APPENDIX A - RATINGS AND DATA

1.01 RATINGS / DATA

BASIC MODEL	AIR FLOW CFM					
	ESP (WET COIL)					
	0.10	0.15	0.20	0.30	0.40	0.50
VAH2030	1160	1060	970	860	795	690
VDH2036	1325	1235	1150	1070	975	890
VDH2040	1590	1500	1400	1290	1200	1090
VDH2048	1650	1570	1500	1415	1290	1200
VAH2060	1850	1780	1700	1625	1510	1395

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

Table 1. Air Flow, CFM vs. ESP (Wet Coil)

Note: Follow local codes and standards when designing duct runs to deliver the required airflow. Minimize noise and excessive pressure drops caused by duct aspect ratio changes, bends, dampers and outlet grilles in duct runs.

Table 2. Air Filter Sizes (inches)

	Qty per unit	P/N	Size	Type	MERV[1] Rating
Return Air Filter	2	93267	20.5" x 22.75" x 2"	Pleated, Disposable	8
Fresh Air Ventilation Filter	1	93617	7.75" x 17.75" x 0.875"	Metal, Washable	N/A
Exhaust Air Ventilation Filter	1	93617	7.75" x 17.75" x 0.875"	Metal, Washable	N/A

[1]MERV = Minimum Efficiency Reporting Value [2]Standard return air filter has MERV rating of 7. Optional filters are available with MERV ratings of 8 and 13.

Table 3. Installed Weight (pounds)

Model	Base	w/Greenwheel	460Vac	w/ GreenWheel & 460Vac
VAH2030	1385	1435	1410	1460
VDH2036	1385	1435	1410	1460
VDH2040	1405	1455	1430	1480
VDH2048	1405	1455	1430	1480
VAH2060	1405	1455	1430	1480

APPENDIX B - BASE STAND INSTALLATION

1.01 TOOLS/FIELD FURNISHED SUPPLIES

⚠ WARNING

TO AVOID PERSONAL INJURY, ADEQUATE PROTECTIVE CLOTHING MUST BE WORN AND PRECAUTIONS IN HANDLING AND INSTALLING THIS EQUIPMENT MUST BE PRACTICED AT ALL TIMES.

- Power Drill/Driver and Extension
- Bit for 5/16” Hex Head Bolts (or Adjustable Wrench)
- Appropriate Bits for Boring Anchor Holes and Fastening Anchor Bolts Through 1/2” Pass Through Holes in Base Stand (4 Locations)

1.02 INSPECTION/UNPACKING/HANDLING

Base stands are shipped to the job site on wooden skids and are enclosed in shrink wrap.
Do not stack the base stands.

IMPORTANT

IMMEDIATELY UPON RECEIPT, INSPECT THIS EQUIPMENT TO DETERMINE VISIBLE AND CONCEALED DAMAGE. ALL DAMAGE MUST BE REPORTED TO THE FREIGHT CARRIER WITHIN 15 DAYS, ON THE FREIGHT CARRIER’S FORM.

The label on the base stand identifies the part number of the base stand.

Base Stand Height	Part Number
2”	S/12822
4”	S/12792
5”	S/12793

Remove the shrink wrap from the base stand and dispose of the wooden skid. Retain the bag of 5/16” bolts and flat washers to fasten the cabinet to the base stand. **Do not install the Vanguard heat pump or air conditioner to the base stand at this time.**

Place the base stand (as shown in Figure 1) on the floor, measuring carefully to determine the exact location, based on where the heat pump or air conditioner is intended to be placed. It is important to be sure of base stand location when the unit is going to be located set off from the finished inside wall. The unit will be located directly on top of the base stand, and the base stand will be anchored to the floor.

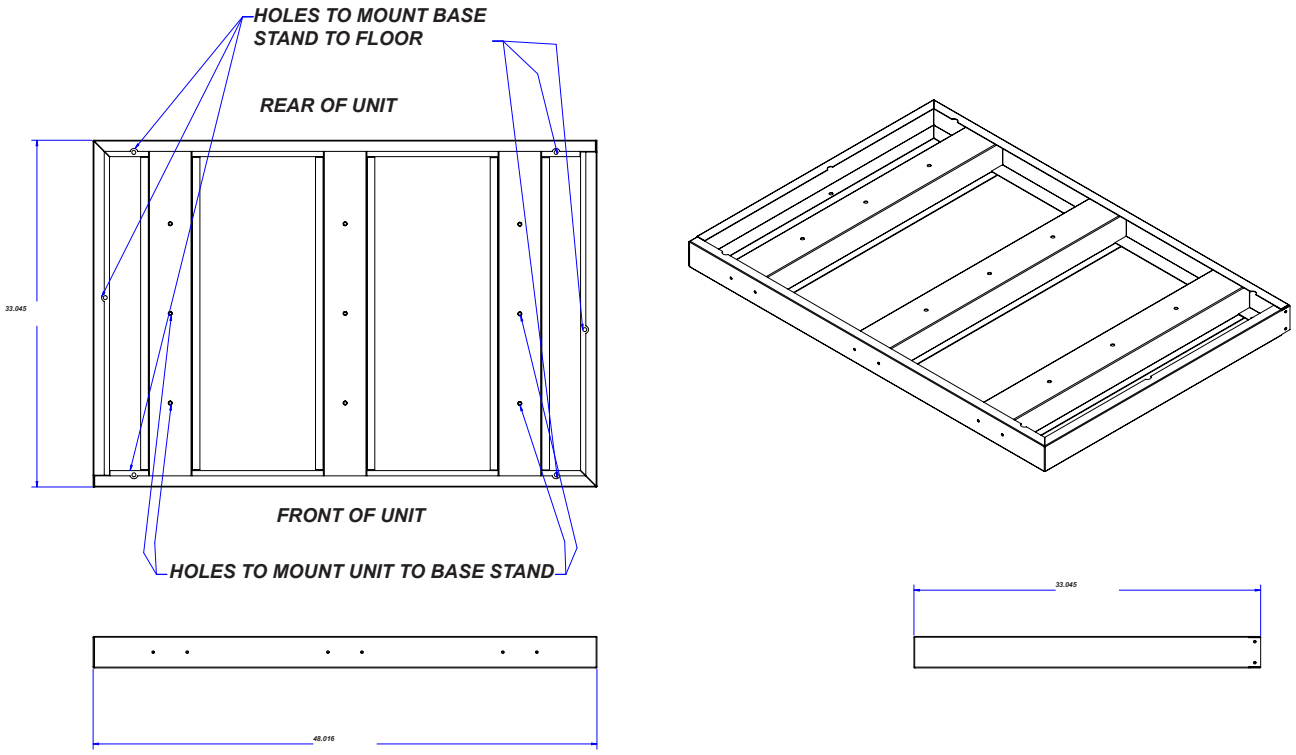


Figure 1. Vanguard Base Stand

Also, recheck the locations of the electrical and condensate stub-outs to ensure they are located properly, relative to the cabinet knock-out openings as shown in the Installation and Start-Up Manual, Figures 3 and 4.

IMPORTANT
STUB OUTS SHOULD BE LOCATED (FROM THE FLOOR OR WALL) TO ALIGN WITH SELECTED CABINET KNOCK OUT ON THE CABINET, AS SHOWN IN FIGURE3. THIS IS A REQUIREMENT IF A BASE STAND IS TO BE INSTALLED AND STUB OUTS ARE COMING THROUGH THE FLOOR

Lastly, remeasure to be sure that the wall opening for the Vanguard heat pump and air conditioner air box is located properly, taking the height of the base stand into account, before proceeding to install the base stand.

