J Series Variable Speed Air Handler

Field Reference Guide

Updated June 2023

Johnson Controls

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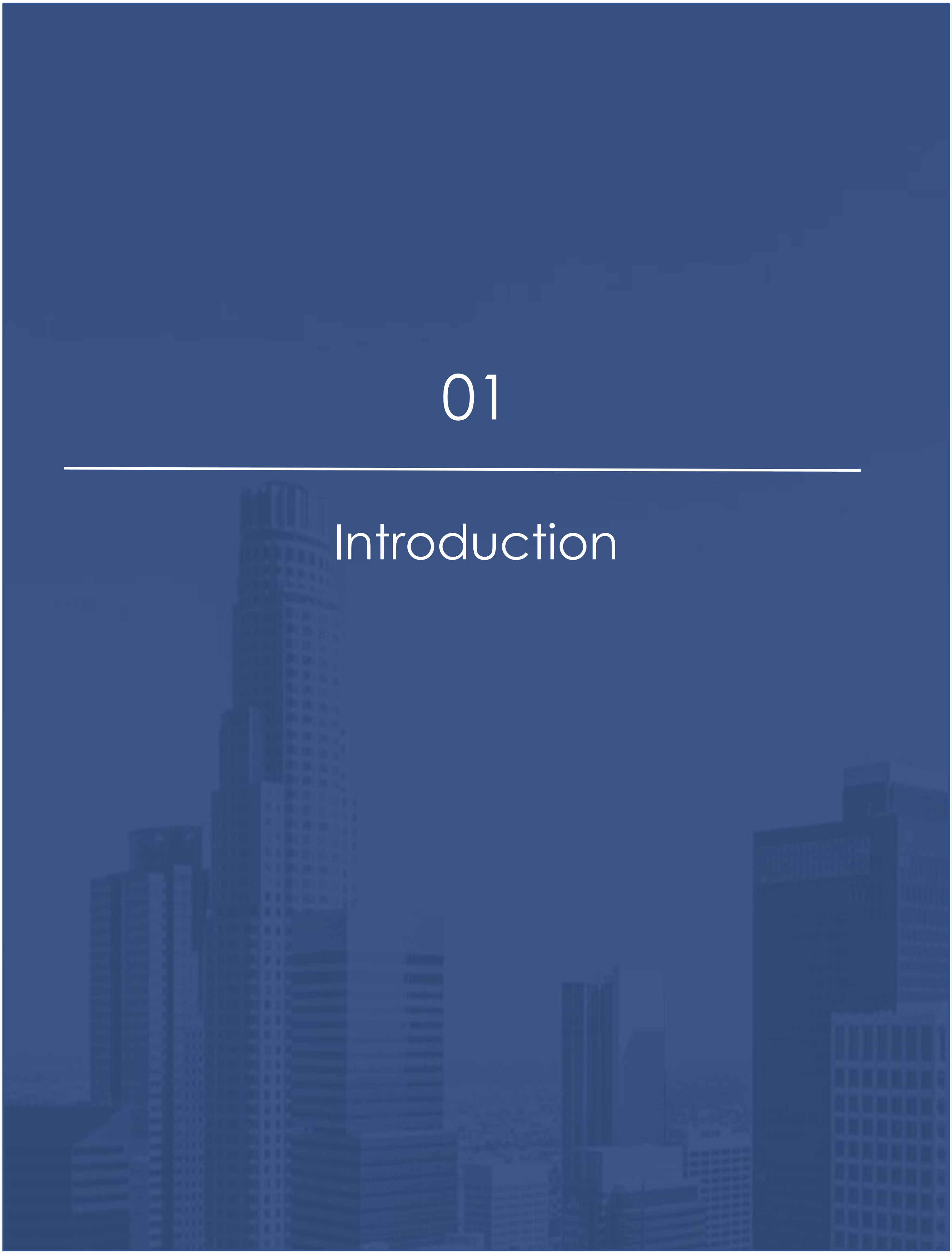


01

Introduction

Available Models

Ducted Systems Variable Speed air handlers are available in two configurations:

- Single piece (JHVT)
- Modular (JMVT)

Note: Both models are A2L sensor compatible.

Single Piece air handlers and coils are shipped with a factory installed TXV. An R-22 or R-410A TXV or orifice is field installed to meet your refrigerant choice or application. All kits are bolt-on and require no brazing to install.

Single Piece Air Handlers – JHVT

Four variations of multi-position single piece air handlers are available. The JHVT series is communications-capable and contains a direct drive variable speed ECM blower motor.

Modular Air Handlers – JMVT

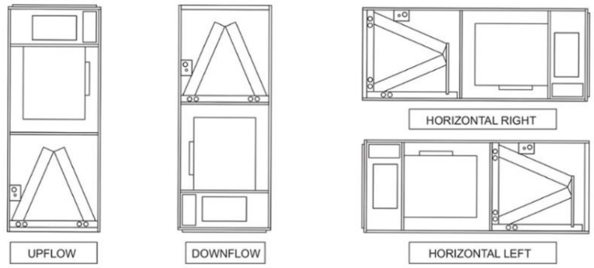
Modular air handlers are multi-position and communications capable.

The primary benefit of the modular air handler design is that the separated air handler and coil components allow for applications where a single piece air handler will not fit. ** This is convenient in attic applications where a small access door or a limited turn radius requires the use of a shorter, more maneuverable model.

**Indoor coil and modular air handler are designed to be directly coupled. There should be no offset fittings between the two sections.

Features

Multiple Positions



Upflow / Downflow / Horizontal Application

Single piece (JHVT) and modular (JMVT) air handlers can be applied in upflow, downflow, horizontal right or horizontal left configurations. Upflow and horizontal right are the standard configuration. Single piece air handler installation in downflow and horizontal configuration requires field conversion as described in the Installation Manual. Modular air handlers (blower only, no coil) do not require conversion, although the cased coils require modification for installation on the horizontal right configuration as noted below.

Coils (XAF/XAM/XAH/XAU)

Cooling and heat pump coils are designed to be installed with Unitary Products modular air handlers, and to be matched with Unitary Products cooling and heat pump outdoor units. **XAF** series coils are fully cased and are for upflow and downflow applications. They are available in Flex (no metering device) and Factory installed metering device versions. The **XAM** series coils have an EEV, are fully cased, and are installable in all positions (upflow, downflow, horizontal left, horizontal right). Horizontal right XAM application requires field conversion. **XAH** series coils are fully cased and are for horizontal applications (Right or Left). They are available in Flex (no metering device) and Factory installed metering device versions. **XAU** series coils are uncased and available as flex coils – without a factory installed metering device.

The XAF/XAM/XAH/XAU MaxAlloy coils are all aluminum in construction. Appropriate considerations for aluminum coils must be adhered to during cleaning, installation, and service.

Thermostatic Expansion Valve

Thermostatic expansion valves (TXV) provide the increased refrigerant control required for high efficiency systems. All JHVT air handlers come with a factory installed TXV but allow for field installation of a chatleff style metering device.

Insulated Cabinet

Next generation insulation and gasket design - reduces thermal transmission paths and reduces sweating

Durable Finish Inside and Out

A G30 galvanized steel case provides a coated edge that resists corrosion and rust creep. All internal coil sheet metal parts, except for the coil heater plate, are made of G90 pre-painted steel. Coil header plates are not painted due to the brazing process during production. The coil header plates are treated after the brazing process with a corrosion resistant spray to reduce the probability of rust.

Case Depth

These models have 20.5” casing which provide ease of attic access and tight applications.

Thermal Plastic Drain Pan

Positive slope for drainage reduces potential for mold or contaminates.

Factory Sealed

Achieves less than 2% at 1 in. W.C. external static pressure when tested in accordance with ASHRAE Standard 193.

Enhanced Filter Rack

All models have integrated internal filter racks provided for use with 1” thick standard size filters. Refer to installation manual for filter size (Table 11).

Accessories

A full line of matching accessories is available for use with the blower and coils to provide application flexibility. Refer to Price Manual for specific model numbers where not shown.

Electric Heaters

8HK models shown under electrical data include sequential operation and temperature dual-limit switches for safe, efficient operation. Service disconnects are provided where shown.

Bottom Rack Filter Kit

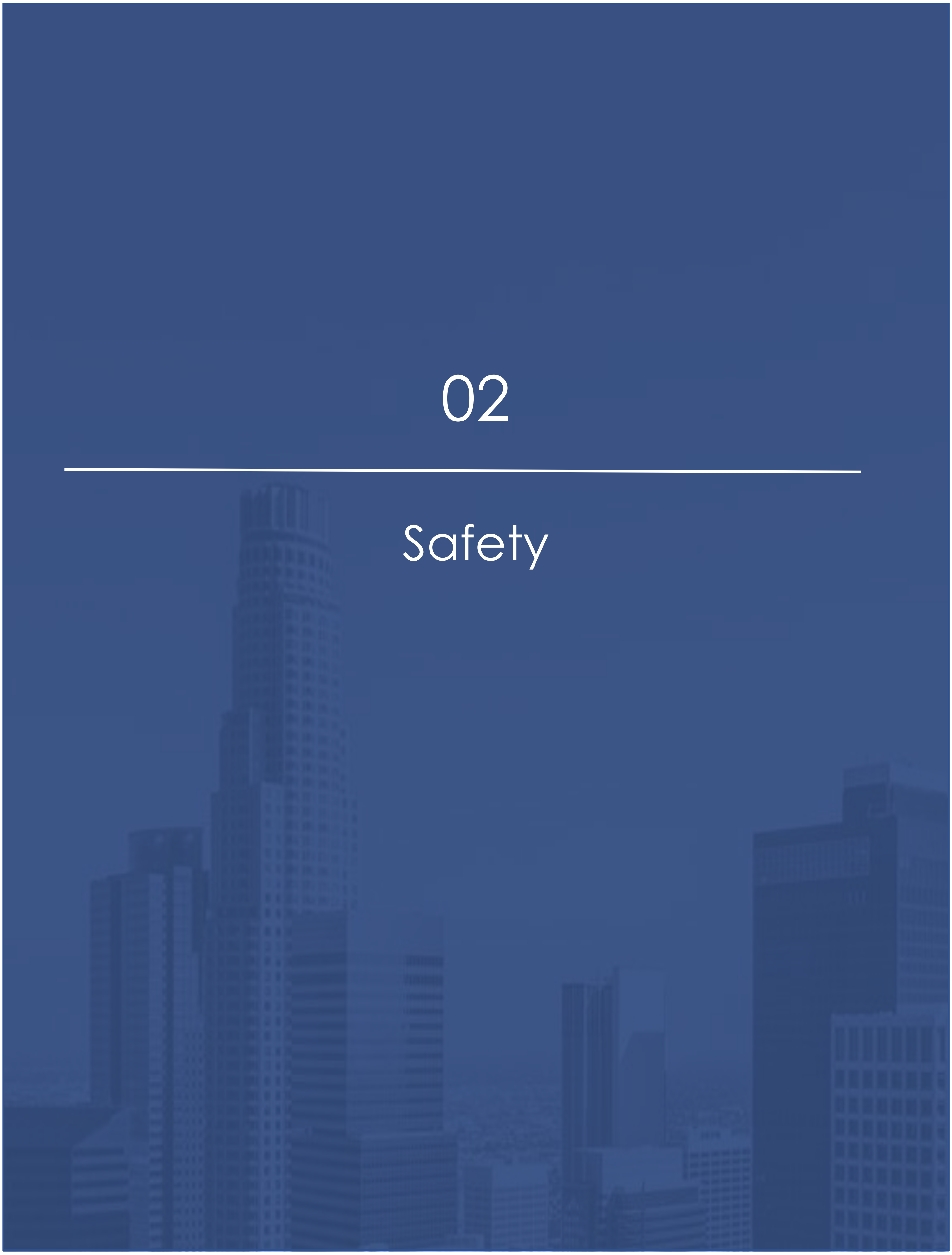
The filter frame accessory allows installation of an external air handler filter in an upflow application, a downflow application or a horizontal application. Refer to Price Manual for specific part numbers.

Combustible Floor Base Accessory

If an electric heat accessory which is rated for greater than zero clearance to combustible surfaces is installed in these air handlers in the downflow operating positions on a combustible floor, one of the following combustible floor base accessory models is required: S1-1FB1917, S1-1FB1921, or S1-1FB1924.

Breaker Moisture Seal Accessory

A clear circuit breaker moisture barrier seals the breakers from humidity and dust. The flexibility of the clear cover allows circuit breakers to be turned ON or OFF without removing the cover. The cover firmly attaches to the access panel around the circuit breakers with the use of double backed adhesive tape. To ensure that moisture or dust does not contaminate circuit breakers, an S1- 02435672000, Circuit Breaker, Cover Seal may be ordered.



02

Safety

Safety Symbols

Reminder – use this manual in conjunction with the technical literature for each product. This manual Does Not Supersede the Installation Manual and Technical Guide provided with the equipment. Always read and follow all instructions before installing equipment. Understand and pay particular attention to the signal words **DANGER**, **WARNING** or **CAUTION**.

⚠DANGER

An overpressure protection device, such as a pressure regulator, must be installed in the gas piping system upstream of the furnace and must act to limit the downstream pressure to the gas valve so it does not exceed 0.5 psig [14" w.c. (3.48 kPa)]. Pressures exceeding 0.5 psig [14" w.c. (3.48 kPa)] at the gas valve will cause damage to the gas valve, resulting in a fire or explosion or cause damage to the furnace or some of its components that will result in property damage and loss of life.

Sample Danger Label

DANGER indicates an imminently hazardous situation which could result in death or serious injury.

⚠WARNING

The duct system must be properly sized to obtain the correct airflow for the furnace size that is being installed.

Refer to the furnace rating plate for the correct rise range and static pressures or to Table 6 for the correct rise range.

If the ducts are undersized, the result will be high duct static pressures and/or high temperature rises which can result in a heat exchanger OVERHEATING CONDITION. This condition can result in premature heat exchanger failure, which can result in personal injury, property damage, or death.

