INSTALLATION MANUAL

MODULAR
NON-VARIABLE SPEED AIR HANDLERS
MODELS: MA

ISO 9001
Certified Quality
Management System

LIST OF SECTIONS

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SECTION I: GENERAL

This modular air handler provides the flexibility for installation in any upflow, downflow, or horizontal application. These versatile models may be used for cooling or heat pump operation with or without electric heat.

A BRAND LABEL (available from Distribution) may be applied to the center of the blower access panel.

The unit can be positioned for bottom return air in the upflow position, top return air in the downflow position, and right or left return in the horizontal position.

Top and side power wiring and control wiring, accessible screw terminals for control wiring and easy to install electric heaters all combine to make the installation easy, and minimize installation cost.

SECTION II: SAFETY

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

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

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

CAUTION 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 only property damage.

⚠WARNING

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

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

⚠CAUTION

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

⚠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.

1. Install this air handler only in a location and position as specified in SECTION III of these instructions.
2. Always install the air handler to operate within the air handler's intended maximum outlet air temperature. Only connect the air handler to a duct system which has an external static pressure within the allowable range, as specified on the air handler rating plate.
3. When an air handler is installed so that supply ducts carry air circulated by the air handler to areas outside the space containing the air handler, the return air shall also be handled by duct(s) sealed to the air handler casing and terminating outside the space containing the air handler.
4. The air handler is not to be used for temporary heating of buildings or structures under construction.
5. The size of the unit should be based on an acceptable heat loss or gain calculation for the structure. ACCA, Manual J or other approved methods may be used.

SAFETY REQUIREMENTS

1. This air handler should be installed in accordance with all national and local building/safety codes and requirements, local plumbing or wastewater codes, and other applicable codes.
2. Refer to the unit rating plate for the air handler model number, and then see the dimensions page of this instruction for supply air plenum dimensions in Figure 3. The plenum must be installed according to the instructions.
3. Provide clearances from combustible materials as listed under Clearances to Combustibles.
4. Provide clearances for servicing ensuring that service access is allowed for electric heaters and blower.
5. Failure to carefully read and follow all instructions in this manual can result in air handler malfunction, death, personal injury and/or property damage.
6. Check the rating plate and power supply to be sure that the electrical characteristics match.
7. Air handler shall be installed so the electrical components are protected from water.
8. Installing and servicing heating/cooling equipment can be hazardous due to the electrical components. Only trained and qualified personnel should install, repair, or service heating/cooling equipment. Untrained service personnel can perform basic maintenance functions such as cleaning and replacing the air filters. When working on heating/cooling equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.
9. These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances these instructions exceed certain local codes and ordinances, especially those who have not kept up with changing residential and non-HUD modular home construction practices. These instructions are required as a minimum for a safe installation.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. Also, before installation the unit should be checked for screws or bolts, which may have loosened in transit. There are no shipping or spacer brackets which need to be removed.

Also check to be sure all accessories such as heater kits, suspension kits, and coils are available. Installation of these accessories or field conversion of the unit should be accomplished before setting the unit in place or connecting any wiring, electric heat, ducts or piping.

LIMITATIONS

These units must be wired and installed in accordance with all national and local safety codes.

Voltage limits are as follows:

Air Handler Voltage	Voltage code	[1]Normal Operating Voltage Range
208/230-1-60	21	187-253
460-3-60	41	432-504

1. Rated in accordance with ARI Standard 110, utilization range "A".

Airflow must be within the minimum and maximum limits approved for electric heat, evaporator coils and outdoor units.

Entering Air Temperature Limits			
Wet Bulb Temp.°F		Dry Bulb Temp. °F	
Min.	Max.	Min.	Max.
57	72	65	95

SECTION III: UNIT INSTALLATION

CLEARANCES

Clearances must be taken into consideration, and provided for as follows:

1. Refrigerant piping and connections - minimum 12" recommended.
2. Maintenance and servicing access - minimum 36" from front of unit recommended for blower motor / coil replacement.
3. Condensate drain lines routed to clear filter and panel access.
4. Filter removal - minimum 36" recommended.
5. A combustible floor base accessory is available for downflow applications of this unit, if required by local code.

LOCATION

Location is usually predetermined. Check with owner's or dealer's installation plans. If location has not been decided, consider the following in choosing a suitable location:

1. Select a location with adequate structural support, space for service access, clearance for air return and supply duct connections.
2. Use hanging brackets to wall mount unit as shown.
3. Normal operating sound levels may be objectionable if the air handler is placed directly over some rooms such as bedrooms, study, etc.
4. Select a location that will permit installation of condensate line to an open drain or outdoors allowing condensate to drain away from structure.
5. When an evaporator coil is installed in an attic or above a finished ceiling, an auxiliary drain pan should be provided under the air handler as is specified by most local building codes.
6. Proper electrical supply must be available.

NOTICE

In severe high humidity, high temperature indoor unit environments, seal completely with adequate fiberglass insulation using vapor barrier on the outside.

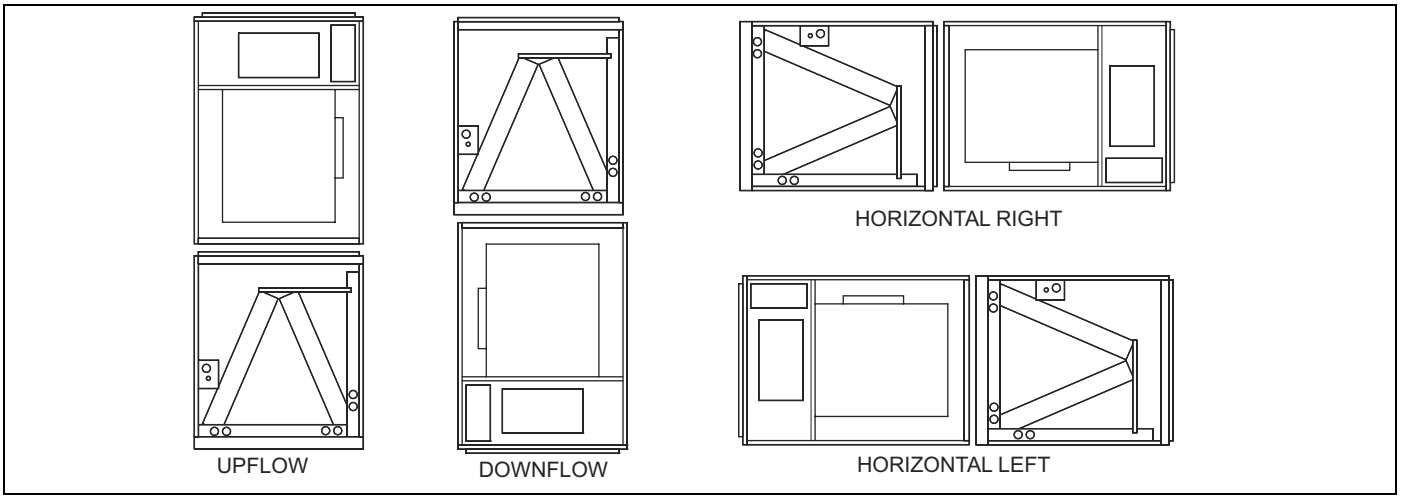


FIGURE 1: Typical Installation with MC Multi-Position Coils

DOWNFLOW AND HORIZONTAL CONVERSION

These air handler units are supplied ready to be installed in a upflow, downflow and left or right hand horizontal position.

If the unit is to be installed with an evaporator coil, refer to Figure 1 for unit positioning information.

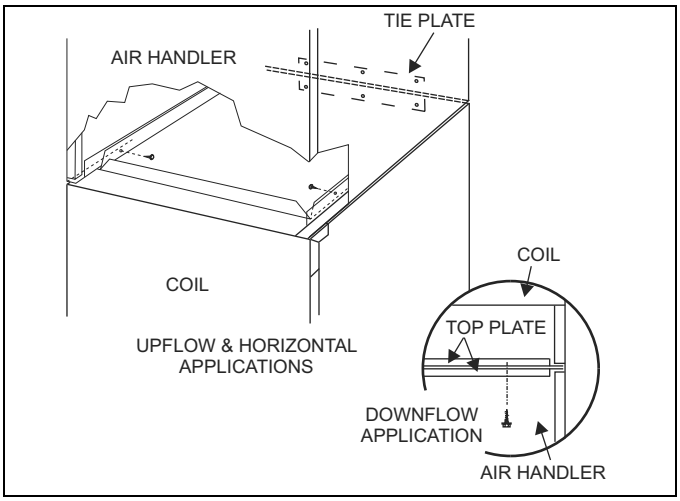


FIGURE 2: Coil and Air Handler Attachment Details

AIR HANDLER AND COIL UPFLOW AND HORIZONTAL

1. Apply neoprene gasket to top of coil casing.
2. Position blower casing over coil opening.
3. Attach tie plate to casings of air handler and coil using screws.
4. Remove blower access panel and coil filter door.
5. Disconnect wiring to blower motor. **Note location of wires as these will be reconnected in a later step.*
6. Remove blower motor and housing.
7. Fasten duct flanges of coil to duct flanges of air handler with screws. See Figure 1.
8. Secure base of air handler to top of coil using screws.
9. Locate 2” wide foam gasket.
10. On the interior of the air handler/coil attachment point, apply foam gasket over duct flanges on the sides and back.
11. Reinstall blower motor and housing by reversing the process in Steps 3 and 4.
12. Complete electrical and blower speed connections as outlined in other sections of this document.
13. Reposition and replace blower access panel.

AIR HANDLER AND COIL DOWNFLOW

1. Position blower casing over duct connection and secure such that the supply air end of the blower is down.
2. Apply neoprene gasket to return-air side of air handler.
3. Place coil casing over blower return opening.
4. Attach tie plate to casings of air handler and coil using screws.
5. Remove blower access panel and coil filter door.
6. Disconnect wiring to blower motor.
   **Note location of wires as these will be reconnected in a later step.*
7. Remove blower motor and housing.
8. Fasten duct flanges of coil to base of air handler with screws. See Figure 1.
9. Secure base of air handler to base of coil using screws.
10. Locate 2” wide foam gasket.
11. On the interior of the air handler/coil attachment point, apply foam gasket over duct flanges on the sides and back.
12. Reinstall blower motor and housing by reversing the process in Steps 3 and 4.
13. Complete electrical and blower speed connections as outlined in other sections of this document.
14. Reposition and replace blower access panel.

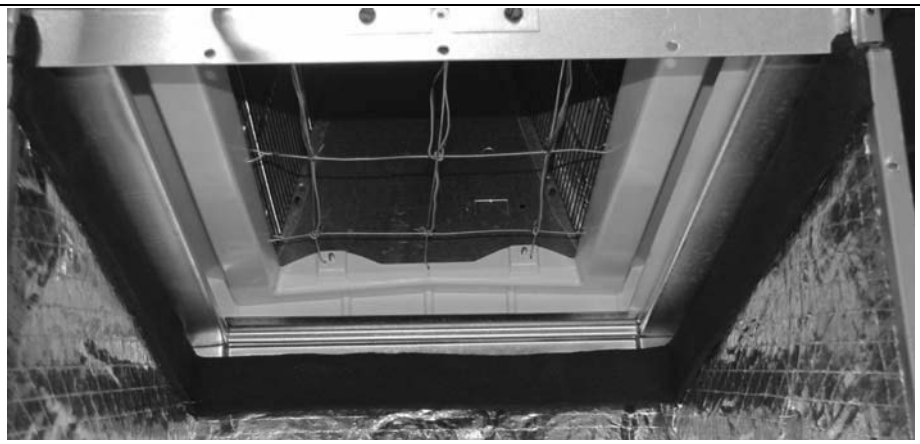


FIGURE 3: Gasket Location

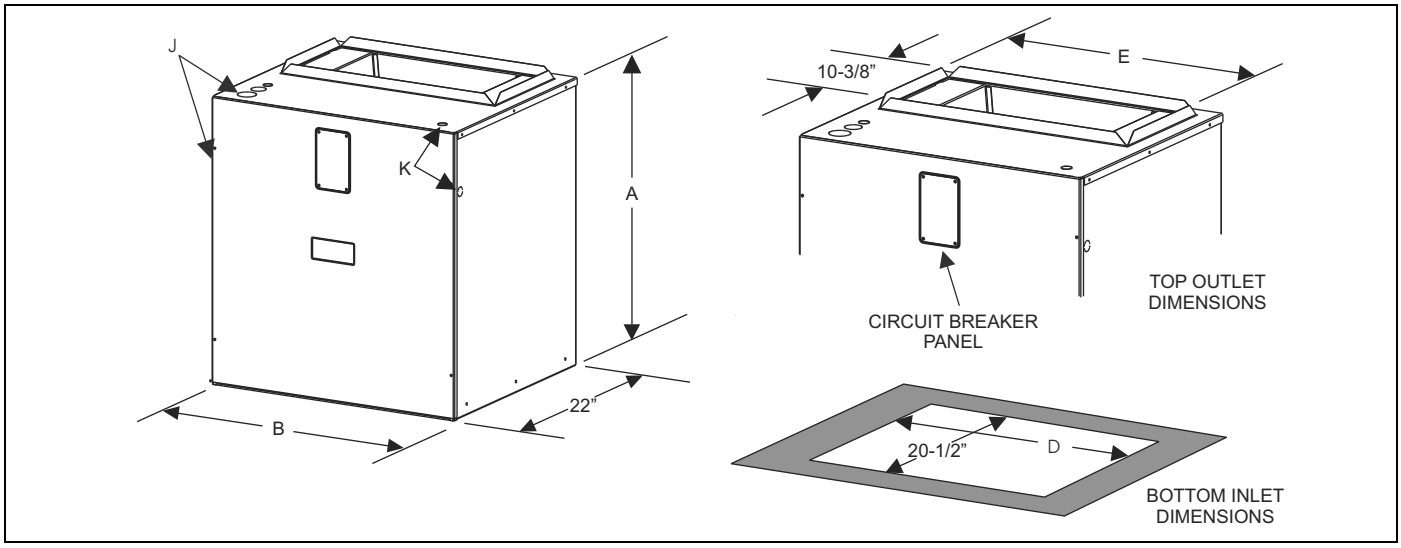


FIGURE 4: Dimensions & Duct Connection Dimensions

TABLE 1: Dimensions

MA MODELS	Dimensions				Wiring Knockouts[1]	
	A	B	D	E	J	K
	Height	Width			Power	Control
08B	25	17-1/2	16-1/2	14-19/32	7/8" (1/2") 1 3/8" (1") 1 23/32" (1 1/4")	7/8" (1/2")
12B		17-1/2	16-1/2	14-19/32		
14D		24-1/2	23-1/2	21-19/32		
16C		21	20	18-3/32		
20D		24-1/2	23-1/2	21-19/32		

1. Actual size (Conduit size).

DUCT CONNECTORS

⚠WARNING

Use 1/2" screws to connect ductwork to bottom of unit. Longer screws will pierce the drain pan and cause leakage. If pilot holes are drilled, drill only though field duct and unit bottom flange.

Air supply and return may be handled in one of several ways best suited to the installation. See Figure 3 for dimensions for duct inlet and outlet connections.

The vast majority of problems encountered with combination heating and cooling systems can be linked to improperly designed or installed duct systems. It is therefore highly important to the success of an installation that the duct system be properly designed and installed.

Use flexible duct collars to minimize the transmission of vibration/noise into the conditioned space. If electric heat is used, non-flammable material must be used.

Where return air duct is short, or where sound may be a problem, sound absorbing glass fiber should be used inside the duct. Insulation of duct work is a must where it runs through an unheated space during the heating season or through an uncooled space during the cooling season. The use of a vapor barrier is recommended to prevent absorption of moisture from the surrounding air into the insulation.

The supply air duct should be properly sized by use of a transition to match unit opening. All ducts should be suspended using flexible hangers and never fastened directly to the structure. This unit is not designed for non-ducted (freeblow) applications. Size outlet plenum or transition to discharge opening sizes shown in Figure 3.

Duct work should be fabricated and installed in accordance with local and/or national codes. This includes the standards of the National Fire Protection Association for Installation of Air-Conditioning and Ventilating Systems, NFPA No. 90B.

AIR FILTERS

Air filters and filter racks must be field supplied.

⚠CAUTION

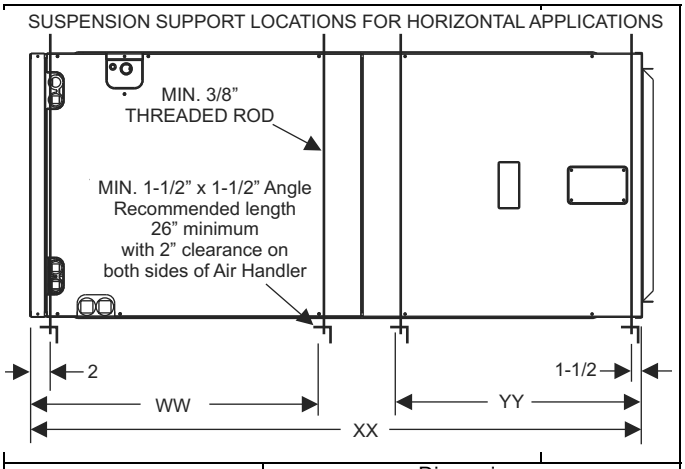
Equipment should never be operated without filters.

