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

(Specifications subject to change without notice.)

Installation Form RZ-NA 442 (Version A)
Obsoletes Form RZ-NA 442

Applies to: Model ADF/ADFH

REZNOR Thomas&Betts

Table of Contents

References: Operating/Maintenance/Service Manual, Form RZ-NA 442-OMS
Replacement Parts, Form RZ-NA 742

FOR YOUR SAFETY

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

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

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

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, page 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.

These systems are design-certified to ANSI Standards by the American Gas Association and are approved by the Canadian Gas Association. 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. 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.

1. Installation Codes/ Requirements (cont'd)

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. **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.

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); (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).

2. Warranty

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

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.**

3. Dimensions

Figure 1A - Optional Outside Air Hood for All Sizes

Outside air hood is shipped separately for field installation.

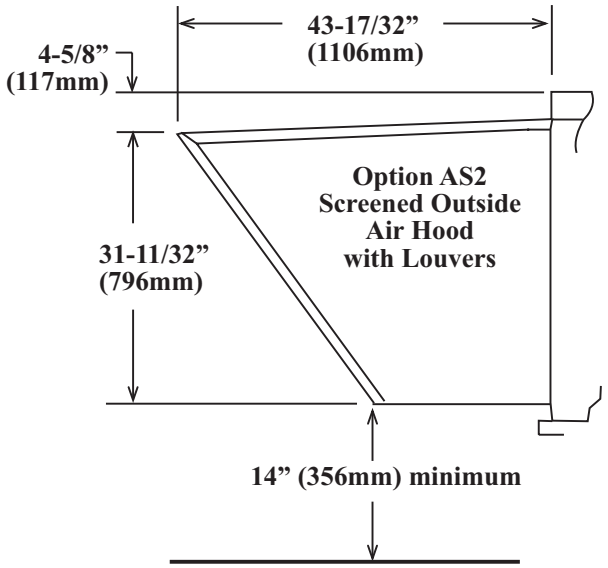


Figure 1B - Optional Horizontal Discharge Damper - applies to all Sizes

The motor for the factory-installed optional horizontal discharge damper is externally mounted on the control side of the damper frame. Horizontal damper frame extends 6-5/8" (168mm) beyond the heater duct connection.

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

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

Figure 1C - Models ADF/ADFH 300 and 500

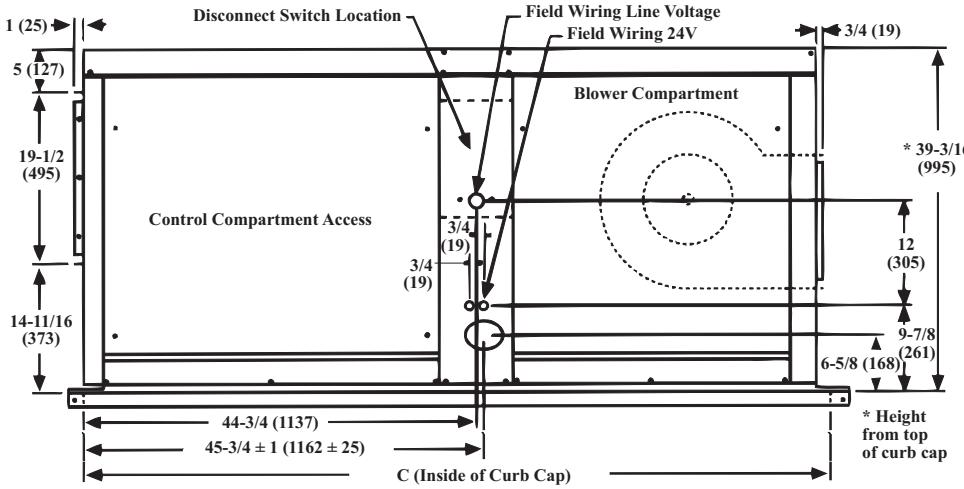
Dimensions (inches)

Discharge	Horizontal		Vertical**			
Models	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

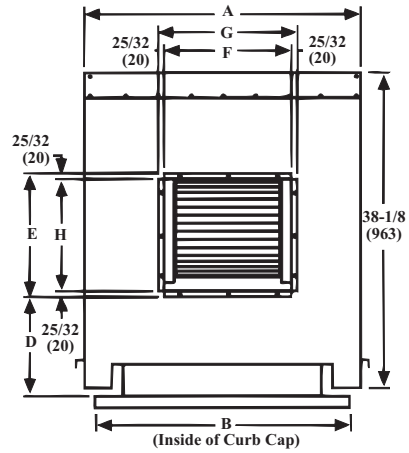
Dimensions (mm)

Discharge	Horizontal		Vertical**			
Models	ADF300	ADF500	ADF300	ADF500	ADFH300	ADFH500
A	864	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

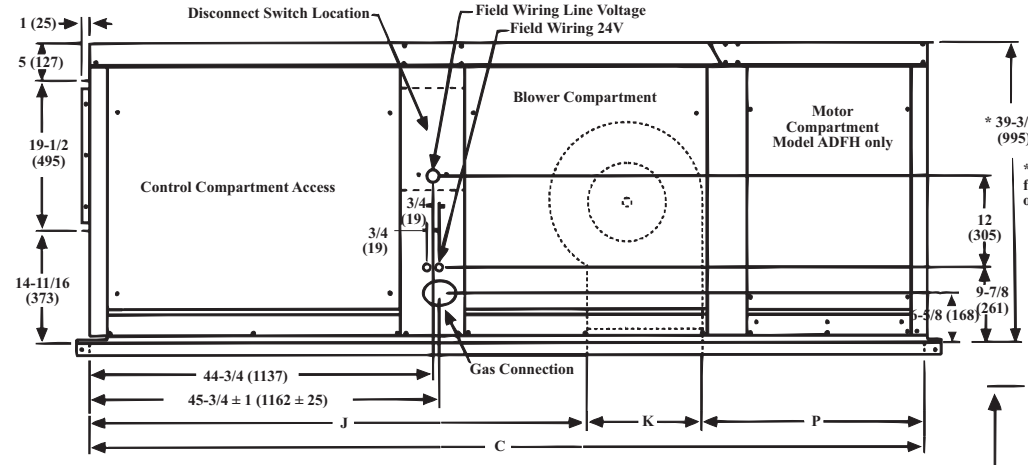
**** Models ADFH 300/500 have a motor compartment required for high temperature discharge. Models 300/500 with optional vertical discharge have same cabinet length as the standard horizontal discharge unit.**



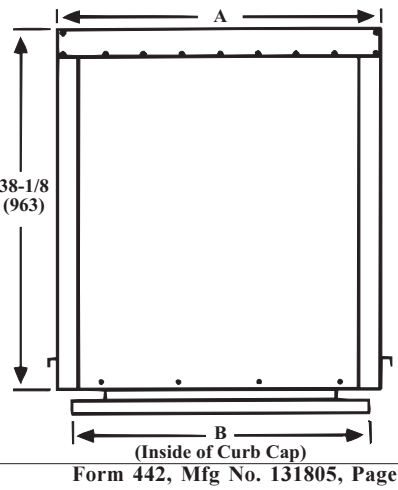
LEFT SIDE VIEW - HORIZONTAL DISCHARGE MODEL ADF ONLY)



FRONT VIEW - HORIZONTAL DISCHARGE (MODEL ADF ONLY)



LEFT SIDE VIEW VERTICAL DISCHARGE

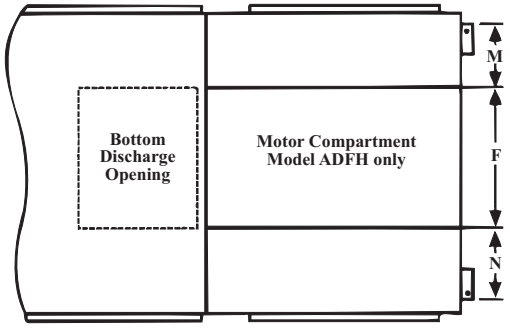


FRONT VIEW - VERTICAL DISCHARGE

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 1B.



