

GAS DIRECT-FIRED MAKEUP AIR/HEATING SYSTEM INSTALLATION, OPERATION, AND MAINTENANCE

DISCONTINUED MODEL RDF



⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly could result in serious injury, death, or property damage.
- Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.
- Be sure to read and understand the installation, operation, and service instructions in this manual.
- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Leave the building immediately.
- Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

DO NOT DESTROY. PLEASE READ CAREFULLY. KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

TABLE OF CONTENTS

1.0 General	2	6.0 Mechanical	9
1.1 Hazard Labels and Notices	2	6.1 Gas Piping and Pressures	9
1.2 General Description	3	6.2 Unit Inlet Air	11
1.3 Warranty	3	6.3 Supply Air Discharge	15
1.4 Installation Codes/Requirements	3	6.4 Blowers, Drives, and Motors	16
2.0 Location	4	7.0 Electrical Supply and Wiring	17
3.0 Uncrating/ Preparation	4	8.0 Controls	19
4.0 Clearances and Dimensions	4	9.0 Check-Test Start	22
4.1 Clearances	4	Before Startup	22
4.2 Dimensions	5	Startup	23
5.0 Mounting	5	After Startup	25
5.1 Weights	6	APPENDIX	26
5.2 Rigging	6	Technical Data	26
5.3 Mounting on Field-Supplied Supports	6	INDEX	27
5.4 Mounting on a Roof Curb	6	INSTALLATION RECORD	28

1.0 General

1.1 Hazard Labels and Notices

There are warning labels on the unit and throughout this manual. For your safety, read the definitions below and comply with all boxes labeled CAUTION, WARNING, and DANGER during installation, operation, maintenance and service of this heater.

HAZARD INTENSITY LEVELS

Hazard Intensity
Levels Apply to
Warnings throughout
this Manual

1. **DANGER:** Failure to comply will result in severe personal injury or death and/or property damage.
2. **WARNING:** Failure to comply could result in severe personal injury or death and/or property damage.
3. **CAUTION:** Failure to comply could result in minor personal injury and/or property damage.

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.

WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons. See Hazard Levels above.

WARNING: On makeup air heaters which also recirculate room air, outside ventilation air must be provided in accordance with the information shown on the heater nameplate.

Recirculation of room air may be hazardous in the presence of:

- (a) Flammable solids, liquids, and gases;
- (b) Explosive materials; or
- (c) Substances which may become toxic when exposed to heat.

1.2 General Description

The information in this manual applies to Model RDF Series 3 direct-fired makeup air heating systems. The typical system consists of a direct-fired, natural gas-fueled burner, and a draw-through blower housed in a weatherized cabinet. The system may be installed either indoors or outdoors.

This direct-fired makeup air system provides tempered makeup air. Makeup air is defined as air that enters a building or area due to negative pressure created by an air exhaust load in excess of the volume of entering air. This system warms the outside air and monitors the volume and temperature of the makeup air added to the building. The system may be used to provide ventilation in whole building or in spot applications. In whole building applications, adding controlled makeup air will cause less infiltration of dust and dirt; will eliminate continuous backdraft in chimneys and vents; and will reduce space heating fuel costs.

This system is available with various air control options to meet a wide range of application requirements. Depending on the air control option ordered, the supply air volume may be varied or the outside air may be supplemented with up to 75% building air (recirculation) for increased energy savings.

These systems are designed-certified to ANSI and CSA Standards. **(NOTE:** Optional recirculation is available for U.S. installations only; recirculation is not available for Canadian installations.)

In order to retain certification, the installer must adhere to the installation and operation requirements in the instruction manual. These direct-fired makeup air systems are not approved for residential use.

1.3 Warranty

Refer to the limited warranty information on the warranty card included in the "Owner's Envelope".

1.4 Installation Codes/ Requirements

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction. The qualified agency installing this system is responsible for the installation. These units must be installed in accordance with local building codes. In the absence of local codes, the unit must be installed in accordance with the National Fuel Gas Code ANSI Z223.1a (latest edition) or CAN/CGA B149, Installation Codes for Gas Burning Appliances. These codes are available from CSA Information Services, 1-800-463-6727.

Before installation, always consult authorities having local jurisdiction to verify that local codes and procedures are being followed.

The building should always provide adequate relief for the heater to operate at its rated capacity. It should be noted that this can be accomplished by taking into account, through standard engineering methods, the structure's designed infiltration rate; by providing properly sized relief openings; by interlocking a powered exhaust system; or by a combination of these methods. **Excessive recirculation or insufficient ventilation air which results in inadequate dilution of the combustion products generated by the heater may create hazardous concentrations of carbon dioxide, carbon monoxide, nitrogen dioxide, and other combustion products into the heated space.**

If the failure or malfunction of this heater creates a hazard to other fuel burning equipment in the building, interlock the system to open inlet dampers or other such devices.

Recirculation Requirements - Do not install a system with optional recirculation (building air) in the presence of flammable solids, liquids, or gases; explosive materials (i.e., grain dust, coal dust, gun powder, etc.); or substances which may become toxic when exposed to heat (i.e. refrigerants, aerosols, etc.). If a system with recirculation is being installed in an area where propane forklifts or other fossil fuel powered equipment are used, the ventilation requirements for that equipment **must** be met. Recirculation is not recommended in uninsulated buildings where outside temperatures fall below 32°F (0°C).

If in doubt regarding an application, consult the heater manufacturer's representative before installation.

1.0 General (cont'd)

2.0 Location

3.0 Uncrating/ Preparation

1.4 Installation Codes/Requirements (cont'd)

Codes for Special Installations: (1) Aircraft Hangar -- Installation in an aircraft hangar must be in accordance with the Standard for Aircraft Hangars, ANSI/NFPA 409 (latest edition) or CAN/CGA B149 Installation Codes; (2) Public Garage -- Installation in a public garage must be in accordance with the Standard for Parking Structures, ANSI/NFPA 88A (latest edition) or the Standard for Repair Garages, ANSI/NFPA 88B (latest edition) or in Canada with CAN/CGA B149 Installation Codes.

Location must comply with clearances in Paragraph 4.1. Makeup air should enter at the highest point practical. By doing this, the fresh air will entrain dust laden air at the ceiling and move it toward the point of exhaust. Also, fresh air directed downward from the roof or ceiling will mix with hot ceiling air resulting in improved distribution of heat in the building.

Always introduce fresh makeup air so that it moves across the greatest distance within the room or building before reaching an exhauster.

Immediately upon uncrating the unit, check the gas specifications and electrical voltage (system rating plate is in the control compartment) to be sure that they agree with the supply at the installation site. Check for any damage that may have been incurred during shipment. If damage is found, document the damage with the carrier and contact your distributor.

The following control parts are **shipped loose** inside the unit:

- a 3-position control switch mounted in a 4x4 junction box (except units with Option AG37) NOTE: If an optional remote console is ordered, this switch is mounted on the console; the console is shipped separately.

Depending on the gas and/or air controls selected, the following additional parts are shipped inside the unit or separately.

Gas Controls	Shipped-Loose Parts
Options AG30, AG32, AG33, AG47, AG48	*Remote Temperature Selector
Option AG31	*Remote Temperature Selector, Space Override Thermostat
Option AG36	Remote Console
Air Controls	Shipped-Loose Parts
Option AR19, AR22	*Potentiometer
Option AR20, AR23	Remote Pressure Sensor
Option AR32	Toggle Switch
Option AR36	Photohelic Pressure Sensor
Option AR37	Photohelic Pressure Sensor

*If an optional remote console is ordered, these controls are mounted on the console. The console is shipped separately.

On all sizes with an **optional dirty filter switch**, the tubing and clamps are shipped inside the cabinet.

Be sure that all shipped-separate accessories for the installation are available. Other shipped-separate accessories could include a roof curb, a remote console, an outside air hood, a disconnect switch, and/or an indoor filter cabinet.

4.0 Clearances and Dimensions

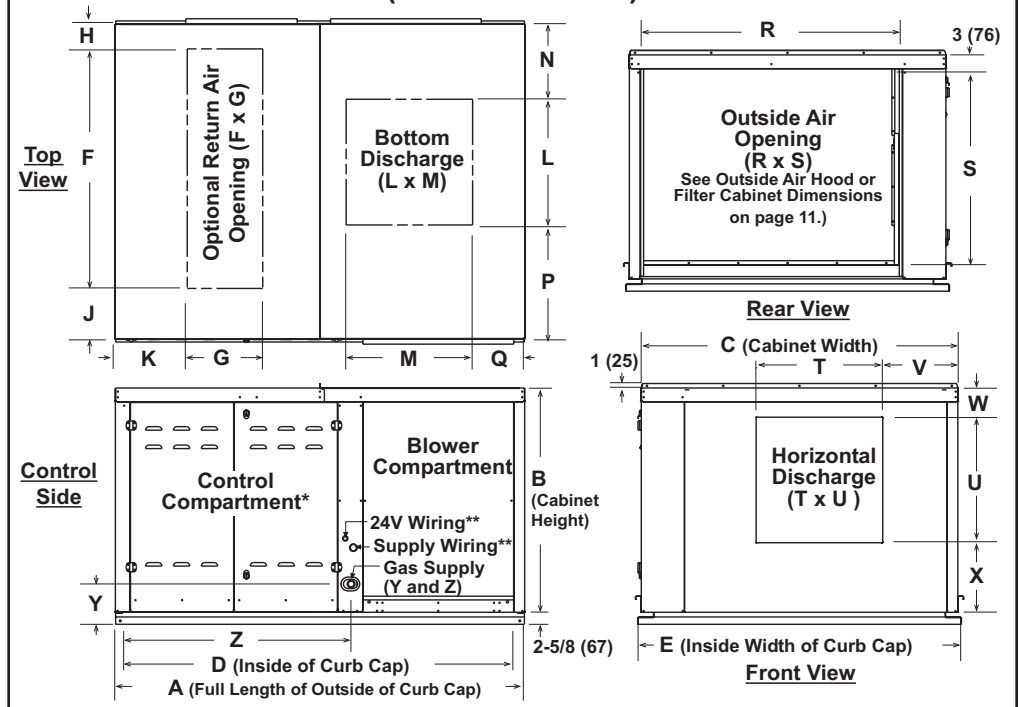
4.1 Clearances

Clearance to combustibles is defined as the minimum distance from the heater to a surface or object that is necessary to ensure that a surface temperature of 90°F above the surrounding ambient temperature is not exceeded. In order to service the system, the minimum clearance on the control side of the unit must be equal to the width of the unit.

Clearances - inches (mm)				
Top	Control Side	Side Opposite Controls	Bottom	
			To Combustibles	To Non-Combustibles
3 (76)	Width of unit	3 (76)	3 (76)	0 - Curb

4.2 Dimensions

FIGURE 1 - Dimensions (inches and mm)



* RDF-2 and RDF-3 systems have double hinged doors as illustrated. Control compartment on RDF-1 has a single hinged door.

** Configuration is for RDF-2 and RDF-3. The supply connection on the RDF-1 systems is above the control wiring connection.

Dimensions (inches)

Model Sizes	A	B	C	D	E	F	G	H	J	K	L	M
1-20-3, 1-40-3, 1-50-3, 1-65-3	88	37-1/8	44-3/16	84-13/16	45-1/2	24-1/2	10-1/2	5-7/16	14-9/32	15-5/8	21-29/32	19-1/8
2-80-3, 2-120-3	88	48-11/16	68-1/4	84-13/16	69-1/2	52	16-1/4	5-5/16	10-15/16	15-1/2	27-9/32	27-7/32
3-180-3, 3-260-3	135-3/4	61-5/8	82-9/16	132-9/16	83-1/8	64-9/16	19-1/16	5-5/32	13-13/32	21-5/8	37	37-3/32
Model Sizes	N	P	Q	R	S	T	U	V	W	X	Y	Z
1-20-3, 1-40-3, 1-50-3, 1-65-3	7-11/16	14-5/8	12-5/8	31-1/8	31-1/8	21-3/4	18-3/4	7-3/4	5-1/4	13-1/8	8-9/16	42-7/32
2-80-3, 2-120-3	16-5/16	24-21/32	11-7/32	55-3/16	42-5/8	27-1/4	27-1/4	16-5/32	6-11/32	15-3/32	8-3/4	48-15/16
3-180-3, 3-260-3	14-9/16	31-9/16	7-7/16	67-1/8	55-9/16	36-3/4	36-3/4	14-7/16	4	20-7/8	8-11/16	56

Dimensions (mm)

Model Sizes	A	B	C	D	E	F	G	H	J	K	L	M
1-20-3, 1-40-3, 1-50-3, 1-65-3	2235	943	1122	2154	1156	622	267	138	363	397	556	486
2-80-3, 2-120-3	2235	1237	1734	2154	1765	1321	413	135	278	394	691	691
3-180-3, 3-260-3	3448	1565	2097	3367	2111	1640	484	131	341	549	940	942
Model Sizes	N	P	Q	R	S	T	U	V	W	X	Y	Z
1-20-3, 1-40-3, 1-50-3, 1-65-3	195	371	321	791	791	552	476	197	133	333	217	1072
2-80-3, 2-120-3	414	626	285	1402	1083	692	692	410	161	383	222	1243
3-180-3, 3-260-3	370	802	189	1705	1411	933	933	367	102	530	221	1422

5.0 Mounting

Mounting the system is the responsibility of the installer. Verify that the supporting structure has sufficient load-carrying capacity to support the weight.

Depending on the building and its use, determine whether or not additional measures should be taken to reduce the effect of blower vibration and/or noise.

When selecting a location for an outdoor installation, position the unit so that the air inlet will **NOT** be facing into the prevailing wind. A minimum of 14" (356mm) clearance is required from the bottom of the air inlet hood to the mounting surface.

Prior to installation, be sure that the method of support is in agreement with all local building codes. For both indoor and outdoor installations, check for service platform requirements. If an outdoor system is being installed with bottom discharge and/or return air, a full perimeter roof curb is recommended.

5.0 Mounting (cont'd)

5.1 Weights

NOTE: Net weights are approximate for the standard system. Optional equipment is not included.

Net Weight of Basic Model RDF System								
Sizes	1-20	1-40	1-50	1-65	2-80	2-120	3-180	3-260
lbs	915	925	935	950	1455	1505	2410	2480
kg	415	420	424	431	670	683	1093	1125

5.2 Rigging

All units are mounted on a full curb cap base furnished with four lifting lugs for attaching rigging. To prevent damage to the cabinet, use spreader bars with the rigging chains.

5.3 Mounting on Field-Supplied Supports

The system is equipped with a load-bearing curb cap which forms an integral part of the unit. The curb cap provides required clearance from combustibles. Whether the system is being mounted directly on a surface or being placed "up" on additional structure, the horizontal length must be supported by two 4x4 treated wooden rails. Refer to **FIGURE 2** for the appropriate lengths and spacing. When the system is placed on the rails, the curb cap "skirt" must fit over the edge of the boards with the rails setting inside the horizontal length of the curb cap.

If the rails are laid directly on the mounting surface, position them as shown in **FIGURE 3**. Set the system on the rails leaving the "ends" underneath open for ventilation.

If the wooden rails are not placed directly on a surface, cross-supports should be placed underneath the rails at the ends and at the cabinet "joint". Refer to **FIGURE 3**.

IMPORTANT NOTE: Mount an outdoor unit with a minimum of 14" clearance from the bottom of the inlet air hood to the mounting surface.

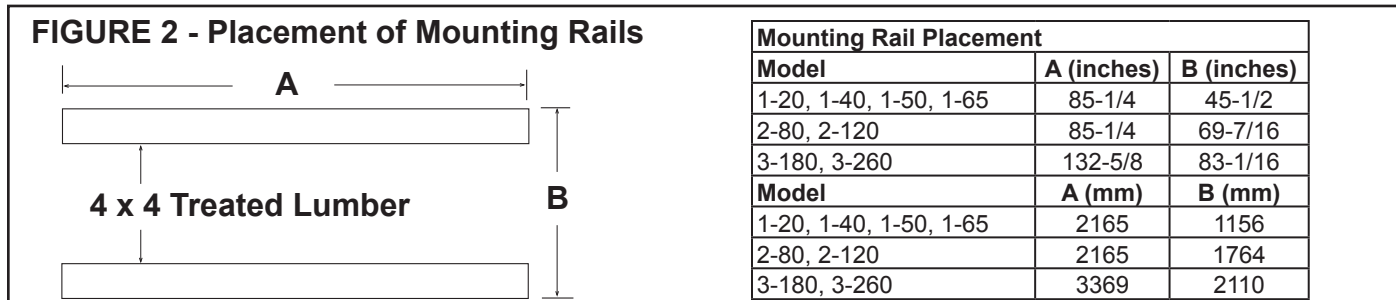
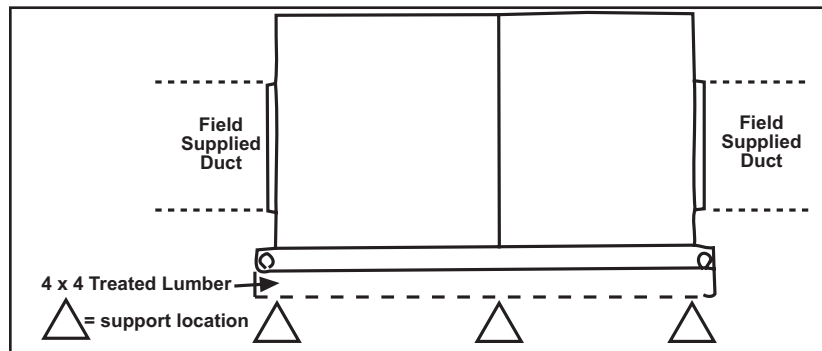


FIGURE 3 - Cross Support Mounting Requirements



5.4 Mounting on a Roof Curb

CAUTION: Before installing curb, recheck to be sure that the correct curb has been ordered. Be sure that the curb selected matches the unit ordered. Verify the dimensions of the curb received with the dimension table in **FIGURE 4**.

Roof Curb Dimensions for Model RDF Series 3

Whether the roof curb is Option CJ3 designed for the system or a field-supplied curb, the roof curb dimensions in **FIGURE 4** and the ductwork opening dimensions in **FIGURE 6** apply.

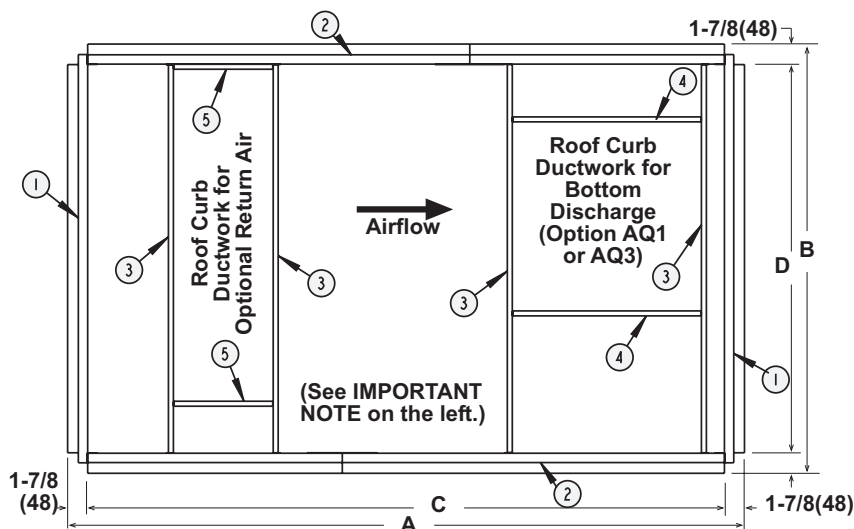
The roof curb designed for the system includes dividers that will create internal ductwork and duct connection flanges for ease of installation and so that the building ductwork can be attached before the system is set on the roof curb.

