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

(Specifications subject to change without notice.)

Operation/Maintenance/Service
Form RZ-NA 441-OMS

Applies to: **Model Series DV**

REZNOR Thomas&Betts

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References: Installation Manual, Form RZ 441
Replacement Parts Manual, Form RZ 741

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 DV, 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.

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.

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**

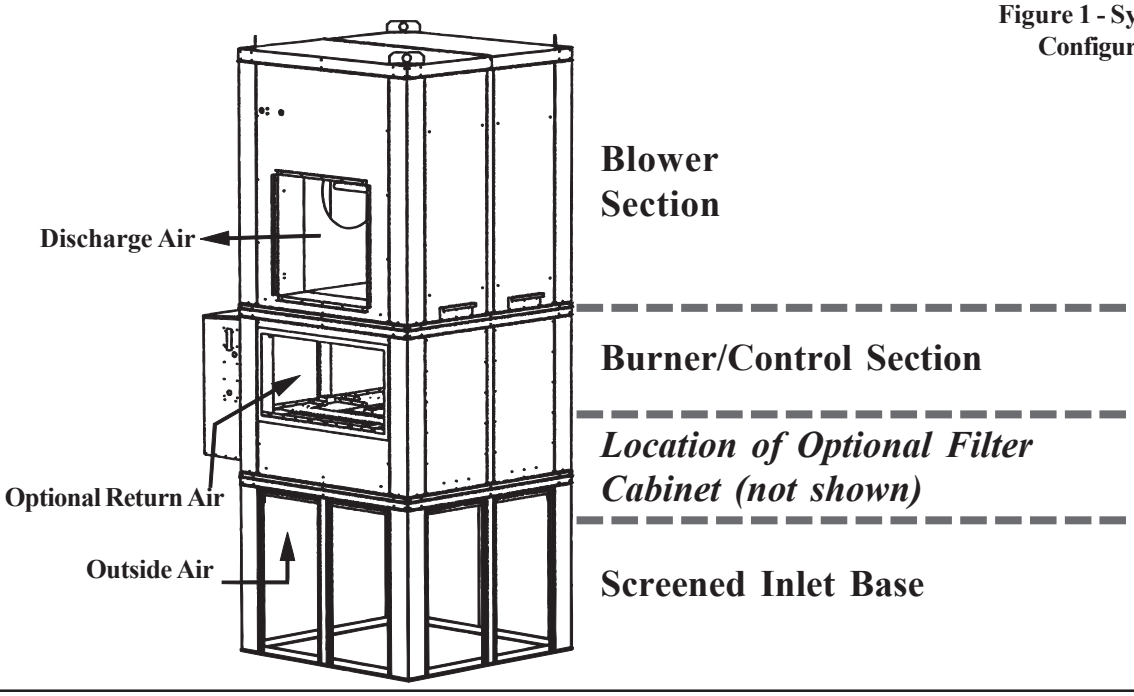


Figure 1 - System Configuration

R 1. Drive Components

The blower, motor and drive components are located in the blower cabinet at the top of the system. Systems with horizontal discharge have a cabinet with eight removable door panels. Systems with vertical discharge have a cabinet with six removable door panels. Remove the panels required to access the components being serviced.

1A. Blower Bearings

All blowers are Class I with pillow block bearings. 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 over lubricating.

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.

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

1B. Blower Belts

Check belts for proper tension and wear. Adjust belt tension as needed. Replace worn belts.

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 belt tension by means of the adjusting screw on the motor base until the belt can be depressed 1/2" to 3/4" (Figure 2). Tighten the lock nut on the adjusting screw. Be sure the belt is aligned in the pulleys.

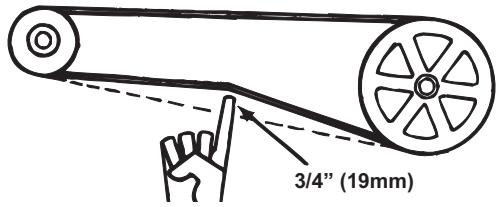


Figure 2 - Belt Tension

R E 2. Filters

If the system includes filters, check the filters quarterly. Filters could be either in the optional inlet base or in an optional filter cabinet.