TOP VIEW - VERTICAL DISCHARGE

3. Dimensions (cont'd)

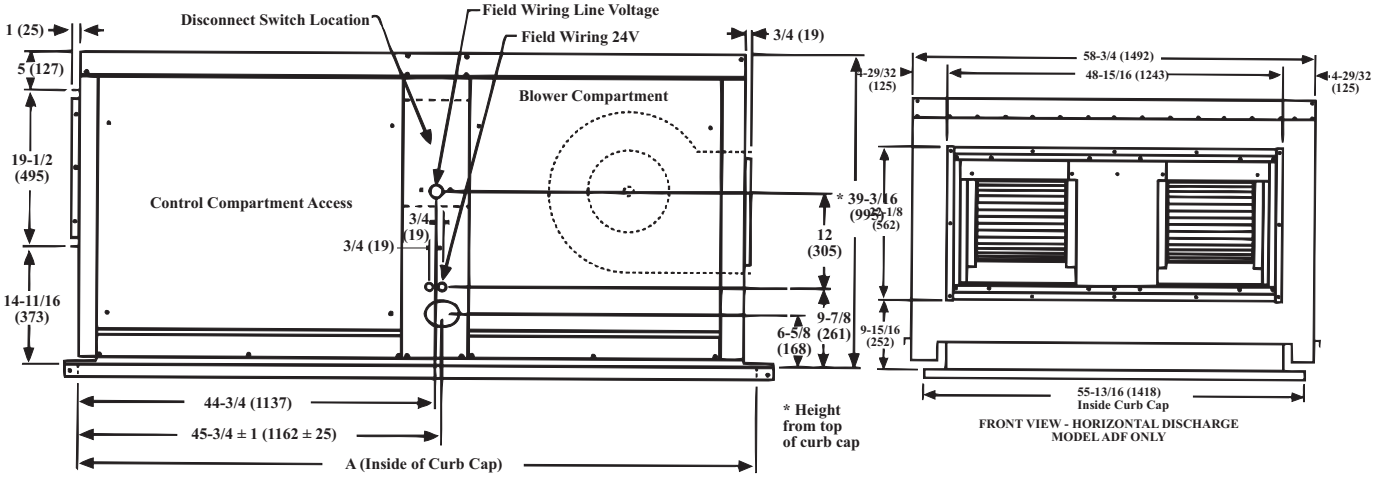
Figure 1D - Models ADF/ADFH 700 and 1200

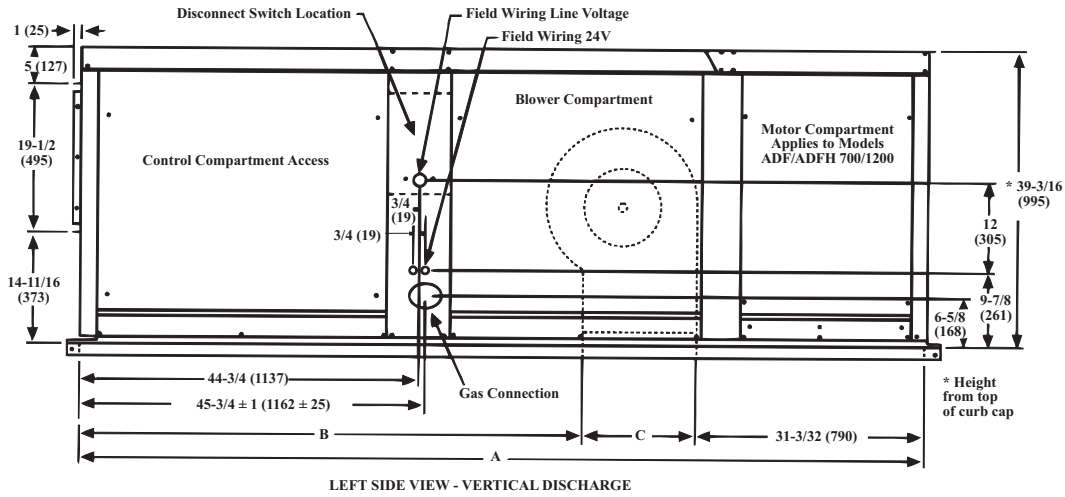
Dimensions (inches)

Discharge	Horizontal	Vertical	
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)

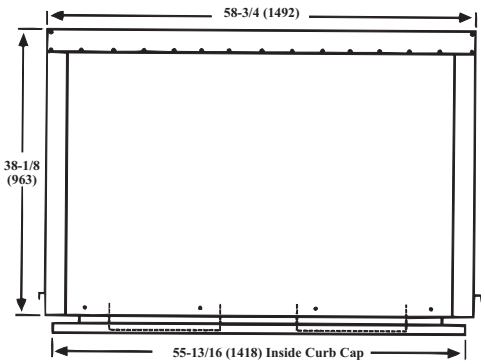
Discharge	Horizontal	Vertical	
Models	ADF	ADF/ADFH	ADF/ADFH
Size	700/1200	700	1200
A	2340	2973	2973
B	-	1832	1775
C	-	351	408

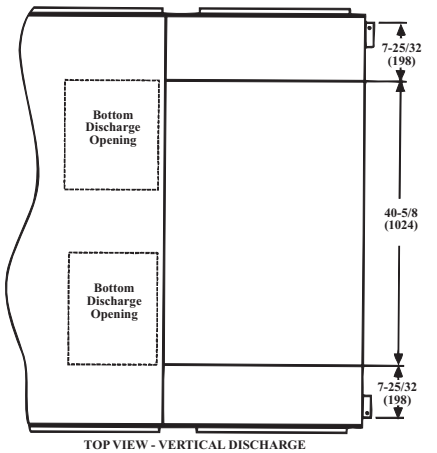




Duct Dimensions (with and without discharge dampers)	
Models	**Horizontal**
ADF 700/1200	48-15/16" x 22-1/8" 1243mm x 562mm
Models	**Vertical**
ADF/ADFH 700/1200	C x 40-5/16" (1024mm)

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 1B, page 2





4. Technical Data

Size		300	500	700	1200
Maximum Capacity (MBH)		500	750	1250	1250
CFM Range	ADF Models	2,000 - 5,000	2,000 - 5,500	3,000 - 10,000	3,000 - 15,500
	ADFH Models	2,000 - 6,000	2,000 - 7,300	3,000 - 10,000	3,000 - 15,500
Maximum Temperature Rise (°F)		130	130	130	130
Maximum Discharge Temperature (°F)	ADF - for U.S.A. [1]	120	120	120	120
	ADFH - for U.S.A. [1]	140	140	140	140
	ADF - for Canada	75	75	75	75
	ADFH - for Canada [2]	140	140	140	140
Control Amps (24V) [3]		4.0	4.0	4.0	4.0
Maximum Gas Pressure [4]		1/2 psig	1/2 psig	1/2 psig	1/2 psig
Gas Connection (inches) [5]		3/4	3/4	3/4	3/4

[1] Certified to ANSI Z83.18, Direct Gas-Fired Industrial Air Heaters; ANSI Z83.17, Direct Gas-Fired Door Heaters
[2] Approved to CAN1-3.12, Direct Gas-Fired Door Heaters
[3] For full load amps, add motor amps to control amps.
[4] For inlet gas pressure over 1/2 psig but not greater than 5 psi, order a field-installed regulator kit, Option CZ1 or CZ2.
[5] Gas connection size depends on manifold option selection; standard is 3/4".

5. Uncrating/Preparation

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 it with the transporting agency and notify your Reznor distributor immediately.

A control switch is shipped with all units. The switch is either shipped in the furnace control compartment or if a remote console is ordered, the switch is mounted on the remote console. The optional remote console is shipped separately and, if applicable, should be at the job site.

Depending on the gas controls ordered, the following parts are shipped loose inside the unit or separately and should be at the installation site:

Gas Controls	Shipped-Loose Parts
Option AG30	Remote Temperature Selector
Option AG31	Remote Temperature Selector Space Override Thermostat
Option AG32	Remote Temperature Selector
Option AG33	Remote Temperature Selector (Selectrastat)
Option AG35	Remote Temperature Selector
Option AG36	Remote Console

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 (with or without filters), a disconnect switch, a supply gas regulator, a door switch, an evaporative cooling module, a fill and drain kit, and/or a water hammer arrestor.

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

6. Clearances - All Models & Sizes

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.

7. 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.

8. Mounting

Mounting is the responsibility of the installer. 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)

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.

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.

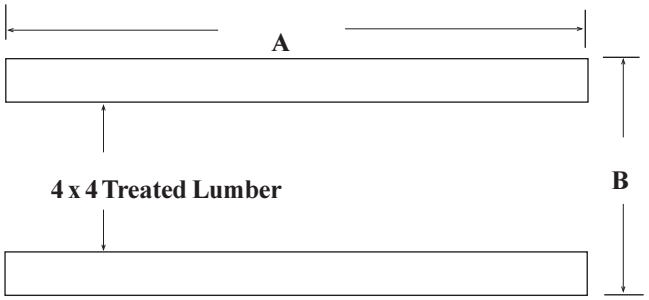
If the rails are laid directly on a surface, position them as shown in Figure 2. Set the system on the rails leaving the "ends" underneath open for ventilation.

8. Mounting (cont'd)

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 ora 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 17 for additional information.)

