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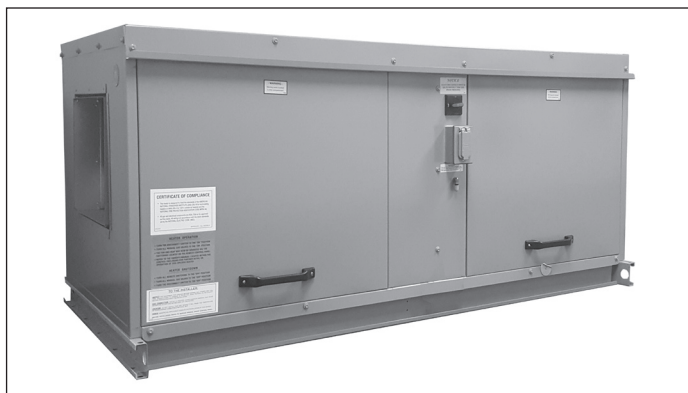
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February, 2017

INSTALLATION AND SERVICE MANUAL

direct-fired make-up air units

models MCV/MVV



Intertek

Models MCV/MVV are ETL certified to meet the U.S. and Canadian requirements in ANSI Z83.4-2015/CSA 3.7-2015 Standards for Non-Recirculating Direct Gas-Fired Industrial Air Heaters.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects, or other reproductive harm. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

FOR YOUR SAFETY

IF YOU SMELL GAS:

1. Open windows (indoor installation only).
2. Do not touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

IMPORTANT

The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.

Inspection upon Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local Modine Manufacturing sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at the point of installation.
3. Inspect unit upon arrival for conformance with description of product ordered (including specifications where applicable).

SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

WARNING

1. Do not install direct-fired units down stream from any cooling system which utilizes refrigerants for cooling.
2. Failure to follow proper lifting instructions could result in property damage, serious injury, or death. Lifting should only be done by a qualified rigging company. Use ALL lifting points. Test lift to ensure proper balance and rigging. Never lift in high winds.
3. All field gas supply lines should be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
4. Gas pressure to the unit controls must never exceed the pressure shown on the unit's rating plate. The unit and its individual shutoff valve(s) must be disconnected from the gas supply during any test pressure in excess of 1/2 psig (3.5 kPa).
5. For test pressure less than 1/2 psig (3.5 kPa), the unit's gas control must be isolated from the supply gas piping by closing the unit's manual shutoff valve(s).
6. For indoor units, where required by Code, use a dedicated line for venting gas to the outside of the building.
7. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
8. If equipped with the factory installed disconnect switch option, when the switch is in the "OFF" position, supply power remains energized at the supply power terminal strip and the top of the disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.
9. All appliances must be wired strictly in accordance with the wiring diagram furnished with the unit. Any wiring that is different from the wiring diagram could result in a hazard to persons and property.
10. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.

WARNING

11. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than the rated voltage.
12. Proper air velocity over the burner is critical. If the velocity is not within the unit specifications, the unit will not operate efficiently, may have nuisance shutdowns, and may produce excessive carbon monoxide (CO) or other gases.
13. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at owner's risk.

CAUTION

1. Purging of air from gas supply lines should be performed as described in ANSI Z223.1 – latest edition "National Fuel Gas Code", or in Canada in CAN/CGA-B149 codes.
2. Do not operate unit with a gas input rate greater than that shown on the unit's rating plate.
3. When using a drill bit to clean the burner gas ports, do not distort or enlarge the ports. Do not use a power drill.
4. Since a failure of the unit may affect the proper operation of other fuel burning equipment in the building, the unit must be electrically interlocked to open balancing air inlet dampers, or other such devices.
5. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
6. Do not reuse any mechanical or electrical component which has been wet. Such components must be replaced.

TABLE OF CONTENTS / SI (METRIC) CONVERSION FACTORS

IMPORTANT

1. Start-up and adjustment procedures should be performed by a qualified service agency.
2. When lubricating bearings, be sure to keep the grease clean, do not over lubricate, and do not mix petroleum grease with silicone.
3. To check most of the Possible Remedies in the troubleshooting guide listed in Tables 38.1 and 39.1, refer to the applicable sections of the manual.
4. Installation in airplane hangers must be in accordance with the Standard for Aircraft Hangars, ANSI/NFPA 409, and (2) public garages in accordance with the Standard from Parking Structures, ANSI/NFPA 88A, or the Standard for Repair Garages, ANSI/NFPA 88B and with CAN/CGA B149 Installation Codes.
5. Adequate building relief must be provided so as to not over-pressurize the building when the heating system is operating at its rated capacity. This can be accomplished by taking into account, through standard engineering methods, the building structure design infiltration rate; by providing proper sized relief openings; by interlocking a power exhaust system; or by a combination of these methods.
6. The heater inlet must be located in accordance with the applicable code provisions for ventilation air.
7. Field constructed intake accessories should be properly designed and installed to minimize the entry of snow and rain.
8. All air to the unit must be ducted directly from the outdoors. Recirculation of room air is not permitted through the burner.
9. If in doubt regarding the application, contact your local Modine Manufacturing sales representative.

Table 3.1 - SI (Metric) Conversion Factors

To Convert	Multiply By	To Obtain	To Convert	Multiply By	To Obtain
"W.C.	0.249	kPa	feet	0.305	m
°F	(°F-32) x 5/9	°C	Gal/Hr.	0.00379	m ³ /hr
Btu	1.06	kJ	Gal/Hr.	3.79	l/hr
Btu/ft ³	37.3	kJ/m ³	gallons	3.79	l
Btu/hr	0.000293	kW	Horsepower	746	W
CFH (ft ³ /hr)	0.000472	m ³ /min	inches	25.4	mm
CFH (ft ³ /hr)	0.00000787	m ³ /s	pound	0.454	kg
CFM (ft ³ /min)	0.0283	m ³ /min	psig	6.89	kPa
CFM (ft ³ /min)	0.000472	m ³ /s	psig	27.7	"W.C.

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UNIT LOCATION/SOUND AND VIBRATION ATTENUATION

UNIT LOCATION

⚠ DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

⚠ WARNING

Do not install direct-fired units down stream from any cooling system which utilizes refrigerants for cooling.

Location Recommendations

1. Do not locate any gas-fired equipment where chlorinated, halogenated or acid vapors are present in the combustion air atmosphere.
2. When locating units, consider general space and heating requirements and availability of gas and electrical supply.
3. Where necessary to provide working clearance beneath the unit, the unit must be installed at a suitable height above the floor or otherwise adequately protected.
4. Be sure the structural support at the unit location is adequate to support the weight of the unit.
5. For economical installation and operation, locate each unit close to the space it will serve, and close to the utilities that will serve the unit.
6. Adequate building relief must be provided so as to not over-pressurize the building when the heating system is operating at its rated capacity. This can be accomplished by taking into account, through standard engineering methods, the building structure design infiltration rate; by providing proper sized relief openings; by interlocking a power exhaust system; or by a combination of these methods.
7. The heater inlet must be located in accordance with the applicable code provisions for ventilation air.
8. All air to the unit must be ducted directly from the outdoors. Recirculation of room air is not permitted through the burner.
9. Be sure that the minimum clearances to combustible material and recommended service clearances are maintained. Units are designed for installation on non-combustible surfaces or combustible surfaces with the minimum clearances shown in Table 4.1.
10. Field constructed intake accessories should be properly designed and installed to minimize the entry of snow and rain.
11. If in doubt regarding the application, contact your local Modine Manufacturing sales representative.

Table 4.1 - Combustible Materials and Service Clearances

Model Size	Minimum Clearance to Combustible Materials				Minimum Clearance for Service Access
	Top	Bottom	Sides	Ends	(Both Sides)
All	6"	6"	6"	6"	36"

Sound and Vibration Attenuation

All mechanical equipment generates some sound and vibration which may require attenuation. Locate the equipment away from critical areas whenever possible. Frequently, units can be mounted above utility areas, corridors, restrooms, and other non-critical areas. Generally, a unit should be located within 15 feet of a primary support beam. Smaller deflections mean less vibration and noise transmission.

For roof curb-mounted units, Figure 4.1 shows suggested methods of sound attenuation. Field-installed vibration isolators are available for suspended or rail/slab mounted units. Refer to Figures 4.2 and 4.3.

Figure 4.1 - Suggested Sound Attenuation

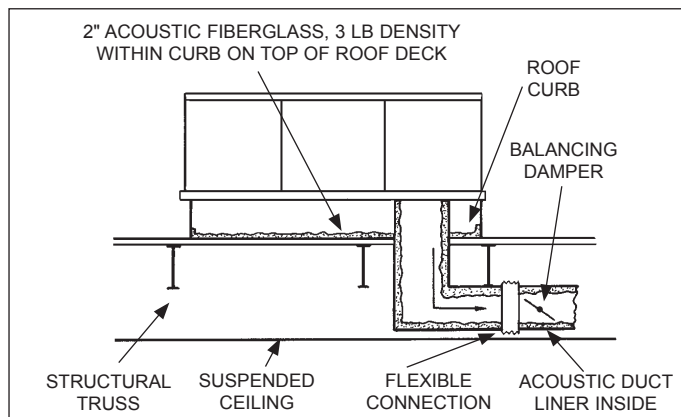


Figure 4.2 - Vibration Feet (Slab or Rail Mounted Units)

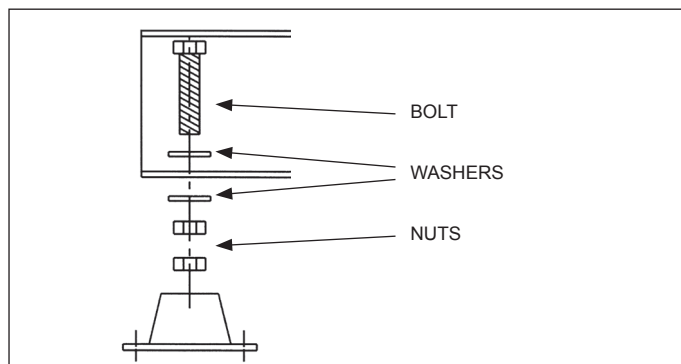
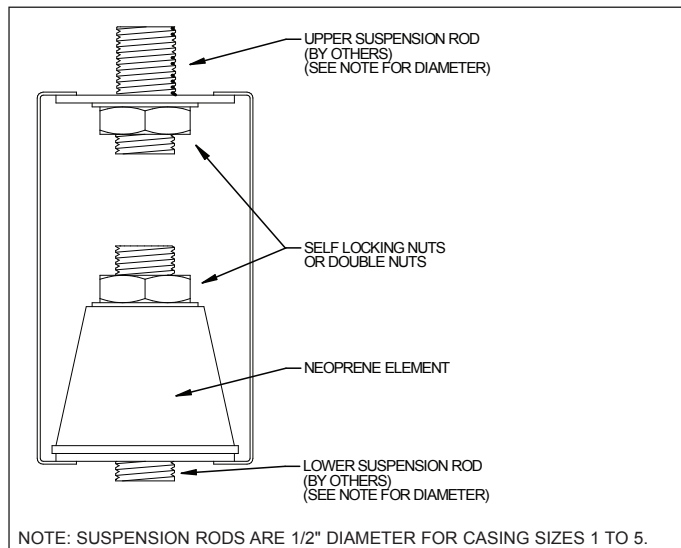


Figure 4.3 - Vibration Hangers (Suspended Units)



MOUNTING OPTIONS

UNIT INSTALLATION

Prior to installing the unit in the final installed location, review the following:

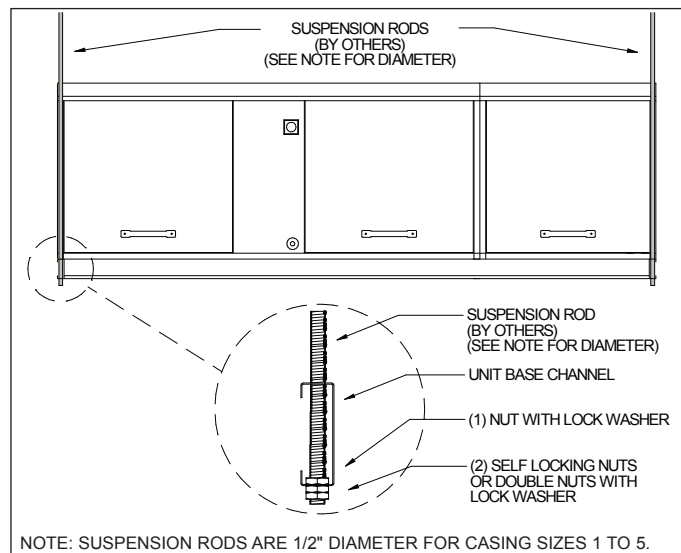
1. Follow site preparation instructions for applicable unit mounting method. Covered in this section are suspended, rail mounted, slab mounted, and curb mounted units.
2. Check the rating plate of the unit before lifting to insure that the model number shown matches that shown on the plans. Although units may look similar, their function, capacities, options, and accessories may vary widely.
3. Check unit dimensions for proper fit.
4. Follow proper rigging instructions on page 6.

Suspended Units

Be sure the structure from which the unit and accessories are hung is adequate to handle the weight, which can be found on page 34. The unit must be level in a horizontal position.

Combination lifting and support points are supplied with each unit. Refer to Figure 5.1 for the recommended mounting method and pages 30-32 for dimensions.

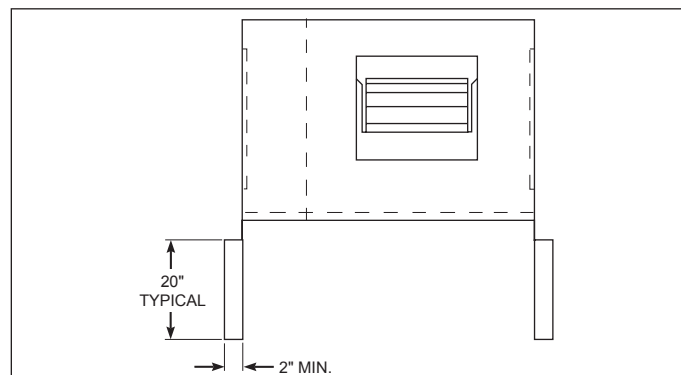
Figure 5.1 - Unit Suspension



Rail Mounted Units

If mounting on a roof, the roof structure must be adequately designed to support the live weight load of the unit and rail mounting support structure. Use two continuous rails for the length of the unit (in direction of air flow) as shown in Figure 5.2. The unit must be level in a horizontal position.

Figure 5.2 - Unit Rail Supports



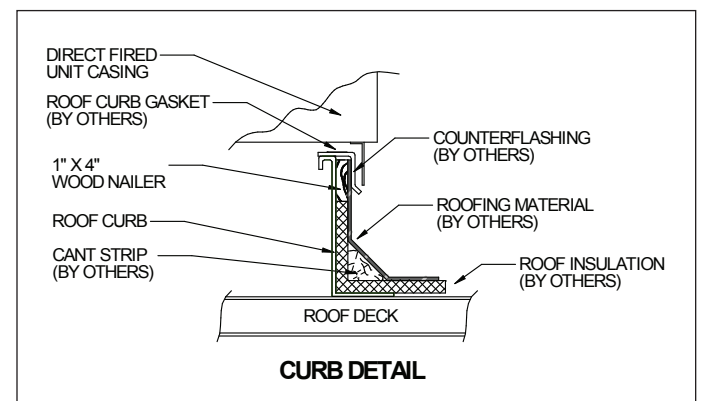
Slab Mounted Units

For ground level installation of the unit, prepare a horizontally level concrete slab at least 4" thick, which extends 6 inches beyond the unit on an adequate footing and a generous bed of gravel for proper drainage. The slab should include 1/2" threaded anchor bolts spaced according to the anchor holes in the base. The anchor bolts should extend at least 4-1/2" above the surface of the slab to allow clearance for mounting washers, bolts, and nuts (by others).

Roof Curb Mounted Units

An optional 20" high roof curb is available to simplify site preparation and raise the unit above roof water and snow levels. It can be installed on the roof in advance of the unit. The curb is shipped knocked down with separate instructions for its assembly, flashing, and sealing with the roof. See page 33 for dimensions. Refer to Figure 5.3.

Figure 5.3 - Typical Roof Curb Details



Roof Curb Installation

1. The roof structure must be adequately designed to support the live weight load of the unit and any other required support structure. The roof curb should be supported at points no greater than five feet apart. Additional truss reinforcement should be provided, if necessary.
2. Maintain an 8" minimum height from the top of the roof deck to the top of the curb.
3. Outside curb dimensions must be held when installing the curb, and the top of the curb must be level to insure weather tightness. All corners must be square.
4. Thoroughly clean and dry the top of the curb surface.
5. Caulk or use gasket around the top perimeter of the curb.
6. Following the Rigging Instructions in the next section, lift the unit into place and set the unit down evenly on curb.
7. If units are supplied with accessories for field-mounting, attach all accessories after the unit has been set into place.
8. Final electric and gas connections must be made after the unit is installed to allow for tolerance in setting of the unit on the curb. Instructions for these connections are covered in a later section of this manual.

RIGGING INSTRUCTINS / DUCT INSTALLATION

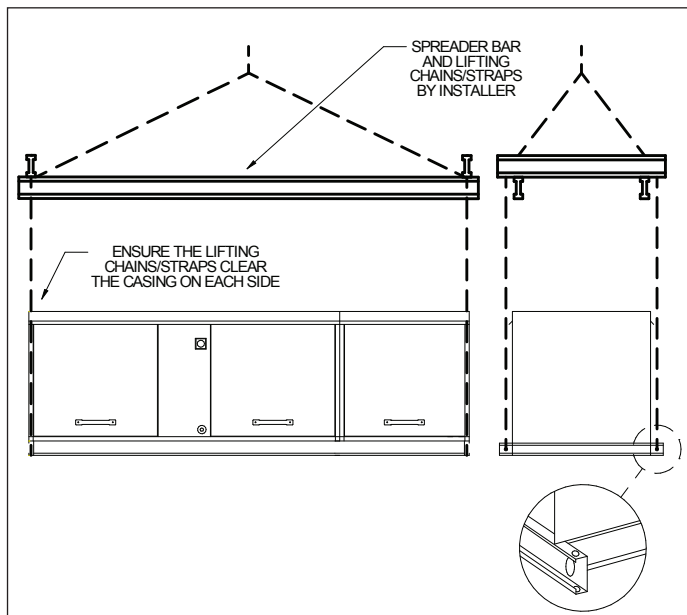
RIGGING INSTRUCTIONS

WARNING

Failure to follow proper lifting instructions could result in property damage, serious injury, or death. Lifting should only be done by a qualified rigging company. Use ALL lifting points. Test lift to ensure proper balance and rigging. Never lift in high winds.

1. Each unit is supplied with four mounting and lifting brackets, integral to the unit base, with holes for lifting hooks.
2. When lifting the equipment, connect sturdy steel cables, chains, or straps with eye loops as illustrated in Figure 6.1.
3. For stability in lifting and lowering and to prevent damage to the unit, include a spreader bar as illustrated in Figure 6.1.
4. Avoid twisting or uneven lifting of the unit. The cable length from the lifting point on the unit to the spreader bar should always be longer than the distance between the outer lifting points.
5. For units with inlet accessories shipped separately, it is recommended that the unit and accessories be lifted separately and the accessories assembled to the unit after the unit is set into place.

Figure 6.1 - Typical Rigging



DUCT INSTALLATION

To assure proper air flow from the discharge of the unit, follow these recommendations.

1. Be sure discharge ducts are properly sized for the airflow.
2. As a general rule, all discharge ducts should have a straight run of at least three (3) hydraulic duct diameters (Dh) before making turns in the ductwork.

For Rectangular Ducts: $Dh = 4A/P$

For Circular Ducts: $Dh = D$

where:

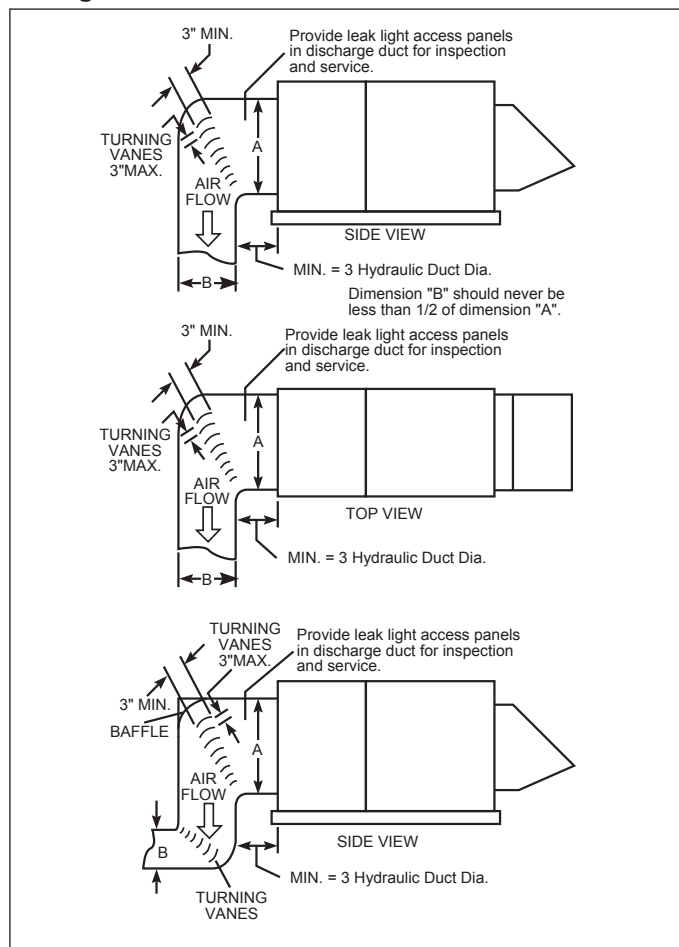
A = Cross Sectional Area of Rectangular Duct

P = Perimeter of Rectangular Duct

D = Diameter of Round Cut

3. Figure 6.2 shows the recommended duct layout for various discharge ductwork.
4. Where ductwork (or other enclosure) is installed to the inlet or outlet of the unit in such a way as to cause a possible gas trap and accumulation of a flammable mixture, a pre-purge cycle must be incorporated to provide not less than 4 complete air changes to the ductwork (or enclosure) by volume prior to an ignition attempt.
5. Fire dampers (supplied by others) installed in the inlet or outlet duct systems must be provided with electrical interlocks connected in the safety limit control circuit so as to cause the heater to shut down in case of fire in the ductwork or unit. The electrical interlocks must be so arranged that the safety circuit is electrically energized only when the fire damper is in the wide-open position.

Figure 6.2 - Recommended Discharge Duct Configurations



UNIT INSTALLATION

Gas Connections

⚠ WARNING

1. All field gas supply lines should be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to the unit controls must never exceed the pressure shown on the unit's rating plate. The unit and its individual shutoff valve(s) must be disconnected from the gas supply during any test pressure in excess of 1/2 psig (3.5 kPa).
3. For test pressure less than 1/2 psig (3.5 kPa), the unit's gas control must be isolated from the supply gas piping by closing the unit's manual shutoff valve(s).
4. For indoor units, where required by Code, use a dedicated line for venting gas to the outside of the building.

⚠ CAUTION

Purging of air from gas supply lines should be performed as described in ANSI Z223.1 - latest edition "National Fuel Gas Code", or in Canada in CAN/CGA-B149 codes.

1. Installation of piping must be in accordance with local codes, and ANSI Z223.1-latest edition, "National Fuel Gas Codes". (In Canada CAN/CGA-B149 Code.)
2. Piping to units must conform to local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to the unit rating plate to determine the Btu capacity of the unit and the type of gas the unit is designed to use. Using this information, refer to the ASHRAE Guide Fundamentals Handbook, or other gas pipe sizing guide, to determine the correct supply pipe size. Allow sufficient pipe size based on allowable pressure drop in supply line. Where several units are served by the same main, the total capacity of all the units served by the main must be used. Do not use pipe sizes smaller than 1/2".
3. Pipe size to the unit must match the factory side access gas connection size, as shown in Table 7.1.

