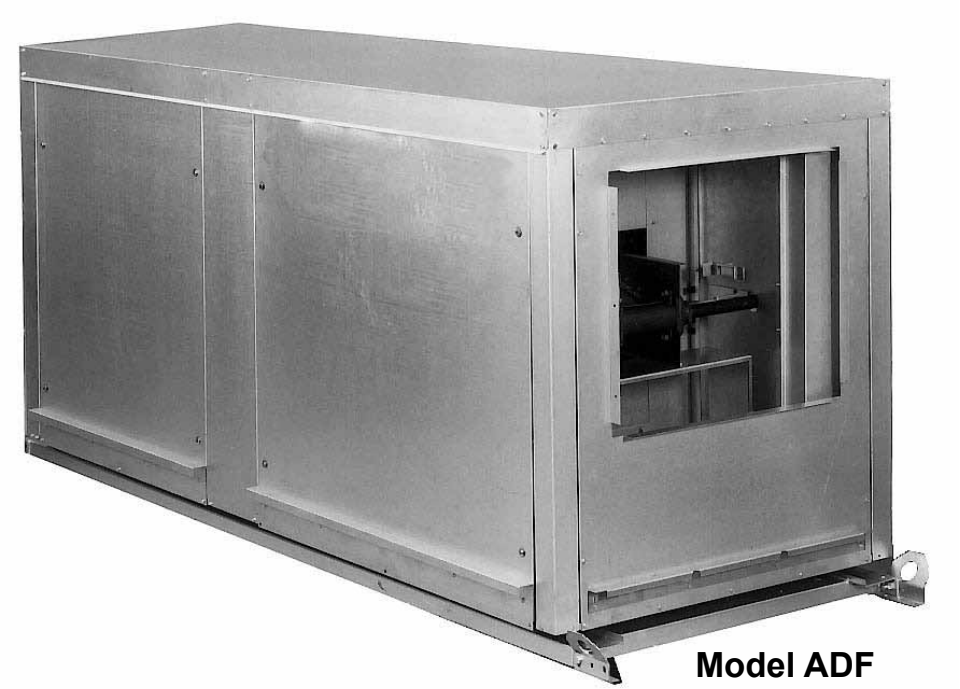
Installation

Applies to: **Indoor or Outdoor Gas, Direct-Fired, Makeup Air/Heating Systems, Model ADF and Model ADFH**



Model ADF

⚠ 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.**

Table of Contents

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 Apply to Warnings throughout 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.**

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.

1.2 General Description

The information in this manual applies to Model ADF and Model ADFH in Sizes 300, 500, 700 and 1200. Both Model ADF and ADFH are direct-fired makeup air heating systems. Model ADFH is designed with a high discharge air temperature.

These systems consist of a direct-fired, gas-fueled burner and a draw-through blower housed in a weatherized cabinet. The systems may be installed either indoors or outdoors and are available for use with either natural or propane gas.

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 (or cools if equipped with an evaporative cooling module) 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.

1.3 Warranty

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

1.4 Installation Codes

These systems are design-certified to ANSI and CSA Standards. 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.

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.

This direct-fired makeup air system must be installed in accordance with local building codes. In the absence of local codes, in the United States, the unit must be installed in accordance with the National Fuel Gas Code (latest edition). A Canadian installation must be in accordance with the CAN/CGA B149.1 and B149.2 Installation Code for Gas Burning Appliances and Equipment. These codes are available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.

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. 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.

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.

2.0 Location

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.

3.0 Uncrating and Preparation

3.1 Uncrating and Inspecting

Check for any damage that may have been incurred during shipment. If damage is found, document the damage with the carrier and immediately contact an authorized Reznor® distributor.

Check the gas specifications and electrical voltage (system rating plate is in the control compartment) to be sure that they agree with the utilities at the installation site.

Locate the 4x4 junction box with a 3-positon switch shipped inside the unit. (**NOTE**: Two exceptions - 1) If an optional remote console was ordered, this switch is mounted on the console which is shipped separately. 2) If gas control Option AG37 was ordered, the junction box is not included)

3.2 Preparing for Installation

Shipped-Separate Components

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

Gas Control Options	Shipped-Loose Parts
AG30, AG32, AG33, AG35	*Temperature Selector , Discharge Air Sensor
AG31	*Temperature Selector, Discharge Air Sensor, Space Override Thermostat
AG36	Remote Console
AG49, AG50	Control Switch, P/N 29054

*If an optional remote console is ordered, this control may have been ordered to be mounted on the console. The console is shipped separately.

Be sure that all shipped-separate accessories for the installation are available. Shipped-separate accessories could include a roof curb, an indoor filter cabinet, an outside air hood, a disconnect switch, a supply gas regulator, a door switch, an evaporative cooling module, a fill and drain or freeze kit, and/or a water hammer arrestor.

Be sure that all necessary equipment, tools, and manpower are available at the installation site.

4.0. Clearances and Dimensions

4.1 Clearances to Combustibles

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.

Top	Control Side*	Opposite Side	Bottom
0	0	0	0

*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.

4.2 Dimensions

4.2.1 Dimensions of Models ADF/ADFH Sizes 300 and 500

Dimensions (inches) - Illustration in FIGURE 1A (Sizes 300 and 500)						
Models	Horizontal Discharge		Vertical** Discharge			
	ADF300	ADF500	ADF300	ADF500	ADFH300	ADFH500
A	34	47-3/4	34	47-3/4	34	47-3/4
B	31-1/16	44-13/16	31-1/16	44-13/16	31-1/16	44-13/16
C	85-13/16	85-13/16	85-13/16	85-13/16	109-1/2	109-1/2
D	11-27/32	12-11/16	-	-	-	-
E	15-5/16	17-11/16	-	-	-	-
F (inside)	15-15/16	14-13/16	15-15/16	14-13/16	15-15/16	14-13/16
G	17-1/2	16-3/8	-	-	-	-
H (inside)	13-3/4	16-1/8	-	-	-	-
J	-	-	64-19/32	62-11/32	64-19/32	62-11/32
K	-	-	13-13/16	16-1/16	13-13/16	16-1/16
M	-	-	7	8-1/8	7	8-1/8
N	-	-	8-1/8	21-3/4	8-1/8	21-3/4
P	-	-	7-13/32	7-13/32	31-3/32	31-3/32

** Models ADFH 300/500 have a motor compartment required for high temperature discharge. Models 300/500 with optional vertical discharge have same cabinet length as the standard horizontal discharge unit.

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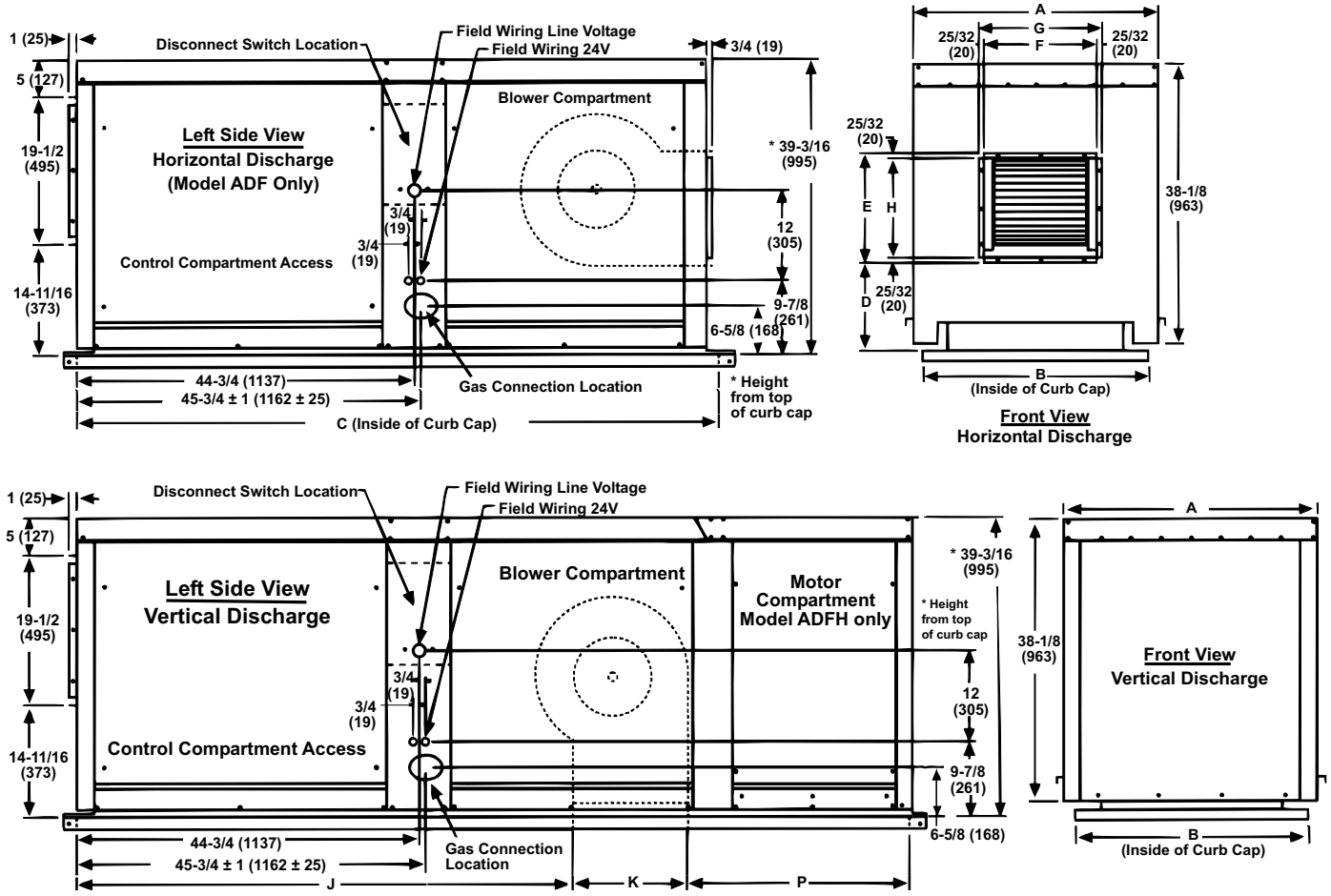
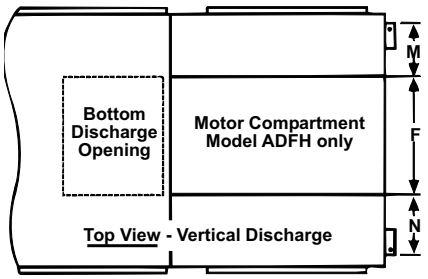
Dimensions (mm) - Illustration in FIGURE 1A (Sizes 300 & 500)						
Models	Horizontal Discharge		Vertical** Discharge			
	ADF300	ADF500	ADF300	ADF500	ADFH300	ADFH500
A	34	1213	864	1213	864	1213
B	789	1138	789	1138	789	1138
C	2180	2180	2180	2180	2781	2781
D	301	322	-	-	-	-
E	389	449	-	-	-	-
F (inside)	405	376	405	376	405	376
G	445	416	-	-	-	-
H (inside)	349	408	-	-	-	-
J	-	-	1640	1584	1640	1584
K	-	-	351	408	351	408
M	-	-	178	206	178	206
N	-	-	206	552	206	552
P	-	-	188	188	790	790

FIGURE 1A - Dimensions of Models ADF/ADFH 300 and 500 - inches (mm)



Duct Dimensions	
(with and without discharge dampers)	
Models	**Horizontal**
ADF 300/500	G x E
Models	**Vertical**
ADF/ADFH 300/500	F x K
NOTE: Motor for optional dampers with horizontal discharge is externally mounted on the control side of the damper frame. Horizontal damper frame extends 6-5/8" (168mm) beyond the duct connection on the heater. See **FIGURE 19**, page 18.	