Sample Warning Label

WARNING indicates a potentially hazardous situation which could result in death or serious injury.

⚠CAUTION

The indoor coil must be installed in the supply air duct, downstream of the furnace. Cooled air may not be passed over the heat exchanger.

Sample Caution Label

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.

Safety Specific Rules

Follow these specific safety rules for a safe application:

- Air conditioning systems utilizing gas heating can only use natural gas or propane (LP) gasses as an approved fuel. LP applications require installation of the appropriate LP conversion kit. Refer to the unit rating plate or Installation Manual for information on proper inlet and manifold pressures.
- Install air conditioning systems only in locations and positions as specified in the Installation Manual.
- Provide adequate clearances for service, combustion, and ventilation air to the unit. The recommended clearances are specified in the Installation Manual.
- Test for gas leaks as specified in the Installation Manual.
- Only connect the equipment to a duct system which has an external static pressure within the allowable range as specified in the Installation Manual.
- These unites are not to be used for temporary heating or cooling of buildings or structures under construction. Improper installation will shorten equipment life, reduce product efficiency, and void the warranty.
- Always install the systems to operate within the equipment's intended temperature and operating ranges.
- The size of the unit should be based on an acceptable and approved heat load calculation for the structure being conditioned.

Safety Requirements

Follow these safety requirements for a safe application:

- All equipment should be installed in accordance with all national and local building/safety codes and requirements, local plumbing or wastewater codes, and other applicable codes. In the absence of local codes, install in accordance with the most recent National Electrical Code, National Fuel Gas Code and/or Natural Gas and Propane Installation Code (latest editions). Furnaces have been certified to the latest edition of standard ANSI and CSA standards.
- Only approved heat accessories shall be installed on these air conditioning units local.
- Refer to the unit rating plate for the equipment model number, and refer to the Installation Manual for proper air plenum dimensions.
- Provide clearances from combustible materials as listed under Clearances to Combustibles in the Installation Manual and the equipment rating plate.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and indoor fan motor.
- Provides clearances for servicing.
- Failure to carefully read and follow all instructions in this manual and the equipment Installation Manual can result in equipment malfunction, death, personal injury and/or property damage.
- Check the rating plate and power supply to be sure that the electrical characteristics match. All commercial 15 through 25-ton units distributed in North America use nominal 208/230 volts AC, nominal 460 volts AC, or nominal 575 volts AC 3 Phase, 60-Hertz power supply. DO NOT CONNECT THIS APPLIANCE TO A POWER SUPPLY OR A VOLTAGE OTHER THAN THE RANGE SPECIFIED ON THE UNIT DATA TAG.
- The equipment shall be installed so the access panels are readily available, and the electrical components are protected from water infiltration.
- Installing and servicing HVAC equipment can be hazardous due to the electrical and mechanical components. Only trained and qualified personnel should install, repair, or service HVAC equipment. When working on equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.
- The Installation manual covers minimum requirements needed to conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances. These instructions are required as a minimum for safe installation and operation.

General Awareness

Safety is ALWAYS the primary concern for everyone. On the job injuries can be significantly reduced when proper guidelines are followed. Always be aware of all company, local, state and/or OSHA (Occupational Safety and Health Administration) regulations.

Jobsite Safety

Keeping the job site clean of trash, extra tools and equipment will significantly reduce the chance for injuries. Since each job is unique and has its own hazards, all new workers to the area should be made aware of the location of hire and first-aid equipment, fire escape routes, and other dangers.

Hazardous Materials

Many different chemicals and compounds are used in the service and installation of HVAC systems. Please read the directions and use caution along with PPDs whenever handling these materials. Read and understand the MSDS for all materials used.

Confined Spaces

Never enter or work in a confined space without taking the appropriate precautions. Have someone available outside the space ready to assist or summon help if necessary. Even spaces that seem relatively safe can quickly become hazardous if a pipe were to break and fill the space with refrigerant, steam, poisonous fumes or other gasses. Welding or brazing in a confined space is especially hazardous.

Pressure

High pressures have always been part of the HVAC profession. Wear the proper personal protective devices including safety glasses and gloves. Proper hose ratings and manifolds are required for high-pressure refrigerants.

Electrical Safety

Jewelry should be removed prior to any electrical work being performed. Ensure that the equipment disconnect switch removes the primary power source prior to taking resistance readings or disconnecting any wires or connections. Removal of system power should be verified with the voltage function of a multimeter. All electrical safety guidelines should be always followed. Only trained, qualified technicians should perform electrical maintenance, installation, inspections and troubleshooting of electrical equipment.

Electrocution occurs when a current as low as 6 to 200mA flows through the heart, disrupting its normal operation and causing death. Electrical shock is an injury that occurs because of exposure to an electrical current. Inspect all extension cords and power tools regularly. Fuses and circuit breakers are designed to protect equipment, not people. For personal electrical protection, GFCI or Ground Fault Circuit Interrupters are highly recommended.

Lock-Out Tag-Out

OSHA Standards cover the servicing and maintenance of machines and equipment, in which unexpected energizing or startup of the machines or equipment, or release of stored energy, could cause injury to employees.

These standards establish minimum requirements for the control of such hazardous energy. To ensure safety, put a lock that is tagged with the technician’s name on the electrical disconnect or breaker of the equipment or circuit which is being serviced.

Be aware of others who may be working on the same circuit or other circuits served by the same electrical panel. The technician should also be aware that other technicians may not have used the proper Lock-Out, Tag-Out procedures.

Fire Safety & Burns

While brazing, keep the area clear of combustible material or use a heat shield to help reduce risk of fire.

Check equipment regularly and never try to modify or repair regulators.

While servicing the refrigeration circuit, improper use of equipment and tools can result in serious burns that are associated with refrigerants. This may include frostbite, which is a deep tissue injury. Proper personal protection devices must be in use when servicing the refrigeration system.

Personal Safety

Personal safety always includes remaining aware of the surroundings, using properly maintained tools, and correct use of items designed for personal protection.

Personal Protection Devices (PPD)

- Hard Hat: Hard hats must be worn when there is a danger of head injury.
- Safety Glasses: Eye protection should be worn at all times while on a job site.
- Gloves: Assist in the prevention of serious injury to the hands from serious cuts as well as injuries from high-pressure gasses such as refrigerants. Rubber gloves can protect the technician’s hands from chemicals when inspected and worn properly.
- Safety Shoes: Work shoes with steel toes for foot protection. There are also electrical safety shoes that can aid in protecting the technician against electrical shock and/or electrocution. At a minimum, leather work shoes with rubber soles are required.
- Respirator: Used in a confined space where the air can be dissipated by refrigerant which can cause asphyxiation.
- Safety Harness: Used when working above grade level. Ladders must be tied down. Ensure that PPDs provide the intended protection. They should be inspected regularly, used properly and never altered or modified in any way.

Clothing

Rotating and moving components pose a serious risk. Loose fitting clothing and ties should not be worn when servicing rotating equipment. If any clothing becomes entangled in moving parts, serious injury or death is a likely result.

Jewelry

Serious injury or death can result if jewelry contacts an energized circuit or is caught in moving parts. Leave jewelry at home or in your service bag or service vehicle.

Lifting

To avoid back injuries, always adhere to proper lifting techniques. Be aware of personal limitations and seek help with items that are too heavy to safely lift. A back support belt may provide additional protection.

03

Component Familiarization

Component Familiarization

The cooling and heat pump coils are to be installed with Ducted Systems air handlers and matched with Ducted Systems outdoor units. Flex coils are shipped without a factory installed metering device, and an R-407C or R-410A TXV is installed in the field for the refrigerant type desired. FMID coils contain a factory mounted TXV, which is to be matched to the outdoor unit.

The XAF/XAM/XAH/XAU MaxAlloy coils are all aluminum in construction. Appropriate considerations for aluminum coils must be adhered to during cleaning, installation, and service.

Note
The coil connections should not be open to the air for more than 5 minutes to prevent moisture and contaminants from entering the system. If the coil cannot be brazed into the refrigeration systems in that time, the ends should be temporarily sealed or plugged.

Full-Cased Upflow/Counterflow Position Coils (XAF)

The fully cased coils (XAF) may be used for either upflow or downflow applications. These coils cannot be used in horizontal applications.

Full-Cased Horizontal Position Coils (XAH)

The fully cased coils (XAH) may be used for either horizontal left or right applications. These coils cannot be used in Upflow/Counterflow applications.

Full-Cased Upflow/Counterflow Coils (XAM)

The XAM multi-position coils may be used for upflow, downflow, and horizontal left or right applications. Factory Installed EEV for Variable Capacity System Matches. Coil cabinets are insulated with ¾" foil face insulation to prevent sweating.

XAM coils are supplied ready to be installed in a horizontal left position. Horizontal right installation requires field conversion. Be sure to follow the instructions in the Installation Manual concerning conversion.

Un-Cased Upflow/Counterflow Coils (XAU)

The XAM multi-position coils may be used for upflow or downflow applications. These are Flex coils and do not come with factory installed metering device.

Metering Devices

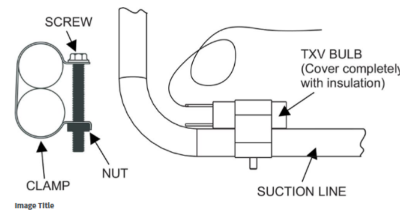
The metering device, refrigerant type and valve size applied to the coil in the single piece air handler can be identified by the model nomenclature. If the model number nomenclature identifies the coil as a flex coil design, the coil requires a field-installed metering device.

Thermostatic Expansion Valve (TXV)

Split systems using TXV metering devices are charged by the subcooling method. The TXV is designed to maintain a relatively constant superheat within the evaporator coil.

TXV Operating Forces

The TXV has three operating forces that control the flow of refrigerant through the system to maintain suction superheat at the evaporator outlet: one opening force and two closing forces.



1. Sensing Bulb Pressure (Opening):

The sensing bult is the “opening force” of the TXV. It is located at the outlet of the coil, on the suction line, downstream of the header. It is mounted to the top of the suction line and measures the temperature of the suction line.

As the load increases on the coil, the superheat and the suction line temperature increases. The sensing bulb pressure increases as the suction line temperature increases. When the sensing bult pressure increases, pressure is exerted on the TXV diaphragm. This opens the valve and allows more refrigerant to flow into the evaporator.

2. Spring Pressure (Closing):

The spring pressure is one of the “closing forces” on the TXV. The TXV assemblies on these units have a factory-adjusted (non-adjustable) spring. It is in the body of the valve and exerts pressure on a set of pushrods which are in direct contact with the diaphragm within the powerhead assembly. The pressure of the spring and the refrigerant pressure within the coil opposes the sensing bulb pressure.

3. Evaporator Pressure (Closing)

Evaporator pressure is another “closing force” on the TXV. The external equalizer line is a small capillary line that is attached to the top of the suction line at the outlet of the coil and downstream of the sensing bulb. This line allows coil pressure to be applied on the diaphragm. The pressure of the coil, in addition to the spring pressure, opposes the sensing bulb pressure.

Note
The coil connections should not be open to the air for more than 5 minutes to prevent moisture and contaminants from entering the system. If the coil cannot be brazed into the refrigeration system in that time, the ends should be temporarily sealed or plugged.

Note
For models that have a factory installed TXV, take caution not to apply high temperatures to the TXV assembly or equalizer line while brazing.

Electronic Expansion Valve (EEV)

The AVV air handler features a factory-installed electronic expansion valve (EEV) for matching with a variable capacity air conditioner or heat pump. Variable capacity heat pumps features a second EEV located in the outdoor unit.

Electronic Expansion Valve

The 500-step valve is driven by a 12 VDC stepper motor from the EEV control. A stepper motor is a small motor that can move the rotor in very small increments or steps. The valve needle serves as the rotor. Threaded on one end into a “nut” type component, the needs moves slightly. The result is a more precise refrigerant control than that offered by conventional expansion valves.

Successful EEV operation requires three components: the transducer, the thermistor, and the controller. The controller receives values from the transducer and thermistor. Algorithms in the controller process the input values to determine necessary output to the EEV.

Valve Body and Motor Stator

Valve Body

The valve body consists on two basic components – the metering needle and motor rotor.

Valve Body

Motor Stator

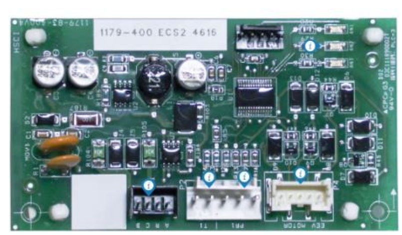
The motor stator slips over the valve body and is held in place by a retaining clip that snaps over the liquid inlet.

Motor Stator

EEV Control

The EEV control is shown below. In addition to the connection points, the control features three (3) LEDs, that provide visual information to the technician.

- Yellow LED – EEV closing
- Green LED – EEV opening
- Red LED – Power and diagnostics



Indoor EEV Control

EEV Homing

The EEV is homed to establish the valve position. After homing, the valve is driven to mid-position (250 steps) if no compressor call exists. If there is a demand for compressor operation, the control transitions to Start Up mode.

EEV Start-Up

When the call for compressor activated, the valve enters the Startup Mode. In this mode, the EEV is homed (fully closed) followed by driving to the fully open position for 15 seconds. The valve is then driven to the position it was in at the end of the previous cycle as stored in the controller memory. This position is held for the first 60 seconds of compressor operation (>900 RPM) unless one of the following conditions exist:

- Superheat is below setpoint.
- A fault retry and compressor speed has been active > 30 seconds.

If communication is lost, such as might occur in Repair Mode, the EEV is still functional. System operation is confirmed when suction pressure drops below 175 psi. The EEV returns to the last position stored for 60 seconds, after which the EEV controls superheat at 6 degrees Fahrenheit. If the suction pressure rises above 209 psig, the control assumes the system is in heating mode and opens the valve fully.

EEV Shutdown

Once the demand for compressor operation is terminated, the EEV enters Shutdown Mode. In this mode the control will store the valve position and the valve will remain in its current position until the next compressor call.

