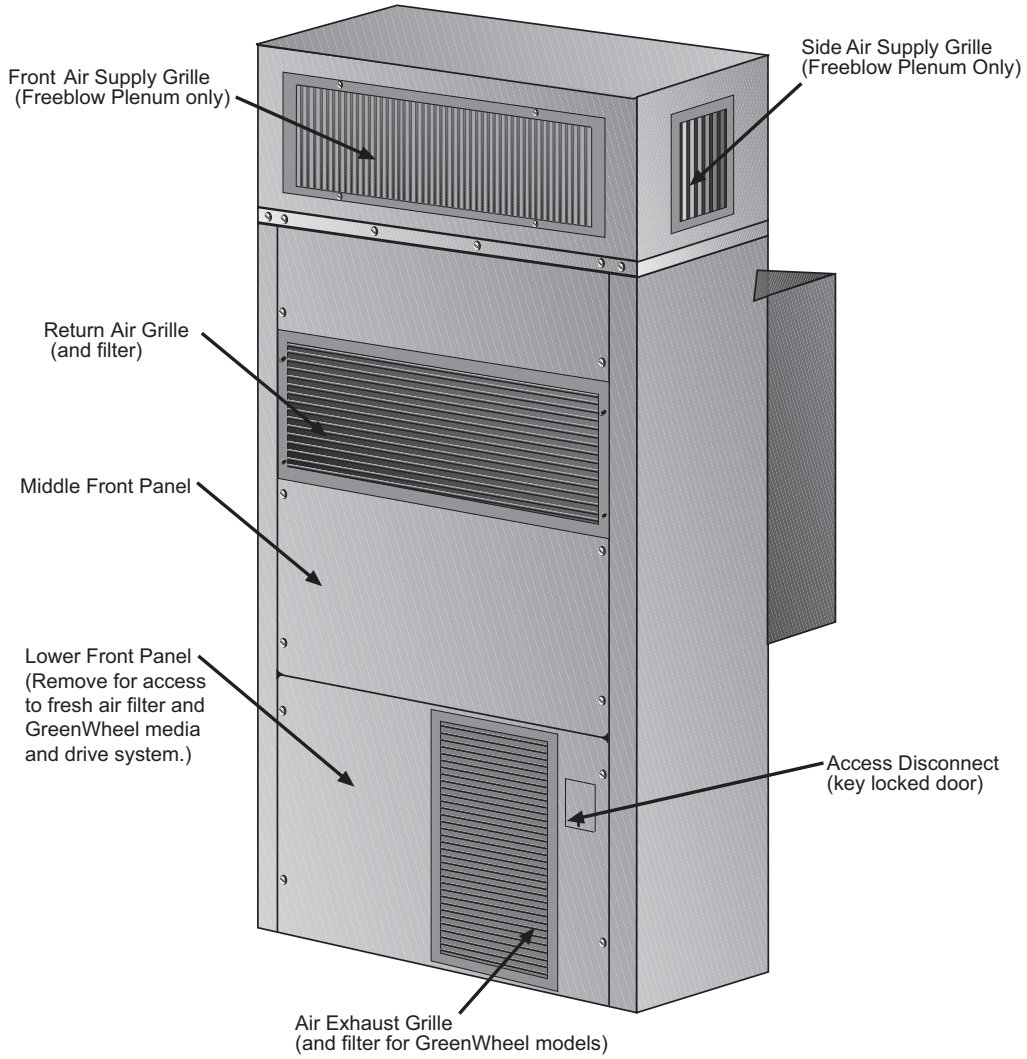
BEFORE PERFORMING MAINTENANCE ON THE SCHOLAR QV™, SWITCH ELECTRIC POWER OFF AT THE DISCONNECT LOCATED BEHIND THE KEY LOCKED DOOR ON THE LOWER FRONT PANEL (SEE FIGURE 1). FAILURE TO DO THIS COULD RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

A. **Air filters** on the Scholar QV™ heat pump model VAI 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.

To inspect and replace air return filters, remove the air return grille shown in Figure 10. Air return filters are disposable. If they need replacement, replace with a new filter and dispose of the used filter. Check Appendix A for replacement filter sizes.

Figure 10. Scholar QV™Heat Pump Model VAI Access Information



IMPORTANT

WHEN SCHOLAR QV™ IS EQUIPPED WITH THE GREENWHEEL® VENTILATION SYSTEM, THE EXHAUST FILTER MUST ALSO BE CHECKED AND CHANGED. IT IS LOCATED BEHIND THE EXHAUST AIR GRILLE IN THE LOWER CABINET PANEL. (SEE FIGURE 5.) THE FILTER IS DISPOSABLE AND SHOULD BE REPLACED WITH A STANDARD SIZE 12" X 20" X 1" AIR FILTER.

The fresh air intake filter is located within the Scholar QV™ and the lower cabinet panel must be removed to access this filter. After removal of the cabinet panel, a panel within the compartment will have the following label on it (see Figure 11). This panel is removed by removing two screws and taking it out of the compartment on the lower left side . The fresh air filter is then removed by reaching into the opening and pulling sideways on the filter. This is a washable filter and can be cleaned with water and reinstalled. If the filter has deteriorated, replace it with a new one. Filter sizes are listed in Appendix A.

Figure 11. Fresh Air Filter Label on Interior Panel

ATTENTION!!!
FRESH AIR FILTER IS BEHIND THIS PANEL.

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. Removal of the lower cabinet panel (see Figure 5) will provide access to the inside surface of the GreenWheel media. 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.

IMPORTANT

BE SURE TO REPLACE THE METAL FRESH AIR FILTER ACCESS PANEL AFTER REINSTALLING THE FRESH AIR FILTER, AND PRIOR TO REINSTALLING THE LOWER CABINET PANEL.

Replace the air return grille, the exhaust air grille and the lower cabinet panel, as appropriate, prior to turning the disconnect to "ON" position.

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. **Indoor/Outdoor Coils** may be cleaned by vacuuming or by use of a commercially available coil cleaning spray. Do not use a solvent containing bleach, acetone or flammable substances. Do not wet any electrical components. Be sure system has dried before restarting.

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

E. **Condenser.** Periodically inspect the outdoor condenser coil and the cabinet air reliefs for dirt or obstructions. Remove foreign objects such as leaves, paper, etc. If the condenser coil is dirty, it may be washed off with a commercial solvent intended for this purpose. TURN OFF POWER BEFORE CLEANING! Be sure that all electrical components are thoroughly dry before restoring power.

F. **Condensate Lines**. Each Scholar QV™ air conditioner or heat pump has a primary and secondary condensate line. The primary condensate lines 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. The secondary drain line for the indoor pan exits the unit through the external louver. In the event that the primary drain does not function, the condensate will flow out of the unit through the secondary drain and should be visible on the exterior of the school. An overflow out the back side of the outdoor drain pan functions as the secondary drain for the outdoor pan. Should the primary drain for the outdoor pan become clogged, condensate will overflow the outdoor pan and should be visible on the exterior of the building.

1.07 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.

B. **Indoor Blower and Motor.** The indoor blower assembly consists of two, direct drive, centrifugal indoor blowers and a single motor.

C. **Outdoor Air Mover.** A backward curved motorized impeller is standard on the 2, 2 ½, 3 and 3 ½ ton units. A belt drive centrifugal blower is standard on the 4 and 5 ton units.

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 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 QV™ unit will turn off and lockout. The high pressure switch opens at 400 psig and resets at 300 psig.

The low pressure (A/C) or loss of charge (HP) switch and indoor coil freeze stat is bypassed for 8-1/2 minutes during each start-up. The system will lockout if the low pressure switch or indoor coil freeze stat remains open after the 8-1/2 minute by-pass at start-up or if either device opens three times within one hour. The low pressure switch is located on the suction line (low side) and the loss of charge switch is on the liquid line (high side). Both switches open at 35 psig and reset 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 QV™ 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. **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.

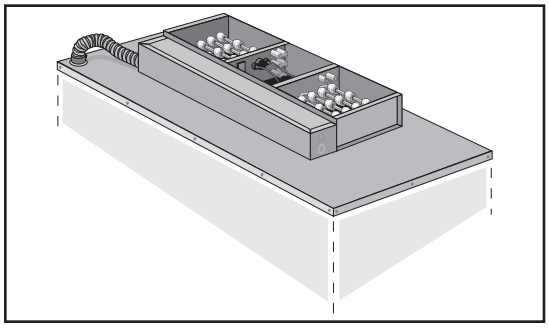
H. **Exhaust Air Ventilation Blower** is used to exhaust classroom air. The blower can exhaust up to 450 CFM of air from the classroom. In the standard configuration, both the exhaust and the intake ventilation blowers are controlled by a single speed controller. This speed controller permits the motor 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.

I. **Intake Ventilation Air Blower** is used to introduce outside air into 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.

J. **Electric Resistance Heat** is installed above the indoor blower outlets as shown in Figure 12. Electric heat is factory installed in the 2 through 3.5 ton Scholar QV™ units and field installed in the 4 and 5 ton 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.

Figure 12. Electric Strip Heat



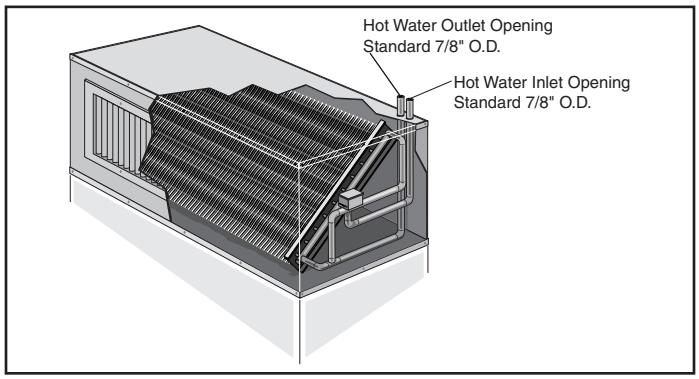
K. **Electric Resistance Heat Controls.** Included with the electric heat assembly are temperature switches designed to turn power off to the heaters if the temperature is too high. There are two types of temperature switches. The first is an auto-reset type that turns power off to the heater if it senses 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.

L. **Hot Water or Steam Coil** is installed above the indoor blower outlets as shown in Figure 13. Steam or hot water coil capacities for the unit are shown in Appendix A. 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. Steam valves and piping are specific to each application and must be designed by the installer. 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.

Figure 13. Hot Water Coil & Plenum



M. **Programmable Logic Controller (PLC) Microprocessor.** The Scholar QV™ 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 QV unit PLC's to allow run time leveling and does not require additional equipment installed in the Scholar QV 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.

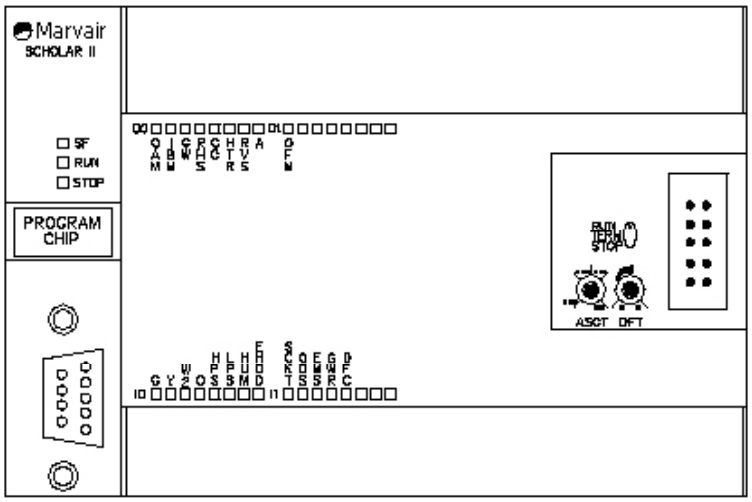
The PLC microprocessor provides for the following control and operation functions:

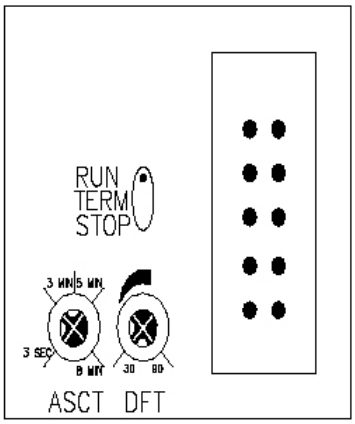
- **Anti-Short Cycle Timer** - Prevents the compressor from destructive short cycling due to momentary power interruptions. One of three time intervals can be field selected.
- **Defrost Timer (heat pump only)** - Adjustable defrost control that is based upon both time and temperature. The time interval 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 accessed by removing the middle cabinet panel. (The panel below the return air grille.) After removing the middle cabinet panel, remove the cover to the control center.