SUSPENSION KITS

A suspension kit is available. Models 1BH0601 (unit size 018-060) is designed specifically for the units contained in this instruction (upflow application only). For installation of these accessory kits, see the instructions packed with the kit.

HORIZONTAL SUSPENSION

For suspension of these units in horizontal applications, it is recommended to use angle steel support brackets with threaded rods, supporting the units from the bottom, at the locations shown in Figure 4.



Units (Nominal Tons)	Dimension		
	WW	XX	YY
1-1/2 - 3 Ton	16"	48"	22"
3-1/2 - 5 Ton	24"	53" - 58"	22"

FIGURE 5: Typical Horizontal Installation

SECTION IV: ELECTRIC HEATER INSTALLATION

If the air handler requires electric heat, install the electric heat kit according to the installation instructions included with the kit. After installing the kit, mark the air handler nameplate to designate the heater kit that was installed. If no heater is installed, mark the name plate appropriately to indicate that no heat kit is installed.

The HEAT ENABLE jumper (See Figure 5) must be moved to the HEAT position to enable operation of the heater.

Use only 4HK heater kits, as listed on Air Handler name plate and in these Instructions. Use data from Tables 11 through 18 for information on required minimum motor speed tap to be used for heating operation, maximum over-current protection device required and minimum electrical supply wiring size required for listed combination of Air Handler and Heater Kit.

For Upflow, Downflow and Horizontal right hand applications the kits can be installed without modification.

Field modification is required for Horizontal left-hand airflow application only. Follow instructions with heater for modification.

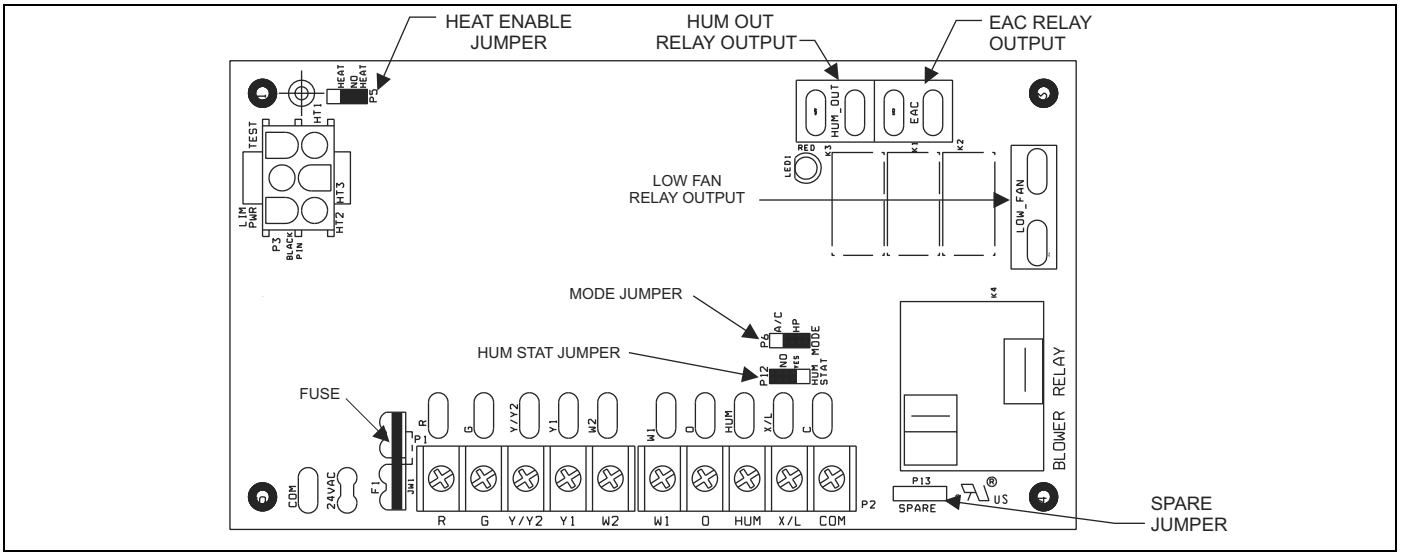


FIGURE 6: Control Board

SECTION V: LOW VOLTAGE CONTROL CONNECTIONS

The 24 volt power supply is provided by an internally wired low voltage transformer which is standard on all models, However, if the unit is connected to a 208 volt power supply, the low voltage transformer must be rewired to the 208 volt tap. See the unit wiring label.

Field supplied low voltage wiring can exit the unit on the top right hand corner or the right hand side panel. Refer to Figure 3.

Remove desired knockout and pierce foil faced insulation to allow wiring to pass through. Use as small of a hole as possible to minimize air leakage.

Install a 7/8" plastic bushing in the selected hole and keep low voltage wiring as short as possible inside the control box.

To further minimize air leakage, seal the wiring entry point at the outside of the unit.

The field wiring is to be connected at the screw terminals of the control board. Refer to Figures 10 & 11.

NOTICE

All wiring must comply with local and national electrical code requirements. Read and heed all unit caution labels.

NOTICE

It is possible to vary the amount of electric heat turned on during the defrost cycle of a heat pump. Standard wiring will only bring on the first stage of electric heat during defrost. See Heat Output and Limit Connections and Table 6 for additional information on heat during defrost cycle.

TABLE 2: Low Voltage Connections

Terminal	Signal	Comment
R	24 VAC power (fused)	
G	Continuous Fan operation	
Y/Y2	Second or full stage compressor operation	
Y1	First stage compressor operation	Not used with outdoor units having one stage compressors.
W2	Second stage heat operation	
W1	First stage heat operation	
O	Reversing valve operation	24 VAC will be present at this terminal when the MODE jumper is in the AC position. This is normal.
HUM	Humidity switch input	24 VAC will be present at this terminal when the HUM STAT jumper is in the NO position. This is normal.
X/L	Connection point for heat pump fault indicator	This terminal is a connection point only and does not affect air handler control operation.
COM	24 VAC common	

The low voltage connections may be connected to the screw terminals or the quick connect terminals. The screw terminals and the quick connect terminals are physically connected on the control board.

HUMIDITY SWITCH INPUT

The air handler control is designed to work with a humidity control that closes when the humidity is below the set-point. The control is open when the humidity is above the set-point. This humidity control may be referred to as a humidistat or a dehumidistat.

The humidity switch controls both humidification and de-humidification operation of the control. The control provides humidification using the HUM OUT relay output and de-humidification by lowering the blower speed. This is accomplished using the LOW FAN output and a field installed two-speed fan relay kit for non-variable speed models and the de-humidification input of the motor for variable speed models. The humidity switch should be connected to the R and HUM terminals of the control. See Figures 10 & 11.

SECTION VI: REQUIRED CONTROL SET-UP

IMPORTANT: The following steps must be taken at the time of installation to insure proper system operation.

1. Consult system wiring diagram to determine proper thermostat wiring for your system.
2. If heat kit is installed, change HEAT ENABLE jumper from NO HEAT to HEAT position.
3. If a humidstat is installed, change HUM STAT jumper from NO to YES.
4. Set the MODE jumper to A/C (Air Conditioner) or HP (Heat Pump) position depending on the outdoor unit included with the system.

FUNCTIONALITY AND OPERATION

Jumper Positions

Heat Enable Jumper

The HEAT ENABLE jumper configures the control for heat kit operation. The jumper must be in the HEAT position if a heat kit is installed with the air handler.

With the jumper in the NO HEAT position, the control will not energize the heat relay outputs or sense the limit switch input.

If the jumper is not present, the control will operate as if the jumper is in the HEAT position. If the jumper is not present and a heat kit is not present, the control will sense an open limit condition and the blower will run continuously.

Hum Stat Jumper

The HUM STAT jumper configures the control to monitor the humidity switch input. With the jumper in the NO position, the control will energize the HUM terminal with 24 VAC continually. With the jumper in the YES position, the control will monitor the HUM input to control the HUM OUT output to control an external humidifier.

If the jumper is not present, the control will operate as if the jumper is in the YES position.

Mode Jumper

The MODE jumper configures the control to operate properly with an air conditioner (AC position) or heat pump (HP position). With the jumper in the AC position, the control will energize the O terminal with 24 VAC continually. With the jumper in the HP position, the O input signal is received from the room thermostat.

If the jumper is not present, the control will operate as if the jumper is in the HP position.

SPARE Jumper

The control includes a spare jumper that can be used if a jumper is lost. The SPARE jumper does not have any effect on the operation of the control.

Status and Fault Codes

The control includes an LED that displays status and fault codes. These codes are shown in Table 3. The control will display the fault codes until power is removed from the control or the fault condition is no longer present.

TABLE 3: Fault Codes

Fault or Status Condition	LED1 (RED) Flash Code
Status	
No power to control	OFF
Normal operation	2s ON / 2s OFF
Control in test mode	Rapid Flash
Control failure	ON
Limit Faults	
Limit switch currently open (not in lockout)	1
Multiple limit openings with no call for heat	2
Multiple limit openings during one call for heat	3
Single long duration limit opening	4
Multiple long duration limit openings	5
Fan failure	6
Wiring Related Faults	
Simultaneous call for heating and cooling	7
Internal Control Faults	
Control recovered from internal event	9

External Relay Outputs

The control includes three outputs to drive external relays having 24 VAC coils. The outputs have a maximum rating of 1.0 Amp pilot duty at 24 VAC.

HUM OUT

The HUM OUT output can be used to drive an external relay or solenoid (24 VAC coil) to control a humidifier. The output is energized when the HUM input is energized, the HUM STAT is in the YES position, and the control has a thermostat call for heating (heat pump or electric heat).

EAC

The EAC output can be used to drive an external relay (24 VAC coil) to control an electronic air cleaner. The output is energized whenever the blower relay on the control is energized. Models having a high efficiency non-variable speed motor use the EAC output as an input to the motor. The EAC output can also be used to drive an electronic air cleaner relay as long as the load of the EAC relay does not exceed 1.0 Amp. An additional connection to the EAC terminals must be made using a piggyback terminal or similar device.

LOW FAN

The LOW FAN output can be used to drive an external relay (24 VAC coil) that switches the power input to the motor to a lower speed tap. An accessory kit is available for this application.

The LOW FAN output is energized when the control has the following inputs.

TABLE 4: Low Fan Control Inputs

Input	Operational Mode
G	Continuous Fan operation
Y1 or Y1 and O	First stage compressor operation
Y/Y2 and HUM de-energized with HUM STAT jumper in YES position	Dehumidification during cooling

Blower Delays

The control includes the following blower delays:

TABLE 5: Blower Delays

Condition	Blower Delay
Following call for cooling	60 seconds
Following call for heat pump heating	30 seconds
Following call for electric heat heating	10 seconds

Heat Output and Limit Connections

The control is connected to the heater relays and limit switch using the 6-pin connector. The relay outputs and the limit switch signal are 24 VDC.

The control energizes the heat relays and senses the limit switch input as shown in Table 6 when the HEAT ENABLE jumper is in the HEAT position.

TABLE 6: Heat Relays

Input	Heat Relay Output
W1	HT1
W2	HT1 and HT2
W1 and W2	HT1 and HT2 and HT3

The control energizes the first stage of electric heat immediately, the second stage 10 seconds after the call for second stage heat, and the third stage 20 seconds after the call for third stage heat.

Depending on the heat kit installed in the air handler, the control provides the flexibility to configure the amount of heat delivered with the first stage heating call. As an example, when the control's W1 input is connected to the room thermostat's first stage heat signal, a call for first stage heat will energize one heating element (HT1). If the control's W2 input is connected to the room thermostat's first stage heat signal, a call for first stage heat will energize two heating elements (HT1 & HT2). With either configuration, the control will energize three heating elements (HT1, HT2, & HT3) when it receives a first and second stage heat input from the thermostat.

Limit Switch and Lockout Operation

Limit Switch Operation

If the HEAT ENABLE jumper is in the HEAT position and the limit switch opens (fault code 1), the control will immediately de-energize all electric heat relay outputs and energize the blower (if it wasn't already energized). When the limit switch closes, the control will re-energize electric heat according to the thermostat inputs using normal timings.

Fan On Lock Condition

If the limit switch opens multiple times during a single call for electric heat (fault code 3) or if the limit switch opens for a long duration (fault code 4), the control will energize the blower until power is removed from the control. The control will cycle the heat outputs on and off as the limit re-closes and opens. The constant fan operation will signal the homeowner that a problem has occurred and a service call is required.

Soft Lockout

If the limit switch opens for a second long duration period during a single call for heat (fault code 5), the control will keep the blower locked on and lock out the heat outputs for one hour. The control will only reset this one hour lockout when the power is removed from the control. After the one hour period has passed, the control will re-energize electric heat according to the thermostat inputs using normal timings. The blower will remain locked on from the first long duration limit opening.

Hard Lockout

The control has a hard lockout condition during which the control will keep all heat outputs de-energized until power is removed from the control. The control de-energizes the blower five minutes after entering the hard lockout condition.

If the limit switch closes and re-opens during the one hour soft lockout period, the control will enter a hard lockout condition and continue to indicate a fault code 5.

If the limit switch opens twice when no call for electric heat is present (fault code 2), the control will enter a hard lockout condition.

If the limit switch opens multiple times soon after a soft lockout reset (fault code 6), the control will enter a hard lockout condition.

Wiring Related Faults

If the control receives a simultaneous call for heating and cooling (fault code 7), the control will perform both heating and cooling operations.

SECTION VII: LINE POWER CONNECTIONS

Power may be brought into the unit through the supply air end of the unit (top when unit is vertical) or the left side panel. Use the hole appropriate to the unit's orientation in each installation to bring conduit from the disconnect. The power lead conduit should be terminated at the electrical control box. To minimize air leakage, seal the wiring entry point at the outside of the unit. See Figure 3.

Refer to Tables to determine proper wire sizing:

Tables 8 & 9 for cooling only or,
Tables 12 & 13 for single phase or,
Tables 15 & 16 for three phase or,
Table 18 for 460V.

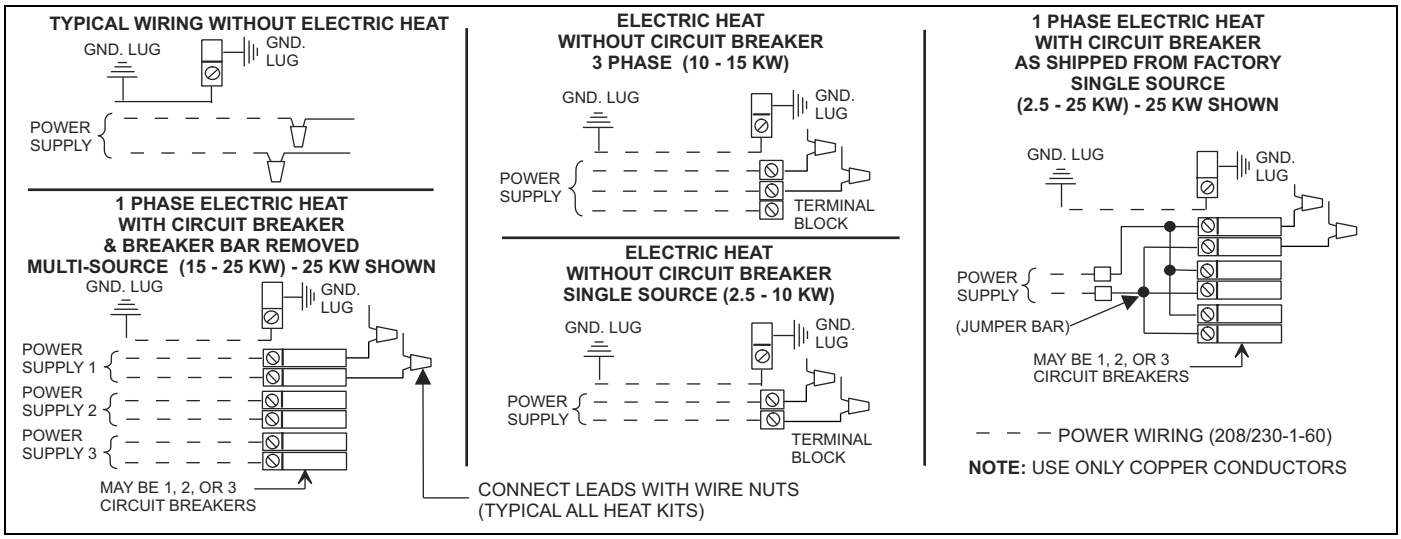


FIGURE 7: Line Power Connections

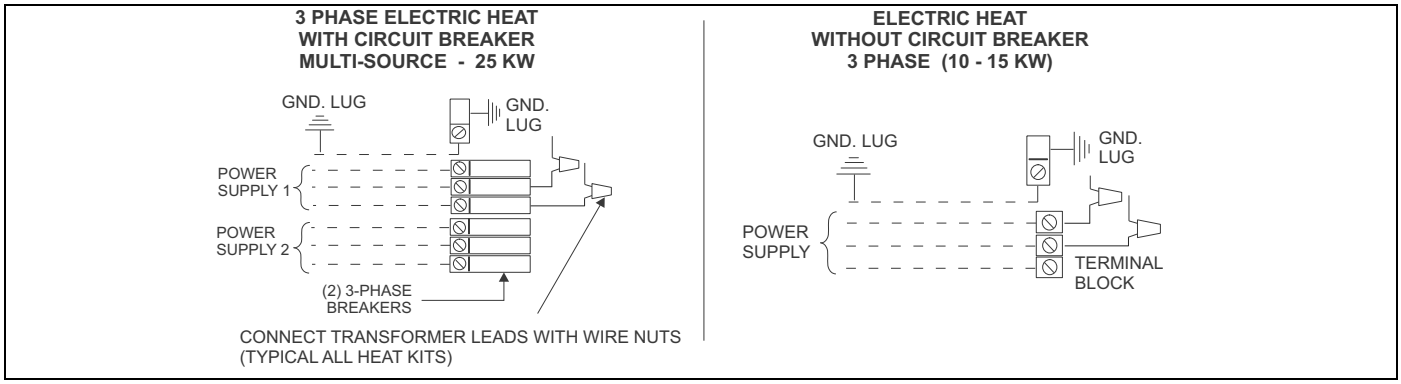


FIGURE 8: 460V - Line Power Connections

SECTION VIII: BLOWER SPEED CONNECTIONS

All air handlers contain 3-speed blower motors which are prewired to the control board.