Defrost

During defrost operation, the outdoor EEV is driven fully open (bypass).

Floodback Prevention

Should superheat drop below 1 degree Fahrenheit, the controller closes the valve until superheat rises above 1 degree Fahrenheit.

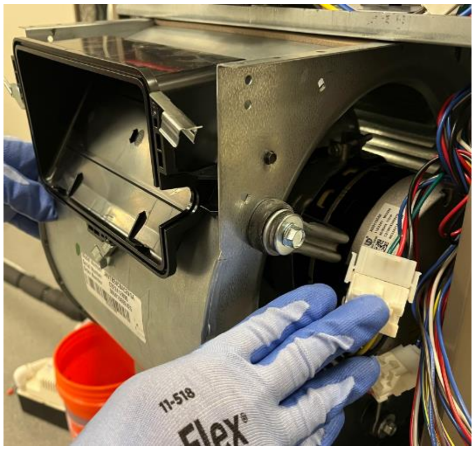
Indoor EEV Control LEDs

There are three LEDs on the indoor EEV controller. The green LED illuminates when the valve is being driven open. The yellow LED indicates the valve is being closed. It is normal for these LED to flash momentarily as the valve is often driven in incremental steps. The LEDs are OFF if the valve is not being driven. The red LED is illuminated when power is applied.

- The green LED illuminates when the valve is being driven open.
- The yellow LED indicates the valve is being closed.
- The red LED is illuminated solid on when power is applied and there are no faults.
    - The red LED, when flashing, provides diagnostic information.
    - Additional information is available in the Residential Variable Capacity Air Conditioning & Heat Pumps Field Reference Guide.

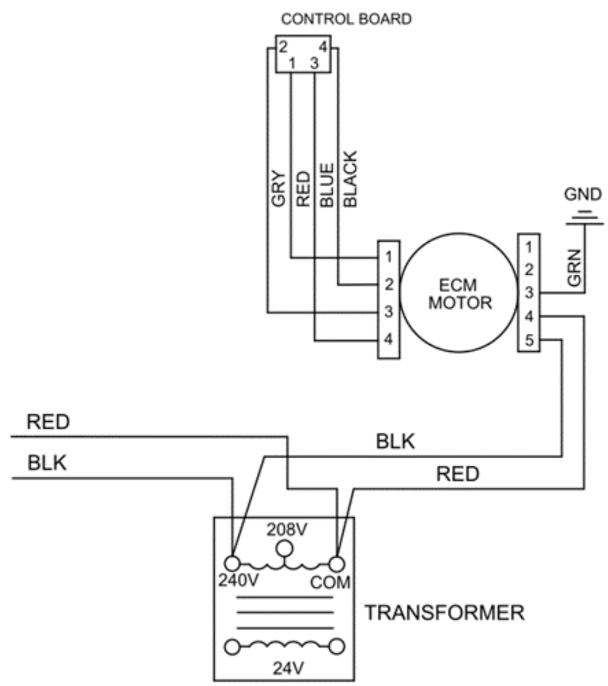
Blower Motor (Variable Speed ECM Models)

JHVT/JMVT Models



ClimateTalk™ Blower Motor

The indoor blower motor is a constant CFM type and communicates with the control board using the ClimateTalk™ communications protocol. Most of the motor diagnostics must be performed using the variable speed control board. Unlike previous constant CFM blower motors used in the past, these motors and the control board have back and forth communication, not conventional signals therefore there is limited testing that can be done using a voltmeter. The motors used are single piece therefore a failure with the motor control results in a complete motor replacement unlike previous premium variable speed motors where a motor module could be replaced without motor replacement. The motor is listed as 115/230V on its nameplate. However, in the air handling unit application it is configured for 230V as we do not offer a 115V air handling unit. If the motor were being used for a 115-volt application, there would be a jumper wire in the motor flat 5 pin connector bonding pins 1 and 2 together. Most of the motor related fault codes if displayed should be easy to diagnose using information from the installation manual, a voltmeter, and a manometer with static pressure probes. See Troubleshooting Section for blower faults and possible solutions.



Multi-Tap Transformer

The multi-tap transformer is prewired for 240-volt AC operation. If the supply voltage is 208 volts AC, the push-on connector located at the 240-volt tap must be moved to the 208 volt tap. There are no changes required to the COM or 24-volt AC connections.

If the transformer is not wired correctly, damage to the equipment will occur. Identify the voltage that is being supplied to the primary side of the transformer from the electrical panel or disconnect. Ensure that the transformer is properly wired to the primary voltage taps.

JHVT/JMVT Control Board

This section details the inputs and outputs of the AVC/AVV/MVC control board.

Note
If the air handler is being installed with a communicating thermostat, the P3 9-pin connector must be removed from the control board. Wiring for specific applications can be found in the Appendix of the Installation Manual.

If the table below the temperature/resistance conversion for the Leaving Air Temperature sensor. If the sensor is replaced, an exact replacement part must be used.

Temperature	Resistance	Temperature	Resistance
30°F	34545	95°F	6531
35°F	29986	100°F	5827
40°F	26092	105°F	5208
45°F	22758	110°F	4663
50°F	19896	115°F	4182
55°F	17434	120°F	3757
60°F	15310	125°F	3381
65°F	13474	130°F	3047
70°F	11883	135°F	2750
75°F	10501	140°F	2487
80°F	9299	145°F	2251
85°F	8250	150°F	2041
90°F	7334	155°F	1854

Humidity Control with Communicating Thermostat

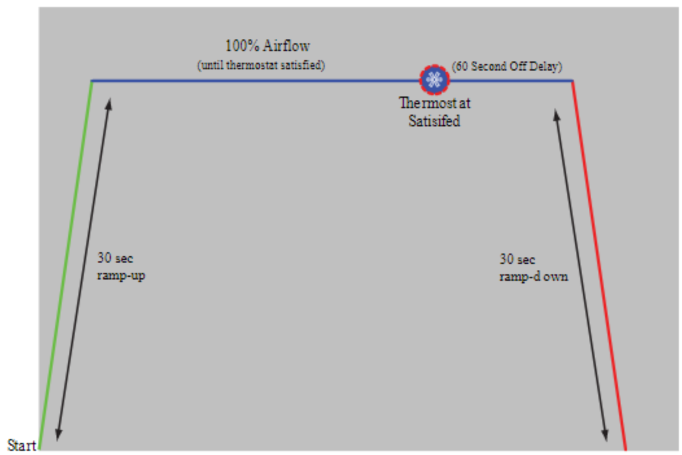
An external humidistat which is built into the communicating thermostat controls both humidification and de-humidification. When humidity is below the set point, the communicating thermostat energizes the P2 HUM terminals. When humidity is above the set point, the communicating thermostat will reduce airflow by 15% to remove moisture. The communicating control ignores the status of the humidistat selection jumper.

The control governs dehumidification during cooling using the reduced blower speeds. A selection jumper is provided on the control to distinguish between an open humidistat (calling for de-humidification) and a non-connected humidistat.

If the jumper is not connected to either terminal, the control responds as if no humidistat is connected.

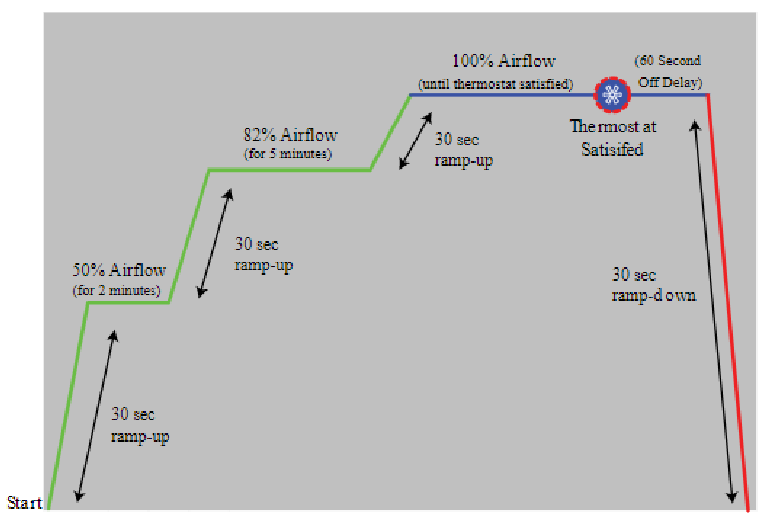
Delay Jumper Details

Tap A is the default profile. It provides a 30-second ramp-up from zero airflow to full capacity and a 30-second ramp-down from full capacity back to zero airflow. The motor will take 30 seconds to ramp from one speed to the other.



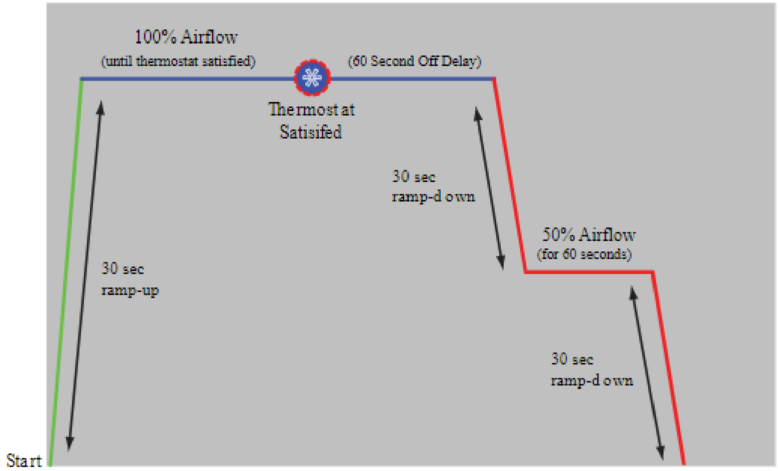
Delay Tap A Profile

Tap B is the humid profile. This profile is best suited for installations where the humidity is frequently very high during cooling season. On a "call for cooling", the 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.



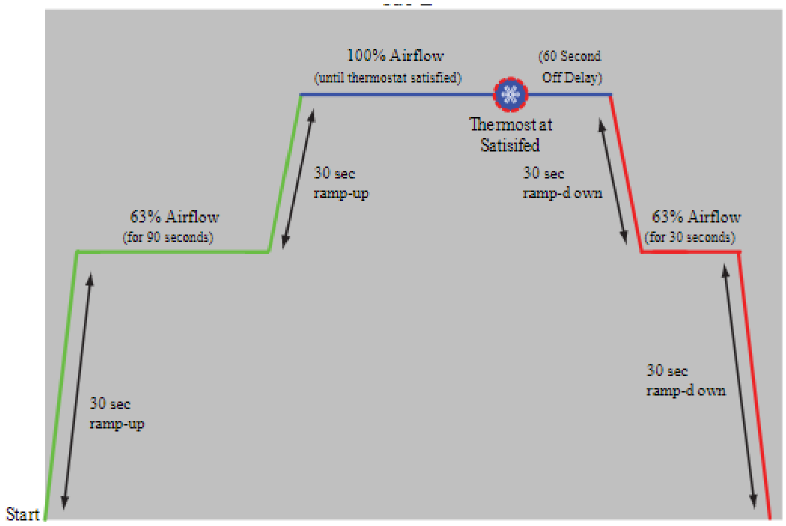
Delay Tap B Profile

Tap C is the dry profile. This profile is best suited 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 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, and then ramp down to zero.



Delay Tap C Profile

Tap D is the normal profile, best suited for most areas where neither excessive humidity nor extremely dry conditions are the norm.



Delay Tap D Profile

Electric Heat

Electric heat applications include:

- Standalone electric heat
- Air conditioning with electric heat
- Heat pump with supplemental electric heat

Each of the air handler models are approved for use with specific electric heat accessories. The air handler Installation Manual and name plate provide potential application combinations, electrical data and limitations.

<u>Aftermarket heat kits may not be used. Use only the heat kits which are UL approved and specified in the appropriate Technical Guide.</u>

8HK Heat Kits

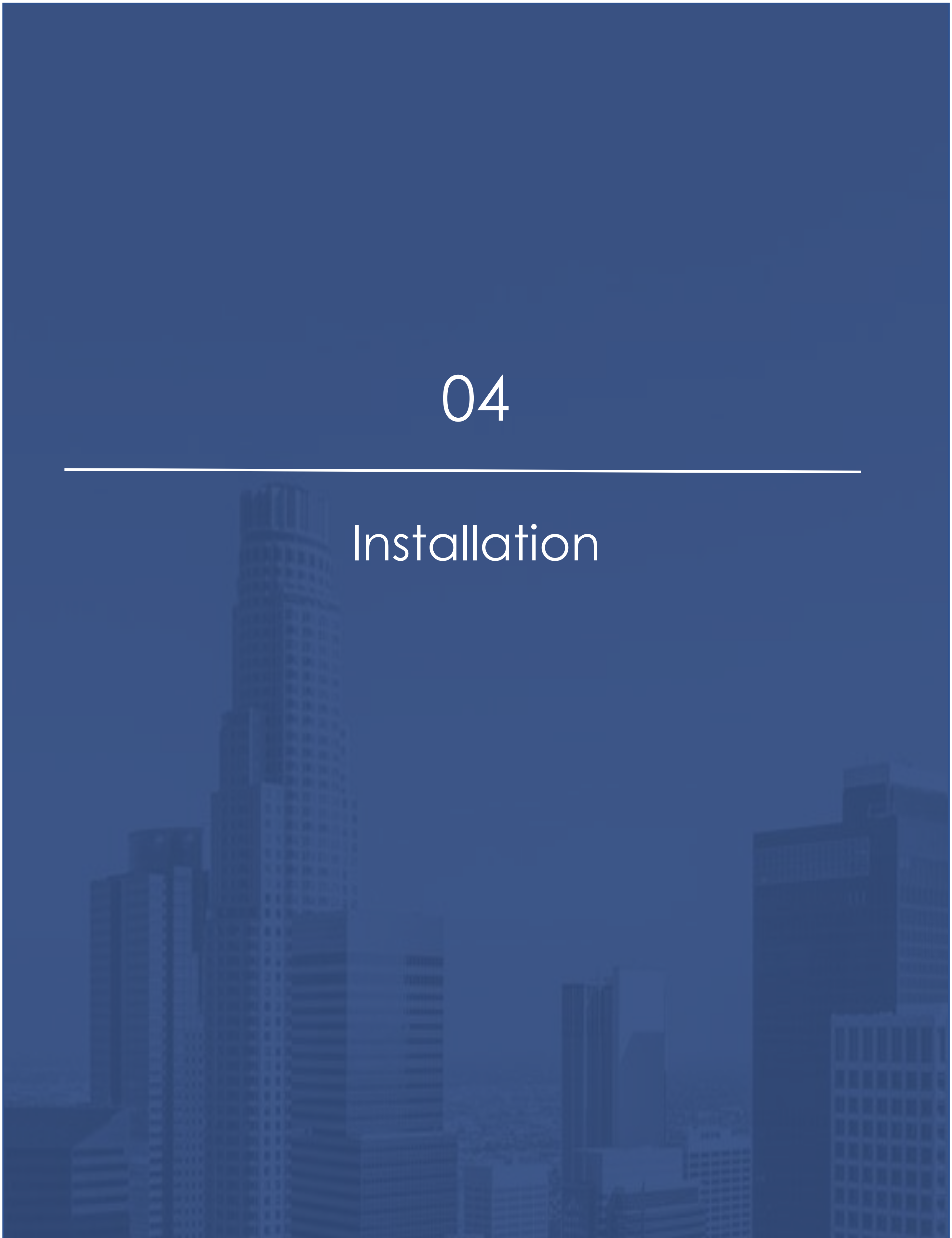
Follow the 8HK Installation Manual to ensure proper application and installation. Always follow the most up-to-date instructions which are always available in the Product Catalog on Solution Navigator.

