MMVE

SunTherm™ HEATING PRODUCTS

INSTALLATION MANUAL

MODULAR AIR HANDLER WITH ELECTRIC OR HOT WATER HEATING
MODELS: MM SERIES

LIST OF SECTIONS

1 – General	1	7 – Line Voltage and Control Box Wiring	12
2 – Safety	2	8 – Field Installed Electric Heater Kits	16
3 – Return Air and Clearance Requirements	5	9 – Thermostat Wiring and Connections	17
4 – Supply Air and Duct Connector Installation	7	10 – Motor, Blower and Furnace Startup	22
5 – Furnace Installation	8	11 – Final System Checkout	24
6 – Hydronic Heating	8	12 – Wiring Diagrams	25

LIST OF FIGURES

1 – Electric Air Handler Dimensions	4	20 – 2 Stage Heating / Cooling Wiring Diagram	19
2 – Hydronic Air Handler Dimensions	4	21 – 2 Stage Heating / Cooling Wiring Diagram	20
3 – Clearance for Service	5	22 – 2 Stage Heating / Heat Pump Wiring Diagram	20
4 – Closet Clearances	6	23 – 2 Stage Heating / Heat Pump Wiring Diagram	20
5 – Typical Closet Installations	6	24 – X-13 motor Terminals	22
6 – Accessory Air Filter Box for 1" or 2" Air Filters	7	25 – Blower Mounting Plate and Screw Locations	22
7 – Combustible Floor Base Installation - Downflow	8	26 – Blower Assembly and Blower Deck	23
8 – Component Locations – Electric Heat Control Box	15	27 – ECM Motor Control Plug Pin out	23
9 – Component Locations – No Heat Control Box	15	28 – ECM Control Board Diagram	24
10 – Component Locations – Hydronic Heat No Pump	15	29 – MMVE 18-72 – 0 kW Heater Wiring Diagram	25
11 – Component Locations – Hydronic Heat With Pump	15	30 – MMVE 18-72 – 5 kW Heater Kit Wiring Diagram	26
12 – Control Box Circuit Breaker Location	16	31 – MMVE 25-72 – 10 kW Heater Kit Wiring Diagram	26
13 – Front Panel Circuit Breaker Location	16	32 – MMVE 37-72 – 15 kW Heater Kit Wiring Diagram	27
14 – No Heat & Electric Heat Control Box Power Connections	17	33 – MMVE 37-72 – 20 kW Heater Kit Wiring Diagram	27
15 – Hydronic Control Box Power Connection Locations	17	34 – MMVE 18-36 – Hydronic Heat w/ Pump No Choke Wire Dia	28
16 – 1 Stage Heating / Cooling Wiring Diagram	18	35 – MMVE 37-72 – Hydronic Heat w/ Pump and Choke Wire Dia	28
17 – 1 Stage Heating / Cooling Wiring Diagram	19	36 – MMVE 18-36 – Hydronic Heat No Pump or Choke Wire Dia	29
18 – 1 Stage Heating / Heat Pump Wiring Diagram	19	37 – MMVE 37-72 – Hydronic Heat w/ Choke No Pump Wire Dia	29
19 – 1 Stage Heating / Heat Pump Wiring Diagram	19		

LIST OF TABLES

1 – Electric / Hydronic Air Handler Model Specifications	3	13 – Wiring Requirements–115V Hydronic Single Branch Circuit	13
2 – Electric Air Handler Dimensions Table	4	14 – Wiring Requirements–208/240V Electric Single Branch Circuit	13
3 – Hydronic Air Handler Dimensions Table	4	15 – Wiring Requirements–208/240V Electric Single Branch Circuit	13
4 – Air Handler Model Nomenclature	5	16 – Wiring Requirements–208/240V Electric Duel Branch Circuit	14
5 – Clearance to Combustibles	6	17 – Wiring Requirements–208/240V Electric Duel Branch Circuit	14
6 - Htg Cap Boiler Loop 65°F EAT 180 °F EAT 20°F **Δt** No Pump	8	18 – Electric Heater Electrical Data	14
7 - Htg Cap Boiler Loop 65°F EAT 180 °F EAT 20°F **Δt** No Pump	9	19 – Accessory Field Installed Electric Heater Kit Model Numbers	16
8 - Htg Cap Boiler Loop 65°F EAT 180 °F EAT 20°F **Δt** No Pump	9	20 - Accessory Field Installed Electric Heater Kit Nomenclature	17
9 – Htg Cap Factory Pump 65°F EAT Stated EAT 1.5 and 2 Ton	10	21 – Low Voltage Wire Gauge and Max lengths	17
10 – Htg Cap Factory Pump 65°F EAT Stated EAT 2, 2.5 and 3 Ton	10	22 – Recommended Heating / Cooling /Heat Pump Wire Color Codes	21
11– Htg Cap Factory Pump 65°F EAT Stated EAT 3, 3.5, 4 & 5 Ton	11	23 – X-13 Motor Terminal Connections	22
12 – Wiring Requirements–115V Hydronic Single Branch Circuit	12	24 – ECM Motor Control Connector Terminal Description	23

SECTION I: GENERAL

The following list includes important facts and information regarding the electric furnace and its inclusions.

1. Air handler is rated at either 120 volts AC or 240 volts AC at 60 Hertz
2. Air handler size varies by model
3. Four-wire thermostat operation for heating and cooling
4. Seven wire thermostat for heat pump operation.
5. Air Handlers equipped with blower for A/C or Heat Pump operation
6. This air handler is designed for multi position, upflow and horizontal application
7. This air handler must not be operated without the door installed

NOTE: This air handler and its components listed on the A/C and Heat Pump equipment sticker were listed in combination as a system by ETL for the United States and Canada.

SAVE THIS MANUAL FOR FUTURE REFERENCE

SECTION II: SAFETY

This is a safety alert symbol. When you see this symbol on labels or in manuals; be alert to the potential for personal injury. Understand and pay particular attention to the signal words **DANGER, WARNING,** or **CAUTION.**

DANGER: indicates an **imminently** hazardous situation, which if not avoided, **will result in death or serious injury.**

WARNING: indicates a **potentially** hazardous situation, which if not avoided, **could result in death or serious injury.**

CAUTION: indicated a **potentially** hazardous situation, which if not avoided, **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving property damage.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance; or for additional information consult a qualified contractor, installer, or service agency.

⚠WARNING

FIRE OR ELECTRICAL HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage.
A fire or electrical hazard may result causing property damage, personal injury or loss of life.

⚠CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state, and national codes including, but not limited to; building, electrical, and mechanical codes.

IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HFC's) as of July 1, 1992. Approved methods of reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance

Safety Requirements

This appliance should be installed in accordance with all national and local building/safety codes and requirements, local plumbing or waste water codes, and other applicable codes. In the absence of local codes, install in accordance with the following codes.

- Standard for the Installation of Air Conditioning and Ventilating Systems (NFPA 90A)
- Standard for the Installation of Warm Air heating and Air Conditioning Systems (NFPA 90B)
- National Electrical Code (NFPA 70)
- Canadian Electrical Code, Part I (CSA C22.2) or ANSI/NFPA No. 70
- All local codes (State, City, and Township)

NOTE: All applicable codes take precedence over any recommendation made in these instructions.
SunTherm assumes no responsibility for units installed in violation of any code or regulation.

1. Refer to the unit rating plate for the air handler model number, and then see the dimensions page of this instruction for return air plenum dimensions in Figures 1 and 2. The plenum must be installed according to the above listed codes or the instructions in this manual.
2. Refer to the dimensions page of this instruction for the duct connector and combustible floor base dimensions shown in Figure 7. The duct connector and combustible floor base must be installed according to the instructions in this manual.
3. These models **ARE NOT** ETL listed or approved for installation into a **Manufactured (Mobile) Home**.
4. Provide clearances from combustible materials as listed under **Clearances to Combustibles.**
5. Provide clearances for servicing ensuring service access is allowed for the control box, electric elements, hot water coil and the blower.

⚠WARNING

Hot water from a boiler used to satisfy heating requirements can be heated to temperatures of 180°F. Parts containing water this hot can scald very quickly. Use extreme caution when servicing or performing maintenance on any parts containing hot water.

6. Check the rating plate and the power supply to be sure the electrical characteristics match.
7. Failure to carefully read and follow all instructions in this manual can result in malfunction of the air handler, death, personal injury, and/or property damage.
8. Electric air handler shall be installed so the electrical components are protected from water.
9. Installing and servicing heating/cooling equipment can be hazardous due to electrical components.
10. Only trained and qualified personnel should install repair or service heating/cooling equipment. Untrained service personnel can perform basic maintenance functions such as cleaning of exterior surfaces and replacing the air filters. Observe all precautions in the manuals and on the attached labels when working on this appliance.
11. These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances these instructions exceed certain local codes and ordinances, especially those who have not kept up with changing home and/ or HUD construction practices. These instructions are to be followed and are the minimum requirement for a safe installation.
12. The size of the unit should be based on an acceptable heat loss calculation for the structure. ACCA, Manual J or other approved methods may be used.
13. Check the rating plate and power supply to be sure that the electrical characteristics match. The 115 VAC models use nominal 115 VAC, 1 Phase, 60-Hertz power supply. DO NOT CONNECT THIS APPLIANCE TO A 50 HZ POWER SUPPLY OR A VOLTAGE ABOVE 130 VOLTS.
14. The 240 VAC models use nominal 240 VAC, 1 Phase, 60-Hertz power supply. DO NOT CONNECT THIS APPLIANCE TO A 50 HZ POWER SUPPLY OR A VOLTAGE ABOVE 250 VOLTS.
15. Ground connections MUST BE securely fastened to the control box and ground wires MUST BE secured to the ground lugs control box with terminals.

⚠WARNING

ALWAYS SHUT OFF ELECTRICITY AT THE DISCONNECT SWITCH OR TURN OFF THE CIRCUIT BREAKERS IN THE MAIN ELECTRICAL ENTRANCE BEFORE PREFORMING ANY SERVICE ON THE APPLIANCE.

GENERAL INFORMATION

This single piece air handler provides the flexibility for installation in any upflow, downflow, or horizontal application. The versatile models may be used with or without electric heat or hot water heat. The direct drive variable speed ECM motor, optional (3) speed PSC motor, or the (5) five speed X-13 motors provide a selection of air volume to match any application.

The unit can be positioned for bottom air return in the upflow position, top air return in the downflow position, or air return through the end of the unit in the horizontal position.

NOTE: Refer to the instructions in this manual for the proper downflow conversion kit and instructions on the proper conversion to downflow.

Inspection

As soon as the furnace is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. Before installing the air handler you should check the cabinet for screws or bolts which may have loosened in transit. There are no shipping or spacer brackets which need to be removed before startup.

See local Distributor for more information. Mortex Products, Inc assumes no liability for freight damage.

Also check to be sure all accessories such as heater kits, and coils are available. Installation of these accessories should be accomplished before the air handler is set in place or the connecting of the wiring, electric heat, ducts or piping.

Electric Heat				
Models	MM**18,24	MM**25,30,36	MM**37,42,48,60	MM**72
Input, kW	5,10	5,10,15	5,10,15,20	5,10,15,20
Blower Size-Heat (D x W)	9 X 6	10 X 7	12 X 9	12 X 10
Unit Voltage	240V, 60 HZ, 1 PH			
Max. External SP (Duct), In. W.C.	0.50			
Thermostat Circuit	24 VAC, 60 Hz, 40VA			

Hydronic Heat				
Models	MM**18,24	MM**25,30,36	MM**37,42,48,60	MM**72
Hot Water Coil (Rows)	2,3	2,3,4	2,3,4	2,3,4
Blower Size-Heat (D x W)	10 X 7	10 X 7	12 X 9	12 X 10
Unit Voltage	115V, 60 HZ, 1 PH			
Max. External SP (Duct), In. W.C.	0.50			
Thermostat Circuit	24 VAC, 60 Hz, 40VA			

Table 1 Air Handler Model Specifications

Available Blower Motors

1. Standard Blower Motor - – VAR SPD ECM MOTOR
2. Optional Blower Motor - 3 SPD PSC MOTOR
3. Optional Blower Motor – 5 SPD X-13 MOTOR

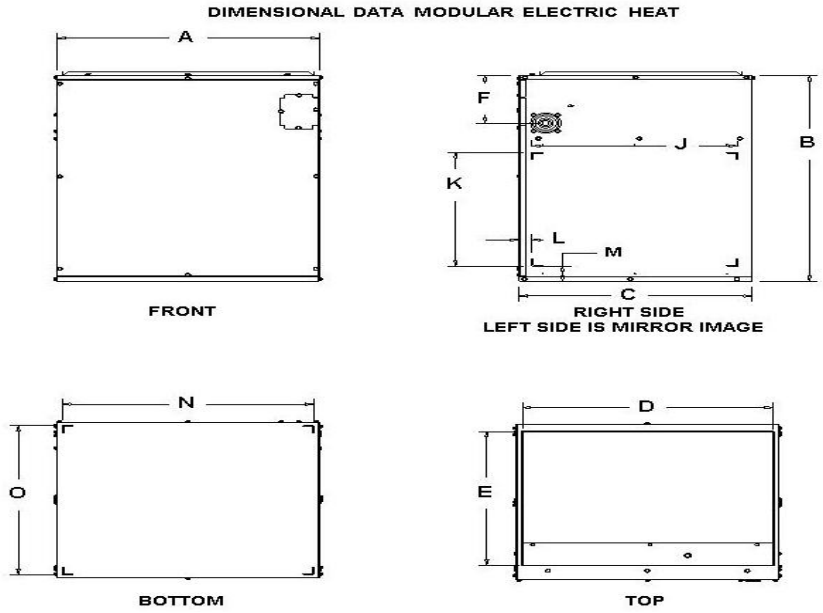

Figure 1: DIMENSIONAL DATA MODULAR ELECTRIC HEAT

Model	A	B	C	D	E	F	J	K	L	M	N	0
MM**18, 24	17.50	29.00	21.00	15.63	12.50	6.75	19.25	16.50	1.125	1.9375	16.50	20.00
MM**30, 36	21.00	29.00	21.00	19.00	12.50	6.75	19.25	16.50	1.125	1.9375	20.00	20.00
MM**37, 42, 48, 60, 72	24.50	29.00	21.75	22.25	14.25	6.75	19.25	16.50	1.125	1.9375	23.00	20.9375

Table 2: DIMENSIONAL DATA MODULAR ELECTRIC HEAT

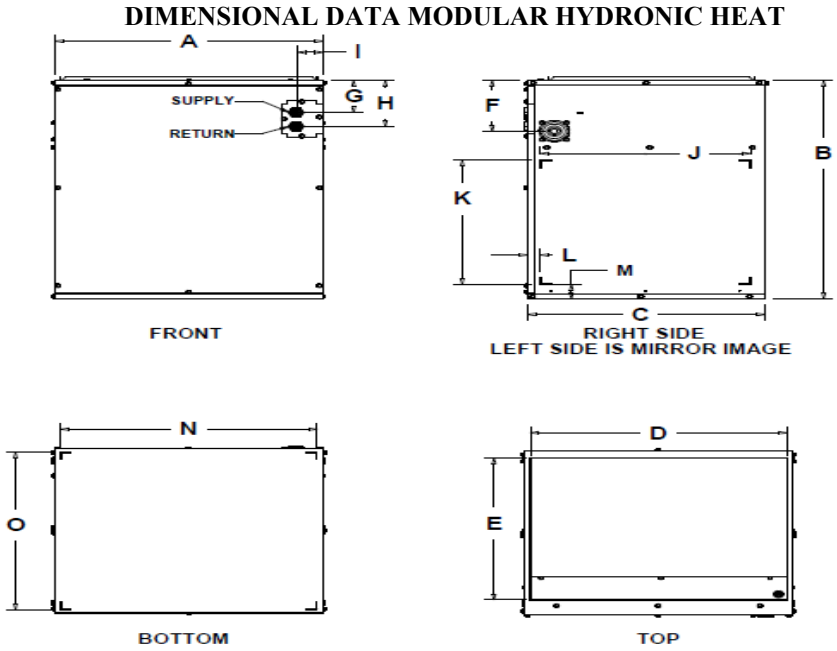

Figure 2: DIMENSIONAL DATA MODULAR HYDRONIC HEAT

Model	A	B	C	D	E	F	G	H	I
MM**18, 24	17.50	29.00	21.00	16.00	18.00	6.75	3.875	5.75	2.50
MM**30, 36	21.00	29.00	21.00	18.875	18.00	6.75	3.875	5.75	2.50
MM**37, 42, 48, 60, 72	24.50	29.00	21.75	23.50	18.75	6.75	4.25	6.00	2.50

Model	J	K	L	M	N	O
MM**18, 24	19.25	16.50	1.125	1.9375	16.50	20.00
MM**30, 36	19.25	16.50	1.125	1.9375	20.00	20.00
MM**37, 42, 48, 60, 72	19.25	16.50	1.125	1.9375	23.50	20.9375

Table 3: DIMENSIONAL DATA MODULAR HYDRONIC HEAT

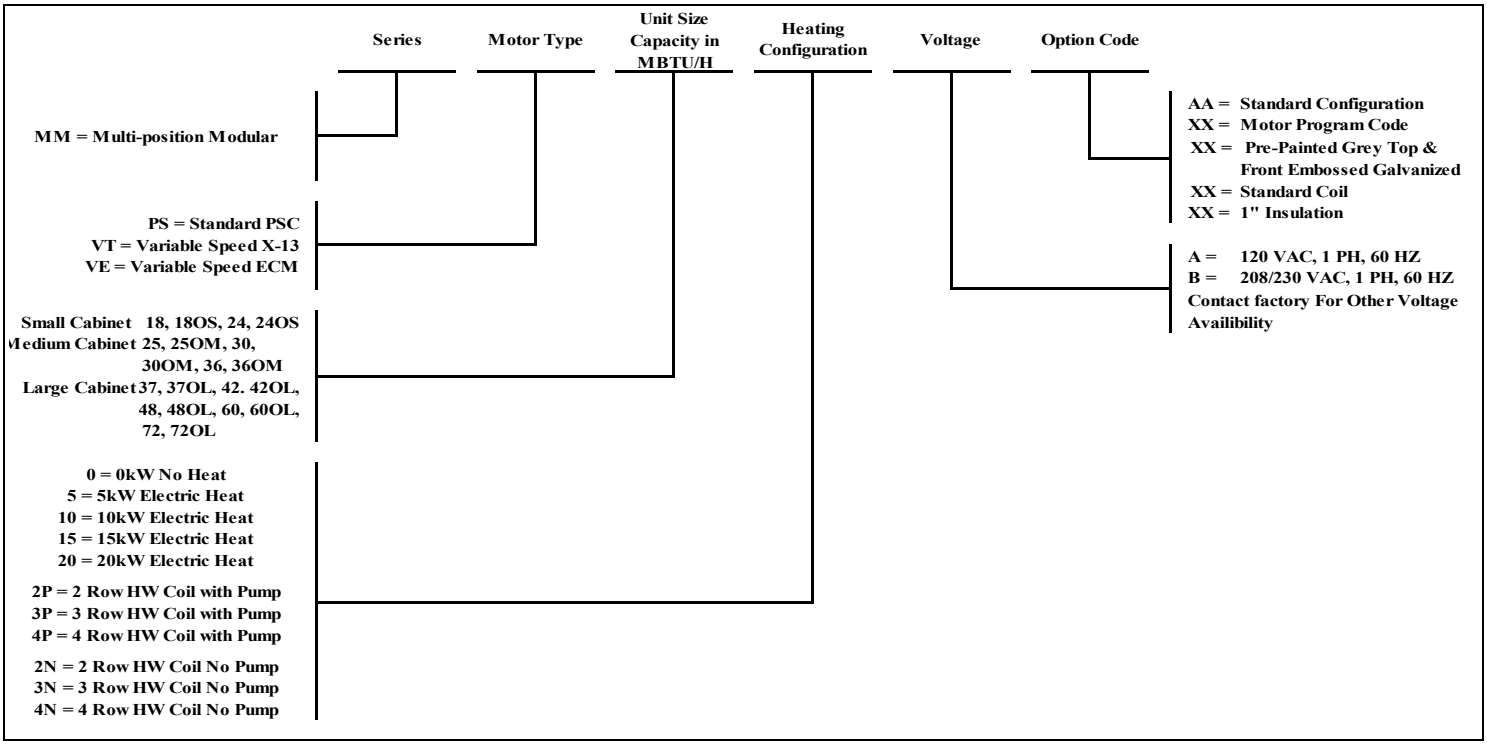

Table 4: Air Handler Model Nomenclature

NOTE 1: Electric heaters may be factory or field installed.
NOTE 2: MM = Multiposition Modular "Heating Only".

