



**INDOOR OR OUTDOOR,
GAS, DIRECT-FIRED,
MAKEUP AIR/
HEATING SYSTEMS**

(Specifications subject to change without notice.)

REZNOR *Thomas & Betts*

**Operation/Maintenance/Service
Form RGM 443-OMS**

Applies to: Model Series DFA

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Reference: Installation Manual, Form RGM 443

FOR YOUR SAFETY

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

If you smell gas:

1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

WARNING: Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment.

**KEEP THIS BOOKLET
FOR MAINTENANCE
AND
SERVICE REFERENCE.**

**Operating/Maintenance/Service
Instructions**

The information in this manual applies to Model Series DFA, direct-fired heating/makeup air systems. As with any gas burning equipment, regular maintenance procedures are required to ensure continued safety, reliability and efficiency of the installation.

If service is required, this system should be serviced only by a qualified service person. Service information in this booklet is intended as a guideline for a qualified gas-fired equipment service person.

Figure 1 - Maintenance/Service Access - Horizontal Configuration System

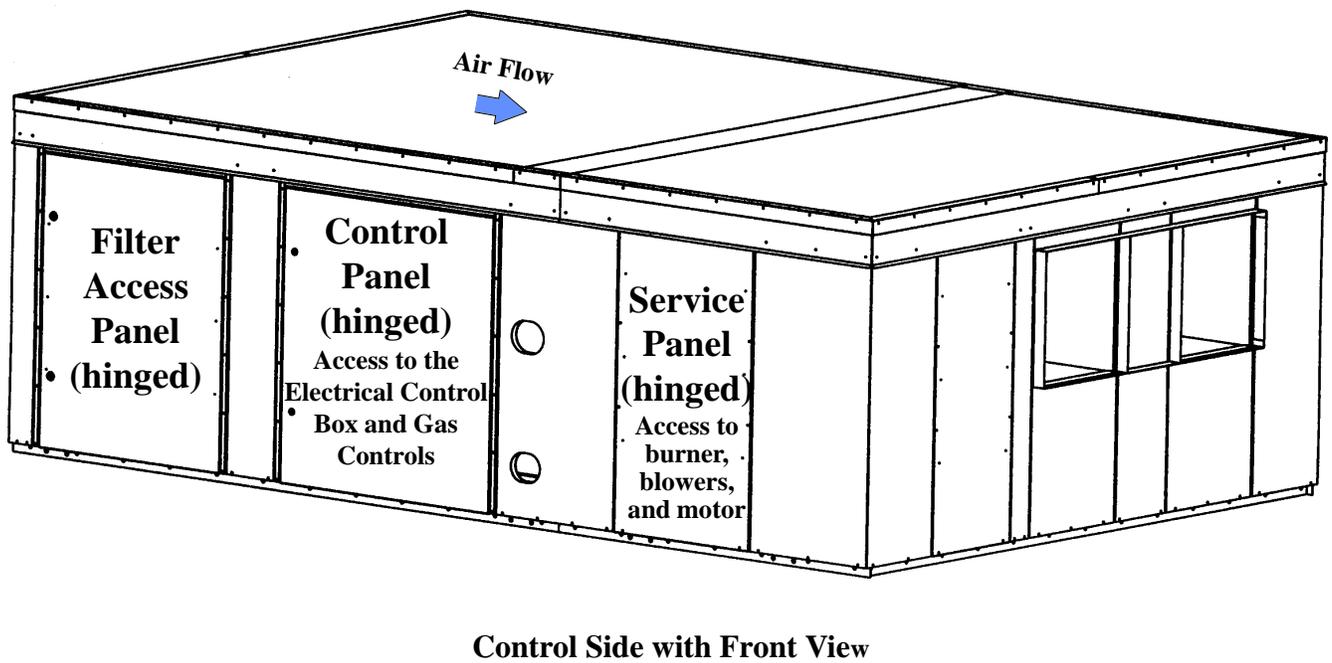
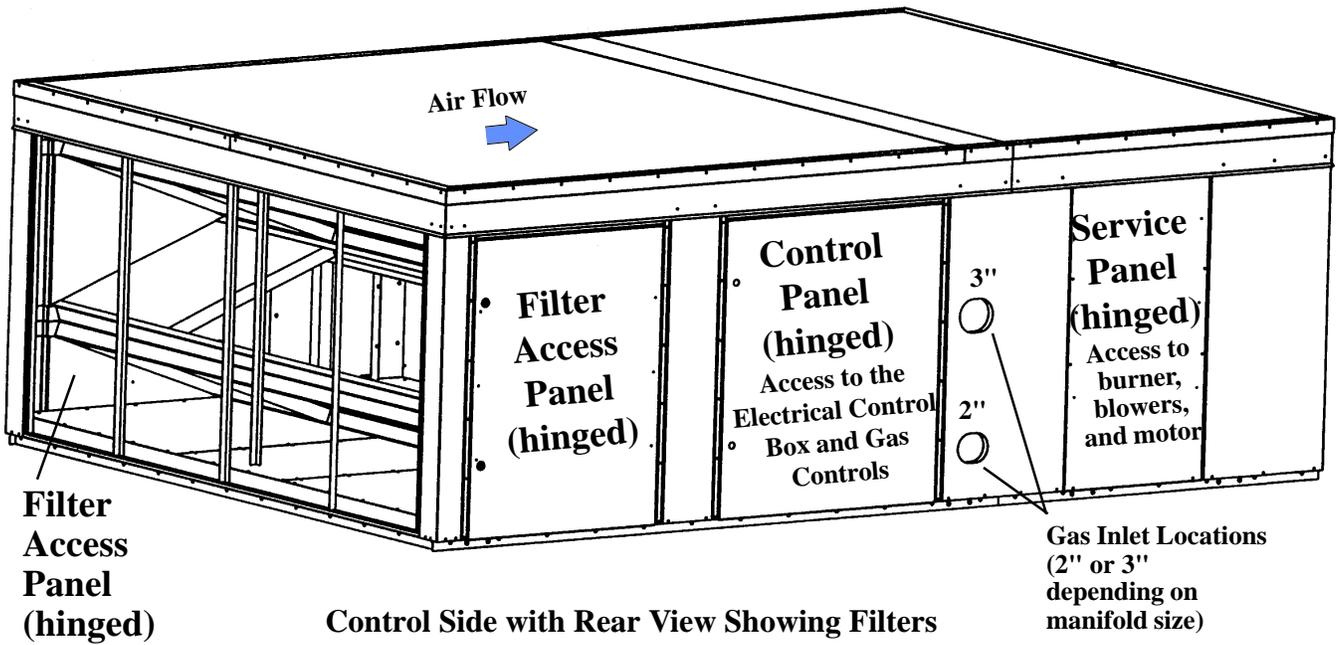
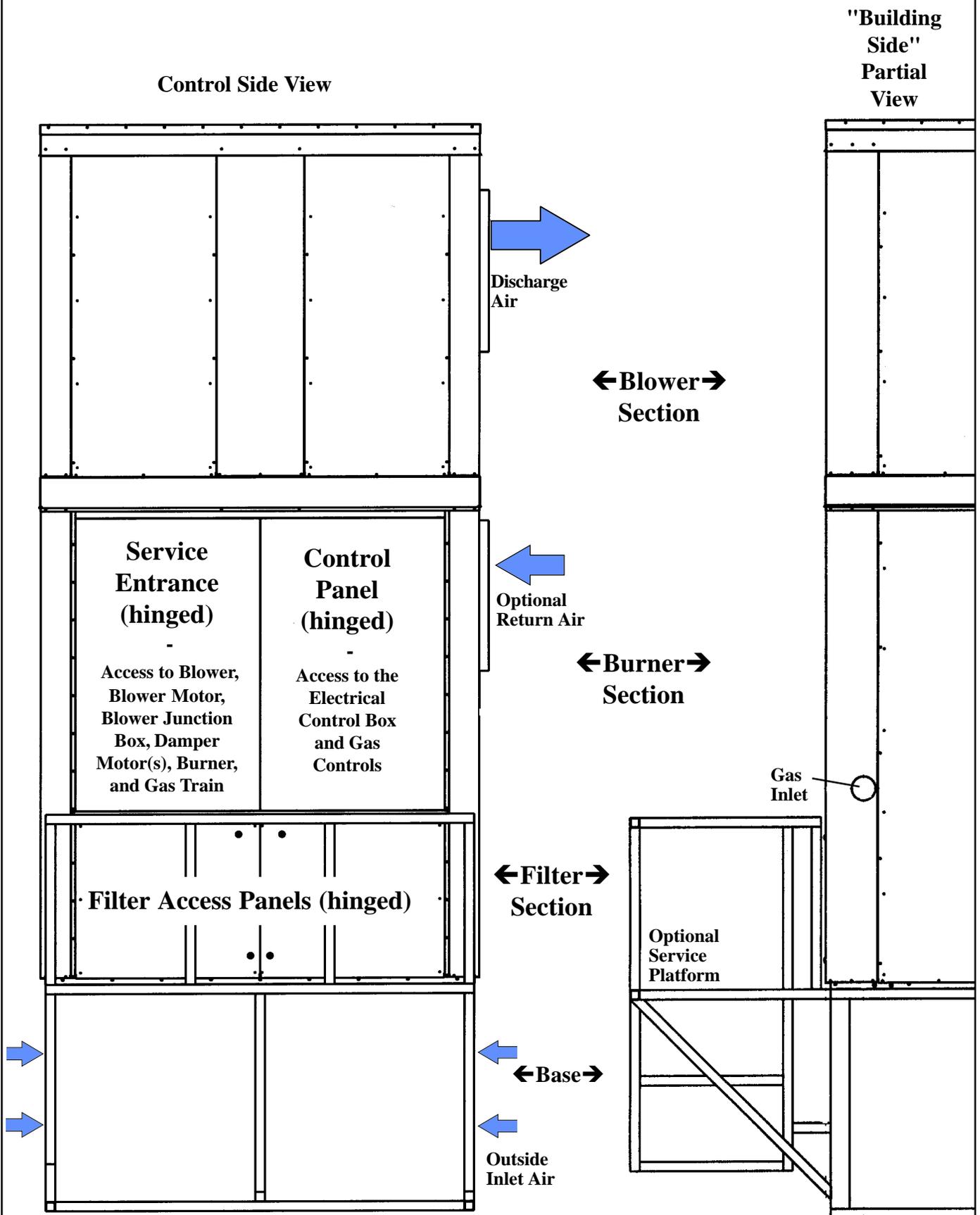