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 QV 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.

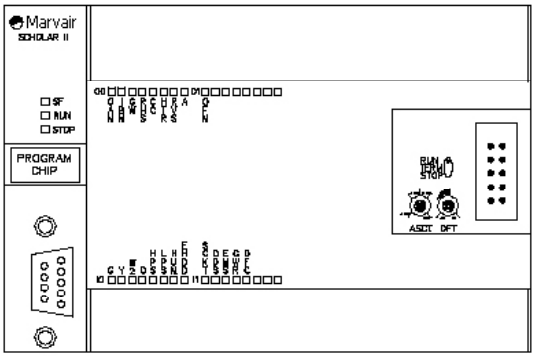
The **Anti-short Cycle Timer (ASCT)** is located to the far left of the switch. The anti-short cycle timer prevents the compressor from destructive short cycling by allowing the compressor to restart only after a selected time interval has passed from compressor shutdown. The timer begins when the compressor 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 QV™ 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 QV™ 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. On the 2, 2 ½, 3 and 3 ½ ton heat pumps, 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. On 4 & 5 ton units, a toggle switch in the control box controls this function. In the "EHDD" position, electric heat will operate in the defrost mode. In the "NORM" position, electric heat does **not** operate in the defrost mode. 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)

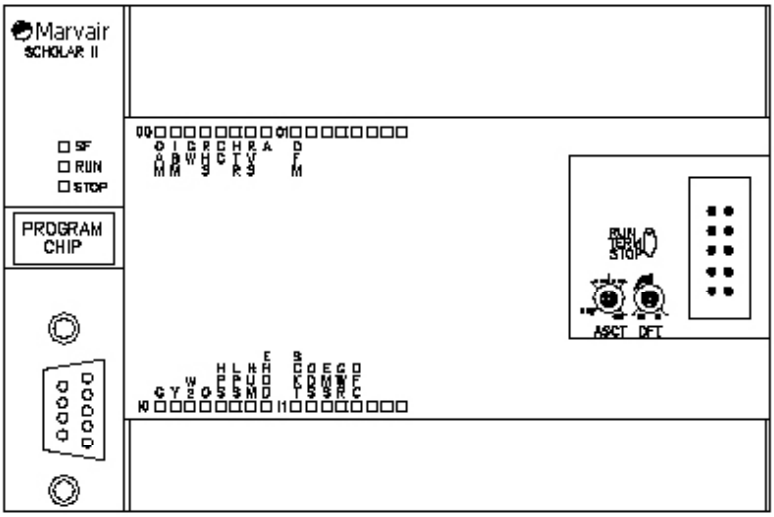
- **EMS** – Energy Management System. A shutdown input from an external source.

- **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 QV™ 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 on the following page.

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 Switch is designed to guard against the operation of the system in the event of a loss of refrigerant. If the Low Pressure Switch stays on 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.

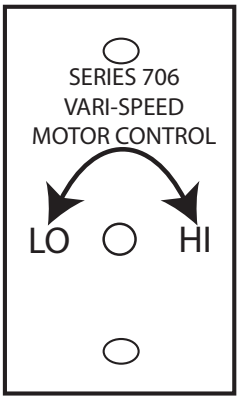
In cold weather the pressure in the refrigerant system is low prior to operation. When the Scholar QV™ unit starts in the heat pump mode during cold weather, low pressure could cause the system to lock out. To guard against nuisance lockouts, the Scholar QV unit will not shut off if the Low Pressure 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 off 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.

N. **Indoor Blower Fan Speed Control.** The indoor blower speed control is located within the middle cabinet panel of Scholar QV™ unit. 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 14. Reference unit label for minimum required air flow settings for specific unit model.

Figure 14. Indoor Blower Speed Control Adjustment Instructions



O. **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.

1.08 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="15">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

<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="14">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 Outdoor Filter</td><td>Low on Charge</td><td>Dirty Filters</td></tr>
<tr><td>Inoperative Outdoor Fan</td><td>Low Ambient Temperature</td><td>Dirty Indoor Coil</td></tr>
<tr><td>Overcharge</td><td>Inoperative Compressor Valves</td><td>Inadequate Indoor Air Flow</td></tr>
<tr><td>Recirculation of Outdoor Air</td><td>Outdoor Check Valve Closed</td><td>Inoperative Indoor Blower</td></tr>
<tr><td>Non-condensibles</td><td>Restricted Indoor Metering Device</td><td>Low on Charge</td></tr>
<tr><td>Higher than Ambient Air Entering Outdoor Coil</td><td>Restricted Filter Drier</td><td>Restricted Indoor Metering Device</td></tr>
<tr><td>Wrong Outdoor Fan Rotation</td><td>Reversing Valve Failure</td><td>Restriction in System</td></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td>Recirculation of Indoor Air</td></tr>
<tr><td>Wrong Indoor Blower Rotation</td></tr>
<tr><td>Inadequate Ducts</td></tr>
<tr><td>Outdoor Check Valve Closed</td></tr>
<tr><td>Restricted Filter Drier</td></tr>
</table>

Heating 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 Filters	Low on Charge	Dirty Outdoor Coil	
Dirty Indoor Coil	Low Indoor Temperature	Inadequate Air Flow Over Outdoor Coil	
Inoperative Indoor Blower	Closed Indoor Check Valve	Inoperative OD Fan	
Overcharge	Inoperative Compressor Valves	Low on Charge	
Inadequate Indoor Air Flow	Restricted Outdoor Metering Device	Restricted Outdoor Metering Device	
Non-condensibles	Restricted Filter Drier	Restriction in System	
Wrong Indoor Blower Rotation	Reversing Valve Failure	Closed Indoor Check Valve	
Inadequate Ducts		Recirculation of Out-door Air	
		Restricted Filter Drier	

Defrost Mechanical Checks Flow Chart

Defrost System		
No Defrost	**Incomplete Defrost**	**Excessive Defrost**
Reversing Valve Stuck	Poor Sensor Location	Wrong Defrost Control Timer Setting
No Defrost Timer Control Power	Wrong Defrost Control Timer Setting	Poor Sensor Location
Failed Defrost Control	Failed Defrost Relay (doesn't stop O.D. Fan)	Low System Charge
Failed Defrost Relay	Thermostat Satisfies During Defrost	Wind Affecting in Defrost
Loose Default Sensor		

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 supesheat. 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	Temp. (°F)	R-22 PSIG	Temp. (°F)	R-22 PSIG	Temp. (°F)	R-22 PSIG	Temp. (°F)	R-22 PSIG
-150	29.4	-30	4.9	35	61.5	100	196.0		
-140	29.1	-25	7.5	40	68.5	105	210.8		
-130	28.5	-20	10.2	45	76.1	110	226.4		
-120	27.7	-15	13.0	50	84.1	115	242.8		
-110	26.6	-10	16.5	55	92.6	120	260.0		
-100	25.7	-5	20.1	60	101.6	125	278.1		
-90	23.0	0	24.0	65	111.3	130	297.0		
-80	20.2	5	28.3	70	121.4	135	316.7		
-70	16.6	10	32.8	75	132.2	140	337.4		
-60	11.9	15	37.8	80	143.7	145	359.1		
-50	6.1	20	43.1	85	155.7	150	381.7		
-40	0.6	25	48.8	90	168.4				
-35	2.6	30	54.9	95	181.8				

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 counterclockwise.
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.

1.09 SERVICE

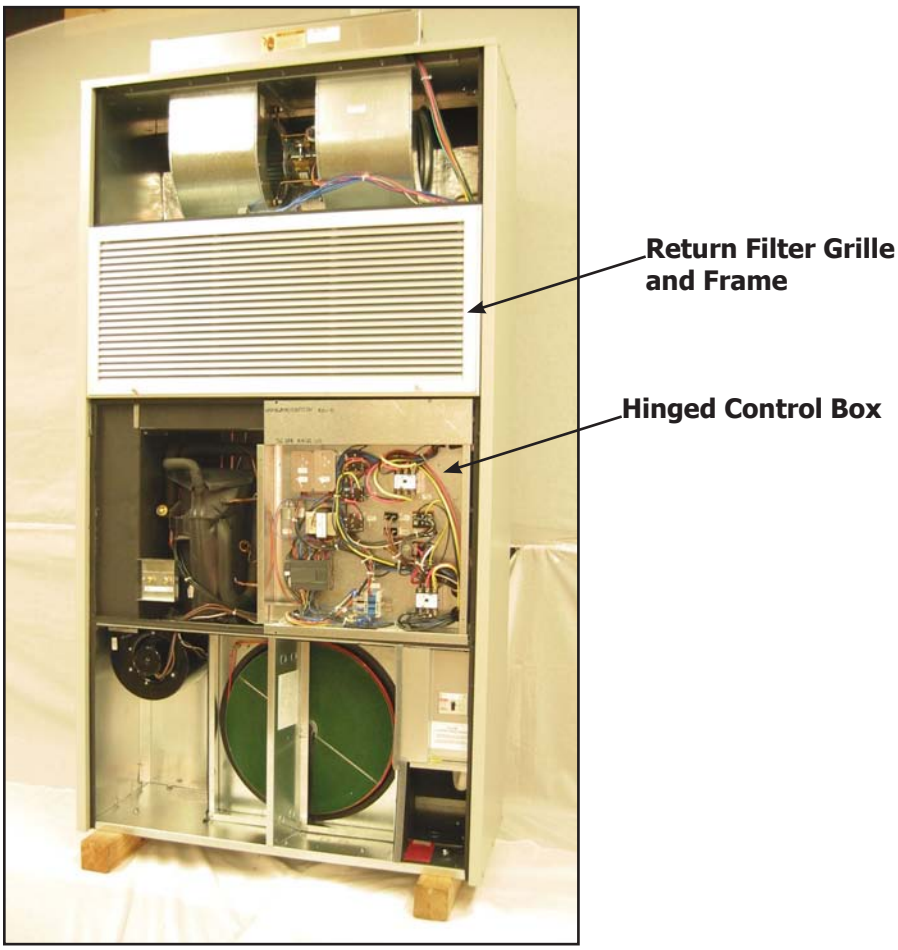
A. **Removal procedures for the Outdoor Air Mover**.

Tools Required

- Torx Head #25 screw driver
- 5/16” nut driver
- 1/2” wrench
- 17mm wrench
- Adjustable crescent wrench

The outdoor air mover is a reversed inclined impeller. The motor and blower is a single assembly that is removed together. The blower/motor assembly is located in the front middle panel, behind the control box.

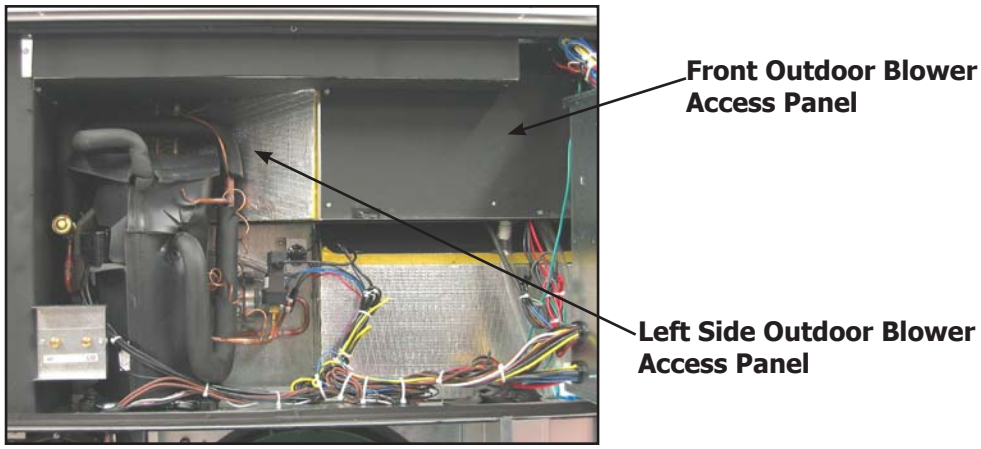
1. Remove the aluminum return filter grille frame.



2. Remove the front middle panel and remove the two screws on the left side of the control box. The control box is hinged on the right side. Swing control box to fully open.

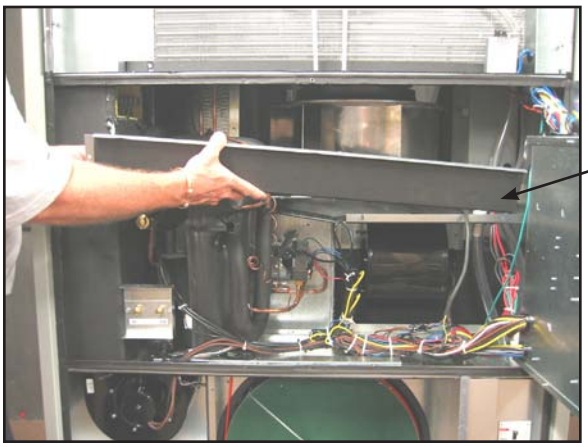
3. Disconnect the wires to the blower.