4.0. Clearances and Dimensions (cont'd)

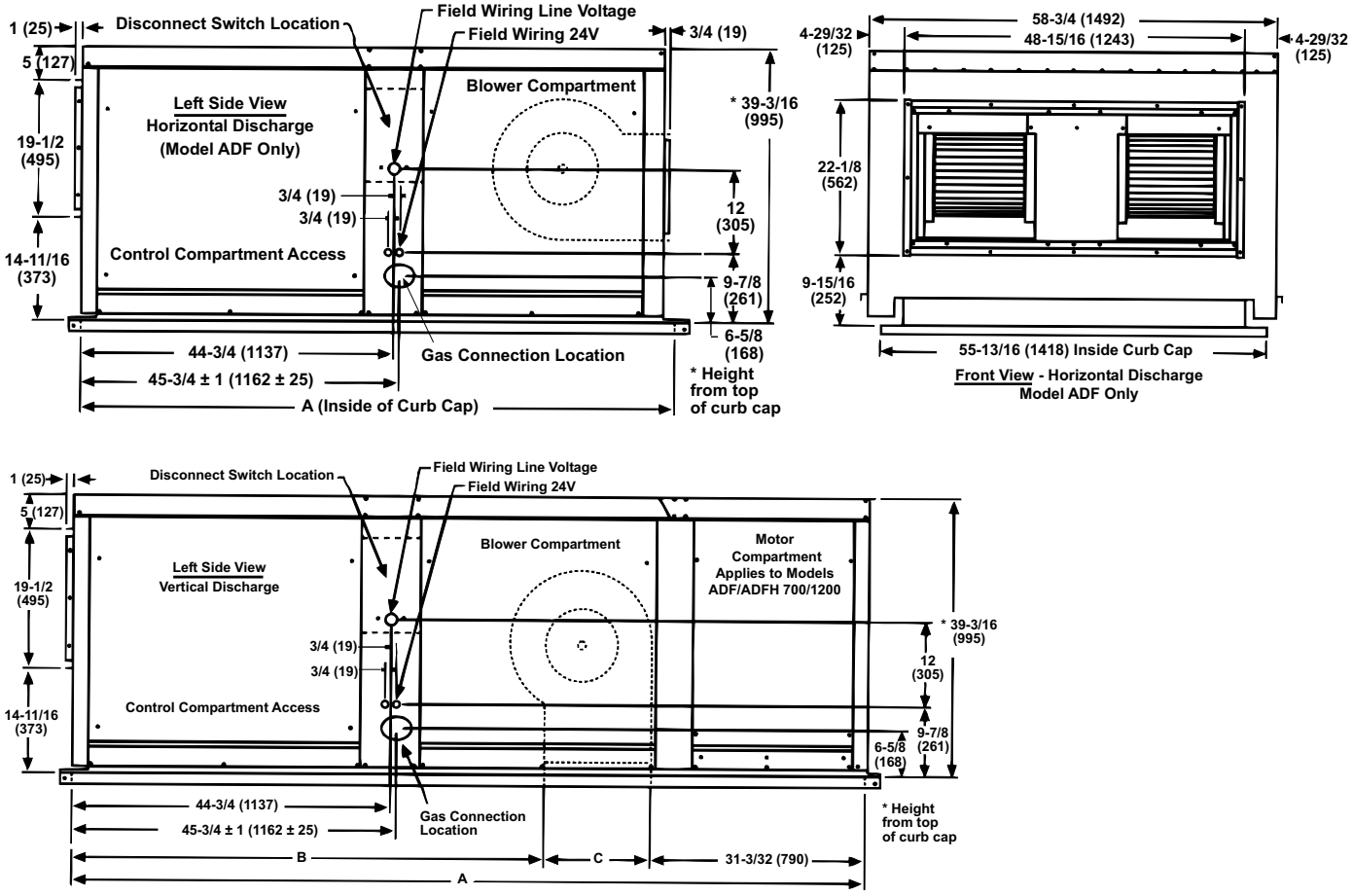
4.2 Dimensions (cont'd)

4.2.2 Dimensions of Models ADF/ADFH Sizes 700 and 1200

Dimensions (inches) - FIGURE 1B			
	Horizontal Discharge	Vertical Discharge	
Models	ADF	ADF/ ADFH	ADF/ ADFH
Size	700/1200	700	1200
A	92-1/8	117-1/32	117-1/32
B	-	72-1/8	69-7/8
C	-	13-13/16	16-1/16

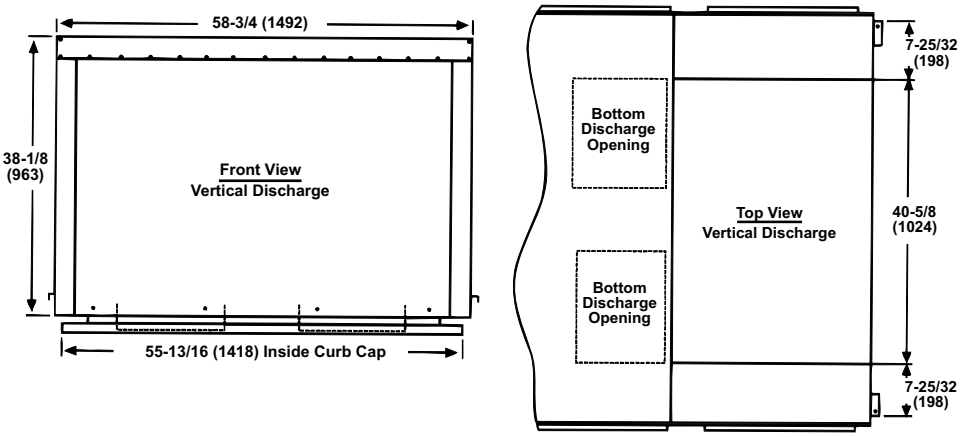
Dimensions (mm) - FIGURE 1B			
	Horizontal Discharge	Vertical Discharge	
Models	ADF	ADF/ ADFH	ADF/ ADFH
Size	700/1200	700	1200
A	2340	2973	2973
B	-	1832	1775
C	-	351	408

FIGURE 1B - Dimensions of Models ADF/ADFH 700 and 1200 - inches (mm)



Duct Dimensions	
(with and without discharge dampers)	
Models	**Horizontal**
ADF 700/1200	48x15/16x22-1/8 (1243x562)
Models	**Vertical**
ADF/ADFH 700/1200	Cx40-15/16 (Cx1024)

NOTE: Motor for optional dampers with horizontal discharge is externally mounted on the control side of the damper frame. Horizontal damper frame extends 6-5/8" (168mm) beyond the duct connection on the heater. See **FIGURE 19**, page 18.



5. Mounting

Mounting is the responsibility of the installer.

Depending on the building and its use, determine whether or not additional field measures should be taken to reduce the effect of blower vibration and/or noise. Determining the need for and installing vibration isolation is the responsibility of the installer.

When selecting a location for an outdoor installation, position the unit so that the air inlet will **NOT** be facing into the prevailing wind.

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.

5.1 Weights

Verify that the supporting structure has sufficient load-carrying capacity to support the weight.

NOTE: Net weights are approximate for the standard cabinet, blowers, and base. **Optional equipment is not included and can add *substantial* weight to the figure in the table.**

Net Weight - lbs (kg)			
Model	**ADF**	**ADF**	**ADFH**
Discharge	**Horizontal**	**Vertical**	**Vertical**
Size 300	700 (318)	700 (318)	790 (358)
Size 500	775 (352)	775 (352)	885 (401)
Size 700	930 (422)	1080 (490)	1080 (490)
Size 1200	950 (431)	1100 (499)	1100 (499)

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

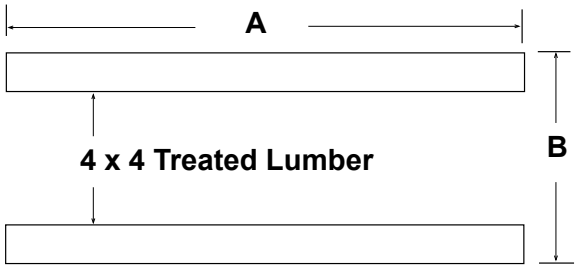
The system is equipped with a load-bearing curb cap which forms an integral part of the unit. Whether the system is being mounted directly on a surface or being placed "up" on additional structure, the horizontal length must be supported by two 4x4 treated wooden rails. Refer to **FIGURE 2** for the 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 a surface, position them as shown in **FIGURE 2**. 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 or a minimum of 9" service clearance from the bottom of an evaporative cooling module to the mounting surface (Evaporative cooling module for Sizes 700 and 1200 must be mounted. Leg height adjusts from 9" to 16". See Paragraph 6.2.4 for additional information.)