Figure 2 - Maintenance/Service Access - Vertical Configuration System



Maintenance Section

This direct-fired makeup air system is designed to require only a minimum amount of maintenance. Some maintenance procedures outlined in this Section require inspection only and some require action. Frequency requirements of each maintenance procedure are listed in the Maintenance Schedule. Depending on the environment and the number of operating hours, more frequent inspection and/or cleaning may be required to certain components.

Although maintenance requirements are minimal, the routine maintenance procedures in this Section are necessary to ensure safe, reliable, and/or efficient operation. The paragraphs which follow discuss the components and systems that require routine inspection/maintenance. At the beginning of each paragraph, there is a code indicating why that maintenance procedure is necessary. The legend for that code is shown below.

Maintenance Codes	Reason for Maintenance
S	= Safety (to avoid personal injury and/or property damage)
R	= Continued Reliability
E	= Efficient Operation

WARNING: Disconnect all power to the system before doing any maintenance. Failure to do so may cause electrical shock, personal injury, or death.

Maintenance Schedule

- See Chart Lubricate bearings, Paragraph 1
- Quarterly Check the filters, Paragraph 2
 Check air pressure sensing tubes, Paragraph 4
- Semi-Annually Check blower belts, Paragraph 1
 Verify gas pressures, Paragraph 3
 Clean air pressure sensing tubes, Paragraph 4
 Check indicator lights, Paragraph 5
- Annually Check main burner and pilot assembly, Paragraph 6
 Check the rubber roof (horizontal configuration system), Paragraph 7

R 1A. Blower Bearings

Recommended Bearing Lubrication Schedule (months)						
RPM	Bearing Bore Diameter (Inches)					
	1/2 to 1	>1 to 1-1/2	>1-1/2 to 1-15/16	>1-15/16 to 2-1/2	>2-1/2 to 3-3/16	>3-3/16 to 3-15/16
to 500	6	6	6	6	5	4
501 - 1000	6	6	6	5	4	3
1001 - 1500	5	5	5	4	3	2
1501 - 2000	5	4	5	3	2	1

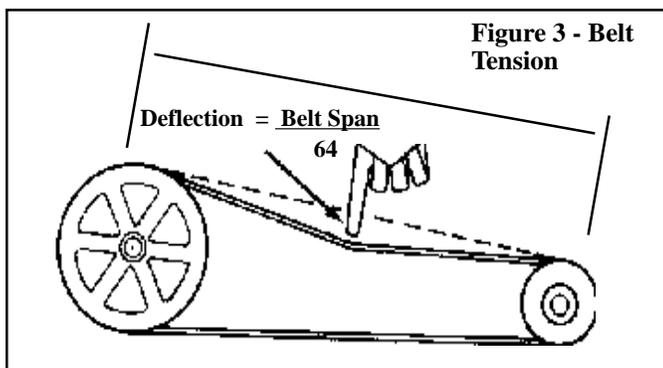
All systems have pillow block bearings that require cleaning and lubricating. Clean the fitting and add type NLG-2 or -2 standard grade grease. Add grease with a handgun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by overlubricating.

NOTE: If unusual environmental conditions exist (temperatures below 32°F or above 200°F; moisture; or contaminants), more frequent lubrication is required.

CAUTION: If the blower is unused for more than three months, the bearings should be purged with new grease prior to startup.

R 1B. Blower Belts

Check belt tension. Proper belt tension is important to the long life of the belt and motor. A loose belt will cause wear and slippage. Too much tension will cause excessive motor and blower bearing wear. If adjustment is required, adjust the motor base until the belt can be depressed 1/64" for each inch of belt span (Figure 3). Be sure the belt is aligned in the pulleys.



R E 2. Filters

If the system includes filters, check the filters quarterly. Clean or replace as needed.

Horizontal Configuration System - The filter cabinet has a set of hinged doors on either side of the cabinet.

Vertical Configuration System - The filter cabinet has a set of hinged doors on the control side only. Use the hook provided to reach the filters.

Model Size	System Configuration	Quantity of 2" Filters	
		30" x 25"	30" x 12"
218	Horizontal	12	—
	Vertical	15	—
220	Horizontal	12	6
	Vertical	18	—
225	Horizontal	30	—
227	Vertical	30	—
230	Horizontal	36	6
233	Vertical	36	6

Figure 4A - Filter Arrangement for a Size 218 Horizontal Configuration System

**3 rows -- (4) 30" x 25",
2" filters per row**

Air Flow

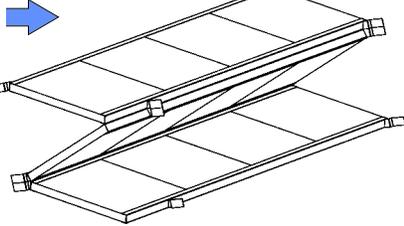


Figure 4B - Filter Arrangement for a Size 220 Horizontal Configuration System

**3 rows -- (4) 30" x 25",
(2) 30" x 12", 2" filters
per row**

Air Flow

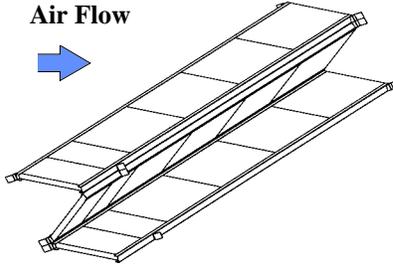


Figure 4C - Filter Arrangement for a Size 225 or 227 Horizontal Configuration System

**6 rows -- (5) 30" x 25",
2" filters per row**

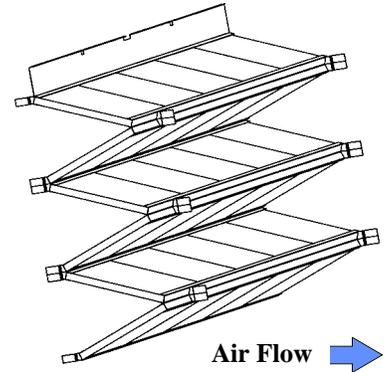


Figure 4D - Filter Arrangement for a Size 230 or 233 Horizontal Configuration System