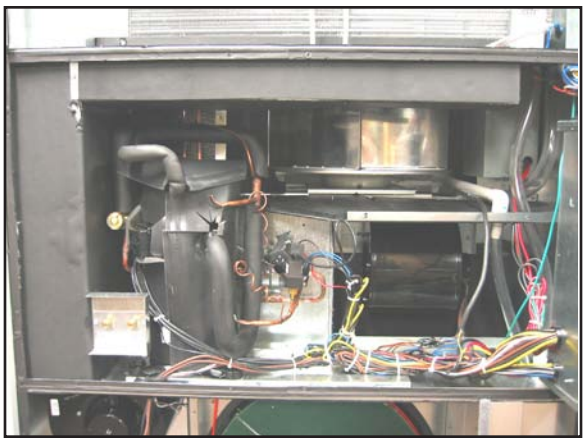
4. Remove the front outdoor blower access panel by removing the 6 screws in front & one screw in the front top behind the air filter.



5. Remove the bottom and front of the horizontal fresh air plenum. Note some of the screw heads may be covered with insulation.

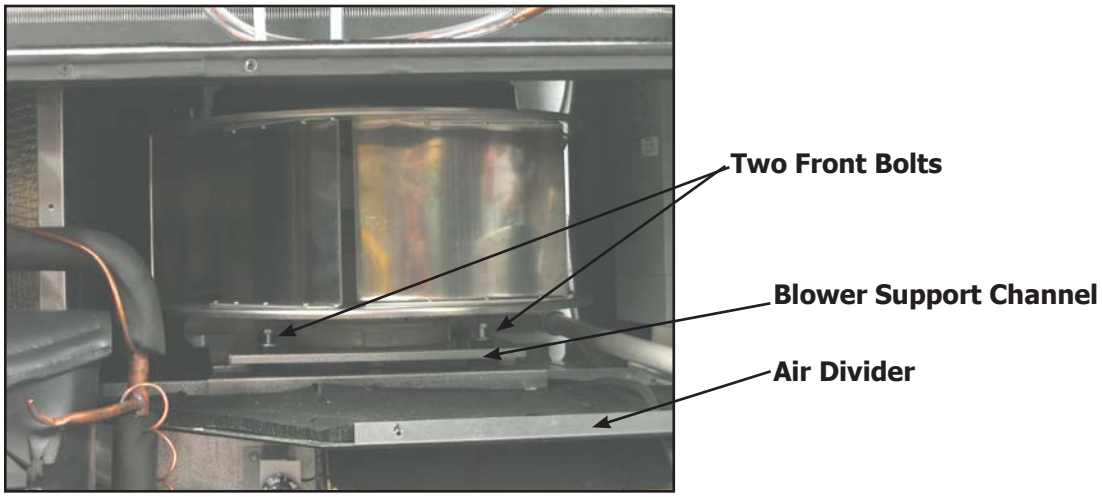
6. Remove the left side access panel by removing the 3 screws, two of the screw heads are covered by insulation. One of the screws is on the outside back. Push the panel towards the rear of the unit to disengage "S" lock.





Blower access panels removed.

7. Remove the blower support channel.

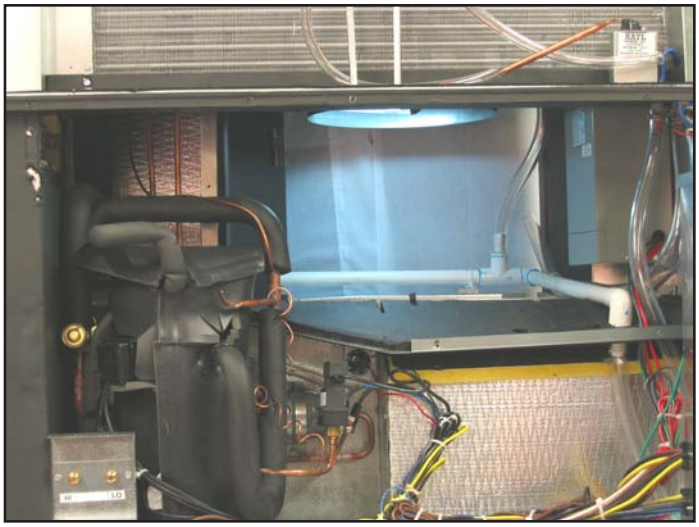


8. Loosen several of the screws holding the air divider, allowing the air divider to drop down several inches for blower clearance.

9. Remove the four front and rear bolts that secure the blower assembly.

10. Remove the rear two grommets from the bolt holes.

11. Slide the assembly out of the unit.



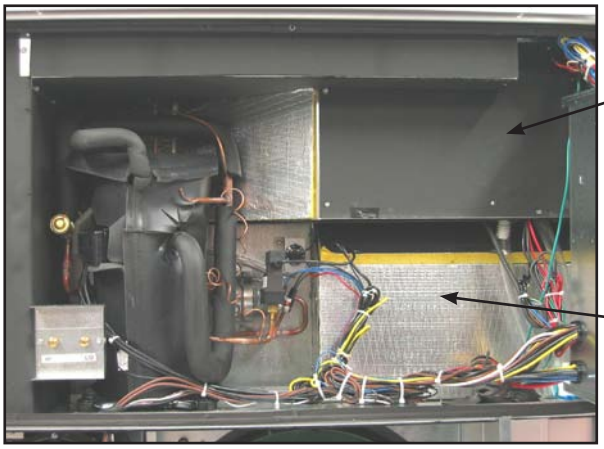
B. **Removal procedures for the Fresh Air Exhaust Blower and Motor**.

Tools Required
- Torx Head #25 screw driver
- 5/16" nut driver

The fresh air exhaust blower & motor is located in the middle compartment, to the right of the compressor behind a sheet metal panel.

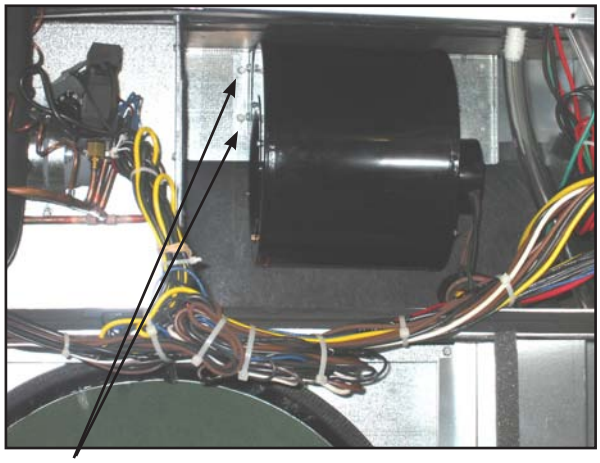
1. Remove the outdoor motor access panel by removing the 4 screws on the top of the panel and the 9 screws on the sides and the bottom of the panel.

2. Remove the fresh air exhaust blower motor access panel.



3. Disconnect the wires to the motor.

4. Remove the 4 screws that hold the motor to the bulkhead.



Blower Support Screws. Two more on right side of the blower (not shown).

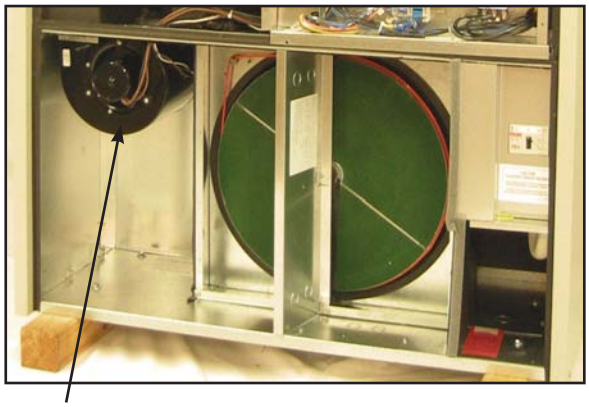
C. **Removal procedures for the Fresh Air Intake Blower and Motor**.

Tools Required
- Torx Head #25 screw driver
- 5/16” nut driver

The fresh air intake blower motor is located in the lower compartment, to the left of the GreenWheel.

1. Remove the 4 screws that hold the motor to the bulkhead

2. Disconnect wires.

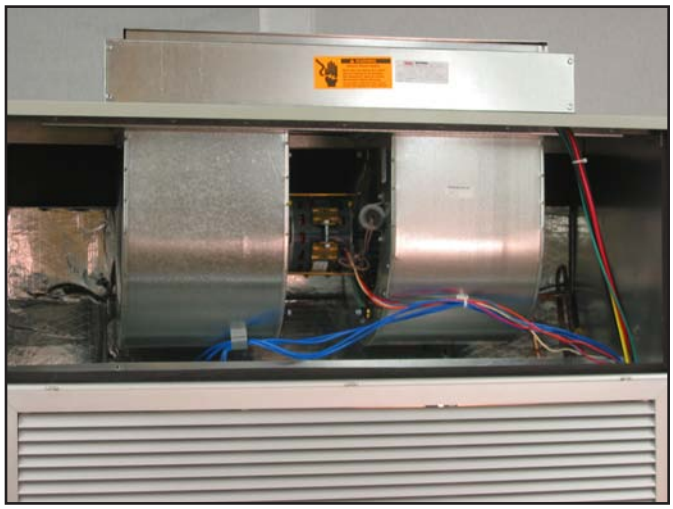


Fresh Air Intake Blower and Motor

D. **Removal procedures for the Indoor Blower Motor Assembly**.

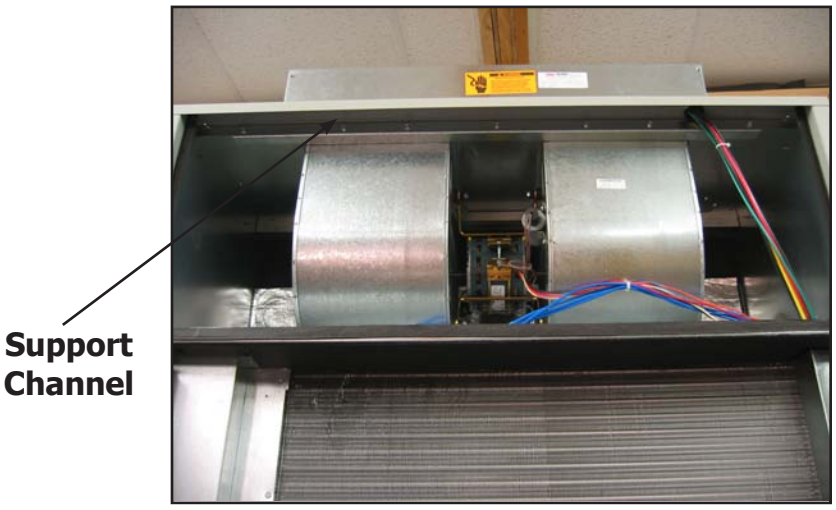
Tools Required
- Torx Head #25 screw driver
- 5/16” nut driver
- Razor knife

The indoor blower motor assembly is located in the upper compartment.



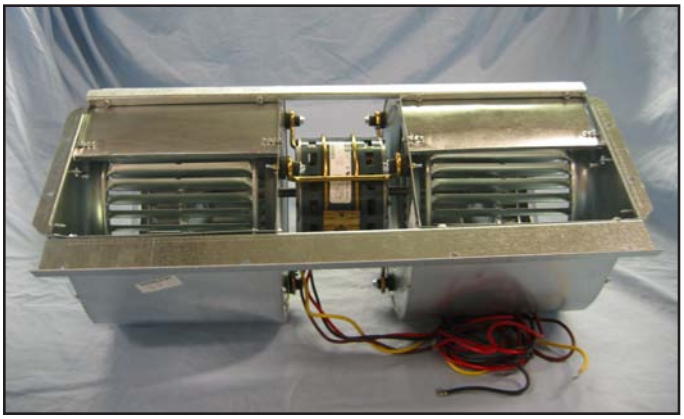
1. Disconnect wires.

