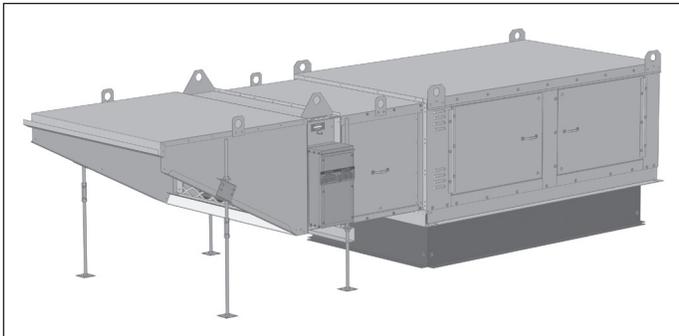


## INSTALLATION AND SERVICE MANUAL direct-fired make-up air units models MDB/MRB



Model MDB is ETL certified to meet the U.S. and Canadian requirements in the latest version of ANSI Standard Z83.4, Non-Recirculating Direct Gas-Fired Industrial Air Heaters.



Model MRB is ETL certified to meet the U.S. requirements only in the latest version of ANSI Z83.18, 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. 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.
3. Gas pressure to the unit controls must never exceed 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 pressure in excess of 1/2 psig (3.5 kPa).
4. 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).
5. For indoor units, where required by Code, use a dedicated line for venting gas to the outside of the building.
6. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
7. If equipped with the Deadfront 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 dead front disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.
8. All appliances must be wired strictly in accordance with the wiring diagram furnished with the unit. Any wiring different from the wiring diagram could result in a hazard to persons and property.
9. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
10. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than the rated voltage.
11. 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. For model MDB (100% Make Up Air) units, adjustments to the position of the burner opening baffles are permitted when instructions herein are properly followed. For model MRB (Return Air) units, the baffles for the burner, burner bypass, and return air openings must not be modified or adjusted.
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.
3. 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.
4. Do not operate unit with a gas input rate greater than that shown on the unit's rating plate.
5. When using a drill bit to clean the burner gas ports, do not distort or enlarge the ports. Do not use a power drill.
6. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
7. Do not reuse any mechanical or electrical component which has been wet. Such component must be replaced.

### IMPORTANT

1. Start-up and adjustment procedures should be performed by a qualified service agency.
2. To check most of the Possible Remedies in the troubleshooting guide listed in Table 42.1, refer to the applicable sections of the manual.
3. Installation in the airplane hangers must be in accordance with the Standard for Aircraft Hangars, ANSI/NFPA 409, and (2) public garage 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.
4. 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.
5. The heater inlet shall be located in accordance with the applicable code provisions for ventilation air.
6. Field constructed intake accessories should be properly designed to minimize the entry of snow and rain.
7. For model MDB (100% Make Up Air) units, all air to the unit must be ducted directly from the outdoors. Recirculation of room air is not permitted over the burner. For model MRB (Return Air) units, recirculation of room air is permitted if it does not pass over the burner. Return air ductwork must be ducted to the return air opening only, while all air passing over the burner must be ducted directly from the outdoors.
8. If in doubt regarding the application, contact your local Modine Manufacturing sales representative.

# TABLE OF CONTENTS / SI (METRIC) CONVERSION FACTORS / UNIT LOCATION

## Table of Contents

Inspection upon Arrival . . . . .	1
Special Precautions . . . . .	2
SI (Metric) Conversion Factors . . . . .	3
Unit Location . . . . .	3
Location Recommendations . . . . .	3
Sound and Vibration Attenuation . . . . .	4
Mounting Options . . . . .	4-6
Suspended Units . . . . .	4
Rail Mounted Units . . . . .	5
Slab Mounted Units . . . . .	5
Roof Curb Mounted Units . . . . .	6
Roof Curb Installation . . . . .	6
Duct Installation . . . . .	7
Utility Location . . . . .	7
Rigging Instructions . . . . .	7
Unit Installation . . . . .	8-10
Gas Connections . . . . .	8
Manifold Arrangements . . . . .	9
Electrical Connections . . . . .	10
Prior to Operation . . . . .	10-17
Controls Descriptions . . . . .	11-16
Controls Locations . . . . .	16
Gas Controls . . . . .	17
Start-Up Procedure . . . . .	18-23
Blower/Motor Adjustment . . . . .	21
Adjusting Burner Profile Pressure Differential . . . . .	22
Setting the Dirty Filter Switch . . . . .	23
Sequence of Operation . . . . .	24
Control Applications . . . . .	25-26
General Performance Data . . . . .	27
Accessory Static Pressure Drop and Blower Performance Data . . . . .	28-31
Blower Sheave Assembly Data . . . . .	32
Unit and Accessory Dimensions . . . . .	34-39
Unit and Accessory Weights . . . . .	40
Maintenance . . . . .	41-42
Service and Troubleshooting . . . . .	42-43
Control Definitions . . . . .	44
Start-up Report . . . . .	45
Replacement Parts Ordering . . . . .	46
Model Nomenclature/Serial Number Format . . . . .	47
Warranty . . . . .	Back Page

## 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 shall 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 as 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 shall be located in accordance with the applicable code provisions for ventilation air.
8. For model MDB (100% Make Up Air) units, all air to the unit must be ducted directly from the outdoors. Recirculation of room air is not permitted over the burner. For model MRB (Return Air) units, recirculation of room air is permitted if it does not pass over the burner. Return air ductwork must be ducted to the return air opening only, while all air passing over the burner must be ducted directly from the outdoors.
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 3.2
10. Field constructed intake accessories should be properly designed to minimize the entry of snow and rain.
11. 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 <sup>3</sup> /hr
Btu	1.06	kJ	Gal/Hr.	3.79	l/hr
Btu/ft <sup>3</sup>	37.3	kJ/m <sup>3</sup>	gallons	3.79	l
Btu/hr	0.000293	kW	Horsepower	746	W
CFH (ft <sup>3</sup> /hr)	0.000472	m <sup>3</sup> /min	inches	25.4	mm
CFH (ft <sup>3</sup> /hr)	0.0000787	m <sup>3</sup> /s	pound	0.454	kg
CFM (ft <sup>3</sup> /min)	0.0283	m <sup>3</sup> /min	psig	6.89	kPa
CFM (ft <sup>3</sup> /min)	0.000472	m <sup>3</sup> /s	psig	27.7	"W.C.

**Table 3.2 - Combustible Materials and Service Clearances**

Model Size	Minimum Clearances to Combustible Materials				Minimum Clearance For Service Access (Both Sides)
	Top	Bottom	Sides	Ends	
All	6"	0"	6"	6"	30"

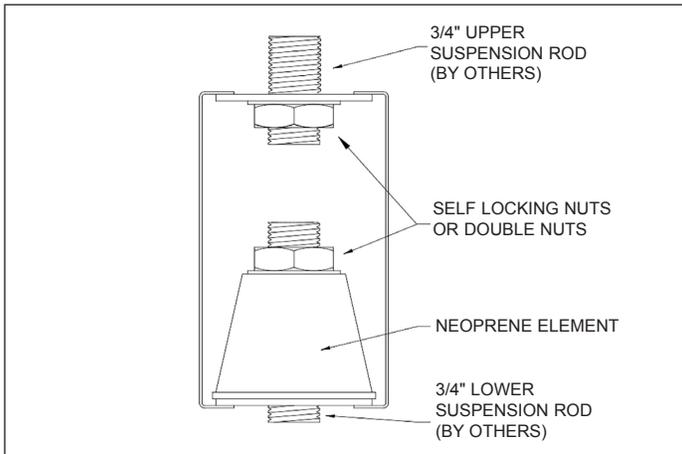
# MOUNTING OPTIONS

## Sound and Vibration Levels

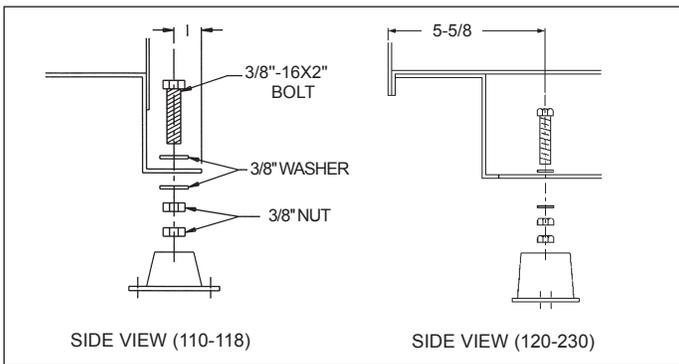
All mechanical equipment generates some sound and vibration which may require attenuation. Locate the equipment away from critical areas whenever possible. Frequently, units can be mounted above utility areas, corridors, restrooms, and other non-critical areas. Generally, a unit should be located within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

Field-installed, factory-supplied vibration isolators are available for suspended or rail/slab mounted units. Figures 4.1 through 4.2 show how suspended or rail/slab-mounted vibration isolators should be installed. For roof curb-mounted units (not supplied with factory-installed internal vibration isolation), Figure 4.3 shows suggested methods of sound attenuation.

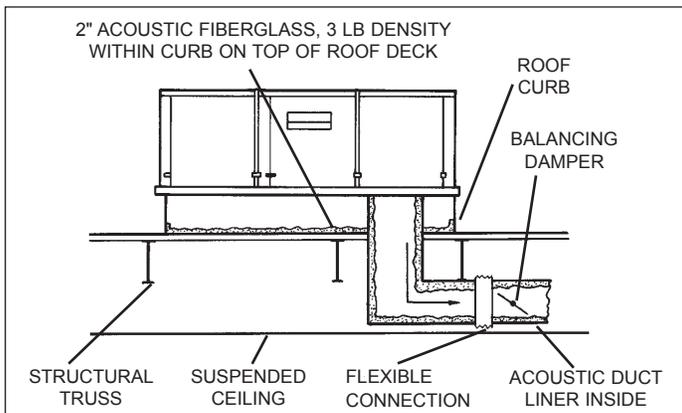
**Figure 4.1 - Vibration Hangers (Suspended Units)**



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



**Figure 4.3 - Suggested Sound Attenuation**



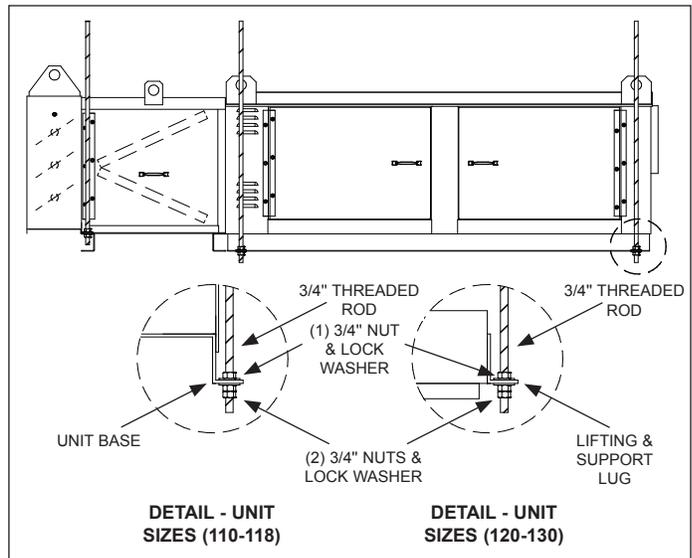
# MOUNTING OPTIONS

## Suspended Units

Combination lifting and support lugs are supplied with each unit. Units with accessory devices, such as filter sections, inlet dampers, etc., must have provisions for separately supporting these accessories. Each accessory is supplied with its own lifting and support lugs. (Refer to Figure 4.4 for the recommended mounting method and pages 34-37 for dimensions.)

Be sure the structure from which the unit and accessories are hung is adequate to handle the weight, which can be found on page 40. The unit must be level in a horizontal position.

**Figure 4.4 - Unit Suspension**



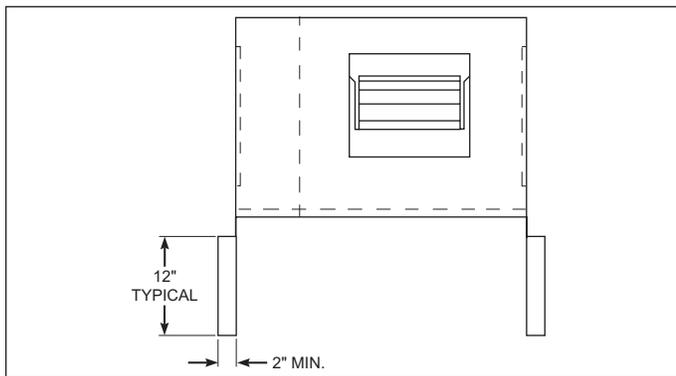
# MOUNTING OPTIONS

## Rail-Mounted Units

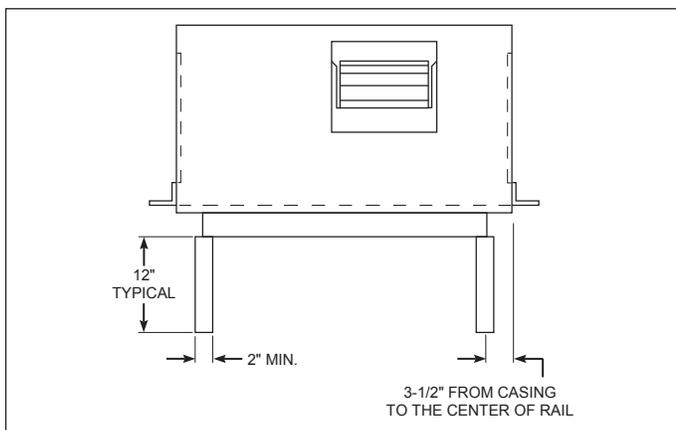
1. If mounting on a roof, the roof structure must be adequately designed to support the live weight load of the unit and rail mounting support structure.
2. To insure longevity and integrity of the section joints, use two continuous rails for the length of the unit (in direction of airflow), including the V-bank filter section if equipped.
3. The unit must be level in a horizontal position.
4. If there is an inlet hood, that must be supported as shown in the section, "Inlet Accessory Support" on page 6.
5. If there is an inlet damper, that does not require separate support.

See Figures 5.1 and 5.2 for recommended mounting methods.

**Figure 5.1 - Unit Rail Supports (Size 110-118)**



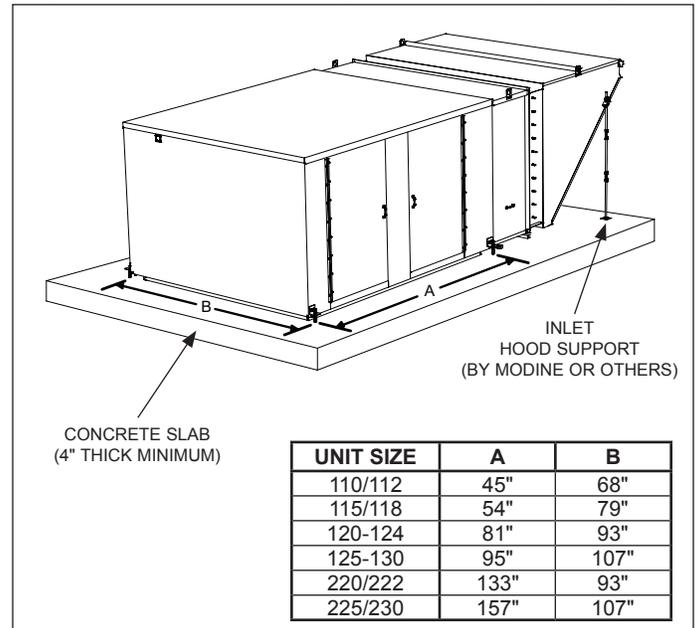
**Figure 5.2 - Unit Rail Supports (Size 120-230)**



## Slab-Mounted Units

1. For ground level installation of the unit, prepare a 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 3/4" threaded anchor bolts spaced according to Figure 5.3 for securing the unit in place. 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).
2. The unit must be level in a horizontal position.
3. If there is an inlet hood, that must be supported as shown in Figure 5.3 and section, "Inlet Accessory Support" on page 6.
4. If there is a V-bank filter section, it includes supports that allow it to be mounted level with the main unit.
5. If there is an inlet damper, that does not require separate support.

**Figure 5.3 - Slab-Mounting Anchor Bolt Spacing**



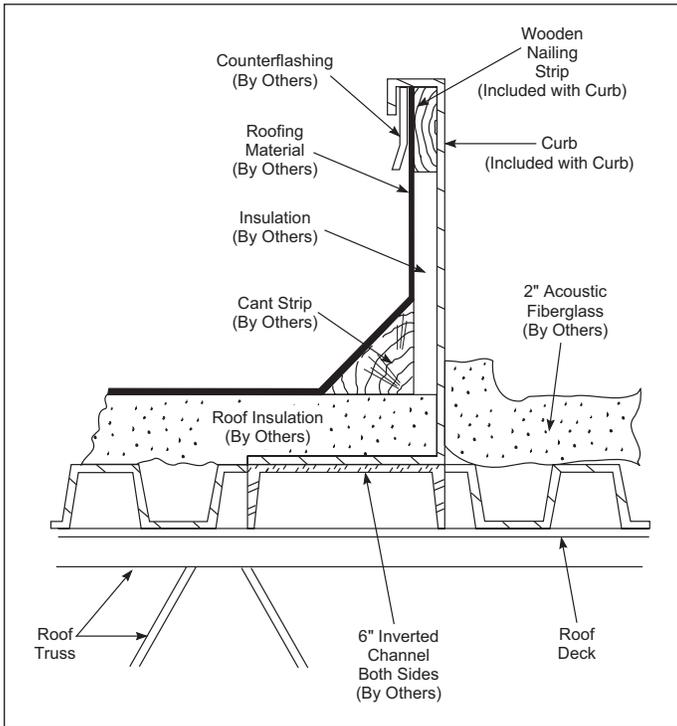
UNIT SIZE	A	B
110/112	45"	68"
115/118	54"	79"
120-124	81"	93"
125-130	95"	107"
220/222	133"	93"
225/230	157"	107"

# MOUNTING OPTIONS / ROOF CURB INSTALLATION

## Roof Curb-Mounted Units

An optional 14" or 24" high roof curb is available to simplify site preparation and raise the unit above roof water and snow levels. It can be installed with the roof, and 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 38 for dimensions.

**Figure 6.1 - Typical Roof Curb Details with Unit Installed Over Areas where Sound is Not Critical**

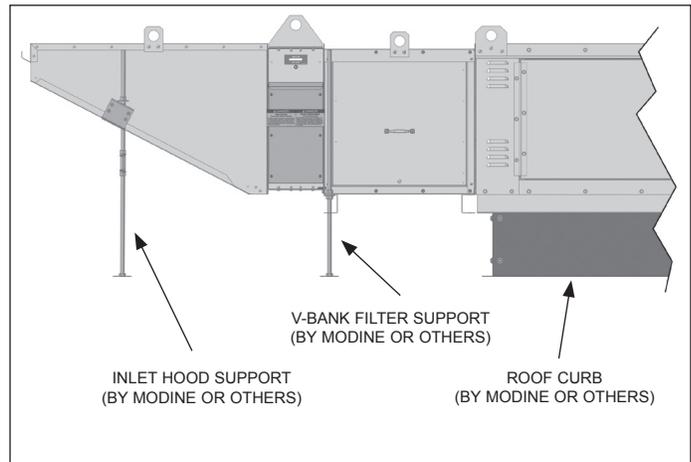


## Inlet Accessory Support

If the unit has unsupported inlet accessories such as V-bank filters and/or inlet hood, a method of support is required as shown in Figure 6.2.

1. If there is an inlet hood, Modine offers a factory supplied, field installed Inlet Hood Support kit. Refer to the latest revision of Modine Literature #7-591 for more information.
2. If there is a V-bank filter section, Modine offers a factory supplied, field installed V-Bank Support kit. Refer to the latest revision of Modine Literature #7-591 for more information.
3. If there is an inlet damper, that does not require separate support.

**Figure 6.2 - Inlet Accessory Support On Roof Curb Mounted Units**



## 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. If the roof curb is supplied by Modine, refer to the latest revision of literature #7-590, "Installation Instructions - Direct Fired Roof Curb" for instructions.
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. All dimensions have a tolerance of  $\pm 1/8$ ".
5. 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. For electrical power supply, allow approximately eight feet of wire, plus provisions for weather tight flexible conduit for connection to the unit, as required by local codes.
6. Maintain an 8" minimum height from the top of the roof deck to the top of the curb.
7. Accessory items, such as inlet hood, V-bank filters, and discharge dampers must be supported separately. (Refer to the following section for additional information.)

# DUCT INSTALLATION / UTILITY LOCATION / RIGGING INSTRUCTIONS

## DUCT INSTALLATION

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

1. Be sure properly sized and designed discharge ducts are installed.
2. Units with twin blowers should have a common discharge plenum of at least three (3) hydraulic duct diameters.
3. As a general rule, all discharge ducts should have a straight run of at least three (3) hydraulic duct diameters before making turns in the ductwork.

**For Rectangular Ducts:  $D_h = 4A/P$**

**For Circular Ducts:  $D_h = D$**

where:  **$D_h$  = Hydraulic Diameter**

**A = Cross Sectional Area of Rectangular Duct**

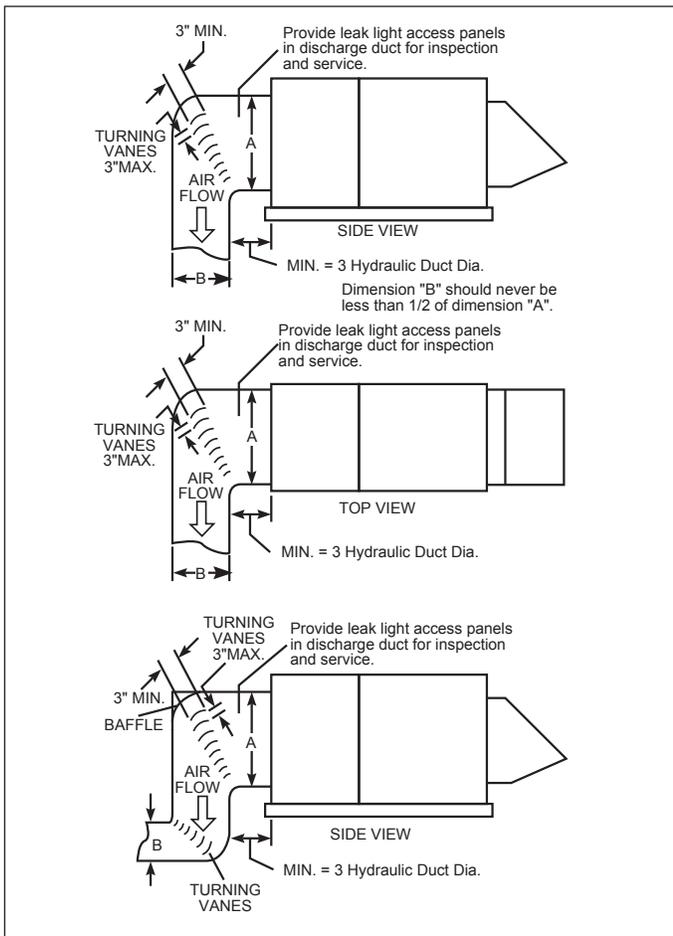
**P = Perimeter of Rectangular Duct**

**D = Diameter of Round Cut**

Figure 7.1 shows the recommended duct layout for various discharge ductwork. Return ducts should be designed in the same manner.

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 shall be incorporated to provide not less than 4 complete air changes to the ductwork (or enclosure) by volume prior to an ignition attempt.

**Figure 7.1 - Recommended Field-Installed Discharge Duct Configurations**



## Fire Dampers

Fire dampers (supplied by others) installed in the inlet or outlet duct systems shall 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.

## UTILITY LOCATION

Electric and control connections can be made either from the side or the bottom of the unit. The factory-supplied gas connection is located on the side of the unit. For units without factory-supplied and mounted disconnects, holes can be cut in the fixed side panels, or the bottom of the unit. Sealing of holes cut in the unit casing for utility connections should be done with care to prevent air and water leaks.

## RIGGING INSTRUCTIONS

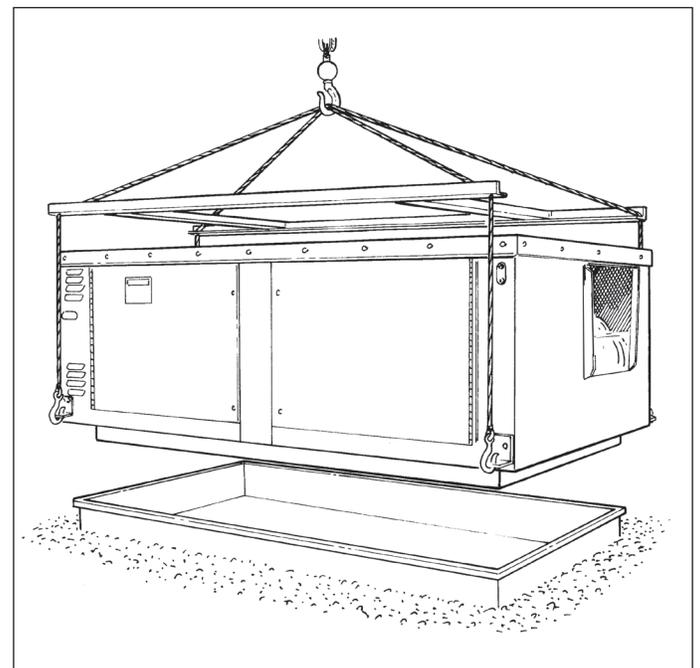
Each unit supplied with four mounting and lifting brackets with 1" clearance holes for lifting hooks.

**When units are supplied with factory-mounted accessories, DO NOT use the accessory lifting eyes to support the load of the unit.** The accessory lifting eyes should only be used to steady the load. The main load should be placed on the unit's lifting lugs.

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 put into place.

The units lifting lugs are supplied at the base of the unit to provide maximum strength for lifting. **In order to lift the unit without damaging the casing, SPREADER BARS MUST BE USED!** Figure 7.2 shows the proper method for lifting the unit using spreader bars.