FIGURE 2 - Placement of Mounting Rails

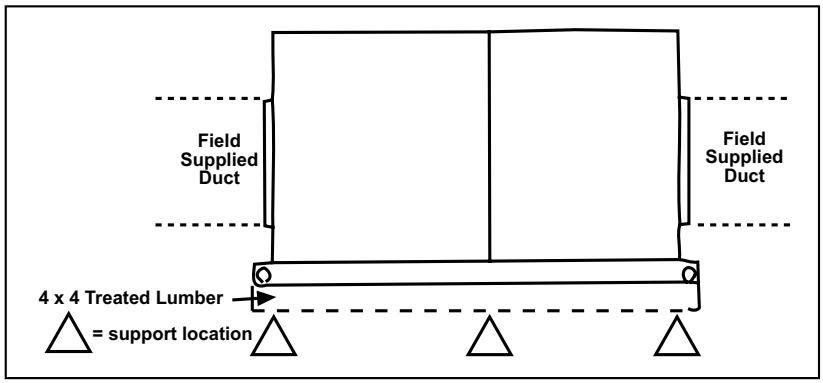


Discharge	Horizontal	Vertical		Both
Model	ADF	ADF	ADFH	ADF/ADFH
	Dimension A (inches)			B (inches)
300	85-13/16	85-13/16	109-1/2	31-1/16
500	85-13/16	85-13/16	109-1/2	44-13/16
700	92-1/8	117-1/32	117-1/32	55-13/16
1200	92-1/8	117-1/32	117-1/32	55-13/16
	Dimension A (mm)			B (mm)
300	39	39	50	14
500	39	39	50	20
700	42	53	53	25
1200	42	53	53	25

5.0 Mounting (cont'd)

5.3 Mounting on Field-Supplied Supports (cont'd)

FIGURE 3 - Cross Support Mounting Requirements



5.4 Mounting on a Roof Curb

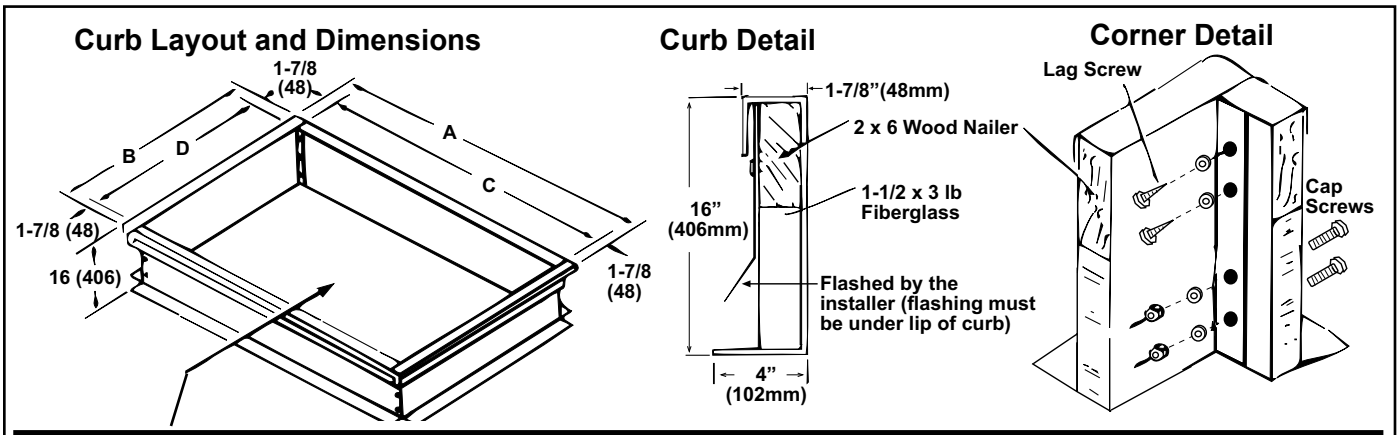
CAUTION: Before assembly, re-check to be sure that the correct curb has been ordered. Be sure that the curb selected matches the unit ordered. Verify the dimensions of the curb received with the curb dimension table, FIGURE 4.

Installation Instructions for 16" Optional Roof Curb (Option CJ3) - Refer to FIGURE 4

NOTE: Curb rail sections and hardware for assembling curb are provided with optional roof curb. Insulation and flashing are field supplied.

1. Position the curb cross rails as shown in the assembly illustration in **FIGURE 4**. Fasten curbing pieces with bolts and lag screws as illustrated in the corner detail.
2. Check the assembly for squareness. The curb must be adjusted so that the diagonal measurements are equal within a tolerance of ± 1/8".
3. Level the roof curb. To ensure a good weatherproof seal between the 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 roof deck before installing flashing.
4. Install field-supplied flashing.
5. Before placing the unit into position, apply furnished 1/4" x 1-1/4" foam sealant tape to the top surface of the curb, making good butt joints at the corners. The unit must be sealed to the curb to prevent water leakage into the curb area due to blowing rain and capillary action.

FIGURE 4 - Optional Roof Curb (Shipped separately to be field assembled)



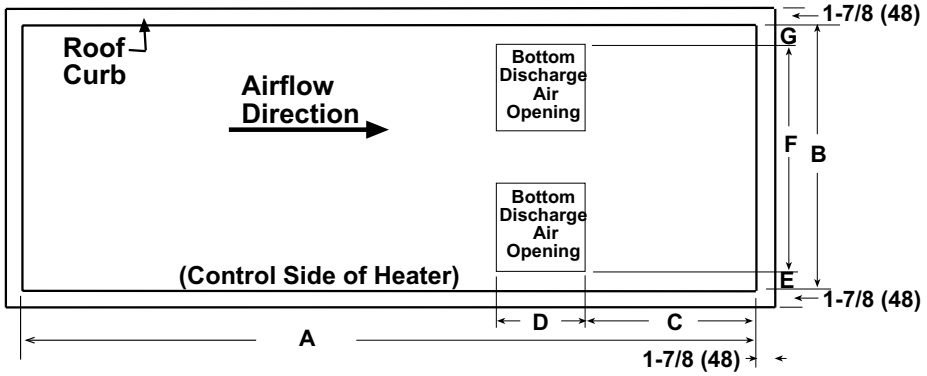
IMPORTANT: Area enclosed by roof curb must comply with clearance to combustible materials.If roof is constructed of combustible materials, area within curb must be either ventilated, left open, or covered with non-combustible material which has an "R" value of at least 5.0. If area within curb is left open, higher radiated sound levels may result.

Model	ADF300	ADF500	ADFH300	ADFH500	ADF700/1200		ADFH700/1200
Discharge	Horizontal or Vertical		Vertical Only		Horizontal	Vertical	Vertical Only
Roof Curb Dimensions (inches) - FIGURE 4							
A	84-9/16	84-9/16	108-1/4	108-1/4	90-7/8	115-25/32	115-25/32
B	29-13/16	43-9/16	29-13/16	43-9/16	54-1/2	54-1/2	54-1/2
C*	80-13/16	80-13/16	104-1/2	104-1/2	87-1/8	112-1/32	112-1/32
D*	26-1/16	39-13/16	26-1/16	39-13/16	50-13/16	50-13/16	50-13/16
Roof Curb Dimensions (mm) - FIGURE 4							
A	2148	2148	2750	2750	2308	2941	2941
B	757	1106	757	1106	1384	1384	1384
C*	2053	2053	2654	2654	2213	2846	2846
D*	662	1011	662	1011	1291	1291	1291
***C and D are roof opening dimensions.**							

Bottom (Vertical) Duct Connections

If the system being installed has a vertical discharge, the duct opening has flanges for connection to field-installed ductwork. See **FIGURE 5** for duct opening and spacing in relationship to currently manufactured Reznor® roof curbs.

FIGURE 5 - Vertical Duct Connection in Relationship to Reznor® Roof Curb



Dimensions - inches (mm)							
Model	A	B	C	D	E	F	G
ADF300	80-13/16 (2053)	26-1/16 (662)	4-25/32 (121)	13-13/16 (351)	5-5/8 (143)	15-15/16 (405)	4-1/2 (114)
ADF500	80-13/16 (2053)	39-13/16 (935)	4-25/32 (121)	16-1/16 (408)	19-1/4 (489)	14-13/16 (376)	5-3/4 (146)
ADF700	112-1/32 (2846)	50-13/16 (1291)	28-19/32 (726)	13-13/16 (351)	5-5/16 (135)	40-5/16 (1024)	5-5/16 (135)
ADF1200	112-1/32 (2846)	50-13/16 (1291)	28-19/32 (726)	16-1/16 (408)	5-5/16 (135)	40-5/16 (1024)	5-5/16 (135)
ADFH300	104-1/2 (2654)	26-1/16 (662)	28-19/32 (726)	13-13/16 (351)	5-5/8 (143)	15-15/16 (405)	4-1/2 (114)
ADFH500	104-1/2 (2654)	39-13/16 (935)	28-19/32 (726)	16-1/16 (408)	19-1/4 (489)	14-13/16 (376)	5-3/4 (146)
ADFH700	112-1/32 (2846)	50-13/16 (1291)	28-19/32 (726)	13-13/16 (351)	5-5/16 (135)	40-5/16 (1024)	5-5/16 (135)
ADFH1200	112-1/32 (2846)	50-13/16 (1291)	28-19/32 (726)	16-1/16 (408)	5-5/16 (135)	40-5/16 (1024)	5-5/16 (135)

6.0 Mechanical

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). Gas supply piping installation must conform with good practice and with all local codes.

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.

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 6**. 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.

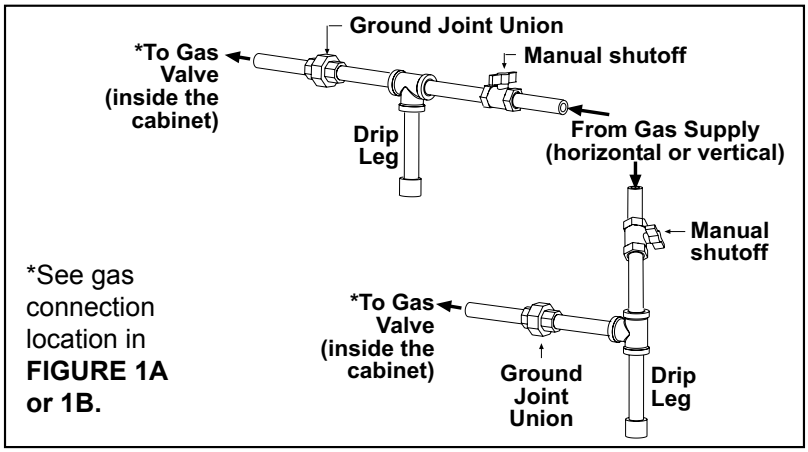
WARNING: All components of the gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME.

6.1 Gas Piping and Pressures (cont'd)

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													
	3/4"		1"		1-1/4"		1-1/2"		2"		2-1/2"		3"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
20'	190	116	350	214	730	445	1100	671	2100	1281	3300	2013	5900	3599
30'	152	93	285	174	590	360	890	543	1650	1007	2700	1647	4700	2867
40'	130	79	245	149	500	305	760	464	1450	885	2300	1403	4100	2501
50'	115	70	215	131	440	268	670	409	1270	775	2000	1220	3600	2196
60'	105	64	195	119	400	244	610	372	1105	674	1850	1129	3250	1983
70'	96	59	180	110	370	226	560	342	1050	641	1700	1037	3000	1830
80'	90	55	170	104	350	214	530	323	990	604	1600	976	2800	1708
90'	84	51	160	98	320	195	490	299	930	567	1500	915	2600	1586
100'	79	48	150	92	305	186	460	281	870	531	1400	854	2500	1525
125'	72	44	130	79	275	168	410	250	780	476	1250	763	2200	1342
150'	64	39	120	73	250	153	380	232	710	433	1130	689	2000	1220
175'	59	36	110	67	225	137	350	214	650	397	1050	641	1850	1129
200'	55	34	100	61	210	128	320	195	610	372	980	598	1700	1037
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.														