FIGURE 4 - Dimensions of Optional Roof Curb (Option CJ3) - Shipped Separately

IMPORTANT NOTE:

Area enclosed by roof curb must comply with clearance to combustible materials. If the roof is constructed of combustible materials, area within the roof curb must be ventilated, left open, or covered with non-combustible material which has an "R" value of at least 5. If area within curb is left open, higher radiated sound levels may result.

NOTE: Drawing is not proportional for all sizes.



Roof Curb Dimensions ($\pm 1/8"$ or 3mm) and Approximate Weights						
Sizes	1-20-3, 1-40-3, 1-50-3, 1-65-3	2-80-3, 2-120-3	3-180-3, 3-260-3			
	inches	mm	inches	mm	inches	mm
A	84-5/8	2149	84-5/8	2149	131-3/4	3346
B	43-5/8	1108	67-9/16	1716	82-1/16	2084
C	80-7/8	2054	80-7/8	2054	128	3251
D	39-7/8	1013	63-13/16	1621	78-5/16	1989
Height	16 inches (406 mm)					
Weight	171 lbs (78 kg)		224 lbs (102 kg)		307 lbs (139 kg)	

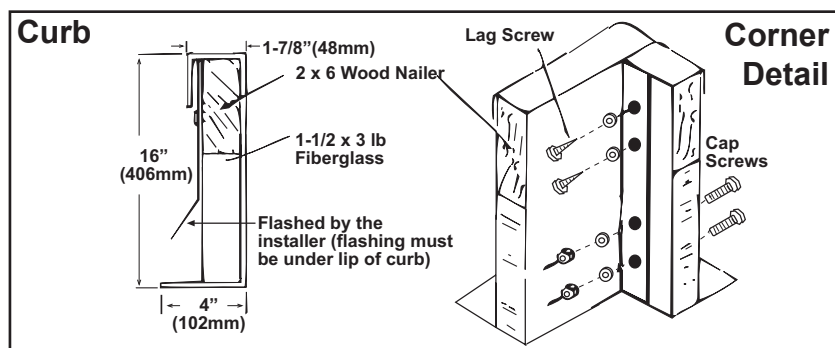
Components in Option CJ3 Roof Curb (Refer to FIGURE 4 to identify the Item)

Components in Roof Curb Option CJ3		
Roof Curb Frame and Internal Ductwork Dividers (See FIGURE 4.)		
Item	Qty	Description
1	2	Curb Front and Back Assemblies
2	2	Curb Side Assemblies
3	4	Full Width Curb Dividers -- two (2) for bottom discharge supply air duct opening and two (2) for optional return air duct opening
4	2	Cross Dividers for Bottom Discharge Supply Air Opening
5	2	Cross Dividers for Optional Return Air Opening
Roof Curb Corner Hardware		
For Top Two "Holes"	8	5/16" x 1" Lag Screws, P/N 16243
	8	5/16" Lockwasher, P/N 1333
For Bottom Two "Holes"	8	5/16" x 3/4" Hex Head Cap Screw, P/N 16247
	8	5/16" Lockwasher, P/N 1333
	8	5/16-18 Hex Nut, P/N 1035
Hardware to Assemble and Attach Dividers to make Ductwork Openings		
Qty of 64	#10 Sheetmetal Screws, P/N 11813	

Roof Curb Installation Instructions

1. If installing an Option CJ3 curb, follow these instructions. If installing a field-supplied curb, the curb must be level and must be sealed to the system curb cap.
2. Position the roof curb end assemblies and side assemblies as shown in the drawing in **FIGURE 4**. Fasten with bolts and lag screws as illustrated in the corner detail (**FIGURE 5**).

FIGURE 5 - Option CJ3 Roof Curb Cross Section and Corner Detail



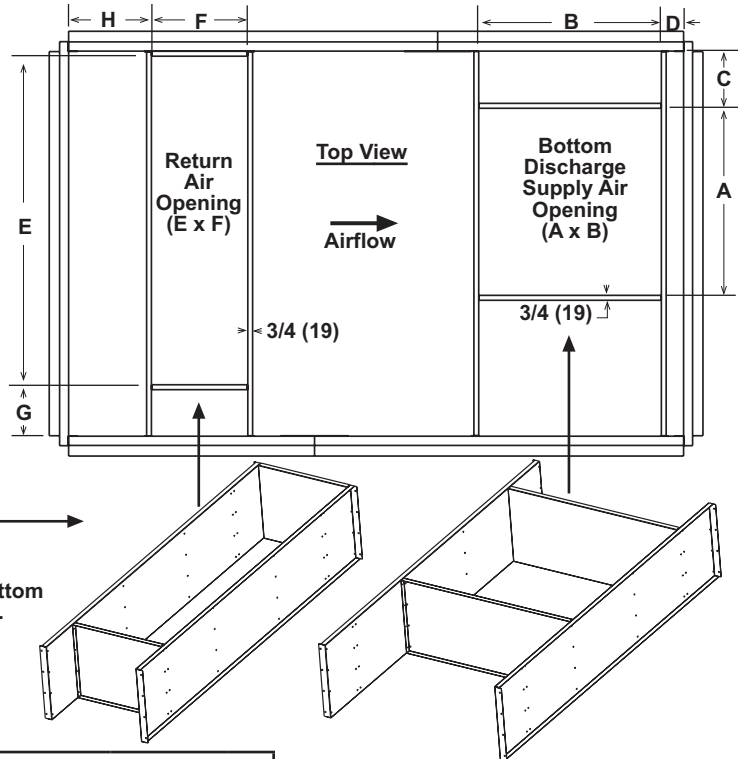
5.0 Mounting (cont'd)

5.4 Mounting on a Roof Curb (cont'd) Roof Curb Installation Instructions (cont'd)

FIGURE 6 - Divider Locations for Bottom Ductwork Openings

NOTES:

- Drawing is not proportional for all sizes.
- 3/4" (19mm) measurement is the width of the flanges where the roof curb mates with the heater. Flange surface must be sealed.
- When cutting duct openings in the roof, cut opening(s) 1" (25mm) larger than duct size opening for installation clearance.



Roof Curb Duct Opening Dimensions ($\pm 1/8"$ or 3mm)							
Sizes	1-20, 1-40, 1-50, 1-65		2-80, 2-120		3-180, 3-260		
	inches	mm	inches	mm	inches	mm	
A	23-11/32	593	28-13/32	722	38	965	A
B	20-1/8	511	28-11/32	720	38	965	B
C	5	127	13-15/32	342	11-19/32	294	C
D	10-1/4	260	7	178	4-5/8	17	D
E	25-1/2	648	54-11/16	1389	66-3/4	1695	E
F	11-1/2	292	17-23/32	432	20-1/16	510	F
G	11-15/32	291	8	203	10-15/32	266	G
H	11-1/32	280	11-3/32	282	17-1/4	438	H

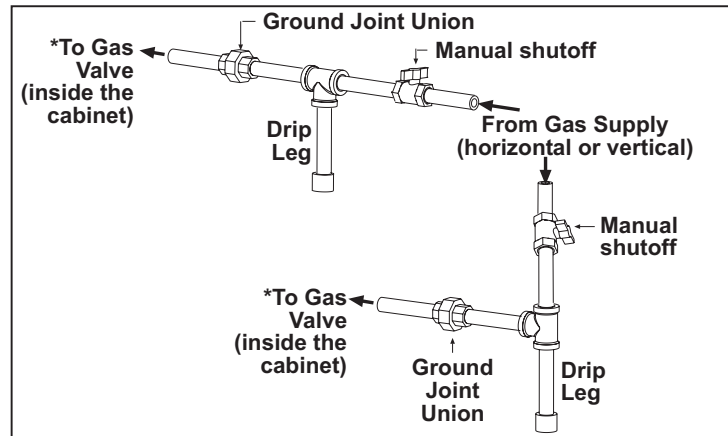
3. If the system has a bottom discharge and/or a return air inlet, use the sheetmetal screws to sub-assemble the dividers. Refer to the dimensions in **FIGURE 6** to appropriately position the roof curb dividers to create the needed duct opening flanges. Attach the dividers to the roof curb with sheetmetal screws. **NOTE:** If the system does not have a bottom discharge and/or a return air opening, the dividers for an opening that is not going to be used may be installed but are not required.
4. Check the assembly for squareness. The curb must be adjusted so that the diagonal measurements are equal within a tolerance of $\pm 1/8"$.
5. Level the roof curb. To ensure a good weatherproof seal between the unit curb cap and the roof curb, the roof curb must be leveled in both directions with no twist end to end. Shim as required and secure curb to the roof deck before installing flashing.
6. Install field-supplied flashing.
7. Before placing the RDF unit on the curb, apply furnished 1/4" x 1-1/4" foam sealant tape to the top perimeter surface of the curb, making good butt joints at corners. The sealant tape must be applied to the curb rails to prevent water leakage into the curb area due to blown rain and capillary action. Also place the foam sealant tape on the perimeter of the top surface of the duct opening(s), being sure to make good butt joints at corners. If installing ductwork from the top, it is recommended that tape be put on again after the ductwork is "dropped in", sealing below and above the duct flanges.

6.0 Mechanical

FIGURE 7 - Gas Supply Connection

6.1 Gas Piping and Pressures

All piping must be in accordance with the requirements of the National Fuel Gas Code ANSI/Z223.1 (latest edition) or CSA B149.1 and B149.2. Gas supply piping installation must conform with good practice and with all local codes. Read this section of the installation manual to determine the minimum gas supply pressure required to provide a maximum gas capacity. Minimum gas supply pressure is also stated on the heater rating plate. The heater manifold terminates at the gas supply connection with a black iron pipe union. See **FIGURE 7**. Local codes may require a 6" condensate trap. Gas connection is either 1", 1-1/4", or 2" depending on the size of the system.



WARNING: High pressure testing of supply lines is acceptable, provided the supply line has been disconnected from the unit and the pipe end is capped. See Hazard Levels, page 2.

Gas Supply Piping

Capacity of Piping - Cubic Feet per Hour based on 0.3" w.c. Pressure Drop														
Specific Gravity for Natural Gas -- 0.6 (Natural Gas -- 1000 BTU/Cubic Ft)														
Specific Gravity for Propane Gas -- 1.6 (Propane Gas -- 2550 BTU/Cubic Ft)														
Length of Pipe	Diameter of Pipe													
	1"		1-1/4"		1-1/2"		2"		2-1/2"		3"		4"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
20'	350	214	730	445	1100	671	2100	1281	3300	2013	5900	3599	12000	7320
30'	285	174	590	360	890	543	1650	1007	2700	1647	4700	2867	9700	5917
40'	245	149	500	305	760	464	1450	885	2300	1403	4100	2501	8300	5063
50'	215	131	440	268	670	409	1270	775	2000	1220	3600	2196	7400	4514
60'	195	119	400	244	610	372	1105	674	1850	1129	3250	1983	6800	4148
70'	180	110	370	226	560	342	1050	641	1700	1037	3000	1830	6200	3782
80'	170	104	350	214	530	323	990	604	1600	976	2800	1708	5800	3538
90'	160	98	320	195	490	299	930	567	1500	915	2600	1586	5400	3294
100'	150	92	305	186	460	281	870	531	1400	854	2500	1525	5100	3111
125'	130	79	275	168	410	250	780	476	1250	763	2200	1342	4500	2745
150'	120	73	250	153	380	232	710	433	1130	689	2000	1220	4100	2501
175'	110	67	225	137	350	214	650	397	1050	641	1850	1129	3800	2318
200'	100	61	210	128	320	195	610	372	980	598	1700	1037	3500	2135

Note: When sizing supply lines, consider possibilities of future expansion and increased requirements. Refer to National Fuel Gas Code for additional information on line sizing.

WARNING: All components of the gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME.

Supply Pressure Requirement by Manifold Option

These direct-fired makeup air systems are designed to operate on a natural gas supply differential pressure range of a minimum of 4.3-5.0" w.c. plus the manifold pressure drop. Maximum supply pressure depends on specific unit firing rate and manifold selection. If the natural gas supply pressure is above the maximum allowed, it is necessary to install a field-supplied step-down gas regulator in the supply line. Order and install the appropriate Gas Regulator Kit, Option CZ1 (1") or CZ2 (1-1/2"). These kits include spring-loaded, lockup type regulators that comply with national and local codes specifying that type of regulator. Follow the instructions provided with the kit. Measure the gas pressure between the step-down regulator and the unit.

Maximum Supply Pressure by Manifold

Manifold Option BM75, BM76, BM77 - 1/2 psi

Manifold Option BM78, BM79 - 2 psi

Manifold Option BM80, BM81 - 5 psi

6.0 Mechanical (cont'd)

6.1 Gas Piping and Pressures (cont'd) Supply Pressure Requirement by Manifold Option (cont'd)

Minimum Supply Gas Pressure ("w.c.) for Full Fire																
Manifold Option	BM75				BM76		BM77		BM78		BM79		BM80		BM81	
with Gas Control Option	AG1		AG3		AG 30, 31, 32, 33, 36, 37, 47, 48, or 51											
Manifold Size	1"		1"		1"		1"		1"		1-1/4"		1-1/4"		2"	
MBH	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro
250	4.0	1.4	4.0	N/A	4.1	1.6	4.3	1.5	4.4	1.6	4.6	1.6	4.5	1.6	5.1	1.8
500	5.3	1.9	5.0	N/A	5.8	2.3	6.2	2.2	6.0	2.3	5.2	1.9	5.0	1.7	5.3	1.9
750	7.5	2.7	6.8	N/A	8.5	3.3	9.5	3.3	8.4	3.3	6.1	2.3	5.7	2.0	5.5	1.9
1000					12.4	4.7			11.7	4.6	7.4	2.8	6.7	2.4	5.8	2.1
1250											9.1	3.5	8.0	2.9	6.2	2.2
1500											11.2	4.3	9.6	3.5	6.6	2.4
1750											13.6	5.3	11.5	4.2	7.2	2.6
2000											16.5	6.3	13.7	5.0	7.8	2.8
2500											23.3	8.9	18.9	7.0	9.4	3.4
3000															11.3	4.1

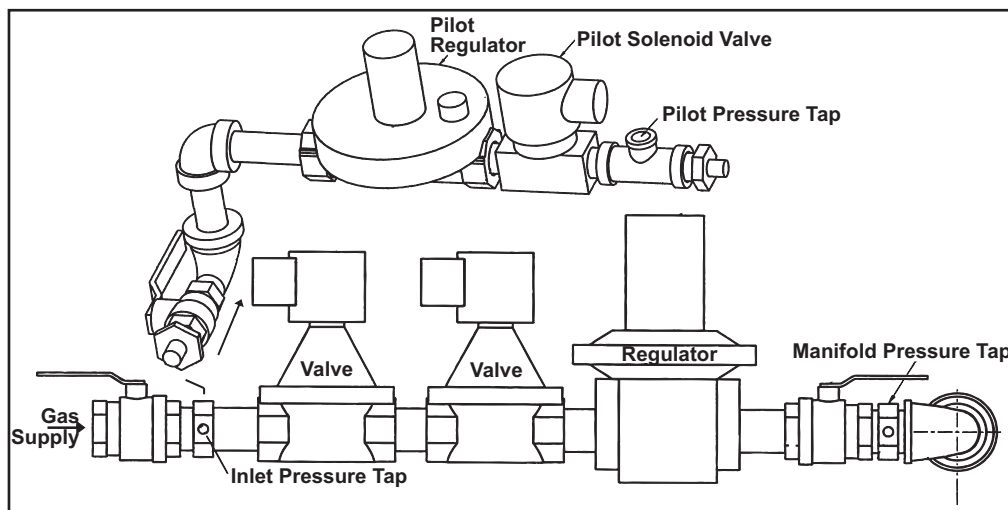
Pilot Supply Pressure

These systems are designed to operate on a natural gas pilot supply pressure of 3.5" w.c. or propane gas of 6.0" w.c. Measure both operating pressure and pilot supply pressure with the blower in operation.

Manifold Pressure

Manifold pressure is defined as the gas pressure as measured at the burner pressure tap. Measure manifold gas pressure with the blowers operating. Minimum gas pressure at the burner is typically 4.3" w.c. for natural gas or typically 1.5" w.c. for propane gas. High gas pressure switches included in the gas train monitor gas pressure downstream

FIGURE 8 - Pressure Tap Locations for Measuring Manifold and Pilot Pressure



Gas Pressure Switches

from the safety valves. If the gas pressure at this point on a system equipped with a high gas pressure switch (standard with Manifolds BM 78, 79, 80, and 81 or Option BP2 with other manifolds) exceeds the setpoint, the switch will open the electrical circuit to the burner, stopping all gas flow. The high gas pressure switch is a manual 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: Model RDF units manufactured prior to April 1993 installed indoors with optional gas pressure switches require a 3/4" vent line to the outdoors. Beginning with units manufactured April 1993, the gas pressure switches incorporate a vent limiting device and do not require venting to the outdoors.)