**Figure 7.2 - Typical Rooftop Rigging**



# UNIT INSTALLATION

## UNIT INSTALLATION

1. Follow site preparation instructions for applicable curb, rail, or slab mounting. 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. Check unit dimensions for proper fit.
2. If the unit is mounted on a factory-supplied curb:
  - a. Install roof curb using previous roof curb instructions (page 6).
  - b. Thoroughly clean and dry the top of the curb surface.
  - c. Attach the factory-supplied curb gasket around the top perimeter of the curb.
  - d. Lift the unit into place and set the unit down evenly on curb.
  - e. If units are supplied with accessories for field-mounting, attach all accessories after the unit has been put into place.
  - f. Make final unit connections to the electric power supply and remote control circuits. Connect gas lines. Caulk all utility clearance holes on the unit after connections have been made.
3. If the unit is to be rail or slab-mounted, follow directions listed on pages 4 and 5.
4. Do not modify or block combustion or ventilation openings.
5. Units require field-support of the accessory inlet hood. Be sure that the accessory hood is properly supported. (See Unit and Accessory Drawings on pages 34-39).
6. Some models may be split-shipped to accommodate maximum shipping widths. When assembling unit sections, make sure that the sections are properly gasketed, caulked, and secured before operating the equipment.

3. After threading and reaming the ends, inspect piping and remove loose dirt and chips.
4. Support piping so that no strains are imposed on the unit controls.
5. Use two wrenches when connecting field piping to units.
6. Provide a drip pocket before each unit and in the line where low spots cannot be avoided. (See Figure 8.1).
7. Take-off to unit should come from top or side of main to avoid trapping condensate.
8. Piping subject to wide temperature variations should be insulated.
9. Pitch piping at least 1/4" per 15 feet of horizontal run.
10. Compounds used on threaded joints of gas piping must be resistant to action of liquefied petroleum gases.
11. Purge air from gas supply lines.
12. After air has been purged, check for gas leaks in the piping systems using a soap/water solution.
13. Install a ground joint union and gas cock external to the unit for easy servicing of controls, including a 1/8" NPT plugged tapping accessible for test gauge connections (see Figure 8.1).
14. Allow at least 5 feet of piping between any high pressure regulator and the unit control string.

Standard field gas supply connection sizes are shown in Table 8.1.

## Gas Connections

### ⚠ WARNING

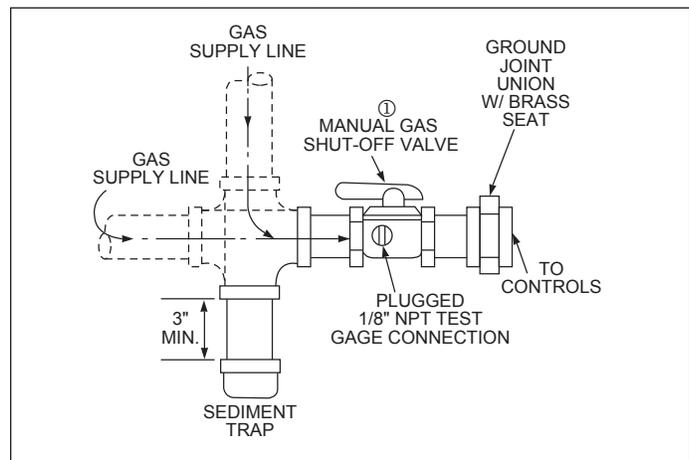
1. All field gas supply lines should be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to the unit controls must never exceed the pressure shown on the unit's rating plate. The unit and its individual shutoff valve(s) must 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).

### ⚠ 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. Avoid pipe sizes smaller than 1/2".

**Figure 8.1 - Required Piping to Unit's Gas Controls**



① Manual gas shut-off valve is in the "off" position when handle is perpendicular to pipe.

**Table 8.1 - Field Gas Supply Connections**

MBH Digit 9-12	Natural		Propane	
	8-14" W.C. Digit 13=A	1-5 psig Digit 13=B	11-14" W.C. Digit 13=C	1-5 psig Digit 13=D
275-400	3/4"	n/a	3/4"	n/a
550-720	1"	n/a	1"	n/a
825	1-1/4"	1"	1"	3/4"
1000	1-1/4"	1"	1"	1"
1100	1-1/4"	1-1/4"	1-1/4"	1"
1375	1-1/2"	1-1/4"	1-1/4"	1"
1650	2"	1-1/4"	1-1/2"	1-1/4"
1925-2200	2"	1-1/2"	2"	1-1/4"
2475	2-1/2"	1-1/2"	2"	1-1/4"
2750-3575	2-1/2"	2"	2"	1-1/2"
3850-4950	n/a	2"	n/a	2"
5225-7425	n/a	2-1/2"	n/a	n/a

# INSTALLATION

## Manifold Arrangements

**⚠ WARNING**

For indoor units, where required by Code, use a dedicated line for venting gas to the outside of the building.

The standard ETL manifold arrangement is designed to meet ANSI standards and is designed for a gas inlet pressure of 8" to 14" water column. Optional 1-5 psig manifolds are available.

All Modine Manufacturing standard ETL manifold options comply to IRI safety requirements.

Controls supplied for IRI manifolds are in accordance with correspondence received from Industrial Risk Insurers dated November, 1995.

Optional manifold arrangements are available to comply with Factory Mutual (FM) requirements.

### FM Manifolds

All Modine Manufacturing standard ETL manifolds up to and including 2,500,000 Btu/Hr meet FM safety control requirements.

Units required to comply with FM requirements that are selected with manifold inputs greater than 2,500,000 Btu/Hr require the selection of an optional FM manifold to satisfy FM safety requirements.

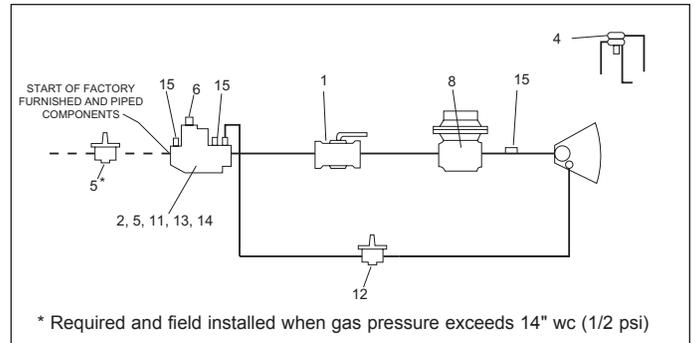
For units selected to meet FM requirements, if there is to be any form of blocked inlets in the entering air stream, such as filters or inlet dampers (potential gas traps to the outside), the optional FM with restriction manifold must be selected, regardless of Btu/Hr input. Intake screens or vertical inlet ductwork (above the unit inlet opening) are not considered blockages, while inlet dampers are considered to be blockages. The FM less restriction option may only be used when inlet restrictions do not exist.

Controls supplied for FM manifolds are in accordance with correspondence received from Factory Mutual dated November, 1995.

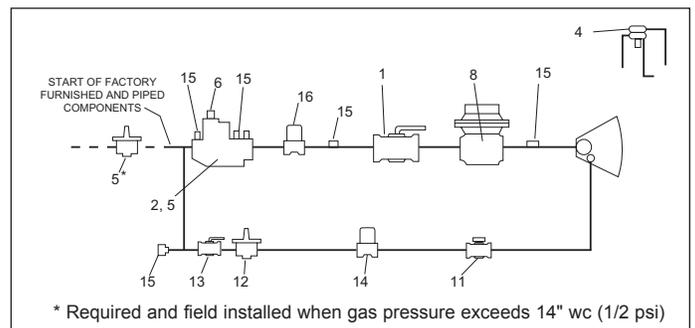
**Table 9.1 - Component Listing for Figures 9.1 through 9.4**

Ref.	Component
1	Auxiliary Gas Shut-Off Valve
2	Combination Main Gas Valve
3	High and Low Gas Pressure Switch
4	Main Air Flow Proving Switch
5	Main Gas Pressure Regulator
6	Main Gas Shut-Off Valve
7	Main Gas Valve
8	Modulating Valve
9	Motorized Main Gas Valve
10	N/A
11	Orificed Pilot Needle Valve
12	Pilot Gas Pressure Regulator
13	Pilot Gas Shut-Off Valve
14	Pilot Gas Valve
15	Plugged Test Port
16	Redundant Main Gas Valve

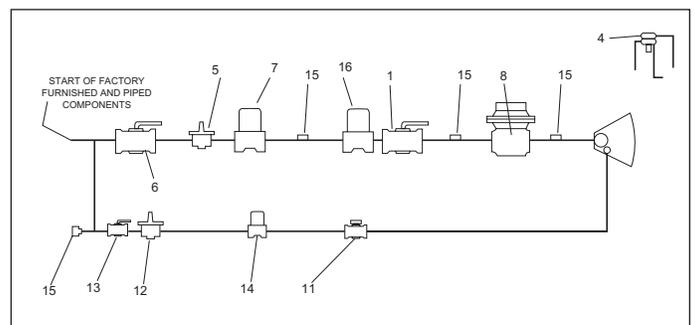
**Figure 9.1 - Typical Manifold Component Arrangements Standard, IRI, & FM Arrangement - Up to 400,000 Btu/Hr**



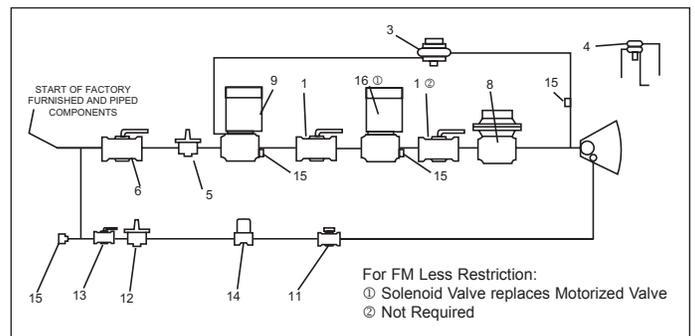
**Figure 9.2 - Typical Manifold Component Arrangements Standard, IRI, & FM Arrangement - Over 400,000 Btu/h and up to 720,000 Btu/Hr**



**Figure 9.3 - Typical Manifold Component Arrangements Standard & IRI Arrangement - Over 720,000 Btu/Hr FM (Less & With Restriction) - Up to 2,500,000 Btu/Hr**



**Figure 9.4 - Typical Manifold Component Arrangements FM (Less & With Restriction) - Over 2,500,000 BTU/HR**



The manifold arrangements shown in Figures 9.1 through 9.4 are typical and may not match the unit supplied. Refer to the manifold piping diagram that shipped with the unit for actual arrangement.

# INSTALLATION / PRIOR TO OPERATION

## Electrical Connections

### WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. If equipped with the Deadfront 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 dead front 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 wiring diagram furnished with the unit. Any wiring 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

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 percent of each other. If not, advise the utility company.
6. External electrical service connections that must be installed include:
  - a. Supply power connection (115, 208, 230, 460, or 575 volts).
  - b. Connection of thermostats, remote monitoring panels, building pressure sensors, time clocks, or any other accessory control devices that may be supplied (115 and/or 24 volts - refer to unit wiring diagram).
7. All outdoor electrical connections must be weatherized to prevent moisture from entering the electrical compartment. Refer to the unit dimensional drawings on pages 34 through 37 for the electrical knock-out locations.
8. All supply power electrical connections are made in the electrical section of the unit.

9. Refer to the wiring diagram for the terminal location of all wiring.

**Note:** If the unit is not factory supplied with an optional timed freeze protection (low-temperature system), 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.

## PRIOR TO OPERATION

Although this unit has been assembled and fire-tested at the factory, the following pre-operational procedures must be performed to assure the unit has not been damaged or mis-aligned during shipment. This will help assure proper on-site operation.

1. Remove all shipping straps, braces and tie downs.
2. Check burner to insure proper location and alignment.
3. Check blower and motor alignment, as well as belt tension.
4. Check bearings for alignment and tightness. Check bearing to shaft set screws for tightness.
5. Check all electrical connections for tightness.
6. Check gas piping for leaks using a soap/water solution.
7. Check gas tightness of safety shut-off valve following procedure below.

### Test Procedure for Checking Gas Tightness of Safety Shut-Off Valve

1. While the unit is off, attach a pressure gauge to the downstream side of the second safety shut off valve (SSOV) closest to burner.
2. Following normal start-up procedure described in this manual, allow the burner to go to main flame.
3. Shut the unit off and let the pressure drop to zero.
4. Close hand shut-off valve immediately downstream of the second SSOV and wait 5 minutes.
5. There should be no changes in pressure. If the pressure increases, the second SSOV needs to be replaced.
6. Remove the test plug located between the two SSOV's and let the pressure to drop to zero.
7. Move the pressure gauge to the test port between the two SSOV's and wait 5 minutes. Make sure to replace the plug in the test port downstream side of the second SSOV.
8. There should be no changes in pressure. If the pressure increases, the first SSOV needs to be replaced.
9. Remove the pressure gauge and plug the test port.
10. Open the hand shut-off valve and the unit is ready for operation.

### Evaporative Cooling Units

For units equipped with an evaporative cooler, refer to Installation and Service Manual - Evaporative Coolers (Literature 7-569).

After these preliminary checks have been made, the unit can be prepared for start-up.

Each unit is supplied with this Installation and Service Manual, which includes a Field Start-Up Form on page 45. The Field Start-Up Form must be followed and properly filled out by the installer, with one copy kept with the unit.

# CONTROL DESCRIPTIONS

Before continuing with the start-up and checkout procedure, it is important to familiarize yourself with the controls furnished with the unit. Review the documents shipped with the unit to determine which controls are included.

Pages 11 through 16 provide photographs and descriptions for each control. The typical locations of the electrical and gas controls are shown on pages 16 through 17. The typical locations of the blower and motor components are shown on page 21.

Once a thorough review of these controls and devices has been made, the step-by-step Start-Up Procedure as described on pages 18 through 24 must be performed.

## Standard Safety Controls and Manifold

### Low Air Flow Proving Switch (PS-10)

The low air flow proving switch monitors the pressure drop across the burner profile plate to insure that sufficient air flow exists before allowing the burner to operate. The low air flow proving switch is located in the gas controls cabinet and is electrically interlocked with the gas controls. See page 17 for location.

### High Air Flow Cutoff Switch (PS-11)

The high air flow cutoff switch monitors the pressure drop across the burner profile plate to insure that the air flow through the burner does not exceed the maximum design velocity. The high air flow cutoff switch is located in the gas controls cabinet and is electrically interlocked with the gas controls. See page 17 for location.

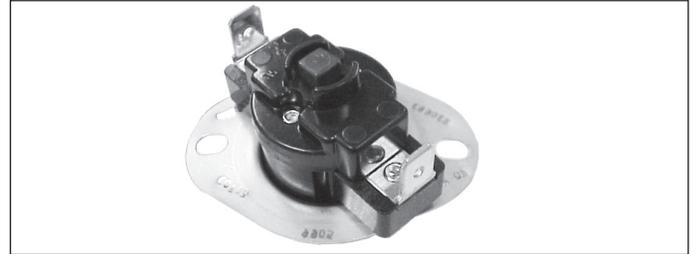
**Figure 11.1 - Low Airflow Proving/High Airflow Cutoff Switch (only one shown)**



### High Temperature Limit Control (FL-02)

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 gas controls. See page 21 for location. If the limit control opens a service person must inspect the unit, determine the cause, and take corrective action.

**Figure 11.2 - High Temperature Limit Control**



### Flame Safeguard Control (RE-02)

All units are equipped with a flame safety control. This control senses if the pilot flame has been established through the use of a flame rod flame sensor.

The flame safeguard control has a built-in pre-purge timer, and an ignition-timing device. The pre-purge timer allows the unit to purge any residual gas in the unit before a try for ignition can take place. The pre-purge time is approximately 10 seconds. After pre-purge has occurred, the spark ignition sequence will begin. If the pilot flame is not proved within the time period allowed (10 to 25 seconds), the safeguard control will go into lockout and will have to be manually reset before a new try for ignition can occur.

**Figure 11.3 - Honeywell Flame Safeguard Control**



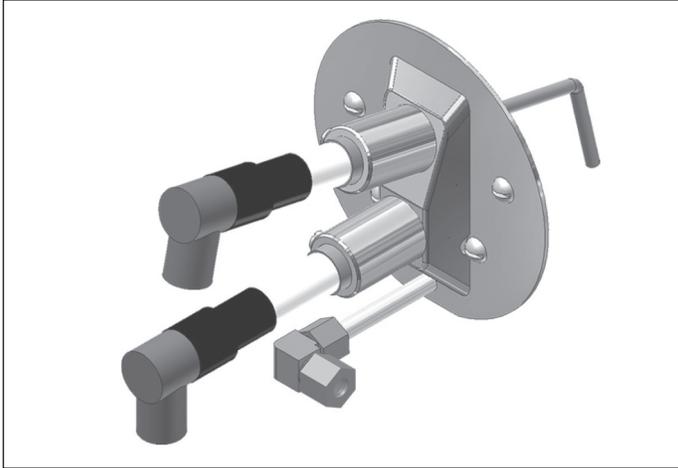
# CONTROL DESCRIPTIONS

## Main Burner/Pilot Safety Flame Rods

A flame rod is a flame-sensing device that senses if the pilot has been established using the flame rectification principle. The flame rod monitors the pilot flame to assure it is established. If a flame is present, the flame rod will send an electrical signal to the flame safeguard control and allow ignition of the main burner.

For units with burner lengths that are greater than three feet (1925 MBH or greater), the burner assembly will include a flame rod main flame sensor mounted at the burner end opposite the pilot.

**Figure 12.1 - Flame Rod & Pilot/Ignitor Assembly**



## Manifold Features

### Main Gas Valve

All units are supplied with redundant automatic main gas shut-off valves. These valves may be in the form of a combination gas valve (having two valve seats in one valve body) or two separate valves. The solenoid gas valves are electrically operated and allow gas flow to the unit's modulating gas valve. The motorized valve uses a hydraulic pump to open the valve and includes a heavy-duty self-closing return spring for positive shut-off in the event of a power loss to the valve. See page 17 for locations.

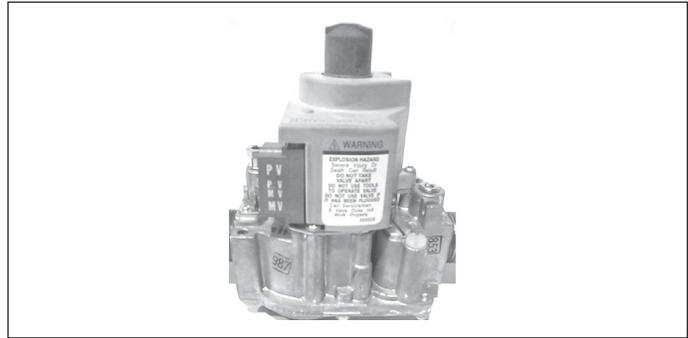
The type of main shutoff gas valve supplied with the unit may vary depending on whether the unit was ordered with a standard manifold or an FM or IRI manifold. To determine which valve type was supplied, see the model number of unit shipped and Table 12.1.

**Table 12.1 - Main Shutoff Gas Valve Type**

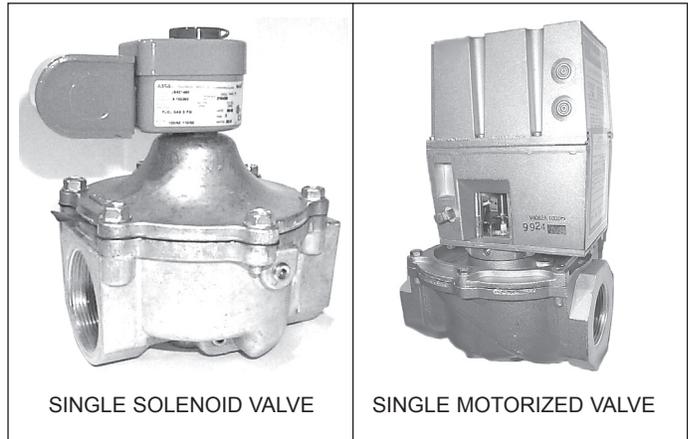
		Main Gas Valve Quantity by Type		
		VG-05	VG-02 & VG-03	
MBH Digit 9-12	Insurance Digit 15	Combination Redundant	Single Solenoid	Single Motorized
Up to 720	1, 2 or 3	1	n/a	n/a
Over 720 to 2,500	1, 2 or 3	n/a	2	n/a
Over 2,500	1	n/a	2	n/a
	2	n/a	1	1
	3	n/a	n/a	2

Digit 15:  
 1=ETL/IRI  
 2=FM less Restriction  
 3=FM with Restriction

**Figure 12.2 - Combination Gas Valve (VG-05)**



**Figure 12.3 - Single Solenoid and Motorized Gas Valves (VG-02/03)**



### Pilot Gas Solenoid Gas Valve (VG-01)

The pilot solenoid gas valve serves as a separate shut-off valve for the pilot gas. See page 17 for locations.

### Combination High/Low Gas Pressure Switch (PS-04/07)

When required by local codes, a combination high/low gas pressure switch can be added to the unit controls. The switch monitors the gas pressure downstream from the safety gas shut-off valves in the case of high gas pressure, and ahead of all of the automatic gas valves in the case of low gas pressure. The gas pressure safety switches will shut off all electric power to the gas safety shut-off valves if excessive (high pressure switch) or low gas pressure (low pressure switch) is experienced. A combination high/low gas pressure switch is standard for FM manifolds over 2500MBH (Digit 9-12>2500 and Digit 15=2 or 3).

**Figure 12.4 - High/Low Gas Pressure Switch**



# CONTROL DESCRIPTIONS

## Modulating Temperature Controls

Units are supplied with modulating temperature controls and gas valve.

Depending on the type of gas and temperature controls ordered with the unit, one or more of the following devices will be used. Check the unit's model number to determine which type of temperature controls were supplied.

### Modulating Gas Valve (VG-07)

Controlled by the Modulating Valve control amplifier, the valve is modulated to control the flow of gas to the burner. See page 17 for locations.

**Figure 13.1 - Modulating Control Gas Valve**



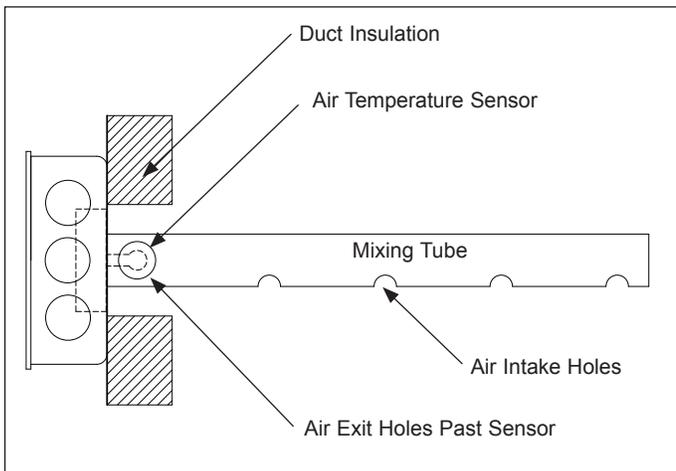
### Modulating Valve Control Amplifier (RE-26)

The amplifier converts the temperature control signal from the discharge air temperature sensor (and room temperature sensor if Max 44 is used) and modulates the gas control valve to maintain the air temperature at the sensor's set-point temperature. Refer to Item #9 in Figure 16.2 on page 16.

### Discharge Air Sensor

1. Install the discharge air sensor in a single perimeter supply duct, not to exceed 20 feet downstream of unit.
2. Be sure to orient the mixing tube so the air intake holes face into the direction of airflow in the duct.
3. Be careful not to block the discharge air sensor ports with insulation. If blocked, the air sensor will not function properly.

**Figure 13.2 - Maxitrol System Discharge Air Sensor**



## MAXITROL System 14

### Discharge Air Temperature Control

System 14 is an electronic modulating discharge air temperature control system with a remote temperature dial for adjusting the discharge air temperature set point. A field mounted and wired discharge air sensor monitors the discharge air temperature and controls an electronic modulating gas valve which modulates the main burner gas flow to maintain the desired discharge air temperature. The temperature set point range for this system is 55-90°F.

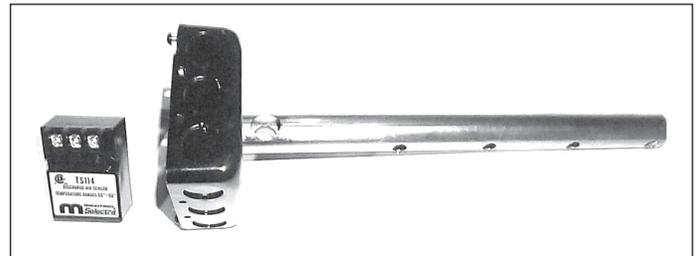
The discharge air sensor is mounted in the junction box at the end of the mixing tube. The air mixing tube is then field-mounted in the discharge air duct with the air inlet holes of the mixing tube facing the discharge air from the unit. (see Figure 13.2).

The accessory System 14 Remote Panel must be used. The System 14 Remote Panel includes a remote Temperature Set Point Dial, a Summer/Off/Winter Selector switch, a Main Valve On light and a Flame Failure Alarm light (see Figure 13.4).

This system may be used with an accessory room temperature override thermostat. Upon a call for heat from the room override, the stat automatically overrides the discharge air temperature setting by 15°F to provide warmer discharge air until the room override stat is satisfied.

For return air units, model MRB, depending on design conditions, this control may be acceptable, but requiring additional control devices with the system. Also included are a factory installed/set return air stat and a factory installed/set outside air stat. If the temperature sensed falls below the setpoint for either stat, the unit will go to 100% outside air mode until both stats are satisfied. Please refer to the Gas Control Selection Table 14.1 for additional guidance.

**Figure 13.3 Discharge Air Sensor with Mixing Tube**



**Figure 13.4 - Remote Temperature Dial for Maxitrol 14**



# CONTROL DESCRIPTIONS

## MAXITROL System 44

### Space Temperature Control

System 44 is an electronic modulating room temperature control system, which utilizes a Selectra-Stat modulating room thermostat to control the main burner firing rate based on the room air temperature set point. The stat monitors the room space temperature and sends a signal back to the control amplifier to modulate the gas control valve to maintain proper space set-point temperature. The temperature set point range for this system is 55-90 degrees F.