FILTER BASE ASSEMBLY KIT – FIELD INSTALLED
86ET0002 – 16"X 20" X 2" Small Cabinet, **86ET0001** – 20" X 20" X 2" Medium Cabinet, **86ET0003** – 20" X 24" X 2" Large Cabinet

SECTION III: CLEARANCE AND RETURN AIR REQUIREMENTS

LOCATION

Access for servicing is an important factor in the location of any air handler. Provide a minimum of 30 inches in front of the appliance for access to the control box, heating elements, water pump, blower and air filters. This access may be provided by a closet door or by locating the appliance so that a wall or partition is not less than 30 inches from the front access Panel Location is usually predetermined. Check with owner's or dealer's installation plans. If location has not been decided, consider the following in choosing a suitable location.

1. Select a location with adequate structural support, space for service access, clearance for return and supply duct connections.
2. Normal operating sound levels may be objectionable if the air handler is placed directly over or under some rooms such as bedrooms, study, etc.
3. Caution should be taken to locate the unit so that supply and return air ducts are about the same length causing even air distribution of supply and return air to and from the living spaces.
4. Locate appliance where electrical supply wiring can be easily routed to main electrical panel and where electrical wiring will not be damaged.
5. Locate appliance where thermostat wiring can be easily routed to the thermostat and where the wiring will not be damaged.
6. Some states, cities and counties require additional insulation to be installed on the exterior casing of the air handler to prevent sweating. Refer to the state, city, county or local code for insulation requirement to be sure the installation is in compliance.
   It is recommended that air handlers installed in non-conditioned spaces be insulated on the exterior of the entire cabinet, including the front access panel with one (1) inch thick fiberglass with the vapor barrier on the outside.

Appliance Clearances

This appliance is approved for zero (0) inches clearance to combustible material on any part of the air handler exterior casing and the inlet or outlet ducts providing NO electric heater is being used. There is a one (1) inch clearance on the supply plenum and supply air duct when an electric heater is installed in the appliance. Refer to Table 5 for clearance to combustibles information.

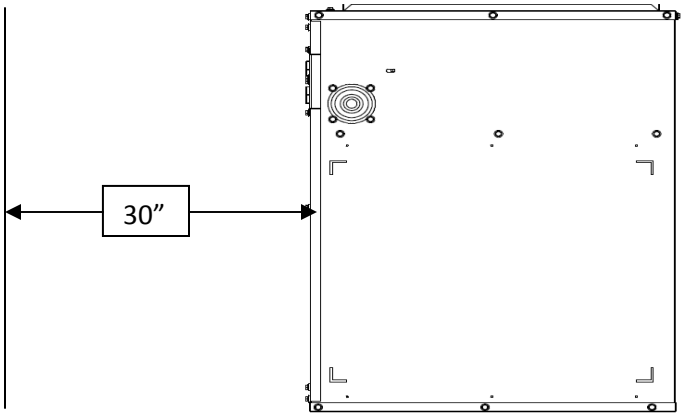

Figure 3: Clearance – Access for Service

MODEL	TOP (in)	BACK (in)	SIDES (in)	FRONT OF FURNACE		DUCT (in)
				ALCOVE (in)	CLOSET (in)	
Hydronic	0	0	0	30	6	0
Electric	0	0	0	30	6	1

Table 5: Clearances to Combustibles

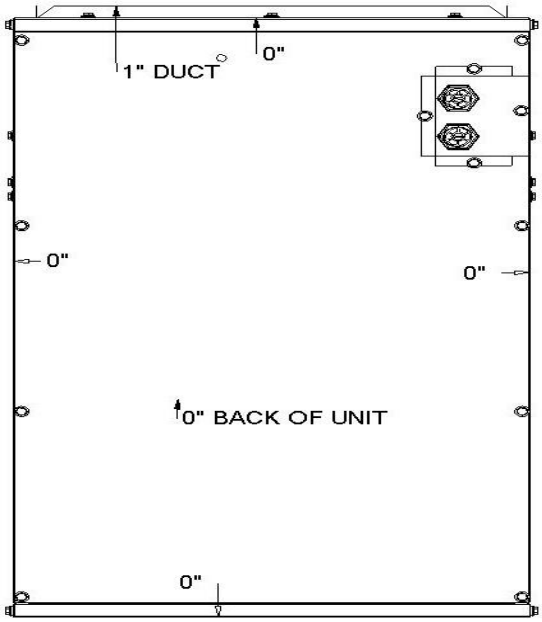

Figure 4: Closet Clearances

Return Air
In order for the air handler to work properly, a closet or alcove must have a certain total free area opening for the return air.

For Air Handlers with a 1/3 HP Blower Motor On (MMVE, MMVT, MMPS 18 and 24 models)
- Minimum 200 in² free area opening
- Use Return Grille or Coil Cabinet

For Air Handlers with a 1/2 HP Blower Motors On (MMVE, MMVT, MMPS 25, 30, and 36 models)
- Minimum 250 in² free area opening
- Use Return Grille, A/C Coil Cabinet, or any return grille with a minimum 250 in² free area opening

For Air Handlers with Electric Heat that use a 3/4 HP Blower Motor On (MMVE, MMVT, MMPS 37, 42, 48, and 60 models)
- Minimum 390 in² free area opening
- Use Return Grille, or A/C Coil Cabinet, or any return grille with a minimum 390 in² free area opening

For Air Handlers with Hydronic Heat that use a 1.0 HP Blower Motor On (MMVE 37, 42, 48, and 60 models)
- Minimum 390 in² free area opening
- Use Return Grille, or A/C Coil Cabinet, or any return grille with a minimum 390 in² free area opening

For Air Handlers with hydronic heat that use a 3/4 HP Blower Motor On (MMPS 37, 42, 48, and 60 models)
- Minimum 390 in² free area opening
- Use Return Grille, or A/C Coil Cabinet, or any return grille with a minimum 390 in² free area opening

For Air Handlers that use a 1.0 HP Blower Motor On (MMVE, MMVT 72 models)
- Minimum 430 in² free area opening
- Use Return Grille, or A/C Coil Cabinet, or any return grille with a minimum 430 in² free area opening

Bottom Return Only – Recommended Grille Size
800 CFM – 20 X 20 Grille – 324 in²
1000 CFM – 20 X 25 Grille - 414 in²
1200 CFM – 25 X 25 Grille - 414 in²
1400 CFM – 25 X 30 Grille - 644 in²
1600 CFM – 25 X 30 Grille - 644 in²
1800 CFM – 30 X 30 Grille - 784 in²
2000 CFM – 30 X 35 Grille - 924 in²
2400 CFM – 30 X 40 Grille - 1064 in²

The return air opening can be located in in the floor, on a closet front door or in a side wall above the furnace casing. If opening for the return air is located in the floor, side walls, or closet door anywhere below the appliance casing, a 6 inch minimum clearance between the appliance and the wall or door must be provided on the side where the return is located to provide for proper air flow. The 6 inch minimum clearance is not required if there is a return grille installed above the appliance casing, providing the grille has a sufficient return air opening.

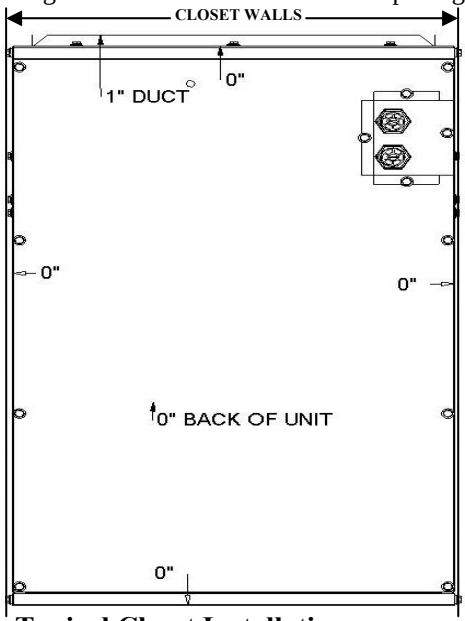

Figure 5: Typical Closet Installations

Provisions shall be made to permit the air in the rooms and the living spaces to return to the furnace. Failure to comply may cause a reduction in the amount of return air available to the blower, causing reduced air flow resulting in improper heating of the living space. The reduced air flow may cause the furnace to cycle on the limit causing premature heating element failure.

Upflow Accessory Filter Box Kit

Accessory filter box kit can be used on the return air end of the air handler when configured in the upflow position. The filter kit is placed over the return plenum in the floor and sealed to the plenum using sealant or caulking material and/or tape. The Air Handler is placed on top of the return filter box and the return opening sealed to prevent leaks.

Accessory filter box kit can be used on the return air end of the air handler when configured in the downflow position in place of a wall, door or ceiling mounted return filter grille.

NOTE: Make sure the flow arrow on the air filter is pointing towards the coil.

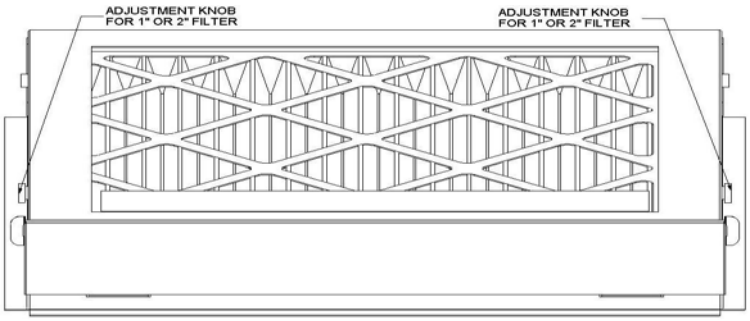

Figure 6: Accessory Air Filter Box for 1" or 2" Air Filters. Filter Size Adjustment knob is on both sides

SECTION IV: FURNACE & SUPPLY AIR DUCT INSTALLATION

AIRFLOW CONFIGURATION:

Unit is shipped from the factory arranged to be installed in an upflow or horizontal right to left air flow position. Horizontal right to left means, when facing the front of the unit, when the unit is laid on its side, the supply air opening is to the left and the return opening is to the right. These models are field convertible to a horizontal left to right air flow position

UPFLOW APPLICATION:

In an upflow installation the discharge outlet is at the top. Normal upflow installation will be in a closet or basement. If installed in a closet, the closet should have a platform framed in, that with an opening at the top of the platform centered in the closet that measure at least 12 inches in height. A filter frame and filter can be used that covers the opening and is sealed to prevent air by-passing the filter. A filter grille can be used that is located as described in RETURN AIR REQUIREMENTS. The minimum filter size is shown in the table below.

Standard Throw away Air Filter @ 300 ft/min or less
800 CFM = 20 x 20 x 1
1000 CFM = 20 x 25 x 1
1200 CFM = 20 x 30 x 1
1400 CFM = 25 x 30 x 1
1600 CFM = 25 x 30 x 1
1800 CFM = 30 x 30 x 1
2000 CFM = 30 x 40 x 1 or two 30 x 20 x 1
2400 CFM = 30 x 40 x 1 or two 30 x 20 x 1

Pleated Air Filter @ 500 ft/min or less
800 CFM = 16 x 16 x 1
1000 CFM = 18 x 20 x 1
1200 CFM = 20 x 20 x 1
1400 CFM = 20 x 20 x 1
1600 CFM = 20 x 25 x 1
1800 CFM = 20 x 30 x 1 or two 20 x 15 x 1
2000 CFM = 20 x 30 x 1 or two 20 x 15 x 1
2400 CFM = 25 x 30 x 1 or two 14 x 30 x 1
Pleated filters are not recommended for use with PSC Motors. The other option is to use the SunTherm Filter Base Accessory Kit. This filter base is placed on the closet floor and secured with screws. The unit is placed on top of the filter base and secured to the base with screws. Use seal strip, tape or calking to seal between the unit and the base.

Connect the supply air outlet to a plenum to the top of the unit and secure it with screws. Use a Non-tape sealant such as mastic or an aerosol sealant to seal duct leakage.
If installed in a basement, run supply and return duct work in accordance with local codes. Use a Non-tape sealant such as mastic or an aerosol sealant to seal duct leakage.

HORIZONTAL APPLICATION

Horizontal applications will normally be used in an attic or crawl space. This type of installation requires supply air plenum or duct to be connected to the supply collar and a return air plenum or duct be attached to the unit inlet collar. The supply ducts will be connected to the supply air plenum and routed thru the attic to a register in each room. Use a Non-tape sealant such as mastic or an aerosol sealant to prevent leaks in the ducts and the plenum.

The opposite end of the return air duct is attached to a return filter grille housing. The filter grille is usually located in a wall, just below the ceiling or the ceiling in a hallway. Use a Non-tape sealant such as mastic or an aerosol sealant to prevent leaks in the ducts and the plenum.

The unit is shipped to be installed without modification in a right to left configuration. See AIRFLOW CONFIGURATION for details.

DOWNFLOW APPLICATION:

The unit is designed for downflow configuration.
Flip the unit so the top is now the bottom of the unit.

INSTALLATION ON COMBUSTIBLE FLOORING

⚠WARNING

Combustible Floor Base MUST BE USED when the unit is being installed on combustible flooring. The unit cannot be installed on carpeting.
Failure to use the combustible floor base combustible flooring or installing the unit on carpeting could result in a fire causing personnel injury, property damage or loss of life.

Before installing the combustible floor base make sure that there is a minimum of R-12 insulation between the sheet metal and any wood or combustible flooring. Refer to Figure 7 for typical combustible floor base installation.

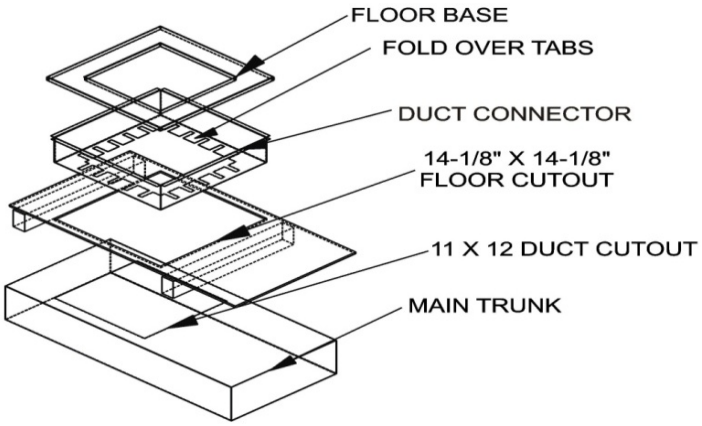

Figure 7: Combustible Floor Base Installation

SECTION V: FURNACE INSTALLATION

Installing the Air Handler

Closet Installation

Prior to installing the furnace make sure the holes are cut into the floor for the refrigerant tubing, the drain line, the electrical wiring, the thermostat wiring and the condenser control wiring.

1. Remove the top shipping cover and corner posts.
2. Remove the bottom shipping cover.
3. Remove the blower and control box access panel (door).
4. Place the unit into position using one of the following choices:

A. If the Combustible Floor Base is used you slide the unit on to the combustible floor base until the unit is touching the flanges on the back of the floor base.

B. If the Combustible Floor Base is not used you slide the unit over the duct opening until the opening in the unit lines up with the duct opening in the floor.

5. Secure the unit by one of the two choices:

A. If the Combustible Floor Base is used you secure the furnace to the floor by drilling two holes through the furnace base and the floor base at the right and left front inside corners of the cabinet. Use two screws to secure the furnace to the floor.

B. If the Combustible Floor Base is not used you secure the unit to the floor by drilling two holes through the furnace base at the left and right front inside corners of the cabinet. Use two screws to secure the unit to the floor.

6. Use calking, sealers, and/or tape to seal between the combustible floor base and the opening on the unit or between the opening on the unit and the duct in the floor.
7. Connect the electrical supply wires and the thermostat control wires in the control box.
8. Re-install the blower and control box access panel (door) and secure with the screws that were removed in step 2
9. Turn the power on to the unit by following the procedure in the Users Information Manual.
10. Set the thermostat to the desired temperature.

SECTION VI: HYDRONIC HEATING

Water Piping

All piping must be supported independent of coils to prevent vibration and stress on coil headers. Swing joints or flexible fittings must be provided to absorb expansion and contraction strains. Rigid piping reduces the effectiveness of vibration isolators. Coil water pipes must be adequately vented in order to prevent air binding. Units are provided with manual air vents mounted through the manifold panel.

Hot Water Piping:

If a residential water heater is used for space heating water, do not exceed a distance of 70’ between the air handler and the water heater. The water heater should be the quick recovery type. Air handler and water heater must be located indoors and not subject to freezing temperatures.