Adjust blower motor speed to provide airflow within the minimum and maximum limits approved for evaporator coil, electric heat and outdoor unit. Speed tap adjustments are made at the motor terminal block, See Figure 8 or 9. Airflow data is shown in Tables 19 & 20.

Connect motor wires to motor speed tap receptacle for speed desired. See wiring label for motor wiring details.

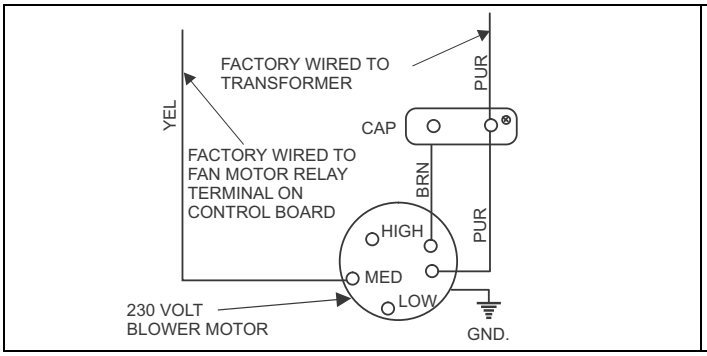


FIGURE 9: Blower Speed Connections

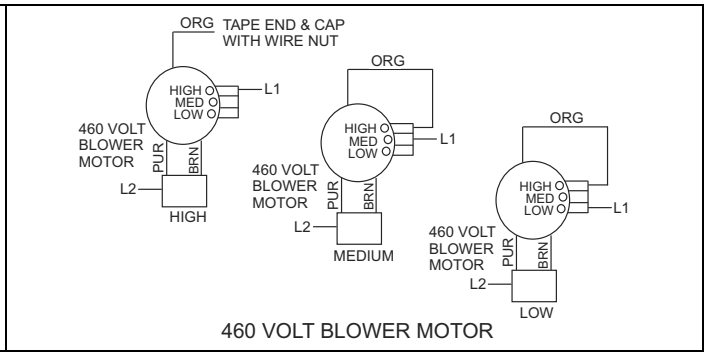


FIGURE 10: 460V - Blower Speed Connections

SECTION IX: UNIT DATA

TABLE 7: Physical and Electrical Data

Models: MA		MA08BN21	MA12BN21	MA12BN41	MA14DN21
Blower - Diameter x Width		10 x 9	10 x 9	10 x 9	10 x 10
Motor	HP	1/4 HP	3/4 HP	3/4 HP	1/2 HP
	Nominal RPM	1075	1075	1075	1075
Voltage		208/230	208/230	460	208/230
Amps	Full Load	1.5	3.5	2.3	2.4
Permanent Filter[1]	Type	DISPOSABLE OR PERMANENT			
	Size	16 x 20 x 1	16 x 20 x 1	16 x 20 x 1	24 x 20 x 1
	Filter Bulk Pack	1PF0601BK	1PF0601BK	1PF0601BK	1PF0604BK
Shipping / Operating Weight (lbs.)		75/71	82/78	82/78	94/88
Models: MA		MA16CN21	MA16CN41	MA20DN21	MA20DN41
Blower - Diameter x Width		10 x 10	10 x 10	11 x 10	11 x 10
Motor	HP	1 HP	1 HP	1 HP	1 HP
	Nominal RPM	1075	1075	1075	1075
Voltage		208/230	460	208/230	460
Amps	Full Load	4.0	2.6	7.4	3.7
Permanent Filter[1]	Type	DISPOSABLE OR PERMANENT			
	Size	20 x 20 x 1	20 x 20 x 1	24 x 20 x 1	24 x 20 x 1
	Filter Bulk Pack	1PF0602BK	1PF0602BK	1PF0604BK	1PF0604BK
Shipping / Operating Weight (lbs.)		90/84	90/84	97/91	97/91

1. Field Supplied.

TABLE 8: Electrical Data - Cooling Only (60 Hz) - 208/230

Models MA	**Total Motor Amps**		**Minimum Circuit Ampacity**		**Max. O.C.P.[1] Amps/Type**	**Minimum Wire Size A.W.G.**
	60 Hertz		**60 Hertz**			
	208V	**230V**	**208V**	**230V**		
08BN21	1.4	1.5	1.8	1.9	15	14
12BN21	2.1	3.5	2.6	3.0	15	14
14DN21	3.3	2.4	4.1	4.4	15	14
16CN21	3.6	4.0	4.5	5.0	15	14
20DN21	4.8	7.4	6.0	6.5	15	14

1. OCP = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 9: Electrical Data - Cooling Only (60 Hz) - 460

Models MA	**Total Motor Amps**	**Minimum Circuit Ampacity**	**Max. O.C.P.[1] Amps/Type**	**Minimum Wire Size A.W.G.**
	60 Hertz	**60 Hertz**		
12BN41	2.3	3.5	15	14
16CN41	2.6	3.9	15	14
20DN41	3.7	5.6	15	14

1. OCP = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 10: Conversion Table

KW & MBH Conversions - for Total Power Input Requirement					
FOR	208V	OPERATION MULTIPLY	240V	TABULATED KW & MBH BY	.751
	230V		240V		.918
	220V		240V		.840

TABLE 11: Electrical Data - 1 Ø - 208/230-1-60

Models MA	Heat Kit - Single Phase	Max. Static	Min. Speed Tap	Total Heat[1]				KW Staging					
				KW		MBH		W1 Only		W2 Only		W1 + W2	
				208V	240V	208V	240V	208V	240V	208V	240V	208V	240V
08BN21	4HK*6500206	0.5	Lo	1.9	2.5	6.4	8.5	1.9	2.5	1.9	2.5	1.9	2.5
	4HK*6500506	0.5	Lo	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Med	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Hi	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Hi	9.8	13.0	33.3	44.4	3.3	4.3	6.5	8.6	9.8	13.0
12BN21	4HK*6500506	0.5	Lo	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Med	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Med	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Med	9.8	13.0	33.3	44.4	3.3	4.3	6.5	8.6	9.8	13.0
	4HK165N1506	0.5	Med	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
14DN21	4HK*6500506	0.5	Lo	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Lo	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Med	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501506	0.5	Med	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Hi	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Hi	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
16CN21	4HK*6500506	0.5	Lo	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Lo	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Med	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.50	Med	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK16501506	0.5	Med	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Hi	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Hi	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
20DN21	4HK*6500806	0.5	Lo	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Lo	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.50	Med	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK16501506	0.5	Med	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Med	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Med	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
	4HK16502506	0.5	Med	18.0	24.0	61.5	81.9	3.6	4.8	10.8	14.4	18.0	24.0

1. See conversion Table 10.
* May be 0 (no breaker) or 1 (with breaker).

TABLE 12: Electrical Data - (For **Multi-Source** Power Supply) - Copper Wire 1 Ø - 208/230-1-60

Models MA	Heater Model	Min. Circuit Ampacity			Max. O.C.P.[1] Amps/Type			75°C Wire Size - AWG		
		Circuit			Circuit			Circuit		
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
		208/240	208/240	208/240	208/240	208/240	208/240	208/240	208/240	208/240
12BN21	4HK16501306	41.8/49.5	19.5/22.5	–	45/50	20 / 25	–	8/8	10/10	–
	4HK165N1506	47.5/54.4	21.7/25.0	–	50/60	25 / 25	–	8/6	10/10	–
14DN21	4HK16501506	47.8/55.0	21.7/25.0	–	50/60	25 / 25	–	8/6	10/10	–
	4HK16501806	44.2/50.8	39.7/45.8	–	50/60	40 / 50	–	8/6	8/8	–
	4HK16502006	47.8/55.0	43.3/50.0	–	50/60	45 / 50	–	8/6	8/8	–
16CN21	4HK16501306	42.2/48.9	22.9/26.0	–	50/50	30/30	–	6/6	12/10	–
	4HK16501506	47.8/55.0	21.7/25.0	–	50/60	25 / 25	–	8/6	10/10	–
	4HK16501806	44.2/50.8	39.7/45.8	–	50/60	40 / 50	–	8/6	8/8	–
	4HK16502006	47.8/55.0	43.3/50.0	–	50/60	45 / 50	–	8/6	8/8	–
20DN21	4HK16501306	43.5/49.9	24.2/27.0	–	50/50	30/30	–	6/6	10/10	–
	4HK16501506	49.3/56.5	21.7/25.0	–	50/60	25 / 25	–	8/6	10/10	–
	4HK16501806	45.7/52.3	39.7/45.8	–	50/60	40 / 50	–	8/6	8/8	–
	4HK16502006	49.3/56.5	43.3/50.0	–	50/60	45 / 50	–	8/6	8/8	–
	4HK16502506	49.3/56.5	43.3/50.0	21.7/25.0	50/60	45 / 50	25/25	8/6	8/8	10/10

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 13: Electrical Data - (For **Single Source** Power Supply) - Copper Wire 1 Ø - 208/230-1-60

Models MA	Heat Kit - Single Phase*	Heater Amps	Field Wiring					
			Min. Circuit Ampacity		Max. O.C.P.[1] Amps/Type		75°C Wire Size - AWG	
		240V	208V	240V	208V	240V	208V	240V
08BN21	4HK*6500206	10.4	13.03	14.88	15	15	14	14
	4HK*6500506	20.0	23.42	26.88	30	30	10	10
	4HK*6500806	31.3	35.60	41.00	40	45	8	8
	4HK*6501006	40.0	45.08	51.88	50	60	8	6
	4HK16501306	54.2	60.4	69.6	70	70	4	4
12BN21	4HK*6500506	20.0	25.79	29.38	30	30	10	10
	4HK*6500806	31.3	37.98	43.50	40	45	8	8
	4HK*6501006	40.0	47.46	54.38	50	60	8	6
	4HK16501306	54.2	61.3	72.1	70	90	4	3
	4HK165N1506	60.0	69.13	79.38	70	90	4	3
14DN21	4HK*6500506	20.0	24.29	28.00	30	30	8	10
	4HK*6500806	31.3	36.48	42.13	40	45	8	8
	4HK*6501006	40.0	45.96	53.00	50	60	8	6
	4HK16501506	60.0	67.63	78.00	70	90	4	3
	4HK16501806	73.3	82.07	94.63	90	100	4	3
	4HK16502006	80.0	89.29	103.00	100	110	3	2
16CN21	4HK*6500506	20.0	26.17	30.00	30	30	8	8
	4HK*6500806	31.3	38.35	44.13	40	45	8	8
	4HK*6501006	40.0	47.83	55.00	50	60	8	6
	4HK16501306	54.2	65.2	74.80	70	80	4	2
	4HK16501506	60.0	69.50	80.00	70	90	4	3
	4HK16501806	73.3	83.94	96.63	90	100	4	3
	4HK16502006	80.0	91.17	105.00	100	110	3	2
20DN21	4HK*6500806	31.3	42.60	48.38	45	50	8	8
	4HK*6501006	40.0	52.08	59.25	60	60	8	6
	4HK16501306	54.2	67.7	77.00	70	80	4	2
	4HK16501506	60.0	73.75	84.25	90	90	3	3
	4HK16501806	73.3	88.19	100.88	90	110	3	2
	4HK16502006	80.0	95.42	109.25	100	125	3	2
	4HK16502506	100.0	117.08	134.25	125	150	1	1/0

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

* May be 0 (no breaker) or 1 (with breaker).

TABLE 14: Electrical Data - 3 Ø - 208/230-3-60

Models MA	Heat Kit - Three Phase	Max. Static	Min. Speed Tap	Total Heat[1]				KW Staging					
				KW		MBH		W1 Only		W2 Only		W1 + W2	
				208V	240V	208V	240V	208V	240V	208V	240V	208V	240V
08B	4HK06501025	0.5	Hi	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
12B	4HK06501025	0.5	Med	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK065N1525	0.5	Hi	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
14D	4HK06501025	0.5	Med	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Med	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK06501825	0.5	Hi	12.9	17.2	44.7	58.7	12.9	17.2	12.9	17.2	12.9	17.2
16C	4HK06501025	0.5	Med	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Med	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK06501825	0.5	Hi	12.9	17.2	44.7	58.7	12.9	17.2	12.9	17.2	12.9	17.2
20D	4HK06501025	0.5	Lo	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Med	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK16501825	0.5	Med	12.9	17.2	44.7	58.7	12.9	17.2	12.9	17.2	12.9	17.2
	4HK16502525	0.5	Med	18.0	24.0	61.4	81.4	9.0	12.0	18.0	24.0	18.0	24.0

1. See conversion Table 10.

TABLE 15: Electrical Data - (For **Multi-Source** Power Supply) - Copper Wire 3 Ø - 208/230-3-60

Models MA	Heater Model	Min. Circuit Ampacity			Max. O.C.P.[1] Amps/Type			75°C Wire Size - AWG		
		Circuit			Circuit			Circuit		
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
		208/240	208/240	208/240	208/240	208/240	208/240	208/240	208/240	208/240
20D	4HK16501825	31.1/35.1	22.4/25.9	–	35/40	25/35	–	8/8	10/10	–
	4HK16502525	40.0/45.4	31.3/36.1	–	40/50	35/40	–	8/8	8/8	–

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 16: Electrical Data - (For **Single Source** Power Supply) - Copper Wire 3 Ø - 208/230-3-60

Models MA	Heat Kit - Three Phase	Heater Amps 240V	Field Wiring					
			Min. Circuit Ampacity		Max. O.C.P.[1] Amps/Type		75°C Wire Size - AWG	
			208V	240V	208V	240V	208V	240V
08B	4HK06501025	23.1	26.8	30.8	30	35	10	8
12B	4HK06501025	23.1	27.6	31.9	30	35	10	8
	4HK065N1525	34.7	40.1	47.8	45	50	8	8
14D	4HK06501025	23.1	29.1	33.3	30	35	10	8
	4HK06501525	34.7	41.6	46.4	45	50	8	8
	4HK06501825	41.4	48.9	56.1	50	60	8	6
16C	4HK06501025	23.1	29.5	33.9	30	35	10	8
	4HK06501525	34.7	42.0	48.4	45	50	8	8
	4HK06501825	41.4	49.3	56.8	50	60	6	6
20D	4HK06501025	23.1	33.8	38.1	35	40	8	8
	4HK06501525	34.7	43.5	52.6	45	60	8	6

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.
2. Heaters are 3 Phase.