If the filters are in the perimeter of the inlet base; they are two-inch permanent filters. Remove and clean the filters as needed.

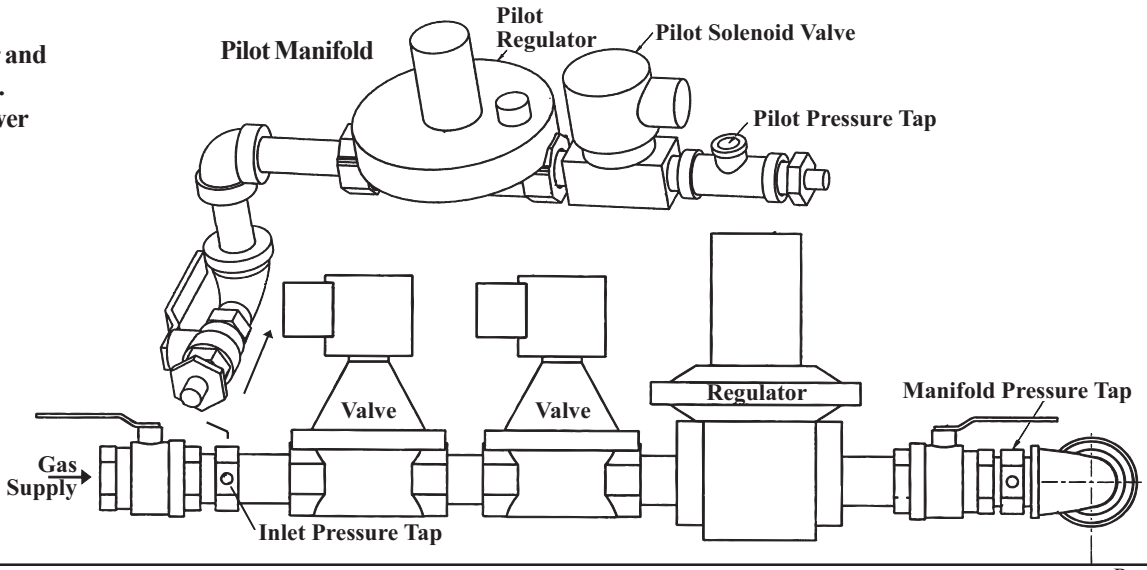
If the filters are in a filter cabinet (the filter cabinet is always between the inlet base and the burner/control section), remove the filter cabinet door panels to access the V-bank filter rack. Filters may be either 2" disposable, 1" or 2" permanent, or 1" or 2" disposable pleated. Clean or replace as needed.

Sizes and Quantity of Filters in the Filter Cabinet (same for all types of filters)						
Size	109	112	115	118	122	125
16" x 16"	4	4	-	-	16	16
16" x 20"	4	4	6	6	-	-
16" x 25"	-	-	6	6	8	8

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 3 for pressure tap locations. Verify against pressures listed on the rating plate.

Figure 3 - Location of pressure taps for measuring burner and pilot gas pressure. Measure with blower operating.



S 4. Air Pressure

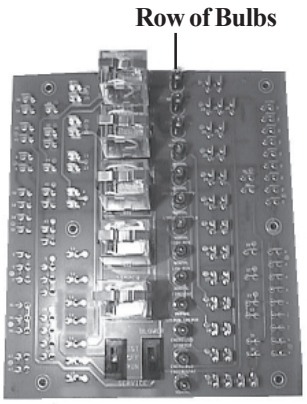
Profile plate sensing tubes should be checked quarterly and cleaned no less than semiannually. If the sensing tubes become even partially blocked, false pressure readings may be relayed. To clean, remove the screened end caps. Clean the screens and the tubes, if necessary. Replace the cleaned end caps. 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 below the junction box, locate the tubing connections. Remove the cap at each connection and attach the slope gauge using two field-supplied 1/4" x 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 7). 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 4 - Circuit Indicator Board, P/N 151263



