SunTherm™ HEATING PRODUCTS

USERS INFORMATION MANUAL

Intertek 9700771

MULTI-POSITION DX AND CHILLED WATER COOLING
WITH ELECTRIC OR HOT WATER HEATING
MODELS: MS SERIES

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

LIST OF SECTIONS - USERS INFORMATION MANUAL

LIST OF SECTIONS -SERVICE AND MAINTENANCE MANUAL

LIST OF FIGURES

LIST OF TABLES

CONTACT INFORMATION

Manufactured and Distributed by:

Mortex Products Inc
501 Terminal Rd
Fort Worth, TX 76106

www.mortx.com

SECTION 1: GENERAL

The following list includes important facts and information regarding the air handler models covered in this manual.

1. Electric heat air handlers are rated for 208 - 240 VAC at 60 Hz and hydronic air handlers are rated for 115 VAC at 60 Hz.
2. Air handler models are available in a small, medium, or large cabinet.
3. All air handlers are designed for A/C or heat pump operation.
4. Electric heat models are designed for upflow, downflow and horizontal applications. Hydronic heat models are designed for upflow and horizontal applications only.
5. The air handler must not be operated without the access panels installed.
6. This air handler and its components are listed by ETL in the United States and Canada.
7. This air handler is for use at elevations of 10,000 ft (3,048m) or less.
8. This appliance is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of this appliance by a person responsible for their safety. Children must not be allowed to play with this appliance.

USERS MUST READ ALL INSTRUCTIONS IN THIS MANUAL.

THIS MANUAL MUST BE SAVED FOR FUTURE REFERENCE.

This is a safety alert symbol. When this symbol is seen 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: Indicates 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

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 liquids in the vicinity of this air handler or any other appliance.

⚠ WARNING

Any adjustment, service or maintenance by the homeowner 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 service or repair information on this air handler.

⚠ 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 air handler 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.

⚠ DANGER

Do not use this air handler if any part has been under water. A flood damaged air handler 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.

SAFETY REQUIREMENTS

1. This air handler must be kept clear and free of combustible materials, gasoline and other flammable vapors and liquids.
2. Never store flammable materials of any kind near this air handler. Gasoline, solvents and other volatile liquids should be stored only in approved containers outside the home. These materials vaporize easily and are extremely dangerous.
3. 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 air handler.
4. Follow the instructions exactly as shown in **Section 4: Startup and Shutdown Instructions** in this manual to properly start up or shut down this air handler.
5. If overheating occurs, turn the power off to the air handler and contact a qualified contractor, installer, or service agency.
6. Never store cleaning materials such as bleaches, detergents, powder cleaners, etc. near the air handler. 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 air handler as a storage area for items which could block or obstruct air-flow the space around the air handler. This 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 air handler rating plate for requirements for safe operation.
9. Provide clearance for service access to the control box, electric heat elements or hydronic coil, and 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 no less than 18 inches above the floor and the air handler must be located or protected to avoid physical damage by vehicles.
12. These instructions cover minimum requirements and conform to existing national standards and safety codes.
13. In some cases, 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 air handler.

⚠ 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 homeowner must never try to perform service, repair or maintenance on this air handler.
Untrained service personnel can perform only basic maintenance functions such as cleaning of exterior surfaces and replacing the air filters ONLY!
Observe all precautions in the manuals and on the attached labels when working on this air handler.

SECTION 3: OWNERS INFORMATION AND SEASONAL INFORMATION

How The Air Handler Works – Heating Cycle

Electric Heat Models:
When the thermostat calls for heat on the electric heat models, the heater contactor is energized, sending 208/240 VAC through to the electric heaters causing them to heat up. The indoor fan motor is then energized on the selected heating speed tap after an "ON" time delay which causes the circulating blower to draw air from the living space, passes it across the heater coils, and circulates the warmed air through the duct system to the living space. When the thermostat is satisfied, the electric heaters are de-energized and the blower is de-energized after an "OFF" time delay. The heating cycle has ended and the air handler is now in the stand-by mode awaiting the next call for heat.

Hydronic Heat Models:
When the thermostat calls for heat on the hydronic heat models, a pump relay will be energized causing a flow of hot water through the hot water coil which heats the coil. The indoor fan motor is energized on the heating speed tap after an "ON" time delay which causes the circulating blower to draw air from the living space, passes it across the hot water coil, and circulates the warmed air through the duct system to the living space. When the thermostat is satisfied, the circulating pump is de-energized and the blower is de-energized after an "OFF" time delay. The heating cycle has ended and the air handler is now in the stand-by mode awaiting the next call for heat.

How The Air Handler Works – Cooling Cycle

When the thermostat calls for cooling operation, 24 VAC is sent to the compressor contactor coil causing it to close which energizes the compressor and outdoor fan motor. The indoor fan motor is also energized on the selected cooling speed tap which causes the circulating blower to draw air from the living space, passes it across the cooling coil in the air handler, and circulates the cooled air through the duct system to the living space. When the thermostat is satisfied, the compressor contactor is de-energized which turns off the compressor and outdoor fan motor. The blower is de-energized after an "OFF" time delay. The cooling cycle has ended and the air handler is now in the stand-by mode awaiting the next call for cooling.

How The Air Handler Works – Heat Pump Heating Cycle

When the thermostat calls for heat pump heating operation, 24 VAC is sent to the compressor contactor causing it to close which energizes the compressor and outdoor fan motor. If not already in the heating position from a previous heating cycle, the reversing valve in the outdoor unit switches position causing the flow of the refrigerant to reverse and heat the coil inside the air handler. The indoor fan motor is energized on the selected heat pump heating speed tap which causes the circulating blower to draw air from the living space, passes it across the coil in the air handler, and circulates the warmed air through the duct system to the living space. When the thermostat is satisfied, the compressor contactor is de-energized which turns off the compressor and outdoor fan motor. The blower is also de-energized after an "OFF" time delay. The heat pump heating cycle has ended and the air handler is now in the stand-by mode awaiting the next call for heat pump heating.

Examination of the Air Handler

The homeowner should perform a visual examine the air handler every month for any defects or problems. The items to be inspected are:

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

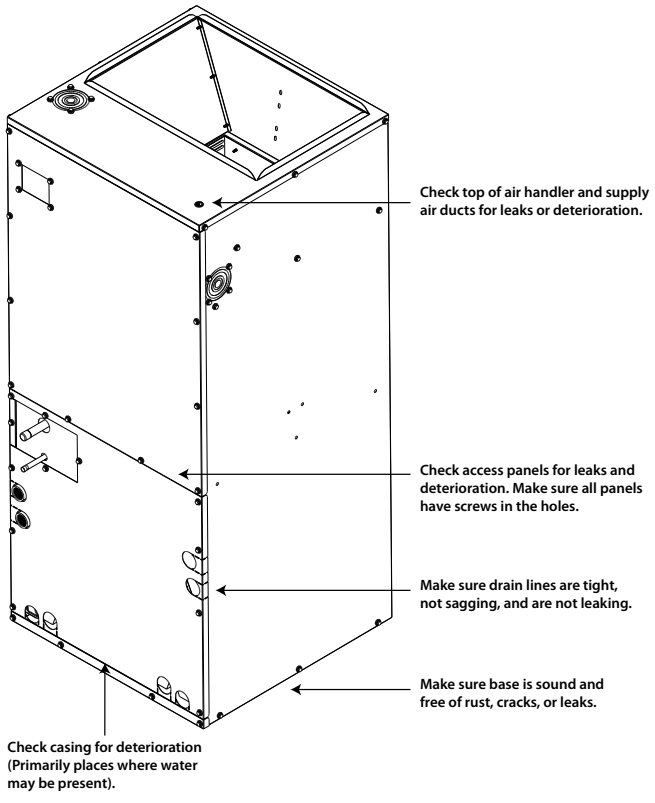


Figure 1: Air Handler Visual Check Points

The Service Technician
If the air handler gives any indication of improper operation, the homeowner or user should call a qualified service technician. The service technician is qualified to perform the normal routine care of the air handler and 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. The homeowner or user must not attempt to service or repair this air handler except for the cleaning and filter maintenance tasks presented in **"Section 5: Owner Maintenance"** of this **User Information Manual.**

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

The manufacturer warrants the air handler 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 adjustments, installing parts or components on the air handler that are not listed for use with this air handler, improper operating conditions, or repairs performed by the air handler user or homeowner.

Some specific examples of service calls which will be excluded from warranty reimbursement are:
1. Correcting faulty duct system in the home. This can be due to not enough ducts or ducts that 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 outdoor unit or air quality devises which are not approved for use with this air handler.
5. Improper thermostat settings or calibrating the thermostat.
6. Problems caused by construction debris which has fallen into the air handler.
7. Replacement of fuses.
8. Insufficient air-flow problems caused by dirty air filters.
9. Air handler malfunction or component premature failure caused by restrictions in the return or supply ducts causing low air-flow.

The homeowner should establish a clear understanding of these responsibilities with the installer and /or service company so there will be no misunderstanding of what will be covered under warranty later.

While Homeowner or User is Away
The air handler is equipped with safety shutoff devices which are designed to prevent it from overheating in case of a malfunction. For this reason, it is never practical to assume the air handler will operate unattended for a long period of time. Examples of a malfunction that can cause significant damage to the home would be:

1. The air handler blower motor fails and the heater elements cycle on the safety shutoff devices while the temperature inside the home continues to drop. Water pipes will freeze and could burst once their temperature falls below 32°F resulting in significant damage to the structure.

2. The air handler blower motor or outdoor unit fails in the summer resulting in the temperature inside the home to rise above the setpoint. If the temperature of the home rises above the rated temperature of appliances, appliance failure can occur.

3. If the homeowner to be away from home for a long period of time, they should have someone check on the home every day, especially when the outside temperatures will be below 35°F or above 75°F to ensure the air handler is operating properly. This will help prevent water pipes from freezing or appliances from failing.

The Air Handler Fails to Operate Properly
If any abnormalities are observed while the air handler 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, especially ON/OFF switches used for servicing the air handler. These are often mistaken for light switches and are turned off.
3. Check any inline fuses that may have been installed on the air handler to determine if one has blown.
4. Make sure the air filters are clean, return grilles clean, are not obstructed, and supply air registers are open.

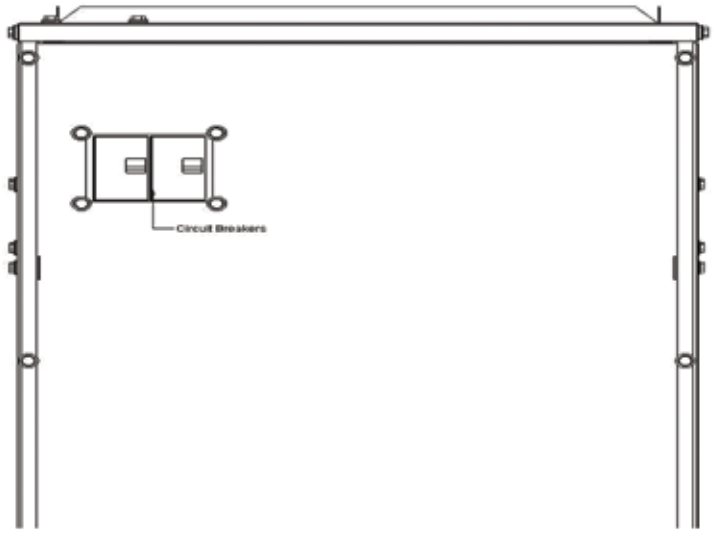


Figure 2: Front Access Panel Circuit Breaker Locations

⚠ WARNING

AIR HANDLERS WITH ELECTRIC HEATERS
Should overheating occur, turn the circuit breakers on the control box and the main electrical service entrance (Home Circuit Breaker Box) to the off position. Call qualified service personnel to troubleshoot and repair the air handler. Do not allow the air handler to continue to cycle on the over temperature limit controls.

When to Call for Service Assistance

Very often time can be saved if the homeowner provides the 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 identify the problem, allowing them to arrive with the correct 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 has already been checked prior to calling the service agency.

SERVICE AGENCY INFORMATION

Fill in Below

MODEL NUMBER: _____

SERIAL NUMBER: _____

SERVICE COMPANY: _____

ADDRESS: _____

TELEPHONE (DAYTIME): _____

TELEPHONE (EMERGENCY) _____

NOTES: _____

SECTION 4: STARTUP AND SHUTDOWN INSTRUCTIONS

⚠ WARNING

Failure to follow the following instructions exactly may result in a fire causing property damage, personal injury, and/or loss of life.

Read the instructions below before trying to start the air handler.

A. **BEFORE OPERATING:** Check around perimeter of the air handler to make sure there are no flammable materials in the area. If vapors of any kind are smelled, DO NOT turn on the power to the air handler until vapors have been ventilated and removed from the area of the air handler.

B. **VISUALLY CHECK THE AIR HANDLER:** Visually check the air handler 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 air handler to make sure there are no gaps or holes and ducts are securely fastened to the air handler.

Turning On / Starting the Air Handler

1. **STOP!** Read the safety information above before proceeding.
2. Set the thermostat mode to the "OFF" setting.
3. Turn the circuit breakers for the air handler in the main electrical panel to the "ON" position.
4. Turn the circuit breaker(s) located on the front panel of an electric heat air handler to "ON" position (See Figure 2).
5. Turn the service disconnect switch near the air handler (if one is present) to the "ON" position.
6. Set the thermostat to the desired mode and temperature.