6.2 Unit Inlet Air

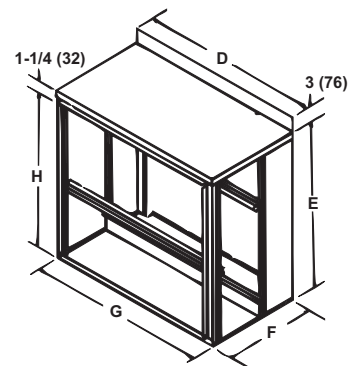
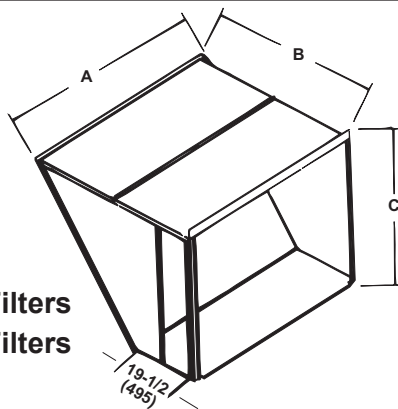
6.2.1 Outside Air Hood or Indoor Filter Cabinet

FIGURE 9 - Dimensions and Weights

Option AS2, Outside Air Hood

Option AS6, Outside Air Hood with 1" Filters

Option AS7, Outside Air Hood with 2" Filters



Option AW3, Indoor Filter Cabinet with 1" Filters

Option AW6, Indoor Filter Cabinet with 2" Filters

Dimensions						
Size	1-20, 1-40, 1-50, 1-65		2-80, 2-120		3-180, 3-260	
	inches	mm	inches	mm	inches	mm
A	38	965	62	1575	74-1/4	1886
B	55	1397	54	1372	64	1626
C	36	914	47-1/2	1207	61-3/8	1559
D	35-9/16	903	59-9/16	1513	71-9/16	1818
E	33-1/8	841	44-5/8	1133	58-1/2	1486
F	19-1/2	495	19-1/2	495	19-1/2	495
G (Duct Connection)	32-15/16	837	56-15/16	1446	69-3/8	1762
H (Duct Connection)	30-3/8	772	41-7/8	1064	57-7/16	1459

Weights and Filter Sizes

Model Sizes	Filtr Qty	AS6, AW3	AS7, AW6	AS2		AS6		AS7		AW3		AW6	
		Filter Size		lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1-20, 1-40, 1-50, 1-65	3	12x35x1	12x35x2	225	102	250	113	270	122	100	45	120	54
2-80, 2-120	4	12x35x1	12x35x2	310	141	350	159	380	172	150	68	180	82
	4	12x24x1	12x24x2										
3-180, 3-260	12	12x35x1	12x35x2	400	181	450	204	490	222	200	91	240	109

Installation Instructions for Optional Screened Air Hood for Outdoor Units (Options AS2, AS6, AS7) and Filter Sections for Indoor Units (Options AW3, AW6)

CAUTION: It is recommended that the inlet to the outside air hood NOT be facing into prevailing wind.

All of these air inlet accessories are designed to be attached directly to the system cabinet. To prevent damage, it is recommended that the system be set in its permanent location before installing the air hood or filter cabinet option. All are shipped separately; installation requirements depend on the size (see below).

Provide a minimum of 14" (356mm) clearance from the bottom of the air hood to the mounting surface.

Hood and Filter Cabinet Options by ITEM and Application				
Item	Options	Description	For Sizes	Installation Requirements
1	AS2, AS6, AS7	Outdoor Screened Air Hood with & without filters	1-20, 1-40, 1-50, 1-65, 2-80, 2-120	Factory Assembled; Field Installed - Follow instructions below.
2	AS2, AS6, AS7	Outdoor Screened Air Hood with & without filters	3-180, 3-260	Field Assembled and Installed - Follow instructions pages 12 to 15.
3	AW3, AW6	Indoor Filter Cabinet with Filters	All	Factory Assembled; Field Installed - Follow instructions below.

Installation STEPS for ITEMS 1 and 3 in the Table above - Refer to FIGURE 10.

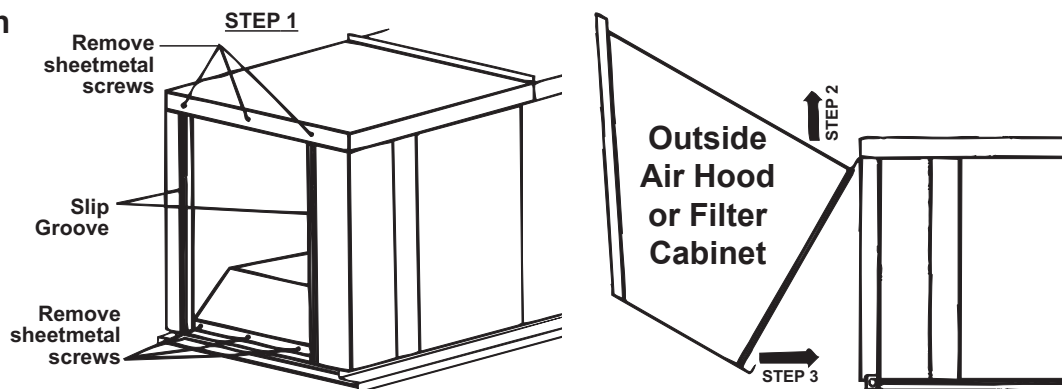
- 1) Remove the sheetmetal screws from the bottom rear inset and across the top rear of the cabinet.
- 2) Align edges of assembly to the slip grooves. Slide top edge of assembly under the lip formed by the top rear of the cabinet.
- 3) Rotate the inlet assembly so that it fits into the recess across the bottom of the cabinet. Replace all screws removed in Step 1.
- 4) If the system has filters with an optional dirty filter light, follow the instructions beginning on page 18 to attach the sensing tubes.

6.0 Mechanical (cont'd)

6.2 Unit Inlet Air (cont'd)

6.2.1 Outside Air Hood or Indoor Filter Cabinet (cont'd)

FIGURE 10 - Attach factory assembled Cabinet or Hood



Assembly and Installation Instructions for **ITEM 2** in the Table on page 11 - Refer to FIGURES 11A-11N.

Option AS2, Outdoor Screened Air Hood without Filters - **Pkg P/N 71150**

Option AS6, Outdoor Screened Air Hood with 1" Filters - **Pkg P/N 71152**

Option AS7, Outdoor Screened Air Hood with 2" Filters - **Pkg P/N 72627**

Option Components (qty in parenthesis)	AS2	AS6	AS7
Top of Inlet Hood Cabinet Section		(1) 91575	
Top of Inlet Hood		(1) 91576	
Clamp for Top Seam (Hood to Cabinet)		(1) 91577	
Bottom of Hood Cabinet Section		(1) 91567	
Supports (2 pieces per leg)		(6) 91581	
Left Side of Hood		(1) 91568	
Right Side of Hood		(1) 91569	
Intermediate Posts - Cabinet Section		(2) 91578	
Rt/Lft Corner Post - Cabinet Section		(2) 91579	
Doors (Filter Access on AS6 and AS7)		(2) 91585	
Center Louver Top/Bottom Supports		(2) 91582	
Factory-assembled Louver Sections w/Screen		(2) 113003	
Top and Bottom Filter Channels	N/A	(2) 91580	(2) 94224
Pre-assembled Center Filter Channels	N/A	(5) 91586	(5) 94223
Top/Btm Filter Block Off Plate	N/A	(2) 91584	(2) 98764
Filter Block Off Sections	N/A	(6) 263784	(5) 263784
Permanent Filters	N/A	(12) 1", 87251	(10) 2", 94383
Sheetmetal Screws #10 x 1/2" long		(100) 11813	
Screws 1/4-20 x 5/8" long (bolt type)		(15) 10393	
Hex Nuts 1/4-20 (Keps)		(15) 7328	
Sheetmetal Screws #14-110 x 3/4" long		(3) 41463	
J Type Clip-On Nut		(5) 1849	

1. **Screened Air Inlet Hoods with Filters** (Options AS6 and AS7 for Sizes 3-180, 3-260) - Build filter racks and cabinet section; **follow all Steps**.

Screened Air Inlet Hood without Filters (Option AS2 for Sizes 3-180, 3-260) - Build cabinet section; skip Steps 1A, 1B, and 1C. **Start with Step 1D** ignoring filter rack illustrations.

Step 1A - Assemble Inner Side of Filter Rack (Applies to Options AS6 and AS7 only; for Option AS2 without filters, proceed to Step 1D)

Parts Required -- Right corner post, left corner post, three of the five pre-assembled center filter channels, and twelve 1/2" long screws

Corner posts come with two sets of holes.

For 1" filters (Option AS6), attach the three filter channel assemblies using the holes in the corner posts closest to the inside.

For 2" filters (Option AS7), attach the three filter channel assemblies using the holes in the corner posts closest to the outside edge.

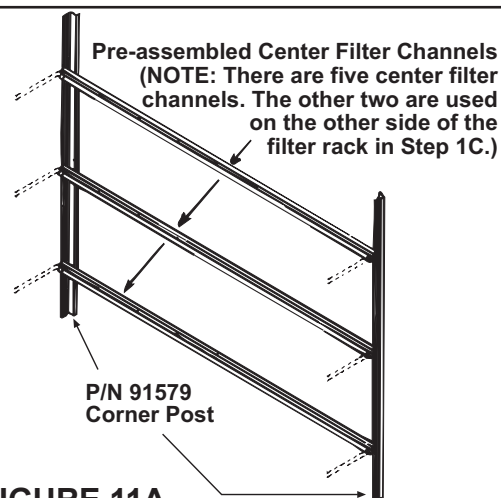


FIGURE 11A

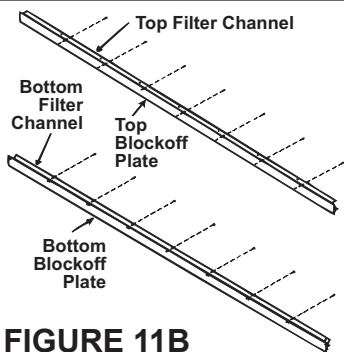


FIGURE 11B

Step 1 B - Sub-assemble Top and Bottom Filter Channels and Filter Blockoff Plates (AS6 & AS7)

Parts Required - Top and bottom filter channel; top and bottom filter blockoff plates; and 14 screws (1/2" long)

Assemble the top blockoff plate and the top filter channel being sure the filter channel groove is on the same side as the 90° bend in the blockoff plate but directed away from it. Use seven screws to attach the top blockoff plate to the top filter channel. Repeat the process with the bottom filter channel and bottom blockoff plate.

Step 1C - Assemble Outer Side of Filter Rack (Options AS6 and AS7 only)

Parts Required - Two intermediate posts; two remaining pre-assembled center filter channels; the top and bottom filter channel/blockoff plate assemblies from Step 1B; and 12 sheetmetal screws (1/2" long)

For 1" filters (Option AS6), attach the channel assemblies to the holes closest to the inside of the intermediate posts.

For 2" filters (Option AS7), attach the channel assemblies to the holes closest to the outside edge of the posts.

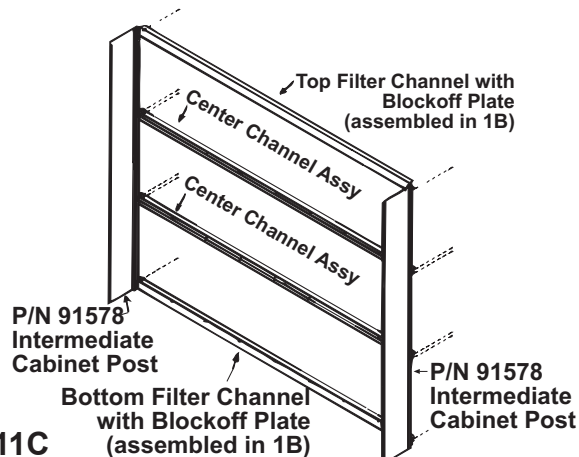


FIGURE 11C

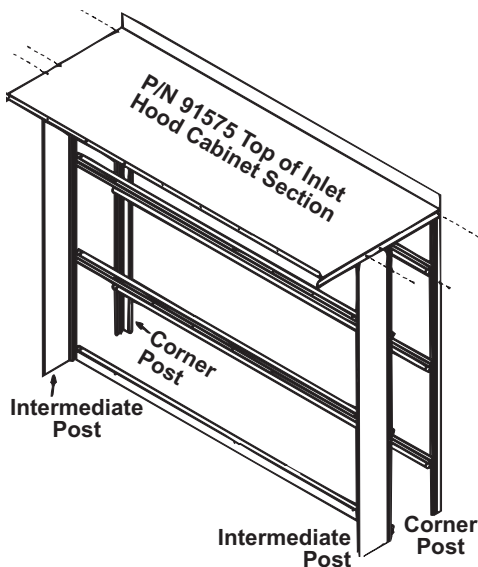


FIGURE 11D

Step 1D - Attach Cabinet Section To Corner Posts and Intermediate Posts (Options AS2, AS6, AS7)

Parts Required - Cabinet top; the two corner cabinet posts (if inlet hood with filters, posts will be sub-assembled to filter channels - Step 1A) (if AS2 with no filters, ignore illustrated filter rack); the two intermediate cabinet posts (if inlet hood with filters, posts will be sub-assembled to filter channels - Step 1C); and six 1/2" long sheetmetal screws. Attach cabinet section top to the four posts as illustrated.

Step 1E - Attach Cabinet Section Bottom

Parts Required - Subassembly from Step 1D; cabinet section bottom; and six 1/2" sheetmetal screws.

Position the cabinet section bottom to the inside of the four posts (corners). Attach as illustrated.

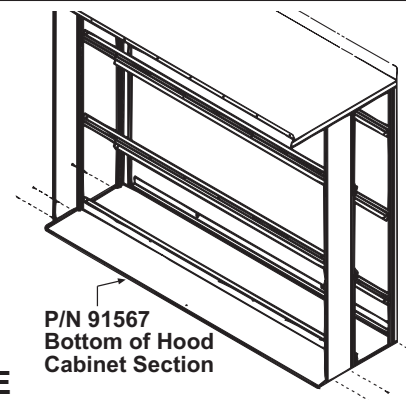


FIGURE 11E

2. Assemble and Install Support Legs

Step 2A - Sub-assemble Legs

Parts Required - Six support leg halves and six 5/8" bolts and nuts

Assemble support legs as illustrated. Adjust legs to shortest length and tighten bolts finger tight. Length of supports will be re-adjusted to suit the application after cabinet is installed.

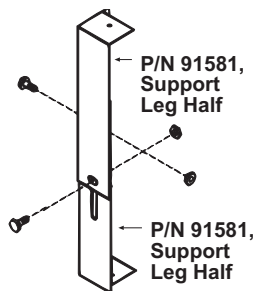


FIGURE 11F

Step 2B - Install Support Legs

Parts Required - Three sub-assembled legs and three 3/4" sheetmetal screws

Attach leg assemblies to cabinet bottom.

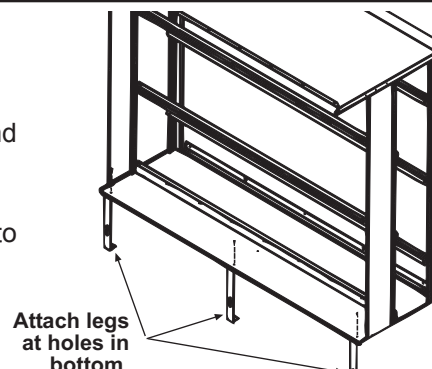


FIGURE 11G

6.0 Mechanical (cont'd)

6.2 Unit Inlet Air (cont'd)

6.2.1 Outside Air Hood or Indoor Filter Cabinet (cont'd)

Assembly and Installation Instructions for ITEM 2 in the Table on page 11 (cont'd)

3. Attach Assembled Cabinet Section

Step 3 - Attach Filter Cabinet to System

On the air inlet opening side of the system cabinet, remove the sheetmetal screws from the bottom rear inset and the screws across the top edge.

Align the edges of the inlet hood cabinet section with the grooves in the system cabinet. Slide top edge of the inlet hood cabinet section underneath the edge of the system cabinet top.

Rotate the assembly so that it fits into the recess across the bottom of the cabinet opening. Attach by replacing the two corner screws and one center screw across the top, the three screws across the bottom, and one halfway up on each side as illustrated.

Adjust the support legs to the appropriate height and tighten bolts securely.

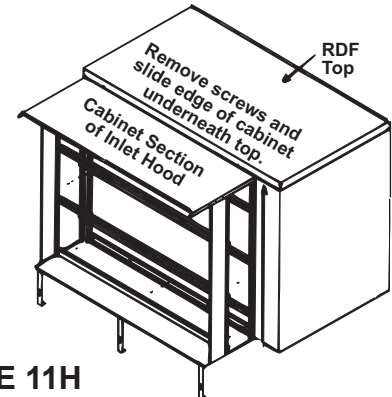


FIGURE 11H

4. Assemble Air Inlet Hood Section

Step 4A - Attach Hood Sides

Parts Required - Right and left triangular shaped sides and 18 sheetmetal screws (1/2" long)

Attach the sides to the intermediate posts and bottom panel of the installed cabinet section.

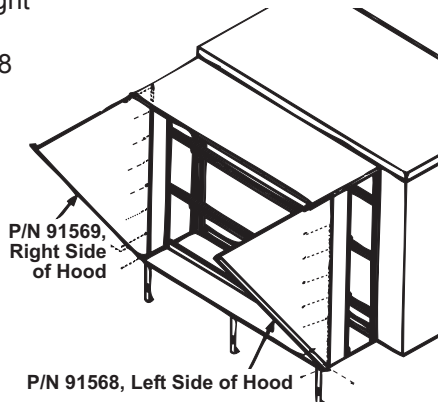


FIGURE 11J

Step 4B - Attach Hood Section Top

Parts Required - Hood section top and ten 1/2" long screws

Attach hood section top as illustrated.

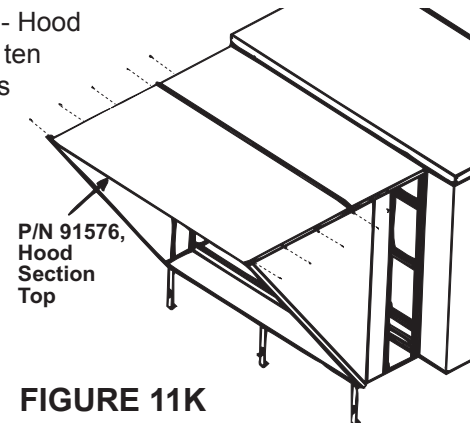


FIGURE 11K

Step 4C - Install Top Clamp

Parts Required - Top clamp and nine 5/8" long screws (bolt type) and nuts

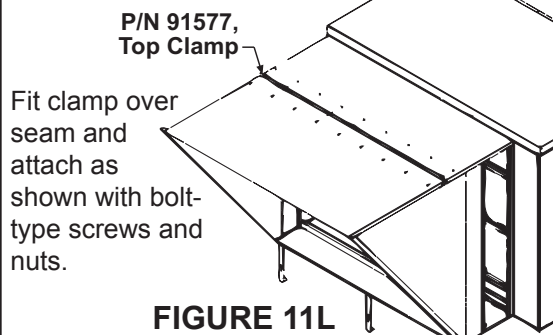


FIGURE 11L

Step 4D - Install Center Louver Supports

Parts Required - Center louver supports and four 1/2" long screws

At the holes in the center of the top and bottom of the hood, use the screws to attach the center louver supports inside the hood.

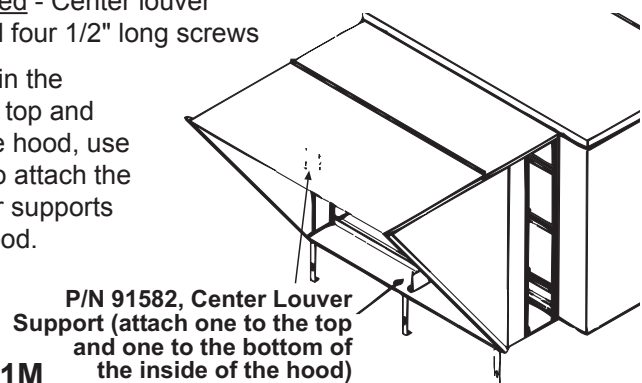


FIGURE 11M

Step 4E - Install Louvers

Parts Required - Two factory-assembled louver sections; 19 screws (1/2" long); and five Tinnerman clips

Position one louver section in the left side of the hood; attach it to the hood side and the center supports. Install the other louver section in the right side. In the center, join the two louver sections with five screws and clips.

