



Installation, Start-up, Operating and Service and Maintenance Instructions Series G

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**Always Ask For
 FACTORY
 AUTHORIZED
 PARTS**



ISO 9001
 QMI-SAI Global

Use of the AHRI Certified™ Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to www.ahridirectory.org.

NOTE: Read the entire instruction manual before starting the installation.

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SAFETY CONSIDERATIONS

WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, personal injury, death, or property damage.

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified service agency must use only factory-authorized and listed kits or accessories when modifying this product.

CAUTION

FURNACE RELIABILITY HAZARD

Failure to follow this caution may result in unit component damage.

Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, unit leveling, and unit sizing.

Installing and servicing heating equipment can be hazardous due to gas and electrical components. **Only trained and qualified personnel should install, repair, or service heating equipment.** Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in literature, on tags, and on labels attached to or shipped with furnace and other safety precautions that may apply.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

Wear safety glasses, protective clothing and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

This is the safety-alert symbol . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used

to identify hazards which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

1. Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
2. Install this furnace only in a location and position as specified in the "Location" section of these instructions.
3. Provide adequate combustion and ventilation air to the furnace space as specified in "Air for Combustion and Ventilation" section.
4. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in the "Venting" section of these instructions.
5. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in the "Gas Piping" section.
6. Always install furnace to operate within the furnace's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, as specified in the "Start-Up, Adjustments, and Safety Check" section. See furnace rating plate.
7. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. See "Air Ducts" section.
8. A gas-fired furnace for installation in a residential garage must be installed as specified in the warning box in the "Location" section.
9. The furnace may be used for construction heat provided that the furnace installation and operation complies with the first CAUTION in the LOCATION section of these instructions.
10. These Multipoise Gas-Fired Furnaces are CSA (formerly A.G.A. and C.G.A.) design-certified for use with natural and propane gases (see furnace rating plate) and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces, and garages. The furnace is factory-shipped for use with natural gas. A CSA (A.G.A. and C.G.A.) listed accessory gas conversion kit is required to convert furnace for use with propane gas.
11. See Fig. 1 for required clearances to combustible construction.
12. Maintain a 1-in. (25 mm) clearance from combustible materials to supply air ductwork for a distance of 36 in. (914 mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.
13. These furnaces SHALL NOT be installed directly on carpeting, tile, or any other combustible material other than wood flooring. In downflow installations, factory accessory floor base MUST be used when installed on combustible materials and wood flooring. Special base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CNRV, CNPV, CAP, or CAR or when Coil Box Part No. KCAKC is used. See Fig. 1 for clearance to combustible construction information.

⚠ WARNING FIRE, EXPLOSION, ASPHYXIATION HAZARD	INSTALLATION
IMPROPER adjustment, alteration, service, maintenance, or installation can cause serious injury or death.	MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION
⚠ CAUTION	<p>This forced air furnace is equipped for use with natural gas at altitudes 0 - 10,000 ft (0 - 3,050m). An accessory kit, supplied by the manufacturer, shall be used to convert to propane gas use or may be required for some natural gas applications. This furnace is for indoor installation in a building constructed on site. This furnace may be installed on combustible flooring in alcove or closet at minimum clearance as indicated by the diagram from combustible material. This furnace may be used with a Type B-1 Vent and may be vented in common with other gas fired appliances.</p> <p>This furnace is approved for UPFLOW, DOWNFLOW, and HORIZONTAL installations. Clearance arrows do not change with furnace orientation.</p> <p style="text-align: right;">Clearance in inches</p> <p>Vent Clearance to combustibles: For Single Wall vents 6 inches (6 po). For Type B-1 vent type 1 inch (1 po).</p>
Check entire gas assembly for leaks after lighting this appliance.	
INSTALLATION	MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION
<ol style="list-style-type: none"> This furnace must be installed in accordance with the manufacturer's instructions and local codes. In the absence of local codes, follow the National Fuel Gas Code ANSI Z223.1 / NFPA54 or CSA B-149, 1 Gas Installation Code. This furnace must be installed so there are provisions for combustion and ventilation air. See manufacturer's installation information provided with this appliance. 	DOWNFLOW POSITIONS:
OPERATION	<p>† Installation on non-combustible floors only. For Installation on combustible flooring only when installed on special base, Part No. KGASB0201ALL or NAHA01101SB, Coil Assembly, Part No. CAR, CAP, CNPV, CNRV, END4X, ENW4X, WENC, WTNC, WENW OR WTNW.</p> <p>∅ 18 inches front clearance required for alcove.</p> <p>* Indicates supply or return sides when furnace is in the horizontal position. Line contact only permissible between lines formed by intersections of the Top and two Sides of the furnace jacket, and building joists, studs or framing.</p>
<p>This furnace is equipped with manual reset limit switch(es) in burner compartment to protect against overheat conditions that can result from inadequate combustion air supply or blocked vent conditions.</p> <ol style="list-style-type: none"> Do not bypass limit switches. If a limit opens, call a qualified serviceman to correct the condition and reset limit switch. 	<p>336996-101 REV. C</p>