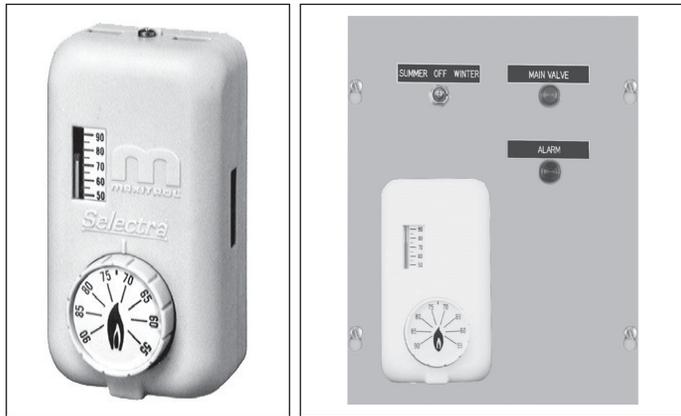
This control system also includes a field mounted and wired discharge air sensor, which is used as a high and low temperature limit control. The discharge air sensor will prevent make-up air from being delivered to the space at temperatures below the low setpoint, even if the room thermostat is satisfied. 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.

When specifying this control system, the accessory System 44 Remote Panel must be used. The System 44 Remote Panel includes an electronic Modulating Room Thermostat, a Summer/Off/Winter selector switch, a Main Valve On light and a Flame Failure Alarm light (see Figure 14.1).

For return air units, model MRB, depending on design conditions, this control may be acceptable, but requiring additional control devices with the system. Also included are a factory installed/set return air stat and a factory installed/set outside air stat. If the temperature sensed falls below the setpoint for either stat, the unit will go to 100% outside air mode until both stats are satisfied. Please refer to the Gas Control Selection Table 14.1 for additional guidance.

The Selectra-Stat is used in conjunction with a discharge air sensor and air mixing tube. The discharge air sensor serves to limit the minimum and maximum discharge air temperature from the unit.

Figure 14.1 - Room Stat for Maxitrol 44



## DDC Compatible Controls

### Building Management Control (4-20mA or 0-10VDC)

The DDC compatible control system is an electronic modulating control system, which utilizes a 4-20mA or 0-10VDC input signal (by others) to control the discharge air temperature. This system is available on MDB units only.

This system requires a field supplied air temperature sensor that is compatible with the building management system. This sensor is wired to the building management system and based on the temperature reading from that thermostat, the building management system will increase or decrease the signal to the makeup air unit gas controls. An increase or decrease in the input signal modulates the main burner gas flow to maintain the desired discharge air temperature.

Provided with this system is a discharge air sensor which is used as a high temperature limit control. The discharge air sensor will prevent make-up air being delivered to the space that is above the maximum operating limit of 105°F. The sensor is factory mounted for single blower units (unit sizes 110-130) and field installed for twin blower units (unit sizes 220-230).

For return air units, model MRB, depending on design conditions, this control may be acceptable, but requiring additional control devices with the system. Also included are a factory installed/set return air stat and a factory installed/set outside air stat. If the temperature sensed falls below the setpoint for either stat, the unit will go to 100% outside air mode until both stats are satisfied. Please refer to the Gas Control Selection Table 14.1 for additional guidance.

## Gas Control Selection for Model MRB Units

Table 14.1 is to be used for Model MRB units only to determine applicability of the various available gas control systems to meet requirements of ETL certification and ANSI Z83.18. For additional information on these control systems, please see Gas Control Descriptions above.

Table 14.1 - Gas Control System Selection for Model MRB Units

Gas Control System	RA/OA Ratio	Minimum Outside Air Temperature (per ASHRAE) ①	Maximum Discharge Air Temp	Room Override
Maxitrol 14	75/25	-30°F and Above	90°F	Not Available
	70/30	-30°F to Lower than 10°F		
	70/30	10°F and Above	90°F ②	Accessory
Maxitrol 44 or SC11	75/25	-30°F to Lower than -10°F	90°F	Not Applicable
		-10°F to Lower than 0°F	95°F	
		0°F and Above	100°F	
	70/30	-30°F to Lower than -20°F	95°F	
		-20°F to Lower than -10°F	100°F	
	-10°F and Above	105°F		

① Minimum return air temperature is 55°F. For return air temperatures below 55°F, please contact the factory.

② Room override accessory can override discharge air setting by 15°F to a maximum discharge air temperature of 105°F.

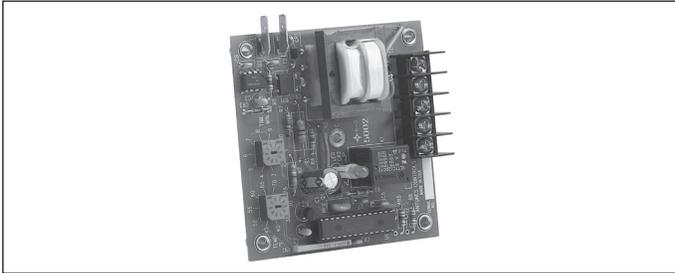
# OPTIONAL CONTROLS

## Timed Freeze Protection (TC-24)

The optional timed freeze protection system is factory installed with the sensor (30°-75°F adjustable) factory mounted in the discharge airstream for single blower units (unit sizes 110-130) and field installed for twin blower units (unit sizes 220-230). For field installed sensors, the sensor should be mounted near the discharge air sensor as noted on page 13.

On initial start-up, the timed delay in the system allows the unit to go through the normal ignition sequence. The timed delay is a manual reset switch and adjustable for 1-10 minutes. In the event that the unit fails to fire after this period, the discharge air sensor will sense the cold air and will shut down the entire unit.

**Figure 15.1 - Timed Freeze Protection Control**



## Mild Temperature Inlet On/Off Stat (TC-03)

An optional mild temperature On/Off inlet stat may be supplied with the unit, factory mounted in the piping compartment. The purpose of the mild temperature On/Off stat is to shut the main burner off 100% during mild weather so undesirable temperature build-up in the space will not occur.

**Figure 15.2 - Mild Temperature Inlet On/Off Stat**



## Variable Frequency Drive (VFD)

(Shipped separately for field mounting by others)

Variable air volume 100% Make-Up units are equipped with a VFD. The VFD controls the speed of the blower motor to vary the air flow (cfm) from 40% to 100% of the full rated air flow. The VFD is controlled by either a two-speed interlock, building pressure control or a building management system.

**Figure 15.3 - Variable Frequency Drive**



## Photohelic Building Pressure Control (PS-13)

(Optional for VFD equipped MDB Units or 75/25 MRB units)

The control includes a photohelic pressure switch with pressure gauge, an outdoor air pressure pick up tube and a pick-up tube wind and rain shield kit. Return air units also include an outside air burner bypass damper linked to a return air damper and a floating damper motor to control the mixture of outside and return air.

The purpose of the control is to sense the difference between the indoor building pressure and the outdoor atmospheric pressure. This system is used when one make-up air unit handles varying exhaust loads. As more exhaust fans are turned on, pressure in the building will tend to become negative. The photohelic pressure switch senses this change in pressure and controls the unit operation to bring in more outside air to bring the building pressure back to near atmospheric.

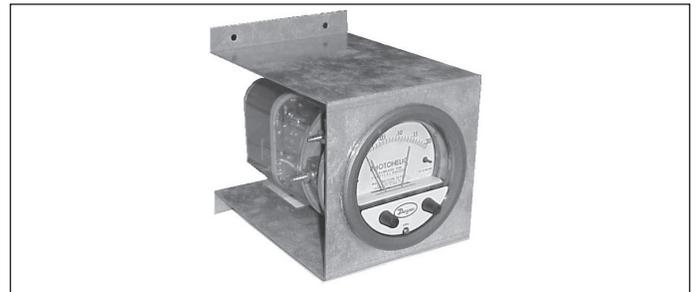
For MDB units, the VFD will vary the motor speed between 40% and 100% of the rated airflow for the selected unit. For MRB units, the floating damper motor adjusts the position of the outside air bypass damper and return air damper to vary the outside air/return air ratio from a minimum 25% outside air (75% maximum return air) to 100% outside air (0% return air). The damper motor is a non-spring return type motor so when power is interrupted to the motor via the photohelic pressure switch, the motor will remain in its current position.

Note: The building pressure control's low pressure tap must be vented to the outdoors and fitted with the wind and rain shield provided with the photohelic control.

Adjusting the pressure adjusting knobs on the face of the pressure gauge sets the desired building pressure set point range. The smaller the difference between the high and low pressure needles, the more sensitive the setting will be. The larger the difference, the less sensitive the setting.

**Figure 15.4 - Photohelic Building Pressure Control**

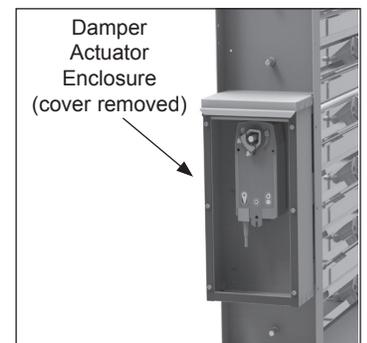
(Shipped separately for field mounting by others)



## Inlet or Discharge Air Shut-Off Dampers

If an optional inlet or discharge outside air shut-off damper is supplied with the unit, the damper will include an electric damper operator motor. The motor is connected to the damper blades via damper linkages.

The damper operator motor includes a damper motor end switch that is interlocked with the unit's blower motor and burner controls. The burner and blower controls cannot operate unless the damper motor end switch has closed.



# OPTIONAL CONTROLS / CONTROLS LOCATIONS

## Deadfront Non-Fused Disconnect Switch (SW-01) (Mounted in the electrical control cabinet when furnished)

### ⚠ WARNING

If equipped with the Deadfront 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 dead front disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.

The dead front disconnect switch is factory installed in the electrical control cabinet when furnished. The disconnect switch is designed so that it must be turned "OFF" before entry to the electrical control cabinet can be obtained. When in the "OFF" position, power is disconnected to all unit wiring electrically following the switch but remains energized before the switch (See Warning).

Figure 16.1  
Deadfront Non-Fused Disconnect

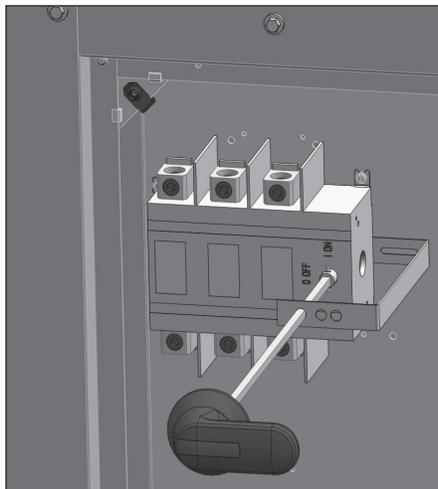
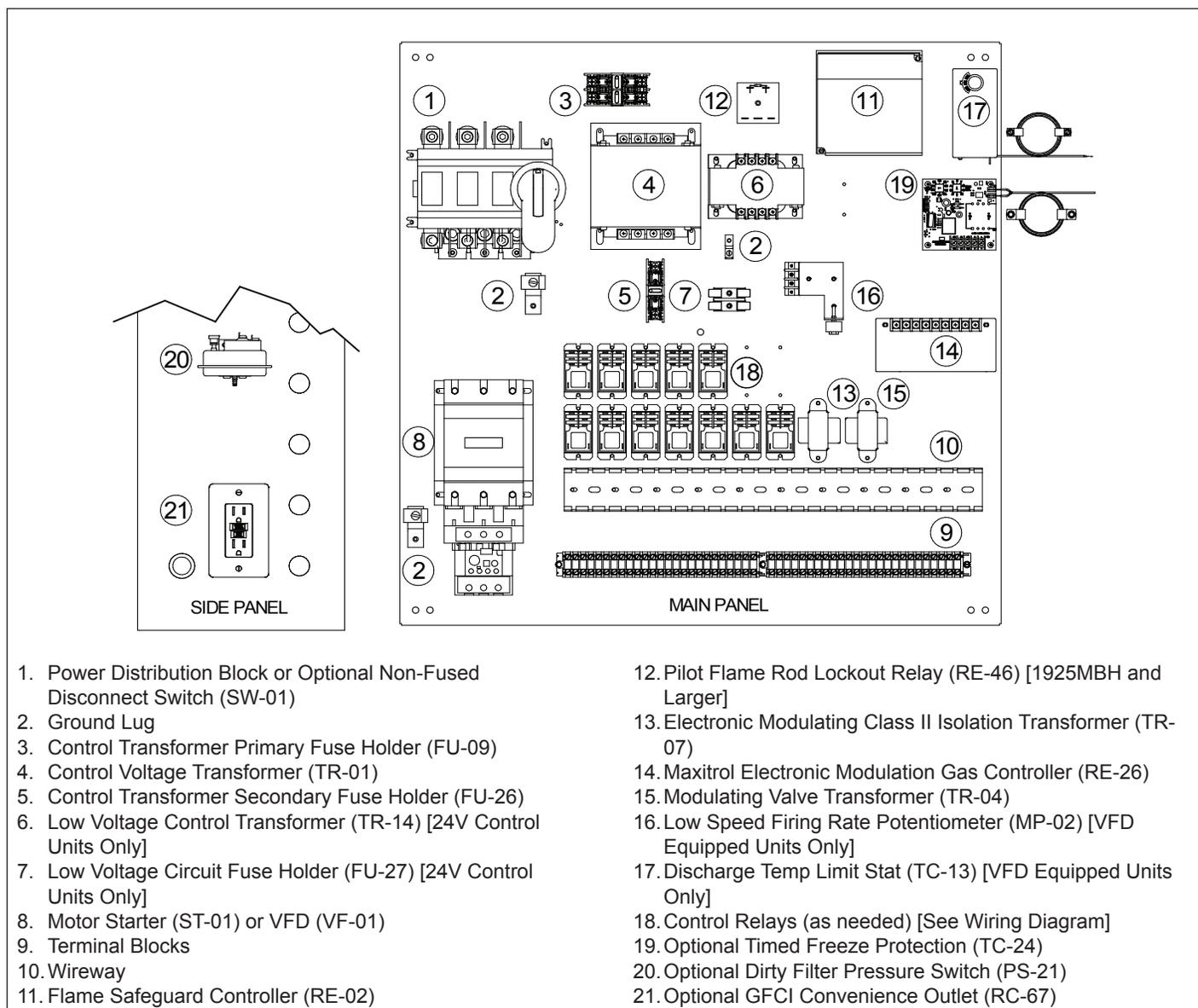


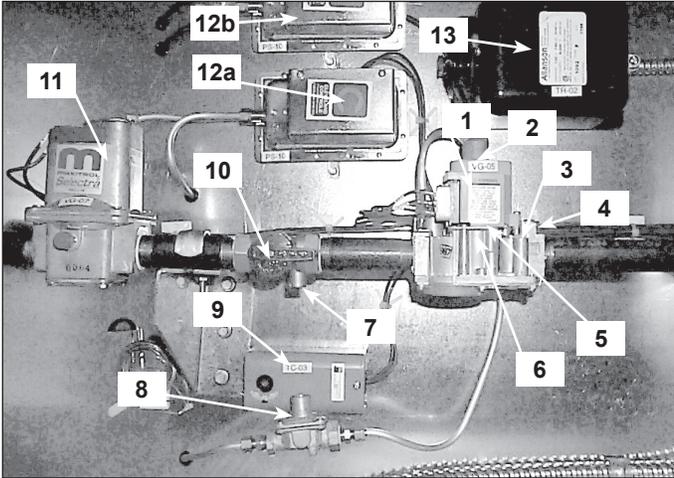
Figure 16.2 - Electrical Control Cabinet ①



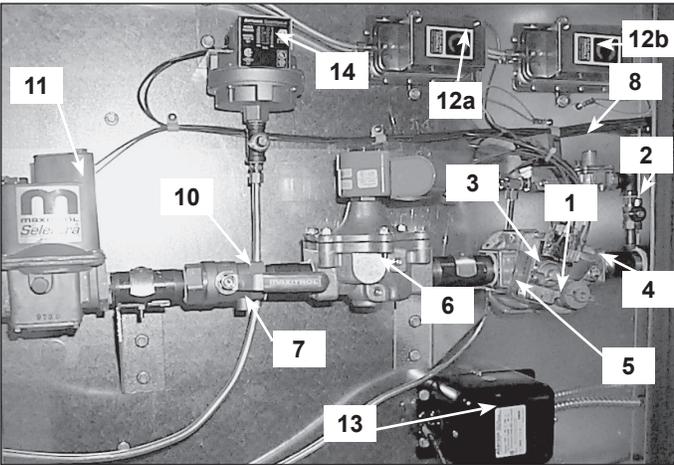
① Typical right hand access component mounting shown for most model sizes and types. Depending on unit configuration, not all components shown may be included and location may vary slightly.

# PIPING CONTROL CABINET COMPONENTS

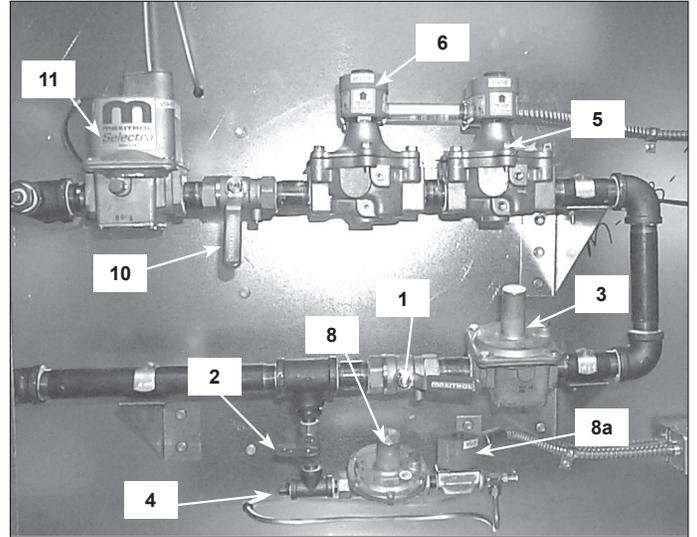
**Figure 17.1 - Typical Gas Control String Through 400 MBH**



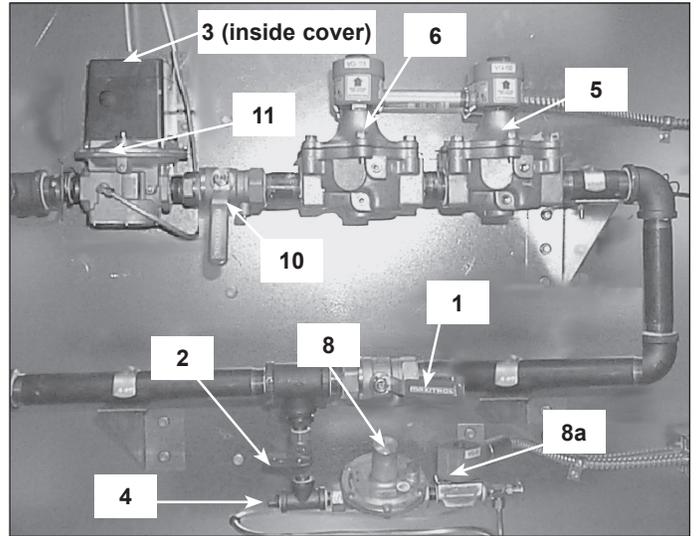
**Figure 17.2 - Typical Gas Control String Over 400 MBH Through 720 MBH**



**Figure 17.3 - Typical Gas Control String 720 Through 1000 MBH**



**Figure 17.4 - Typical Gas Control String Over 1000 MBH**



1. Main Gas Hand Shut-Off Valve
2. Pilot Gas Hand Shut-Off Valve
3. Main Gas Regulator
4. Inlet Gas Pressure Test Port
5. Main Gas Solenoid Valve
6. Redundant Main Gas Solenoid Valve
7. Mod. Valve Inlet Gas Pressure Test Port
8. Pilot Gas Regulator
- 8.a. Pilot Gas Solenoid Valve (Above 720MBH)
9. Optional Inlet On/Off Stat
10. Mod. Valve Hand Shut-Off Valve
11. Modulating Main Gas Valve
- 12.a Low Air-Flow Proving Switch (PS-10)
- 12.b High Airflow Cutoff Switch (PS-11)
13. Ignition Transformer
14. Optional Gas Pressure Switch

The piping arrangements shown are typical and may not match the unit supplied. Refer to the manifold piping diagram and wiring diagram that shipped with the unit for actual arrangement.

# START-UP PROCEDURE

## Controls Locations

### 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.

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)*

**After the unit has been installed and the preliminary checks have been made, 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 stats to their lowest settings.
3. Check to see that there are no obstructions to the inlet air supply or the discharge air supply ducts (and return air unit openings).
4. Check to see that all wiring is secure and properly connected and protected.
5. Recheck belt tension and pulley alignment. (See Page 21)
6. Check bearings for proper lubrication. (If the unit has been supplied with spider bearings, the bearings are permanently lubricated and do not require additional lubrication.)
7. Check to make sure that all air filters are in place, and that they are installed properly according to direction of air flow.
8. Perform a visual inspection of the unit to make sure no damage has occurred during installation. Make sure all service doors have been replaced and/or closed.
9. With the optional Summer/Off/Winter switch still in the "Off" position, turn on the electric supply to the unit.
10. Move the optional Summer/Off/Winter switch to the "Summer" position. 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 make and allow the blower motor to operate.
11. Check to make sure that the inlet and/or discharge damper (if supplied) opens properly without binding.
12. Check the blower for proper direction of rotation.

13. Check the blower speed (rpm). For units equipped with a VFD, blower speed should be checked at both high and low speeds. (See page 21 for motor and blower adjustment).
14. Check the motor speed (rpm). For units equipped with a VFD, motor speed should be checked at both high and low speeds.
15. Check the motor voltage (for units equipped with a VFD, the voltage should be checked at high speed). On three phase systems, check to make sure all legs are in balance.
16. Check the motor amp draw (for units equipped with a VFD, the amp draw should be checked at high speed) to make sure it does not exceed the motor nameplate rating. 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 or may not allow the burner to fire because of an open high airflow cutout switch (PS-11), or can consume excessive energy. Air volume measurement and adjustment will be necessary.
17. Measure the unit air volume being delivered and compare to the rated air volume on the unit serial plate. If the measured air volume does not match, adjust the fan RPM by adjusting the sheave on the motor (as described in the "Blower/Motor Adjustment" section on page 21.)
18. Recheck the gas supply pressure by installing a gas pressure gauge connected to the inlet gas pressure test port. See Figure 9.1 through 9.4 on page 9 to locate the inlet gas pressure test port. 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.
19. Check pilot and pilot ignition. For this step, open the pilot gas hand valve only.
20. Check to make sure that all manual reset safety devices have been reset to their normal operating position.  
**Note:** If high and/or low gas pressure switches have been supplied, the first main gas hand valve will also have to be opened at this time. However, the second main gas hand valve located before the modulating gas valve should be kept in the closed position.
21. Set the Summer/Off/Winter switch to the "Winter" position and move the temperature controls to call for heat.  
**Note:** If a mild temperature inlet On/Off stat has been supplied the set point of the stat may have to be adjusted to allow initiation of the pilot ignition sequence. If this is necessary, raise the set point of the inlet stat.
22. Check to see that the pilot lights properly.  
The spark ignitor should begin to spark in approximately 10 seconds, and the pilot flame should be established within 10 seconds.

# START-UP PROCEDURE

## Start-Up Procedure (continued)

23. Check for proper signal output for the pilot safety control.

The unit has been supplied with a flame rod sensor. The output signal from the sensor should be stable and in accordance with the flame safeguard manufacturer's recommended signal strength.

For units with a Honeywell flame safeguard control the signal should be between 3-5 Vdc (Min. of 1.25 Vdc, Max. of 5 Vdc).

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.

24. 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. (If the flame safeguard control does not go into lockout, see separate vendor literature shipped with the unit for trouble shooting and corrections.)

25. Turn the pilot gas hand valve to the on position and reset the flame safeguard relay using the flame safeguard manual reset button. Allow the unit to re-establish the pilot.

26. 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. Check the pressure differential across the profile plate using an inclined manometer per the following:

a. Review Table 19.1 to determine which Reference View (Figure 20.1) applies to the unit.

- For Views 1, 2, and 4, remove the factory installed plastic tubing that runs between the aluminum pickup tubes and the tee that splits the tubing to both the low airflow proving switch (PS-10) and the high airflow cutoff switch (PS-11). The tubing should be removed from the aluminum air pressure differential pick-up tubes. Slide the inclined manometer tubes over the ends of the aluminum pickup tubes.
- For View 3, remove the factory installed plastic tubing that runs between the aluminum pickup tubes and the high airflow cutoff switch (PS-11). The tubing should be removed from the aluminum air pressure differential pick-up tubes. Slide the inclined manometer tubes over the ends of the aluminum pickup tubes.

b. The low airflow proving switch (PS-10) must be jumped out of the circuit during this test. To jumper the switch, place a jumper wire on the unit terminal strip to which the switch is wired. For units with 24V flame safeguard controls, the typical terminals are 21 and 40. For units with 115V flame safeguard controls, the typical terminals are 105 and 134. For additional information on identifying the flame safeguard control voltage and appropriate terminals, see both page 11 of this manual and the job specific wiring diagram supplied with the unit. Note that the jumper wire must be removed after completing this test.

c. The test is to be run with the unit operating (blower running) in the 100% outdoor air mode. For units equipped with a VFD, the unit must be running at high speed.

d. If the outdoor air temperature is below 60°F, fire the 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 Table 42.1, Section E for additional guidance. If the outdoor temperature is 60°F or greater, do not fire the main burner.

e. Read the pressure differential reading on the manometer and compare against the required value in Table 19.2. Note that the pressure differential reading is dependent on the elevation above sea level for which the unit is installed and must be within +/- 0.05"W.C.

For example, for a MRB unit installed at 4500 feet above sea level, with a 70°F discharge air temperature, the profile pressure differential should be 0.50"W.C. The actual installed pressure differential reading must be 0.50"W.C. +/- 0.05"W.C., or 0.45"W.C. to 0.55"W.C.