Table 7.1 - Field Gas Supply Connections

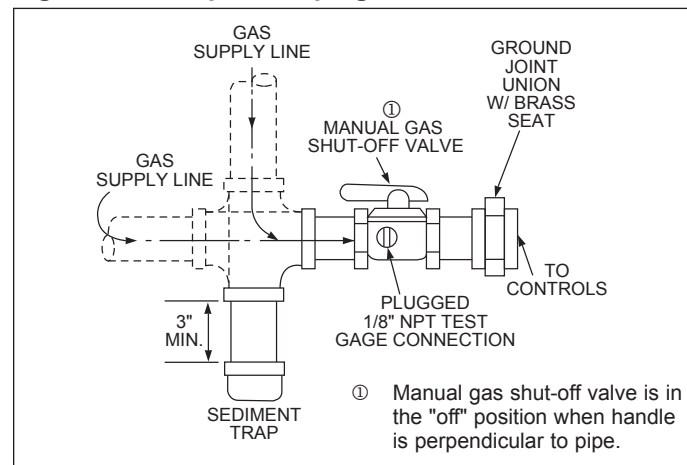
Manifold Size (Digits 9-12)	Connection Pipe Size	Inlet Pressure Range
0290	1/2"	7-14"
0375, 0625	3/4"	8-14"
0750, 0938, 1125, 1200	1"	0.5-1 psig
1500, 1875, 2100	1-1/4"	0.5-5 psig

4. Install a ground joint union with brass seat and a manual shut-off valve external to the unit casing, as shown in Figure 7.1, adjacent to the unit for emergency shut-off and easy servicing of controls. Include a 1/8" NPT plugged tapping accessible for test gauge connections.
5. Provide a sediment trap, as shown in Figure 7.1, before each unit and where low spots in the pipe line cannot be avoided.
6. This unit requires a constant minimum gas supply pressure when the unit is operating at maximum gas flow. Refer to Table 7.1 for the allowable range. If the gas supply pressure exceeds the range shown in Table 7.1, a gas pressure regulator must be installed before the unit to

prevent damage to the internal valve components. If the pressure is lower than the range shown in Table 7.1, the heater may not perform to specifications.

7. Support piping so that no strains are imposed on the unit controls when connected.
8. Blow out the gas line to remove debris before making connections.
9. Purge line to remove air before attempting to start unit. Purging of air from gas lines should be performed as described in ANSI Z223.1-latest edition "National Fuel Gas Code", or in Canada in CAN/CGA-B149.
10. All field gas piping must be pressure/leak tested prior to unit operation. Use a non-corrosive bubble forming solution or equivalent for leak testing. The heater and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi. The heater must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi.
11. Weatherize all utility clearance holes on the unit after connections have been made.

Figure 7.1 - Required Piping to Unit Gas Controls



Manifold Arrangements/Compliance

The standard ETL manifold arrangement is designed to meet ANSI standards. Additional manifold arrangements are available to comply with the requirements of FM (Factory Mutual) or GE GAP 4.3.1 (formerly IRI - Industrial Risk Insurers).

Refer to Model Number Digit 15 and the piping diagram affixed to the unit access door to determine which manifold arrangement was ordered.

INSTALLATION / PRIOR TO START-UP/OPERATION

Electrical Connections

⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. If equipped with the factory installed disconnect switch option, when the switch is in the "OFF" position, supply power remains energized at the supply power terminal strip and the top of the disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.
3. All appliances must be wired strictly in accordance with the wiring diagram furnished with the unit. Any wiring that is different from the wiring diagram could result in a hazard to persons and property.
4. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
5. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

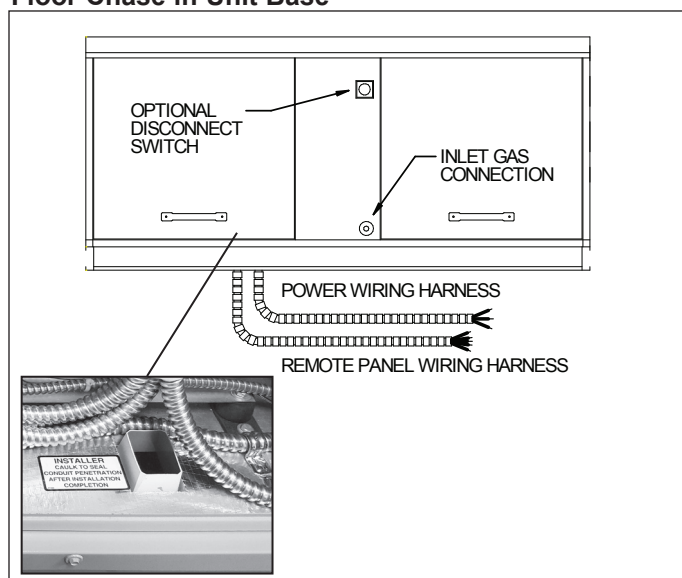
⚠ CAUTION

1. Since a failure of the unit may affect the proper operation of other fuel burning equipment in the building, the unit shall be electrically interlocked to open balancing air inlet dampers, or other such devices.
 2. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
1. Installation of wiring must conform with local building codes or, in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Part 1, Electrical Code.
 2. Job specific wiring diagrams are furnished with each unit. A permanent laminated diagram is located on the inside of the electric control cabinet door. All units are supplied with a labeled terminal strip for ease of wiring. Refer to this diagram for all wiring connections.
 3. Make sure all multi-voltage components (motors, transformers, etc.) are wired in accordance with the power supply voltage.
 4. The power supply to the unit must be protected with a lockable fused or circuit breaker disconnect switch. If a disconnect switch is not supplied with the unit, the field supplied disconnect must have adequate ampacity and must be installed in accordance with Article 430 of the National Electric Code, ANSI/NFPA 70.
 5. The power supply must be within 5% percent of the voltage rating and each phase must be balanced within 2% of each other. If not, advise the utility company.
 6. For ease of electrical connections, the unit includes two 10 foot long pre-wired wiring harnesses in flexible conduit. One harness is for the power wiring. The other harness is for the remote panel wiring. The wiring in both harnesses are labeled for ease of field connections. The harnesses can be routed through the base of the unit through the factory installed wiring harness floor chase. Refer to Figure 8.1.
 7. If the floor chase is not used and electrical connections

are made through the side of the unit, all outdoor electrical connections must be weatherized to prevent moisture from entering the electrical compartment.

8. External electrical connections to be installed include:
 - Supply power connection (115, 208, 230, 460, or 575 volts).
 - Connection of thermostats, remote monitoring panels, time clocks, or other accessory control devices that may be supplied (115 and/or 24 volts - refer to unit wiring diagram).
 - Connection of external electrical interlocks from devices such as fire damper actuator end switches, smoke detectors, exhaust fan interlocks, etc. Electrical interlocks that are to shut the unit down for safety reasons must be connected in the safety limit control circuit to cause the heater to shut down.

Figure 8.1 - Factory Installed Wiring Harnesses with Floor Chase in Unit Base



9. If the unit is not factory supplied with an optional timed freeze protection, then a low-temperature limit control must be field supplied and installed in areas where freeze protection is needed in the event of burner shutdown.
10. When complete, seal the opening of the floor chase (see Figure 8.1) so it is air tight.

PRIOR TO START-UP/OPERATION

Each unit is supplied with this Installation and Service Manual, which includes a Field Start-Up Form starting on page 41. The Field Start-Up Form must be followed and properly filled out by the installer, with one copy kept with the unit.

Before continuing with the start-up and checkout procedure, it is important to familiarize yourself with the controls and features of the unit. Review the following:

- Documents shipped with the unit to determine which options/controls are included.
- Pages 9 through 11 provide a detailed description of the model nomenclature.
- Pages 12 through 21 provide photographs, locations, and descriptions for unit features, options, accessories, and controls.

Once a thorough review of these controls and devices has been made, the step-by-step Start-Up Procedure as described on pages 22 through 27 must be performed.

MODEL NOMENCLATURE DESCRIPTION

Model Nomenclature Description

The following section details the 23 digit model number.

Digits 1,2,3 - Product Type

MCV = Direct Fired, 100% Outside Air, Constant Speed Fan

MVV = Direct Fired, 100% Outside Air, Variable Speed Fan

Digit 4,5,6 - Casing Size and Blower Wheel Size

Designates the Casing Size (1-5) and the Blower Size (08-20). Each has a defined airflow capability range. See Table 9.1.

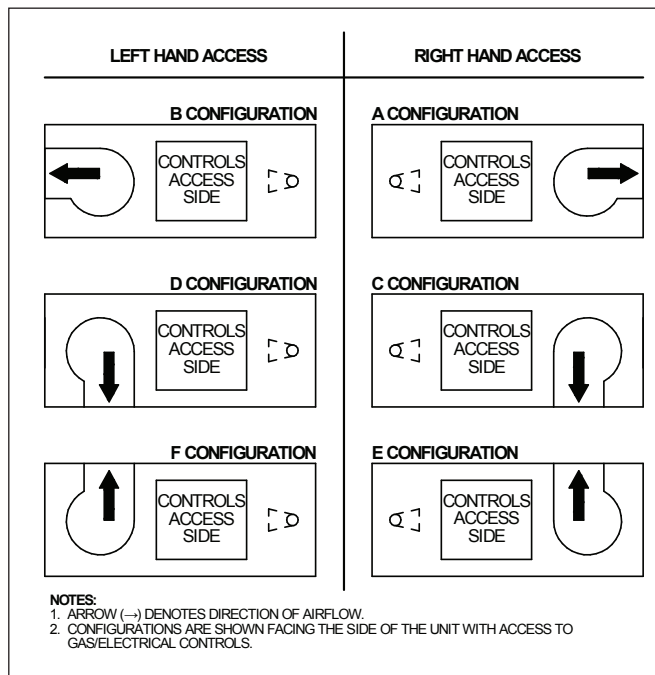
Table 9.1 - Casing Size and Blower Wheel Sizes

Casing Size (Digit 4)	Blower Size (Digits 5,6)	Blower Size Description	Airflow Range (CFM)	
			Min.	Max.
1	08	10 x 8"	800	2,200
2	10	10 x 10"	1,400	3,500
	12	12 x 12"	2,400	3,500
3	15	15 x 15"	3,200	8,000
4	18	18 x 18"	5,000	9,500
5	20	20 x 20"	5,500	14,000

Digit 7 - Unit Configuration

Designates the discharge location and controls access side. The control side is determined by looking into the intake of the unit and then specifying the access side (right or left hand). Includes access to gas manifold and electrical compartment. All units are horizontal orientation. See Figure 9.1.

Figure 9.1 - Unit Configurations - Graphical



Digit 8 - Burner Type

The burner design used influences maximum temperature rise and turndown capability.

X = MAXON Series NP-LE AIRFLO® with the following:

- Maximum temperature rise of 131°F for natural gas
- Maximum temperature rise of 95°F for propane gas
- Maximum supply air temperature of 130°F
- Maximum 30:1 turn down ratio

Digit 9,10,11,12 - Maximum Input Capacity (MBH)

Manifold/burner combinations are sized based on available burner lengths and manifold component capabilities. The model number will reflect the maximum rating for the selected manifold/burner combination, however the actual firing rate will be set to meet actual job requirements. Refer to Table 9.2.

Example:

Unit is to be sized for a firing rate of 1,758,400 Btu/Hr (1758 MBH). The unit would be ordered with Digits 9-12 of the model number selected as 1875 (1500 MBH would be too small). When the unit is produced, it will be setup to have an actual capacity of 1758 MBH.

Table 9.2 - Maximum Input Capacity

Digits 9-12	Maximum Input Capacity
0290	290,000 Btu/Hr
0375	375,000 Btu/Hr
0625	625,000 Btu/Hr
0750	750,000 Btu/Hr
0938	937,500 Btu/Hr
1125	1,125,000 Btu/Hr
1200	1,200,000 Btu/Hr
1500	1,500,000 Btu/Hr
1875	1,875,000 Btu/Hr
2100	2,100,000 Btu/Hr

Digit 13 - Gas Type and Inlet Pressure

Specifies the gas type and gas inlet pressure being used. For inlet gas pressure higher than shown in Table 9.3, install a field supplied step-down pressure regulator.

N = Natural Gas, Standard Pressure (see Table 9.3)

P = Propane Gas, Standard Pressure (see Table 9.3)

Table 9.3 - Standard Inlet Gas Pressure Ranges

Manifold Size (Digits 9-12)	Connection Pipe Size	Inlet Pressure Range
0290	1/2"	7-14"
0375, 0625	3/4"	8-14"
0750, 0938, 1125, 1200	1"	0.5-1 psig
1500, 1875, 2100	1-1/4"	0.5-5 psig

MODEL NOMENCLATURE DESCRIPTION (CONTINUED)

Digit 14 - Gas Control System

The gas control system controls the burner firing rate of the unit. All gas control types offered feature electronic modulation.

A = Maxitrol System 14

System 14 features a remote temperature dial for adjusting the discharge air temperature set point and a factory installed discharge air sensor and controls to maintain the desired discharge air temperature. The temperature set point range for this system is 55-90°F.

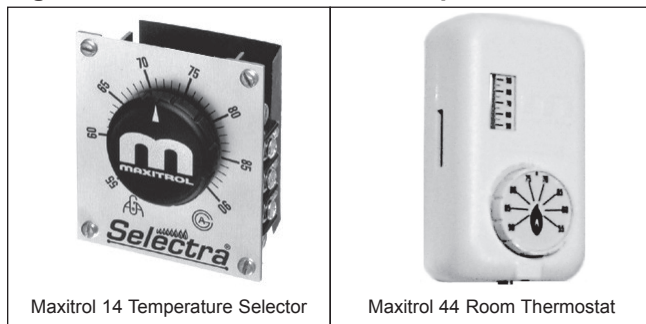
This system can be used with a remote panel mounted room temperature override thermostat. The thermostat automatically overrides the discharge air temperature setting to provide warmer discharge air until the room override thermostat is satisfied.

B = Maxitrol System 44

System 44 features a modulating room thermostat to control the main burner firing rate based on the room air temperature set point. The temperature set point range for this system is 55-90°F.

This system also includes a factory installed discharge air sensor, which is used as a high and low temperature limit control. The discharge air sensor will prevent make-up air from being delivered to the space at temperatures below the low setpoint, even if the room thermostat is satisfied. It will also prevent the room thermostat from over firing the burner when mild outdoor temperatures exist and the maximum firing capacity of the burner is not required to achieve an appropriate discharge air temperature.

Figure 10.1 - Maxitrol 14 & 44 Temp Selectors



C = Maxitrol SC25 for 4-20mA Control

D = Maxitrol SC25 for 0-10VDC Control

The SC25 system utilizes an external 4-20mA or 0-10VDC input signal (from the customer control system) to control the discharge air temperature.

This system includes a discharge air sensor high temperature limit control. The discharge air sensor will prevent make-up air being delivered to the space that is above the operating limit of 120°F.

L = Honeywell SPYDER Controller with LonWorks Protocol

M = Honeywell SPYDER Controller w/BACnet MS/TP Protocol

The SPYDER system is an advanced building management system (BMS) compatible HVAC controller with either a BACnet MS/TP or LonWorks interface. The system includes a LCD remote user interface that is easily navigated to provide access to all information needed to completely control, maintain, and troubleshoot the unit. All capabilities available at the remote are available over the network. The controller does allow the unit to function as a standalone device, therefore networking with a BMS is not required. The system includes a Maxitrol SC11 signal conditioner for the SPYDER to interface with the gas control system. Refer to page 21 for additional information on the TR75 LCD remote user interface.

Digit 15 - Insurance Compliance

All standard manifold arrangements are ETL certified to meet the ANSI standards for direct fired make-up air units.

Optional manifold arrangements are available to meet the requirements of FM (Factory Mutual) or GE GAP (formerly IRI - Industrial Risk Insurers).

E = ETL (standard)

F = FM

G = GE GAP 4.3.1 (formerly IRI)

Digit 16 - Additional Manifold Options

Additional manifold options are available to provide either additional equipment protection, compliance with local code requirements, and/or enhanced serviceability.

N = None

A = Inlet Gas Pressure Gauge (IGPG)

An inlet gas pressure gauge provides visual indication of the incoming gas pressure to the unit. Units require a minimum pressure to provide successful ignition and correct combustion performance.

B = Burner Gas Pressure Gauge (BPG)

A burner gas pressure gauge provides visual indication of the gas pressure being delivered to the burner. Correct gas pressure to the burner is required to provide the firing rate capacity for the actual job design conditions. It also ensures proper flame performance at low fire conditions.

C = High and Low Gas Pressure Switches (HLGPS)

A high gas pressure switch monitors the gas supply pressure downstream of all the gas controls and disables the gas controls if high gas pressure is experienced immediately before the burner. This will shut off all gas flow to the burner to avoid the gas controls from being damaged or causing the unit to over fire.

A low gas pressure switch monitors the gas supply pressure upstream of all the gas controls and disables the gas controls if low gas pressure is experienced. This will shut off all gas flow to the burner to avoid the burner from having difficulty lighting properly or maintaining a proper flame.

Both the low and high gas pressure switches are manual reset so that a service person must inspect the unit to make sure that none of the gas controls have been damaged. The switch must then be reset to allow the unit to operate when the gas pressure is returned to the normal operating pressure.

D = IGPG and BPG

Combination of options A and B above.

E = IGPG and HLGPS

Combination of options A and C above.

F = BPG and HLGPS

Combination of options B and C above.

G = IGPG, BPG, and HLGPS

Combination of options A, B, and C above.

Digit 17 - Ignition/Flame Safeguard System

Designates the ignition system and flame safeguard system used to maintain safe burner operation.

A = Direct Spark Ignition with Flame Rod Flame Supervision
(Standard on units up to and including 1125 MBH)

B = Interrupted Pilot Ignition with Flame Rod Supervision
(Standard on units 1200 MBH and larger)

MODEL NOMENCLATURE DESCRIPTION (CONTINUED)

Digit 18 - Supply Voltage

Indicates the supply voltage for the unit. A step down transformer may be included for reducing the supply voltage to either 24V or 115V for the unit controls.

- | | |
|-------------------|-------------------|
| 1 = 115V/60Hz/1Ph | 5 = 230V/60Hz/3Ph |
| 2 = 208V/60Hz/1Ph | 6 = 460V/60Hz/3Ph |
| 3 = 230V/60Hz/1Ph | 7 = 575V/60Hz/3ph |
| 4 = 208V/60Hz/3Ph | |

Digit 19 - Blower Bearings and Vibration Isolation

The blower assemblies are available in several configurations of bearing type and vibration isolation. All units feature neoprene vibration isolation as standard with several upgrades available depending on the Casing Size of the unit selected.

A = Spider Bearings - Neoprene Vibration Isolation

Spider bearings include blower mounted bearing brackets with permanently lubricated ball bearings. Spider bearings are designed for use in low motor horsepower applications and are standard for Casing Sizes 1-4.

Neoprene vibration isolation provides basic isolation of the blower and motor from the base of the unit to minimize the transmission of vibration.

B = Pillow Block Bearings - Neoprene Vibration Isolation

Pillow block bearings include heavy-duty pillow block bearing housings with greasable internal ball bearings that are rigidly fastened to two blower support channels. Pillow block bearings are optional on Casing Sizes 1-4 and standard on Casing Size 5 units.

Neoprene vibration isolation provides basic isolation of the blower and motor from the base of the unit to minimize the transmission of vibration.

C = Spider Bearings - Spring Vibration Isolation

Spider bearings are as described above in option A.

The neoprene isolation is replaced by spring isolation with up to 1" deflection, providing a robust vibration isolation solution. This option is available on Casing Sizes 2-4.

D = Pillow Block Bearings - Spring Vibration Isolation

Pillow block bearings are as described above in option B.

The neoprene isolation is replaced by 1" deflection spring isolation providing a robust vibration isolation solution. This option is available on Casing Sizes 2-5.

E = Spider Bearings - Rubber-In-Shear Vibration Isolation

Spider bearings are as described above in option A.

The neoprene isolation is replaced by rubber-in-shear (R-I-S) isolation providing a robust vibration isolation solution that rivals spring isolation at a lower cost. This option is available on Casing Sizes 1-4.

F = Pillow Block Bearings - Rubber-In-Shear Vibration Isolation

Pillow block bearings are as described above in option B.

The neoprene isolation is replaced by rubber-in-shear (R-I-S) isolation providing a robust vibration isolation solution that rivals spring isolation at a lower cost. This option is available on Casing Sizes 1-5.

Extended grease lines are available as an option on units with pillow block bearings to allow for greasing of the bearings from outside the unit cabinet. Please see the Options section for additional information on this option.

For suspended or slab mounted units, field installed vibration hangers or feet are also available as a cost-effective vibration isolation solution. Please refer to the Accessories section for

additional information.

Digit 20 - Motor Horsepower

The required motor horsepower is determined by the airflow (CFM) and total static pressure (internal + external static pressure) and varies based on the blower size selected in Breeze® AccuSpec.

Model MCV units include a factory installed motor starter with overload protection as standard. For model MVV units, the VFD replaces the motor starter.

- | | |
|-----------|-----------|
| A = 1/2 | F = 3 |
| B = 3/4 | G = 5 |
| C = 1 | H = 7-1/2 |
| D = 1-1/2 | J = 10 |
| E = 2 | K = 15 |

Digit 21 - Motor Type

Blower motors are available in Open Drip Proof and Totally Enclosed styles. Motors rated for 3 phase voltages that are 1HP and larger are NEMA Premium Efficiency motors.

- 1 = Open Drip Proof (ODP)
- 5 = Totally Enclosed (TE)

Digit 22 - Cabinet Finish and Installation Location

Casings are made with G90 galvanized steel and can be provided as either unpainted or painted, as well as for indoor or outdoor installations. Casing is insulated with 1" thick, 1-1/2 lb. density foil-faced insulation as standard with G90 galvanized steel liners available as an option.

- A = Unpainted, Outdoor Installation
- B = Unpainted, Indoor Installation
- C = Painted Exterior, Outdoor Installation
- D = Painted Exterior, Indoor Installation
- E = Painted Interior and Exterior, Outdoor Installation
(Requires Digit 23=2 for Double Wall Galvanized Liner Option)
- F = Painted Interior and Exterior, Indoor Installation
(Requires Digit 23=2 for Double Wall Galvanized Liner Option)

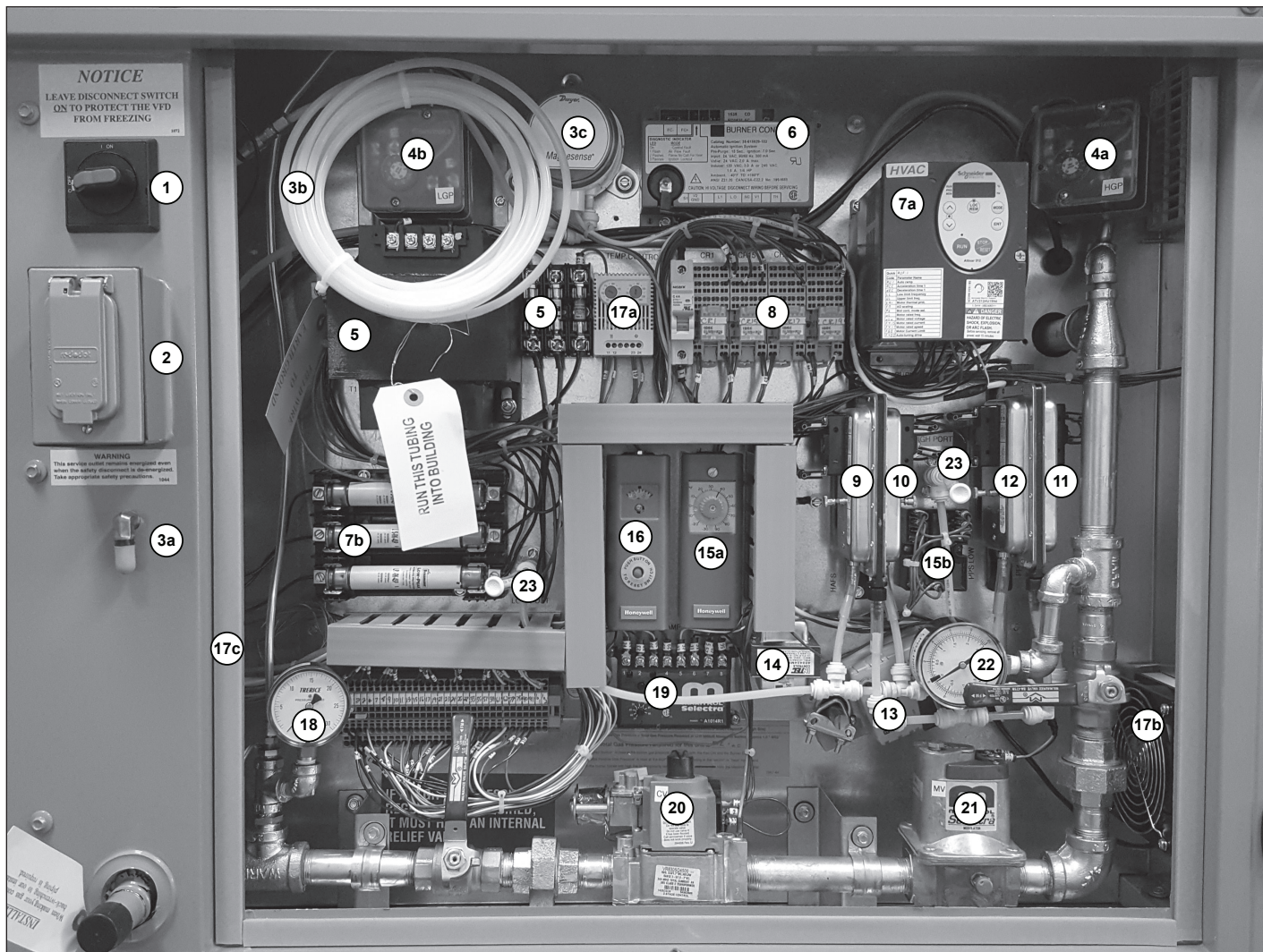
Digit 23 - Cabinet Insulation

All units are fully insulated as standard (walls, roof, and floor).