2. Remove the 7 screws that hold the blower into the support channel.



3. Cut or remove caulking around the blower outlets.

4. Slide blower assembly out of cabinet.



E. **Access to the Outdoor TXV and Defrost Sensor**.

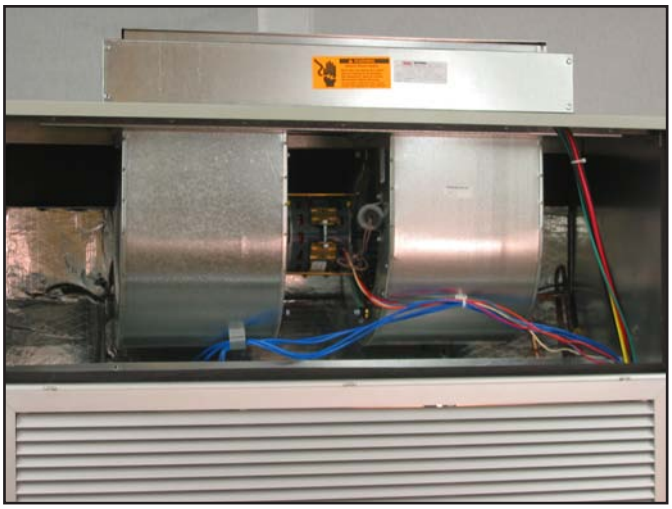
Tools Required
- Torx Head #25 screw driver
- 5/16” nut driver

The outdoor TXV and defrost sensor are located in the outdoor air box in front of the coil. They can be accessed by one of two ways. First, is access from the indoor blower compartment. The other access is from the left side of the outdoor air box.

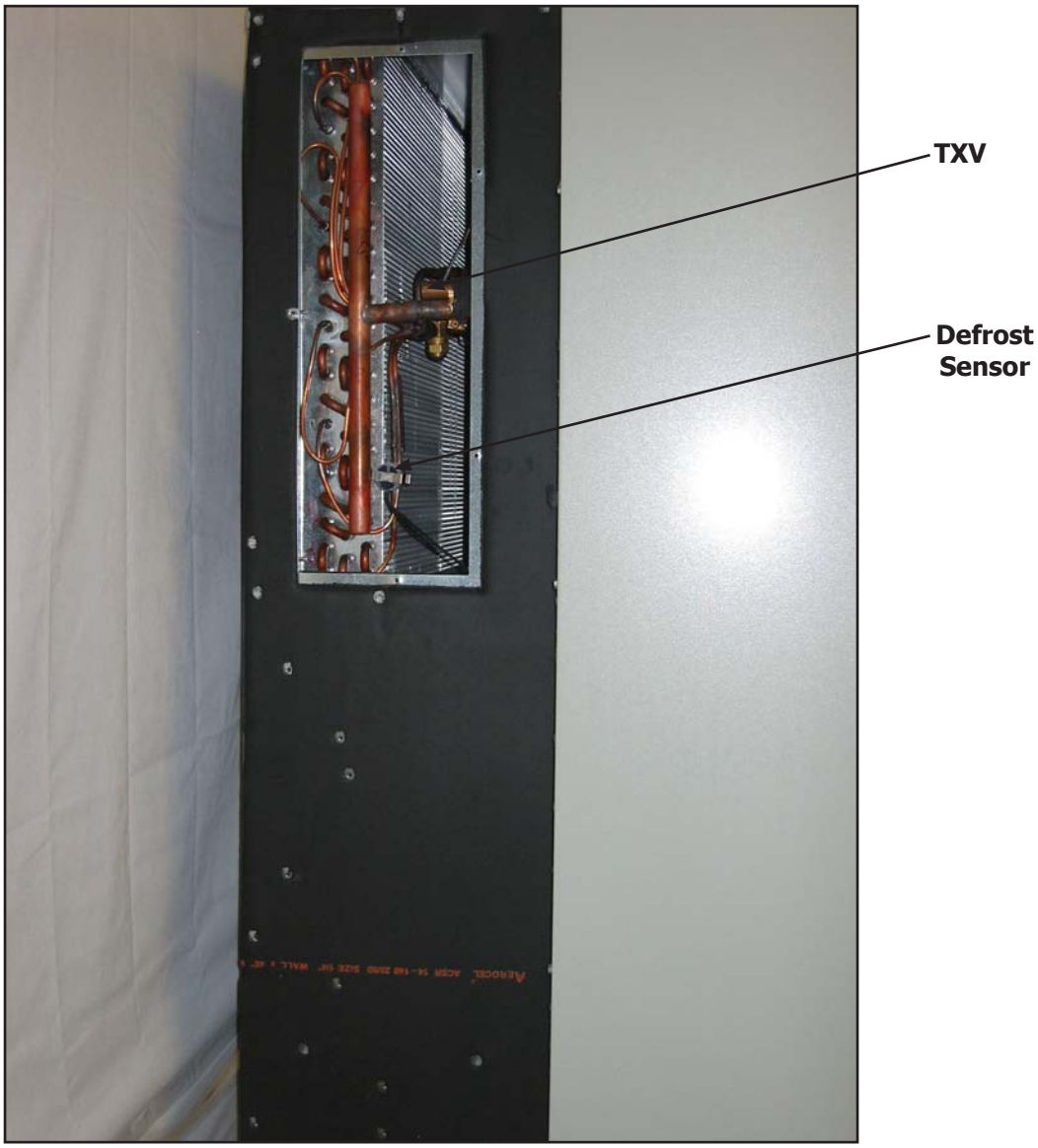
From the indoor blower compartment:

1. Remove the indoor blower assembly as described in section 1.08D.

2. Remove access panel in rear of blower compartment.



Access to the outdoor TXV and defrost sensor from the outdoor air box.



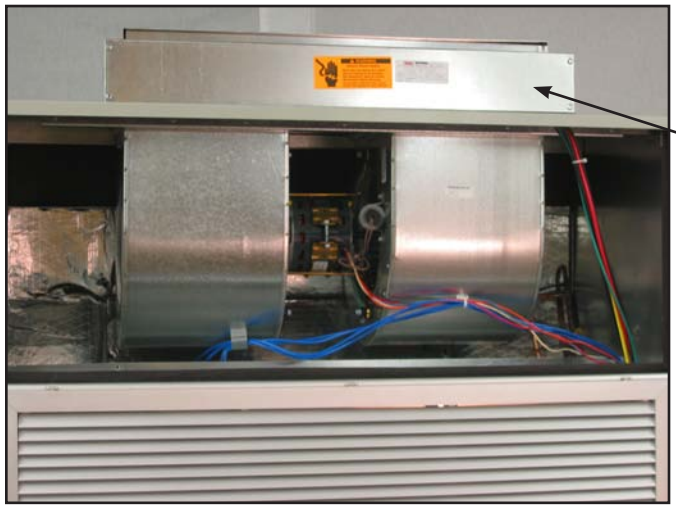
F. **Electric Heaters and Limit Switches.**

Tools Required
- Torx Head #25 screw driver
- 5/16” nut driver
- Ohmmeter

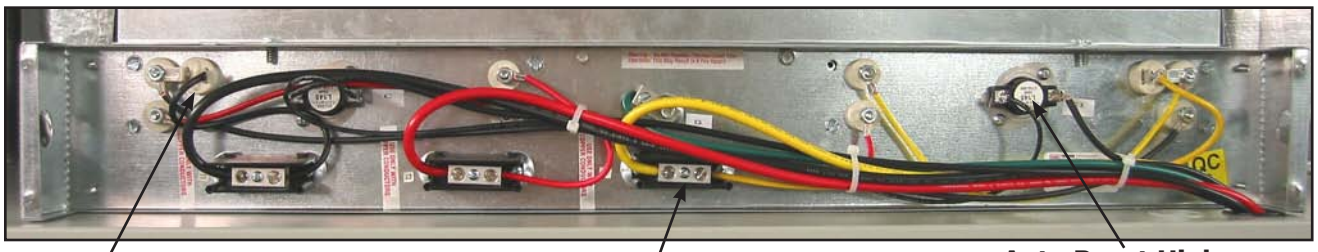
The electric heater and limit switch assembly is located on top the Scholar QV™ air conditioner or heat pump, over the indoor blower air discharge. The heaters are available in 5, 10 &15 kW for operation on 208/230v., 1Ø; 208/230 v., 3Ø; and 460v, 3Ø. The model number of the heat pump or air conditioner will indicate the power supply and kW.

1. Remove the front panel of the plenum. The heater assembly is located above the indoor blower air discharge.

2. Remove the front panel of the assembly.



3. Temperature limit switches.



4. To determine if a switch has failed, use an ohmmeter. If continuity is not shown across the switch, the switch should be replaced.

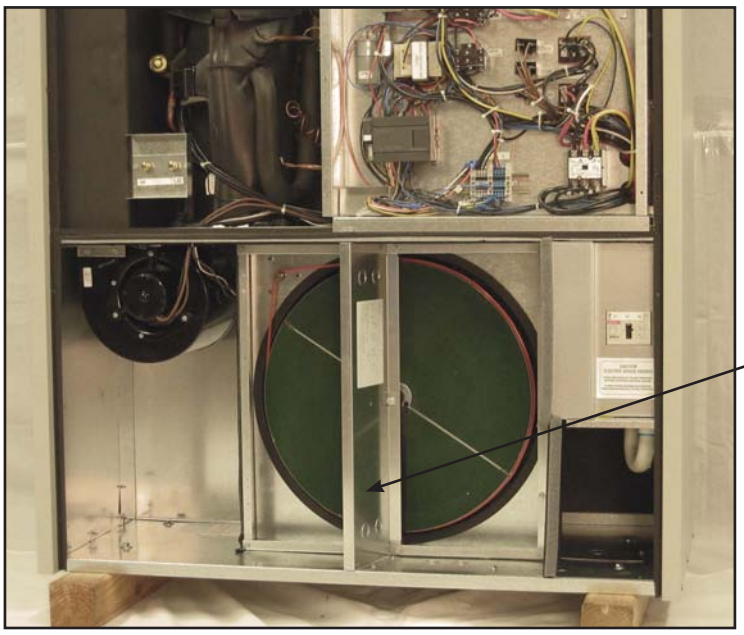
G. **Greenwheel removal instructions.**

Tools Required
- Torx Head #25 screw driver
- Snap ring pliers
- 5/16" nut driver
- 7/16" wrench

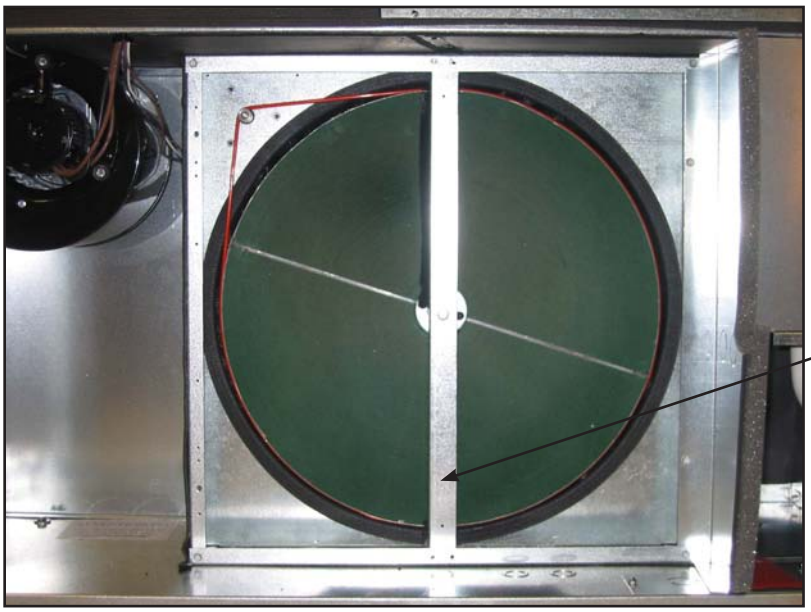
The GreenWheel® energy recovery ventilator is located in the lower compartment.