Figure 2 - Placement of Mounting Rails



	Dimension A (inches)			B (inches)
Discharge	Horizontal	Vertical		Both
Model	ADF	ADF	ADFH	ADF/ADFH
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)
Discharge	Horizontal	Vertical		Both
Model	ADF	ADF	ADFH	ADF/ADFH
300	39	39	50	14
500	39	39	50	20
700	42	53	53	25
1200	42	53	53	25

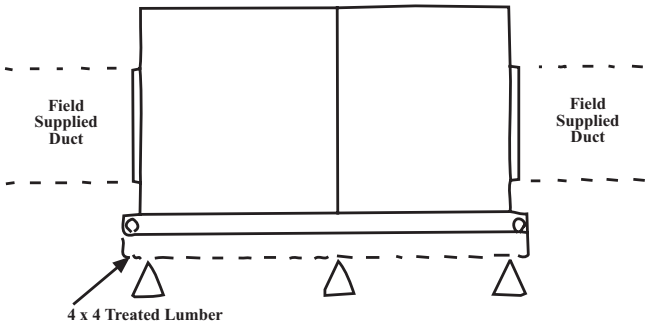


Figure 3 - Cross support mounting requirements

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

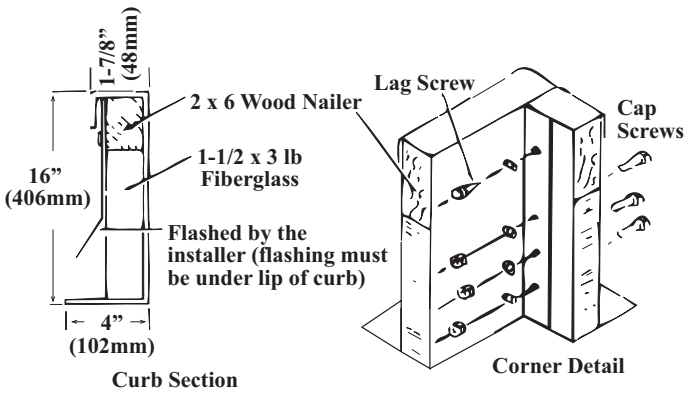
NOTE: Curb rail sections and hardware for assembling curb are provided. Insulation and flashing are field supplied.

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, Figure 4.
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.

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 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.

Roof Curb Dimensions (inches)

Model	ADF300	ADF500	ADFH300	ADFH500	ADF700/1200		ADFH700/1200
Discharge	Horizontal or Vertical		Vertical Only		Horizontal	Vertical	Vertical Only
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)

Model	ADF300	ADF500	ADFH300	ADFH500	ADF700/1200		ADFH700/1200
Discharge	Horizontal or Vertical		Vertical Only		Horizontal	Vertical	Vertical Only
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.

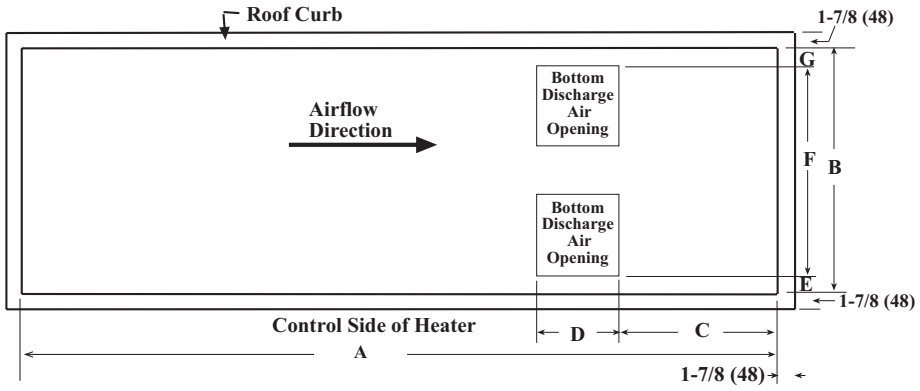


Figure 5 - Vertical Duct Connection in Relationship to Reznor® Roof Curb

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)

9. 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, 1228 17th Street, N.W., Washington, DC 20036. A manual covering duct sizing in detail may be purchased directly from them.

Installing Ducts (See Paragraph 5 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.

10. Electrical Supply & Connections

All electrical wiring and connections including electrical grounding MUST be in accordance with the National Electric Code ANSI/NFPA No. 70 (latest edition) or the Canadian Electrical Code part 1-C.S.A. Standard C22.1 Check and comply with any local ordinance or utility company requirements that apply.

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, see Paragraph 12 or 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. (NOTE: Systems with an C.G.A. label include a disconnect switch.) Install the disconnect switch in accordance with Article 430 of the National Electrical Code ANSI/NFPA 70. 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 7.)

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.

Control Wiring

Refer to Figure 7 for location of control wiring connections. Low voltage wiring must be in individual conduit, separated from primary high voltage wiring.

Control Wiring Maximum Lengths

Volts	Wire Gauge	Total Wire Length	Distance from Unit to Control
24	18	150 feet	75 feet
24	16	250 feet	125 feet
24	14	350 feet	175 feet

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.

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.

Optional Remote Console - The console is a 16 gauge steel box with an engraved plastic cover, terminal blocks, and a mounting ring. The box may either be recessed into or mounted on a wall. The console includes three lights and a summer/winter/off control switch. Also, if the system is thermostat controlled, a thermostat may have been ordered mounted on the console. Or, if the system has electronic modulation gas controls (Option 30, 31, 32, or 35), a temperature selector is mounted on the console.

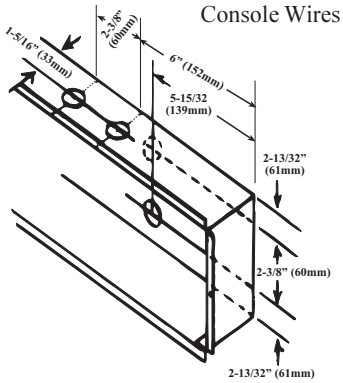
Figure 6 - Dimensions of Optional Remote Console

Console Length = 10-3/4" (273mm)

Console Height = 7-3/16" (183mm)

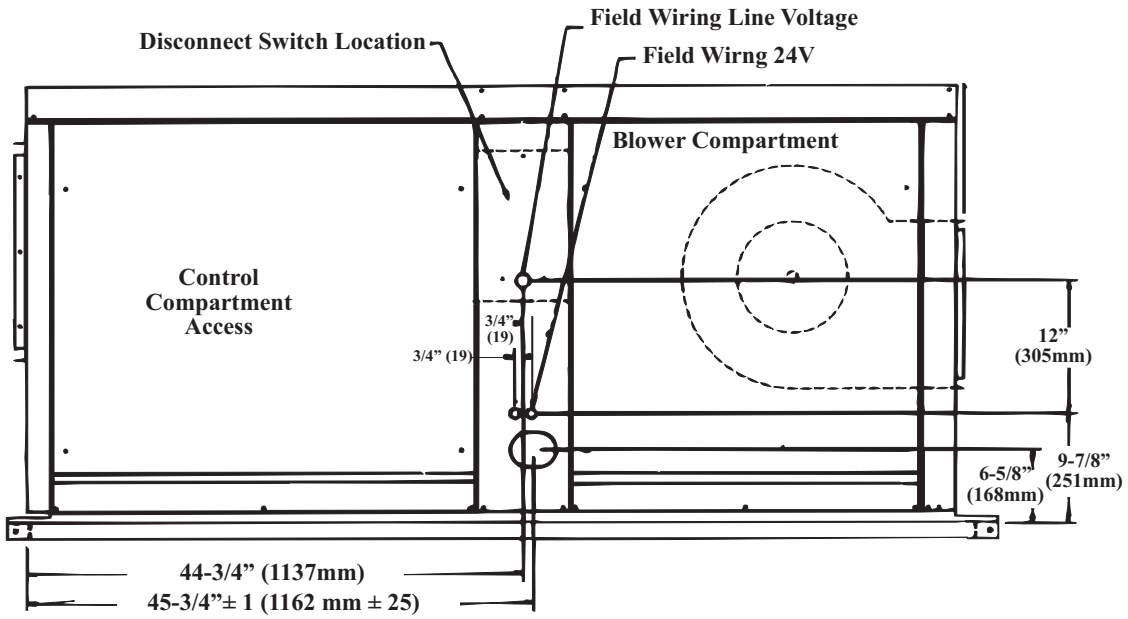
Console Depth = 2-5/8" (67mm)

(NOTE: Deduct 5/8" from length and height when recessing box.)



Optional Dirty Filter Light (only with Remote Console Option RC14) - When the optional remote console includes a fourth light, it is a dirty filter indicator light. The light is activated by an adjustable, single-pole/normally open differential pressure switch that senses air flow across the filter bank. The switch which is located in the main electrical control box requires field setting of the indicator light setpoint. The sensing tubes are attached to the switch. One tube extends to the opening in the burner section and is positioned to sense the airflow as it leaves the filter section. The other tube is shipped in the unit. After the unit is installed, extend that tube through the filter rack and attach it to the entering side of the filter section.

Figure 7 - Disconnect Switch Location and Wiring Connection Locations (Model ADF is illustrated; same dimensions/ locations apply to Model ADFH)



Set the switch after the system is in operation. Instructions are included in Check/Test/Startup, Paragraph 14.

Optional Door Switch - 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.

11. Gas Piping and Pressures

All piping must be in accordance with the requirements of the National Fuel Gas Code ANSI/Z223.1 (latest edition) published by the American Gas Association or CAN1 B149.1 and B149.2 as published by the Canadian Gas Association. 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 8. Local codes may require a 6" condensate trap.