MODEL	CFM	GPM	BTUH	LAT °F	LWT °F	APD IWC	WPD FT	ROWS	FPI
MM**18	500	2.7	26,290	116.5	160	0.07	1.2	2	10
	600	3.0	29,630	113.5		0.09	1.5		
	700	3.4	32,690	111.1		0.12	1.8		
MM**18	500	4.0	39,000	137.0		0.10	1.2	3	
	600	4.6	44,500	133.4		0.14	1.5		
	700	5.1	49,600	130.3		0.18	1.8		
MM**24	600	3.0	29,630	113.5		0.09	1.5	2	
	800	3.6	35,510	108.9		0.15	2.1		
	900	3.9	38,140	107.1		0.19	2.4		
MM**24	600	4.6	44,500	133.4		0.14	1.5	3	
	800	5.6	54,300	127.6		0.23	2.2		
	900	6.0	58,700	125.7		0.28	2.5		

Table 6: Hot Water Capacity-Boiler Loop 65°F EAT 180°F EWT 20°F Δt (No Pump) Small Cabinet 1.5 and 2.0 Ton

MODEL	CFM	GPM	BTUH	LAT °F	LWT °F	APD IWC	WPD FT	ROWS	FPI
MM**25	600	3.4	33,080	118.8	160	0.07	1.8	2	10
	800	4.1	40,000	114.1		0.11	1.1		
	900	4.4	43,120	112.2		0.13	1.2		
	600	4.7	45,530	138.0		0.10	1.5	3	
	800	5.7	56,060	132.6		0.16	2.2		
	900	6.2	60,880	130.4		0.20	2.6		
	600	5.6	54,160	148.2		0.15	3.1	4	
	800	6.9	67,160	142.4		0.24	4.4		
	900	7.5	73,140	139.9		0.29	4.9		
MM**30	900	4.4	42,780	111.8		0.14	1.2	2	
	1000	4.7	45,680	110.1		0.16	1.4		
	1200	5.2	51,010	107.2		0.23	1.7		
	900	6.2	60,500	130.0		0.21	2.5	3	
	1000	6.7	65,020	128.0		0.25	2.9		
	1200	7.5	73,410	124.4		0.34	3.7		
	900	7.5	73,140	139.9		0.29	4.9	4	
	1000	8.1	78,830	137.7		0.34	5.2		
	1200	9.2	89,455	133.7		0.46	5.7		
MM**36	1000	4.7	45,680	110.1		0.16	1.4	2	
	1200	5.2	51,010	107.2		0.23	1.7		
	1400	5.7	55,830	104.8		0.29	2.1		
	1000	6.7	65,020	128.0		0.25	2.9	3	
	1200	7.5	73,410	124.4		0.34	3.7		
	1400	8.3	81,080	121.4		0.44	1.4		
	1000	8.1	78,830	137.7		0.34	5.2	4	
	1200	9.2	89,455	133.7		0.46	5.7		
	1400	10.2	99,230	130.4		0.60	6.6		

Table 7: Hot Water Capacity-Boiler Loop 65°F EAT 180°F EWT 20°F Δt (No Pump) Med Cabinet 2.0, 2.5, 3.0 Ton

MODEL	CFM	GPM	BTUH	LAT °F	LWT °F	APD IWC	WPD FT	ROWS	FPI
MM**37	1000	5.4	52,500	116.4	160	0.09	1.6	2	10
	1200	6.1	59,100	113.4		0.12	2.0		
	1400	6.7	65,130	110.9		0.15	2.4		
	1000	7.5	72,930	135.2		0.13	3.1	3	
	1200	8.5	83,040	131.8		0.18	1.1		
	1400	9.5	92,390	128.9		0.23	1.4		
	1000	8.8	85,910	147.2		0.17	1.3	4	
	1200	10.1	98,890	144.0		0.23	1.7		
	1400	11.4	111,020	141.1		0.31	2.1		
MM**42	1200	6.1	59,100	113.4		0.12	2.0	2	
	1400	6.7	65,130	110.9		0.15	2.4		
	1600	7.3	70,690	108.7		0.19	2.8		
	1200	8.5	83,040	131.8		0.18	1.1	3	
	1400	9.5	92,390	128.9		0.23	1.4		
	1600	10.4	101,100	126.3		0.29	1.6		
	1200	10.1	98,890	144.0		0.23	1.7	4	
	1400	11.4	111,020	141.1		0.31	2.1		
	1600	12.6	122,430	138.6		0.39	2.5		
MM**48	1400	6.7	65,130	110.9		0.15	2.4	2	
	1600	7.3	70,690	108.7		0.19	2.8		
	1800	7.8	75,860	106.9		0.24	3.2		
	1400	9.5	92,390	128.9		0.23	1.4	3	
	1600	10.4	101,100	126.3		0.29	1.6		
	1800	11.2	109,250	124.0		0.36	1.9		
	1400	11.4	111,020	141.1		0.31	2.1	4	
	1600	12.6	122,430	138.6		0.39	2.5		
	1800	13.7	133,200	136.2		0.47	3.0		
MM**60	1800	7.8	75,860	106.9		0.24	3.4	2	
	2000	8.3	80,690	105.2		0.28	3.9		
	2100	8.5	83,000	104.4		0.31	4.2		
	1800	9.5	92,390	128.9		0.36	5.2	3	
	2000	12.0	116,930	121.9		0.43	8.4		
	2100	12.4	120,600	120.0		0.46	8.9		
	1800	13.7	133,200	136.2		0.47	11.0	4	
	2000	14.7	143,400	134.1		0.57	12.7		
	2100	15.4	147,245	132.0		0.46	13.9		
MM**72	2000	8.3	80,690	101.5		0.45	2.2	2	
	2200	8.6	83,400	99.9		0.53	2.4		
	2400	9.0	87,300	98.6		0.61	2.6		
	2000	12.0	116,930	117.1		0.67	5.2	3	
	2200	12.3	119,560	115.1		0.79	5.8		
	2400	12.9	125,700	113.3		0.92	6.3		
	2000	14.7	143,400	128.9		0.89	9.0	4	
	2200	15.1	147,400	126.8		1.05	9.5		
	2400	16.0	155,600	124.8		1.72	10.2		

Table 8: Hot Water Cap-Boiler Loop 65°F EAT 180°F EWT 20°F Δt (No Pump) Large Cabinet 3.0, 3.5, 4.0, 5.0 Ton

MODEL	CFM	GPM	BTUH 120°F	BTUH 130°F	BTUH 140°F	BTUH 150°F	BTUH 160°F	APD IWC	ROWS	FPI
MM**18	500	4	13,600	16,200	18,840	21,510	24,200	0.07	2	10
	600		14,890	17,760	20,660	23,600	26,570	0.09		
	700		15,990	19,090	22,230	25,410	28,620	0.12		
MM**18	500		18,160	21,580	25,000	28,500	32,000	0.10	3	
	600		20,170	24,000	27,840	31,700	35,600	0.14		
	700		21,900	26,000	30,280	34,500	38,800	0.18		
MM**24	600		14,890	17,760	20,660	23,600	26,570	0.09	2	
	800		16,960	20,250	23,600	26,990	30,420	0.15		
	900		17,810	21,280	24,810	28,390	32,010	0.19		
MM**24	600		20,170	24,000	27,840	31,700	35,600	0.14	3	
	800		23,400	27,900	34,300	34,160	41,600	0.23		
	900		24,800	29,500	34,300	39,160	44,000	0.28		

Table 9: Hot Water Capacity- -with Factory Pump 65°F EAT @ Stated EWT - Small Cabinet 1.5, and 2.0 Ton

MODEL	CFM	GPM	BTUH 120°F	BTUH 130°F	BTUH 140°F	BTUH 150°F	BTUH 160°F	APD IWC	ROWS	FPI
MM**25	600	4	16,210	16,320	22,460	25,630	28,820	0.07	2	10
	800		18,620	22,220	25,860	29,540	33,260	0.11		
	900		19,620	23,420	27,270	31,170	35,110	0.13		
	600		21,010	25,000	29,030	33,090	37,190	0.10	3	
	800		24,490	29,180	33,930	38,720	43,560	0.16		
	900		25,940	30,920	35,960	41,060	46,210	0.20		
	600		24,840	29,415	34,005	38,605	43,200	0.15	4	
	800		29,770	35,270	40,785	46,315	51,860	0.24		
	900		31,895	37,790	43,710	49,645	55,595	0.29		
MM**30	900		19,620	23,420	27,270	31,170	35,110	0.13	2	
	1000		20,510	24,500	28,540	32,630	36,770	0.16		
	1200		22,050	26,350	30,720	35,150	39,630	0.22		
	900		25,940	30,920	35,960	41,060	46,210	0.20	3	
	1000		27,230	32,470	37,780	43,160	48,580	0.24		
	1200		29,440	35,140	40,910	46,760	52,670	0.33		
	900		31,895	37,790	43,710	49,645	55,595	0.29	4	
	1000		33,836	40,100	46,385	52,685	59,010	0.34		
	1200		37,260	44,165	51,104	58,065	65,045	0.46		
MM**36	1000		20,510	24,500	28,540	32,630	36,770	0.16	2	
	1200		22,050	26,350	30,720	35,150	39,630	0.22		
	1400		23,340	27,910	32,550	37,260	42,040	0.29		
	1000		27,230	32,470	37,780	43,160	48,580	0.24	3	
	1200		29,440	35,140	40,910	46,760	52,670	0.33		
	1400		31,270	37,350	43,510	49,750	56,070	0.43		
	1000		33,836	40,100	46,385	52,685	59,010	0.34	4	
	1200		37,260	44,165	51,104	58,065	65,045	0.46		
	1400		40,195	47,660	55,150	62,670	70,220	0.60		

Table 10: Hot Water Capacity- -with Factory Pump 65°F EAT @ Stated EWT - Medium Cabinet 2.0, 2.5 and 3.0 Ton

MODEL	CFM	GPM	BTUH 120°F	BTUH 130°F	BTUH 140°F	BTUH 150°F	BTUH 160°F	APD IWC	ROWS	FPI
MM**37	1000	7	26,320	31,350	36,430	41,570	46,740	0.09	2	10
	1200		28,770	34,300	39,900	45,550	51,260	0.12		
	1400		30,880	36,840	42,880	48,980	55,140	0.15		
	1000		34,230	40,720	47,280	53,890	60,550	0.13	3	
	1200		37,800	45,010	52,290	59,640	67,050	0.18		
	1400		40,860	48,690	56,600	64,590	72,660	0.23		
	1000		39,630	47,090	54,620	62,190	69,810	0.17	4	
	1200		44,170	52,530	60,960	69,460	78,020	0.23		
	1400		48,080	57,220	66,440	75,750	85,130	0.31		
MM**42	1200		28,770	34,300	39,900	45,550	51,260	0.12	2	
	1400		30,880	36,840	42,880	48,980	55,140	0.15		
	1600		32,720	39,050	45,470	51,970	58,540	0.19		
	1200		37,800	45,010	52,290	59,640	67,050	0.18	3	
	1400		40,860	48,690	56,600	64,590	72,660	0.23		
	1600		43,530	51,890	60,360	68,910	77,550	0.29		
	1200		44,170	52,530	60,960	69,460	78,020	0.23	4	
	1400		48,080	57,220	66,440	75,750	85,130	0.31		
	1600		51,490	61,310	71,230	81,250	91,340	0.39		
MM**48	1400		30,880	36,840	42,880	48,980	55,140	0.15	2	
	1600		32,720	39,050	45,470	51,970	58,540	0.19		
	1800		34,340	41,010	47,770	54,620	61,550	0.24		
	1400		40,860	48,690	56,600	64,590	72,660	0.23	3	
	1600		43,530	51,890	60,360	68,910	77,550	0.29		
	1800		45,870	54,710	63,670	72,720	81,870	0.36		
	1400		48,080	57,220	66,440	75,750	85,130	0.31	4	
	1600		51,490	61,310	71,230	81,250	91,340	0.39		
	1800		54,490	64,910	75,450	86,090	96,820	0.47		
MM**60	1800		34,340	41,010	47,770	54,620	61,550	0.24	2	
	2000		35,780	42,750	49,820	56,990	64,240	0.28		
	2100		36,450	43,550	50,770	58,080	65,480	0.31		
	1800		45,870	54,710	63,670	72,720	81,870	0.36	3	
	2000		47,960	57,220	66,610	76,110	85,710	0.43		
	2100		48,920	58,380	67,970	77,670	87,480	0.46		
	1800		54,490	64,910	75,450	86,090	96,820	0.47	4	
	2000		57,160	68,120	79,200	90,400	101,710	0.57		
	2100		58,380	69,590	80,930	92,390	103,750	0.62		
MM**72	2000		35,780	42,750	49,820	56,990	64,240	0.45	2	
	2200		36,700	43,800	50,900	58,000	65,200	0.53		
	2400		38,000	45,300	52,600	60,000	67,500	0.67		
	2000		47,960	57,220	66,610	76,110	85,710	0.67	3	
	2200		49,500	58,900	68,300	77,900	87,500	0.79		
	2400		51,300	61,000	70,800	80,700	90,700	0.92		
	2000		57,160	68,120	79,200	90,400	101,710	0.89	4	
	2200		59,200	70,400	81,600	92,900	104,400	1.05		
	2400		61,500	73,000	84,800	96,500	108,400	1.22		

Table 11: Hot Water Capacity-with Factory Pump 65°F EAT @ Stated EWT - Large Cabinet 3.0, 3.5, 4.0 & 5.0 Ton

⚠WARNING

Air handler must be located so that if any connections should leak, water will not cause damage to the adjacent area. When such locations can't be avoided, a suitable drain pan should be installed under the air handler, not over 1-1/2" deep, with minimum length and width at least 2" greater than the air handler dimensions and connected to an adequate drain. Under no circumstances is the manufacturer to be held libel for any water damage in connection with this air handler.

Total hot water piping should not exceed 140 feet. All hot water piping to the coil should be 3/4 inch ID (7/8 inch OD) copper. CPVC piping may be used in applications where the water temperature does not exceed 150°F. It is recommended a water isolation valve and a union be placed in the water lines to and from the coil, near the coil, for serviceability, repair or replacement of the coil.

A thermal expansion tank is recommended on any closed loop system to relieve thermal expansion due to pressure increase.

⚠WARNING

Toxic chemicals used for treatment of boilers or non-potable water heating appliances shall never be introduced into a potable water space heating system.

After piping has been installed, allow the system to fill with water and check connections for leaks. To insure complete filling of the system, follow start-up procedure.

⚠WARNING

When system requires water at temperatures higher than required for other uses, a means such as a mixing valve shall be installed to temper the water for those uses in order to reduce the scald hazard potential.

SECTION VII: LINE VOLTAGE WIRING

Power Supply Wiring

The unit internal wiring is complete except for the power supply and the thermostat wires. See wiring diagram and/or Tables 12 thru 17 for wire size, fuse/circuit breaker size, and ground wire sizes. The use of cable connectors on incoming power supply wires to relieve any strain on wiring is recommended. Follow the steps below to connect the power supply wires.

Single Circuit Line Wiring Connections

1. Remove the blower and control box access panel (door).
2. Remove the control box cover.
3. Install the cable connectors on the 7/8" dia holes on the right side of the control box.
4. Strip ½" of the insulation on the end of each wire.
5. Insert the wires through the holes in the casing and through the cable connectors.
6. Insert the black wire into the L1 screw terminal on the first circuit breaker from the top and tighten the set screw to clamp down on the wire.
7. Insert the white or red wire into the L2 screw terminal on the first circuit breaker down from the top and tighten the set screw to clamp down on the wire.
8. If you are using a single circuit for a 5 kW, 10kW, 15kW or 20kW model you will need to install a black jumper wire from the L1 terminal on circuit breaker #1 to the L1 terminal on circuit breaker #2 and a white or red jumper wire from the L2 terminal on circuit breaker #1 to the L2 terminal on circuit breaker #2. Refer to Figures 8, 12 and 13 for circuit breaker locations.
   Note: The 100 amp 4 Pole Jumper Bar Assembly part number 68BAE001 can be used in place of the jumper wires.
9. Insert the green wire into the ground lug and tighten the set screw.

Dual Circuit Line Wiring Connections: 15kW or 20kW Models

10. You will need to insert the black wire from the second power supply into the L1 screw terminal on the second circuit breaker down from the top and tighten the set screw to clamp down on the wire.
11. You will need to insert the white or red wire from the second power supply into the L2 screw terminal on the second circuit breaker down from the top and tighten the set screw to clamp down on the wire.
12. You will need to insert both green wires into the ground lug and tighten the set screw.
13. Tighten the screws on the cable connectors until the power supply wires are securely fastened to the connector.

NOTE: The furnaces are equipped with either one or two circuit breakers. These circuit breakers protect the wiring inside of the furnace in the event of a short circuit. Additionally, these breakers provide a means of disconnecting the power to the unit. The circuit breakers in the furnace are not meant to protect the branch circuit wiring between the furnace and the home's breaker panel. General wire and breaker sizes are shown in Tables 12 thru 17. If sheathed cable is used, refer to NEC National Electrical Code (NFPA 70) or the Canadian Electrical Code, Part I (CSA C22.1) and local codes for additional requirements concerning supply circuit wiring. Electrical data can be found in Table 18.

IMPORTANT - All installation on field wiring must be rated at 60ºC or higher. Please refer to the wiring diagrams on the furnace or the tables this manual for more information.

The 15kW and 20kW models may be connected to a single or dual branch circuit.

IMPORTANT - Refer to the NEC National Electrical Code (NFPA 70) or the Canadian Electrical Code, Part I (CSA C22.1) and local codes for wiring material requirements.

	AIR HANDLER MODELS					
	**VE18, 24	**VT 18, 24	**PS 18, 24	**VE25, 30, 36	**VT 25, 30, 36	**PS 25, 30, 36
Indoor Blower Type	ECM	X-13 (CTM)	PSC	ECM	X-13 (CTM)	PSC
Indoor Blower Amps	1.80	2.72	4.40	2.31	2.72	7.70
Circuit Load - FLA - 120 VAC	2.00	2.92	4.60	2.51	2.92	7.90
Min. Wire Size (90°C)	#14	#14	#14	#14	#14	#14
Minimum Wire Size (75°C)	#14	#14	#14	#14	#14	#14
Minimum Wire Size (60°C)	#14	#14	#14	#14	#14	#14
Ground Wire Size	*	*	*	*	*	*
Max Fuse/Circuit Breaker Amps	15	15	15	15	15	15

Table 12: Wiring Requirements – 120 VAC Hydronic 18-36 kBTU Models - Single Branch Circuit

15kW and 20kW Two Stage models may have a dual or single power supply.
Single power supply will require circuit breaker jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 12.
** = Model Series – MM

	AIR HANDLER MODELS				
	**VE37, 42, 48, 60	**VE72	**VT37, 42, 48, 60	**VT72	**PS37, 42, 48, 60
Indoor Blower Type	ECM	ECM	X-13 (CTM)	X-13 (CTM)	PSC
Indoor Blower Amps	6.31	8.48	5.71	8.48	11.00
Circuit Load - FLA - 120 VAC	6.5	8.7	5.9	8.7	11.2
Min. Wire Size (90°C)	#14	#14	#14	#14	#14
Minimum Wire Size (75°C)	#14	#14	#14	#14	#14
Minimum Wire Size (60°C)	#14	#14	#14	#14	#14
Ground Wire Size	*	*	*	*	*
Max Fuse Amps	15	15	15	15	15

Table 13: Wiring Requirements – 120 VAC Hydronic 37-60kBTU Models - Single Branch Circuit

15kW, and 20kW Two Stage models may have a dual or single power supply.
Single power supply will require circuit breaker jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 13.
** = Model Series – MM

	AIR HANDLER MODELS														
	**VE18, 24		**VT 18, 24		**PS 18, 24		**VE25, 30, 36			**VT 25, 30, 36			**PS 25, 30, 36		
5 kW Heater Amps - 208/240 VAC	18.0/20.88		18.0/20.88		18.0/20.88		18.0/20.88			18.0/20.88			18.0/20.88		
10 kW Heater Amps - 208/240 VAC	36.1/41.66		36.1/41.66		36.1/41.66		36.1/41.66			36.1/41.66			36.1/41.66		
15 kW Heater Amps - 208/240 VAC	N/A		N/A		N/A		54.1/62.5			54.1/62.5			54.1/62.5		
Indoor Blower Type	ECM		X-13 (CTM)		PSC		ECM			X-13 (CTM)			PSC		
Indoor Blower Amps	0.78		0.72		2.00		2.03			1.66			3.00		
Heater - kW	5	10	5	10	5	10	5	10	15	5	10	15	5	10	15
Circuit Load - FLA - 230 VAC	21.66	42.44	21.60	42.38	22.88	43.66	22.91	43.69	64.53	22.54	43.32	64.16	23.88	44.66	65.50
Min. Wire Size (90°C)	#10	#6	#10	#6	#10	#6	#10	#6	#3	#10	#6	#4	#10	#6	#3
Minimum Wire Size (75°C)	#10	#6	#10	#6	#10	#6	#10	#6	#3	#10	#6	#4	#10	#6	#3
Minimum Wire Size (60°C)	#10	#4	#10	#4	#10	#4	#10	#4	#2	#10	#4	#3	#10	#4	#2
Ground Wire Size	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Max Fuse Amps	30	60	30	60	30	60	30	60	90	30	60	80	30	60	90

Table 14: Wiring Requirements – 208/230 VAC Electric Heat 18-36 kBTU Models - Single Branch Circuit

15kW, and 20kW Two Stage models may have a dual or single power supply.
Single power supply will require circuit breaker jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 14.
** = Model Series – MM

	AIR HANDLER MODELS																			
	**VE37, 42, 48, 60				**VE72				**VT37, 42, 48, 60				**VT72				**PS37, 42, 48, 60			
5 kW Heater Amps - 208/240 VAC	18.0/20.88				18.0/20.88				18.0/20.88				18.0/20.88				18.0/20.88			
10 kW Heater Amps - 208/240 VAC	36.1/41.66				36.1/41.66				36.1/41.66				36.1/41.66				36.1/41.66			
15 kW Heater Amps - 208/240 VAC	54.1/62.5				54.1/62.5				54.1/62.5				54.1/62.5				54.1/62.5			
20 kW Heater Amps - 208/240 VAC	72.2/83.33				72.2/83.33				72.2/83.33				72.2/83.33				72.2/83.33			
Indoor Blower Type	ECM				ECM				X-13 (CTM)				X-13 (CTM)				PSC			
Indoor Blower Amps	2.50				3.75				6.80				5.72				3.60			
Heater - kW	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Circuit Load - FLA - 230 VAC	23.3	44.2	65.0	85.8	24.6	45.4	66.3	87.1	27.6	48.5	69.3	90.1	26.6	47.4	68.2	89.1	24.4	45.3	66.1	86.9
Min. Wire Size (90°C)	#10	#6	#3	#3	#8	#6	#3	#2	#10	#4	#3	#2	#10	#6	#3	#2	#10	#6	#3	#2
Minimum Wire Size (75°C)	#10	#6	#3	#2	#8	#6	#3	#1	#10	#4	#3	#1	#10	#6	#3	#1	#10	#6	#3	#1
Minimum Wire Size (60°C)	#10	#4	#2	N/A	#8	#4	#2	N/A	#10	#4	#2	N/A	#10	#4	#2	N/A	#10	#4	#2	N/A
Ground Wire Size	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Max Fuse Amps	30	60	90	110	35	60	90	125	35	70	90	125	35	60	90	125	35	60	90	125