1. Remove the four screws in the lower front panel.

2. Remove the vertical divider plate.

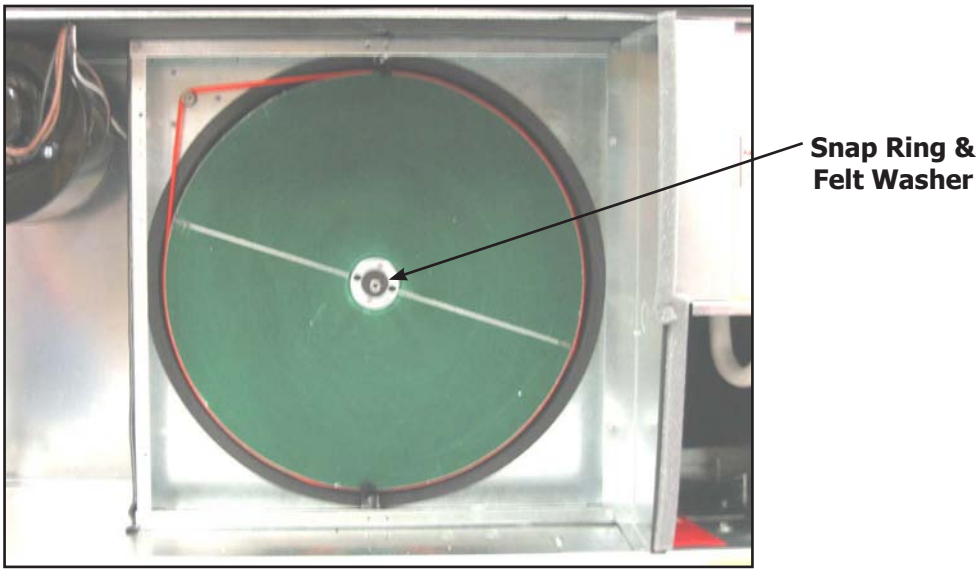


3. Remove brush assembly.



4. Remove felt washer.

5. Remove the snap ring. Note snap ring pliers are required.



6. Remove orange belt and slide the GreenWheel off the shaft.

H. **Removal procedures for the Greenwheel drive motor.**

Tools Required
- Torx Head #25 screw driver
- 5/16” nut driver
- 3/8” wrench

The GreenWheel® drive motor is located in the lower compartment behind the GreenWheel.

1. Remove the Greenwheel as described in section G above.

2. Remove the fresh air intake filter as described in Item A in Section 1.05.

3. Disconnect wires.

4. Remove 3 lock nuts that hold the motor in place.

5. Reach in through filter opening and remove the motor.

1.10 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
Cindy Gray ext.113 cgray@airxcel.com • Sam Boggs ext.146 sboggs@airxcel.com

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 and speak with Cindy at extension 113 or Sam at extension 146.

1.11 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.

1.12 PARTS LIST

Scholar QV™ Air Conditioner Parts List

SPARE PARTS		VAI24AC	VAI30AC	VAI36AC	VAI40AC	VAI49AC	VAI60AC
Compressor, Scroll	ACA	10221	10109	10079	10052	10202	10096
	ACC	10116	10118	10092	10093	10203	10097
	ACD	10114	10117	10091	10094	10204	10098
Capacitor, Scroll Compressor		50280	50321	50310	50322	50294	50315 (2)
(MFD/Voltage)		(35 / 370)	(45 / 370)	(50 / 370)	(55 / 370)	(60 / 440)	(40 / 370)
Refrigerant R22 (Oz)	B, H, J, N	116	124	136	100	194	250
	HR	n/a	124	122	100	194	250
	C	n/a	125	125	100	n/a	n/a
	LAUSD	n/a	125	125	n/a	194	250
	50 Hz	n/a	n/a	n/a	n/a	180	235
Sound Blanket, Compressor		20039	20039	20017	20017	20038	20038
Indoor Coil		60111 18 x 33	60111 18 x 33	60111 18 x 33	60111 18 x 33	60001 18 x 41.75	60004 18 x 41.75
Distributor, Indoor, Cooling (Circuits)		20091 (6)	20091 (6)	20091 (6)	n/a	n/a	n/a
Orifice, Indoor, Cooling		20066 (.062)	20066 (.062)	20066 (.062)	n/a	n/a	n/a
Distributor, Indoor with Nozzle (HGR, LAUSD)		20196 (1-1/2)	20196 (1-1/2)	20194 (2)	20225 (2-1/2)	20277 (4)	20277 (4)
Expansion Valve, Cooling (HGR, LAUSD)		20192	20192	20193	20032 (Adj.)	20218 (Adj.)	20226 (Adj.)
Coil, Evaporator, Reheat (HGR)		60051	60051	60051	60051 (2)	60051 (2)	60051 (2)
Valve, 3-Way Diverting (HGR)		20257	20257	20257	20257	20257	20257
Coil, Solenoid, 3-Way Diverting (HGR)		20028	20028	20028	20028	20028	20028
Outdoor Coil		60049 24 x 32.18	60049 24 x 32.18	60049 24 x 32.18	60059 24 x 32.18	60000 32 x 36	60005 36 x 40
Filter Drier (Reversible)		70388	70388	70388	70388	70388	70388
Indoor Motor, 230 Volt (HP/RPM)	ACA/ACC	40048 1/4 825	40048 1/4 825	40048 1/4 825	40048 1/4 825	40099 1/2 1075	40099 1/2 1075
Indoor Motor, 460 Volt (HP/RPM)	ACD	40049 1/4 825	40049 1/4 825	40049 1/4 825	40049 1/4 825	n/a	n/a
Capacitor, Indoor		50238	50238	50238	50238	50360	50360
Blower, L.H.		30012	30012	30012	30012	30090	30090
Blower, R.H.		30013	30013	30013	30013	30092	30092
Blower Wheel / Housing		10-8T DD	10-8T DD	10-8T DD	10-8T DD	10-8 DD	10-8 DD
Outdoor Motor, Belt Drive, 230 Volt	HPA	n/a	n/a	n/a	n/a	40122 3/4 hp	40122 3/4 hp
Outdoor Motor, Belt Drive, 230 Volt	HPC	n/a	n/a	n/a	n/a	P/40002 3/4 hp	P/40002 3/4 hp
Outdoor Motor, Belt Drive, 460 Volt	HPD	n/a	n/a	n/a	n/a	P/40002 3/4 hp	P/40002 3/4 hp
Capacitor, Outdoor		Capacitor is Mounted On Motor					
Outdoor Blower Assembly (Wheel/Housing)		n/a	n/a	n/a	n/a	30085	30085
Outdoor Motor/Impeller		40064	40064	40064	40064	n/a	n/a
Capacitor, Outdoor Motor		50295	50295	50295	50295	n/a	n/a
Ring, Inlet		01310	01310	01310	01310	n/a	n/a
High Pressure Control (400 Open, 300 Close)		70080	70080	70080	70080	70080	70080
Low Pressure Control (35 Open, 60 Close)		70050	70050	70050	70050	70050	70050
Accumulator (Orifice)		n/a	n/a	n/a	n/a	70330 (.040)	70340 (.055)
Contactor, Compressor, 40 Amp	ACA	50030	50030	50030	50030	50030	50030
Contactor, Compressor, 30 Amp	ACC/ACD	50040	50040	50040	50040	50040	50040
Circuit Breaker, 2 Pole, 60 Amp	ACA	70178	70178	70178	70178	70178	70178
Circuit Breaker, 3 Pole, 60 Amp	ACC	70183	70183	70183	70183	70183	70183
Circuit Breaker, 3 Pole, 40 Amp	ACD	70299	70299	70299	70299	70299	70299
Low Voltage Transformer (75 VA)		50053	50053	50053	50053	50053	50053
Transformer (460 to 230 Volts)		50147 1.5 KVA	50147 1.5 KVA	50147 1.5 KVA	50147 1.5 KVA	P/50007 2.0 KVA	P/50007 2.0 KVA
Contactor, Heat, 3 Pole, 40A	ACA	50030	50030	50030	50030	50030	50030
Contactor, Heat, 3 Pole, 30A	ACC/ACD	50040	50040	50040	50040	50040	50040
Fusible Link (305°F Open, 20 Amps)	ACA/ACC	80460	80460	80460	80460	80460	80460
Limit Control, One Time (300°F Open, 25A)	ACD	01276	01276	01276	01276	01276	01276
Limit Control, Auto Reset (145°F Open / 105°F Close)		01275	01275	01275	01275	01275	01275
Relay, Energy Management (EMS) Sub-Base P/N 50501		50511	50511	50511	50511	50511	50511

Scholar QV™ Air Conditioner Parts List (cont'd)

SPARE PARTS		VAI24AC	VAI30AC	VAI36AC	VAI40AC	VAI49AC	VAI60AC
Transformer, Reheat, Std. Unit (XFMR)	ACD	50068	50068	50068	50068	50068	50068
Programmable Logic Controller		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
Filter, Return Air (1" Thick)		81191 (2) 16" x 16"	81191 (2) 16" x 16"	81191 (2) 16" x 16"	81191 (2) 16" x 16"	81159 (2) 15" x 20"	81159 (2) 15" x 20"
Filter, Return Air, Optional (2" Thick)		81196 (2) 16" x 16"	81196 (2) 16" x 16"	81196 (2) 16" x 16"	81196 (2) 16" x 16"	81174 (2) 15" x 20"	81174 (2) 15" x 20"
Filter, Exhaust (12" x 20" x 1")		80214	80214	80214	80214	80214	80214
Filter, Fresh Air (11" x 22" x 1")		80771	80771	80771	80771	80771	80771
Grille, Exhaust Air		81145	81145	81145	81145	81145	81145
Grille, Return Air with 7.5 Blank		80771	80771	80771	80771	n/a	n/a
Grille, Return Air with 7.5 Blank (Control Cutout)		81287	81287	81287	81287	n/a	n/a
Grille, Return Air		n/a	n/a	n/a	n/a	81156	81156
GREENWHEEL® ERV							
GreenWheel Blower, 400 CFM		40015	40015	40015	40015	40015	40015
Energy Recovery Wheel		01226	01226	01226	01226	01226	01226
Motor, GreenWheel Drive		40007	40007	40007	40007	40007	40007
Fan Speed Controller (230 Volt)		70049	70049	70049	70049	70049	70049
Belting, 3/16" Round Urethane		P/80390	P/80390	P/80390	P/80390	P/80390	P/80390
HEATERS							
Heater, 5 kW, 240 Volts, 20.8A	ACA	70223	70223	70223	70223	70223	70223
Heater, 7.5 kW, 240 Volts, 31.2A	ACA	70252	70252	70252	70252	70252	70252
Heater, 10 kW, 240 Volts, 41.6A	ACA	70245	70245	70245	70245	70245	70245
Heater, 5 kW, 240 Volts, 12A	ACC	70220	70220	70220	70220	70220	70220
Heater, 7.5 kW, 240 Volts, 18A	ACC	70250	70250	70250	70250	70250	70250
Heater, 10 kW, 240 Volts, 24A	ACC	70221	70221	70221	70221	70221	70221
Heater, 15 kW, 240 Volts, 36.1A	ACC	70222	70222	70222	70222	70222	70222
Heater, 5 kW, 480 Volts, 6A	ACD	70216	70216	70216	70216	70216	70216
Heater, 7.5 kW, 480 Volts, 9A	ACD	70219	70219	70219	70219	70219	70219
Heater, 10 kW, 480 Volts, 12A	ACD	70217	70217	70217	70217	70217	70217
Heater, 15 kW, 480 Volts, 18.4A	ACD	70218	70218	70218	70218	70218	70218