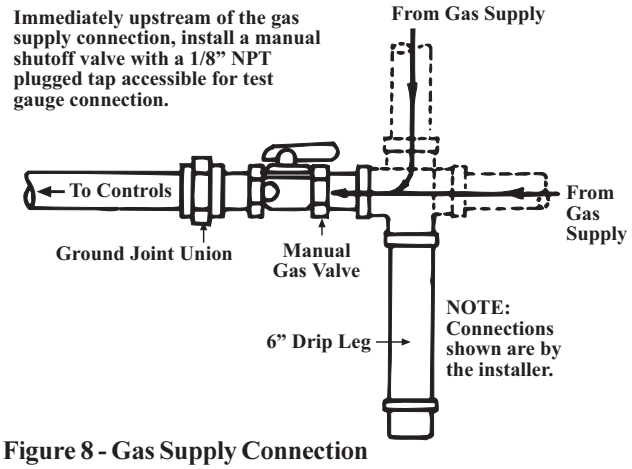


Figure 8 - Gas Supply Connection

Gas Connection Size

Burner Size BTU	Pipe Size
250,000 - 500,000	3/4"
>500,000 - 750,000	1"
>750,000 - 1,250,000	1-1/4"

CAUTION: Gas piping connection is determined by burner BTU. Use this table as a reference for connection at the unit only.

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.

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.

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 14" 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.

NOTE: The required gas supply pressures listed above are the minimum and maximum only. Two factors are needed to determine a more accurate inlet gas supply pressure needed for a specific installation: (1) gas pressure required at the burner, and (2) the pressure lost as the gas flows through the selected gas train. The required gas pressure at the burner depends on whether or not the system is being operated at maximum capacity and the differential gas pressure calculation. The pressure drop depends on which gas control and manifold combination is selected. Follow the steps and instructions in Paragraph 13, Check-Test-Start, to determine minimum gas inlet pressure (but no less than 6" w.c. natural gas) for your installation.

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.

11. Gas Piping and Pressures (cont'd)

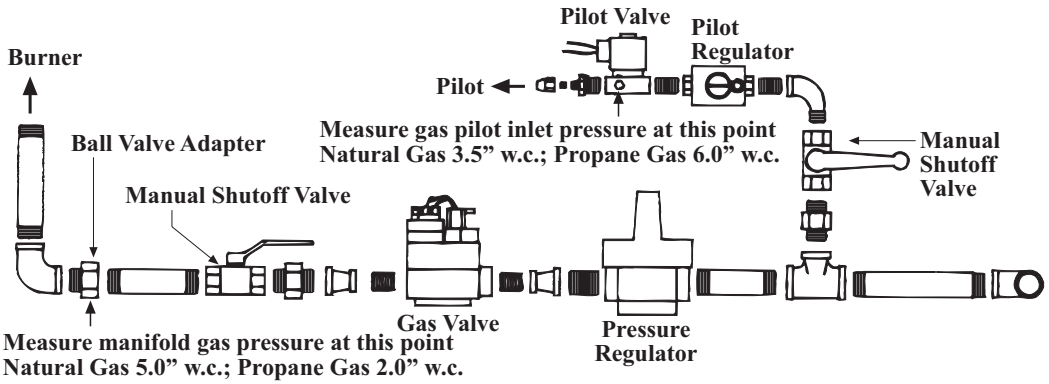


Figure 9 - Location of pressure taps for measuring burner and pilot supply pressure. Measure with blower operating.

Pilot Supply Pressure (cont'd) - See Figure 9 for locations of pressure taps for measuring operating pressure and pilot supply pressure. 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 (See Figure 9). Measure manifold gas pressure with the blowers operating.

Firing Rate	Minimum Gas Pressure at the Burner
Maximum	Natural Gas 5" w.c.; Propane Gas 2" w.c.
Less-than-maximum	Calculate using the formulas in Chart 1 below

If the system is to be operated at a firing rate that is less than maximum, the required manifold gas pressure can be calculated by using the formula in Chart 1 below.

In planning for providing sufficient manifold gas pressure, the pressure drop through the gas train must be considered. Chart 2 lists the pressure drops through the various gas trains operating at maximum firing rate and the formulas for calculating the pressure drops if the installation is operated at less-than-maximum firing rate.

To determine minimum inlet pressure required to provide adequate manifold, pressure, add the pressure measured at the burner tap (manifold pressure) plus the gas train pressure drop from Chart 2, page 11.

Chart 1 - Formula to Calculate Gas Pressure Required at the Burner for Input Rate that is Less Than Maximum Capacity

Burner Size	Fuel	Pressure @ Max Capacity	Formula	Manifold Pressure for Specified Rate
Std - 6"	Natural Gas	5" w.c. X	$\left(\frac{\text{Input Rate}}{250{,}000}\right)^2$ =	"w.c. natural gas
	Propane Gas	2" w.c. X	$\left(\frac{\text{Input Rate}}{250{,}000}\right)^2$ =	"w.c. propane gas
BL2 - 12"	Natural Gas	5" w.c. X	$\left(\frac{\text{Input Rate}}{500{,}000}\right)^2$ =	"w.c. natural gas
	Propane Gas	2" w.c. X	$\left(\frac{\text{Input Rate}}{500{,}000}\right)^2$ =	"w.c. propane gas
BL3 - 18"	Natural Gas	5" w.c. X	$\left(\frac{\text{Input Rate}}{750{,}000}\right)^2$ =	"w.c. natural gas
	Propane Gas	2" w.c. X	$\left(\frac{\text{Input Rate}}{750{,}000}\right)^2$ =	"w.c. propane gas
BL4 - 24"	Natural Gas	5" w.c. X	$\left(\frac{\text{Input Rate}}{1{,}000{,}000}\right)^2$ =	"w.c. natural gas
	Propane Gas	2" w.c. X	$\left(\frac{\text{Input Rate}}{1{,}000{,}000}\right)^2$ =	"w.c. propane gas
BL5 - 30"	Natural Gas	5" w.c. X	$\left(\frac{\text{Input Rate}}{1{,}250{,}000}\right)^2$ =	"w.c. natural gas
	Propane Gas	2" w.c. X	$\left(\frac{\text{Input Rate}}{1{,}250{,}000}\right)^2$ =	"w.c. propane gas

Example of Calculation to Determine Required Gas Pressure

System: Model ADF500 with ANSI Rating Plate
Natural Gas
Option AG31 Gas Controls
Option BL3 Burner (18")
Option BM50 Manifold
600,000 BTU Input Rate

Calculation: 5" w.c. x $(600{,}000 \div 750{,}000)^2$ =
5" w.c. x $(.8)^2$ =
5" w.c. x .64 = 3.2" w.c.

IMPORTANT NOTE ON DETERMINING ACTUAL MINIMUM GAS INLET PRESSURE: The burner gas pressure requirements listed (both maximum firing and less-than-maximum calculations) are established by the burner manufacturer and represent only the positive force of the gas pressure. With the unit operating, actual differential burner gas pressure requirement is determined by two factors: 1) the positive force created by the gas pressure, less 2) the suction or negative pressure created by the operation of the blower. For a more accurate determination of the minimum inlet gas pressure requirement, follow the steps in Paragraph 13, Check-Test-Start, to measure differential burner gas pressure and add that differential pressure to the pressure drop through the selected gas train (gas control and manifold combination) in Chart 2.)

Chart 2 - Gas Train Pressure Drops at Maximum Rate and Formula for Calculating Pressure Drop at an Input Rate Less than Full Capacity (IR = Input Rate)

Manifold/Gas Controls for ADF/ADFH Models certified to ANSI Standards (for U.S.A.)

Pipe Size	Option Selections: Manifold/ Burner Size	Gas Control	Fuel Type	Maximum Rate	Gas Train Pressure Drop at Maximum Rate (approx.)	Formula for Calculating Drop at a Specific Rate (See Example below)
3/4"	Std or BM40 / 6" Burner	Std (AG1)	Natural	250,000	1.34" w.c.	$(IR)^2 (2.143 \times 10^{-11})$
			Propane	250,000	.51" w.c.	$(IR)^2 (8.159 \times 10^{-12})$
3/4"	Std or BM40 / 12" Burner	Std (AG1)	Natural	400,000	2.08" w.c.	$(IR)^2 (1.298 \times 10^{-11})$
			Propane	400,000	.79" w.c.	$(IR)^2 (4.942 \times 10^{-12})$
3/4"	Std or BM40 / 6" Burner	AG3	Natural	250,000	1.25" w.c.	$(IR)^2 (2.007 \times 10^{-11})$
			Propane	250,000	.48" w.c.	$(IR)^2 (7.647 \times 10^{-12})$
3/4"	Std or BM40 / 12" Burner	AG3	Natural	400,000	2.08" w.c.	$(IR)^2 (1.298 \times 10^{-11})$
			Propane	400,000	.79" w.c.	$(IR)^2 (4.942 \times 10^{-12})$
3/4"	BM43 or 44 / 6" or 12" Burner	AG30, 31, 32,	Natural	400,000	2.43" w.c.	$(IR)^2 (1.522 \times 10^{-11})$
		33, 35, 36 or 37	Propane	400,000	.93" w.c.	$(IR)^2 (5.799 \times 10^{-12})$
3/4"	BM47 / 6" or 12" Burner	AG30, 31, 32,	Natural	500,000	2.62" w.c.	$(IR)^2 (1.049 \times 10^{-11})$
		33, 35, 36 or 37	Propane	500,000	1.00" w.c.	$(IR)^2 (4.000 \times 10^{-12})$
1"	BM48 / 12" or 18" Burner	AG30, 31, 32,	Natural	750,000	4.01" w.c.	$(IR)^2 (7.131 \times 10^{-12})$
		33, 35, 36 or 37	Propane	750,000	1.53" w.c.	$(IR)^2 (2.717 \times 10^{-12})$
1"	BM50 / 12" or 18" Burner	AG30, 31, 32,	Natural	750,000	3.24" w.c.	$(IR)^2 (5.758 \times 10^{-12})$
		33, 35, 36 or 37	Propane	750,000	.99" w.c.	$(IR)^2 (1.757 \times 10^{-12})$
1-1/4"	BM51 / 18", 24" or 30" Burner	AG30, 31, 32,	Natural	1,250,000	4.91" w.c.	$(IR)^2 (3.140 \times 10^{-12})$
		33, 35, 36 or 37	Propane	1,250,000	1.87" w.c.	$(IR)^2 (1.196 \times 10^{-12})$
1-1/4"	BM53 / 18", 24" or 30" Burner	AG30, 31, 32,	Natural	1,250,000	3.82" w.c.	$(IR)^2 (2.140 \times 10^{-12})$
		33, 35, 36 or 37	Propane	1,250,000	1.45" w.c.	$(IR)^2 (1.196 \times 10^{-12})$
1-1/4"	BM54 / 18", 24" or 30" Burner	AG30, 31, 32,	Natural	1,250,000	4.61" w.c.	$(IR)^2 (2.949 \times 10^{-12})$
		33, 35, 36 or 37	Propane	1,250,000	1.76" w.c.	$(IR)^2 (1.123 \times 10^{-12})$