1.03 INSTALLATION

After the base stand is located on the floor, mark the floor in the locations where 1/2" through holes go through the bottom flange of the base stand. Be sure the floor is a hard, smooth surface and the base stand is level. If the floor is carpeted, cut out a base stand "footprint," so the base stand rests on the non-carpeted floor.

Anchor the base stand to the floor with the four field supplied anchors.

Now remove the lower front cabinet panel from the heat pump or air conditioner, removing the shipping skid bolts, air box support and installing the plenum (as appropriate), following the instructions provided in Appendix C.

⚠ WARNING

WHEN MOVING/RAISING THE VANGUARD CABINET, UTILIZE ADEQUATE RESOURCES TO HANDLE THE 1,100 LB. CABINET. THIS IS TO AVOID PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT/FACILITIES.

With appropriate resources to lift the Vanguard unit, place it on the base stand while guiding the air box through the wall opening and maintaining clearance between the plenum (as appropriate) and the ceiling. The Vanguard heat pump aligns and rests on the base stand.

After the cabinet is resting on the base stand, align the four 3/8” through holes in the base with the receiving weld nut holes in the base stand. Thread the four 5/16” machine bolts with flat washers loosely into the base stand. Tighten bolts evenly to affix the cabinet firmly to base stand.

IMPORTANT

DO NOT OVERTIGHTEN MACHINE BOLTS OR CABINET BASE WILL BOW.

APPENDIX C - INSTALLATION OF THE FREEBLOW PLENUM

1.01 TOOLS/FIELD FURNISHED SUPPLIES

⚠ WARNING

TO AVOID PERSONAL INJURY, ADEQUATE PROTECTIVE CLOTHING MUST BE WORN AND PRECAUTIONS IN HANDLING AND INSTALLING THIS EQUIPMENT MUST BE PRACTICED AT ALL TIMES.

- Power Drill/Driver and Extension
- 5/16” Nut Driver

1.02 INSPECTION/UNPACKING/HANDLING

Plenums are shipped to the job site on a wooden skid and are enclosed in shrink wrap. Do not stack plenums. Protect plenums from outside weather conditions. Part numbers for the freeblow plenum grilles are as follows:

Part #	Description
91969	Freeblow plenum side supply grille (two per plenum)
91970	Front supply grille (two per plenum)

IMPORTANT

IMMEDIATELY UPON RECEIPT, INSPECT THIS EQUIPMENT TO DETERMINE VISIBLE AND CONCEALED DAMAGE. ALL DAMAGE MUST BE REPORTED TO THE FREIGHT CARRIER WITHIN 15 DAYS, ON THE FREIGHT CARRIER’S FORM.

⚠ WARNING

THIS EQUIPMENT MUST BE INSTALLED IN CONFORMANCE WITH ALL APPLICABLE LOCAL AND NATIONAL ELECTRICAL, PLUMBING AND BUILDING CODES.

THIS EQUIPMENT SHOULD BE INSTALLED AND SERVICED ONLY BY A TRAINED PROFESSIONAL HEAT PUMP SERVICE PERSON.

⚠ WARNING

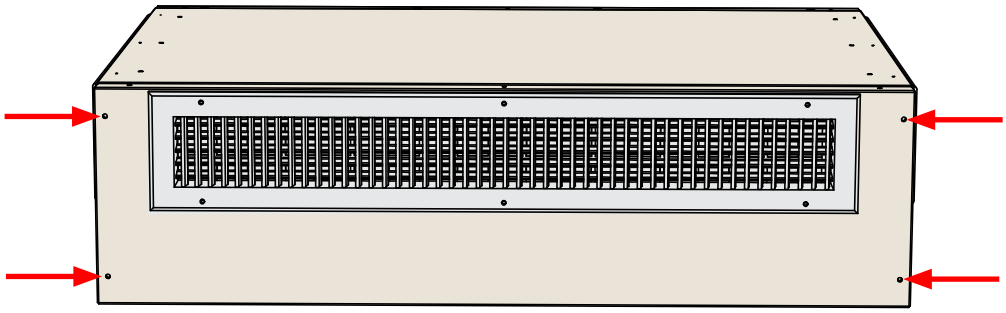
BEFORE INSTALLING, SERVICING OR MAINTAINING THIS EQUIPMENT, SWITCH THE ELECTRIC POWER TO “OFF” AT THE DISCONNECT LOCATED BEHIND THE FRONT DOOR ON THE LOWER PANEL. FAILURE TO DO THIS COULD RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

Remove the front plenum panel from the plenum. Retain the screws and panels for reinstallation after plenum has been installed.

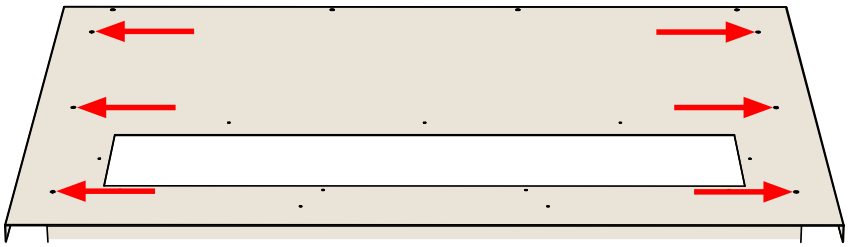
For freeblow plenum and standard height ducted plenums, the plenums should be installed onto the Vanguard cabinet, prior to installing the cabinet into its final location. On extended height ducted plenums, the Vanguard heat pump or air conditioner may have to be installed in its final location before the ducted plenum is fastened to the top of the cabinet.

1.03 PLENUM INSTALLATION

1. Prior to mounting the plenum on top of the Vanguard unit, remove the front panel from the plenum. Retain the screws (red arrows) for reinstallation after the plenum has been installed.



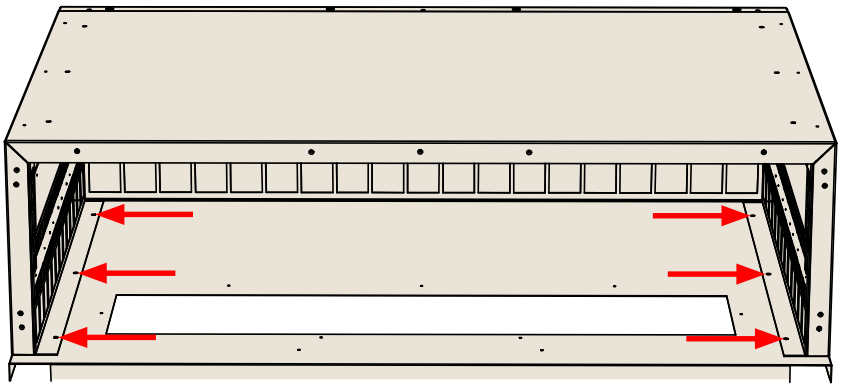
2. On the top panel of the Vanguard unit, locate the 6 holes that correspond with the six mounting holes in the plenum.



3. After the front panel has been removed, lift the plenum onto the top of the Vanguard unit.

THE PLENUM IS HEAVY. USE CARE WHEN PLACING THE PLENUM ON TOP OF THE VANGUARD HEAT PUMP OR AIR CONDITIONER.

4. Locate the 6 holes on the side flanges (3 on each side) of the plenum.
5. Secure the plenum to the Vanguard unit with the six ½" hex head screws.
6. Attach the front panel top the front of the plenum with the six screws. Make sure that the two screws located between the supply grilles are at the top.
7. Adjust the vanes on the grilles to deliver the optimize air flow to the classroom.