Scholar QV™ Heat Pump Parts List

SPARE PARTS		VAI24HP	VAI30HP	VAI36HP	VAI40HP	VAI49HP	VAI60HP
Compressor, Scroll	HPA	10221	10109	10079	10052	10202	10096
	HPC	10116	10118	10092	10093	10203	10097
	HPD	10114	10117	10091	10094	10204	10098
Capacitor, Scroll Compressor (MFD/Voltage)		50280 (35 / 370)	50321 (45 / 370)	50310 (50 / 370)	50322 (55 / 370)	50294 (60 / 440)	50315 (2) (40 / 370)
Refrigerant R22 (Oz)	B, H, J, N	116	124	136	100	194	250
	HR	n/a	124	122	100	194	250
	C	n/a	125	125	100	n/a	n/a
	LAUSD	n/a	125	125	n/a	194	250
	50 Hz	n/a	n/a	n/a	n/a	180	235
Sound Blanket, Compressor		20039	20039	20017	20017	20038	20038
Indoor Coil		60111 18 x 33	60111 18 x 33	60111 18 x 33	60111 18 x 33	60001 18 x 41.75	60004 18 x 41.75
Distributor, Indoor, Cooling (Circuits)		20091 (6)	20091 (6)	20091 (6)	n/a	n/a	n/a
Orifice, Indoor, Cooling		20066 (.062)	20066 (.062)	20066 (.062)	n/a	n/a	n/a
Distributor, Indoor with Nozzle (HGR, LAUSD)		20196 (1-1/2)	20196 (1-1/2)	20194 (2)	20225 (2-1/2)	20277 (4)	20277 (4)
Expansion Valve, Cooling (HGR, LAUSD)		20192	20192	20193	20032 (Adj.)	20218 (Adj.)	20226 (Adj.)
Defrost Sensor		50120	50120	50120	50120	50120	50120
Coil, Evaporator, Reheat (HGR)		60051	60051	60051	60051 (2)	60051 (2)	60051 (2)
Valve, 3-Way Diverting (HGR)		20257	20257	20257	20257	20257	20257
Coil, Solenoid, 3-Way Diverting (HGR)		20028	20028	20028	20028	20028	20028
Outdoor Coil		60049 24 x 32.18	60049 24 x 32.18	60049 24 x 32.18	60059 24 x 32.18	60005 36 x 40	60005 36 x 40
Distributor, Outdoor, Heating (Circuits)		20092 (6)	20092 (6)	20092 (6)	20033 (9)	20230 (9)	20230 (9)
Orifice, Outdoor, Heating		20064 (.053)	20064 (.053)	20083 (.055)	20198 (.070)	20094 (.065)	20198 (.070)
Indoor Motor, 230 Volt (HP/RPM)	HPA/HPC	40048 1/4 825	40048 1/4 825	40048 1/4 825	40048 1/4 825	40099 1/2 1075	40099 1/2 1075
Indoor Motor, 460 Volt (HP/RPM)	HPD	40049 1/4 825	40049 1/4 825	40049 1/4 825	40049 1/4 825	n/a	n/a
Capacitor, Indoor		50238	50238	50238	50238	50360	50360
Blower, L.H.		30012	30012	30012	30012	30090	30090
Blower, R.H.		30013	30013	30013	30013	30092	30092
Blower Wheel / Housing		10-8T DD	10-8T DD	10-8T DD	10-8T DD	10-8 DD	10-8 DD
Outdoor Motor, Belt Drive, 230 Volt	HPA	n/a	n/a	n/a	n/a	40122 3/4 hp	40122 3/4 hp
Outdoor Motor, Belt Drive, 230 Volt	HPC	n/a	n/a	n/a	n/a	P/40002 3/4 hp	P/40002 3/4 hp
Outdoor Motor, Belt Drive, 460 Volt	HPD	n/a	n/a	n/a	n/a	P/40002 3/4 hp	P/40002 3/4 hp
Capacitor, Outdoor		Capacitor is Mounted On Motor					
Outdoor Blower Assembly (Wheel/Housing)		n/a	n/a	n/a	n/a	30085	30085
Outdoor Motor/Impeller		40064	40064	40064	40064	n/a	n/a
Capacitor, Outdoor Motor		50295	50295	50295	50295	n/a	n/a
Ring, Inlet		01310	01310	01310	01310	n/a	n/a
Reversing Valve, RV		20220A	20220A	20220A	20220A	20220A	20220A
Reversing Valve, RV, Alternate		20135B	20135B	20135B	20135B	20220B	20220B
Solenoid Coil, RV		50225A	50225A	50225A	50225A	50225A	50225A
Solenoid Coil, RV, Alternate		50225B	50225B	50225B	50225B	50225B	50225B
Filter Drier (Reversible)		70388	70388	70388	70388	70388	70388
High Pressure Control (400 Open, 300 Close)		70080	70080	70080	70080	70080	70080
Loss of Charge Switch (35 Open, 60 Close)		70050	70050	70050	70050	70050	70050
Accumulator (Orifice)		n/a	n/a	n/a	n/a	70330 (.040)	70340 (.055)
Contactor, Compressor, 40 Amp	HPA	50030	50030	50030	50030	50030	50030
Contactor, Compressor, 30 Amp	HPC/HPD	50040	50040	50040	50040	50040	50040
Circuit Breaker, 2 Pole, 60 Amp	HPA	70178	70178	70178	70178	70178	70178
Circuit Breaker, 3 Pole, 60 Amp	HPC	70183	70183	70183	70183	70183	70183
Circuit Breaker, 3 Pole, 40 Amp	HPD	70299	70299	70299	70299	70299	70299
Low Voltage Transformer (75 VA)		50053	50053	50053	50053	50053	50053
Transformer (460 to 230 Volts)		50147 1.5 KVA	50147 1.5 KVA	50147 1.5 KVA	50147 1.5 KVA	P/50007 2.0 KVA	P/50007 2.0 KVA
Contactor, Heat, 3 Pole, 40A	HPA	50030	50030	50030	50030	50030	50030

Scholar QV™ Heat Pump Parts List (cont'd)

SPARE PARTS		VAI24HP	VAI30HP	VAI36HP	VAI40HP	VAI49HP	VAI60HP
Contactor, Heat, 3 Pole, 30A	HPC/HPD	50040	50040	50040	50040	50040	50040
Fusible Link (305°F Open, 20 Amps)	HPA/HPC	80460	80460	80460	80460	80460	80460
Limit Control, One Time (300°F Open, 25A)	HPD	01276	01276	01276	01276	01276	01276
Limit Control, Auto Reset (145°F Open / 105°F Close)		01275	01275	01275	01275	01275	01275
Transformer, Reheat, Std. Unit (XFMR)	HPD	50068	50068	50068	50068	50068	50068
Programmable Logic Controller		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
Filter, Return Air - 1" Thick (inches)		81191 (2) 16" x 16"	81191 (2) 16" x 16"	81191 (2) 16" x 16"	81191 (2) 16" x 16"	81159 (2) 15" x 20"	81159 (2) 15" x 20"
Filter, Return Air, Optional - 2" Thick (inches)		81196 (2) 16" x 16"	81196 (2) 16" x 16"	81196 (2) 16" x 16"	81196 (2) 16" x 16"	81174 (2) 15" x 20"	81174 (2) 15" x 20"
Filter, Exhaust (12" x 20" x 1")		80214	80214	80214	80214	80214	80214
Filter, Fresh Air (11" x 22" x 1")		80771	80771	80771	80771	80771	80771
Grille, Exhaust Air		81145	81145	81145	81145	81145	81145
Grille, Return Air with 7.5 Blank		80771	80771	80771	80771	n/a	n/a
Grille, Return Air with 7.5 Blank (Control Cutout)		81287	81287	81287	81287	n/a	n/a
Grille, Return Air		n/a	n/a	n/a	n/a	81156	81156
GREENWHEEL® ERV							
GreenWheel Blower, 400 CFM		40015	40015	40015	40015	40015	40015
Energy Recovery Wheel		01226	01226	01226	01226	01226	01226
Motor, GreenWheel Drive		40007	40007	40007	40007	40007	40007
Fan Speed Controller (230 Volt)		70049	70049	70049	70049	70049	70049
Belting, 3/16" Round Urethane		P/80390	P/80390	P/80390	P/80390	P/80390	P/80390
HEATERS							
Heater, 5 kW, 240 Volts, 20.8A	HPA	70223	70223	70223	70223	70223	70223
Heater, 7.5 kW, 240 Volts, 31.2A	HPA	70252	70252	70252	70252	70252	70252
Heater, 10 kW, 240 Volts, 41.6A	HPA	70245	70245	70245	70245	70245	70245
Heater, 5 kW, 240 Volts, 12A	HPC	70220	70220	70220	70220	70220	70220
Heater, 7.5 kW, 240 Volts, 18A	HPC	70250	70250	70250	70250	70250	70250
Heater, 10 kW, 240 Volts, 24A	HPC	70221	70221	70221	70221	70221	70221
Heater, 15 kW, 240 Volts, 36.1A	HPC	70222	70222	70222	70222	70222	70222
Heater, 5 kW, 480 Volts, 6A	HPD	70216	70216	70216	70216	70216	70216
Heater, 7.5 kW, 480 Volts, 9A	HPD	70219	70219	70219	70219	70219	70219
Heater, 10 kW, 480 Volts, 12A	HPD	70217	70217	70217	70217	70217	70217
Heater, 15 kW, 480 Volts, 18.4A	HPD	70218	70218	70218	70218	70218	70218

APPENDIX A - RATINGS / DATA - SCHOLAR QV™ HEAT PUMPS & AIR CONDITIONER

Figure 1a. Heat Pump & Air Conditioner Model VAI Performance Ratings

BASIC MODEL	Rated Cooling (BTUH)	Rated Airflow[2] (WET COIL, CFM)	Rated SEER[1]	Rated Heating[4] (BTUH 47°F)	Rated COP[4] (47°F)	Rated Heating[4] (BTUH 17°F)	Rated COP[4] (17°F)	Sensible Heat Ratio	HSPF[3,4]
VAI24	23,600	800	10.7	22,600	2.9	14,100	2.1	0.77	6.70
VAI30	30,000	1,000	10.6	28,400	3.0	18,200	2.2	0.77	7.00
VAI36	35,600	1,200	10.5	34,000	3.0	20,800	2.1	0.70	6.90
VAI40	39,500	1,300	10.0	37,500	2.9	22,000	1.9	0.70	6.60
VAI49	47,000	1,740	9.25	47,000	3.0	27,000	2.0	0.70	6.60
VAI60	56,500	2,000	10.1	55,000	3.1	32,500	2.0	0.70	6.70

Cooling rated at 95°/75°F outdoor, and 80°/67°F indoor. Heating rated at 70°F indoor and 47°/43°F outdoor.
Sensible heat ratio rated at 95°F outdoor, and 80°/67°F indoor.
[1]Highest efficiency ratings obtained with blank-off plate in place (no outside air).
[2]Airflow ratings shown are for standard unit configuration (N-option) with or without electric heat. All ratings are at 230V or 460V.
[3]HSPF applies only to single phase units.
[4]Model VAI heat pumps only.

Figure 1b. Heat Pump & Air Conditioner Model VAI Performance Data - Cooling

COOLING PERFORMANCE, MBTU/HR									
BASIC MODEL	OUTDOOR AMBIENT TEMPERATURE, °F DRY BULB								
	75	**80**	**85**	**90**	**95**	**100**	**105**	**110**	**115**
VAI24	25.6	25.1	24.6	24.1	23.6	22.5	21.5	20.5	19.4
VAI30	32.6	31.9	31.3	30.6	30.0	28.6	27.3	25.9	24.5
VAI36	38.0	37.1	36.7	35.9	35.6	33.7	32.0	30.3	28.8
VAI40	42.2	41.2	40.7	39.8	39.5	37.4	35.5	33.6	32.0
VAI49	49.7	48.5	47.9	46.8	46.5	44.0	41.8	39.6	37.7
VAI60	59.9	58.4	57.7	56.4	56.5	53.0	50.3	47.7	45.4

Rated indoor airflow @ 80°F DB/67°F WB cooling. Cooling sensible heat ratio is .77 on models VAI24/30/36/49.
Cooling sensible heat ratio is .70 on models VAI40/60.

Figure 1c. Heat Pump Model VAI Performance Data - Heating

HEATING PERFORMANCE, MBTU/HR							
BASIC MODEL	OUTDOOR AMBIENT TEMPERATURE, °F DRY BULB						
	10	**20**	**30**	**40**	**50**	**60**	**70**
VAI24	12.8	14.7	16.5	19.8	23.4	24.8	25.7
VAI30	17.2	18.6	20.1	25.2	29.5	30.7	32.0
VAI36	19.0	21.6	24.1	29.8	34.8	36.5	37.3
VAI40	19.5	23.1	26.6	32.8	38.4	40.0	41.2
VAI49	23.9	28.3	32.7	40.2	47.1	49.1	50.5
VAI60	28.9	34.0	39.1	48.1	56.3	58.7	60.4

Rated indoor airflow @ 70°F DB heating.