**6 rows -- (6) 30" x 25",
(1) 30" x 12",
2" filters per row**

Air Flow

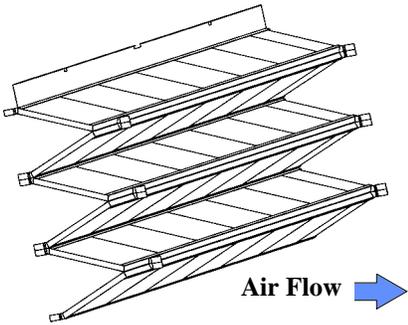


Figure 4E - Filter Arrangement for a Size 218 Vertical Configuration System

**3 rows -- (5) 30" x 25",
2" filters per row**

Air Flow

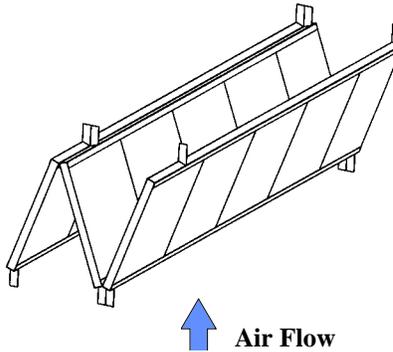


Figure 4F - Filter Arrangement for a Size 220 Vertical Configuration System

**3 rows -- (6) 30" x 25",
2" filters per row**

Air Flow

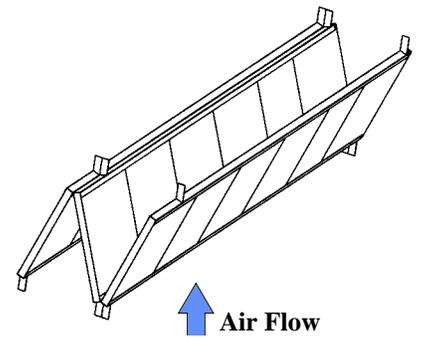


Figure 4G - Filter Arrangement for a Size 225 or 227 Vertical Configuration System

**6 rows -- (5) 30"
x 25", 2" filters
per row**

Air Flow

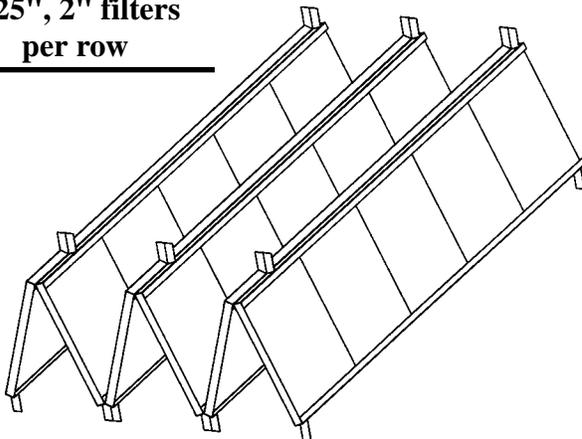
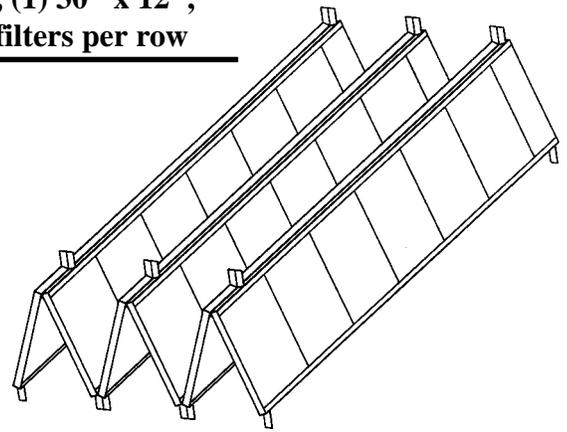


Figure 4H - Filter Arrangement for a Size 230 or 233 Vertical Configuration System

**6 rows -- (6) 30" x
25", (1) 30" x 12",
2" filters per row**

Air Flow

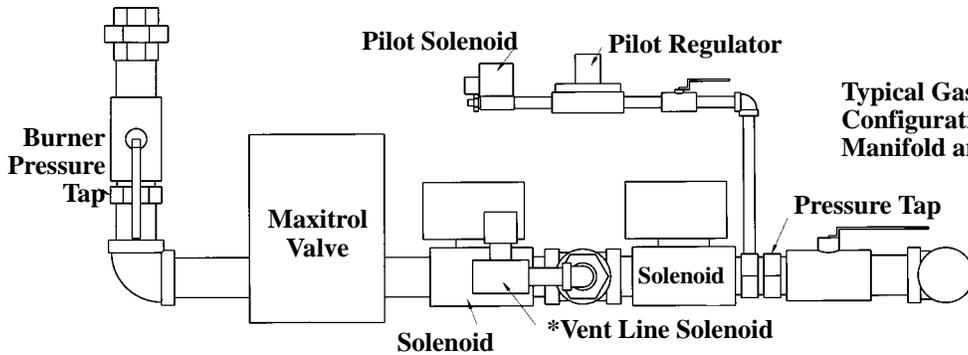
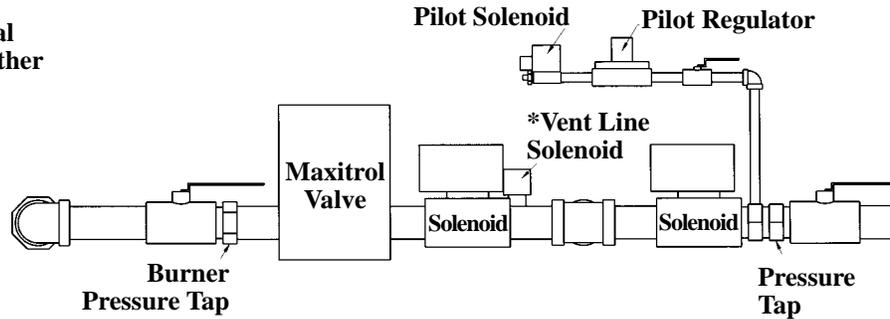


S 3. Manifold Gas Pressure

Semiannually, check the gas pressure to the burner and to the pilot. Measure both manifold pressure and pilot supply pressure with the blower in operation. Refer to Figure 5 for pressure tap locations. Verify against pressures listed on the rating plate.

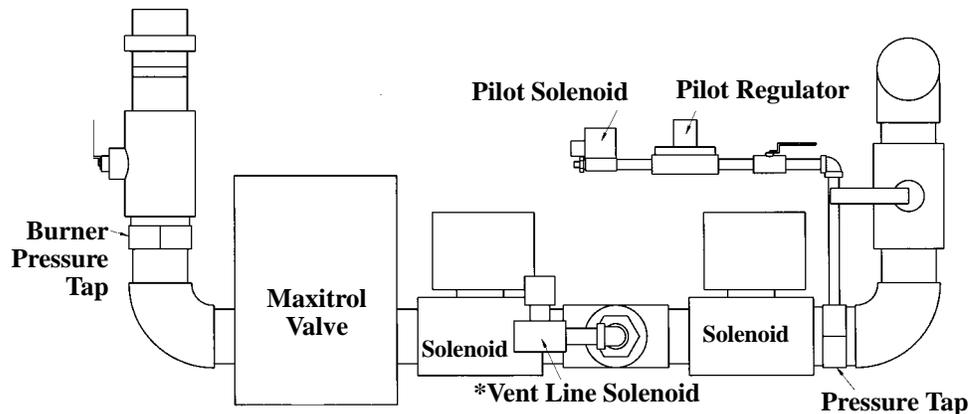
Figure 5 - Location of pressure taps for measuring burner and pilot supply pressure. Measure with blower operating.

Typical Gas Train of a Vertical Configuration System with either a 2" or 3" Manifold and Gas Connection



Typical Gas Train of a Horizontal Configuration System with a 2" Manifold and Gas Connection

Typical Gas Train of a Horizontal Configuration System with a 3" Manifold and Gas Connection



*Vent valve is included only on systems with Manifold Option BM58 to meet IRI requirements. If system with optional vent valve is installed indoors, vent valve must be vented to the outdoors.

S 4. Air Pressure

Profile plate sensing tubes should be checked quarterly and cleaned no less than semiannually. If the sensing tubes become even partially blocked, false pressure readings may be relayed. To clean, remove the screened end caps. Clean the screens and the tubes, if necessary. Replace the cleaned end caps. Check the pressure differential across the profile plate using a slope gauge. Air pressure differential should be between $-.5''$ and $-.7''$ w.c.

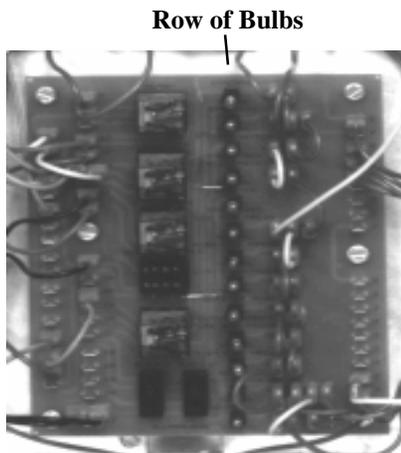
To attach the slope gauge, open the control compartment door panel. Just above the junction box, locate the tubing connections. Remove the cap at each connection and attach the slope gauge using two field-supplied $1/4'' \times 1/8''$ female NPT barbed tubing connections. For instructions on measuring air pressure, see Service Section, Paragraph 9.