Manifold/Gas Controls for ADF/ADFH Models approved to CAN Standards (for Canada)

Pipe Size	Option Selections: Manifold/ Burner Size Control	Gas Type	Fuel Rate	Maximum Rate (approx.)	Gas Train Pressure Drop at Maximum (See Example below)	Formula for Calculating Drop at a Specific Rate
3/4"	BM46 / 6" or 12" Burner	AG30, 31, 32,	Natural	500,000	2.62" w.c.	$(IR)^2 (1.049 \times 10^{-11})$
		33, 35, 36 or 37	Propane	500,000	1.00" w.c.	$(IR)^2 (4.000 \times 10^{-12})$
1"	BM49 / 6", 12" or 18" Burner	AG30, 31, 32,	Natural	750,000	3.63" w.c.	$(IR)^2 (6.452 \times 10^{-12})$
		33, 35, 36 or 37	Propane	750,000	1.38" w.c.	$(IR)^2 (2.459 \times 10^{-12})$
1-1/4"	BM52 / 18", 24" or 30" Burner	AG30, 31, 32,	Natural	1,250,000	3.82" w.c.	$(IR)^2 (2.444 \times 10^{-12})$
		33, 35, 36 or 37	Propane	1,250,000	1.45" w.c.	$(IR)^2 (9.305 \times 10^{-13})$

Example:

Model ADF 500 with ANSI Rating Plate
Natural Gas
Option 31 Gas Controls
Option BL3 (18") Burner
Option BM50 Manifold
600,000 BTU Input Rate

Solution: Formula for Gas Train Pressure Drop = $(IR)^2 (5.758 \times 10^{-12})$

$(600{,}000)^2 (5.758 \times 10^{-12}) =$

$360{,}000{,}000{,}000 (5.758 \times 10^{-12}) =$

$(2{,}072{,}880{,}000{,}000.00 \times 10^{-12} = 2.07$" w.c.

Instructions: Select formula from Chart 2, calculate, and add to manifold pressure drop in Chart 1.

11. Gas Piping and Pressures (cont'd)

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.

Optional Gas Pressure Switches - Gas pressure switches included in the system's 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 (Option BP2) exceeds the setpoint, the switch will open the electrical circuit to the burner, stopping all gas flow. The high gas pressure switch is a 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: Both high and low gas pressure switches incorporate a vent limiting device and do not require venting to the outdoors when used in an application installed indoors.)

Gas Piping for Optional Vent Valve (applies only to an indoor installation with Manifold Option BM53) **-** When a system installed indoors is equipped with an optional vent valve (part of manifold Option BM53), piping must be field-installed to terminate the vent outdoors. Locate the 3/4" male pipe threads protruding (from the bottom pan underneath the control compartment). Extend the 3/4" piping to the outside of the building and terminate with a screen.

12. Blowers, Drives, and Blower Motors

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 10). Be sure the belt is aligned in the pulleys.

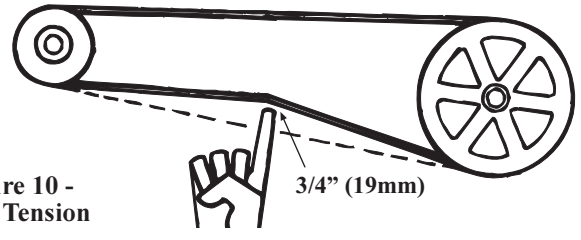


Figure 10 - Belt Tension

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 13, 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 Check-Test-Start Procedure in Paragraph 13.

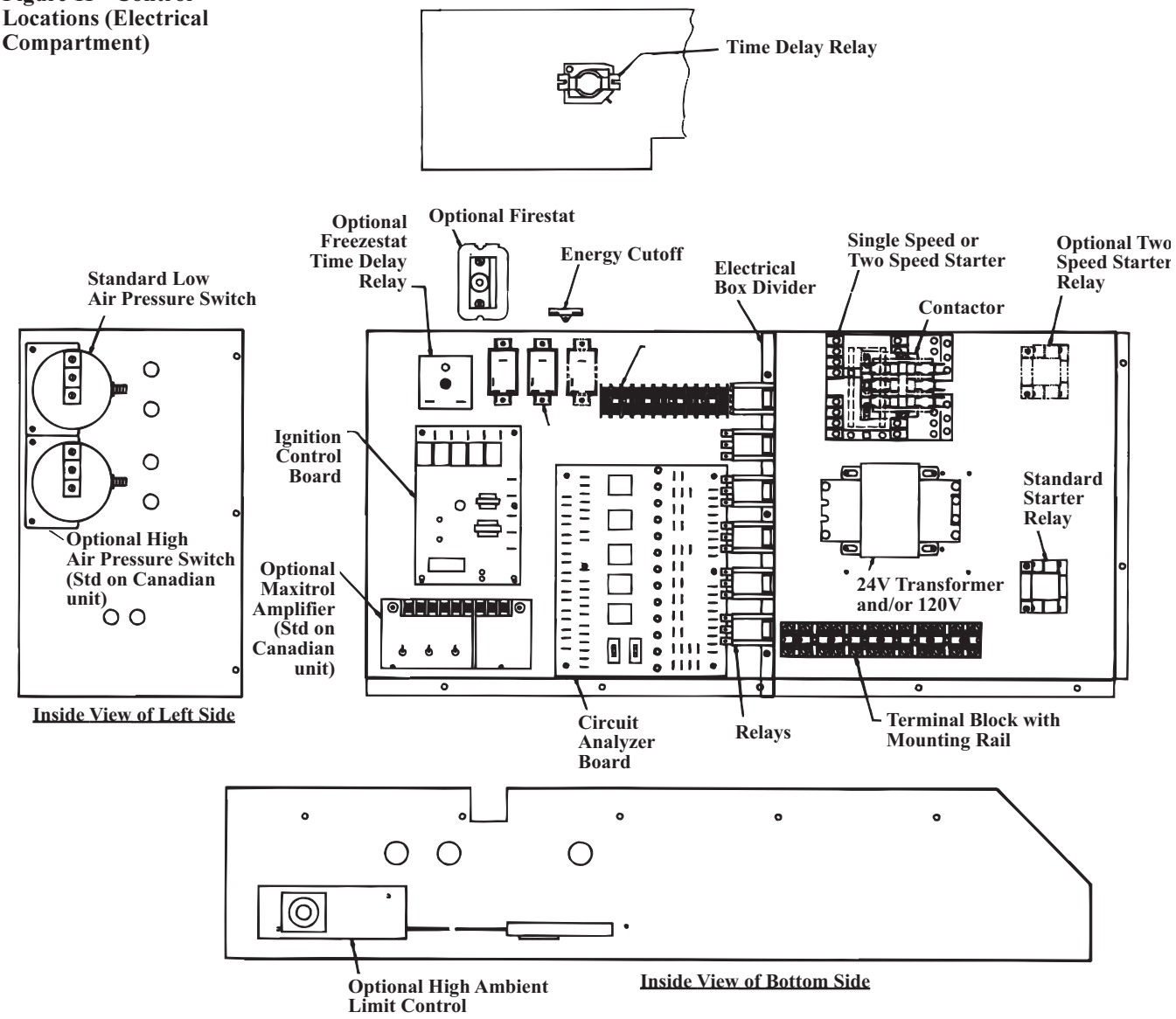
Motor Loads - Use an ammeter to check motor amps. Amps may be adjusted downward by reducing blower RPM or by increasing duct system static pressure. The open motor amp chart below can be used for sizing line wiring. For accurate amps, read the motor manufacturer's rating plate; amps will vary depending 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	2.0	1.0	--
3/4	11.0	5.5	2.9	2.6	1.3	--
1	13.0	7.5	3.7	3.2	1.6	1.4
1-1/2	15	7.5	5.6	5.0	2.7	2.0
2	N/A	N/A	7.0	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	22.0	21.0	10.5	8.4
10	N/A	N/A	30.0	26.0	13.0	10.4
15	N/A	N/A	43.1	39.0	19.5	16.0
20	N/A	N/A	58.7	53.0	26.5	21.2

13. Check-Test-Start

Figure 11 - Control Locations (Electrical Compartment)



Check/Test/Startup Procedures

Before Startup - Turn power and gas off.