Table 15: Wiring Requirements – 208/240 VAC Electric Heat 37-60 kBTU Models - Single Branch Circuit

15kW, and 20kW Two Stage models may have a dual or single power supply. - Single power supply may require jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 15.
** = Model Series – MM

	AIR HANDLER MODELS																	
	**VE25, 30, 36				**VT 25, 30, 36				**PS 25, 30, 36				**VE37, 42, 48, 60					
5 kW Heater Amps - 208/240 VAC	18.0/20.88				18.0/20.88				18.0/20.88				18.0/20.88					
10 kW Heater Amps - 208/240 VAC	36.1/41.66				36.1/41.66				36.1/41.66				36.1/41.66					
15 kW Heater Amps - 208/240 VAC	18/20.8		38.1/41.7		18/20.8		38.1/41.7		18/20.8		38.1/41.7		18/20.8		38.1/41.7			
20 kW Heater Amps - 208/240 VAC	N/A				N/A				N/A				36.1/41.7		36.1/41.7			
Indoor Blower Type	ECM				X-13 (CTM)				PSC				ECM					
Indoor Blower Amps	2.03				1.66				3.00				2.50					
Heater - kW	5	10	15		5	10	15		5	10	15		5	10	15		20	
Circuit	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	2
Circuit Load - FLA	22.9	43.7	43.7	20.8	22.5	43.3	43.3	20.8	23.9	44.7	44.7	20.8	23.3	44.2	44.2	20.8	44.2	41.7
Min. Wire Size (90°C)	#10	#6	#6	#10	#10	#6	#6	#10	#10	#6	#6	#10	#10	#6	#6	#10	#6	#6
Minimum Wire Size (75°C)	#10	#6	#6	#10	#10	#6	#6	#10	#10	#6	#6	#10	#10	#6	#6	#10	#6	#6
Minimum Wire Size (60°C)	#10	#4	#4	#10	#10	#4	#4	#10	#10	#4	#4	#10	#10	#4	#4	#10	#4	#4
Ground Wire Size	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Max Fuse Amps	30	60	60	30	30	60	60	30	30	60	60	30	30	60	60	30	60	60

Table 16: Wiring Requirements – 208/240 VAC Electric Heat 25-60 kBTU Models – Dual Branch Circuit

15kW, and 20kW Two Stage models may have a dual or single power supply. - Single power supply may require jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 16.
** = Model Series – MM

	AIR HANDLER MODELS																							
	**VE72						**VT37, 42, 48, 60						**VT72						**PS37, 42, 48, 60					
5 kW Heater Amps - 208/240 VAC	18.0/20.88						18.0/20.88						18.0/20.88						18.0/20.88					
10 kW Heater Amps - 208/240 VAC	36.1/41.66						36.1/41.66						36.1/41.66						36.1/41.66					
Circuit Number	1			2			1			2			1			2			1			2		
15 kW Heater Amps - 208/240 VAC	18.0/20.8			38.1/41.7			18.0/20.8			38.1/41.7			18.0/20.8			38.1/41.7			18.0/20.8			38.1/41.7		
20 kW Heater Amps - 208/240 VAC	36.1/41.7			36.1/41.7			36.1/41.7			36.1/41.7			36.1/41.7			36.1/41.7			36.1/41.7			36.1/41.7		
Indoor Blower Type	ECM						X-13 (CTM)						X-13 (CTM)						PSC					
Indoor Blower Amps	3.75						6.80						5.72						3.60					
Heater - kW	5	10	15		20		5	10	15		20		5	10	15		20		5	10	15		20	
Circuit	1	1	1	2	1	2	1	1	1	2	1	2	1	1	1	2	1	2	1	1	1	2	1	2
Circuit Load - FLA - 230 VAC	24.6	45.4	45.4	20.8	45.4	41.7	27.6	48.5	48.5	20.8	48.5	41.7	26.6	47.4	47.4	20.8	47.4	41.7	24.4	45.3	45.3	20.8	45.3	41.7
Min. Wire Size (90°C)	#8	#6	#6	#10	#6	#6	#8	#4	#6	#10	#6	#6	#10	#6	#6	#10	#6	#6	#8	#6	#6	#10	#6	#6
Minimum Wire Size (75°C)	#8	#6	#6	#10	#6	#6	#8	#4	#4	#10	#4	#6	#10	#6	#6	#10	#6	#6	#8	#6	#6	#10	#6	#6
Minimum Wire Size (60°C)	#8	#4	#4	#10	#4	#4	#8	#4	#4	#10	#4	#4	#10	#4	#4	#10	#4	#4	#8	#4	#4	#10	#4	#4
Ground Wire Size	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Max Fuse Amps	35	60	60	30	60	60	35	70	70	30	70	60	35	60	60	30	60	60	35	60	60	30	60	60

Table 17: Wiring Requirements – 208/240 VAC Electric Heat 37-72 kBTU Models – Dual Branch Circuit

15kW, and 20kW Two Stage models may have a dual or single power supply. - Single power supply may require jumper bar or a jumper wire.
+ Refer to the National Electrical Code Table 250-95 for Non-Sheathed Conductor Ground Wire.
* Ground conductor **must be the same size and temperature rating** as the other conductors listed in Table 17.
** = Model Series – MM

		ELECTRIC HEATER SIZES					
		5 kW	10 kW	15 kW		20 kW	
	BRANCH CIRCUIT	1	1	1	2	1	2
240 VAC, 60 HZ, 1 PH	BTU	17,033	34,067	34,067	17,033	34,067	34,067
	kW	4.99	10	10	4.99	10	10
230 VAC, 60 HZ, 1 PH	BTU	15,876	33,686	33,686	15,876	33,686	33,686
	kW	4.65	9.78	9.78	4.65	9.78	9.78
220 VAC, 60 HZ, 1 PH	BTU	14,736	30,222	30,222	14,736	30,222	30,222
	kW	4.3186	8.8572	8.8572	4.3186	8.8572	8.8572
Heating Element Capacity	BTU	17,033	34,067	51,149		68,232	
	kW	4.99	9.9984	14.9904		19.9968	

Table 18: Electric Heater Electrical Data

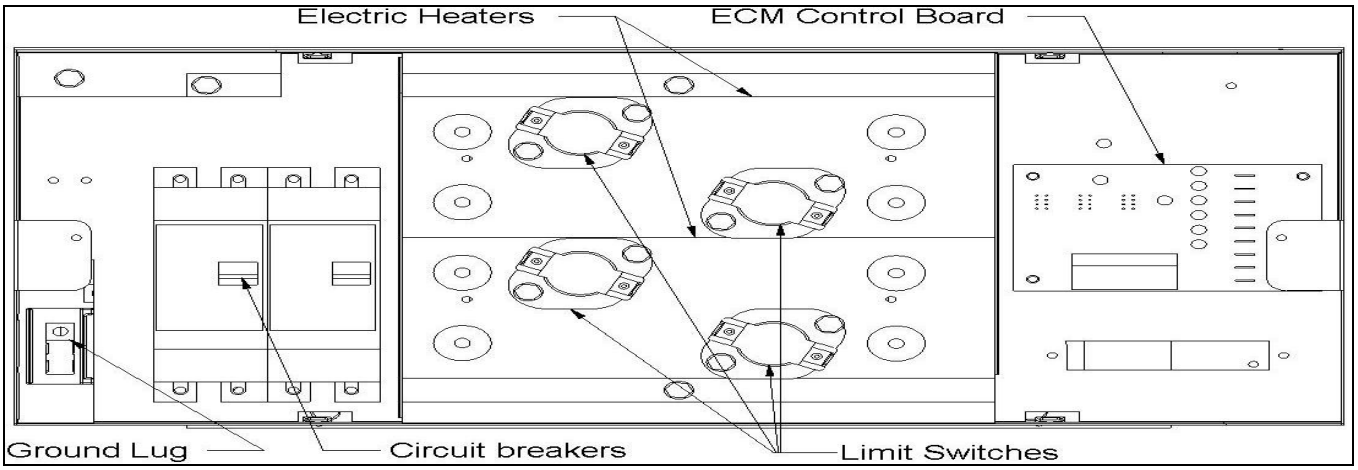

Figure 8: Component Locations – Electric Heat Control Box

Casing or cabinet must be permanently grounded in accordance with the National Electrical Code or other applicable codes.

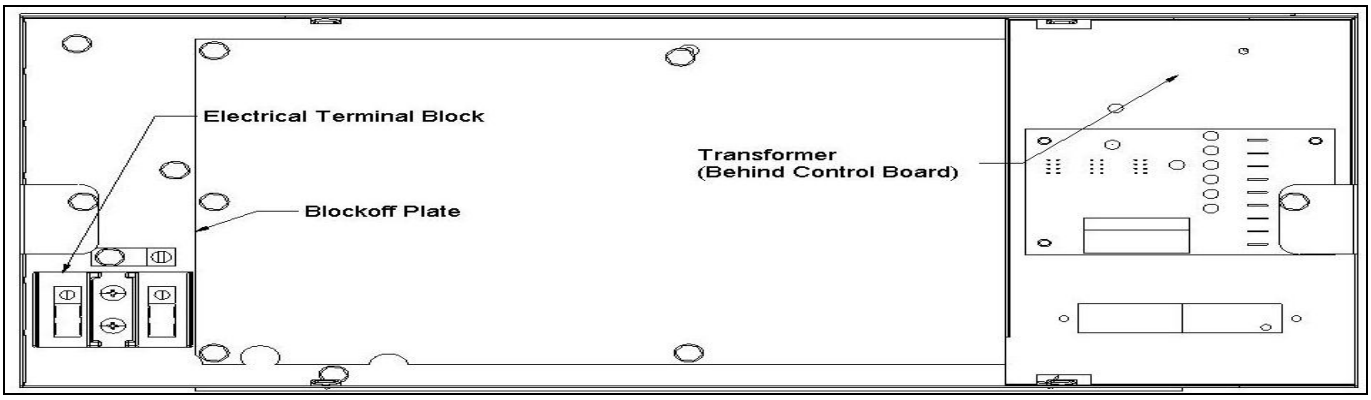

Figure 9: Component Locations – No Heat Control Box

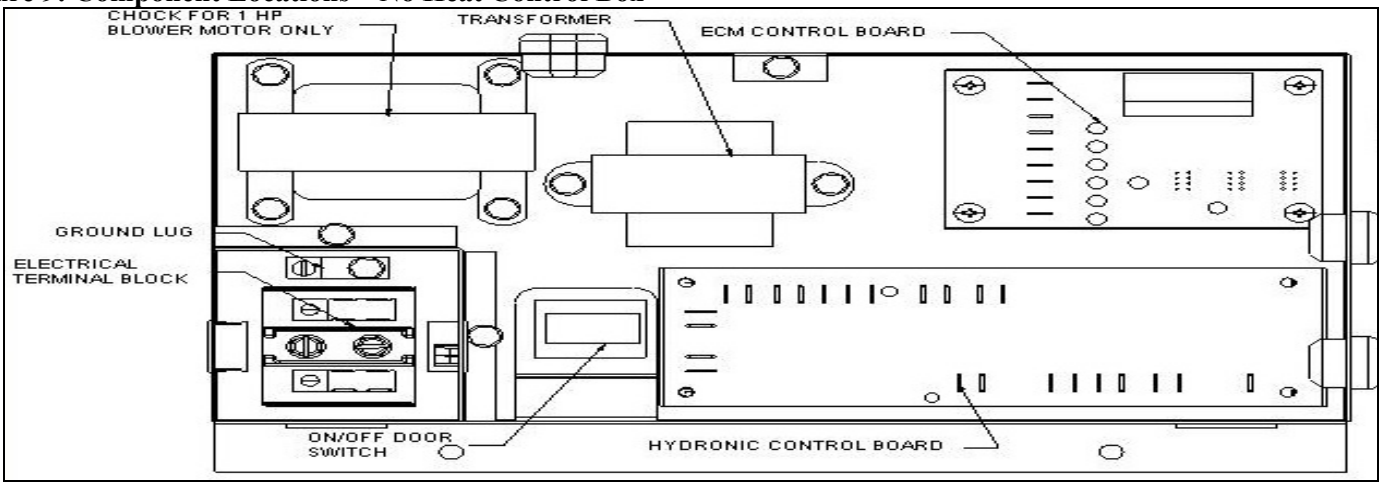

Figure 10: Component Locations – Hydronic Heat Control Box No Pump

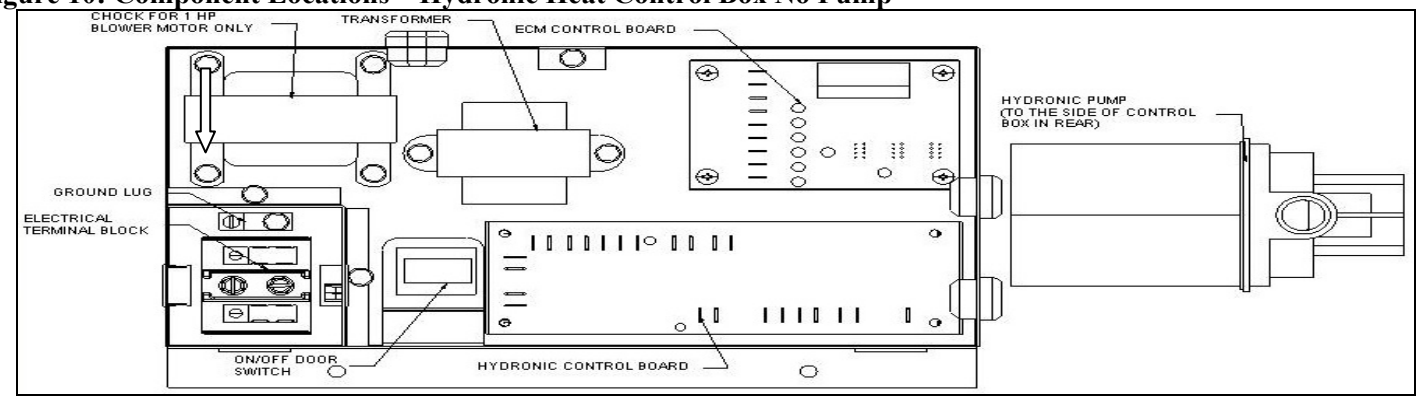

Figure 11: Component Locations – Hydronic Heat Control Box With Pump

⚠WARNING

For personal safety be sure to turn the electrical power "OFF" at the main entrance (Home Circuit Breaker Box) and at the unit control box circuit breakers before attempting any service or maintenance operations. Homeowners should never attempt to perform any maintenance which requires opening the air handler control box door.

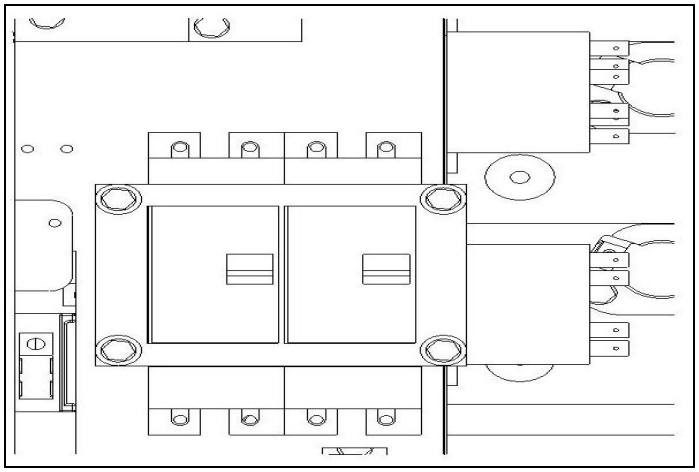

Figure 12: Control Box Circuit Breaker Location.

⚠WARNING

This air handler is not equipped with a shield that covers the line voltage electrical supply wires and the circuit breaker connections. Take precautions to prevent accidental electrical shock. Be sure to turn the electrical power "OFF" at the main entrance (Home Circuit Breaker Box) and at the control box circuit breakers before removing the front panel. Refer to Figure 13 for drawing of the front panel circuit breaker location.

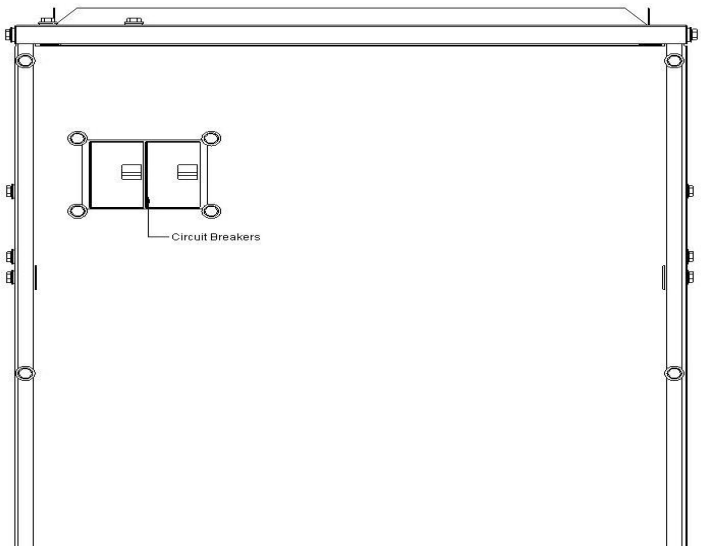

Figure 13: Circuit Breaker Front Panel Location

SECTION VIII: FIELD INSTALLED ELECTRIC HEATER KITS

This instruction covers the physical installation of the following electric heat kits on the MM series models. Refer to Tables 12 thru 18 for electrical specifications.

Models equipped with circuit breakers					
Model No	Cabinet Size	Voltage	Phase	Hertz	Heater kW
BSHK05B	Small	208/240	1	60	5
BSHK10B	Small	208/240	1	60	10
BMHK05B	Medium	208/240	1	60	5
BMHK10B	Medium	208/240	1	60	10
BMHK15B	Medium	208/240	1	60	15
BMHK20B	Medium	208/240	1	60	20
BLHK05B	Large	208/240	1	60	5
BLHK10B	Large	208/240	1	60	10
BLHK15B	Large	208/240	1	60	15
BLHK20B	Large	208/240	1	60	20

Table 19: Electric Heater Kit Model Numbers.

NOTE: The field installed electric heater kits with no circuit breakers will not be available for purchase after January 1, 2012 . The UL1995 safety standard governing electric heaters and circuit breakers on air handlers is requiring the use of circuit breakers on all electric heaters after January 1, 2012.

The models are MM are configured as follows:
Small cabinet **VE18,24 - **VT 18, 24 - **PS 18, 24
Medium cabinet **VE25, 30, 36 - **VT25, 30, 36 - **PS25, 30, 36.
Large cabinet **VE37, 42, 48, 60, 72 - **VT37, 42, 48, 60, 72 - **PS37, 42, 48, 60, 72.

The field installed electric heat accessories are used on cooling or heat pump models that were not purchased with electric heat from the factory. Each air handler model is approved for use with the field installed accessory electric heat kit.

INSTALLING THE HEATERS

1. Follow the instructions in the USERS INFORMATION MANUAL to properly shut down the air handler.
2. Remove the block off plate shown in Figure 9 and discard. Retain the screws, they will be used to secure the electric heater mount plate.
3. Insert electric heat kit into the opening where the block off plate was removed. Secure the mounting plate with the screws that were removed from the block off plate.
4. Connect the six pin male plug on the electric heater assembly to the six pin female plug mounted on the side of the low voltage control box divider panel.
5. Remove the wiring diagram from the kit, remove the paper that covers the adhesive back and place the electric heat wiring diagram over the wiring diagram located on the blower housing.
6. Follow the instructions in the USERS INFORMATION MANUAL to properly start up the air handler.