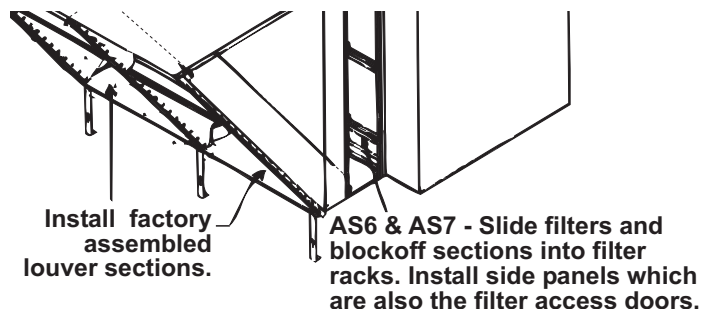


FIGURE 11N

Step 5. - Install Filters, Block Off Sections and Door Panels

On hoods with filters, position filters and blockoffs on filter racks.

If the system has an optional dirty filter switch, follow the instructions on page 19 to connect the sensing tubes. Slide the "door" panels into position on each side of the cabinet section. Fasten each panel with two 1/2" long screws.

6.2.2 Evaporative Cooling Module

If installing an evaporative cooling module, it is shipped separately. Follow the instructions in the manual with the evaporative cooling module.

6.3 Supply Air Discharge

Distribution of Makeup Air

Makeup air can be introduced to the building either through distribution ducts or through controlled pressurization with little or no ductwork. Makeup air should be introduced and maintained using the lowest possible air velocity. With ductwork distribution, this is accomplished using a multiplicity of discharge openings over the greatest centerline distance. When a makeup air system is automatically controlled to maintain a set building pressure, the entering air will travel naturally toward the relief areas at the perimeter walls using the building structure as the distribution ductwork.

Makeup air should enter at the highest point practical. By doing this, the fresh air will entrain dust laden air at the ceiling and move it toward the point of exhaust. Also, fresh air directed downward from the roof or ceiling will mix with hot ceiling air resulting in improved distribution of heat in the building.

Always introduce fresh makeup air so that it moves across the greatest distance within the room or building before reaching an exhaust.

Proper sizing of warm air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for such information is the Air Conditioning Contractors Association, 1228 17th Street, N.W., Washington, DC 20036. A manual covering duct sizing in detail may be purchased directly from them.

- ☐ The type of duct installation depends in part on the type of construction of the roof (wood joist, steelbar joist, steel truss, pre-cast concrete, etc.) and the ceiling (hung, flush, etc.).
- ☐ Rectangular ducts should be constructed of not lighter than No. 26 U.S. gauge galvanized iron or No. 24 B&S gauge aluminum.
- ☐ All duct sections 24" or wider, and over 48" in length, should be cross-broken on top and bottom and have seams or angle-iron braces. Joints should be S and drive strip or locked.
- ☐ Warm air ducts should not contact masonry walls. Insulate around all air ducts through masonry walls with not less than 1/2" of insulation.
- ☐ Insulate all exposed warm air ducts passing through an unheated space with at least 1/2" thickness of insulation.
- ☐ **Duct Supports** - Suspend all ducts securely from adjacent building members. Do not support ducts from unit duct connections.
- ☐ **Duct Connections** - At the heater, use a flexible canvas connection on indoor units to eliminate vibration transmission.
On outdoor roof curb, down discharge connections, either drop an appropriate sized and flanged duct into the roof curb prior to setting the unit or attach ductwork to the bottom flange (using curb dividers as ductwork). If dropping ductwork from the top, it is recommended that the top perimeter be sealed above and below the added ductwork. Do not use screws. See ductwork connection locations and sizing, pages 7 and 8.

On outdoor horizontal installations, the ducts can be slid over the flange of the heater and then sealed for an airtight and watertight fit. On horizontal duct-to-heater connections and connections to the flanges at the bottom of the curb, use sheetmetal screws to fasten ducts to the heater flange.

Use stiffening flanges around the perimeter of all duct connections.

- ☐ **Return Air Duct** - The return air duct **must be sized for a pressure drop of .5" w.c. at 2440 fpm in order to balance the system.** If not sized properly, there may be difficulty in obtaining the desired airflow over the burner when the return air damper is full open.

Sizing and Installation of Distribution Ductwork

(See **FIGURE 1**, page 4, for duct opening dimensions.)

6.0 Mechanical (cont'd)

FIGURE 12 - Belt Tension

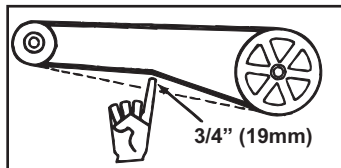
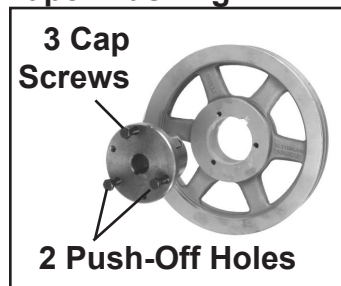


FIGURE 13 - Split Taper Bushing



6.4 Blowers, Drives, and Motors

Belt Tension - 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 belt tension by means of the adjusting screw on the motor base until the belt can be depressed 1/2" to 3/4" (**FIGURE 12**). Tighten the lock nut on the adjusting screw. Be sure the belt is aligned in the pulleys.

Motor and Belt Shipping Position for Sizes 2-80, 2-120, 3-180, 3-260 - To relieve tension on the motor mounting bracket, the belt(s) are taken off the motor and blower sheaves before shipping. The belt(s) are taped to the blower shaft to prevent loss or damage during shipment. Install the belt(s) and adjust for proper belt tension.

Blower Pulley - Size 2-80 and 2-120 systems equipped with 3 and 5 HP motors with a 15.4" diameter and larger blower pulley or a 7-1/2 HP and larger motor and all Size 3-180 and 3-260 systems are equipped with a split taper bushing in the blower pulley. The split taper bushings must be loosened in order to remove the pulley. Follow these instructions to loosen the bushing.

- 1) Notice that there are three cap screws in the bushing and two holes without screws, called push-off holes (See **FIGURE 13**).
- 2) Remove the three cap screws.
- 3) Put two of the cap screws into the two push-off holes. Tighten these two screws evenly until the pulley is loosened.
- 4) Pulley may now be removed from the shaft.

Blower Speed Adjustment - Units are set at the factory for the RPM required to meet the CFM and external static pressure specified on the order. If the estimated external static is incorrect, or changes are made to the duct system, the blower RPM may have to be changed. Motors are equipped with adjustable pitch pulleys which permit adjustment of blower speed. Instructions are included in Paragraph 9.0, Check-Test-Start for adjusting blower speed.

Blower Rotation - Each blower housing is marked for proper rotation. Instructions for checking blower rotation are included in the startup procedures in Paragraph 9.0.

Motor Loads - Use an ammeter to check motor amps. Amps may be adjusted downward by reducing blower RPM or by increasing duct system static pressure. For accurate amps, read the motor manufacturer's rating plate; amps will vary depending upon motor manufacturer. The chart below can be used for sizing line wiring.

Blower Motor Full Load Amps (open motors)						
Motor HP	115V/1	230V/1	208V/3	230V/3	460V/3	575V/3
1/2	9.8	4.9	2.2	2.0	1.0	N/A
3/4	13.8	6.9	3.1	2.8	1.4	N/A
1	16.0	8.0	4.1	3.6	1.8	1.4
1.5	N/A	10.0	5.75	5.2	2.6	2.0
2	N/A	N/A	7.5	6.8	3.4	2.4
3	N/A	N/A	10.6	9.6	4.8	3.6
5	N/A	N/A	16.8	15.2	7.6	5.4
7.5	N/A	N/A	21.0	19.0	9.5	8.4
10	N/A	N/A	29.0	25.2	12.6	10.4
15	N/A	N/A	42.0	40.0	20.0	16.0
20	N/A	N/A	53.0	50.0	25.0	20.0
25	N/A	N/A	66.0	63.0	31.5	26.0
30	N/A	N/A	78.0	74.0	37.0	28.5

CAUTION: The motor amp chart lists full load amp requirement of standard motor and standard controls. Optional controls will increase amp requirement. Add motor amps and control amps for approximate unit full load amps. System FLA is shown on the rating plate.

7.0 Electrical Supply and Wiring

All electrical wiring and connections including electrical grounding **MUST** be completed in accordance with local, state and national codes and regulations and with the National Electric Code (ANSI/NFPA 70) or in Canada the Canadian Electrical Code Part 1 C.S.A. C.22.1.

Run a separate line voltage supply directly from the building electrical panel to the disconnect switch for the system. All external wiring must be within approved conduit and have a minimum temperature rise rating of 60°C. For motor load amps, see Paragraph 6.4 or check the motor nameplate. System FLA is on the rating plate.

Specific wiring diagrams and complete instructions are packed with each unit and should be kept readily accessible in legible condition.

Wire Gauge - 100 ft (30M) maximum								
Full Load Amps	5	10	15	20	25	30	35	40
Wire Gauge	14	14	12	10	8	8	6	6

CAUTION: If any of the original wire in the unit must be replaced, the replacement wire must have a temperature rating of at least 105°C except for controls mounted in the discharge airstream which must be 150°C. See Hazard Levels, page 2.

Disconnect Switch

A safety disconnect is required. Refer to **FIGURE 14** for recommended location and install the disconnect switch in accordance with Article 430 of the National Electrical Code ANSI/NFPA 70 or in accordance with Canadian Electrical Code Part 1-C.S.A. Standard C22.1. When attaching the disconnect switch to the heater, use hardware with "teeth" to provide electrical grounding. The "teeth" should face the disconnect switch, scratching off the painted surface. Attach the disconnect tightly against the heater cabinet. Run cable so that it does not interfere with cabinet panels or doors. When providing or replacing fuses in a fusible disconnect switch, use dual element time delay fuses and size according to 1.25 times the maximum total input amps.

Convenience Outlet Option

When a convenience outlet option is included, an individual power supply must be provided to the receptacle. This circuit **MUST** BE on a ground fault breaker to meet requirements. All wiring to the convenience outlet must meet National Electrical Code ANSI/NFPA No. 70 (latest edition) or the Canadian Electrical Code Part 1-C.S.A. Standard C22.1. and any local or utility codes that may apply.

Control Wiring

A 7/8" diameter opening suitable for watertight conduit connection is provided as the entrance of 24-volt control wiring to the electrical compartment. For location, see **FIGURE 14**, page 18. Low voltage wiring must be in individual conduit, separated from primary high voltage wiring.

Volts	Wire Gauge	Total Wire Length	Distance from Unit to Control
Control Wiring Maximum Lengths (ft)			
24	18	150	75
24	16	250	125
24	14	350	175
Control Wiring Maximum Lengths (M)			
24	18	45.7	22.9
24	16	76.2	38.1
24	14	106.7	53.3

CAUTION: Supply voltage and 24-volt control wiring cannot be installed in the same conduit. Maxitrol systems will be adversely affected if control wiring is in conduit with supply voltage wiring. If required, field-supplied wiring between any Maxitrol components must be completed with shielded wiring.

A 3-position control switch mounted in a 4x4 box is supplied with each system (exception - not included with systems with Option AG37 designed for computer control), either packed loose inside the unit, or if an optional control console (Option RC13 or RC14; See **FIGURE 15**) is ordered, the switch is mounted on the console.

Control wiring requirements depend on the options selected. Follow the custom wiring diagram supplied with the system to connect any remote controls. In this paragraph,

7.0 Electrical
Supply and
Wiring (cont'd)

Control Wiring (cont'd)

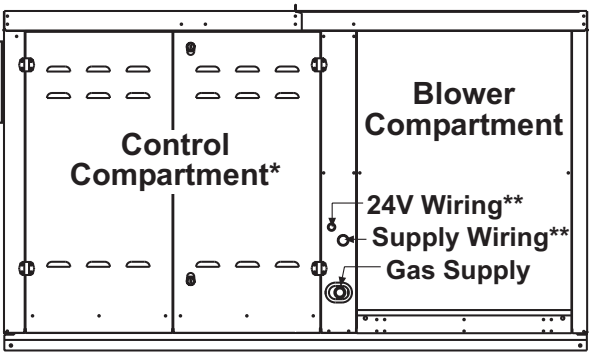
there is a brief description of the optional electrical controls used for airflow. Refer to the operation manual, Form O-ADF/RDF, for additional control information.

FIGURE 14 - Location of Gas Connection, Electrical Supply Connection, and Control Wiring Connections on RDF Series 3 Direct-Fired Systems

NOTES:

* RDF-2 and RDF-3 Series 3 systems have double hinged doors as illustrated. Control compartment on RDF-1 Series 3 systems has a single hinged door.
** Configuration shown is for RDF-2 and RDF-3 Series 3. The supply connection on the RDF-1 Series 3 systems is above the control wiring connection.

Disconnect
Switch
Location



Control Side

Remote Console

If ordered, the optional remote console is shipped separately. Remote consoles include terminal blocks for wiring. Depending on what gas control or inlet air options were ordered, the console could include a temperature selector and/or a potentiometer. If a dirty filter switch is ordered the indicator light is on the console. See FIGURE 15 for console size.

FIGURE 15 - Remote Console Dimensions

Technical Data of the Remote Console (Variations depend on options selected; consult custom wiring diagram for controls and to determine wiring required.)

Control Switch	Qty of Lights*	Temperature Selector**	Potentiometer***	Dimensions - inches (mm)		
				L****	H****	D
Yes	3	Yes	No	10-3/4 (273)	7-5/8 (194)	2-5/8 (67)
Yes	3	No	No	10-3/4 (273)	7-5/8 (194)	2-5/8 (67)
Yes	3	Yes	Yes	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)
Yes	3	No	Yes	10-3/4 (273)	7-5/8 (194)	2-5/8 (67)
Yes	4	Yes	No	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)
Yes	4	No	Yes	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)
Yes	4	Yes	Yes	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)
Yes	4	No	No	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)

* 3 - Blower On, Burner On, and Safety Lockout on both RC13 and RC14; 4th light is Dirty Filter Indicator on Option RC14 only

** On the console with Gas Control Options AG 31, 32, 33, 47, or 48

*** On the console with Air Control Options AR19 or AR22

**** Subtract 1" (25mm) when recessing

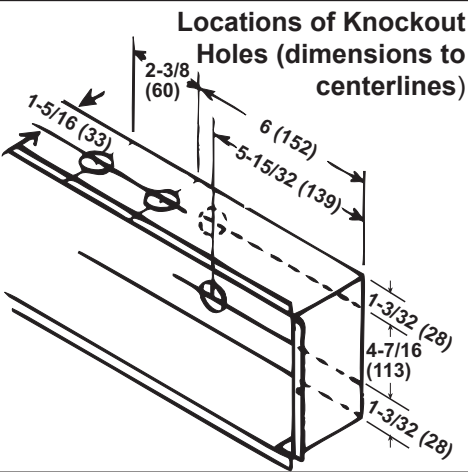


FIGURE 16 - Option RC14 with Dirty Filter Light and Potentiometer



Dirty Filter Light

When a console with a dirty filter indicator is selected, the remote console includes a fourth light (dirty filter indicator light). The light is activated by an adjustable, single-pole/normally open differential pressure switch that senses air pressure across the filter bank. There are field-installation procedures that must be done for the proper operation of the dirty filter indicator light.

Dirty Filter Light Installation Instructions

□ Before the system is operating, connect the sensing tubes from the switch to their sensing locations in the field-installed filter cabinet. (Cabinet installation instructions are in Paragraph 6.2.)

- 1) Run the tubes through the holes in the cabinet wall. Pull gently to extend the tubing to its entire length without stress.
- 2) Position the tubing approximately at the center of the height of the filter rack.
- 3) Identify the tube connected to the positive connection on the switch (FIGURE 17) as the positive pressure tube. Determine the length of tubing required to attach the positive pressure tube so that it will sense pressure at the inlet side of the filter rack.

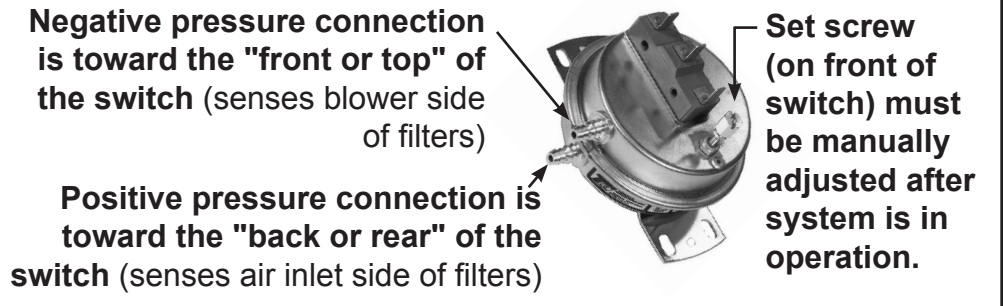
Identify the tube connected to the negative connection on the switch (FIGURE 17) as the negative pressure tube. Determine the length of tubing required to

attach the **negative pressure tube so that it will sense the pressure at the blower side** of the filter rack.

(NOTE: Tubing shipped is the same length for all sizes of systems; cut to the appropriate length for the smaller systems.)

- 4) If required, cut the tubing to the proper lengths. Using the clamps provided, attach the ends of the tubing to the filter rack at about center height being careful not to kink or compress the tubing.

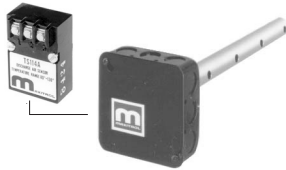
**FIGURE 17 - Dirty
Filter Pressure Switch**



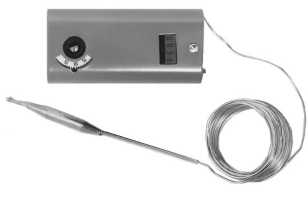
- **After the system is operating, the filter switch must be manually set.** With clean filters in place, blower doors closed, and blower in operation, increase the pressure setting by adjusting the set screw on the switch clockwise until the filter light is energized or the screw is bottomed out. At that point, adjust the set screw three full turns counterclockwise or until the screw is top ended. At that setpoint, the filter light will be activated at approximately 50% filter blockage.

8.0 Controls

**FIGURE 18 -
Discharge Sensor
and Mixing Tube**



**FIGURE 19 - Control
used for Outside Air
Cutoff and
Discharge
Temperature Low
Limit (Freezestat)**



Discharge Sensor (Maxitrol) for Gas Control Options AG30, AG31, AG32, AG33, AG47, AG48 - A discharge sensor may be shipped separately for field installation. Attach the discharge sensor and mixing tube in the ductwork about six feet (1.8 M) from the discharge opening of the system.

The sensor housing is not waterproof. If the installation is outdoors, field-fabricate a waterproof protective enclosure for the discharge sensor, being careful not to affect its air temperature sensing capability. If the ductwork is insulated, be sure that the sensing bulb is mounted so that it is fully exposed to the airstream being sensed.