☐**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 to check air flow on the air entering side of the filter section.

☐**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. Remove the control compartment door panel --

☐Close all manual gas valves.

14. Check-Test Start (cont'd)

Before Startup (cont'd)

☐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.

7. In the blower compartment --

☐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 12) 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 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.

Startup

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 (See Figure 9, Paragraph 11).

☐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. A single 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 wiring 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 (1) burner differential **air** pressure on the slope gauge **(connected to the unit in Startup Step 1)** and (2) the negative pressure created in the gas line by operation of the blower (as measured by the manometer installed in Startup Step 1) .

☐(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.

(1) Turn the disconnect switch OFF.
(2) Vertical Discharge -- Remove the blower door on the control side of the unit.
(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 -.5" and -.7" w.c. If the slope gauge reading is within those limits, no adjustments are necessary. If the slope gauge reading is not within these limits, do the following:

If the slope gauge reading is *greater than* -.5" (such as -.3" w.c.), adjust the drive to increase 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.

If the slope gauge reading is *less than* -.7" (such as -.9" 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 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 -.5" to -.7" 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) Record the negative pressure reading (blower operating) on the manometer in the gas line. (The measurement will be needed in Step 7 to calculate differential gas pressure at the burner.).

☐(F) 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.

☐(G) 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 counter-clockwise 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.

☐(H) 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.

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 (See Figure 9).

☐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.

13. Check-Test Start (cont'd)

☐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. Check main burner gas differential pressure (burner differential gas pressure consists of two factors: (1) the suction or negative pressure created by the operation of the blower (recorded in Startup Step 4E) and (2) the positive force created by the actual gas pressure.

☐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.

Calculate the burner differential gas pressure to determine absolute minimum supply pressure--

Factor 1 - Actual gas pressure reading with burner and blower operating

Factor 2 - Negative pressure reading in the gas line with the blower operating

Ignoring the minus, deduct the negative pressure from the actual gas pressure.

EXAMPLE:		
	Gas Pressure Reading	5.7" w.c.
	Negative Pressure	-.6" w.c.
	Differential Pressure	5.1" w.c.

Minimum supply pressure is the differential burner pressure plus the pressure drop as listed in the table in Paragraph 11.

Determine pressure required for less-than-maximum firing: For maximum firing rate, a minimum of 5" w.c. of actual measured natural gas pressure is required at the burner. (If maximum firing rate is not required, divide the actual input rate by the maximum rate, square the answer, and multiply by 5" 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.

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.

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 Five-Day Week (Guide Only)

Substance	Percent	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

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

FIELD-INSTALLED ACCESSORIES

14. Optional 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 (U.S. Patent 4,999,037) 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.

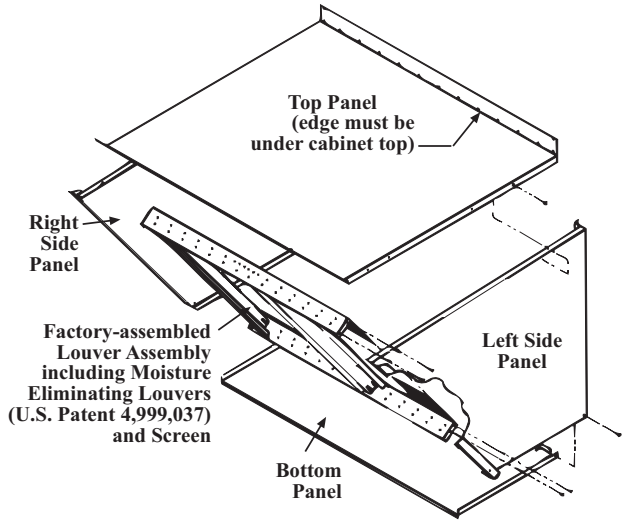


Figure 12A - Assembly Drawing of Option AS2, Outside Air Hood Without Filters

Size	Top Panel	Bottom Panel	Louver Assembly	Left Side	Right Side
300	100228	100235	103774	100217	100216
500	100230	100237	103776	100217	100216
700/1200	100232	100239	103778	100217	100216

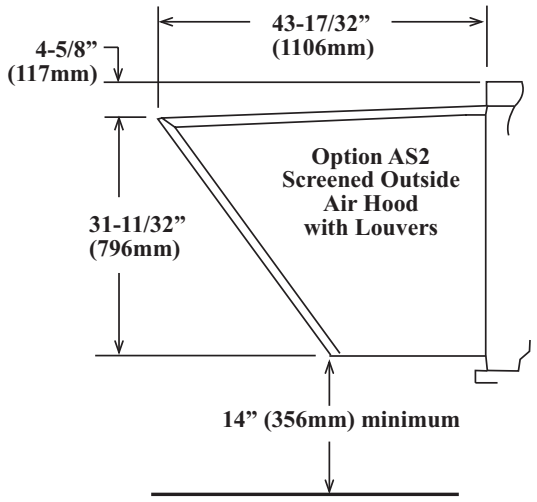
NOTE: Either a Reznor designed optional air inlet hood or evaporative cooling module is required on outdoor installations to ensure complete weather resistance and to retain certification.

Installation Instructions

(Refer to Air Hood Assembly Drawing in Figure 12A. 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 12B - Dimensions of Optional Outside Air Hood Without Filters



The width of the outside air hood is the same as the width of the cabinet.

Model Size	Width of Outside Air Hood
300	34" (864mm)
500	47-3/4" (1213mm)
700	58-3/4" (1492mm)
1200	58-3/4" (1492mm)

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

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.

15. Optional Screened Outside Air Hood with Filters - Options AS6, AS7, AS9, AS10, AS11, AS12

Screened air hoods are available with a filter rack and 1" or 2" disposable filters, 1" or 2" permanent filters, or 1" 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 15.

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

Field-Installed Accessories (cont'd)

15. Air Hood With Filters (cont'd)

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

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

1. On the inlet end of the system, remove the row of factory-installed screws attaching the cabinet top.

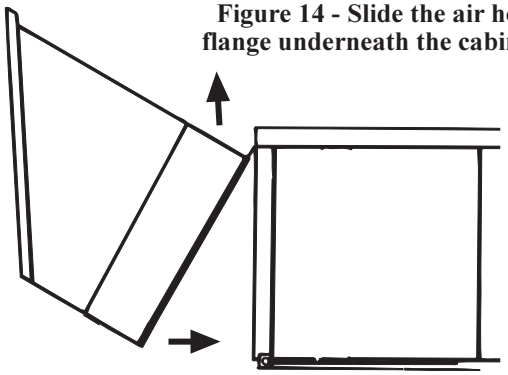
Figure 13 - Optional Screened Outside Air Hood with Filters

Factory assembled and shipped separately for field installation.

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 14).
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.

Figure 14 - Slide the air hood top flange underneath the cabinet top.



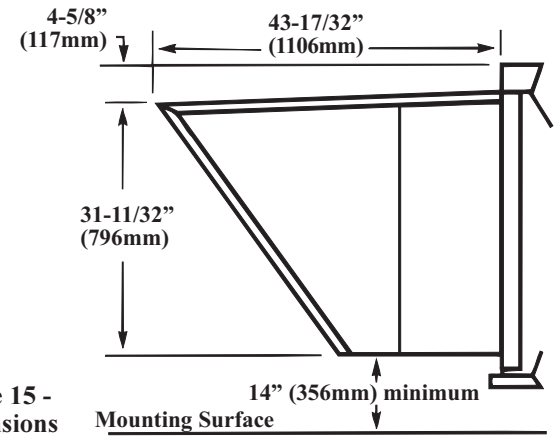


Figure 15 - Dimensions

The width of the outside air hood is the same as the width of the cabinet.

Model Size	Width of Outside Air Hood
300	34" (864mm)
500	47-3/4" (1213mm)
700	58-3/4" (1492mm)
1200	58-3/4" (1492mm)

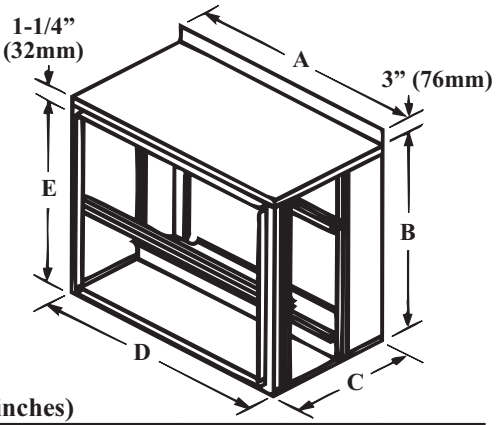
Provide a minimum of 14" clearance from the bottom of the air hood to the mounting surface.