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

S 6. Main Burner and Pilot Assembly

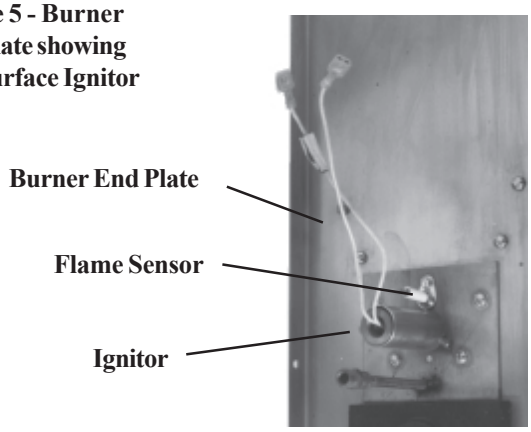
For the most part, the burner and pilot are self cleaning. However, if the application is extremely dirty or dusty, cleaning of the burner and pilot may be necessary. Inspect the burner annually. Follow these instructions. If it is necessary to replace any parts, use only factory-authorized replacements.

1) Turn off the gas and power supply to the system.
2) Remove the door panels in the burner/control cabinet (four or six depending on whether or not the system has return air). Locate the pilot.
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.

CAUTION: Wear eye protection while pressure cleaning and drilling.

Figure 5 - Burner End Plate showing Hot Surface Ignitor



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.

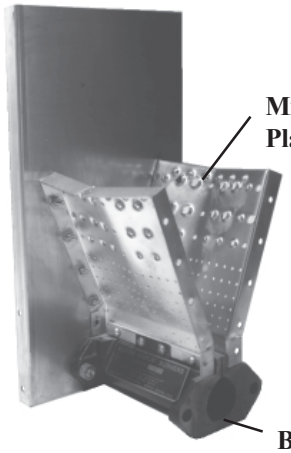
WARNING: Do not enlarge burner ports or performance may be drastically affected.

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.

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

Figure 6 - Illustration of the first Burner Section



Full length of the burner is made up of a series of 6" or 12" burner sections in a linear or oval configuration

WARNING: Burner profile plates are factory set to match CFM requirements.

Do not adjust profile plates without contacting your Sales Representative for technical assistance.