Shutting Down / Turning Off the Air Handler

1. Set the thermostat mode to the "OFF" mode.
2. Turn the circuit breaker(s) for the air handler in the main electrical panel to the "OFF" position.
3. Turn the circuit breakers on the front of an electric heat air handler to the "OFF" position (See Figure 2).
4. Turn the service disconnect switch near the air handler (if one is present) to the "OFF" position.

SECTION 5: OWNER MAINTENANCE

All appliances need annual maintenance in order to operate properly. The annual service must be performed 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. Figures 4 and 6 indicate the location of the air filters in either an accessory air filter base or return air filter grille.

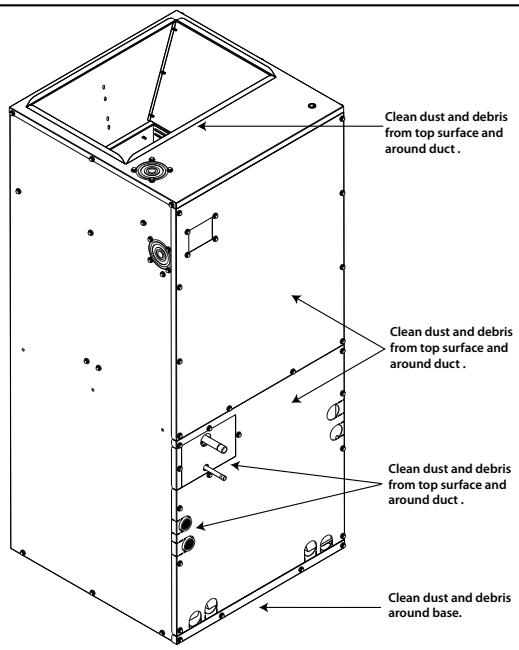


Figure 3: Homeowner / Users Cleaning Points

Air Filter Replacement – Accessory Filter Base Kit

Follow these easy steps to replace the air filters.

1. Remove the white handled thumb screws on the front of the accessory filter box kit located just below the air handler.
2. Let the top of the hinged access panel rotate outward.
3. Remove the air filter. The air filter is a disposable filter. Do not attempt to clean the filter and reuse it.
4. Check the size of the air filter that was removed to make sure it is replaced with a filter that is the same size.
5. Clean any excess dirt or debris around the front area where the air filter is located. Be careful not to use any small vacuum cleaner parts or any small brushes to clean inside the filter box, around the filter track. These parts or brushes can fall off or drop into the return duct causing a restriction of the return air-flow.
6. Slide the air filter into the filter rack, push the hinged access panel closed and tighten the thumb screw.

NOTE: Make sure the flow arrows on the air filter are pointing towards the coil.

Downflow / Horizontal Air Filter Replacement

Air handlers that are installed in a downflow or horizontal position generally have filters in one or more filter grilles located in the ceiling and/or wall. Use the following procedure to replace the air filter in a filter grille.

1. Remove the thumb screw(s) on the filter grille or pull down on the latches on each side of the grille to release the hinged grille from the frame (See Figure 6).
   Caution: If the grille is mounted in the ceiling, do not stand under the hinged grille when releasing the thumb screws(s) or latches and support the grille until it has been lowered.
2. Carefully allow the hinged grille to rotate downward (ceiling mount) or outward (wall mount) and let it hang open.
3. Remove the air filter. If the air filter is a disposable filter. **Do not attempt to clean the filter and reuse it.**
4. Check the size of the air filter that was removed to make sure it is replaced with the same size filter.
5. Clean any dust or debris from both sides for the louvers and around the area where the filter is placed before the new air filter is installed.
6. Place the new air filter into the grille assembly and push the hinged grille closed. Tighten the thumb screw(s) or push the latches in on each side of the hinged grille until the grille is securely fastened to the frame.
   NOTE: Make sure the flow arrows on the air filter are pointing towards the air handler.

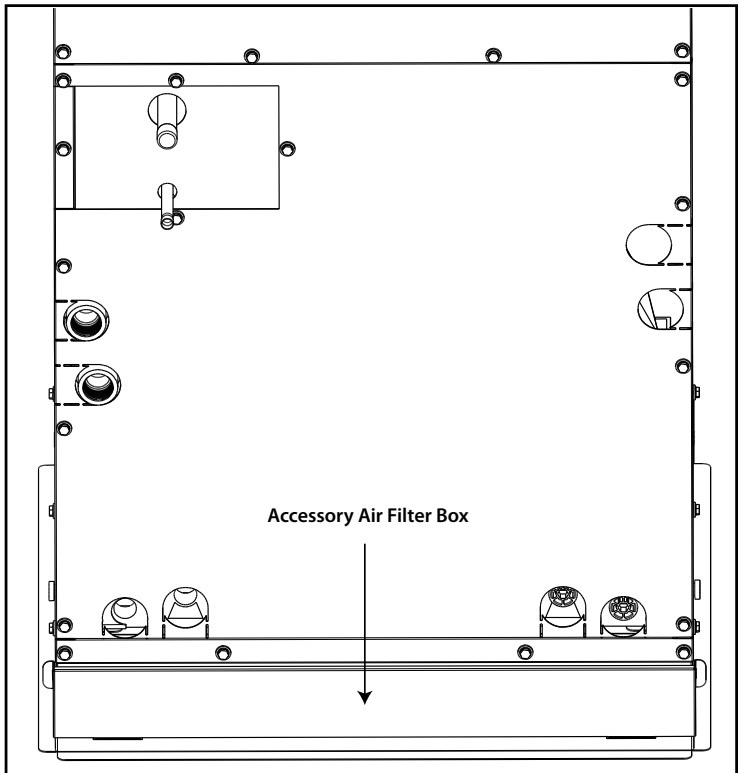
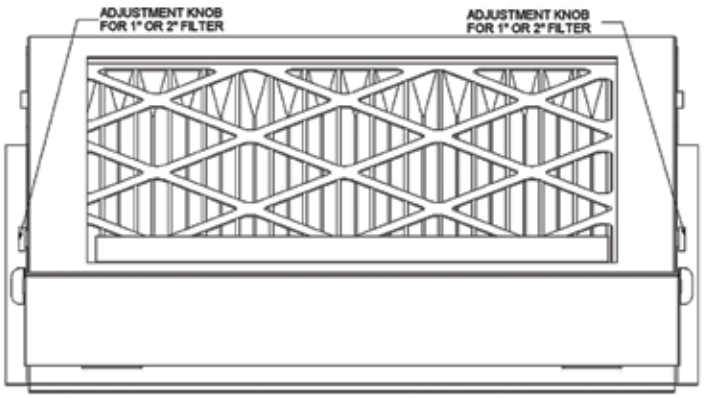


Figure 4: Accessory Air Filter Base



Note: Adjustment knobs are on each side.

Figure 5: Accessory Air Filter Base Adjustment for 1" or 2" Filters

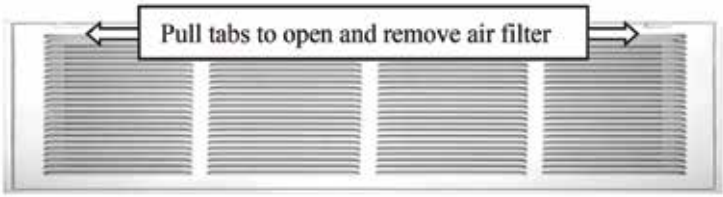


Figure 6: Return Air Filter Grille

SERVICE AND MAINTENANCE MANUAL

SECTION 1: SAFETY

THE HOMEOWNERS AND AIR HANDLER USERS MUST STOP HERE!

This section has been designed to assist a **qualified service technician** in performing service and maintenance on this air handler.

The homeowner and/or air handler user **must never** attempt to perform any service or maintenance on the air handler, especially when it involves the removal or adjustment of any parts and/or components.

⚠ DANGER

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

This is a safety alert symbol. When this symbol is seen 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: Indicates 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.

SAFETY REQUIREMENTS

1. Air-handlers with electric heaters may have a dual electrical supply circuit. Check each electrical circuit with a meter to be sure the power has been disconnected before servicing.
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 start up or shut down this air handler.
4. Make sure all moving parts have come to a complete stop before attempting to perform any work once the air handler access panels have been removed. Moving parts can cause serious injury if clothing or body parts get caught in the moving part.

⚠ 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.

⚠ 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 air handler. Make sure to disconnect both power supplies if the air handler has a dual power supply circuit. Dual circuits may be used on the 15kW and 20kW 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 air handler 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 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 2: 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 indoor coil for dust, debris or damage.
8. Check the indoor coil drain pan for proper drainage to prevent water backup into the air handler.
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 the **Section 4: Startup and Shutdown Section** in the **Users Information Manual** section of this manual to properly shut down the air handler.
2. Remove the upper access panel on the front of the air handler.
3. Remove the lower access panel on the front of the indoor coil compartment.
4. Unplug the wire harnesses from the blower motor.
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 . (See Figure 7)
6. Place a piece of cardboard on top of the indoor 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 indoor coil compartments.
7. Check the indoor coil condensate drain pan for any debris and ensure the drain pan is properly draining by pouring water into the drain pan.
8. Remove any excess water that may have spilled from checking the indoor coil 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.
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(s) located on the wheel blade. Moving or removing a balance weight will cause the blower wheel to vibrate. If the blower wheel is vibrating, it must be replaced.
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, the motor could run hotter than normal which could shorten the life of the motor.
12. Check and clean any dust in the supply and return ducts with the brush and vacuum cleaner as far as can be reached. If the ducts look like they have an excessive amount of dust, dirt or debris, recommend to the homeowner or user to call a professional to properly clean the duct system.
13. Check and clean any dust, dirt, or debris from all controls and all surfaces in the control box. If dust or dirt is left on the components, they could operate at a much hotter temperature than normal causing premature component failure.
14. Reinstall the blower assembly and secure the assembly to the blower mounting plate by using the screws that were removed in step 5.
15. Reinstall the lower access panel on the front of the indoor coil compartment.
16. Reinstall the upper access panel on the air handler.
17. Follow the instructions as shown in **Section 4: Startup and Shutdown Section** in the **Users Information Manual** section of this manual to properly start up the air handler.

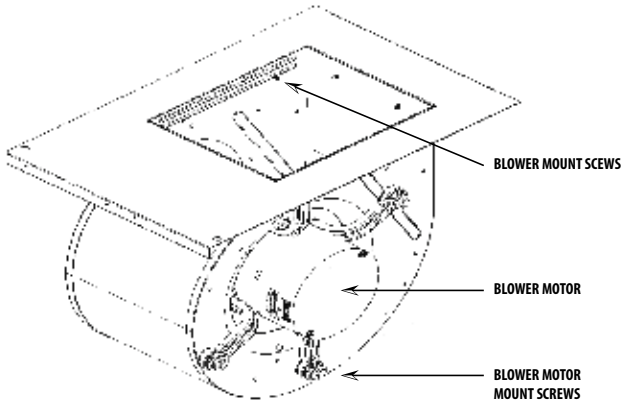


Figure 7: Blower Assembly and Mounting Screw Location

SECTION 3: AIR HANDLER CONTROLS

Electric Heat Models
This section discusses the air handler controls and how they operate. Refer to Figures 8 and 9 for component locations.

Limit Control(s) – Each electric heater element has an overtemperature limit control directly in front of it to sense overheating of the element. The limit electrical contacts open if the temperature rises above the set point of the limit control and interrupts the 24 VAC signal to the heater contactor coil which de-energizes the heater element. When the temperature of the element cools sufficiently for the limit control to reset, the heater elements are re-energized and the heater cycles until the cause for the overheating is corrected.

Heater Contactor(s) – The electric heater contactor turns the heater elements on and off. The contactor is controlled by the thermostat. On a call for heat by the thermostat, 24 VAC is applied to the 24 VAC coil of the contactor causing the electrical contacts of the contactor to close which energizes the heater elements. When the call for heat has been satisfied, the 24 VAC signal is removed from the 24 VAC coil on the contactor causing the electrical contacts of the contactor to open which de-energizes the heater elements. Models with 5kw and 10kw heaters have a single contactor and 15kw and 20kw heaters have two contactors.

Circuit Breaker(s) – The circuit breakers provide over-current protection for the air handler internal electrical components. Circuit breakers or fuses in the home's breaker box and must be sized to protect the line voltage wires connected to the air handler circuit breakers. Models with 5kw and 10kw heaters have a single circuit breaker and 15kw and 20kw heaters have two circuit breakers.