The air distribution system which is field supplied and installed downstream of the specified **ducted plenum** must be engineered to assure sufficient air flow, even under adverse conditions, such as dirty filters. The information provided in Figure 1, Appendix A should be used to design the air distribution system duct size leaving the Vanguard unit, keeping the external static pressure to a minimum.

Applications using duct work should be designed and installed in accordance with the current edition of the National Fire Protection Association codes and standards 90A and 90B. The duct system must be engineered to insure sufficient air flow through the unit to prevent over-heating of the heater element. This includes proper supply duct sizing, sufficient quantity of supply registers, adequate return and filter area. Ductwork must be of correct material and must be properly insulated. The duct work must be constructed of galvanized steel with a minimum thickness of .019. Ductwork must be firmly attached, secured and sealed to prevent air leakage. Do not use duct liner on inside of supply duct within four feet of the unit.

Galvanized metal duct extensions should be used to simplify connections to ductwork and grilles. Use fabric boots to prevent the transmission of vibration through the duct system. The fabric must be U.L. rated to a minimum of 197°F.

Auxiliary devices which may be a POTENTIAL IGNITION SOURCE shall not be installed in the duct work. Examples of such POTENTIAL IGNITION SOURCES are hot surfaces with a temperature exceeding 1,292ºF (700°C) and electric switching devices.

APPENDIX D - TRIM STRIP INSTALLATION

1.01 TOOLS/FIELD FURNISHED SUPPLIES

⚠ WARNING

TO AVOID PERSONAL INJURY, ADEQUATE PROTECTIVE CLOTHING MUST BE WORN AND PRECAUTIONS IN HANDLING AND INSTALLING THIS EQUIPMENT MUST BE PRACTICED AT ALL TIMES.

- Power Drill/Driver and Extension
- Tape Measure
- Self-tapping Sheet Metal Screws, 1/2” Long (one for every foot of trim strip)
- Bit for Field Supplied Sheet Metal Screws
- Metal Saw to Cut Trim Strips to Required Lengths
- File to Debur Field Sawed/Cut Metal Edges
- Acoustical Insulation

1.02 INSPECTION/UNPACKING/HANDLING

Trim strips are ordered to fill the gap between the Vanguard cabinet and the finished inside surface of the wall, when the cabinet is offset from the wall.

Trim strips are available in multiple depths and have a 1 inch 90° flange on one end to fit flush to the finished inside wall. Trim strips can be used to accommodate cabinets with an offset from the wall.

Trim strips are strapped to a skid for shipment to the job site. They are painted to match the cabinet color.

IMPORTANT

IMMEDIATELY UPON RECEIPT, INSPECT THIS EQUIPMENT TO DETERMINE VISIBLE AND CONCEALED DAMAGE. ALL DAMAGE MUST BE REPORTED TO THE FREIGHT CARRIER WITHIN 15 DAYS, ON THE FREIGHT CARRIER’S FORM.

1.03 PREPARATION OF VANGUARD HEAT PUMP AND AIR CONDITIONER FOR TRIM STRIP INSTALLATION

The Vanguard heat pump and air conditioner cabinet and plenum (as appropriate) must be installed, with the floor fasteners in place and the outside louver installed, to ensure the fixed location of the system prior to installation of the trim strips. Check the cabinet for vertical plumb and parallelism to the inside of the finished wall prior to installing the trim strips.

1.04 INSTALLATION OF TRIM STRIPS

Cut the trim strips to appropriate lengths to fill the gaps between the finished inside wall and the cabinet sides and top. To reduce sound transmission through the trim strips, apply acoustical insulation on the side of the strips that face the outdoor air box.

Debur all field cut or sawed metal edges.

IMPORTANT

CAREFULLY MARK, INDENT AND DRIVE SCREWS THROUGH THE TRIM STRIPS TO AVOID DAMAGING THE PAINTED SURFACES.

Field supplied screws should be self tapping zinc coated sheet metal type, 1/2” long with head color of satin aluminum, to match the cabinet finish.

APPENDIX E - OUTDOOR LOUVER/COLLAR INSTALLATION

1.01 TOOLS/FIELD FURNISHED SUPPLIES

⚠ WARNING

TO AVOID PERSONAL INJURY, ADEQUATE PROTECTIVE CLOTHING MUST BE WORN AND PRECAUTIONS IN HANDLING AND INSTALLING THIS EQUIPMENT MUST BE PRACTICED AT ALL TIMES.

- Power Drill/Driver and Extension
- T25 TORX Bits
- Sealant Caulk (tube)
- Caulking Applicator
- Ladder (as appropriate)
- Masonry Penetrating Fasteners (6 per collar)
- Scribe/punch

1.02 INSPECTION/UNPACKING/HANDLING

Louver/collar assemblies, louvers and collars are shipped to the job site in corrugated containers. Do not stack these containers. Louvers and collars are to be handled as fragile items.

IMPORTANT

IMMEDIATELY UPON RECEIPT, INSPECT THIS EQUIPMENT TO DETERMINE VISIBLE AND CONCEALED DAMAGE. ALL DAMAGE MUST BE REPORTED TO THE FREIGHT CARRIER WITHIN 15 DAYS, ON THE FREIGHT CARRIER'S FORM

A. The following louver/collar assemblies, louvers and collars are suitable for all Vanguard units.

Part Number	Description
93206	Clear anodized louver/collar assembly
93206-BRZ	Dark bronze louver/collar assembly

To minimize damage, remove the louver and louver parts from the corrugated container just prior to installation. Retain the bag of screws and caps for installation of the louver.

⚠ WARNING

THIS EQUIPMENT MUST BE INSTALLED IN CONFORMANCE WITH ALL APPLICABLE LOCAL AND NATIONAL ELECTRICAL, PLUMBING AND BUILDING CODES.
THIS EQUIPMENT SHOULD BE INSTALLED AND SERVICED ONLY BY A TRAINED PROFESSIONAL HVAC SERVICE PERSON.

⚠ WARNING

BEFORE INSTALLING, SERVICING OR MAINTAINING THIS EQUIPMENT, SWITCH THE ELECTRIC POWER TO "OFF" AT THE DISCONNECT LOCATED BEHIND THE KEY LOCKED DOOR ON THE LOWER FRONT PANEL. FAILURE TO DO THIS COULD RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

1.03 PREPARATION OF VANGUARD HEAT PUMP OR AIR CONDITIONER FOR LOUVER/COLLAR INSTALLATION

Note: Custom louvers may have installation requirements different from louvers with a collar. Follow engineer's drawings and instructions for installation of these louvers.

The Vanguard heat pump or air conditioner should be installed following the instructions in this manual. After installation, the Vanguard air box should be from 1-1/4" to 1-3/8" from the outside surface of the finished wall, as shown in Figure 1.