FIGURE 6 - Gas Supply Connection



Supply Pressure

These direct-fired makeup air systems are designed to operate on a natural gas supply pressure range of a minimum of 6" w.c. to a maximum of 28" w.c. 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"). 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 - 1/2 psi
Manifold Option BM78, BM79 - 2 psi

Minimum Supply Gas Pressure for Full Fire										
Manifold Option	**BM75**				**BM76**		**BM78**		**BM79**	
with Gas Control Option	**AG1**		**AG3**		**AG 30, 31, 32, 33, 35, 36, or 37**		**AG 30, 31, 32, 33, 35, 36, or 37**			
Manifold Size	**1"**		**1"**		**1"**		**1"**		**1-1/4"**	
MBH	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
500	5.3	1.9	5.0	N/A	5.8	2.3	6.0	2.3	5.2	1.9
750	7.5	2.7	6.8	N/A	8.5	3.3	8.4	3.3	6.1	2.3
1000	--	--	--	--	12.4	4.7	11.7	4.6	7.4	2.8
1250	--	--	--	--	--	--	--	--	9.1	3.5

Pilot Supply Pressure

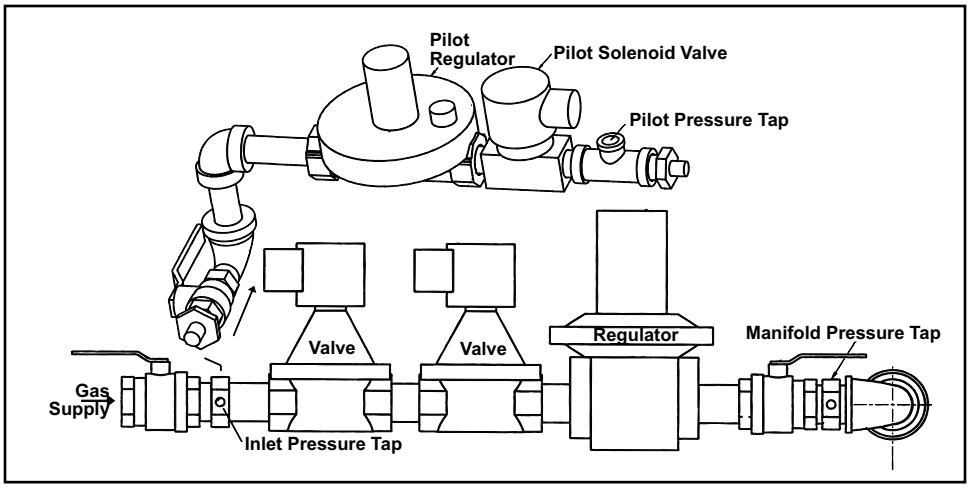
These systems are designed to operate on a natural gas pilot supply pressure of 3.5" w.c. or a propane gas pilot supply pressure of 6" w.c.

Measure both operating pressure and pilot supply pressure with the blowers 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.

FIGURE 7 - Pressure Tap Locations for Measuring Manifold and Pilot Pressure



Gas Pressure Switches

Gas pressure switches included in the gas train monitor gas pressure downstream 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 and 79 or optional (BP2 or BP4) 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.

An optional low gas pressure switch (Option BP3 or BP4) 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.

6.2 Unit Inlet Air

6.2.1 Screened Outside Air Hood without Filters (Option AS2)

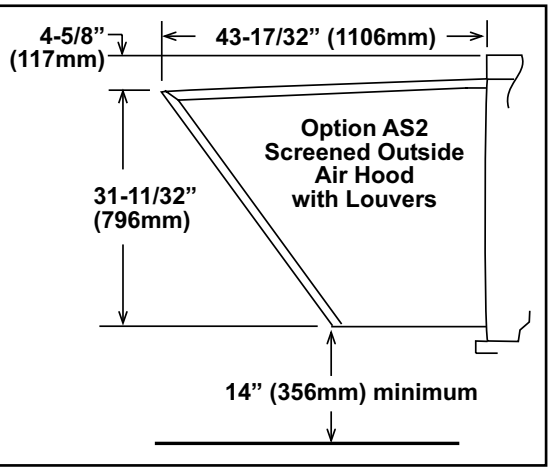
Option AS2, Screened Outside Air Hood, is a weatherized hood designed to be field-assembled and installed around the inlet air opening. The air hood includes a pre-assembled louver assembly designed to help eliminate moisture from the inlet air. Complete instructions are packaged with the air hood option.

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

FIGURE 8A - Dimensions of Outside Air Hood Option AS2

Outside air hood is shipped separately for field installation. Dimensions are the same for all sizes.

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



6.0 Mechanical (cont'd)

6.2 Unit Inlet Air (cont'd)

6.2.1 Screened Outside Air Hood without Filters (cont'd)

Installation Instructions

(Refer to Air Hood Assembly Drawing in FIGURE 8B. All screw ends except those across the bottom should be inside the air hood.)

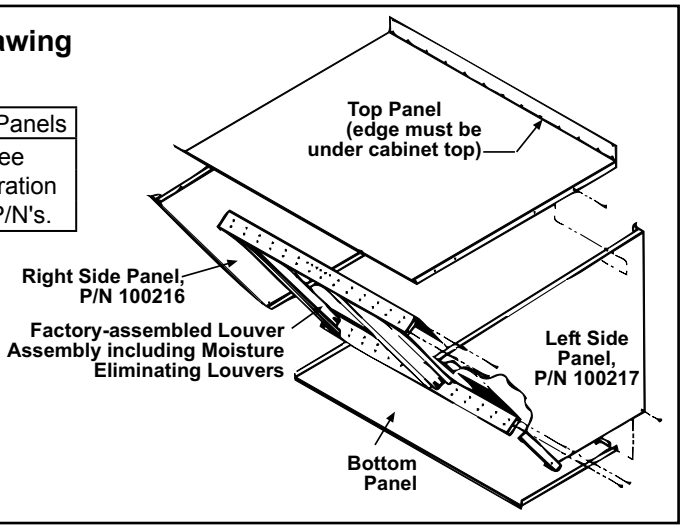
To avoid possible damage, it is recommended that the outside air hood be installed after the unit has been placed on the roof. The air hood should be installed before the heater is operated. Do not install the air hood while the heater or blower is in operation.

1. **Install Top Panel** - On the air inlet end of the cabinet, remove the row of factory-installed screws attaching the cabinet top. Slide the air hood top panel underneath the edge of the cabinet top. The edge of the air hood top panel **must** be between the cabinet top and end panel. Reinsert all of the sheet metal screws.
2. **Install Side Panels** - Slide the air hood right side panel into the slot between the cabinet end panel and corner leg. Be sure that the side panel is underneath and to the inside of the air hood top panel. Attach to the cabinet and the air hood top using the required number of self-drilling sheet metal screws. Repeat with the left side panel.

FIGURE 8B - Component P/N's and Assembly Drawing of Option AS2, Outside Air Hood Without Filters

Size	Top Panel	Bottom Panel	Louver Assy	Side Panels
300	100228	100235	103774	See illustration for P/N's.
500	100230	100237	103776	
700 & 1200	100232	100239	103778	

NOTE: Either a Reznor® designed optional air inlet hood or evaporative cooling module is required on outdoor installations to ensure complete weather resistance and to retain certification.



3. **Install Bottom Panel** - Position the air hood bottom panel so that it is to the inside of the two side panels and above the factory-installed support angle. Attach to both side panels.

   If the bottom panel does not rest tightly against the support angle, follow these instructions to adjust the position of the support angle:

   a) Slightly loosen (do not remove) the support angle screws.
   b) Slide the support angle up (holes are slotted) so that it is against the bottom panel.
   c) Tighten the screws.

   Attach the support angle to the air hood bottom panel. The bottom panel of the air hood and the support angle should be tight together; do not draw with the sheet-metal screws.
4. **Install the Louver Assembly** - With the intake screen toward the inside of the hood, position the pre-assembled vertical louver assembly in the inlet opening of the air hood. Using the remaining sheet metal screws, attach the louver assembly to the air hood side panels using the holes provided.

6.2.2 Screened Outside Air Hood with Filters - Options AS6, AS7, AS10, AS12

Screened air hoods are available with a filter rack and 2" disposable filters, 1" or 2" permanent filters, or 2" disposable pleated filters. Screened air hoods with filters are shipped factory-assembled for field installation. To avoid possible damage, it is recommended that the outside air hood be installed after the unit is in its permanent location. The dimensions are shown in **FIGURE 9B**.

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

Follow the instructions below to attach the outside air hood to the inlet air end of the system cabinet.

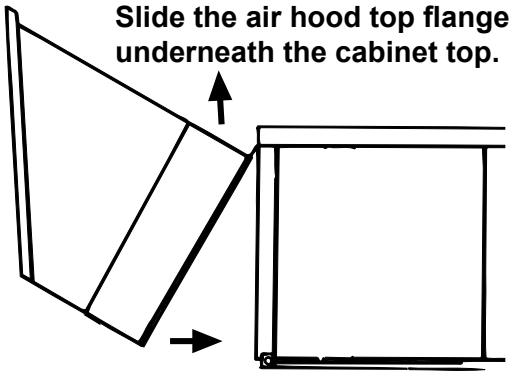
FIGURE 9A - Optional Screened Outside Air Hood with Filters

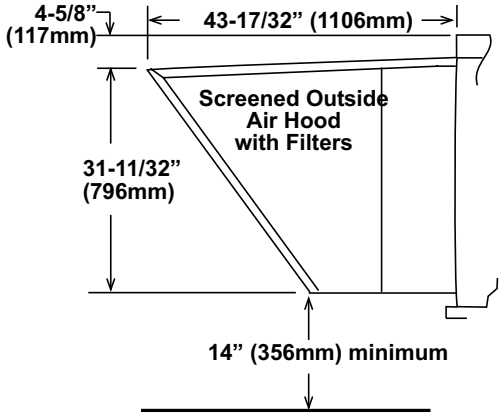
Factory assembled and shipped separately for field installation.

FIGURE 9B - Installation and Dimensions of Outside Air Hood with Filters

Instructions for installing pre-assembled outside air hood with filters:

1. On the inlet air end of the system, remove the row of factory-installed screws attaching the cabinet top.
2. Tip the assembled air hood slightly and slide the top flange underneath the cabinet top. The air hood must be between the cabinet top and the end panel. Slide the side flanges into the slots between the corner posts and the end panel. (See **FIGURE 9A**).
3. Re-insert all of the screws across the top of the cabinet.
4. The air hood bottom should be resting on the factory-installed support angle across the bottom of the cabinet. If the bottom panel does not rest tightly against the support angle, follow these instructions to adjust the position of the support angle:
   a) Slightly loosen (do not remove) the support angle screws.
   b) Slide the support angle up (holes are slotted) so that it is against the bottom panel.
   c) Tighten the screws.
5. If equipped with an optional dirty filter switch, locate the coil of clear tubing attached to the dirty filter switch in the electrical compartment. Extend the tubing to the air entering side of the filter rack. Attach the end of the tubing being careful that it is not compressed or kinked. (See Paragraph 7.3 for switch details.)