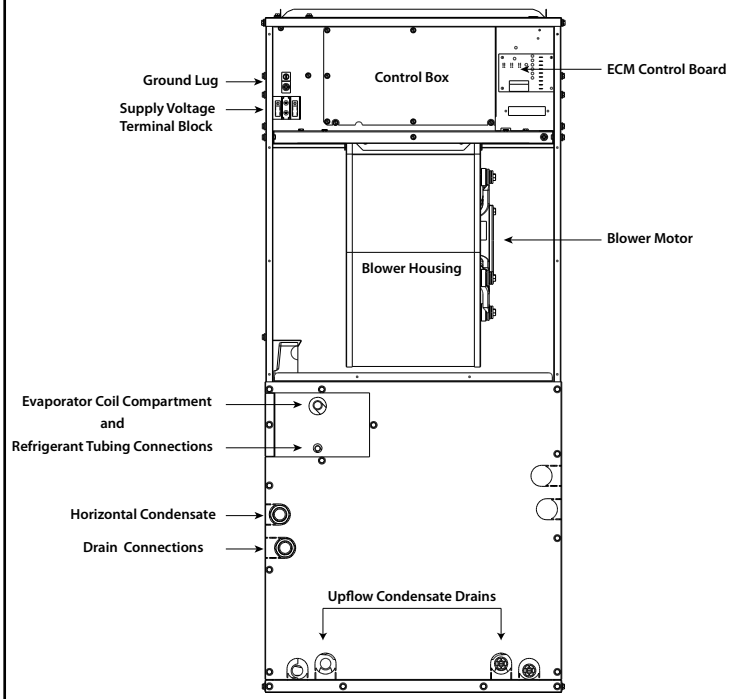


Figure 8: Component Locations – Electric Heat Models

Transformer – The transformer is used to reduce line voltage from 208 – 240 VAC to 24 VAC. The transformer provides the required 24 VAC for the system control circuit.

ECM Control Board – Models with ECM motors have an electronic control board that controls the heating and cooling blower CFM, blower ON and OFF delays, +/- blower CFM adjustment, cooling dehumidification, and climate profiles using jumper pins on the control board. The motor program for each air handler model resides in the motor's control module.

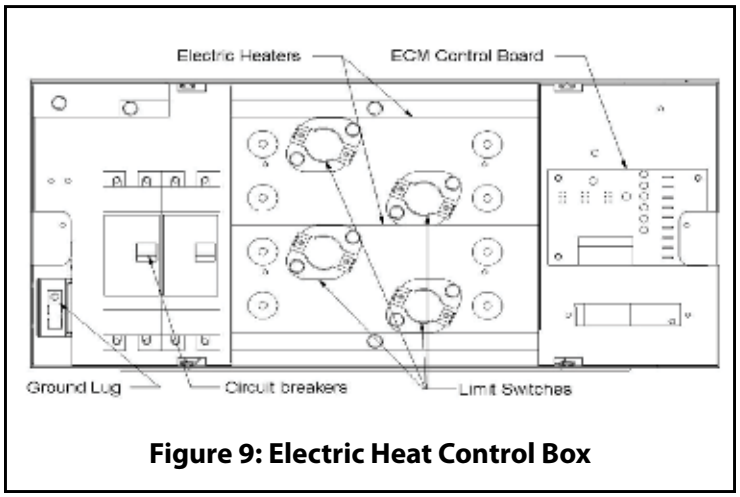


Figure 9: Electric Heat Control Box

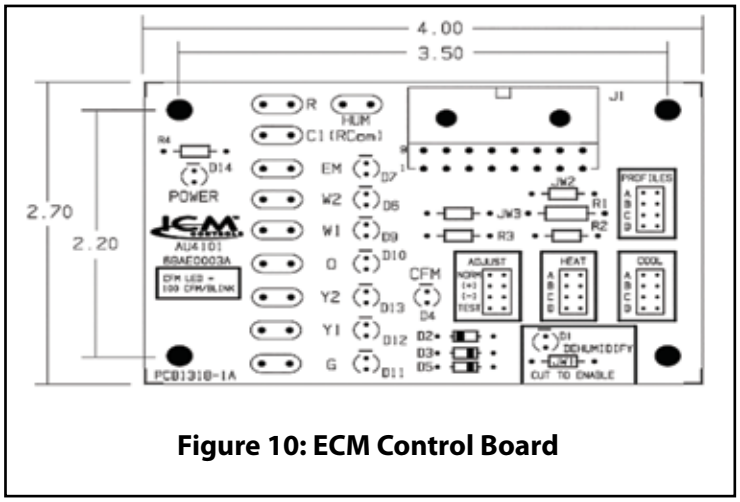


Figure 10: ECM Control Board

HYDRONIC HEAT MODELS
This section discusses the controls for hydronic heat models and explains how they operate. Refer to Figures 12 and 13 for component locations.

Transformer – The transformer is used to reduce the line voltage from 115 VAC to 24 VAC. The transformer provides the required 24 VAC for the system control circuit.

Hydronic Control Board (See Figure 11) – The hydronic control board is used on all hydronic models. This control board has on-board relays for blower motor control on models with constant torque motors and has an on-board pump relay that controls the pump function. On models with ECM motors, the ECM control board controls the ECM motor instead of the hydronic control board.

ECM Control Board (See Figure 10) – Models with ECM motors have an electronic control board that controls the heating and cooling blower CFM, blower ON and OFF delays, +/- blower CFM adjustment, cooling dehumidification, and climate profiles using jumper pins on the control board. The motor program for each air handler model resides in the motor's control module.

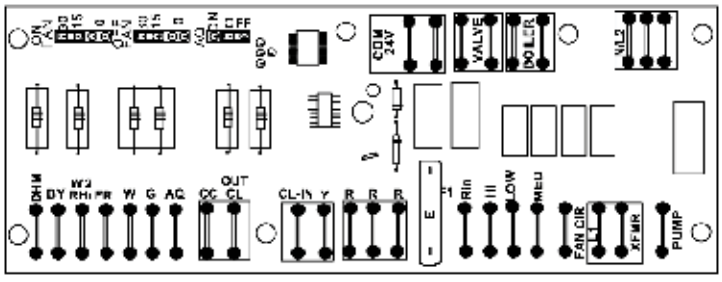


Figure 11: ICM AY1015 Hydronic Control Board for Constant Torque and ECM Motors

Hydronic Control Board Terminals and Descriptions
ICM AY1015 - Mortex Part No. 68AE0011 - The terminals and functions are explained below.

Line Voltage Terminals AY1015
L1 – Supply Voltage (115 VAC) to the control
L2 – Supply Neutral (115 Neutral) to the control
XFMR and L2 – 115 VAC supply to transformer
Pump and L2 – 115 VAC to the water pump

24 VAC Terminals AY1015:
Rin – 24 VAC supply from the transformer
24V COM – 24 VAC common from the transformer
R – Fused 24 VAC output connections
Y – Connect to the thermostat Y terminal
CC – Connect **CC** and **24V COM** to the compressor contactor on the outdoor unit.
CLin & Clout – connection between Y and CC
AQ – 24 VAC from aquastat temperature switch
G – 24 VAC from thermostat G terminal
W – 24 VAC from thermostat W terminal
FR – 24 VAC from freeze protection switch
RH/W2 – 24 VAC from thermostat W2 terminal
BY – 24 VAC from the priority switch on tank less heater
DHM – 24 VAC from thermostat DHM terminal
VALVE – 24 VAC and 24V COM to zone valve
BOILER – switch, connect to "T" terminals on boiler aquastat

Hydronic Control Board Terminal Functions
HI & COM – 24 VAC cooling speed tap to blower motor (constant torque models only)
MED & COM - 24 VAC dehumidification speed tap to blower motor (constant torque models only)
LO & COM - 24 VAC heating speed tap to blower motor (constant torque models only)
FAN CIR & COM – 24 VAC continuous fan speed tap to blower motor (constant torque models only)

CLin and CLout – These terminals must be connected to transfer 24 VAC from the Y terminal to the CC terminal. When the compressor lockout switch is used, the switch is secured to the water coil. The two yellow wires are connected to the CLin and the CLout terminals. When the temperature of the water coil reaches 38°F, the switch opens which de-energizes the CC terminal on the control board. When the water temperature has risen above 42°F the compressor lockout switch will close. The control will send 24 VAC to the CC terminal on the control board.

NOTE: If the compressor lockout switch is not used, place a jumper wire between CLin and CLout to get 24 VAC from the Y terminal to the CC terminal. The indoor blower will not be energized in the cooling mode until the CC terminal has 24 VAC at the terminal.

AQ – The aquastat switch is placed on the hot water line exiting side of the air handler coil. The aquastat is connected to the R terminal and the AQ terminal on the control board.
The AQ jumper pin shown in Figure 13 must be in the ON position to use this feature. When there is a call for heat (24 VAC on the W terminal) and the water line temperature reaches the aquastat switch setting, the switch will close sending 24 VAC to the AQ terminal turning on the blower motor. The blower motor will not energize until the aquastat switch is closed. When the call for heat has been satisfied, the indoor blower will be de-energized after the selected OFF delay.

VALVE – There are two terminals used to power a 24 VAC zone valve or solenoid valve. The terminal closest to the 24V COM terminals is a 24VAC common terminal to the valve. See Figure 13. The other terminal is the 24 VAC output to the valve. When there are 24 VAC to the W terminal the control board will send 24 VAC to the valve terminals. The VALVE terminals de-energize when the 24 VAC is removed from the W terminal.

BOILER - There are two terminals that are connected to a switch. The terminals do not output any voltage and are dry contacts. The BOILER switch is designed to be connected to the "T" terminals on a boiler aquastat to energize the boiler when the control board has a call for heat (24 VAC on W).

G – When 24 VAC is placed on the G terminal the control will energize the indoor blower by the FAN CIR terminal with NO delay. When the 24 VAC signal has been removed from the G terminal, the indoor blower will be de-energized with NO delay.

If there is a call for heat (24 VAC on the W terminal) while 24 VAC is present on the G terminal, the control will energize the pump, valve and boiler and the indoor fan motor will be de-energized. The indoor fan motor will be energized by the LOW terminal after the selected ON delay. When the call for heat has been satisfied, the control will de-energize the valve, pump and boiler and the indoor fan motor will switch to the FAN CIR speed terminal after the selected OFF delay.

If there is a call for cooling while there is 24 VAC on the G terminal, the control will switch the indoor blower speed to the HI terminal. When the call for cooling has been satisfied, the control will switch the indoor blower back to the FAN CIR speed.

W – When 24 VAC is present on the W terminal, the control will energize the pump, valve and boiler and the indoor fan will be energized by the LOW terminal after the selected ON delay. When the call for heat has been satisfied, the control will de-energize the valve, pump and boiler and the indoor fan motor will be de-energized after the selected OFF delay.

FR – The FR terminal energizes the control board freeze protection. The freeze protection switch is secured to the water coil. The two white wires are connected to the R terminal and to the FR terminal on the control board. When the temperature of the coil is below 38°F, the freeze protection switch closes and sends 24 VAC to the FR terminal. The control will energize the pump, valve and boiler. The control will not energize the indoor fan motor even when there is a call for heat with 24 VAC on the W terminal. When the water temperature has risen above 42°F, the freeze protection switch will open. The control will de-energize the pump, valve and boiler, if there is not a call for heat. If there is a call for heat at the time FR is de-energized, the pump, valve and boiler will remain ON and the control will energize the indoor fan motor with the LOW terminal after the selected ON delay.

RH/W2 – **RH** is only used for the reheat mode with a thermostat that has the reheat function.

BY – Bypass terminal is used when the heating and domestic hot water system are managed with the same tankless hot water system. The domestic water line has a normally open flow switch that is connected to the R and the BY terminals on the control board. When the domestic water flow switch detects the flow of water, the switch closes sending 24 VAC to the BY terminal. The control will de-energize the PUMP, VALVE, BOILER terminals and the indoor blower. When the domestic water flow has stopped the domestic water flow switch will open and the PUMP, VALVE, and BOILER terminals will resume normal operation. The indoor blower will be energized after the selected ON delay.

Y – When there is a call for cooling (24 VAC is placed on the Y terminal), the control will energize the indoor blower with the HI terminal after the selected ON delay. When the call or cooling has been satisfied, the indoor blower will be de-energized after the selected OFF delay.

DHM – **IMPORTANT NOTE:** MSVT air handlers are not set up for cooling mode dehumidification. Connecting a humidistat to the DHM terminal will cause the indoor blower to shut off in the cooling mode upon a call for dehumidification resulting in the indoor coil freezing up and outdoor unit compressor failure. Cooling dehumidification may be enabled on MSVE air handlers using the ECM control board.

SECTION 4: SEQUENCE OF OPERATION

Continuous Blower – Electric Heat Models

The thermostat has a manual fan switch that can be moved to the "ON" position for continuous fan position. This setting causes the thermostat to complete the circuit between "R" and "G" thermostat terminals. For models with constant torque motors, this sends 24 VAC to the selected indoor blower motor speed tap for the cooling mode (BLACK motor speed tap wire). The indoor blower will operate continuously until the fan switch on the thermostat is switched from "ON" to the "AUTO" setting which will cause the constant torque blower motor to be de- energized after a 30 second OFF time delay that is programmed into the motor's control module.

Models with ECM motors operate similarly except the thermostat inputs go to the ECM control board which will energize the ECM motor to deliver the continuous fan CFM programmed into the motor's control module.

Continuous Blower – Hydronic Heat Models

The thermostat has a manual switch that can be moved to the "ON" position for continuous fan operation. For models with constant torque motors, this setting causes the thermostat to complete the circuit between "R" and "G" thermostat terminals sending 24 VAC to the "G" terminal on the hydronic control board. The hydronic control board will then energize the "FAN CIR" terminal which sends 24 VAC to the selected indoor blower motor speed tap for the continuous fan mode (BLUE motor speed tap wire). The indoor blower will operate continuously until the fan switch on the thermostat is switched from "ON" to the "AUTO" setting. When the thermostat is switched back to "AUTO", the blower motor motor's control module.

Models with ECM motors operate similarly except the thermostat inputs go to the ECM control board which will energize the ECM motor to deliver the continuous fan CFM programmed into the motor's control module.