TABLE 17: Electrical Data - 460-3-60

MA Models	Heater Models	MAX. STATIC & MIN. CFM		Total Heat1		KW Staging		
				KW	MBH	W1 Only	W2 Only	W1 + W2
		Static	Taps	480V	480V	480V	480V	480V
12BN41	4HK06501046	0.5”	Med	9.6	3.28	9.6	9.6	9.6
16CN41	4HK06501046	0.5”	Med	9.6	3.28	9.6	9.6	9.6
	4HK06501546	0.5”	Med	14.4	4.92	14.4	14.4	14.4
20DN41	4HK06501046	0.5”	Med	9.6	3.28	9.6	9.6	9.6
	4HK06501546	0.5”	Med	14.4	4.92	14.4	14.4	14.4
	4HK06502946	0.5”	Med	28.8	9.84	14.4	28.8	28.8

TABLE 18: Electrical Data - (For **Single Source** Power Supply) - Copper Wire 3 Ø - 460-3-60

MA Models	Heater Models	Field Wiring		
		Min. Circuit Ampacity	Max. O.C.P.[1] Amps/Type	Wire Size - AWG 75°C
		480V	480V	480V
12BN41	4HK06501046	17.4	20	12
16CN41	4HK06501046	17.8	25	10
	4HK06501546	24.9	25	10
20DN41	4HK06501046	19.1	25	10
	4HK06501546	26.3	30	8
	4HK06502946	48.0	50	8

1. OCP = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 19: Air Flow Data - 60 Hz Models (230 & 460 Volt)

Models MA	Models MC	Blower Motor Speed	230 / 460 Volt - 60 Hz									
			CFM[1] @ External Static Pressure - IWC									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
08B	MC18B	High	1102	986	870	754	638	521	405	289	173	57
		Med.	831	737	644	551	457	364	271	178	84	N/A
		Low	615	537	458	379	300	221	142	63	N/A	N/A
	MC24B	High	1112	1001	890	780	669	558	447	336	225	114
		Med.	851	759	667	576	484	392	300	208	116	25
		Low	643	562	480	399	317	236	154	73	N/A	N/A
12B	MC30B MC35B	High	1429	1363	1290	1212	1133	1037	929	670	534	375
		Med.	1213	1153	1097	1037	977	896	697	549	453	220
		Low	1075	1032	990	927	873	770	611	494	405	212
	MC36B	High	1607	1533	1463	1395	1319	1044	851	725	673	673
		Med.	1308	1258	1197	1146	1097	887	742	648	608	609
		Low	1148	1108	1061	1017	976	807	690	613	582	582
	MC43B	High	1462	1396	1322	1254	1172	1067	941	693	585	464
		Med.	1205	1154	1102	1046	980	897	704	560	441	220
		Low	1075	1020	969	906	842	735	592	470	364	190
14D	MC48D	High	1715	1671	1608	1547	1460	1338	1232	1003	727	508
		Med.	1471	1438	1367	1318	1263	1180	920	824	587	503
		Low	1379	1330	1276	1227	1157	1047	866	681	567	392
	MC60D	High	1763	1713	1649	1581	1511	1407	1276	995	852	N/A
		Med.	1487	1462	1412	1356	1280	1210	1087	795	726	N/A
		Low	1381	1353	1292	1225	1186	1057	863	780	669	N/A
	MC62D	High	1746	1699	1655	1579	1486	1399	1264	1093	796	581
		Med.	1486	1442	1393	1333	1270	1189	1081	776	628	450
		Low	1392	1336	1285	1226	1158	1061	882	740	680	445
16C	MC42C	High	1959	1874	1802	1708	1606	1486	1408	1264	953	810
		Med.	1631	1587	1542	1473	1395	1315	1218	967	821	533
		Low	1447	1431	1401	1363	1304	1241	1098	844	751	712
	MC43C MC35C	High	1825	1742	1660	1578	1486	1396	1306	1187	802	577
		Med.	1637	1572	1507	1431	1361	1276	1171	1043	722	493
		Low	1510	1456	1403	1341	1278	1202	1088	785	684	456
	MC48C	High	2018	1895	1772	1649	1525	1402	1279	1156	1033	910
		Med.	1684	1595	1506	1417	1328	1240	1151	1062	973	884
		Low	1561	1476	1392	1308	1223	1139	1055	970	896	801
	MC60C	High	1830	1748	1670	1590	1518	1428	1320	1199	772	543
		Med.	1638	1573	1510	1443	1370	1289	1185	992	679	475
		Low	1522	1479	1426	1364	1314	1218	1114	885	652	487
20D	MC48D	High	2226	2190	2103	2035	1931	1845	1683	1541	1465	1328
		Med.	2115	2087	2017	1951	1851	1744	1542	1466	1406	1254
		Low	N/A	N/A	N/A	1716	1643	1554	1451	1379	1292	1151
	MC60D	High	2326	2235	2192	2107	2027	1906	1786	1538	1469	1368
		Med.	2150	2089	2036	2008	1944	1852	1692	1499	1416	1295
		Low	2012	1923	1834	1718	1676	1600	1447	1389	1311	1200
	MC62D	High	2357	2321	2254	2191	2139	1951	1859	1656	1556	1472
		Med.	2212	2144	2111	2069	1986	1862	1727	1566	1498	1369
		Low	2066	1934	1910	1817	1723	1646	1514	1442	1381	1245

1. Includes return air filter, coil, and 10kW electric heater.

All MA series air handler units are UL Listed up to 0.50" w.c. external static pressure, including air filter, wet coil, and largest KW size heater.

TABLE 20: Air Flow Data - 60 Hz Models (208 Volt)

Models MA	Models MC	Blower Motor Speed	208 Volt - 60 Hz									
			CFM[1] @ External Static Pressure - IWC									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
08B	MC18B	High	1080	964	848	732	615	499	383	267	150	34
		Med.	712	628	544	461	377	293	210	126	42	N/A
		Low	529	452	376	299	223	146	70	N/A	N/A	N/A
	MC24B	High	1039	932	825	717	610	502	395	288	180	73
		Med.	743	659	575	491	407	323	239	156	72	N/A
		Low	532	460	387	315	242	169	97	24	N/A	N/A
12B	MC30B MC35B	High	1399	1339	1267	1192	1098	1023	915	673	534	377
		Med.	1080	1039	994	943	876	778	639	525	415	211
		Low	932	895	868	829	776	656	543	447	351	214
	MC36B	High	1434	1267	1099	932	764	597	430	262	95	N/A
		Med.	1083	955	827	699	571	443	315	187	59	N/A
		Low	933	818	703	588	473	359	244	129	14	N/A
	MC43B	High	1444	1377	1311	1247	1172	1091	971	721	573	442
		Med.	1086	1047	1005	959	905	819	647	534	438	220
		Low	942	920	887	827	768	655	536	477	366	209
14D	MC48D	High	1549	1498	1448	1383	1325	1235	1125	936	658	548
		Med.	1275	1269	1225	1181	1115	997	811	684	548	392
		Low	1190	1162	1112	1074	975	817	737	625	493	358
	MC60D	High	1545	1490	1463	1378	1337	1231	1115	850	739	572
		Med.	1266	1248	1207	1140	1101	1005	839	687	564	469
		Low	1192	1186	1126	1067	992	842	740	638	507	347
	MC62D	High	1564	1520	1455	1400	1336	1257	1154	813	755	549
		Med.	1303	1262	1225	1165	1117	1028	827	744	590	398
		Low	1204	1161	1104	1060	1001	870	745	554	532	462
16C	MC42C	High	1782	1712	1619	1524	1435	1323	1213	985	798	557
		Med.	1468	1415	1355	1298	1233	1144	1005	791	669	493
		Low	1310	1278	1239	1185	1125	1045	934	725	561	424
	MC35C MC43C	High	1771	1705	1619	1528	1450	1361	1261	1102	721	504
		Med.	1486	1445	1393	1325	1265	1198	1041	791	663	457
		Low	1314	1300	1258	1214	1164	1108	891	753	550	410
	MC48C	High	1983	1865	1747	1629	1511	1393	1275	1157	1039	921
		Med.	1529	1446	1363	1280	1197	1114	1031	948	865	782
		Low	1312	1249	1185	1122	1059	995	932	868	805	742
	MC60C	High	1819	1738	1657	1570	1491	1396	1289	1178	777	544
		Med.	1489	1452	1409	1349	1293	1207	1112	834	627	475
		Low	1321	1310	1271	1233	1184	1120	1022	725	583	419
20D	MC48D	High	2250	2180	2139	2062	1971	1855	1683	1553	1461	1342
		Med.	1953	1956	1905	1858	1755	1649	1528	1440	1355	1245
		Low	N/A	N/A	1544	1538	1455	1401	1346	1285	1195	1081
	MC60D	High	2251	2186	2144	2073	2003	1921	1809	1574	1478	1370
		Med.	1987	1945	1926	1887	1836	1761	1643	1472	1387	1213
		Low	1492	1517	1521	1523	1507	1436	1379	1308	1213	1128
	MC62D	High	2208	2123	2092	2054	1910	1762	1595	1496	1435	1298
		Med.	1959	1945	1913	1862	1766	1661	1513	1420	1315	1182
		Low	N/A	N/A	N/A	1546	1491	1407	1354	1258	1184	1088

1. Includes return air filter, coil, and 10kW electric heater.

All MA series air handler units are UL Listed up to 0.50" w.c. external static pressure, including air filter, wet coil, and largest KW size heater.

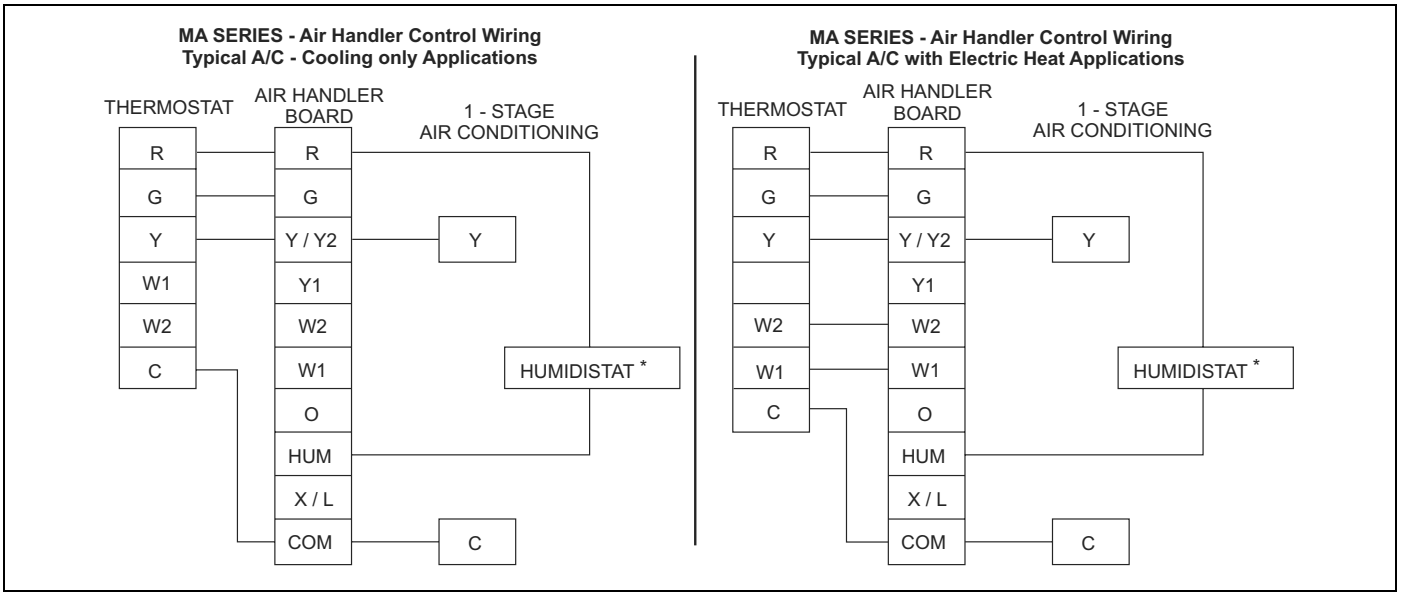


FIGURE 11: Cooling Models with Electric Heat Wiring

* Optional dehumidification humidistat switch contacts open on humidity rise.

Notes:

1. "Y" Terminal on Air Handler Control Board must be connected for full CFM and applications requiring 60 second blower off delay for SEER enhancement.
2. Move HUM STAT Jumper on AH Control Board to YES position if Humidistat is used.
3. MODE Jumper on AH control board should be set to A/C for air conditioners.

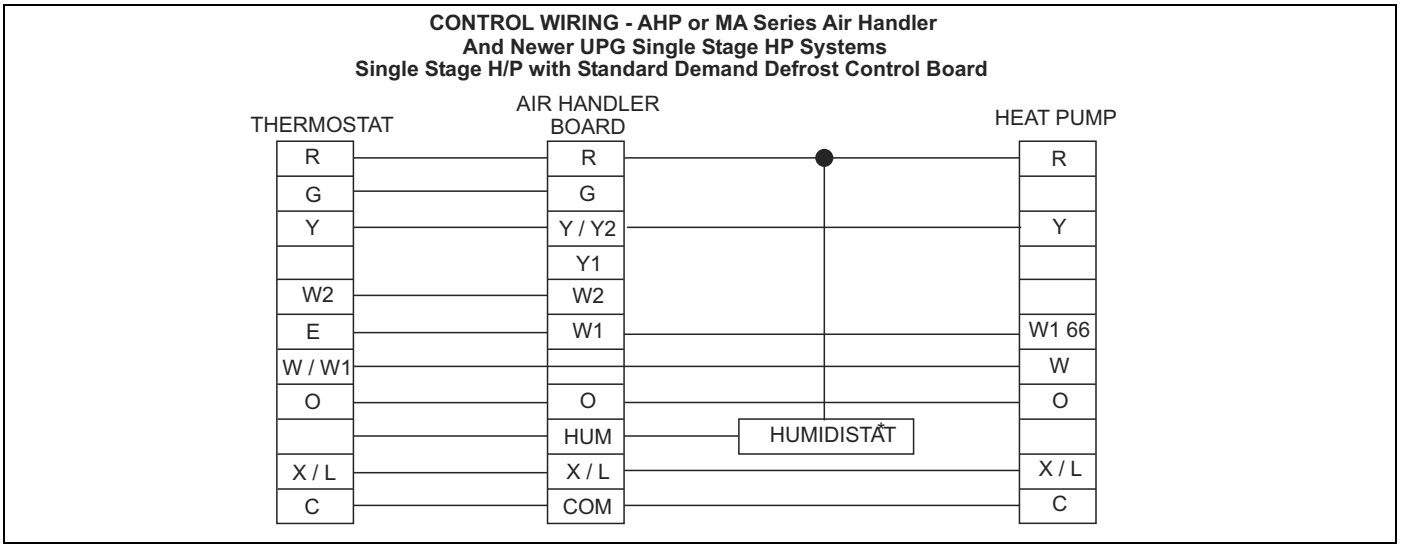


FIGURE 12: Single-Stage Cooling Wiring

* Optional dehumidification humidistat switch contacts open on rise.

Notes:

1. "Y" Terminal on Air Handler Control Board must be connected for full CFM and applications requiring 60 second blower off delay for SEER enhancement.
2. Move HUM STAT Jumper on AH Control Board to YES position if Humidistat is used.
3. MODE Jumper on AH control board should be set to HP for heat pumps.
4. To change quantity of heat during HP defrost cycle - Reverse connections at W1 & W2 on Air Handler Control Board.

SECTION X: MAINTENANCE

Filters must be cleaned or replaced when they become dirty. Inspect at least once per month. The frequency of cleaning depends upon the hours of operation and the local atmospheric conditions. Clean filters keep unit efficiency high.

LUBRICATION

The bearings of the blower motor are permanently lubricated.