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.

16. Optional Indoor Filter Cabinet - Options AW12, AW13, AW3, AW6, AW14, 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 cabinets are available with 1" or 2" permanent filters, or 1" or 2" disposable, 1" or 2" permanent filters, or 1" or 2" pleated disposable filters. There is a filter access door on both sides of the cabinet.

Figure 16 - Dimensions of Indoor Filter Cabinet



Dimensions (inches)

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

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

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 Figure 14 that illustrates installation of an outdoor filter cabinet which includes a screened inlet hood. The indoor cabinet which does not have the hood is attached the same way.)

   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.
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.

17. Optional Evaporative Cooling Module - Options AS3, AS4, AS5, 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 6" or 12" rigid cellulose or 6" or 12" rigid glass fiber. Six-inch media provides 68% efficiency; 12" media provides 90% efficiency. Efficiency values are 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.

Heater Size	Moisture Elimination Pad Required 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

Evaporative Cooling Module Installation Instructions:

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. Follow the instructions in this section for water connections and water flow adjustments. 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 23.

Figure 17 - Dimensions of optional evaporative cooling module factory-installed on Sizes 300 and 500

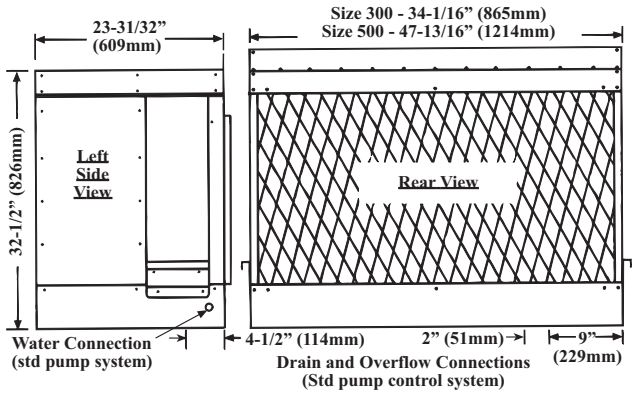


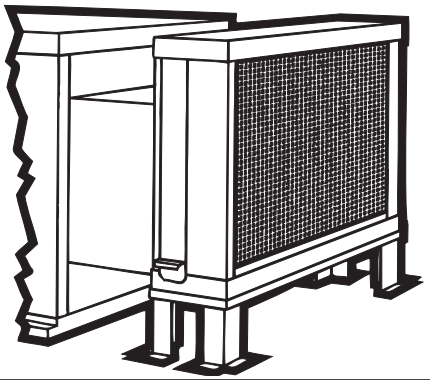
Figure 18 - Factory-installed Evaporative Cooling Module Option on Models ADF/ADFH 300 and 500

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, 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.

Figure 19 - Optional Evaporative Cooling Module on an ADF/ADFH 700 or 1200.

Assembled module is shipped separately for field installation.



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

Weights of Evaporative Cooling Module with Wet Media and Full Reservoir (lbs)	
Module with 6" rigid cellulose media (Option AS3)	349 lbs
Module with 12" rigid cellulose media (Option AS4)	431 lbs
Module with 6" rigid glass fiber media (Option AS5)	420 lbs
Module with 12" rigid glass fiber media(Option AS8) ...	514 lbs

☐ 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.

Figure 20 - Field-assembled Base for Optional Evaporative Cooler on Sizes 700 and 1200

Field Installed Accessories (cont'd)

17. Optional Evaporative Cooling Module - Options AS3, AS4, AS5, AS8 (cont'd)

Evaporative Cooling Module Water Connections and Adjustments

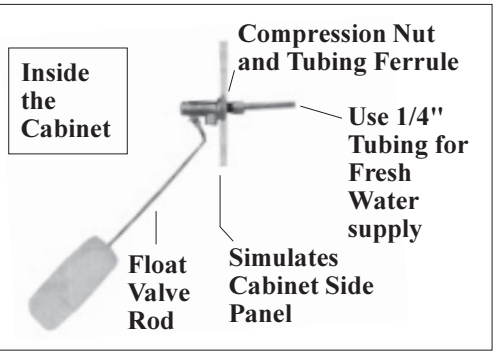
WARNINGS: Water reservoir must be drained and pump motor turned off when outside temperature falls below 32°F. Pump must never be operated without water in the reservoir. See Hazard levels, page 2.

Supply and Drain Water Connections

Float Valve (Figure 21) - 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 21. Place nut and ferrule over tubing and insert tubing into the float valve stem. Tighten nut securely.

Figure 21 - 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.

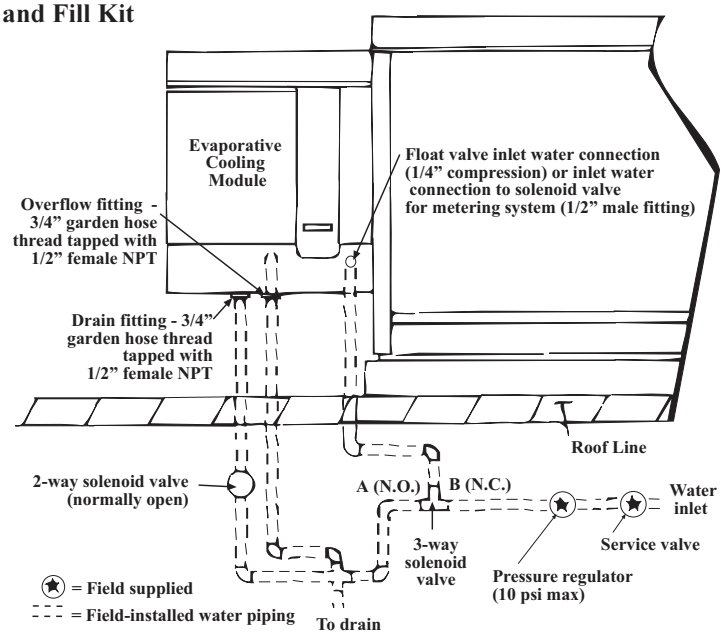
All Cooling Modules - A manual water shutoff should be installed upstream of the inlet, at a convenient non-freezing location, to allow the water supply to be turned on and off. If necessary, install a bleed line between the manual valve and the cooling module inlet to allow drainage of the line between 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 23. If installing an optional fill and drain kit, follow the instructions. Consult the wiring diagram for electrical connections.

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 (See Figure 22). Attach a 1/4" I.D. hose to the barb and run the hose to the nearest drain.

Figure 23 - Water connections including Optional Drain and Fill Kit



Instructions for Installing Optional Fill & Drain Kit

NOTE: Follow these 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 Connections (requires black and white 14-gauge wire) - Refer to Wiring Diagram provided with the furnace:

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.

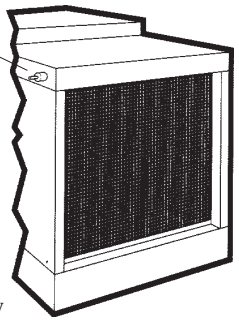


Figure 22 - Air Inlet View of the Evaporative Cooling Module Showing Bleed Line Fitting

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

Float and Pump Control System -- Turn on the water supply. Check for good flow.

When the float valve (Figure 21) 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. After the first week of operation, the water flow should be re-checked because the soaker hose weave will tighten slightly affecting the 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.

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 -- Using the ball valve, located in the middle of the length of hose running from the pump to the distribution line inlet (Figure 24), 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.

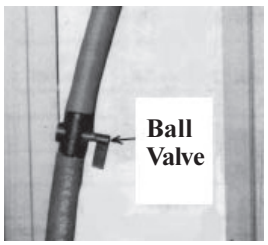


Figure 24 - Disconnect the power and adjust the water flow with the ball valve.

AquaSaver® Timed Metering Control System -- NOTE: Water flow and pad wetting time should be adjusted 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. Adjustments are correct when **1)** the water rises from the holes in the sprinkler pipe (See Figure 25A) 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 24, adjust the water flow depending on the pad height. See Figure 25A.

2) AquaSaver® Timer Adjustment - At any given temperature, the media pads should completely wet from top to bottom during the ON cycle. If the ON time is less than 45 seconds or greater than 90 seconds at 80°F, adjust the timer. Remove the junction box cover to access the timer adjustment screw (See Figure 25B).

