SunTherm™ HEATING PRODUCTS

USERS INFORMATION MANUAL

Multi-Position, Upflow and Horizontal DX and Chilled Water Cooling with Electric Heating
MODELS: MLVT & MLPS SERIES

For Installation In:
1. Modular Homes & Buildings
2. Residential Homes

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CONTACT INFORMATION

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Fort Worth, TX 76106
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SECTION I: GENERAL

The following list includes important facts and information regarding the air handler and its inclusions.

1. Air Handler is rated at 240 volts AC at 60 Hertz for electric heat models.
2. Air Handler is available in a small or medium cabinet size.
3. All air handlers are equipped with a blower for A/C or Heat Pump operation.
4. Multi-position models are designed for upflow and horizontal application.
5. This air handler must not be operated without the doors installed.

NOTE: This air handler and its components are listed as a combination AC or Heat Pump system by ETL for sale in the United States and Canada.

⚠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.

Do not store or use gasoline or other flammable vapors and

USERS MUST READ ALL INSTRUCTIONS IN THIS MANUAL AND THIS MANUAL MUST BE SAVED 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

Any adjustment, service or maintenance by the home owner and/or user may create a condition where the operation of the product could cause personal injury or property damage.

Only qualified service personnel, a contractor, or an installer may refer to the service and maintenance section of this manual for assistance or for additional information on this appliance.

⚠ CAUTION

This product requires periodic routine maintenance and cleaning of the exterior surfaces by the homeowner or user to remove dust and debris. Any additional service must be performed by qualified personnel. This appliance must be serviced and maintained as specified in these instructions and/or to any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.

⚠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.

SAFETY REQUIREMENTS

1. This air handler must be kept clear and free of combustible materials, gasoline and other flammable vapors and liquids.
2. Insulating materials may be combustible. The air handler must be kept free and clear of insulating materials. The air handler area must be examined when installed in an insulated space or when insulation is added to be sure that the insulation material has been kept away from the appliance.
3. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly Startup or Shutdown this appliance.
4. If overheating occurs, turn off the power to the appliance and contact a qualified contractor, installer, or service agency.

⚠DANGER

Do not use this appliance if any part has been under water. A flood damaged furnace is extremely dangerous. Attempts to use the air handler can result in a fire.

A qualified contractor, installer, or service agency must be contacted to inspect the air handler for any water damage and replace all components, control system parts, or electrical parts that have been damaged. If enough damage is present, the air handler may need to be replaced

5. NEVER - Store flammable materials of any kind near your appliance. Gasoline, solvents and other volatile liquids should be stored only in approved containers outside the home. These materials vaporize easily and are extremely dangerous.
6. NEVER – Store cleaning materials such as bleaches, detergents, powder cleaners, etc. near the appliance. These chemicals can cause corrosion of the air handler sheet metal and the electric heaters, the blower and the electrical controls.
7. NEVER – Use the area around the appliance as a storage area for items which could block or obstruct the normal air flow to the air handler or the space around the appliance. The flow of air is required for safe and proper operation. Never block or obstruct air openings used for ventilation and cooling of the air handler electrical components.
8. Refer to the appliance rating plate for the air handler model number, for the operating specifications for safe operation.
9. Provide clearances for servicing ensuring service access is allowed for the control box, electric elements and the blower.
10. 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.
11. If the air handler is installed in a residential garage it must be installed so that the electric heaters are located not less than 18 inches above the floor and the air handler must be

located or protected to avoid physical damage by vehicles.

⚠WARNING

FIRE OR ELECTRICAL HAZARD

Servicing heating/cooling equipment can be hazardous due to electrical components.

Only trained and qualified personnel can service or repair heating/cooling equipment. The home owner **must never** try to perform service, repair or maintenance on this appliance.

Untrained service personnel can perform only 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

12. 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 modular home and residential home construction practices. These instructions are to be followed and are the minimum requirement to perform service or repairs on this appliance.

SECTION III: OWNERS INFORMATION AND SEASONAL INFORMATION

How The Air Handler Works – Heating Cycle

The appliance is equipped with the controls necessary for proper and safe operation. Circuit breaker location is shown in Figure 2.

The air handler is equipped with a relay(s), time delay relay, transformer, circuit breakers (Electric Heat Models Only), and a blower assembly. The transformer provides 24 VAC to the thermostat.

When the thermostat calls for heat on the electric heat models, the relay(s) energize sending 240 VAC thru the limit switches to the electric heaters causing them to get hot. The indoor fan motor is then energized on the selected heating speed tap after an "ON" time delay and the circulating blower draws cool air from the living space(s), passes it across the heater coils and circulates the warmed air through the duct work to the living space(s). When the thermostat is satisfied the electric heaters are de-energized. The blower is also de-energized after an "OFF" time delay and the heating cycle has ended and the air handler is ready for the next call for heat to start the next cycle.

How the Air Handler Works – Cooling Cycle

When the thermostat calls for cooling, 24 VAC is sent to the compressor contactor causing it to close energizing the compressor and the outdoor fan motor. The indoor fan motor is then energized on the selected cooling speed tap after an "ON" time delay and the circulating blower draws air from the living space(s), passes it across the cooling coil in the air handler and circulates the cooled air through the duct work to the living space(s). When the thermostat is satisfied the compressor contactor is de-energized turning off the compressor and the outdoor fan motor. The blower is also de-energized after an "OFF" time delay and the cooling cycle has ended and the air handler is ready for the next call for cooling to start the next cycle.

When the thermostat calls for heat pump, 24 VAC is sent to the compressor contactor causing it to close energizing the compressor and the outdoor fan motor. The reversing valve is energized causing the flow of the refrigerant to reverse and heat the coil inside the air handler. The indoor fan motor is then energized on the selected heat pump speed tap after an "ON" time delay and the circulating blower draws air from the living space(s), passes it across the coil in the air handler and circulates the warmed air through the duct work to the living space(s). When the thermostat is satisfied the compressor contactor is de-energized turning off the compressor and the outdoor fan motor. The blower is also de-energized after an "OFF" time delay and the heat pump cycle have ended and the air handler is ready for the next call for heat pump to start the next cycle.

Examination of the air handler

The home owner should perform a visual examine the furnace every month for any defects or problems. The items to be inspected are:

1. The physical support of the furnace is sound without sagging cracks, gaps, etc. around the base so as to provide a seal between the support and the base.
2. The furnace casing for any obvious signs of deterioration from rust or corrosion.
3. The return and supply duct connections are physically sound and are sealed to the furnace casing.
4. The furnace must be serviced by qualified personnel annually, preferably at the start of each heating season.

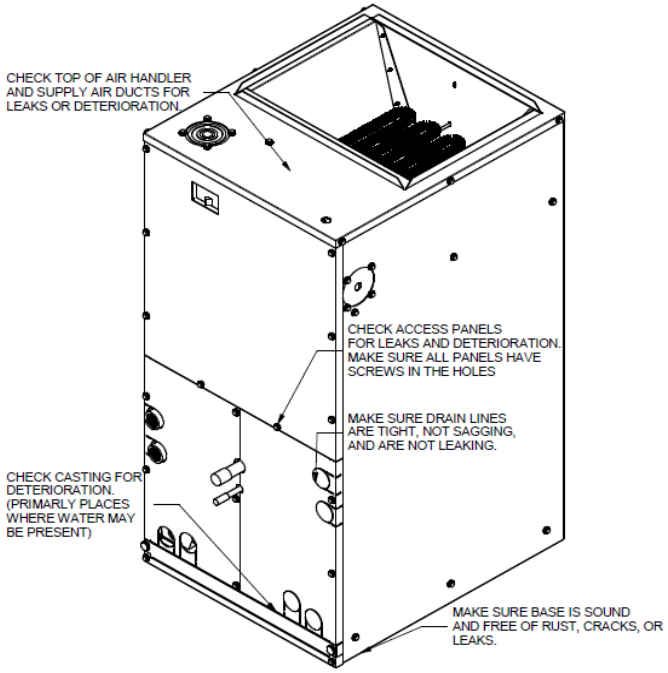

Figure 1: Air Handler Examination Check Points

The Service Technician
The air handler's best friend is a qualified service technician. If the appliance gives any indication of improper operation, call the service technician. The service technician is allowed to perform the normal routine care of your appliance. He can detect potential problems and make corrections before trouble develops. Preventative maintenance of this type will allow the air handler to operate with minimal concerns to the homeowner and will add years of comfort.