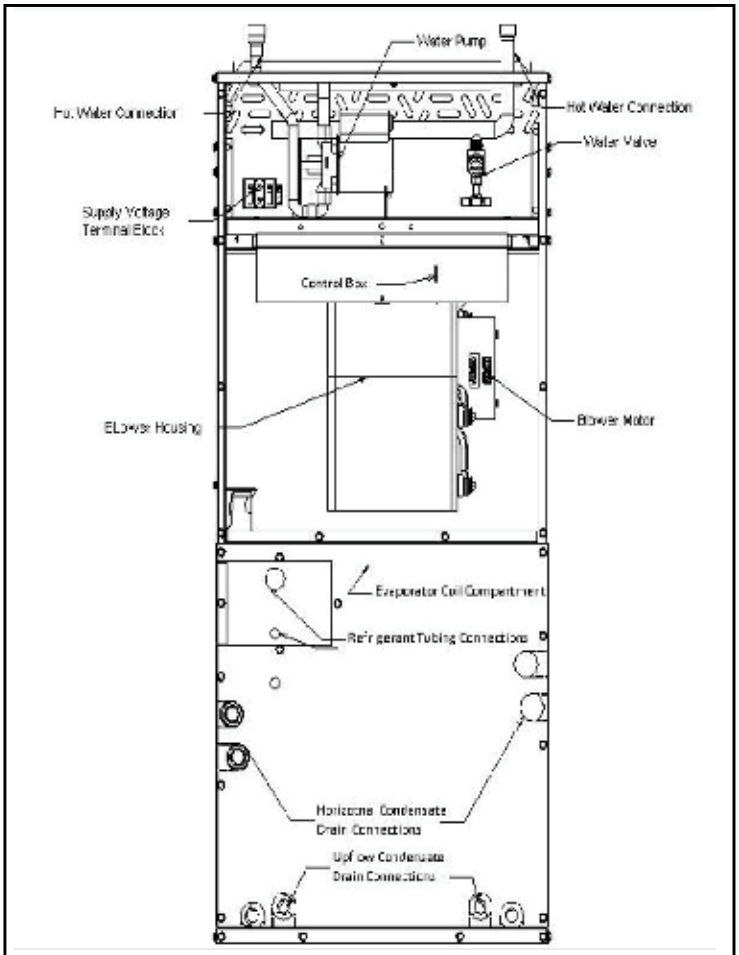


Figure 12: Component Locations Hydronic Heat Models

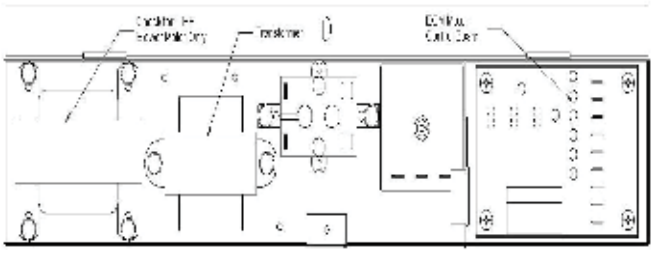


Figure 13: Hydronic Heat Control Box – No Pump

Intermittent Blower – Cooling - Electric Heat Models
The thermostat has a manual fan switch that can be moved to the "AUTO" position for intermittent fan operation. When the thermostat calls for cooling on models with constant torque motors, the circuit is completed between the "R", "Y" and "G" terminals causing the motor to operate on the selected speed tap for the cooling mode (BLACK motor speed tap wire).

When the thermostat is satisfied, the circuit between "R", "Y" and "G" will open, the blower motor will shut down after a 30 second OFF delay which is programmed into the motor control module.

Special 2-stage MSVT models are designed to accommodate 2-stage cooling/heat pump operation by providing 2 levels of airflow based on the "Y1" and "Y2" signals from a 2-stage thermostat. Airflow for "Y1" is approximately 75% of "Y2" airflow.

MSVE models with ECM motors operate similarly except the motor speed controls are built into the ECM control board which will energize the ECM motor to deliver the cooling CFM selected by the COOL jumper on the ECM control board. MSVE models are designed to accommodate 2-stage cooling/heat pump heating operation by providing 2 levels of airflow based on the "Y1" and "Y2" signals from a 2-stage thermostat. Airflow for "Y1" is approximately 70% of "Y2" airflow. Single-stage cooling/heat pump heating applications with a MSVE air handler require the wire from the thermostat "Y" terminal to be connected to both the "Y1" and "Y2" air handler low voltage pigtails for full nominal airflow to be delivered.

Intermittent Blower – Cooling - Hydronic Heat Models
The thermostat has a manual fan switch that can be moved to the "AUTO" position for intermittent fan operation. When the thermostat calls for cooling, the circuit is completed between the "R", "Y" and "G" terminals sending 24 VAC to the hydronic control board through the "Y" and "G" terminals. The blower motor will be energized on the selected cooling speed (BLACK motor speed tap wire) through the "HI" terminal on the control board after the selected ON time delay.

When the thermostat is satisfied, the circuit between "R", "Y" and "G" opens. The hydronic control board will de-energize the "HI" terminal on the control board after the selected OFF time delay on the hydronic control board and the blower motor will shut down. The blower is now in the stand-by mode awaiting the next cooling cycle.

Special 2-stage MSVT models are designed to accommodate 2-stage cooling/heat pump operation by providing 2 levels of airflow based on the "Y1" and "Y2" signals from a 2-stage thermostat. Airflow for "Y1" is approximately 75% of "Y2" airflow.

MSVE models with ECM motors operate similarly except the motor speed controls are built into the ECM control board which will energize the ECM motor to deliver the cooling CFM selected by the COOL jumper on the ECM control board. MSVE models are designed to accommodate 2-stage cooling/heat pump heating operation by providing 2 levels of airflow based on the "Y1" and "Y2" signals from a 2-stage thermostat. Airflow for "Y1" is approximately 70% of "Y2" airflow. Single-stage cooling/heat pump heating applications with a MSVE air handler require the wire from the thermostat "Y" terminal to be connected to both the "Y1" and "Y2" air handler low voltage pigtails for full nominal airflow to be delivered.

Intermittent Blower - Heating - Electric Heat Models
When the thermostat is set to 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, the white pigtail wire on the air handler to the 24 VAC coil on the first heater contactor. This signal energizes the heater contactor, closing the contacts and sending 208 - 240 VAC to the heaters. The 24 VAC signal from the "W" thermostat terminal will also energize the motor's selected heating speed tap (RED motor speed tap wire). When the call for heat has ended, the "W" thermostat terminal is de-energized which will de-energize the motor and open the heater contactor contacts. The air handler is now in the stand-by mode awaiting the next heating cycle.

Some models have a "W2" terminal that is connected to the 24 VAC coil on the second heater contactor. This terminal is to be used for second stage heat and is connected to the wire from the thermostat "W2" terminal. A thermostat that has a second stage heating feature (W2 terminal) is required to use this feature. The second stage heat cycle is typically enabled when the room temperature typically falls more than 3 degrees below the thermostat heating set point. The thermostat energizes the second stage heater to aid in heating the room back to the thermostat set point. Once the room temperature is within one degree of the thermostat heating set point, the second stage heater is de-energized until the thermostat calls for second stage heat again.

Models with ECM motors operate similarly except the motor speed controls are built into the ECM control board which will energize the ECM motor to deliver the heating CFM selected by the HEAT jumper on the ECM control board.

Intermittent Blower - Heating - Hydronic Heat Models

When the thermostat is in the HEAT mode and the fan switch on the thermostat is set to AUTO, a 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 that is connected to the "W" terminal on the air handler hydronic control board. The hydronic control board then energizes the water pump relay on the control board which sends 115 VAC to the PUMP terminal. This will energize the water pump and start the circulation of hot water through the water coil. The hydronic control board energizes the motor on the selected heating speed (RED motor speed tap wire) through the "LOW" terminal on the control board after the selected ON time delay.

When the call for heat has ended, the "W" terminal is de-energized which opens the control board pump relay contacts shutting down the pump. The blower motor will shut down after the selected OFF time delay. The air handler is now in the stand-by mode awaiting the next heating cycle.

Models with ECM motors operate similarly except the motor speed controls are built into the ECM control board which will energize the ECM motor to deliver the heating CFM selected by the HEAT jumper on the ECM control board.

SECTION 5: TROUBLESHOOTING

⚠ 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. Homeowners should never attempt to perform any maintenance which requires opening the air handler control box cover.

⚠ WARNING

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

⚠ WARNING

To avoid personal injury, take precautions to not touch non-insulated electrical components.

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

The following checks should be made before troubleshooting the air handler controls when the blower does not operate or there is a no-heat or no-cooling issue.

1. Check all circuit breakers in the air handler and at the building main electrical panel. 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, 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 air handler to make sure they are turned on, especially ON/OFF switches used for servicing the air handler. The service switch is often mistaken for a light switch and is turned off.
4. Check all wiring connections, especially those on the components, to ensure they are securely fastened.

ELECTRIC HEAT MODELS

If the air handler is equipped with electric heaters, check to make sure there is 208 - 240 VAC between the terminals on the load side of the circuit breakers in the control box . If 208-240 VAC is not present, check to see if the circuit breaker(s) in the air handler control box or in the building breaker box are tripped. If 208-240 VAC is present on the load side of the circuit breaker in the control box, check to make sure there is 24 VAC between to the RED thermostat pigtail or "R" low voltage terminal block terminal and ground. If 24 VAC is not present, but there is 208-240 VAC on the load side of the circuit breaker, check to see if the in-line fuse connected to the transformer secondary circuit is blown. If the fuse is not blown, check the wiring and connections from the transformer to the low voltage terminal block or ECM control board, and the RED pigtail connection on the ECM control board (if applicable). If the wiring and connections are OK and there is 208-240 VAC at the transformer primary, replace the transformer. If 24 VAC is present between the RED thermostat pigtail or "R" terminal and ground, continue the troubleshooting process by conducting the following checks.

ECM Motor Check – Electric Heat Models

If the motor is not running and there is 208-230 VAC on the load side of the circuit breaker in the control box, check the line voltage wiring and connections between the circuit breaker and the line voltage motor terminal block and the low voltage wiring and connections between the control board and the motor terminal block. Check to see if 24 VAC is present between the "G" and "C" terminals on the ECM control board when the thermostat is calling for cooling or continuous fan or between the "W1" and "C" terminals on the ECM control board when the thermostat is calling for heat. If 208 - 240 VAC and 24 VAC are present at the above points, perform the following checks to verify proper functioning of the ECM control board.

ECM Control Board Check: Voltmeter will not read between pins 4, 5, 7, 11 and 1 or 3 because these signals are not full wave signals. To verify ECM control board is functioning properly in the heating mode check for 24 VAC between pins 1 and 2. To verify ECM board is functioning properly in the cooling mode check for 24 VAC between pins 1 and 6 also 1 and 15. If the ECM control board is OK, replace the motor or motor control module.

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 +COOL setting.

Table 1: ECM Motor Control Connector Terminal Descriptions

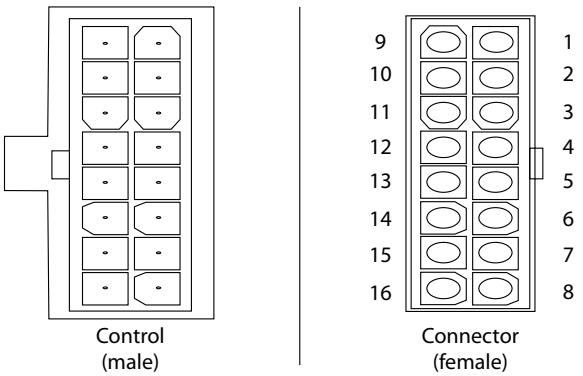


Figure 14: ECM Motor Control Pin Positions

Constant Torque Motor Check – Electric Heat Models
If the blower motor will not run in both the heating and cooling modes and there is 208-230 VAC on the load side of the circuit breaker in the control box, check the connections in the blower motor 6-pin plugs (BMMP and BMFP). If those connections are OK, proceed with the following checks.

If the motor is not running, check for 208 - 240 VAC between the L and N motor terminals and for 24 VAC at either the RED or BLACK wires connecting to 2 of the motor terminals 1 - 5 when the thermostat is calling for blower operation. Refer to Figure 15 and Tables 3 and 4 for terminal locations and definitions. If the 208 - 240 VAC is present between the L and N terminals and 24 VAC is measured between motor terminal C and one of the motor speed tap wires, but the motor is not operating, replace the motor. If 208 - 240 VAC is not present between the L and N motor terminals, check the 6wiring connections to the control board and circuit breaker. If 24 VAC is not present at any of the motor speed tap wires going to the motor terminal block terminals 1 – 5, check the connections to the control board and check to see if the in-line 3A fuse connected to the transformer secondary is blown.

Heating Mode – Electric Heat Models - Constant Torque Motor If 24 VAC is not present between the "W" terminal on the air handler's low voltage terminal block and ground when the thermostat is calling for heat, check the wiring and wiring connections from the thermostat "W" terminal to the "W" terminal on the air handler's low voltage terminal block. If 24 VAC is present on the "W" terminal on the low voltage terminal block, check for 24 VAC on the RED motor speed tap wire connected to the motor terminal block. If 24 VAC is not present on the RED motor speed tap wire, check the wiring and wiring connections between the low voltage terminal block and the blower motor terminal block. If the wiring and connections are OK, replace the motor.