Figure 25A - Adjust Water Flow with the Ball Valve in Figure 24

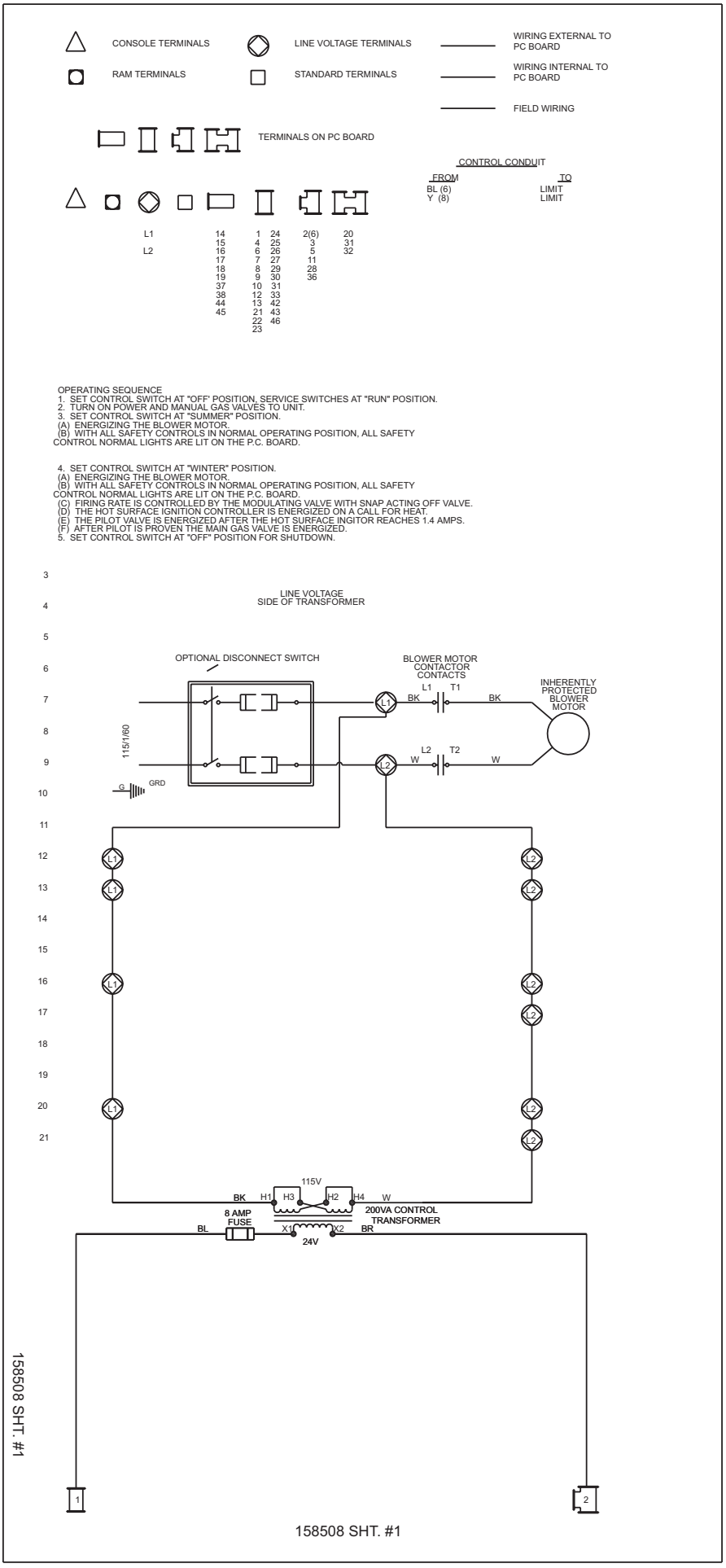
Pad Height	A = Water rise from PVC Sprinkler Pipe
24"	1/8" to 1/2"
48"	1/4" to 1/2"

Figure 25B - Junction Box with AquaSaver® Controls

— To ***increase*** the ON time, turn the adjustment screw ***clockwise;*** one complete turn will increase ON cycle by 12 to 14 seconds.

— To ***decrease*** the ON time, turn the adjustment screw ***counterclockwise;*** one complete turn will decrease ON cycle by 12 to 14 seconds.

Typical Wiring Diagram



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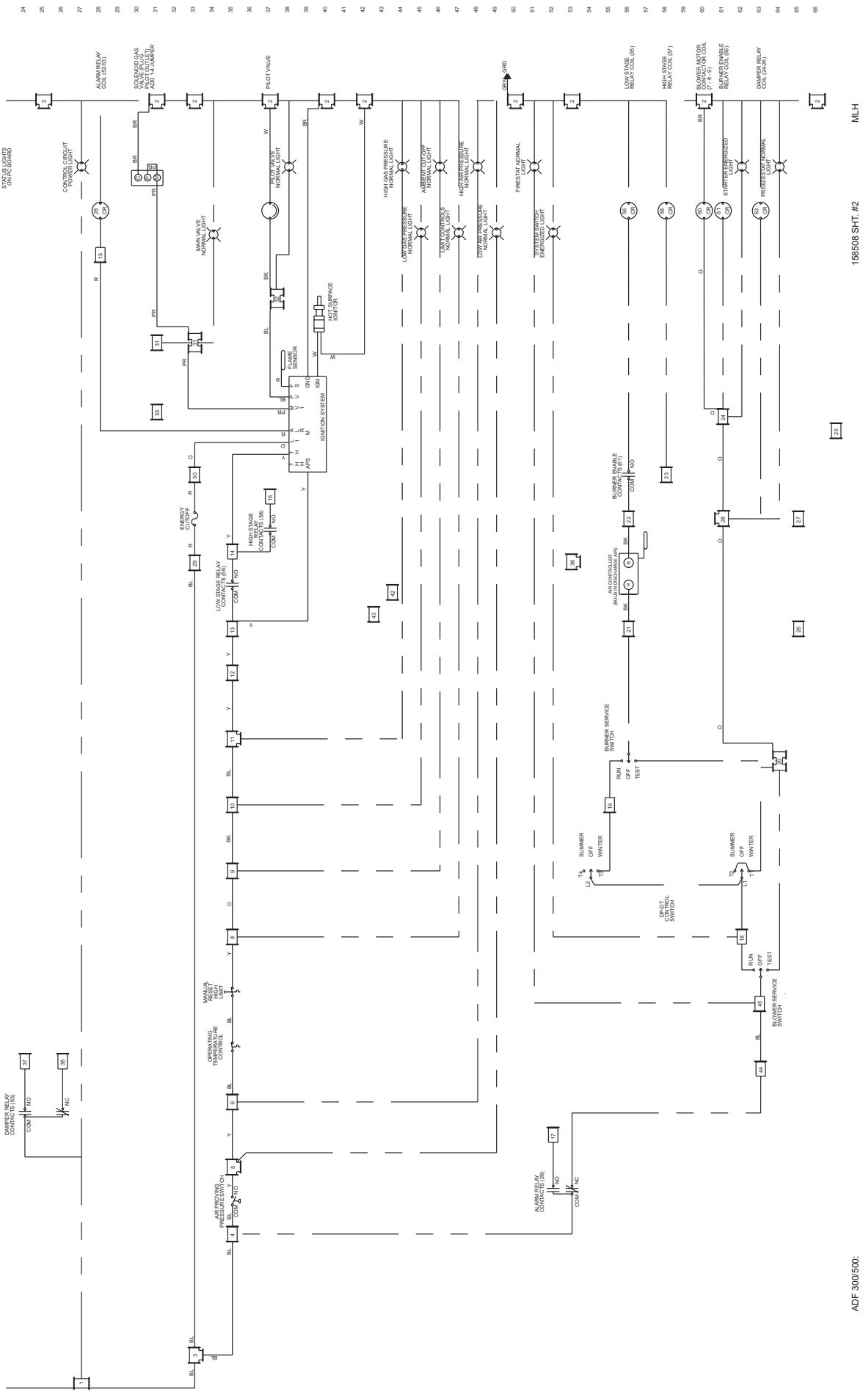
STATUS LIGHTS ON PIC BOARD
CONTROL CIRCUIT POWER LIGHT
ALARM RELAY COIL (50,53)
SOLENOID GAS VALVE COIL (PILOT OUTLET) ADD 14 JUMPER
MAIN VALVE NORMAL LIGHT
PILOT VALVE
PILOT VALVE NORMAL LIGHT
HIGH GAS PRESSURE NORMAL LIGHT
LOW GAS PRESSURE NORMAL LIGHT
AMBIENT CUT-OFF NORMAL LIGHT
LIMIT CONTROLS NORMAL LIGHT
HIGH FLAME PRESSURE NORMAL LIGHT
LOW FLAME PRESSURE NORMAL LIGHT
GRD
FIRESTAT NORMAL LIGHT
SYSTEM SWITCH ENERGIZED LIGHT
LOW STAGE RELAY COIL (55)
HIGH STAGE RELAY COIL (57)
BLOWER MOTOR CONTACTOR COIL (7 - 8 - 9)
BURNER ENABLE RELAY COIL (61)
STARTER ENERGIZED LIGHT
DAMPER RELAY COIL (24,26)
FIRESTAT NORMAL LIGHT
FLAME SENSOR
HOT SURFACE IGNITOR
IGNITION SYSTEM
EMERGY CUTOFF
HIGH STAGE CONTACTS (58)
LOW STAGE RELAY CONTACTS (56)
BURNER ENABLE CONTACTS (61)
AIR CONTROLLER (BLUE IN HIGH/ARGE AIR)
BURNER SERVICE SWITCH
RUN
OFF
TEST
SUMMER
OFF
WINTER
T4
T2
DP-DT CONTROL SWITCH
BLOWER SERVICE SWITCH
DAMPER RELAY CONTACTS (65)
MANUAL RESET HIGH LIMIT
OPERATING TEMPERATURE CONTROL
AIR PROVING PRESSURE SWITCH
ALARM RELAY CONTACTS (28)
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