NOTE: Width is the same as cabinet without filters; see **FIGURE 8A**.

6.2.3 Indoor Filter Cabinet - Options AW3, AW6, AW13, AW15

The optional filter cabinets are designed for field attachment to systems that are installed indoors. The cabinet has a 1" duct flange for attachment of ductwork to bring in outside makeup air to the system. The cabinet is available with 1" or 2" permanent, 2" disposable, or 2" pleated disposable filters. There is a filter access door on both sides of the cabinet.

Installation Instructions: The cabinet and filter racks with filters are factory assembled and shipped separately for attachment to the system at the job site.

1. On the inlet end of the system, remove the row of factory-installed screws attaching the cabinet top.
2. Tip the assembled filter cabinet slightly and slide the top flange underneath the cabinet top. (Refer to **FIGURE 9B above.**)

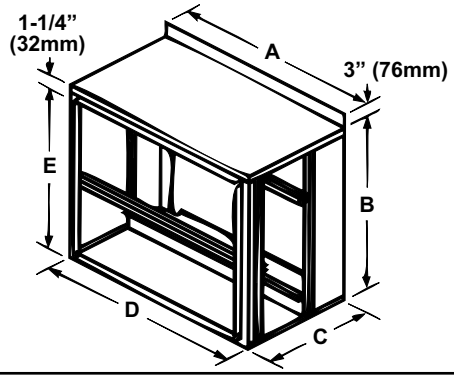


FIGURE 10 - Dimensions of Indoor Filter Cabinet

Size	300	500	700/1200		Size	300	500	700/1200
Dimensions (inches)					Dimensions (mm)			
A	34-1/8	47-13/16	58-15/16		A	867	1214	1497
B	33-1/16	33-1/16	33-1/16		B	840	840	840
C*	16-13/16	16-13/16	16-13/16		C*	427	427	427
D**	31-1/4	45	56		D**	794	1143	1422
E**	30-1/2	30-1/2	30-1/2		E**	775	775	775

* Includes 1" duct flange extending perpendicular to the duct opening.
** Duct connection.

The filter cabinet flange must be between the cabinet top and the end panel. Slide the side flanges into the slots between the corner posts and the end panel.

6.0 Mechanical (cont'd)

6.2 Unit Inlet Air (cont'd)

6.2.3 Indoor Filter Cabinet (cont'd)

3. Re-insert all of the screws across the top of the cabinet.
4. The filter cabinet should be resting on the factory-installed support angle across the bottom of the cabinet. If the cabinet does not rest tightly against the support angle, follow these instructions to adjust the position of the support angle:
   a) Slightly loosen (do not remove) the support angle screws.
   b) Slide the support angle up (holes are slotted) so that it is against the bottom panel.
   c) Tighten the screws.
5. If equipped with an optional dirty filter switch, locate the coil of clear tubing attached to the dirty filter switch in the electrical compartment. Extend the tubing to the air entering side of the filter rack. Attach the end of the tubing being careful that it is not compressed or kinked. (See Paragraph 7.3 for switch details.)

6.2.4 Evaporative Cooling Module - Options AS4 and AS8

Evaporative cooling provides excellent comfort cooling at low initial equipment and installation costs and low operating and maintenance costs. Direct evaporative cooling works on the principles that water in direct contact with a moving airstream will eventually evaporate if the droplets have long enough exposure and that the evaporation will lower the air temperature.

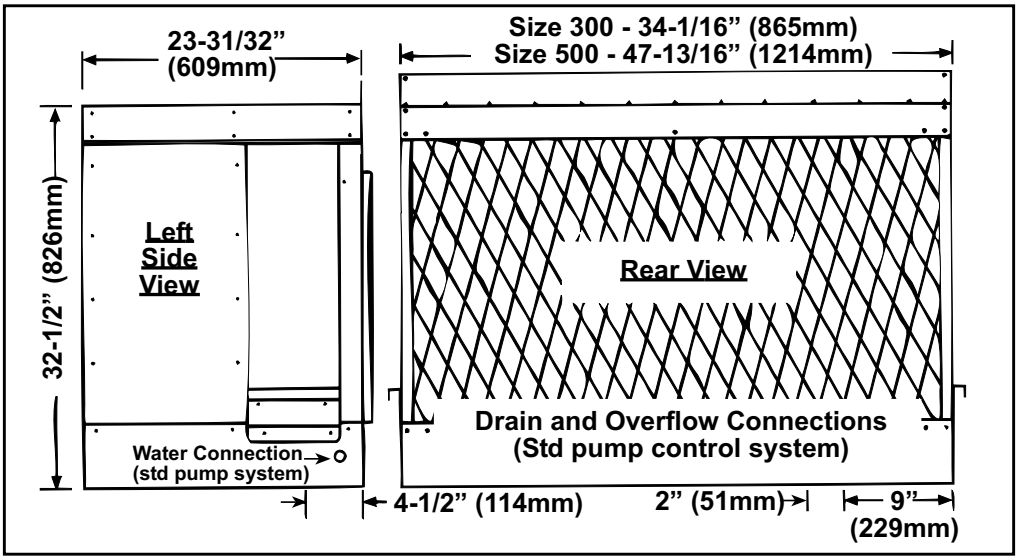
The optional evaporative cooling module is equipped with high efficiency pad media of either 12" rigid cellulose or 12" rigid glass fiber. 12" media provides 90% efficiency. Efficiency value is stated at maximum allowable CFM (without the optional moisture elimination pad) and with an inlet dry bulb temperature of 95°F and an inlet wet bulb temperature of 65°F. Evaporative cooling efficiency is a function of inlet temperature (wet and dry bulbs) and of face velocity through the pads. The stated cooling efficiency will rise with the decrease of velocity and increase of inlet temperature. Moisture elimination pads (Option ASA1) may be used on all units but are required on high CFM units (velocity above 6000 FPM) as listed in the table below.

FIGURE 11A - Factory-installed Evaporative Cooling Module Option on Models ADF/ADFH 300 and 500

Model/Size	Moisture Elimination Pad Required Size on the Evaporative Cooling Module at
ADF/ADFH 300	3200 CFM
ADF/ADFH 500	4500 CFM
ADF/ADFH 700	11200 CFM
ADF/ADFH 1200	11200 CFM

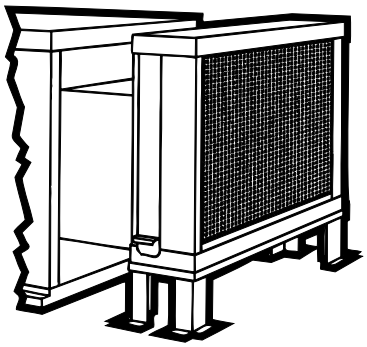
Models ADF/ADFH 300/500 - When ordered with an evaporative cooling option, Sizes 300 and 500 are shipped as a factory-assembled makeup air heating/evaporative cooling system. The module is factory installed including all wiring connections (See **FIGURE 11A**). Follow the instructions in this section for water connections and water flow adjustments.

FIGURE 11B - Dimensions of optional evaporative cooling module factory-installed on Sizes 300 and 500



Models ADF/ADFH 700/1200 - The evaporative cooling module for Sizes 700 and 1200 is assembled at the factory and shipped separately for field-connection to the makeup air system cabinet. The shipped separate option includes the cooling module,

FIGURE 12 - Optional Evaporative Cooling Module on an ADF/ ADFH 700 or 1200. Assembled module is shipped separately for field installation.



an adjustable base, and the transition ductwork between the cooling module and the cabinet. Complete installation instructions including dimensions are packaged with the evaporative cooling module package.

Included in the cooling module installation booklet is a preparation checklist. All items in that checklist should be addressed prior to beginning installation of the evaporative cooling module. Four of those items are listed below.

Adjustable Leg Height
16" maximum; 9" minimum

- ☐ Make certain the roof or platform is capable of handling the additional load of a full cooling module reservoir.

Wts of Evaporative Cooling Module w/ Wet Media & Full Reservoir	
Module with 12" rigid cellulose media (Option AS4).	431 lbs (196 kg)
Module with 12" rigid glass fiber media (Option AS8)	514 lbs (233 kg)

- ☐ Make certain the roof is level and free of debris where the cooling module will be mounted.
- ☐ Do not mount directly on soft tar roofs where the legs could sink and tilt the cooling module. Provide a weather-resistant, solid wood or metal base under the cooling module support legs.
- ☐ Make certain that there will be adequate clearance between the bottom of the reservoir and the roof (or platform) to allow for drain and overflow pipe connections.

All Sizes - If an optional fill and drain kit is part of the installation, the kit is shipped separately. Connect the fill and drain kit as illustrated in **FIGURE 14**.

Evaporative Cooling Module Water Connections and Adjustments

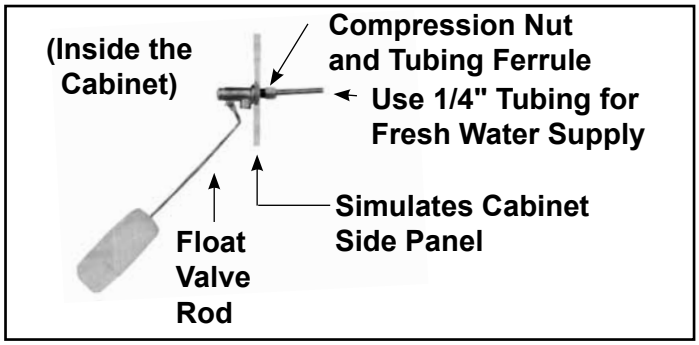
WARNINGS: Water reservoir must be drained and pump motor turned off when outside temperature falls below 32°F. Pump must never be operated without water in the reservoir. See Hazard levels, page 2.

Supply and Drain Water Connections

Float Valve (**FIGURE 13**) - In a module with pump and float controls, a float valve maintains the appropriate water level in the reservoir.

Use a field-supplied 1/4" diameter tubing with a compression nut and tubing ferrule to connect the fresh water supply to the inlet of the float valve. See **FIGURE 13.** Place nut and ferrule over tubing and insert tubing into the float valve stem. Tighten nut securely.

FIGURE 13 - Connect Fresh Water Supply to Inlet of Float Valve



AquaSaver® Timed Metering Control System - If the cooling module is equipped with an optional timed metering system, connect a 1/2" water line to the fitting on the side of the cooling module.

Due to various water pressures and installation conditions, the water supply line may bang abruptly when the solenoid valve in the AquaSaver system closes. This banging can be minimized by installing an optional water hammer arrestor in the supply line. If installing an optional water hammer arrestor, select an indoor (above 32°F) location, either horizontal or vertical, in line with and as close to the solenoid valve as possible. Follow the manufacturer's instructions to install and maintain the water hammer arrestor.

6.0 Mechanical (cont'd)

6.2 Unit Inlet Air (cont'd)

6.2.4 Evaporative Cooling Module - Options AS4 and AS8 (cont'd)

Supply and Drain Water Connections (cont'd)

All Cooling Modules - A manual water shutoff should be installed upstream of the inlet, at a convenient non-freezing location, to allow the water supply to be turned on and off. If necessary, install a bleed line between the manual valve and the cooling module inlet to allow drainage of the line between the shutoff valve and the cooling module.