Figure 1d. Model VAI Air Flow, CFM vs. ESP (Wet Coil)

AIR FLOW CFM						
BASIC MODEL	ESP (WET COIL)					
	0.10	**0.15**	**0.20**	**0.30**	**0.40**	**0.50**
24	920	890	860	800	—	—
30	1150	1100	1075	1000	—	—
36	1380	1340	1290	1200	—	—
40	1380	1340	1290	1200	—	—
49	1840	1780	1740	1600	1490	1400
60	2250	2190	2100	2000	1900	1790

CFM = Cubic Feet per Minute, Indoor Air Flow ESP = External Static Pressure in Inches of Water
Rated at 240 Volts

Figure 2a. Summary Electrical Ratings (Wire/Fuse Sizing) for Heat Pump Model VAI with Manual ("N") or Motorized ("B") Fresh Air Ventilation System - QV Version

ELECT. HEAT		00 = None		05 = 5 kw				7.5 = 7.5 kw				10 = 10 kw				15 = 15 kw			
BASIC	VOLTAGE	CKT #1		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2	
MODEL	Ph-Hz	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24HPA	208-230/1/60	20.5	30	46.5	50	n/a	n/a	40.0	45	19.6	20	46.5	50	26.0	30	n/a	n/a	n/a	n/a
VAI30HPA	208-230/1/60	22.1	35	48.1	50	n/a	n/a	41.6	50	19.6	20	48.1	50	26.0	30	n/a	n/a	n/a	n/a
VAI36HPA	208-230/1/60	25.2	40	51.2	60	n/a	n/a	44.8	50	19.6	20	51.2	60	26.0	30	n/a	n/a	n/a	n/a
VAI40HPA	208-230/1/60	27.7	45	53.7	60	n/a	n/a	47.3	60	19.6	20	53.7	60	26.0	30	n/a	n/a	n/a	n/a
VAI49HPA	208-230/1/60	34.2	50	34.2	50	26.0	30	34.2	50	39.1	40	34.2	50	52.1	60	n/a	n/a	n/a	n/a
VAI60HPA	208-230/1/60	41.5	60	41.5	60	26.0	30	41.5	60	39.1	40	41.5	60	52.1	60	n/a	n/a	n/a	n/a
VAI24HPC	208-230/3/60	14.8	20	29.8	30	n/a	n/a	37.3	40	n/a	n/a	45.0	45	n/a	n/a	37.3	40	22.5	25
VAI30HPC	208-230/3/60	17.2	25	32.2	35	n/a	n/a	39.7	40	n/a	n/a	47.3	50	n/a	n/a	39.7	40	22.5	25
VAI36HPC	208-230/3/60	18.1	25	33.1	35	n/a	n/a	40.6	45	n/a	n/a	48.2	50	n/a	n/a	40.6	45	22.5	25
VAI40HPC	208-230/3/60	20.8	30	35.8	40	n/a	n/a	43.3	50	n/a	n/a	51.0	60	n/a	n/a	43.3	50	22.5	25
VAI49HPC	208-230/3/60	28.6	40	43.6	45	n/a	n/a	51.1	60	n/a	n/a	58.7	60	n/a	n/a	28.6	40	45.1	50
VAI60HPC	208-230/3/60	31.8	45	46.8	50	n/a	n/a	54.3	60	n/a	n/a	31.8	45	30.1	35	31.8	45	45.1	50
VAI24HPD	460/3/60	7.8	15	15.3	20	n/a	n/a	19.1	20	n/a	n/a	22.8	25	n/a	n/a	30.3	35	n/a	n/a
VAI30HPD	460/3/60	8.6	15	16.1	20	n/a	n/a	19.8	20	n/a	n/a	23.6	25	n/a	n/a	31.1	35	n/a	n/a
VAI36HPD	460/3/60	9.5	15	17.0	20	n/a	n/a	20.7	25	n/a	n/a	24.5	25	n/a	n/a	32.0	35	n/a	n/a
VAI40HPD	460/3/60	10.2	15	17.7	20	n/a	n/a	21.5	25	n/a	n/a	25.2	30	n/a	n/a	32.7	35	n/a	n/a
VAI49HPD	460/3/60	14.4	20	21.9	25	n/a	n/a	25.6	30	n/a	n/a	28.9	30	n/a	n/a	36.4	40	n/a	n/a
VAI60HPD	460/3/60	14.9	20	22.4	25	n/a	n/a	26.1	30	n/a	n/a	29.4	30	n/a	n/a	37.4	40	n/a	n/a

Figure 2b. Summary Electrical Ratings (Wire/Fuse Sizing) for Heat Pump Model VAI with PowerVent ("J") Ventilation System - QV Version

ELECT. HEAT		00 = None		05 = 5 kw				7.5 = 7.5 kw				10 = 10 kw				15 = 15 kw			
BASIC	VOLTAGE	CKT #1		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2	
MODEL	Ph-Hz	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24HPA	208-230/1/60	21.5	30	47.5	50	n/a	n/a	41.0	45	19.6	20	47.5	50	26.0	30	n/a	n/a	n/a	n/a
VAI30HPA	208-230/1/60	23.1	35	49.1	50	n/a	n/a	42.6	50	19.6	20	49.1	50	26.0	30	n/a	n/a	n/a	n/a
VAI36HPA	208-230/1/60	26.2	40	52.2	60	n/a	n/a	45.8	50	19.6	20	52.2	60	26.0	30	n/a	n/a	n/a	n/a
VAI40HPA	208-230/1/60	28.7	45	54.7	60	n/a	n/a	48.3	60	19.6	20	54.7	60	26.0	30	n/a	n/a	n/a	n/a
VAI49HPA	208-230/1/60	35.2	50	35.2	50	26.0	30	35.2	50	39.1	40	35.2	50	52.1	60	n/a	n/a	n/a	n/a
VAI60HPA	208-230/1/60	42.5	60	42.5	60	26.0	30	42.5	60	39.1	40	42.5	60	52.1	60	n/a	n/a	n/a	n/a
VAI24HPC	208-230/3/60	15.8	20	30.8	35	n/a	n/a	38.3	40	n/a	n/a	46.0	50	n/a	n/a	38.3	40	22.5	25
VAI30HPC	208-230/3/60	18.2	25	33.2	35	n/a	n/a	40.7	45	n/a	n/a	48.3	50	n/a	n/a	40.7	45	22.5	25
VAI36HPC	208-230/3/60	19.1	25	34.1	40	n/a	n/a	41.6	45	n/a	n/a	49.2	50	n/a	n/a	41.6	45	22.5	25
VAI40HPC	208-230/3/60	21.8	30	36.8	45	n/a	n/a	44.3	50	n/a	n/a	52.0	60	n/a	n/a	44.3	50	22.5	25
VAI49HPC	208-230/3/60	29.6	40	44.6	45	n/a	n/a	52.1	60	n/a	n/a	59.7	60	n/a	n/a	29.6	40	45.1	50
VAI60HPC	208-230/3/60	32.8	45	47.8	50	n/a	n/a	55.3	60	n/a	n/a	32.8	45	30.1	35	32.8	45	45.1	50
VAI24HPD	460/3/60	8.3	15	15.8	20	n/a	n/a	19.6	20	n/a	n/a	23.3	25	n/a	n/a	30.8	35	n/a	n/a
VAI30HPD	460/3/60	9.1	15	16.6	20	n/a	n/a	20.3	25	n/a	n/a	24.1	25	n/a	n/a	31.6	35	n/a	n/a
VAI36HPD	460/3/60	10.0	15	17.5	20	n/a	n/a	21.2	25	n/a	n/a	25.0	25	n/a	n/a	32.5	35	n/a	n/a
VAI40HPD	460/3/60	10.7	15	18.2	20	n/a	n/a	22.0	25	n/a	n/a	25.7	30	n/a	n/a	33.2	35	n/a	n/a
VAI49HPD	460/3/60	14.9	20	22.4	25	n/a	n/a	26.1	30	n/a	n/a	29.4	30	n/a	n/a	37.4	40	n/a	n/a
VAI60HPD	460/3/60	15.4	20	22.9	25	n/a	n/a	26.6	30	n/a	n/a	29.9	30	n/a	n/a	37.9	40	n/a	n/a

Figure 2c. Summary Electrical Ratings (Wire/Fuse Sizing) for Heat Pump Model VAI with GreenWheel® Energy Recovery Ventilator (ERV) ("H") - QV Version

ELECT. HEAT		00 = None		05 = 5 kw				7.5 = 7.5 kw				10 = 10 kw				15 = 15 kw			
BASIC	VOLTAGE	CKT #1		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2		CKT #1		CKT #2	
MODEL	Ph-Hz	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24HPA	208-230/1/60	21.7	30	47.7	50	n/a	n/a	41.2	45	19.6	20	47.7	50	26.0	30	n/a	n/a	n/a	n/a
VAI30HPA	208-230/1/60	23.3	35	49.3	50	n/a	n/a	42.8	50	19.6	20	49.3	50	26.0	30	n/a	n/a	n/a	n/a
VAI36HPA	208-230/1/60	26.4	40	52.4	60	n/a	n/a	46.0	50	19.6	20	52.4	60	26.0	30	n/a	n/a	n/a	n/a
VAI40HPA	208-230/1/60	28.9	45	54.9	60	n/a	n/a	48.5	60	19.6	20	54.9	60	26.0	30	n/a	n/a	n/a	n/a
VAI49HPA	208-230/1/60	35.3	50	35.3	50	26.0	30	35.3	50	39.1	40	35.3	50	52.1	60	n/a	n/a	n/a	n/a
VAI60HPA	208-230/1/60	42.6	60	42.6	60	26.0	30	42.6	60	39.1	40	42.6	60	52.1	60	n/a	n/a	n/a	n/a
VAI24HPC	208-230/3/60	16.0	20	31.0	35	n/a	n/a	38.5	40	n/a	n/a	46.2	50	n/a	n/a	38.5	40	22.5	25
VAI30HPC	208-230/3/60	18.4	25	33.4	40	n/a	n/a	40.9	45	n/a	n/a	48.5	50	n/a	n/a	40.9	45	22.5	25
VAI36HPC	208-230/3/60	19.3	25	34.3	40	n/a	n/a	41.8	45	n/a	n/a	49.4	50	n/a	n/a	41.8	45	22.5	25
VAI40HPC	208-230/3/60	22.0	30	37.0	45	n/a	n/a	44.5	50	n/a	n/a	52.2	60	n/a	n/a	44.5	50	22.5	25
VAI48HPC	208-230/3/60	29.7	40	44.7	45	n/a	n/a	52.2	60	n/a	n/a	59.8	60	n/a	n/a	29.7	40	45.1	50
VAI60HPC	208-230/3/60	32.9	45	47.9	50	n/a	n/a	55.4	60	n/a	n/a	32.9	45	30.1	35	32.9	45	45.1	50
VAI24HPD	460/3/60	8.4	15	15.9	20	n/a	n/a	19.7	20	n/a	n/a	23.4	25	n/a	n/a	30.9	35	n/a	n/a
VAI30HPD	460/3/60	9.2	15	16.7	20	n/a	n/a	20.4	25	n/a	n/a	24.2	25	n/a	n/a	31.7	35	n/a	n/a
VAI36HPD	460/3/60	10.1	15	17.6	20	n/a	n/a	21.3	25	n/a	n/a	25.1	30	n/a	n/a	32.6	35	n/a	n/a
VAI40HPD	460/3/60	10.8	15	18.3	20	n/a	n/a	22.1	25	n/a	n/a	25.8	30	n/a	n/a	33.3	35	n/a	n/a
VAI49HPD	460/3/60	14.9	20	22.4	25	n/a	n/a	26.2	30	n/a	n/a	29.4	30	n/a	n/a	37.4	40	n/a	n/a
VAI60HPD	460/3/60	15.4	20	22.9	25	n/a	n/a	26.7	30	n/a	n/a	29.9	30	n/a	n/a	37.9	40	n/a	n/a

MCA and MFS calculated at 240 VAC. NA = Not Applicable

MCA = Minimum Circuit Ampacity (Wire Size Amps) MFS = Maximum Fuse or HACR Circuit.

The minimum circuit ampacity and maximum fuse size for the VAI24-60 units with steam and hot water plenums are the same as the minimum circuit ampacities and maximum overcurrent values of VAI24-60 units with no electric heat. 15 kW only operates during "S" circuit or emergency heat modes.

Figure 2d. Summary Electrical Ratings (Wire/Fuse Sizing) for Air Conditioner Model VAI with Manual ("N") or Motorized ("B") Fresh Air Ventilation System - QV Version

ELECT. HEAT		00 = None		05 = 5 kw		7.5 = 7.5 kw		10 = 10 kw		15 = 15 kw	
BASIC	VOLTAGE	CKT #1		CKT #1		CKT #1		CKT #1		CKT #1	
MODEL	Ph-Hz	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24ACA	208-230/1/60	20.5	30	28.5	30	41.6	45	54.6	60	n/a	n/a
VAI30ACA	208-230/1/60	22.1	35	28.5	35	41.6	45	54.6	60	n/a	n/a
VAI36ACA	208-230/1/60	25.2	40	28.5	40	41.6	45	54.6	60	n/a	n/a
VAI40ACA	208-230/1/60	27.7	45	28.5	45	41.6	45	54.6	60	n/a	n/a
VAI49ACA	208-230/1/60	34.2	50	34.2	50	44.3	50	57.3	60	n/a	n/a
VAI60ACA	208-230/1/60	41.5	60	41.5	60	44.3	60	57.3	60	n/a	n/a
VAI24ACC	208-230/3/60	14.4	20	17.5	20	25.0	30	32.6	35	47.6	50
VAI30ACC	208-230/3/60	16.8	25	17.5	25	25.0	30	32.6	35	47.6	50
VAI36ACC	208-230/3/60	17.7	25	17.7	25	25.0	30	32.6	35	47.6	50
VAI40ACC	208-230/3/60	20.4	30	20.4	30	25.0	30	32.6	35	47.6	50
VAI49ACC	208-230/3/60	28.6	40	28.6	40	28.6	40	35.3	40	50.3	60
VAI60ACC	208-230/3/60	31.8	45	31.8	45	31.8	45	35.3	45	50.3	60
VAI24ACD	460/3/60	7.8	15	9.1	15	12.9	15	16.6	20	24.1	25
VAI30ACD	460/3/60	8.6	15	9.1	15	12.9	15	16.6	20	24.1	25
VAI36ACD	460/3/60	9.5	15	9.5	15	12.9	15	16.6	20	24.1	25
VAI40ACD	460/3/60	10.2	15	10.1	15	12.9	15	16.6	20	24.1	25
VAI49ACD	460/3/60	14.4	20	14.4	20	14.4	20	17.6	20	25.1	30
VAI60ACD	460/3/60	14.9	20	14.9	20	14.9	20	17.6	20	25.1	30