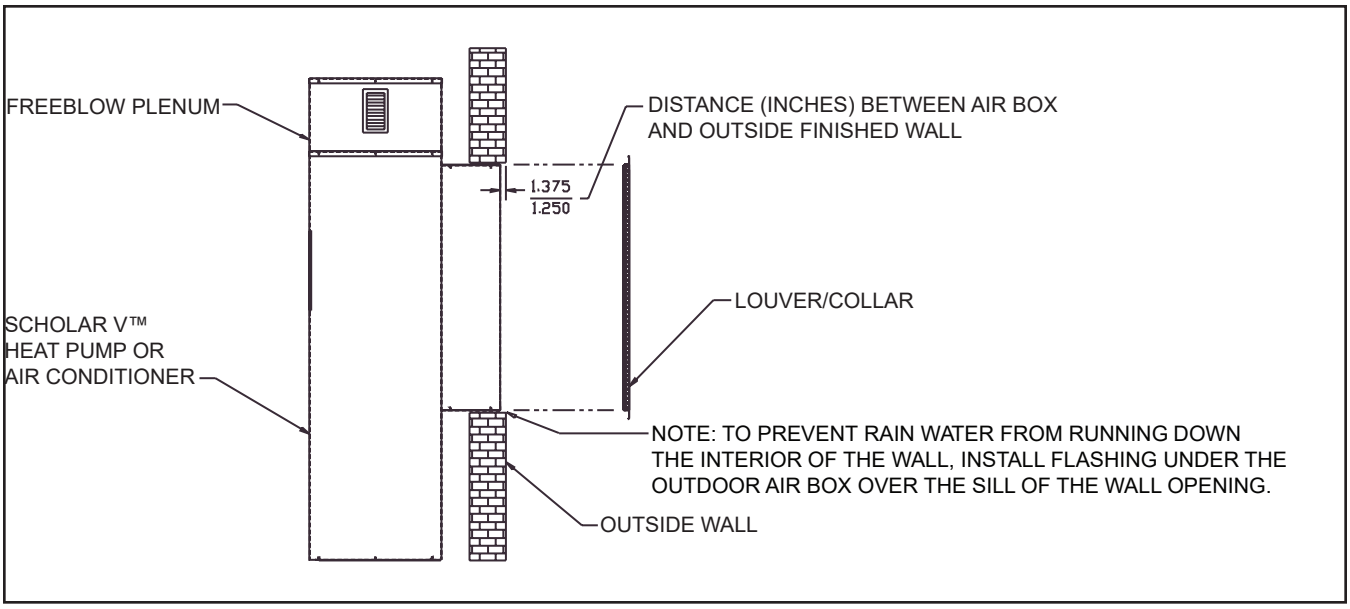


Figure 1. Dimension between Vanguard Air Box and Finished Outside Wall for Outdoor Louver/Collar Assembly Installation.

⚠ CAUTION

WHEN FASTENING LOUVER/COLLAR ASSEMBLY TO AIR BOX (OR EXTENSION) DO NOT OVERTIGHTEN LOUVER SCREWS. OVERTIGHTENING SCREWS WILL CAUSE DAMAGE AND WARP THE LOUVER/COLLAR ASSEMBLY.

1.04 INSTALLATION OF LOUVER/COLLAR ASSEMBLY, LOUVER AND COLLAR

A. Louver/Collar Assembly

The preassembled louver/collar is fastened from the outside of the building in one assembly.

1. The louver/collar assembly is **fastened directly to the air box** as shown in Figure 2, with six screws supplied with the louver/collar. Prior to installing the louver, apply caulk around the perimeter flange of the outdoor air box. Be careful not to block the weep holes on the bottom flange. To ensure proper fit up of the collar to the outside wall surface, be sure the unit is positioned as shown in Figure

   1. After the six screws have been installed and appropriately tightened (do not over torque), the color coordinated screw caps are snapped into place to cover the screw fastener heads. Provide a water seal around the top & both sides edges of the collar/wall interface, by applying an even bead of sealant caulk at the collar/wall interface.

2. The louver/collar assembly is **fastened directly to the outside wall**, as shown in Figure 2.

B. Louver

The louver itself may be fastened to the air box as shown in Figure 2.

C. Collar

The collar itself may be fastened to the outside wall by following the instructions in Figure 2.

IMPORTANT

BE SURE AIR BOX IS PLACED 1-3/8” TO 1-1/2” INSET FROM OUTSIDE WALL SURFACE.

USE LOUVER/COLLAR SCREWS THAT ARE COMPATIBLE WITH THE COLOR OF THE COLLAR.

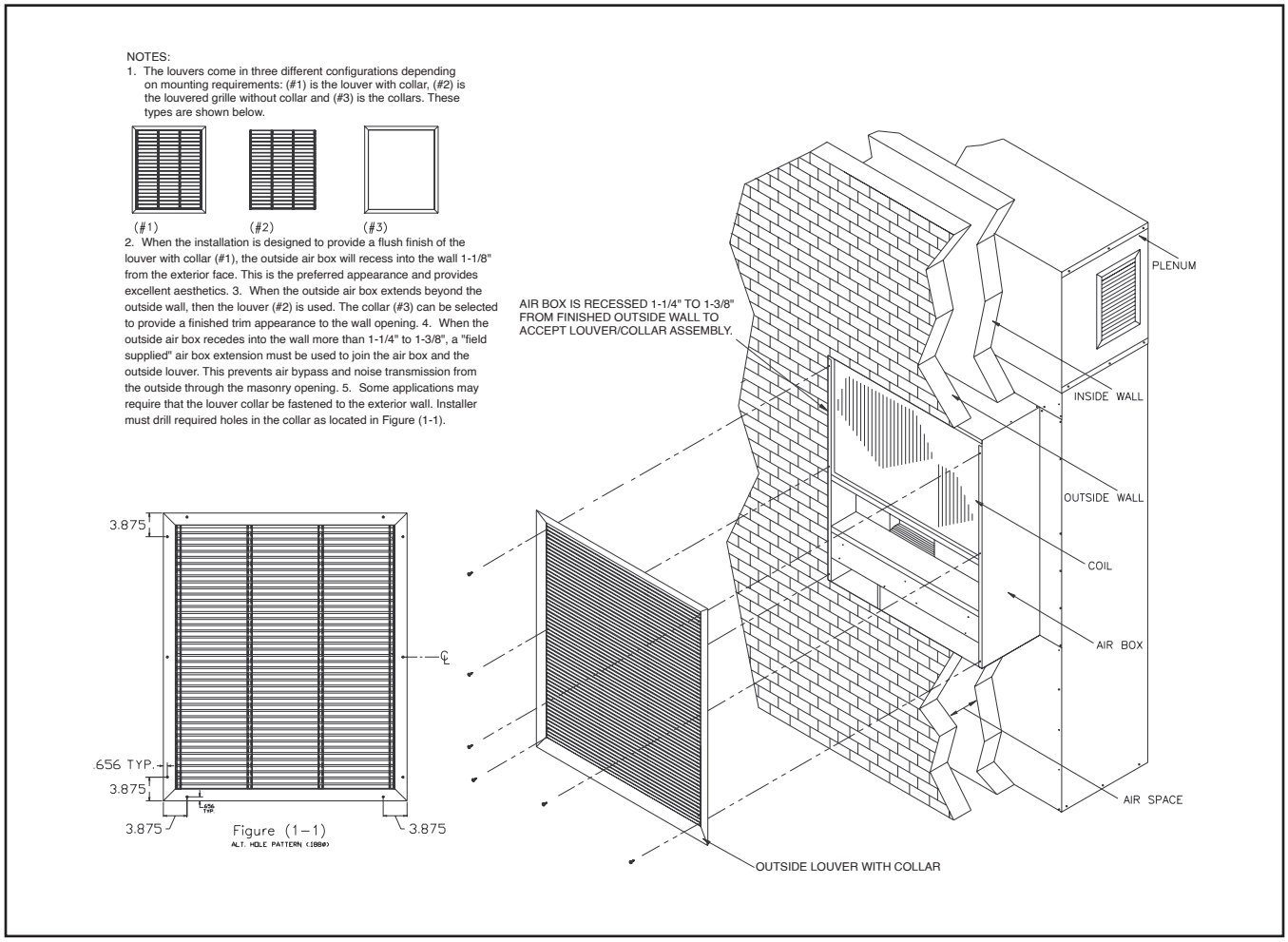


Figure 2. Installation of Louver/Collar Assembly to Air Box

APPENDIX F - STARTUP & COMMISSIONING CHECKLIST

Please complete the information on this form and email to MarvairCustServ@airxcs.com.