Warranty and Responsibilities
It is the sole responsibility of the homeowner to make certain the furnace has been properly installed and adjusted to operate properly.

The manufacturer warrants the appliance to be free from defects in material or workmanship for a stated time in the warranty agreement. The manufacturer will not be responsible for any repair costs to correct problems due to improper setup, improper installation, improper furnace adjustments, installing parts or components on the appliance that are not listed for use with this appliance, improper operating procedures by the user or repairs performed by the appliance user or owner.

Some specific examples of service calls which will be excluded from warranty reimbursement are:
1. Correcting faulty duct work in the home. This can be due to not enough ducts or ducts are too small to provide proper air flow through the air handler.
2. Correcting electrical wiring problems in the supply wiring to the air handler.
3. Resetting circuit breakers or on/off switches used for servicing.
4. Problems caused by installation and operation of any air conditioning unit, heat pump, or other air quality devise which is not approved for use with this air handler.
5. Adjusting or calibrating the thermostat.
6. Problems caused by construction debris which has fallen into the air handler.
7. Replacement of fuses.
8. Problems caused by dirty air filters.
9. Problems caused by restrictions in the return or supply air flow causing low air flow.

The home owner should establish a firm understanding of these responsibilities with the installer or Service Company so there will be no misunderstanding of what will be covered under warranty at a later date.

While you are away
The air handler is equipped with safety shutoff devices which are designed to prevent the appliance from overheating in case of a malfunction. For this reason it is never practical to assume the appliance will operate unattended for a long period of time. An example of a malfunction that can cause significant damage to the home would be:
If the blower motor fails the heaters will cycle on the safety shutoff devices while the temperature inside your home continues to drop. All of the water pipes will freeze once the temperature falls below 32°F.

If you are planning to be away from home for a long period of time, have someone check on your home everyday, especially when the outside temperatures will be below 35°F to ensure the air handler is operating properly. This may prevent water pipes from freezing.

The Furnace Fails to Operate Properly
If any abnormalities are observed while the furnace is operating normally, perform the following checks:
1. Check the setting on the thermostat to make sure the thermostat is set above the room temperature.
2. Check to see if the electrical power is turned on at the circuit breakers at the main service circuit breaker box or check any on/off switches that may be used for service disconnect switches.
3. Check any inline fuses that may have been installed on the air handler to determine if it has blown.
4. Make sure the air filters are clean, return grilles clean, are not obstructed, and supply air registers are open.

If the cause of the malfunction is not obvious do not attempt to service the appliance yourself. Call a qualified service agency/company to repair the appliance.

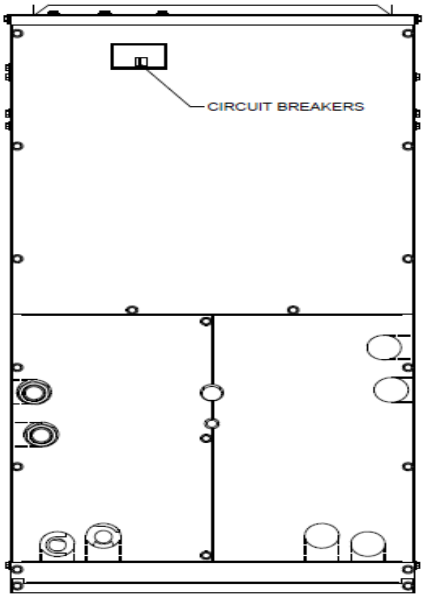

Figure 2: Front Access Panel Circuit Breaker Locations

⚠WARNING

AIR HANDLERS WITH ELECTRIC HEATERS
Should overheating occur turn the circuit breakers on the control box and the main electrical service entrance (Circuit Breaker Box) to the off position. Call qualified service personnel to troubleshoot and repair the appliance. DO NOT allow the air handler to continue to cycle on the limits.

When to Call For Service Assistance
Very often time can be saved if you give a service agency the information about the air handler ahead of time. This will enable the service agency to determine the specific components used and possibly indentify the problem, thus arriving with the parts to fix the problem. Write down the model number, Serial Number and be prepared to describe what the air handler is or is not doing and what you have checked prior to calling.

SERVICE AGENCY INFORMATION
Fill in Below
MODEL NUMBER:_____
SERIAL NUMBER:_____

SERVICE COMPANY:_____
ADDRESS:_____
TELEPHONE (DAYTIME):_____
TELEPHONE (EMERGENCY)_____
NOTES: _____
_____
_____
_____
_____
_____
_____
_____

SECTION IV: STARTUP AND SHUTDOWN INSTRUCTIONS

Read the instructions below before trying to start the appliance.

⚠WARNING

If you do not follow these instructions exactly, a fire may result causing property damage, personal injury, and/or loss of life.

A. BEFORE OPERATING; check around perimeter of the furnace to make sure there are no flammable materials in the area. If you smell vapors of any kind, DO NOT turn on the power to the appliance until vapors have been ventilated and removed from the area of the appliance.
B. CHECK THE FURNACE; visually check the appliance for loose screws and/or panels that may be missing or have fallen off.
C. CHECK DUCT CONNECTIONS; visually check the connections of the ducts to the appliance to make sure there are no gaps or holes and ducts are securely fastened to the furnace.

Turn On / Start the Appliance
1. STOP! Read the safety information above before proceeding.
2. Set the thermostat to the lowest setting.
3. Turn off all electrical power to the appliance at the main service disconnect box.
4. Remove the upper and lower access door.
5. Turn off the circuit breakers on the appliance control box.
6. Remove the control box cover.
7. Visually check the control box for loose wire connections and faulty or loose components.
8. Visually check the blower compartment for obstructions or loose debris.
9. Replace the control box cover.
10. Turn the circuit breakers to the on position.
11. Replace the upper and lower access door.
12. Turn the circuit breakers in the main service disconnect box to the on position.
13. Set the thermostat to the desired setting.

Shutting Down or Turning Off the Appliance
1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the appliance at the main service disconnect box.
3. Remove the upper access door.
4. Turn off the circuit breakers on the appliance control box.
5. Replace the upper access door.

SECTION V: OWNER MAINTENANCE

All appliances need annual maintenance in order to operate properly. The annual service must be preformed by qualified service personnel. The homeowner is expected to perform general cleaning of the exterior surfaces and replacement of the air filters. Air filters must be checked every month and replaced as needed.