**Table 19.1 - Profile Pickup Tube Pressure Drop**

Model Configuration				Figure 20.1 Reference Drawing	Pressure Setting Group ②
Model	Gas Type	Model Digit 17 ①	Serial Number Digit 19		
MDB	Natural	A	1 or <blank>	View 1	A
		B thru H	1 or <blank>	View 2	C
			2	View 3	A
	Propane	A	1 or <blank>	View 1	B
		B thru H	1 or <blank>	View 2	D
			2	View 3	B
MRB	Natural	F thru N	1 or <blank>	View 4	B

- ① Model Digit 17=A represents single speed units.  
 Model Digit 17=B thru H represents variable frequency drive units (on Model MDB only).  
 Model Digit 17=F thru N represents return air units (on Model MRB only).
- ② For correct profile pressure drop values, refer to Table 19.2 for the Pressure Setting Group determined in the table above.

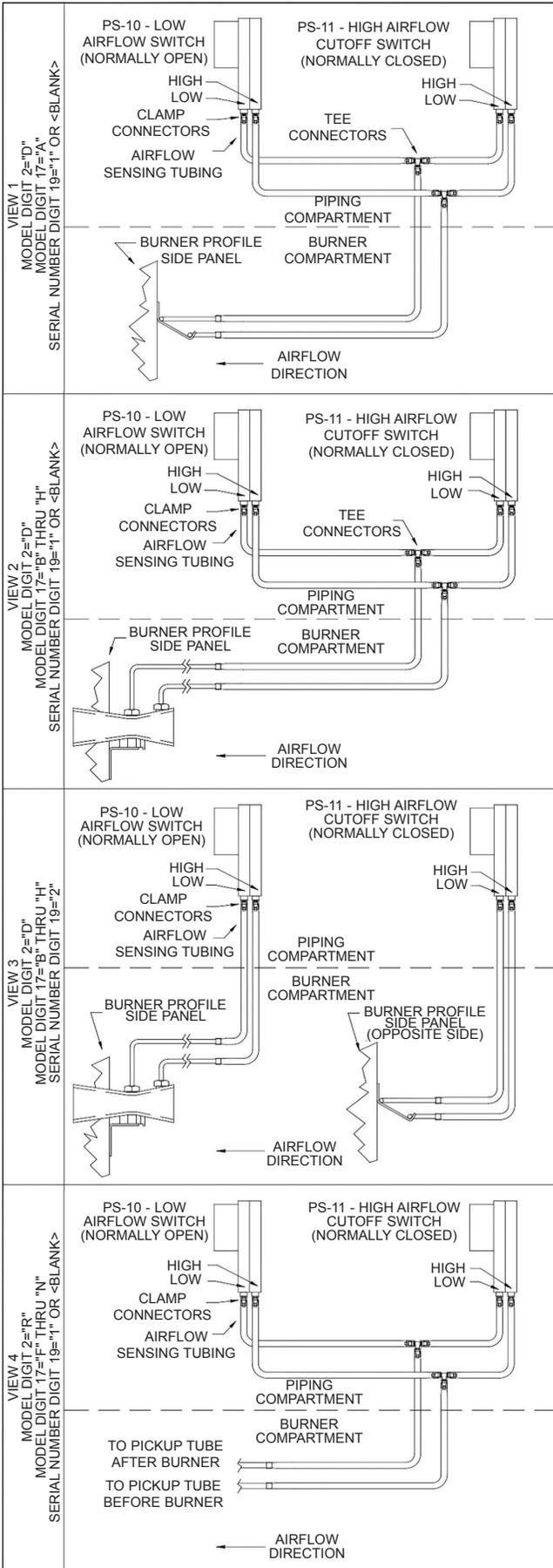
**Table 19.2 - Profile Pickup Tube Pressure Drop (W.C.)**

Pressure Setting Group ③	Elevation Above Sea Level (ft)						
	0-2000	2001-3000	3001-4000	4001-5000	5001-6000	6001-7000	7001-7500
A	0.47	0.42	0.41	0.39	0.38	0.36	0.36
B	0.60	0.54	0.52	0.50	0.49	0.46	0.46
C	1.41	1.27	1.22	1.18	1.13	1.09	1.07
D	1.80	1.62	1.56	1.50	1.47	1.38	1.38

③ Refer to Table 19.1 to determine the correct Pressure Setting Group to use.

# START-UP PROCEDURE

**Figure 20.1 - Profile Pressure Pickup Tube Reference Views**



## Start-Up Procedure (continued)

- f. If the required differential cannot be achieved, the blower speed may have to be adjusted. Refer to page 25 for blower adjustments.

For example, if the required burner velocity pressure differential should be between 0.45"W.C. and 0.55"W.C. and the actual reading is less than 0.45", the blower speed will have to be increased. If the actual reading is greater than 0.55" the blower speed will have to be reduced.

Note: Whenever the blower speed is changed, the motor amp draw must be rechecked to assure that the motor does not become overloaded.

If the required differential cannot be achieved through blower speed adjustments, refer to the section, "Adjusting Burner Profile Pressure Differential" on page 22.

- g. When the correct burner velocity pressure differential is achieved, turn the unit off and open the main disconnect switch. Remove replace the tubing removed in Step (a) and the low airflow pressure switch jumper that was added in Step(b).

Steps 27-33 must be performed on HIGH SPEED if unit is equipped with a VFD.

27. The high fire manifold pressure (at the burner) 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 products of combustion being introduced into the heated space. The procedure is outlined in the following steps.
28. 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.
29. Open the main gas manual hand valve and start the unit. Observe the flame at low fire start to make sure it lights across the entire length of the burner and is stable with a clean blue flame.
30. Adjust the temperature control setting to force the unit to high fire. Observe the pressure indicated on the "U" tube manometer:
  - If the pressure is not more than 1/2" higher or lower than indicated on the unit serial plate, adjust the gas valve regulator until the pressure matches the setting on the unit serial plate.
  - If the pressure is more than 1/2" higher or lower than indicated on the unit serial plate, check the inlet gas pressure to the unit. Adjust the main gas supply regulator to supply the correct gas inlet pressure to the setting shown on the unit serial plate.
31. 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.
32. Turn the temperature controls down to their lowest setting and check the low fire burner flame. It should still be stable and burning clean and 1 to 2 inches long. If necessary, adjust the low fire gas pressure on Maxitrol valve (VG-07) so the unit operates correctly as described.
33. Recycle the ignition sequence to make sure the burner lights off smoothly and the gas lights across the entire length of the burner.

# START-UP PROCEDURE

Steps 34-35 must be performed on LOW SPEED if unit is equipped with a VFD. If the unit does not have a VFD, proceed to step 36.

34. Adjust the VFD speed to the low speed setting and the temperature controls to force the unit to high fire.
35. Observe the pressure indicated on the "U" tube manometer and adjust the manifold pressure by adjusting the low speed input potentiometer (MP-02) and NOT the gas valve regulator. Adjust the pressure to match the low speed manifold pressure on the unit serial plate. The flame will be approximately 10 to 12" in length and may be yellow in color.
36. 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.

## Multi-Speed and Return Air Units

Units with VFD's or return air options require the following additional start-up checks.

### Two-Speed Units (VFD)

1. Check the motor and blower speed at both high and low speed.
2. Check motor amps at both high and low speed.

### VFD Building Pressure Control

Check to make sure the building pressure control is operating properly. The building pressure control is designed to decrease or increase motor and blower speed as building pressure increases or decreases.

To check if this is occurring, turn on an exhaust fan and observe the motor speed. The motor speed should increase. The VFD display will also indicate that the frequency (Hz) is increasing. With all exhaust fans operating (maximum exhaust fan load), the VFD will continue to increase blower speed toward full speed to meet the building pressurization requirements.

### Return Air Units (Not available in Canada)

#### 70/30, 75/25 Return Air Units

1. Check to make sure that the outside air burner by-pass damper and return air damper operate correctly and without binding.
2. Check the position of the by-pass and return air damper based on the mode of operation in Table 21.1.

#### 75/25 Building Pressure Control Return Air Units

(Not available in Canada)

1. Check to make sure that the outside air burner by-pass damper and return air damper operate correctly and without binding.
2. Check to make sure the building pressure control is operating correctly.

The building pressure control is designed to change the position of both the outside air and return air-mixing dampers as the pressure in the building increases or decreases.

To check if this is occurring, turn on an exhaust fan and observe the return air damper position. It should start to close. Turn on additional exhaust fans. The return air damper should close further.

With all of the exhaust fans operating (maximum exhaust load) the return air damper should be in the fully closed position, and the burner by-pass damper should be in the fully open position (see Table 21.1).

**Table 21.1 - Outside Air Bypass - Return Air Damper Positions**

Mode	Damper Positions	
	By-Pass Damper	Return Air Damper
100% Outside Air	Open	Closed
With Return Air	Closed	Open

## Final Step

After all of the initial start-up procedures have been performed, the unit is ready for commissioning. 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.

## Blower/Motor Adjustment

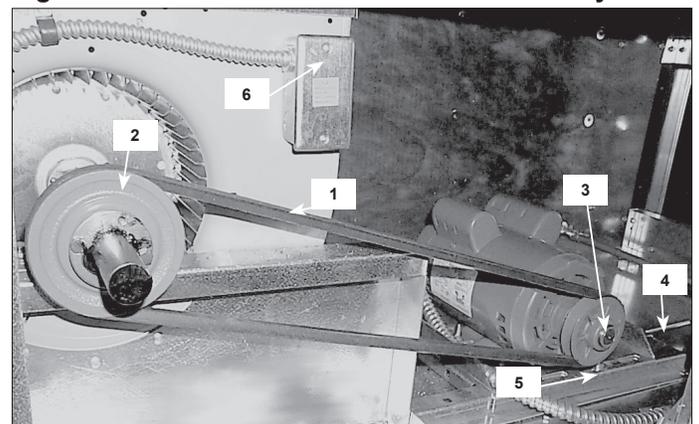
Units are supplied with adjustable drive sheaves. All units are supplied with an adjustable motor mounting plate.

Follow electrical connections for supplying power to the motor. Check for the proper blower rotation. The correct direction of rotation is marked on the blower housing. Start blower and check blower speed (rpm) using a hand-held tachometer (strobe-type, or reflective-type tachometer are preferred types).

Measure the unit air volume being delivered and compare to the rated air volume on the unit serial plate. If the measured air volume does not match, adjust the fan RPM by adjusting the sheave on the motor (refer to Figure 21.1) as follows:

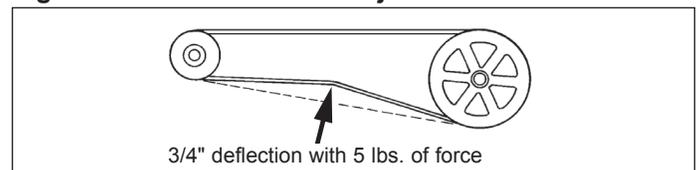
- a. Loosen motor base and take belt(s) off of the motor sheave.
- b. Loosen set screw(s) on the outer side of the adjustable motor sheave.
- c. To speed up the blower, turn the outer side of the drive sheave clockwise to close the pulley. To slow the blower speed, turn the outer side of the adjustable sheave counterclockwise to open the pulley. If proper air flow and/or blower speed cannot be obtained, contact the factory for alternate drive selections.
- d. Retighten motor sheave set screw(s) and replace belt.
- e. 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 OVER TIGHTEN! (see Figure 21.2).
- f. Recheck blower speed and air volume delivered after adjustment. Repeat steps until air volume matches the rated air volume on the unit serial plate.
- g. Check motor amps to make sure the actual motor amp draw does not exceed the motor nameplate amp draw.

**Figure 21.1 - Blower and Motor Drive Assembly**



1. Drive Belt
2. Blower Sheave
3. Motor Sheave
4. Belt Tension Adjusting Screw
5. Motor Base Fastening Bolts
6. High Temperature Limit Control

**Figure 21.2 - Belt Tension Adjustment**



# START-UP PROCEDURE

## Adjusting Burner Profile Pressure Differential

### **WARNING**

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.

### **IMPORTANT**

1. On model configurations that allow adjustments to the burner profile plates, the only adjustment permitted is repositioning within the range of the adjustment slots to increase or decrease air velocity across the burner. No other modifications are permitted.
2. Repositioning of burner profile plates is only available on select models, as indicated in the instructions. Do NOT attempt to alter or reposition the plates in models not setup to accommodate adjustments.
3. The burner profile pressure differential has been factory set based on the unit configuration and operating characteristics on the original unit order. If the profile pressure differential is outside the allowable range, every effort should be made to correct the condition without changing the profile plate positions.
4. Changes to the position of the burner profile plates may impact the temperature rise of the unit.

To adjust the position of the burner profile plates, the unit **MUST** meet the following criteria:

- Digits 1-3 of the Model Number must be "MDB".
- Serial Number Digit 18 must be "A".

If the unit does not meet **BOTH** of these criteria, do not attempt to alter or adjust the burner profile plates.

Before adjusting the burner profile plates, it is important to understand why the pressure is outside what is shown in Table 19.2. Based on the design airflow and total static pressure, the unit is set at the factory to provide the correct burner profile pressure drop, which is a result of the correct airflow (air velocity). The following are common causes for incorrect airflow:

- Low burner profile pressure drop is often a result of the external static pressure (typically ductwork) being higher than originally designed. The high external static will cause a reduction in airflow which may result in the low airflow proving switch not closing, disabling the burner.
- High burner profile pressure drop is often a result of the external static pressure (typically ductwork) being lower than originally designed. The low external static will cause an increase in airflow which may result in the high airflow cutoff switch opening, disabling the burner.

To account for an increase or decrease in airflow, the unit needs to be balanced. Before attempting to adjust the burner profile plates, the following should be completed:

- Correct any ductwork or duct termination design issues that may be creating external static pressure differences from design.
- Adjust the fan RPM by adjusting the sheave on the motor as described in the "Blower/Motor Adjustment" section on page 21.

- If the supply fan is driven by a factory supplied variable frequency drive, it may be possible, depending on actual conditions, to adjust the blower speed via the VFD. Contact Modine Technical Service for guidance.

If the steps above have been completed and it is desired to make additional adjustments via the adjustable burner profile plates, the following is the process for adjustment:

1. Turn power on to the unit. With the unit running and the gas controls set to discharge at 70°F, measure the burner profile differential pressure, as outlined in step 26 on page 19, to determine if the pressure differential must be increased or decreased to match what is shown in Table 19.2.
2. Once the measurement has been made, disconnect power to the unit and open the burner access door.
3. Remove the screws as indicated in Figure 23.1. Note that the quantity of screws to be removed will vary by unit size and the quantity shown in Figure 23.1 is for reference only.
4. To adjust the position of the burner profile plates, loosen the remaining 2 screws in the slots of each plate and carefully move the plates to the desired position, then retightening the 2 screws in the slots of each plate. Since small changes can have a significant impact, it is recommended that plates be moved approximately 1/16" to 1/8". Both top and bottom plates should be moved equally to maintain consistent top and bottom clearance to the burner. To determine which direction to move the plates, review the following:

- To decrease the pressure differential, the open area around the burner needs to increase by moving the top plate up and the bottom plate down.
- To increase the pressure differential, the open area around the burner needs to decrease by moving the top plate down and the bottom plate up.

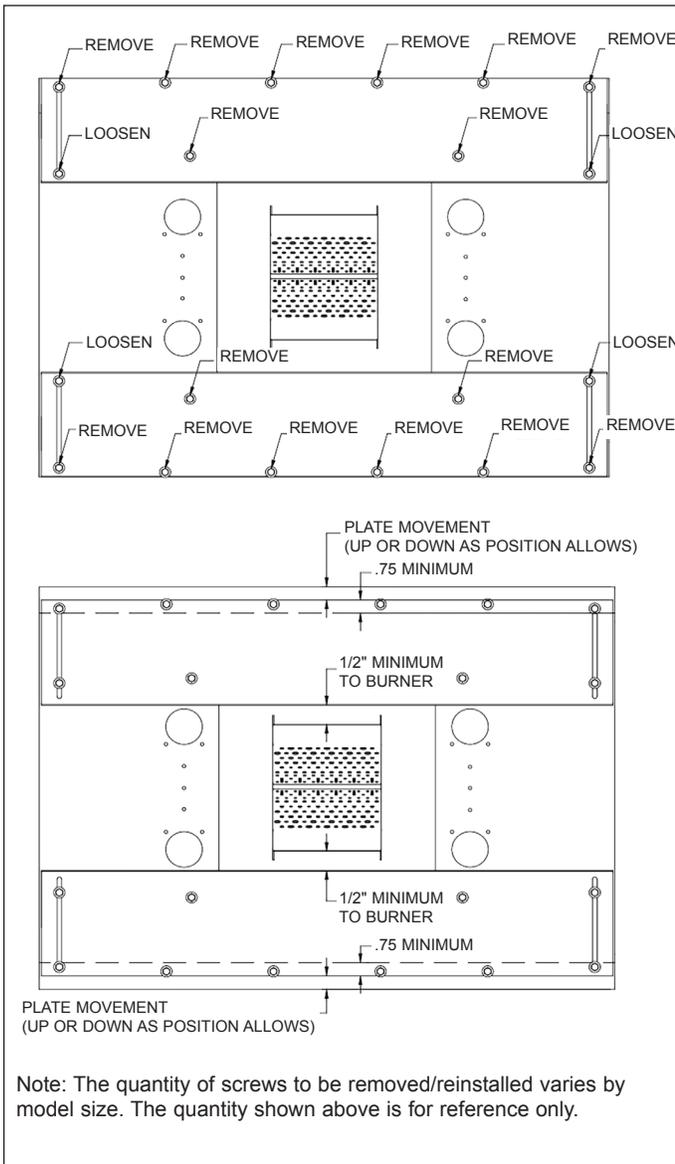
The range of adjustability will vary based on the unit configuration and factory setting. Some configurations will allow adjustment to increase or decrease the opening size. Other units will allow adjustment in only one direction. The following rules apply:

- When adjusting to decrease the open area (top plate moved down, bottom plate moved up), the top of the top plate and the bottom of the bottom plate must overlap a minimum of 3/4" with the sheet metal material behind the plate to allow enough material for attaching with the screws.
  - When moving the plates closer to the burner, there must be a minimum of 1/2" clearance between the edge of the plate to the top or bottom of the burner mixing plates.
5. With the adjustment made, close the burner door.
  6. Repeat steps 1 through 5 until the measured pressure differential meets the requirement of Table 19.2.
  7. Once the profile pressure differential meets the required reading of Table 19.2, disconnect power to the unit, open the burner access door, and replace all the screws removed in step 3 above. To replace the screws, use the holes in the burner profile plates as a guide to drill pilot holes in the sheet metal behind the plates.
  8. Close the burner access door.

# START-UP PROCEDURE

- Since the position of the burner profile plates has changed from the setting at the factory, the air volume delivered by the unit has changed. Re-check the motor amp draw (for units equipped with a VFD, the amp draw should be checked at high speed) to make sure it does not exceed the motor nameplate rating. If the motor amps are too high, recheck for proper airflow. Contact Modine Technical Service for additional guidance.

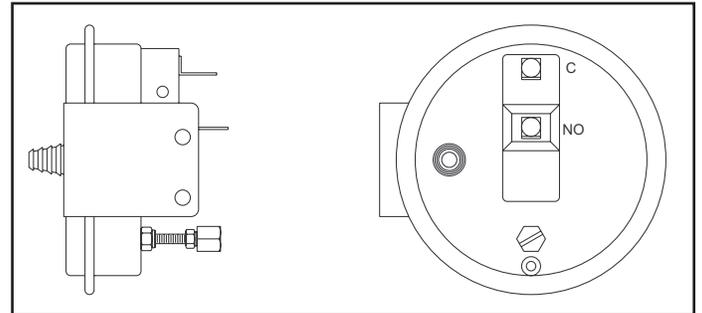
**Figure 23.1 - Burner Profile Plate Adjustment**



## Setting the Dirty Filter Switch

The dirty filter pressure switch is factory installed in the piping section. The dirty filter pressure 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.

**Figure 23.2 - Dirty Filter Pressure Switch**



## Setting the Dirty Filter Switch

The range of the dirty filter pressure switch is adjustable between 0.17" to 5.0" W.C.

- Ensure that the unit filters are clean. Clean or replace if necessary.
- Connect the leads of a continuity tester to the NO and C terminals of the dirty filter pressure switch.
- Set the thermostat so that there is a call for heat. This should fire the burner and the blower should start.
- Turn the set screw of the pressure switch clockwise until it stops. This will set the pressure at 5.0" W.C. and the continuity tester should be sensing an open circuit.
- Begin turning the screw counterclockwise until the continuity tester senses a closed circuit. This determines the base pressure of the system.
- Turn the screw clockwise until the continuity tester senses an open circuit and then one additional full turn (This is approximately 0.25" W.C.) This will allow for the increase in static pressure due to dirty filters.

# START-UP PROCEDURE

## Sequence of Operation

### Remote Switch in “Off” Position

With the Summer/Off/Winter switch in the “Off” position, the unit is shut down and neither the blower nor the burner will operate.

### Remote Switch in “Summer” Position

With the remote switch in the “Summer” position, the following sequence of operation will occur.

**Note:** If freeze protection is furnished with the unit, the freeze protection timer will be energized at this time to provide power to the inlet and/or discharge damper motor (if furnished with unit).

1. The inlet and/or discharge air damper motor is energized.
2. When the damper is fully open, the internal damper motor end switch will make and allow power to be supplied to the blower motor or blower motor starter.
3. The gas controls and temperature controls are locked out to prevent heating during the “Summer” mode of operation.

### Remote Switch in “Winter” Position

With the remote switch in the “Winter” position, the following sequence of operation will occur.

**Note:** If freeze protection is furnished with the unit, the freeze protection timer will be energized at this time to provide power to the inlet and/or discharge damper motor (if furnished with unit).

1. The inlet and/or discharge air damper motor is energized.
2. When the damper is fully open, the internal damper motor end switch will make and allow power to be supplied to the blower motor or blower motor starter.
3. Air flow pressure switch proves (closes) and allows power to be supplied to the flame safeguard sequence enabling circuit. Power is supplied through the normally closed high temperature limit(s) control contact. (Blower light is lit if supplied)
4. After 10 seconds of pre-purge time, the flame safeguard ignition sequence is energized, the pilot ignitor is energized, the pilot valve is opened, and the pilot is lit. (If the following optional controls are supplied, the power to the flame safeguard is routed through the high and/or low gas pressure switch(s), mild temperature inlet On/Off stat, motorized proof of closure valve, and timed freeze protection relay.)
5. After the pilot is lit and proved, the main gas valves are energized and the burner fires at low fire. The main valve “on” light is lit.
6. Burner remains on low fire momentarily, then the temperature controls take over and fire the burner based on load demands.

**Note:** 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 becomes excessive.

If a flame failure should occur, the flame failure alarm light on the remote panel will light. The flame safeguard relay will go into the lockout mode. The flame safeguard must be reset manually in order to restart the unit (reset button is located in the electrical cabinet of the unit). Before resetting, a service person must inspect the unit, determine the cause, and take corrective action.

**Figure 24.1 - Typical Remote Control Panel**  
(Shipped separately for mounting by others)



# CONTROL APPLICATIONS - 100% Makeup Air Units - Model MDB

Tables 25.1 through 25.3 show the sequence of operation for 100% Makeup Air Two Speed and VFD Airflow Control Options and associated Control Types. Note that in all cases, the controlling thermostat is based on the gas controls selected and the firing rate control is not controlled by the night setback thermostat. For additional information on gas controls options, please see page 13-14.

**Table 25.1 - Two Speed VFD Control Types**

Control Type "A" - Manual High/Low Speed Switch			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Low	Continuous - Low	100% OA (50% CFM) ①	Per Gas Controls
High	Continuous - High	100% OA (100% CFM) ①	Per Gas Controls
Control Type "B" - High/Low Speed Exhaust Fan Interlocks			
# of Exhaust Fans Operating Operation	Blower Operation	Air Delivery	Controlling Thermostat
0	Off ②	None	Per Gas Controls
1	Continuous - Low	100% OA (50% CFM) ①	Per Gas Controls
2	Continuous - High	100% OA (100% CFM) ①	Per Gas Controls

① If used with the Two Speed VFD Airflow Control Option, the VFD low speed is factory set for a speed between 40% and 100% as specified by the customer. If VFD low speed is 50% of high speed, then either fan can start the unit. If the low speed is higher or lower than 50% of high speed, it is critical that the exhaust fans always be started in the same order.

**Table 25.2 - VFD with Building Pressurization Controller Control Types**

Control Type "A" - Continuous Operation			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
None (power on)	Continuous	100% OA (40%-100% air volume)	Per Gas Control
Control Type "B" - Manual Occupied/Unoccupied Switch with Night Setback Stat			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	100% OA (40%-100% air volume)	Per Gas Controls
Unoccupied	Intermittent ②	100% OA (40% air volume)	Per Gas Controls (Enabled by Night Setback Stat)
Control Type "C" - Time Clock with Night Setback Stat			
Time Clock Mode	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	100% OA (40%-100% air volume)	Per Gas Controls
Unoccupied	Intermittent ②	100% OA (40% air volume)	Per Gas Controls (Enabled by Night Setback Stat)

**Table 25.3 - VFD Building Management (DDC) System Control Types**

Control Type "A" - 4-20mA Building Management Control System Analog Signal			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Unit enabled by contact closure from DDC system ②	Continuous	100% OA (40%-100% air volume)	Per Gas Controls
Control Type "B" - 0-10VDC Building Management Control System Analog Signal			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Unit enabled by contact closure from DDC system ②	Continuous	100% OA (40%-100% air volume)	Per Gas Controls

**Note:** The VFD varies the speed of the motor to provide between 40% and 100% of the total unit airflow, based on the analog signal received from the building management system.

② A separate inlet or discharge air damper is required if 100% shut-off of outside air is required when the unit is not operating.

## CONTROL APPLICATIONS - Return Air Units - Model MRB

Tables 26.1 through 26.2 show the sequence of operation for Return Air Two-Position and Floating Airflow Control Options and associated Control Types. Note that in all cases, the controlling thermostat is based on the gas controls selected and the firing rate control is not controlled by the night setback thermostat. For additional information on gas controls options, please see page 13-14.

Model MRB units feature outside air bypass and return air dampers and either a two-position damper actuator or a floating damper actuator with a remote mounted room to outside air photohelic pressure controller. The function of the dampers are as follows:

- As the outside air bypass dampers are opened and the return air dampers closed more outside air is introduced to the building (less return air).
- As the outside air bypass dampers are closed and the return air dampers opened less outside air is introduced to the building (more return air).