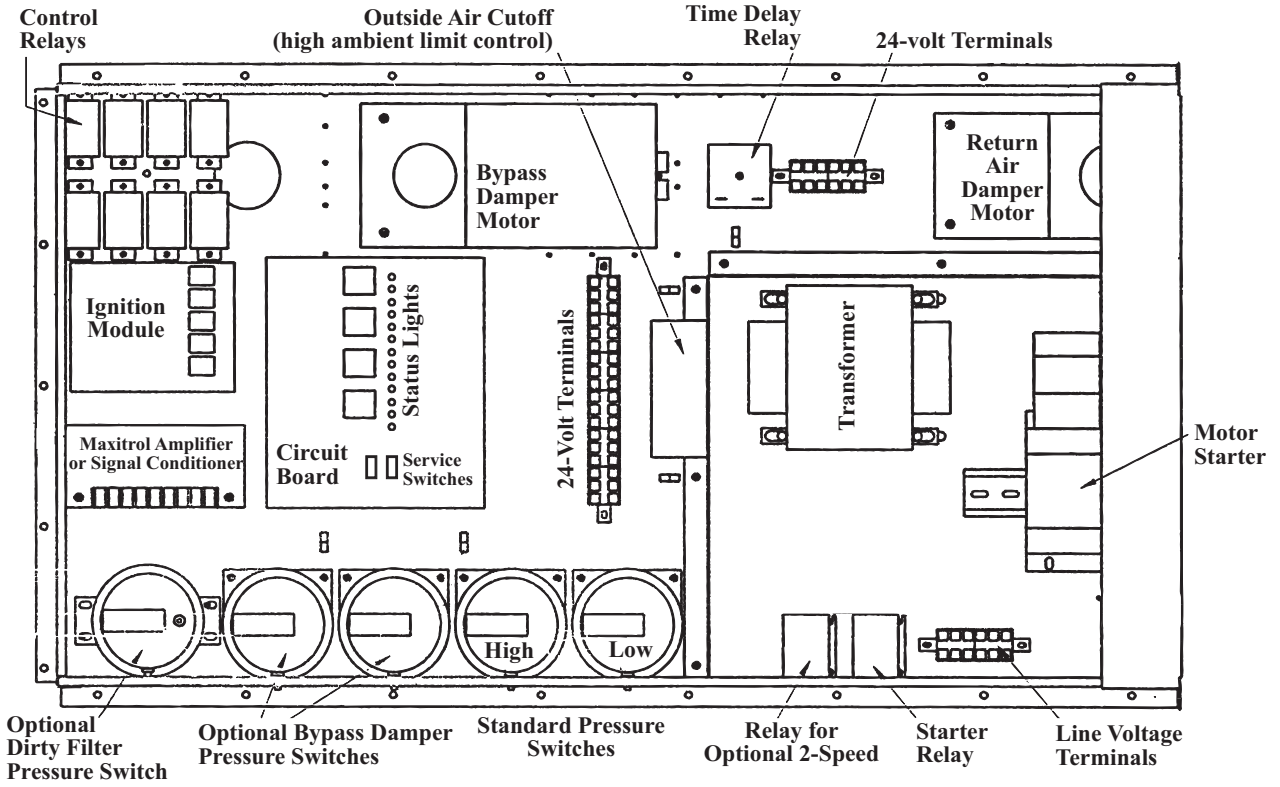
Operation/Service Section

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 7 and to the individual illustrations to identify and locate each of the controls. The wiring diagrams for this unit are located in the main electrical box.

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 7 - Control Locations



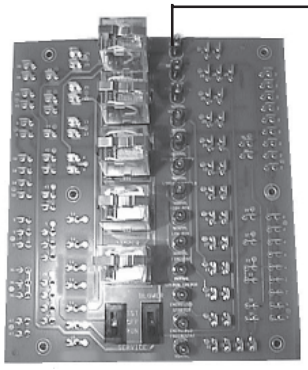
NOTE: Wiring diagrams for the unit are located on the inside of the electrical box door.

7. Electronic Circuit Board with Diagnostic Lights

Location: Control Compartment Electrical Box (See Figure 7)

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 19.

Figure 8 - Diagnostic Circuit Board, P/N 151263



Column of 13 indicator bulbs; always replace burned out bulbs, P/N 125189.

8. Temperature Limit Safety Controls

Location: 1) Manual Reset Limit Switch is mounted on a 2x4 electrical box located in the blower section. To access the manual reset, remove the blower section access panel to the left of the discharge (left when facing the discharge); **2)** Emergency Cutoff Limit Control is in the burner/control cabinet just above the electrical box.

• Manual Reset Limit Control - Blower Cabinet

Figure 9 - Manual Reset Limit

Capillary tubing is in a holder that extends into the

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.

8. Temperature Limit Safety Controls (cont'd)

• Emergency Cut Off Limit Control

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

Figure 11 - ECO Limit Control, P/N 82414

Setting 305°F

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 restarting the system.

9. Air Pressure Switches

Location: Control Compartment Electrical Box (See Figure 7.)

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

Figure 12 - Air Pressure Switch

• 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, AR23, AR32, AR33, AR34, AR36, or AR37)

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 null switch (Option AR20 or AR23), a photohelic pressure switch (Option AR36 or AR37), or a field-supplied computer signal (Option AR33 or AR34). With Options AR19, AR20, AR33, and AR36 the supply air is varied by adjusting the position of a damper at the blower discharge. With Options AR22, AR23, AR34, and AR37, a return air damper is adjusted to vary the volume of return air. The unit is arranged so that a fixed amount (20%) of the rated volume flows over the burner at a constant velocity. The remainder (80%) 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.