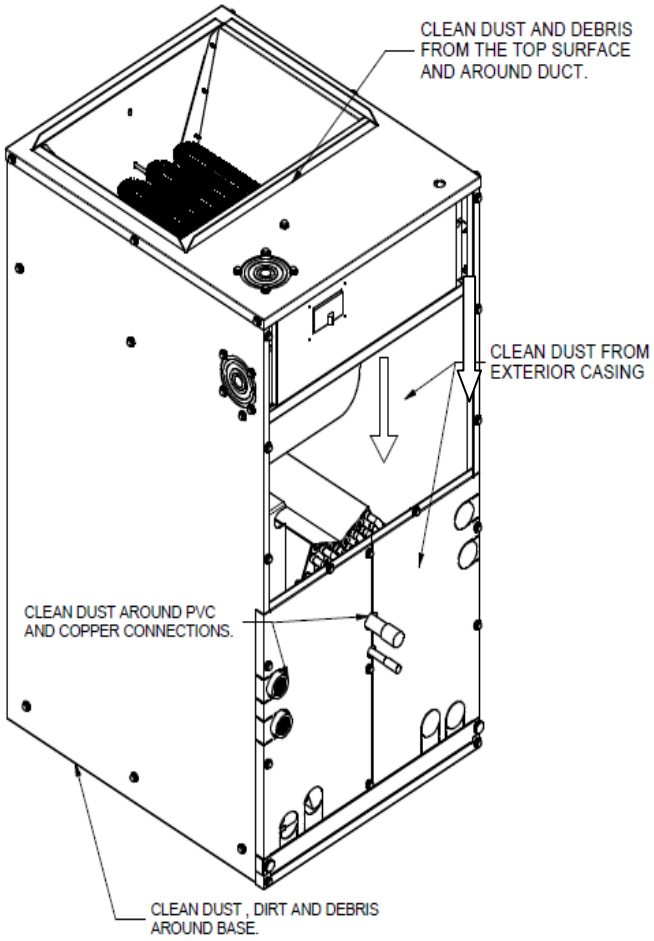

Figure 3: Home Owner / Users Cleaning Points

SERVICE AND MAINTENANCE MANUAL

SECTION I: SAFETY

THE HOME OWNERS AND / OR APPLIANCE USERS MUST STOP HERE!

This section has been designed to assist a **qualified service agency** in performing service and maintenance on this appliance.

The homeowners and/or the appliance user must never attempt to perform any service or maintenance on the appliance especially when it involves the removal or adjustment of any parts and/or components.

⚠WARNING

The manufacturer will not be responsible for any repairs due to removal of parts or improper parts changes, improper maintenance, improper adjustments or improper modifications to this air handler that were performed by the homeowner and/or the appliance user.

The manufacturer will not be responsible if the homeowner and/or appliance user use this section of the instructions in an attempt to perform maintenance or repairs to the furnace. This practice is very dangerous and may result in a fire causing property damage, personal injury, loss of life and/or will void the appliance warranty.

The following safety rules must be followed when servicing this furnace.


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 adjustment, service or maintenance may create a condition where the operation of the product could cause personal injury or property damage.

Refer to this manual for assistance or for additional information consult the Technical Support Group.

⚠ CAUTION

This product must be serviced and maintained as specified in these instructions and/or to any applicable local, state, and national codes including, but not limited to building, electrical, and mechanical codes.

⚠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.

SAFETY REQUIREMENTS

1. The air handlers with electric heaters may have a dual electrical supply circuit. Make sure you check each electrical circuit with a meter to be sure the power has been disconnected.
2. Insulating materials may be combustible. The air handler must be kept free and clear of insulating materials.
3. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly Startup or Shutdown this appliance.
4. Make sure all moving parts have come to a complete stop before attempting to perform any work once the appliance door has been removed. Moving parts can cause serious injury if clothing or body parts get caught in the moving part.

⚠WARNING

ELECTRICAL SHOCK, FIRE HAZARD

Failure to follow the safety warnings exactly or improper servicing could result in dangerous operation, serious injury, property damage, and/or death.

- Before servicing, disconnect all electrical power to the appliance. Make sure you disconnect both power supplies if the appliance has a dual power supply circuit. Dual circuits may be used on the 15kW models.
- When servicing controls, label all wires prior to disconnecting to aid in proper reconnection of wires.
- Verify proper operation after servicing by turning the thermostat above the room temperature for a brief period of time to ensure proper appliance operation

⚠WARNING

FIRE HAZARD

NEVER PLACE A JUMPER BETWEEN "R" & "W"

Placing jumper wire between the RED and WHITE thermostat wires at the air handler in order to override the thermostat and energize the heater elements is an extremely dangerous practice that can result in damage to the thermostat, dangerous operation, serious injury, property damage and/or death.

SECTION II: AIR HANDLER MAINTENANCE

The interior sections of the air handler must be cleaned and adjusted by a qualified service contractor once a year or before the start of each heating or cooling season. The following items must be checked:

1. The blower wheel and motor for excessive dirt.
2. The electric heaters for wear, damage or corrosion.
3. The electrical components for excessive dust, dirt, wear, or deterioration.
4. The supply air duct system for excessive dust, dirt or debris
5. The return air duct system for excessive dust, dirt or debris
6. All electrical wiring for wear, insulation cracks and/or damage.
7. Check the air conditioning evaporator coil for dust, debris or damage.
8. Check the evaporator coil drain pan for proper drainage to prevent water backup into the unit.
9. The air handler casing and all interior sheet metal panels or dividers.

Air Handler Cleaning Procedure

1. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly shutdown this appliance.
2. Remove the upper access door on the front of the air handler.
3. Remove the lower access door on the front of the evaporator coil compartment.
4. Constant Torque (CT) Motors - Unplug the wire harnesses from the blower motor.
   PSC Motor – Unplug the wires from the 6 pin plug at the bottom of the control box.
5. Remove the two screws on the left and right side and the center screw on the bracket in front of the blower mounting plate and slide the blower out. Refer to Figure 6.
6. Place a piece of cardboard on top of the evaporator coil to prevent dirt or debris from falling onto the coil. Use a vacuum cleaner and a small brush to remove any dirt and debris from the blower and evaporator coil compartments.
7. Check the evaporator condensate drain pan for any debris and ensure the pan is properly draining by pouring water into the drain to check it.
8. Remove any excess water that may have spilled from checking the evaporator condensate drain.
9. Check in the area above the blower compartment where the heater elements are located and remove any dust, dirt or debris from around the heater elements. Be careful not to damage the heater elements with the vacuum hose or the brush.