⚠ CAUTION

To prevent damage, carefully insert the electric heating assembly through the rectangular opening in the front of the discharge opening so the heat element support rod is seated into the hole on the back side of the discharge opening.

⚠ CAUTION

After installing the electric heater, a one inch clearance must be maintained on all sides of the supply air duct and/or plenum for a minimum of thirty six inches from the air handler discharge opening.

POWER SUPPLY CONNECTIONS

If the air handler has been installed prior to installing the electric heaters or if an older unit is being replaced, the supply power wires must be checked to make sure the wires are the proper sizes to handle the current load for the heaters Refer to Tables 12 thru 17 for correct wire size. If the supply power wire size is incorrect, new wires will need to be installed. Follow the instructions "Power Supply Wiring" on page 15 of these instructions for proper installation.

For circuit breaker models only - After the supply wiring has been connected to the circuit breakers you must remove the transformer and indoor blower motor wires from the terminal block and connect them to load side of circuit breaker #1. Refer to Figure 9 for terminal block location and Figure 8 for circuit breaker location.

LOW VOLTAGE CONNECTIONS

If the air handler was previously installed, nothing will need to change on the low voltage wiring. If this is a new installation refer to SECTION VII on page 19 of these instructions.

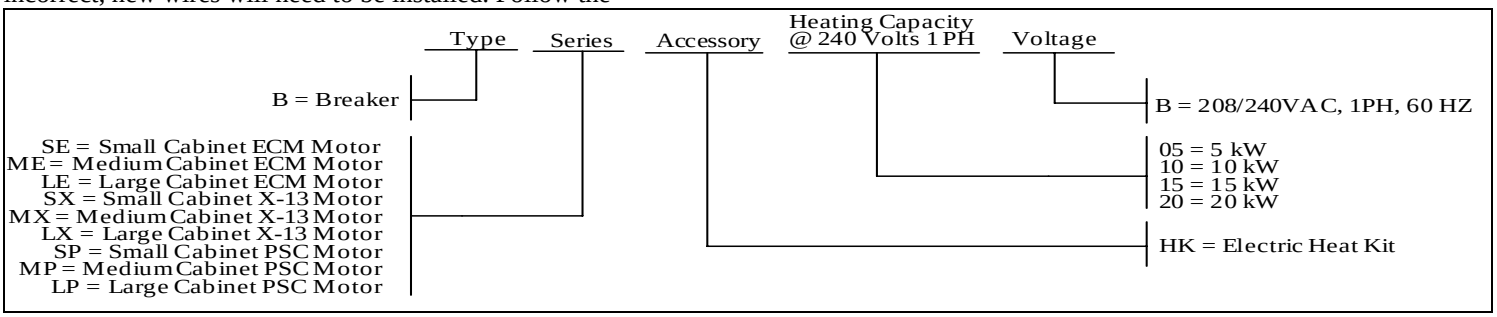

Table 20: Accessory Heater kit Nomenclature

SECTION IX: THERMOSTAT WIRING AND CONNECTIONS

Thermostat Wiring

Thermostat wires connect through side of furnace and should be no smaller than 22 gauge. Refer to Table 21 for recommended wire gauge, lengths and maximum current for each wire gauge.

Max. Thermostat Wire Length	Thermostat Wire Gauge	Thermostat Wire Maximum Current
0 - 100 Feet	22	3.0 Amps
0 - 125 Feet	20	3.0 amps
0 - 250 Feet	18	3.0 amps

Table 21: Low Voltage Wire Gauge and Max Lengths

Thermostat wires can enter through the side or top of the unit. When bringing wiring through the top or side of the furnace, cable connectors must be installed to hold wiring in place and to relieve any strain on the wiring.

The use of a five-conductor cable from the thermostat to the furnace is recommended for typical heating or heating/cooling installations with a two or three-conductor cable from the furnace to the condenser. The typical heating/cooling connections are listed in Tables 16, 17, 20 and 21.

A seven-conductor cable from the thermostat to the furnace is recommended for a typical heat pump installation with a five-conductor cable from the furnace to the condenser.

The thermostat wire colors and the typical heat pump heating/cooling connections are listed in Tables 18, 19, 22 and 23.

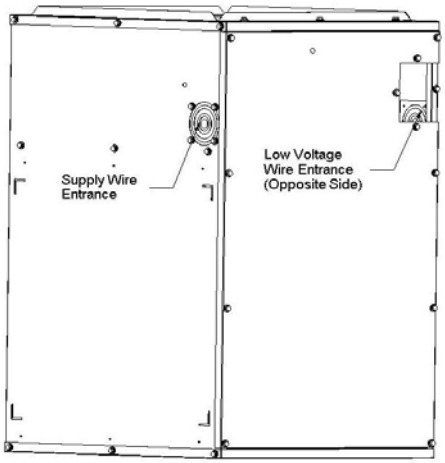

Figure 14: No Heat and Factory Installed Electric Heat Control Box Wiring Connection Locations

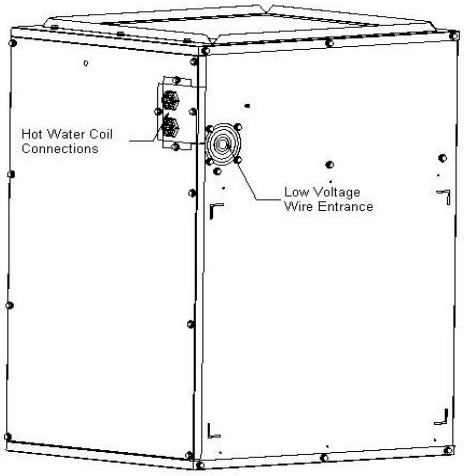

Figure 15: Hydronic Control Box Wiring Connection Locations

Thermostat Installation
The thermostat heat anticipator must be-set at 0.4 Amps if the thermostat has a manual heat anticipator adjustment. This setting should be checked at the time of installation.

The thermostat may be a “self-setting" type in which case no heat anticipator setting will be found on the thermostat, eliminating the need for any field adjustment.

Thermostat should be located on an inside wall in an open area to more closely regulate average room air, preferably, where there is air movement back to furnace. Locating height of thermostat is important. Thermostat should be located preferably in a hall way upstream from the furnace return airflow, not within three feet of from any windows and 52 to 66 inches above the floor.

DO NOT place the thermostat within three feet of any of the furnace supply air registers
DO NOT place the thermostat within three feet of any of the air conditioner supply air registers

Maintenance, operating and/or programming instructions are in the envelope accompanying the thermostat. Give the envelope to the home owner.

⚠ CAUTION

Do not locate thermostat within three feet of any of the following items:

1 Furnace supply air registers
2 Cooling unit supply air registers
3 Lights or heat lamps
4 Aquariums
5 Televisions, stereo, amplifiers, surround sound systems
6 Stoves or any cooking appliance
7 Refrigerator
8 Washer and/or dryer
9 Hot water tank
10 Sink or near any hot water
11 Within 15 feet of any electric space heater
12 Within two feet of any sunlight

Separate Heating and Cooling System; Same Thermostat
If the furnace and the cooling unit have separate transformers be sure to use a thermostat with isolated heating and cooling contacts “RC” and “RH” to prevent interconnection of Class II 24 Volt Systems Refer to Figures 16 thru 23. Cycle furnace and the air conditioner separately to make sure it will operate correctly.

Most new thermostats have separate heating and cooling contacts for use with homes that have a air handler and air conditioner that are completely separate and each have a 24 VAC transformer for system control. These thermostats have a “RC” terminal for cooling and a “RH” terminal for heating. Connect the cooling unit red wire from the “R” terminal on the outdoor unit to the “RC” terminal on the thermostat and the RED air handler pigtail wire to the “RH” terminal on the thermostat. Refer to Figures 16 thru 23 for typical low voltage wire connections.

If you have separate furnace and air conditioner with separate transformers and your thermostat does not have the “RC” and “RH” terminals it is recommended that you purchase a new thermostat. If the furnace and air conditioner are both connected to the thermostat “R” terminal it can cause transformer burnout or it can cause either the furnace or air conditioner control system to go into lockout.

Separate Heating and Cooling Units, Separate Thermostats
If the heating/cooling system in your house is a central heating and cooling system but, the furnace and the cooling unit are controlled by separate thermostats, then the use of a thermostat interlock switch is required in order to prevent the furnace and the air conditioner from operating at the same time.

⚠ CAUTION

When using separate thermostats a thermostat interlock system must be provided to prevent simultaneous operation of the furnace and air conditioner. Simultaneous operation can result in equipment overheating, equipment damage, and wasted energy.

Do Not connect the Yellow wire to the thermostat unless an outdoor unit is installed.

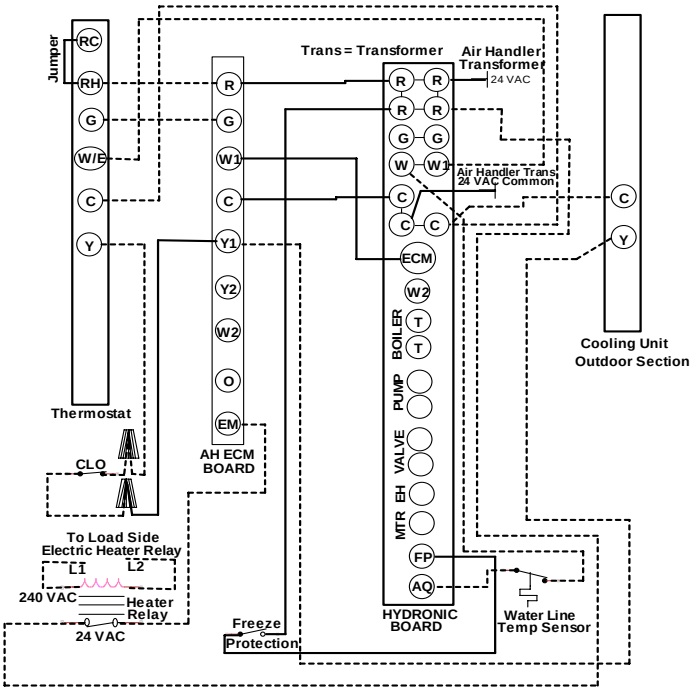

Figure 16 Typical Hydronic Single Stage Heating with Single Stage Cooling Wiring Diagram

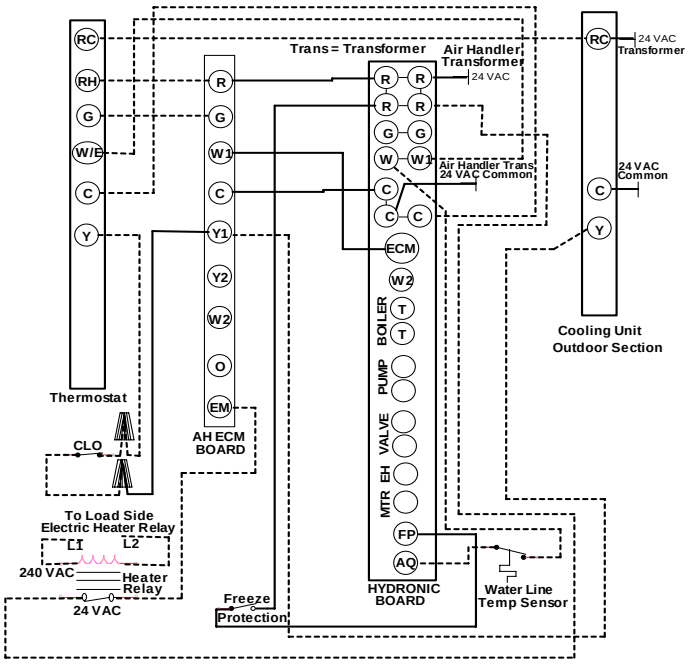

Figure 17: Typical Hydronic Single Stage Heating with Single Stage Cooling Wiring Diagram

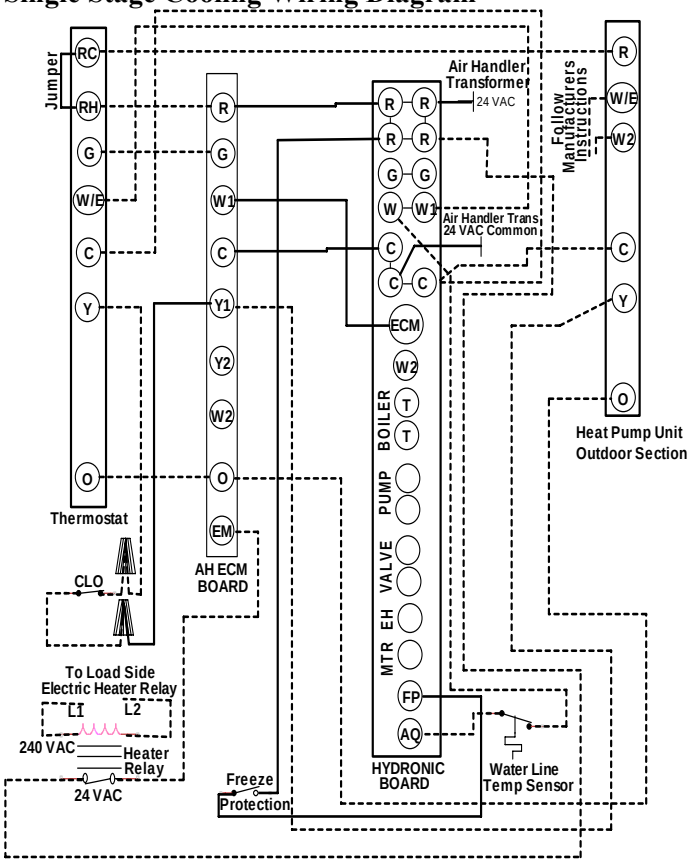

Figure 18: Typical Hydronic Single Stage Heating with Single Stage Heat Pump Wiring Diagram

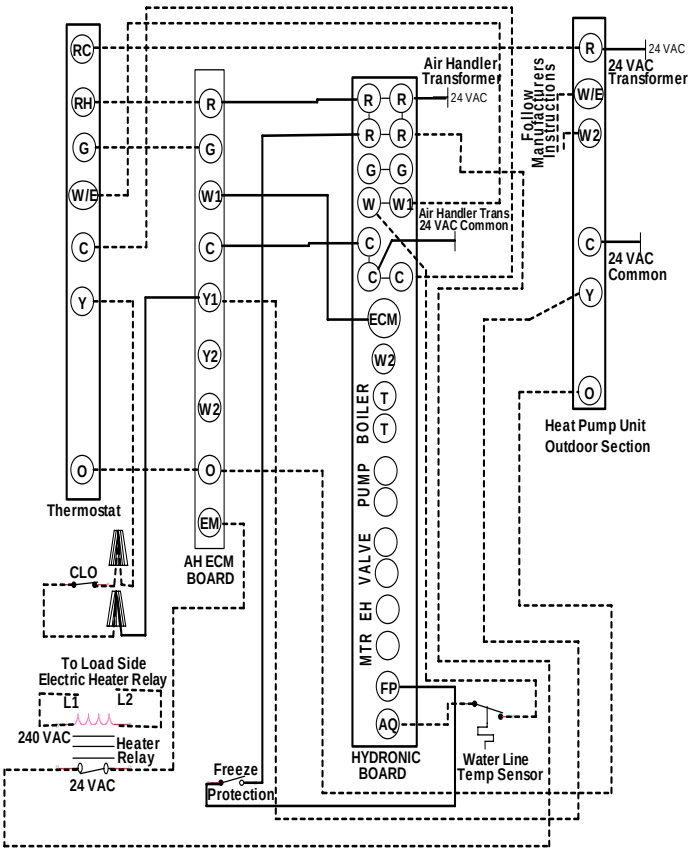

Figure 19: Typical Hydronic Single Stage Heating with Single Stage Heat Pump Wiring Diagram

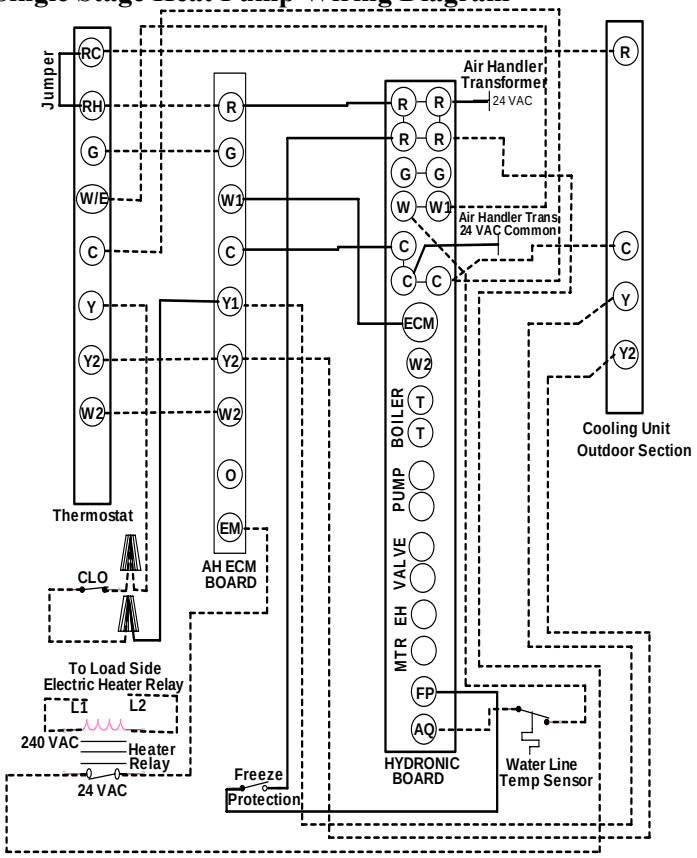

Figure 20: Typical Hydronic Two Stage Heating with Two Stage Cooling Wiring Diagram

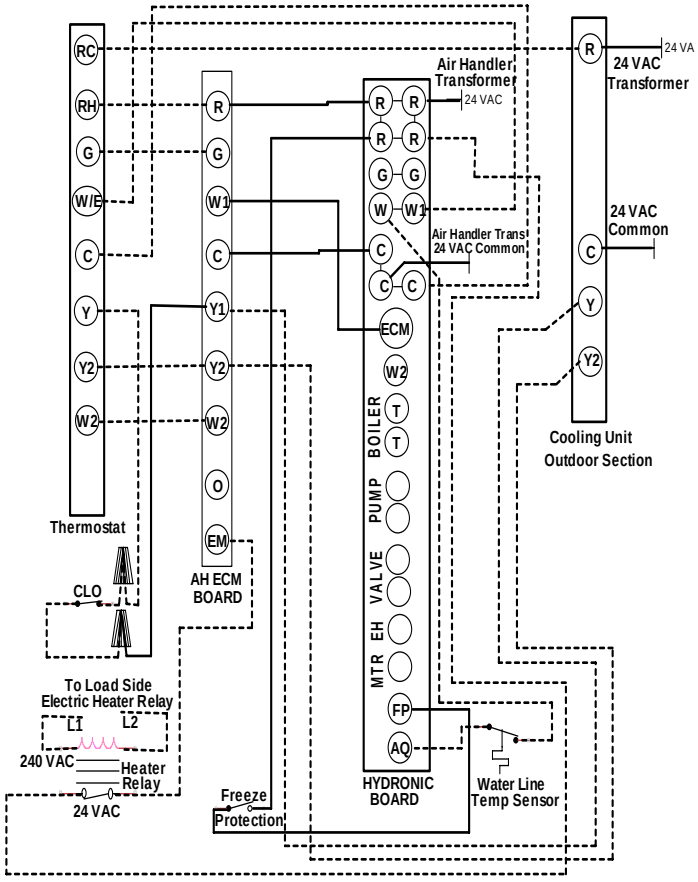

Figure 21: Typical Hydronic Two Stage Heating with Two Stage Cooling Wiring Diagram