R 5. Circuit Indicator Board (check lights)

The circuit indicator board is located in the control compartment electrical box (See Figure 9). Check operation of all indicator lights by switching lights that are not lit with one that is currently lit. Replace all burned out indicator bulbs (P/N 125189).

Figure 6 -
Circuit
Indicator

Check
bulbs not
lit with
other
bulbs;
replace
any
burned
out bulbs



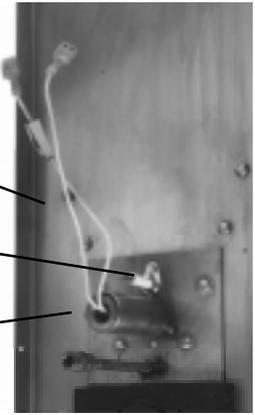
S 6. Main Burner and Pilot Assembly

For the most part, the burner and pilot are self cleaning. However, if the application is extremely dirty or dusty, cleaning of the burner and pilot may be necessary. Inspect the burner annually. Follow these instructions. If it is necessary to replace any parts, use only factory-authorized replacements.

- 1) Turn off the gas and power supply to the system.
- 2) **Vertical Configuration Systems** - Open the service compartment door. The burner is accessible from inside the compartment.
Horizontal Configuration Systems - Open the access panel on the discharge end of the system (on the control side).
- 3) Disconnect the two ignition wires (male and female quick connections) and disconnect the flame sensor lead at the burner. Remove the set screw located in the ignitor tube (set screw holds the brass bushing in place). Carefully remove the brass bushing and the ignitor.
Check the hot surface ignitor for cracks or unusual deterioration. Check the flame rod for integrity. Replace the flame rod (P/N 131188) and/or the hot surface ignitor (P/N 121865) if not in good condition.
- 4) Clean the burner and pilot by back-flushing, using high pressure air (40-80 lbs). Continue until dust particles are completely expelled from both the upstream and downstream sides of the burner.

Figure 7 - Burner
End Plate showing
Hot Surface Ignitor

Burner End Plate
Flame Sensor
Ignitor



CAUTION: Wear eye protection while pressure cleaning and drilling.

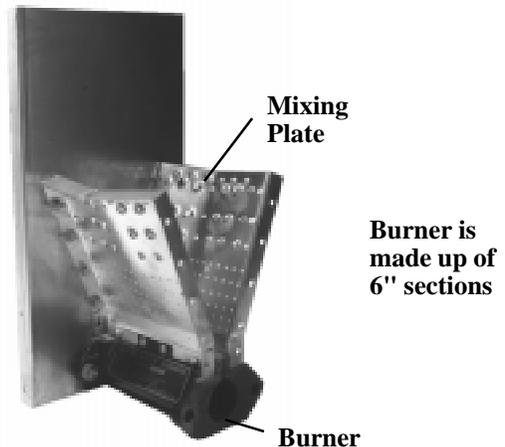
If air pressure does not unplug burner orifices or pilot tube, drill burner orifices with a Size #50 drill and/or pilot tube with a Size #55 drill.

WARNING: Do not enlarge burner ports or performance may be drastically affected.

Inspect the upstream and downstream sides of the mixing plates. Remove any accumulation of scale or foreign material with a wire brush. If any mixing plate fasteners are loose or missing, tighten or replace. Always use zinc plated or stainless fasteners.

If any cracks are present, replace that mixing plate. Because of the effect of flame temperature on the metal, fasteners may be difficult to remove. Be careful not to damage the gaskets that go between the mixing plates and the burner body. The gaskets are designed to overlap approximately $1/16''$ for tight air seal.

Figure 8 - Illustration of the first Burner Section



- 5) Follow Steps in reverse order to re-install the pilot assembly. Close all panels and check for proper operation.

WARNING: Burner profile plates are factory set to match CFM requirements. Do not adjust profile plates without contacting your Sales Representative for technical assistance.

R 7. Inspect the Synthetic Rubber Roof

At least annually, do the following inspection:

- Visually inspect the roof for damage.
- Remove any debris from the roof.
- Inspect perimeter attachment of the membrane. Ensure that all fasteners and sealants are secure.
- Inspect field seam on horizontal units for lifting or separating and for missing caulking.

WARNING: If repairs are necessary, use only approved EPDM® roof system components. Do not use asphalt based roof cements.

EPDM® is a tradename of Manville Roofing Systems, a Division of Schuller International, Inc.

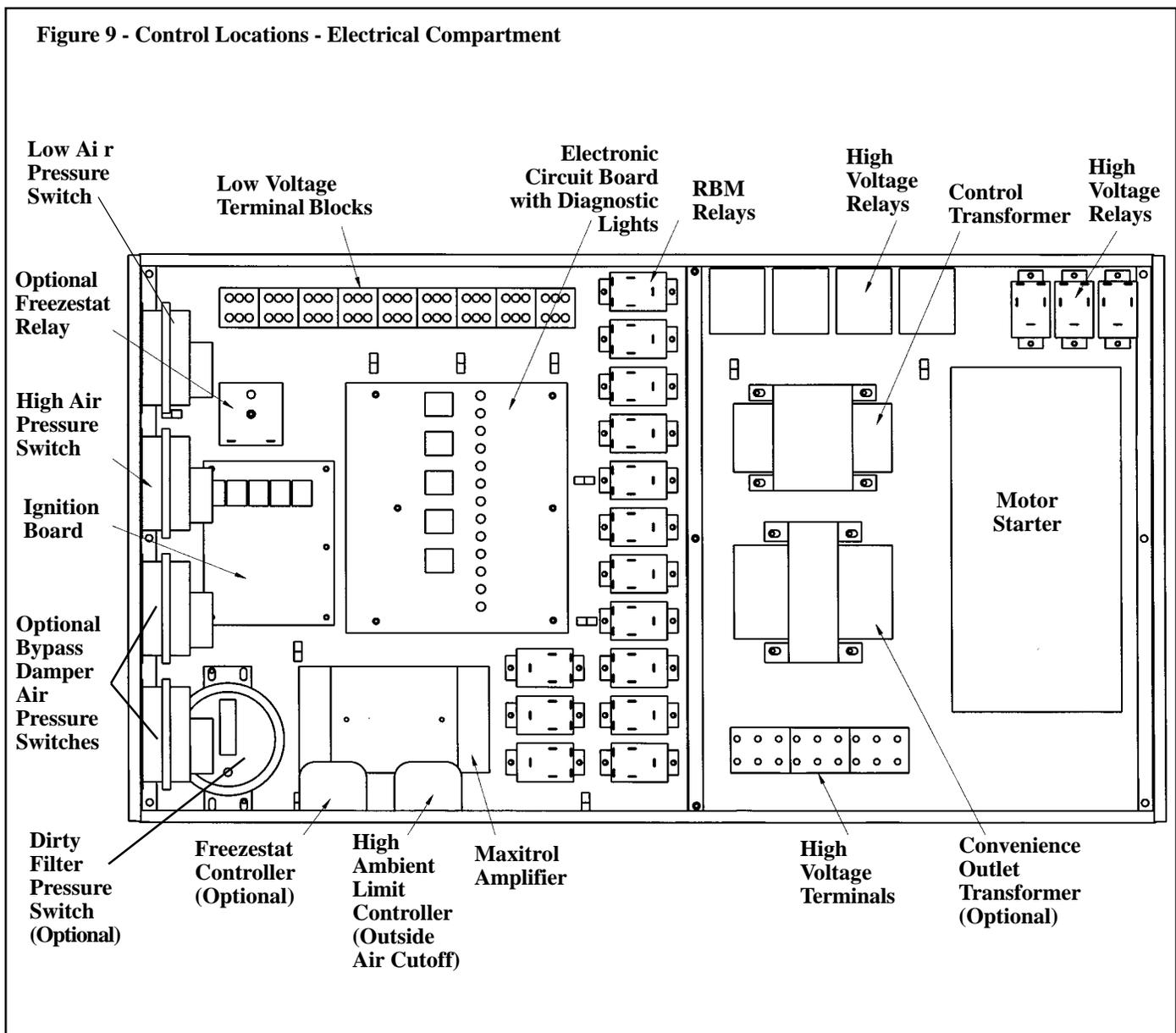
Operation/Service Section

Controls - Location, Operation, and Service

To service this system, it is necessary to understand the normal operation of the controls and the function of the diagnostic circuit board. Refer to the electrical box drawing in Figure 9 and to the individual illustrations to identify and locate each of the controls.

WARNING: Service work on this system should only be done by a qualified gas service person. The service information and the troubleshooting guides are intended as an aid to a qualified service person.