Air Filters

Equipment should never be operated without field supplied air filters. A 1” filter access rack is provided. Standard 1” permanent washable or throw-away filters may be used.

04

Installation



Installation

Proper installation and start up enables equipment to operate at peak efficiency and provides the end user with the comfort and efficiency expected from the system.

This section DOES NOT REPLACE THE INSTALLATION MANUAL for the specific air handler model. This guide is designed to be a companion to the model-specific Installation Manual. Be sure to THOROUGHLY READ the instructions provided with the air handler.

For specific start up details, see Section 5, Start Up.

Do not use for temporary heat. Air handlers are not to be used as temporary heat. Materials used in the construction process greatly reduce air handler efficiency and operational life. Drywall dust, varnishes, paints and sawdust rob the end user of their investment in their comfort system.

Inspection

When an air handler 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. Also, before installation, the unit should be checked for screws, bolts, or wiring connections which may have loosened in transit. There are no shipping or spacer brackets that require removal.

Recommended Minimum Clearances

Ample clearances should be provided to permit easy access to the unit. The following minimum clearances are recommended:

- Refrigerant piping and connections – minimum 12” recommended.
- Maintenance and servicing access – minimum 36” from the front of the unit, recommended for blower motor/coil replacement.
- Condensate drain lines routed to clear filter and panel access.
- Filter removal – minimum 36” recommended.
- The duct work and plenum connected to this unit are designed for zero clearance to combustible materials.
- A combustible floor base accessory is available for downflow applications of this equipment, if required by local code.

Air Handler Location

The air handler shall be located using the following guidelines:

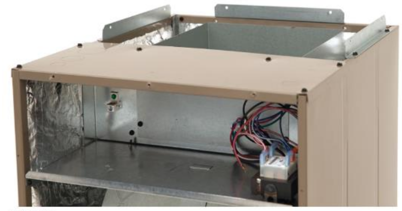
- Select a location with adequate structural support, space for service access, clearance for air return and supply duct connections.
- Using hanging brackets to wall mount the air handler is not recommended.
- Normal operating sound levels may be objectionable if the air handler is placed directly over sound sensitive rooms such as bedrooms and study areas.
- Select a location that will permit installation of condensate line to an open drain or outdoors allowing condensate to drain away from structure when matched with an air conditioning or heat pump unit.

Note
The primary and secondary drain line must be trapped to allow proper drainage of condensate. If the secondary drain line is not used, it must be capped. Additionally, the secondary drain line must be piped to a location that will allow for visual inspection.

- When an evaporator coil is installed in an attic, above a finished ceiling, or any area that may be damaged by leaking water, an auxiliary drain pan must be provided under the air handler as is specified by most local building codes.
- Proper electrical supply must be available.

Note
In severe high humidity, high temperature indoor unit environments, an accessory insulation blanket is available to supplement the standard cabinet insulation. Insulate using the appropriate insulation kit or seal completely with adequate fiberglass insulation with an exterior vapor barrier.

Ductwork Installation


Duct Flanges

To properly design the ductwork for the building, refer to the ASHRAE Fundamentals Handbook chapter on “Duct Design”, or ACCA Manual ‘D’. It is imperative that the duct system is designed properly per these methods. As with all residential equipment, the air handlers are designed to deliver their rated airflow up to 0.5” w.c. total external static pressure. Higher external static values can cause problems with system performance and customer comfort. This may include:

- Inadequate airflow to the conditioned space.
- Inadequate cooling performance, including evaporator coil frosting/freezing in the cooling mode, possibly leading to liquid refrigerant getting back to the compressor and eventual compressor failure.
- Customer complaints of noisy operation. If whistling is heard in and around the air handler area during blower operation, it is likely that there is an airflow restriction, which may include an undersized duct system.
- Temperature rise outside of the allowable range on the electric heat accessory, causing undue stress on the heating elements, limit trips or melting of the fusible links.
- Increased energy consumption due to fan operation conditions.

For more information on locating problems in Air Distribution, see Chapter 5 Start Up. Included is a discussion on measuring external statis pressure (ESP)in the duct system.

Air Handler Configurations

All air handlers may be installed in upflow, downflow, horizontal right, and horizontal left. The air handlers, as shipped from the factory, are configured differently depending upon the model type. Horizontal right applications always require field conversion. For information regarding conversion of air handlers to another configuration refer to the Installation Manual for the model specified.

Horizontal Suspension

Air handler units can be installed in a suspended horizontal position. It is recommended that horizontally suspended units are supported from the bottom with angle steel support brackets and threaded rod. For more information and suspension support locations, refer to the Installation Manual for the model specified.

Refrigerant Line Connections

When preparing to make refrigerant line connections, relieve the pressure from the coil by removing the plugs. The coil is pressurized with an inert gas during the manufacturing process. The technician must braze the coil into the system within two minutes after removing the plugs to prevent moisture and contaminants from entering the system. If the coil is going to be open for more than two minutes, replace the plugs in the copper tubing.

During the brazing process, temperatures exceed 800 degrees Fahrenheit. At these temperatures, oxidation forms inside of the copper tubing if a dry nitrogen purge is not used during brazing to displace oxygen. If oxidation forms, it is released in the refrigerant flowing through the system during normal operation, and can accumulate in the filter drier, metering device, or reversing valve, possibly causing improper operation and component failure.

Oxidized Fitting

Use heat sinks to prevent heat damage to the coil and metering device. Wrap a wet rag around smaller components to provide protection during brazing. Keep an approved fire extinguisher present during all brazing operations.

Prior to brazing, remove the grommets where tubes exit the cabinet to prevent burning. Braze joints using a phosphorous copper allow material, such as Silfos-5, or an equivalent brazing alloy with at least 5% silver content. Do not use soft solder. After brazing, re-attach the grommets to the lines to prevent air leakage. Lines should be sound isolated by using appropriate hangers or strapping.

Silfos-5

Note
Route the refrigerant lines to the coil in a manner that will not obstruct service access to the coil, air handling system, or filter.

Indoor Vapor (Suction) Thermistor

Care must be taken not to overheat the indoor coil vapor (suction) line thermistor during brazing. The thermistor will not withstand exposure to extreme heat.

Note
Research has proven that applying wet rags on the vapor (suction) line before commencing the brazing process is sufficient to prevent thermistor overheating.

Electronic Expansion Valve (AVV)

The indoor Electronic Expansion Valve is shipped in the closed position to prevent damage to the valve during transit. The valve MUST be driven open to permit the flow of nitrogen during brazing. There are two methods of opening the valve – power the valve open or manually opening the valve.

During installation, the EEV control harness must be connected to furnace or air handler control with the equipment powered up to drive the EEV open. Powering the indoor unit provides low voltage power to the EEV control. The control will first home the valve followed by driving the valve to mid-position. A small quantity of nitrogen can then flow through the coil during brazing.

EEV Manual Tool

Available from Source 1, this tool allows technicians to manually operate the EEV. When the EEV motor is removed, this tool slips over the valve body. The technician then rotates the tool in the desired direction. Magnets in the tool cause the EEV rotor to turn. The part number is S1-02649686000.

Pressure Testing

The lineset and indoor coil are pressurized up to 250 psig with dry nitrogen and leak tested with a bubble type leak detector. Do not use refrigerant to purge or leak test the system. Do not exceed the rated test pressure located on the indoor coil data plate when pressure testing the systems. Nitrogen charge can be released into the atmosphere.

Evacuation

The vapor line, liquid line and indoor coil, must be evacuated to 500 microns or less. This ensures that moisture and non-condensables are evacuated from the system.

R-410A Considerations

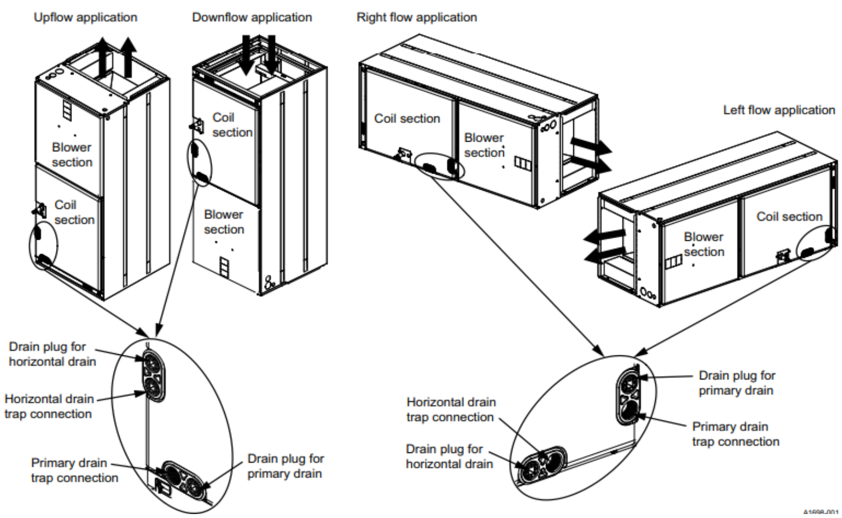
With R-410A having POE oil with much greater hygroscopic properties, utilize all of the necessary tools and following all of the installation procedures to ensure proper equipment operation is a must.

Condensate Drain

The drain line must be routed so that it does not interfere with accessibility to the coil, air handling system, or filter. It should not be exposed to freezing temperatures. Primary and secondary drain connections must be made with the unused secondary drain connection plugged with the provided cap.

The drain pan connections are ¾" PVC, copper or steel pipe fittings. Since the drains are not subject to any pressure, it is not necessary to use Schedule 40 PVC pipe for drain lines unless required by local codes.

The evaporator drain line must be trapped a minimum of three inches and should be pitched away from the coil drain pan. Drain lines must be no smaller than the coil drain connection.



If an open drain is not available, identify the local building code requirements for drainage before installing a condensate drain. A plugged drain can cause property damage; therefore, properly size the condensate drain and seal the fittings and connections with an approved sealing compound. All threaded drain connections should be hand-tightened, with no more than 1 turn past hand tight. Take care when applying sealing compounds to the drain pan connection. Excessive sealant and tightening of the drain pan connection can result in pan failure. After installation, prime the trap with water.

Line Power Connections

Power may be brought into the unit through the supply air end of the unit (top when unit is vertical), right or the left side panel. Use the knockout appropriate to the unit's orientation in each installation to bring the conduit from the disconnect. The power supply wiring leads should be terminated at the electrical control box. Refer to tables in the Installation Manual to determine wire size. To minimize air leakage, seal around the wiring entry point at the outside of the unit.

Indoor Vapor (Suction) Thermistor

Air handlers can be connected to the wall thermostat and outdoor unit using either conventional low voltage thermostat wiring when a standard thermostat is used or four wire digital communications wiring when a Residential Communicating Control is used. Residential Communicating Controls may only be used on communication-capable air handlers. This includes the JHVT and JMVT models.

Communicating (JHVT/JMVT)

The control wiring for the Communicating System links the components and continually communicates commands, operating conditions, and other data over a four-wire connection.

To operate in full communications (COMM) mode, a communicating air handler must be installed with a matching touch screen communicating wall thermostat and an outdoor air conditioner or heat pump with a fully communicating control.

A non-communicating outdoor unit may be used with a communicating air handler and thermostat. When an outdoor communicating control board is added, the system allows full communication between the air handler and thermostat with limited exchange of commands to the outdoor unit. Fault and operating conditions are not transmitted in this application. When conventional 24-volt wiring is connected to the outdoor unit, the system allows full communication between the air handler thermostat, but no digital communication with the outdoor unit.

Electronic Air Cleaner (EAC OUT)

The JHVT/JMVT models contain EAC terminals on the unit control board to energize a 24-volt relay during blower operation.

Humidifier (HUM OUT)

The JHVT/JMVT control is designed to work with a humidity control that closes when the humidity is below the set-point. To use this feature, the humidity thermostat address must be changed from 0 to 1 and a humidistat must be wired between the air handling unit field control wiring R and HUM connections. The control is open when the humidity is above the set-point. The humidity switch controls de-humidification operation of the control during cooling operation by reducing indoor airflow approximately 15% when the humidistat is open. This humidity control may be referred to as a humidistat or a dehumidistat.