The maximum return air is based on the Return Air/Outside Air ratio selected. Available ratios are 75/25 or 70/30.

**Table 26.1 - Two Position (75/25 or 70/30 Return Air/Outside Air Ratio) Control Types**

Control Type "A" - Manual Occupied/Unoccupied Switch			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	100% OA	Per Gas Controls
Unoccupied	Continuous	Minimum OA	Per Gas Controls
Control Type "B" - Manual Occupied/Unoccupied Switch with Night Setback Stat			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	100% OA	Per Gas Controls
Unoccupied	Intermittent ①	Minimum OA	Per Gas Controls (Enabled by Night Setback Stat)
Control Type "C" - Time Clock with Night Setback Stat			
Time Clock Mode	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	100% OA	Per Gas Controls
Unoccupied	Intermittent ①	Minimum OA	Per Gas Controls (Enabled by Night Setback Stat)

**Table 26.2 - Floating Position Outside Air Bypass and Return Air Dampers for Building Pressurization Control Types**

Control Type "A" - Continuous Operation			
Changeover Switch Setting	Blower Operation	Air Delivery	Delivery Thermostat
N/A	Continuous	Floating 25% to 100% OA	Per Gas Controls
Control Type "B" - Manual Occupied/Unoccupied Switch with Night Setback Stat			
Changeover Switch Setting	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	Floating 25% to 100% OA	Per Gas Controls
Unoccupied	Intermittent ①	25% OA, 75% RA	Per Gas Controls (Enabled by Night setback Stat)
Control Type "C" - Time Clock with Night Setback Stat			
Time Clock Mode	Blower Operation	Air Delivery	Controlling Thermostat
Occupied	Continuous	Floating 25% to 100% OA	Per Gas Controls
Unoccupied	Intermittent ①	25% OA, 75% RA	Per Gas Controls (Enabled by Night Setback Stat)

① A separate inlet or discharge air damper is required if 100% shut-off of outside air is required when the unit is not operating.

# GENERAL PERFORMANCE DATA

**Table 27.1 - General Performance Data** ①②

Model Size	Min CFM (All Units)	Model MDB Units		Model MRB Units	
		Max CFM	Max Input Btu/hr ③	Max CFM (75/25) ④	Max CFM (70/30) ⑤
110	1,600	3,300	432,400	3,000	3,000
112	2,000	4,700	615,800	4,380	4,500
115	3,000	6,500	851,700	6,000	6,000
118	3,500	10,000	1,310,300	6,190	6,630
120	6,000	13,500	1,769,000	12,000	12,000
122	8,000	16,500	2,162,100	12,980	13,900
124	10,000	21,500	2,162,100	n/a ⑤	n/a ⑤
125	10,000	21,500	2,817,300	20,000	20,000
127	12,000	26,000	3,406,900	23,260	24,000
130	14,000	30,000	3,931,100	23,260	24,920
220	18,000	27,000	3,538,000	25,345	26,000
222	25,000	33,000	4,324,200	25,345	27,155
225	30,000	46,000	6,027,700	38,685	41,450
230	36,000	60,000	7,862,200	38,685	41,450

- ① See blower performance data on pages 30-31 for available total static pressure drop capability.
- ② ETL certified maximum allowable discharge air temperature is 105°F. Maximum air temperature rise is 115°F for Natural Gas, 100°F for LP Gas. (LP only available on model MDB units)
- ③ Maximum Btu/hr based on max CFM and temp rise with -30°F entering air. Actual max Btu/hr may be lower depending on job conditions.
- ④ CFM shown is with -10°F outside air with a 100°F air temperature rise. Actual capability may vary with different conditions. Please refer to the AccuSpec software with your conditions.
- ⑤ Model Size 124 is available only for 100% outside air applications.

# STATIC PRESSURE DROP DATA

Table 28.1 - Accessory Static Pressure Drop Data (Inches W.C.)

Model Size	CFM	2" Permanent V-Bank Filters	2" Throwaway V-Bank Filters	2" Farr 30/30 V-Bank Filters	Inlet Dampers	Inlet Hood with Filters	Inlet Hood without Filters	Evap Cooler with Flat Bank Filters	Evap Cooler with Rainhood & Filters	3-Way Louvers	4-Way Louvers	Discharge Damper	Ductless Discharge	CFM
110	2600	0.15	0.18	0.19	0.01	0.06	0.01	0.04	0.08	0.05	0.05	0.05	0.41	2600
	2800	0.18	0.20	0.22	0.01	0.07	0.02	0.05	0.09	0.06	0.05	0.05	0.47	2800
	3000	0.20	0.22	0.25	0.01	0.08	0.02	0.05	0.10	0.07	0.06	0.06	0.54	3000
	3300	0.24	0.26	0.30	0.01	0.09	0.02	0.06	0.11	0.09	0.08	0.08	0.65	3300
112	2000	0.10	0.11	0.12	0.00	0.04	0.01	0.03	0.05	0.03	0.03	0.03	0.12	2000
	2500	0.14	0.17	0.18	0.01	0.06	0.01	0.04	0.07	0.05	0.04	0.04	0.19	2500
	3000	0.20	0.22	0.25	0.01	0.08	0.02	0.05	0.10	0.07	0.06	0.06	0.27	3000
	3500	0.26	0.29	0.33	0.01	0.10	0.02	0.06	0.12	0.10	0.09	0.09	0.37	3500
	4000	0.34	0.37	0.43	0.02	0.12	0.03	0.08	0.15	0.13	0.11	0.11	0.48	4000
	4500	0.42	0.45	0.54	0.02	0.15	0.04	0.10	0.19	0.16	0.14	0.14	0.61	4500
115	3000	0.05	0.07	0.06	0.00	0.03	0.00	0.03	0.05	0.02	0.02	0.02	0.14	3000
	3500	0.07	0.08	0.08	0.00	0.04	0.01	0.03	0.06	0.03	0.02	0.02	0.19	3500
	4000	0.08	0.10	0.11	0.01	0.05	0.01	0.04	0.07	0.04	0.03	0.03	0.25	4000
	4500	0.10	0.12	0.13	0.01	0.06	0.01	0.05	0.09	0.04	0.04	0.04	0.31	4500
	5000	0.12	0.15	0.16	0.01	0.07	0.01	0.06	0.11	0.06	0.05	0.05	0.39	5000
	5500	0.15	0.17	0.19	0.01	0.08	0.02	0.06	0.12	0.07	0.06	0.06	0.47	5500
	6000	0.17	0.20	0.23	0.01	0.09	0.02	0.07	0.14	0.08	0.07	0.07	0.56	6000
	6500	0.20	0.22	0.26	0.01	0.10	0.02	0.09	0.16	0.09	0.08	0.08	0.65	6500
118	3500	0.07	0.08	0.08	0.00	0.04	0.01	0.03	0.06	0.03	0.02	0.02	0.09	3500
	4000	0.08	0.10	0.11	0.01	0.05	0.01	0.04	0.07	0.04	0.03	0.03	0.12	4000
	5000	0.12	0.15	0.16	0.01	0.07	0.01	0.06	0.11	0.06	0.05	0.05	0.19	5000
	6000	0.17	0.20	0.23	0.01	0.09	0.02	0.07	0.14	0.08	0.07	0.07	0.27	6000
	7000	0.22	0.25	0.30	0.02	0.11	0.03	0.10	0.19	0.11	0.10	0.10	0.37	7000
	8000	0.28	0.32	0.39	0.02	0.14	0.04	0.13	0.24	0.14	0.12	0.12	0.48	8000
	9000	0.35	0.39	0.49	0.03	0.17	0.04	0.16	0.29	0.18	0.16	0.16	0.61	9000
120	6000	0.05	0.06	0.06	0.00	0.03	0.00	0.04	0.06	0.02	0.02	0.02	0.13	6000
	7000	0.06	0.08	0.08	0.00	0.04	0.01	0.04	0.08	0.03	0.03	0.03	0.17	7000
	8000	0.08	0.09	0.10	0.01	0.05	0.01	0.05	0.10	0.04	0.03	0.03	0.23	8000
	9000	0.09	0.11	0.12	0.01	0.06	0.01	0.06	0.12	0.05	0.04	0.04	0.29	9000
	10000	0.11	0.13	0.15	0.01	0.07	0.01	0.07	0.14	0.06	0.05	0.05	0.35	10000
	11000	0.13	0.15	0.17	0.01	0.08	0.02	0.09	0.17	0.07	0.06	0.06	0.43	11000
	12000	0.15	0.17	0.20	0.01	0.09	0.02	0.10	0.19	0.09	0.08	0.08	0.51	12000
	13000	0.17	0.20	0.24	0.01	0.10	0.02	0.12	0.22	0.10	0.09	0.09	0.60	13000
122	8000	0.08	0.09	0.10	0.01	0.05	0.01	0.05	0.10	0.04	0.03	0.03	0.15	8000
	9000	0.09	0.11	0.12	0.01	0.06	0.01	0.06	0.12	0.05	0.04	0.04	0.19	9000
	10000	0.11	0.13	0.15	0.01	0.07	0.01	0.07	0.14	0.06	0.05	0.05	0.24	10000
	11000	0.13	0.15	0.17	0.01	0.08	0.02	0.09	0.17	0.07	0.06	0.06	0.29	11000
	12000	0.15	0.17	0.20	0.01	0.09	0.02	0.10	0.19	0.09	0.08	0.08	0.35	12000
	13000	0.17	0.20	0.24	0.01	0.10	0.02	0.12	0.22	0.10	0.09	0.09	0.41	13000
	14000	0.19	0.22	0.27	0.02	0.11	0.02	0.14	0.25	0.12	0.10	0.10	0.47	14000
	15000	0.22	0.25	0.31	0.02	0.13	0.03	0.15	0.29	0.13	0.12	0.12	0.54	15000
	16000	0.25	0.28	0.35	0.02	0.14	0.03	0.17	0.32	0.15	0.13	0.13	0.61	16000
124	10000	0.11	0.13	0.15	0.01	0.07	0.01	0.07	0.14	0.06	0.05	0.05	0.24	10000
	12000	0.15	0.17	0.20	0.01	0.09	0.02	0.10	0.19	0.09	0.08	0.08	0.35	12000
	14000	0.19	0.22	0.27	0.02	0.11	0.02	0.14	0.25	0.12	0.10	0.10	0.47	14000
	16000	0.25	0.28	0.35	0.02	0.14	0.03	0.17	0.32	0.15	0.13	0.13	0.61	16000
	18000	0.30	0.34	0.44	0.03	0.17	0.04	0.21	0.40	0.19	0.17	0.17	0.78	18000
	20000	0.37	0.40	0.54	0.03	0.20	0.05	0.24	0.49	0.24	0.21	0.21	0.96	20000
21500	0.42	0.46	0.62	0.04	0.22	0.06	0.26	0.56	0.28	0.24	0.24	1.11	21500	

# STATIC PRESSURE DROP DATA

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

Model Size	CFM	2" Permanent V-Bank Filters	2" Throwaway V-Bank Filters	2" Farr 30/30 V-Bank Filters	Inlet Dampers	Inlet Hood with Filters	Inlet Hood without Filters	Evap Cooler with Flat Bank Filters	Evap Cooler with Rainhood & Filters	3-Way Louvers	4-Way Louvers	Discharge Damper	Ductless Discharge	CFM
127	16000	0.12	0.14	0.16	0.01	0.10	0.01	0.07	0.14	0.05	0.04	0.04	0.25	16000
	18000	0.14	0.17	0.20	0.02	0.13	0.02	0.09	0.17	0.06	0.06	0.06	0.31	18000
	20000	0.17	0.20	0.24	0.02	0.15	0.02	0.11	0.21	0.08	0.07	0.07	0.38	20000
	22000	0.20	0.23	0.29	0.03	0.17	0.03	0.13	0.24	0.09	0.08	0.08	0.46	22000
	24000	0.23	0.26	0.34	0.03	n/a	0.03	0.15	0.28	0.11	0.10	0.10	0.55	24000
	26000	0.27	0.30	0.39	0.04	n/a	0.04	0.18	0.33	0.13	0.12	0.12	0.65	26000
130	14000	0.09	0.11	0.12	0.01	0.08	0.01	0.06	0.11	0.04	0.03	0.03	0.14	14000
	16000	0.12	0.14	0.16	0.01	0.10	0.01	0.07	0.14	0.05	0.04	0.04	0.18	16000
	18000	0.14	0.17	0.20	0.02	0.13	0.02	0.09	0.17	0.06	0.06	0.06	0.23	18000
	20000	0.17	0.20	0.24	0.02	0.15	0.02	0.11	0.21	0.08	0.07	0.07	0.29	20000
	22000	0.20	0.23	0.29	0.03	0.17	0.03	0.13	0.24	0.09	0.08	0.08	0.35	22000
	24000	0.23	0.26	0.34	0.03	n/a	0.03	0.15	0.28	0.11	0.10	0.10	0.42	24000
	26000	0.27	0.30	0.39	0.04	n/a	0.04	0.18	0.33	0.13	0.12	0.12	0.49	26000
	28000	0.30	0.34	0.45	0.05	n/a	0.04	0.21	0.37	0.15	0.13	0.13	0.57	28000
30000	0.34	0.38	0.52	0.05	n/a	0.05	0.24	0.42	0.18	0.15	0.15	0.65	30000	
220	18000	0.12	0.15	0.17	0.01	0.08	0.01	0.08	0.15	0.05	0.05	0.05	0.29	18000
	19000	0.13	0.16	0.18	0.01	0.08	0.02	0.09	0.17	0.06	0.05	0.05	0.32	19000
	20000	0.15	0.17	0.20	0.01	0.09	0.02	0.10	0.18	0.06	0.06	0.06	0.35	20000
	21000	0.16	0.19	0.22	0.01	0.10	0.02	0.11	0.20	0.07	0.06	0.06	0.39	21000
	22000	0.17	0.20	0.24	0.01	0.10	0.02	0.11	0.22	0.08	0.07	0.07	0.43	22000
	23000	0.19	0.21	0.26	0.02	0.11	0.02	0.12	0.23	0.08	0.07	0.07	0.47	23000
	24000	0.20	0.23	0.28	0.02	0.11	0.02	0.13	0.25	0.09	0.08	0.08	0.51	24000
	25000	0.21	0.25	0.31	0.02	n/a	0.03	0.15	0.27	0.10	0.09	0.09	0.55	25000
	26000	0.23	0.26	0.33	0.02	n/a	0.03	0.16	0.29	0.11	0.10	0.10	0.60	26000
	27000	0.25	0.28	0.35	0.02	n/a	0.03	0.17	0.31	0.12	0.10	0.10	0.64	27000
222	25000	0.21	0.25	0.31	0.02	n/a	0.03	0.15	0.27	0.10	0.09	0.09	0.37	25000
	26000	0.23	0.26	0.33	0.02	n/a	0.03	0.16	0.29	0.11	0.10	0.10	0.41	26000
	27000	0.25	0.28	0.35	0.02	n/a	0.03	0.17	0.31	0.12	0.10	0.10	0.44	27000
	28000	0.26	0.30	0.38	0.02	n/a	0.03	0.18	0.33	0.13	0.11	0.11	0.47	28000
	29000	0.28	0.31	0.41	0.03	n/a	0.04	0.19	0.35	0.13	0.12	0.12	0.50	29000
	30000	0.30	0.33	0.43	0.03	n/a	0.04	0.21	0.38	0.14	0.13	0.13	0.54	30000
	31000	0.31	0.35	0.46	0.03	n/a	0.04	0.22	0.40	0.15	0.14	0.14	0.58	31000
	32000	0.33	0.37	0.49	0.03	n/a	0.04	0.24	0.42	0.16	0.14	0.14	0.61	32000
	33000	0.35	0.39	0.52	0.03	n/a	0.05	0.25	0.45	0.17	0.15	0.15	0.65	33000
	225	30000	0.14	0.17	0.18	0.01	0.09	0.02	0.07	0.14	0.04	0.04	0.04	0.31
32000		0.16	0.19	0.20	0.01	0.10	0.02	0.08	0.16	0.05	0.04	0.04	0.35	32000
34000		0.18	0.21	0.23	0.02	0.11	0.02	0.09	0.17	0.06	0.05	0.05	0.40	34000
36000		0.20	0.23	0.26	0.02	0.12	0.03	0.10	0.19	0.06	0.06	0.06	0.45	36000
38000		0.22	0.25	0.28	0.02	n/a	0.03	0.11	0.21	0.07	0.06	0.06	0.50	38000
40000		0.24	0.27	0.31	0.02	n/a	0.03	0.12	0.23	0.08	0.07	0.07	0.55	40000
42000		0.26	0.29	0.34	0.02	n/a	0.03	0.13	0.25	0.09	0.08	0.08	0.61	42000
44000		0.29	0.32	0.38	0.03	n/a	0.04	0.14	0.27	0.09	0.08	0.08	0.67	44000
46000		0.31	0.34	0.41	0.03	n/a	0.04	0.16	0.29	0.10	0.09	0.09	0.73	46000
230	44000	0.29	0.32	0.38	0.03	n/a	0.04	0.14	0.27	0.09	0.08	0.08	0.35	44000
	46000	0.31	0.34	0.41	0.03	n/a	0.04	0.16	0.29	0.10	0.09	0.09	0.38	46000
	48000	0.34	0.37	0.44	0.03	n/a	0.04	0.17	0.31	0.11	0.10	0.10	0.42	48000
	50000	0.36	0.40	0.48	0.03	n/a	0.05	0.18	0.34	0.12	0.11	0.11	0.45	50000
	52000	0.39	0.43	0.52	0.04	n/a	0.05	0.20	0.36	0.13	0.12	0.12	0.49	52000
	54000	0.42	0.46	0.56	0.04	n/a	0.06	0.21	0.39	0.14	0.13	0.13	0.53	54000
	56000	0.45	0.49	0.60	0.04	n/a	0.06	0.23	0.41	0.15	0.14	0.14	0.57	56000
	58000	0.48	0.52	0.64	0.05	n/a	0.07	0.25	0.44	0.16	0.14	0.14	0.61	58000
60000	0.51	0.55	0.68	0.05	n/a	0.07	0.26	0.47	0.18	0.16	0.16	0.65	60000	

# BLOWER PERFORMANCE DATA

Table 30.1 - Unit Performance Table ① ②

Model Size	CFM	Total Static Pressure ("W.C.)																			
		0.25		0.5		0.75		1		1.25		1.5		1.75		2		2.5		3	
		BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM
110	1600	0.49	882	0.59	998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1800	0.58	908	0.69	1017	0.82	1119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2000	0.69	939	0.83	1042	1.02	1139	1.14	1231	-	-	-	-	-	-	-	-	-	-	-	-
	2200	0.86	974	1.04	1071	1.16	1163	1.27	1250	1.38	1334	1.48	1415	-	-	-	-	-	-	-	-
	2400	1.07	1012	1.19	1103	1.30	1190	1.41	1274	1.52	1355	1.66	1432	1.80	1507	1.95	1580	-	-	-	-
	2600	1.22	1052	1.34	1139	1.45	1222	1.57	1302	1.72	1379	1.86	1453	2.01	1526	2.17	1596	-	-	-	-
	2800	1.39	1095	1.49	1177	1.64	1256	1.79	1332	1.93	1406	2.09	1478	2.25	1547	2.42	1615	2.76	1746	-	-
	3000	1.57	1140	1.72	1218	1.87	1293	2.02	1366	2.19	1437	2.36	1505	2.53	1573	2.70	1638	-	-	-	-
	3300	1.95	1210	2.11	1282	2.28	1353	2.45	1421	2.63	1487	2.80	1552	2.98	1615	-	-	-	-	-	-
112	2000	0.56	717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2500	0.78	751	1.02	843	1.15	927	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3000	1.15	795	1.30	880	1.43	959	1.57	1033	1.74	1103	-	-	-	-	-	-	-	-	-	-
	3500	1.46	846	1.64	925	1.82	998	2.00	1068	2.20	1134	2.40	1197	2.60	1258	2.81	1317	-	-	-	-
	4000	1.92	904	2.13	976	2.34	1044	2.56	1109	2.78	1172	2.99	1232	3.22	1290	3.44	1346	3.89	1452	4.35	1553
	4500	2.51	965	2.74	1032	2.98	1096	3.22	1157	3.46	1216	3.70	1273	3.94	1328	4.18	1381	4.67	1483	-	-
	4700	2.78	991	3.02	1056	3.27	1118	3.52	1177	3.76	1235	4.01	1291	4.26	1345	4.51	1397	4.99	1491	-	-
115	3000	0.78	599	1.06	682	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3500	1.07	618	1.25	696	1.42	768	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4000	1.29	641	1.46	715	1.67	784	1.89	848	2.14	909	-	-	-	-	-	-	-	-	-	-
	4500	1.53	668	1.76	737	1.99	802	2.24	864	2.50	922	2.77	978	3.05	1031	-	-	-	-	-	-
	5000	1.89	697	2.13	763	2.39	825	2.66	883	2.93	939	3.22	993	3.51	1044	3.81	1094	-	-	-	-
	5500	2.32	729	2.59	791	2.86	850	3.14	906	3.43	959	3.73	1011	4.03	1061	4.34	1109	4.97	1200	-	-
	6000	2.83	762	3.11	821	3.40	877	3.70	931	4.00	982	4.31	1032	4.63	1080	4.95	1126	-	-	-	-
6500	3.41	798	3.71	853	4.02	907	4.33	958	4.65	1007	4.97	1055	-	-	-	-	-	-	-	-	
118	3500	0.99	510	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4000	1.16	519	1.37	591	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5000	1.51	543	1.80	610	2.11	671	2.43	728	2.76	782	-	-	-	-	-	-	-	-	-	-
	6000	2.07	574	2.43	636	2.78	693	3.15	747	3.52	798	3.89	847	4.27	893	4.65	938	-	-	-	-
	7000	2.82	611	3.22	668	3.62	721	4.03	772	4.44	820	4.85	866	5.27	910	5.71	953	6.59	1034	-	-
	8000	3.76	652	4.20	705	4.64	754	5.09	802	5.56	847	6.03	891	6.50	933	6.98	974	7.94	1051	8.93	1124
	9000	4.89	696	5.39	745	5.89	791	6.40	836	6.91	879	7.43	920	7.94	960	8.46	999	9.51	1073	-	-
10000	6.30	743	6.85	788	7.40	831	7.95	873	8.50	914	9.06	953	9.62	991	-	-	-	-	-	-	
120	6000	1.53	447	1.89	503	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7000	1.94	466	2.34	519	2.76	568	3.21	614	-	-	-	-	-	-	-	-	-	-	-	-
	8000	2.48	489	2.90	538	3.35	585	3.82	628	4.30	670	-	-	-	-	-	-	-	-	-	-
	9000	3.14	514	3.59	560	4.06	604	4.55	646	5.06	685	5.60	724	6.16	760	6.74	796	-	-	-	-
	10000	3.93	542	4.41	585	4.90	626	5.43	666	5.97	704	6.54	740	7.13	775	7.72	809	8.97	874	-	-
	11000	4.86	571	5.37	612	5.91	651	6.47	688	7.05	724	7.64	759	8.24	792	8.86	825	10.15	888	11.52	947
	12000	5.97	602	6.53	640	7.10	677	7.68	712	8.28	747	8.90	780	9.52	812	10.18	843	11.53	904	12.94	961
	13000	7.27	634	7.85	670	8.45	705	9.06	738	9.69	771	10.34	803	11.01	834	11.69	864	13.09	922	14.55	977
13500	7.98	651	8.58	686	9.19	719	9.82	752	10.47	784	11.14	815	11.82	845	12.51	875	13.94	932	-	-	
122	8000	2.24	426	2.74	478	3.27	528	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9000	2.75	442	3.28	490	3.83	537	4.41	581	-	-	-	-	-	-	-	-	-	-	-	-
	10000	3.36	460	3.91	506	4.49	549	5.09	590	5.74	630	6.41	669	-	-	-	-	-	-	-	-
	11000	4.06	481	4.65	523	5.26	564	5.91	603	6.59	641	7.28	677	8.00	713	-	-	-	-	-	-
	12000	4.88	503	5.51	542	6.17	580	6.85	617	7.55	653	8.27	688	9.01	722	9.77	756	11.38	820	-	-
	13000	5.84	526	6.51	563	7.20	599	7.91	634	8.64	668	9.39	701	10.16	734	10.96	766	12.62	827	14.35	887
	14000	6.95	551	7.65	585	8.37	619	9.11	652	9.87	685	10.66	716	11.47	747	12.30	778	14.01	837	15.79	894
	15000	8.19	576	8.92	609	9.68	641	10.46	672	11.26	703	12.08	733	12.92	763	13.78	792	15.55	848	17.39	903
	16000	9.58	602	10.36	633	11.16	663	11.98	693	12.81	723	13.66	751	14.54	780	15.43	807	17.26	862	19.15	914
16500	10.35	615	11.15	645	11.96	675	12.80	704	13.65	733	14.52	761	15.41	789	16.31	816	18.18	869	-	-	
124	10000	2.63	362	3.19	407	3.78	451	4.40	493	-	-	-	-	-	-	-	-	-	-	-	-
	12000	3.68	384	4.29	424	4.92	462	5.60	499	6.32	535	7.06	571	-	-	-	-	-	-	-	-
	14000	5.03	413	5.72	447	6.43	481	7.17	514	7.92	547	8.71	579	9.52	610	10.36	640	-	-	-	-
	16000	6.81	444	7.55	475	8.31	505	9.10	535	9.91	565	10.76	594	11.63	622	12.53	650	14.37	705	16.31	758
	18000	8.99	478	9.79	506	10.63	534	11.49	561	12.37	587	13.27	614	14.20	640	15.14	665	17.09	716	19.12	765
	20000	11.67	514	12.55	540	13.45	565	14.37	589	15.31	614	16.27	638	17.26	662	18.26	685	-	-	-	-
21500	14.03	542	14.95	566	15.91	589	16.88	613	17.86	635	18.87	658	19.89	681	-	-	-	-	-	-	-

① Total static pressure should include external static pressure and accessory / option static pressure from Tables 28.1 or 29.1.  
 ② Brake Horsepower and RPM values are approximate. Please consult the AccuSpec selection software for accurate values.