- 1 = 1" Fiberglass Insulation - Foil Faced
- 2 = 1" Fiberglass Insulation - Galvanized Double Wall Liners

UNIT FEATURES - CONTROL CABINET

Figure 12.1 - Standard Feature and Factory Mounted Option Locations - Control Cabinet



The following refer to Figure 12.1. These items are described in greater detail on the following pages. Note that (S) indicates a Standard feature and (O) indicates an Optional feature.

1. (O) Non-Fused Disconnect Switch
2. (O) GFI Convenience Outlet
3. (O) Space Pressure Control, consisting of:
 - a. Outdoor Pressure Pickup
 - b. Indoor Pressure Pickup with Tubing
 - c. Space Pressure Transmitter
4. (O) High and Low Gas Pressure Switches
 - a. High Gas Pressure Switch
 - b. Low Gas Pressure Switch
5. (S) Control Power Transformer and Fuses
6. (S) Flame Safeguard Control
7. (O) Variable Frequency Drive and Fuses
 - a. Variable Frequency Drive
 - b. Fuses for VFD Protection
8. (S & O) Control Relays
9. (S) High Air Flow Cutoff Switch
10. (S) Low Air Flow Proving Switch
11. (S) High Burner Profile Pressure Switch
12. (S) Low Burner Profile Pressure Switch
13. (S) Profile Bypass Damper Actuator
14. (S) 24V Isolation Transformer
15. (O) Timed Freeze Protection, consisting of:
 - a. Low Limit Discharge Duct Thermostat
 - b. Freeze Protection Timer
16. (S) High Temperature Limit Thermostat
17. (O) Cabinet Temperature Control, consisting of:
 - a. Enclosure Mounted Thermostat
 - b. Enclosure Cooling Fan
 - c. Enclosure Heater
18. (O) Inlet Gas Pressure Gauge
19. (S) Temperature Control Amplifier or Signal Conditioner
20. (S) Main Gas Valve
21. (S) Modulating Gas Valve
22. (O) Burner Gas Pressure Gauge
23. (S) Profile Pressure Test Ports (Qty 2)

UNIT FEATURES - CONTROL CABINET

The following details the standard and factory installed options available as shown in Figure 12.1. [(S)=Standard, (O)=Option]

1. (O) Non-Fused or Fused Disconnect Switch

⚠ WARNING

If equipped with the factory installed disconnect switch option, when the switch is in the "OFF" position, supply power remains energized at the supply power terminal strip and the top of the disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.

Factory installed on the stationary panel next to the door, the switch provides a convenient method of turning off power to the unit. When in the "OFF" position, power is disconnected to all unit wiring electrically following the switch but remains energized before the switch (See Warning). Available as non-fused or fused.

2. (O) GFI Convenience Outlet

Includes a 115V/1ph duplex weatherproof service receptacle mounted on the exterior of the cabinet. Available as either powered by others (shown) or powered by the unit (not shown). When powered by unit, the unit includes an additional unit-mounted disconnect switch and step-down transformer for supply voltages above 115V.

3. (O) Space Pressure Control

This configuration is typically used to maintain a slightly positive pressure in the building to reduce infiltration. It is also used to provide variable volume make-up air for buildings that have multiple exhaust loads that cannot be interlocked to one make-up air unit. This option includes the following factory installed items:

- Outdoor Pressure Pickup (or Indoor Pressure Pickup for indoor mounted units)
- Indoor Pressure Pickup with 12' Tubing for routing to space (or Outdoor Pressure Pickup for indoor units)
- Pressure Transmitter

The pressure transmitter monitors the space pressure relative to the outdoor air pressure and adjusts the VFD speed from full rated speed to as low as 35% of rated speed to bring in more or less outside air.

4. (O) High and Low Gas Pressure Switches

- The low gas pressure switch monitors the gas supply pressure ahead of all the gas train components to ensure there is sufficient pressure for proper ignition. If the gas pressure is below the setpoint of the switch, the flame safeguard controller is disabled and the switch must be manually reset to allow the unit to function.
- The high gas pressure switch monitors the gas pressure between the gas manifold components and the burner to ensure the gas pressure has not exceeded the maximum rating. Gas pressures above the maximum rating may damage the gas train components or cause the unit to overfire. If the gas pressure is above the setpoint of the switch, the flame safeguard controller is disabled and the switch must be manually reset to allow the unit to function.

5. (S) Control Power Transformer and Fuses

All units include a transformer used to reduce the supply voltage to the voltage required for the unit controls.

6. (S) Flame Safeguard Control

The flame safeguard control monitors safety devices to determine if the gas ignition sequence should be initiated. Once initiated, the control will also monitor a flame rod flame sensor to ensure proper burner flame control. The control includes a pre-purge timer to clear any residual gas in the unit before ignition can be initiated. The ignition type varies by unit capacity as follows:

- Digits 9-12=0290-1125 MBH: Direct Spark (Shown in Figure 12.1)

Figure 13.1 - Fireye μ M Flame Safeguard Control



- Digits 9-12=1200-2100 MBH: Interrupted Pilot (See Figure 13.1)

7. (O) Variable Frequency Drive and Fuses

Units with model number Digit 2=V are equipped with a factory installed VFD to provide control of air volume through varying the speed of the blower from 100% down to as low as 35%. The VFD can be programmed to provide any one of the following control configurations:

- Constant Speed (field adjustable):** VFD will operate at full speed but can be adjusted in the field.
- Two Speed:** VFD will operate at full rated speed or user defined low speed. The remote panel will include a High/Low speed switch for high/low speed changeover.
- External 4-20mA or 0-10VDC Control Signal:** VFD can be externally controlled from full rated speed down to 35% of rated speed. Unit includes terminals for landing external control wiring.
- Space Pressure Control:** See #3 for information on this control configuration.

8. (S & O) Control Relay

Includes double-pole, double throw (DPDT) contacts for sequence of operation control switching. The function of the relays must be specified at the time of order.

9. (S) High Air Flow Cutoff Switch

The switch monitors the pressure drop across the burner to ensure the air flow through the burner does not exceed the maximum design velocity. The switch is electrically interlocked with the flame safeguard control (#6).

10. (S) Low Air Flow Proving Switch

The switch monitors the pressure drop across the burner to insure that sufficient air flow exists before allowing the burner to operate. The switch is electrically interlocked with the flame safeguard control (#6).

UNIT FEATURES - CONTROL CABINET

Items #11 through #13 are part of the Auto-Velocity™ profile system that constantly and automatically adjusts a burner profile bypass damper to maintain proper burner air velocity for optimal combustion. The system has a range of operation to allow for correction of airflow changes from filters becoming dirty, changes in airflow when using a VFD, or slight changes in system duct static pressure. It does not eliminate the requirement for proper system balancing at commissioning. The Auto-Velocity™ profile system components are as follows (refer to Figures 12.1 and 14.1):

11. (S) High Burner Profile Pressure Switch

The switch monitors the pressure drop across the burner and if the pressure is too high (excessive airflow), the profile bypass damper motor (#13) is energized to adjust the profile balancing damper to allow more airflow to bypass the burner to reduce the pressure drop (velocity) into the acceptable range.

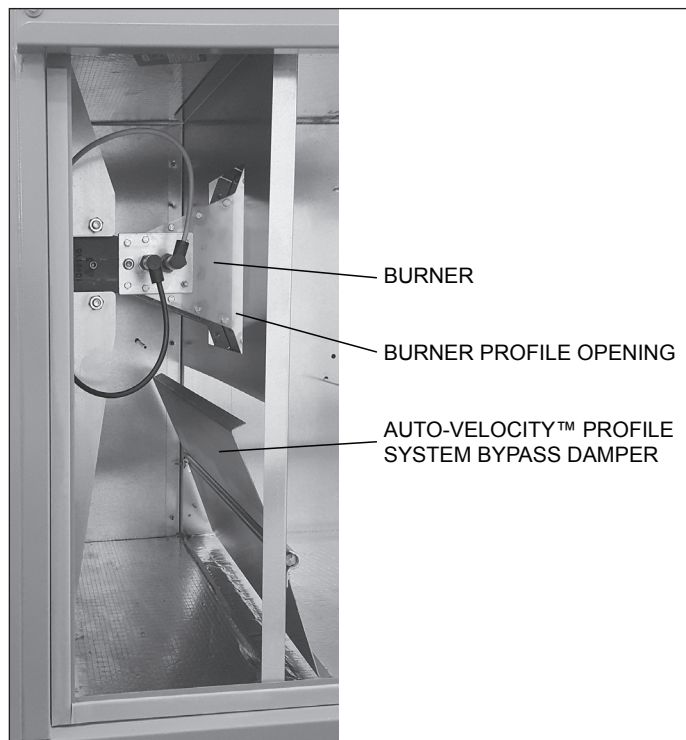
12. (S) Low Burner Profile Pressure Switch

The switch monitors the pressure drop across the burner and if the pressure is too low (reduced airflow), the profile balancing motor (#13) is energized to adjust the profile balancing damper to allow less airflow to bypass the burner to increase the pressure drop (velocity) into the acceptable range.

13. (S) Profile Bypass Damper Actuator

The damper actuator is directly coupled to the profile bypass damper and will increase or decrease the opening position based on changes in burner profile velocity as measured by the high and low profile pressure switches (#11 and #12).

Figure 14.1 - Auto-Velocity™ Profile System



14. (S) 24V Isolation Transformer

A 24V to 24V transformer is used to electrically isolate sensitive controls from the rest of the control circuit.

15. (O) Timed Freeze Protection

A low limit duct thermostat monitors the discharge air temperature and if below the setpoint, the unit will shut down to prevent delivery of cold air. Includes the following:

a. Low Limit Discharge Duct Thermostat: The control is mounted in the control cabinet while the sensor is mounted in the blower cabinet (see Figure 15.1).

b. Freeze Protection Timer: The 5 minute timer allows the unit to go through the normal start-up sequence while temporarily bypassing the low limit discharge duct thermostat.

16. (S) High Temp Limit Thermostat

The high temperature limit control prevents the burner from firing if excessive heated air temperatures are experienced. The limit control is mounted on the blower housing and is electrically interlocked with the flame safeguard control (#6). The switch requires a manual reset if tripped.

17. (O) Cabinet Temperature Control

Cabinet temperature control options are available for units with a factory mounted VFD. In extreme ambient temperatures, the temperature in the cabinet can impact the performance and longevity of the VFD. Includes some or all of the following:

a. Enclosure Mounted Thermostat: Activates heating and/or cooling fan operation as needed. Always included with either (b) or (c).

b. Enclosure Cooling Fan: Required for locations where the unit is in ambient temperatures 85°F and higher.

c. Enclosure Heater: Required for locations where the unit is in ambient temperatures below 0°F. For temperatures between 0° and 15°F, the heater is recommended but not required.

18. (O) Inlet Gas Pressure Gauge

The inlet gas pressure gauge option allows a contractor to easily determine if the gas pressure entering the unit is within the range required without having to connect an external manometer.

19. (S) Temperature Control Amplifier or Signal Conditioner

The amplifier converts the temperature control signal from the discharge air temperature sensor (and room temperature sensor if the Maxitrol 44 system is used) or external signal for Maxitrol SC25 systems and modulates the gas valve (#21) to maintain the air temperature setpoint.

20. (S) Main Gas Valve

All units are supplied with redundant automatic main gas shut-off valves to control gas flow to the modulating gas valve (#21). These valves may be a combination gas valve as shown, which have two valve seats in one valve body (Digits 9-12=0625 and smaller), or two separate valves on units with larger capacities (Digits 9-12=0750 to 2100).

21. (S) Modulating Gas Valve

The modulating gas valve is controlled by the temperature control amplifier or signal conditioner (#19) to vary the flow of gas to the burner.

22. (O) Burner Gas Pressure Gauge

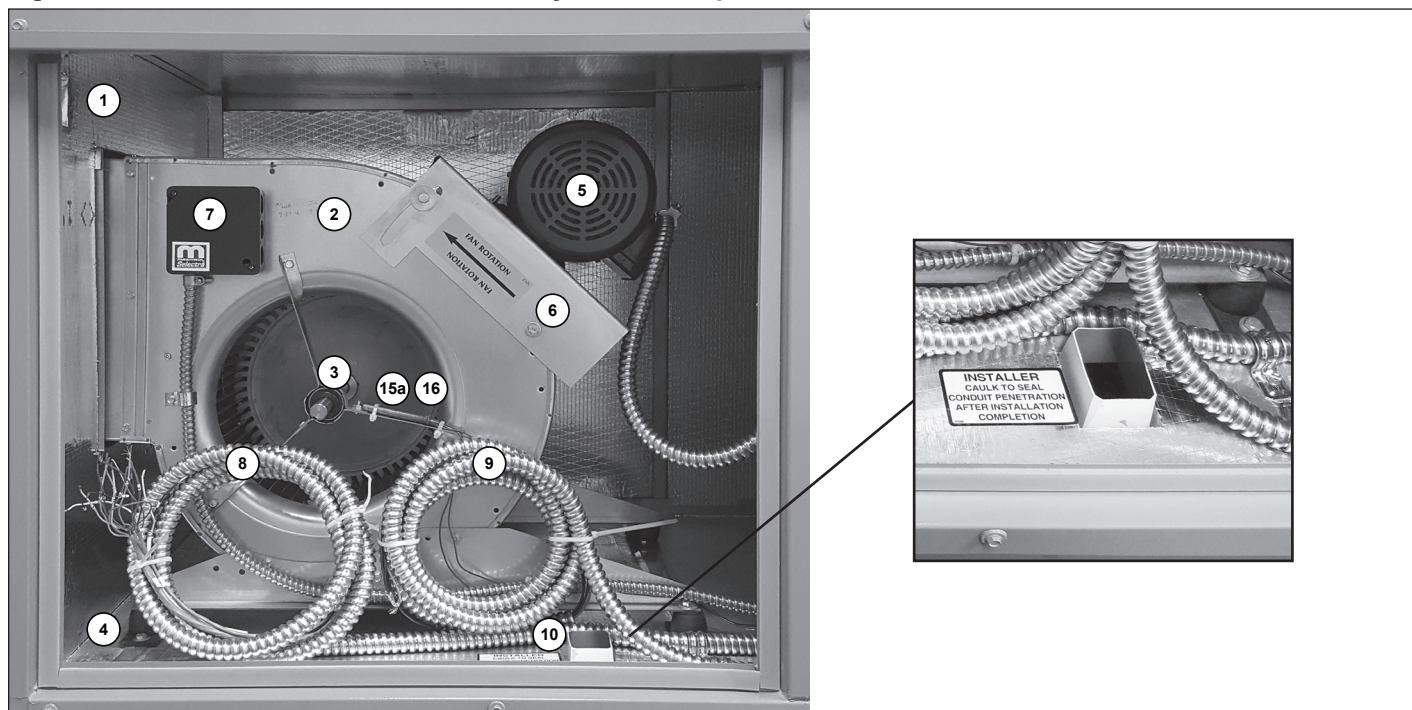
The burner gas pressure gauge option allows a contractor to easily determine if the gas pressure to the burner matches the manifold pressure listed on the serial plate to ensure the unit is firing at the correct capacity without having to connect an external manometer.

23. (S) Profile Pressure Test Ports (2)

Used during startup to easily connect a manometer to measure profile pressure drop during unit balancing.

UNIT FEATURES - BLOWER CABINET

Figure 15.1 - Standard Features and Factory Mounted Option Locations - Blower Cabinet



The following refer to Figure 15.1. These items are described in greater detail on this page. Note that (S) indicates a Standard feature and (O) indicates an Optional feature.

1. (S) Flame Observation Port

Provides visible indication of the flame and flame quality while the unit is operating with the casing closed.

2. (S) DWDI Blower Wheel

Double Width, Double Inlet blower wheel with sizes as indicated on page 9.

3. (S) Blower Bearing Assembly

Most blower assemblies are available with either spider bearings or pillow block bearings as follows:

- **Spider Bearings (shown):** Standard for Casing Sizes 1-4, not available on Casing Size 5. Spider bearings include blower mounted bearing brackets with ball bearings. Spider bearings are designed for use in lower torque applications as seen on the smaller blowers. Spider bearings are permanently lubricated.
- **Pillow Block Bearings:** Optional for Casing Sizes 1-4, standard for Casing Size 5. This option includes two heavy duty pillow block bearing housings rigidly fastened to two blower support channels. Pillow block bearings are available for all applications, but are required for high torque applications seen on larger blowers. Pillow block bearings require lubrication as part of normal maintenance.

(O) Extended Bearing Grease Lines (not shown)

Extended grease lines are an available option for pillow block bearings. They include factory installed grease lines extending from the blower bearings to Zerk fittings on the outside of the unit cabinet.

4. (S) Blower/Motor Vibration Isolation

All units include neoprene blower/motor assembly vibration isolation as standard. For more robust vibration isolation, the following options are detailed further on page 11:

- (O) Rubber-In-Shear isolation on all sizes (Fig 15.1).
- (O) Spring isolation on all except Casing Size 1.

5. (S) Supply Air Blower Motor

6. (S) Adjustable Motor Base

Provides adjustability of the motor position to ensure correct drive belt tension.

7. (S) Maxitrol Discharge Air Sensor

Standard for Maxitrol 14 and 44 gas controls systems, the sensor provides functions specific to the gas control type.

- **Maxitrol 14:** The sensor measures the discharge air temperature and provides feedback to the Maxitrol 14 controller to maintain the discharge air temperature setpoint by modulating the gas valve.
- **Maxitrol 44:** The sensor measures the discharge air temperature and provides feedback to the Maxitrol 44 controller to limit the modulation range so that temperatures do not fall outside the allowed range.

For more information, refer to page 10.

8. (S) Wiring Harness - Control Wiring

The 10 foot long pre-wired harness in flexible conduit allows for quick connection to the remote panel mounted in the space. The wires are numbered to correspond to a numbered terminal strip within the remote panel.

9. (S) Wiring Harness - Power Wiring

The 10 foot long pre-wired harness in flexible conduit allows for quick connection to the supply power for the unit.

10. (S) Floor Mounted Wiring Chase

Provides an easy pathway through the floor of the unit to route the Control and Power Wiring Harnesses to the space without needing to drill holes.

15a.(O) Timed Freeze Protection

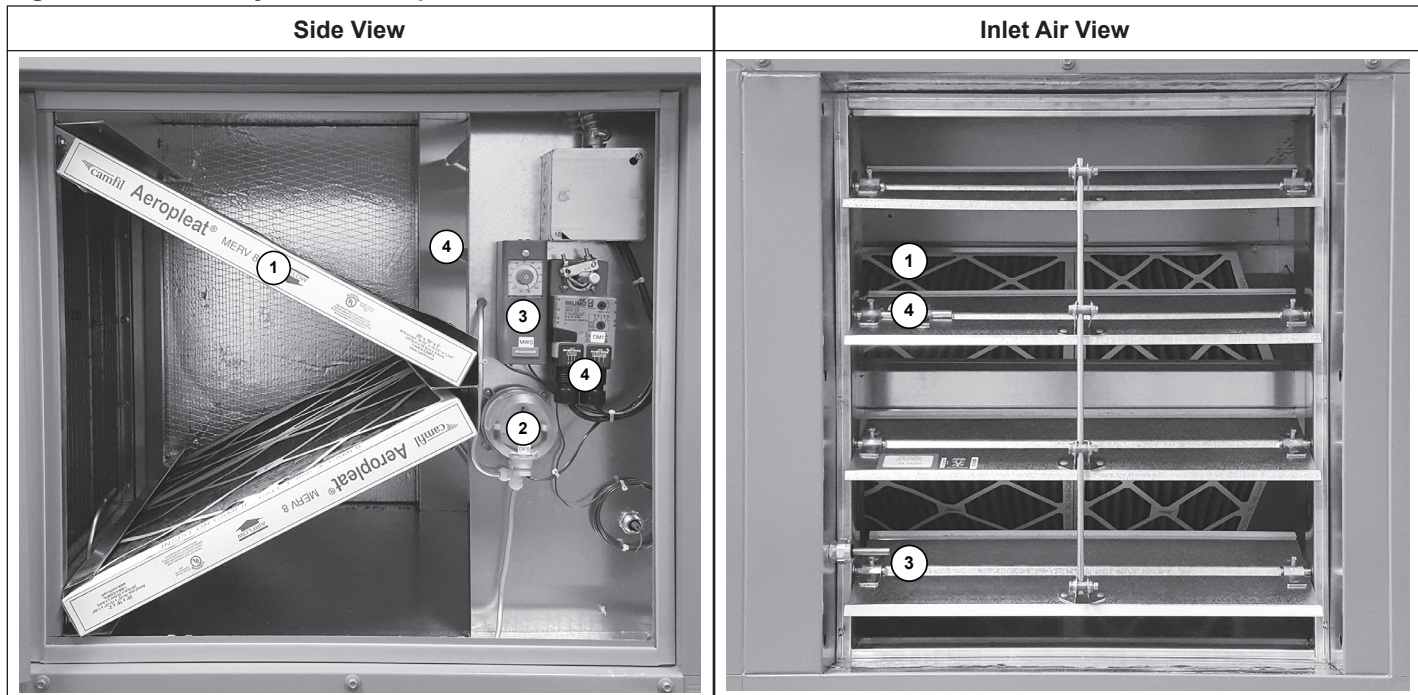
The timed freeze protection discharge sensor. See page 14 for a full description of this feature.

16. (S) High Temp Limit Thermostat

The high temp limit discharge sensor. See page 14 for a full description of this feature.

UNIT FEATURES - OPTIONAL SIDE ACCESS FILTER SECTION

Figure 16.1 - Factory Mounted Options - Side Access Filter Section



The following refer to Figure 16.1. These items are described in greater detail on this page. Note that (S) indicates a Standard feature and (O) indicates an Optional feature.

1. (O) Side Accessible Filters

The side access filter section is optional and is used to filter outside air drawn through the unit. Available either painted or unpainted to match the unit. The section is available with several filter configurations:

- 2" permanent, aluminum mesh washable filters
- 2" disposable MERV 8 pleated filters (shown)
- 2" disposable MERV 13 pleated filters

2. (O) Dirty Filter Switch

A differential pressure switch that measures the pressure drop across the filter media. When the pressure drop exceeds the setpoint, the switch closes to indicate the filters need to be serviced.

3. (O) Mild Temperature Inlet Duct Thermostat

Used to automatically shut off the burner when the inlet air temperature reaches the desired setpoint to prevent the burner from running at low fire during mild outdoor air temperature conditions.

4. (O) Inlet Damper

Used to prevent conditioned building air from exiting the building through the unit when the unit is not operating. Both standard and low leak dampers are available. The inlet damper option includes a 2-position damper actuator that is available as either power or spring closed. The damper actuator includes an end switch to prevent unit operation unless the dampers are open.

Discharge dampers are also available. Please see page 21 for additional details.

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UNIT FEATURES - OPTIONAL EVAPORATIVE COOLER

Evaporative Cooling Module

Outdoor units can be provided with a factory installed evaporative cooling module. The evap casing is unpainted, 304 grade stainless steel to provide outstanding corrosion resistance. The evaporative cooler is a simple, non-recirculating design that reduces up-front costs and maintenance. Benefits of the non-recirculating design are the following:

- A recirculation pump and float switch are not required.
- No sump required, reducing maintenance and water usage to reduce microbial growth that can occur from poorly maintained recirculating systems.
- There is a continuous wash-down of the media with fresh water to keep it flushed, increasing the lifespan of the media and reducing maintenance.
- There is reduced risk of freeze damage that can be seen with recirculating units with a sump.