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 below the electrical control 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.

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.

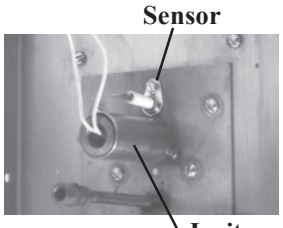
Service: If the pressure check determines that an air flow switch is not functioning properly, the switch cannot be serviced and must be replaced with an identical replacement. Low air pressure switch is P/N 86986; high air pressure switch is P/N 86987; bypass damper switches, P/N 87249 (normally closed,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

10. Ignition System

Location: Ignition Controller Module in the Control Compartment Electrical Box (See Figures 7 and 13.); Ignitor and Flame Sensor on the Burner (See Figure 14.)

Figure 13 - Ignition Control Module in the Electrical Compartment, P/N 157953

Figure 14 - Ignitor, P/N 121865, and Flame Sensor, P/N 134706, on the Burner



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).

Service: The modular ignition controller does an internal self-check each time that it is energized and will lockout if not found to be func-

tioning properly. If the ignition controller locks out and there is no other cause, the controller module must be replaced.

11. Gas Train Including Direct-Fired Burner, Gas Control Systems, Manifold Arrange-ments, and Gas Pressure Switches

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

Refer to the wiring diagrams in the main electrical box to determine which controls are on the system being serviced. **NOTE:** All field-supplied control wiring for Maxitrol controls must ***not*** be run inside conduit with line voltage wiring. To avoid any potential electrical interference, all field-supplied wiring for Maxitrol controls should be shielded wiring and must be grounded at the unit only.

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.

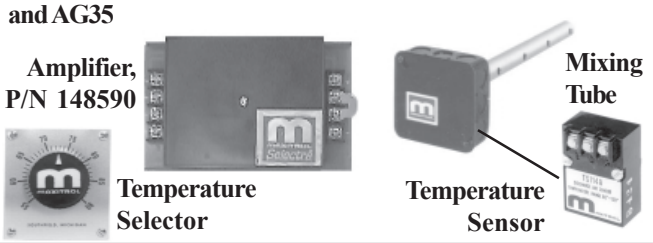
These modulating gas control options are electronic because in all cases the gas valve acts to adjust the flow of the gas to the main burner in response to DC volts emanating from an amplifier. When the DC voltage is between 0 and 5 volts, the main valve seat is closed. Low fire flow is accomplished 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.

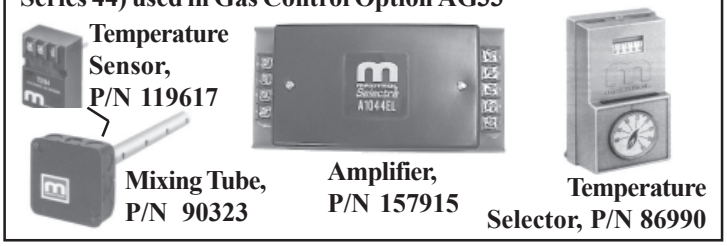
The Option AG30, AG31, AG32 and AG35 electronic modulation systems are comprised of Maxitrol Series 14 controls. Options AG30 and AG31 systems electronically maintain a constant discharge air temperature in the range of 55-90°F (55-75°F for C.G.A.). Option AG31 includes an overriding thermostat. Option 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 15 - Components of the Gas Control System (Maxitrol Series 14) used in Gas Control Options AG30, AG31, AG32, and AG35



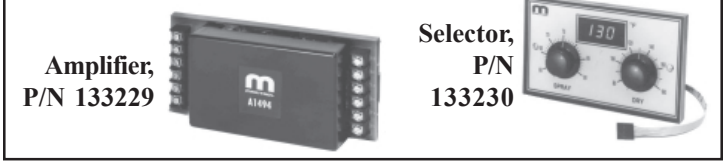
Option AG33 electronic modulation system is comprised of Maxitrol Series 44 controls. The low limit (20-60°F) and the high limit (60-140°F) for control of discharge air temperature are set at the amplifier located in the control compartment. The space temperature is set at the remote selectrastat (55-90°F 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 16 - 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 17 - 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 milliamps or 0-10 volt) to control the modulation of the gas valve.