Cooling Mode or Continuous Fan - Electric Heat Models - Constant Torque Motor
If 24 VAC is not present between the "G" and "C" terminals on the air handler's low voltage terminal block when there is a call for cooling or continuous fan operation, check for 24 VAC between the "R" and "C" terminals on the thermostat. If 24 VAC is not present at the thermostat "R" terminal, check the wiring from the "R" terminal on the air handler's low voltage terminal block to the thermostat. If there is 24VAC at the thermostat "R" terminal, but not at the "G" terminal on the thermostat when there is a call for cooling or continuous fan operation, replace the thermostat. If there is 24 VAC between the "G" and "C" terminals on the air handler's low voltage terminal block, check for 24 VAC on the BLACK motor speed tap wire connected to the motor terminal block. If 24 VAC is not present on the BLACK motor speed tap wire, check the wiring and wiring connections between the low voltage terminal block and the blower motor terminal block. If the wiring and connections are OK, replace the motor.

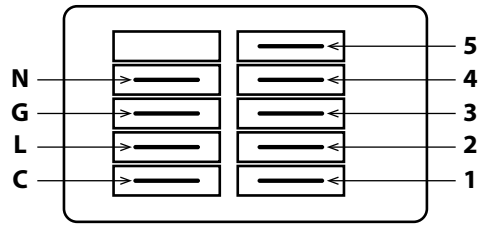


Figure 15: Constant Torque Motor Terminals

Terminal	Connection
C	Speed Tap Common - 24 VAC Common
L	Supply Voltage - 240 Vac Line 1
G	Ground Connection
N	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 2: Constant Torque Motor Terminal Connections Single-Stage Cooling/Heat Pump Electric Heat Models

Terminal	Connection
C	Speed Tap Common - 24 VAC Common
L	Supply Voltage - 240 Vac Line 1
G	Ground Connection
N	Supply Voltage - 240 Vac Line 2
1	Heating Speed Tap - 24 VAC Input
2	1st Stage Cooling Speed Tap 1.5, 2.5, 3.5, 4.5 Tons - 24 VAC Input
3	1st Stage Cooling Speed Tap 2.0, 3.0, 4.0, 5.0 Tons - 24 VAC Input
4	2nd Stage Cooling Speed Tap 1.5, 2.5, 3.5, 4.5 Tons - 24 VAC Input
5	2nd Stage Cooling Speed Tap 2.0, 3.0, 4.0, 5.0 Tons - 24 VAC Input

Table 3: Constant Torque Motor Terminal Connections 2-Stage Cooling/Heat Pump Electric Heat Models

HP	ECM	C.T.
1/3	0.78	0.72
1/2	2.00	1.66
3/4	2.50	2.09
1.0	3.75	5.72

Table 4: 208 / 240 Volt Blower Motor Full Load Amperage (FLA) Chart – Electric Heat Models

Heating Element Is Not Heating

Check for 208 - 240 VAC between terminals T1 and T2 of the heater contactor(s). If 208 - 240 VAC is present, check the resistance across the heating element terminals. If the heating element resistance is infinity (open circuit), replace the defective heating element.

The heater design is as follows:

- The 5 kW model has one 5 kW heating element.
- The 10 kW model has one heater assembly with two 5 kW heating elements.
- The 15 kW model has one heater assembly with two 5 kW heating elements (top) and one heater assembly with one 5 kW heating element (bottom).
- The 20 kW model has two heater assemblies, each with 5 kW heating elements.

If 208 - 240 VAC is not present between the T1 and T2 terminals (load) of a heater contactor, but there is 208-240 VAC present between terminals L1 and L2 (line) of that heater contactor, check for an open limit control and replace the open limit control.

If 208-240 VAC is not present between the T1 and T2 terminals (load) of a heater contactor, but 208-240 VAC is present between the terminals L1 and L2 (line) of the heater contactor(s) and there is 24 VAC across the coil of that contactor, replace the heater contactor.

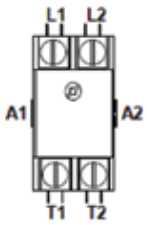


Figure 16: Heater Contactor Terminals

HYDRONIC HEAT MODELS

Hydronic Control Board

Models with hydronic heat have a hydronic control board. There should be 115 VAC between the L1 and N terminals on the power terminal block or between pins #4 and #5 in the power cable plug at the motor, and 115 VAC between the XFMR and N/L2 terminals on the control board. There should also be 24 VAC between the "Rin" and "COM" terminals on the control board. Also check to make sure there is 24 VAC between to the "R" terminal and "COM" terminal on the control board. If there is 24 VAC between "Rin", but 24 VAC is not present between the "R" and "COM" terminals, check the fuse on the control board to see if it is blown. If there is 24 VAC at both of these locations, continue the troubleshooting process by conducting the following checks.

ECM Motor Check – Hydronic Heat Models

Models equipped with an ECM motor have an ECM control board in addition to the hydronic control board. If the motor is not running, check for 115 VAC between the L1 and N terminals on the power terminal block or motor power cable plug terminals #4 and #5. If 115 VAC is not present, check the wiring and connections to restore 115 VAC power to the air handler. If the 115 VAC is present at the motor, but the motor is not operating, check the ECM control board to determine if 24 VAC is present between the "C1" and "W1" terminals if the thermostat is calling for heat or between the "C1" and "G" if the thermostat is calling for cooling or continuous fan. If 24 VAC is not present, check the thermostat and thermostat wiring and connections. If 24 VAC is present, perform the tests in ECM Control Board Check on the page 15 of these instructions to verify the ECM control board is functioning properly. If the above checks are normal, replace the motor or motor control module.

Constant Torque Motor Check – Hydronic Heat Models

If the motor is not running when there is a call for heat, cooling, or continuous fan, check for 115 VAC between the L and N motor terminals and check for 24 VAC between the "COM/24V" terminal and either the "HI", "MED", or "LO" terminal on the control board. If 115 VAC is present between motor terminals L and N, and 24 VAC is present between the "COM/24V" terminal and either the "HI", "MED" or "LO" terminal on the control board, but the motor is not operating, check the wiring connections at the motor terminals and the motor connector plugs BMMP and BMFP. If these connections are secure, replace the motor. Refer to Figure 15 and Tables 5 and 6 for terminal locations and definitions.

TERMINAL	CONNECTION
C	Speed Tap Common - 24 VAC Common
L	Supply Voltage - 115 VAC
G	Ground Connection
N	Supply Voltage - Neutral
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 5: Constant Torque Motor Terminal Connections Single-Stage Cooling/Heat Pump Hydronic Heat Models

Terminal	Connection
C	Speed Tap Common - 24 VAC Common
L	Supply Voltage - 115 VAC
G	Ground Connection
N	Supply Voltage - Neutral
1	Heating Speed Tap - 24 VAC Input
2	1st Stage Cooling Speed Tap 1.5, 2.5, 3.5, 4.5 Tons - 24 VAC Input
3	1st Stage Cooling Speed Tap 2.0, 3.0, 4.0, 5.0 Tons - 24 VAC Input
4	2nd Stage Cooling Speed Tap 1.5, 2.5, 3.5, 4.5 Tons - 24 VAC Input
5	2nd Stage Cooling Speed Tap 2.0, 3.0, 4.0, 5.0 Tons - 24 VAC Input

Table 6: Constant Torque Motor Terminal Connections 2-Stage Cooling/Heat Pump Hydronic Heat Models

HP	ECM	C.T.
1/3	1.80	2.72
1/2	2.31	2.72
3/4	6.31	5.71
1.0	8.48	8.48

Table 7: 115 Volt Blower Motor Full Load Amperage (FLA) Chart

Removing the Blower

1. Turn off the circuit breaker to the air handler at the main electrical panel.
2. Switch the air handler circuit breaker(s) to "OFF" (electric heat models) or the local power disconnect switch to "OFF" (hydronic heat models).
3. Remove the blower / control box access panel.
4. Unplug the wire harnesses from the blower motor.
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. After repairs or checks have been completed, 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 blower / control box access panel.
8. Switch the air handler circuit breaker(s) to "ON" (electric heat models) or the local power disconnect switch to "ON" (hydronic heat models).
9. Turn the circuit breaker to the air handler at the main electrical panel to "ON".
10. Set the thermostat to the desired mode and temperature and observe the air handler startup to ensure it is operating correctly.

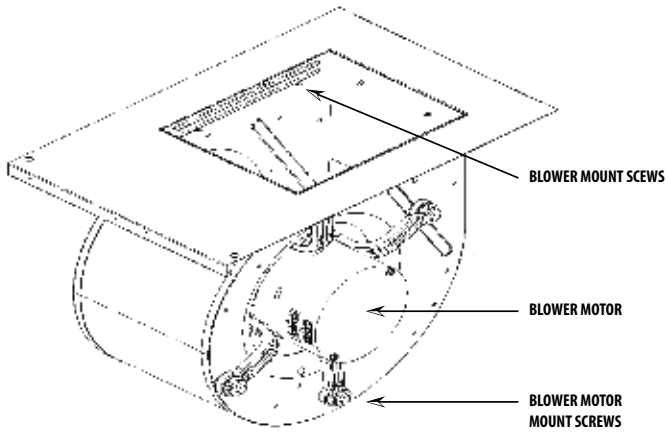


Figure 17: Blower Mounting Plate Screw Locations

SECTION 6: BLOWER PERFORMANCE

Model Number	Motor HP	Volts 1 Ph. 60 Hz	Motor Code	Blower Wheel	Speed Tap	CFM @ 0.10" ESP	CFM @ 0.20" ESP	CFM @ 0.30" ESP	CFM @ 0.40" ESP	CFM @ 0.50" ESP	CFM @ 0.60" ESP
MSVT18 Electric Heat	0.33	208/240	VD1	10 X 7	1	699	639	565	536	451	402
					2	741	676	592	517	527	458
					3	908	849	777	679	745	655
					4	1022	963	905	840	761	703
					5	1102	1054	996	928	884	812
MSVT24 Electric Heat	0.33	208/240	VD1	10 X 7	1	861	786	708	638	547	615
					2	924	872	814	726	663	656
					3	1067	1013	963	894	826	758
					4	1139	1093	1042	982	918	857
					5	1220	1157	1105	1049	985	893
MSVT25 Electric Heat	0.50	208/240	VE1	10 X8	1	995	934	855	793	712	649
					2	1047	994	926	876	782	700
					3	1146	1075	1019	957	880	811
					4	1224	1161	1099	1030	972	904
					5	1300	1247	1186	1115	1058	996
MSVT30 Electric Heat	0.50	208/240	VE1	10 X8	1	898	829	784	741	691	604
					2	999	962	918	888	847	811
					3	1164	1120	1087	1060	1022	990
					4	1260	1222	1197	1162	1131	1098
					5	1353	1321	1289	1258	1229	1197
MSVT36 Electric Heat	0.50	208/240	VE1	10 X8	1	1161	1135	1086	1056	1027	992
					2	1261	1228	1198	1153	1129	1100
					3	1361	1310	1286	1262	1227	1201
					4	1478	1431	1405	1383	1351	1309
					5	1568	1536	1507	1470	1440	1400
MSVT37 Electric Heat	0.75	208/240	VF1	12 X 9	1	1466	1406	1249	1198	1150	1075
					2	1487	1454	1383	1328	1291	1231
					3	1516	1508	1462	1415	1365	1319
					4	1588	1600	1569	1520	1471	1423
					5	1672	1672	1657	1619	1557	1520
MSVT42 Electric Heat	0.75	208/240	VF1	12 X 9	1	1483	1458	1370	1315	1267	1238
					2	1524	1503	1445	1392	1343	1286
					3	1587	1607	1556	1512	1466	1423
					4	1671	1648	1667	1607	1572	1532
					5	1707	1685	1722	1678	1633	1599
MSVT48 Electric Heat	0.75	208/240	VF1	12 X 9	1	1579	1560	1544	1491	1445	1397
					2	1685	1671	1626	1587	1544	1507
					3	1739	1746	1711	1674	1629	1579
					4	1802	1778	1809	1764	1718	1682
					5	1876	1870	1896	1870	1836	1782
MSVT60 Electric Heat	0.75	208/240	VF1	12 X 9	1	1579	1560	1544	1491	1445	1397
					2	1685	1671	1626	1587	1544	1507
					3	1745	1734	1745	1712	1656	1616
					4	1958	1953	1943	1919	1874	1828
					5	2038	2015	2010	2005	1977	1934
MSVT72 Electric Heat	1.00	208/240	VV	12 X 10	1	1910	1865	1826	1787	1750	1715
					2	2088	2054	2019	1969	1932	1895
					3	2240	2201	2162	2129	2088	2050
					4	2370	2339	2290	2246	2208	2170
					5	2504	2470	2441	2393	2351	2310

Table 8: MSVT Blower Performance – Single-Stage Cooling/Heat Pump Electric Heat Models With Constant Torque Motors - Without Air Filters

Notes: 1) Minimum CFM for Electric Heat: 5 - 10kW = 650 CFM; 15kW = 1000 CFM; 20 kW = 1400 CFM