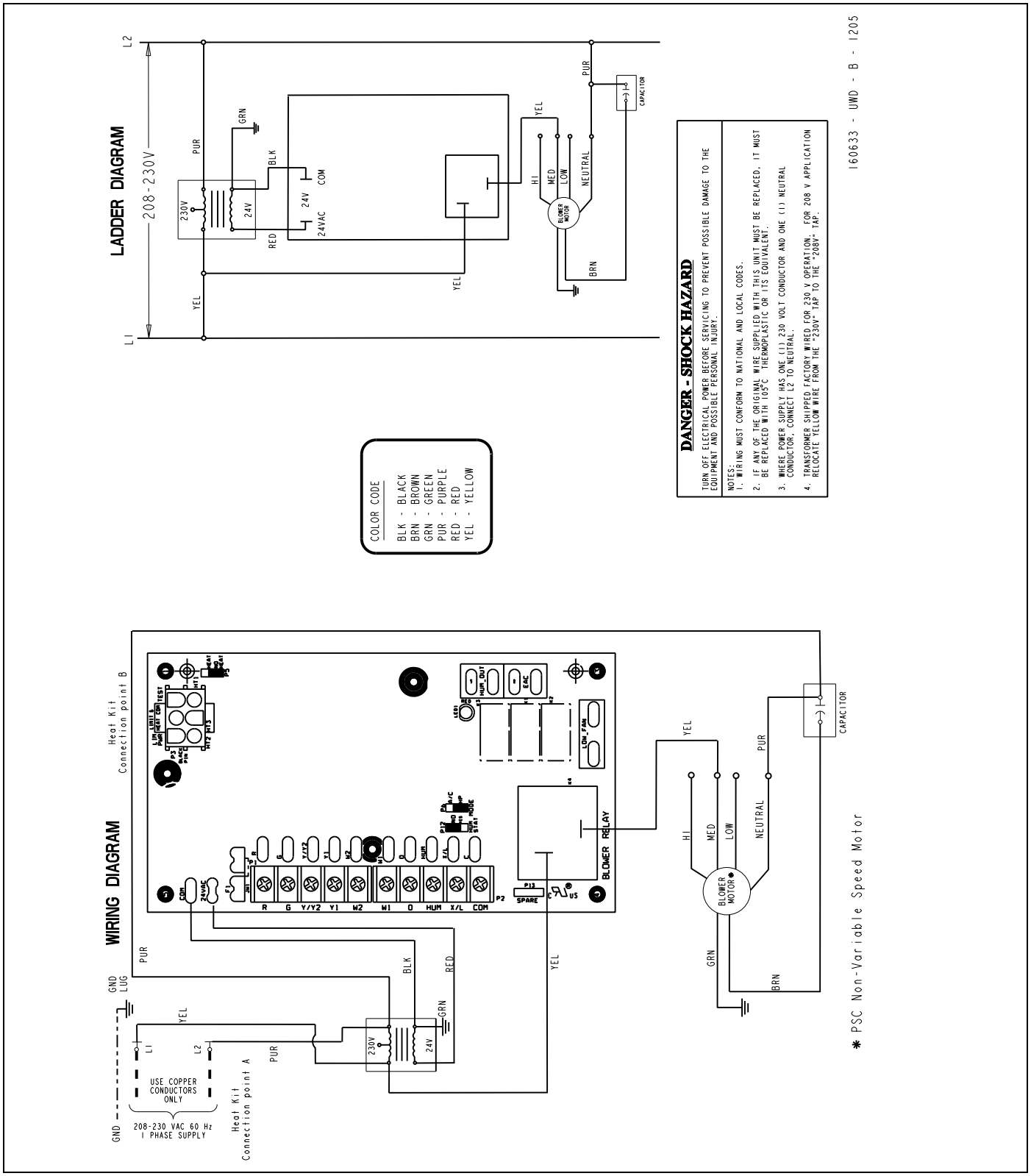


FIGURE 13: Wiring Diagram

INSTALLATION MANUAL

MODULAR
VARIABLE SPEED AIR HANDLERS

MODELS: MV

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ISO 9001 Certified Quality Management System

LIST OF SECTIONS

LIST OF FIGURES

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SECTION I: GENERAL

This modular air handler provides the flexibility for installation in any upflow, downflow, or horizontal application. These versatile models may be used for cooling or heat pump operation with or without electric heat.

A BRAND LABEL (available from Distribution) may be applied to the center of the blower access panel.

The unit can be positioned for bottom return air in the upflow position, top return air in the downflow position, and right or left return in the horizontal position.

Top and side power wiring and control wiring, accessible screw terminals for control wiring and easy to install electric heaters all combine to make the installation easy, and minimize installation cost.

SECTION II: SAFETY

⚠ This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, or **CAUTION**.

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

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

CAUTION 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 only property damage.

⚠WARNING

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

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

⚠ CAUTION

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

⚠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.

1. Install this air handler only in a location and position as specified in SECTION III of these instructions.
2. Always install the air handler to operate within the air handler's intended maximum outlet air temperature. Only connect the air handler to a duct system which has an external static pressure within the allowable range, as specified on the air handler rating plate.
3. When an air handler is installed so that supply ducts carry air circulated by the air handler to areas outside the space containing the air handler, the return air shall also be handled by duct(s) sealed to the air handler casing and terminating outside the space containing the air handler.
4. The air handler is not to be used for temporary heating of buildings or structures under construction.
5. The size of the unit should be based on an acceptable heat loss or gain calculation for the structure. ACCA, Manual J or other approved methods may be used.

SAFETY REQUIREMENTS

1. This air handler should be installed in accordance with all national and local building/safety codes and requirements, local plumbing or wastewater codes, and other applicable codes.
2. Refer to the unit rating plate for the air handler model number, and then see the dimensions page of this instruction for supply air plenum dimensions in Figure 3. The plenum must be installed according to the instructions.
3. Provide clearances from combustible materials as listed under Clearances to Combustibles.
4. Provide clearances for servicing ensuring that service access is allowed for electric heaters and blower.
5. Failure to carefully read and follow all instructions in this manual can result in air handler malfunction, death, personal injury and/or property damage.
6. Check the rating plate and power supply to be sure that the electrical characteristics match.
7. Air handler shall be installed so the electrical components are protected from water.
8. Installing and servicing heating/cooling equipment can be hazardous due to the electrical components. Only trained and qualified personnel should install, repair, or service heating/cooling equipment. Untrained service personnel can perform basic maintenance functions such as cleaning and replacing the air filters. When working on heating/cooling equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.
9. These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances these instructions exceed certain local codes and ordinances, especially those who have not kept up with changing residential and non-HUD modular home construction practices. These instructions are required as a minimum for a safe installation.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. Also, before installation the unit should be checked for screws or bolts, which may have loosened in transit. There are no shipping or spacer brackets which need to be removed.

Also check to be sure all accessories such as heater kits, suspension kits, and coils are available. Installation of these accessories or field conversion of the unit should be accomplished before setting the unit in place or connecting any wiring, electric heat, ducts or piping.

LIMITATIONS

These units must be wired and installed in accordance with all national and local safety codes.

Voltage limits are as follows:

Air Handler Voltage	Voltage code	Normal Operating Voltage Range[1]
208/230-1-60	21	187-253

1. Rated in accordance with ARI Standard 110, utilization range "A".

Airflow must be within the minimum and maximum limits approved for electric heat, evaporator coils and outdoor units.

Entering Air Temperature Limits			
Wet Bulb Temp.°F		Dry Bulb Temp. °F	
Min.	Max.	Min.	Max.
57	72	65	95

SECTION III: UNIT INSTALLATION

CLEARANCES

Clearances must be taken into consideration, and provided for as follows:

1. Refrigerant piping and connections - minimum 12" recommended.
2. Maintenance and servicing access - minimum 36" from front of unit recommended for blower motor / coil replacement.
3. Condensate drain lines routed to clear filter and panel access.
4. Filter removal - minimum 36" recommended.
5. A combustible floor base accessory is available for downflow applications of this unit, if required by local code.

LOCATION

Location is usually predetermined. Check with owner's or dealer's installation plans. If location has not been decided, consider the following in choosing a suitable location:

1. Select a location with adequate structural support, space for service access, clearance for air return and supply duct connections.
2. Use hanging brackets to wall mount unit as shown.
3. Normal operating sound levels may be objectionable if the air handler is placed directly over some rooms such as bedrooms, study, etc.
4. Select a location that will permit installation of condensate line to an open drain or outdoors allowing condensate to drain away from structure.
5. When an evaporator coil is installed in an attic or above a finished ceiling, an auxiliary drain pan should be provided under the air handler as is specified by most local building codes.
6. Proper electrical supply must be available.

NOTICE

In severe high humidity, high temperature indoor unit environments, seal completely with adequate fiberglass insulation using vapor barrier on the outside.

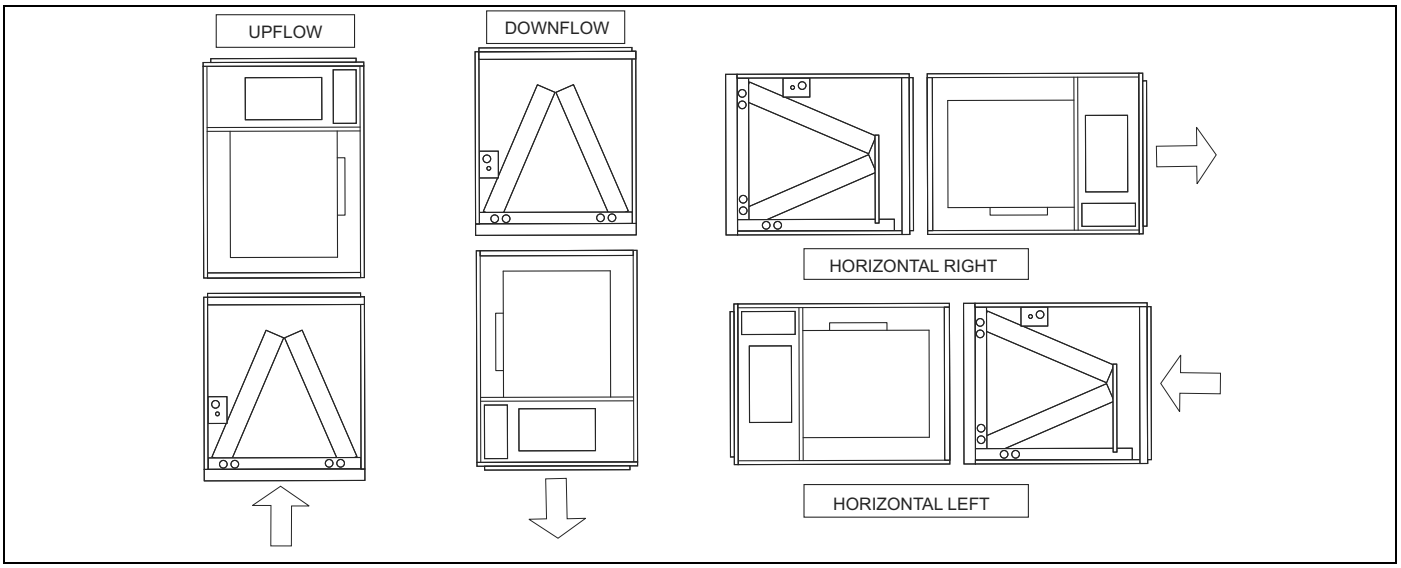


FIGURE 1: Typical Installation with MC or FC Evaporator Coil (MC required for horizontal applications)

DOWNFLOW AND HORIZONTAL CONVERSION

These air handler units are supplied ready to be installed in a upflow, downflow and left or right hand horizontal position.

If the unit is to be installed with an evaporator coil, refer to Figure 1 for unit positioning information.

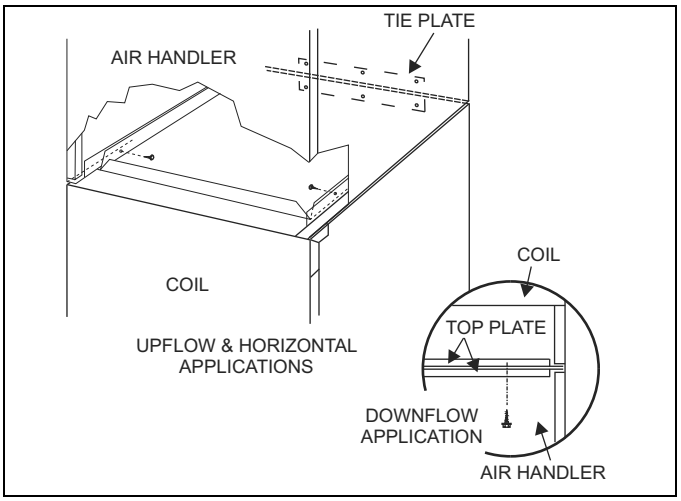


FIGURE 2: Coil and Air Handler Attachment Details

AIR HANDLER AND COIL UPFLOW AND HORIZONTAL

1. Apply neoprene gasket to top of coil casing.
2. Position blower casing over coil opening.
3. Attach tie plate to casings of air handler and coil using screws.
4. Remove blower access panel and coil filter door.
5. Disconnect wiring to blower motor. **Note location of wires as these will be reconnected in a later step.*
6. Remove blower motor and housing.
7. Fasten duct flanges of coil to duct flanges of air handler with screws. See Figure 1.
8. Secure base of air handler to top of coil using screws.
9. Locate 2" wide foam gasket.
10. On the interior of the air handler/coil attachment point, apply foam gasket over duct flanges on the sides and back.
11. Reinstall blower motor and housing by reversing the process in Steps 3 and 4.
12. Complete electrical and blower speed connections as outlined in other sections of this document.
13. Reposition and replace blower access panel.

AIR HANDLER AND COIL DOWNFLOW

1. Position blower casing over duct connection and secure such that the supply air end of the blower is down.
2. Apply neoprene gasket to return-air side of air handler.
3. Place coil casing over blower return opening.
4. Attach tie plate to casings of air handler and coil using screws.
5. Remove blower access panel and coil filter door.
6. Disconnect wiring to blower motor.
   **Note location of wires as these will be reconnected in a later step.*
7. Remove blower motor and housing.
8. Fasten duct flanges of coil to base of air handler with screws. See Figure 1.
9. Secure base of air handler to base of coil using screws.
10. Locate 2" wide foam gasket.
11. On the interior of the air handler/coil attachment point, apply foam gasket over duct flanges on the sides and back.
12. Reinstall blower motor and housing by reversing the process in Steps 3 and 4.
13. Complete electrical and blower speed connections as outlined in other sections of this document.
14. Reposition and replace blower access panel.

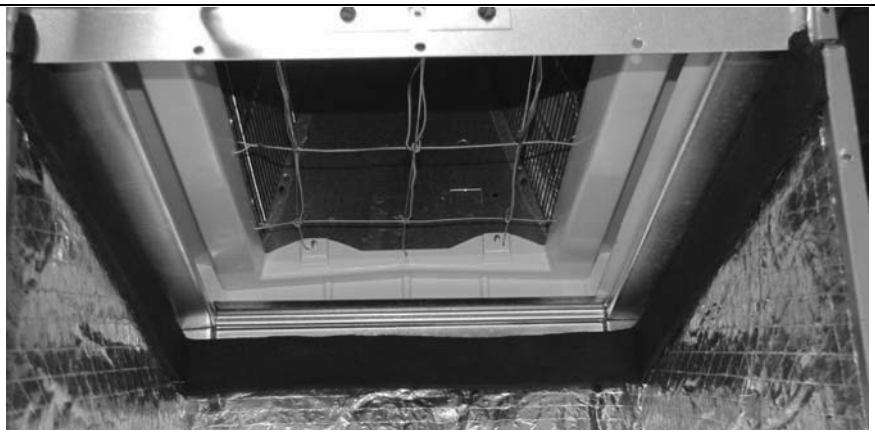


FIGURE 3: Gasket Location

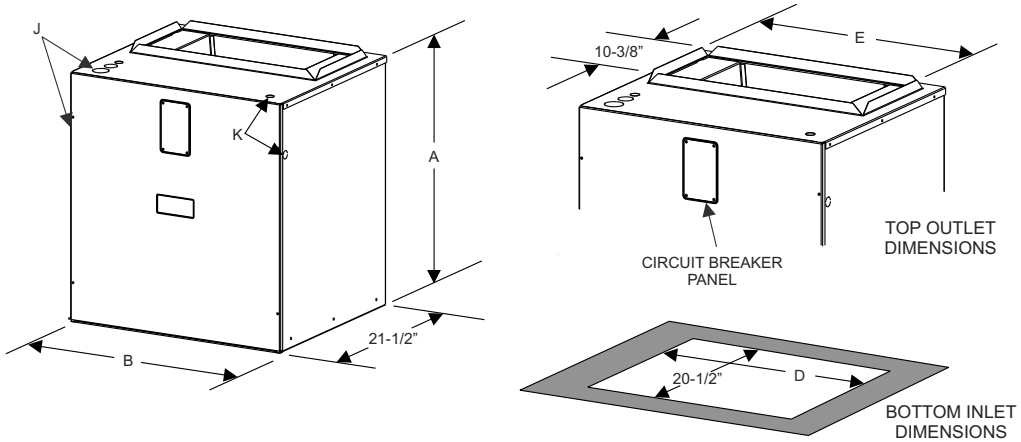


FIGURE 4: Dimensions & Duct Connection Dimensions

TABLE 1: Dimensions

Models MV	Dimensions				Wiring Knockouts[1]	
	A	B	D	E	J	K
	Height	Width			Power	Control
12B	25	17-1/2	16-1/2	14-19/32	7/8" (1/2") 1 3/8" (1") 1 23/32" (1 1/4")	7/8" (1/2")
12D		24-1/2	23-1/2	21-19/32		
16C		21	20	18-3/32		
20D		24-1/2	23-1/2	21-19/32		

1. Actual size (Conduit size).

DUCT CONNECTORS

⚠WARNING

Use 1/2" screws to connect ductwork to bottom of unit. Longer screws will pierce the drain pan and cause leakage. If pilot holes are drilled, drill only though field duct and unit bottom flange.

Air supply and return may be handled in one of several ways best suited to the installation. See Figure 3 for dimensions for duct inlet and outlet connections.

The vast majority of problems encountered with combination heating and cooling systems can be linked to improperly designed or installed duct systems. It is therefore highly important to the success of an installation that the duct system be properly designed and installed.

Use flexible duct collars to minimize the transmission of vibration/noise into the conditioned space. If electric heat is used, non-flammable material must be used.

Where return air duct is short, or where sound may be a problem, sound absorbing glass fiber should be used inside the duct. Insulation of duct work is a must where it runs through an unheated space during the heating season or through an uncooled space during the cooling season. The use of a vapor barrier is recommended to prevent absorption of moisture from the surrounding air into the insulation.

The supply air duct should be properly sized by use of a transition to match unit opening. All ducts should be suspended using flexible hangers and never fastened directly to the structure. This unit is not designed for non-ducted (freeblow) applications. Size outlet plenum or transition to discharge opening sizes shown in Figure 3.