Float Switch

The JHVT/JMVT models contain Float Switch terminals on the unit control board that can be set to Enable (Open) or Enable (Closed). This feature is **only available when using a communicating room thermostat**.

Leaving Air Temperature Sensor (Leaving Air Temp)

A plenum air temperature sensor (thermistor) can be connected to the LEAVING AIR TEMP SENSOR terminals on the control board. The communicating control can then monitor the temperature of the supply air in the plenum.

8HK Electric Heat Kit Installation

Electric Heat Kit Installation

Only apply electric heat kits that are specifically approved by Johnson Controls Ducted Systems for a particular model. Follow all required safety guidelines and required installation details as supplied in the instructions provided with the heat kit. Follow the 8HK Installation Manual to ensure proper application and installation. Always follow the most up-to-date instructions which are always available in the Product Catalog on Solution Navigator.

Electric Heat Kit Installed

05

Start-up

Online Ducted Systems Residential Start-up Form

The online form is for use with all Ducted Systems residential products. The form allows savings for later completion. Completed form data is sent to your inox for archive purposes.

Prior to start-up, all the installation procedures outlined in the indoor and outdoor equipment Installation Manuals must be completed. This includes proper installation of the indoor unit, outdoor unit, thermostat, electrical wiring, and accessory kits.

Required Tools

The following tools are required to properly set up air handlers:

- A thermometer or portable, digital thermometer to verify the supply and return air temperatures. For best accuracy, use thermocouple-type thermometers and probes.
- Magnehelic gauge
- Digital multimeter
- 1/4” nut driver
- Phillips head screwdriver

Cooling Blower Speed

The cooling blower speed is selected based on the requirements of the application. If the airflow is set too high for the application, proper dehumidification of the return air will not occur, and the desired temperature drop across the evaporator coil will not be obtained. If the airflow is set too low, frost and ice may form on the evaporator coil, leading to eventual refrigerant flood back to the compressor. For the best possible comfort and equipment longevity, the system external static pressure (ESP) is measured and used with the provided blower charts to determine the best speed to use for the application.

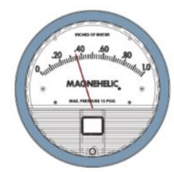
For optimum performance, 400 CFM per ton of air conditioning is used. For example, a 3-ton system should have 1200 CFM of air moving through the evaporator coil.

To determine the total external static pressure, both the supply and return static pressures are measured.

When establishing airflow for cooling mode, create a call for cooling. If outdoor conditions are too cold for outdoor unit operation, de-energize the outdoor unit disconnect switch.

Details

To measure the supply static pressure, connect the Magnehelic gauge, incline manometer, or digital manometer in the locations shown below. The blower performance charts provided with the air handlers indicate blower performance with filter in place. If an external filter is not used, ensure that the internal 1" filter is clean.



Magnehelic© Gauge

The total external statis pressure is determined either by taking the supply and return static pressures individually and adding them, or simply by using two probes and noting the reading on the gauge.

When the total external static pressure has been determined, apply the total static pressure to the blower performance chart for the air handler model being serviced. The CFM delivered is where the ESP reading intersects with the blower speed being used. Remember that 400 CFM per ton is the target value. If required, change the blower speed to get as close as possible to 400 CFM per ton.

After a blower speed change, re-check the total ESP and consult the blower performance chart to verify CFM.

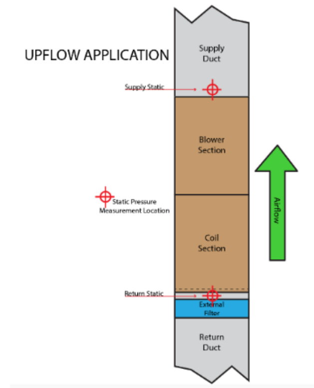
JHVT/JMVT Airflow and Comfort Setting Selections for ECM Motors

The airflow and comfort setting selection must be set properly at the time of installation and start-up for proper system operation.

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

The JHVT and JMVT model air handlers are designed to deliver a constant airflow (CFM) even when external static pressure (ESP) in the duct system exceeds the recommended 0.5” w.c. value. Therefore, if too many supply registers are closed, a filter becomes clogged, or there is a restriction in the duct, the motor will automatically operate at a higher speed and torque to compensate for the higher ESP. This results in a higher operating sound level and reduced electrical efficiency.

Variable speed ECMs automatically adjust to provide constant CFM from 0.0” to 0.6” w.c. static pressure. From 0.6” to 1.0” w.c. static pressure, CFM is reduced by 2% per 0.1” w.c. increase in external static pressure. Operation within duct systems with greater than 1.0” w.c. external static pressure is not recommended as this results in excessive operational sound and electrical consumption as the blower speed is maximized in an attempt to overcome the additional restriction.



The blower performance charts provided with the air handlers indicate blower performance with filter in place. With this series air handler, 1st and 2nd stage air flow can be set up independently using dipswitches. If an external filter is not used, ensure that the internal 1” filter is clean.

Cooling Airflow (LO COOL and HI COOL)

The airflow delivered by the air handler during cooling operation is adjusted to match the cooling capacity of the outdoor condensing unit. This is done by setting the “LO COOL” and “HI Cool” dipswitches on the control board SW4.

There are three dipswitches to set for both “LO COOL” and “HI COOL”. dipswitches have three positions which will deliver sufficient airflow in cooling mode for the cooling capacities shown in the air handler Installation Manual. The white box on the dipswitch setting is where the dipswitch should be set to. The number “0” indicated OFF or down position and the number “1” indicated ON or up position. See the air handler Installation Manual for further information.

Delay

The DELAY tap affects the blower ramping times and selection is determined by the type of climate the equipment resides in. The selections are described in Chapter 3 of this field reference guide.

Heat Pump Airflow

The heat pump airflow setting is the same as the cooling airflow setting required. However, the Configuration jumper must be set to the HP position for proper operation of the “O” terminal.

Electric Heat Airflow

On JHVT/JMVT models, the blower speed required for electric heat is different than cooling. Refer to the Installation Manual for the required airflow for the electric heater installed. Find the desired airflow in the Electric Heat Airflow table in the Installation Manual and set the “HEAT” dip switches on SW4 switch bank on the control as indicated. As shown below, the design blower speeds are specified for use with selected 8HK heat kits. Consult the manual for the model-specific instruction.

Table 13: Electrical heat: minimum fan CFM for single-phase heat kits

Heater kit models[1,2]	Nominal kW at 240 V	Airflow configuration heat dip switch setting*	Aux heat configuration heat kit selection dip switch setting	Air handler models (CFM^3)										
				B18B	B24C	B36D	C36D	C42F	D42F	C48G	D48G	C60H	D60H	D60J
8HK(0,1)6500206	2.4	00	0001	625	650	625	825	825	825	825	825	825	825	825
8HK(0,1)6500506	4.8	00	0010	650	650	650	825	825	825	825	825	825	825	825
8HK(0,1)6500806	7.7	00	0011	750	800	750	1100	1100	1150	1100	1150	1100	1150	1150
8HK(0,1)6501006	9.6	00	0100	790	950	750	1100	1100	1500	1100	1500	1100	1500	1500
8HK(1,2)6501506	14.4	00	0101		650, 950	650, 975	825, 1100	825, 1100	825, 1575	825, 1100	825, 1575	825, 1100	825, 1575	825, 1700
8HK(1,2)6502006	19.2	00	0110			750, 975	1100, 1300	1100, 1300	1325, 1575	1100, 1300	1325, 1575	1100, 1300	1325, 1575	1500, 1700
8HK(1,2)6502506	24	00	0111								1325, 1650		1325, 1650	1500, 1800

In all installations, the temperature rise in the heating mode must not exceed the values on the rating plate during all modes. If the temperature rise exceeds the allowable range, you can increase the heat kit airflow by approximately 20%, change the 1 & 2 on SW4 from 00 to 01. If the temperature rise still exceeds the allowable range, the system external static pressure must be verified to determine the location of the problem. Inadequate duct systems with excessive external static pressure must be corrected to ensure proper equipment operation, longevity, and customer comfort.

Note
Do not change the “HEAT” dipswitches position for heat pump heating CFM selection. The two “HEAT” dipswitches are for Electric Heater kit fan speed. The LO COOL and HI COOL dipswitches are for heat pump airflow selection as well.

Fan Only Airflow (CONT FAN)

The variable speed air handling unit control can operate the indoor blower motor continuous fan speed at 4 different settings which are percentages of each individual model unit maximum airflow amount. The factory / default setting is 00 or OFF, OFF. This setting is switches 2 and 3 on SW5, an address of 00 is 40%. If a different amount of airflow is desired during continuous blower operation, the address must be changed. Note that the maximum airflow amount is based on the maximum CFM the model air handling unit can produce, not the maximum CFM set on the HI COOL setting. For example, a C36D air handling unit maximum CFM is 1350 CFM. Regardless of HI COOL setting, a continuous fan address of 11 will result in 1350 CFM during a continuous fan call. A continuous fan call, however, is ignored during a heat pump heating or air conditioning cooling call. A change of this setting will not cause a fault and the control configuration does not need to be reset again by holding the pushbutton.

Refrigerant Charge Verification

Following airflow setup, the system refrigerant charge must be verified. Systems with a TXV metering device must be verified with the subcooling method. Fixed orifice metering device applications must be verified with the superheat method. Variable capacity systems utilize charge verification mode on the outdoor unit technician interface to confirm system charge. Consult the outdoor unit Installation Instructions for specific details on system charge requirements and expected values.

06

Inputs & Operation

Introduction

A complete understanding of air handler operation is critical to success as a service technician. This chapter provides insight on the heating mode (electric and heat pump), cooling mode, and continuous fan operation of the Ducted Systems air handlers.

General Operation Description

Standby Mode

When there is no demand from the thermostat for fan operation, the control is considered to be in Standby Mode. In this mode, it de-energizes all outputs until action is initiated by a thermostat call. In Standby, it continually monitors all thermostat inputs.

Blower Motor Control

When there is a thermostat demand for Fan Operation (G), after a 7 second delay, the control energizes the blower relay. When the thermostat demand for Fan Operation is removed the control continues to energize the blower relay for 60 seconds and then return to Standby Mode.

Faults

Control Fault: If the control detects a fault on the control board (including a fault within the microprocessor), it immediately de-energizes all outputs, ignores all inputs, and enters a 1-hour Hard Lockout. The control resets itself after 1 hour to clear the fault.

Power Up Operation: When power is first applied to the control, all outputs are turned off and all timers are reset. The control performs an initial self-check routine before entering Standby Mode.

Hard Lockout: If the control detects a dipswitch configuration fault, it will immediately de-energize all outputs, ignores all inputs, and enters a Hard Lockout until the issue has been corrected.

Power Interruption: If power to the control is interrupted for less than 20 milliseconds, the control resumes operation at the same point in the timing cycle that the interruption began but may not go to any other mode of operation. Power interruptions greater than 100 milliseconds may reset the control as a power-up sequence. Power interruptions less than 100 milliseconds do not affect timings. Power interruptions of any duration do not directly cause lockout.

Operational Detail: Variable Speed Models

Powerup Operation

When power is first applied to the control, all outputs are turned off and all timers are reset.

Standby Mode

When there is no demand from the thermostat for heating, cooling, or fan operation, the control is considered to be in Standby Mode. In this mode, it de-energizes all outputs and flashes the “heartbeat” status code on the STATUS LED until action is initiated by a thermostat call. In Standby, it shall continually monitor refrigerant leak detection, all thermostat inputs, LAS temperature, and the float switch inputs.

Normal Cooling Mode

During normal cooling mode the control energizes the ECM blower. If HUM is set to ON, the cooling blower speed will reduce by 15% if there is no active HUM Input. When the demand for cooling has been satisfied, the control runs the blower for an off delay based of Delay Profile selected.

Compressor Heating Mode

During Normal Compressor Heating mode, the control causes the following to occur:
- Energize ECM blower.
- Energize HUM_OUT contacts (if set to ON)

When the demand for compressor heating has been satisfied, the control runs the blower for a 30 second off-delay.

Electric Heating Mode

During Normal Electric Heating Mode, the control causes all of the following to occur:
- Energize ECM blower.
- Energize HUM_OUT contacts (if set to ON)
- Energize Heat Kit outputs.

If the thermostat is sending a demand for first stage electric heat (W1), the control immediately energizes the first stage heat output. If the thermostat is sending a demand for second stage electric heat (W2), the control immediately energizes the second stage heat output. If the thermostat is sending a demand for third stage electric heat, the control energizes the first and second stage heat output. During this condition, the control does not implement any delays between energizing the first stage heat output and the second stage heat output.

Note
The staging for the heat kit depends on the dipswitch selection on SW3.

When the thermostat demand reduces the number of stages, the control immediately de-energizes the highest heat stage currently energized. Heat relay outputs are unaffected by any Heat Pump demand (heating or cooling mode).

Fan Only Mode

During Normal Fan Only operation, the control energizes the ECM blower. The commanded CFM is based off the CONT FAN dip switch setting.

Humidity Control – Conventional Wiring

An external humidistat controls de-humidification during cooling only. When humidity is below the set point, the humidistat will apply “24VAC” to the HUM input. When humidity is above the set point, the humidistat will be open. A selection dipswitch is provided on the control to distinguish between an open humidistat (calling for de-humidification) and a non-connected humidistat.

The HUM STAT dipswitch has 2 positions. “ON or 1” enables de-humidification during cooling. “OFF or 0” disables de-humidification logic and energizes the HUM input terminal.

The control shall energize the HUM_OUT terminals any time there is a conventional wiring call for Heat Pump or Electric Heating.

Humidity Control with Communicating Thermostat

An external humidistat which is built into the HVAC System Master thermostat shall control both humidification and de-humidification. When humidity is below the set point, the HVAC System Master shall set the HUM input bit high (1). When humidity is above the set point, the HVAC System Master shall set the HUM input bit low (0). The control shall ignore the status of the humidistat selection dipswitch.