All cooling modules are equipped with an overflow and drain fitting. The fittings are in the cabinet bottom and come complete with a locknut and a sealing gasket. Check these fittings for tightness before installing the overflow and drain piping. The drain and overflow fitting will accommodate a 3/4" garden hose thread and is tapped with a 1/2" female pipe thread for iron pipe.

An optional automatic fill and drain kit (Option CT1) is available that will automatically release supply water to the cooling module when a call for cooling is made and will drain all water from the reservoir when the cooling switch is deactivated or a cooling thermostat is satisfied. See **FIGURE 14**. If installing an optional fill and drain kit, follow the instructions. Consult the wiring diagram for electrical connections.

FIGURE 14 - Water Connections including Optional Drain and Fill Kit

Instructions for Installing Optional Fill & Drain Kit

NOTE: Follow this part of the instructions included in the valve packages for attaching valves to the water line only. The remainder of the instructions with the valves do not apply to this type of application.

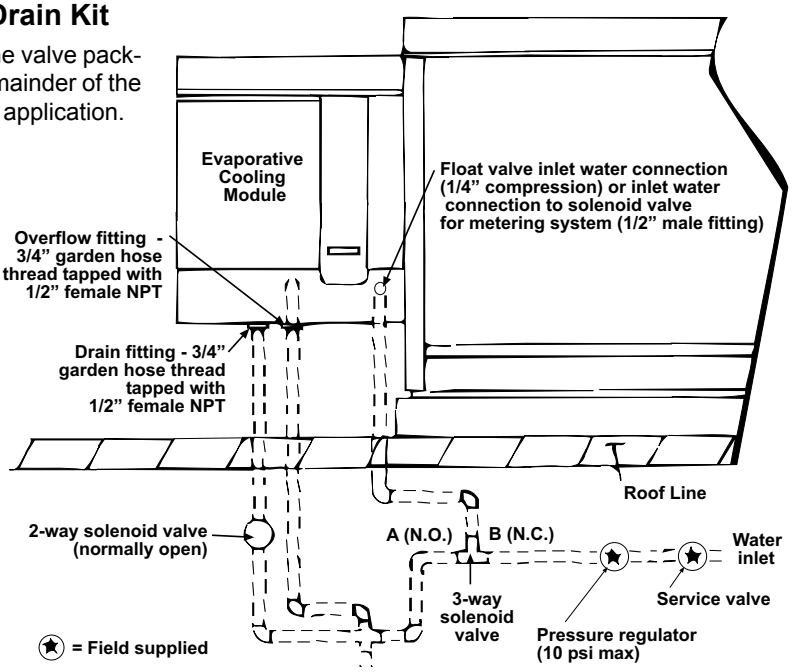
Water Line Connections (See illustration)

Supply (3-Way Valve) Connections - connect the water supply line to **"B"** (normally closed). Connect the water drain line to **"A"** (normally open). Connect the middle outlet to supply the water to the cooling module reservoir.

Drain (2-Way Valve) Connections - Connect the drain pipe from the reservoir to **"A"**. Connect the outlet side to **"B"** and connect into drain lines from the cooling reservoir and the supply valve.

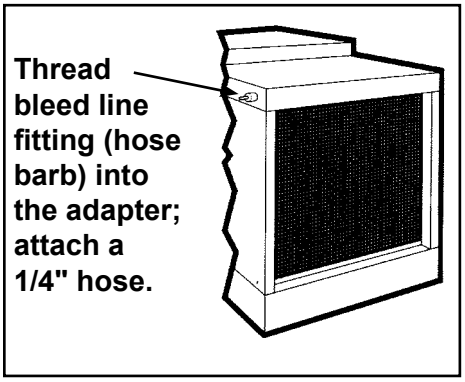
WARNING: Risk of electrical shock. Disconnect the power.

Electrical Connection (requires black and white 14-gauge wires) - Refer to furnace wiring diagram:



1. Refer to the wiring diagram for terminal connections (NOTE: If kit is not ordered with the system, connections will not be shown on the diagram. Terminal connections are specific to each system. Contact the factory for terminal connections. Be prepared to provide all model information.)
2. Run field-supplied black wire from the electrical compartment (terminal on the wiring diagram) of the evaporative cooling module and connect to the black wire on both the 3-way and the 2-way valve.
3. Run field-supplied white wire from the electrical compartment (terminal on the wiring diagram) of the evaporative cooling module and connect to the white wire on both the 3-way and the 2-way valve.

FIGURE 15 - Bleed Line Fitting

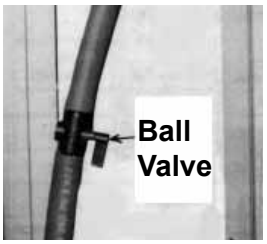


Bleed Line Connection (Does not apply to module with optional timed metering system.) - Shipped in the evaporative cooling module bottom pan, find a 1/4" I.D. x 1/2" N.P.T. nylon bleed line fitting (hose barb). Thread the fitting into the female adapter located opposite the pump/inlet side of the water distribution line. The hose barb will protrude from the side of the cabinet (**FIGURE 15**). Attach a 1/4" I.D. hose to the barb and run the hose to the nearest drain.

Discharging a quantity of water by "bleed off" will limit the concentration of undesirable minerals in the water being circulated through the cooling module. Minerals buildup because evaporation only releases "pure water vapor" causing the concentration of contaminants in the water to increase as the evaporation process continues to occur. The minerals accumulate on the media, in the water lines, on the pump, and in the reservoir. Adequate bleed off is important to maintaining an efficiently operating evaporative cooling system.

Filling & Adjusting the Water Level in the Reservoir

FIGURE 16 - Disconnect the power and adjust the water flow with the ball valve.



WARNING: Adjust ball valve only when the power is disconnected from the system. Failure to do so can cause electrical shock, personal injury, or death.

Float and Pump Control System -- Turn on the water supply. Check for good flow. When the float valve (**FIGURE 13**) shuts off the water supply, measure the water depth. The depth of the water should be approximately 3". It may be necessary to adjust the float valve to obtain the proper water level or to free the float valve from obstructions. To adjust the float valve, simply bend the rod upward to raise the water level or downward to decrease the water level.

Adjusting Water Flow Over Pads

Proper water flow over the evaporative cooling media is critical to extend the life and maintain the efficiency of the pads. Follow the instructions to adjust water flow.

CAUTION: Do not flood the media pads with extreme quantities of water for long periods as this will cause premature breakdown of the media. An even flow from top to bottom of the media with the least amount of water is all that is required to assure maximum efficiency and media life span. More water does not provide more evaporation or more cooling.

Float and Pump Control System - Using the ball valve, located in the middle of the length of hose running from the pump to the distribution line inlet (**FIGURE 16**), adjust the valve handle to allow the flow to completely dampen the media pads from top to bottom.

Operate the unit watching the water flow. After 15 minutes with the blower in operation, the water should have completely dampened the pads but should not be flowing off the entering side of the media. If water is flowing off the entering side of the media, turn the system off, disconnect the power, and reduce the entering water flow.

AquaSaver® Timed Metering Control System - Check water flow and pad wetting time at maximum air flow and wet bulb depression to assure complete wetting of the media at the extreme operating conditions.

In addition to adjusting water flow, the timing of the water on/off cycle can be adjusted. Water flow and timing adjustments are correct when **I)** the water rises from the holes in the sprinkler pipe (See **FIGURE 17**) consistently along the entire pipe length, **2)** the media pads wet evenly after a few "ON" cycles (no dry spots or dry streaks), and **3)** a slight amount of excess water collects at the drain at the completion of the "ON" cycle.

1) AquaSaver® Water Flow Adjustment - Using the ball valve illustrated in **FIGURE 16,** adjust the water flow depending on the pad height.

FIGURE 17 - Adjust Water Flow with the Ball Valve in FIGURE 16

Pad Height	A = Water rise from PVC Sprinkler Pipe
24"	1/8" to 1/2"
48"	1/4" to 1/2"

2) AquaSaver® Timer Adjustment - At any given temperature, the media pads should completely wet from top to bottom during the ON cycle. The micro-processor has three pre-set timing settings based on media size. The appropriate setting is selected by changing the position of the suitcase jumper at J2 on the micro-processor (**FIGURE 18**). Remove the cover and check the setting.

FIGURE 18 - AquaSaver® Micro-processor Control

If the jumper is at the appropriate location for the media, replace the cover. If the jumper needs to be moved, move it to the appropriate setting. The setting will go into effect when the power is restored.

Check the "ON" timing; the media pads should be wet from top to bottom during the ON cycle.

If the pre-set timing is not suitable for the application, follow the instructions supplied with the micro-processor to change the calibration of the ON and/or OFF cycle.

6.0 Mechanical (cont'd)

6.3 Supply Air Discharge

6.3.1 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 exhauster.

Sizing and Installation of Distribution Ductwork - 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, 2800 Shirlington Road, Suite 300, Arlington, VA 22206 (www.acca.org). A manual covering duct sizing in detail may be purchased directly from them.

Installing Ducts (See Paragraph 4.2 for duct connection dimensions.)**:**

- ☐ 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 installations, the ducts can be slid over the flange of the heater and then sealed for an airtight and watertight fit. On duct-to-heater connections, use sheetmetal screws to fasten ducts to the heater flange. Use stiffening flanges around the perimeter of the duct connections.

6.3.2 Two-Position Discharge Dampers, Option AQ4

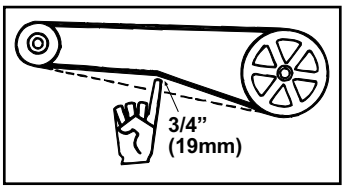
A Model ADF unit ordered with Option AQ4 has a factory installed horizontal open/closed discharge damper. The direct-coupled damper motor is rated for low ambient temperature and is externally mounted on the control side of the damper frame. The horizontal damper frame extends 6-5/8" (168mm) beyond the heater duct connection as illustrated in **FIGURE 19**.

FIGURE 19 - Model ADF with Horizontal, Two-Position Discharge Damper, Option AQ4

The two-position (open/closed) vertical discharge damper **(Option AQ3)** is available on both Model ADF and ADFH. Discharge dampers are open when the unit is operating and are closed when the unit is shut down.

6.4 Blowers, Drives, and Blower Motors

FIGURE 20 - 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" or 3/4" (**FIGURE 20)**. Be sure the belt is aligned in the pulleys.

Motor Pulleys and Blower Speed - 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 9.2, Startup, for adjusting blower speed.

Blower Rotation - Each blower housing is marked for proper rotation. Checking blower rotation is included in Startup, Paragraph 9.2

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. The open motor amp chart below can be used for sizing line wiring. For accurate amps, read the motor manufacturer's rating plate; amps will vary depending upon type of motor and motor manufacturer.