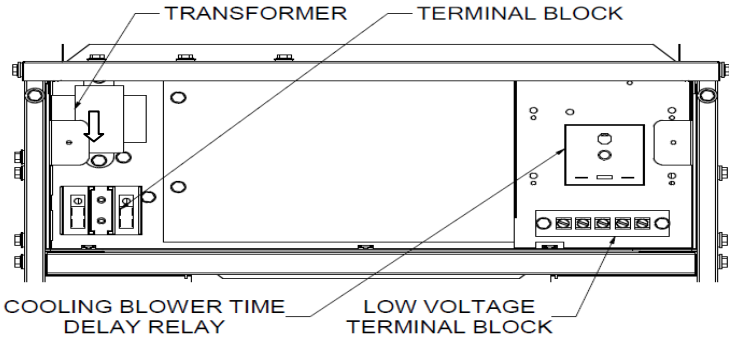

Figure 4: No Electric Heat Control Box

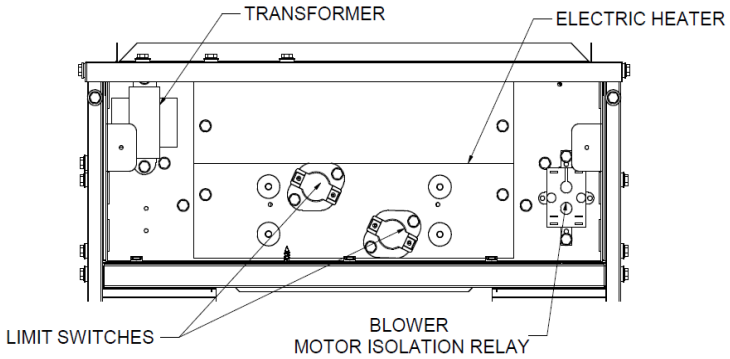

Figure 5: Electric Heat Control Box

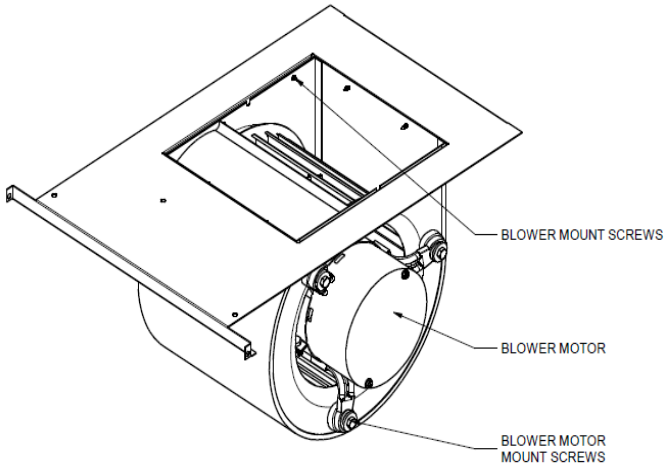

Figure 6: Blower Assembly and Mounting Screw Location

10. Check the blower wheel for dust and debris. Use the brush and the vacuum cleaner to remove any dust or debris from the wheel. Be careful not the move or accidentally remove the blower wheel balance weight located on the wheel blade. If it is moved or removed it will cause the blower wheel to vibrate. If the wheel is vibrating, you must replace it.

11. Check the blower motor for dust and debris. Be sure to clean the openings on the motor housing as these openings are used to cool the motor. If the dust, dirt or debris has not been removed from these openings it will cause the motor to run hotter than normal and will shorten the life of the motor.
12. Check and clean with the brush and vacuum cleaner any dust in the supply and return ducts as far as you can reach. If these ducts look like they have an excessive amount of dust, dirt or debris you should recommend to the home owner or user to call a professional to properly clean the duct system.
13. Check and clean any dust, dirt, or debris from all of the controls and all of the surfaces in the control box. If dust or dirt is left on the components they will operate at a much hotter temperature causing premature component failure.
14. Reinstall the blower assembly and secure the assembly to the casing by using the screws that was removed in step 5.
15. Reinstall the lower access door on the front of the evaporator coil compartment.
16. Reinstall the upper access door on the air handler.
17. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly startup this appliance.

SECTION III: AIR HANDLER CONTROLS

Electric Heat Models

This section discusses the air handler controls and how they operate. Refer to Figures 4 and 5 for component locations.

1. **The Limit Controls** – Each electric heater element has a limit control directly in front of it to sense overheating of the element and open if the temperature gets above the set point of the limit control.
2. **The Heater Contactors** – The electric heater contactors simply turn the heater elements on and off. The contactors are controlled by the thermostat. On a call for heat 24 VAC is sent to the contactor(s) 24 VAC coil energizing the contactor. When the call for heat has been satisfied the 24 VAC is removed from the contactors 24 VAC coil de-energizing the contactor(s).
3. **Cooling Time Delay Relay (TDR)** – The cooling adjustable time delay relay is used only on models with a PSC motor. When the thermostat calls for cooling or the fan switch on the thermostat is moved from the "AUTO" to the **"ON"** position, 24 VAC is placed on the "G" terminal from the thermostat to the 24 VAC coil on the time delay relay. The relay controls the blower on time delay and is not adjustable. The time delay relay setting is 0.4 - 30 seconds **"ON".**
4. **Circuit breakers** – The circuit breakers are designed as over-current protection for the air handler internal electrical components. Field wiring must be protected by field supplied circuit breakers or fuses sized to protect the wire connected to the air handler circuit breakers.
5. **Transformer** – The transformer is used to step down voltage from 240 VAC to 24 VAC. The transformer provides the required 24 VAC for the system control circuit.
6. **Blower Motor Isolation Relay** - This relay is used to load the TDR when using a PSC or CT motor or for isolation between the high and low speeds of a motor. The wiring has been designed so that the normally closed contacts are used for heating and the normally open contacts are used for cooling. The relay coil is energized after the thermostat has a call from the "G" terminal starting the time delay cycle on the time delay relay. Once the time delay relay has reached the delay setting the relay contacts close energizing the isolation relay coil. The normally closed contacts on the isolation relay open and the normally open contacts close, energizing the motor on the selected cooling speed.

1. **PSC Blower Motor Isolation Relay** - This relay is a single pole double throw relay. Is required for isolation between the high and low speeds of a motor. The wiring has been designed so that the normally closed contacts are used for heating and the normally open contacts are used for cooling. The relay coil is energized after the thermostat has a call from the "G" terminal. The normally closed contacts on the isolation relay open and the normally open contacts close, energizing the motor on the selected cooling speed.
2. **CT Motor Isolation Relay** - This relay is a single pole double throw relay. Is used to disable the high speed tap when the low speed is being used. The wiring has been designed so that the normally closed contacts are used for heating and the normally open contacts are used for cooling. The relay coil is energized after the thermostat has a call from the "G" terminal. The normally closed contacts on the isolation relay open and the normally open contacts close, energizing the motor on the selected cooling speed after the selected time delay.

3.

SECTION IV: SEQUENCE OF OPERATION

Continuous Blower – Electric Heat Models

The thermostat has a manual fan switch that can be moved to the "**On"** position or it can be programmed for **continuous** fan operation. This setting causes the thermostat to complete the circuit between "R" and "G" terminals causing the time delay relay to start the time delay cycle. Once the time delay relay has completed the on-delay cycle the contacts will close sending 24 volts to the isolation relay coil. The isolation relay will close the normally open contacts (Terminals #2 and #4) sending voltage to selected indoor blower motor speed tap connected to terminal #4. The normally closed contacts (Terminals #5 and #6) will open.

The indoor blower will operate continuously until the fan switch on the thermostat has been switched from the "**ON**" position to the **"AUTO"** position. When the fan switch on the thermostat is turned to the **"AUTO"** position the indoor blower will turn off immediately with no delay.

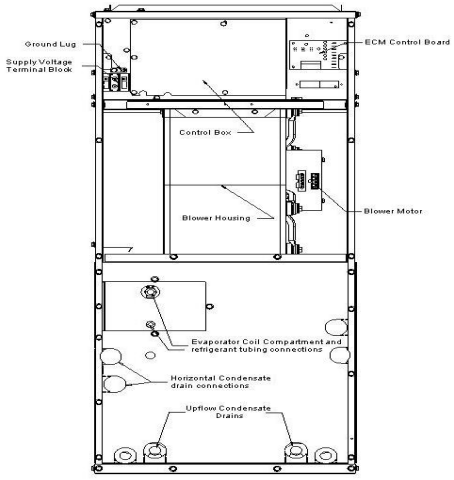

Figure 7: Component Locations – Electric Heat Models

Intermittent Blower – Cooling

Electric Heat Models

The thermostat has a manual fan switch that can be moved to the "**Auto"** position or it can be programmed for **auto** fan operation. When the thermostat calls for cooling, a circuit is completed in the thermostat between the "R", "Y" and "G" Terminals. The indoor fan motor is energized from the "G" terminal on the thermostat causing the time delay relay to start the on-time delay. The time delay relay contacts will close the circuit to the isolation relay coil after the **"ON"** delay is complete. The isolation relay normally open contacts (Terminals #2 and #4) will close and the motor will operate on the selected speed tap that has been placed on terminal #4. When the thermostat is satisfied the circuit between "R", "Y" and "G" will open. The time delay relay will open the circuit to the isolation relay and the blower motor will turn off. The CT blower motor will have a 13 second off-delay. The blower is now in the standby mode waiting for the next cooling cycle

The Heating Cycle

Electric Heat Models

When the thermostat is in the HEAT mode and the fan switch on the thermostat is set to AUTO. The call for heat closes the thermostat circuit between the "R" and "W" terminals. 24 VAC is sent from the "W" terminal on the thermostat, through the white thermostat wire, to the white pigtail wire on the air handler, to the 24 VAC coil on the first heater relay. This signal energizes the heater relay, closing the contacts and sending 240 vac to the heaters. The PSC blower motor low speed wire is also connected to the heater terminal on the first heater relay so the blower is energized at the same time as the heater. The blower will continue to operate until the thermostat is satisfied. When the call for heat has been removed, the "W" terminal is de-energized and the heater relay opens turning off the heater and the PSC blower motor. The Constant Torque (CT) blower motor is connected to the normally closed contacts of the isolation relay. The 24 VAC signal from the "W" terminal on the thermostat is connected to the blower motor low speed tap and will energize the motor at the same time as the heater relay and will de-energize the motor at the same time as the heater relay.