Figure 18 - Maxitrol A200 Signal Conditioner, P/N 134170, used in Gas Control Option AG37

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

Service - All Maxitrol Controls: 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.

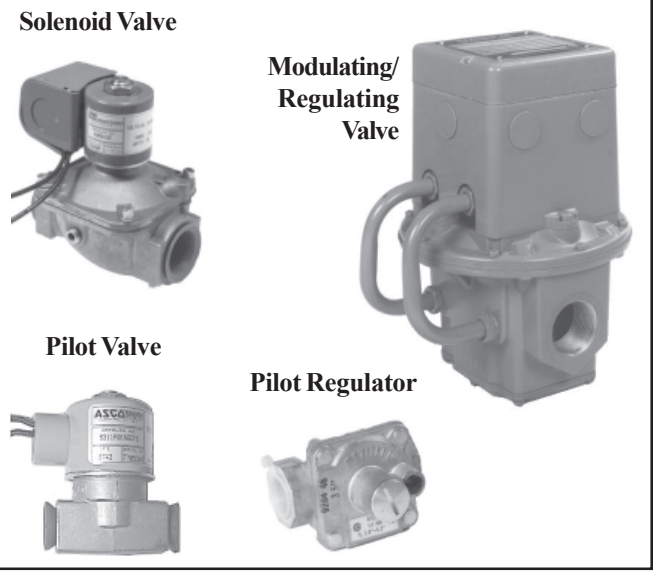
Manifold Arrangements

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 pressure drops through the various types of manifolds by option designation (BM). To determine the required minimum supply pressure for natural gas, add 5.0" w.c. to the natural gas manifold pressure drop. For propane gas, add 2.0" w.c.

Figure 19 - Gas Manifold Control Components



Manifold Pressure Drops (" w.c.)

Manifold Opt / Manifold Size	BM62 1"		BM63 3/4"		BM64 1"		BM65 1-1/4"		BM67 1-1/4"		BM68 2"		BM53 1-1/4"		BM66 2"	
MBH	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro
250	.56	.21	.66	.25	.43	.17	.22	.09	.19	.07	.07	.03	.22	.09	.07	.03
500	2.23	.85	2.65	1.01	1.74	.66	.89	.34	.76	.29	.27	.10	.89	.34	.27	.10
750	5.02	1.91	5.96	2.27	3.91	1.49	2.01	.77	1.71	.65	.61	.23	2.01	.77	.61	.23
1000	--	--	--	--	6.95	2.65	3.58	1.36	3.04	1.16	1.09	.41	3.58	1.36	1.09	.41
1250	--	--	--	--	--	--	5.59	2.13	4.76	1.81	1.70	.65	5.59	2.13	1.70	.65
1500	--	--	--	--	--	--	8.05	3.07	6.85	2.61	2.44	.93	8.05	3.07	2.44	.93
1750	--	--	--	--	--	--	10.96	4.17	9.32	3.55	3.33	1.27	10.96	4.17	3.33	1.27
2000	--	--	--	--	--	--	14.31	5.45	12.18	4.64	4.34	1.66	14.31	5.45	4.34	1.66
2250	--	--	--	--	--	--	18.11	6.90	15.41	5.87	5.50	2.09	18.11	6.90	5.50	2.09
2500	--	--	--	--	--	--	22.36	8.52	19.02	7.25	6.79	2.59	22.36	8.52	6.79	2.59
2750	--	--	--	--	--	--	--	--	--	--	8.21	3.13	--	--	8.21	3.13
3000	--	--	--	--	--	--	--	--	--	--	9.77	3.72	--	--	9.77	3.72

Gas Pressure Switches

If the gas train includes either or both high and low gas pressure switches, the switches monitor gas pressure downstream from the safety valves.