Date: _____/_____/_____

A. Owner & Location

Equipment Owner: _____

Address: _____

City: _____

State: _____ , Zip: _____

B. Installing Contractor

Company: _____ Installer: _____

Address: _____

City: _____

State: _____ , Zip: _____

C. Equipment Information

Unit Model No.: _____

Unit Serial No.:_____

Compressor Model No.: _____

Compressor Serial No.: _____

D. Pre-Start Up

Is there shipping damage? ..... ❒Yes ❒No

If so, describe? _____

_____

Will this damage prevent starting the unit? ..... ❒Yes ❒No

Incoming Power

✓ Has Power been connected? ..... ❒Yes ❒No

✓ Has the ground wire been connected?..... ❒Yes ❒No

✓ Has the circuit protection been sized and installed properly? ..... ❒Yes ❒No

Controls

✓ Has the thermostat / control been connected and verified? ..... ❒Yes ❒No

✓ Are all wiring terminals (including main power supply) tight? ..... ❒Yes ❒No

✓ If unit has a crankcase heater, has it been energized for 24 hours? ..... ❒Yes ❒No

✓ Has the correct voltage been selected on the control transformer (24vac)? ..... ❒Yes ❒No

Condensate

✓ Has primary drain tube been properly place thru the opening in the bottom of the unit?..... ❒Yes ❒No

✓ Has water been placed in drain pan to confirm proper drainage?..... ❒Yes ❒No

✓ Is the correct filter(s) in place and clean?..... ❒Yes ❒No

Refrigerant Piping

✓ Is there any evidence of refrigerant leaks (oil leaks, etc.)? ..... ❒Yes ❒No

If leaks are found, report them to Marvair Warranty Service Dept.

E. Check Incoming Power at Terminal Block and verify Proper Voltage and Balance BEFORE STARTING UNIT.

❒ 208/230V 1 Phase 60 Hz. ❒ 208/230V 3 Phase 60 Hz. ❒ 460V 3 Phase 60 Hz.

❒ ❒ 380V 3 Phase 50Hz. ❒ 575 3 Phase 60 Hz. ❒ Other_____

Single Phase Units

✓ Measured Line to Line Volts L1&L2 = _____V.

✓ Is incoming voltage between Min and Max voltage listed on unit Data Label?..... ❒Yes ❒No

An incoming voltage that is Not between the Minimum and Maximum listed on the unit Data Label Must be addressed and corrected before placing the unit into full time operation. Improper voltage can cause the compressor to overheat and cause premature failure.

Three Phase Units

✓ Measured Line to Line Volts L1&L2 _____V., L1&L3 _____V., L2&L3 _____V.

✓ Is incoming voltage between Min and Max voltage listed on unit Data Label?.....❒Yes ❒No

An incoming voltage that is Not between the Minimum and Maximum listed on the unit Data Label Must be addressed and corrected before placing the unit into full time operation. Improper voltage can cause the compressor to overheat and cause premature failure.

✓ Measured Line to Line Balance

✓ Is incoming voltage properly balanced? (use formula below to calculate balance) ..❒Yes ❒No

Average Voltage = (L1&L2 + L1&L3 + L2&L3)/3 = _____V.
Deviation Difference = Average Voltage - Maximum Deviation = _____V. Voltage Imbalance = (Deviation Difference x 100)/ Average Voltage = _____%
A Voltage Imbalance greater than 2% with the unit running must be addressed and corrected. Excess Line to Line Voltage Imbalance can cause the compressor to overheat and cause premature failure.

Example:

$$\text{Voltage Imbalance} = \frac{(\text{Average Voltage} - \text{Maximum Deviation}) \times 100}{\text{Average Voltage}}$$

Measured Voltages:
L1 & L2 = 241 Volts
L1 & L3 = 243 Volts
L2 & L3 = 235 Volts
719 / 3 = 239.7 Volts (Average Voltage)

239.7 (Average Voltage) – 235 (Maximum Deviation) = 4.7 (Deviation Difference)
(4.7 x 100)/239.7 = 1.95% Voltage Imbalance (*Less than 2% is acceptable)*

F. Cooling Mode (Mechanical Cooling)

Close the Compressor (Cooling) circuit breaker. Power will be applied to the thermostat / control device. Setup / Configure the control for the desired settings. Adjust the cooling setpoint so there is No demand for cooling. The unit will not be running.

Cooling Start

If using a standard thermostat, Set the Control to ON, Mode to Cooling, Fan to Auto (other controls, set appropriately for cooling mode). *Note: The reversing valve (Marvair Heat Pumps) is energized for "Cooling". The "O" signal from the thermostat is Required.*

Adjust the cooling setpoint to approximately four degrees below the current indoor temperature. After the initial start-up delay (.3 to 5 minutes), the unit will sequence on, start cooling.

✓ Is the indoor blower motor (IBM) On? (if IBM fails to come on, Check Phase Monitor) ❒Yes ❒No
✓ Is the Compressor On? (if Compressor fails to come on, Check Phase Monitor) ... ❒Yes ❒No
✓ Is the Condenser Fan (CFM) On? (Ambient conditions may be delay CFM) ..... ❒Yes ❒No
✓ Is incoming power properly Phased? (YES! If "Green LED" on Phase Monitor is On)❒Yes ❒No

*If incoming power is Not properly phased, **Red** LED on Phase Monitor will be on; swap any two incoming power wires, either at the distribution panel or at the incoming power terminal block. Never rewire power wiring internal to the control box.*

RECHECK Incoming Power and Voltage Balance in Cooling Mode.

✓ Measured Line to Line Volts L1&L2 _____V., L1&L3 _____V., L2&L3 _____V.
✓ Is incoming voltage between Min and Max voltage listed on unit Data Label?.....❒Yes ❒No

An incoming voltage that is Not between the Minimum and Maximum listed on the unit Data Label Must be addressed and corrected before starting unit. Improper voltage can cause the compressor to overheat and cause premature failure.

✓ Measured Line to Line Balance
✓ Is incoming voltage properly balanced? (use formula below to calculate balance) ..❒Yes ❒No

Average Voltage = (L1&L2 + L1&L3 + L2&L3)/3 = _____V.
Deviation Difference = Average Voltage - Maximum Deviation = _____V.
Voltage Imbalance = (Deviation Difference x 100)/ Average Voltage = _____%

A Voltage Imbalance greater than 2% with the unit running Must be addressed and corrected. Excess Line to Line Voltage Imbalance can cause the compressor to overheat and cause premature failure.

Example:

$$\text{Voltage Imbalance} = \frac{(\text{Average Voltage} - \text{Maximum Deviation}) \times 100}{\text{Average Voltage}}$$

Measured Voltages:
L1 & L2 = 241 Volts
L1 & L3 = 243 Volts
L2 & L3 = 235 Volts

719 / 3 = 239.7 Volts (Average Voltage)

239.7 (Average Voltage) – 235 (Maximum Deviation) = 4.7 (Deviation Difference)
(4.7 x 100)/239.7 = 1.95% Voltage Imbalance (*Less than 2% is acceptable*)

Cooling (Check and Record Readings)

After about 10 minutes of operating in the cooling mode, check and record the following data points.