# BLOWER PERFORMANCE DATA

Table 31.1 - Unit Performance Table ① ②

Model Size	CFM	Total Static Pressure ("W.C.)																			
		0.25		0.5		0.75		1		1.25		1.5		1.75		2		2.5		3	
		BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM
125	10000	2.45	356	3.08	404	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12000	3.30	373	3.97	416	4.67	457	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14000	4.40	395	5.11	434	5.88	471	6.70	507	7.55	541	8.43	575	-	-	-	-	-	-	-	-
	16000	5.80	420	6.59	455	7.41	489	8.27	522	9.16	554	10.08	585	11.06	615	12.06	645	-	-	-	-
	18000	7.55	448	8.40	480	9.27	511	10.18	541	11.13	571	12.11	600	13.13	628	14.17	656	16.36	709	-	-
	20000	9.67	478	10.58	507	11.53	536	12.50	564	13.50	591	14.53	618	15.60	645	16.69	670	18.96	721	-	-
	21500	11.55	501	12.51	529	13.49	556	14.51	582	15.56	608	16.63	634	17.73	659	18.86	684	-	-	-	-
127	12000	2.69	315	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14000	3.48	327	4.17	366	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	16000	4.45	341	5.19	378	5.99	412	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18000	5.65	358	6.47	392	7.32	424	8.20	455	9.11	485	-	-	-	-	-	-	-	-	-	-
	20000	7.12	377	7.99	408	8.89	438	9.82	467	10.79	495	11.80	522	12.83	548	-	-	-	-	-	-
	22000	8.84	397	9.77	426	10.74	454	11.74	481	12.77	508	13.82	533	14.90	558	16.01	583	-	-	-	-
	24000	10.87	418	11.87	445	12.90	472	13.96	497	15.04	522	16.15	546	17.28	570	18.44	593	-	-	-	-
26000	13.23	441	14.30	466	15.39	491	16.51	515	17.65	538	18.81	561	20.00	584	-	-	-	-	-	-	
130	14000	3.23	292	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	16000	3.98	300	4.85	338	5.82	374	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18000	4.88	310	5.81	345	6.83	379	7.90	412	-	-	-	-	-	-	-	-	-	-	-	-
	20000	5.99	323	6.98	355	8.02	387	9.12	417	10.29	446	11.52	475	-	-	-	-	-	-	-	-
	22000	7.30	337	8.33	367	9.42	396	10.57	425	11.78	452	13.05	479	14.37	505	-	-	-	-	-	-
	24000	8.83	352	9.91	380	11.06	407	12.26	434	13.51	460	14.82	486	16.17	511	17.57	535	-	-	-	-
	26000	10.60	368	11.75	394	12.95	420	14.20	445	15.50	470	16.84	561	18.23	518	19.67	541	22.69	586	-	-
	28000	12.65	384	13.85	409	15.10	434	16.40	457	17.75	481	19.13	504	20.57	526	22.05	548	-	-	-	-
30000	14.96	402	16.23	425	17.54	448	18.88	471	20.28	493	21.72	515	23.20	536	24.72	557	-	-	-	-	
220	18000	6.18	516	7.08	562	8.02	606	8.98	648	9.98	688	11.03	726	12.10	763	-	-	-	-	-	-
	19000	6.94	530	7.87	574	8.84	617	9.83	657	10.87	696	11.95	734	13.05	770	14.18	805	-	-	-	-
	20000	7.76	545	8.73	587	9.72	628	10.76	668	11.84	706	12.94	742	14.07	778	15.22	812	-	-	-	-
	21000	8.66	559	9.66	601	10.70	640	11.77	679	12.87	716	14.00	751	15.16	786	16.35	820	18.80	884	-	-
	22000	9.63	575	10.67	615	11.75	653	12.85	690	13.99	726	15.15	761	16.34	795	17.55	828	-	-	-	-
	23000	10.69	590	11.77	629	12.88	666	14.02	702	15.18	737	16.38	771	17.60	804	18.84	836	-	-	-	-
	24000	11.84	606	12.96	644	14.10	680	15.27	715	16.47	749	17.69	782	18.94	814	-	-	-	-	-	-
	25000	13.08	622	14.23	659	15.40	694	16.61	728	17.84	761	19.09	794	-	-	-	-	-	-	-	-
26000	14.41	639	15.59	674	16.80	708	18.04	742	19.30	774	-	-	-	-	-	-	-	-	-	-	
27000	15.83	656	17.05	690	18.29	723	19.56	755	-	-	-	-	-	-	-	-	-	-	-	-	
222	25000	10.64	518	11.92	556	13.25	593	14.64	628	16.07	663	17.56	697	19.08	729	20.66	761	23.95	823	-	-
	26000	11.64	530	12.95	567	14.32	602	15.74	637	17.20	671	18.71	704	20.27	736	21.87	767	25.20	828	26.93	857
	27000	12.71	542	14.06	578	15.46	613	16.90	646	18.40	679	19.93	711	21.53	743	23.15	773	26.53	833	28.29	861
	28000	13.85	555	15.23	589	16.66	623	18.14	656	19.66	688	21.24	719	22.86	750	24.51	780	27.94	838	29.72	866
	29000	15.06	567	16.48	601	17.95	634	19.45	666	21.02	697	22.62	728	24.26	758	25.94	787	29.43	844	-	-
	30000	16.35	580	17.81	613	19.30	645	20.86	676	22.44	707	24.08	737	25.74	766	27.46	795	-	-	-	-
	31000	17.72	593	19.21	625	20.75	656	22.33	687	23.95	717	25.61	746	27.31	774	29.05	803	-	-	-	-
	32000	19.17	606	20.71	637	22.28	668	23.89	698	25.53	727	27.23	755	28.97	783	-	-	-	-	-	-
33000	20.72	620	22.28	650	23.88	680	25.52	709	27.21	737	28.94	765	-	-	-	-	-	-	-	-	
225	30000	10.05	411	11.57	448	13.17	483	14.84	516	16.59	547	18.42	577	20.32	606	-	-	-	-	-	-
	32000	11.54	424	13.12	460	14.77	493	16.50	525	18.29	556	20.17	585	22.11	613	24.12	641	-	-	-	-
	34000	13.20	438	14.83	472	16.55	504	18.32	535	20.18	565	22.10	594	24.08	621	26.13	648	-	-	-	-
	36000	15.04	452	16.74	485	18.50	516	20.34	546	22.24	575	24.21	603	26.24	630	28.34	656	32.73	706	-	-
	38000	17.07	466	18.82	498	20.65	528	22.55	557	24.50	586	26.52	613	28.60	639	30.74	664	35.24	713	37.58	737
	40000	19.29	481	21.12	512	23.00	541	24.95	569	26.96	597	29.04	623	31.17	649	33.38	673	37.97	721	-	-
	42000	21.73	497	23.61	526	25.56	554	27.57	582	29.64	608	31.78	634	33.98	659	36.24	683	-	-	-	-
	44000	24.37	512	26.32	541	28.34	568	30.40	595	32.55	620	34.75	645	37.01	670	39.32	693	-	-	-	-
46000	27.25	528	29.27	555	31.35	582	33.50	608	35.70	633	37.96	657	-	-	-	-	-	-	-	-	
230	36000	9.71	312	11.56	347	13.50	381	15.53	414	-	-	-	-	-	-	-	-	-	-	-	-
	38000	10.78	318	12.68	352	14.67	385	16.76	416	-	-	-	-	-	-	-	-	-	-	-	-
	40000	11.94	325	13.90	357	15.95	389	18.09	419	20.32	449	-	-	-	-	-	-	-	-	-	-
	42000	13.20	332	15.22	363	17.33	393	19.52	423	21.81	451	24.17	479	-	-	-	-	-	-	-	-
	44000	14.56	339	16.64	369	18.81	398	21.07	427	23.40	455	25.81	482	28.30	508	-	-	-	-	-	-
	46000	16.03	346	18.17	375	20.40	404	22.72	431	25.10	458	27.57	485	30.11	510	-	-	-	-	-	-
	48000	17.62	354	19.82	382	22.12	410	24.48	436	26.92	462	29.50	488	32.05	513	34.74	538	-	-	-	-
	50000	19.32	362	21.59	389	23.94	416	26.37	442	28.87	467	31.45	492	34.12	516	36.86	540	-	-	-	-
	52000	21.15	370	23.48	397	25.89	422	28.38	448	30.94	472	33.60	496	36.32	520	39.11	543	44.87	589	-	-
	54000	23.11	379	25.49	404	27.97	429	30.52	454	33.16	478	35.87	501	38.65	524	41.48	547	47.36	591	-	-
	56000	25.18	387	27.65	412	30.18	436	32.81	460	35.51	483	38.28	506	41.11	529	44.00	551	49.98	594	-	-
58000	27.41	396	29.94	420	32.55	444	35.24	467	38.00	489	40.82	512	43.71	534	46.66	555	-	-	-	-	
60000	29.77	405	32.38	428	35.06	451	37.82	474	40.63	496	43.51	518	46.46	539	49.46	560	-	-	-	-	

① Total static pressure should include external static pressure and accessory / option static pressure from Tables 28.1 or 29.1.

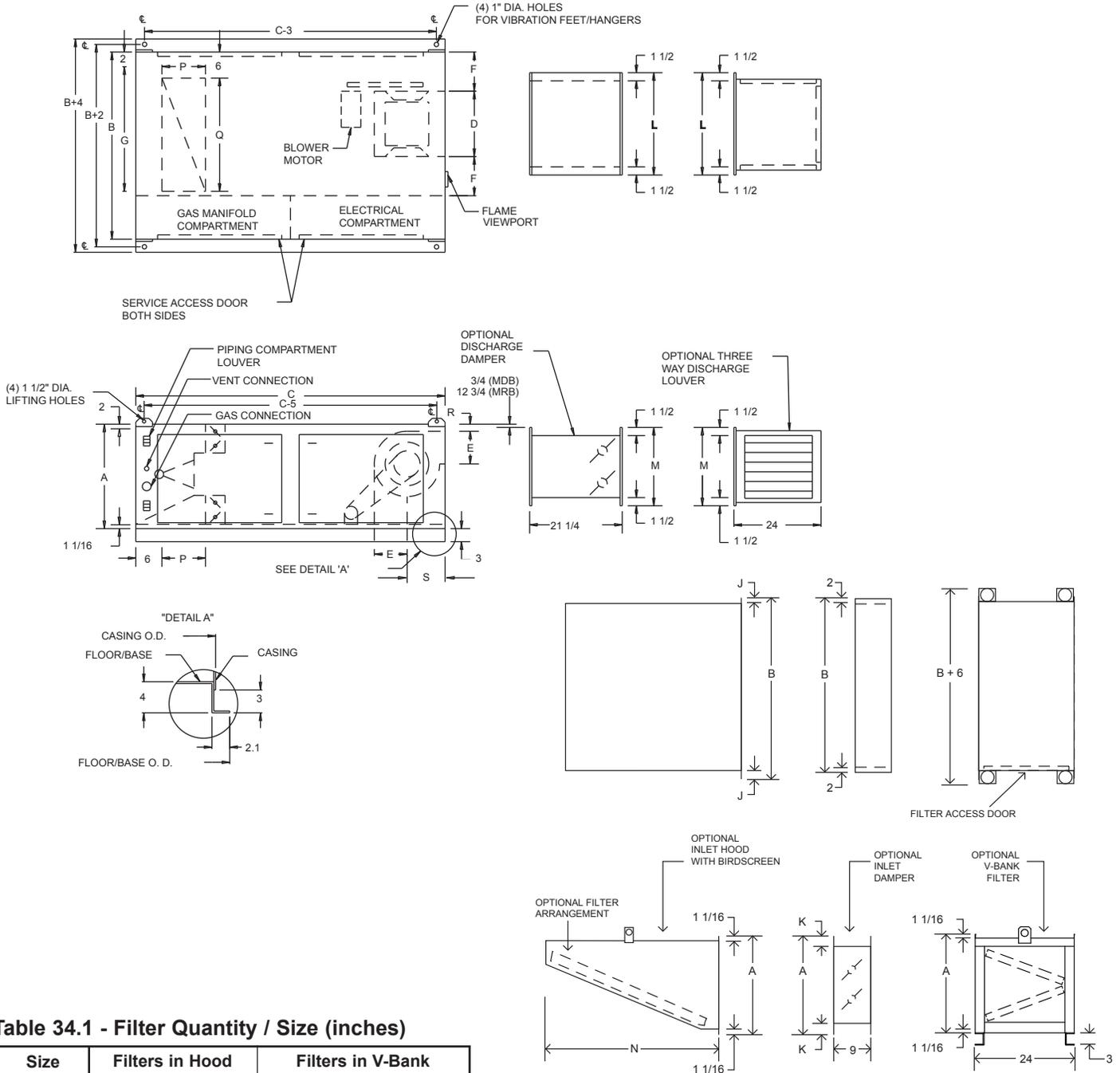
② Brake Horsepower and RPM values are approximate. Please consult the AccuSpec selection software for accurate values.



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# UNIT AND ACCESSORY DIMENSIONS

## MDB/MRB 110-118 Dimensions



**Table 34.1 - Filter Quantity / Size (inches)**

Size	Filters in Hood	Filters in V-Bank
110-112	(4) 20 x 20 x 2	(4) 20 x 20 x 2
115-118	(6) 20 x 25 x 2	(6) 20 x 25 x 2

**Table 34.2 - MDB / MRB Unit Dimensions (All dimensions in inches)**

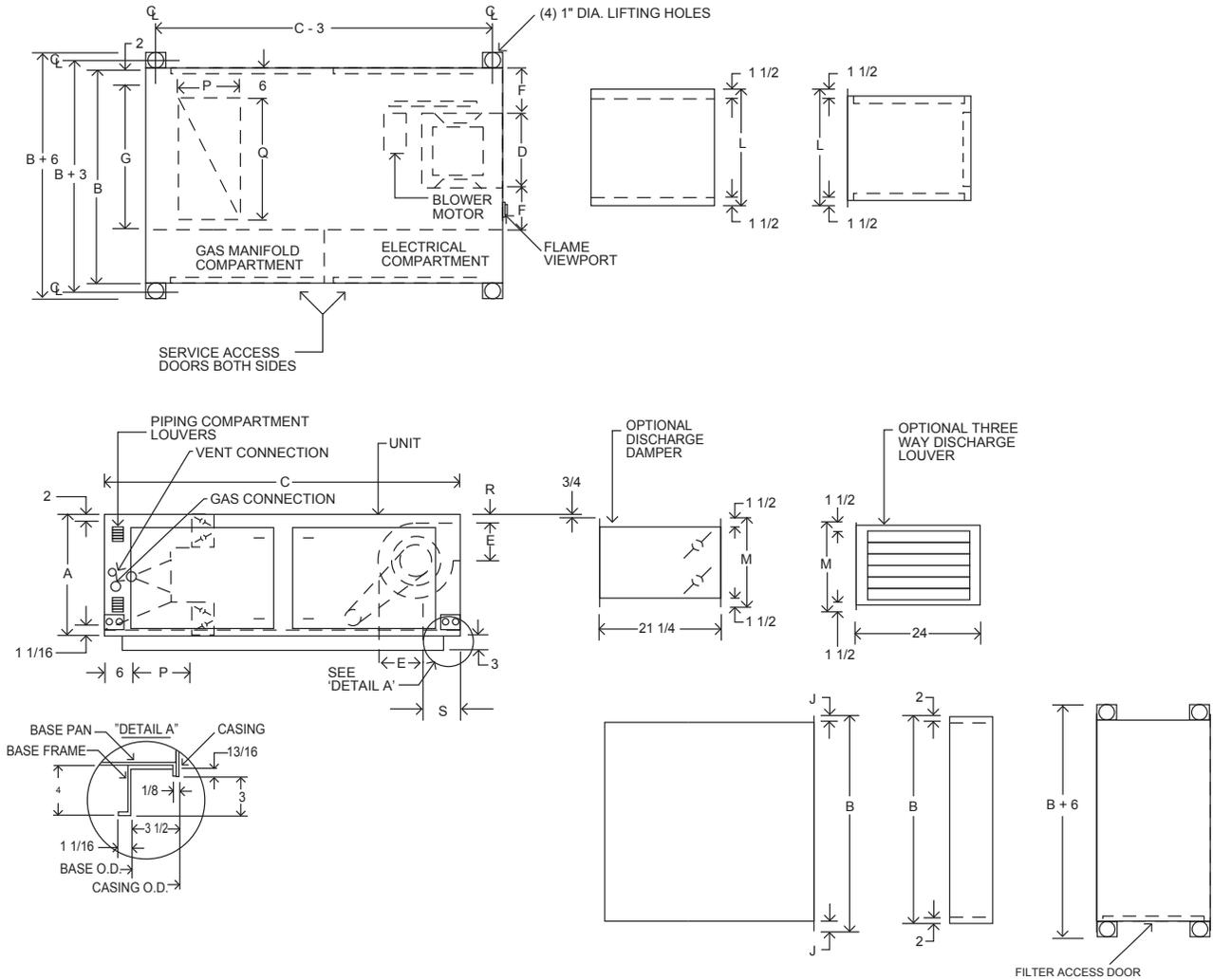
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
110	24/36 ①	43	71	13 1/4	11 1/2	9 7/8	30	1 1/8	1 1/2	③	21	20	38 1/2	10	26	②	6 1/4
112	24/36 ①	43	71	15 3/4	13 9/16	8 5/8	30	1 1/8	1 1/2	③	21	20	38 1/2	10	26	②	7 3/16
115	36	52	82	18 3/4	16	11 5/8	39	7/8	1	1 1/4	26 1/2	25 1/2	54 3/8	12	35	2 1/4	8 5/8
118	36	52	82	22	19	10	39	7/8	1	1 1/4	26 1/2	25 1/2	54 3/8	12	35	2 1/4	10 9/16

Note: All accessories shipped completely assembled for easy installation. Some accessories shipped separately. All data subject to change. All dimensions subject to manufacturing tolerances.

- ① 24" for MDB models, 36" for MRB models.
- ② 2-1/4" for MDB models, 14-1/4" for MRB models.
- ③ 3/4" for MDB models, 1-1/4" for MRB models.

# UNIT AND ACCESSORY DIMENSIONS

## MDB/MRB 120-130 Dimensions



**Table 35.1 - Filter Quantity / Size (inches)**

Model Size	Filter Location	
	Inlet Hood	V-Bank Section
120		
122	(9) 20 x 25 x 2	(12) 20 x 25 x 2
124		
125	(6) 20 x 25 x 2	(10) 20 x 20 x 2
127	(9) 16 x 25 x 2	(10) 20 x 25 x 2
130		

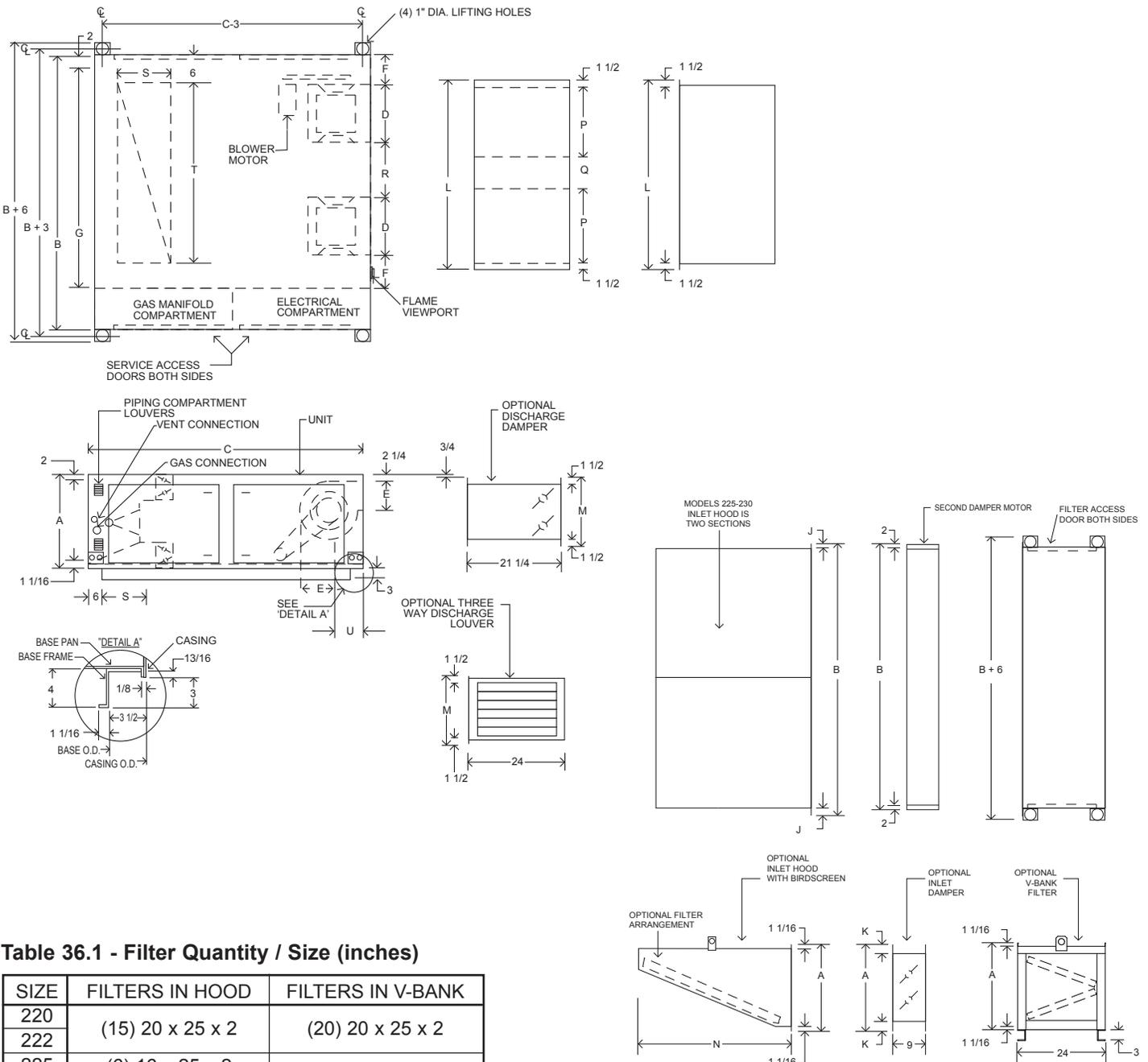
**Table 35.2 - MDB / MRB Unit Dimensions (All dimensions in inches)**

Model Size	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
120	48	78	96	24 7/8	24 7/8	18 9/16	59	1 5/16	1 1/2	1 3/4	31 1/2	31	45 3/8	14	55	2 1/4	11 1/4
122	48	78	96	27 3/8	27 3/8	17 5/16	59	1 5/16	1 1/2	1 3/4	31 1/2	31	45 3/8	14	55	2 1/4	12 1/4
124	48	78	96	28 3/8	31 3/8	16 13/16	59	1 5/16	1 1/2	1 3/4	31 1/2	31	45 3/8	14	55	2 1/4	13 1/4
125	60	92	110	31 3/8	31 3/8	22 5/16	73	1 1/16	1	2 1/4	41 1/2	42	56	20	69	2 1/4	13 1/4
127	60	92	110	34 3/8	34 3/8	20 13/16	73	1 1/16	1	2 1/4	41 1/2	42	56	20	69	2 1/4	15 1/4
130	60	92	110	36 7/8	36 7/8	19 9/16	73	1 1/16	1	2 1/4	41 1/2	42	56	20	69	2 1/4	16 1/4

Note: All accessories shipped completely assembled for easy installation. Some accessories shipped separately. All data subject to change. All dimensions subject to manufacturing tolerances.

# UNIT AND ACCESSORY DIMENSIONS

## MDB/MRB 220-230 Dimensions



**Table 36.1 - Filter Quantity / Size (inches)**

SIZE	FILTERS IN HOOD	FILTERS IN V-BANK
220	(15) 20 x 25 x 2	(20) 20 x 25 x 2
222		
225	(6) 16 x 25 x 2	(36) 20 x 25 x 2
230	(18) 20 x 25 x 2	

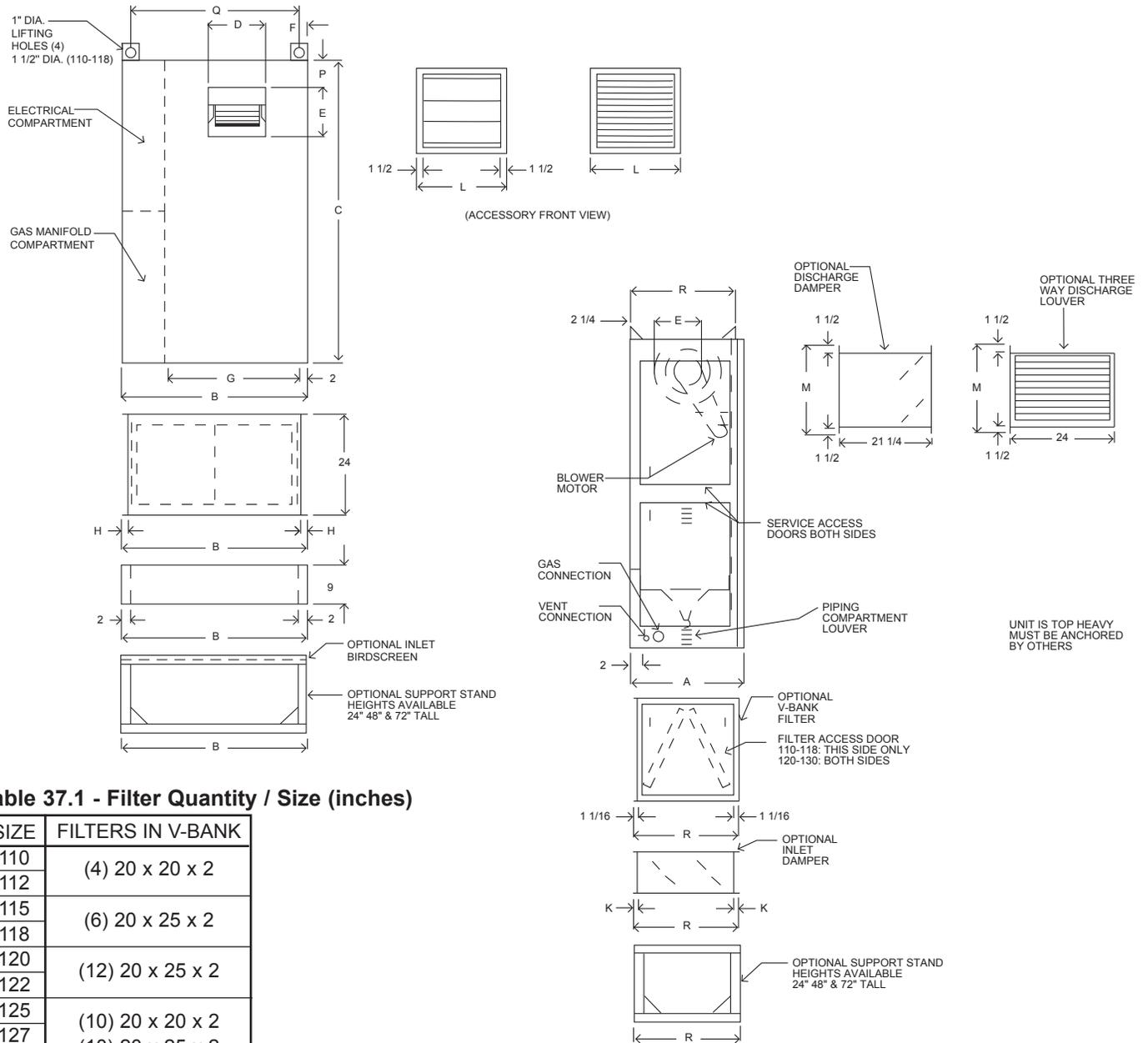
**Table 36.2 - MDB / MRB Unit Dimensions (All dimensions in inches)**

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U
220	48	130	96	24 7/8	24 7/8	16 1/16	111	2 11/16	2 1/2	1 3/4	88	31	45 3/8	28 1/2	28	32 1/8	14	107	11 1/4
222	48	130	96	27 3/8	27 3/8	14 13/16	111	2 11/16	2 1/2	1 3/4	88	31	45 3/8	28 1/2	28	29 5/8	14	107	12 1/4
225	60	154	110	31 3/8	31 3/8	18 13/16	135	2 3/8	2	2 1/4	110	42	56	38 1/2	30	37 5/8	20	131	13 1/2
230	60	154	110	36 7/8	36 7/8	16 1/16	135	2 3/8	2	2 1/4	110	42	56	38 1/2	30	32 1/8	20	131	16 3/4

Note: All accessories shipped completely assembled for easy installation. Some accessories shipped separately. All data subject to change. All dimensions subject to manufacturing tolerances.