Refer to the wiring diagram and connect the sensor to the terminal strip in the blower section electrical box. Use shielded wire to alleviate any electrical interference that may cause an erroneous discharge temperature reading.

Outside Air Cutoff Control (Option BN2) - 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 cutoff (high ambient 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 this 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;
- would shutdown completely only on Option BN2 control, once burner has been fired; 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".

If at startup, it is determined that the outside air cutoff control is not set properly, change the setting on the control (located in the main electrical compartment) and test for proper operation.

8.0 Controls (cont'd)

**FIGURE 20 -
Optional
Door Switch**



**FIGURE 21 -
Optional
Firestat**



**FIGURE 22 -
Optional
Potentiometer**



**FIGURE 23 -
Pressure Null
Switch**



Installation Instructions for Pressure Null Switch (See FIGURE 24):

Discharge Temperature Low Limit (Option BE2) - If the system has an optional low limit switch for discharge temperature (freezestat), the control is in the blower section electrical box. The sensing bulb must be field-mounted in the blower discharge duct connector. Uncoil the control and extend the bulb to the blower discharge, being careful to not interfere with any mechanical parts. Use the bulb holder provided and mount the sensor according to the manufacturer's instructions.

Door Switch (Option BX1) - If the system is to be used as an overhead door heater, an optional door switch (Option BX1) must be installed. The function of the switch is to energize and interlock the system when an outside overhead door reaches approximately 80% of full open travel. The switch will de-energize the system when the overhead door closes approximately 20%. Follow the installation instructions in the door switch option package and the wiring diagram.

Firestat (Option BD2) - If the system has an optional firestat, the control is factory installed in the heated airstream so that the sensor can be extended into the duct. The firestat requires manual reset and is installed in an accessible location.

Optional Potentiometer (applies to systems with Air Control Option AR19 for makeup air only or AR22 for outside and recirculation air)

- If the system includes Air Control Option AR19, the discharge damper is controlled by a manually set potentiometer. If the system includes Air Control Option AR22, the potentiometer controls the return air damper. The potentiometer is shipped loose in the control compartment, or if a remote console is ordered, it is mounted on the console. Follow the wiring diagram to connect the potentiometer.

Optional Pressure Null Switch (applies to systems with Air Control Option AR20 for makeup air only or AR23 for outside and recirculation air)

- If the system includes Air Control Option AR20, the discharge damper is controlled by a pressure null switch. If the system includes Air Control Option AR23, the pressure null switch controls the return air damper. The pressure null switch is shipped in the control cabinet. Refer to the following paragraphs and to the manufacturer's installation instructions to install and connect this switch.

The pressure null switch is Dwyer #1460-0 with a range of .01-.12" w.c. The pressure null switch is a diaphragm operated differential pressure switch used in makeup air applications to 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 the modulating outside air dampers. 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 and the recirculated air damper towards the closed position. Conversely, as less pressure is required, the switch drives the dampers in the opposite direction.

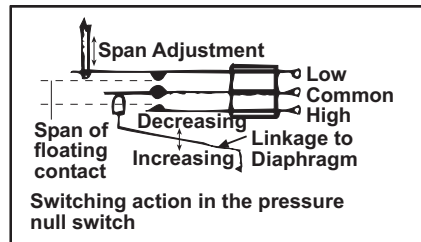
Select an indoor location free from excessive vibration where oil or water will not drip on the switch and where ambient temperature will be within a range of -30°F (dry air) to 110°F.

Mount the switch with the diaphragm in a vertical plane. The switch is position sensitive and is calibrated to operate properly when the diaphragm is vertical. Mount switch securely.

Connect the pressure taps on the top of the switch to sources of air pressure differential. Metal tubing with 1/4" O.D. is recommended but any tubing which will not unduly restrict the airflow can be used. To maintain a positive building pressure, vent the low pressure tap to the outdoors and allow the high pressure tap to monitor building pressure. To maintain a negative building pressure, reverse the functions of the high and low pressure taps. In either case, be sure that the outdoor vent is protected from the wind and screened from insects.

Adjustment of the Switch - The "high" actuation point of the null switch is indicated on a calibrated scale secured to the transparent range screw enclosure. Building pressure is set by turning the adjustment screw. The "low" actuation point is set by adjusting the span on the null by turning the span adjustment screw. The span range is .01 - .03" w.c.

FIGURE 24 - Pressure Null Switch included in Air Control Options AR20 and AR23



IMPORTANT: To eliminate shipping damage to the switch contacts, the manufacturer reduced the span adjustment to zero before shipping. The span should be adjusted prior to using the switch. (If the switch has been installed, disconnect the vent tube so that the null switch is in a neutral position.) Remove the switch electrical box cover and while observing the contacts, turn the span adjustment screw slowly in a clockwise direction. Continue turning the adjustment screw until you are able to see gaps between the common and both the low and high contacts. A minimum gap provides the greatest sensitivity. The wider the gap, the lower the sensitivity.

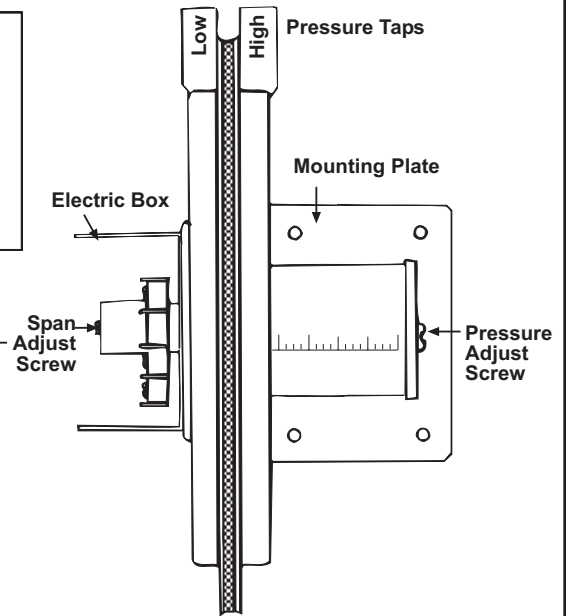


FIGURE 25 - Photohelic Pressure Switch

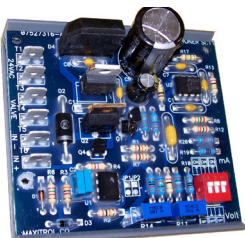


Optional Photohelic Pressure Switch (applies to systems with Air Control Option AR36 for makeup air only or AR37 for outside and recirculation air) - If the system includes Air Control Option AR36, the discharge damper is controlled by a photohelic pressure switch. If the system includes Air Control Option AR37, the photohelic pressure switch controls the return air damper. The photohelic pressure switch is shipped separately.

The photohelic switch uses relays to control between high and low pressure setpoints. When the pressure changes, reaching either setpoint, the beam from an LED to the limiting phototransistor will be cut off by the helix-driven light shield. The resulting signal change is electronically amplified to actuate its DPDT slave relay and switching occurs. Pressure rating is 0" w.c. to .25" w.c.

Mount the switch with the scale vertical in a location where the ambient temperature is between 20° and 120°F. Pneumatic pressure sensing lines may be run any distance. Refer to the manufacturer's installation instructions and the wiring diagram to install and connect this switch.

FIGURE 26 - Signal Conditioner



Optional Field-Provided Computer Control (applies to systems with Air Control Option AR33 or AR34 and/or with Gas Control Option AG37 or AG51) - If the system includes Air Control Option AR33, the discharge damper is controlled by a field-supplied 0-10VDC or 4-20 milliamp signal. If the system includes Air Control Option AR34, the computer controls the return air damper.

With AG37, the gas valve and burner modulation are controlled by the field-supplied computer signal. With AG51, the gas valve and burner modulation and outside air damper are controlled by the field-supplied computer signal.

Follow the signal conditioner manufacturer's instructions included with the system for connecting to the field-provided control.

Optional Photoelectric Duct Smoke Detector - If the system has an optional photoelectric air duct smoke detector,

the control is shipped separately for field installation. The sensor must be field-mounted in the discharge duct and electrically connected in the blower section electrical box. Follow the manufacturer's instructions and the wiring diagram for mounting and connecting the control.

FIGURE 27 - Duct Smoke Detector (cover removed)

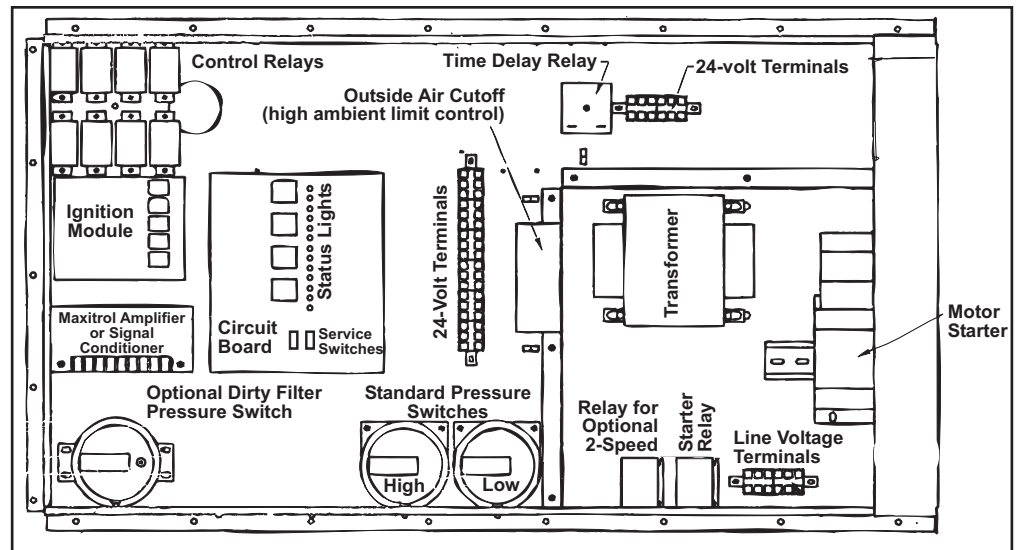


9.0 Check-Test Start

**FIGURE 28 -
Control Locations
in the Electrical
Compartment**

(NOTE: Locations may not be identical, but controls should be similar.).

Check/Test/Startup Procedures (Follow Steps in Sequence)



IMPORTANT NOTE: These instructions are designed for systems manufactured beginning 8/2003 equipped with hot surface ignition and standard diagnostic lights. If the system being started was manufactured prior to 8/2003, contact your representative or the factory service department for appropriate startup procedures.

Before Startup

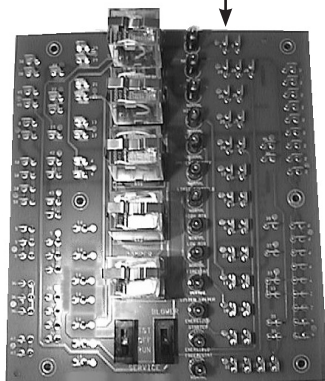
KEY to Check/Test/ Startup Procedures:

- ☐ Procedure applies to all units.
- ☐ Procedure only applies to units with the optional component referred to in that procedure.

- ☐ 1. Check to be sure that all field-installed accessories are installed.
- ☐ 2. Check all field-installed wiring.
- ☐ 3. Check all ductwork for obstructions; open all diffusers.
- ☐ 4. Turn the three-position switch or optional summer/off/winter remote console switch to OFF position. To prevent someone from turning the system on, tape the switch leaving a note that it should be left in the OFF position.
- ☐ 5. If the system includes an air control with a remote potentiometer, set the position as follows:
 - Option AR19 (Variable Air Volume) - Turn full "open"
 - Option AR22 (Return Air) - Turn full "closed"
- ☐ 6. Check disconnect switch --
 - ☐ Turn disconnect switch OFF.
 - ☐ Check disconnect switch to be sure that it is tightly secured against the cabinet.
 - ☐ If disconnect is fusible, check that fuses are installed. If fuses are not installed, insert dual element time delay fuses sized 1.25 times the maximum total input amps. Verify continuity of fuses.
- ☐ 7. Open the hinged gas/electric control compartment door --
 - ☐ Close all manual gas valves.
 - ☐ Check all wiring and wiring connections on gas controls and electrical components.
 - ☐ If equipped with any manually reset devices such as an optional firestat limit switch, a high limit switch, and/or optional high gas pressure switch, reset devices. Check setpoint on the high ambient burner cutoff air control (60°F).
- ☐ 8. Open the hinged door to the blower compartment --
 - ☐ Remove any blocking and shipping supports.
 - ☐ Check that the blower belts are installed and have correct tension and that pulleys are in alignment and locked to the shaft (See Paragraph 6.4).
 - Inside the compartment, remove the cover from the limit switch junction box.
 - ☐ Reset manual limit switch.
 - ☐ Check wiring connections to limit switches, discharge air sensor, and motor.
 - ☐ Replace the junction box cover.
- ☐ 9. Turn ON gas supply valve and inlet manual shutoff valve on the manifold.
 - ☐ Leak test gas connections upstream of the electric gas valve. Be sure all connections are tight and leak tested. **WARNING: DO NOT TEST WITH OPEN FLAME.**
 - ☐ Turn OFF manual gas valves.
- ☐ 10. Turn blower service switch (Electrical Compartment, See **FIGURE 28**) to OFF position. If present, verify that damper test switch is in TEST position.

Startup

Diagnostic Lights



1. Prepare system for startup testing --

- ☐ Attach a slope gauge (0 to 1.0" scale) to the tubing connections in the control compartment. The two connections are located just left of 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" OD barbed hose connections.)
- ☐ Connect a "U"-tube manometer to the main burner pressure tap.
- ☐ Check status lights (check at each step in the Startup procedure.)
Turn ON disconnect switch; "Circuit Control Power" light is lit; Turn OFF disconnect switch.
- ☐ Turn the disconnect switch **ON** and the blower service switch to **TEST** position.
"Control Switch Energized", "Starter Energized", and if equipped with a freezestat, **"Freezestat"** lights are lit. After blower obtains normal speed, check for these lights - **"Outside Air Cutoff Normal"; "Low Air Pressure Normal", "Limit Controls Normal"; "High Air Pressure Normal";** and if equipped with options; **"Low Gas Pressure Normal";** and/or **"High Gas Pressure Normal".**
- ☐ Check for blower rotation. If the blower is turning backwards (see rotation arrows), do the following:
Turn the disconnect switch **OFF**
Single-phase units -- rewire motor per instructions on motor wiring plate
Three-phase units -- interchange any two motor leads at the contactor or starter
Turn disconnect switch **ON** and verify rotation.

2. Measure burner differential air pressure on the slope gauge installed in Preparation Step 1. With the blower operating, differential air should read between -.25" and -.75" w.c. If the slope gauge reading is not within the limits of these numbers, do one of the following:

If the slope gauge reading is greater than -.25" (such as -.10" w.c.), adjust the drive to increase the blower speed.

- (1) Turn disconnect switch OFF.
- (2) ☐ If equipped with a discharge damper, remove opposite side blower door panel.
Turn disconnect switch ON.
Check that discharge damper is full open by loosening or tightening the linkage.
Turn disconnect switch OFF.
Replace door panel.
Turn disconnect switch ON and recheck slope gauge.
Turn disconnect switch OFF.
- (3) If reading is still greater than -.25" w.c., adjust drive to increase fan RPM.
For systems with smaller than 7-1/2 HP motor
 - (a) Loosen belt tension and remove belt.
 - (b) Loosen the setscrew on the side of the pulley away from the motor.
 - (c) Turn adjustable half of the pulley inward to increase blower speed. One turn will change speed 8 to 10%.
 - (d) Tighten the setscrew on the flat portion of the pulley shaft.**For systems with 7-1/2 HP and larger motor**
 - (a) Slack off all belt tension by moving the motor toward driven shaft until the belts are free of grooves. For easiest adjustment, remove the belts from the grooves.
 - (b) On the outer locking ring, locate the two locking screws that are directly across from each other. Loosen, but do not remove, those two screws. Do not loosen any other screws.
 - (c) Adjust sheave to desired pitch diameter by turning the outer locking ring. One complete turn of the outer locking ring will result in .233" change in pitch diameter. To increase blower speed, decrease diameter. **CAUTION: Do not adjust sheaves in either direction to the point where moveable and stationary flanges are in contact.**
 - (d) Re-tighten the locking screws.

All Motor Sizes - Replace the belts and check belt tension. Be sure that belts are aligned in the pulley grooves and are not angled from pulley to pulley.

If the slope gauge reading is less than -.75" (such as -1.0" w.c.), adjust the drive to decrease the blower speed.

- (1) Turn disconnect switch OFF.
- (2) ☐ If equipped with a discharge damper, remove opposite side blower door panel.
Turn disconnect switch ON.
Check that discharge damper is full open by loosening or tightening the linkage.
Turn disconnect switch OFF.
Replace door panel.
Turn disconnect switch ON and recheck slope gauge.
Turn disconnect switch OFF.
- (3) If reading is still less than -.75" w.c., adjust drive to decrease fan RPM.
For systems with smaller than 7-1/2 HP motor
 - (a) Loosen belt tension and remove the belt.
 - (b) Loosen the setscrew on the side of the pulley away from the motor.
 - (c) Turn the adjustable half of the pulley outward to decrease blower speed. One turn will change speed 8% to 10%.
 - (d) Tighten the setscrew on flat portion of the pulley shaft.**For systems with 7-1/2 HP and larger motor**
 - (a) Slack off all belt tension by moving the motor toward driven shaft until the belts are free of grooves. For easiest adjustment, remove the belts from the grooves.
 - (b) On the outer locking ring, locate the two locking screws that are directly across from each other. Loosen, but do not remove, those two screws. Do not loosen any other screws.
 - (c) Adjust sheave to desired pitch diameter by turning the outer locking ring. One complete turn of the outer locking ring will result in .233" change in pitch diameter. To decrease blower speed, increase diameter. **CAUTION: Do not adjust sheaves in either direction to the point where moveable and stationary flanges are in contact.**
 - (d) Re-tighten the locking screws.

All Motor Sizes - Replace the belts and check belt tension. Be sure that belts are aligned in the pulley grooves and are not angled from pulley to pulley.

9.0 Check-Test Start (cont'd)

Startup (cont'd)

2. Measure burner differential air pressure (cont'd)

- ☐ Turn on the disconnect switch and re-check the slope gauge. If air pressure differential is within the limits of -.25" to -.75" w.c., no further adjustment is required. If the air pressure differential is not within those limits, re-adjust the blower speed.
- ☐ When the differential air pressure is within the limits, check the motor amp draw with an ammeter to be sure that the motor is not overloaded. Amps are shown on the motor nameplate.
- ☐ If an inlet or outlet duct system is attached to the heater, run the blower to purge the volume of air from the duct system with at least four air changes.
- ☐ Turn the blower switch to OFF and damper test switch to RUN. Turn the disconnect switch OFF. Disconnect the manometer and the slope gauge. Replace the caps.