Blower Motor Full Load Amps (open motors)						
HP	115/1	230/1	208/3	230/3	460/3	575/3
1/2	8.8	4.4	2.1	2	1	--
3/4	11	5.5	2.9	2.6	1.3	--
1	13	7.5	3.7	3.2	1.6	1.4
1-1/2	15	7.5	5.6	5	2.7	2
2	N/A	N/A	7	6.6	3.3	2.4
3	N/A	N/A	9.1	8.4	4.2	3.6
5	N/A	N/A	13.4	13.2	6.6	5.4
7-1/2	N/A	N/A	22	21	10.5	8.4
10	N/A	N/A	30	26	13	10.4
15	N/A	N/A	43.1	39	19.5	16
20	N/A	N/A	58.7	53	26.5	21.2

7.0 Electrical and Wiring

7.1 General

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.

7.2 Supply Wiring

Wire Gauge Sizes - 100 ft maximum								
FLA	5	10	15	20	25	30	35	40
Wire Gauge	14	14	12	10	8	8	6	6

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, check the motor nameplate.

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

Disconnect Switch - A safety disconnect is required. An outdoor installation requires a weatherproof disconnect switch. Install either an optional UL-listed disconnect or a field-supplied equivalent. 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. (Refer to **FIGURE 21**.)

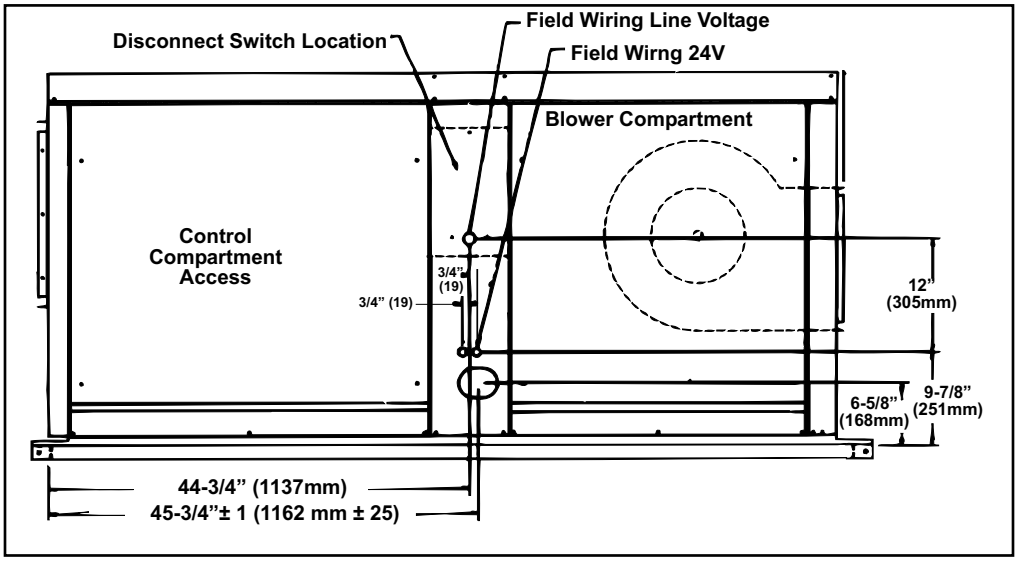
When providing or replacing fuses in a fusible disconnect switch, use dual element time delay fuses and size 1.25 times the maximum total input amp as stated on the unit rating plate.

7.0 Electrical and Wiring (cont'd)

7.2 Supply Wiring (cont'd)

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.

FIGURE 21- Disconnect Switch Location and Wiring Connection Locations (Model ADF is illustrated; same dimensions/locations apply to Model ADFH)



7.3 Control Wiring

Refer to **FIGURE 21** for location of control wiring connection. Low voltage wiring must be in individual conduit, separated from primary high voltage wiring.

A 3-position control switch is supplied with each system, either packed loose inside the unit, or if an optional control console 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. For additional reference, the control manufacturer's instructions are included in the owner's envelope.

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

Remote Console

FIGURE 22 - Remote Console Dimensions (Dimensions, components, and wiring required depend on options selected; refer to the wiring diagram to identify options.)

The optional remote console is shipped separately. Remote consoles include terminal blocks for wiring. If ordered with a remote console, the toggle switch is mounted on the console and depending on what gas control option was ordered, the console could include a temperature selector. If a dirty filter switch is ordered the indicator light is on the console. See **FIGURE 22** for console size.

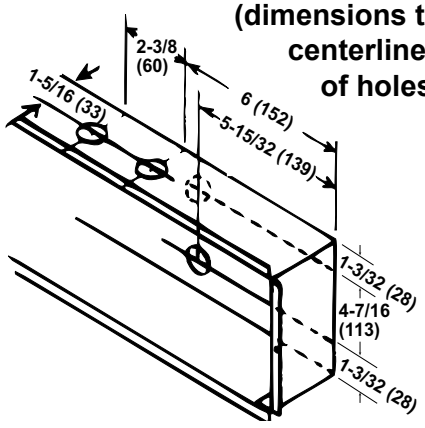
Control Switch	Qty of Lights*	Temperature Selector**	Dimensions - inches (mm)		
			L****	H****	D
Yes	3	Yes	10-3/4 (273)	7-5/8 (194)	2-5/8 (67)
Yes	3	No	10-3/4 (273)	7-5/8 (194)	2-5/8 (67)
Yes	4	Yes	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)
Yes	4	No	15-3/4 (400)	7-5/8 (194)	2-5/8 (67)

* 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, or 35

**** Subtract 1" (16mm) when recessing

Locations of Knockout Holes (dimensions to centerlines of holes)



Dirty Filter Light (on the Remote Console)

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 proper operation of the dirty filter indicator light.

Dirty Filter Switch Installation Instructions

☐ **Before the system is operating,** connect the sensing tubes from the switch to their sensing locations in the field-installed filter cabinet.

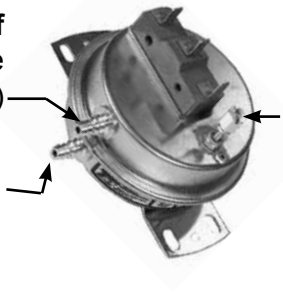
1) Run the tubes through the holes in the cabinet wall. Pull gently to extend the tubing to its entire length without stress.
2) Position the tubing approximately at the center of the height of the filter rack.
3) Identify the tube connected to the positive connection on the switch (**FIGURE 23**) as 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 23**) 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.

☐ **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.

FIGURE 23 - Dirty Filter Pressure Switch



8.0 Controls

Discharge Sensor and Mixing Tube

Discharge Temperature Sensor (Maxitrol) for Gas Control Options AG30, AG31, AG32, AG33, and AG36

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.

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 my 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

8.0 Controls (cont'd)

Control used for Outside Air Cutoff and Discharge Low Temperature Limit (Freezestat)

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;
- may shutdown; or
  Burner shutdown or modulating operation will depend on the temperature rise between the outside air and the discharge air setting.
- may remain on continuous low fire.
  If the outside air control is set too high, the burner will continuously burn on low fire as long as the control switch is set to "winter".

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

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.

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.

Optional Door Switch

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.

Optional Firestat

Firestat (Option BD5)

If the system has an optional firestat, the control is shipped separately for field installation. Mount it on the discharge ductwork so that the sensor extends into the duct. This control requires manual reset so should be installed in an accessible location.

Follow the manufacturer's instructions and the wiring diagram to mount the firestat and connect the wires in the blower section electrical box. The firestat is a manually reset control; check reset when starting the unit.

Optional Field-Provided Computer Control (with Option AG37 only)

If the system includes Gas Control Option AG37, the gas valve and burner modulation are controlled by a field-supplied 0-10VDC or 4-20 milliamp computer signal.

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

9.0 Commissioning and Startup

9.1 Checks Before Startup

☐1. Check to be sure that all field-installed accessories are installed. If equipped with an optional dirty filter switch, check that the sensor tubing shipped in the unit is extended through the filter rack and attached correctly.

☐**2.** Check all field-installed wiring.

☐**3.** Check all ductwork for obstructions; open all diffusers.

☐**4.** Turn the remote 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. 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 correct fuses. Verify continuity of fuses.

6. Open the hinged gas/electrical control compartment door --

☐Close all manual gas valves.

☐Open hinged electrical panel cover.

☐Check all wiring and wiring connections on gas controls and electrical components.

☐If equipped with any manually reset devices such as a firestat limit switch, or high gas pressure switch, reset devices.

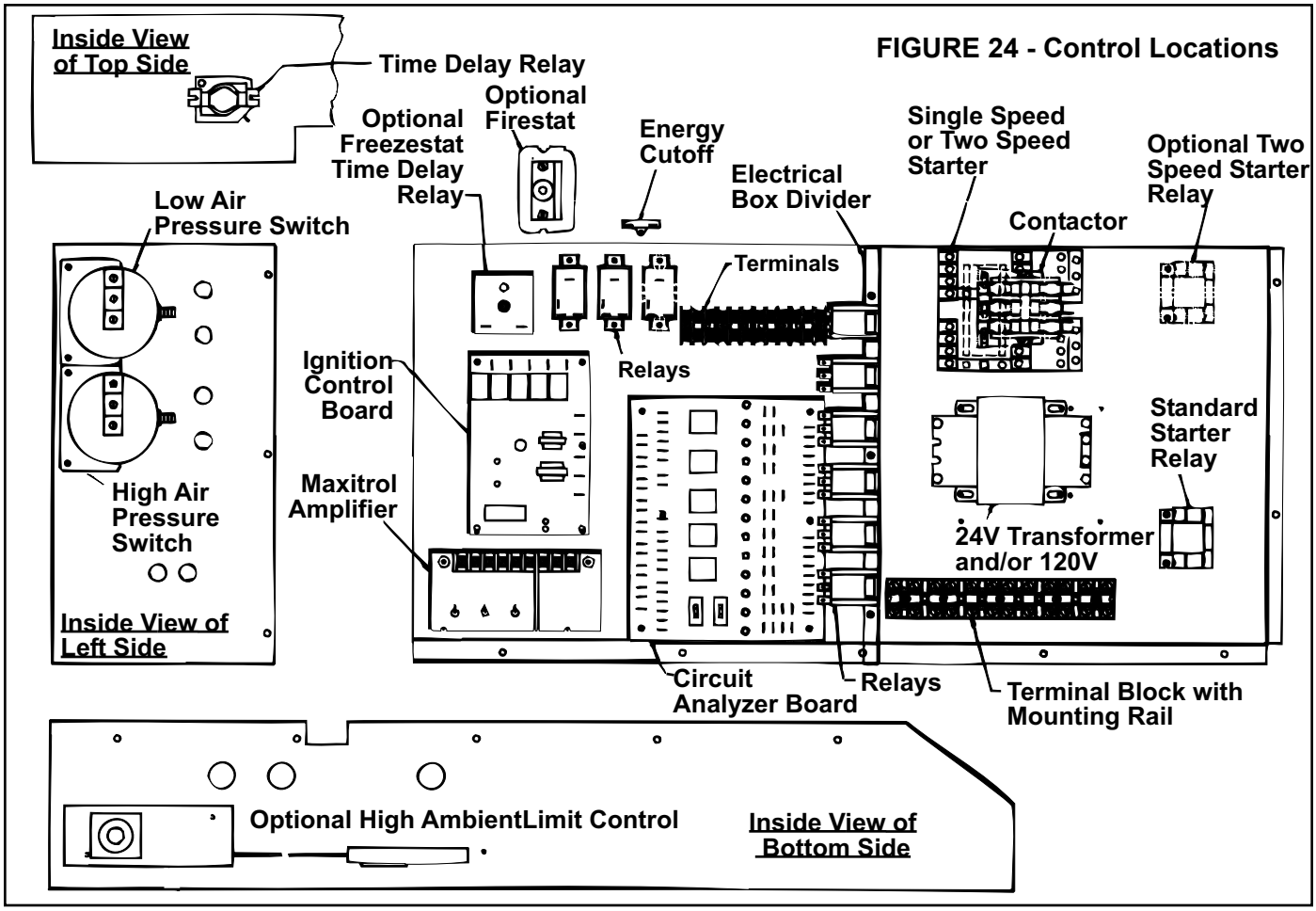


FIGURE 24 - Control Locations

7. Open the hinged blower compartment door --

☐Remove any blocking and shipping supports.