Inside Temperature (IAT)	ºF
Outside Temperature (OAT)	ºF
Entering Condenser Air Temperature (Should be same temp as OAT)	ºF
Leaving Condenser Air Temperature (Acceptable Range 15º - 20º above OAT)	ºF
Return Air Temperature (RAT) db (Should be same temp as IAT)	ºF
Return Air Temperature (RAT) wb (used to calculate RH% of Return Air)	ºF
Supply Air Temperature (SAT) db (Acceptable Range 15º - 20º below RAT)	ºF
Return Air Temperature (SAT) wb (used to calculate RH% of Supply Air)	ºF
Compressor Amps (L1)	ºF
Compressor Amps (L2)	ºF
Compressor Amps (L3)	ºF

Cooling Stop

Adjust the cooling setpoint to approximately two degrees above the current indoor temperature. The unit will sequence off, stop cooling.

✓ Did the Compressor stop? ..... ❒Yes ❒No

✓ Did the Condenser Fan (CFM) stop? ..... ❒Yes ❒No

✓ Did the indoor blower motor (IBM) Stop? ..... ❒Yes ❒No

G. Electric Reheat Mode

NOTE: If the HVAC system you are testing is not configured with Dehumidification Option, Skip this section of the Start-up / Commissioning Checklist.

✓ Has the Humidistat Control been installed & wired to the Dehumidification input? . ❒Yes ❒No

✓ Has the Humidistat Control been properly setup for dehumidification? ..... ❒Yes ❒No

Adjust the cooling setpoint so there is No demand for cooling. Adjust the Humidity setpoint so there is No demand for dehumidification. The unit will not be running.

Electric Reheat Start

Adjust the Humidity setpoint to approximately ten percent below the current indoor Humidity (Humidistat display should indicate current RH%). After the short delay, the unit will sequence on, start dehumidifying.

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No

✓ Is the Compressor On? ..... ❒Yes ❒No

✓ Is the Condenser Fan (CFM) On? (Ambient conditions may delay CFM) ..... ❒Yes ❒No

✓ Is the Heater On? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Electric Reheat Lock-Out

While the system is still operating in “Dehumidification Mode”. Activate Mechanical Cooling. Do Not change the Humidity Setpoint on the Humidistat. Simply adjust the cooling setpoint to approximately four degrees below the current indoor temperature. After the short delay, the unit will sequence on, start cooling. Notice: system did not turn off. The Only change that occurred is “Heater turned off”.

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No

✓ Is the Compressor On? ..... ❒Yes ❒No

✓ Is the Condenser Fan (CFM) On? ..... ❒Yes ❒No

✓ Is the Heater Off? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Electric Reheat Re-Start

While the system is still operating in “Cooling Mode” from the previous test. Re-Start Dehumidification.

Do Not change the Humidity Setpoint on the Humidistat. Simply adjust the cooling setpoint to approximately four degrees above the current indoor temperature. After the short delay, the unit will sequence on, start dehumidification. Notice: system did not turn off. The Only change that occurred is “Heater turned on”.

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No
✓ Is the Compressor On? ..... ❒Yes ❒No
✓ Is the Condenser Fan (CFM) On? ..... ❒Yes ❒No
✓ Is the Heater On? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Electric Reheat Stop

Adjust the Humidity setpoint to approximately five percent above the current indoor Humidity (Humidistat display should indicate current RH%). After the short delay, the unit will sequence off.

✓ Did the Compressor Stop? ..... ❒Yes ❒No
✓ Did the Condenser Fan (CFM) Stop? ..... ❒Yes ❒No
✓ Did the indoor blower motor (IBM) Stop? ..... ❒Yes ❒No
✓ Is the Heater Off? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

H. Cooling Mode (Economizer Cooling)

NOTE: If the HVAC system you are testing is Not configured with Economizer Cooling Option, Skip this section of the Start-up / Commissioning Checklist.

✓ Has the Economizer Control Board been properly wired to the Control? ..... ❒Yes ❒No
✓ Has the Economizer Control Board Ambient selections been properly setup? ..... ❒Yes ❒No
✓ Has the Economizer Control Board Minimum Opening selection been properly setup? ❒Yes ❒No
✓ Are ambient conditions suitable for Economizer Cooling? (If not, skip this section) ❒Yes ❒No

Economizer Cooling Start

If using a standard thermostat, Set the Control to ON, Mode to Cooling, Fan to Auto (other controls, set appropriately for cooling mode).

Adjust the cooling setpoint to approximately two degrees below the current indoor temperature. After the initial start-up delay (.3 to 5 minutes), the unit will sequence on, start cooling. The damper will modulate to maintain 55ºF mixed air temperature, thru the supply.

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No
✓ Is the Compressor Off? (Compressor Should be Off!) ..... ❒Yes ❒No
✓ Is the Economizer Damper Open?
(Damper Should be modulating, to control supply air temp.) ..... ❒Yes ❒No

Economizer Cooling (Check and Record Readings)

After about 10 minutes of operating in the cooling mode, check and record the following data points.

All unit panels MUST be in place for proper operation and testing.

Inside Temperature (IAT)	_____ ºF
Outside Temperature (OAT)	_____ ºF
Return Air Temperature (RAT) db (Should be same temp as IAT)	_____ ºF
Return Air Temperature (RAT) wb (used to calculate RH% of Return Air)	_____ ºF
Supply Air Temperature (SAT) db (Acceptable Range 55ºF (+/- 3ºF)	_____ ºF
Return Air Temperature (SAT) wb (used to calculate RH% of Supply Air)	_____ ºF

Economizer Cooling Stop

Adjust the cooling setpoint to approximately two degrees above the current indoor temperature. The unit will sequence off.

✓ Is the Economizer Damper Closed? ..... ❒Yes ❒No

✓ Is the indoor blower motor (IBM) Off? ..... ❒Yes ❒No

Heating Mode (Mechanical Heating Heat Pump)

Close the Compressor (Cooling) circuit breaker. Close the Heating (Heat) circuit breaker. Power will be applied to the thermostat / control device. Setup / Configure the control for the desired settings. Adjust the heating setpoint so there is No demand for heating or cooling. The unit will not be running.

Heating Start (Mechanical Heating Heat Pump)

If using a standard thermostat, Set the Control to ON, Mode to Heat, Fan to Auto (other controls, set appropriately for heating mode). *Note: The reversing valve (Marvair Heat Pumps) is deenergized for "Cooling". The "O" signal from the thermostat is Not Required.*

Adjust the heating setpoint to approximately two degrees above the current indoor temperature. After the initial start-up delay (.3 to 5 minutes), the unit will sequence on, start heating.

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No

✓ Is the Compressor On? ..... ❒Yes ❒No

✓ Is the Condenser Fan (CFM) On? (Ambient conditions may be delay CFM) ..... ❒Yes ❒No

✓ Is the Heater Off? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Heating (Mechanical Heating Heat Pump) (Check and Record Readings)

After about 10 minutes of operating in the heating mode, check and record the following data points.

Inside Temperature (IAT)	ºF
Outside Temperature (OAT)	ºF
Entering Condenser Air Temperature (Should be same temp as OAT)	ºF
Leaving Condenser Air Temperature (Acceptable Range 15º - 20º below OAT)	ºF
Return Air Temperature (RAT) db (Should be same temp as IAT)	ºF
Return Air Temperature (RAT) wb (used to calculate RH% of Return Air)	ºF
Supply Air Temperature (SAT) db (Acceptable Range 15º - 20º above RAT)	ºF
Return Air Temperature (SAT) wb (used to calculate RH% of Supply Air)	ºF
Compressor Amps (L1)	ºF
Compressor Amps (L2)	ºF
Compressor Amps (L3)	ºF

Auxiliary Heat (ODT)

While the system is operating in “Mechanical Heating Mode”. Activate Auxiliary Heat (ODT).