Duct work should be fabricated and installed in accordance with local and/or national codes. This includes the standards of the National Fire Protection Association for Installation of Air-Conditioning and Ventilating Systems, NFPA No. 90B.

AIR FILTERS

Air filters and filter racks must be field supplied.

⚠ CAUTION

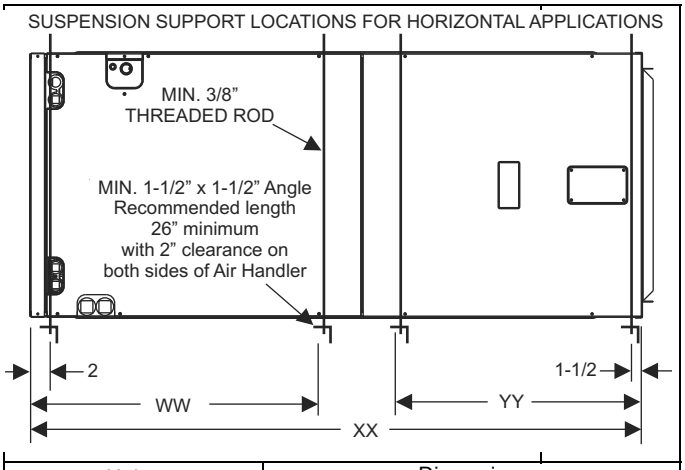
Equipment should never be operated without filters.

SUSPENSION KITS

A suspension kit is available. Models 1BH0601 (unit size 018-060) is designed specifically for the units contained in this instruction (upflow application only). For installation of these accessory kits, see the instructions packed with the kit.

HORIZONTAL SUSPENSION

For suspension of these units in horizontal applications, it is recommended to use angle steel support brackets with threaded rods, supporting the units from the bottom, at the locations shown in Figure 4.



Units (Nominal Tons)	Dimension		
	WW	XX	YY
1-1/2 - 3 Ton	16"	48"	22"
3-1/2 - 5 Ton	24"	53" - 58"	22"

FIGURE 5: Typical Horizontal Installation

SECTION IV: ELECTRIC HEATER INSTALLATION

If the air handler requires electric heat, install the electric heat kit according to the installation instructions included with the kit. After installing the kit, mark the air handler nameplate to designate the heater kit that was installed. If no heater is installed, mark the name plate appropriately to indicate that no heat kit is installed.

The HEAT ENABLE jumper (See Figure 5) must be moved to the HEAT position to enable operation of the heater

Use only 4HK heater kits, as listed on Air Handler name plate and in these Instructions. Use data from Tables 9 and 12 for information on required minimum motor speed tap to be used for heating operation, maximum over-current protection device required and minimum electrical supply wiring size required for listed combination of Air Handler and Heater Kit.

For Upflow, Downflow and Horizontal right hand applications the kits can be installed without modification.

Field modification is required for Horizontal left-hand airflow application only. Follow instructions with heater for modification.

NOTICE

If a heat kit with a circuit breaker is installed in the air handler, the circuit breaker cover cladding must be removed to gain access to the sheet metal cover plate. Some local codes may require that the circuit breaker remain visible. If so, do not re-install circuit breaker cover cladding.

SECTION V: LOW VOLTAGE CONTROL CONNECTIONS

This air handler can be connected to the wall thermostat and outdoor A/C or heat pump using either conventional low voltage (24 VAC) thermostat wiring OR using four-wire digital communications wiring. To use conventional low voltage wiring, see the section below entitled "Conventional Low Voltage Control Wiring". To use four-wire communications control wiring, see the section below entitled "Control Wiring using Communicating Controls".

The Communicating System consists of several intelligent communicating components including the Communicating Thermostat Control (touch-screen wall thermostat), variable speed air handler, air conditioner (15 and 18 SEER premium air conditioners) or heat pump (13, 15 and 18 SEER premium heat pumps), which continually communicate with each other via a four-wire connection called the A-R-C-B. Commands, operating conditions, and other data are passed continually between components over the A-R-C-B bus. See Figure 8. The result is a new level of comfort, versatility, and simplicity.

In order to use this air handler in full communications (COMM) mode, it MUST be installed with the matching touch-screen Communicating Control (wall thermostat) and an outdoor air conditioner or heat pump with a fully communicating control.

This air handler may also be used along with the Communicating Thermostat Control and a non-communicating outdoor air conditioner through the addition of a communicating Outdoor Aux Control board to the outdoor unit. This system allows full communication between the air handler and thermostat and limited communication to the outdoor unit.

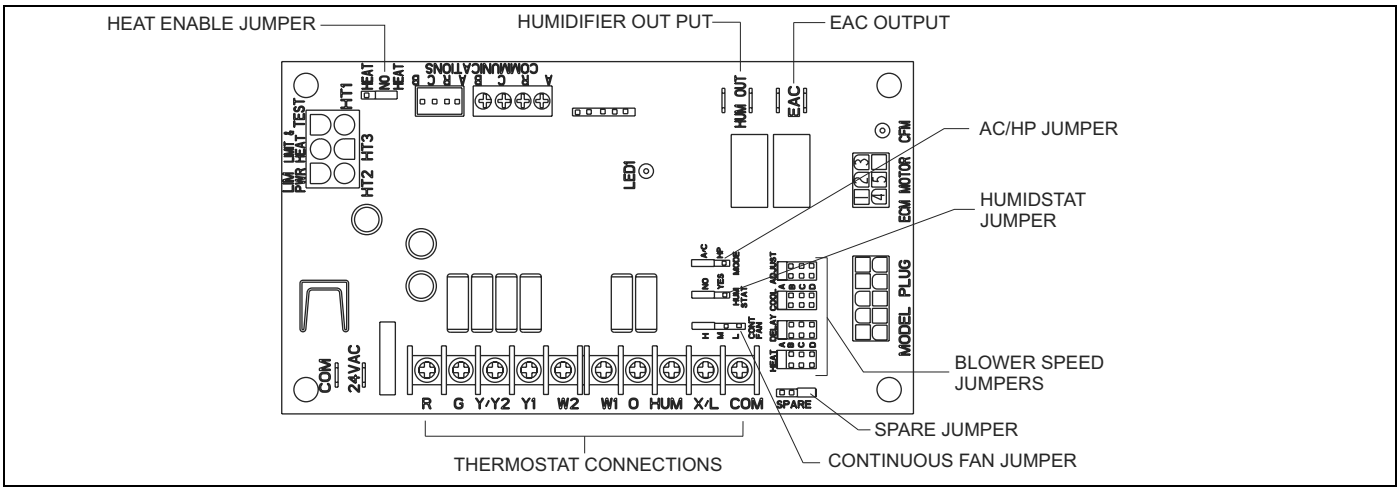


FIGURE 6: Air Handler Control Board – Communications Connections

CONVENTIONAL LOW VOLTAGE CONTROL WIRING (24 VAC)

The 24 volt power supply is provided by an internally wired low voltage transformer which is standard on all models, However, if the unit is connected to a 208 volt power supply, the low voltage transformer must be rewired to the 208 volt tap. See the unit wiring label.

Field supplied low voltage wiring can exit the unit on the top right hand corner or the right hand side panel. Refer to Figure 3.

Remove desired knockout and pierce foil faced insulation to allow wiring to pass through. Use as small of a hole as possible to minimize air leakage.

Install a 7/8" plastic bushing in the selected hole and keep low voltage wiring as short as possible inside the control box.

To further minimize air leakage, seal the wiring entry point at the outside of the unit.

The field wiring is to be connected at the screw terminals of the control board. Refer to Figure 6 or 7.

NOTICE

All wiring must comply with local and national electrical code requirements. Read and heed all unit caution labels.

It is possible to vary the amount of electric heat turned on during the defrost cycle of a heat pump. Standard wiring will only bring on the first stage of electric heat during defrost. See Heat Output and Limit Connections and Table 4 for additional information on heat during defrost cycle.

TABLE 2: Low Voltage Connections

Terminal	Signal	Comment
R	24 VAC power (fused)	
G	Continuous Fan operation	
Y/Y2	Second or full stage compressor operation	
Y1	First stage compressor operation	Not used with outdoor units having one stage compressors.
W2	Second stage heat operation	
W1	First stage heat operation	
O	Reversing valve operation	24 VAC will be present at this terminal when the MODE jumper is in the AC position. This is normal.
HUM	Humidity switch input	24 VAC will be present at this terminal when the HUM STAT jumper is in the NO position. This is normal.
X/L	Connection point for heat pump fault indicator	This terminal is a connection point only and does not affect air handler control operation.
COM	24 VAC common	

The low voltage connections may be connected to the screw terminals or the quick connect terminals. The screw terminals and the quick connect terminals are physically connected on the control board.

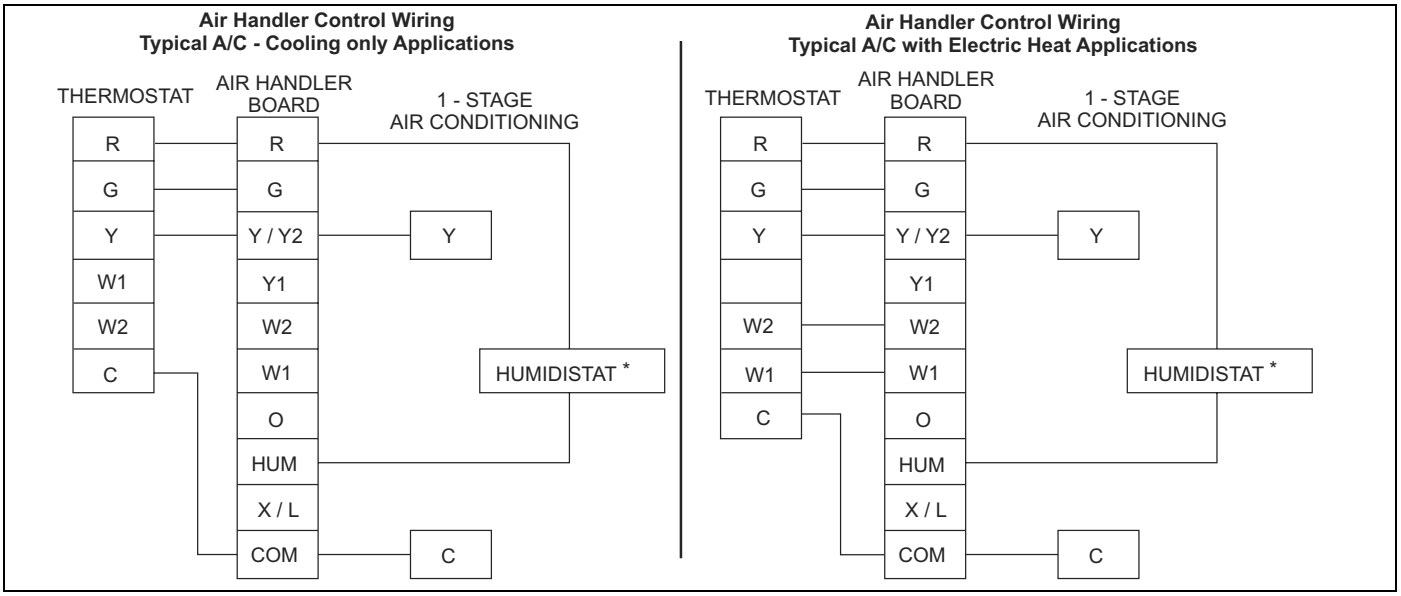


FIGURE 7: Cooling Models with and without Electric Heat Wiring

* Optional dehumidification humidistat switch contacts open on humidity rise.

NOTES:
1. "Y/Y2" Terminal on air handler control board must be connected for full CFM and applications requiring 60 second blower off delay for SEER enhancement.
2. Remove humidistat jumper on air handler control board.
3. For heat pump applications - set MODE jumper on air handler control board to the HP position.
4. To change quantity of heat during HP defrost cycle - reverse connections at W1 and W2 on air handler control board.

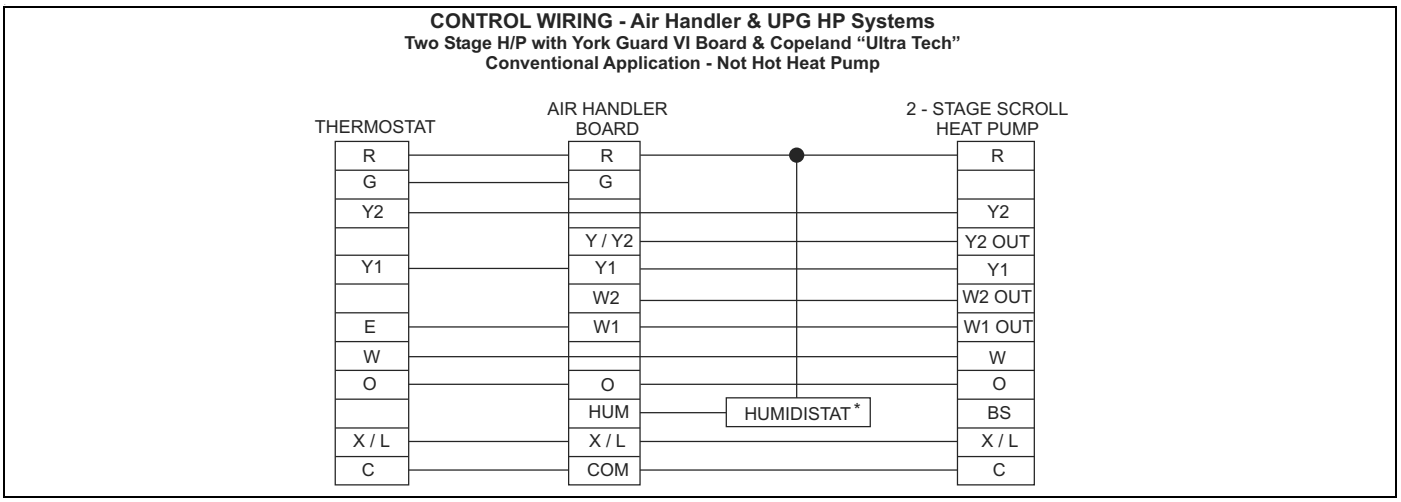


FIGURE 8: Two-Stage Heat Pump Wiring

* Optional dehumidification humidistat switch contacts open on humidity rise.

NOTES:
1. "Y/Y2" Terminal on air handler control board must be connected for full CFM and applications requiring 60 second blower off delay for SEER enhancement.
2. Remove humidistat jumper on air handler control board.
3. For heat pump applications - set MODE jumper on air handler control board to the HP position.
4. To change quantity of heat during HP defrost cycle - reverse connections at W1 and W2 on air handler control board

CONTROL WIRING USING COMMUNICATING CONTROLS

Use the wiring diagram below to connect the air handler control, Communicating Control (wall thermostat) and communicating outdoor unit. Be sure that all of the "A" terminals are connected together, all of the "B" terminals are connected together, all of the "C" terminals are connected together and all of the "R" terminals are connected together. See Figure 8. When using a fully communicating system, the large screw terminals (C, G, R, etc.) on the air handler control are not used. The four small screw terminals in the terminal block on the end of the furnace control should be used.

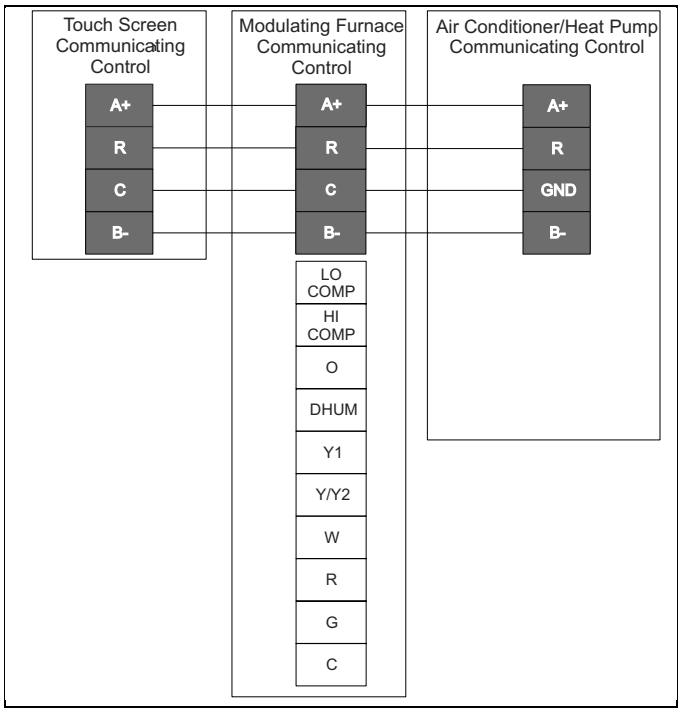


FIGURE 9: Air Handler with Communicating AC or HP

HUMIDITY SWITCH INPUT

The air handler control is designed to work with a humidity control that closes when the humidity is below the set-point. The control is open when the humidity is above the set-point. This humidity control may be referred to as a humidistat or a dehumidistat.