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Fig. 1 - Clearances to Combustibles

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INTRODUCTION

The Series G 4-way multipoise Category I fan-assisted furnace is CSA (formerly A.G.A. and C.G.A.) design-certified. A Category I fan-assisted furnace is an appliance equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber and/or heat exchanger. The furnace is factory-shipped for use with natural gas. This furnace is not approved for installation in mobile homes, recreational vehicles, or outdoors.

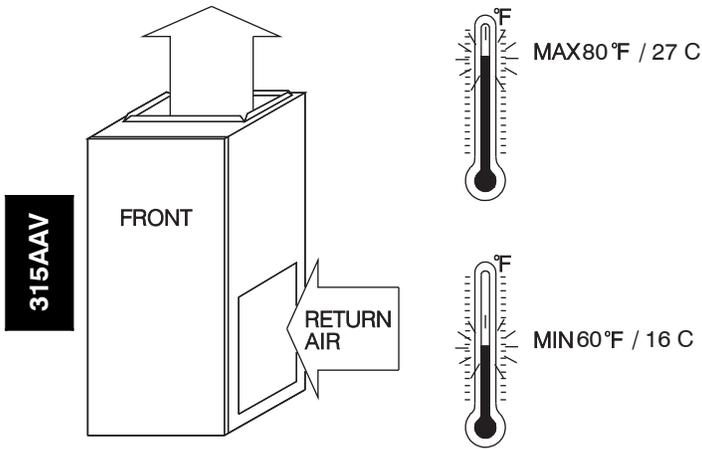


Fig. 2 - Return Air Temperature

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This furnace is designed for minimum continuous return-air temperature of 60°F (15°C) db or intermittent operation down to 55°F (13°C)db such as when used with a night setback thermostat. Return-air temperature must not exceed 80°F (27°C) db. Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and controls. (See Fig. 2.)

For accessory installation details, refer to the applicable instruction literature.

NOTE: Remove all shipping brackets and materials before operating the furnace.

CODES AND STANDARDS

Follow all national and local codes and standards in addition to these instructions. The installation must comply with regulations of the serving gas supplier, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction.

In the United States, follow all codes and standards for the following:

Safety

NFPA 54/ANSI Z223.1-2012 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B .

General Installation

Current edition of the NFGC and the NFPA 90B. For copies, contact the National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; (www.NFPA.org) or for

only the NFGC, contact the American Gas Association, 400 N. Capitol Street, N.W., Washington, DC 20001 (www.AGA.org) .

Combustion and Ventilation Air

Section 9.3 NFPA 54/ANSI Z223.1-2012, Air for Combustion and Ventilation .

Duct Systems

Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 2001 Fundamentals Handbook Chapter 34 or 2000 HVAC Systems and Equipment Handbook Chapters 9 and 16.

Acoustical Lining and Fibrous Glass Duct

Current edition of SMACNA and NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts

Gas Piping and Gas Pipe Pressure Testing

NFPA 54/ANSI Z223.1-2012 ; chapters 5, 6, and 7 and National Plumbing Codes .

Electrical Connections

National Electrical Code (NEC) ANSI/NFPA70-2011 .