Figure 9 - Control Locations - Electrical Compartment

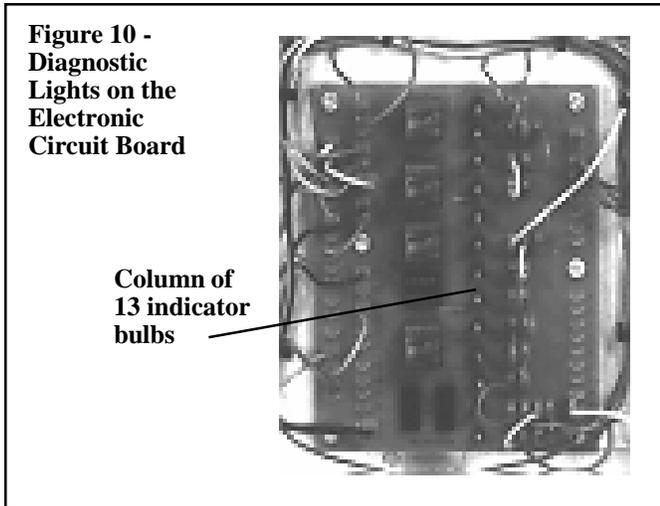


8. Electronic Circuit Board with Diagnostic Lights

Location: Control Compartment Electrical Box

Function: The diagnostic lights on the circuit board are designed to assist in troubleshooting. When the system is operating properly, the lights on the circuit board are lit. If the system fails to operate properly, all lights on the circuit board up to that one that represents the component or system that has failed will be lit. For more detailed information, refer to the Troubleshooting Guide in Paragraph 15.

Service: Replacing burned out bulbs is the only service required. If a bulb is not lit, check the bulb by switching it with a bulb that is lit. Always replace burned out bulbs.



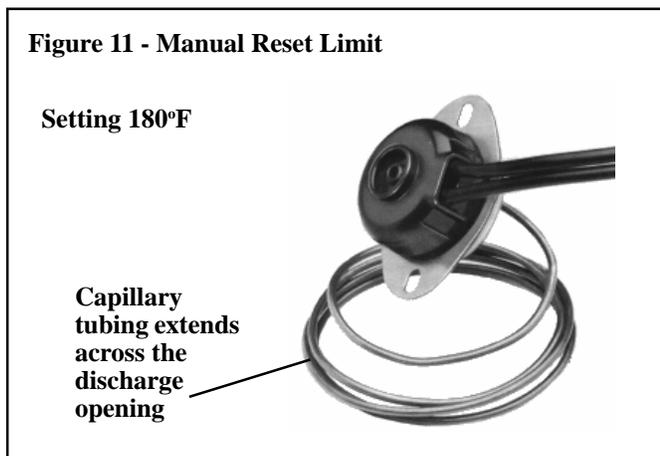
9. Temperature Limit Safety Controls

Location: 1) Manual Reset Limit Switch is in the blower compartment with the capillary tubing and sensor extended across the blower discharge; 2) Emergency Cutoff Limit Control is in the control compartment on the wall to the right of the electrical box

• Manual Reset Limit Control

Function: The manual reset limit is a temperature activated safety control. Re-start of the system can be done only after the limit control is cooled and the reset button is depressed.

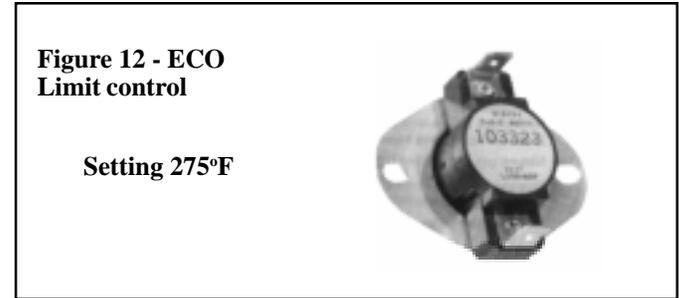
CAUTION: If the manual reset limit activates, find and correct the cause before re-starting the system.



Service: Failure of the manual reset limit requires replacement of the control.

• Emergency Cut Off Limit Control

Function: The emergency cut off is a fusible link high temperature limit which provides extra redundant protection against overheating. If the temperature sensitive limit control malfunctions, the electrically activated emergency cutoff will shutdown the system.

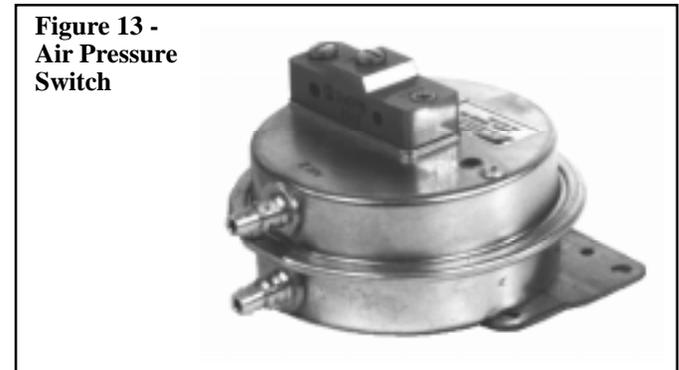


Service: If this limit activates, the manual limit control has failed and must be replaced. The cause for activating the emergency cut off limit control must be found and corrected before re-starting the system.

10. Air Pressure Switches

Location: Control Compartment (See Figure 9)

Depending on the options selected, there are two or four switches.



• Low Air Flow Switch

Function: The low air flow switch is a velocity pressure switch that monitors air flow across the burner. Until the air flow attains adequate volume for combustion, the switch remains open. When the switch recognizes adequate air volume, it closes, permitting both the pilot and burner to operate. Low pressure switch is normally open; it closes on pressure rise at .2" w.c. Do not alter or adjust setting.

• High Air Flow Switch

Function: The high air flow switch is a velocity pressure switch that monitors air flow across the burner. If the high air flow switch senses air velocity above the prescribed limit, it will shutdown gas flow to the burner. High pressure switch is normally closed; it opens when pressure rises above .9" w.c. Do not alter or adjust setting.

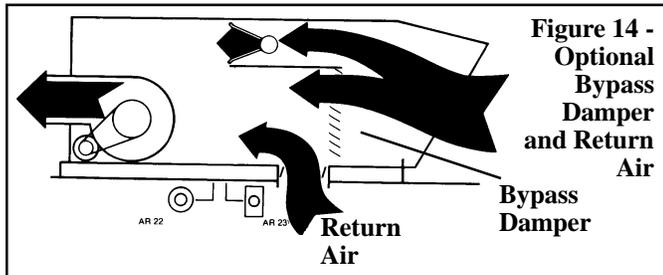
• Bypass Damper Air Flow Switches (systems with Air Control Options AR19, AR20, AR22, or AR23)

Function: With a bypass damper, the volume of outside air supplied to the building is adjusted by a manually set potentiometer (Option AR19 and AR22) or automatically by a pressure sensor switch (Option AR20 or AR23). With Options AR19 and AR20, the supply air is varied by adjusting the position of a damper at the blower discharge. With Options AR22 and AR23, a return air damper is adjusted to vary the volume of return air. The unit is arranged so that a fixed amount (25%)

10. Air Pressure Switches (cont'd)

• Bypass Damper Air Flow Switches (cont'd)

of the rated volume flows over the burner at a constant velocity. The remainder (75%) of the rated air volume flows either through a balancing bypass damper or a combination of bypass and return air dampers. As the supply air volume is varied by the return air or discharge damper, the balancing damper is adjusted to maintain the required air velocity over the burner. Adjustment of the bypass damper is controlled by the bypass damper pressure switches. One pressure switch is normally closed with a setting of .5" w.c.; the other is normally open with a setting of .65" w.c. balancing bypass damper (See Figure 14).



Sensing Pressure Check: (requires a slope gauge, several feet of 1/4" O.D. tubing and two 1/4" O.D. barbed tees.)

Attach a slope gauge (0 to 1.0" scale) to the tubing connections in the control compartment. The two connections are located just above the electrical box. Remove the caps on the 1/8" NPT test connections and attach the slope gauge. (The recommended method for attaching the slope gauge is to use field-supplied 1/8" female NPT x 1/4" O.D. barbed hose connections.)

A) If the system includes an optional discharge damper, before measuring burner differential air pressure, check to be sure that the damper is fully open. Turn the disconnect switch OFF. Check damper. If not fully open, adjust damper to the fully open position. Turn ON the disconnect switch.

B) With the blower operating, the pressure differential on the slope gauge should read between -.5" and -.7" w.c. If the slope gauge reading is within those limits, no adjustments are necessary.

If the slope gauge reading is not within the setpoint limits of the air flow switches (.2" to .9" w.c.), and the system is operating, replace the air pressure switch(es).

If the slope gauge reading is not between -.5" and -.7" w.c., but within the setpoint limits, clean the sensing tubes (Follow the instructions in Maintenance Section, Paragraph 4).