The furnace is now in standby mode waiting for the next heating cycle.

Some models have a brown pigtail wire that is connected to the 24 VAC coil on the second heater relay. This pigtail wire is to be used for second stage heat. It is connected to the thermostat "W2" terminal. You must have a thermostat that has the second stage heating feature "W2" to use this feature. The second stage heat cycle is enabled when the room temperature typically falls more than 3 degrees below the thermostat set point. The thermostat energizes the second heater to aid in heating the room back to the thermostat set point. Once the room is within 1 degree of the thermostat set point the second stage heater is de-energized until the thermostat calls for second stage heat "W2" again.

The Cooling Cycle

Electric Heat Models

When the thermostat calls for cooling

The thermostat closes the circuit between the "R", "Y" and "G" terminals. 24 VAC is sent from the "Y" terminal through the yellow thermostat wire to the 24 VAC coil terminal on the condenser contactor; energizing the contactor and starting the compressor and outdoor fan motor. At the same time the "G" terminal is sending 24 VAC through the green pigtail wire to the indoor blower time delay relay. The time delay relay has an adjustable time delay circuit of 0.4 - 30 second **"ON"** delay. The time delay relay closes the normally open contacts sending 24 VAC to terminal #1 on the isolation relay coil (Coil between terminals #1 and #3). The isolation relay coil is energized closing the normally open contacts (Terminals #2 and #4) and opening the normally closed contacts (Terminals #5 and #6) sending 24 VAC to the selected Constant Torque (CT) motor speed tap wire connected to isolation relay terminal #4. The PSC motors; terminal #4 is sending 240 VAC to the selected speed tap wire.

When the thermostat call for cooling has been satisfied the thermostat opens the circuit between the "R", "Y" and "G" terminals. The 24 VAC signal is removed from the thermostat "Y" terminal de-energizing condenser contactor and outdoor fan motor. At the same time the "G" terminal 24 VAC signal is removed from the green pigtail wire de-energizing the time delay relay.

The cooling cycle is complete, and the cooling unit is in the standby mode ready for the start of the next cooling cycle.

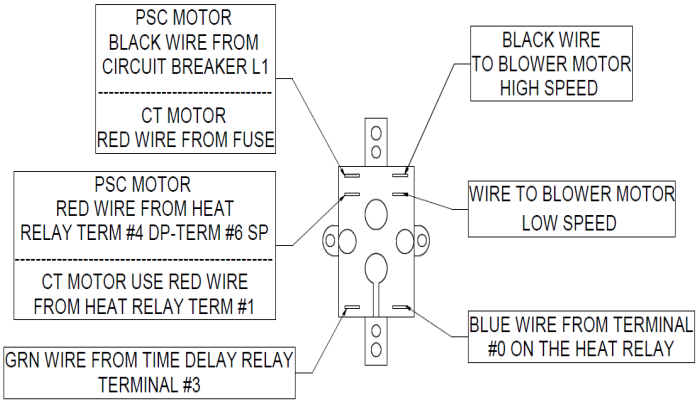

Figure 8: Motor Speed Tap Isolation Relay – Constant Torque (CT) and PSC Motors

⚠WARNING

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

SECTION V: TROUBLE SHOOTING

The following checks should be made before trouble shooting the air handler controls for a no heat issue.

1. Check all of the circuit breakers. Make sure they are turned to the "ON" position and have not tripped.
2. Check all fuses, especially any supply line fuses that were installed during installation. If the fuse is blown, check the wiring with an OHM meter for a short to ground. If shorted, repair the short, and then replace the fuse.
3. Check any electrical switches that are external to the furnace to make sure they are turned on.
4. Check all wiring connections, especially on any of the components, to ensure they are securely fastened.

Electric Heat Models

If you have electric heaters and there is 240 volts coming out of the control box circuit breakers and you have 24 volts between to the "R" wire and ground, then continue on through the rest of the checks.

Constant Torque (CT) Motor Check – Electric Heat Models

If the motor is not running, check for 240 volts between the "L" and "L2/N" terminals and 24 volts on the selected speed tap terminal and the "COM" terminal. If the 240 volts and 24 volts is present at the motor terminals but the motor is not operating, then replace the motor. Refer to Figure 10 and Table 1 for terminal locations and definitions.

If 240 volts is not present check the connections to the circuit breaker or check for an open breaker.

Heating Mode

If 24 volts is not present check the thermostat "W" wire. If 24 volts is present, check the Heat Relay Terminal #1 and terminal 0. If 24 volts is present, check isolation relay terminal #6 and terminal #3, if 24 volts is present replace the wire going to the motor. If 24 volts is not present at the isolation relay, then, change the relay.

Cooling Mode

If 24 volts is not present check the thermostat "G" wire. If 24 volts is present, check the time delay relay Terminal #1 and 24 V COM. If 24 volts is present, check isolation relay terminal #4 and 24 V COM, if 24 volts is present replace the wire going to the motor. If 24 volts is not present at the time delay relay terminal #1 but is present at terminal #3, change the time delay relay. If 24 volts is present between terminal #1 and #0, terminal #2 and #0 of the isolation relay coil but is not present on terminal #4 and #0 change the isolation relay.

PSC Motor Check – Electric Heat Models

If the motor is not running, check for 240 volts at the motor speed tap terminal. If the 240 volts is present at the motor speed tap terminal but the motor is not operating, then replace the motor.

Heating Mode

If 240 volts is present at the motor check between the Heat Relay Terminal #4 and L2. If 240 volts is present, check isolation relay between terminal #6 and L2, if 240 volts is present replace the motor. If 240 volts is present between terminal #2 and L2, but, is not present between the heat relay terminal #4 and L2 and 24 VAC is present on the coil, change the heat relay. If 240 volts is present between terminal #5 and L2 but is not present between the isolation relay terminal #6 and L2 and 24 VAC is present on the coil, change the relay.

Cooling Mode Blower Check

Check the thermostat "G" pigtail wire.

1. If 24 VAC is present on the pigtail wire, check the time delay relay terminal 3 and COM, then, terminal 1 and COM for a 24 VAC signal. If a 24 VAC signal is present on terminal #1 but not on terminal 3 wait for the selected time delay and check again. After the time delay has expired if there is still not 24 VAC signal on terminal 3 then replace the time delay relay.
2. If 24 VAC is present on terminal 3, then, check terminals 1 and 0 of the isolation relay. If 24 VAC is present on the relay coil but the relay has not energized, go to the next step
3. Check to see if there is 240 VAC between terminal 2 on the isolation relay and L2 If 240 volts is present, check isolation relay terminal #4 and L2, if 240 volts is present replace the motor. If 240 volts is not present between Terminal #4 and L2 but is present between terminal #2 and L2, change the relay.
4. If 240 volts is not present at the isolation relay, check for 240 volts between terminal #4 and L2 of the heat relay. If 240 Volts is not present, change the heat relay.