Model Number	Motor HP	Volts 1 Ph. 50/60 Hz.	Motor Code	Blower Wheel	Speed Tap	CFM @ 0.10" ESP	CFM @ 0.20" ESP	CFM @ 0.30" ESP	CFM @ 0.40" ESP	CFM @ 0.50" ESP	CFM @ 0.60" ESP
MSVT18 MSVT24 Hydronic Heat	0.50	115	VJ1	10 X 8	1	710	626	552	436	429	376
					2	848	788	732	646	552	537
					3	908	844	789	747	678	570
					4	1076	1020	972	899	808	667
					5	1187	1111	1040	962	842	691
MSVT24 Hydronic Heat	0.75	115	VK1	10 X 8	1	911	839	788	717	695	590
					2	1030	909	909	842	766	761
					3	1080	1023	976	920	849	780
					4	1158	1104	1038	985	917	861
					5	1254	1203	1146	1093	1035	973
MSVT30 Hydronic Heat	0.75	115	VK1	10 X 8	1	1018	973	935	902	858	808
					2	1065	1022	989	958	923	880
					3	1154	1118	1082	1051	1020	984
					4	1269	1231	1191	1166	1135	1111
					5	1358	1326	1294	1270	1237	1210
MSVT36 Hydronic Heat	0.75	115	VK1	10 X 8	1	1158	1121	1086	1053	1024	994
					2	1267	1236	1199	1166	1140	1105
					3	1358	1327	1290	1260	1236	1204
					4	1608	1545	1483	1414	1332	1255
					5	1643	1589	1512	1431	1351	1279
MSVT37 Hydronic Heat	1.00	115	VX1	12 X 10	1	1240	1202	1145	1088	1027	975
					2	1344	1307	1254	1202	1161	1096
					3	1409	1369	1324	1278	1237	1175
					4	1504	1453	1414	1373	1312	1273
					5	1589	1558	1504	1462	1409	1373
MSVT42 Hydronic Heat	1.00	115	VX1	12 X 10	1	1445	1395	1354	1306	1251	1215
					2	1522	1479	1440	1391	1344	1296
					3	1603	1571	1518	1484	1431	1381
					4	1692	1650	1615	1575	1530	1484
					5	1805	1758	1722	1681	1638	1595
MSVT48 Hydronic Heat	1.00	115	VX1	12 X 10	1	1592	1560	1511	1473	1430	1376
					2	1691	1658	1627	1576	1540	1494
					3	1789	1750	1717	1677	1631	1592
					4	1888	1847	1817	1771	1739	1695
					5	2162	2091	2031	1950	1880	1796
MSVT60 Hydronic Heat	1.00	115	VX1	12 X 10	1	1564	1523	1482	1421	1381	1336
					2	1653	1607	1564	1511	1477	1435
					3	1734	1701	1653	1618	1572	1523
					4	1895	1849	1818	1773	1730	1683
					5	2151	2085	2015	1939	1870	1776

Table 9: MSVT Blower Performance – Single-Stage Cooling/Heat Pump Hydronic Heat Models With Constant Torque Motors - Without Air Filters

Model Number	Motor HP	Volts 1 Ph. 50/60 Hz	Blower Code	Blower Wheel	Speed Tap Descriptions	Speed Tap	CFM @ 0.10" E.S.P	CFM @ 0.20" E.S.P	CFM @ 0.30" E.S.P	CFM @ 0.40" E.S.P	CFM @ 0.50" E.S.P	CFM @ 0.60" E.S.P	CFM @ 0.70" E.S.P
MSVT18**B MSVT24**B Electric Heat	1/3	208/240	VD2	10 X 7	2nd Stage - 2.0 Tons	5	1062	999	938	873	799	785	707
					2nd Stage - 1.5 Tons	4	880	835	771	726	653	577	509
					1st Stage - 2.0 Tons	3	744	679	628	538	511	442	348
					1st Stage - 1.5 Tons	2	634	546	464	403	348	292	209
					All Heating kW's	1	962	906	836	768	776	704	646
MSVT25**B Electric Heat	1/2	208/240	VE2	10 X 8	2nd Stage - 2.0 Tons	5	1072	1015	952	880	810	776	700
					2nd Stage - 1.5 Tons	4	929	871	821	737	683	589	589
					1st Stage - 2.0 Tons	3	816	706	634	558	527	434	347
					1st Stage - 1.5 Tons	2	786	635	482	404	338	264	200
					All Heating kW's	1	980	933	860	791	720	709	627
MSVT30**B MSVT36**B Electric Heat	1/2	208/240	VE2	10 X 8	2nd Stage - 3.0 Tons	5	1467	1415	1356	1286	1272	1196	1095
					2nd Stage - 2.5 Tons	4	1280	1210	1140	1060	988	995	915
					1st Stage - 3.0 Tons	3	1061	1001	934	865	794	766	682
					1st Stage - 2.5 Tons	2	908	849	779	702	676	611	596
					All Heating kW's	1	1302	1221	1141	1065	982	992	923
MSVT37**B Electric Heat	3/4	208/240	VF2	12 X 9	2nd Stage - 3.0 Tons	5	1541	1500	1425	1349	1262	1172	1083
					2nd Stage - 2.5 Tons	4	1458	1320	1194	1088	1065	998	814
					1st Stage - 3.0 Tons	3	1319	1178	946	588	558	445	354
					1st Stage - 2.5 Tons	2	1306	1094	928	425	220	---	---
					All Heating kW's	1	1451	1320	1198	1097	1062	989	860
MSVT42**B MSVT48**B Electric Heat	3/4	208/240	VF2	12 X 9	2nd Stage - 4.0 Tons	5	1950	1896	1858	1801	1711	1611	1515
					2nd Stage - 3.5 Tons	4	1775	1726	1669	1600	1487	1384	1378
					1st Stage - 4.0 Tons	3	1464	1411	1260	1170	1062	978	945
					1st Stage - 3.5 Tons	2	1478	1352	1131	995	967	852	848
					All Heating kW's	1	1793	1759	1697	1623	1522	1464	1406
MSVT60**B Electric Heat	3/4	208/240	VF2	12 X 9	2nd Stage - 5.0 Tons	5	2100	2054	2016	1942	1865	1780	1681
					2nd Stage - 4.5 Tons	4	1942	1920	1870	1795	1696	1586	1485
					1st Stage - 5.0 Tons	3	1546	1480	1402	1295	1200	1182	1082
					1st Stage - 4.5 Tons	2	1498	1371	1226	1126	1026	1034	1026
					All Heating kW's	1	1663	1625	1545	1466	1368	1273	1170

Table 10: MSVT Blower Performance – 2-Stage Cooling/Heat Pump Models With Electric Heat & Constant Torque Motors – Without Air Filters

Notes:

1) Minimum CFM for Electric Heat: 5 - 10kW = 650 CFM; 15kW = 1000 CFM; 20 kW = 1400 CFM

2) The motor speed tap for electric heat is connected to Speed Tap 1 on the motor terminal block from the factory. Speed tap 1 is designed to provide sufficient CFM for all kW's available in a specific model, but may result in a lower than desired supply temperature for lower kW heaters. The heating speed tap on the motor terminal block may be moved to another available speed tap with lower CFM as long as the minimum CFM requirement for the installed electric heater kW is met.

Model Number	Motor HP	Volts 1 Ph. 50/60 Hz	Blower Code	Blower Wheel	Speed Tap Descriptions	Speed Tap	CFM @ 0.10" E.S.P	CFM @ 0.20" E.S.P	CFM @ 0.30" E.S.P	CFM @ 0.40" E.S.P	CFM @ 0.50" E.S.P	CFM @ 0.60" E.S.P	CFM @ 0.70" E.S.P
MSVT18**B MS2T24**B Hydronic Heat	1/2	115	VJ2	10 x 8	2nd Stage - 2.0 Tons	5							
					2nd Stage - 1.5 Tons	4							
					1st Stage - 2.0 Tons	3							
					1st Stage - 1.5 Tons	2							
					Hyd Heat / Cont Fan	1							
MSVT25**B Hydronic Heat	3/4	115	VK2	10 x 8	2nd Stage - 2.0 Tons	5							
					2nd Stage - 1.5 Tons	4							
					1st Stage - 2.0 Tons	3							
					1st Stage - 1.5 Tons	2							
					Hyd Heat / Cont Fan	1							
MSVT30**B MSVT36**B Hydronic Heat	3/4	115	VK2	10 x 8	2nd Stage - 3.0 Tons	5							
					2nd Stage - 2.5 Tons	4							
					1st Stage - 3.0 Tons	3							
					1st Stage - 2.5 Tons	2							
					Hyd Heat / Cont Fan	1							
MSVT37**B Hydronic Heat	1	115	VX2	12 x 10	2nd Stage - 3.0 Tons	5							
					2nd Stage - 2.5 Tons	4							
					1st Stage - 3.0 Tons	3							
					1st Stage - 2.5 Tons	2							
					Hyd Heat / Cont Fan	1							
MSVT42**B MSVT48**B Hydronic Heat	1	115	VX2	12 x 10	2nd Stage - 4.0 Tons	5							
					2nd Stage - 3.5 Tons	4							
					1st Stage - 4.0 Tons	3							
					1st Stage - 3.5 Tons	2							
					Hyd Heat / Cont Fan	1							
MSVT60**B Hydronic Heat	1	115	VX2	12 x 10	2nd Stage - 5.0 Tons	5							
					2nd Stage - 4.5 Tons	4							
					1st Stage - 5.0 Tons	3							
					1st Stage - 4.5 Tons	2							
					Hyd Heat / Cont Fan	1							

Table 11: MSVT Blower Performance – 2-Stage Cooling/Heat Pump Models w/Hydronic Heat & Constant Torque Motors – Without Air Filters

Model Number	Nominal Tons	Motor HP	Volts 1 Ph. 50/60 Hz.	Motor Code	Blower Wheel	Jumper	CFM @ 0.10"	CFM @ 0.20"	CFM @ 0.30"	CFM @ 0.40"	CFM @ 0.50"
MSVE18,24 Electric Heat	1.5 & 2.0	1/3	240	VA	9 X 6	A	837	837	824	817	806
						B	744	733	721	717	713
						C	705	697	689	681	677
						D	634	620	615	611	602
MSVE18,24 Hydronic Heat	1.5 & 2.0	1/3	120	VG	10X7	A	884	884	884	880	880
						B	799	792	789	789	789
						C	691	691	691	691	690
						D	589	589	589	589	584
MSVE25,30,36 Electric Heat	1.5 - 3.0	1/2	240	VB	10 X 7	A	1422	1421	1421	1416	1416
						B	1215	1214	1214	1214	1208
						C	898	989	989	982	969
						D	865	865	865	866	858
MSVE25,30,36 Hydronic Heat	1.5 - 3.0	1/2	120	VH	10 X 7	A	1294	1255	1200	1137	1058
						B	1131	1104	1075	1082	1023
						C	974	942	909	853	831
						D	808	769	736	702	657
MSVE37,42,48,60 Electric Heat	3.0 - 5.0	3/4	240	VC	12 X 9	A	1957	1919	1900	1871	1847
						B	1576	1565	1547	1517	1487
						C	1495	1482	1451	1432	1409
						D	1411	1385	1372	1338	1311
MSVE37,42,48,60 Hydronic Heat	3.0 - 5.0	1	120	VI	12 X 9	A	2001	1994	1994	1987	1972
						B	1820	1820	1820	1804	1796
						C	1587	1599	1604	1604	1604
						D	1385	1385	1385	1385	1385
MSVE72 Electric Heat	6.0	1	240	VU	12 X 10	A	2393	2393	2393	2393	2388
						B	2227	2227	2221	2221	2221
						C	2012	2012	2005	2005	2005
						D	1795	1795	1795	1795	1795
MSVE72 Hydronic Heat	6.0	1	120	VW	12 X 10	A	2132	2119	2091	2077	2063
						B	1921	1901	1901	1886	1886
						C	1724	1724	1724	1724	1707
						D	1508	1508	1508	1488	1488

Table 12: MSVE Blower Performance – Models With ECM Motors (Y1+Y2, W, W1, or W2) - Without Air Filters

Notes: 1) For single-stage cooling/heat pump systems, connect the wire from the "Y" thermostat terminal to both the "Y1" and "Y2" air handler low voltage pigtails to assure full nominal airflow.
2) "Y1" CFM (1st stage cooling/heat pump heating) is approximately 70% of the values shown in Table 12.
3) Continuous blower CFM is approximately 50% of the values shown in Table 12.
4) Minimum CFM for Electric Heat: 5 - 10kW = 650 CFM; 15kW = 1000 CFM; 20 kW = 1400 CFM

SECTION 7: ECM MOTOR CLIMATE PROFILES

The ECM motor has an extensive array of programmable features for varying air-flow as a function of time. These options are beneficial to enhance comfort and efficiency in furnaces, air conditioners and heat pumps.

The climate profiles can be adjusted in the installation to optimize comfort by moving the PROFILES jumper pin on the ECM control board (See Figure 18). The ECM motor supports four field selectable cooling profiles and a non-adjustable heating profiles. Each profile, which represents one complete thermostat cycle, has 4 unique components called Pre-Run, Short Run, Full Capacity, and Off Delay.

Cooling Profiles (See Figure 20)
These profiles are used to provide dehumidification and improve system efficiency.
Pre-Run Period provides a reduced indoor airflow at compressor startup as a percentage of the selected cooling CFM for a specific duration of time to increase dehumidification of the air. The percentage of airflow reduction and duration varies with each profile.
The Short Run Period continues to provide a reduced airflow CFM to a lesser extent for a specific time to achieve various degrees of dehumidification and reduce re-evaporation. In arid climates, a profile can be selected that eliminates the short run period to achieve full capacity cooling sooner since additional dehumidification is unnecessary.
The OFF Delay Period is intended to allow the blower to run for a period of time after the compressor shuts off to allow the residual cooling capacity in the cold evaporator coil to be distributed into the conditioned space. For the humid climate profile, this time is programmed to zero to minimize re-evaporation of moisture in the evaporator coil and drain pan back into the conditioned space.