# UNIT AND ACCESSORIES DIMENSIONS

## MDB 110-130 Dimensions (Vertical Units)



**Table 37.1 - Filter Quantity / Size (inches)**

SIZE	FILTERS IN V-BANK
110	(4) 20 x 20 x 2
112	(4) 20 x 20 x 2
115	(6) 20 x 25 x 2
118	(6) 20 x 25 x 2
120	(12) 20 x 25 x 2
122	(12) 20 x 25 x 2
125	(10) 20 x 20 x 2
127	(10) 20 x 25 x 2
130	(10) 20 x 25 x 2

**Table 37.2 - MDB Vertical Unit Dimensions (all dimensions in inches)**

SIZE	A	B	C	D	E	F	G	H	K	L	M	P	Q	R
110	24	43	71	13 1/4	11 1/2	9 7/8	30	1 1/8	3/4	21	20	6 1/4	38	24
112	24	43	71	15 3/4	13 9/16	8 5/8	30	1 1/8	3/4	21	20	7 3/16	47	24
115	36	52	82	18 3/4	16	11 5/8	39	7/8	1 1/4	26 1/2	25 1/2	8 5/8	47	36
118	36	52	82	22	19	10	39	7/8	1 1/4	26 1/2	25 1/2	10 9/16	47	36
120	51	78	96	24 7/8	24 7/8	18 9/16	59	1 5/16	1 3/4	31 1/2	31	11 1/4	75	48
122	51	78	96	27 3/8	27 3/8	17 5/16	59	1 5/16	1 3/4	31 1/2	31	12 1/4	75	48
125	63	92	110	31 3/8	31 3/8	22 5/16	73	1 1/16	2 1/4	41 1/2	42	13 1/4	89	60
127	63	92	110	34 3/8	34 3/8	20 13/16	73	1 1/16	2 1/4	41 1/2	42	15 1/4	89	60
130	63	92	110	36 7/8	36 7/8	19 9/16	73	1 1/16	2 1/4	41 1/2	42	16 1/4	89	60

Note: All accessories shipped completely assembled for easy installation. Some accessories shipped separately. All data subject to change. All dimensions subject to manufacturing tolerances.

# ROOF CURB DIMENSIONS

Figure 38.1 - Roof-Curb Dimensions - Size 110-130

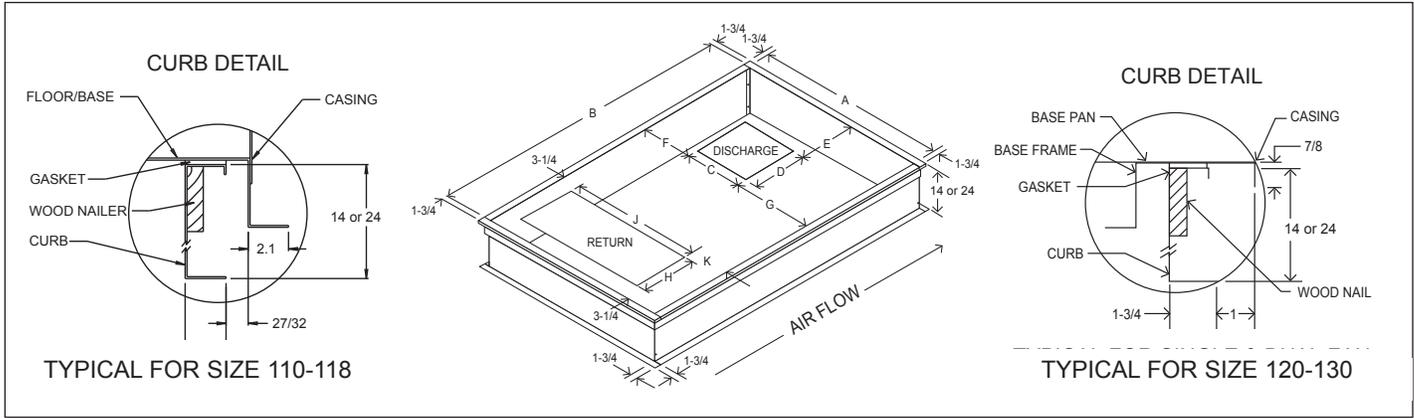


Table 38.1 - Roof-Curb Dimensions - Size 110-130 (inches)

Model Size	Curb Inside Dimensions		Discharge Air Dimensions (optional)					Return Air Dimensions (optional)			Gasket Length (Feet)	Curb Weight (lbs)	
	A	B	C	D	E	F	G	H	J	K		14" High	24" High
110	37 1/2	65 1/2	13 1/4	11 1/2	3 1/2	7 1/8	17 1/8	10	26	8 1/4	19	115	180
112	37 1/2	65 1/2	15 3/4	13 9/16	4 7/16	5 7/8	15 7/8						
115	46 1/2	76 1/2	18 3/4	16	5 7/8	8 7/8	18 7/8	12	35	8 1/4	23	140	215
118	46 1/2	76 1/2	22	19	7 13/16	7 1/4	17 1/4						
120	72 1/2	90 1/2	24 7/8	24 7/8	8 1/2	16 13/16	30 13/16	14	55	14 1/4	29	220	375
122	72 1/2	90 1/2	27 3/8	27 3/8	9 1/2	14 9/16	30 9/16						
124	72 1/2	90 1/2	28 3/8	31 3/8	10 1/2	14 1/16	30 1/16	n/a	n/a	n/a			
125	86 1/2	104 1/2	31 3/8	31 3/8	10 1/2	19 9/16	35 9/16	20	69	14 1/4	34	240	410
127	86 1/2	104 1/2	34 3/8	34 3/8	12 1/2	18 1/16	34 1/16						
130	86 1/2	104 1/2	36 7/8	36 7/8	13 1/2	16 13/16	32 13/16						

Figure 38.2 - Roof-Curb Dimensions - Size 220-230

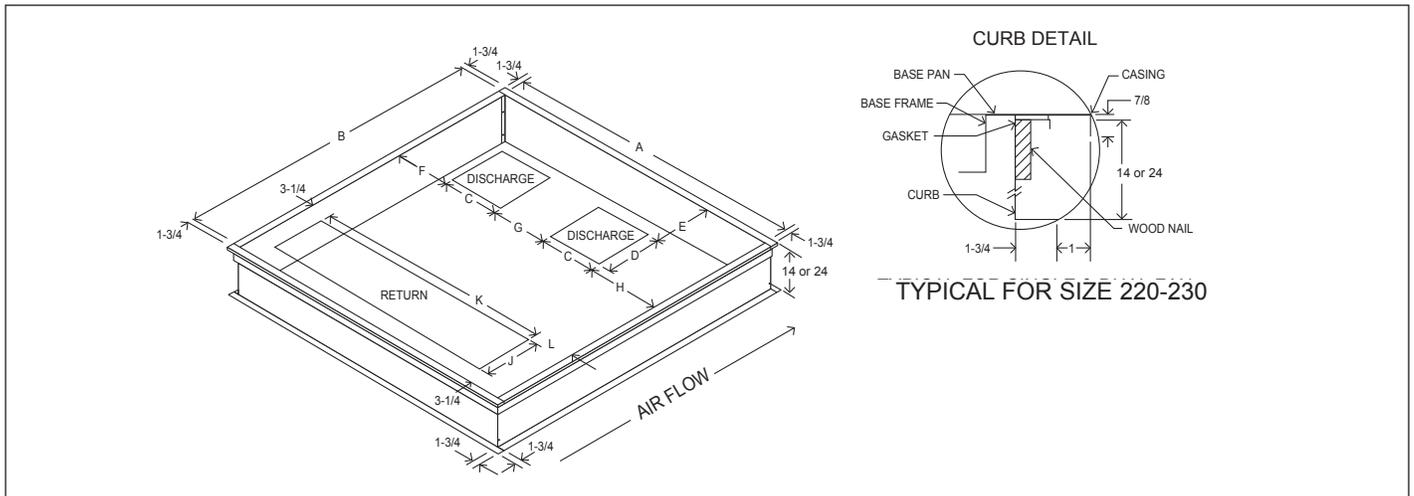


Table 38.2 - Roof-Curb Dimensions - Size 220-230 (inches)

Model Size	Curb Inside Dimensions		Discharge Air Dimensions (optional)					Return Air Dimensions (optional)				Gasket Length (Feet)	Curb Weight (lbs)	
	A	B	C	D	E	F	G	H	J	K	L		14" High	24" High
220	124 1/2	90 1/2	24 7/8	24 7/8	8 1/2	13 5/16	32 1/8	29	14	107	14	38	285	485
222	124 1/2	90 1/2	27 3/8	27 3/8	9 1/2	12 1/16	29 5/8							
225	148 1/2	104 1/2	31 3/8	31 3/8	10 1/2	16 1/16	37 5/8	32	20	131	14	44	315	540
230	148 1/2	104 1/2	36 7/8	36 7/8	14	13 5/16	32 1/8							

# EVAPORATIVE COOLING UNIT DIMENSIONS

Figure 39.1 - Evaporative Cooling Module

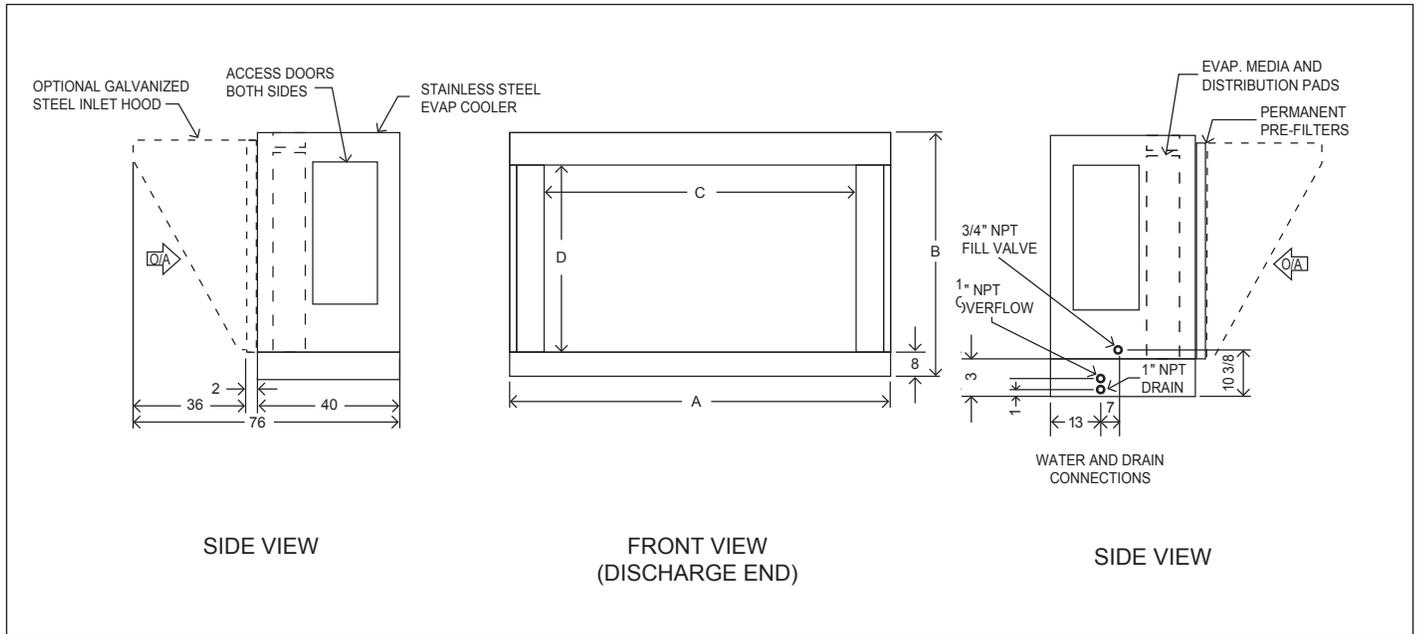


Table 39.1 - Evaporative Cooling Specifications

Model Size	Evaporative Cooler				2" Pre-Filters				12" Evaporative Media				2" Dist. Pad		Weight (Lbs.)				
	A	B	C	D	CFM Range		Qty	Size (L x H)	Face Area (sq ft)	Max. Vel. (FPM)	Qty	Size (W x H)	Face Area (sq ft)	Max Vel. (FPM)	Qty	Size (W x H)	Ship	Oper	Hood
					Min	Max													
110	48	47	39	17	1,600	3,300	6	16 x 20	13.33	248	4	12 x 36	12.00	275	1	12 x 48	265	525	62
112	48	47	39	17	2,000	4,700	6	16 x 20	13.33	353	4	12 x 36	12.00	392	1	12 x 48	265	525	62
115	60	59	48	29	3,000	6,500	6	20 x 25	20.83	312	5	12 x 36	15.00	433	1	12 x 48	395	720	75
118	60	59	48	29	3,500	10,000	6	20 x 25	20.83	480	5	12 x 48	20.00	500	1	12 x 48	395	720	75
120	84	71	74	41	6,000	13,500	3	20 x 20	35.00	386	7	12 x 60	35.00	386	1	12 x 60	610	1065	105
							12	16 x 20							1	12 x 24			
122	84	71	74	41	8,000	16,500	3	20 x 20	35.00	471	7	12 x 60	35.00	471	1	12 x 60	610	1065	105
							12	16 x 20							1	12 x 24			
124	84	71	74	41	10,000	21,500	3	20 x 20	35.00	614	7	12 x 60	35.00	614	1	12 x 60	610	1065	105
							12	16 x 20							1	12 x 24			
125	108	71	88	53	10,000	21,500	9	20 x 20	45.00	478	9	12 x 60	45.00	478	1	12 x 48	755	1340	110
							9	16 x 20							1	12 x 60			
127	108	83	88	53	12,000	26,000	9	20 x 25	56.25	462	9	12 x 72	54.00	481	1	12 x 48	835	1420	125
							9	16 x 25							1	12 x 60			
130	108	83	88	53	14,000	30,000	9	20 x 25	56.25	533	9	12 x 72	54.00	556	1	12 x 48	835	1420	125
							9	16 x 25							1	12 x 60			
220	144	71	126	41	18,000	27,000	12	16 x 20	60.00	450	12	12 x 60	60.00	450	2	12 x 72	1065	1845	140
							12	20 x 20											
222	144	71	126	41	25,000	33,000	12	16 x 20	60.00	550	12	12 x 60	60.00	550	2	12 x 72	1065	1845	140
							12	20 x 20											
225	180	95	150	53	30,000	46,000	9	20 x 25	106.25	433	15	12 x 72	105.00	438	3	12 x 60	1735	2710	175
							27	20 x 20				15							
230	180	95	150	53	36,000	60,000	9	20 x 25	106.25	565	15	12 x 72	105.00	571	3	12 x 60	1735	2710	175
							27	20 x 20				15							

# UNIT AND ACCESSORY WEIGHTS

Figure 40.1 - Unit Weights

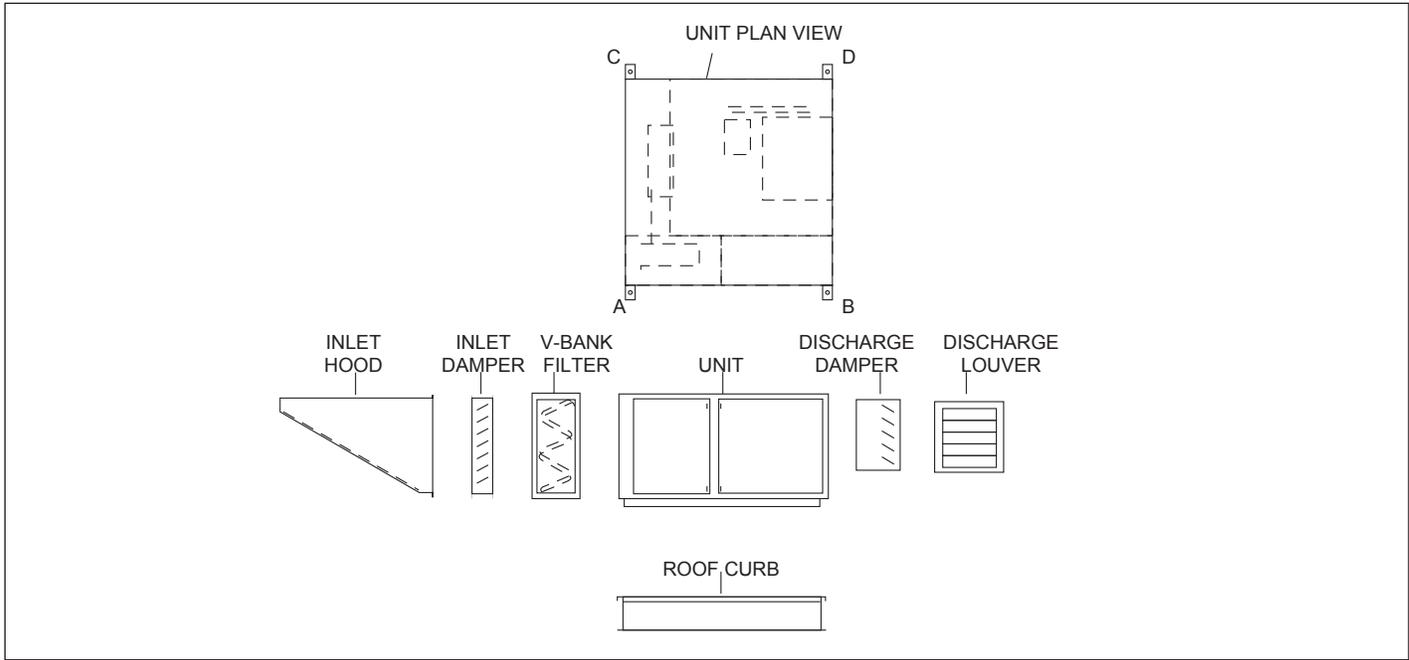


Table 40.1 - Unit Weights (all weight in pounds)

Model Type	Digit 7	Digit 19	110	112	115	118	120	122	124	125	127	130	220	222	225	230
MDB	A-F	A or B	440	500	800	850	1200	1275	1300	1655	1725	1805	1850	2050	2620	2795
		C	475	535	850	900	1260	1335	n/a	1730	1800	1880	2100	2300	2895	3070
	G-J	A or B	480	540	850	900	1350	1425	n/a	1905	1975	2055	n/a	n/a	n/a	n/a
MRB	A-F	A or B	555	615	885	935	1345	1420	n/a	1880	1950	2030	2070	2270	2925	3100
		C	590	650	935	985	1405	1480	n/a	1955	2025	2105	2320	2520	3200	3375
Weight Distribution		A	125	140	220	235	325	345	350	445	465	490	510	570	725	780
		B	100	120	200	210	300	315	325	400	415	430	395	435	610	645
		C	90	100	160	170	250	265	270	365	380	395	435	475	560	590
		D	125	140	220	235	325	345	350	445	465	490	510	570	725	780

Table 40.2 - Accessory Weights (all weight in pounds)

Accessory	Model Size					
	110, 112	115, 118	120, 122, 124	125, 127, 130	220, 222	225, 230
Inlet Hood	80	125	165	220	235	385
Inlet Damper	70	95	170	230	260	380
V-Bank Filter Section	120	160	245	325	365	505
Discharge Damper	60	80	95	135	210	285
Discharge Louver	80	95	115	150	225	310
14" Roof Curb	115	140	220	240	285	315
24" Roof Curb	180	215	375	410	485	540
24" High Vertical Unit Inlet Stand	55	70	180	225	-	-
48" High Vertical Unit Inlet Stand	75	90	220	265	-	-

Table 40.3a - Approximate Motor Weights (all weight in pounds)

HP	3/4		1		1-1/2		2		3		5		7-1/2	
Motor Type	ODP	TE	ODP	TE	ODP	TE	ODP	TE	ODP	TE	ODP	TE	ODP	TE
Weight	25	25	40	40	40	45	50	50	78	80	90	100	150	145

Table 40.3b - Approximate Motor Weights (all weight in pounds)

HP	10		15		20		25		30		40		50	
Motor Type	ODP	TE												
Weight	220	160	310	240	360	250	425	500	485	525	580	510	710	775

# MAINTENANCE

## ⚠ 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.

All heating equipment should be serviced before each heating season to assure 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.

### Blower Assembly

The blower assembly includes the fan bearings, drive sheaves, and drive belts.

Belt tension should be rechecked shortly after the unit has been installed to check for belt stretching.

After the initial start-up period, monthly checks are recommended.

Blower bearings should be checked and lubricated monthly if the bearings are not of the permanently-lubricated type. On units provided with spider bearings, the bearings are permanently lubricated and should not require additional lubrication. Units provided with pillow block bearings are also supplied with permanent lubrication; however, see vendor's literature supplied with unit for lubrication recommendations.

Bearings should be checked for any unusual wear and replaced if necessary. Also make sure bearings are secure.

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.

### Filters

If the unit is supplied with a dirty filter switch and light, clean or replace the filters any time the dirty filter light comes on. See pages 34-37 for quantities and sizes.

Units that do not have the optional dirty filter switch and light should have the filters checked monthly. Clean or replace if necessary. In dirty atmospheres, filter maintenance may be required more often.

### Burners

Generally, direct-fired burners tend to be self-cleaning; however, if the unit is installed in a severely dirty environment, a periodic cleaning of the burner may be required.

Depending on the size of the burner, it may not be practical to attempt to remove the burner from the unit for cleaning. Use the following steps to clean the burner.

1. Turn off all gas and power. Remove the pilot and ignitor assembly from the burner.
2. Break the gas union at the burner and isolate the burner piping from the manifold piping.
3. Seal the open end of the manifold piping with duct tape or other means to prevent dirt from entering the manifold pipe and/or gas controls.
4. Using a high-pressure air hose (40 to 80 PSI) flush the burner gas ports from the flame side of the burner. Continue to flush the burner until all dust particles are removed.

**Note:** If air pressure alone is not sufficient to clean the burner gas ports, the ports may be cleaned by using the appropriately sized bit from a NUMBERED DRILL SET.

Check the manufacturer's name stamped on the burner AND check the type of gas the unit was designed to use. The gas type can be found on the unit's rating plate. With this information, use the following table to determine the correct numbered drill bit size. Push the bit by hand through the gas ports to clean them.

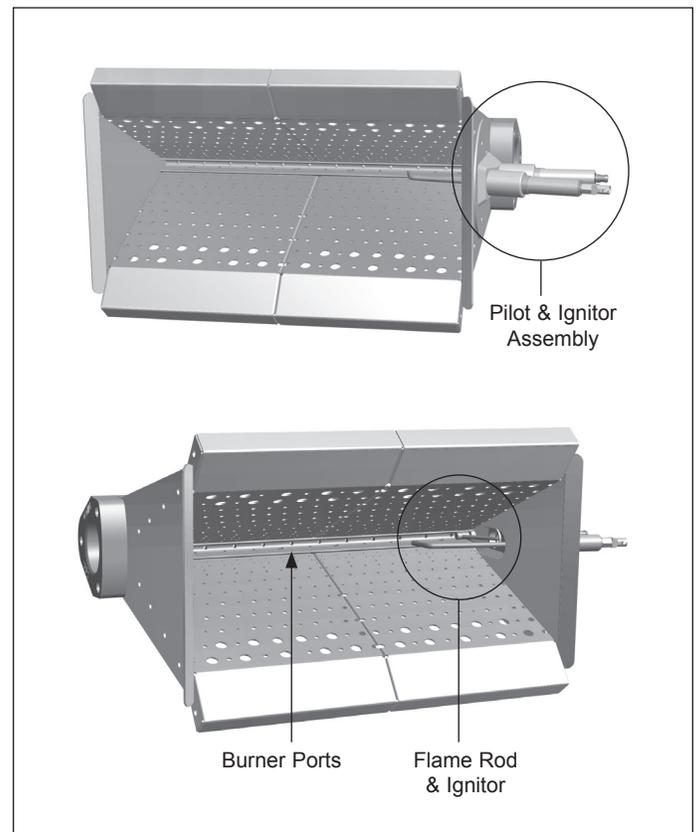
Burner	Gas Type	Drill #
Midco	Natural and Propane	#31

5. Remove the protective cover that was placed on the manifold piping in Step 3 and reconnect the gas union.
6. Reassemble pilot and ignitor assembly to the burner.
7. After cleaning and re-assembly, use a soap/water solution to check for gas leaks in the piping.
8. Restore power and gas to the unit.