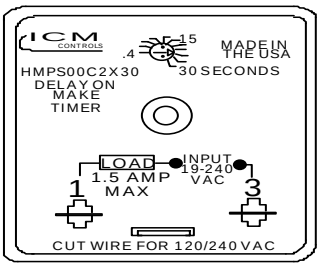

Figure 9: Adjustable Time Delay Relay (TDR) Terminals

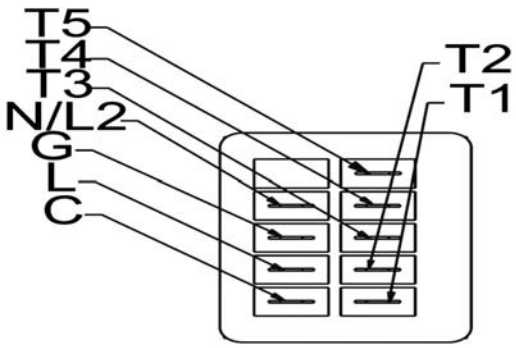

Figure 10: Constant Torque (CT) Motor Terminals

⚠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.

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 1: CT Motor Terminal Connections

Heater Element Is Not On

Check for 240 VAC between each of the heater elements. If 240 VAC is present, check the current draw on each heater. If there is almost no current draw check the limit for that heater. If the limit is good but there still is no current flow then, check to see if the heater is defective.

The heater amps are as follows:

5 kW Heater = 20.8 amps
8 kW Heater = 33.34 amps
10 kW Heater = 41.6 amps

The heater design is as follows:

The 5 kW model has one 5 kW heater element.
The 8 kW Model has one 8 kW Heater element.
The 10 kW model has one heater with two 5 kW elements
The 15 kW model has one heater with two 5 kW elements (top heater) and one heater with one 5 kW element (bottom heater).
The 20 kW model has one heater with two 5 kW elements (top heater) and one heater with two 5 kW elements (bottom heater).

If 240 VAC is not present at the heater element but there is 240 VAC present between the line terminal of the heater relay and L2 circuit breaker but not across the heater, then, check the limit control for an open limit and replace the open limit control.

If 240 VAC is not present at the heater element or between the load terminal of the heater relay and the L2 circuit breaker, but is present between the line terminal of the heater relay and L2 circuit breaker; then, replace the heater relay.

DP - Double Pole Contactor

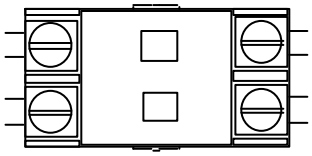

Figure 11: Heater Relay Terminal Designations

HP	CT	PSC
1/3	0.72	2.00
1/2	1.66	3.00
3/4	2.09	3.60

Table 2: 208 / 240 Volt Blower Motor Tested FLA

Replacing the Blower

1. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly shutdown this appliance.
2. Remove the upper access door on the front of the air handler.
3. Remove the lower access door on the front of the evaporator coil compartment.
4. Constant Torque (CT) Motors - Unplug the wire harnesses from the blower motor.
   PSC Motor – Unplug the wires from the 6 pin plug at the bottom of the control box.
5. Remove the two screws on the left and right side and the center screw on the bracket in front of the blower mounting plate and slide the blower out.
6. Reinstall the blower assembly and secure the assembly to the casing by using the bracket and screws that were removed in step 5.
7. Reinstall the lower access door on the front of the evaporator coil compartment.
8. Reinstall the upper access door on the air handler.
9. Follow the instructions exactly as shown in Startup and Shutdown Section in this manual to properly startup this appliance.
10. Set the thermostat above the room temperature so the unit will operate and you can observe the appliance startup to ensure the appliance is operating correctly.
11. After proper operation has been observed and documented, set the thermostat to the desired temperature.

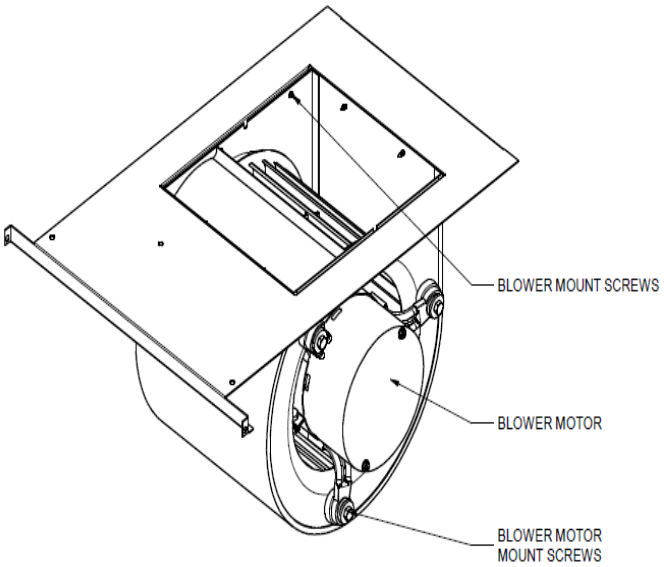

Figure 12: Blower Mounting Plate Screw Locations

⚠WARNING

To avoid personal injury take precautions not come into contact with non-insulated electrical components.

Avoid wearing loose clothing or any items that can come in contact with moving parts, such as the blower wheel. This can cause serious personal injury

SECTION VI: BLOWER PERFORMANCE

BLOWER PERFORMANCE SELECTECH MOTOR AIR FLOW											
Model Number	**Nominal Tons**	**Motor HP**	**Volts 1 Ph. 50/60 Hz.**	**Motor Code**	**Blower Wheel**	**Motor Tap**	**CFM @ 0.10"**	**CFM @ 0.20"**	**CFM @ 0.30"**	**CFM @ 0.40"**	**CFM @ 0.50"**
MLVT18,24 Electric	1.5 & 2.0	0.33	240	LA	9 x 7T	1	539	496	508	468	440
						2	595	558	545	541	498
						3	688	643	609	599	614
						4	734	697	652	629	633
						5	778	738	709	679	675
MLVT30,36 Electric	1.5 Thru 3.0	0.50	240	LC	10 x 7T	1	814	767	718	674	646
						2	953	907	872	829	799
						3	1002	965	933	899	857
						4	1156	1129	1096	1067	1044
						5	1217	1192	1166	1129	1107
BLOWER PERFORMANCE SELECTECH MOTOR AMPS											
Model Number	**Nominal Tons**	**Motor HP**	**Volts 1 Ph. 50/60 Hz.**	**Motor Code**	**Blower Wheel**	**Motor Tap**	**AMPS @ 0.10"**	**AMPS @ 0.20"**	**AMPS @ 0.30"**	**AMPS @ 0.40"**	**AMPS @ 0.50"**
MSVT18,24 Electric	1.5 & 2.0	0.33	240	LA	9 x 7T	1	0.32	0.33	0.35	0.37	0.39
						2	0.38	0.40	0.42	0.43	0.45
						3	0.53	0.55	0.57	0.58	0.60
						4	0.60	0.62	0.65	0.67	0.68
						5	0.70	0.73	0.74	0.76	0.78
MSVT30,36 Electric	1.5 Thru 3.0	0.50	240	LC	10 x 7T	1	0.46	0.48	0.50	0.53	0.55
						2	0.65	0.68	0.70	0.72	0.75
						3	0.75	0.77	0.80	0.82	0.84
						4	1.05	0.18	1.10	1.13	1.16
						5	1.19	1.23	1.27	1.30	1.32