Heating Profiles (See Figure 21)
These profiles are used to provide enhance comfort and to improve system efficiency. There are a variety of profiles available to accommodate most popular heating technologies. It may be desirable for a **gas** or **oil furnace** to have a short Pre-Run delay at very low airflow until the heat exchanger is up to an adequate temperature. At the end of the heating cycle, an OFF delay can be used to improve system efficiency by continuing to move air across the exchanger until the residual heat is removed. For **electric heat**, a relatively rapid increase of the airflow to full CFM is necessary to prevent overheating of the heating elements. Likewise, rapidly reducing the CFM to zero will prevent blowing cool air into the home after the heating elements have been de-energized. The standard **"Electric"** and **"Heat Pump Heating"** profiles are programmed into the motors used in this air handler and are not field adjustable.

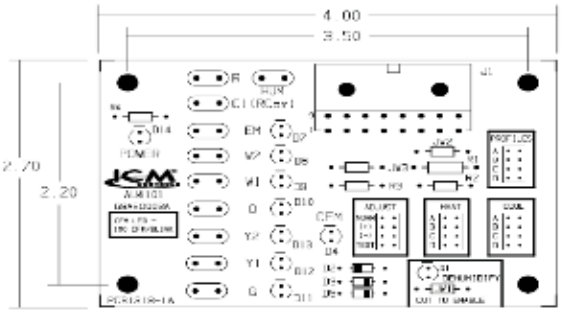
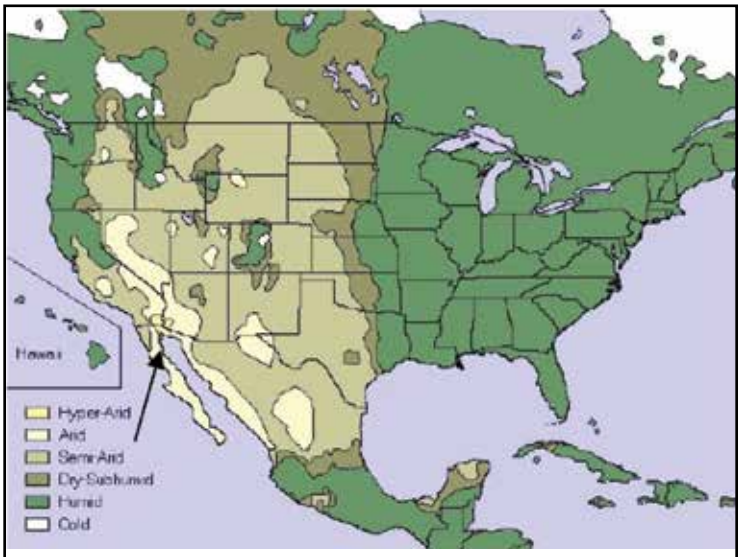


Figure 18: ECM Control Board Layout



NOTE: Cold area is shaded in white in Canada only.

Figure 19: North America Climate Map

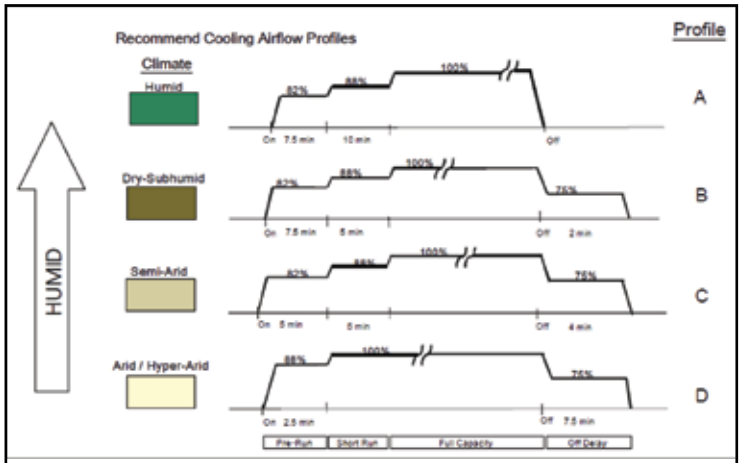


Figure 20: ECM Climate Profiles for Cooling

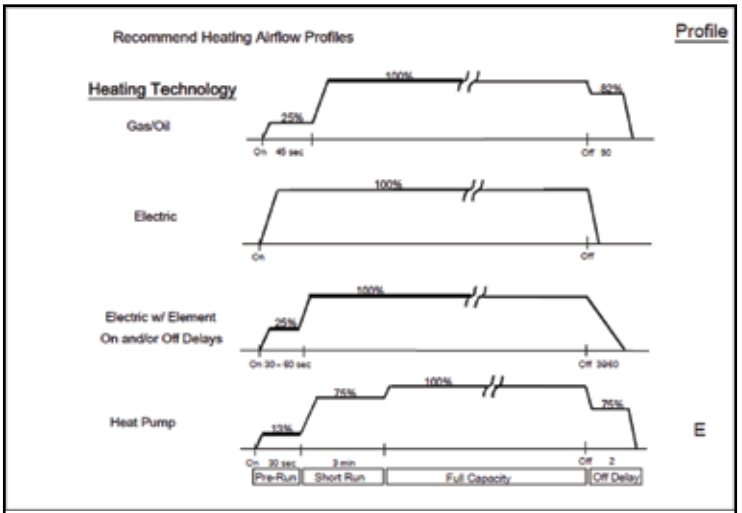


Figure 21: ECM Climate Profiles for Heating

MSVE, MSVT, MSPS	
Part #	**Description**
DFK44-12-DX	Downflow Conversion Kit - Small Cabinet - 12 Tubes High - DX Coil
DFK44-14-DX	Downflow Conversion Kit - Small Cabinet - 14 Tubes High - DX Coil
DFK44-16-DX	Downflow Conversion Kit - Small Cabinet - 16 Tubes High - DX Coil
DFK44-16-CW	Downflow Conversion Kit - Small Cabinet - 16 Tubes High - Chilled Water Coil
DFK45-14-DX	Downflow Conversion Kit - Medium Cabinet - 14 Tubes High - DX Coil
DFK45-16-DX	Downflow Conversion Kit - Medium Cabinet - 16 Tubes High - DX Coil
DFK45-18-DX	Downflow Conversion Kit - Medium Cabinet - 18 Tubes High - DX Coil
DFK45-20-DX	Downflow Conversion Kit - Medium Cabinet - 20 Tubes High - DX Coil
DFK45-20-CW	Downflow Conversion Kit - Medium Cabinet - 20 Tubes High - Chilled Water Coil
DFK18-16-DX	Downflow Conversion Kit - Large Cabinet - 16 Tubes High - DX Coil
DFK18-18-DX	Downflow Conversion Kit - Large Cabinet - 18 Tubes High - DX Coil
DFK18-20-DX	Downflow Conversion Kit - Large Cabinet - 20 Tubes High - DX Coil
DFK18-22-DX	Downflow Conversion Kit - Large Cabinet - 22 Tubes High - DX Coil
DFK18-24-DX	Downflow Conversion Kit - Large Cabinet - 24 Tubes High - DX Coil
DFK18-28-DX	Downflow Conversion Kit - Large Cabinet - 28 Tubes High - DX Coil
DFK18-28-CW	Downflow Conversion Kit - Large Cabinet - 28 Tubes High - Chilled Water Coil
BSHK05B	Small Cabinet 5 kW Heater Kit with circuit breakers
BSHK10B	Small Cabinet 10 kW Heater Kit with circuit breakers
SSHK05B	Small Cabinet 5 kW Heater Kit, no circuit breakers
SSHK10B	Small Cabinet 10 kW Heater Kit, no circuit breakers
BMHK05B	Medium Cabinet 5 kW Heater Kit with circuit breakers
BMHK10B	Medium Cabinet 10 kW Heater Kit with circuit breakers
BMHK15B	Medium Cabinet 15kW Heater Kit with circuit breakers
SMHK05B	Medium Cabinet 5 kW Heater Kit, no circuit breakers
SMHK10B	Medium Cabinet 10 kW Heater Kit, no circuit breakers
BLHK05B	Large Cabinet 5 kW Heater Kit with circuit breakers
BLHK10B	Large Cabinet 10 kW Heater Kit with circuit breakers
BLHK15B	Large Cabinet 15 kW Heater Kit with circuit breakers
BLHK20B	Large Cabinet 20 kW Heater Kit with circuit breakers
SLHK05B	Large Cabinet 5 kW Heater Kit, no circuit breakers
SLHK10B	Large 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
86ET0001	Accessory 20 x 20 x 2 Filter Base Kit
86ET0002	Accessory 16 x 20 x 2 Filter Base Kit
86ET0003	Accessory 20 x 24 x 2 Filter Base Kit

Table 13: Accessory List

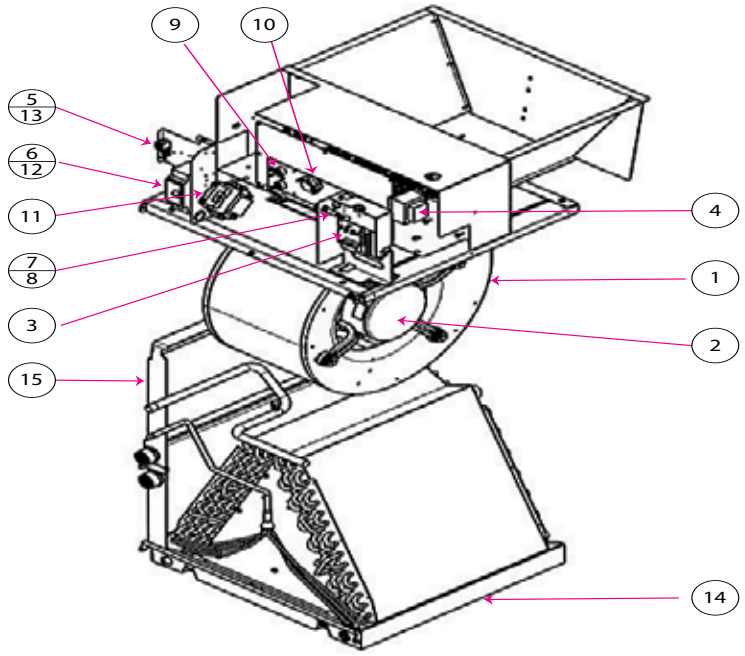


Figure 22: MS 18, 24 Electric Heat Air Handler Replacement Parts Schematic

M S**18, 24 COOL ONLY OR ELECTRIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0001	9 x 6 Blower Assembly
2	1	R65BV0001	1/3 HP 208/230 VAC ECM Blower Motor - MSVE
2	1	R65BV0025	1/3 HP 208/230 VAC Constant Torque Blower Motor - MSVT
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0003	208/240 VAC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R73MH0001	3 Amp Glass Tube Fuse
8	1	R73MHA001	Fuse Holder
5 kW Electric Heat M S18, 24**			
9	1	R86CG0073	5 kW Electric Heater Element
10	1	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	1	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD013	30 Amp Circuit Breaker
13	1	R68GF0022	Ground Lug - 1/0-14 Wire
10 kW Electric Heat M S18, 24**			
9	1	R86CG0074	10 kW Electric Heater Element
10	2	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	1	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD018	60 Amp Circuit Breaker
13	1	R68GF0022	Ground Lug - 1/0-14 Wire
Drain Pans (Plastic)			
14	1	R86EB0202	16.625"W x 19.000" D - Vertical (71AA0013)
15	1	R86EB0252	20.250"W x 19.500" D - Horizontal (71AA0046)

Table 14: MS 18, 24 Electric Heat Air Handler Replacement Parts List

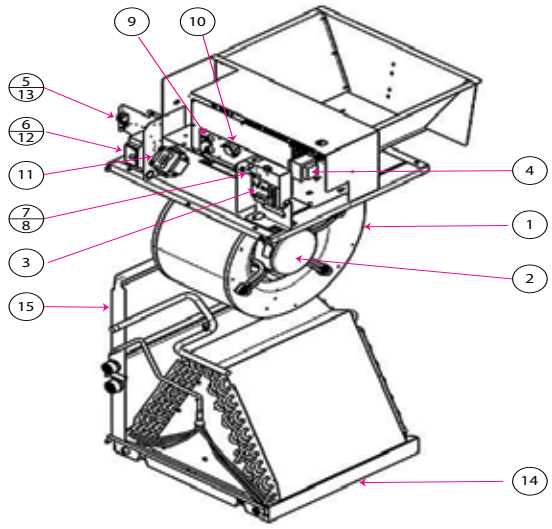


Figure 23: MS 25, 30, 36 Electric Heat Air Handler Replacement Parts Schematic

MS**25, 30, 36 COOL ONLY OR ELECTRIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0002	10 x 7 Blower Assembly
2	1	R65BV0002	1/2 HP 208/230 VAC ECM Blower Motor - MSVE
2	1	R65BV0026	1/2 HP 208/230 VAC Constant Torque Blower Motor - MSVT
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0003	208/240 V AC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R73MH0001	3 Amp Glass Tube Fuse
8	1	R73MHA001	Fuse Holder
5 kW Electric Heat M S25, 30, 36**			
13	1	R86CG0073	5 kW Electric Heater Element
14	1	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
15	1	R68AB0019	Double Pole Electric Heater Contactor
16	1	R68BAD013	30 Amp Circuit Breaker
17	1	R68GF0022	Ground Lug - 1/0-14 W ire
10 kW Electric Heat M S25, 30, 36**			
9	1	R86CG0074	10kW Electric Heater Element
10	2	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	1	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD018	60 Amp Circuit Breaker
13	1	R68GF0022	Ground Lug - 1/0-14 Wire
15 kW Electric Heat M S25, 30, 36**			
9	1	R86CG0075	15kW Electric Heater Element
10	3	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	2	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD018	60 Amp Circuit Breaker
12	1	R68BAD013	30 Amp Circuit Breaker
13	2	R68GF0022	Ground Lug - 1/0-14 Wire
Drain Pans (Plastic)			
14	1	R86EB0204	19.625”W x 19.000” D - Vertical (71A A 0015)
20	1	R86EB0222	23.875”W x 19.500” D - Horizontal (71A A 0031)