Venting

NFPA 54/ANSI Z223.1-2012; chapters 12 and 13.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE

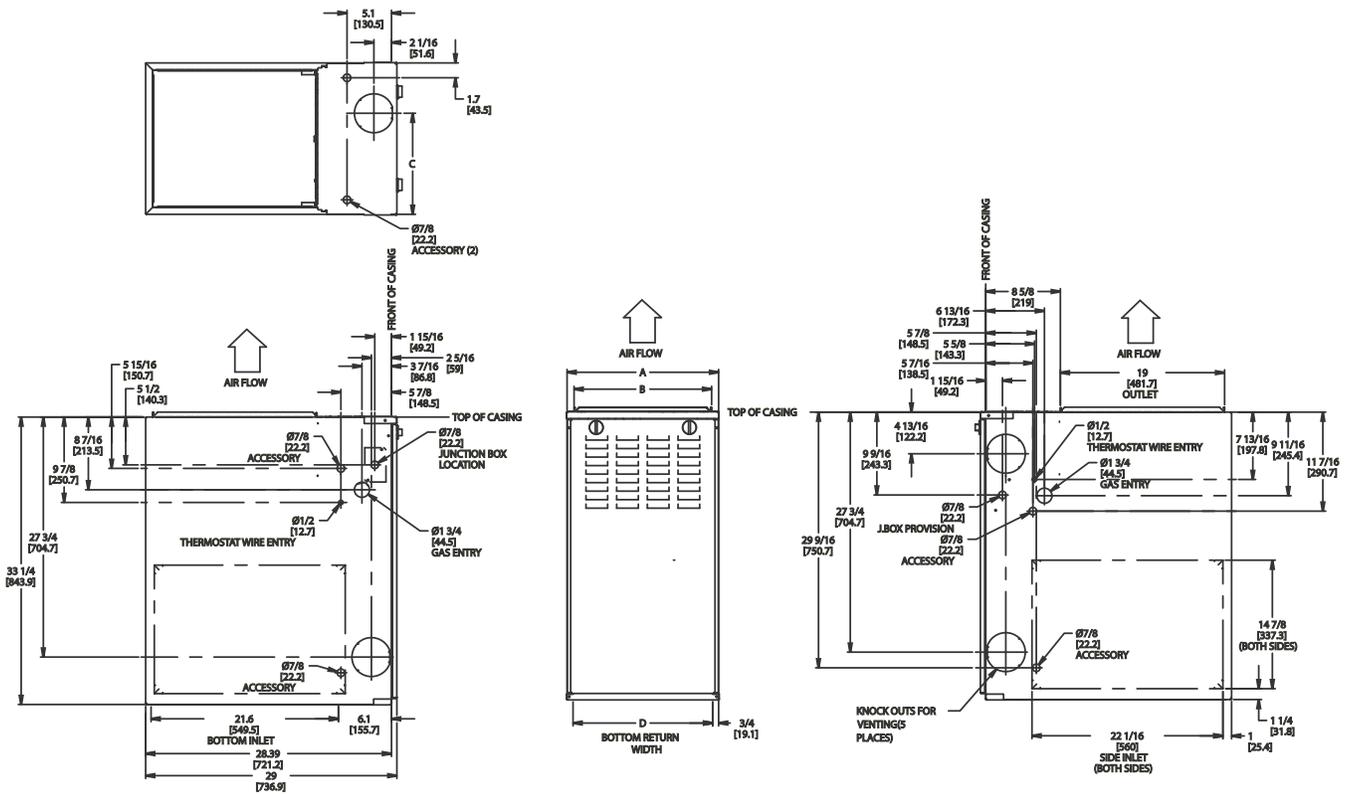
⚠ CAUTION

FURNACE RELIABILITY HAZARD

Failure to follow this caution may result in unit component damage.

Electrostatic discharge can affect electronic components. Take precautions during furnace installation and servicing to protect the furnace electronic control. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure. These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, and the person at the same electrostatic potential.

1. Disconnect all power to the furnace. Multiple disconnects may be required. **DO NOT TOUCH THE CONTROL OR ANY WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.**
2. Firmly touch the clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.
3. After touching the chassis, you may proceed to service the control or connecting wires as long as you do nothing to recharge your body with static electricity (for example; **DO NOT** move or shuffle your feet, do not touch ungrounded objects, etc.).



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NOTES:

1. Two additional 7/8-in. (22 mm) diameter holes are located in the top plate.
2. Minimum return-air openings at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendations for equivalent diameters.
 - a. For 800 CFM—16-in. (406 mm) round or 14 1/2 x 12-in. (368 x 305 mm) rectangle.
 - b. For 1200 CFM—20-in. (508 mm) round or 14 1/2 x 19 1/2-in. (368 x 495 mm) rectangle.
 - c. For 1600 CFM—22-in. (559 mm) round or 14 1/2 x 22 1/16-in. (368 x 560mm) rectangle.
 - d. For airflow requirements above 1800 CFM, see Air Delivery table in Product Data literature for specific use of single side inlets. The use of both side inlets, a combination of 1 side and the bottom, or the bottom only will ensure adequate return air openings for airflow requirements above 1800 CFM.