If the gas pressure in a system equipped with a high gas pressure switch (Option BP2) exceeds the setpoint, the switch will open the electrical circuit to the burner, stopping all gas flow. The high gas pressure switch is a manually reset device.

A low gas pressure switch (Option BP3) will shutoff the gas flow if the gas pressure drops below the setpoint of the low pressure switch. The low gas pressure switch will automatically reset when the gas pressure rises above the setpoint.

(NOTE: Both high and low gas pressure switches incorporate a vent limiting device and do not require venting to the outdoors when used in an application installed indoors.)

Figure 20 - Gas Pressure Switches

Low, P/N 93850 (automatic)

High, P/N 93849 (manual reset)

12. Outside Air Cutoff Control (Option BN2; required on C.G.A.-certified units)

Location: The control is in the electrical box (See Figure 7.); 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

Figure 21 - Outside Air Cutoff Control

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.

13. Door Switch (Option BX1; required on C.G.A.-certified units)

Location: The control is installed on an overhead door opening to control the operation of the heater to coincide with the opening and closing of the door.

Function: The function of the switch is to energize and interlock the heating unit when an outside overhead door reaches approximately 80% of full open travel. The switch will de-energize the furnace when the overhead door closes approximately 20%. The complete switch includes a limit switch electrically wired to the heater and a roller yoke for mechanical activation by a field-supplied trigger on the overhead door.

Figure 22 - Door Switch, P/N 124253

14. Inlet Air Controls

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

Description: The system is equipped with one of the 11 types of inlet air control arrangements listed below. All systems provide a constant flow of outside air across the burner at the required air volume (CFM).

Refer to the wiring diagrams in the main electrical box to determine which controls are on the system being serviced.

●**Option AR1** - 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 20% 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 20% 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 remotely located, 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 remotely located building pressure sensor.

●**Option AR32** - a combination of outside makeup air and bypass return air including a two-position actuator. The two position actuator changes the position of the damper to provide either 100% outside air or 20% outside/80% return air. Control is from a SPDT toggle switch mounted on a 4x4 box (or if ordered, the switch is mounted on a remote console).

●**Option AR33** - 100% outside makeup air with variable supply air volume (CFM). The discharge damper controlling the variable air supply is automatically controlled by a 0-10 VCD or 4-20 milliamp signal. 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 AR34** - 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 0-10 VCD or 4-20 milliamp signal.

●**Option AR35** - a constant supply of 100% makeup air to the unit but including a two-position inlet shutoff damper that closes the dampers when the system is not operating. The damper attaches to the duct flange of the optional inlet base (used only with the optional inlet base that has three closed sides and a duct connection for outside air).

●**Option AR36** - 100% outside makeup air with variable supply air volume (CFM). The discharge damper controlling the variable air supply is automatically controlled by a remotely located photohelic pressure sensor. 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 AR37** - 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 remotely located photohelic pressure sensor.

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.

Figure 23 - 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 a remotely located switch that requires manual adjustment.

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

Figure 24 - Potentiometer, P/N 16110

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

Figure 25 - Pressure Null Switch (building pressure sensor), P/N 88052

14. Inlet Air Controls (cont'd)

Pressure Null Switch (cont'd)

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.

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.

Photohelic Pressure Switch (automatic building pressure sensor)

Figure 26 - Photohelic Pressure Sensor, P/N 159893

Description/Function: The photohelic pressure switch is a phototransister relay operated positive pressure switch used in makeup air applications to automatically control building pressure. It maintains a selected positive pressure setpoint by changing the amount of outside air being introduced to the building through a modulating outside air damper. As more pressure is required in the building, the 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.