Table 15: MS 25, 30, 36 Electric Heat Air Handler Replacement Parts List

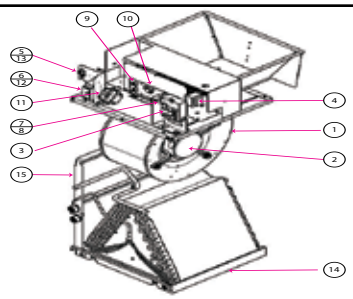


Figure 24: MS 37, 42, 48, 60, 72 Electric Heat Air Handler Replacement Parts Schematic

MS**37, 42, 48, 60, 72 COOL ONLY OR ELECTRIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0017	12 x 9 Blower Assembly - MS**37, 42, 48, 60
1	1	R69AD0019	12 x 10 Blower Assembly - MS**72
2	1	R65BV0003	3/4 HP 208/230 VAC ECM Blower Motor - MSVE**37, 42, 48, 60
2	1	R65BV0027	3/4 HP 208/230 VAC Constant Torque Blower Motor - MSVT**37, 42, 48, 60
2	1	R65BV0004	1.0 HP 208/230 VAC ECM Blower Motor - MSVE**72
2	1	R65BV0028	1.0 HP 208/230 VAC Constant Torque Blower Motor - MSV T**72
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0003	208/240 VAC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R73MH0001	3 Amp Glass Tube Fuse
8	1	R73MHA001	Fuse Holder
5 kW Electric Heat MS25, 30, 36**			
9	1	R86CG0073	5 kW Electric Heater Element
10	1	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	1	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD013	30 Amp Circuit Breaker
13	1	R68GF0022	Ground Lug - 1/0-14 W ire
10 kW Electric Heat MS37, 42, 48, 60, 72**			
9	1	R86CG0074	10 kW Electric Heater Element
10	2	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	1	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD018	60 Amp Circuit Breaker
13	1	R68GF0022	Ground Lug - 1/0-14 W ire
15 kW Electric Heat MS25, 30, 36, 42, 48, 60, 72**			
9	1	R86CG0075	15 kW Electric Heater Element
10	3	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	2	R68AB0019	Double Pole Electric Heater Contactor
12	1	R68BAD018	60 Amp Circuit Breaker
12	1	R68BAD013	30 Amp Circuit Breaker
13	2	R68GF0022	Ground Lug - 1/0-14 Wire
20 kW Electric Heat MS37, 42, 48, 60, 72**			
9	2	R86CG0074	10 kW Electric Heater Element
10	4	R68CA0003	Limit Switch - Opens 165°F - Closes 135°F
11	2	R68AB0019	Double Pole Electric Heater Contactor
12	2	R68BAD018	60 Amp Circuit Breaker
13	2	R68GF0022	Ground Lug - 1/0-14 Wire
18	2	R68GF0022	Ground Lug - 1/0-14 Wire
Drain Pans (Plastic)			
14	1	R86EB0250	23.625" W x 20.500" D - Vertical (71A A 0037)
15	1	R86EB0251	32.125" W x 20.750" D - Horizontal (71A A 0038)

Table 16: MS 37, 42, 48, 60, 72 Electric Heat Air Handler Replacement Parts List

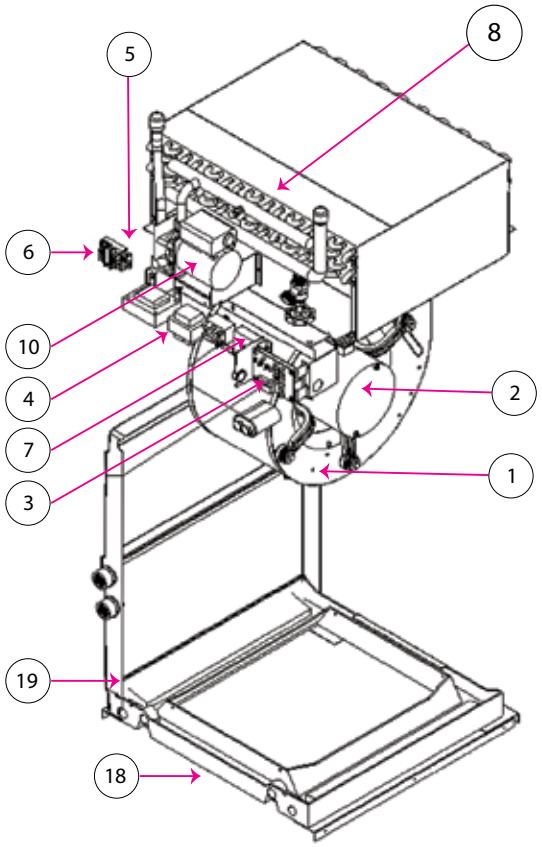


Figure 25: MS 18, 24 Hydronic Heat Air Handler Replacement Parts Schematic

MS**18, 24 COOL ONLY OR HYDRONIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0002	10 x 7 Blower Assembly
2	1	R65BV0001	1/3 HP 115 VAC ECM Blower Motor - MSVE
2	1	R65BV0021	1/3 HP 115 VAC Constant Torque Blower Motor - MSVT
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0002	120 VAC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R68AE0011	ICM AY1015 Hydronic Control Board
8	1	R86CH0017	2 Row Hydronic Coil 14.75 x 16
8	1	R86CH0018	3 Row Hydronic Coil 14.75 x 16
8	1	R86CH0025	4 Row Hydronic Coil 14.75 x 16
9	1	R68DC0045	3 Amp Automotive Blade Fuse
10	1	R78AA0007	4 GPM Pump 115 VAC
11	1	R68DD0005	White Wire Freeze Protector
12	1	R68DD0006	Yellow Wire Compressor Lockout Switch
13	1	R66AB0006	Sensor Clip HW/AH
14	1	R74BA0004	Valve - Air Bleed Body
15	2	R74BA0005	Valve - Air Bleed Core
16	1	R74BB0001	1/2" Boiler Drain
Drain Pans (Plastic)			
18	1	R86EB0202	16.625"W x 19.000" D - Vertical (71AA0013)
19	1	R86EB0252	20.250"W x 19.500" D - Horizontal (71AA0046)

Table 17: MS 18, 24 Hydronic Heat Air Handler Replacement Parts List

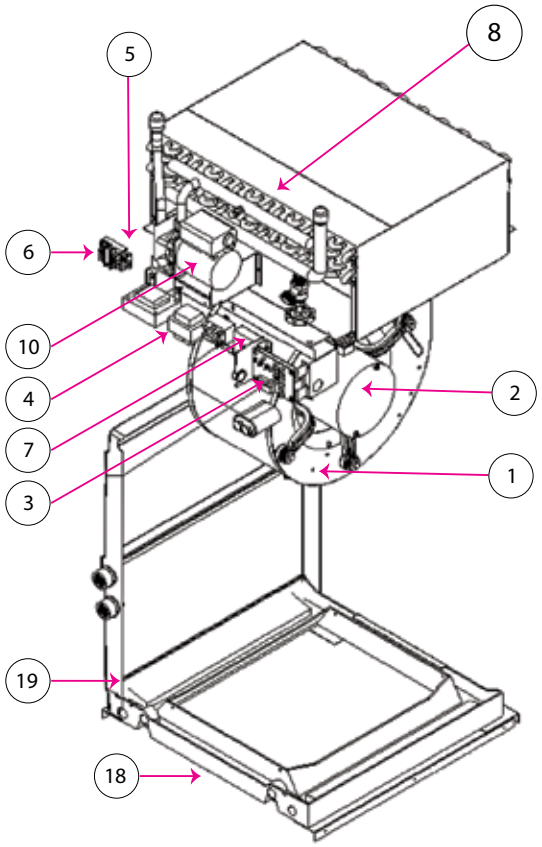


Figure 26: MS 25, 30, 36 Hydronic Heat Air Handler Replacement Parts Schematic

MS**25, 30, 36 COOL ONLY OR HYDRONIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0002	10 x 7 Blower Assembly
2	1	R65BV0002	1/2 HP 115 VAC ECM Blower Motor - MSVE
2	1	R65BV0022	1/2 HP 115 VAC Constant Torque Blower Motor - MSVT
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0002	120 VAC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R68AE0011	ICM AY1015 Hydronic Control Board
8	1	R86CH0019	2 Row Hydronic Coil 14.75 x 20
8	1	R86CH0020	3 Row Hydronic Coil 14.75 x 20
8	1	R86CH0021	4 Row Hydronic Coil 14.75 x 20
9	1	R68DC0045	3 Amp Automotive Blade Fuse
10	1	R78AA0007	4 GPM Pump 115 VAC
11	1	R68DD0005	White Wire Freeze Protector
12	1	R68DD0006	Yellow Wire Compressor Lockout Switch
13	2	R66AB0006	Sensor Clip HW/AH
14	1	R74BA0004	Valve - Air Bleed Body
15	1	R74BA0005	Valve - Air Bleed Core
16	1	R74BB0001	1/2" Boiler Drain
Drain Pans (Plastic)			
18	1	R86EB0204	19.625"W x 19.000" D - Vertical (71AA0015)
19	1	R86EB0222	23.875"W x 19.500" D - Horizontal (71AA0031)

Table 18: MS 25, 30, 36 Hydronic Heat Air Handler Replacement Parts List

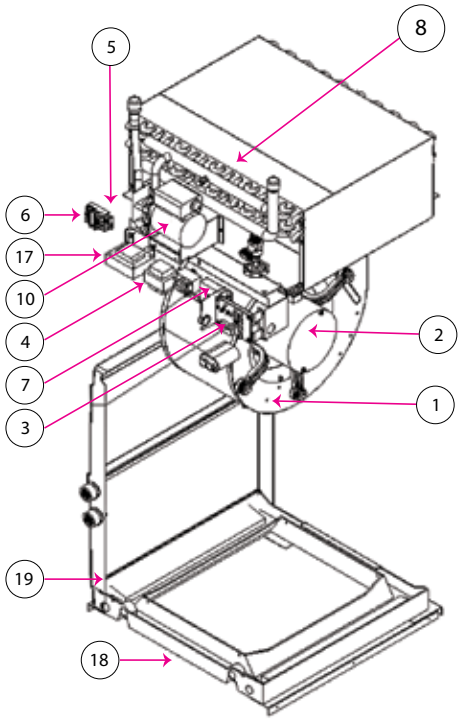


Figure 27: MS 37, 42, 48, 60, 72 Hydronic Heat Air Handler Replacement Parts Schematic

MS**37, 42, 48, 60, 72 COOL ONLY OR HYDRONIC HEAT			
Item #	Qty	Part #	Description
1	1	R69AD0017	12 x 9 Blower Assembly - MS**37, 42, 48, 60
1	1	R69AD0019	12 x 10 Blower Assembly - MS**72
2	1	R65BV0004	1.0 HP 115 VAC ECM Blower Motor - MSVE
2	1	R65BV0024	1.0 HP 115 VAC Constant Torque Blower Motor - MSVT
3	1	R68AE0003	ECM Blower Motor Control Board - MSVE
4	1	R68AA0002	115 VAC to 24 VAC Transformer
5	1	R68DC0001	Ground Lug
6	1	R68DC0018	Power Terminal Block
7	1	R68AE0011	ICM AY1015 Hydronic Control Board
8	1	R86CH0022	2 Row Hydronic Coil 15.75 x 24
8	1	R86CH0023	3 Row Hydronic Coil 15.75 x 24
8	1	R86CH0024	4 Row Hydronic Coil 15.75 x 24
9	1	R68DC0045	3 Amp Automotive Blade Fuse
10	1	R78AA0008	7 GPM Pump 115 VAC
11	1	R68DD0005	White Wire Freeze Protector
12	1	R68DD0006	Yellow Wire Compressor Lockout Switch
13	2	R66AB0006	Sensor Clip HW/AH
14	1	R74BA0004	Valve - Air Bleed Body
15	1	R74BA0005	Valve - Air Bleed Core
16	1	R74BB0001	1/2" Boiler Drain
17	1	R68AA0004	Choke - Used on 1.0 HP MSVE Motors
Drain Pans (Plastic)			
18	1	R86EB0250	23.625"W x 20.500" D - Vertical (71AA0037)
19	1	R86EB0251	32.125"W x 20.750" D - Horizontal (71AA0038)

Table 19: MS 37, 42, 48, 60, 72 Hydronic Heat Air Handler Replacement Parts List

61M1S003C
Supersedes: 61M1S003B