Fig. 3 - Dimensional Drawing

Table 1 - Dimensions - In. (mm)

FURNACE SIZE	A CABINET WIDTH	B OUTLET WIDTH	C TOP AND BOTTOM FLUE COLLAR	D BOTTOM INLET WIDTH	VENT CONNECTION SIZE	SHIP WT. LB (KG)	ACCESSORY FILTER MEDIA CABINET SIZE
070-12/036070	14-3/16 (360)	12-9/16 (319)	9-5/16 (237)	12-11/16 (322)	4 (102)	115 (52)	16 (406)
090-16/048090	17-1/2 (445)	15-7/8 (403)	11-9/16 (294)	16 (406)	4 (102)	130 (59)	16 (406)
110-20/060110	21 (533)	19-3/8 (492)	13-5/16 (338)	19-1/2 (495)	4 (102)	155 (70)	20 (508)
135-22/066135	24-1/2 (622)	22-7/8 (581)	15-1/16 (383)	23 (584)	4 (102)*	166 (75)	24 (610)
155-22/066155	24-1/2 (622)	22-7/8 (581)	15-1/16 (383)	23 (584)	4 (102)*	175 (79)	24 (610)

*135 and 155 size furnaces require a 5 or 6-in. (127 or 152 mm) vent. Use a vent adapter between furnace and vent stack. See Installation Instructions for complete installation requirements.

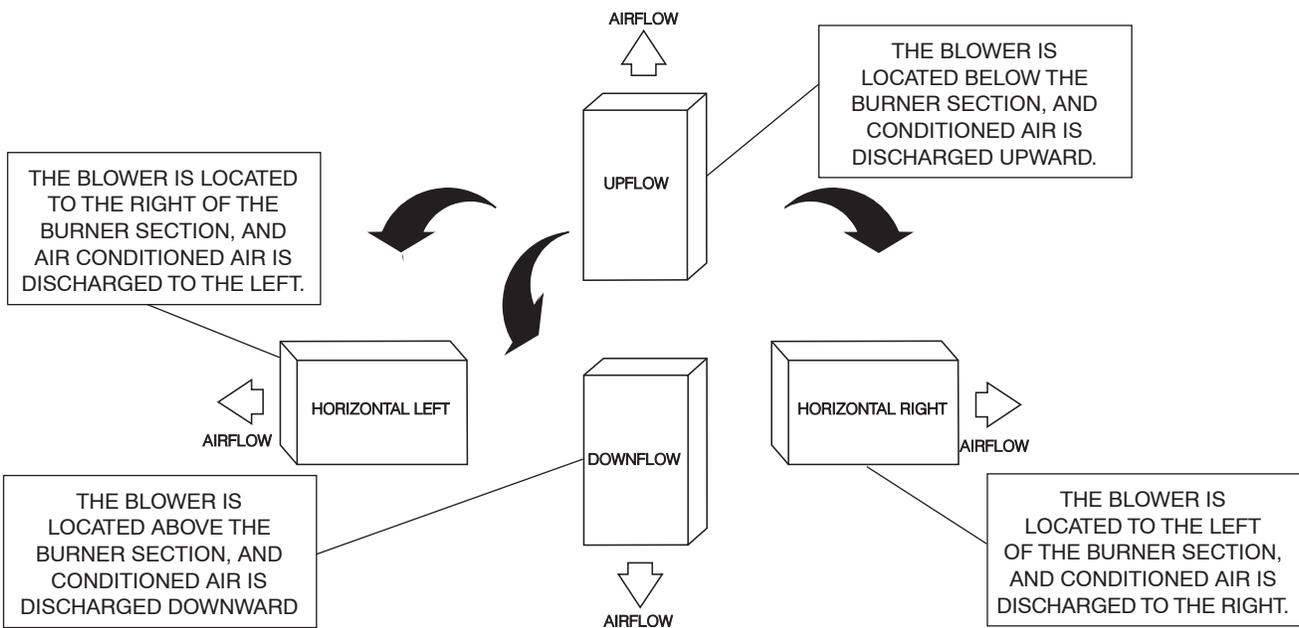
4. If you touch ungrounded objects (and recharge your body with static electricity), firmly touch a clean, unpainted metal surface of the furnace again before touching control or wires.
5. Use this procedure for installed and uninstalled (ungrounded) furnaces.
6. Before removing a new control from its container, discharge your body's electrostatic charge to ground to protect the control from damage. If the control is to be installed in a furnace, follow items 1 through 4 before bringing the control or yourself in contact with the furnace. Put all used and new controls into containers before touching ungrounded objects.
7. An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

LOCATION

GENERAL

This multipoise furnace is shipped in packaged configuration. Some assembly and modifications are required when used in any of the four applications shown in Fig. 4.