The humidity switch controls both humidification and de-humidification operation of the control. The control provides humidification using the HUM OUT relay output and de-humidification by lowering the blower speed. This is accomplished using the de-humidification input of the motor for variable speed models. The humidity switch should be connected to the R and HUM terminals of the control. See Figures 6 or 7.

The 24 volt power supply is provided by an internally wired low voltage transformer which is standard on all models, However, if the unit is connected to a 208 volt power supply, the low voltage transformer must be rewired to the 208 volt tap. See the unit wiring label.

Field supplied low voltage wiring can exit the unit on the top right hand corner or the right hand side panel. Refer to Figure 3.

Remove desired knockout and pierce foil faced insulation to allow wiring to pass through. Use as small of a hole as possible to minimize air leakage.

Install a 7/8" plastic bushing in the selected hole and keep low voltage wiring as short as possible inside the control box.

To further minimize air leakage, seal the wiring entry point at the outside of the unit.

The field wiring is to be connected at the screw terminals of the control board. Refer to Figures 6 or 7.

NOTICE

All wiring must comply with local and national electrical code requirements. Read and heed all unit caution labels.

It is possible to vary the amount of electric heat turned on during the defrost cycle of a heat pump. Standard wiring will only bring on the first stage of electric heat during defrost. See Heat Output and Limit Connections and Table 4 for additional information on heat during defrost cycle.

The low voltage connections may be connected to the screw terminals or the quick connect terminals. The screw terminals and the quick connect terminals are physically connected on the control board.

SECTION VI: REQUIRED CONTROL SET-UP

IMPORTANT

The following steps must be taken at the time of installation to insure proper system operation.

1. Consult system wiring diagram to determine proper thermostat wiring for your system.
2. If heat kit is installed, change HEAT ENABLE jumper from NO HEAT to HEAT position.
3. If a humidistat is installed, change HUM STAT jumper from NO to YES.
4. Set the MODE jumper to A/C (Air Conditioner) or HP (Heat Pump) position depending on the outdoor unit included with the system.
5. Set airflow and comfort setting jumper to proper positions.

FUNCTIONALITY AND OPERATION

Jumper Positions

HEAT ENABLE Jumper

The HEAT/NO HEAT jumper configures the control for heat kit operation. The jumper must be in the HEAT position if a heat kit is installed with the air handler.

With the jumper in the NO HEAT position, the control will not energize the heat relay outputs or sense the limit switch input.

If the jumper is not present, the control will operate as if the jumper is in the HEAT position. If the jumper is not present and a heat kit is not present, the control will sense an open limit condition and the blower will run continuously.

Hum Stat Jumper

The HUM STAT jumper configures the control to monitor the humidity switch input. With the jumper in the NO position, the control will energize the HUM terminal with 24 VAC continually. With the jumper in the YES position, the control will monitor the HUM input to control the HUM OUT output to control an external humidifier.

If the jumper is not present, the control will operate as if the jumper is in the YES position.

Mode Jumper

The MODE jumper configures the control to operate properly with an air conditioner (AC position) or heat pump (HP position). With the jumper in the AC position, the control will energize the O terminal with 24 VAC continually. With the jumper in the HP position, the O input signal is received from the room thermostat.

If the jumper is not present, the control will operate as if the jumper is in the HP position.

SPARE Jumper

The control includes a spare jumper that can be used if a jumper is lost. The SPARE jumper does not have any effect on the operation of the control.

Airflow and Comfort Setting Jumpers

See separate section.

Status and Fault Codes

The control includes an LED that displays status and fault codes. These codes are shown in Table 3. The control will display the fault codes until power is removed from the control or the fault condition is no longer present.

TABLE 3: Fault Codes

Fault or Status Condition	LED1 (RED) Flash Code
Status	
No power to control	OFF
Normal operation	2s ON / 2s OFF
Control in test mode	Rapid Flash
Control failure	ON
Limit Faults	
Limit switch currently open (not in lockout)	1
Multiple limit openings with no call for heat	2
Multiple limit openings during one call for heat	3
Single long duration limit opening	4
Multiple long duration limit openings	5
Fan failure	6
Wiring Related Faults	
Simultaneous call for heating and cooling	7
Internal Control Faults	
Control recovered from internal event	9

External Relay Outputs

The control includes two outputs to drive external relays having 24 VAC coils. The outputs have a maximum rating of 1.0 Amp pilot duty at 24 VAC.

HUM OUT

The HUM OUT output can be used to drive an external relay or solenoid (24 VAC coil) to control a humidifier. The output is energized when the HUM input is energized, the HUM STAT is in the YES position, and the control has a thermostat call for heating (heat pump or electric heat).

EAC

The EAC output can be used to drive an external relay (24 VAC coil) to control an electronic air cleaner. The output is energized whenever the blower relay on the control is energized.

Heat Output and Limit Connections

The control is connected to the heater relays and limit switch using the 6-pin connector. The relay outputs and the limit switch signal are 24 VDC.

The control energizes the heat relays and senses the limit switch input as shown in Table 4 when the HEAT ENABLE jumper is in the HEAT position.

TABLE 4: Heat Relays

Input	Heat Relay Output
W1	HT1
W2	HT1 and HT2
W1 and W2	HT1 and HT2 and HT3

The control energizes the first stage of electric heat immediately, the second stage 10 seconds after the call for second stage heat, and the third stage 20 seconds after the call for third stage heat.

Depending on the heat kit installed in the air handler, the control provides the flexibility to configure the amount of heat delivered with the first stage heating call. As an example, when the control's W1 input is connected to the room thermostat's first stage heat signal, a call for first stage heat will energize one heating element (HT1). If the control's W2 input is connected to the room thermostat's first stage heat signal, a call for first stage heat will energize two heating elements (HT1 and HT2). With either configuration, the control will energize three heating elements (HT1, HT2, and HT3) when it receives a first and second stage heat input from the thermostat.

Limit Switch and Lockout Operation

Limit Switch Operation

If the HEAT ENABLE jumper is in the HEAT position and the limit switch opens (fault code 1), the control will immediately de-energize all electric heat relay outputs and energize the blower (if it wasn't already energized). When the limit switch closes, the control will re-energize electric heat according to the thermostat inputs using normal timings.

Fan On Lock Condition

If the limit switch opens multiple times during a single call for electric heat (fault code 3) or if the limit switch opens for a long duration (fault code 4), the control will energize the blower until power is removed from the control. The control will cycle the heat outputs on and off as the limit re-closes and opens. The constant fan operation will signal the homeowner that a problem has occurred and a service call is required.

Soft Lockout

If the limit switch opens for a second long duration period during a single call for heat (fault code 5), the control will keep the blower locked on and lock out the heat outputs for one hour. The control will only reset this one hour lockout when the power is removed from the control. After the one hour period has passed, the control will re-energize electric heat according to the thermostat inputs using normal timings. The blower will remain locked on from the first long duration limit opening.

Hard Lockout

The control has a hard lockout condition during which the control will keep all heat outputs de-energized until power is removed from the control. The control de-energizes the blower five minutes after entering the hard lockout condition.

If the limit switch closes and re-opens during the one hour soft lockout period, the control will enter a hard lockout condition and continue to indicate a fault code 5.

If the limit switch opens twice when no call for electric heat is present (fault code 2), the control will enter a hard lockout condition.

If the limit switch opens multiple times soon after a soft lockout reset (fault code 6), the control will enter a hard lockout condition.

Wiring Related Faults

If the control receives a simultaneous call for heating and cooling (fault code 7), the control will perform both heating and cooling operations.

SECTION VII: LINE POWER CONNECTIONS

Power may be brought into the unit through the supply air end of the unit (top when unit is vertical) or the left side panel. Use the hole appropriate to the unit's orientation in each installation to bring conduit from the disconnect. The power lead conduit should be terminated at the electrical control box. Refer to Tables 10, 11, 13 or 14 to determine proper wire sizing. Also see Figure 3. To minimize air leakage, seal the wiring entry point at the outside of the unit.

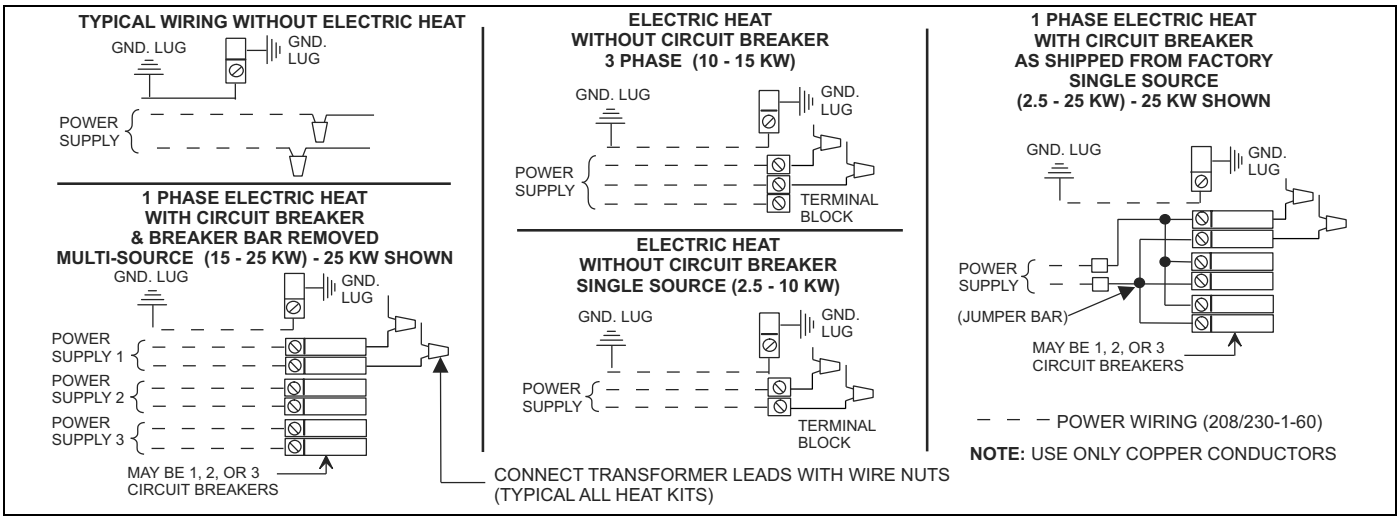


FIGURE 10: Line Power Connections

SECTION VIII: AIRFLOW AND COMFORT SETTING SELECTION

AIRFLOW SELECTION

The airflow and comfort setting selection jumpers must be set properly at the time of installation for proper system operation. Place jumpers in the proper locations based on the information shown in Table 15 and Figure 5.

Inputs to air handler control board are passed to the motor which determines the target CFM to be delivered. The following inputs will produce the CFM per the appropriate table and selected tap settings.

NOTICE

Incorrect airflow and comfort settings may result in decreased system efficiency and performance.

These variable speed air handlers are designed to deliver constant airflow (CFM) regardless of the external static pressure (ESP) in the ductwork. Therefore, if too many supply registers are closed, a filter becomes clogged, or there is a restriction in the ductwork, the motor will automatically operate at a higher speed to compensate for the higher ESP. This may result in a higher operating sound level.

To Set Cooling Airflow:

Refer to the outdoor unit technical guide for the recommended airflow with the matching evaporator coil. Refer to Table 15 for the possible high speed cooling and heat pump airflow selections.

Find the recommended system airflow in Table 15 for the installed air handler model.

Select the COOL airflow you need from Table 15. Set the COOL and ADJUST Jumpers on the control as indicated in Table 15.

To Set Heat Pump Airflow:

The heat pump airflow setting is the same as the cooling airflow setting. No additional airflow setting is required. However, you must set the MODE jumper to the HP position for proper system operation (See Figure 5).

To Set Electric W1 Heat Airflow:

The blower speed required for 1st stage electric heat is different than cooling. Refer to Table 15 for the possible CFM selections. Refer to Table 9 for the minimum required airflow for the electric heater installed. Find the desired airflow in Table 15 for low heat. Set the HEAT jumper on the control as indicated in Table 15.

To Set W2 Electric Heat Airflow:

Airflow for any W2 input, which is for Stages 2 & 3 of electric heat, is the indicated CFM for high heat tap selection on Table 15.

⚠ CAUTION

DO NOT change the ADJUST tap position on the control as this will change your cooling airflow previously selected.

Fan Only CFM:

When the connection is made from "R" to "G", the fan only mode is activated. In this mode, the airflow will depend on the position of the CONT Fan jumper. In the “H” position, the blower will deliver 85-90% of full capacity. In the “M” position, the blower will deliver 60-65% of full capacity. In the “L” position, the blower will deliver 30-35% of full capacity.

Blower Ramp-Up /Ramp-Down:

To minimize the sound made by the blower when it speeds up or slows down, the blower will slowly ramp up or down from one speed to another. Changes in blower speed during A/C or heat pump heating can take up to 30 seconds. Changes in blower speed during electric strip heating can take up to 15 seconds.

COMFORT SETTINGS

TABLE 5: Comfort Setting Selection

DELAY TAP	COMFORT SETTING
A	Normal
B	Humid
C	Dry
D	Temperate

Normal

The normal setting provides a ramp-up from zero airflow to full capacity and a ramp-down from full capacity back to zero airflow.

Humid

The humid setting is best-suited for installations where the humidity is frequently very high during cooling season, such as in the southern part of the country. On a call for cooling, t

he blower will ramp up to 50% of full capacity and will stay there for two minutes, then will ramp up to 82% of full capacity and will stay there for five minutes, and then will ramp up to full capacity, where it will stay until the wall thermostat is satisfied.

Dry

The dry setting is best suited to parts of the country where excessive humidity is not generally a problem, where the summer months are usually dry. On a call for cooling the motor will ramp up to full capacity and will stay there until the thermostat is satisfied. At the end of the cooling cycle, the blower will ramp down to 50% of full capacity where it will stay for 60 seconds. Then it will ramp down to zero.

Temperate

The temperate setting is best suited for most of the country, where neither excessive humidity nor extremely dry conditions are the norm. On a call for cooling, the motor will ramp up to 63% of full capacity and will stay there for 90 seconds, then will ramp up to full capacity. At the end of the cooling cycle, the motor will ramp down to 63% of full capacity and will stay there for 30 seconds, then will ramp down to zero.

SECTION IX: UNIT DATA

TABLE 6: Physical and Electrical Data - Cooling Only (60 Hz)

Models		**MV12B**	**MV12D**	**MV16C**	**MV20D**
Blower - Diameter x Width		10 x 7	10 x 10	10 x 10	10 x 10
Motor	HP	1/2	1/2	3/4	1
	Nominal RPM	1200	1200	1200	1200
Voltage		230			
Amps	Full Load (230)	4.3	4.3	5.0	7.0
Permanent Filter[1]	Type	DISPOSABLE OR PERMANENT			
	Size	16 x 20 x1	24 x 20 x 1	20 x 20 x 1	24 x 20 x1
	Filter Bulk Pack	1PF0601BK	1PF0604BK	1PF0602BK	1PF0604BK
Shipping / Operating Weight (lbs.)		75/71	88/82	88/82	94/88

1. Field Supplied.

TABLE 7: Electrical Data - Cooling Only (60 Hz)

Models	**Total Motor Amps**		**Minimum Circuit Ampacity**		**Max. O.C.P. Amps/Type[1]**	**Minimum Wire Size A.W.G.**
	60 Hertz		**60 Hertz**			
	208V	230V	208V	230V		
12B	4.7	4.3	5.9	5.4	15	14
12D	4.7	4.3	5.9	5.4	15	14
16C	6.1	5.0	7.6	6.9	15	14
20D	7.8	7.0	9.7	8.8	15	14

1. OCP = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 8: Conversion Table

kW & MBH Conversions - for Total Power Input Requirement					
FOR	208V	OPERATION MULTIPLY	240V	TABULATED kW & MBH BY	.751
	230V		240V		.918
	220V		240V		.840

TABLE 9: Electrical Data - 1 Ø - 208/230-1-60

Models MV	Heater Models*	Max. Static	Min. Speed Tap	Total Heat[1]				kW Staging					
				kW		MBH		W1 Only		W2 Only		W1 & W2	
				208v	230v	208v	230v	208v	230v	208v	230v	208v	230v
12B	4HK*6500506	0.5	Heat-C	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Heat-C	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Heat-B	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Heat B	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK165N1506	0.5	Heat-B	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
12D	4HK*6500506	0.5	Heat-C	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Heat-C	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Heat-B	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Heat B	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK16501506	0.5	Heat-B	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Heat-A	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Heat-A	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
16C	4HK*6500506	0.5	Heat-D	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Heat-D	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Heat-C	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Heat C	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK16501506	0.5	Heat-C	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Heat-B	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Heat-B	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
20D	4HK*6500506	0.5	Heat-C	3.6	4.8	12.3	16.4	3.6	4.8	3.6	4.8	3.6	4.8
	4HK*6500806	0.5	Heat-C	5.6	7.5	19.2	25.6	2.8	3.75	5.6	7.5	5.6	7.5
	4HK*6501006	0.5	Heat-C	7.2	9.6	24.6	32.8	3.6	4.8	7.2	9.6	7.2	9.6
	4HK16501306	0.5	Heat C	9.8	13	33.3	44.4	3.3	4.3	6.5	8.7	9.8	13.0
	4HK16501506	0.5	Heat-C	10.8	14.4	36.9	49.1	3.6	4.8	7.2	9.6	10.8	14.4
	4HK16501806	0.5	Heat-C	13.2	17.6	45.1	60.1	3.3	4.4	6.6	8.8	13.2	17.6
	4HK16502006	0.5	Heat-C	14.4	19.2	49.2	65.5	3.6	4.8	7.2	9.6	14.4	19.2
	4HK16502506	0.5	Heat-C	18.0	24.0	61.5	81.9	3.6	4.8	10.8	14.4	18.0	24.0