### Gas and Electric Controls

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

**Figure 41.1 - Midco Burner Assembly**



# MAINTENANCE / SERVICE AND TROUBLESHOOTING

## Care of Heater 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.

## ⚠ WARNING

When servicing or repairing this equipment, use only factory-approved service replacements parts. A complete replacement parts list may be obtained by contacting the factory. Refer to the rating plate on the unit for complete unit 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 component must be replaced.

## IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Table 42.1, refer to the applicable sections of the manual.

## SERVICE AND TROUBLESHOOTING

Table 42.1 - Service & Troubleshooting

Trouble	Possible Cause	Possible Remedy
A. Power Failure	<ol style="list-style-type: none"> <li>1. Disconnect not turned on.</li> <li>2. Blown fuses.</li> <li>3. Main to unit disconnect not on.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn to disconnect.</li> <li>2. Check and replace.</li> <li>3. Turn on power at main.</li> </ol>
B. Dampers Won't Operate	<ol style="list-style-type: none"> <li>1. Disconnect not turned on.</li> <li>2. Blown fuses.</li> <li>3. Main to unit disconnect not on.</li> <li>4. Failed damper motor.</li> <li>5. Loose wiring to motor.</li> <li>6. Damper linkage binding.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn on disconnect.</li> <li>2. Check and replace.</li> <li>3. Turn on power at main.</li> <li>4. Check and/or replace.</li> <li>5. Check and tighten.</li> <li>6. Check and clear.</li> </ol>
C. Motor Failure	<ol style="list-style-type: none"> <li>1. Disconnect not turned on.</li> <li>2. Blown fuses.</li> <li>3. Main to unit disconnect not on.</li> <li>4. Failed motor.</li> <li>5. Loose wiring to motor.</li> <li>6. Starter fuses blown.</li> <li>7. Motor overloaded.</li> <li>8. Improper supply voltage.</li> <li>9. Motor overheating.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn on disconnect.</li> <li>2. Check and replace.</li> <li>3. Turn on power at main.</li> <li>4. Check and/or replace.</li> <li>5. Check and tighten.</li> <li>6. Check and/or replace.</li> <li>7. Check for proper speed.</li> <li>8. Check and correct.</li> <li>9. Check firing rate of unit.</li> </ol>
D. Blower Not Turning	<ol style="list-style-type: none"> <li>1. See Problems "A" and "C"</li> <li>2. Broken drive belt(s).</li> <li>3. Bearings seized.</li> <li>4. Improper supply voltage.</li> </ol>	<ol style="list-style-type: none"> <li>1. See Problems "A" and "C"</li> <li>2. Check and replace.</li> <li>3. Check and replace.</li> <li>4. Check and correct.</li> </ol>
E. No Burner Operation	<ol style="list-style-type: none"> <li>1. See Problems "A" thru "D"</li> <li>2. Damper end switch not functioning.</li> <li>3. Failed air flow switch.</li> <li>4. Loose wiring connection at air proving.</li> <li>5. No pilot.</li> <li>6. Pilot not proving.</li> <li>7. Flame safeguard in lockout mode.</li> <li>8. High limit tripped.</li> <li>9. Too high or low gas pressure.</li> <li>10. Failed control transformer.</li> <li>11. Blown control transformer fuse.</li> <li>12. Failed or malfunctioning main gas valve(s).</li> <li>13. Faulty or failed freeze stat or inlet on/off stat.</li> <li>14. Failed safeguard control.</li> <li>15. Airflow too low, low airflow proving switch is open.</li> <li>16. Airflow too high, high airflow cutoff switch is open.</li> </ol>	<ol style="list-style-type: none"> <li>1. See Problems "A" thru "D"</li> <li>2. Check and/or replace.</li> <li>3. Check and/or replace.</li> <li>4. Check and tighten.</li> <li>5. See Problem "F"</li> <li>6. See Problem "F"</li> <li>7. Check and reset.</li> <li>8. Check and/or replace.</li> <li>9. Check pressure switches and gas pressure.</li> <li>10. Check and/or replace.</li> <li>11. Check and/or replace.</li> <li>12. Check and/or replace</li> <li>13. Check and/or replace.</li> <li>14. See vendors instructions shipped with unit.</li> <li>15. Check for reason of insufficient airflow and current.</li> <li>16. Check for reason of excessive airflow and correct</li> </ol>

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.

# SERVICE AND TROUBLESHOOTING

Trouble	Possible Cause	Possible Remedy
F. No Pilot	<ol style="list-style-type: none"> <li>No gas to pilot.</li> <li>Dampers not functioning.</li> <li>Pilot tube plugged or damaged</li> <li>Freeze stat failure.</li> <li>Inlet On/Off stat failure.</li> <li>Flame safeguard in lockout</li> <li>Failed flame safeguard.</li> <li>Failed air flow switch</li> <li>Too high or low gas pressure.</li> <li>See Problem "E" – No Burner</li> </ol>	<ol style="list-style-type: none"> <li>Check hand valve and pilot solenoid valve.</li> <li>See Problem "B"</li> <li>Check and repair/or replace.</li> <li>Check and/or replace.</li> <li>Check and/or replace.</li> <li>Check and reset.</li> <li>See vendor's instructions shipped with unit.</li> <li>Check and/or replace.</li> <li>Check pressure switches and gas pressure.</li> <li>See Problem "E" Operation.</li> </ol>
G. Pilot Will Not Prove	<ol style="list-style-type: none"> <li>Inadequate signal to safeguard control.</li> <li>Insufficient gas pressure to pilot.</li> <li>Loose lead wires.</li> <li>Soiled flame rod.</li> <li>Moisture on flame rod lead.</li> <li>Defective flame rod.</li> <li>Defective flame safeguard.</li> <li>Short in sensing leads.</li> <li>Excessive air velocity across burner.</li> </ol>	<ol style="list-style-type: none"> <li>Check flame signal Vdc. See vendor literature for type of flame safeguard supplied with unit.</li> <li>Check and adjust.</li> <li>Check and correct.</li> <li>Clean and/or replace.</li> <li>Check and dry leads.</li> <li>Check or replace. See vendor literature shipped with unit.</li> <li>Check or replace. See vendor literature shipped with unit.</li> <li>Check and repair.</li> <li>Check burner velocity and correct.</li> </ol>
H. Erratic Temperature	<ol style="list-style-type: none"> <li>Defective temperature selector or sensor.</li> <li>Temperature sensor subject to poor air flow or located in drafty area.</li> <li>Discharge sensor blocked by duct insulation.</li> <li>Faulty amplifier or proportioning motor.</li> </ol>	<ol style="list-style-type: none"> <li>See vendor literature shipped with unit.</li> <li>Check sensor location and move if required.</li> <li>Check and remove blockage</li> <li>See vendor literature shipped with unit.</li> </ol>
I. Unable to Achieve High Fire.	<ol style="list-style-type: none"> <li>Low gas supply pressure.</li> <li>Modulating controls improperly set.</li> <li>Faulty temperature sensor.</li> <li>Faulty amplifier or proportioning motor.</li> </ol>	<ol style="list-style-type: none"> <li>Check and adjust.</li> <li>See vendor literature shipped with unit.</li> <li>Check and/or replace.</li> <li>See vendor literature shipped with unit.</li> </ol>
J. Unable to Achieve Low Fire.	<ol style="list-style-type: none"> <li>Modulating controls improperly set.</li> <li>Faulty temperature sensor.</li> <li>Faulty amplifier or proportioning motor.</li> </ol>	<ol style="list-style-type: none"> <li>See vendor literature shipped with unit.</li> <li>Check and/or replace</li> <li>See vendor literature shipped with unit.</li> </ol>
K. No Gas Flow	<ol style="list-style-type: none"> <li>Manual gas valve(s) closed.</li> <li>See Problem "E", Items 2 thru 14</li> </ol>	<ol style="list-style-type: none"> <li>Open manual gas valve(s).</li> <li>See Problem "E", Items 2 thru 14</li> </ol>
L. Unable to Achieve Desired Discharge Temperature, or Space Temperature	<ol style="list-style-type: none"> <li>Temperature sensors improperly set or faulty.</li> <li>Improper gas supply pressure.</li> <li>Faulty amplifier or proportioning motor.</li> <li>Air flow too high.</li> <li>Burner capacity undersized.</li> </ol>	<ol style="list-style-type: none"> <li>Adjust or replace.</li> <li>Check and correct.</li> <li>See vendor literature shipped with unit.</li> <li>Check blower speed and/or burner velocity differential pressure.</li> <li>Check rating plate for conformance to design specifications.</li> </ol>
M. Floating 75/25 Damper Functioning Incorrectly or Not Functioning damaged, or disconnected.	<ol style="list-style-type: none"> <li>Defective building pressure switch.</li> <li>Pressure switch improperly set.</li> <li>Pressure switch pick-up tubes blocked,</li> <li>Outdoor pressure pick-up tube not routed to outdoors.</li> <li>Faulty damper motor.</li> <li>Dampers binding.</li> <li>Damper linkages loose.</li> <li>No power to damper motor.</li> </ol>	<ol style="list-style-type: none"> <li>Check and/or replace.</li> <li>See vendor literature shipped with unit.</li> <li>Check and repair or reconnect.</li> <li>Route tube to outdoors.</li> <li>Check and/or replace.</li> <li>Check and repair.</li> <li>Check and retighten.</li> <li>Check power supply to motor.</li> </ol>
N. Two Position 70/30, 75/25 Dampers Not Functioning	<ol style="list-style-type: none"> <li>Damper position selector switch or relay defective.</li> <li>Faulty damper motor.</li> <li>Dampers binding.</li> <li>Damper linkages loose.</li> <li>No power to damper motor.</li> </ol>	<ol style="list-style-type: none"> <li>Check and/or replace.</li> <li>Check and/or replace.</li> <li>Check and repair.</li> <li>Check and tighten.</li> <li>Check power supply to motor.</li> </ol>

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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## Direct Gas-Fired Make-Up Air Unit Start-Up Report

Job Name:	Date:	
Address:	Model No.:	
City & State:	Order No.:	
Start-Up Check List "ALL ITEMS MUST BE CHECKED"		Serial No.:
1. All shipping straps, braces, tie downs removed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Unit installed level and secure?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Gas burner properly located and aligned?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
4. Blower and motor alignment okay?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. Bearings aligned and tight on shaft/bearing supports?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
6. Electrical connections checked and secure?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
7. Gas piping checked, tightened if necessary, and free of leaks?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
8. Any visible damage to unit? Describe: _____ If damaged, was the damage repaired?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
9. Air inlet and discharge checked for obstructions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10. Bearings checked for proper lubrication?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
11. Filters in place and correct to direction of air flow?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12. Belt tension checked? _____ Yes	<input type="checkbox"/> No	<input type="checkbox"/>
13. Electric supply to unit: _____ Volts, _____ Hz, _____ Phase	<input type="checkbox"/> Done	
14. Gas supply to unit: _____ Natural, _____ Propane	<input type="checkbox"/> Done	
15. Gas supply pressure to unit: _____ " W.C., _____ PSIG	<input type="checkbox"/> Done	
16. Inlet and/or discharge dampers operating correctly?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
17. Blower rotation correct? _____ Yes	<input type="checkbox"/> No	<input type="checkbox"/>
18. Blower speed: Hi Speed _____ RPM, Lo Speed _____ RPM	<input type="checkbox"/> Done	
19. Motor speed: Hi Speed _____ RPM, Lo Speed _____ RPM	<input type="checkbox"/> Done	
20. Is unit noisy? Excessive vibration? If so, has the problem been corrected?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21. Motor voltage (High Speed): L1-L2 _____ V, L1-L3 _____ V, L2-L3 _____ V Done	<input type="checkbox"/>	
22. Motor amps (High Speed): L1 _____ Amp, L2 _____ Amp, L3 _____ Amp Done	<input type="checkbox"/>	
23. Pilot sensor amps: _____ Flame Rod, _____ UV, _____ μAmp, _____ Vdc Done	<input type="checkbox"/>	
24. Flame safeguard functioning correctly? Time required to go into lockout: _____ Seconds	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/>	<input type="checkbox"/>
25. Air flow proving switch and profile velocity differential pressure checked? Differential velocity pressure reading: High Speed _____ "w.c., Low Speed _____ "w.c. Outdoor air temperature at time of test: _____ °F	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/>	<input type="checkbox"/>
26. Low fire check: Does burner light off smoothly and across full burner length? High fire check: Is flame clean and stable, and does flame modulate in response to temperature control(s)? _____ Burner manifold pressure reading: _____ "w.c.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/>	<input type="checkbox"/>
27. Gas input checked? At maximum firing rate: _____ Btu/Hr At minimum firing rate: - _____ Btu/Hr	<input type="checkbox"/> Done	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
28. Burner by-pass and return air damper operating correctly (if provided)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	<input type="checkbox"/>	<input type="checkbox"/>

Name(s) of Customer/Owner instructed in operation and maintenance of unit: \_\_\_\_\_

Comments: \_\_\_\_\_

Start-Up Company Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

# REPLACEMENT PARTS ORDERING

## Ordering

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 ①

		DIRECT INDUSTRIAL HEATER FOR INDUSTRIAL/COMMERCIAL USE RADIATEUR INDUSTRIEL SANS CIRCULATION D AIR			
MODINE MANUFACTURING 1221 MAGNOLIA AVENUE BUENA VISTA, VA 24416; PHONE 800-828-4328		FOR OUTDOOR INSTALLATION ONLY INSTALLER À L'EXTÉRIEUR SEULEMENT		Intertek 9900100	
ANSI Z83.4 CSA 3.7-2013 NON-RECIRCULATING DIRECT INDUSTRIAL AIR HEATER					
MODEL NUMBER NUMÉRO DE MODÈLE	MDB127AC1375BA3CA6BH2GH	MAX INPUT (BTU/H) MAX DÉBIT CALORIFIQUE (W)	1169504 342782	BLOWER RPM VENTILATEUR RPM	435
SERIAL NUMBER NUMÉRO DE SÉRIE	33007504421700000A1	MIN INPUT (BTU/H) MIN DÉBIT CALORIFIQUE (W)	62500 18319	PROFILE VELOCITY (FPM) PROFIL VÉLOCITÉ (M/S)	2750 14
GAS TYPE TYPE DE GAZ	NATURAL GAS 1050 BTU/FT3 GAZ NATUREL 40 MJ/M3	MIN SUPPLY PRESSURE FOR MAX INPUT ADJUSTMENT PRESSION MIN ALIMENTATION POUR AJUSTEMENT DE L'ENTRÉE MAX		1 PSI 6895 Pa	
INLET SUPPLY PRESSURE ENTRÉE DE L'ALIMENTATION PRESSION	MAX 5 PSI / MIN 1 PSI MAX 34475 Pa / MIN 6895 Pa	NORMAL MANIFOLD PRESSURE (AT BURNER) AT MAX INPUT (INC) PRESSION D'AMMISSION NORMALE (À BRÔLEUR) AU MAX ENTRÉE (Pa)		2.8 697	
MOTOR HP MOTOR V	10 7457	MOTOR VOLTS CONTROL VOLTS	460V/60Hz/3Ph 115V/60Hz/1Ph	MOTOR AMPS CONTROL AMPS	11.9 3.8
EQUIPPED FOR 20000 CFM AGAINST 0.5 INCHES WATER COLUMN EXTERNAL STATIC PRESSURE. CONÇU POUR FONCTIONNER À UN DÉBIT D'AIR DE 33980 M3/H ET À UNE PRESSION STATIQUE EXTÉRIEURE DE 125 Pa.					
DESIGN CONDITIONS: MIN OUTSIDE AIR TEMP: -30 °F; MAX DISCHARGE AIR TEMP: 105 °F; MAX AIR TEMP RISE: 115 °F					
CONDITIONS DE DESIGN: MIN TEMP AIR EXTÉRIEUR: -34 °C; MAX DÉCHARGE AIR TEMP: 40 °C; MAX AIR AUGMENTATION DE TEMP: 46 °C					
MIN CLEARANCE FOR SERVICE ACCESS (BOTH SIDES): 30 IN DÉGAGEMENT MINIMUM POUR LA MAINTENANCE (DES DEUX CÔTÉS): 76 CM			MIN CLEARANCE TO COMBUSTIBLE MATERIAL: TOP & SIDES 6 IN, BOTTOM 0 DISTANCES MIN AUX MATIÈRES COMBUSTIBLES: HAUT ET LES CÔTÉS 15.2 cm, BAS 0 cm.		
START UP INSTRUCTIONS: (1) TURN OFF ALL POWER. (2) CLOSE ALL GAS VALVES. (3) WAIT 5 MINUTES. (4) OPEN ALL GAS VALVES AND TURN ON ALL POWER. (5) SET TEMP CONTROL TO CALL FOR HEAT. (SYSTEM WILL START AUTOMATICALLY.) INSTRUCTIONS DE DÉMARRAGE: (1) COUPEZ TOUTE ALIMENTATION. (2) FERMEZ TOUTES LES VANNES DE GAZ. (3) ATTENDEZ 5 MINUTES. (4) OUVERT TOUTE GAZ ET VANNES RÉTABLISSEZ L'ALIMENTATION. (5) RÉGLER LA TEMP À APPEL DE CHALEUR. (SYSTÈME DÉMARRE AUTOMATIQUEMENT.)					
SHUT DOWN INSTRUCTIONS: (1) TURN OFF ALL POWER. (2) CLOSE ALL GAS VALVES. INSTRUCTIONS ARRÊTER: (1) COUPEZ TOUTE ALIMENTATION. (2) FERMEZ TOJTES LES VANNES DE GAZ.					
<b>FOR YOUR SAFETY</b>					
THE USE AND STORAGE OF GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN OPEN CONTAINERS IN THE VICINITY OF THIS APPLIANCE IS HAZARDOUS.					
<b>POUR VOTRE SÉCURITÉ</b>					
IL EST DANGEREUX D'UTILISER OU D'ENTREPOSER DE L'ESSENCE OU AUTRES LIQUIDES OU VAPEURS INFLAMMABLES DAN DES RÉCIPIENTS OUVERTS À					

① MRB units are certified for use in the U.S. only and will be labeled with the ETL-US symbol only.

Table 46.1 - Serial Number Format

<b>Serial Number Digit:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>
	9	9	9	9	9	9	0	1	0	1	0	1	1	2	3	4	5	F	1
Order Number																			
Sequential Number On Order 01 = Single Unit Orders, etc.																			
Week of Manufacture:																			
Year of Manufacture																			
SPO Number																			
Profile Type <blank> or F = Fixed A = Adjustable																			
Profile Pressure Sensing <blank> or 1 = Single Pickup Tube Assembly 2 = Dual Pickup Tube Assembly																			

# MODEL NOMENCLATURE

1,2	3	4	5,6	7	8	9,10,11,12	13	14	15	16	17	18	19	20	21	22	23
PT	DS	BQ	BS	UC	CF	MBTU	GT	GC	I	MO	AC	SV	BT	HP	MT	SA	PA

## 1,2 - Product Type (PT)

MD - 100% Make Up Air  
MR - Return Air

## 3 - Design Sequence (DS)

B - Internally Assigned

## 4 - Blower Quantity (BQ)

1 - Single Blower Unit  
2 - Twin Blower Unit

## 5,6 - Blower Size (in.) (BS)

10 - 10"	22 - 22"
12 - 12"	24 - 25" x 22" (single blower units only)
15 - 15"	25 - 25"
18 - 18"	27 - 27"
20 - 20"	30 - 30"

## 7 - Unit Configuration (UC) (See Figure 51.1)

A - Horizontal, right access, straight discharge (bottom return on MR)  
B - Horizontal, left access, straight discharge (bottom return on MR)  
C - Horizontal, right access, bottom discharge (bottom return on MR)  
D - Horizontal, left access, bottom discharge (bottom return on MR)  
E - Horizontal, right access, top discharge (not available on MR units)  
F - Horizontal, left access, top discharge (not available on MR units)  
G - Vertical, right access, top discharge (not available on MR units)  
J - Vertical, right access, top-right discharge (not available on MR units)

## 8 - Cabinet Finish and Location of Installation (CF)

A - Unpainted, Outdoor Installation  
B - Unpainted, Indoor Installation  
C - Painted, Outdoor Installation  
D - Painted, Indoor Installation

## 9, 10, 11, 12 - Maximum Burner Input (MBH) (MBTU)

0275	3850
0400	4125
0550	4400
0825	4675
1000	4950
1100	5225
1375	5500
1650	5775
1925	6050
2200	6325
2475	6600
2750	6875
3025	7150
3300	7425
3575	

Example: If burner rating is 389MBH, 0400 will be used in model number.

## 13 - Gas Type and Inlet Pressure

A - Natural Gas (8-14")  
B - Natural Gas (1-5 psi)  
C - Propane Gas (11-14") (Model MDB Only)  
D - Propane Gas (1-5 psi) (Model MDB Only)

## 14 - Gas Control System (GC)

A - Maxitrol 14  
B - Maxitrol 44  
C - SC11 DDC (4-20 mA)  
D - SC11 DDC (0-10 VDC)

## 15 - Insurance (I)

1 - IRI (standard ETL)  
2 - FM less Restriction  
3 - FM with Restriction

## 16 - Additional Manifold Options (MO)

C - High & Low Gas Pressure Switch  
N - None

## 17 - Air Control Option (AC)

A - 100% MUA - Single Speed  
B - 100% MUA - Two Speed (Motor or VFD) - Type A  
C - 100% MUA - Two Speed (Motor or VFD) - Type B  
D - 100% MUA - DDC Control (VFD only) - Type A  
E - 100% MUA - DDC Control (VFD only) - Type B  
F - Space Pressure Control (MD with VFD or MR) - Type A  
G - Space Pressure Control (MD with VFD or MR) - Type B  
H - Space Pressure Control (MD with VFD or MR) - Type C  
I - Return Air - Fixed 75/25 Dampers - Type A  
J - Return Air - Fixed 75/25 Dampers - Type B  
K - Return Air - Fixed 75/25 Dampers - Type C  
L - Return Air - Fixed 70/30 Dampers - Type A  
M - Return Air - Fixed 70/30 Dampers - Type B  
N - Return Air - Fixed 70/30 Dampers - Type C

## 18 - Supply Voltage (SV)

1 - 115/60/1	5 - 230/60/3
2 - 208/60/1	6 - 460/60/3
3 - 230/60/1	7 - 575/60/3
4 - 208/60/3	

## 19 - Bearings and Vibration Isolation (BT)

A - Spider Bearings - No Vibration Isolation  
B - Pillow Block Bearings - No Vibration Isolation  
C - Pillow Block Bearings - With Spring Vibration Isolation

## 20 - Motor HP (HP)

A - 3/4	H - 10
B - 1	I - 15
C - 1.5	J - 20
D - 2	K - 25
E - 3	L - 30
F - 5	M - 40
G - 7.5	N - 50

## 21 - Motor Type (MT)

1 - ODP  
2 - ODP - High Efficiency  
5 - TE  
6 - TE - High Efficiency

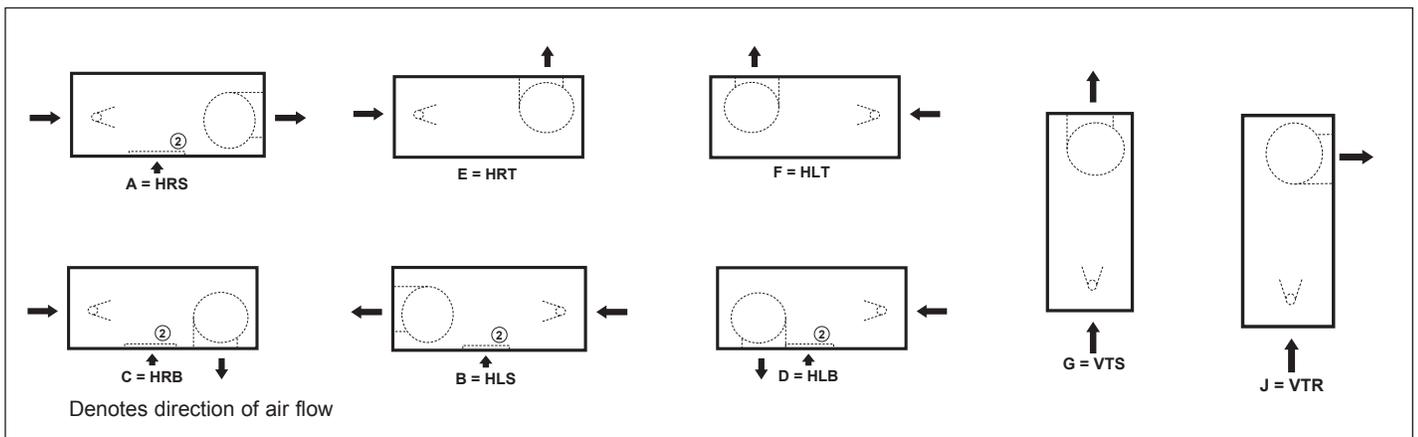
## 22 - Sheave Arrangement (SA)

A - (see Sheave Tables)

## 23 - Profile Assembly (PA)

A - (Internally assigned)

Figure 47.1- Unit Configurations ①



① Configurations are shown facing the side of the unit with the gas and electrical controls.  
② For models with return air (Series MRB).

# 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.

<b>Component</b> Applicable Models	<b>"APPLICABLE WARRANTY PERIOD"</b>
<b>Heat Exchangers</b> Gas-Fired Units	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
<b>Heat Exchangers</b> Low Intensity Infrared Units  <b>Compressors</b> 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
<b>Burners</b> Low Intensity Infrared Units  <b>Other</b> 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
<b>Heat Exchangers/Coils</b> Indoor and Outdoor Duct Furnaces and System Units, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators, Geothermal Units  <b>Compressors</b> Vertical Unit Ventilators, Geothermal Units  <b>Burners</b> High Intensity Infrared Units  <b>Sheet Metal Parts</b> 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.



## Building HVAC

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