* Your unit may be configured with an outdoor thermostat configured as “Auxiliary Heat” or “Mechanical Heat Lockout”, or No outdoor thermostat. *

Do Not change the temperature setpoint on the thermostat / control. Simply adjust the ODT set-point to approximately four degrees below the current outdoor temperature. After the short delay, the unit will activate Auxiliary Heat, start heating with Both Mechanical heat and Electric heat. Notice: system did not turn off. The Only change that occurred is “Electric Heat” turned On. *Note: The “S” Circuit (Marvair Heat Pump control board) must be set to “No”, to allow Auxiliary Heat.*

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No
✓ Is the Compressor On? ..... ❒Yes ❒No
✓ Is the Condenser Fan (CFM) On? ..... ❒Yes ❒No
✓ Is the Heater On? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Mechanical Heat Lockout ODT (Electric Heat ONLY

While the system is operating in “Mechanical Heating Mode”. Activate Mechanical Heat Lockout (ODT).

- Your unit may be configured with an outdoor thermostat configured as “Auxiliary Heat”, “Mechanical Heat Lockout”, or No outdoor thermostat. *

Do Not change the temperature setpoint on the thermostat / control. Simply adjust the ODT setpoint to approximately four degrees below the current outdoor temperature. After the short delay, the unit will activate Mechanical Heat Lockout, start heating with Only Electric heat. Notice: system did not turn off. “Mechanical Heat” turned Off and “Electric Heat” turned On. *Note: The “S” Circuit (Marvair Heat Pump control board) must be set to “Yes”, to allow Mechanical Heat Lockout.*

✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No
✓ Is the Compressor Off? ..... ❒Yes ❒No
✓ Is the Condenser Fan (CFM) Off? ..... ❒Yes ❒No
✓ Is the Heater On? (Clamp an AmpProbe on one leg of the heater contactor to verify) ❒Yes ❒No

Heating (Check and Record Readings)

After about 10 minutes of operating in the heating mode, check and record the following data points.

Inside Temperature (IAT)	ºF
Outside Temperature (OAT)	ºF
Return Air Temperature (RAT) db (Should be same temp as IAT)	ºF
Return Air Temperature (RAT) wb (used to calculate RH% of Return Air)	ºF
Supply Air Temperature (SAT) db (Acceptable Range 15º - 20º below RAT)	ºF
Return Air Temperature (SAT) wb (used to calculate RH% of Supply Air)	ºF
Heater Contactor Amps (HCAL1)	ºF
Heater Contactor Amps (HCAL2)	ºF
Heater Contactor Amps (HCAL3)	ºF
Heater Circuit Volts (L1&L2)	ºF
Heater Circuit Volts (L1&L3)	ºF
Heater Circuit Volts (L2&L3)	ºF

Calculate Heater kW

Single Phase Units

Heater kW = (HCAL1*L1&L2)/1000 = _____kW.

Example: $\frac{\text{HCAL1 * L1\&L2}}{1000}$

Measured Voltage: L1&L2 = 241 Volts

Measured Amperage: L1 = 20.7 Amps

4988.7 / 1000 = 4.99kW (5kW)

Three Phase Units

Heater kW = (HCAL1*L1&L2) + (HCAL2*L1&L3) + (HCAL3*L2&L3)/1000 = _____kW.

Example: $\frac{\text{(HCAL1*L1\&L2) + (HCAL2*L1\&L3) + (HCAL3*L2\&L3)}}{1000}$

Measured Voltage: L1&L2 = 241 Volts

Measured Amperage: L1 = 8.28 Amps

1995.48

Measured Voltage: L1&L3 = 243 Volts

Measured Amperage: L1 = 8.22 Amps

1997.46

Measured Voltage: L1&L2 = 235 Volts

Measured Amperage: L1 = 8.57 Amps

2013.95

6006.89 / 1000 = 6.01kW (6kW)

Outdoor Thermostat Set Point ODT

Adjust the ODT setpoint to the temperature appropriate for your application (either “Auxiliary Heat” or “Mechanical Heat Lockout”). If you need assistance selecting the proper temperature contact tour HVAC system designer responsible for the application. After adjusting the ODT for your application, the HVAC system will go back to Mechanical Cooling. *Note: The range of the Outdoor Thermostat is 0ºF to 50ºF.*

- ✓ Is the indoor blower motor (IBM) On? ..... ❒Yes ❒No
- ✓ Is the Compressor On? ..... ❒Yes ❒No
- ✓ Is the Condenser Fan (CFM) On? (Ambient conditions may be delay CFM) ..... ❒Yes ❒No
- ✓ Is the Heater Off? (Clamp an AmpProbe on one leg of the heater contactor to verify.) ❒Yes ❒No

Heating Mode Stop (Mechanical Heating Heat Pump)

Adjust the heating setpoint to approximately two degrees below the current indoor temperature. The unit will sequence off, stop heating.

- ✓ Did the Compressor stop? ..... ❒Yes ❒No
- ✓ Did the Condenser Fan (CFM) stop? ..... ❒Yes ❒No
- ✓ Did the indoor blower motor (IBM) Stop? ..... ❒Yes ❒No

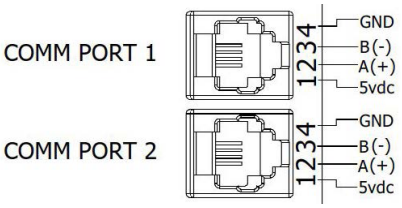
** If you see readings that are out of the normal range or features that seem to be operating incorrectly. **

Please provide a description of the issue in the Notes section below and if you need help, call: Marvair Technical and Warranty Support: (888) 726-2734

This number is manned M-F, 8:00am to 5:00pm eastern.
Technical support calls will be returned M-F, 5:00pm to 8:00pm eastern.
Only Emergency Dispatch calls will be returned M-F, 8:00pm to 8:00am Eastern (and weekends & holidays).

Appendix G: Electronic Control Board Modbus Map

Default Modbus RTU Settings
Slave ID = 1
Baud = 19200
Data Bits = 8
Stop Bits = 1
Parity = None
First Coil 1 , No. of Coils 30



RJ11 Pinout for Communication

Discrete Bit/Bool: Read with Function Code 02 multi discrete input read, Write to RW coil with Function Code 05 Single Coil write. Coils and DI RO share a common space. Attempted Writes to RO DI inputs result in error return. Func 0x0F multiple coil writes not supported.