1. See conversion Table 10.
* May be 0 (no breaker) or 1 (with breaker).

TABLE 10: Electrical Data - 208/230-3-60

Models	Heat Kit - Three Phase	Max. Static	Min. Speed Tap	Total Heat[1]				KW Staging					
				KW		MBH		W1 Only		W2 Only		W1 + W2	
				208V	230V	208V	230V	208V	230V	208V	230V	208V	230V
12B	4HK06501025	0.5	Heat-B	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
12D	4HK06501025	0.5	Heat-B	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Heat-B	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK06501825	0.5	Heat-A	12.9	17.2	44.7	58.7	12.9	17.2	12.9	17.2	12.9	17.2
16C	4HK06501025	0.5	Heat-C	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Heat-C	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK06501825	0.5	Heat-B	12.9	17.2	44.7	58.7	12.9	17.2	12.9	17.2	12.9	17.2
20D	4HK06501025	0.5	Heat-C	7.2	9.6	24.6	32.8	7.2	9.6	7.2	9.6	7.2	9.6
	4HK06501525	0.5	Heat-C	10.8	14.4	36.9	49.1	10.8	14.4	10.8	14.4	10.8	14.4
	4HK16502525	0.5	Heat-C	18.0	24.0	61.4	81.4	9.0	12.0	18.0	24.0	18.0	24.0

1. See conversion Table 10.

TABLE 11: Electrical Data - (For **Single Source** Power Supply) - Copper Wire 1 Ø - 208/230-1-60

Models MV	Heater Models*	Heater Amps 240V	Field Wiring					
			Min. Circuit Ampacity		Max. O.C.P. Amps/Type[1]		75°C Wire Size - AWG	
			208V	230V	208V	230V	208V	230V
12B	4HK*6500506	20.0	27.54	30.38	30	35	10	8
	4HK*6500806	31.3	39.73	44.50	40	45	8	8
	4HK*6501006	40.0	49.21	55.38	50	60	8	6
	4HK16501306	54.2	64.00	72.80	70	80	4	2
	4HK165N1506	60.0	70.88	80.38	90	90	4	3
12D	4HK*6500506	20.0	27.54	30.38	30	35	10	8
	4HK*6500806	31.3	39.73	44.50	40	45	8	8
	4HK*6501006	40.0	49.21	55.38	50	60	8	6
	4HK16501306	54.2	64.00	72.80	70	80	4	2
	4HK16501506	60.0	70.88	80.38	90	90	4	3
	4HK16501806	73.3	85.32	97.00	90	100	4	3
	4HK16502006	80.0	92.54	105.38	100	125	3	1
16C	4HK*6500506	20.0	29.29	31.88	30	35	10	8
	4HK*6500806	31.3	41.48	46.00	45	50	8	8
	4HK*6501006	40.0	50.96	56.88	60	60	6	6
	4HK16501306	54.2	66.40	75.20	70	80	4	2
	4HK16501506	60.0	72.63	81.88	90	90	3	3
	4HK16501806	73.3	87.07	98.50	90	100	3	2
	4HK16502006	80.0	94.29	106.88	100	125	3	1
20D	4HK*6500506	20.0	29.29	31.88	30	35	10	8
	4HK*6500806	31.3	41.48	46.00	45	50	8	8
	4HK*6501006	40.0	53.08	58.75	60	60	6	6
	4HK16501306	54.2	68.40	77.20	70	80	4	2
	4HK16501506	60.0	74.75	83.75	90	90	3	3
	4HK16501806	73.3	89.19	100.38	90	110	3	2
	4HK16502006	80.0	96.42	108.75	100	125	3	1
	4HK16502506	100.0	118.08	133.75	125	150	1	1/0

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.
* May be 0 (no breaker) or 1 (with breaker).

TABLE 12: Electrical Data - (For **Single Source** Power Supply) - Copper Wire - 208/230-3-60

Models	Heat Kit - Three Phase	Heater Amps 240V	Field Wiring					
			Min. Circuit Ampacity		Max. O.C.P.[1] Amps/Type		75°C Wire Size - AWG	
			208V	230V	208V	230V	208V	230V
12B	4HK06501025	23.1	30.9	34.3	35	35	8	8
12D	4HK06501025	23.1	30.9	34.3	35	35	8	8
	4HK06501525	34.7	43.4	48.8	45	50	8	8
	4HK06501825	41.4	50.6	57.1	50	60	8	6
16C	4HK06501025	23.1	32.6	35.1	35	35	8	8
	4HK06501525	34.7	45.1	49.6	45	50	8	8
	4HK06501825	41.4	52.4	58.0	60	60	6	6
20D	4HK06501025	23.1	34.8	37.6	35	40	8	8
	4HK06501525	34.7	47.3	52.1	50	60	8	6

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.
2. Heaters are 3 Phase.

TABLE 13: Electrical Data - (For **Multi-Source** Power Supply) - Copper Wire 1 Ø - 208/230-1-60

Models MV	Heater Models	Min. Circuit Ampacity			Max. O.C.P. Amps/Type[1]			75°C Wire Size - AWG		
		Circuit			Circuit			Circuit		
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
		208/230	208/230	208/230	208/230	208/230	208/230	208/230	208/230	208/230
12B	4HK16501306	41.7/47.9	22.4/25.0	–	50/50	30/30	–	6/6	12/10	–
	4HK165N1506	49.2/55.4	21.7 / 25.0	–	50/60	25/25	–	8 / 6	10/10	–
12D	4HK16501306	41.7/47.9	22.4/25.0	–	50/50	30/30	–	6/6	12/10	–
	4HK16501506	49.2/55.4	21.7/25.0	–	50/60	25/25	–	8 / 6	10/10	–
	4HK16501806	45.6/51.2	39.7/45.8	–	50/60	40/50	–	8 / 6	8/8	–
	4HK16502006	49.2/55.4	43.3/50.0	–	50/60	45/50	–	8 / 6	8/8	–
16C	4HK16501306	42.9/49.1	23.6/26.2	–	50/50	30/30	–	6/6	12/10	–
	4HK16501506	51.0/56.9	21.7/25.0	–	50/60	25/25	–	8 / 6	10/10	–
	4HK16501806	17.3/52.7	39.7/45.8	–	50/60	40/50	–	8 / 6	8/8	–
	4HK16502006	51.0/56.9	43.3/50.0	–	50/60	45/50	–	8 / 6	8/8	–
20D	4HK16501306	43.9/50.1	24.6/27.2	–	50/60	30/30	–	6/6	10/10	–
	4HK16501506	53.1/58.8	21.7/25.0	–	60/60	25/25	–	6 / 6	10/10	–
	4HK16501806	49.5/54.6	39.7/45.8	–	50/60	40/50	–	8 / 6	8/8	–
	4HK16502006	53.1/58.8	43.3/50.0	–	60/60	45/50	–	6 / 6	8/8	–
	4HK16502506	49.3/56.5	43.3/50.0	21.7/25.0	50/60	45/50	25/25	8 / 6	8/8	10/10

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 14: Electrical Data - (For **Multi-Source** Power Supply) - Copper Wire - 208/230-3-60

Models	Heater Model	Minimum Circuit Ampacity			Max. O.C.P.[1] Amps/Type			75°C Wire Size - AWG		
		Circuit								
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
		208/230	208/230	208/230	208/230	208/230	208/230	208/230	208/230	208/230
20D	4HK16502525	41.0/44.9	31.3/36.1	–	45/45	35/40	–	8/8	8/8	–

1. O.C.P. = Over Current Protection device, must be HACR type Circuit Breaker or Time Delay fuse.

TABLE 15: Air Handler Air Flow Data

HIGH/LOW SPEED COOLING AND HEAT PUMP AIRFLOW									
CFM				m³/min				JUMPER SETTINGS	
12B		12D		12B		12D			
High	Low	High	Low	High	Low	High	Low	COOL Tap	ADJ Tap
1385	896	1411	907	39.2	25.4	39.9	25.7	A	B
1137	745	1159	767	32.2	21.1	32.8	21.7	B	B
1203	777	1227	799	34.1	22.0	34.7	22.6	A	A
1019	650	1007	662	28.8	18.4	28.5	18.7	B	A
1085	690	1083	716	30.7	19.5	30.7	20.3	A	C
943	615	958	629	26.7	17.4	27.1	17.8	C	B
889	585	908	603	25.2	16.6	25.7	17.1	B	C
746	493	767	537	21.1	14.0	21.7	15.2	D	B
817	537	840	568	23.1	15.2	23.8	16.1	C	A
646	467	660	516	18.3	13.2	18.7	14.6	D	A
738	481	780	532	20.9	13.6	22.1	15.1	C	C
580	465	603	517	16.4	13.2	17.1	14.6	D	C
16C		20D		16C		20D		JUMPER SETTINGS	
High	Low	High	Low	High	Low	High	Low	COOL Tap	ADJ Tap
2005	1433	2404	1579	56.8	40.6	68.1	44.7	A	B
1768	1145	2022	1313	50.1	32.4	57.2	37.2	B	B
2009	1299	2167	1388	56.9	36.8	61.3	39.3	A	A
1615	1040	1801	1159	45.7	29.4	51.0	32.8	B	A
1787	1159	1924	1256	50.6	32.8	54.5	35.6	A	C
1524	988	1818	1175	43.1	28.0	51.5	33.3	C	B
1445	940	1620	1024	40.9	26.6	45.9	29.0	B	C
1350	883	1638	1049	38.2	25.0	46.4	29.7	D	B
1384	906	1628	1030	39.2	25.6	46.1	29.2	C	A
1215	800	1442	929	34.4	22.6	40.8	26.3	D	A
1236	810	1434	911	35.0	22.9	40.6	25.8	C	C
1086	716	1305	859	30.7	20.3	36.9	24.3	D	C

HIGH / LOW SPEED ELECTRIC HEAT AIRFLOW									
CFM				m³/min				JUMPER SETTINGS	
12B		12D		12B		12D			
High	Low	High	Low	High	Low	High	Low	HEAT Tap	ADJ Tap
1385	900	1411	913	39.2	25.5	39.9	25.8	A	N / A
1228	795	1258	817	34.8	22.5	35.6	23.1	B	N / A
1137	748	1159	769	32.2	21.2	32.8	21.8	C	N / A
917	603	928	619	26.0	17.1	26.3	17.5	D	N / A
16C		20D		16C		20D		JUMPER SETTINGS	
High	Low	High	Low	High	Low	High	Low	HEAT Tap	ADJ Tap
2006	1411	2408	1515	56.8	39.9	68.2	42.9	A	N / A
1868	1243	2218	1285	52.9	35.2	62.8	36.4	B	N / A
1468	983	1902	1070	41.6	27.8	53.8	30.3	C	N / A
1248	840	1407	823	35.3	23.8	39.8	23.3	D	N / A

1. Airflow at nominal voltage, bottom return at 0.5 external static pressure, tested without filter installed, dry coil conditions.
2. These units have variable speed motors that automatically adjust to provide constant CFM from 0.0” to 0.6” w.c. static pressure.
3. From 0.6” to 1.0” static pressure, CFM is reduced by 2% per 0.1” increase in static.
4. Operation on duct systems with greater than 1.0” w.c. external static pressure is not recommended.
5. Both the COOL and the ADJUST tap must be set to obtain the cooling airflow desired (CFM).
6. The ADJ tap does not affect the HEAT tap setting.
7. Low speed cooling used only with two stage outdoor units. (Speed is preset to 65% of high speed).
8. Dehumidification speed is 85% of jumper selected COOL tap and ADJUST tap.
9. When operating in both heat pump and electric heat modes, the airflow (CFM) will be per HEAT Tap CFM values only.
10. At some settings, LOW COOL and/or LOW HEAT airflow may be lower than what is required to operate an airflow switch on certain models of electronic air cleaners. Consult the instructions for the electronic air cleaner for further details.
11. Airflow (CFM) indicator light (LED2) flashes once for every 100 CFM (i.e.: 12 Flashes is 1200 CFM) – blinks are approximate +/- 10% of actual CFM.

SECTION X: MAINTENANCE

Filters must be cleaned or replaced when they become dirty. Inspect at least once per month. The frequency of cleaning depends upon the hours of operation and the local atmospheric conditions. Clean filters keep unit efficiency high.

LUBRICATION

The bearings of the blower motor are permanently lubricated.

SECTION XI: WIRING DIAGRAM

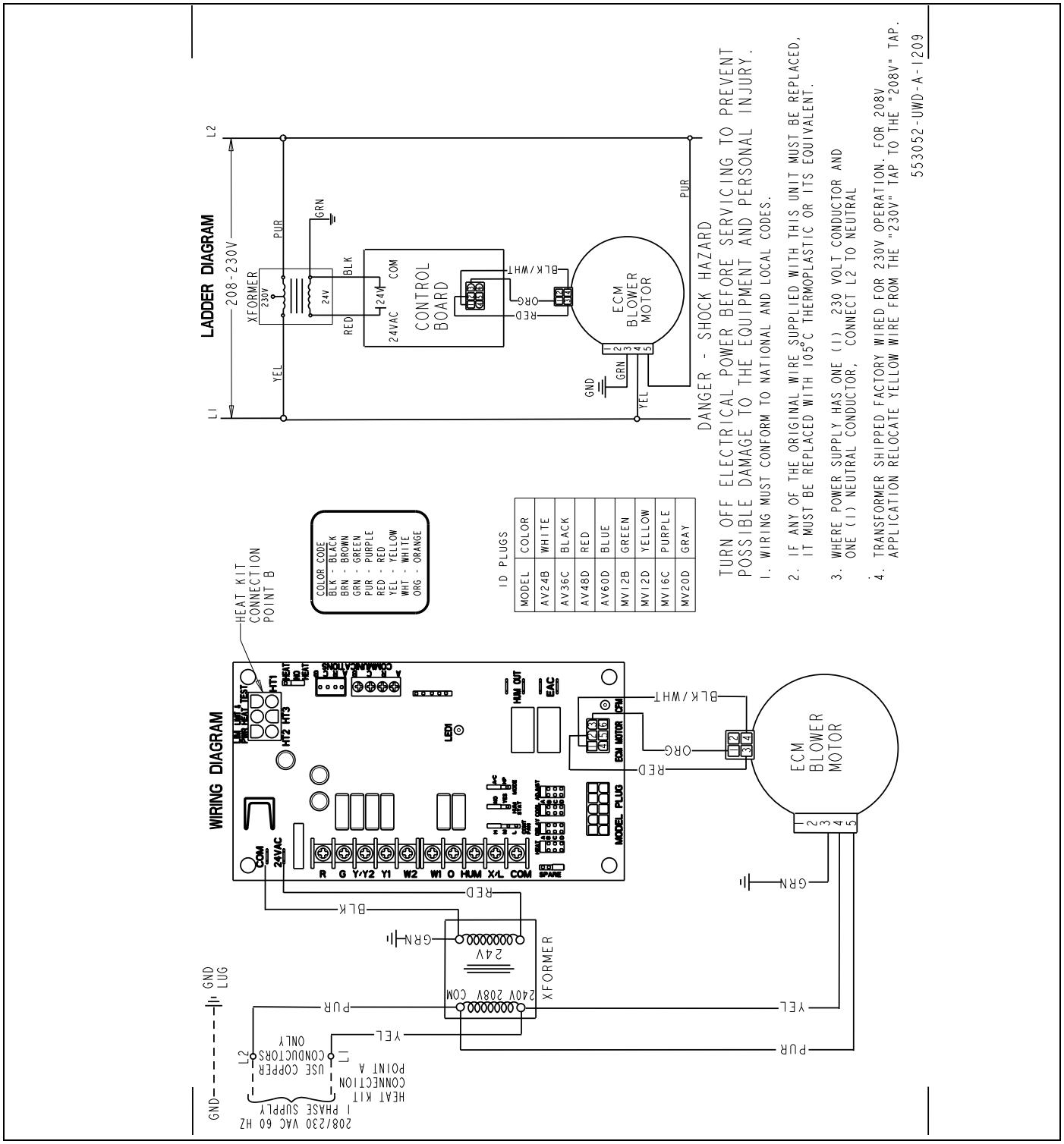


FIGURE 11: Wiring Diagram

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