Figure 18.1 - Evaporative Cooler - Side Access

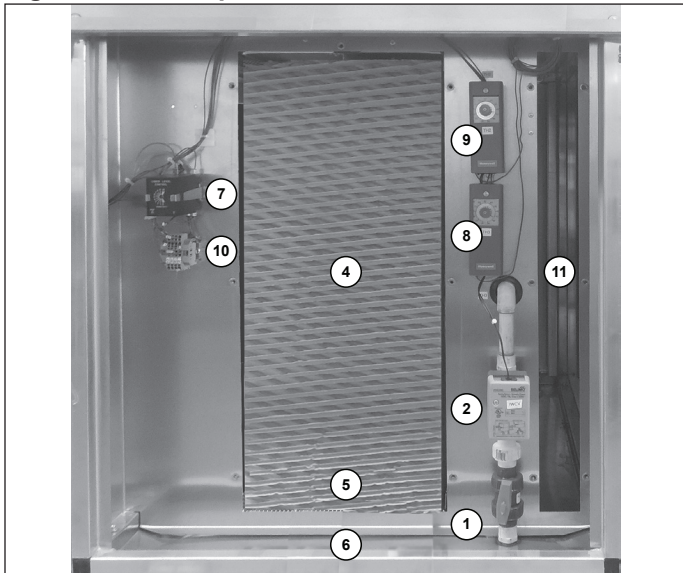


Figure 18.2 - Evaporative Cooler - Inlet Air Opening



The following details the standard and factory installed options available as shown in Figures 18.1 and 18.2. [(S)=Standard, (O)=Option]

1. (S) Water Supply Connection

Includes a hand shut-off valve as standard. An accessory Water Supply Valve Kit (not pictured) is available that provides the following:

- Supply water valve (2-way)
- Supply line drain valve (2-way)
- Freeze thermostat

When ordered, this kit is shipped loose for field installation in a frost free environment (typically below the roof line). Refer to the Installation & Service Manual for additional details.

2. (S) Internal Water Control Valve (IWCV)

Valve controlled by the Liquid Level Controller (LLC) to allow water flow to the water distribution piping when wetted media is required.

3. (S) PVC Water Distribution Piping

The piping includes spray nozzles that uniformly distribute water on the face of the media.

4. (S) Evaporative Cooling Media

The standard media is Munters 12" CELdek® Cellulose evaporative cooling media.

For applications requiring UL 900, Class 2 fire rating and compliance with NFPA codes, optional Munters 12" GLASdek® Fiberglass media is offered. The media is accessible from the side access opening (media access cover removed for display purposes).

5. (S) Overflow Water Sensor (OWS) (not shown)

On a call for cooling, the Liquid Level Controller (#7) monitors the overflow water sensor, located at the bottom of the media, and opens the IWCV (#2) to provide water flow to wet the media. When the OWS senses moisture, that is an indication that the media is saturated and the LLC turns off the IWCV (#2) to conserve water.

6. (S) 304 Stainless Steel Casing and Pitched Drain Pan

Stainless steel offers outstanding corrosion resistance. Includes shipped loose adjustable leveling legs for support (not shown).

7. (S) Liquid Level Controller (LLC)

Controller that monitors the OWS (#5) to determine if the IWCV (#2) should be open or closed. Optimizes water consumption to avoid excessive water usage.

8. (S) Outdoor Air Thermostat

Measures the outside air temperature, and if the temperature is above the setpoint, a call for cooling is initiated to the LLC (#7).

9. (O) Freeze Thermostat

Measures the outside air temperature, and if the temperature is below the setpoint, prevents the evaporative cooler supply water valve from being energized. This is part of the Water Supply Valve Kit discussed in #1.

10. (S) Auxiliary Wiring Terminal Strip

The auxiliary wiring terminal strip is used for factory wiring between the evap cooler controls and the main unit terminal strip.

11. (O) 2" Permanent Aluminum Mesh Pre-Filters

Optional pre-filters (not shown) can be added in the empty slot indicated by #11. The filters are accessible from the side access opening (filter access cover removed for display purposes).

Also available as a field installed accessory (not shown) is an inlet hood that can be with or without 2" thick permanent aluminum mesh filters.

UNIT FEATURES - OPTIONAL EVAPORATIVE COOLER

Evaporative Cooling Performance Example

Evaporative cooling works by placing a wet media in the entering air stream of the cooling unit. As the air passes through the media, sensible heat from the air is transferred to the water in the cooling media, causing the water to evaporate. Because the sensible heat from the air is simply transferred to the water, and both the water vapor and cooled air remain in the system, there is no net energy change in the system. However, the dry bulb temperature of the air has been lowered and provides cooling for the space.

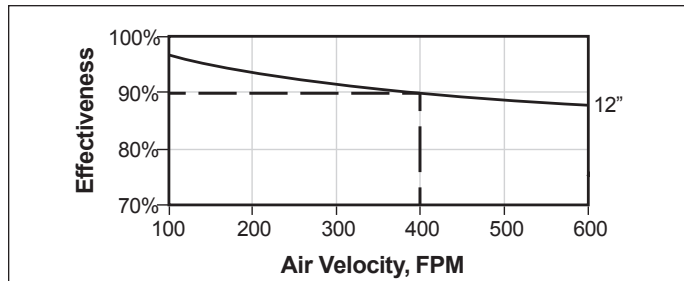
The temperature of the cooling air will be dependent on three criteria. These criteria are:

- The design dry bulb temperature
- The design wet bulb temperature
- The percent effectiveness of the cooling media which is obtained from the media performance curve shown in Figure 19.1. The effectiveness is based on the velocity, which can be calculated by dividing the airflow in CFM by the face area of the cooling media as shown in Table 19.1.

Table 19.1 - Evaporative Cooler Performance Data

Unit Casing Size (Digit 4)	Evap Cooler Size	Max CFM	Media Area (sq. ft.)
1	EVCNR1	2,200	4.00
2	EVCNR2	3,500	5.78
3	EVCNR3	5,000	9.17
	EVCNR4	7,500	13.33
4	EVCNR4	7,500	13.33
	EVCNR5	9,500	20.00
5	EVCNR5	11,000	20.00
	EVCNR6	14,000	25.00

Figure 19.1 - Evaporative Cooler Effectiveness Curve



Example: Determine the final dry bulb temperature for a unit with Casing Size 4, rated airflow of 8000 CFM, installed in Phoenix, Arizona. Also, determine the approximate gallons per hour evaporated and the apparent cooling capacity of the evaporative cooler.

The following are the steps to determine the solution to the example problem above:

1. The 1.0% design conditions are 110°F DB/70°F WB.
2. There are two options for Casing Size 4 units shown in Table 19.1, however only one can be operated at 8000 CFM, the EVCNR5 unit. The Media Area is 20.0 ft². The air velocity is then calculated as follows:

$$\text{FPM} = \text{CFM} / \text{Media Face Area} = 8000 \text{ CFM} / 20 \text{ ft}^2 = \mathbf{400 \text{ FPM}}$$
3. The media effectiveness is determined in Figure 19.1 (Y-axis) by finding where the effectiveness curve intersects 400 FPM velocity on the X-axis. In this example, the effectiveness is approximately **90%**.
4. Determine final dry bulb air temperature of conditioned air by using the following formula:

$$\text{LAT} = \text{EAT DB} - (\% \text{ Eff.} \times (\text{EAT DB} - \text{EAT WB}))$$

$$\text{LAT} = 110^\circ\text{F} - (0.90 \times (110^\circ\text{F} - 70^\circ\text{F})) = \mathbf{74^\circ\text{F DB}}$$
5. The gallons per hour evaporated is calculated as follows:

$$\text{G.P.H.} = (1.2 \times \text{CFM} \times (\text{EAT DB} - \text{LAT DB})) / 10,000$$

$$\text{G.P.H.} = (1.2 \times 8,000 \text{ CFM} \times (110^\circ\text{F} - 74^\circ\text{F})) / 10,000 = \mathbf{34.6}$$
6. The cooling capacity, Q, of the unit is defined as the apparent cooling capacity because it is dependent on a specific set of temperature conditions. As these conditions change, so will the apparent cooling capacity. The formula is as follows:

$$Q = 1.08 \times (\text{EAT DB} - \text{LAT DB}) \times \text{CFM}$$

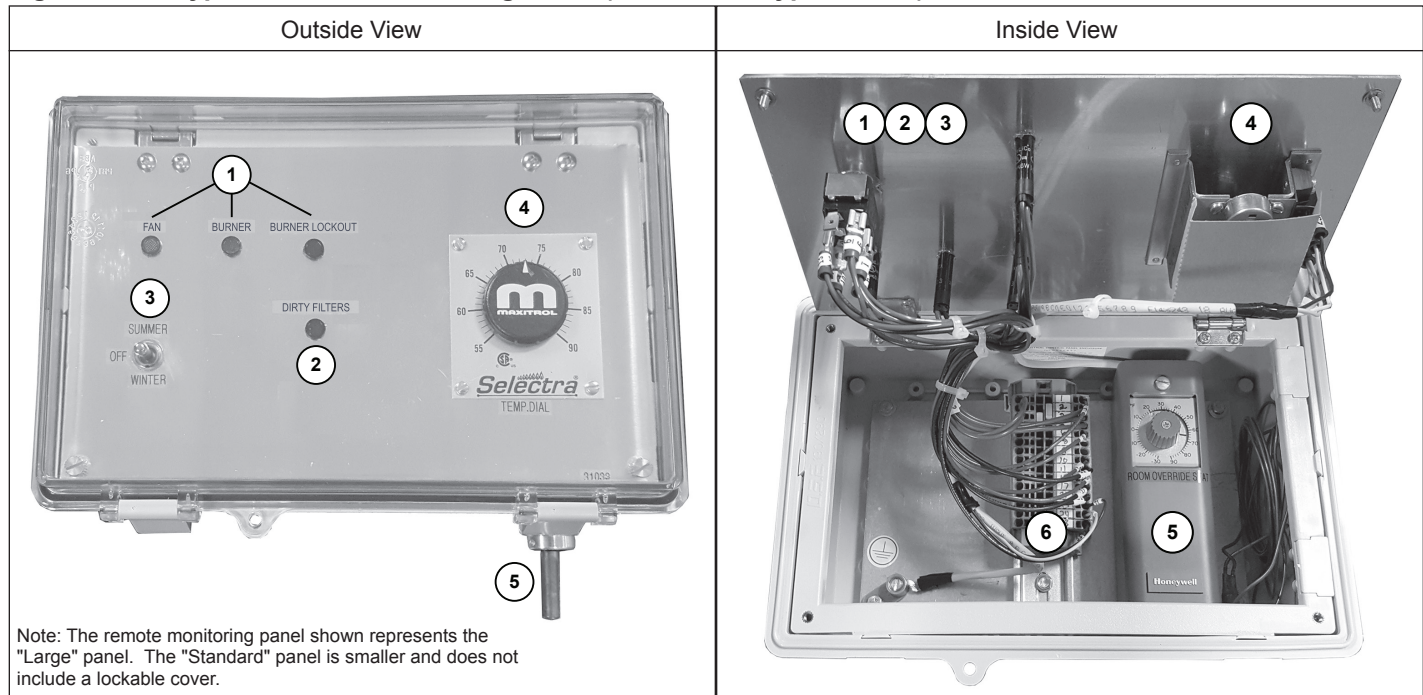
$$Q = 1.08 \times (110^\circ\text{F} - 74^\circ\text{F}) \times 8,000 \text{ CFM} = \mathbf{311,040 \text{ Btu/Hr}}$$

Definition of Terms

- EAT = Entering Air Temperature
 LAT = Leaving Air Temperature
 DB = Dry Bulb
 WB = Wet Bulb
 % Eff. = Percent Effectiveness
 Q = Apparent Cooling Capacity

ACCESSORIES - FIELD INSTALLED - REMOTE PANEL

Figure 20.1 - Typical Remote Monitoring Panel (Maxitrol 14 Type Shown)



Note: The remote monitoring panel shown represents the "Large" panel. The "Standard" panel is smaller and does not include a lockable cover.

The following refer to Figure 20.1. These items are described in greater detail on this page. Note that (S) indicates a Standard feature and (O) indicates an Optional feature.

Remote Monitoring Panel

The remote monitoring panel is used to monitor/control the operation of the make-up air unit for all gas control types (model Digit 14=A, B, C, or D) except the Honeywell SPYDER control system (model Digit 14=L or M). Available panels are:

- **Standard Panel:** 4-3/8" H x 7-3/4" W x 2-3/8" D, rated NEMA 5 (satisfies NEMA 1, 2, and 5 requirements)
- **Large Panel:** 7-1/2" H x 10-1/2" W x 5-5/8" D, rated NEMA 4X (satisfies NEMA 1, 4, and 4X requirements), includes a clear polycarbonate lockable cover (Figure 20.1)

Remote monitoring panel features include:

1. (S) Standard LEDs

The standard lights included with each panel are:

- **Fan:** Indicates if the fan is operating.
- **Burner:** Indicates if the burner is on.
- **Burner Lockout:** Indicates if there is a flame failure resulting in the burner being locked out of operation.

2. (O) Dirty Filters LED

The optional light indicates if the filters need to be cleaned or replaced. Requires a Dirty Filter switch (#2 on page 16).

3. (S) Standard Switch

All panels include a Summer/Off/Winter switch that can be Summer (fan without heat), Winter (fan with heat), and Off (unit in standby).

3. (O) Optional Switch(es) (not shown)

Depending on the unit configuration, the remote panel may have additional switch(es). Other possible switches are:

- **Evap On/Off:** For units with an Evaporative Cooler.
- **High/Low:** Speed switch for units with 2-speed variable frequency drive motor control.

4. (S) Temperature Control

Depending on the unit configuration, the remote panel may have one of the following temperature controls:

- **Discharge Temp Setpoint Dial:** Maxitrol 14 units
- **Modulating Room Thermostat:** Maxitrol 44 units
- **None:** Maxitrol SC25 units

5. (O) Room Override Thermostat

Used only with Maxitrol 14 gas controls, the room thermostat automatically overrides the discharge air temperature setting to provide warmer discharge air until the room override thermostat is satisfied. This option is only available on the Large remote panel.

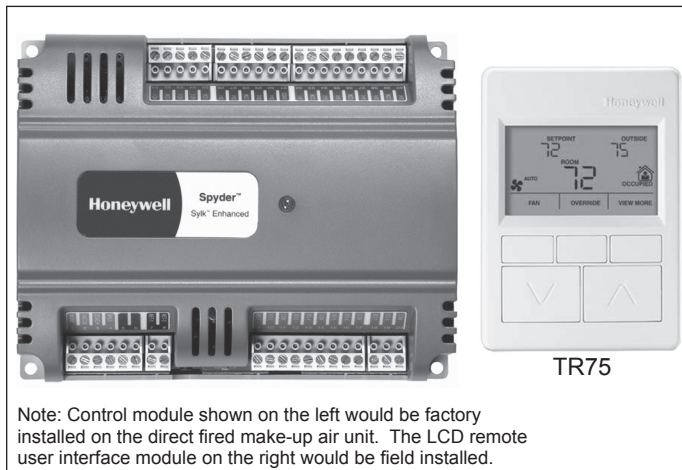
6. (S) Wiring Terminal Strip

The wiring terminal strip provides an easy means of connecting the flexible conduit wiring harness from the unit to the remote panel. The wiring harness wires are numbered, as are the corresponding terminals on the terminal strip.

For information on units equipped with the Honeywell SPYDER Controller and LCD Interface module, see the following page.

ACCESSORIES - FIELD INSTALLED - REMOTE PANEL/OTHER

Figure 21.1 - Honeywell SPYDER Controller/Interface



Honeywell SPYDER LCD Remote User Interface

Available only on the Honeywell SPYDER controlled units (model Digit 14=L or M), the TR75 remote user interface provides access to all information needed to control, maintain, and troubleshoot the unit. A few of the key features of this system include:

- Replaces the remote monitoring panel shown on page 20.
- A simple 2-wire terminal connection from the unit provides power and communications to the remote.
- Alarm codes indicate faults that can lock out the burner or unit, including mechanical and/or electrical issues.
- The network interface capability allows easy and cost effective connection to either a BACnet MS/TP or LonWorks building management system (BMS).
- All capabilities available at the remote are available over the network. Set point changes at the remote are reflected in the network points and vice versa.
- No custom programming is required, only the configuration of network parameters.
- Electrical components and associated cost are reduced by integrating them into the controller programming.
- On loss of power all programming and set points are retained in flash memory for up to ten years.
- Sensors and outputs are always connected to the same controller terminals regardless of unit type, simplifying start-up, maintenance, and service.

Timeclock

A timeclock can be used for occupancy control to automatically turn the unit on during scheduled occupied periods and off during unoccupied periods. Two timeclocks are offered:

- **Programmable:** The programmable time clock is an electronic 7-day, 24-hour digital display electronic timer with battery backup. In addition to automatic on/off control, the timeclock can be programmed for other time-specific functions throughout the day and with different programs for each day of the week.
- **Mechanical:** The mechanical time clock does not allow the different sequences for each day of the week.

Smoke Detector

Low profile duct style photoelectronic smoke detector designed to detect the presence of smoke in the duct. Once the smoke is sensed, the smoke detector will de-energize the unit.

Inlet Hood

Used to prevent entry of rain into the fresh air opening of the unit and includes mesh bird screen on opening. Available either painted or unpainted and with or without 2" permanent aluminum mesh washable filters. Inlet hood is shipped knocked down for field assembly.

Discharge Damper

Used to prevent conditioned building air from exiting the building through the unit when the unit is not operating. Both standard and low leak dampers are available. The discharge damper includes a 2-position damper actuator that is available as either power or spring closed. The damper actuator includes an end switch to prevent unit operation unless the dampers are open. The damper is fully assembled and the housings are always painted. The discharge damper ships as follows:

- **Straight discharge units (Digit 7=A or B):** Factory installed to the unit.
- **Bottom discharge units (Digits 7=C or D):** Ships loose for field installation.
- **Top discharge units (Digit 7=E or F):** Factory installed to the unit.

Factory installed inlet dampers are available. Please see page 16 for additional details.

Discharge Diffusers (3-Way or 4-Way)

The adjustable louvers provide either 3-way or 4-way control of discharge airflow direction. The diffuser is factory assembled but shipped loose for field installation. Discharge diffusers are always painted.

Roof Curb (Outdoor Units Only)

The roof curb is constructed of galvanized steel and is designed to support the unit and side access filter section (if equipped). The curb does not extend to the optional evaporative cooler (evaporative cooler is supplied with support legs). The curb is knocked down for field assembly and includes 1" x 4" nailer strips and curb to unit gasket material. Available with or without insulation. Roof curb is 20" tall.

Vibration Feet (Slab Mounted Units Only)

Used to provide vibration isolation, vibration feet consist of rubber-in-shear double deflection isolators with support mounting.

Vibration Hangers (Suspended Units Only)

Used to provide vibration isolation, vibration hangers consist of rubber-in-shear double deflection hanging isolators.

START-UP PROCEDURE

Start-Up Procedure

WARNING

1. If equipped with the factory installed disconnect switch option, when the switch is in the "OFF" position, supply power remains energized at the supply power terminal strip and the top of the disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.
2. Proper air velocity over the burner is critical. If the velocity is not within the unit specifications, the unit will not operate efficiently, may have nuisance shutdowns, and may produce excessive carbon monoxide (CO) or other gases.

CAUTION

1. Do not operate unit with a gas input rate greater than that shown on the unit's rating plate.
2. Purging of air from gas supply lines should be performed as described in ANSI Z223.1 - latest edition "National Fuel Gas Code", or in Canada in CAN/CGA-B149 codes.

IMPORTANT

Start-up and adjustment procedures should be performed by a qualified service agency.

Before Performing the Start-Up

Before performing the start-up, review "PRIOR TO START-UP/ OPERATION" on page 8 of this manual. To properly perform the start-up, the following instruments are required.

- Volt Meter (25-600 volt)
- Amp Meter (0-100 amp)
- Micro-Amp Meter (0-20 mAmp)
- Ohm Meter
- Gas Pressure Gauge (Range dependent on inlet pressure to unit)
- Slack Tube Manometer, or 0-30" w.c. Pressure Gauge
- Inclined Manometer (0-5" w.c.)
- Hand Held Tachometer (contact, reflective, or strobe type)

Pre-Start-Up Inspection

Although this unit has been assembled and fire-tested at the factory, the following pre-operational procedures must be performed to assure the unit is ready for operation.

1. Before proceeding, turn off all power to the unit. Turn all manual hand gas valves to the closed position.
 - Remove all shipping straps, braces and tie downs.
 - Perform a visual inspection of the unit to make sure no damage has occurred during installation.
 - Check burner to insure proper location and alignment.
 - Check blower and motor alignment, as well as belt tension. For adjustments, refer to section "Blower/Motor Adjustment" on page 26.
 - Check bearings for alignment and tightness. Check bearing to shaft set screws for tightness.
 - Check all electrical connections for tightness.
 - Check to see that there are no obstructions to the inlet air supply or the discharge air supply ducts.

- Check bearings for proper lubrication. If the unit has been supplied with spider bearings (model Digit 19=A, C, or E), the bearings are permanently lubricated and do not require additional lubrication.
 - Check to make sure that all air filters are in place, and that they are installed properly according to direction of air flow.
 - Check gas piping for leaks using a soap/water solution.
2. After these preliminary checks have been made, the unit can be prepared for start-up.

Performing the Start-Up

After the unit has been installed and the preliminary checks have been made from the previous section, the following start-up must be performed.

1. Turn off all power to the unit. Turn all hand gas valves to the closed position.
2. Set the optional Summer/Off/Winter switch on the remote control panel to the "Off" position, and set all thermostats to their lowest settings.
3. Make sure all service doors have been replaced and/or closed.
4. With the optional Summer/Off/Winter switch still in the "Off" position, turn on the electric supply to the unit.
5. Move the optional Summer/Off/Winter switch to the "Summer" position (or activate the unit with heat disabled). The inlet and/or discharge outside air damper (if supplied) should open. When they are in the full open position, the damper motor end switch should close and allow the blower motor to operate.
6. Check to make sure that the inlet and/or discharge damper (if supplied) opens properly without binding.
7. Check the blower for proper direction of rotation.
8. Check the motor speed (rpm). For units equipped with a VFD, check motor speed at both high and low speeds.
9. Check the blower speed (rpm). For units equipped with a VFD, check blower speed at both high and low speeds.
10. Check the motor voltage. For units equipped with a VFD, check the voltage at high speed. On three phase systems, check to make sure all legs are in balance within 2% of each other.
11. Check the motor amp draw to be sure it does not exceed the motor nameplate rating. For units equipped with a VFD, check the amp draw at high speed. If the motor amps are too high, it could be a result of the system static pressure being lower than designed, resulting in excessive airflow. Excessive airflow can cause the fan motor protection to trip on overload, can result in decreased air temperature rise, may not allow the burner to fire because of an open high airflow cutout switch, and/or can consume excessive energy. Air volume measurement and adjustment will be necessary.
12. Measure the unit air volume being delivered and compare to the rated air volume on the unit serial plate. The most accurate way to measure the air volume is by using a pitot traverse method downstream of the blower. Other methods can be used but should be proven and accurate. If the measured air volume does not match, first correct any ductwork or duct termination design issues that may be creating external static pressure differences from design. If further correction is required, adjust the fan RPM by adjusting the sheave on the motor as described in the "Blower/Motor Adjustment" section on page 26.
13. Recheck the gas supply pressure by installing a gas pressure gauge connected to the inlet gas pressure test

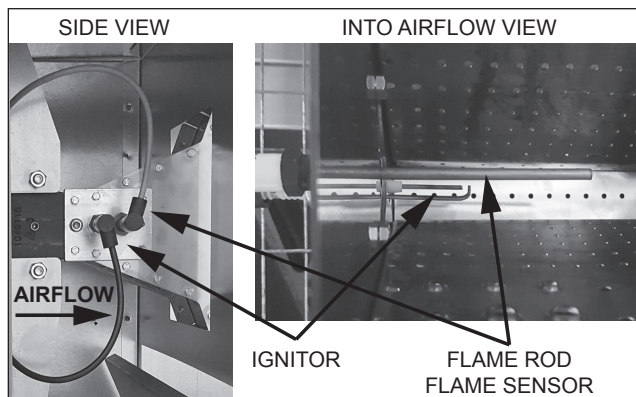
START-UP PROCEDURE (continued)

port indicated on the piping diagram included with the unit. If the unit has an inlet gas pressure gauge option (Model Digit 16=A, D, E, or G), the pressure can be read directly from the gauge without needing to connect a separate gauge. Refer to rating plate for proper gas supply pressure to unit. If inlet gas pressure exceeds the maximum pressure specified on the rating plate, a gas pressure regulator must be added upstream of the factory furnished and piped components.

Refer to the heater rating plate for determining the minimum gas supply pressure for obtaining the maximum gas capacity for which this heater is specified.