DETERMINE the type of gas control system from the Model or Serial No. Suffix on the unit rating plate:

Suffix	Where	Option	Gas Control System
None	N/A	AG1	Single Stage with Air Controller
-2	Model No.	AG3	Two Stage with Two-Stage Ductstat
-MV-7	Serial No.	AG30 or AG31	Maxitrol Series #14 Outside Air Only (Amplifier A1014U-00)
-MV-8	Serial No.	AG32	Maxitrol Series #14A Outside Air Only (Amplifier A1014U-00)
-MV-9	Serial No.	AG33	Maxitrol Series #44 Outside Air Only (Amplifier A1044)
-MV-B	Serial No.	AG36	Paint Spray Booth System (Maxitrol 94)
-MV-C	Serial No.	AG37	Maxitrol Series #DDC for Outside Air Only (Signal Conditioner)
-MV-D	Serial No.	AG47	Maxitrol Series #14 Outside Air and Recirculation (Amplifier ADFM14)
-MV-E	Serial No.	AG48	Maxitrol Series #44 Outside Air and Recirculation (Amplifier ADFM44)
-MV-F	Serial No.	AG51	Maxitrol Series DDC for Outside Air and Recirculation

For units with Maxitrol Series 14 or 14A, remove and individually tape wires from Terminals 4 & 8 on the amplifier

For units with Maxitrol Series 44, remove and individually tape wires from Terminals 2, 4 and 8 on the amplifier

For units with Maxitrol Series DDC, the customer provided input signal must be 4-20 milliamps (conditioner dip switch "on") or 0-10 volt DC (conditioner dip switch "off")

3. Check pilot and burner ignition and pilot operation (hot surface ignition)

- ☐ Turn the disconnect switch ON. Turn blower service switch and burner service switch to TEST position.
- ☐ Observe for ignition through the viewport.
Check for lights - Lights listed in prior Steps should be energized. After 15-20 seconds, the **"Pilot Valve"** light will light to signal the pilot ignition, followed by the **"Main Valve"** light signaling main burner operation.
- ☐ With both the burner and blower operating, measure the gas pressure at the burner. Gas pressure should match the required manifold pressure listed on the rating plate. (If pressure does not match the required pressure, further testing is required in Step 5.) Remove the manometer.
- ☐ Leak test all connections in the pilot and main burner supply lines. **WARNING: DO NOT TEST WITH OPEN FLAME.**
- ☐ Check output of pilot flame signal. Microammeter reading should be .5 or greater.
- ☐ To check lockout feature of the pilot ignition system, turn pilot manual shutoff valve OFF. Pilot should lockout after two trials for ignition. To reset unit, open the valve and cycle the main disconnect switch.
- ☐ Turn OFF the manual gas valve. Wait 30 seconds for unit to cool. Return both burner and blower switch to OFF position. Turn OFF disconnect switch.

4. Check pilot pressure --

- ☐ To check pilot gas pressure, connect a "U"-tube manometer to the pressure tap on the downstream side of the pilot solenoid valve.
- ☐ Put BOTH the blower and burner switch in TEST position. Turn ON disconnect switch. Blower should be energized.
- ☐ Measure pilot gas pressure. Pilot pressure for natural gas should be 3.5" w.c.; pilot pressure for propane gas should be 6" w.c. Pilot pressure should be correct, but if the pressure is not correct, discontinue startup until the pilot gas pressure is regulated correctly.
(To adjust pilot pressure, remove the cap from the regulator. Turn adjustment clockwise to increase gas pressure or counterclockwise to decrease gas pressure.) When pressure is correct, shut off the gas, remove the manometer, and replace the pressure tap cap on the pilot solenoid valve.

5. Verification of inlet gas pressure -- If, with the blower and burner operating, the inlet main gas pressure measured in Step 3 does not correspond to the minimum stated on the rating plate, check the main burner inlet gas pressure. If the main inlet gas pressure is lower than stated on the rating plate, full burner firing rate will not be achieved. Check main gas supply service regulator for adjustment.

☐ Turn disconnect switch OFF.

☐ Re-connect the "U"-tube manometer to the main burner pressure tap.

☐ Turn pilot manual shutoff valve back ON.

☐ Turn the disconnect switch ON; ignition sequence will occur.

☐ Observe main burner. Light off should occur along the entire length of the burner.

☐ After approximately one minute, record the gas pressure reading on the manometer.

NOTE: High outside air temperature on high fire may cause the automatic high limit to trip. Manometer reading may only be available for a very short time.

☐ Turn disconnect switch OFF.

☐ Remove the manometer and replace the plug.

☐ Remove all jumper wires and reconnect wires.

☐ Verify that the blower, burner, and damper switches are in RUN position.

CAUTION: If blower or burner service switches are left in TEST position, they will override control from the remote console, switch, or automatic control.

☐ Check that all manual valves are ON.

☐ Close the control door panel; secure latches.

☐ Turn ON the disconnect switch. The system is now operational from the control switch, the remote console, or other type of optional automatic control.

CAUTION: Burner will not operate if ambient air temperature is above setpoint of outside air control (factory setting is 60°F).

Startup for Continuous Operation

After Startup

☐ Return this manual to the owner's envelope. Keep for future reference.

☐ To check for toxic vapors coming from the surrounding outside atmosphere or being produced by the installation (See **DANGER** below), it is recommended that the tempered makeup air entering the building be tested at its point of discharge from the heating unit. The table below shows limits for various substances including carbon monoxide.

Certified, portable detector tubes may be used; follow the manufacturer's instructions.

Limits Based on Eight-Hour Exposure and a Five-Day Week (Guide Only)

Substance	Percent	PPM	Note: At 100°F rise, the CO ₂ concentration will be about 2500 ppm.
Acetaldehyde	.001	10	
Carbon Dioxide	.250	2500	
Carbon Monoxide	.001	10	
Formaldehyde	.000025	0.25	
Nitrogen Dioxide	.0001	1	
Sulphur Dioxide	.00005	0.5	

DANGER:

The gas burner in this direct gas-fired system is designed and equipped to provide safe, 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 a factory representative. **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.

APPENDIX

Technical Data

Model Sizes	1-20-3	1-40-3	1-50-3	1-65-3	2-80-3	2-120-3	3-180-3	3-260-3
Maximum Capacity (MBH)	400	600	750	750	1500	1500	2500	3000
CFM Range	1, 000 - 3,000	2,000 - 4,500	3,000 - 6,000	4,000 - 6,500	6,000 - 12,000	9,000 - 16,000	11,000 - 20,000	16,000 - 28,000
Maximum Temperature Rise	120°F	120°F	120°F	120°F	120°F	120°F	120°F	120°F
Maximum Discharge Temperature	120°F	120°F	120°F	120°F	120°F	120°F	120°F	120°F
Typical Control Amps (24V)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Net Weight (lbs)	915	925	935	950	1455	1505	2410	2480
Gas Connection (inches)	1	1	1	1	1 or 1-1/4	1 or 1-1/4	1, 1-1/4, or 2	1, 1-1/4, or 2

INDEX

A

Air Controls 4

B

Blower Pulley 16

Blowers 16

Blower Speed Adjustment 16

Burner differential air pressure 23

C

Check-Test Start 22

Clearances 4

Installation Codes/Requirements 3

Computer Control 21

Contact 28

Control Wiring 17

Convenience Outlet 17

Roof Curb 7

D

Description 3

Dimensions 5

Disconnect Switch 17

Door Switch 20

Drives 16

Duct Opening Dimensions 8

Ductwork 15

Ductwork Openings 8

E

Electrical Supply 17

Evaporative Cooling Module 15

F

Dirty Filter Light 18

Indoor Filter Cabinet 11

Firestat 20

Freezestat 20

G

Gas Controls 4

Gas Control System 24

Gas Piping and Pressures 9

Gas Supply Connection 9

Gas Supply Piping 9

H

Hazard Labels 2

Outside Air Hood 11

I

Check pilot and burner ignition 24

INSTALLATION RECORD 28

L

Dirty Filter Light 18

Diagnostic Lights 23

Discharge Temperature Low Limit 19

Location 4

M

Distribution of Makeup Air 15

Manifold Pressure 10

Motor Full Load Amps 16

Mounting 5

Mounting on a Roof Curb 6

Mounting on Field-Supplied Support 6

Mounting Rails 6

O

Outside Air Cutoff Control 19

P

Shipped-Loose Parts 4

Photohelic Pressure Switch 21

Check pilot pressure 24

Pilot Supply Pressure 10

Potentiometer 20

Preparation 4

Gas Pressure Switches 10

Supply Pressure 9

Supply Pressure by Manifold 9

Pressure Null Switch 20

Dirty Filter Pressure Switch 19

Pressure Tap Locations 10

R

Remote Console 18

Rigging 6

Roof Curb Option CJ3 7

S

Discharge Sensor 19

Signal Conditioner 21

Smoke Detector 21

After Startup 25

Before Startup 22

Startup 23

Startup for Continuous Operation 25

T

Technical Data 26

U

Uncrating 4

W

Warranty 3

Weights 6

Wire Gauge 17



Model RDF

WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, or property damage.

Be sure to read and understand the installation, operation, and service instructions in this manual.

Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Leave the building immediately.
 - Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

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

Table of Contents

1.0 General	2	3.4 Air Pressure Switches.....	9
1.1 Hazard Labels and Notices	2	3.5 Ignition System	10
1.2 Warnings and Requirements .	2	3.6 Gas Train Including Burner, Gas Controls, Manifold Arrangements, and Gas Pressure Switches	11
2.0 Maintenance	3	3.7 Inlet Air Controls	15
2.1 Maintenance Requirements ...	3	3.8 Other Optional Controls.....	16
2.2 Maintenance Schedule	3	3.9 Troubleshooting.....	18
2.3 Maintenance Procedures	4	Additional References.....	19
3.0 Operation and Service	8	INDEX.....	20
3.1 Control Locations	8		
3.2 Electronic Circuit Board with Lights	8		
3.3 Limit Safety Controls.....	9		

1.0 General

The information in this manual applies to Model Series RDF and ADF 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.

1.1 Hazard Labels and Notices

This booklet includes operation, maintenance and service information. Before beginning any procedure, carefully review the information, paying particular attention to the warnings.

Definitions of Hazard Intensity Levels used in this Manual

HAZARD INTENSITY LEVELS

- 1. DANGER:** Failure to comply will result in severe personal injury or death and/or property damage.
 - 2. WARNING:** Failure to comply could result in severe personal injury or death and/or property damage.
 - 3. CAUTION:** Failure to comply could result in minor personal injury and/or property damage.
-

There are warning labels on the unit and throughout this manual. For your safety, comply with all warnings during installation, operation, maintenance, and service of this system.

1.2 Warnings and Requirements

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.

WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons. See Hazard Levels, above.

WARNING: On makeup air heaters which also recirculate room air, outside ventilation air must be provided in accordance with the information shown on the heater rating plate.

Recirculation of room air may be hazardous in the presence of:

- (a) Flammable solids, liquids, and gases;
- (b) Explosive materials (e.g. grain dust, coal dust, gun powder, etc.); or
- (c) Substances which may become toxic when exposed to heat (e.g. refrigerants, aerosols, etc.).

DANGER: The gas burner in this direct gas-fired system is designed and equipped to provide safe, 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.

2.0 Maintenance

2.1 Maintenance Requirements

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 on the left.

Maintenance Codes

- 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.

2.2 Maintenance Schedule

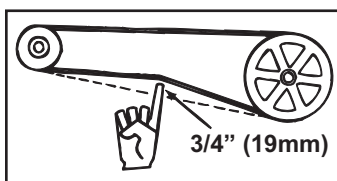
See Chart, Paragraph 2.3.1	☐ Lubricate bearings, Paragraph 2.3.1
Quarterly	☐ Check the filters, Paragraph 2.3.2
	☐ Check air pressure sensing tubes, Paragraph 2.3.4
Semi-Annually	☐ Check blower belts, Paragraph 2.3.1
	☐ Verify gas pressures, Paragraph 2.3.3
	☐ Clean air pressure sensing tubes, Paragraph 2.3.4
	☐ Check indicator lights, Paragraph 2.3.5
Annually	☐ Check main burner and pilot assembly, Paragraph 2.3.6

2.0 Maintenance (cont'd)

2.3 Maintenance Procedures

Recommended Bearing Lubrication Schedule in Months

FIGURE 1 - Belt Tension



R E 2.3.2 Filters

R 2.3.1 Drive Components

The blower, motor and drive components are located in the blower cabinet. Remove the panels required to access the component(s) being serviced.

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.

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

RPM Range	Bearing Bore Diameter (Inches)			NOTE: If unusual environmental conditions exist (temperatures below 32°F or above 200°F; moisture; or contaminants) more frequent lubrication is required.
	1/2 to 1	>1 to 1-1/2	>1-1/2 to 1-15/16	
to 1000	6 months	6 months	6 months	
1001-1500	5 months	5 months	5 months	
1501-2000	5 months	4 months	5 months	

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 1**). Tighten the lock nut on the adjusting screw. Be sure the belt is aligned in the pulleys.

If the system includes filters, check the filters quarterly.

To access the filters, remove the filter cabinet door panels. Clean or replace as needed. If filters are removed, be sure the blockoff plates are returned to the filter rack.

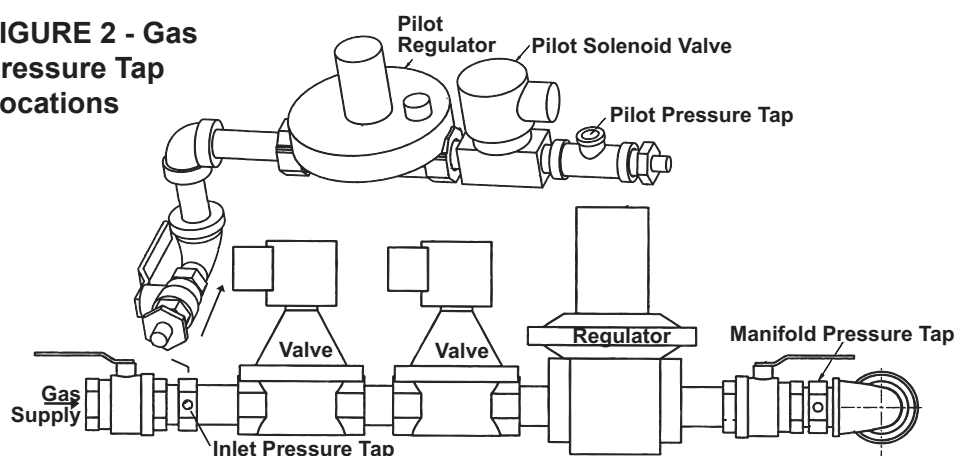
Quantity and Size of Filters by Model

Type	Disposable		Permanent		Pleated Disposable	
Thickness	1"	2"	1"	2"	1"	2"
Model RDF with Optional Filter Cabinet						
1	-	-	(3)12x35	(4)12x35	-	-
2	-	-	(4)12x35	(4)12x35	-	-
	-	-	(4)12x24	(4)12x24	-	-
3	-	-	(12)12x35	(10)12x35	-	-
Model ADF/ADFH with Optional Filter Cabinet						
300	(5)12x30-5/8	(5)12x30-5/8	(10)10x16	(10)10x16	(5)12x32	(5)12x32
500	(5)12x20	(5)12x20	(5)12x20	(5)12x20	(5)12x20	(5)12x20
	(5)12x25	(5)12x25	(5)12x25	(5)12x25	(5)12x26	(5)12x26
700, 1200	(5)12x25	(5)12x25	(5)12x25	(5)12x25	(5)12x25	(5)12x25
	(5)12x30-5/8	(5)12x30-5/8	(5)12x32	(5)12x32	(5)12x32	(5)12x32

S 2.3.3 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. Verify against pressures listed on the rating plate.

FIGURE 2 - Gas
Pressure Tap
Locations



S

2.3.4 Air Pressure

Profile plate sensing tubes should be checked quarterly and cleaned no less than semi-annually. If the sensing tubes become even partially blocked, false pressure readings may be relayed.

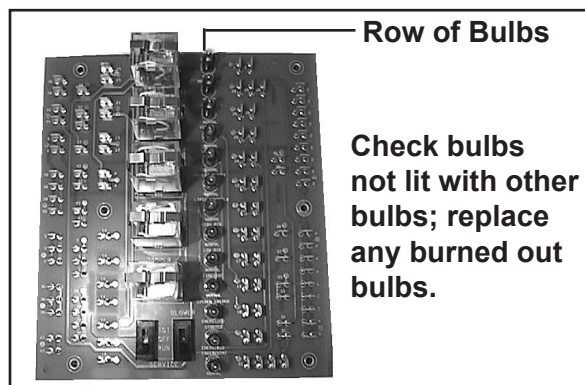
To clean, remove the screened end caps and clean the screens and the tubes. Replace the clean end caps. Check the pressure differential across the profile plate using a slope gauge. To attach the slope gauge, open the control compartment door panel. Just below the junction box, locate the tubing connections. 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 Paragraph 3.4. Air pressure differential should be between $-.25"$ and $-.75"$ w.c.

R

2.3.5 Circuit Indicator Board (check lights)

The circuit indicator board is located in the control compartment electrical box (See **FIGURE 9**, page 8). Check operation of all indicator lights by switching lights that are not lit with one that is currently lit. Replace any burned out indicator bulbs (P/N 125189).

FIGURE 3 - Circuit Indicator Board, P/N 151263



S

2.3.6 Main Burner and Pilot Assembly

CAUTION: Wear eye protection while pressure cleaning and drilling.

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

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. Locate the pilot.

FIGURE 4 - Burner End Plate showing Hot Surface Ignitor

NOTE: Model RDF units manufactured prior to 3/96 have a spark ignition system. Clean ultraviolet sensor and spark plug. Replace as needed.

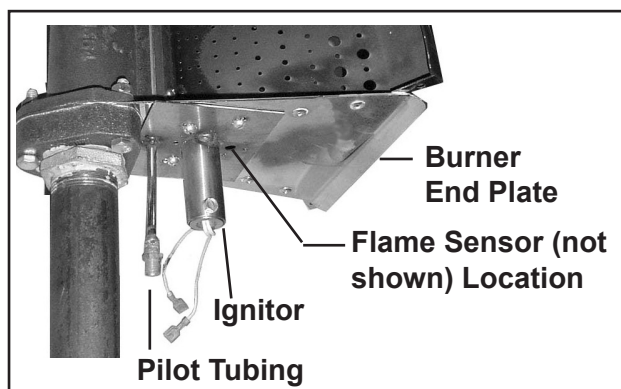
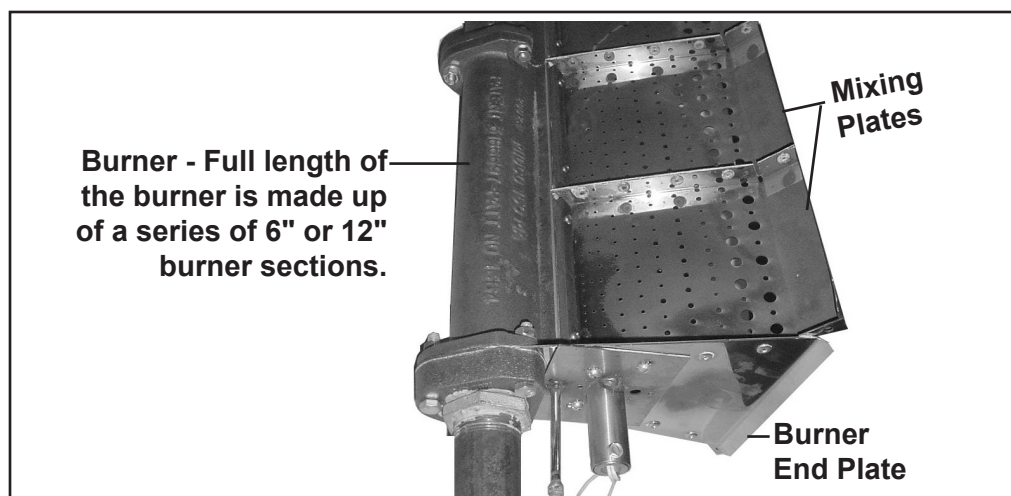


FIGURE 5 - Direct Fired Burner

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



2.0 Maintenance (cont'd)

2.3 Maintenance Procedures (cont'd)

CAUTION: Wear eye protection while pressure cleaning and drilling.