Table 3: MLVT Blower Performance Chart – CFM Data with a Constant Torque (CT) Motor -Without Air Filters

BLOWER PERFORMANCE PEP MOTOR AIR FLOW											
Model Number	**Nominal Tons**	**Motor HP**	**Volts 1 Ph. 50/60 Hz.**	**Motor Code**	**Blower Wheel**	**Motor Tap**	**CFM @ 0.10"**	**CFM @ 0.20"**	**CFM @ 0.30"**	**CFM @ 0.40"**	**CFM @ 0.50"**
MLPS18,24 Electric	1.5 & 2.0	0.33	240	LB	9 x 7T	Low	798	739	680	639	564
						Med Low	831	806	752	676	585
						Med HI	924	856	791	719	605
						High	962	891	820	735	548
MLPS30,36 Electric	2.0 Thru 3.0	0.50	240	LD	10 x 7T	Low	1199	1161	1111	1056	995
						Med Low	1301	1257	1194	1132	1078
						Med HI	1393	1334	1277	1217	1154
						High	1446	1389	1324	1262	1191
BLOWER PERFORMANCE PEP MOTOR AMPS											
Model Number	**Nominal Tons**	**Motor HP**	**Volts 1 Ph. 50/60 Hz.**	**Motor Code**	**Blower Wheel**	**Motor Tap**	**AMPS @ 0.10"**	**AMPS @ 0.20"**	**AMPS @ 0.30"**	**AMPS @ 0.40"**	**AMPS @ 0.50"**
MLPS18,24 Electric	1.5 & 2.0	0.33	240	LB	9 x 7T	Low	1.15	1.06	0.94	0.87	0.77
						Med Low	1.17	1.12	1.03	0.92	0.80
						Med HI	1.27	1.18	1.08	0.98	0.85
						High	1.35	1.25	1.17	1.06	0.97
MLPS30,36 Electric	2.0 Thru 3.0	0.50	240	LD	10 x 7T	Low	1.76	1.65	1.56	1.47	1.38
						Med Low	1.87	1.76	1.67	1.59	1.51
						Med HI	2.03	1.93	1.85	1.78	1.68
						High	2.24	2.17	2.09	2.01	1.92

Table 4: MLPS Blower Performance Chart – CFM Data with a PEP PSC Motor -Without Air Filters

SECTION VII: ACCESSORY AND REPLACEMENT PARTS LISTS

MLVT, MLPS	
Part #	**Description**
BSLK05B	Small Cabinet 5 kW Heater Kit with circuit breakers
BSLK08B	Small Cabinet 8 kW Heater Kit with circuit breakers
BSLK10B	Small Cabinet 10 kW Heater Kit with circuit breakers
SSLK05B	Small Cabinet 5 kW Heater Kit, no circuit breakers
SSLK08B	Small Cabinet 8 kW Heater Kit, no circuit breakers
SSLK10B	Small Cabinet 10 kW Heater Kit, no circuit breakers
BMLK05B	Medium Cabinet 5 kW Heater Kit with circuit breakers
BMLK08B	Medium Cabinet 8 kW Heater Kit with circuit breakers
BMLK10B	Medium Cabinet 10 kW Heater Kit with circuit breakers
BMLK15B	Medium Cabinet 15kW Heater Kit with circuit breakers
SMLK05B	Medium Cabinet 5 kW Heater Kit, no circuit breakers
SMLK08B	Medium Cabinet 8 kW Heater Kit, no circuit breakers
SMLK10B	Medium Cabinet 10 kW Heater Kit, no circuit breakers
R72DB0005	Field Installed Thermal Expansion Valve - 15% Bleed - R-22 - 1.5 - 3.0 Tons
R72DB0003	Field Installed Thermal Expansion Valve - 15% Bleed - R-410A - 1.5 - 2.5 Tons
R72DB0006	Field Installed Thermal Expansion Valve - 15% Bleed - R-22 - 3.0 - 5.0 Tons
R72DB0044	Field Installed Thermal Expansion Valve - Non Bleed - R-410A - 3.5 - 6.0 Tons