☐Check all fasteners for tightness and all parts to be sure they are secure.

☐Rotate the blower wheel to be sure that no parts are rubbing. Check for and remove any obstructions and/or foreign material that may damage the blower wheel.

☐Check that the blower belts have correct tension (See Paragraph 6.4) and that pulleys are in alignment and locked to the shaft.

☐Remove the cover from the limit switch junction box; reset manual limit switch.

☐Check wiring connections to limit switch, discharge air sensor, and motor.

☐Close blower compartment door panel; secure latches.

8. Turn ON gas supply valve and manual shutoff valve on the manifold --

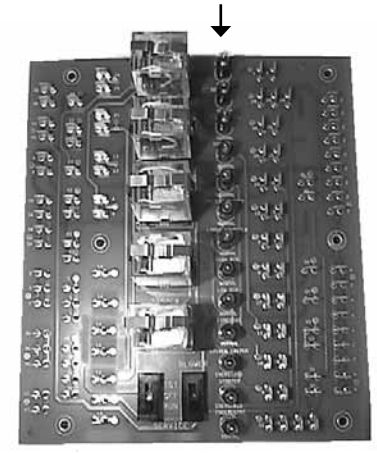
☐Leak test gas connections upstream of the electric gas valve. Be sure all connections are tight and leak tested. **WARNING: DO NOT TEST WITH OPEN FLAME.**

☐Turn OFF manual gas valves.

9.0 Commisoning and Startup (cont'd)

9.2 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

☐ Set BOTH the blower and burner service switches (located on the electronic circuit board) to the OFF position.

2. Observe status lights on the electronic circuit board (assuming an optional control relay is installed) --

☐ Turn ON power to the system at the disconnect switch.

☐ Check the electronic circuit board. One light should be lit **- "Control Power"**.

☐ Turn OFF the disconnect switch.

☐ If the system has an optional relay (check wiring diagram), remove the wire from Terminal 3 and Terminal 4 that connects the circuit to the optional "control relay" contacts. Place a jumper wire from that Terminal 4 to empty Terminal 3.

☐ Turn ON the disconnect switch. One or two lights should be lit **- "Control Power"** - plus if equipped with a firestat - **"Firestat Normal"**

3. Check blower switch and blower rotation.

☐Place the blower switch (on the electronic circuit board) in TEST position. This will bring on one or two additional lights - **"Starter Energized"** - and if equipped with a freezestat - **"Freezestat Normal"**.

NOTE: If unit is equipped with a discharge damper, the damper will begin to open. When the damper reaches 80% open, the blower motor will be energized and **then** the **"Starter Energized"** light will be actuated. After the blower obtains normal speed (minimum .2" positive air pressure), the low air proving switch will close and the following lights will be energized: **"Low Air Pressure Normal"**; **"Limit Controls Normal"**; and if these options are included, **"High Air Pressure Normal"**; **"Outside Air Cutoff Normal"**; **"Low Gas Pressure Normal"**; **"High Gas Pressure Normal"**.

☐Check blower rotation. If blower is turning backwards (see rotation arrows), do the following.

☐(A) Turn disconnect switch OFF and:

Single-phase units - rewire the motor per instructions on the motor plate.

Three-phase units - interchange any two motor leads at the motor contactor or starter.

☐(B) Turn disconnect switch ON and verify correct blower rotation.

☐Check blower operation to be sure there is no excessive vibration. If excessive vibration is present, re-check belt tension, pulley alignment, bearing alignment, blower wheel balance, and that components are attached securely. Determine and eliminate the cause of excessive vibration before the system is put into operation.

4. Measure burner differential air pressure on the slope gauge Measure burner differential **air** pressure on the slope gauge **(connected to the unit in Startup Step 1)** .

☐(A) If the system includes an optional discharge damper, before measuring burner differential air pressure, check that the damper is fully open.

(1) Turn the disconnect switch OFF.
(2) Vertical Discharge - On the control side of the unit, open blower door.
(3) Horizontal or Vertical Discharge - Check damper. If not fully open, adjust damper to the fully open position.
(4) Vertical Discharge - Close the door panel and secure the latches.
(5) Turn ON the disconnect switch.

☐(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 adjustment is necessary. If the slope gauge reading is not within these limits, do the following:

If the slope gauge reading is *greater than* -.25" (such as -.10" w.c.), adjust the drive to increase the blower speed.	**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) **For systems with smaller than 7-1/2 HP motor** (a) Loosen belt tension and remove belt. (b) Loosen the set screw on the side of the pulley away from the motor. (c) Turn adjustable half of the pulley **inward to increase** blower speed. One turn of the pulley will change speed 8 to 10%. (d) Tighten the set screw 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.	(1) Turn disconnect switch OFF. (2) **For systems with smaller than 7-1/2 HP motor** (a) Loosen belt tension and remove the belt. (b) Loosen the set screw 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 of the pulley will change speed 8% to 10%. (d) Tighten the set screw 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 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.

☐(C) 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 the limits, re-adjust the blower speed.

☐(D) 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.

☐(E) 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.

☐(F) If the system includes an optional dirty filter light, while the blower continues to operate, set the switch so that the indicator light (on the remote console) will activate at approximately 50% filter blockage. Calibrate the switch to this measurement by turning 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 this setting the contacts will close causing the light to signal that the filters require cleaning at approximately 50% blockage.

☐(G) Turn the disconnect switch OFF. Disconnect the manometer and the slope gauge. Replace caps removed to connect the slope gauge and the plug in the gas pressure tap.

5. Check pilot and burner ignition --

☐Turn the disconnect switch ON. (Lights as explained in Startup Steps 2 and 3 should be energized). Put the burner switch (on the electronic circuit board) in TEST position. 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. All lights should be lit **except "System Switch" (12 lights total).**

☐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 7.) Remove the manometer.

☐Leak test all connections in the pilot and main burner supply lines. **WARNING: DO NOT TEST WITH OPEN FLAME.**

☐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.

9.0 Commissioning and Startup (cont'd)

9.2 Startup (cont'd)

6. Check pilot pressure and operation --

☐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 blower and burner switches in TEST position. Turn ON disconnect switch. After blower reaches speed, **all** lights should be lit **except** "Pilot Valve" and "Main Valve". Turn on the gas supply. **After 15-20 seconds**, the **"Pilot Valve"** light will be energized, followed by the **"Main Valve"** light.

☐Measure pilot gas pressure. Pilot pressure for natural gas should be 3.5" w.c.; 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.

☐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, cycle the main disconnect switch.

7. Verification of inlet gas pressure --

If, with the blower and burner operating, the main inlet gas pressure measured in Step 4 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 that sated on the rating plate, full burner firing 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 the 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.

☐Calculate the required burner differential gas pressure. Differential gas pressure is the figure used when determining minimum gas supply pressure. Add differential gas pressure plus the drop in gas pressure as it flows through the gas train (See Paragraph 6.1) to determine the minimum required supply pressure of inlet gas. For maximum firing rate, a minimum of 4.3" w.c. of actual measured natural gas pressure is required at the burner (If maximum firing is not required divide the actual input rate by the maximum rate, square the answer, and multiply by 4.3" w.c. to determine the required gas pressure at less than maximum capacity.)

☐Turn disconnect switch OFF. If the gas pressure is determined to be adequate, continue with the startup of the system. If the gas pressure is not adequate for the system, discontinue startup until the gas pressure problem is resolved.

☐Remove the manometer and replace the plug.

9.3 Startup for Continuous Operation

☐If connected in Startup Step 2, remove the jumper wire running from Terminal 3 to Terminal 4. Re-connect the optional "control relay" contacts to Terminal 3 and Terminal 4.

☐Put BOTH the burner and blower switches in RUN position.

☐Close the electrical box and close the control door panel. Secure latches.

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

9.4 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, 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 5-Day Week (Guide Only)

Substance	Percent	PPM	Substance	Percent	PPM
Acetaldehyde	.001	10	Formaldehyde	.000025	0.25
Carbon Dioxide	.250	2500	Nitrogen Dioxide	.0001	1
Carbon Monoxide	.001	10	Sulphur Dioxide	.00005	0.5

Note: At 100˚F rise the CO_2 concentration will be in the order of 2500 ppm.

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 the factory. FAILURE TO PROVIDE PROPER COMBUSTION AIR CAN RESULT IN A HEALTH HAZARD WHICH CAN CAUSE PROPERTY DAMAGE, SERIOUS INJURY, AND/OR DEATH. A direct-fired installation must provide for air changes as required by the applicable installation codes.

Index

Additional References

See your Factory Distributor for the following forms:

- Operation/Maintenance/Service - **Form O-ADF/RDF (P/N 148385)**
- Replacement Parts - **Form P-ADF/ADFH (P/N 270068)**
- Replacement Valves & Ignition Controls by Serial No. Code - **Form P-VALVES (P/N 263995)**

INSTALLATION RECORD - to be completed by the Installer:

Installer:

Name _____

Company _____

Address _____

_____

_____

Phone _____

Distributor (company from which the unit was purchased):

Company _____

Contact _____

Address _____

_____

_____

Phone _____

Model _____ Serial No._____Date of Installation _____

SPECIFIC INSTALLATION NOTES: (i.e. Location, Amps, Gas Pressure, Temperature, Voltage, Adjustments, Warranty, etc.)

_____

_____

_____

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BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair

- Contact the installer listed above.
- If you need additional assistance, contact the Distributor listed above.
- For more information, contact your Factory Representative.

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