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



2.3.7 Optional Evaporative Cooling Module

Instructions for Replacing Evaporative Cooling Media

2.3.6 Main Burner and Pilot Assembly (cont'd)

- 3) Disconnect the two ignition wires (male and female quick connections) and disconnect the flame sensor lead at the burner. Remove the setscrew located in the ignitor tube (setscrew 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 134706**) 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.

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.

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 airtight seal.

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

Media - Over time, excessive amounts of mineral deposits will begin to buildup on the media. Annually, scale and dirt should be washed off the entering surface of the media. Remove the pad retainers and screen. (See Steps 1-3 and 6-8 of Media Replacement Instructions.) Clean the media using a garden hose, mild soap, and a soft bristled brush. When the media becomes too clogged with mineral deposits and dirt that it cannot be cleaned, the pads should be replaced. The average pad life is approximately three cooling seasons.

See charts and **NOTE** below for replacement media information. Follow the instructions and remove and replace pads as shown in **FIGURE 6**.

Evaporative Cooling Media - Model ADF or ADFH with Option AS3, AS4, AS5, or AS8

ADF / ADFH	Media Pad Size & Qty		Replacement P/N's (each) - 12" media *	
	(inches)	Qty	Cellulose	Glass Fiber
300	24 x 12	2	106021	106029
	24 x 7-7/8	1	106022	106030
500	24 x 12	3	106021	106029
	24 x 9-5/8	1	106025	106033
700/	48 x 12	4	107194	107201
1200	48 x 8-5/8	1	107195	107202

* **NOTE:** 6" media is no longer available as a replacement part. Use size to obtain media from a local supplier.

Evaporative Cooling Media - Model RDF with attached Model REC Evaporative Cooling Module

REC	Media Pad		Replacement P/N's (each) *	
	Size	Qty	12" Cellulose	12" Glass Fiber
40	24x12	2	106021	106029
	24x2-3/8	1	106022	106030
50	24x12	2	106021	106029
	24x7-7/8	1	106023	106031
60	24x12	3	106021	106029
	24x1-3/8	1	106024	106032
70	24x12	3	106021	106029
	24x9-5/8	1	106025	106033
80	24x12	4	106021	106029
	24x2-7/8	1	106026	106034
90	24x12	4	106021	106029
	24x8-5/8	1	106027	106035
180	48x12	4	107194	107201
	48x8-5/8	1	107195	107202
360	48x12	8	107194	107201
	48x8-5/8	2	107195	107202

1. Remove the three sheetmetal screws that hold the top pad retainer in place. Release the top pad retainer from the cooling module.
2. Remove the three sheetmetal screws that hold the bottom pad retainer in place. Release bottom pad retainer from the cooling module.
3. Disengage the screen retainers from the sides of the media.
4. Disengage inlet screen from media pads and remove.
5. Slide all media pads horizontally away from the cooling module until clear of bottom reservoir pan. Dispose of properly.

FIGURE 6 - Removal and Replacement of Evaporative Cooling Module Media

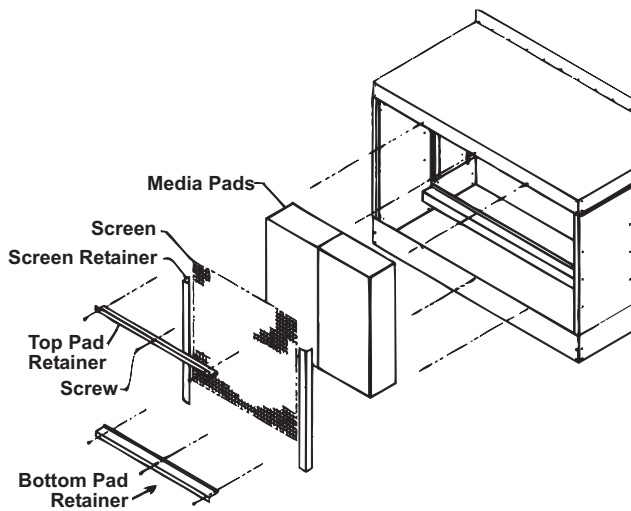
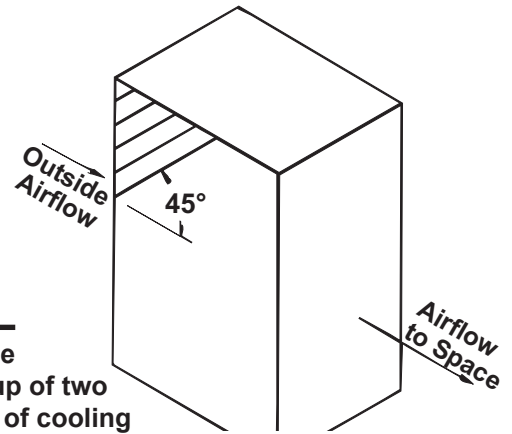


FIGURE 7 - Media must be installed with 45° angle sloping downward toward the incoming outside air.

IMPORTANT: The media is made up of two different sheets of cooling material. Each sheet has its own unique angle. When replacing the cooling media, **BE CERTAIN** that the 45° angle slopes downward toward the incoming outside air (as illustrated above). If the media is not installed properly, water blowoff from the media pads will occur.



6. Replace media by sliding media pads over both support rails until back stop is encountered. Media **must** be placed as shown in **FIGURE 7**.
7. Center screen on the incoming air side of the media.
8. Replace the two side screen retainers by fitting them between the side of the media pad and the side of the cooling module. The retainers should fit snugly, pinching the screen against the media pads.
9. Replace the bottom pad retainer by securing the retainer between the pad and the reservoir pan. Fasten with the three sheetmetal screws removed in Step 2.
10. Replace the top pad retainer by securing the retainer between the pad and top of the cooling module. Fasten with the three sheetmetal screws removed in Step 1.

Other Evaporative Cooling Module Maintenance

REFERENCE:
Evaporative Cooling Module Troubleshooting Guide, Paragraph 3.9, page 19, Chart 2.

Water Feed Line and PVC Distribution Piping - Annually, the water supply line and PVC water distribution pipe should be flushed of debris and contaminants.

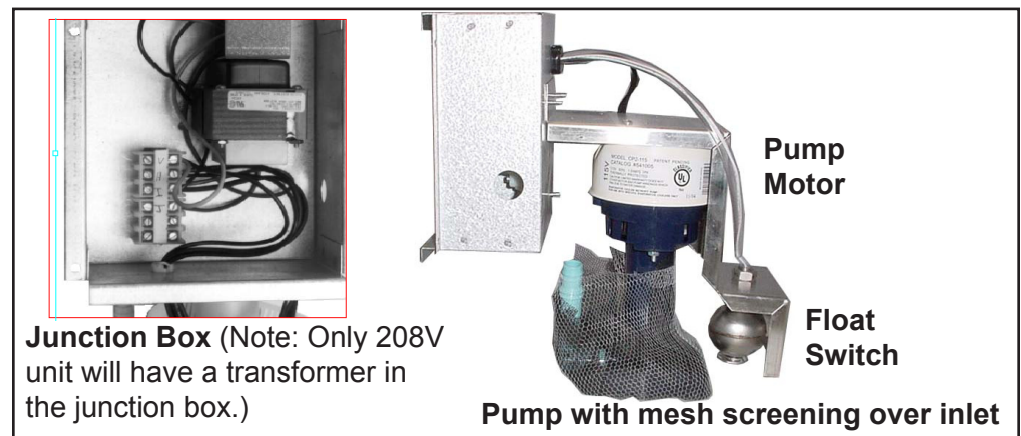
1. Remove the media pads following the media replacement instructions.
2. Remove the water feed line from the downstream side of the ball valve and unscrew the water bleed line barbed hose fitting.
3. Force a fresh water supply through the water inlet hose and thoroughly flush the distribution pipe.
4. Reassemble being careful to install media with air flow direction as shown in **FIGURE 7**.

Water Pump and Inlet Basket Screen (applies to system with float and pump control) -- Annually, the pump and inlet basket screen should be removed, disassembled, and cleaned.

WARNING: Do not expose pump motor or any part of the electrical box to water. Evaporative cooling pump is NOT submersible.

1. Disconnect the power supply to the unit.

FIGURE 8 - Remove Junction Box, Pump and Float Switch as an Assembly



2.0 Maintenance (cont'd)

2.3 Maintenance Procedures (cont'd)

3.0 Operation and Service

2.3.7 Optional Evaporative Cooling Module (cont'd)

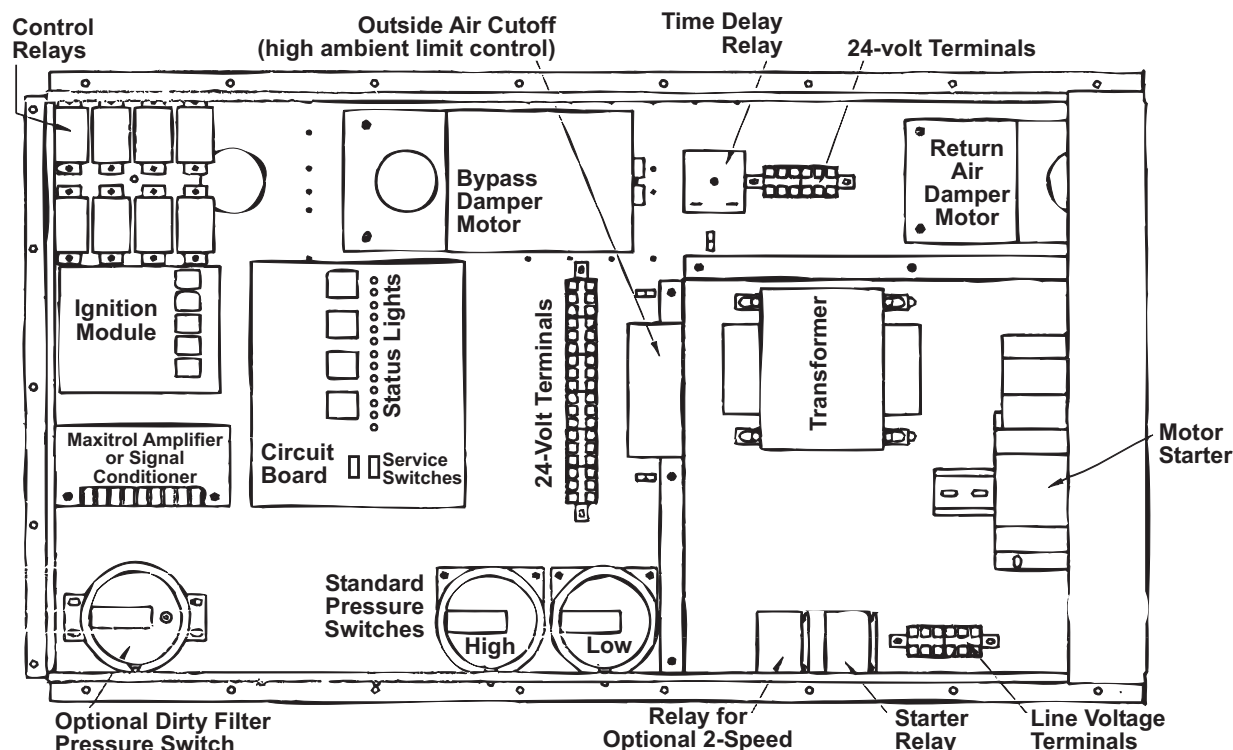
2. Remove the service panel and the junction box door. Disconnect the two-line voltage power supply wires from the terminal block inside the junction box.
3. Disconnect the water feed line hose from the upstream side of the ball valve.
4. Unscrew the four sheetmetal screws holding the junction box to the cooling module. Remove the junction box-pump-float switch assembly (See **FIGURE 8**).
5. Dislodge the inlet basket screen from the pump and clean any buildup of debris and dirt. Carefully remove the base cover plate from the bottom of the pump. Using a mild soap solution, wash all deposits from the inside of the pump and remove all debris from the impeller.
6. Reassemble the pump. Replace the parts in exact reverse order, being careful that everything is returned to its proper position.

3.1 Control Locations

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. 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 9 - Control Identification and Typical Locations

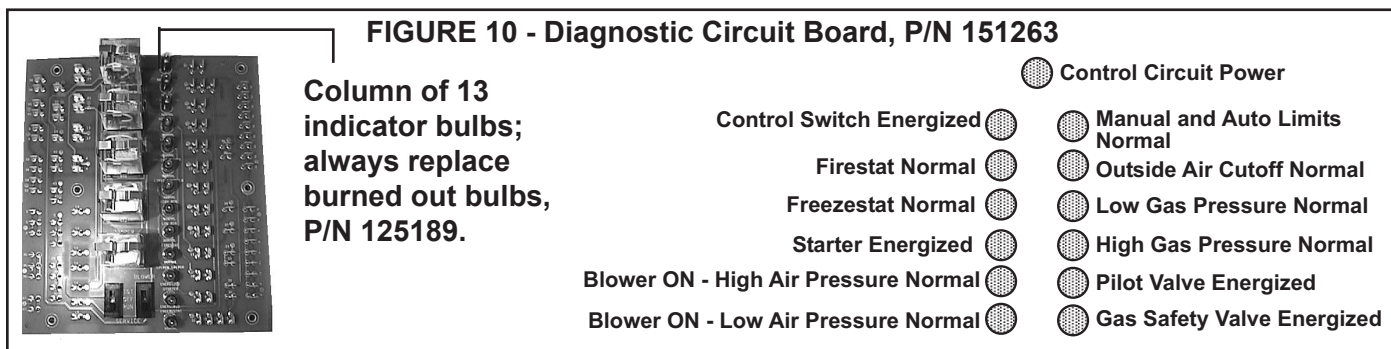


3.2 Electronic Circuit Board with Lights

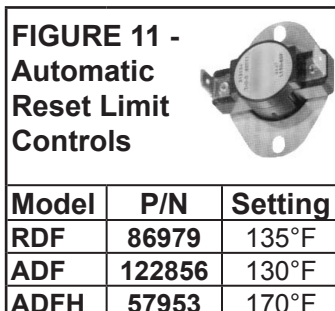
Location: Control Compartment Electrical Box (See **FIGURE 9**)

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 the one that represents the component or system that has failed will be lit. For more detailed information, refer to the Troubleshooting Guide in Paragraph 3.9..

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.



3.3 Limit Safety Controls



Each unit has an automatic temperature activated limit control, a manual reset temperature activated limit control, and an electrical activated energy cutoff device.

• Automatic Reset Limit Control

Function: If the temperature of the discharge air reaches the setpoint, the limit will open the circuit to the burner system and close all burner and pilot valves. The limit control will be activated if total airflow is reduced or if gas pressure surges at the burner causing excessive discharge air temperature. The system will restart when the discharge air temperature decreases below the setpoint.

Service: Failure of this limit requires replacement of the control.

• Manual Reset Limit Control

Function: The manual reset limit has a higher setting than the automatic limit and requires manual resetting to restart the system. If for any reason the automatic limit should fail to protect against overheating, the manual limit will shutdown the system. Should the manual reset limit activate, check the entire system to determine the cause. Make any necessary changes or adjustments before restarting the burner system. Restart of the unit can be done only after the limit has been cooled and the reset button depressed.

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

Service: Failure of this limit requires replacement of the control.

FIGURE 12 - Manual Reset Limit Controls

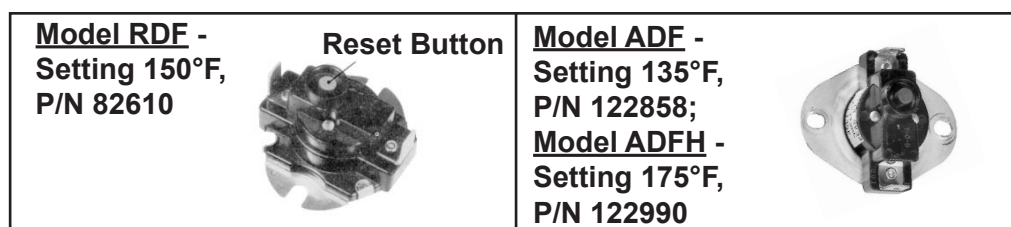
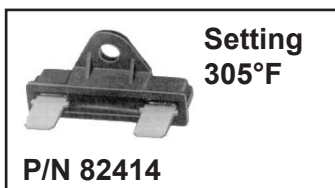


FIGURE 13 - ECO Limit Control



• Emergency Cut Off Limit Control

Function: The emergency cut off is a fusible link high temperature limit which provides onetime redundant protection against overheating. If the temperature sensitive limit controls malfunction, 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.

3.4 Air Pressure Switches

Location: Control Compartment Electrical Box (See **FIGURE 9**.)

• Low Airflow Switch

Function: The low airflow switch is a velocity pressure switch that monitors airflow across the burner. Until the airflow 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 .25" w.c. Do not alter or adjust setting.

3.0 Operation and Service (cont'd)

3.4 Air Pressure Switches (cont'd)

FIGURE 14 - Air Pressure Switch



• High Airflow Switch

Function: The high airflow switch is a velocity pressure switch that monitors airflow across the burner. If the high airflow 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 .75" w.c. Do not alter or adjust setting.

Low and High Airflow Sensing Pressure Check: (requires slope gauge, several feet of 1/4" OD tubing and two 1/4" OD 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 -.25" and -.75" w.c. If the slope gauge reading is within those limits, no adjustments are necessary. If pressure reading is not within limits, consult the factory.
- 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.

Pressure Switches and Bypass Damper Airflow (Applies to Model RDF system with Air Control Option AR19, AR20, AR22, AR23, AR32, AR33, AR34, AR36, or AR37)

Adjustment of the bypass damper is controlled by the same low and high pressure switches described above. With a bypass damper, the volume of outside air supplied to the building is controlled 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. See Paragraph 3.7 for information about inlet air control options.

Service: If the pressure check determines that an airflow 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 203932; high air pressure switch is P/N 203933..