14. For units with Digits 9-12=1125 and smaller, check the flame rod flame sensor signal with the following steps. For units with Digits 9-12=1200 and higher, skip to step #15.
 - a. Check that all manual reset safety devices have been reset to their normal operating position.
 - b. Set the Summer/Off/Winter switch to "Winter" and set the temperature controls to call for heat.
 - c. If a mild temperature inlet duct thermostat has been supplied, the set point of the thermostat may have to be increased to allow initiation of the ignition sequence.
 - d. The spark ignitor should begin to spark in approximately 10 seconds, and the burner flame should be established within 10 seconds.
 - e. Check for proper flame rod flame sensor signal output. The signal should be stable and in accordance with the flame safeguard manufacturer's recommended signal strength. For units with a Fenwal flame safeguard control (#6 in Figure 12.1), the signal should be at least 0.7 μ Amps (microAmps) when measured at the FC+ and FC- terminals.
 - f. Check to make sure the flame sensor and flame safeguard relay is operating correctly. To check, shut off the manual shut off valve immediately after the modulating valve. The burner flame should go out and the unit should try for re-ignition within 2 to 4 seconds. Because the main gas is off, and the burner flame cannot be re-established, the flame safeguard control should go into lockout.
 - g. Turn the manual shut off valve to the on position and reset the flame safeguard control by cycling power via the Summer/Off/Winter switch.

Figure 23.1 - Direct Spark Ignition Components

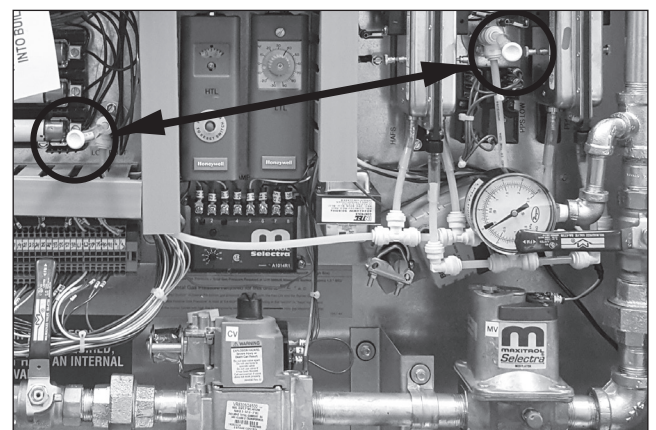


15. For units with Digits 9-12=1200 and higher, check the pilot and pilot ignition by following the next steps. For units with Digits 9-12=1125 and smaller, skip to step #16.
 - a. Open the pilot gas hand valve only.
 - b. Check that all manual reset safety devices have been reset to their normal operating position.
 - c. If high and/or low gas pressure switches have been

supplied (Digit 16=C, E, F, or G), the first main gas hand valve is to be opened. The second main gas hand valve located before the modulating gas valve should be kept in the closed position.

- d. Set the Summer/Off/Winter switch to "Winter" and set the temperature controls to call for heat.
- e. If a mild temperature inlet duct thermostat has been supplied, the set point may need to be increased to allow initiation of the pilot ignition sequence.
- f. Check to see that the pilot lights properly.
- g. The spark ignitor should begin to spark in approximately 10 seconds, and the pilot flame should be established within 10 seconds.
- h. Check for proper flame rod flame sensor signal output for the pilot safety control. The signal should be stable and in accordance with the flame safeguard manufacturer's recommended signal strength. For units with a Fireye flame safeguard control the signal should be between 4VDC and 10VDC when measured at the (+ -) terminals on the Fireye control (pictured in Figure 13.1).
- i. Adjust the pilot regulator and/or pilot line orificed needle valve up or down if the pilot signal reading is outside of the manufacturer's specified range.
- j. Check to make sure the flame sensor and flame safeguard relay is operating correctly. To check, shut off the pilot gas hand valve while the pilot is still lit. The pilot flame should go out and the pilot ignitor should try for re-ignition within 2 to 4 seconds. Because the pilot gas is off, and the pilot cannot be re-established, the flame safeguard control should go into lockout.
- k. Turn the pilot gas hand valve to the on position and reset the flame safeguard relay using the flame safeguard manual reset button.
16. The burner profile velocity pressure differential must be checked after installation with all accessories and ductwork installed to assure correct air velocity across the burner. It is also important that the check of air volume being delivered in step #12 has been completed and adjustments made to ensure airflow matches the rated air volume on the unit serial plate. Check the pressure differential across the burner profile per the following:
 - a. Remove the tubing plugs from the test ports labeled "High Port" and "Low Port" (shown in Figure 23.2) and connect an inclined manometer.
 - b. The test is to be run with the unit operating (blower running). For units equipped with a VFD, the unit must be running at high speed.
 - c. If the outdoor air temperature is below 60°F, fire the

Figure 23.2 - High and Low Pressure Test Ports



START-UP PROCEDURE (continued)

main burner to achieve a discharge air temperature of approximately 70°F. If the burner does not fire under these conditions, refer to the Service and Troubleshooting section of this manual for additional guidance. If the outdoor temperature is 60°F or greater, do not fire the main burner.

- d. Read the pressure differential reading on the manometer and compare against the required value in Table 24.1. It must be within ± 0.05 " w.c. Note that the pressure differential reading is dependent on the elevation of installation above sea level.

For example, for a unit installed at 4500 feet above sea level, with a 70°F discharge air temperature, the profile pressure differential should be 0.55"W.C. The actual installed pressure differential reading must be 0.55"W.C. ± 0.05 "W.C., or 0.50"W.C. to 0.60"W.C.

- e. If the required differential cannot be achieved, adjust

Table 24.1 - Profile Pressure Drop (W.C.)

Elevation Above Sea Level (ft)	Profile Pressure Drop ("W.C.)	Elevation Above Sea Level (ft)	Profile Pressure Drop ("W.C.)
0-2000	0.65	5501-6000	0.52
2001-2500	0.59	6001-6500	0.51
2501-3000	0.58	6501-7000	0.50
3001-3500	0.57	7001-7500	0.49
3501-4000	0.56	7501-8000	0.48
4001-4500	0.55	8001-8500	0.47
4501-5000	0.54	8501-9000	0.46
5001-5500	0.53	9001-9500	0.46

The profile pressure drop values shown assume a discharge temperature of approximately 70°F as discussed in step #16c above.

the fan RPM by adjusting the sheave on the motor as described in the "Blower/Motor Adjustment" section on page 26.

If the required differential cannot be achieved through blower speed adjustments, contact the factory for additional guidance.

- f. When the correct burner velocity pressure differential is verified, turn the unit off and open the main disconnect switch. Remove the manometer and replace the tubing plugs in the "High Port" and "Low Port" test ports.
17. The high fire manifold (burner) pressure must be checked to ensure it matches the pressure shown on the unit serial plate. Over-firing from high pressure can result in poor combustion and undesirable levels of combustion products being introduced to the heated space. The procedure is outlined in the following steps. If the unit is equipped with a VFD, this procedure must be performed at HIGH speed.
 - a. With the unit off, close the main gas manual hand valve. Remove the 1/8" pipe plug test port at the burner and attach a water manometer or "U" tube that is at least 12" high. See piping diagram furnished with the unit for pressure tap locations.
 - b. Start the unit and record the burner suction pressure present at the test port and record the negative number. Next, open the gas valve and allow the burner to ignite (resetting the burner lockout if necessary). Observe the flame during the 10 second at low fire start to make sure it lights across the entire length of the burner and is stable with a clean blue flame.
 - c. Add the high fire pressure listed on the rating plate to

the negative burner suction pressure recorded above. The resulting sum is the actual measured gas pressure required for high fire in the next step.

- d. Initiate a short (10-second) period of high fire. High fire can be achieved by one of the following for methods depending on the unit temperature control:
 - **Discharge temp control (Digit 14 = A):** High fire is achieved by removing wire 29 from terminal 4 on the Maxitrol amplifier.
 - **Space temperature control (Digit 14 = B):** High fire is achieved by removing wire 24 from terminal 4 and wire 28 from terminal 3 on the Maxitrol amplifier.
 - **Signal Conditioner (Digit 14 = C or D):** High fire is achieved by forcing the control system (by others) to output a full modulation signal (10vDC or 20mA) to the Maxitrol signal conditioner.
 - **Honeywell Spyder Control (Digit 14 = L or M):** High fire is achieved by depressing the HF-Test button located in the electrical wire channel cover near the local alarm light. Once the button is pressed once, a 10-second period of high fire begins.

If the actual measured pressure is within $\pm 1/2$ " w.c. from the calculated burner pressure above, adjust the gas valve regulator until the measured pressure matches the calculated pressure.

If the actual measured pressure is not within $\pm 1/2$ " w.c. from the calculated burner pressure above, check the inlet gas pressure to the unit. Adjust the main gas valve regulator to the correct inlet pressure within the range indicated on the unit rating plate. Once corrected, repeat step #17 to measure the burner pressure.

- e. With the high fire manifold pressure set to match the setting on the unit serial plate, observe the flame at high fire. The flame should be stable and burning clean. A slight orange tip may be present and is acceptable.
- f. After the high fire pressure is set, check the low fire burner flame. Low fire can be achieved by one of the following methods depending on the unit temperature control:
 - **Discharge temp control (Digit 14 = A):** Low fire is achieved by removing CR12 or CR15 from its relay base.
 - **Space temperature control (Digit 14 = B):** Low fire is achieved by removing CR12 or CR15 from its relay base.
 - **Signal Conditioner (Digit 14 = C or D):** Low fire is achieved when the external customer control system outputs the minimum modulation signal (4VDC or 0mA) to the Maxitrol signal conditioner.
 - **Honeywell Spyder Control (Digit 14 = L or M):** Low fire is achieved by removing CR12 or CR15 from its relay base.

The flame should still burn clean and be stable during low fire. The flame should be 1-2" long. If necessary, adjust the low fire gas pressure on the Maxitrol modulating control valve so the unit operates correctly as described.
- g. Recycle the ignition sequence to make sure the burner lights off smoothly and the gas lights across the entire length of the burner.
18. With the unit off, close the main gas manual hand valve. Remove the "U" tube manometer and replace the 1/8" pipe plug test port at the burner.
19. Test the gas seal of the safety shut off valve(s) with the

START-UP PROCEDURE (continued)

following steps:

- a. While the unit is off, close the main gas hand valve and attach a pressure gauge to the downstream side of the last safety shut off valve (SSOV) closest to burner. For units with Digits 9-12=0625 or smaller, there is only the one valve (the combination gas valve). For units with Digits 9-12=0750 and larger, there are redundant series piped solenoid valves.
- b. Open the main gas hand valve and, following the start-up procedure described in this manual, turn the unit on and allow the burner to go to main flame.
- c. Shut the unit off and let the pressure drop to 0 (zero).
- d. Close the manual gas hand valve immediately downstream of the second (or combination) SSOV and wait 5 minutes. The main gas manual hand valve should remain open.
- e. There should be no changes in pressure. If the pressure increases, the combination or second SSOV needs to be replaced.
- f. For units with Digits 9-12=0625 or smaller, skip to step #19k. For larger units, close the main gas hand valve and remove the test plug located between the two SSOV's and let the pressure to drop to 0 (zero).
- g. Move the pressure gauge to the test port between the two SSOV's and replace the plug in the test port downstream of the second SSOV.
- h. Open the main gas manual hand valve and wait 5 minutes. The unit should not be operating at this time.
- i. There should be no changes in pressure. If the pressure increases, the first SSOV needs to be replaced.
- j. Close the main gas manual hand valve and remove the pressure gauge and plug the test port.
- k. Open the main gas manual hand valve.

Verify the Auto-Velocity™ Profile System Operation

The Auto-Velocity™ profile system constantly and automatically adjusts a burner profile bypass damper to maintain proper burner air velocity for optimal combustion. The system has a range of operation to allow for correction of airflow changes from filters becoming dirty, changes in airflow when using a VFD, or slight changes in system duct static pressure. It does not eliminate the requirement for proper system balancing at commissioning.

The Auto-Velocity™ profile system normally needs no adjustment or setup, however, the operation should be verified using any or all of the following examples. Note that any unit door that opens to the airstream should be closed. The control cabinet door can be open to observe the rotation of the damper actuator (#13 in Figure 12.1):

1. If the unit has a side access filter section:
 - Remove/open the access door. This will reduce the total static pressure, increasing airflow, and the actuator should turn the damper rod counter-clockwise to open the damper.
 - Replace/close the access door. This will increase the total static pressure, decreasing airflow, and the actuator should turn the damper rod clockwise to close the damper.
2. If you are near the inlet of the unit (typically outdoor units):
 - Place a restriction at the inlet (a sheet of cardboard works well). This will increase the total static pressure, decreasing airflow, and the actuator should turn the damper rod clockwise to close the damper.
 - Remove the restriction at the inlet. This will decrease the total static pressure, increasing airflow, and the actuator should turn the damper rod counter-clockwise to open the damper.
3. If the unit is equipped with a VFD:
 - Reduce the blower speed using the VFD. This will reduce airflow and the actuator should turn the damper rod clockwise to close the damper.
 - Increase the blower speed using the VFD. This will increase airflow and the actuator should turn the damper rod counter-clockwise to open the damper.
4. If the actuator does not control the damper during these verification tests, check the following:
 - Loosen the actuator from the damper rod and verify that the damper can be opened and closed freely without binding or resistance. When retightening the actuator to the damper rod, position of the damper is not important, as the system should automatically adjust the position during normal operation.
 - Check the wiring to pressure switches and the actuator to be sure all connections are tight and wired correctly.
 - Check the tubing that connects the pressure switches to the profile pressure pickup tubes to ensure all tubes are connected, there are no kinks in the tubing, and the tube plugs for the test ports are properly installed.
 - If these do not solve the problem, contact the factory.

START-UP PROCEDURE (continued)

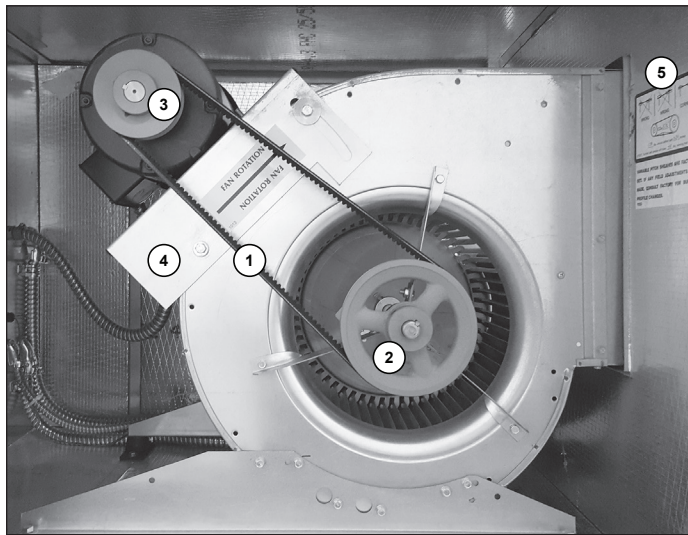
Blower/Motor Adjustment

Units are supplied with an adjustable drive sheave on the motor and an adjustable motor mounting base. Adjustments to the motor sheave should only be done if the unit delivered air volume does not match the design volume shown on the unit serial plate. If the measured air volume does not match, adjust the blower speed by adjusting the sheave on the motor (refer to Figure 26.1) as follows:

1. Loosen motor base and take belt(s) off of the motor sheave.
2. Loosen set screw(s) on the outer side of the adjustable motor sheave.
3. To increase blower speed, turn the outer side of the drive sheave clockwise to close the sheave. To decrease blower speed, turn the outer side of the adjustable sheave counterclockwise to open the sheave. Each 1/2 turn of the sheave will change airflow by approximately 2-5%.
4. Retighten motor sheave set screw(s) and replace belt.
5. Motor base may have to be shifted to obtain proper belt tension. The proper belt tension is achieved when there is a 3/4" deflection of the belt when a force of approximately 5 pounds is applied to the center of the belt using a belt tension gauge. Do not overtighten, otherwise belt and/or bearing life will be compromised. Refer to #5 in Figure 26.1 and Figure 26.2.
6. Recheck blower speed and air volume delivered after adjustment. Repeat steps until air volume matches the rated air volume on the unit serial plate.
7. Check motor amps to make sure the actual motor amp draw does not exceed the motor nameplate amp draw.

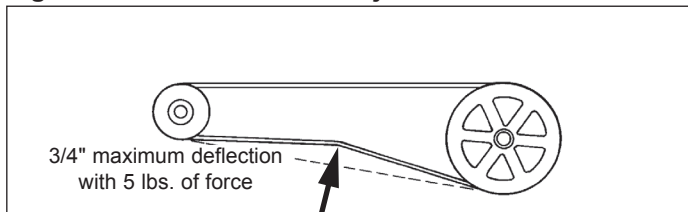
If proper air flow and/or blower speed cannot be obtained, contact the factory for guidance.

Figure 26.1 - Blower and Motor Drive Assembly



- | | |
|------------------------------|---------------------------------|
| 1. Drive Belt | 4. Adjustable Motor Base |
| 2. Blower Sheave (Fixed) | 5. Belt Tension/Alignment Guide |
| 3. Motor Sheave (Adjustable) | |

Figure 26.2 - Belt Tension Adjustment



Setting the Dirty Filter Switch (if equipped)

The dirty filter switch monitors the pressure differential between the two sides of the filters. When the filters become dirty, the differential pressure increases and trips the pressure switch which energizes a light on the remote monitoring panel. The pressure differential switch must be field set because setting the switch requires the blower to be in operation and the ductwork to be installed.

The range of the dirty filter pressure switch is adjustable between 0.2" to 2.0" W.C.

1. Ensure that the unit filters are clean. Clean or replace if necessary.
2. Connect the leads of a continuity tester to the NO and C terminals of the dirty filter switch.
3. With the blower operating, turn the adjustment dial on the switch clockwise to 2.0" and the continuity tester should be sensing an open circuit.
4. Begin turning the dial counterclockwise until the continuity tester senses a closed circuit. This determines the base pressure of the system.
5. Turn the dial clockwise until the continuity tester senses an open circuit and note the setting. Continue to turn the dial clockwise until it is 0.25" above the value at which the switch opened. This will allow for the increase in static pressure due to dirty filters.

Figure 26.3 - Dirty Filter Pressure Switch



Commissioning

After all of the initial start-up procedures have been performed, the unit is ready for commissioning. Check the unit operation in all modes against the General Sequence of Operation on the following pages, or refer to the job specific sequence of operation included with the unit as shipped.

START-UP PROCEDURE (continued)

Sequence of Operation - General

The following describes the general sequence of operation for the unit; however, each job may be slightly different based on unit configuration and application. Each unit includes a laminated job specific sequence of operation affixed to the inside of the control access door. Refer to that document for the actual unit sequence of operation.

Summer/Off/Winter Switch = "Off"

The unit is shut down with no blower or burner operation.

Summer/Off/Winter Switch = "Summer"

1. If timed freeze protection is furnished with the unit, the freeze protection timer will be energized at this time and will pass power to the inlet and/or discharge damper motor (if furnished with unit). It will continue to monitor the supply air temperature for a period of 5 minutes to allow steps 2 and 3 to complete. If after that 5 minutes, the supply air temperature is below the setpoint (typically 40°F), the dampers will close and the unit will be shut down. This prevents inadvertent freezing of the building if the unit is placed in the "Summer" mode when it should be placed in the "Winter" mode.
2. If equipped with inlet or discharge air dampers, the actuator is energized and the dampers will open. When the damper is fully open, the actuator end switch will close and allow power to be supplied to the blower motor control circuit (motor starter or VFD).
3. With the blower motor control circuit energized, the motor starter contacts will close or the VFD will energize the motor to operate the fan.
4. The gas and temperature controls are locked out to prevent heating during the "Summer" mode of operation.
5. If equipped with a cooling section, the cooling section controls are enabled.
6. If the unit has been supplied with a dirty filter switch, the filter light will come on only if the pressure drop across the filters rises above the switch setpoint.

Summer/Off/Winter Switch = "Winter"

1. If timed freeze protection is furnished with the unit, the freeze protection timer will be energized at this time and will pass power to the inlet and/or discharge damper motor (if furnished with unit). It will continue to monitor the supply air temperature for a period of 5 minutes to allow steps 2 and 3 to complete. If after that 5 minutes, the supply air temperature is below the setpoint (typically 40°F), the dampers will close and the unit will be shut down. This prevents inadvertent freezing of the building if the unit is placed in the "Summer" mode when it should be placed in the "Winter" mode.
2. If equipped with inlet or discharge air dampers, the actuator is energized and the dampers will open. When the damper is fully open, the actuator end switch will close and allow power to be supplied to the blower motor control circuit (motor starter or VFD).
3. Before the ignition control sequence can be initiated, the following safety devices are checked for closure:
 - a. The low air flow pressure switch proves that the minimum air flow has been achieved to allow for proper ignition.
 - b. The high air flow pressure switch proves that the air flow is at or below the maximum allowable to ensure clean combustion and reduced flame disturbance.
 - c. The high temperature limit control proves that the

supply air temperature does not exceed the maximum allowable limit for safe operation.

- d. If equipped with high and low gas pressure switches (Digit 16=C, E, F, or G), the switches prove that the gas pressure is sufficient for proper ignition and safely below the maximum allowed pressure to prevent the unit from overfiring and/or damaging the gas manifold components.
 - e. If equipped with the mild temperature inlet duct thermostat option, the thermostat proves that the outside air temperature is low enough to allow burner operation without overheating the space and needlessly burning gas.
4. With the safety devices described in the last step cleared, the flame safeguard controller is enabled to initiate the ignition sequence. After 10 seconds of pre-purge time, the ignitor is energized to produce spark ignition as follows:
 - For units with Digits 9-12=1125 and lower, the main valve(s) opens and with the modulating valve at minimum position, the burner is lit (direct spark ignition).
 - For units with Digits 9-12=1200 and higher, the pilot valve opens and the pilot is lit. Once the pilot is lit and proven with the flame rod flame sensor, the main gas valves open and with the modulating valve at minimum position, the burner is lit (intermittent pilot ignition).
 5. The burner remains on low fire momentarily, then the temperature controls take over and fire the burner based on load demands.
 6. If any of the devices discussed in step #3 open, the gas circuit is disabled, the unit goes into lockout, and the burner lockout light is lit. Before resetting any manual reset devices that have disabled the unit, a service person must inspect the unit, determine the cause, and take corrective action.
 7. If the unit has been supplied with a dirty filter switch, the filter light will come on only if the pressure drop across the filters rises above the switch setpoint.

Sequence of Operation - Blower

The blower control circuit can be configured from the factory as one of the following:

1. **Single Speed Motor Starter** - When initiated, the motor starter contacts will close and the blower motor will operate at rated speed. The speed is fixed and not adjustable; however, the adjustable sheave on the motor can be adjusted. Refer to the Start-Up section for information on blower speed adjustments.
2. **Constant Speed VFD** - When initiated, the VFD will energize the motor and will operate at a fixed frequency as configured on the order. There are typically two reasons for using this control type:
 - To provide manual adjustment of the motor speed for purposes such as one-time balancing of airflow.
 - To provide soft start functionality for larger motors where voltage sag during across-the-line starts is a concern.
3. **Two Speed VFD** - When initiated, the VFD will energize the motor at either the low speed or high speed, depending on the High/Low Speed switch setting. With the unit running, the speed can be changed at any time with that switch. High speed is always 100% or 60Hz while low speed is customer defined on the order and can be as low as 35% or 21Hz.
4. **Modulating VFD based on External Signal Input** - When initiated, the VFD will energize the motor at a frequency proportional to the input of an external control signal. The

START-UP PROCEDURE (continued)

control signal can be either 4-20mA or 0-10VDC. With the unit running, the speed can be changed at any time by changing the control signal level to the variable frequency drive. High speed is always 100% or 60Hz while low speed is low as 35% or 21Hz. The speed is adjustable throughout the range between 35 to 100% (21 to 60Hz).

5. **Modulating VFD based on Building Pressure** - When initiated, the VFD will energize the motor at a frequency proportional to the input of an external control signal from the building pressure sensor. With the unit running, the speed will be changed automatically by the building pressure sensor. High speed is always 100% or 60Hz while low speed is low as 35% or 21Hz. The speed is adjustable throughout the range between 35 to 100% (21 to 60Hz) by the building pressure sensor.

Final Step

With Start-Up and Commissioning complete, set the temperature controls for automatic operation if the unit is to be put into service immediately. If the unit is to be left for stand-by operation, set the optional Summer/Off/Winter switch to the "Off" position and turn the electric power to the unit off at the unit's disconnect switch.