Table 5: MLVT, MLPS Accessory Parts List

SECTION VIII: REPLACEMENT PARTS LISTS

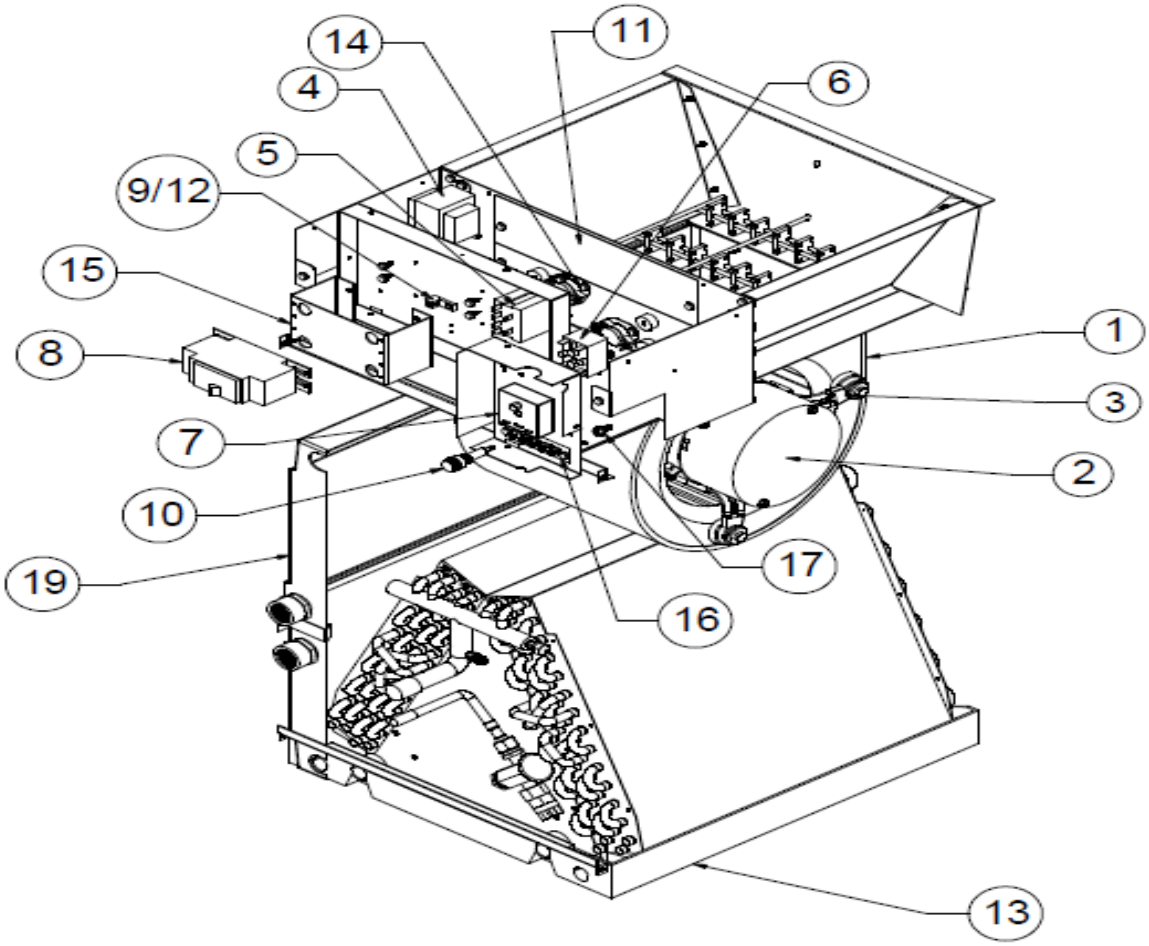

Figure 13: ML 18–24 Electric Heat Air Handler Repair Parts Schematic

ML**18, 24 COOL ONLY OR ELECTRIC HEAT			
Item #	**Qty.**	**Part #**	**Description**
1	1	R68AD0025	9 X 7 T Blower Assembly
2	1	R65BV0063	1/3 HP 120/240 VAC Selectech (CT) Blower Motor
	1	R65BP0022	1/3 HP PEP Blower Motor (PSC Motor)
3	3	TR8744B	Blower Motor Mount Leg (Selectech Motor Only)
	1	R66AB0009	Blower Motor Mount (Selectech Motor Only
	1	R66CA0009	1/4 X 1/2 Hex Bolt (Selectech Motor Only)
	1	R66CB0001	1/4" Nut (Selectech Motor Only)
4	1	R68AA0003	240V to 24V Transformer
6	1	R68BA0001	Fan Motor Isolation Relay
7	1	R68AC0009	Time Delay Relay
9	1	R66GF0022	Ground Lug
10	1	R73MHA001	24 Volt Fuse Holder
11	1	R87AN0009	Block Off Plate
12	1	R66GF0022	Ground Lug
15	1	R87MPSL29	Breaker Mount
16	1	R68DC0017	C, W, W2, G, R Terminal Block
17	1	R66BA0027	Green Ground Screw
18	1	R68DE0008	10.0 MFD/370VAC Capacitor (PEP Blower Motor Only)
5 KW Electric Heat ML18,24**			
11	1	R67AB0015	5 KW Element
14	1	R68CA0009	165 / 135 Limit Switch
5	1	R68AB0007	Single Pole Heat Relay
8	1	R68BAD013	30 Amp Circuit Breaker
10 KW Electric Heat ML18,24**			
11	1	R67AB0017	10 kW Heater Element
14	2	R68CA0009	165 / 135 Limit Switch
5	1	R68AB0007	Electric Heat Relay DP
8	1	R68BAD018	260 SQD 60 Amp Circuit Breaker
DRAIN PANS (PLASTIC)			
13	1	R86EB0202	16.625" W x 19.000" D - Vertical (71AA0013)
19	1	R86EB0252	20.250" H x 19.500" D - Horizontal (71AA0046)

Table 6: ML 18-24 Electric Heat Air Handler Repair Parts List

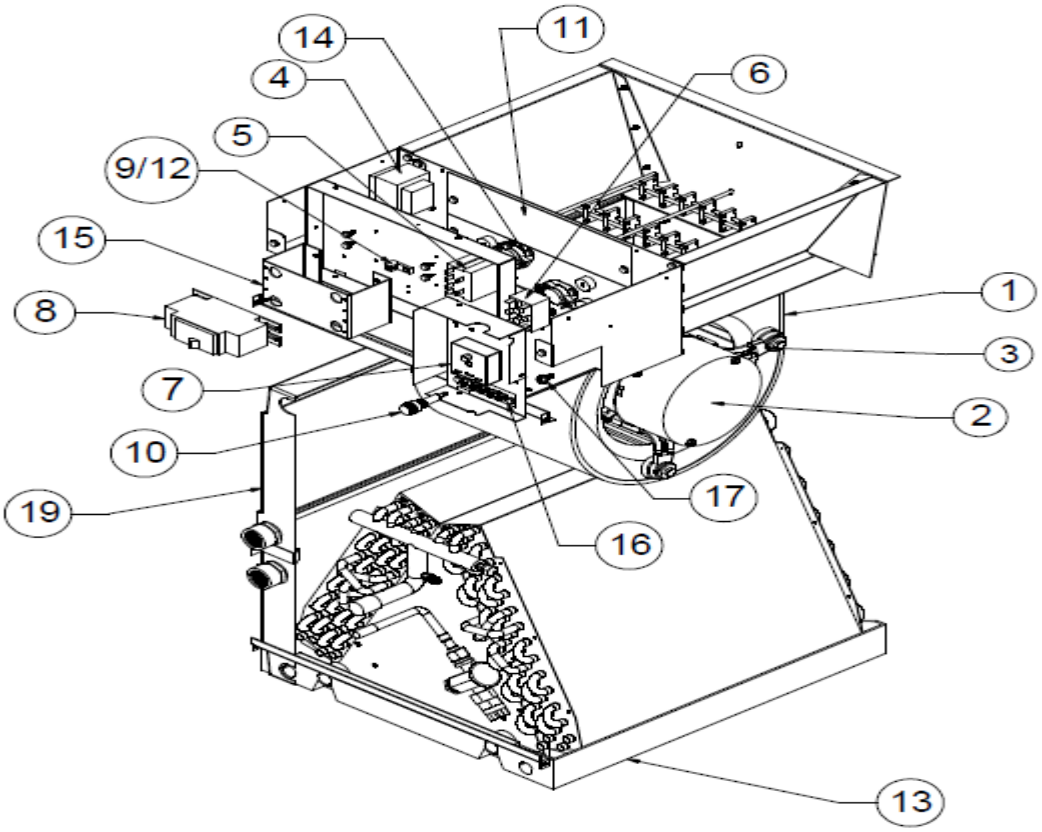

Figure 14: ML 30-36 Electric Heat Air Handler Repair Parts Schematic

ML**30 and 36 COOL ONLY OR ELECTRIC HEAT			
Item #	Qty.	Part #	Description
1	1	R69AD0023	10 X 7 T Blower Assembly
2	1	R65BV0062	1/2 HP Selectech (CT) Blower Motor
	1	R65BP0020	1/2 HP PEP Blower Motor (PSC)
3	4	R66AB0059	Blower Motor Mount Leg
	1	R66AB0058	Blower Motor Mount
	1	R66CA0009	1/4 X 1/2 Hex Bolt
	1	R66CB0001	1/4" Nut
	4	R66CC0006	3/8 X 7/8 Flat Zinc P Washer
4	1	R68AA0003	208/240-24V Transformer
6	1	R68BA0001	Fan Motor Isolation Relay
7	1	R68AC0009	Time Delay Relay
9	1	R66GF0022	Ground Lug
10	1	R73MHA001	24 Volt Fuse Holder
11	1	R87AN0009	Block Off Plate
12	1	R66GF0022	Ground Lug
15	1	R87MPSL29	Breaker Mount
16	1	R68DC0017	C, W, W2, G, R Terminal Block
17	1	R66BA0027	Green Ground Screw
18	1	R68DE0009	15.0 MFD/370VAC Capacitor (PEP Blower Motor Only)
5 KW Electric Heat ML30 and 36**			
11	1	R67AB0019	5 KW Element
14	1	R68CA0009	165 / 135 Limit Switch
5	1	R68AB0008	Single Pole Heat Relay
8	1	R68BAD013	30 Amp Circuit Breaker
10 KW Electric Heat ML30 and 36**			
11	1	R67AB0017	10 kW Heater Element
14	2	R68CA0009	165 / 135 Limit Switch
5	1	R68AB0007	Electric Heat Relay DP
8	1	R68BAD018	260 SQD 60 Amp Circuit Breaker
15 KW Electric Heat ML30 and 36**			
11	1	R86CG0075	15 KW Element
14	3	R68CA0009	165 / 135 Limit Switch
5	1	R68AB0007	Double Pole Heat Relay
5	1	R68AB0008	Single Pole Heat Relay
8	1	R68BAD018	60 Amp Circuit Breaker
8	1	R68BAD013	30 Amp Circuit Breaker
		DRAIN PANS (PLASTIC)	
13	1	R71AA0056	19.625" W x 19.000" D - Vertical (71AA0056)
19	1	R71AA0057	23.875" H x 19.500" D - Horizontal (71AA0057)

Table 7: ML 30-36 Electric Heat Air Handler Repair Parts List