The control energizes the HUM_OUT terminals when the HUM OUT Relay Command input is set high (1).

The control de-energizes the HUM_OUT terminals when the HUM OUT Relay Command input is set low (0).

The control shall control de-humidification during cooling using the reduced blower speeds detailed below. The control shall provide normal airflow during cooling when the HUM input is set high (1). The control shall provide reduced airflow during cooling when the HUM input is set low (0).

Blower Motor Control

The control shall perform a Model and Climate Talk Blower configuration comparison every time power is applied.

The control shall determine the proper Fan speed based upon Thermostat demand, Model Configuration, and the position of the HEAT, LO COOL, HI COOL, and DELAY dipswitches. The control shall then provide the Climate Talk Communicating ECM motor with a CFM signal which corresponds to the Thermostat demand, Model Configuration, and Tap adjustment settings.
The DELAY dipswitch setting shall not affect the blower off delay during any W thermostat call.

The DELAY dipswitch setting only affects operation with compressor only operation (heating and cooling).

Commanded CFM (communications only)

When connected to a communicating thermostat, the control shall be capable of running at a specific CFM value commanded by the thermostat. This feature will allow for highly customizable and controllable airflow during any mode of operation.

If a call for heating, cooling, or fan only operation is present on the communications buss and the commanded CFM value is zero, the control shall energize all outputs and determine the fan speed as though a conventional 24VAC input was present at the control.

If a call for heating, cooling, or fan only operation is present on the communications buss and the commanded CFM value is greater than zero, the control shall energize all outputs as though a 24VAC input was present at the control. The commanded CFM value shall override the normal airflow value and the control shall provide a CFM signal (determined by the formulas defined in the above table) to the blower.

If there is not a call for heating, cooling, or fan only operation on the communications buss and the commanded CFM value is greater than zero, the control shall provide a CFM (Climate Talk Blower) signal (determined by the formulas defined in the above table) to the motor.

Heat Output Staging

Heat output staging depends on the capacity of the electric heat kit installed and Stage 1 KW dipswitch selection. The following table provides heat kit capacity with output stages based on the different inputs with factory set staging dip switches (0,0) on SW3.

1Ø 8HK Heat Acc. Nominal KW	KW Staging per Input		
	W1 Only	W2 Only	W1 & W2
2.5	2.4	2.4	2.4
5	4.8	4.8	4.8
8	7.68	7.68	7.68
10	9.6	9.6	9.6
15	4.8	9.6	14.4
20	9.6	9.6	19.2
25	12	12	24

Some 8HK heat kits have only one stage of heat and some have multiple stages of heat available. Single phase heat kits 10KW and below are single stage. Three phase heat kits 15KW and below are single stage. Single stage heat kits require only one input referenced to as "W1." Multi-stage heat kits require two inputs referenced to as "W1" and "W2." Reference the chart above regarding the amount of heat per stage on multi-stage heat kits.

The air handler control board allows configuration of using the W1 input to the control board itself to operate the W1 input of the heat kit, W2 input of the heat kit, or W1 and W2 inputs of the heat kit. The settings can be changed by the aux heat stage address. Aux heat stage addresses are 2 digits and set on switches 1 and 2 on SW3. The aux heat stage addresses can be found on the aux heat configuration - Stage 1 kW dip switch settings table in the unit installation manual and shown below. For heat pump applications, it is recommended to use only the least amount of electric heat necessary to properly temper the indoor air during unit defrost. Heat pumps energize W1 on the air handling unit control board only during defrost.

W1 = W1	00, 01
W1 = W2	10
W1 = W1 + W2	11

Heat delay outputs are unaffected by any Heat Pump demand (heating or cooling mode).

JHVT/JMVT (Variable Speed ECM)

Thermostat Input	Action	Result				
G	Applied	Fan ON				
		CONT FAN	11 or ON,ON	10 or ON,OFF	01 or OFF,ON	00 or OFF, OFF
		Dipswitch	100%	80%	60%	40%
	Removed	Fan OFF				
G & Y1	Applied	Fan ON				
	Removed	Fan 30 second delay OFF				
G & Y/Y2	Applied	Fan ON				
	Removed	Fan 30 second delay OFF				
G & Y2 or Y/Y2 (with O)	Applied	Fan ON				
	Removed	Fan 60 second delay OFF				
W1 (with or without G)	Applied	Fan ON				
		HT1 relay energized				
	Removed	HT1 relay OFF				
		Fan 30 second delay OFF				
W2 (with or without G)	Applied	Fan ON				
		HT1 relay energized				
		HT2 relay energized after 10 second delay				
	Removed	HT2 relay OFF				
		HT1 relay OFF after ½ second delay				
		Fan 30 second delay OFF				
W1 & W2 (with or without G)	Applied	Fan ON				
		HT1 relay energized				
		HT2 relay energized after 10 second delay				
		HT3 relay energized after 10 second delay				
	Removed	HT3 relay OFF				
		HT2 relay OFF after ½ second delay				
		HT1 relay OFF after ½ second delay				
		Fan 30 second delay OFF				
G & Y/Y2 or Y1 (without O)	Applied	Fan ON				
	Removed	Fan 30 second delay OFF				
G & Y/Y2 or Y1 & W1 (without O)	Applied	Fan ON				
		HT1 relay energized				
	Removed	HT1 relay OFF				
		Fan 30 second delay OFF				
G & Y/Y2 or Y1 & W2 (without O)	Applied	Fan ON				
		HT1 relay energized				
		HT2 relay energized after 10 second delay				
	Removed	HT2 relay OFF				
		HT1 relay OFF after ½ second delay				
		Fan 30 second delay OFF				
G & Y/Y2 or Y1 & W1 & W2 (without O)	Applied	Fan ON				
		HT1 relay energized				
		HT2 relay energized after 10 second delay				
		HT3 relay energized after 10 second delay				
	Removed	HT3 relay OFF				
		HT2 relay OFF after ½ second delay				
		HT1 relay OFF after ½ second delay				
		Fan 30 second delay OFF				

07

Troubleshooting

Introduction

This chapter provides common troubleshooting techniques. It is the responsibility of the technician to become familiar with the equipment being serviced and utilize the appropriate troubleshooting techniques.

Flash Codes

Many control boards installed in air handlers have flash codes to assist in troubleshooting the system.

JHVT/JMVT

Table 6: Fault codes

Fault description	Status LED (AN2)	7-Segment Display 1 (DISP1)	7-Segment Display 2 (DISP2)
No power to control	OFF	—	—
Control normal operation – no call for operation (standby mode)	2 s ON/2 s OFF (heartbeat)	—	—
Control normal operation – in ASCD period	0.1 s ON/0.1 s OFF	d	5, 4, 3, 2, 1
Control normal operation – call for fan only and no active fault codes	ON	F	A
Control normal operation – call for first-stage cooling compressor and no active fault codes	ON	C	1
Control normal operation – call for second-stage cooling compressor and no active fault codes	ON	C	2
Max cool – no faults active	ON	C	3
Control normal operation – call for first-stage heating compressor and no active fault codes	ON	H	1
Control normal operation – call for second-stage heating compressor and no active fault codes	ON	H	2
Max heat – no faults active	ON	H	3
Auxiliary heat 1 – call for first-stage auxiliary heating and no active fault codes	ON	A	1
Auxiliary heat 2 – call for second-stage auxiliary heating and no active fault codes	ON	A	2
Stage 1 emergency heat (W without Y) – no faults active	ON	E	1
Stage 2 emergency heat (W without Y) – no faults active	ON	E	2
Float Switch Active – no faults active	ON	f	I
Software update – control board	ON	b	1
Software update – EE plug	ON	b	2
Software version – control board	ON	—	1 to 9
Software version – EE plug	ON	—	1 to 9
Any fault or event code that would prevent the equipment from running	See fault codes	—	—
No fault codes in memory	Two flashes	—	—
Fault code memory cleared	Three flashes	—	—

Table 7: Fault list

<table>
<tr><th>Fault/status</th><th>Display 1</th><th>Display 2</th><th>Simplified</th><th>Description</th></tr>
<tr><td>Internal control fault</td><td>0</td><td>A</td><td>Control failure</td><td>The control failed and must be replaced.</td></tr>
<tr><td>Model configuration changed</td><td>0</td><td>1</td><td rowspan="4">Configuration faults</td><td>The dip switches on model configuration do not match the stored model on the control. Hold the push button, with no calls to the control, for 6 s to 9 s, to clear and set the new model. If this error shows, 0 2 also usually show.</td></tr>
<tr><td>Blower match error</td><td>0</td><td>2</td><td>There is a mismatch between the motor and the stored model on the control. A few different things could cause this:
1. The motor is not compatible with the selected model. Change the model under model configuration.
2. The motor is not communicating with the control - accompanied by 0 6. Check your wiring, cycle power on the control, and the motor.
3. The model configuration is not set - accompanied by 0 1. Hold the push-button for 6 s to 9 s. Ensure there are no calls to the control or the model does not set.</td></tr>
<tr><td>Heat kit configuration error</td><td>0</td><td>3</td><td>There is a mismatch between the heat kit selection dip switches and the stored model on the control. A few different things could cause this:
1. The dip switches on heat kit selection do not match the stored heat kit on the control. Hold the pushbutton, with no calls to the control, for 6 s to 9 s, to clear and set the new model.
2. The heat kit selected under heat kit selection does not match the model stored in the control. Check your model configuration and your heat kit configuration.</td></tr>
<tr><td>Heat kit staging configuration changed</td><td>0</td><td>4</td><td>The dip switches on stage 1 kW do not match the stored information on the control. Hold the pushbutton, with no calls to the control, for 6 s to 9 s, to clear and set the new model.</td></tr>
<tr><td>Comm lost with HVAC system master</td><td>0</td><td>5</td><td>Comm lost</td><td>The control is no longer communicating with the HVAC system. If the system is conventional, cycle power. If the system is communication, ensure the main thermostat is powered, check the wiring, and check the main thermostat for faults.</td></tr>
<tr><td>Comm lost with motor</td><td>0</td><td>6</td><td>Motor connection lost</td><td>The control is no longer communicating with the ClimateTalk blower. Check the wiring between the motor and the control, and check that the motor is getting power.</td></tr>
</table>

Continued on next page

Table 7: Fault list (continued)

Fault/status	Display 1	Display 2	Simplified	Description
Low voltage (<19 VAC)	0	7	Low voltage error	The control is experiencing a low voltage condition. It continues with outputs already engaged, but does not engage new outputs. Check for damaged wiring and brown-out conditions.
Low voltage (<16 VAC)	0	8		The control is experiencing a very low voltage condition. The control no longer keeps outputs engaged and shuts down the system. Check for damaged wiring and brown-out conditions. Lower voltage means the control does not turn on.
Leaving air temperature sensor failure (open)	1	3	Leaving air temperature sensor error	The leaving air sensor is open. Check the wiring and check for a damaged sensor.
Leaving air temperature sensor failure (short)	1	4		The leaving air sensor is shorted. Check the wiring and check for a damaged sensor.
Low leaving air temperature in cooling	1	5		The leaving air temperature sensor is reporting lower temperatures that may cause condensate in the ductwork and cause damage to equipment. A few different things could cause this: 1. Check for a blockage in the ductwork. 2. Verify that the airflow for the size of the outdoor unit is correct. 3. Verify that the outdoor unit is the correct size for the application. 4. Verify there is nothing obstructing the fan.
High leaving air temperature in heating	1	6		The leaving air temperature sensor is reporting higher temperatures that may cause damage to equipment. A few different things could cause this: 1. Check for a blockage in the ductwork. 2. Verify that the airflow for the size of the outdoor unit is correct. 3. Verify that the heat kit is the correct size for the application. 4. Verify there is nothing obstructing the fan.
High leaving Air temperature in heating (heat pump mode)	1	7	Leaving air temperature sensor error	The leaving air temperature sensor is reporting higher temperatures that may cause damage to equipment. A few different things could cause this: 1. Check for a blockage in the ductwork. 2. Verify that the airflow for the size of the outdoor unit is correct. 3. Verify that the outdoor unit is the correct size for the application. 4. Verify that the heat kit is the correct size for the application. 5. Verify there is nothing obstructing the fan.
Float switch fault activated	1	8	Float switch fault	The float switch tripped. Check there is not excess water in the drain pan, the drain pan is not clogged, and the float switch is operating correctly.
Call for reversing valve while in air conditioner mode	2	2	Incorrect wiring	The control senses 24 VAC on the O terminal. • If the outdoor unit is a non-HMH7 heat pump, make sure the AC/HP switch is correctly set. • If the outdoor unit is an Air Conditioner, check the wiring. • If the outdoor unit is an HMH7 heat pump, ensure that the control is in S1 functionality. See the *S1 Functionality* section for more information.
Call for cooling and indoor heating at the same time	2	4		The control senses 24 VAC on the Y terminal and the W terminal while in air conditioner mode. • If the outdoor unit is a non-HMH7 heat pump, change the AC/HP switch. • If the outdoor unit is an air conditioner, check the wiring to the conventional inputs. • If the outdoor unit is an HMH7 heat pump, ensure that the control is in S1 functionality. See the *S1 Functionality* section for more information.
Call for reversing valve and heating at the same time	2	5		The control senses 24 VAC on the W terminal and the O terminal in heat pump mode. Check the wiring to the conventional inputs. • If the outdoor unit is an HMH7 heat pump, ensure that the control is in S1 functionality. See the *S1 Functionality* section for more information.
Fan running without a call	3	0	Fan faults	The control senses the motor is moving without command. 1. Check the wiring between the motor and the control. 2. Cycle power on both the motor and the control. 3. Verify there is nothing moving the blower besides the motor attached to this air handler control.
Fan failure	3	1		The control senses the motor is not moving with an active demand. 1. Check the motor has sufficient power. 2. Check the wiring between the motor and the control. 3. Verify nothing is blocking the blower fan. 4. Cycle power to both the motor and the control.