NOTE: For high-altitude installations, the high-altitude conversion kit **MUST** be installed at or above 5500 ft. (1676 M) above sea level. Obtain high-altitude conversion kit from your area authorized distributor.



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Fig. 4 - Multipoise Orientations

This furnace must:

- be installed so the electrical components are protected from water.
- not be installed directly on any combustible material other than wood flooring (refer to SAFETY CONSIDERATIONS).
- be located close to the chimney or vent and attached to an air distribution system. Refer to Air Ducts section.
- be provided ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on the furnace clearance to combustible construction label.

If air is exposed to the following substances, it should not be used for combustion air, and outdoor air may be required for combustion:

- Permanent wave solutions
- Chlorinated waxes and cleaners
- Chlorine based swimming pool chemicals
- Water softening chemicals
- De-icing salts or chemicals
- Carbon tetrachloride
- Halogen type refrigerants
- Cleaning solvents (such as perchloroethylene)
- Printing inks, paint removers, varnishes, etc.
- Hydrochloric acid
- Cements and glues
- Antistatic fabric softeners for clothes dryers
- Masonry acid washing materials

All fuel-burning equipment must be supplied with air for fuel combustion. Sufficient air must be provided to avoid negative pressure in the equipment room or space. A positive seal must be made between the furnace cabinet and the return-air duct to prevent pulling air from the burner area and from draft safeguard opening.

⚠ WARNING

CARBON MONOXIDE POISONING / COMPONENT DAMAGE HAZARD

Failure to follow this warning could result in personal injury or death and unit component damage.

Corrosive or contaminated air may cause failure of parts containing flue gas, which could leak into the living space. Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products. Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met, in addition to all local codes and ordinances.

The following types of furnace installations may require OUTDOOR AIR for combustion due to chemical exposures:

- Commercial buildings
- Buildings with indoor pools
- Laundry rooms
- Hobby or craft rooms, and
- Chemical storage areas

⚠ WARNING

FIRE, INJURY OR DEATH HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

When the furnace is installed in a residential garage, the burners and ignition sources must be located at least 18 in. (457 mm) above the floor. The furnace must be located or protected to avoid damage by vehicles. When the furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, the furnace must be installed in accordance with the NFPA 54/ANSI Z223.1-2012. (See Fig. 5.)

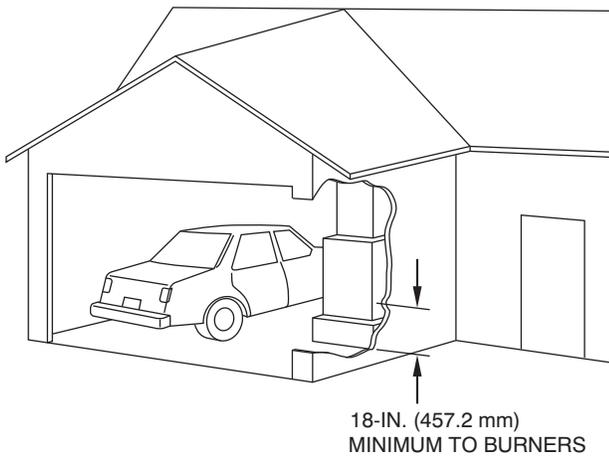


Fig. 5 - Installation in a Garage

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⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Do not install the furnace on its back or hang furnace with control compartment facing downward. Safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace. (See Fig. 6.)