MODBUS PACKET REGISTER ZeroBase ID (ZBI)	Coil ID Value, Human OBI Reference Register ID				
OFFSET	**ID**	**Description**	**Size**	**Data Format**	**R/W**
0	**1**	Current Status of the Y1 Compressor Call	1 bit	0 = no call, 1 = call	RW
1	**2**	Current Status of the Y2 Compressor Call	1 bit	0 = no call, 1 = call	RW
2	**3**	Current Status of the Humidity Call	1 bit	0 = no call, 1 = call	RW
3	**4**	Current Status of the G Fan Call	1 bit	0 = no call, 1 = call	RW
4	**5**	Current Status of the W2 Electric Heating Call	1 bit	0 = no call, 1 = call	RW
5	**6**	Current Status of the FCC Call	1 bit	0 = no call, 1 = call	RO
6	**7**	High Pressure Switch 1 Status	1 bit	0 = Open, 1 = Closed	RO
7	**8**	High Pressure Switch 2 Status	1 bit	0 = Open, 1 = Closed	RO
8	**9**	Low Pressure Switch 1 Status	1 bit	0 = Open, 1 = Closed	RO
9	**10**	Low Pressure Switch 2 Status	1 bit	0 = Open, 1 = Closed	RO
10	**11**	OFM Mode Selection	1 bit	0 = PWM, 1 = 0-10V	RO
11	**12**	IFM Mode Selection	1 bit	0 = PWM, 1 = 0-10V	RO
12	**13**	Technician Speedup Test Mode Status	1 bit	0 = Normal Mode, 1 = Test Mode	RO
13	**14**	Status of Compressor 1 Relay Output	1 bit	0 = Off, 1 = Energized	RO
14	**15**	Status of Compressor 2 Relay Output	1 bit	0 = Off, 1 = Energized	RO
15	**16**	Status of RH RelayOutput	1 bit	0 = Off, 1 = Energized	RO
16	**17**	Status of W2 RelayOutput	1 bit	0 = Off, 1 = Energized	RO
17	**18**	Enables/1 or Disables/0 the communicating mode thermostat functionality. Reads/modifies parameter P22. 0=H,1=C	1 bit	0 = H hardware calls, 1 = Comm/Modbus calls.	RW
18	**19**	Enables or disables reading the hardware thermostat call inputs (Coils1-5,25).	1 bit	0 = Normal usage based on P22. 1 = read HW calls thermostat inputs regardless of programming of P22 as C. Default is 0, normal operations.	RW
19	**20**	Current Status of AC / HP	1 bit	0 = AC, 1 = HP	RO
20	**21**	Current Status of EHDD	1 bit	0 = N, 1 = Y	RO
21	**22**	Current Status of SCKT	1 bit	0 = N, 1 = Y	RO
22	**23**	Current Status of Enable Economizer	1 bit	0 = N, 1 = Y	RO
23	**24**	Current Status of Economizer Sensor Type	1 bit	0 = DB, 1 = EN	RO
24	**25**	Current Status of O Reversing Valve request	1 bit	0 = no call, 1 = call	RW
25	**26**	Current Status of RV output	1 bit	0 = OFF, 1 = Energized	RO
26	**27**	Emergency Ventilation Request	1 bit	0 = Off, 1 = Energized	RW
27	**28**	Pulse Reheat	1 bit	0 = off, 1 = ON (default)	RW
28	**29**	Status of Emergency Ventilation	1 bit	0 = Off, 1 = ON	RO
29	**30**	Status of EC relay output.	1 bit	0 = Off, 1 = ON	RO

Registers: Read with Function Code 04 Multi register reads, Write to RW register with Function Code 06 write single register. Attempted Writes to RO registers result in error return. Func 0x10 multiple register writes not supported.					
MODBUS PACKET REGISTER ZeroBase ID (ZBI)	**Human OBI Register ID**				
	ID	Description	Size	Data Format	R/W
0	**40001**	Heat Setpoint ***Note:*** Register is RW but not currently used. For future use.	16 bit	45-100 degrees Fahrenheit	RW
1	**40002**	Cool Setpoint ***Note:*** Register is RW but not currently used. For future use.	16 bit	45-100 degrees Fahrenheit	RW
2	**40003**	Temperature Calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
3	**40004**	W2 Speed Multiplier	16 bit	0-100, 80 is default. Represents a percentage of the Y2 fan speed	RW
4	**40005**	Dehumidification Speed Multiplier	16 bit	0-100, 80 is default. Represents a percentage of the Y2 fan speed	RW
5	**40006**	OFM Set Speed	16 bit	0 - 1023	RW
6	**40007**	IFM Y1 Set Speed	16 bit	0 - 1023	RW
7	**40008**	IFM Y2 Set Speed	16 bit	0 - 1023	RW
8	**40009**	Modbus Timeout Setting	16 bit	1 - 60, default 10; represents minutes of allowed modbus inactivity before switching to HW call onboard t-stat mode	RW
9	**40010**	Current OFM Speed	16 bit	0 - 1023	RO
10	**40011**	Current IFM Speed	16 bit	0 - 1023	RO
11	**40012**	Anti Short Cycle Compressor 1	16 bit	0 - 360, 0.5 seconds per step	RO
12	**40013**	Anti Short Cycle Compressor 2	16 bit	0 - 360, 0.5 seconds per step	RO
13	**40014**	Voltage Reading	16 bit	0-1023, 1023 = Greater than 20V 965 = 18V cutoff	RO
14	**40015**	P1 Temperature Reading	16 bit	0-160 degrees Fahrenheit, 255 no sensor	RO
15	**40016**	P2 Temperature reading	16 bit	0-160 degrees Fahrenheit, 255 no sensor	RO
16	**40017**	Freeze Sensor 1 Temperature Reading	16 bit	0-160 degrees Fahrenheit, 255 no sensor	RO
17	**40018**	Freeze Sensor 2 Temperature Reading	16 bit	0-160 degrees Fahrenheit, 255 no sensor	RO
18	**40019**	Alarm Status	16 bit	0 = No Fault	RO
				D0 = FLAT CIRCUIT FAULT	
				D1 = HPS1 Fault	
				D2 = Low Voltage	
				D3 = Future Use	
				D4 = Future Use	
				D5 = Future Use	
				D6 = LPS1 Fault	
				D7 = Future Use	
				D8 = Future Use	
				D9 = Future Use	
				D10 = Future Use	
				D11 = Future Use	
				D12 = Future Use	
				D13 = Future Use	
				D14 = Y1 Locked Out	
				D15 = Y2 Locked Out	

19	**40020**	Current Status of MIN POS	16 bit	20 = MIN, 20-100= OPEN %	RW
20	**40021**	Economizer Dry Bulb Temperature setpoint	16 bit	70F=default, 20F-105F	RW
21	**40022**	ODS set	16 bit	50 default, 0-70	RW
22	**40023**	Fan Purge	16 bit	N= 0, 10-90 SECONDS, 90 SEC IS DEFAULT	RW
23	**40024**	Defrost Timer	16 bit	30= default, 30, 60, 90 minutes	RW
24	**40025**	Current SW version number	16 bit	Display sw version decimal	RO
25	**40026**	Supply/Mixed Air Temp reading	16 bit	0-160 degrees Fahrenheit	RO
26	**40027**	SAS/MAS calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
27	**40028**	Outdoor Temp reading	16 bit	0-160 degrees Fahrenheit	RO
28	**40029**	ODS Calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
29	**40030**	LPS1 / Suction Line Temp reading	16 bit	0-160 degrees Fahrenheit, 255 if open or shorted sensor	RO
30	**40031**	Suction Line Temp Calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
31	**40032**	FCC1 / Liquid Line temp reading	16 bit	0-160 degrees Fahrenheit, 255 if open or shorted sensor	RO
32	**40033**	Liquid Line temp Calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
33	**40034**	DS Temp (defrost sensor temp) reading	16 bit	0-160 degrees Fahrenheit	RO
34	**40035**	DS calibration	16 bit	0-18, 9 is default. Less than 9 is a negative offset, 10-18 is a positive offset. Value minus 9 is the correction.	RW
35	**40036**	Dehumidifier Setpoint	16 bit	Default 72 F, 70 - 75F	RW
36	**40037**	Pulse Reheat Differential	16 bit	Default 5 F, 5 - 10F	RW
37	**40038**	Economizer setpoint Entropy Mode A..E as 0..4	16 bit	Default 3/D	RW
38	**40039**	ECO output status	16 bit	0 = off, 20-100	RO