Continued on next page

Table 7: Fault list (continued)

Fault/status	Display 1	Display 2	Simplified	Description
Fan - high voltage failure	3	2	Fan faults	The control senses the motor is receiving too high voltage. 1. Check the voltage going to the blower motor. 2. Check the wiring of power to the motor. 3. Cycle power to the motor and to the control. 4. Verify nothing is blocking the blower.
Fan - low voltage failure	3	3		The control senses the motor is receiving too low voltage. 1. Check the voltage going to the blower motor. 2. Check the wiring of power to the motor. 3. Cycle power to the motor and to the control.
Fan - high current failure	3	4		The control senses the motor is receiving too high current. 1. Check the power going to the blower motor. 2. Check the wiring of power to the motor. 3. Cycle power to the motor and to the control. 4. Verify nothing is blocking the blower.
Fan - low current failure	3	5		The control senses the motor is receiving too low current. 1. Check the power going to the blower motor. 2. Check the wiring of power to the motor. 3. Cycle power to the motor and to the control.
Fan - high temperature failure	3	6		The control senses the motor's internal temperature is too high. 1. Verify the airflow set on the air handler control is correct for the air handler model, heat kit, and staging. 2. Ensure nothing is blocking the blower. 3. Cycle power on the motor and the control.
Fan - low temperature failure	3	7		The control senses the motor's internal temperature is too low. 1. Verify the airflow set on the air handler control is correct for the air handler model, heat kit, and staging. 2. Ensure nothing is blocking the blower. 3. Cycle power on the motor and the control.
Fan - lost rotor	3	8		The control senses the motor has a lost rotor fault. 1. Ensure nothing is blocking the blower. 2. Cycle power on the motor and the control.
Fan - incomplete parameter	3	9		The control delivers incomplete data to the motor. 1. Check wiring between the control and the motor. 2. Check the EE plug is firmly seated into the control. 3. If the issue persists, cycle power to the control and the motor.
Fan - undesired parameter change	4	0		1. The control delivers a parameter change at the wrong time to the motor. Check wiring between the control and the motor. 2. Check the EE plug is firmly seated into the control. 3. If the issue persists, cycle power to the control and the motor.
Fan - fault limit lockout	4	1		The motor hits the fault limit and no longer runs. 1. Check the fault list on the control and troubleshoot those faults. 2. When these faults have been checked, cycle power to the motor and control.

Command CFM Flashes

The number of flashes on the unit control board indicates the amount of CFM (in hundreds) that the control board is requesting. The number of flashes on the green LED represents 100 cubic feet per minute of air flow for each flash.

Example:
12 flashes indicate 1200 CFM
8 flashes indicate 800 CFM

It does not indicate actual air flow if the air handler is operating beyond its external static limitations.

Climate Talk Variable Speed ECM Motor

Troubleshooting the ECM motor is not just an off or off solution. The following four problems will prevent the motor from running:

1. There is no input power to the motor controller (high voltage input).
2. There is improper or no communication to the motor controller (low voltage inputs). This problem could be in the interface board or the low voltage connector.
3. The control has failed and is not sending a call to the motor.
4. The motor has failed.

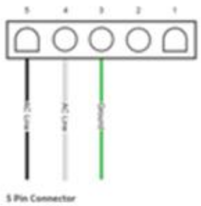
A large percentage of ECM field returns are “No Problem Found”. Do not simply assume the motor has failed because it is not running.

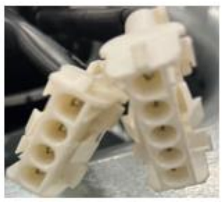
Measure the input power (high voltage) to the motor controller by following these steps:

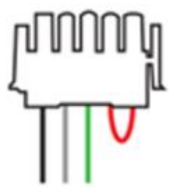
1. Disconnect the power to the system.
2. Disconnect the 5-pin (high voltage) connector.
3. Restore the power to the system.
4. Check for proper input power.

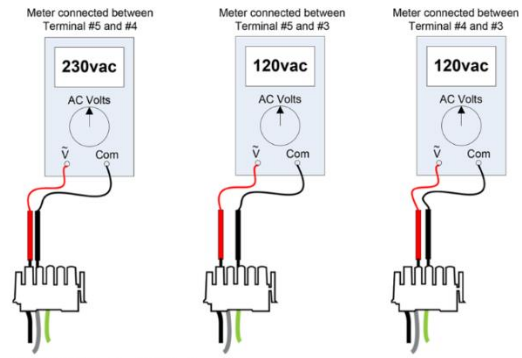
ECM 5-Pin Plug Connector

When the main power is restored, take a power measurement at the 5-pin connector as shown below:









Motor Test 230 Volts AC and 120 Volts AC

Reconnecting the Plug

After all the input high voltage power connections have been confirmed or corrected, turn the power off and reconnect the plug to the motor control. The plug connector is keyed and must be reconnected properly. Do not force the plug in the wrong direction or it will cause permanent damage to the motor. Fully insert the plug to prevent arcing or vibration, which may cause the connection to be broken. When the plug is fully inserted, it will slide gently, all the way in until clicks are heard on both sides.

Motor Grounding

It is especially important to have a properly grounded connection from the connector to the main ground when using ECM motors. This will ensure proper operation and safety. Disconnect the power to the system before checking the resistance. Evaluate the continuity between the two connections with an ohm meter. The resistance reading must be zero between the two connections. If any other readings are indicated, correct the problem immediately. Although the motor may run despite not being properly grounded, this is a safety concern that must be corrected.

Troubleshooting the JHVT and JMVT Model Air Handler ECM Motors

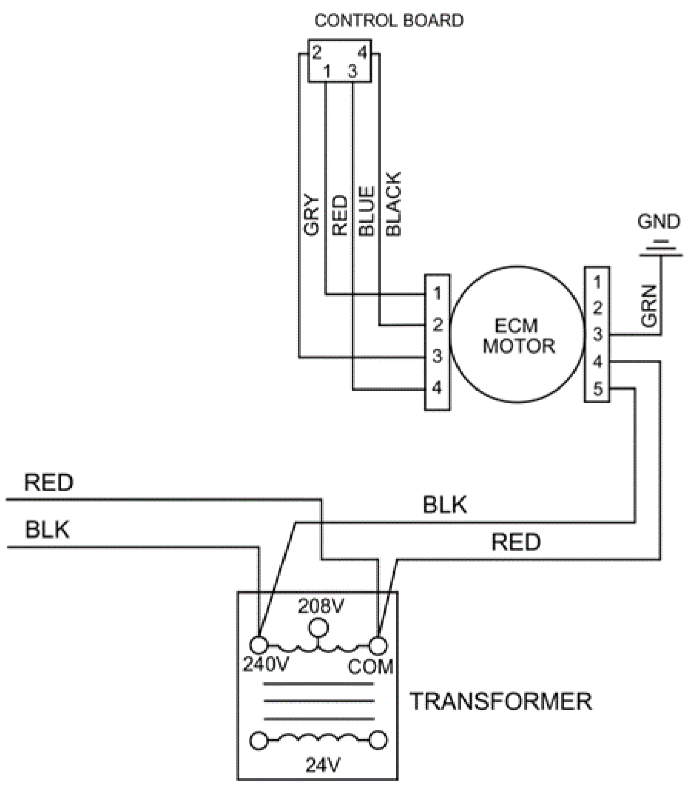
This section provides the information necessary to troubleshoot the ECM motors that are installed on the AVC, AVV, MVC air handlers with communication-capable control boards.

1. Determine the mode of operation present at the thermostat.
2. A line voltage (208/230 volts AC) measurement must be taken to verify that proper voltage is present. The required line voltage as indicated in the table below must be measured between pins 4 and 5 of the 5 pin line voltage connector.
    a. If line voltage is not present, the technician must ensure that the door switch is closed and the electrical connections are properly secured.
    b. If line voltage is present and the motor is not rotating, then advance to step 3.

The 208/230-volt AC line voltage limitations are as follows:

Voltage	Voltage Range
208/230 volts AC	187-253 volts AC

3. The motor flat 4 pin connector for motor communications should be tested between pins 1 and 4 which is RED and BLUE wires. Proper voltage is between 5 – 12 VDC.
4. The control rectangle 4 pin connector for motor communications should be tested between pins 1 and 3 which is RED and BLUE wires. Proper voltage is between 5 – 12 VDC.
5. The control and motor 4 pin connector for communications A+ and B- is GRAY and BLACK wires. There is no field testing that can be done using a voltmeter.



Replacing the Variable Speed ECM Motors

1. Lock-out and tag-out the electrical disconnect, and ensure the motor is de-energized for 5 minutes.

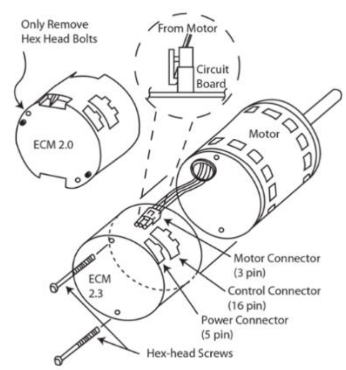
Note
Disconnect AC power from the HVAC system and wait 5 minutes before opening the motor to avoid electrical shock from the motor’s capacitors.

2. Unplug the 5-pin connector and the 4-pin connector from the motor control.
3. Remove the blower assembly from the HVAC system.
4. Remove the two (2) hex-head screws from the back of the control. Support the module to prevent the internal wires from breaking.
6. Ensure the motor module is not damaged by performing the “Module Tests” below.

Variable Speed ECM Motor Control Disassembly Review

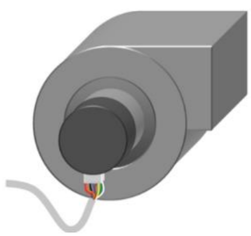
Step 1: Unplug the 4-pin connector and the 5-pin connector from the motor control.
Step 2: Remove the blower assembly from the HVAC system.
Step 3: Remove the two (2) hex-head screws from the back of the control.
Step 4: Unplug the 3-pin connector from inside the control by squeezing the latch and gently pulling on the connector.

Control Disassembly



Control Disassembly.

Variable Speed ECM Motor Module Tests



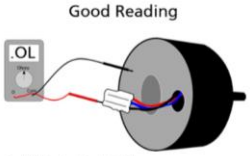
Drip Loop Cable

These tests are no different than taking resistance readings on a 3-phase compressor motor. Confirm that the windings are not shorted to ground and that the resistance is equal when tested phase-to-phase.

Measure the resistance between each of the three motor leads to the unpainted part of the end shield (winding to ground resistance). Typically, a good motor will read infinite ohms to ground on all leads. A grounded motor would read a measurable resistance from any one of the motor leads to ground. For the purpose of this test, the meter is set to the highest ohms scale unless it is auto-ranging, Meg-ohm meters should not be used for this test.

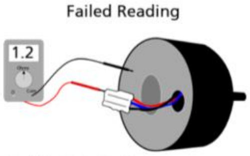
If the motor has a resistance of less than 100k ohms between any one motor lead to ground, the motor must be replaced with an exact replacement.

Good Reading



Good Motor Reading (Test A)

Failed Reading



Failed Motor Reading (Test A)

ECM Motor Failure Footnotes

All repair parts for ECM motors must be obtained as a specific match to the existing motor or control module. Even if the new part looks like a direct replacement, all literature that comes with the new part must be read. There may be a very small but very important change in mounting, programming, or wiring that could make the difference between a long-term repair and a callback.

Frozen Evaporator Coil

Many “no cooling” calls come from a neglected air filter or other causes of restricted airflow. As airflow is reduced, the temperature of the evaporator coil during cooling operation decreases below the freezing point of water and the moisture in the return air will freeze on the coil surface.

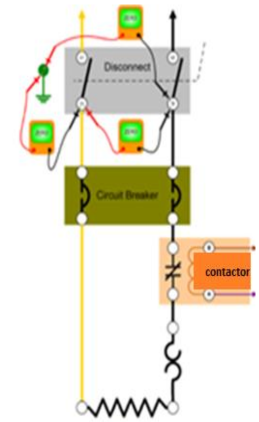
If left running long enough in this condition, the evaporator coil will become a block of ice. As a result, minimal heat transfer will occur between the return air and the refrigerant within the coil. The liquid refrigerant entering the evaporator coil will not be able to boil off to a vapor and will pass into the suction side of the compressor. If liquid refrigerant flows back to the compressor, the compressor may fail.

To prevent such an occurrence, customers must be advised to replace filters on a regular basis and refrain from closing off rooms that are not in use. Closing off registers or rooms does not save operational costs. Rather, it increases static pressure in the system and the possibility of liquid refrigerant floodback. The technician should take the time to explain to the customer that the equipment will continue to run until the conditioned space reaches the desired thermostat setting, regardless if the unused rooms are open or closed. When airflow is properly set up and the customer is educated in regards to his/her role in system upkeep, “no cooling” calls due to airflow restrictions are avoided.

The appearance of frost can also indicate low system refrigerant charge or a restriction. If frost appears on or immediately downstream of a specific component in the refrigeration system, (such as the filter drier or metering device), there is most likely a restriction within that component. A low system refrigerant charge causes a portion of the evaporator coil to drop below 32 degrees F during cooling operation. This causes the moisture in the return air to freeze on the surface of the coil.

If a frozen evaporator coil is encountered during cooling operation, allow the coil to completely defrost. When the coil has defrosted, proper airflow must be verified. Review the methods covered in the external static pressure (ESP) section. At this time, the refrigerant charge may be verified. If the system has a low system refrigerant charge, the system must be leak checked. Any leaks present must be repaired prior to attempting to adjust the system refrigerant charge.

Heat Kit Troubleshooting



Disconnect in the "Off" Position

High voltage troubleshooting is relatively uncomplicated on residential air handler heat kits since the circuitry is limited to disconnect, circuit breaker, relay, thermal overloads, heat elements and associated wiring.

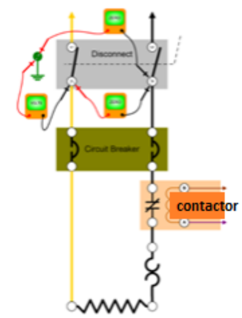
Many troubleshooting procedures require that power remain on the unit for valid readings. The technician must be attentive to his/her personal safety when working on a unit that is energized.