3.5 Ignition System

Location: Ignition Controller Module in the Control Compartment Electrical Box (See FIGURES 9 and 15.); Ignitor and Flame Sensor on the Burner (See FIGURE 16.)

FIGURE 15 - Ignition Control Module in the Electrical Compartment, P/N 157953

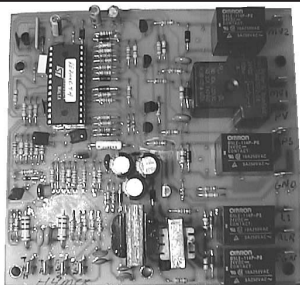
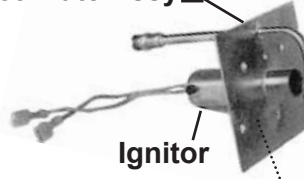
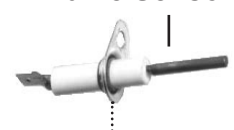


FIGURE 16 - Ignitor, P/N 121865, and Flame Sensor, P/N 134706, on the Burner

Pilot Plate Assy



Flame Sensor



Hot Surface Ignition System with Prepurge Time Delay and Flame Sensor with 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.

3.6 Gas Train Including Burner, Gas Controls, Manifold Arrangements, and Gas Pressure Switches

FIGURE 17 - Single-Stage Gas Valve and Discharge Air Controller in Makeup Air Gas Control System, Option AG1



FIGURE 18 - Two-Stage Gas Valve and Discharge Ductstat in Makeup Air Gas Control System, Option AG3



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).

If the burner ordered is over three feet long (Model RDF with burner Option BL7, BL8, BL9, BL10, BL11, or BL13), a second flame rod is located at the end of the burner. After the main gas valve(s) is energized, a 15-second trial to prove the second flame is initiated. Failure to recognize and prove flame travel to the opposite end of the burner will result in a pre-purge and re-try for ignition.

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.

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 2.3.6 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 (100% Outside Air) Gas Control Systems

• Single-Stage Gas Valve for Makeup Air (Option AG1) (750MBH maximum)

The standard 24-volt, single state gas valve has an integral automatic electric on-off valve, a pressure regulator, a safety pilot valve, and a manual shutoff. The valve operates in response to a call for heat from a unit-mounted air controller that monitors discharge air temperature. The controller has a built-in setpoint selector from 0° - 100°F. Due to different CFM settings and outside temperatures, the average downstream outlet temperature may not match the control setting exactly. After the installation is complete, adjust the setpoint to achieve the desired average outlet air temperature. See the valve manufacturer's literature provided in the owner's envelope for specifications, wiring, and operating information.

• Two-Stage Gas Valve for Makeup Air (Option AG3) (750 MBH maximum)

The single-stage valve is replaced by a two-stage valve having low fire and high fire operation. The two-stage valve is controlled by a unit-mounted ductstat that monitors discharge air temperature. The ductstat has a built-in setpoint selector from 60°-110°F. Available for use with natural gas only.

Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting exactly. After the installation is complete, adjust the setpoint of the ductstat to achieve the desired average outlet air temperature. See the valve manufacturer's literature provided in the owner's envelope for specifications, wiring, and operating information.

• Electronic Modulation Gas Control for Makeup Air (100% Outside Air), 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.

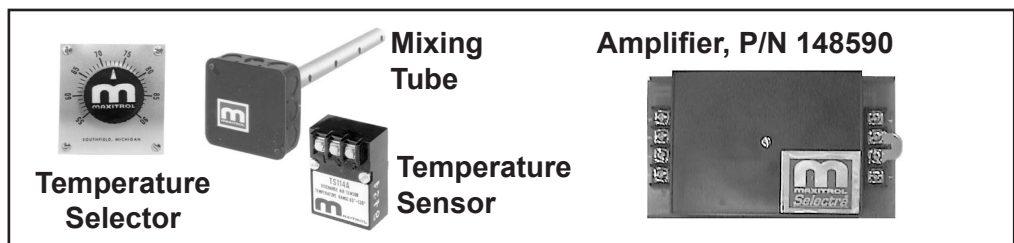
Function: These gas control systems provide heated makeup air at a temperature controlled by a discharge air sensor. Makeup air gas controls apply only to systems with 100% outside air. Each system is equipped with electronic modulation controls that modulate burner flame from 1/25th of full fire input to full fire.

3.0 Operation and Service (cont'd)

FIGURE 20 - Modulating Gas Valve - Options AG30, AG31, AG32, AG33, AG35, AG36

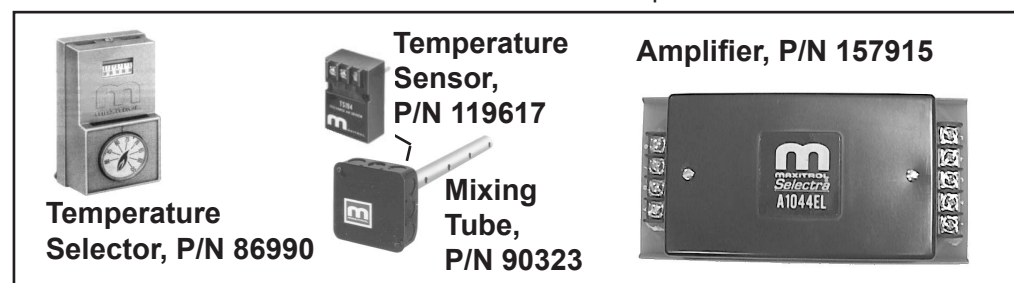


FIGURE 21 - Maxitrol Series 14 Components used in Makeup Air Gas Control Options AG30, AG31, AG32, AG35



Option AG33 electronic modulation system is comprised of Maxitrol Series 44 controls for makeup air. 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 selectrstat (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 22 - Maxitrol Series 44 Components used in Makeup Air 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 23 - Components of the Gas Control System used in Option AG36 designed specifically for paint booths - controls are mounted on a remote console

**Selector,
P/N 133230**



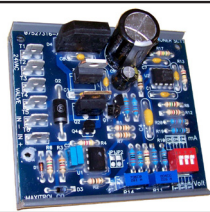
**Amplifier,
P/N 133229**



FIGURE 24 - Maxitrol Signal Conditioner for Computer Control

• **Electronic Modulation Makeup Air Gas Control Option AG37**

**Maxitrol Signal Conditioner,
P/N 134170**



Function: Control Option AG37 does not have a duct sensor or amplifier. Instead, a Maxitrol 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 25 - Modulating Gas Valve - Options AG47 and AG48



Makeup Air with Recirculation Air Gas Control Systems (RDF only)

• **Electronic Modulation Makeup Air with Recirculation Gas Control Options AG47, AG48, and AG51**

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 with recirculation** gas control systems provide a mix of outside and recirculated air heated to 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 and adjust the outside air damper in response to outside and return air sensors.

Both the flow of the gas to the main burner and the outside (bypass) air damper position are adjusted 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 gas flow is accomplished through a mechanical bypass. Minimum outside air is 25%. Carbon dioxide (CO₂) in the discharge air of the unit is maintained to a level in compliance with ANSI Z83.18 requirements.

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

Option AG47 electronic modulation system is comprised of Maxitrol Series 14 controls for makeup air with recirculation. The system electronically operates the burner and/or the outside air damper to maintain a constant discharge air temperature in the range of 40-95°F.

FIGURE 26 - Maxitrol Series 14 Components used in Recirculation Air Gas Control Option AG47



Amplifier, P/N 204454



**Selector,
P/N 204455**



**Discharge Air Sensor,
P/N 204453**



**Return Air Sensor,
P/N 204452
Outside Air Sensor,
P/N 204452**

Option AG48 electronic modulation system is comprised of Maxitrol Series 44 controls for makeup air with recirculation. The low limit (20-60°F) and the high limit (60-140°F) for control of discharge air temperature are set at the amplifier. The space temperature is set at the remote selectstat (55-90°F range) located in the space. When the temperature is below the space temperature setpoint, the control system operates the burner and/or the outside air damper to automatically adjust the discharge air temperature within the maximum and minimum limits set on the amplifier.

3.0 Operation and Service (cont'd)

3.6 Gas Train Including Burner, Gas Controls, Manifold Arrangements, and Gas Pressure Switches (cont'd)

FIGURE 27 -
Maxitrol Series
44 Components
used in
Recirculation
Air Gas Control
Option **AG48**



Amplifier, P/N 204450



**Selector,
P/N 204451**



**Discharge
Air Sensor,
P/N 204453**



**Return Air Sensor,
P/N 204452
Outside Air Sensor,
P/N 204452**

Option AG51 electronic modulation system is comprised of the same Maxitrol Series 44 controls as Option AG48 plus a remote sensor/selector.

FIGURE 28 - Option
AG51 includes Maxitrol
Series 44 Components
used in AG48 plus a
Remote Sensor



**Remote
Sensor/
Selector,
P/N 204456**

Service - ALL Gas Controls: Check all electrical connections. A qualified service person should refer to the control manufacturer's literature for assistance in identifying problems and determining the correct solution. None of the 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 meet ANSI, CSA, FM or GAP (former IRI) requirements.

All manifold arrangements include two 5psi rated manual shutoffs.

These systems are designed to operate on a natural gas supply differential pressure range of a minimum of 4.3-5.0" w.c. plus the manifold pressure drop. Maximum supply pressure depends on manifold selection; see below. If the gas supply pressure is above the maximum allowed, it is necessary to install a field-supplied step-down gas regulator in the supply line. Order and install the appropriate Gas Regulator Kit, Option CZ1 (1") or CZ2 (1-1/2"). Follow the instructions provided with the kit. Measure the gas pressure between the step-down regulator and the unit.

(Refer to the wiring diagram or rating plate to identify the manifold on the system being serviced.)

Manifold Option BM75, BM76 - 1/2 psi
Manifold Option BM78, BM79 - 2 psi
Manifold Option BM80, BM81 - 5 psi

Maximum Supply Pressure by Manifold

The table right lists the minimum supply pressure required for manifold and gas control combinations. Refer to the wiring diagram to be sure which combination of options applies to the system being serviced.

Minimum Supply Gas Pressure ("w.c.) for Full Fire														
Manifold Option	BM75				BM76		BM78		BM79		BM80		BM81	
with Gas Control Option	AG1		AG3		AG 30, 31, 32, 33, 35, 36, 37, 47, 48, or 51		AG 30, 31, 32, 33, 35, 36, 37, 47, 48, or 51							
Manifold Size	1"		1"		1"		1"		1-1/4"		1-1/4"		2"	
MBH	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro	Nat	Pro
250	4.0	1.4	4.0	N/A	4.1	1.6	4.4	1.6	4.6	1.6	4.5	1.6	5.1	1.8
500	5.3	1.9	5.0	N/A	5.8	2.3	6.0	2.3	5.2	1.9	5.0	1.7	5.3	1.9
750	7.5	2.7	6.8	N/A	8.5	3.3	8.4	3.3	6.1	2.3	5.7	2.0	5.5	1.9
1000					12.4	4.7	11.7	4.6	7.4	2.8	6.7	2.4	5.8	2.1
1250									9.1	3.5	8.0	2.9	6.2	2.2
1500									11.2	4.3	9.6	3.5	6.6	2.4
1750									13.6	5.3	11.5	4.2	7.2	2.6
2000									16.5	6.3	13.7	5.0	7.8	2.8
2500									23.3	8.9	18.9	7.0	9.4	3.4
3000													11.3	4.1

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 (standard with manifold Options BM 78, 79, 80 and 81; Option BP2 with other manifolds) 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.

FIGURE 29 - Gas Pressure Switches

Low Gas Pressure Switch, P/N 204375 (automatic)



High Gas Pressure Switch, P/N 204297 (manual reset)



(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 indoor installation.)

3.7 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 20-25% of total rated airflow (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 20-25% of total rated airflow (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 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 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.

Airflow Dampers

Function: Dampers operate in response to controls to provide the rated flow of makeup air to the building. Minimum outside air is 20-25%.

Service: Clean all dampers of dust or dirt.

Damper Motor

FIGURE 30 - 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.

3.0 Operation and Service (cont'd)

3.7 Inlet Air Controls (cont'd)

Pressure Null Switch (automatic building pressure sensor)



FIGURE 32 -
Pressure Null
Switch, P/N 88052

Photohelic Pressure Switch (automatic building pressure sensor)



FIGURE 33 -
Photohelic
Pressure Sensor,
P/N 159893

3.8 Other Optional Controls

FIGURE 34 -
Outside Air Cutoff
Control, P/N 126170



Potentiometer

FIGURE 31 -
Potentiometer,
P/N 16110



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.

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.

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.

Description/Function: The photohelic pressure switch is a phototransistor 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.

Outside Air Cutoff Control (Option BN2)

Location: The control is in the electrical box (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;
- would shutdown completely only on Option BN2 control, once burner has been fired;
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 35 -
Door Switch,
P/N 124253**



Door Switch (Option BX1)

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 36 - Dirty Filter
Pressure Switch,
P/N 105507**



Dirty Filter Switch (component of Remote Console Option RC14)

Location: Switch is located in the main electrical box (See **FIGURE 9**); sensor tubes run to 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 Paragraph 2.3.2). 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 setscrew on the switch clockwise until the filter light is energized or screw is bottomed out. At that point, adjust the setscrew 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 37 -
Firestat,
P/N 42782**



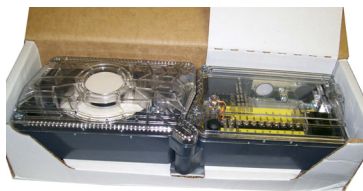
Firestat (Option BD2 or BD4)

Location: Firestat in Option BD2 is factory-mounted in the unit. Firestat in Option BD4 is field-mounted on the return air ductwork with the sensor extending into the duct. This control requires manual reset so it should be mounted in an accessible location.

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

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

**FIGURE 38 -
Photoelectric Smoke
Detector (cover
removed), P/N 159553,
used with sampling
tube, P/N 159714**



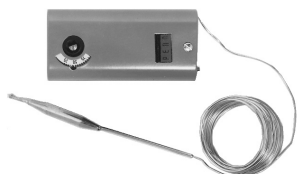
Photoelectric Smoke Detector (Option SA1)

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 39 - P/N 126170



Low Temperature Limit (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. Freezestat Controller is P/N **126170**.

3.0 Operation and Service (cont'd)

3.9 Troubleshooting

Chart 1 - System Troubleshooting (Check the diagnostic lights.)

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 203932).
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 203933).
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.
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.

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.

Chart 2 - Troubleshooting Optional Evaporative Cooling Module

WARNING: Disconnect the power before servicing the cooling module. Failure to do so can cause electrical shock, personal injury or death.

Problem	Probable Cause	Remedy
Float & Pump Control System - Pump does not run. Control is calling for cooling and reservoir is full.	1. Electrical connections	1. Verify all electrical connections. See Wiring Diagram.
	2. Electric float switch on pump	2. Check position of the actuators on the electric float switch.
	3. Dirty pump	3. Clean pump. See Paragraph 2.3.7.
	4. Defective pump	4. Replace pump.
Float & Pump Control System - Required water level (3") not maintained	1. Float valve	1. Adjust float valve. Refer to the installation manual.
	2. Optional drain and fill valves	2. Check valve for proper operation.
	3. Incorrect overflow pipe nipple - should be 3-1/2"	3. Replace pipe nipple.
	4. Drain leaking	4. Tighten drain plug.
Water running off of media pads	1. Excessive water flow 2. Media pads need cleaned or replaced.	1. Adjust ball valve in distribution line. Refer to installation manual. 2. Clean or replace media pads. See Paragraph 2.3.7.
Water not distributing evenly	1. Distribution line clogged	1. Flush distribution line. See Paragraph 2.3.7.
	2. Holes in distribution line turned	2. Check position of distribution line. Holes should be spraying upward. If not positioned with holes toward top, adjust position of PVC line.
	3. Incorrect voltage to pump (float and pump control system)	3. Check voltage at pump terminal in cooling module junction box.
Media pads becoming clogged and discolored quickly (scale/salt deposits) and/or rapid deterioration of the float switch (Float and Pump Control System)	1. Bleed off line clogged	1. Clean bleed line.
	2. Excessive water flow	2. Reduce flow by adjusting ball valve in distribution line. Refer to installation manual.
	3. Inadequate bleed off	3. A uniform build-up of minerals on the entering air face of the media indicates insufficient bleed off. Increase the rate until the mineral deposits dissipate.
Water blowoff from media pads or water being pulled from reservoir	1. Media pads installed incorrectly	1. Install media pads correctly. See Paragraph 2.3.7.
	2. Requires moisture elimination pad (over 600 FPM)	2. Install moisture elimination pad. Consult factory.
	3. Water level not 3 inches (float and pump control system)	3. See second problem listed above (Required water level not being maintained.)

INDEX

A

Air Pressure 5
Air Pressure Switches 9
Amplifier 12

B

Blower Belts 4
Belt Tension 4
Blower Bearings 4
Bulbs 5, 9
Burner 11
Main Burner 5
Bypass Damper Airflow 10

C

Circuit Indicator Board 5
Control Locations 8

D

Damper Motor 15
Dampers 15
Diagnostic Circuit Board 9
Direct-Fired Burner 11, 12, 14
Door Switch 17
Drive Components 4

E

Electronic Circuit Board with Lights 8
Electronic Modulation 11
Emergency Cut Off 9
End Plate 5
Evaporative Cooling Media 6
Evaporative Cooling Module 6

F

Dirty Filter Switch 17
Filters 4
Firestat 17
Flame Sensor 10

G

Gas Controls 14
Gas Pressure 4
Gas Pressure Switch 15
Gas Train 11

H

HAZARD INTENSITY LEVELS 2
Hot Surface Ignition System 10

I

Ignition System 10
Ignitor 10
Inlet Air Controls 15

J

Junction Box 7

L

Automatic Reset Limit Control 9
Manual Reset Limit Control 9
Limit Safety Controls 9
Low Temperature Limit 17

M

Maintenance Codes 3
Maintenance Schedule 3, 6, 8
Manifold Arrangements 14
Maxitrol Series 14 Components 12, 13
Maxitrol Series 44 Components 12, 14
Mixing Plates 5
Mixing Tube 12
Electronic Modulation Makeup Air 13

O

Outside Air Cutoff Control 16

P

Photoelectric Smoke Detector 17
Photohelic Pressure Switch 16
Pilot Assembly 5
Potentiometer 16
Supply Pressure 14
Airflow Sensing Pressure Check 10
Pressure Null Switch 16
Pressure Switch 10

R

Remote Sensor/Selector 14

S

Signal Conditioner 13

T

Temperature Selector 12
Troubleshooting 18

V

Modulating Gas Valve 12, 13
Single-Stage Gas Valve 11
Two-Stage Gas Valve 11

W

Warnings 2

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

Model	Serial No.	Date of Installation	Notes
	Installer	Distributor	
Name			
Company			
Address			
Phone No.			

For more information on Reznor HVAC products:

- Contact your local Reznor representative at 1-800-695-1901
- Refer to the technical specifications, manuals, and consumer materials found at www.reznorhvac.com