C) When air pressure is within the proper range, turn the disconnect switch OFF. Disconnect the manometer and the slope gauge. Replace the caps removed to connect the slope gauge.

Service: If the pressure check determines that an air flow switch is not functioning properly, the switch cannot be serviced and must be replaced with an identical replacement. Low air pressure switch is P/N 86986; high air pressure switch is P/N 86987; bypass damper switches, P/N 87249 (normally closed, set to open at .5" w.c.) or P/N 87250 (normally open, set to close at .65" w.c.).

11. Ignition System

Location: Ignition Controller Module in the Control Compartment Electrical Box (See Figures 8 and 15A); Ignitor and Flame Sensor on the Burner (See Figure 15B)

Hot Surface Ignition System with Prepurge Time Delay and Flame Sensor with 100% Lockout

Function: The ignition system including the controller, the hot surface ignitor, and the flame sensor function to ignite and prove the pilot flame. When there is a call for heat, the modular ignition controller is energized. When the controller reads 1.4 amps going to the hot surface ignitor, it opens the pilot valve for a 15-second trial for ignition. After the pilot flame rod senses pilot flame, the main gas valve is energized. If the pilot flame rod does not sense a pilot flame, the controller shuts down the pilot valve for a 10-second interpurge and then opens it again for a second ignition trial. If pilot flame is not proven on the second trial, the ignition controller locks out and must be manually reset by an interruption of the main circuit (disconnect switch).

Figure 15A - Ignition Control Module in the Electrical Compartment



Figure 15B - Ignitor and Flame Sensor on the Burner



Service: The modular ignition controller does an internal self-check each time that it is energized and will lockout if not found to be functioning properly. If the ignition controller locks out and there is no other cause, the controller module must be replaced.

12. Gas Train Including Direct-Fired Burner, Gas Control Systems, and Manifold Arrangements

Direct-Fired Burner

Function: The design of the direct-fired burner and the controlled velocity of air at the burner ensure complete combustion through the full range of burner sizes and gas inputs as determined by the gas control system. The velocity of air is controlled by the profile plates and monitored by a standard low and high air pressure switch.

Service: Refer to Paragraph 6 in the Maintenance Section for instructions on burner maintenance.

WARNING: Burner profile plates are factory set to match CFM requirements. Do not adjust profile plates without contacting your Sales Representative for technical assistance.

Makeup Air Gas Control Systems

Electronic Modulation Gas Control Options

AG30, AG31, AG32, AG33, AG35, AG36

Function: These makeup air gas control systems provide heated makeup air at a temperature controlled by a discharge air sensor. Each system is equipped with electronic modulation controls that modulate burner flame from 1/25th of full fire input to full fire.

The electronic modulating-type gas controls act in response to discharge and/or room air temperature sensors to change the gas flow rate to the burner, thus lengthening or shortening the flame. The BTU output is varied (modulated) to maintain the required discharge air temperature.

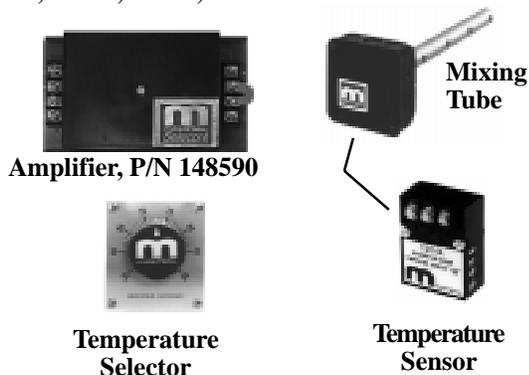
These modulating gas control options are electronic because in all cases the gas valve acts to adjust the flow of the gas to the main burner in response to DC volts emanating from an amplifier. When the DC voltage is between 0 and 5 volts, the main valve seat is closed. Low fire flow is accomplished through a mechanical bypass. The low fire flow rate is set at the factory and should not need adjustment. However, if adjustment is necessary, refer to the Maxitrol literature that is included in the heater owner's envelope.

All of the electronic modulating gas control burner systems include low fire start. On an initial call for heat, the main burner ignites at its lowest input. During mild weather, the burner may then cycle off. Such full shutdown can be dictated by the outdoor ambient cutoff control. As the outside air temperature climbs above the setpoint of the outdoor ambient control, the burner control circuit is de-energized. When moderately cold outside air temperatures exist, the burner will modulate between low flame and high flame. Low fire start and the outdoor ambient control prevent the makeup air system from heating already warm air and providing "too much" heat to the building.

For troubleshooting guides and further explanation of Maxitrol Series 14 and 44 electronic modulation gas control systems, refer to the Maxitrol literature in the owner's envelope.

The Option AG30, AG31, AG32 and AG35 electronic modulation systems are comprised of Maxitrol Series 14 controls. Options AG30 and AG31 systems electronically maintain a constant discharge air temperature in the range of 55-90°F (55-75°F for C.G.A.). Option AG31 includes an overriding thermostat. Option AG32 system will maintain a constant discharge air temperature in the range of 80-130°F. Option AG35 maintains a discharge temperature range of 120-160°F.

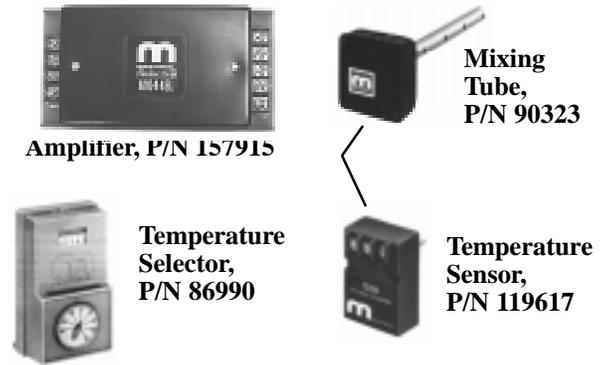
Figure 16 - Components of the Gas Control System (Maxitrol Series 14) used in Gas Control Options AG30, AG31, AG32, and AG35



Option AG33 electronic modulation system is comprised of Maxitrol Series 44 controls. The low limit (20-60°F) and the high limit (60-140°F) for control of discharge air temperature are set at the amplifier located in the control compartment. The space temperature is set at the remote selectostat (55-90°F range) located in the space. When the temperature is below the space temperature setpoint, the control system

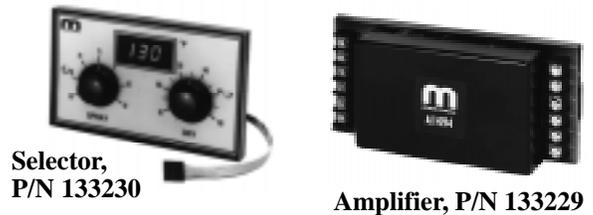
operates the burner to automatically adjust the discharge air temperature within the maximum and minimum limits set on the amplifier.

Figure 17 - Components of the Gas Control System (Maxitrol Series 44) used in Gas Control Option AG33



Option AG36 is a special application gas train that is designed for controlling the environment of a paint booth operation. The system includes a Maxitrol A1494 amplifier, discharge air temperature sensor, dual remote discharge air temperature selector (drying selector 80-140°F and a spray selector 60-90°F), and two switches to control the operation of the modulating gas valve.

Figure 18 - Components of the Gas Control System used in Option AG36 designed specifically for paint booths - controls are mounted on a remote console



Electronic Modulation Gas Control Option AG37

Function: Control Option AG37 does not have a duct sensor or amplifier. Instead, a Maxitrol A200 signal conditioner is activated by a customer-supplied input signal (either 4-20 microamps or 0-10 volt) to control the modulation of the gas valve.

Figure 19 - Maxitrol A200 Signal Conditioner, P/N 134170, used in Gas Control Option AG37



Service: Check all electrical connections. A qualified service person should refer to the Maxitrol Troubleshooting Guides for assistance in identifying problems and determining the correct solution.

None of the Maxitrol controls have field replaceable parts. All components must be replaced with identical replacement parts.