Sequence of Operation - Evaporative Cooler

The non-recirculating evaporative cooling design was developed with water economy in mind. By setting the sensitivity of the liquid level controller to a very high setting, the owner can virtually eliminate wasted water while sacrificing slightly on efficiency. Even using the factory default intermediate setting for sensitivity, only small quantities of excess water drip off the media and get collected and drained away. Below is the sequence of operation for the EVCNR system:

1. With both the Summer/Off/Winter switch in the "Summer" position, and the Evap On/Off switch in the "On" position, the evaporative cooler circuit is enabled.
2. If the unit has been ordered with the Water Supply Valve Kit with Freeze Protection, the freeze thermostat (TH2) monitors the outside air temperature to ensure it is above freezing. One of two operations can happen based on temperature sensed:
 - If the temperature is above the setpoint (65°F adjustable), the Supply Water Valve (SWV) is opened and the Supply Line Drain Water Valve (DWV) is closed, permitting water to flow to the Internal Water Control Valve (IWCV).
 - If the temperature is below the setpoint (65°F adjustable), the Supply Water Valve (SWV) is closed and the Supply Line Drain Water Valve (DWV) is opened, disabling water flow to the Internal Water Control Valve (IWCV) and draining the water supply line to the unit.
3. With water permitted to flow to the IWCV, the Liquid Level Controller (LLC) monitors an outside air thermostat (TH3), and if the temperature is above the set point (75°F adjustable), the LLC will open the IWCV, allowing water to flow to the media water distribution piping, saturating the media.
4. Once the overflow water sensor (OWS) detects moisture/water, the LLC will close the IWCV.
5. With the IWCV closed, if the OWS doesn't sense moisture for a period of 30 seconds, the LLC will re-open the IWCV until the OWS senses moisture/water.
6. If TH3 detects that the outside air temperature has fallen below the setpoint (see step 3), the evap cooler circuit will be in stand-by until the temperature rises above the setpoint.

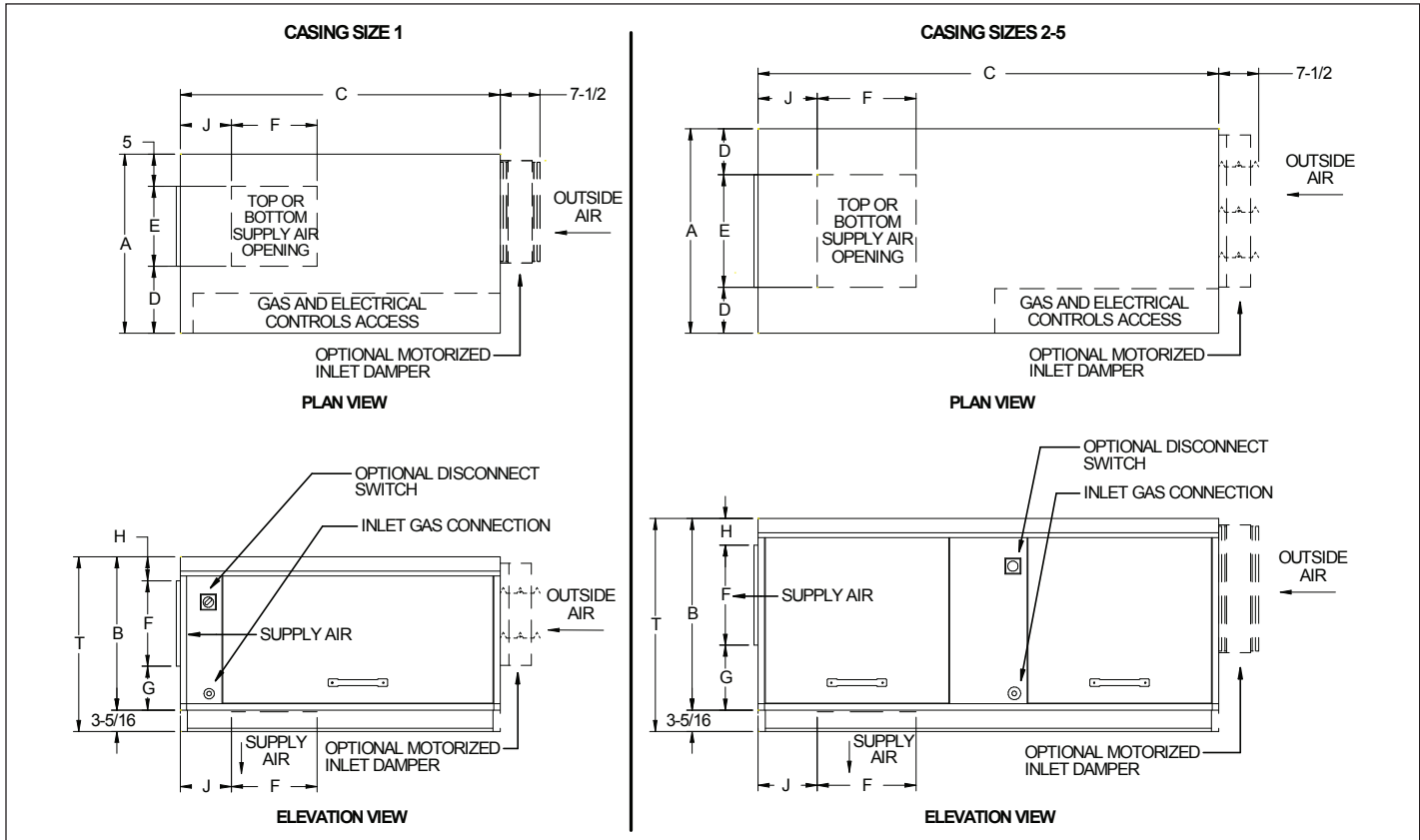
STATIC PRESSURE DROP DATA

Table 29.1 - Accessory Static Pressure Drop Data (Inches W.C.)

CASING SIZE (DIGIT 4)	AIRFLOW (CFM)	SIDE ACCESS FILTER SECTION			INLET HOOD, BIRDSCREEN		DAMPERS		DISCHARGE DIFFUSERS			EVAPORATIVE COOLER					
		2" PERMANENT	2" MERV 8	2" MERV 13	NO FILTERS	2" PERMANENT FILTERS	INLET	DISCHARGE	3-WAY WITH HORIZ. BLADES	3-WAY WITH HORIZ. & VERT. BLADES	4-WAY WITH HORIZ. BLADES	COOLER, 12" MEDIA		INLET HOOD, BIRDSCREEN		EVAPORATIVE COOLER MODEL SIZE	
1	800	0.03	0.05	0.07	0.01	0.07	0.01	0.03	0.03	0.05	0.03	0.04	0.07	0.01	0.04	EVCNR1	
	1000	0.05	0.07	0.10	0.01	0.11	0.02	0.04	0.05	0.07	0.04	0.06	0.11	0.01	0.06		
	1200	0.07	0.10	0.15	0.01	0.16	0.03	0.06	0.07	0.10	0.06	0.09	0.16	0.01	0.09		
	1400	0.10	0.14	0.20	0.02	0.22	0.04	0.08	0.10	0.14	0.08	0.12	0.22	0.02	0.12		
	1600	0.13	0.19	0.26	0.03	0.29	0.05	0.11	0.13	0.19	0.11	0.16	0.29	0.03	0.16		
	1800	0.17	0.23	0.33	0.03	0.36	0.07	0.13	0.17	0.23	0.13	0.20	0.37	0.03	0.20		
	2000	0.21	0.29	0.41	0.04	0.45	0.08	0.17	0.21	0.29	0.17	0.25	0.45	0.04	0.25		
2	2200	0.25	0.35	0.50	0.05	0.54	0.10	0.20	0.25	0.35	0.20	0.30	0.55	0.05	0.30	EVCNR2	
	1400	0.04	0.06	0.08	0.01	0.06	0.02	0.03	0.04	0.06	0.03	0.05	0.09	0.01	0.05		
	1700	0.06	0.08	0.12	0.01	0.08	0.02	0.05	0.06	0.08	0.05	0.07	0.13	0.01	0.07		
	2000	0.08	0.11	0.16	0.02	0.12	0.03	0.07	0.08	0.11	0.07	0.10	0.18	0.02	0.10		
	2300	0.11	0.15	0.22	0.02	0.16	0.04	0.09	0.11	0.15	0.09	0.13	0.24	0.02	0.13		
	2600	0.14	0.19	0.28	0.03	0.20	0.06	0.11	0.14	0.19	0.11	0.17	0.30	0.03	0.17		
	2900	0.17	0.24	0.34	0.03	0.25	0.07	0.14	0.17	0.24	0.14	0.21	0.38	0.03	0.21		
3	3200	0.21	0.29	0.42	0.04	0.30	0.08	0.17	0.21	0.29	0.17	0.25	0.46	0.04	0.25	EVCNR3	
	3500	0.25	0.35	0.50	0.05	0.36	0.10	0.20	0.25	0.35	0.20	0.30	0.55	0.05	0.30		
	3200	0.04	0.06	0.08	0.01	0.12	0.02	0.03	0.04	0.06	0.03	0.12	0.23	0.02	0.12		
	3600	0.05	0.07	0.10	0.01	0.15	0.02	0.04	0.05	0.07	0.04	0.16	0.29	0.03	0.16		
	4000	0.06	0.09	0.13	0.01	0.18	0.03	0.05	0.06	0.09	0.05	0.19	0.35	0.03	0.19		
	4400	0.08	0.11	0.15	0.02	0.22	0.03	0.06	0.08	0.11	0.06	0.23	0.43	0.04	0.23		
	4800	0.09	0.13	0.18	0.02	0.26	0.04	0.07	0.09	0.13	0.07	0.28	0.51	0.05	0.28		
	5000	0.10	0.14	0.20	0.02	0.28	0.04	0.08	0.10	0.14	0.08	0.30	0.55	0.05	0.30		
	5600	0.12	0.17	0.25	0.02	0.35	0.05	0.10	0.12	0.17	0.10	0.17	0.31	0.03	0.17		
	6000	0.14	0.20	0.28	0.03	0.41	0.06	0.11	0.14	0.20	0.11	0.19	0.35	0.03	0.19		
4	6400	0.16	0.22	0.32	0.03	0.46	0.06	0.13	0.16	0.22	0.13	0.22	0.40	0.04	0.22	EVCNR4	
	6800	0.18	0.25	0.36	0.04	0.52	0.07	0.14	0.18	0.25	0.14	0.25	0.45	0.04	0.25		
	7200	0.20	0.28	0.41	0.04	0.58	0.08	0.16	0.20	0.28	0.16	0.28	0.51	0.05	0.28		
	7500	0.22	0.31	0.44	0.04	0.63	0.09	0.18	0.22	0.31	0.18	0.30	0.55	0.05	0.30		
	8000	0.25	0.35	0.50	0.05	0.72	0.10	0.20	0.25	0.35	0.20	-	-	-	-		
	5000	0.07	0.10	0.14	0.01	0.20	0.03	0.06	0.07	0.10	0.06	0.13	0.24	0.02	0.13		
	5500	0.08	0.12	0.17	0.02	0.25	0.03	0.07	0.08	0.12	0.07	0.16	0.30	0.03	0.16		
	6000	0.10	0.14	0.20	0.02	0.30	0.04	0.08	0.10	0.14	0.08	0.19	0.35	0.03	0.19		
	6500	0.12	0.16	0.23	0.02	0.35	0.05	0.09	0.12	0.16	0.09	0.23	0.41	0.04	0.23		
	7000	0.14	0.19	0.27	0.03	0.40	0.05	0.11	0.14	0.19	0.11	0.26	0.48	0.04	0.26		
5	7500	0.16	0.22	0.31	0.03	0.46	0.06	0.12	0.16	0.22	0.12	0.30	0.55	0.05	0.30	EVCNR5	
	8000	0.18	0.25	0.35	0.04	0.52	0.07	0.14	0.18	0.25	0.14	0.16	0.29	0.03	0.16		
	8500	0.20	0.28	0.40	0.04	0.59	0.08	0.16	0.20	0.28	0.16	0.18	0.33	0.03	0.18		
	9000	0.22	0.31	0.45	0.04	0.66	0.09	0.18	0.22	0.31	0.18	0.20	0.37	0.03	0.20		
	9500	0.25	0.35	0.50	0.05	0.74	0.10	0.20	0.25	0.35	0.20	0.22	0.41	0.04	0.22		
	5500	0.04	0.05	0.08	0.01	0.09	0.02	0.03	0.04	0.05	0.03	0.08	0.14	0.01	0.08		
	6500	0.05	0.08	0.11	0.01	0.13	0.02	0.04	0.05	0.08	0.04	0.10	0.19	0.02	0.10		
	7500	0.07	0.10	0.14	0.01	0.17	0.03	0.06	0.07	0.10	0.06	0.14	0.26	0.02	0.14		
	8500	0.09	0.13	0.18	0.02	0.22	0.04	0.07	0.09	0.13	0.07	0.18	0.33	0.03	0.18		
	9500	0.12	0.16	0.23	0.02	0.28	0.05	0.09	0.12	0.16	0.09	0.22	0.41	0.04	0.22		
6	10500	0.14	0.20	0.28	0.03	0.34	0.06	0.11	0.14	0.20	0.11	0.27	0.50	0.05	0.27	EVCNR6	
	11000	0.15	0.22	0.31	0.03	0.37	0.06	0.12	0.15	0.22	0.12	0.30	0.55	0.05	0.30		
	12500	0.20	0.28	0.40	0.04	0.48	0.08	0.16	0.20	0.28	0.16	0.24	0.44	0.04	0.24		
	13000	0.22	0.30	0.43	0.04	0.52	0.09	0.17	0.22	0.30	0.17	0.26	0.47	0.04	0.26		
	13500	0.23	0.33	0.46	0.05	0.56	0.09	0.19	0.23	0.33	0.19	0.28	0.51	0.05	0.28		
	14000	0.25	0.35	0.50	0.05	0.60	0.10	0.20	0.25	0.35	0.20	0.30	0.55	0.05	0.30		

DIMENSIONS - UNITS (without Evap Cooler or Side Access Filter Section)

Figure 30.1 - Unit Dimensions (without Evap Cooler or Side Access Filter Section) (inches)



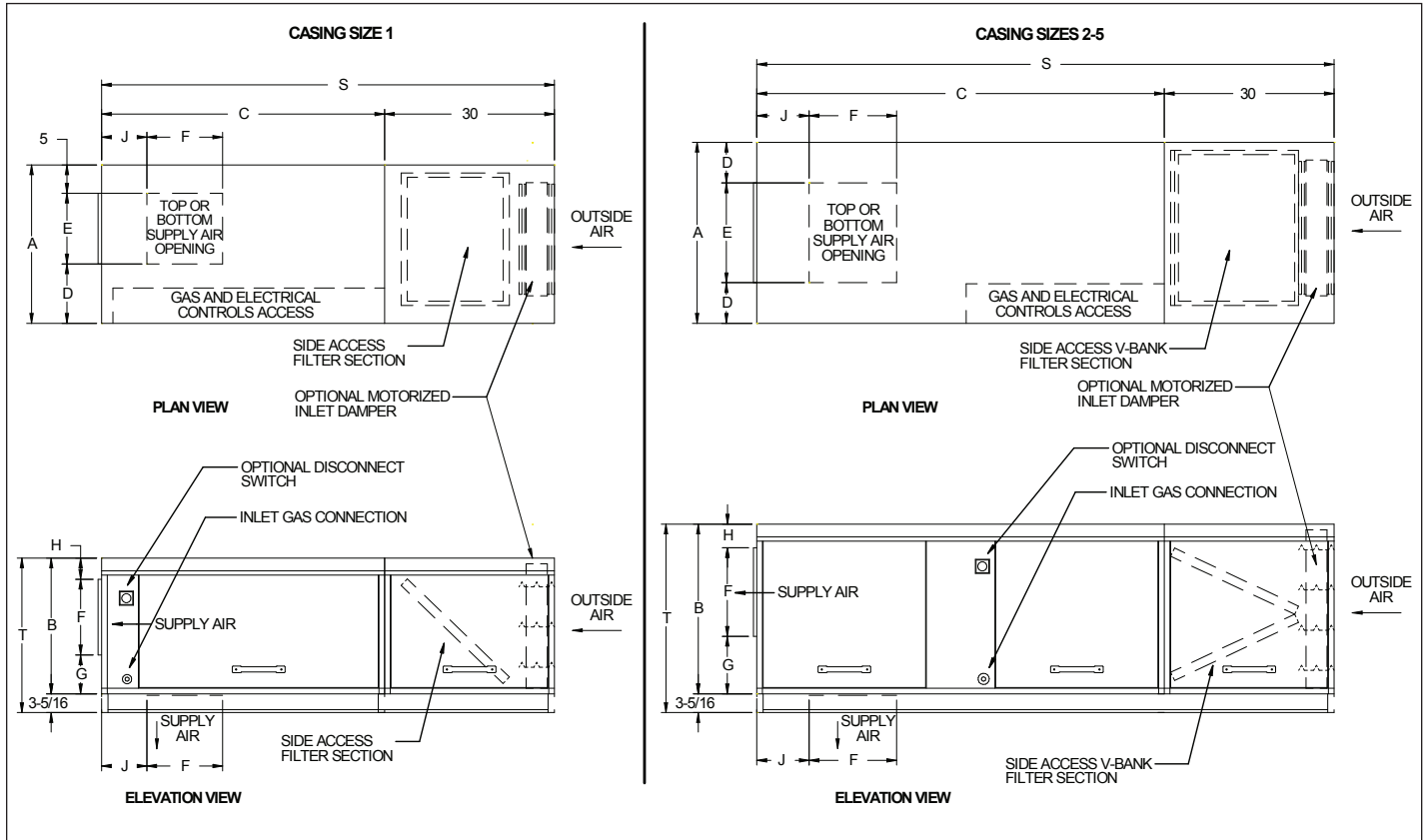
Note: The drawing above is a general drawing for both Unit Configurations (Digit 7) = "B" (Left Hand Access, Straight Discharge) and "D" (Left Hand Access, Bottom Discharge) for reference. For Unit Configurations other than "B" or "D", please see the Breeze® AccuSpec generated submittal package for the selected unit.

Table 30.1 - Unit Dimensions (without Evap Cooler or Side Access Filter Section) (inches)

Unit Size	A	B	C	D	E	F	Discharge Direction			S	T	Inlet Opening (applies only if no inlet damper)	
							Straight		Bottom or Top			Height	Width
							G	H	J				
108	28	24	50	10-1/2	12-1/2	13-3/8	6-7/8	3-3/4	8	N/A	27-5/16	22	19-7/8
210	32	30	72	8-7/16	15-1/8	13-3/8	6-7/8	9-3/4	8	N/A	33-5/16	28	22-7/8
212	32	30	72	7-3/16	17-5/8	15-7/16	8-1/4	6-5/16	9-1/4	N/A	33-5/16	28	22-7/8
315	40	33	92	9-11/16	20-5/8	17-7/8	9-3/8	5-3/4	10-1/2	N/A	36-5/16	31	28-7/8
418	48	38	96	12-1/16	23-7/8	20-7/8	11	6-1/8	12-1/4	N/A	41-5/16	36	36-7/8
520	55	48	96	14-1/8	26-3/4	26-3/4	12-15/16	8-5/16	13-1/2	N/A	51-5/16	46	43-7/8

DIMENSIONS - UNITS (with Side Access Filter Section)

Figure 31.1 - Unit Dimensions (with Side Access Filter Section) (inches)



Note: The drawing above is a general drawing for both Unit Configurations (Digit 7) = "B" (Left Hand Access, Straight Discharge) and "D" (Left Hand Access, Bottom Discharge) for reference. For Unit Configurations other than "B" or "D", please see the Breeze® AccuSpec generated submittal package for the selected unit.

Table 31.1 - Unit Dimensions (with Side Access Filter Section) (inches)

Unit Size	A	B	C	D	E	F	Discharge Direction			S	T	Inlet Opening (applies only if no inlet damper)	
							Straight		Bottom or Top			Height	Width
							G	H	J				
108	28	24	50	10-1/2	12-1/2	13-3/8	6-7/8	3-3/4	8	80	27-5/16	22	20
210	32	30	72	8-7/16	15-1/8	13-3/8	6-7/8	9-3/4	8	102	33-5/16	28	24
212	32	30	72	7-3/16	17-5/8	15-7/16	8-1/4	6-5/16	9-1/4	102	33-5/16	28	24
315	40	33	92	9-11/16	20-5/8	17-7/8	9-3/8	5-3/4	10-1/2	122	36-5/16	31	32
418	48	38	96	12-1/16	23-7/8	20-7/8	11	6-1/8	12-1/4	126	41-5/16	36	40
520	55	48	96	14-1/8	26-3/4	26-3/4	12-15/16	8-5/16	13-1/2	126	51-5/16	46	47

Table 31.2 - Side Access Filter Dimensions (inches)

Model Size	Qty	Size (W x L)	Model Size	Qty	Size (W x L)
108	1	25" X 20" X 2"	315	3	20" X 16" X 2"
				3	20" X 20" X 2"
210	2	20" X 12" X 2"	418	6	20" X 12" X 2"
	2	20" X 16" X 2"		3	20" X 20" X 2"
212	2	20" X 12" X 2"	520	4	20" X 12" X 2"
	2	20" X 16" X 2"		8	20" X 20" X 2"

DIMENSIONS - EVAPORATIVE COOLER

Figure 32.1 - Evaporative Cooler Dimensions (inches)

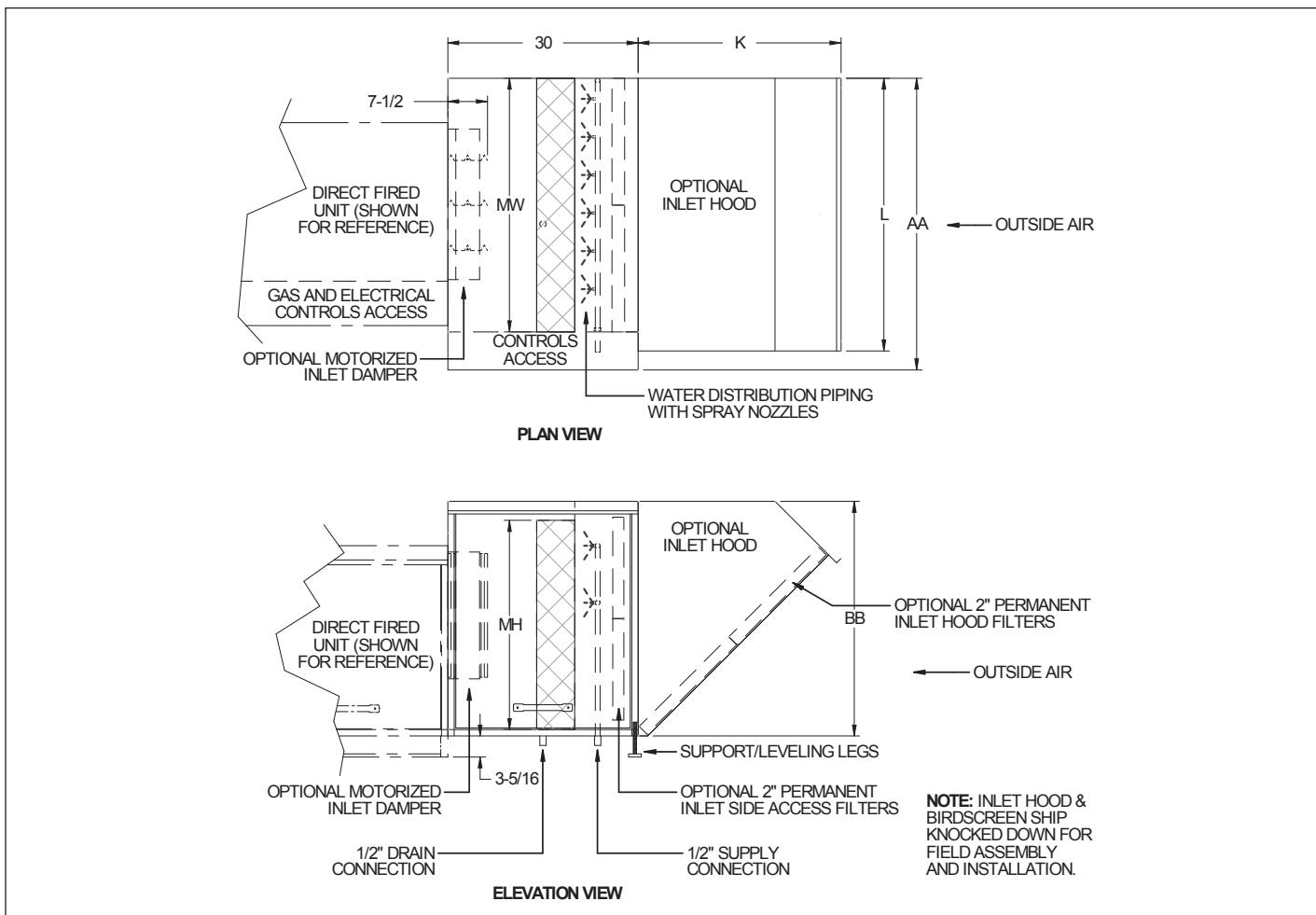


Table 32.1 - Evaporative Cooler Dimensions (inches)