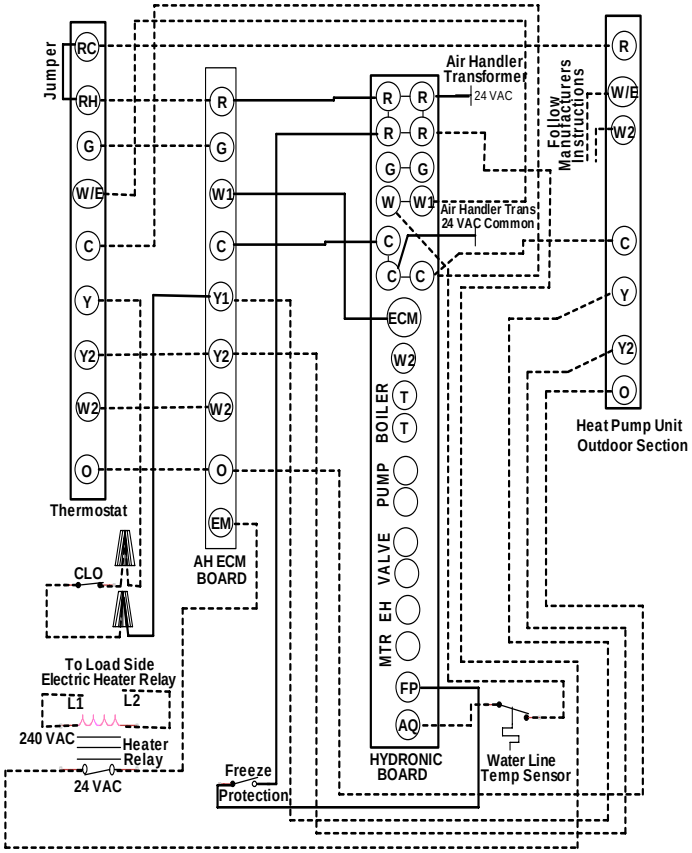

Figure 22: Typical Hydronic Two Stage Heating with Two Stage Heat Pump Wiring Diagram

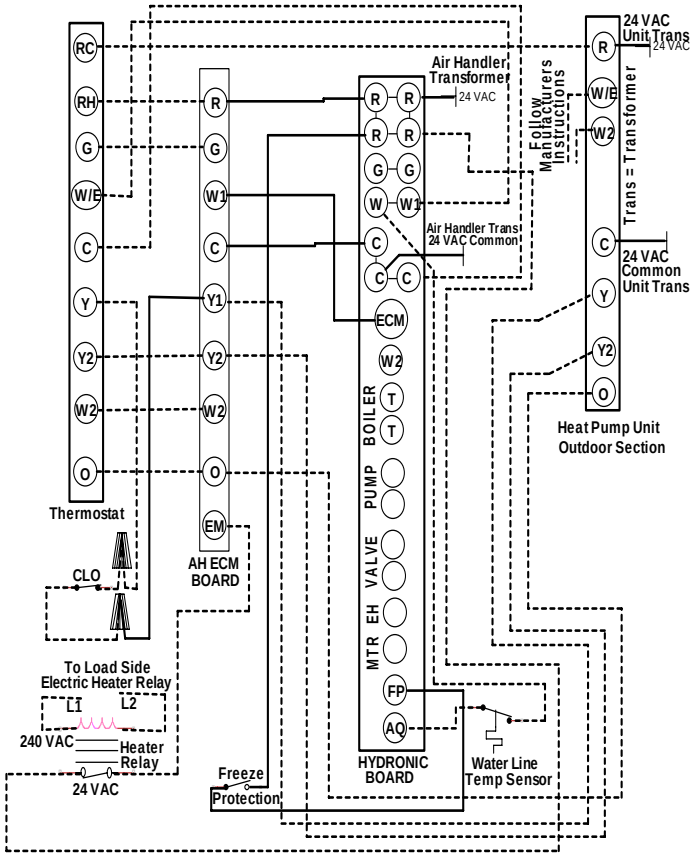

Figure 23: Typical Hydronic Two Stage Heating with Two Stage Heat Pump Wiring Diagram

Heat Pump / Heating / Cooling Thermostat Wire Color Code

Wire Color	Description	Letter Code	Furnace Pig Tail Wire Connection	Thermostat Connection	Condenser Connections
RED	24 VAC	R	Red	R	N/A
WHITE	Heat (1st Stage Heat)	W	White	W/E	N/A
GREEN	Indoor Fan	G	Green	G	N/A
YELLOW	Cooling - Stage 1	Y	Yellow	Y or Y1	Y or Y1
BROWN	24 VAC Common	BRN	Brown	C	C
BLACK	Heat (Optional 2nd Stage Heat)	BLK	Black	W2	N/A
ORANGE	Heat Pump Reversing Valve Solenoid	O	Orange	O	O
BLUE	Cooling - (Optional 2nd Stage Cooling)	BLU	Blue	Y2	Y2
PURPLE	EM (Emergency Heat)	PURP	Purple	N/A	N/A
PINK	HUM (Dehumidification)	PNK	PINK	HM	N/A
GREY	AQ (Aquastat Sensor Switch)	GRY	GREY	N/A	N/A

Table 22: Recommended Heating / Cooling / Heat Pump Thermostat Wire Color Codes and Connections.
Note: Transformer secondary wire color is yellow. Place the yellow transformer secondary wire on the piggyback terminal with the green wire located on the COM terminal on the R200A/53 Hydronic Control Board.

Typical Heating/Cooling Thermostat Wiring Connections

1. Remove blower / control box access door.
2. Remove the control box cover.
3. Install a grommet or strain relief in the 9/16" hole on the top and the right side of the air handler casing to protect the thermostat wire cable.
4. Strip ½" of the insulation on the end of each wire.
5. Insert the wire cable from the thermostat thru the 9/16" hole into the control box and place the thermostat wire cable next to the low voltage pigtails. Secure the thermostat wire cable with a strain relief to prevent wire connections from being pulled apart.
6. Connect the Red (24 VAC) supply thermostat wire to the Red low voltage pigtail wire and secure with a wire nut.
7. Connect the White (First stage heating) thermostat wire to the White low voltage pigtail wire and secure with a wire nut.
8. Connect the Green (Indoor fan) thermostat wire to the Green low voltage pigtail wire and secure with a wire nut.
9. Connect the Yellow (Air conditioning) wire from the thermostat with the Yellow low voltage pigtail wire on the air handler and with the Red wire from the compressor contactor on the condenser unit. Fasten the three wires together securely with a wire nut.
10. Connect the Grey (24 VAC Common) wire from the thermostat with the Grey low voltage pigtail wire on the air handler and with the Grey (Common) wire from the compressor contactor on the outdoor unit. Fasten the three wires together securely with a wire nut.
11. Connect the Brown (2nd stage heating) thermostat wire to the brown low voltage pigtail wire and secure with a wire nut.
12. If a two stage outdoor unit is used then connect the "W2" wire from the outdoor unit to the brown wires discussed in step 11 and secure with a wire nut.

NOTE: If single stage thermostat is used on a two stage air handler connect the black and the white air handler pigtail wires and the white thermostat wire together; then, secure all three wires with a wire nut.

Typical Heat Pump - Heating/Cooling Thermostat Wiring Connections

1. Remove the blower / control box access panel.
2. Remove the control box cover.
3. Install a grommet or a strain relief in the 9/16" diameter hole on the top and the right side of the air handler casing to protect the thermostat wire cable.
4. Strip ½" of the insulation on the end of each wire.
5. Insert the wire cable from the thermostat thru the 9/16" hole into the control box and place the thermostat wire cable next to the low voltage pigtails. Secure the thermostat wire cable with a strain relief to prevent wire connections from being pulled apart.
6. Connect the Red (24 VAC) supply wire from the thermostat to the Red low voltage pigtail wire on the air handler and with the Red wire from the "R" terminal on the outdoor unit. Fasten the three wires together securely with a wire nut.
7. Connect the White (first stage heating) wire from the thermostat to the White low voltage pigtail wire on the air handler and the White wire from the "E" terminal on the outdoor unit. Fasten the three wires together securely with a wire nut.
8. Connect the Green (indoor fan) wire from the thermostat to the Green low voltage pigtail wire on the air handler and securely fasten the two wires together with a wire nut.
9. Connect the Red wire from the "Y" terminal on the outdoor unit. Fasten the three wires together securely with a wire nut.
10. Connect the Grey (24 VAC Common) wire from the thermostat with the Grey low voltage pigtail wire on the air handler and with the Grey (Common) wire from the "C" terminal on the outdoor unit. Fasten the three wires together securely with a wire nut.
11. Connect the Orange (Reversing Valve Solenoid) wire from the thermostat with the Orange wire from the "O" terminal on the condenser unit. Fasten the two wires together securely with a wire nut.
12. Connect the Brown (2nd stage heating) thermostat wire to the brown low voltage pigtail wire and secure with a wire nut.

13. If a two stage outdoor unit is used then connect the "W2" wire from the outdoor unit to the brown wires discussed in step 12 and secure with a wire nut.

NOTE: If single stage thermostat is used on a two stage air handler connect the brown and the white air handler pigtail wires and the white thermostat wire together; then, secure all three wires with a wire nut.

SECTION X: MOTOR, BLOWER AND FURNACE STARTUP SECTION

⚠WARNING

To avoid personal injury or property damage, make certain that the motor leads cannot come into contact with non-insulated metal components of the unit.

Selecting the X-13 Blower Speed

This furnace uses the new X-13 high efficiency motor. This motor operates on 240 VAC. The motor speed tap are 24 VAC, 0.03 amps, 60 Hz, 1 PH. The speed taps can be changed by removing the black wire from the isolation relay terminal #4 or the red wire from the isolation relay terminal #6 and connecting either the blue, orange, or purple wire to the terminal. Table 23 shows the X-13 motor lead connection labeling and the connection definitions.

Terminal	Connection
C	Speed Tap Common - 24 VAC Common
L	Supply Voltage - 240 Vac Line 1
G	Ground Connection
N/L2	Supply Voltage - 240 Vac Line 2
1	Low Speed Tap - 24 VAC Input
2	Medium-Low Speed Tap - 24 VAC Input
3	Medium Speed Tap - 24 VAC Input
4	Medium-High Speed Tap - 24 VAC Input
5	High Speed Tap - 24 VAC Input

Table 23: X-13 Motor Terminal Connections

Total 24 VAC circuit amps are 0.14 amps.

Change Motor Speeds - X-13 Motor

1. Turn off **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
2. Remove the blower door and switch furnace circuit breaker(s) to "OFF".
3. Disconnect the wire from the isolation relay terminal and reconnect the desired wire to the terminal. Here is the X-13 motor speed tap wire color code.
   Black wire is High Speed, Orange wire is Medium High Speed, Blue wire is Medium Speed, Purple wire is Medium Low Speed, and Red wire is Low Speed.
4. Turn the circuit breakers on and reinstall air handler blower door.
5. Turn on **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
6. Set the thermostat to the desired temperature.

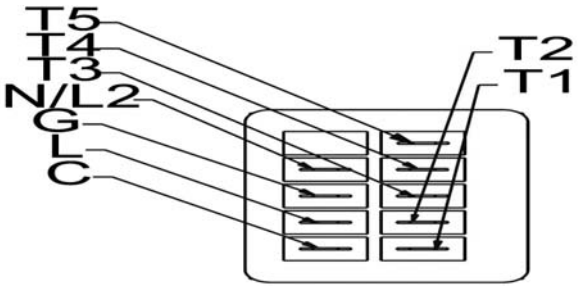

Figure 24: X-13 Motor Terminals

Replacing the X-13, ECM, 3/4 HP PSC and 1 HP PSC Blower Motor

1. Turn off all electrical supply circuits to the air handler at the main service panel.
2. Remove air handler blower door and switch the air handler circuit breaker(s) to "OFF"
3. Disconnect the power cable and the speed tap cable that connect to the blower motor.
4. Remove the two screws on the right side and the two screws on the left side of the blower mounting plate. Refer to Figure 25 for screw locations.

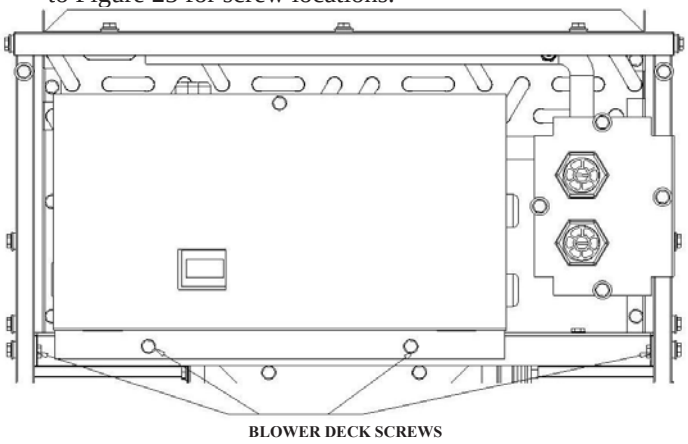

Figure 25: Blower Mounting Plate Screw Locations

5. Slide the blower out of the blower compartment and set on the floor.
6. Loosen the wheel set screw by placing on wrench on the screw head and turning counter clockwise. Loosen the wheel set screw until the shaft can spin freely 360° while inside the wheel hub. The wheel set screw is located on the wheel hub on the opposite side of the motor.
7. Remove the blower motor from the blower housing by removing the screws on the sides of the housing that secure the blower to the housing
8. Remove the blower motor mount assembly by loosening the belly band bolt and nut, then, remove the belly bans and mount legs.
9. Insert the new blower motor into the blower mounting bracket making sure the mounting legs are properly placed into the belly band and the legs are straight. Tighten the belly band screw and nut until belly bans is securely fastened to the motor.
10. Place the motor into the housing so the mount leg holes line up with the rivet nuts in the housing. Place the screw into the mount leg holes and tighten until the mount legs are securely fastened to the housing.

11. Center the blower wheel in the housing, turn the motor shaft so the wheel set screw is located on the center of the flat spot of the shaft and tighten the set screw.
12. Connect the same two cables that were removed in step 3.
13. Slide the blower assembly into the blower deck and insert the screws on the right and left sides of the mounting bracket.
14. Switch the circuit breakers to ON and replace air handler blower door.
15. Turn on all electrical supply circuits to the furnace at the main service (House Circuit Breaker) panel.
16. Set the thermostat to the desired temperature.

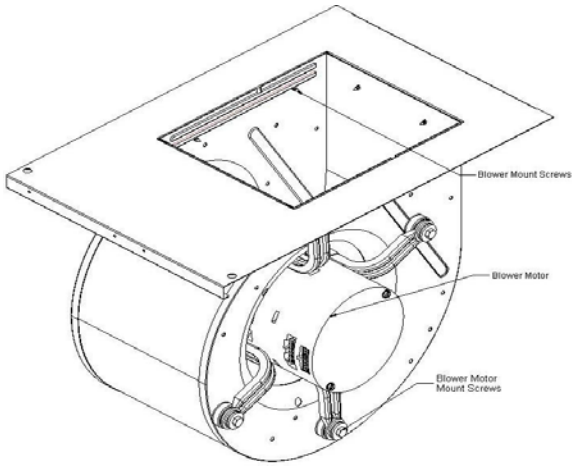

Figure 26: Blower Assembly and Blower Deck

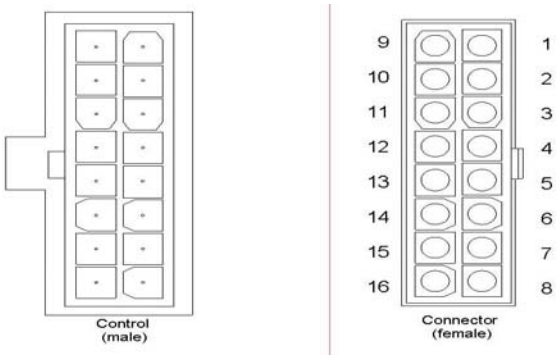

Figure 27: ECM Motor Control Pin out

Pin Number

1	Common C1
2	W/W1
3	Common C2
4	Delay Tap Select
5	Cool Tap Select
6	Y1
7	Adjust Tap Select
8	Output –
9	Reversing Valve (Heat Pump Only)
10	Humidistat (BK)
11	Heat Tap Select
12	24 VAC (R)
13	2nd Stage Heat (EM/W2)
14	2nd Stage Cool (Y/Y2)
15	Fan (G)
16	Output +

Table 24: ECM Motor Control Connector Terminal Descriptions

Change Motor Speeds - ECM Motor

1. Turn off **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
2. Remove the blower door and switch furnace circuit breaker(s) to "OFF".
3. Motor speed can be changed for both heating and cooling modes. Heating blower motor speed change is done by moving the jumper on the **"HEAT"** jumper pins to a different setting. Pin out is shown below:
   A = High Speed, B = Medium High Speed, C = Medium Speed, and D = Low Speed.
   The blower motor speed can also be changed for cooling by moving the jumper on the **"COOL"** jumper pins to a different setting. Pin out is shown below:
   A = High Speed, B = Medium High Speed, C = Medium Speed, and D = Low Speed.
   The **ADJUST** pin is used to increase or decrease the blower motor speed by 10% to 12% from the **HEAT** or **COOL** setting. Placing the jumper in normal will allow no increase or decrease in the motor speed. The **+** setting will increase the motor speed by 10% to 12% above the **HEAT** or **COOL** setting. The **–** setting will decrease the motor speed by 10% to 12% below the **HEAT** or **COOL** setting.

⚠WARNING

The **test** setting on the ADJUST jumper pins must not be used except for trouble shooting to determine if the blower operates. The **test** setting allows the motor to run only at 70% of normal operation and bypasses any delays.

The **PROFILES** jumper pins are used for blower motor on and off delays. See Climate Profiles in the back of the **SERVICE AND MAINTENANCE MANUAL** of these instructions to determine the proper setting for the climate in your area.

4. Turn the circuit breakers on and reinstall air handler blower door.
5. Turn on **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
6. Set the thermostat to the desired temperature.

Change Motor Speeds - PSC Motor

1. Turn off **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
2. Remove the blower door and switch furnace circuit breaker(s) to "OFF".
3. Disconnect the wire from the isolation relay terminal and reconnect the desired wire to the terminal. Here is the PSC motor speed tap wire color code.
   Black wire is High Speed, Blue wire is Medium Speed, and Red wire is Low Speed. Brown wires for capacitor.
4. Turn the circuit breakers on and reinstall air handler blower door.
5. Turn on **all** electrical supply circuits to the air handler at the main service (House Circuit Breaker) panel.
6. Set the thermostat to the desired temperature.

Replacing the 1/3 HP PSC and 1/2 HP PSC Blower Motor

1 Turn off all electrical supply circuits to the air handler at the main service panel.
2 Remove air handler blower door and switch the air handler circuit breaker(s) to “OFF”.
3 Disconnect the power cable and the speed tap cable that connect to the blower motor.
4 Remove the two screws on the right side and the two screws on the left side of the blower mounting plate. Refer to Figure 26 for screw locations.
5 Slide the blower out of the blower compartment and set on the floor.
6 Loosen the wheel set screw by placing on wrench on the screw head and turning counter clockwise. Loosen the wheel set screw until the shaft can spin freely 360° while inside the wheel hub. The wheel set screw is located on the wheel hub on the opposite side of the motor.
7 Remove the blower motor from the blower housing by removing the three (3) screws on the sides of the housing that secure the blower to the housing
8 Place the motor into the housing so the mount leg holes line up with the rivet nuts in the housing. Place the three (3) screws into the mount leg holes and tighten until the mount legs are securely fastened to the housing.
9 Center the blower wheel in the housing, turn the motor shaft so the wheel set screw is located on the center of the flat spot of the shaft and tighten the set screw.
10 Connect the same two wires that were removed in step 3.
11 Slide the blower assembly into the blower deck and insert the screws on the right and left sides of the mounting bracket.
12 Switch the circuit breakers to ON and replace air handler blower door.
13 Turn on all electrical supply circuits to the furnace at the main service (House Circuit Breaker) panel.
14 Set the thermostat to the desired temperature.