12. Gas Train Including Direct-Fired Burner, Gas Control Systems, and Manifold Arrangements (cont'd)

Manifold Arrangements

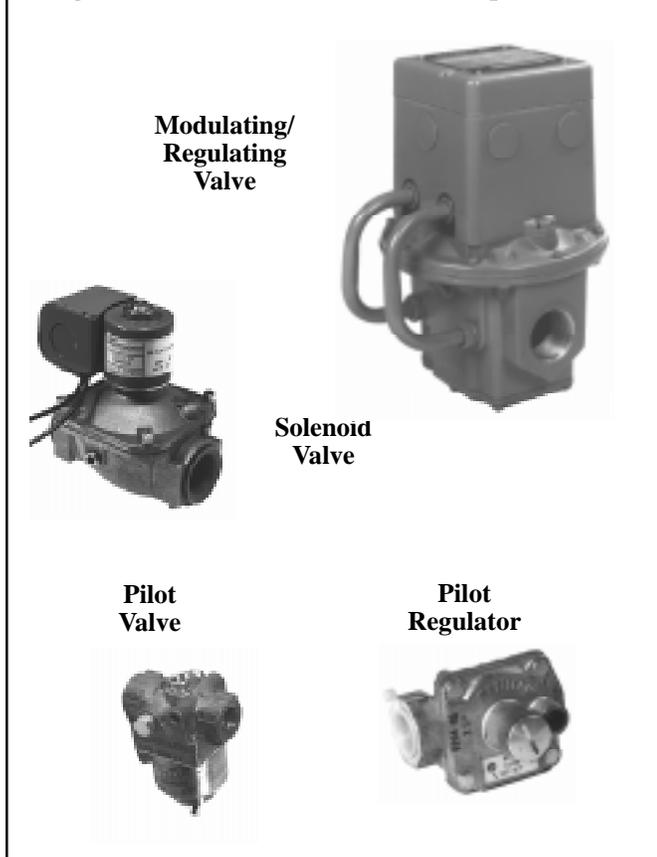
Description: The manifold is the gas train from the gas supply connection to the burner. The manifold selection ordered determines the manifold arrangement including all of the gas train components except the main control valve. Manifold arrangements are available for varying BTUH ranges and gas controls and include versions that meet FM or IRI requirements.

In addition to the Maxitrol valve and two solenoid valves, all manifold arrangements include main gas and pilot gas shut-off cocks, a pilot regulator, and a pilot solenoid valve.

The table below lists the minimum supply pressure for burner and manifold combinations.

Manifold Pressure Drops and Minimum Supply Pressure (" w.c.)											
MBH		250	750	1000	1500	2000	2500	3000	3500	4000	4500
2" Manifold	Pressure Drop	0.07	0.60	1.06	2.39	4.25	6.63	9.55	13.00	16.98	21.49
	Minimum Gas Supply Pressure (5.0"w.c. + P.D.)	5.07	5.60	6.06	7.39	9.25	11.63	14.55	18.00	21.98	26.49
3" Manifold	Pressure Drop	0.01	0.13	0.24	0.54	0.95	1.49	2.15	2.92	3.82	4.83
	Minimum Gas Supply Pressure (5.0"w.c. + P.D.)	5.01	5.13	5.24	5.54	5.95	6.49	7.15	7.92	8.82	9.83
MBH (cont'd)		5000	5500	6000	6500	7000	7500	8000	8500	9000	9500
2" Manifold (cont'd)	Pressure Drop	26.53	32.10	38.21	—	—	—	—	—	—	—
	Minimum Gas Supply Pressure (5.0"w.c. + P.D.)	31.53	37.10	43.21	—	—	—	—	—	—	—
3" Manifold (cont'd)	Pressure Drop	5.96	7.21	8.59	10.08	11.69	13.42	15.26	17.23	19.32	21.52
	Minimum Gas Supply Pressure (5.0"w.c. + P.D.)	10.96	12.21	13.59	15.08	16.69	18.42	20.26	22.23	24.32	26.52

Figure 20 - Standard Gas Control Components



13. Outside Air Cutoff Control

Location: The control is in the electrical box (See Figure 9); the sensor is in the air inlet.

Function: After sensing pilot flame, the burner ignites at its lowest input rate. The "amount of heat" required to reach the desired discharge temperature also depends on the temperature of the incoming outside air. The outside air control is factory set at 60°F (adjustable 25-250°F). The burner reacts differently depending on the entering air temperature and the setting on the outside air control. The burner --

- may not ignite (pilot valve will not open),

If the actual temperature of the outside air is above the setpoint on the outside air control, the burner will not ignite.

- may modulate to satisfy discharge setting,
- may shutdown, or

Burner shutdown or modulating operation will depend on the temperature rise between the outside air and the discharge air setting.

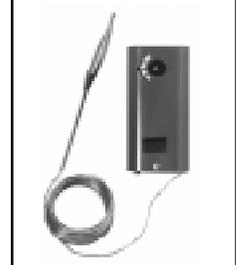
- may remain on continuous low fire.

If the outside air control is set too high, the burner will continuously burn on low fire as long as the control switch is set to "winter".

When the outside air control is set properly for the climate, the system blower will continue to provide the required makeup air (ventilation at the ambient outdoor temperature (burner not operating) even when the control switch is set to "winter".

Service: If the control does not function properly, replace it with an identical switch.

Figure 21 - Outside Air Cutoff Control



14. Inlet Air Controls

Description: The system is equipped with one of five types of inlet air control arrangements. All systems provide a constant flow of outside air across the burner at the required air volume (CFM).

● **Option AR21** - a constant supply of 100% makeup air

● **Option AR19** - 100% outside makeup air with variable supply air volume (CFM). The discharge damper controlling the variable air supply is controlled by a manually set remote potentiometer and can be varied from 100% to 25% of total rated air flow (CFM). In response to changes in the discharge damper setting, the bypass damper balances the volume of air so that the required fixed amount of air volume flows over the burner.

● **Option AR20** - 100% outside makeup air with variable supply air volume (CFM). The discharge damper controlling the variable air supply is automatically controlled by a building pressure sensor and can be varied from 100% to 25% of total rated air flow (CFM). In response to changes in the discharge damper setting, the bypass damper balances the volume of air so that the required fixed amount of air volume flows over the burner.

● **Option AR22** - a combination of outside makeup air and bypass return air including modulating return air and bypass air dampers. The volume of outside air is regulated by a remote manually set potentiometer.

● **Option AR23** - a combination of outside makeup air and bypass return air including modulating return air and bypass air dampers. The volume of outside air is regulated automatically by a remote building pressure sensor.

WARNING: Burner profile plates are factory set to match CFM requirements. Do not adjust profile plates without contacting your Sales Representative for technical assistance.

Air Flow Dampers

Function: Dampers operate in response to controls to provide the rated flow of makeup air to the building.

Service: Clean dampers of dust or dirt.

Damper Motor

Function: The damper motor automatically actuates the return air, bypass, and/or discharge dampers in response to an electrical control device. The damper motor is direct-coupled to the dampers so there is no damper linkage to adjust.

Service: There is no service required on these motors other than external cleaning. If the motors need replaced, replace with an identical damper motor.

Potentiometer

Function: The potentiometer is a manually set switch that operates either the discharge damper (Option AR19) or the return air damper (Option AR22) providing a mixture of return and outside air. It is remotely located switch that requires manual adjustment.

Service: If the potentiometer does not function properly, replace it with an identical switch.

Figure 22 - Damper Motor



Figure 23 - Potentiometer



Pressure Null Switch (automatic building pressure sensor)

Description/Function: The pressure null switch is a diaphragm operated differential pressure switch used in makeup air applications to automatically control building pressure. It maintains a selected positive or negative pressure setpoint by changing the amount of outside air being introduced to the building through modulating outside air damper. As more pressure is required in the building, the pressure null switch activates the damper motor driving the outside air damper towards the full open position (causing the bypass return air damper to go toward the closed position). Conversely, as less pressure is required, the switch drives the outside air damper in the opposite direction.

Figure 24 - Pressure Null Switch (building pressure sensor)



Service: Clean the tubing and the screened ends of the pressure tap vents. Be sure that the switch is installed with the diaphragm in a vertical plane and that the pressure taps are sheltered from the wind. For further service, follow the manufacturer's instructions included with the switch.

15. Dirty Filter Switch

Location: Switch is located in the electrical box (See Figure 9); sensor tubes are on either side of the filter rack; indicator light is on the remote console.

Function: The dirty filter switch is a pressure switch that activates an indicator light on the remote console when the filters need cleaned or replaced (See Service Section, Paragraph 2). This switch is only on systems with an optional console that includes a dirty filter light. The pressure switch is set during installation so that the light will be activated at approximately 50% filter blockage. Contacts should close at .17 to 5.0" w.c. \pm .05" w.c.

Service: Clean the sensor tubes. If the dirty filter indicator system still does not function properly, check the setting of the switch. With clean filters in place, blower doors closed, and blower in operation, decrease the pressure setting by adjusting the set screw on the switch clockwise until the filter light is energized or screw is bottomed out. At that point, adjust the set screw three full turns counterclockwise or until the screw is top ended.

If it is determined that the switch needs replacing, use an identical switch. When a new switch is installed, it must be manually set; follow the instructions above.