Evap Cooler Model Size	Casing		12" Evap Media			Optional Features					
						Inlet Hood		Inlet Hood Filters		Side Access Filters	
	AA	BB	MH	MW	Media Area (sq. ft.)	K	L	Qty	Size	Qty	Size (W x L)
EVCNR1	30	28	24	24	4.00	26	28	2	16" x 25" x 2"	1	24" x 24" x 2"
EVCNR2	38	30	26	32	5.78	32	35	4	16" x 20" x 2"	2	16" x 25" x 2"
EVCNR3	46	37	33	40	9.17	32	43	4	20" x 20" x 2"	4	20" x 16" x 2"
EVCNR4	54	44	40	48	13.33	38	53	6	16" x 25" x 2"	6	16" x 20" x 2"
EVCNR5	66	52	48	60	20.00	46	63	9	20" x 20" x 2"	3	20" x 20" x 2"
										3	20" x 25" x 2"
EVCNR6	66	64	60	60	25.00	58	63	9	20" x 25" x 2"	9	20" x 20" x 2"

DIMENSIONS - INLET HOOD AND ROOF CURB

Figure 33.1 - Inlet Hood Dimensions (inches)

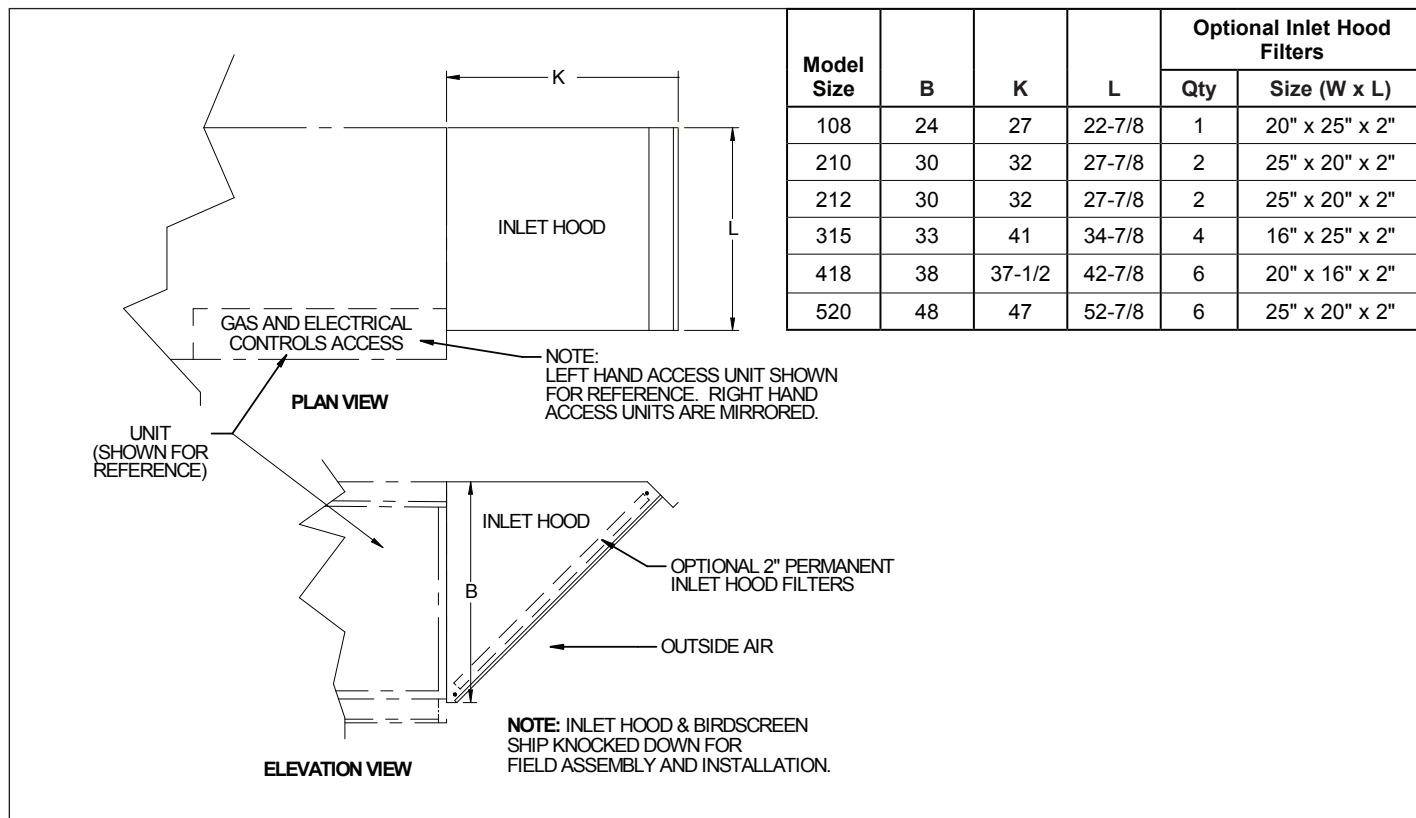
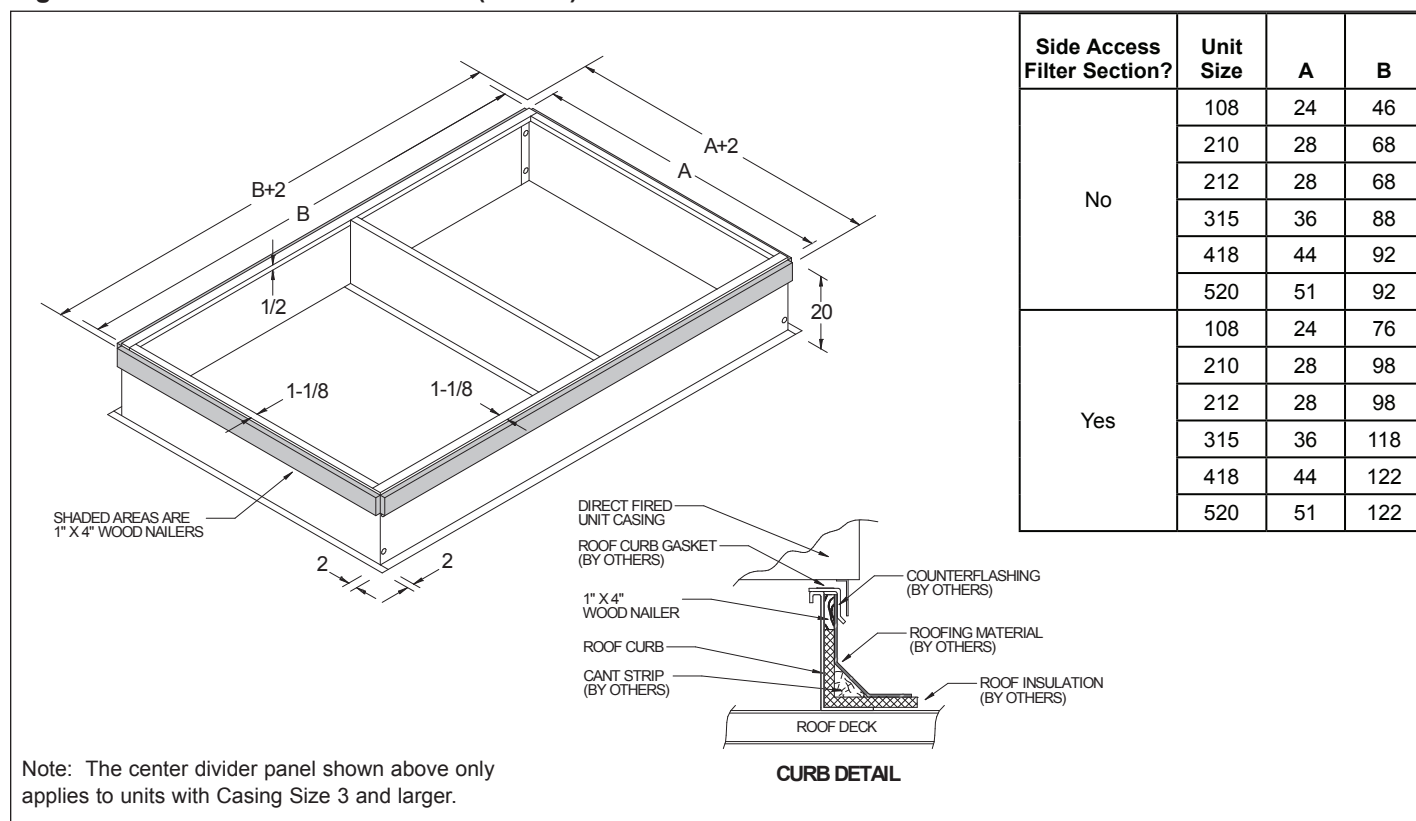


Figure 33.2 - Roof Curb Dimensions (inches)



UNIT AND ACCESSORY WEIGHTS

Table 34.1 - Unit Weights (all weights approximate and in pounds)

Item	Description	Case Size				
		1	2	3	4	5
Base Unit	Unit	285	385	560	715	940
	Double Wall Liners	70	120	180	220	270
Side Access Filter Section	Filter Section	55	70	100	120	150
	Double Wall Liners	40	40	50	60	70
Dampers	Inlet	25	36	46	67	100
	Discharge	25	40	45	50	60
Inlet Hood	Without Filters	35	50	65	75	100
	With Filters	40	60	75	90	120
Roof Curb	Unit without Side Access Filter Section	60	75	105	115	120
	Unit with Side Access Filter Section	85	105	130	140	145
Discharge Diffusers	3-Way with Horizontal Blades	40	45	60	70	80
	3-Way with Horizontal and Vertical Blades	45	55	70	80	95
	4-Way with Horizontal Blades	50	55	70	80	135

Table 34.2 - Evaporative Cooler Weights (all weights approximate and in pounds)

Item	Description	Evaporative Cooler Size					
		1	2	3	4	5	6
Base Evaporative Cooler Unit	Dry	100	120	150	185	235	270
	Operating	150	190	260	345	475	570
Inlet Hood	Without Filters	35	40	65	100	125	150
	With Filters	40	50	80	120	150	175
Side Access Filter	With Filters	10	15	15	20	25	30

Table 34.3 - Motor Weights (all weights approximate and in pounds)

Motor Size	Motor Type	Motors		Factory Mounted VFD
		Single Phase	Three Phase	
1/2 HP	ODP	20	N/A	10
	TE	25	35	
3/4 HP	ODP	25	N/A	10
	TE	30	40	
1 HP	ODP	40	N/A	10
	TE	40	45	
1-1/2 HP	ODP	45	N/A	10
	TE	70	55	
2 HP	ODP	50	N/A	10
	TE	75	85	
3 HP	ODP	90	90	15
	TE	100	95	
5 HP	ODP	100	115	15
	TE	125	130	
7-1/2 HP	ODP	130	125	15
	TE	145	150	
10 HP	ODP	215	215	30
	TE	220	220	
15 HP	ODP	N/A	230	30
	TE	N/A	250	

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MAINTENANCE

⚠ WARNING

1. Disconnect power supply before maintaining the equipment to prevent electrical shock and equipment damage.
2. If equipped with the factory installed disconnect switch option, when the switch is in the "OFF" position, supply power remains energized at the supply power terminal strip and the top of the disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.

⚠ CAUTION

When using a drill bit to clean the burner gas ports, do not distort or enlarge the ports. Do not use a power drill.

IMPORTANT

1. Service and maintenance procedures should be performed by a qualified service agency.
2. When lubricating bearings, be sure to keep the grease clean, do not over lubricate, and do not mix petroleum grease with silicone.

All heating equipment should be serviced before each heating season to ensure proper operation. The following items may be required to have a more frequent service schedule based on the environment in which the unit is installed, and how long the equipment is operated.

Motor Assembly

Check the motor sheave set-screws and the motor slide base bolts for tightness upon initial start-up and before each heating season. The motor bearings are pre-lubricated at the factory for initial operation but should be re-lubricated (when provided with grease fittings) at six (6) month intervals. The recommended lubricants are Shell Oil Company "Dolium R", Chevron Oil "SRI No. 2", or Texaco "Premium RB" lubricant. When lubricating, consider the following:

- Clean the grease fitting and then apply the grease with a proper grease gun. Keep grease clean.
- Use two full strokes for each bearing. Do not over lubricate.
- Do not mix petroleum grease with silicone.
- Lubricate motors at standstill.

Blower Assembly

After initial start-up, check the tightness of the fan sheave, fan hub set screws, fan bearing collar set screws, and fan bearing mounting bolts. These should be also checked again when re-tensioning the v-belts, re-lubricating the fan bearings, and before each heating season. Examine the blower wheel at six (6) month intervals for accumulation of dust and dirt on the fan blades. Any build-up must be cleaned off to maintain performance. If the accumulation is heavy, more frequent cleaning may be required.

Sheaves

Drive sheaves should be checked at the same time the bearings are inspected. Check to make sure the pulleys are in alignment and are securely fastened to the blower and motor drive shafts.

Blower Bearing Lubrication

Model Digit 19=A, C, or E are provided with pre-lubricated sealed bearings which require no additional lubrication for the life of the bearing.

Model Digit 19=B, D, or F are provided with pillow block bearings and should be lubricated annually using ESSO Beacon 325, Shell Alvania #3, or an equivalent grease to those listed. Clean the grease fitting and then apply the grease with a proper grease gun. Inject enough grease until a small amount shows between the seal and the bearing race.

Belts

Due to belt stretching, adjust belt tension after the first one hundred (100) hours of operation. Check belts every three months thereafter for proper tension. Belt adjustment is to be performed as outlined on page 26.

Filters

Inspect monthly or as indicated by the dirty filter light on the remote panel until an appropriate schedule can be established, based on need. Replace or clean as necessary.

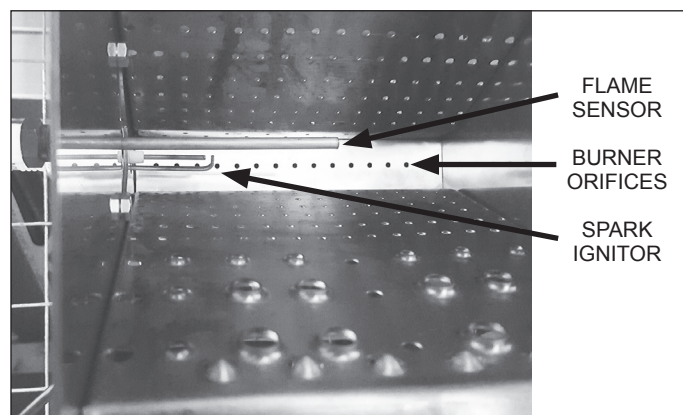
Burner

Annually, prior to each heating season, a check should be made of the burner and components. Clean the igniter and flame rod and examine porcelain for cracks. Perform the following:

1. Inspect the burner carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material on either side of the mixing plates should be removed with a wire brush. Check visually that no holes in the mixing plates are blocked. If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless fasteners.
2. Check burner orifices for carbon build-up and clean. Use a pin vise with a drill bit for cleaning as follows:
 - #43 (#47 at tee sections, if equipped) drill bit for Maxon NP-I burner orifices (*Standard burner for Digit 8=X*)
 - #31 drill bit for Midco natural gas burner orifices
 - #45 drill bit for Midco propane gas burner orifices
 - #50 (1/16") drill bit for Maxon NP-II burner orifices.

DO NOT ENLARGE BURNER ORIFICES - THIS MAY AFFECT PERFORMANCE

Figure 36.1 - Burner Orifices (Direct Spark Ignition Shown)



MAINTENANCE

Gas Train

An annual inspection of the gas control assembly should be made. Internal and external piping should be checked for leaks. Relief vents on gas controls should be checked for clogging.

Air Pressure Switches

An annual check of the tube for the air flow switch, and the entering and leaving side of building pressure switches, should be made to ensure against blockage.

Dampers

Check damper linkage connection and/or set screws for tightness. Lubricate the damper bushings as required.

Casing

For painted units, periodically touch up any scratches.

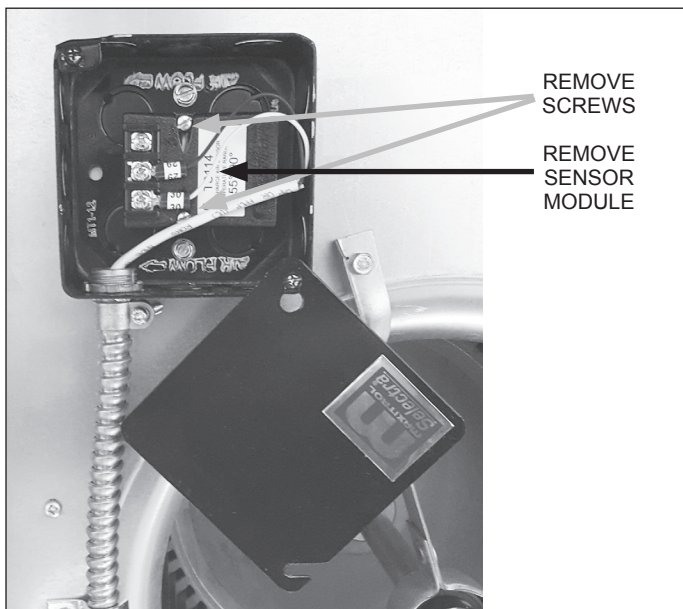
Gaskets

Inspect door gasket seals annually. Replace any showing damage or deterioration.

Discharge Air Sensor

Remove the cover from the sensor assembly junction box (item #7 in Figure 15.1) which will expose the sensor module (Figure 37.1). Remove the two screws that hold the sensor module in the junction box. The sensor assembly junction box does not get removed. Insert a bottle brush into the sensor sampling tube to clean out any dust or dirt, then replace the sensor module and junction box cover.

Figure 37.1 - Discharge Air Sensor Assembly



Gas and Electric Controls

Inspect for general cleanliness and tightness of electric and mechanical connections.

Put the system back into operation and view the burner from the downstream side while cycling the burner through its full firing range. A good flame will be blue, with minimal yellow. The flame length in forced high fire should be 12-18" long. The pilot only flame should be about the size of a baseball when properly adjusted.

Procedure for Extended Shutdown Periods

If the unit is to be shut down for an extended period of time, the following precautions should be followed.

1. Turn off all manual shutoff valve(s) in the gas train of the unit, and in the gas supply line to the unit.
2. Turn off the electric supply to the unit at the unit's disconnect. Lock the disconnect to prevent tampering.
3. If the unit is supplied with filters, remove and store the filters.
4. Protect outside air openings to prevent the unit from being soiled.

SERVICE AND TROUBLESHOOTING

⚠ WARNING

When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at owner's risk.

⚠ CAUTION

Do not reuse any mechanical or electrical component which has been wet. Such components must be replaced.

IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Tables 38.1 and 39.1, refer to the applicable sections of the manual.

Table 38.1 - Service & Troubleshooting

Problem	Possible Cause	Possible Remedy
A. Power Failure	1. Disconnect not turned on.	1. Turn to disconnect.
	2. Blown fuses.	2. Check and replace.
	3. Main to unit disconnect not on.	3. Turn on power at main.
B. Dampers Not Operating	1. Disconnect not turned on.	1. Turn to disconnect.
	2. Blown fuses.	2. Check and replace.
	3. Main to unit disconnect not on.	3. Turn on power at main.
	4. Failed damper motor.	4. Check and/or replace.
	5. Loose wiring to motor.	5. Check and tighten.
	6. Damper linkage binding.	6. Check and clear.
C. Motor Not Operating	1. Disconnect not turned on.	1. Turn to disconnect.
	2. Blown fuses.	2. Check and replace.
	3. Main to unit disconnect not on.	3. Turn on power at main.
	4. Failed motor.	4. Check and/or replace.
	5. Loose wiring to motor.	5. Check and tighten.
	6. Motor overloaded.	6. Check for proper speed.
	7. Improper supply voltage.	7. Check and correct.
	8. Motor overheating.	8. Check firing rate of unit.
D. Blower Not Operating	1. See Problems "A" and "C".	1. See Problems "A" and "C".
	2. Broken drive belt(s).	2. Check and replace.
	3. Bearings seized.	3. Check and replace.
E. Burner Not Operating	1. See Problems "A" thru "D".	1. See Problems "A" thru "D".
	2. Damper end switch not functioning.	2. Check and/or replace.
	3. Failed air flow switch.	3. Check and/or replace.
	4. Loose wiring connection at air proving.	4. Check and tighten.
	5. No pilot.	5. See Problem "F".
	6. Pilot not proving.	6. See Problem "F".
	7. Flame safeguard in lockout mode.	7. Check and reset.
	8. High limit tripped.	8. Check and/or replace.
	9. Too high or low gas pressure.	9. Check pressure switches and gas pressure.
	10. Failed control transformer.	10. Check and/or replace.
	11. Blown control transformer fuse.	11. Check and/or replace.
	12. Failed or malfunctioning main gas valve(s).	12. Check and/or replace
	13. Faulty or failed freeze stat or inlet on/off stat.	13. Check and/or replace.
	14. Failed safeguard control.	14. See vendors instructions shipped with unit.
	15. Airflow too low, low airflow proving switch is open.	15. Check for reason of insufficient airflow and correct.
	16. Airflow too high, high airflow cutoff switch is open.	16. Check for reason of excessive airflow and correct.

SERVICE AND TROUBLESHOOTING

Table 39.1 - Service & Troubleshooting

Problem	Possible Cause	Possible Remedy
F. Pilot Not Operating (Digits 9-12=1200 and Larger)	1. No gas to pilot.	1. Check hand valve and pilot solenoid valve.
	2. Dampers not functioning.	2. See Problem "B".
	3. Pilot tube plugged or damaged	3. Check and repair/or replace.
	4. Freeze stat failure.	4. Check and/or replace.
	5. Inlet On/Off stat failure.	5. Check and/or replace.
	6. Flame safeguard in lockout	6. Check and reset.
	7. Failed flame safeguard.	7. See vendor's instructions shipped with unit.
	8. Failed air flow switch	8. Check and/or replace.
	9. Too high or low gas pressure.	9. Check pressure switches and gas pressure.
	10. See Problem "E" – No Burner	10. See Problem "E" Operation.
G. Flame Will Not Prove	1. Inadequate signal to safeguard control.	1. Check micro-amps or VDC from flame sensor.
	2. Insufficient gas pressure to pilot. (Digits 9-12=1200 and larger only)	2. Check and adjust.
	3. Loose wires from flame sensor.	3. Check and correct.
	4. Dirty flame rod.	4. Clean and/or replace.
	5. Moisture on flame rod leads.	5. Check and dry leads.
	6. Defective flame rod.	6. Check and/or replace.
	7. Defective flame safeguard controller.	7. Check and/or replace.
	8. Short in flame sensor leads.	8. Check and/or replace.
	9. Excessive air velocity across burner.	9. Check burner velocity and correct.
H. Erratic Temperature	1. Defective temperature selector or sensor.	1. Check and/or replace.
	2. Temperature sensor subject to poor air flow or located in drafty area.	2. Check sensor location and move if required.
	3. Discharge sensor blocked by duct insulation.	3. Check and remove blockage.
	4. Faulty amplifier or modulating valve.	4. Check and/or replace.
I. Unable to Achieve High Fire	1. Low gas supply pressure.	1. Check and adjust.
	2. Modulating controls improperly set.	2. See vendor literature shipped with unit.
	3. Faulty temperature sensor.	3. Check and/or replace.
	4. Faulty amplifier or modulating valve.	4. Check and/or replace.
J. Unable to Achieve Low Fire	1. Modulating controls improperly set.	1. See vendor literature shipped with unit.
	2. Faulty temperature sensor.	2. Check and/or replace
	3. Faulty amplifier or modulating valve.	3. Check and/or replace.
K. No Gas Flow	1. Manual gas valve(s) closed.	1. Open manual gas valve(s).
	2. See Problem "E", Items 2 thru 14.	2. See Problem "E", Items 2 thru 14.
L. Unable to Achieve Desired Discharge Temperature, or Space Temperature	1. Temperature sensors improperly set or faulty.	1. Adjust or replace.
	2. Improper gas supply pressure.	2. Check and correct.
	3. Faulty amplifier or proportioning motor.	3. See vendor literature shipped with unit.
	4. Air flow too high.	4. Check blower speed and/or burner velocity differential pressure.
	5. Burner capacity undersized.	5. Check rating plate for conformance to design specifications.
M. Building Pressure Control VFD Control Functioning Incorrectly or Not Functioning	1. Defective building pressure switch.	1. Check and/or replace.
	2. Pressure switch improperly set.	2. See vendor literature shipped with unit.
	3. Pressure switch pick-up tubes blocked.	3. Check and repair or reconnect.
	4. Indoor pressure pick-up tube not routed to indoor space.	4. Route tube to indoor space.
	5. Faulty VFD.	5. Check and/or replace.