SECTION XI: FINAL SYSTEM CHECKOUT

1. Refer to appropriate wiring diagram and recheck all wiring connections. Ensure that all wiring connections are tight.
2. Check blower motor connectors to make sure they are not damaged or loose.
3. If the control box cover was removed; reinstall control box cover.
4. Switch circuit breaker(s) to “ON” position.
5. Switch the furnace circuit breakers in the main service (House Circuit Breaker) panel to the ON position.
6. Set the blower selector switch to the ON position and check all of the duct connections for air leaks. Seal any air leaks found.
7. Set the blower selector switch to the AUTO position.
8. Set the thermostat above the room temperature to check for proper operation of the electric heaters.
9. Set the thermostat to the desired temperature.

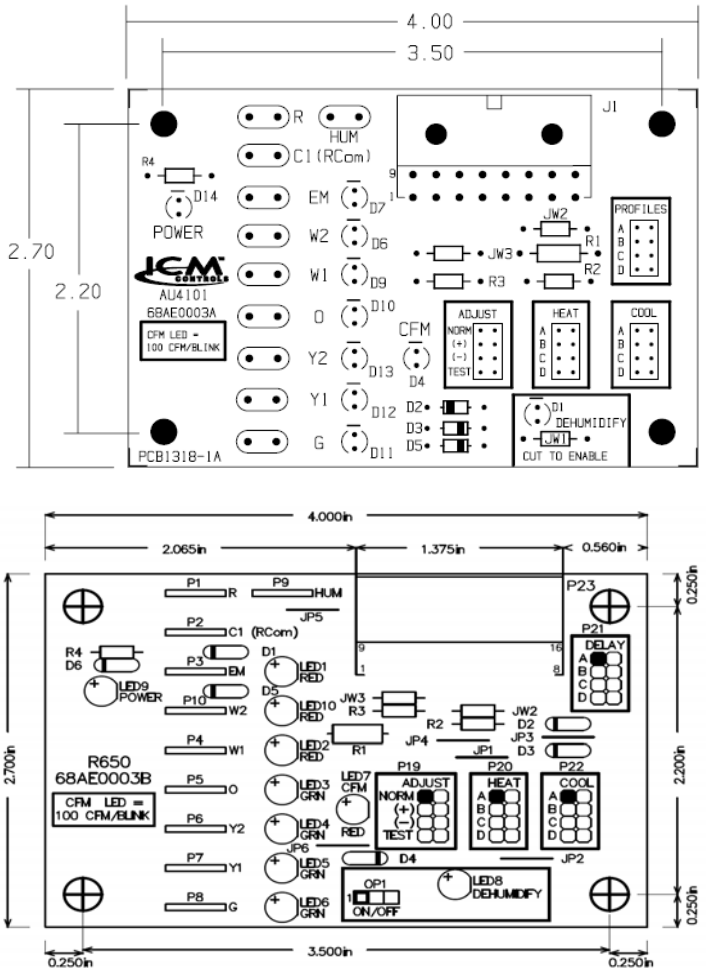

Figure 28: ECM Control Board Diagrams

DEHUMIDIFY – The ECM board has a 0 ohm resistor or a jumper pin that provides 24 VAC to the HUM terminal keeping the motor from initiating the dehumidify program. Once the o ohm resistor is cut, a 24 VAC signal must be present from the thermostat or humidistat when the humidity is below the set point. **The humidistat contacts must open when humidity is above the set point**.

The jumper pin configuration can be changed by moving the jumper from the OFF position to the ON position. Once the jumper pin has been changed to the ON position the humidistat will turn the dehumidify program in the motor on and off. The LED on the board will be lit when the motor is running the “dehumidify” programmed speed.

If the ECM motor dehumidify program is no longer desired by the home owner, simply move the jumper pin back to the OFF position to disable the motor program.

Control Board Flash Code

The ECM control board has a CFM flash code when the air handler is operation to indicate the current CFM.

- Typically flashes once per 100 CFM.
- To determine the selected CFM, count the number of flashes between pause flashes and multiply by 100.
- The sequence is followed by a 10 second OFF period signifying the end of the flash code, then the flash code starts over

Note: Since static will be low due to the removed panel, RPM will be lower to maintain the selected CFM

Example of the flash code:

The air handler is operating at 1400 CFM. The flash code will be 1 second flashes with pulse flashes, 0.1 seconds apart, 14 times, followed by a 10 second off, then the flash code starts over.

Thermostat Heat Anticipator

Some thermostats have a heat anticipator setting that must be set to the settings shown below in order to function correctly. If the heat anticipator setting is too low the furnace will short cycle. If the heat anticipator setting is too high the furnace will run long cycles thus causing the temperature to overrun the temperature setting. This will cause the home owner to feel hot by the time the blower completes its cycle; then cold, by the time the furnace cycles on again.

The heat anticipator should be set to the following settings.
For 5kW, 10kW, 15kW and 20 kW Models Set at 0.4