Figure 25 - Dirty Filter Pressure Switch



16. Troubleshooting

Chart 1 - General Troubleshooting Guide (Check the diagnostic lights on the circuit board)

Symptom or Problem	Cause and Remedy
1. Disconnect switch is closed, but "control power" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Fuses are missing or blown in disconnect switch - replace fuses. 2. Transformer not wired according to diagram - check wiring. 3. Secondary 8A fuse (on transformer) is missing or blown - replace fuse. 4. Indicator light is burned out - replace bulb (P/N 125189).
2. Disconnect switch is closed, but "firestat normal" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. See causes and remedies for Problem 1 above. 2. Optional control relay or door switch contacts are open - to test, jump terminals 3 to 4 or 1 to 2. 3. Firestat option not ordered - verify order/wiring diagram. 4. Firestat manual reset tripped - reset firestat control.
3. Disconnect closed, blower switch in test position, "firestat" light is lit, but "freezestat" light is <i>not</i> lit	<ol style="list-style-type: none"> 1. Freezestat option not ordered - verify order/wiring diagram. 2. Freezestat relay contacts are open - checking setting on control. 3. Indicator bulb is burned out - replace bulb (P/N 125189).
4. Disconnect closed, blower switch in test position, "firestat" and "freezestat" lights are lit, but "starter energized" light is <i>not</i> lit and the blower motor is not operating.	<ol style="list-style-type: none"> 1. End switch on damper motor not closed. - check end switch wiring. 2. Faulty damper relay - replace relay. 3. Damper motor miswired - rewire damper motor per wiring diagram.
5. Disconnect closed, blower switch in test position, "firestat", "freezestat" and "starter energized" lights are lit, but the blower motor is not operating.	<ol style="list-style-type: none"> 1. Blower motor not wired correctly - check wiring diagram on motor. 2. Faulty motor starter - replace (check coil first). 3. Faulty blower motor relay - replace relay.
6. Disconnect closed; blower switch in test position; "firestat", "freezestat" and "starter energized" lights are lit and the blower motor is operating; but the "low air light" is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Low air switch open - verify pressure drop at burner. 2. Indicator light is burned out - replace bulb (P/N 125189). 3. Faulty low air switch - replace pressure switch (P/N 86986).
7. Disconnect closed; blower switch in test position; "firestat", "freezestat", "starter energized" and "low air" lights are lit and the blower motor is operating; but the "high air light" is <i>not</i> lit.	<ol style="list-style-type: none"> 1. High air switch open - verify pressure drop at burner. 2. Indicator light is burned out - replace bulb (P/N 125189). 3. High air switch option not ordered - verify order/wiring diagram. 4. Faulty high air switch - replace pressure switch (P/N 86987).
8. Disconnect closed; blower switch in test position; "firestat", "freezestat", "starter energized", "low air" and "high air" are lit; but the "limit control normal" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Indicator light is burned out - replace bulb (P/N 125189). 2. Tripped manual reset limit control(s) - reset manual control. 3. Faulty manual limit control (s) - replace limit control.
9. Disconnect closed; blower switch in test position; "firestat", "freezestat", "starter energized", "low air", "high air" and "limit control normal" lights are lit; but the "ambient cutoff normal" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Indicator light is burned out - replace bulb (P/N 125189). 2. High ambient control contacts open - check setting on control.
10. Disconnect closed; blower switch in test position; "firestat", "freezestat", "starter energized", "low air", "high air", "limit control normal" and "ambient cutoff normal" lights are lit; but the "low gas pressure normal" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Indicator light is burned out - replace bulb (P/N 125189). 2. Low gas pressure switch option not ordered - verify order/wiring diagram. 3. Low gas pressure switch contacts open - check setting on control. 4. Low gas pressure switch contacts open - check gas pressure. 5. Faulty gas pressure switch - replace gas pressure switch.
11. Disconnect closed; blower switch in test position; "firestat", "freezestat", "starter energized", "low air", "high air", "limit controls normal", "ambient cutoff normal" and "low gas pressure normal" lights are lit; but the "high gas pressure normal" light is <i>not</i> lit.	<ol style="list-style-type: none"> 1. Indicator light is burned out - replace bulb (P/N 125189). 2. High gas pressure switch option not ordered - verify order/wiring diagram. 3. High gas pressure switch contacts open - check setting on control. 4. High gas pressure switch contacts open - check gas pressure. 5. Manual reset on switch tripped - reset pressure switch manual reset. 6. Faulty gas pressure switch - replace gas pressure switch.
12. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; "control power", "high gas normal"; "low gas normal"; "firestat normal"; "system switch energized"; "starter energized" and "freezestat normal" lights are lit; but ignitor is not becoming energized or beginning to glow.	<ol style="list-style-type: none"> 1. Lack of power at L1 on ignition module - ECO blown, find cause then replace ECO. 2. Faulty burner enable relay - replace relay. 3. Low stage relay contacts are not closed - check air controller or thermostat setting. 4. Faulty low stage relay - replace relay. 5. Faulty hot surface ignitor - check continuity at the ignition module and circuit board. If reading is greater than 5-6 ohms, replace ignitor. 6. Faulty ignition module - replace entire module.

Symptom or Problem (cont'd)	Cause and Remedy (cont'd)
<p>13. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; "control power", "high gas normal"; "low gas normal"; "firestat normal"; "system switch energized"; "starter energized" and "freezestat normal" lights are lit; ignitor glowing but "pilot valve normal" light (thus the pilot valve) is <i>not</i> energized.</p>	<ol style="list-style-type: none"> 1. Ignitor not reaching 1.4A threshold - check voltage and current to ignitor. 2. Faulty hot surface ignitor - check continuity, replace ignitor. 3. Faulty ignition module - replace entire module.
<p>14. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; "control power", "high gas normal"; "low gas normal"; "firestat normal"; "system switch energized"; "starter energized" and "freezestat normal" lights are lit; ignitor has reached 1.4A and has opened the pilot valve bringing on the "pilot valve normal" light; but the pilot flame is not present. (After two trials the unit will go into safety lockout requiring cycling of the main disconnect switch.)</p>	<ol style="list-style-type: none"> 1. Air in pilot gas line - bleed pilot line. 2. Inadequate pilot gas pressure - verify pilot gas pressure (3.5" w.c.) 3. Faulty pilot valve - replace pilot solenoid valve. 4. Faulty ignition module - replace entire module.
<p>15. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; all status lights are lit <i>except</i> "main valve normal" light. The pilot flame is present and stable, but the (low stage portion or) main gas valve will not open, or rapid cycling of the main valve is occurring.</p>	<ol style="list-style-type: none"> 1. Microamp signal on flame rod is inadequate - check position and condition of flame rod and signal (minimum 0.5 microamps required.) 2. Grounding for unit or flame rod inadequate - check ground path. 3. Faulty main gas valve - replace main gas valve. 4. Faulty ignition module - replace ignition module. 5. Inadequate main gas pressure - verify main burner pressure.
<p>16. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; all status lights are lit; the pilot flame and low fire on the main burner are present and stable, but the unit will not progress to a high fire condition.</p>	<ol style="list-style-type: none"> 1. Faulty main gas valve - replace main gas valve. 2. Inadequate timing on high fire time delay relay - adjust setting. 3. Faulty high fire time delay relay - replace time delay relay. 4. High stage relay contacts are not closed - check control setting. 5. Inadequate main gas pressure - verify main burner gas pressure. 6. Faulty high stage relay - replace relay. 7. Faulty ignition module - replace entire module.

REFERENCE: For troubleshooting information on the electrical controls, refer to the manufacturer's literature covering that component. Component literature is included in the literature envelope shipped with the system.

DANGER: The gas burner in this direct gas-fired system is designed and equipped to provide safe and economically controlled complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion which produces carbon monoxide, a poisonous gas that can cause death.

Always comply with the combustion air requirements in the installation codes and operating instructions. The amount of air over the burner must be within the specified range. The burner profile plates are set at the factory to match CFM requirements. Do not adjust the burner profile plates without contacting the factory. FAILURE TO PROVIDE PROPER COMBUSTION AIR CAN RESULT IN A HEALTH HAZARD WHICH CAN CAUSE PROPERTY DAMAGE, SERIOUS INJURY, AND/OR DEATH. Direct-fired installations should provide for air changes as required by the applicable installation codes.

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FOR SERVICE OR REPAIR, FOLLOW THESE STEPS IN ORDER:

FIRST:	<p>Contact the Installer</p> <p>Name _____</p> <p>Address _____</p> <p>_____</p> <p>_____</p> <p>Phone _____</p>
SECOND:	<p>Contact REZNOR/Thomas & Betts Corporation</p> <p>150 McKinley Avenue</p> <p>Mercer, PA 16137</p> <p>Phone: (724) 662-4400</p> <p>Model No. _____</p> <p>Unit Serial No. _____</p> <p>Date of Installation _____</p>