If the preceding service diagnostics do not solve your problem, contact your local Modine Manufacturing sales representative for further assistance. Please be sure to have the complete model number and serial number from the unit's rating plate available before calling for service.

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December, 2016

START UP CHECKLIST & REPORT

Direct Gas-Fired Make-Up Air Units, model MCV/MVV, DCV/DVV

IMPORTANT

1. This Start Up Checklist and Report must be used in conjunction with the Installation and Service Manual originally shipped with the unit, in addition to any other accompanying component supplier literature.
2. The use of this Start Up Checklist and Report is specifically intended for a qualified installation and service agency. All installation and service of the unit(s) to which this applies must be performed by a qualified installation and service agency.
3. After completion of start-up, make a copy of this completed form for your files as necessary and leave the original copy with the owner for future reference.

Project Information	Project Name: _____ Address: _____ City, State, ZIP: _____
Equipment Information	Model Number: _____ Serial Number: _____
Start-Up Contractor Information	Company Name: _____ Person Name (Print): _____ Contractor Address: _____ Telephone Number: _____
Owner Operation and Maintenance Review	Owner/Owner's Rep Name (Print): _____ Person Title: _____ CUSTOMERS AUTHORIZED SIGNATURE: I acknowledge that I have been instructed on the operation and maintenance of this equipment: Signature: _____ Date: _____ Telephone Number: _____

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

START UP CHECKLIST & REPORT – Direct Fired MUA models MCV/MVV, DCV/DVV

INITIAL INSPECTION

Installer Responsibilities

1. Remote Panel: All interconnecting wires run from remote to unit	<input type="checkbox"/> Yes <input type="checkbox"/> No
Temperature control interconnect wires to remote ran in: <input type="checkbox"/> Shielded Cable <input type="checkbox"/> Separate Conduit	
Location: <input type="checkbox"/> Inside Wall <input type="checkbox"/> Outside Wall Distance from Unit: ____ Feet (approx.)*	
<i>*NOTE: If the Remote to Main Panel Interconnect Wiring is over 200' Long, Please Consult Factory</i>	
2. Gas supply run connected with proper gas pressure regulator and drip leg	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Electrical supply properly installed to main panel, at voltage and amperage stated on unit nameplate	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Duct connections made and sealed properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Discharge diffuser installed secure, with blades tight and in the open position	<input type="checkbox"/> Yes <input type="checkbox"/> n/a
6. All "shipped loose" items installed properly - filters, vibration isolators, smoke detectors, relays, dampers, louvers, supply fan belts, roof curb, etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No
If No, reason(s): _____	
7. All paint scratches have been properly touched-up	<input type="checkbox"/> Yes <input type="checkbox"/> No
Comments: _____	

Miscellaneous Items

1. Visible Physical Damage?	<input type="checkbox"/> No <input type="checkbox"/> Yes; If Yes, specify _____
2. Installation Location:	<input type="checkbox"/> Outdoor <input type="checkbox"/> Indoor
3. Installation Type	<input type="checkbox"/> Roof Curb <input type="checkbox"/> Platform <input type="checkbox"/> Post <input type="checkbox"/> Suspended <input type="checkbox"/> Other
4. Hardware Tight & Secure	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Damper Linkages Secure	<input type="checkbox"/> Yes <input type="checkbox"/> No
Comments: _____	

Fan & Motor Sheaves

1. Fan & Motor Sheaves Secured Tightly to Shafts	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. V-Belts Aligned Properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Fan Bearing Set screws Tight	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Fan Hub Set Screws Tight	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. V-Belts Tensioned Properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. Fan Bearing Mounting Bolts Tight	<input type="checkbox"/> Yes <input type="checkbox"/> No
7. Fan Motor: Manufacturer _____ HP _____ FLA _____ Frame Size _____	
Comments: _____	

Burner Inspection

1. Spark Igniter Secured Properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Flame Rod Secured Properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Ignition Wire Attached at Igniter & Transformer	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Pilot Line Fittings Tight	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Unions Tight and Secure	<input type="checkbox"/> Yes <input type="checkbox"/> No
Comments: _____	

START UP CHECKLIST & REPORT – Direct Gas-Fired Make-Up Air Units

INITIAL INSPECTION (continued)

Gas Manifold & Vent Piping

1. Manifold Assembly and Components Tight and Securely Mounted	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Vent Screens Installed If Required	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Vent Piping Run to Outdoors (some indoor models)	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Tighten Fittings and Components as Necessary	<input type="checkbox"/> Yes <input type="checkbox"/> No
Comments: _____	

Filters

1. Filters Installed Properly	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Type: <input type="checkbox"/> Aluminum <input type="checkbox"/> Pleated MERV 8 <input type="checkbox"/> Pleated MERV 13 <input type="checkbox"/> Other _____	
Comments: _____	

Electric Service

1. Electrical Service Provided to Unit: _____ Volts _____ Phase _____ Hertz _____ Amps	
2. Unit Nameplate Electrical Requirement: _____ Volts _____ Phase _____ Hertz _____ Amps	
3. Terminal Strip Wires Tight:	Main Panel <input type="checkbox"/> Yes Remote Panel <input type="checkbox"/> Yes
4. Componentry and Relays Mounted Securely in Place	<input type="checkbox"/> Yes
5. Fuse Size (fused disconnects): _____ Volts _____ Amps	
6. Overload Heater Size _____	
7. The Unit has been grounded by the installer at the main unit panel	<input type="checkbox"/> Yes
Comments: _____	

Gas Service (see maximum and minimum gas pressure requirements on unit rating plate)

1. Supply Gas Type: <input type="checkbox"/> Natural Gas <input type="checkbox"/> LP Gas	
2. Service Pressure: _____ <input type="checkbox"/> "WC <input type="checkbox"/> Oz <input type="checkbox"/> PSI	
3. Manual Gas Shut-off Cock in line-of-sight:	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Handle Present on Manual Shut-off Cock:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Comments: _____	

When complete with the Initial Inspection, proceed to the Verification of Operation section.

START UP CHECKLIST & REPORT – Direct Fired MUA models MCV/MVV, DCV/DVV

VERIFICATION OF OPERATION

NOTE: Refer to the Wiring Diagram, Sequence of Operation, and I&S Manual for this section.

Fan Operation

1. The motorized (inlet –or– discharge) Damper is fully open when fan comes on:	<input type="checkbox"/> Yes <input type="checkbox"/> N/A
2. The low temperature limit switch is field set at: _____°F (factory set at 40°F)	<input type="checkbox"/> N/A
3. The low temperature limit timer (TDR) completes its cycle in: _____ minutes _____ seconds (normal: 5 minutes)	
4. Fan Rotation is in the same direction as the rotation arrow:	<input type="checkbox"/> Yes
5. Discharge External Static Pressure: _____ "WC	
6. Check the following (<i>Verify the motor running amps does not exceed the motor nameplate FLA.</i>):	
Unit Off	Fan Running (burner off)
A-B _____ Volts	A-B _____ Volts _____ Amps
B-C _____ Volts	B-C _____ Volts _____ Amps
A-C _____ Volts	A-C _____ Volts _____ Amps
7. Approximate Outdoor Air Temperature: _____°F	

Burner Operation

1. The Profile Pressure Drop is: _____ " WC (measured using taps provided near air flow switch).	
2. Burner Pressure Measurements: Suction Static Pressure: _____ " WC (measured at the manifold pressure tap with unit fan on and gas off). High Fire Pressure: _____ " WC (measured as above, but with fan and gas on, and unit in forced high fire). <i>Note: Manifold Pressure = Suction Pressure + High Fire Pressure (Example: -1.2 +3.4 = 4.6...ignore signs)</i> Refer to the unit rating plate for correct high fire manifold pressure and I&S Manual.	
3. The High Temperature Limit Switch is field set to: _____°F (maximum recommended setting is 130°F)	
4. The Low Gas Pressure Switch is field set to: _____ " WC (factory set at 3" WC)	<input type="checkbox"/> N/A
5. The High Gas Pressure Switch is field set to: _____ " WC (factory set at 1.5" WC <u>above</u> high fire pressure)	<input type="checkbox"/> N/A
6. The Low & High Air Flow Switch (LAFS/HAFS) is factory set and cannot be adjusted!	
7. The pilot flame (low fire) should be the approximate size of a baseball:	<input type="checkbox"/> Yes (adjust as needed)
NOTE: Set low fire gas pressure so there is a continuous "ribbon" of flame approximately 1" wide across face of burner.	
8. Flame Relay (pilot ignition only): For Fireye controllers, it should read 4.0 to 10.0 VDC at terminals marked (+ -) on the flame relay face.	<input type="checkbox"/> Yes
9. Mild Weather Stat (optional): Trips the burner when outside air temp is higher than the stat set point: Setpoint _____°F (factory set at 65°F).	<input type="checkbox"/> Yes <input type="checkbox"/> N/A

Maxitrol Temperature Control System

1. Modulating Regulating Valve ("MR Valve"):	Voltage at Low Fire: _____ Vdc Voltage at High Fire: _____ Vdc
2. Check calibration of the Discharge Temperature Sensor. Adjust if necessary.	
3. (Maxitrol 44 Only) The Discharge Temperature Limits are field set at: Minimum _____°F (factory set at 55°F) Maximum _____°F (factory set at 95°F - <u>maximum</u> is 120°F)	
4. (Maxitrol 44 Only) Burner responds to demand for heat from Room Temperature Selector in remote panel:	<input type="checkbox"/> Yes
5. Operation of Occupied/Unoccupied Switch (if applicable) or time clock verified:	<input type="checkbox"/> Yes <input type="checkbox"/> N/A
6. Is there evidence of temperature hunting?	<input type="checkbox"/> No <input type="checkbox"/> Yes**
** Refer to the Troubleshooting Guide in the I&S Manual for further instructions.	

START UP CHECKLIST & REPORT – Direct Gas-Fired Make-Up Air Units

VERIFICATION OF OPERATION (continued)

Miscellaneous Operational Checks:

1. With the unit fan and burner operating, all of the circuit check lights are illuminated (except the burner lockout pilot light and low temperature limit pilot light if applicable): <input type="checkbox"/> Yes	
2. If furnished, the time clock has been programmed per owner instructions, and training provided to him by me: <input type="checkbox"/> Yes	
3. If provided, the following temperature control stats have been set by me, and instructions provided to the owner: Room Override Stat (w/Maxitrol 14) <input type="checkbox"/> Yes <input type="checkbox"/> N/A Mild Weather Stat <input type="checkbox"/> Yes <input type="checkbox"/> N/A Low Temperature Limit Switch/Timer <input type="checkbox"/> Yes <input type="checkbox"/> N/A	
4. The electrical drawing and sequence of operation is taped to the enclosure door: <input type="checkbox"/> Yes	
5. The I&S Manual was reviewed by me with the owner, and placed back inside the unit enclosure: <input type="checkbox"/> Yes	
6. The owner was instructed by me on the operation of the following controls and options (check those that apply):	
<input type="checkbox"/> Maxitrol 14 Discharge Temperature Control System	<input type="checkbox"/> Maxitrol 44 Space Temperature Control System
<input type="checkbox"/> Smoke Detector	<input type="checkbox"/> CO Detector
<input type="checkbox"/> Magnehelic Gauge	<input type="checkbox"/> Photohelic Gauge
<input type="checkbox"/> 120V GFI Outlet	<input type="checkbox"/> Dirty Filter Switch and/or Light/Alarm
<input type="checkbox"/> Evaporative Cooler	<input type="checkbox"/> Fan Bearing Grease Type & Lube Cycle
<input type="checkbox"/> Filter Maintenance	<input type="checkbox"/> Discharge Diffuser Deflection Blade Adjustment
<input type="checkbox"/> Coil Maintenance	<input type="checkbox"/> Burner Maintenance
<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____
<input type="checkbox"/> _____	<input type="checkbox"/> _____



Additional Comments

REPLACEMENT PARTS ORDERING

Serial Plate Example

When servicing, repairing or replacing parts on these units, locate the serial plate of the unit and always give the complete model number and serial number from the serial plate. The serial plate is located on the door of the electrical control box.

Figure 46.1 - Serial Plate Example

 1500 DEKOVEN AVENUE RACINE, WI 53403-2552 PH.: (800) 828-4328		 ANSI Z83.4-2015/CSA 3.7-2015 NON-RECIRCULATING DIRECT FIRED INDUSTRIAL AIR HEATER FOR INDUSTRIAL/COMMERCIAL USE	
MODEL NO. <input type="text" value="MVV212BX0375NAEGA6EE5C1"/>		SERIAL NO. <input type="text" value="0123456-31033"/>	
AIR FLOW INFORMATION			
EQUIPPED FOR <input type="text" value="3,500 ACFM (1.652 Am³/s)"/>		<input type="text" value="3,176 SCFM (1.499 Sm³/s)"/>	
AGAINST <input (0.0623="" kpa)"="" type="text" value="0.25" wc=""/>		EXTERNAL STATIC PRESSURE	
FOR INSTALLATION ON NONCOMBUSTIBLE CONSTRUCTION ONLY			
GAS & BURNER INFORMATION			
GAS PRESSURE REQUIRED AT THE BURNER FOR MAXIMUM RATED CAPACITY		<input input="" type="text" value="5.2" wc<=""/>	GAS TYPE <input type="text" value="NATURAL"/>
RATED BURNER CAPACITY	MAX. <input type="text" value="318 MBH"/>	MIN. <input type="text" value="18 MBH"/>	
GAS INLET SUPPLY PRESSURE	MAX. <input input="" type="text" value="14" wc<=""/>	MIN. <input input="" type="text" value="7" wc<=""/>	
BURNER PROFILE PRESSURE DIFFERENTIAL	MAX. <input input="" type="text" value="1.0" wc<=""/>	MIN. <input input="" type="text" value="0.4" wc<=""/>	
MAX. DISCHARGE TEMPERATURE	<input type="text" value="131°F"/>	MAX. TEMPERATURE RISE	<input type="text" value="80°F"/>
MOTOR & ELECTRICAL INFORMATION			
<input type="text" value="460"/>	VOLTAGE	<input type="text" value="3"/>	PHASE <input type="text" value="60"/> CYCLES
<input type="text" value="2.00"/>	MOTOR HP	<input type="text" value="2.90"/>	MOTOR FLA <input type="text" value="4.90"/> UNIT FLA
NOTE: FOR CONNECTIONS, USE WIRES SUITABLE FOR AT LEAST 75° C (170° F)			
INSTALLATION CONDITIONS			
<input type="text" value="-20° F"/> MINIMUM AMBIENT AIR TEMPERATURE MINIMUM CLEARANCES TO COMBUSTIBLES ON THE SIDES, FRONT, BACK, TOP AND BOTTOM IS 6". MINIMUM CLEARANCE FOR MAINTENANCE AT THE UNIT INLET IS 36". UNIT SUITABLE FOR INDOOR OR OUTDOOR INSTALLATION. TO SHUT DOWN THE UNIT, TURN THE MAIN DISCONNECT TO THE OFF POSITION. SEE OPERATION & MAINTENANCE MANUAL FOR ALL GAS & ELECTRICAL SCHEMATICS.			
FOR YOUR SAFETY			
IF YOU SMELL GAS: 1. OPEN WINDOWS 2. DON'T TOUCH ELECTRICAL SWITCHES 3. EXTINGUISH ANY OPEN FLAME 4. IMMEDIATELY CALL YOUR GAS SUPPLIER		THE USE AND STORAGE OF GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS APPLIANCE IS HAZARDOUS.	
POUR VOTRE SÉCURITÉ			
SI VOUS SENTEZ UNE ODEUR DE GAZ: 1. OUVREZ LES FENÊTRES 2. NE TOUCHEZ À AUCUN INTERRUPTEUR 3. ÉTEIGNEZ TOUTE FLAMME NUE 4. ADVERTISSEZ IMMÉDIATEMENT VOTRE FOURNISSEUR DE GAZ.		II EST DANGEREUX D'UTILISER OU D'ENTREPOSER DE L'ESSENCE OU AUTRES VAPEURS INFLAMMABLES DANS DES RÉCIPIENTS OUVERTS À PROXIMITÉ DE CET APPAREIL.	

MODEL NOMENCLATURE

Model Nomenclature Description

The following is a list of values available. Not all values are selectable together. Refer to pages 9 through 11 for a complete description of each digit and available values.

Digits 1,2,3 - Product Type

MCV = Direct Fired, 100% Outside Air, Constant Speed Fan

MVV = Direct Fired, 100% Outside Air, Variable Speed Fan

Digit 4,5,6 - Casing Size and Blower Wheel Size

108 – Casing Size 1, 10" x 8" Blower (800 - 2,200 CFM)

210 – Casing Size 2, 10" x 10" Blower (1,400 - 3,500 CFM)

212 – Casing Size 2, 12" x 12" Blower (2,400 - 3,500 CFM)

315 – Casing Size 3, 15" x 15" Blower (3,200 - 8,000 CFM)

418 – Casing Size 4, 18" x 18" Blower (5,000 - 9,500 CFM)

520 – Casing Size 5, 20" x 20" Blower (5,500 - 14,000 CFM)

Digit 7 - Unit Configuration (refer to Figure 47.1)

A - Horizontal, right access, straight discharge

B - Horizontal, left access, straight discharge

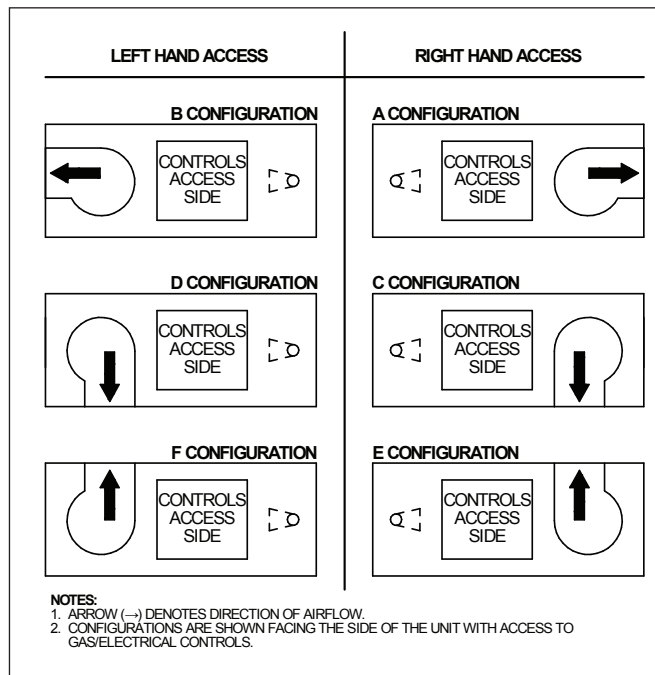
C - Horizontal, right access, bottom discharge

D - Horizontal, left access, bottom discharge

E - Horizontal, right access, top discharge

F - Horizontal, left access, top discharge

Figure 47.1 - Unit Configurations - Graphical



Digit 8 - Burner Type

X = MAXON Series NP-LE AIRFLO® with the following:

Digit 9,10,11,12 - Maximum Input Capacity

0290 - 290,000 Btu/Hr

0375 - 375,000 Btu/Hr

0625 - 625,000 Btu/Hr

0750 - 750,000 Btu/Hr

0938 - 937,500 Btu/Hr

1125 - 1,125,000 Btu/Hr

1200 - 1,200,000 Btu/Hr

1500 - 1,500,000 Btu/Hr

1875 - 1,875,000 Btu/Hr

2100 - 2,100,000 Btu/Hr

For an example of how this is applied to actual design conditions for a selected unit, refer to page 9.

Digit 13 - Gas Type and Inlet Pressure

N = Natural Gas, Standard Pressure (see Table 9.3)

P = Propane Gas, Standard Pressure (see Table 9.3)

Digit 14 - Gas Control System

A = Maxitrol System 14

B = Maxitrol System 44

C = Maxitrol SC25 for 4-20mA Control

D = Maxitrol SC25 for 0-10VDC Control

L = Honeywell SPYDER Controller with LonWorks Protocol

M = Honeywell SPYDER Controller w/BACnet MS/TP Protocol

Digit 15 - Insurance Compliance

E = ETL (standard)

F = FM

G = GE GAP 4.3.1 (formerly IRI)

Digit 16 - Additional Manifold Options

N = None

A = Inlet Gas Pressure Gauge (IGPG)

B = Burner Gas Pressure Gauge (BPGG)

C = High and Low Gas Pressure Switches (HLGPS)

D = IGPG and BPGG

E = IGPG and HLGPS

F = BPGG and HLGPS

G = IGPG, BPGG, and HLGPS

Digit 17 - Ignition/Flame Safeguard System

A = Direct Spark Ignition with Flame Rod Flame Supervision

B = Interrupted Pilot Ignition with Flame Rod Supervision

Digit 18 - Supply Voltage

1 = 115V/60Hz/1Ph

5 = 230V/60Hz/3Ph

2 = 208V/60Hz/1Ph

6 = 460V/60Hz/3Ph

3 = 230V/60Hz/1Ph

7 = 575V/60Hz/3Ph

4 = 208V/60Hz/3Ph

Digit 19 - Blower Bearings and Vibration Isolation

A = Spider Bearings - Neoprene Vibration Isolation

B = Pillow Block Bearings - Neoprene Vibration Isolation

C = Spider Bearings - Spring Vibration Isolation

D = Pillow Block Bearings - Spring Vibration Isolation

E = Spider Bearings - Rubber-In-Shear Vibration Isolation

F = Pillow Block Bearings - Rubber-In-Shear Vibration Isolation

Digit 20 - Motor Horsepower

A = 1/2 F = 3

B = 3/4 G = 5

C = 1 H = 7-1/2

D = 1-1/2 J = 10

E = 2 K = 15

Digit 21 - Motor Type

1 = Open Drip Proof (ODP)

5 = Totally Enclosed (TE)

Digit 22 - Cabinet Finish and Installation Location

A = Unpainted, Outdoor Installation

B = Unpainted, Indoor Installation

C = Painted Exterior, Outdoor Installation

D = Painted Exterior, Indoor Installation

E = Painted Interior and Exterior, Outdoor Installation

F = Painted Interior and Exterior, Indoor Installation

Digit 23 - Cabinet Insulation

1 = 1" Fiberglass Insulation - Foil Faced

2 = 1" Fiberglass Insulation - Galvanized Double Wall Liners

COMMERCIAL WARRANTY

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY COMPONENT WHICH SHALL, WITHIN THE APPLICABLE WARRANTY PERIOD DEFINED HEREIN AND UPON PRIOR WRITTEN APPROVAL, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

These warranties are issued only to the original owner-user and cannot be transferred or assigned. No provision is made in these warranties for any labor allowance or field labor participation. Seller will not honor any expenses incurred in its behalf with regard to repairs to any of Seller's products. No credit shall be issued for any defective part returned without proper written authorization (including, but not limited to, model number, serial number, date of failure, etc.) and freight prepaid.

OPTIONAL SUPPLEMENTAL WARRANTY

Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years on certain compressors. Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years or nine (9) years on certain heat exchangers.

EXCLUSION OF CONSUMABLES & CONDITIONS BEYOND SELLER'S CONTROL

This warranty shall not be applicable to any of the following items: refrigerant gas, belts, filters, fuses and other items consumed or worn out by normal wear and tear or conditions beyond Seller's control, including (without limitation as to generality) polluted or contaminated or foreign matter contained in the air or water utilized for heat exchanger (condenser) cooling or if the failure of the part is caused by improper air or water supply, or improper or incorrect sizing of power supply.

Component Applicable Models	"APPLICABLE WARRANTY PERIOD"
<u>Heat Exchangers</u> Gas-Fired Units except PSH/BSH	TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<u>Heat Exchangers</u> Low Intensity Infrared Units <u>Compressors</u> Condensing Units for Cassettes	FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN SIXTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<u>Burners</u> Low Intensity Infrared Units <u>Other</u> Components excluding Heat Exchangers, Coils, Condensers, Burners, Sheet Metal	TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<u>Heat Exchangers/Coils</u> Indoor and Outdoor Duct Furnaces and System Units, PSH/BSH, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators <u>Compressors</u> Vertical Unit Ventilators <u>Burners</u> High Intensity Infrared Units <u>Sheet Metal Parts</u> All Products	ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST

As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.



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