SECTION XII: WIRING DIAGRAMS

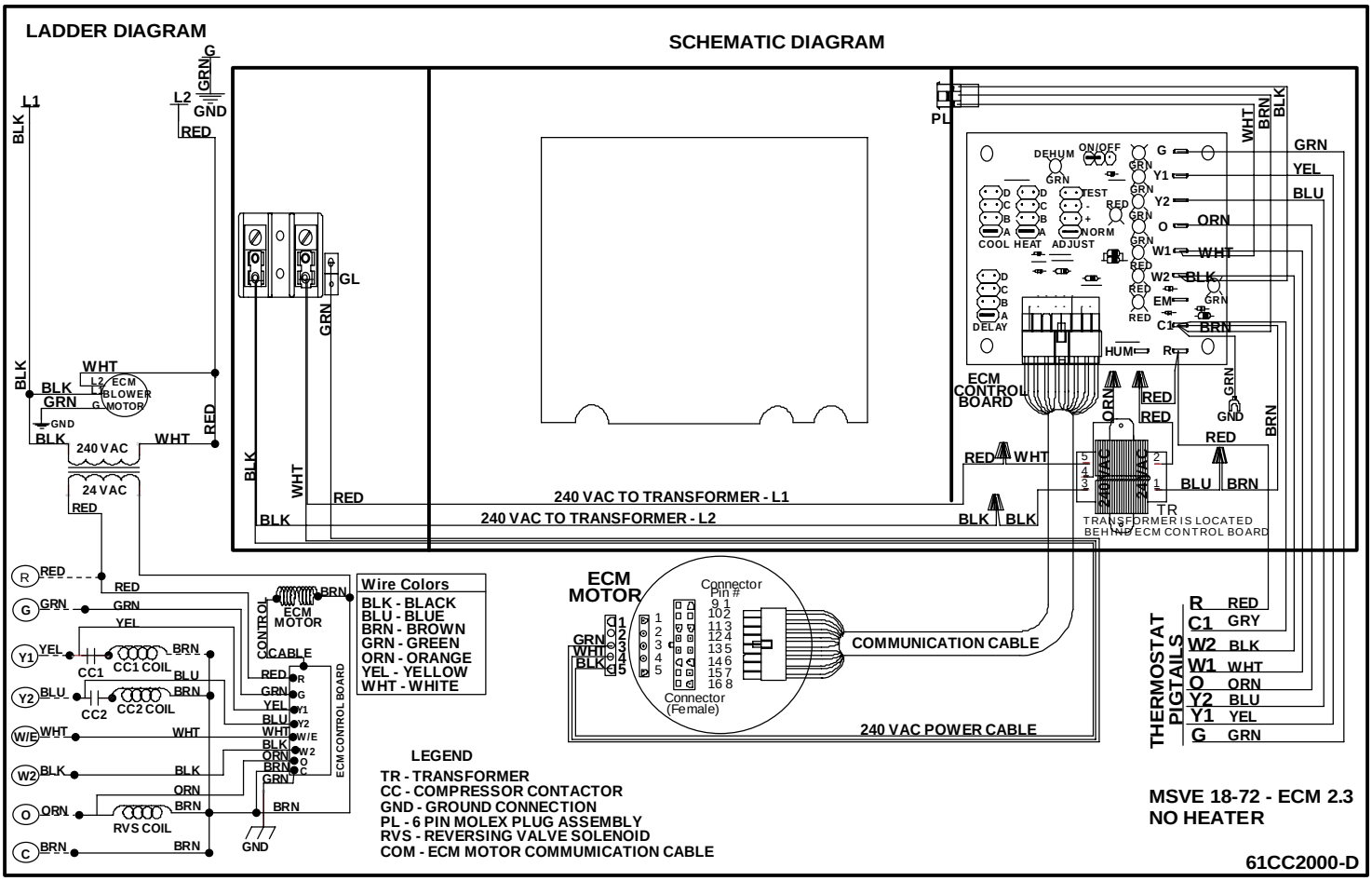

Figure 29: MMVE 18-72 - ECM 2.3 - 0 kW Heater

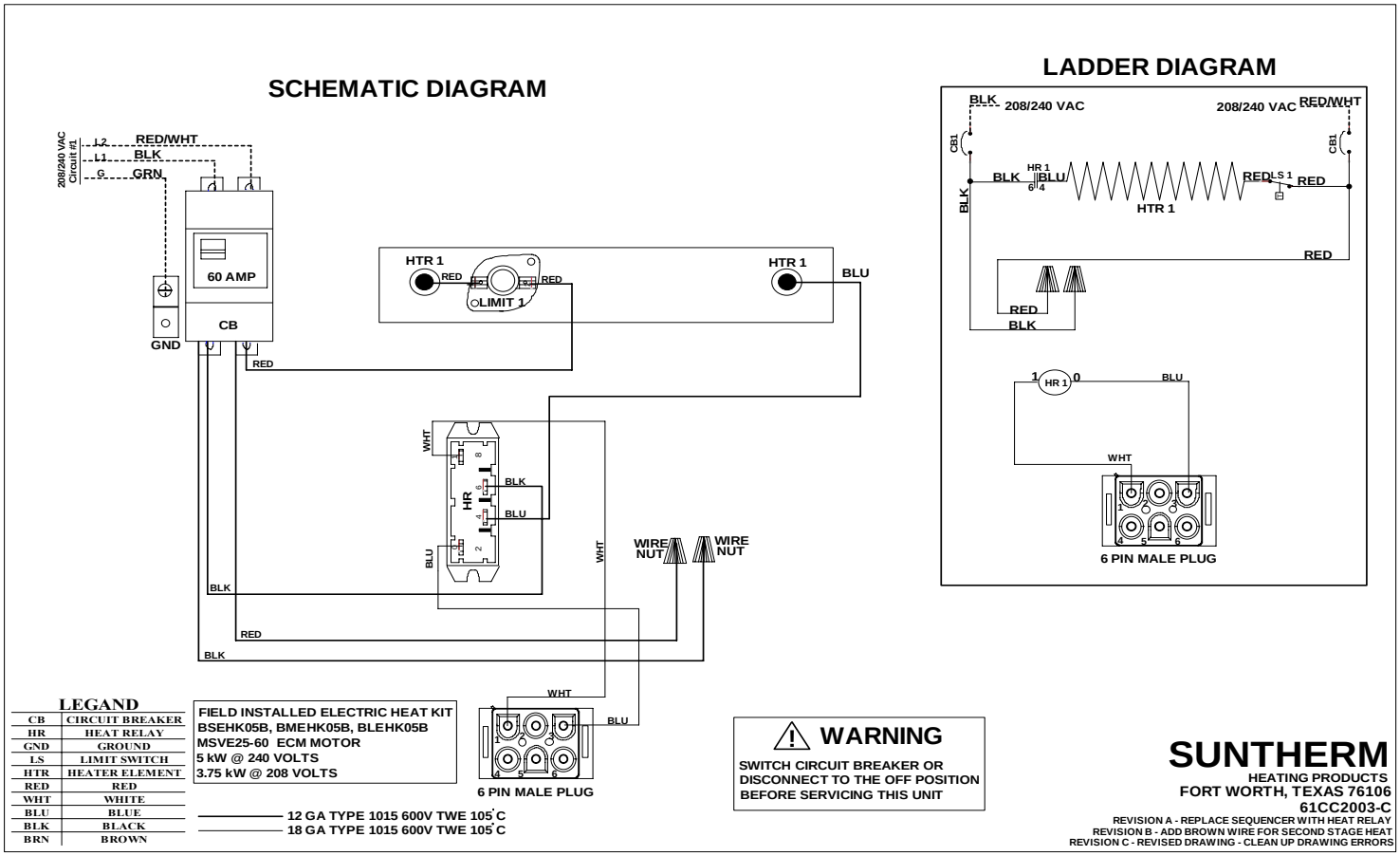

Figure 30: MMVE 18-72 - ECM 2.3 - 5 kW Field Installed Heater Kit

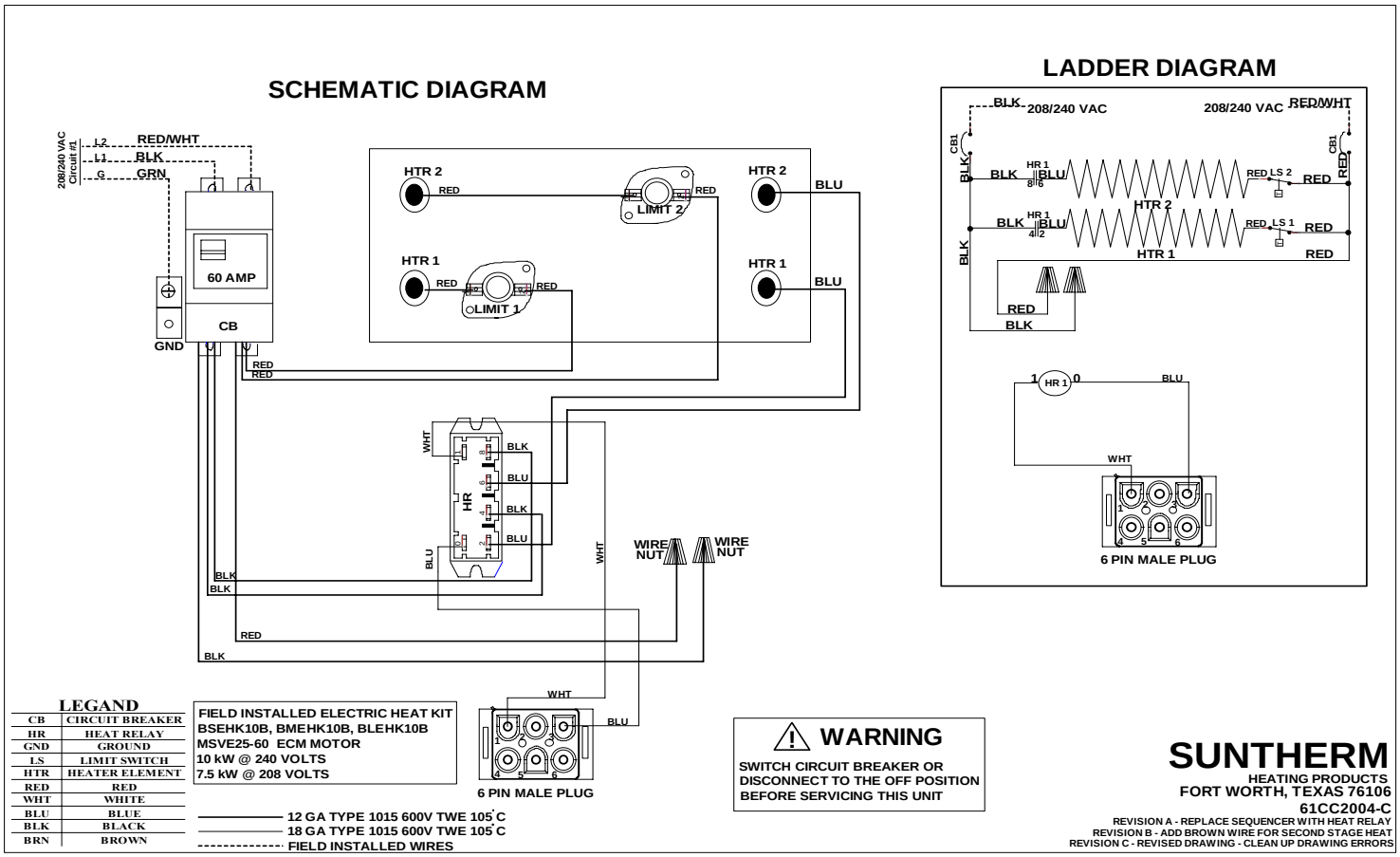

Figure 31: MMVE 18-72 - ECM 2.3 - 10 kW Field Installed Heater Kit

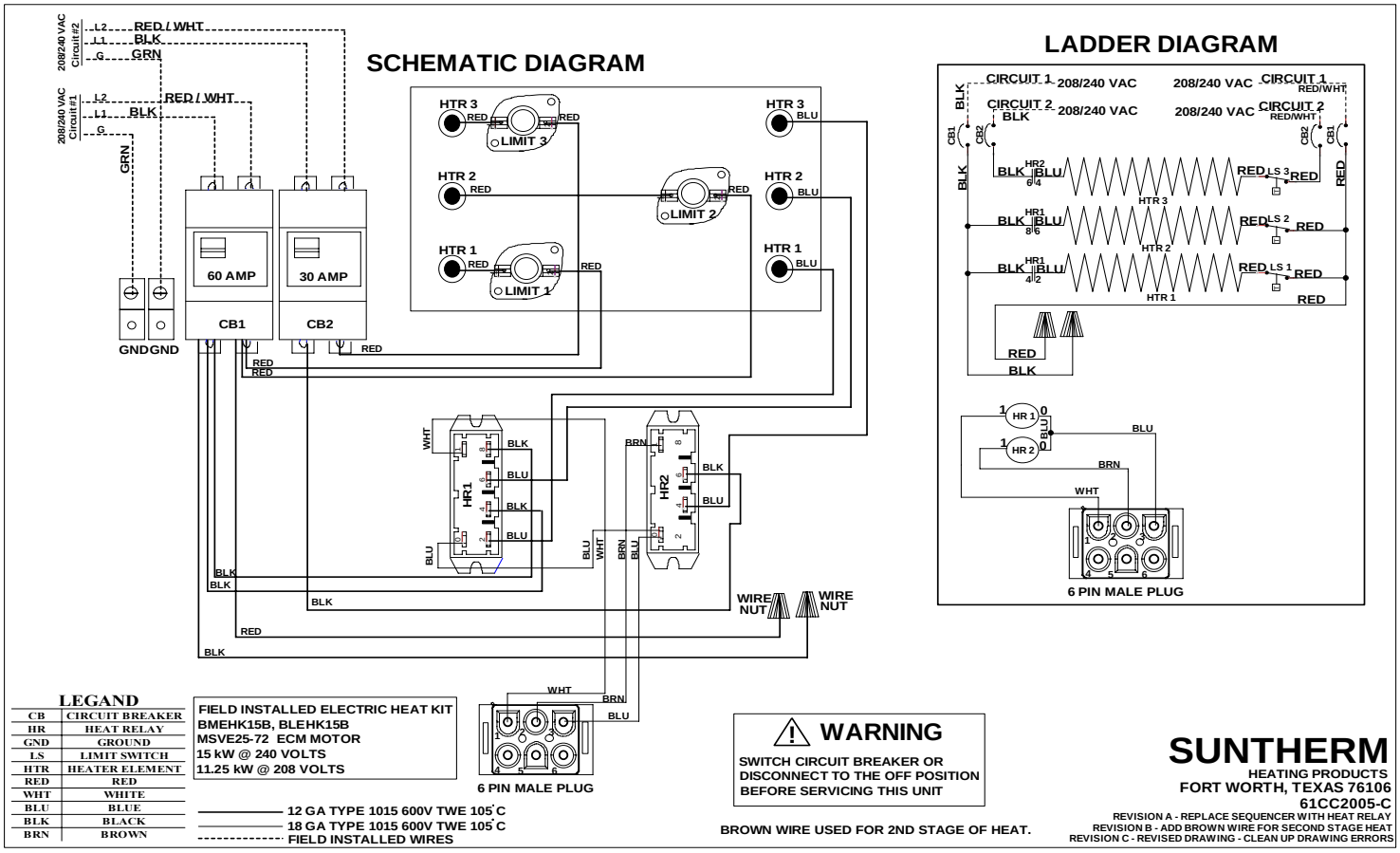

Figure 32: MMVE 37-72 - ECM 2.3 - 15 kW Field Installed Heater Kit

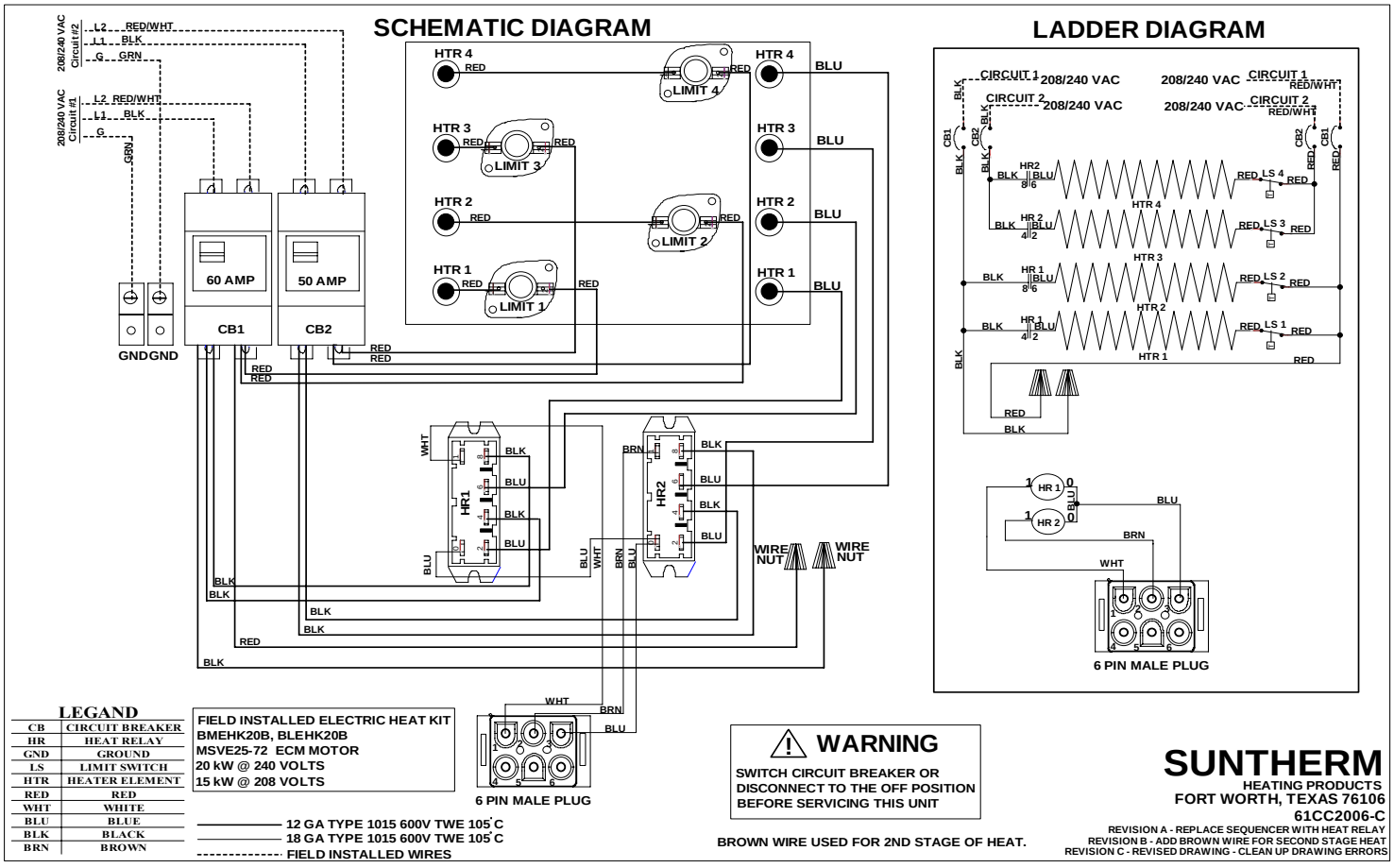

Figure 33: MMVE 37-72 - ECM 2.3 - 20 kW Field Installed Heater Kit

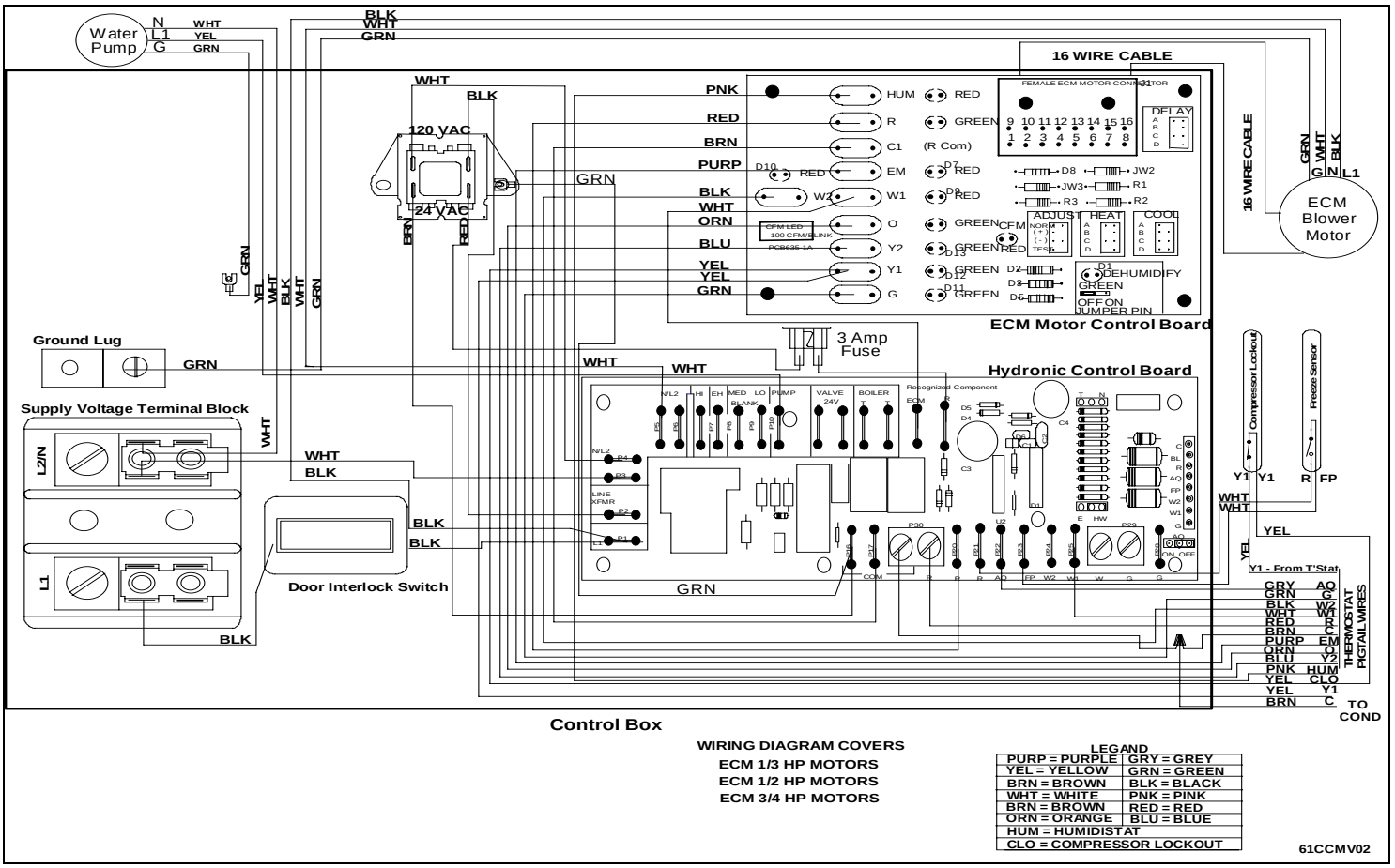

Figure 34: MMVE 18-36 – ECM 2.3 – Hydronic Heat with Pump – No Choke.

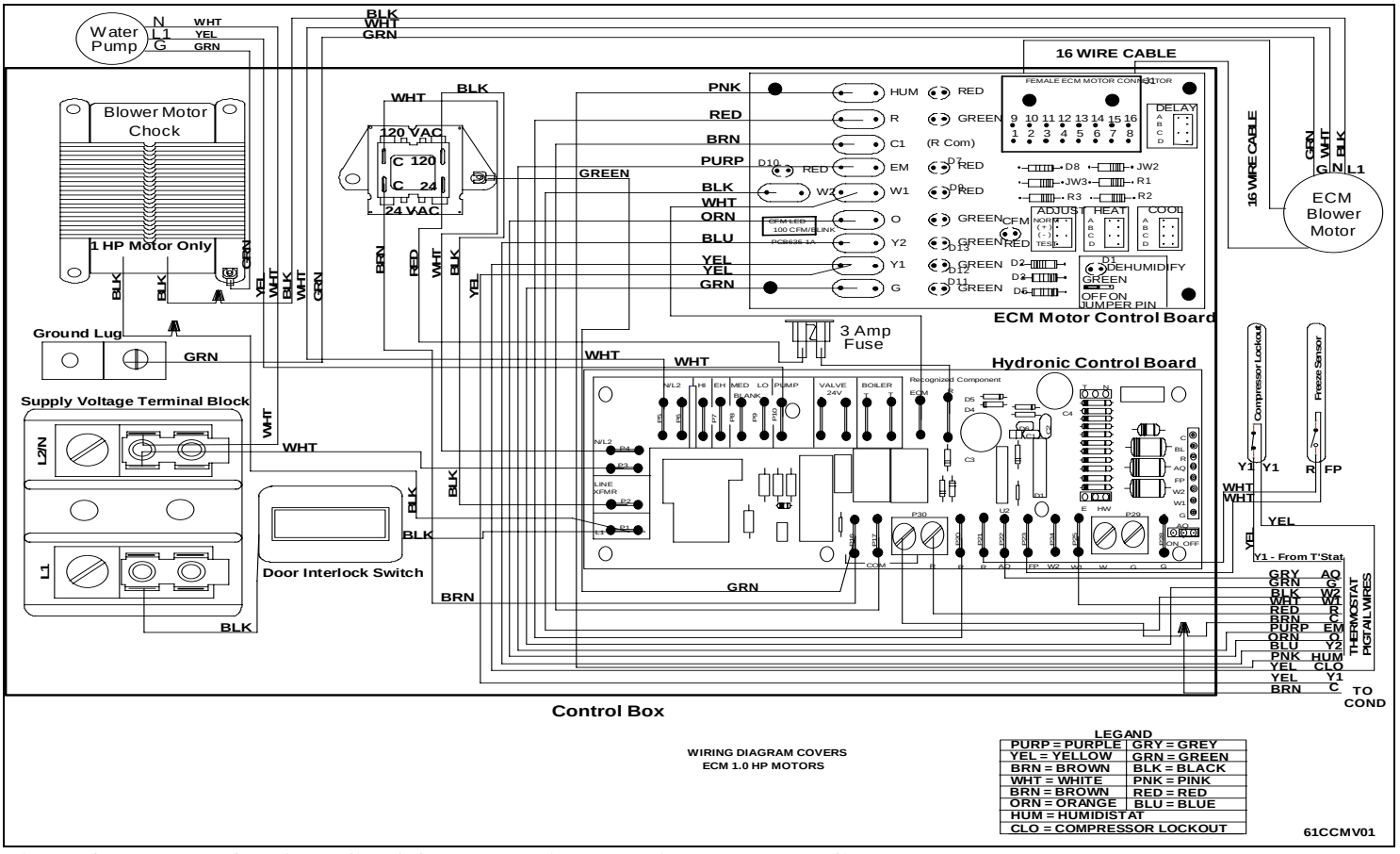

Figure 35: MMVE 37-72 – ECM 2.3 – Hydronic Heat with Pump and Choke.

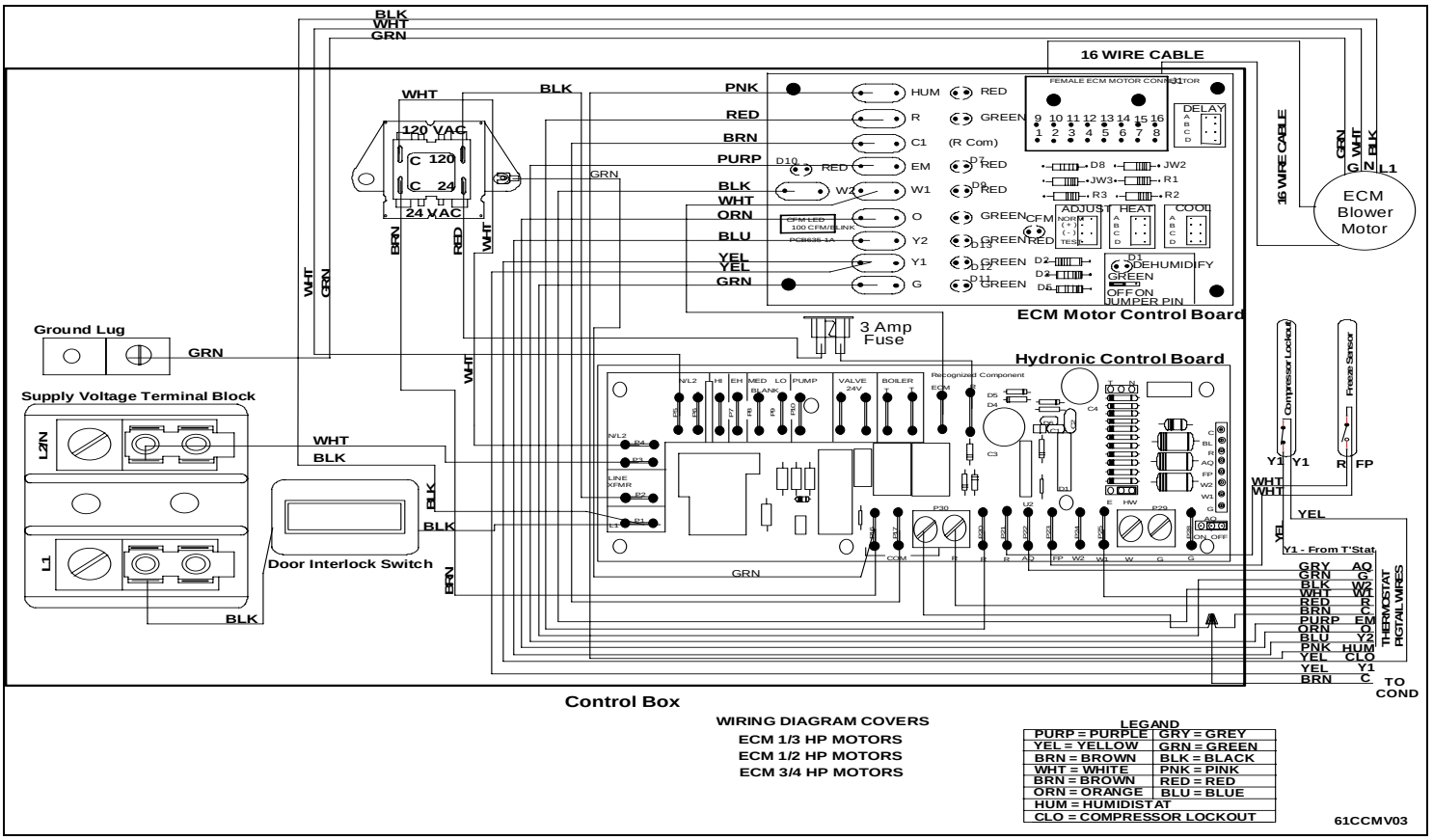

Figure 36 MMVE 18-36 – ECM 2.3 – Hydronic Heat – No Pump or Choke.

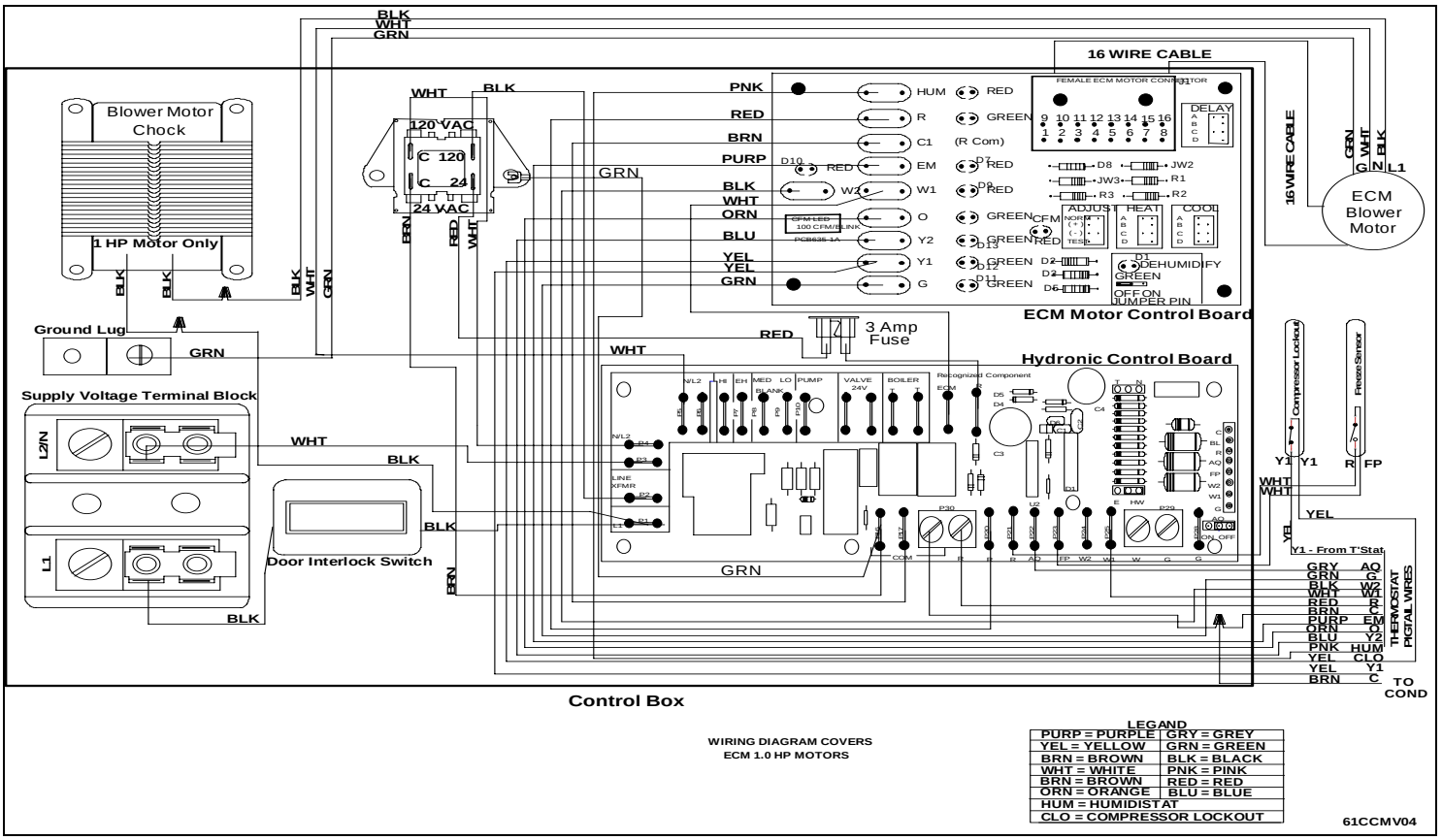

Figure 37 MMVE 37-72 – ECM 2.3 – Hydronic Heat – with Choke - No Pump.