Other procedures for maintenance, service and repair require that the unit power be disengaged. To prevent electrical shock, the technician should ensure line voltage is fully disengaged any time that the disconnect handle is placed in the “off” position.

With a trusted AC voltmeter, make the following readings from the outgoing side (unit side) of the disconnect:

- T1 to T2
- T1 to cabinet ground
- T2 to cabinet ground

As illustrated, all readings should be zero volts with the disconnect in the “off” position to ensure that line voltage is disengaged.



If any of the following readings from the outgoing side (unit side) of the disconnect show voltage, there is risk of electrical shock to the technician since line voltage is still present to the unit:

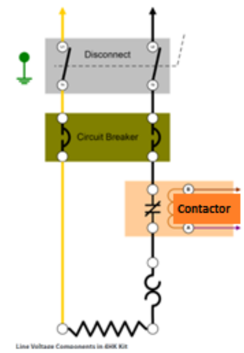
- T1 to T2
- T1 to cabinet ground
- T2 to cabinet ground

The example illustrated shows all readings to be zero except for T1 to cabinet ground. This is an indication that, even though the disconnect handle is in the “off” position, the L1 to T1 knife-blade of the disconnect has not disengaged line voltage to the unit.

The power to the unit must be shut off from the main power-panel if the disconnect will not fully disengage line voltage. A qualified electrician should then replace the failed disconnect.

A systematic approach to line voltage component electrical troubleshooting will provide the greatest diagnostic accuracy. The following method requires that the equipment be powered. The technician must exercise care and caution to avoid electrical shock and other personal safety hazards.

The accompanying diagram is a simplified version representing the line voltage components in a standard 8HK heat kit.



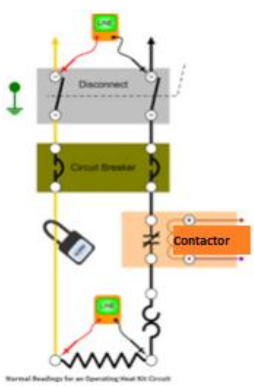
From the top, the items diagrammed are:

- Up arrows represent the connection to the power panel
- A field-mounted power disconnect switch (gray rectangle)
- A circuit breaker (olive rectangle)
- A heat relay (tan rectangle)
- A thermal overload.
- An electric heat element (resistive load).

Electrical troubleshooting of the line voltage components use:

- Voltage readings of the line voltage circuit.
- Amperage readings of the line voltage circuit.
- Confirmation that the 24-volt relay is complete and enabled.

The technician's understanding of readings that are normal, as well as recognition of abnormal readings, is key to heat kit electrical troubleshooting.



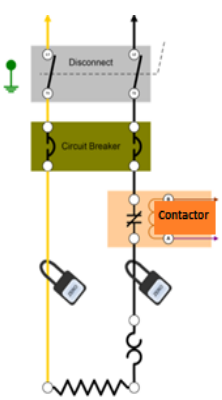
The illustration shows normal readings for an operating heat kit circuit:

- The presence of 24 volts, and normal current draw (typically 1 amp or less) at the relay will confirm the 24-volt circuit is complete and enabled.
- The current draw of the heat strip is normal.

Line voltage is read throughout the circuit between the two "legs":

- Leg 1 (yellow) to Leg 2 (black).

The following diagrams and descriptions discuss troubleshooting methods used to identify a variety of problem conditions. While each condition is discussed in isolation, there may be multiple problems existing on a circuit at the same time.



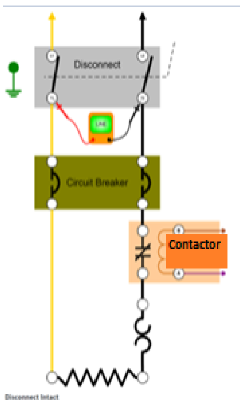
When beginning the electrical troubleshooting process, the amp draw of the individual heating element(s) must be determined. Then read the current draw of one "leg" of the voltage circuit. This reading is used to indicate the type of problem, as well as the urgency and care needed for troubleshooting.

If the current reads normal, the line voltage circuit is complete, and the heat element should be operating. The table below provides expected current readings depending on the capacity of the heat strip and voltage applied. Consider that these readings are dependent on precise measurement and voltage. If the voltage applied varies from 208-, 230- or 240-volts AC, the measurement will also show variations.

19.1 8HK Heatkit Stage Selection

Heat Kit	Stage Selection
8HK*6500206	2.4 KW (only 1 Stage of heat)
8HK*6500506	4.8 KW (only 1 Stage of heat)
8HK*6500806	7.68 KW (only 1 Stage of heat)
8HK*6501006 8HK06501025	9.6 KW (only 1 Stage of heat)
8HK*6501506 8HK06501525	First Stage: 4.8 KW Second Stage: 14.4 KW
8HK*6502006 8HK16502025	First Stage: 8.8 KW Second Stage: 19.2 KW
8HK*6502506 8HK16502525	First Stage: 8.8 KW Second Stage: 24.0 KW

Table 27 – 8HK Heatkit Stage Selections



If the current draw reads zero, the line voltage circuit is currently open. The open circuit may be temporary if the thermal overload tripped due to overheating. In this case, the open circuit may be a secondary result of another condition. However, during periods with zero current draw there is little chance of further damage to the line voltage circuit or equipment.

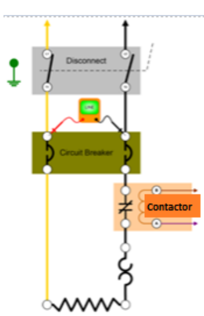
Next is confirmation that the disconnect is intact. Line voltage should be read from the outgoing lugs of the disconnect:

- T1 to T2

If the line voltage is complete at the incoming lugs of the disconnect but is not complete at the outgoing lugs of the on-positioned disconnect, then the connections of the disconnect are faulty.

In most cases where the disconnect is faulty, a qualified electrician will need to be consulted for repairs.

Next is confirmation that the disconnect to circuit breaker and connections are intact.



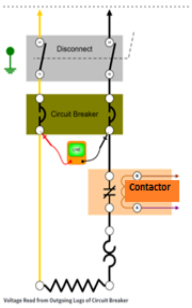
Line voltage should be read from the incoming lugs of the circuit breaker:

- Leg 1 (yellow) to Leg 2 (black)

If these readings are not present, further troubleshooting procedures are required. If the line voltage is complete at the outgoing lugs of the disconnect but is not complete at the incoming lugs of the circuit breaker, then the connections or wiring between the disconnect and circuit breaker are faulty.

Often when these readings are found there will be visible discoloration or damage to the connections or wiring terminals. Typically, the component damage originates with loose connections.

Next is confirmation that there are no blown circuits, and that all circuit breaker connections are intact.

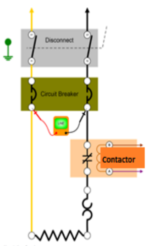


Line voltage should be read from the outgoing lugs of the circuit breaker:

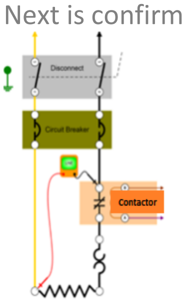
- Leg 1 (yellow) to Leg 2 (black)

If the line voltage is complete at the incoming legs of the circuit breaker but is not complete at the outgoing lugs of the circuit breaker, then a high current situation has tripped the circuit breaker of the connections of the circuit breaker are faulty.

If this occurs, reset the circuit breaker, and monitor the current draw of the heat strip to determine if a fault is causing high current draw.



Next is confirmation that the circuit breaker to relay wiring and connections are intact.



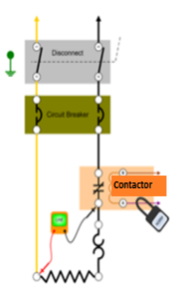
Line voltage should be read from the incoming lugs of the relay:

- L1 to L2

If the line voltage is complete at the outgoing lugs of the circuit breaker but is not complete at the incoming lugs of the relay, then the connections or wiring between the circuit breaker and contactor are faulty.

Often when these readings are found there will be visible discoloration or damage to the connections or wiring terminations. Typically, the component damage originates with loose connections.

Next is confirmation that the relay is energized, and its contacts are engaged.



Line voltage should be read from the outgoing lugs of the relay:

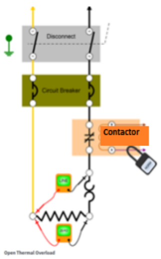
- L1 to L2

If the line voltage is complete at the incoming lugs of the relay but is not complete at the outgoing lugs of the relay, and the relay is confirmed to be energized, then the relay is faulty.

Inspect the faulty relay for indications of mechanical binding such as water damage or corrosion. Typically, these problems can be prevented. Inspection of the faulty relay can reveal if the failure was due to excessively low control circuit voltage, such as overheating damage.

If inspection indicates that the faulty relay has evidence of excessive current draw, then particular attention should be paid to the current draw through the relay after the fault has been corrected.

When power is restored after repairs are made, overall current draw of the unit should be monitored to determine if a unit fault is causing high current draw (amp-meter segment of the illustration).



Next is confirmation that the thermal overload is intact and closed.

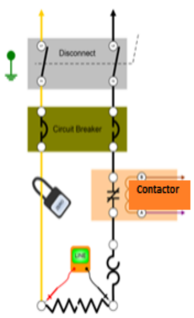
Line voltage should be read from the terminals:

Leg 1 (yellow) to Leg 2 (black) prior to the thermal overload.

If these readings are present, take a voltage reading across the heat element lugs.

If line voltage is not present between the heat element lugs, as in Figure 7-25, then the thermal overload is open.

The final voltage reading confirms that the wiring and connections to the heat element are intact.

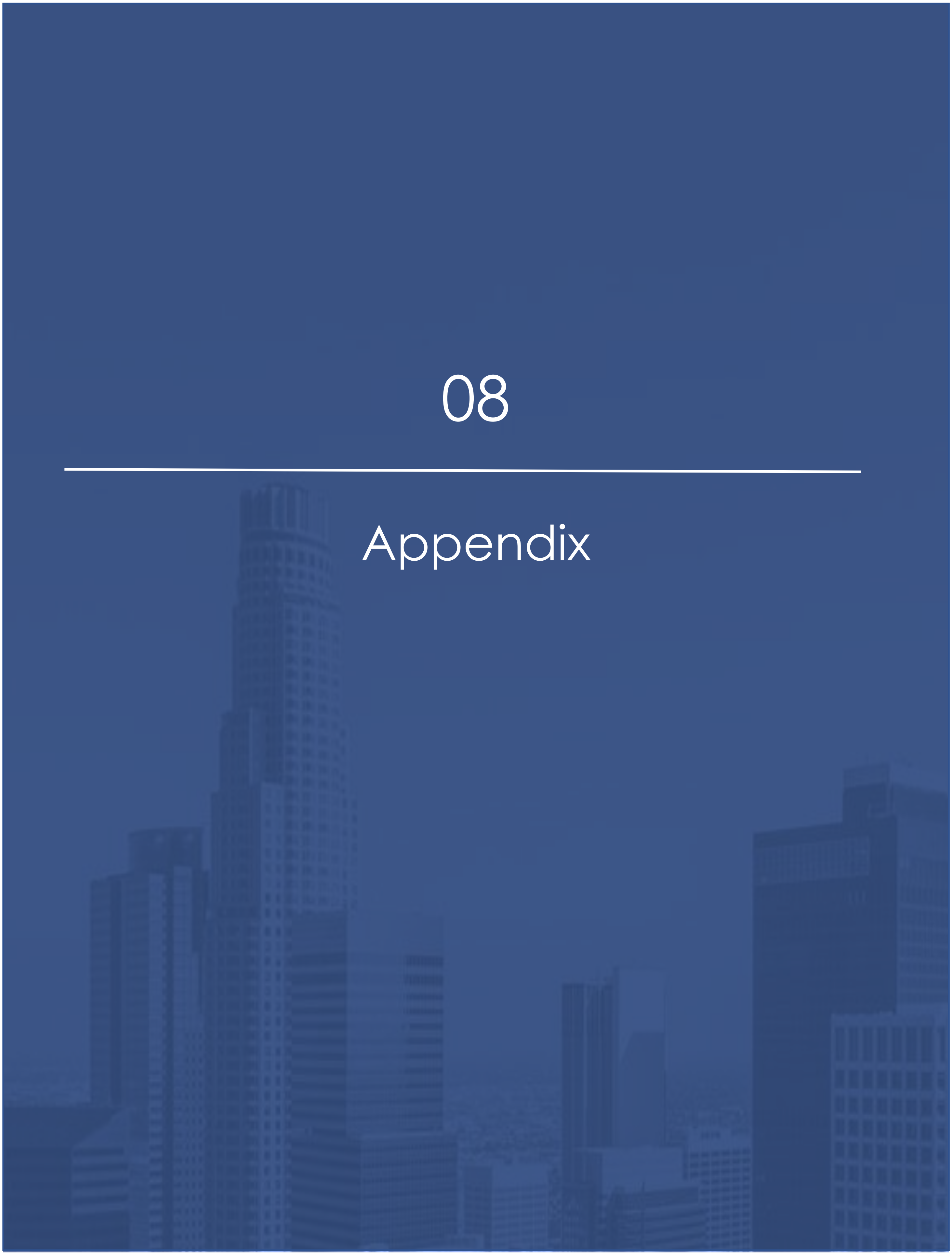


Line voltage should be read from the terminals of the heat element:

Leg 1 (yellow) to Leg 2 (black)

If these readings are not present, then the heat element is open and must be replaced.

If the line voltage is complete at the outgoing lugs of the lay, but is not complete at the heat element lugs, check the connections and wiring.



08

Appendix

Appendix

Note
To view the videos below, be sure to log into Navigator to access.

Model Configuration
Aux Heat Configuration
Airflow Configuration
Settings Configuration