Service: Clean the tubing and the screened ends of the pressure tap vents.

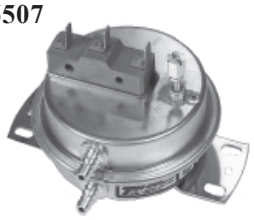
If the interior of the switch is protected from dust, dirt, corrosive gases and fluids, years of trouble-free service may be expected. Zero adjustment should be checked and reset occasionally to maintain accuracy; follow the manufacturer's instructions included with the switch.

There are no field-repairable parts in this switch. If the switch should require repair, contact either the system or the switch manufacturer concerning switch replacement or repair.

15. Dirty Filter Switch

Location: Switch is located in the main electrical box (See Figure 7); sensor tubes run to either side of the filter rack; indicator light is on the remote console.

Figure 27 - Dirty Filter Pressure Switch, P/N 105507



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. ± .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.

16. Photoelectric Smoke Detector (Option SA1)

Location: Field-mounted in the discharge ductwork.

Function: The detector will shut down the system if smoke is detected in the discharge ductwork.

Service: Clean the external surface. Check the wiring and connections.

Figure 28 - Photoelectric Smoke Detector (cover removed), P/N 159553, used with sampling tube, P/N 159714

17. Firestat (Option BD5)

Location: Field-mounted on the discharge ductwork so that the sensor extends into the duct. This control requires manual reset so should be mounted in an accessible location.

Function: The firestat will shut down the system if the temperature in the ductwork reaches 200°F. The switch must be manually reset.

Figure 29 - Firestat, P/N 42782

Service: Clean the external surface. Check the wiring and connections.

18. Freezestat (Option BE2)

Location: The control is in the blower section electrical box; the sensing bulb is field-mounted in the discharge duct.

Function: The freezestat will shut down the system if the discharge temperature falls below the setpoint. The switch is automatic and will startup the heater when the temperature reaches the setpoint.

Service: Clean the external surface. Check the wiring and connections.

Figure 30 - Freezestat Controller, P/N 126170

REFERENCE: For service and 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.

Refer to Paragraph 19 for unit troubleshooting.

19. 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 *not* lit.	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 *not* lit.	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 *not* lit	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 *not* lit and the blower motor is not operating.	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.	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 *not* lit.	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 ***not*** lit.	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 *not* lit.	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 (outside air) cutoff normal"** light is ***not*** lit.	1. Indicator light is burned out - replace bulb (P/N 125189). 2. High ambient control option not ordered - verify order/wiring diagram. 3. 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 (outside air) cutoff normal"** lights are lit; but the **"low gas pressure normal"** light is ***not*** lit.	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 (outside air) cutoff normal"** and **"low gas pressure normal"** lights are lit; but the **"high gas pressure normal"** light is ***not*** lit.	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.	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.
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 not energized.	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.

19. Troubleshooting (cont'd)

Chart 1 (cont'd) - General Troubleshooting Guide (Check the diagnostic lights)

Symptom or Problem (cont'd)	Cause and Remedy (cont'd)
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.)	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.
15. Disconnect closed; blower and burner switches in run position; control switch is in "winter" position; all status lights are lit ***except*** "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.	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.
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.	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.

FOR SERVICE OR REPAIR, FOLLOW THESE STEPS IN ORDER:

FIRST: **Contact the Installer**

Name _____

Address _____

_____

_____

Phone _____

SECOND: **Contact the nearest distributor** (See Yellow Pages). If no listing, contact Authorized Factory Representative, 1-800-695-1901 (Press 1).

THIRD: **Contact** REZNOR®/Thomas & Betts Corporation
150 McKinley Avenue
Mercer, PA 16137
Phone: (724) 662-4400

Model No. _____

Unit Serial No. _____

Date of Installation _____

Thomas&Betts

MANUFACTURER OF HEATING, COOLING, AND VENTILATING SYSTEMS

(800) 695-1901; www.ReznorOnLine.com

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