Figure 2e. Summary Electrical Ratings (Wire/Fuse Sizing) for Air Conditioner Model VAI with PowerVent ("J") Ventilation System - QV Version

ELECT. HEAT		00 = None		05 = 5 kw		7.5 = 7.5 kw		10 = 10 kw		15 = 15 kw	
BASIC	VOLTAGE	CKT #1		CKT #1		CKT #1		CKT #1		CKT #1	
MODEL	Ph-Hz	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24ACA	208-230/1/60	21.5	30	29.5	30	42.6	45	55.6	60	n/a	n/a
VAI30ACA	208-230/1/60	23.1	35	29.5	35	42.6	45	55.6	60	n/a	n/a
VAI36ACA	208-230/1/60	26.2	40	29.5	40	42.6	45	55.6	60	n/a	n/a
VAI40ACA	208-230/1/60	28.7	45	29.5	45	42.6	45	55.6	60	n/a	n/a
VAI49ACA	208-230/1/60	34.3	50	34.3	50	45.3	50	58.3	60	n/a	n/a
VAI60ACA	208-230/1/60	42.5	60	42.5	60	45.3	60	58.3	60	n/a	n/a
VAI24ACC	208-230/3/60	15.4	20	18.5	20	26.0	30	33.6	35	49.6	50
VAI30ACC	208-230/3/60	17.8	25	18.5	25	26.0	30	33.6	35	49.6	50
VAI36ACC	208-230/3/60	18.7	25	18.7	25	26.0	30	33.6	35	49.6	50
VAI40ACC	208-230/3/60	21.5	30	21.5	30	26.0	30	33.6	35	49.6	50
VAI49ACC	208-230/3/60	29.6	40	29.6	40	29.6	40	36.3	40	51.3	60
VAI60ACC	208-230/3/60	32.8	45	32.8	45	32.8	45	36.3	45	51.3	60
VAI24ACD	460/3/60	8.3	15	9.6	15	13.4	15	17.1	20	24.6	25
VAI30ACD	460/3/60	9.1	15	9.6	15	13.4	15	17.1	20	24.6	25
VAI36ACD	460/3/60	10.0	15	10.0	15	13.4	15	17.1	20	24.6	25
VAI40ACD	460/3/60	10.7	15	107.0	15	13.4	15	17.1	20	24.6	25
VAI49ACD	460/3/60	14.9	20	14.9	20	14.9	20	18.1	20	25.6	30
VAI60ACD	460/3/60	15.4	20	15.4	20	15.4	20	18.1	20	25.6	30

MCA and MFS calculated at 240 VAC. NA = Not Applicable
MCA = Minimum Circuit Ampacity (Wire Size Amps) MFS = Maximum Fuse or HACR Circuit.
The minimum circuit ampacity and maximum fuse size for the VAI24-60 units with steam and hot water plenums are the same as the minimum circuit ampacities and maximum overcurrent values of VAI24-60 units with no electric heat. 15 kW only operates during "S" circuit or emergency heat modes.

Figure 2f. Summary Electrical Ratings (Wire/Fuse Sizing) for Air Conditioner Model VAI with GreenWheel® Energy Recovery Ventilator (ERV) ("H") - QV Version

ELECT. HEAT		00 = None		05 = 5 kw		7.5 = 7.5 kw		10 = 10 kw		15 = 15 kw	
BASIC MODEL	VOLTAGE Ph-Hz	CKT #1		CKT #1		CKT #1		CKT #1		CKT #1	
		MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS	MCA	MFS
VAI24ACA	208-230/1/60	21.7	30	29.7	30	42.7	45	55.8	60	n/a	n/a
VAI30ACA	208-230/1/60	23.2	35	29.7	35	42.7	45	55.8	60	n/a	n/a
VAI36ACA	208-230/1/60	26.4	40	29.7	40	42.7	45	55.8	60	n/a	n/a
VAI40ACA	208-230/1/60	28.9	45	29.7	45	42.7	45	55.8	60	n/a	n/a
VAI49ACA	208-230/1/60	35.4	50	35.4	50	45.5	50	58.5	60	n/a	n/a
VAI60ACA	208-230/1/60	42.7	60	42.7	60	45.5	60	58.5	60	n/a	n/a
VAI24ACC	208-230/3/60	15.6	20	18.7	20	26.2	30	33.8	35	48.8	50
VAI30ACC	208-230/3/60	18.0	25	18.7	25	26.2	30	33.8	35	48.8	50
VAI36ACC	208-230/3/60	18.9	25	19.0	25	26.2	30	33.8	35	48.8	50
VAI40ACC	208-230/3/60	21.7	30	21.7	30	26.2	30	33.8	35	48.8	50
VAI49ACC	208-230/3/60	29.8	40	29.8	40	29.8	40	36.5	40	51.5	60
VAI60ACC	208-230/3/60	33.0	45	33.0	45	33.0	45	36.5	45	51.5	60
VAI24ACD	460/3/60	8.4	15	9.7	15	13.5	15	17.2	20	24.7	25
VAI30ACD	460/3/60	9.2	15	9.7	15	13.5	15	17.2	20	24.7	25
VAI36ACD	460/3/60	10.1	15	10.1	15	13.5	15	17.2	20	24.7	25
VAI40ACD	460/3/60	10.8	15	10.8	15	13.5	15	17.2	20	24.7	25
VAI49ACD	460/3/60	14.9	20	14.9	20	14.9	20	18.2	20	25.7	30
VAI60ACD	460/3/60	15.4	20	15.4	20	15.4	20	18.2	20	25.7	30

MCA and MFS calculated at 240 VAC. NA = Not Applicable
MCA = Minimum Circuit Ampacity (Wire Size Amps) MFS = Maximum Fuse or HACR Circuit.
The minimum circuit ampacity and maximum fuse size for the VAI24-60 units with steam and hot water plenums are the same as the minimum circuit ampacities and maximum overcurrent values of VAI24-60 units with no electric heat. 15 kW only operates during "S" circuit or emergency heat modes.

Figure 3a. Model VAI Electrical Characteristics - Compressor, Fan and Blower Motors - QV Version

BASIC	COMPRESSOR					OUTDOOR FAN MOTOR						INDOOR FAN MOTOR					GREENWHEEL® ERV		
MODEL	VOLTS	Hz/Ph	RLA	LRA	MCC	Qty	VOLTS	Hz/Ph	RPM	FLA	HP	VOLTS	Hz/Ph	RPM	FLA	HP	VOLTS	Hz/Ph	RLA
VAI24	208/230	60/1	12.2	63.0	19.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI30	208/230	60/1	13.4	73.0	21.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI36	208/230	60/1	16.0	88.0	25.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI40	208/230	60/1	17.9	104.0	28.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI49	208/230	60/1	19.2	137.0	30.0	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2
VAI60	208/230	60/1	25.0	148.0	39.0	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2
VAI24	208/230	60/3	7.7	55.0	12.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI30	208/230	60/3	9.6	63.0	15.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI36	208/230	60/3	10.2	77.0	16.0	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI40	208/230	60/3	12.4	88.0	19.4	1	208/230	60/1	1040	2.7	0.66 kW	208/230	60/1	825	1.5	1/4	208/230	60/1	2.2
VAI49	208/230	60/3	14.7	91.0	23.0	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2
VAI60	208/230	60/3	17.3	123.0	27.0	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2
VAI24	460	60/3	3.8	27.0	6.0	1	208/230	60/1	1040	2.7	0.66 kW	460	60/1	825	1.1	1/4	208/230	60/1	2.2
VAI30	460	60/3	4.5	31.0	7.0	1	208/230	60/1	1040	2.7	0.66 kW	460	60/1	825	1.1	1/4	208/230	60/1	2.2
VAI36	460	60/3	5.1	39.0	8.0	1	208/230	60/1	1040	2.7	0.66 kW	460	60/1	825	1.1	1/4	208/230	60/1	2.2
VAI40	460	60/3	5.8	44.0	9.0	1	208/230	60/1	1040	2.7	0.66 kW	460	60/1	825	1.1	1/4	208/230	60/1	2.2
VAI49	460	60/3	7.0	50.0	11.0	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2
VAI60	460	60/3	7.4	49.5	11.5	2	208/230	60/1	1040	5.0	1.1 kW	208/230	60/1	1075	4.2	1/2	208/230	60/1	2.2

Figure 3b. Model VAI Electrical Characteristics - Ventilation System Motors

Configuration	Option	Exhaust Air Motor (EXM)				Outdoor Air Motor (OAM)				Wheel Drive Motor			
		Volts	Hz/Ph	FLA	Watts	Volts	Hz/Ph	FLA	Watts	Volts	Hz/Ph	FLA	Watts
Motorized Damper	B	n/a	n/a	n/a	n/a	230	60/1	1.0	127	n/a	n/a	n/a	n/a
Manual Damper (Standard)	N	n/a	n/a	n/a	n/a	230	60/1	1.0	127	n/a	n/a	n/a	n/a
PowerVent with Motorized Damper	J	230	60/1	1.0	127	230	60/1	1.0	127	n/a	n/a	n/a	n/a
GreenWheel® ERV	H	230	60/1	1.0	127	230	60/1	1.0	127	230	60/1	0.2	7.5

n/a = Not Available FLA = Full Load Amps Watts - Power Consumption Hz/Ph = Herts (Frequency)/Number of Phases

Figure 4. Model VAI Steam/Hot Water Output

OUTPUT	BASIC MODEL					
	VAI24	VAI30	VAI36	VAI40	VAI49	VAI60
STEAM[1] (BTUH)	82,800	96,400	108,200	113,500	128,500	145,700
HOT WATER[2] (BTUH)	39,800	43,500	46,400	47,500	50,700	53,800

[1]Rated steam capacity at 70°F mixed air and 2 PSIG steam, 10°F superheat.
[2]Rated hot water heating capacity at 70°F mixed air, 180°F entering water, 2 GPM.
Note: Hot water coil assemblies contain a bypass valve and freeze protection thermostat. No valves or freeze protection thermostat are provided with steam coils.

Figure 5. Model VAI Steam Ratings, BTUH

STEAM PRESSURE, PSIG	AIR FLOW, CFM					
	800	1000	1200	1400	1600	2000
2	82,800	96,400	108,200	118,800	128,500	145,700
4	86,000	100,100	112,400	123,,400	133,500	151,400
6	88,900	103,500	116,300	127600	138,100	156,600
8	91,600	106,600	119,700	131,400	142,200	161,300

Capacities shown at 70°F entering air temperature and 10°F superheat.

Figure 6. Electric Heat Table

OUTPUT	HEATER KW			
	5	7.5	10	15
240 VOLT (BTUH)	16,380	24,500	32,670	49,150
208 VOLT (BTUH)	12,290	18,420	24,570	36,860
480 VOLT (BTUH)	17,070	25,600	34,130	51,200

Electric heaters for VAI24 - VAI40 models are factory installed.
Electric heaters for VAI49 and VAI60 models are field installed..

Figure 7. Model VAI Hot Water Ratings, BTUH

WATER PRESSURE, PSIG	AIR FLOW, CFM					
	800	1000	1200	1400	1600	2000
2	39,800	43,500	46,400	48,700	50,700	53,800
4	48,900	54,900	59,800	63,900	67,600	73,600
6	53,000	60,200	66,200	71,400	76,000	83,900
8	55,300	63,200	70,000	75,800	81,200	90,200

Capacities shown at 180°F entering water temperature and 70°F entering air temperature.

Figure 8. Model VAI Air Filter Sizes (inches)

MODEL	RETURN AIR FILTER*	FRESH AIR FILTER	EXHAUST FILTER**
24/30/36/40	2 - 16" x 16" x 1" (1)	11" x 22" x 1"	12" x 20" x 1"
49/60	2 - 20" x 15" x 1" (1)	11" x 22" x 1"	12" x 20" x 1"

*Two (2) return air filters are required for each unit.
**With GreenWheel™ ventilation system.
(1) Optional 2" Filter

Figure 9. Model VAI Shipping Weight (pounds)

BASIC MODEL	VAI24	VAI30	VAI36	VAI40	VAI49	VAI60
VOLTAGE - 230	450	540	550	565	935	960
VOLTAGE - 460	475	565	575	590	960	985