LOCATION RELATIVE TO COOLING EQUIPMENT

The cooling coil must be installed parallel with, or on the downstream side of the unit to avoid condensation in the heat exchangers. When installed parallel with the furnace, dampers or other flow control must prevent chilled air from entering the furnace. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

⚠ CAUTION

PERSONAL INJURY AND/OR PROPERTY DAMAGE HAZARD

Improper use or installation of this furnace may result in premature furnace component failure. This gas furnace may be used for heating buildings under construction provided that:

- The furnace is permanently installed with all electrical wiring, piping, venting and ducting installed according to these installation instructions. A return air duct is provided, sealed to the furnace casing, and terminated outside the space containing the furnace. This prevents a negative pressure condition as created by the circulating air blower, causing a flame rollout and/or drawing combustion products into the structure.
- The furnace is controlled by a thermostat. It may not be "hot wired" to provide heat continuously to the structure without thermostatic control.
- Clean outside air is provided for combustion. This is to minimize the corrosive effects of adhesives, sealers and other construction materials. It also prevents the entrainment of drywall dust into combustion air, which can cause fouling and plugging of furnace components.
- The temperature of the return air to the furnace is maintained between 55°F (13°C) and 80°F (27°C), with no evening setback or shutdown. The use of the furnace while the structure is under construction is deemed to be intermittent operation per our installation instructions.
- The air temperature rise is within the rated rise range on the furnace rating plate, and the gas input rate has been set to the nameplate value. -The filters used to clean the circulating air during the construction process must be either changed or thoroughly cleaned prior to occupancy.
- The furnace, ductwork and filters are cleaned as necessary to remove drywall dust and construction debris from all HVAC system components after construction is completed.
- Verify proper furnace operating conditions including ignition, gas input rate, air temperature rise, and venting according to these installation instructions.

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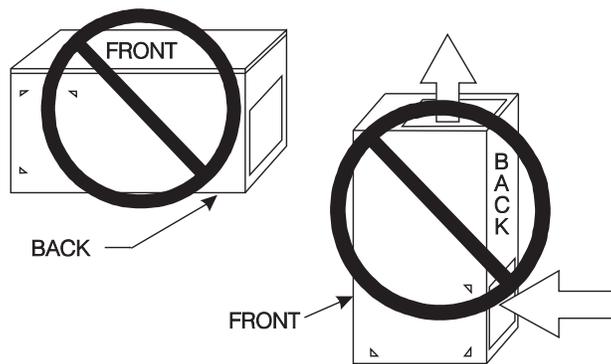


Fig. 6 - Prohibit Installation on Back

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Table 2 – Minimum Free Area Required for Each Combustion Air opening of Duct to Outdoors

FURNACE INPUT (BTUH)	TWO HORIZONTAL DUCTS (1 SQ. IN./2,000 BTUH) (1,100 SQ. MM/KW)		SINGLE DUCT OR OPENING (1 SQ. IN./3,000 BTUH) (734 SQ. MM/KW)		TWO OPENINGS OR VERTICAL DUCTS (1 SQ. IN./4,000 BTUH) (550 SQ. MM/KW)	
	Free Area of Opening and Duct Sq. In. (Sq. mm)	Round Duct Dia. In. (mm)	Free Area of Opening and Duct Sq. In. (Sq. mm)	Round Duct Dia. In. (mm)	Free Area of Opening and Duct Sq. In. (Sq. mm)	Round Duct Dia. In. (mm)
	44,000	22 (14194)	6 (152)	14.7 (9484)	5 (127)	11 (7096)
66,000	33 (21290)	7 (178)	22 (14193)	6 (152)	16.5 (10645)	5 (127)
88,000	44 (28387)	8 (203)	29.3 (18903)	7 (178)	22 (14193)	6 (152)
110,000	55 (35484)	9 (229)	36.7 (23677)	7 (178)	27.5 (17742)	6 (152)
132,000	66 (42580)	10 (254)	44 (28387)	8 (203)	33 (21290)	7 (178)
154,000	77 (49677)	10 (254)	51.3 (33096)	9 (229)	38.5 (24839)	8 (203)

EXAMPLES: Determining Free Area

FURNACE	+	WATER HEATER	=	TOTAL INPUT	=	Result
110,000	+	30,000	=	(140,000 divided by 4,000)	=	35.0 Sq. In. for each two Vertical Ducts or Openings
66,000	+	40,000	=	(106,000 divided by 3,000)	=	35.3 Sq. In. for a Single Duct or Opening
88,000	+	30,000	=	(118,000 divided by 2,000)	=	59.0 Sq. In. for each of two Horizontal Ducts

Table 3 – Minimum Space Volumes for 100% Combustion, Ventilation, and Dilution from Indoors

ACH	OTHER THAN FAN-ASSISTED TOTAL (1,000'S BTUH GAS INPUT RATE)			FAN-ASSISTED TOTAL (1,000'S BTUH GAS INPUT RATE)					
	30	40	50	44	66	88	110	132	154
	Space Volume Ft ³ (M ³)								
0.60	1,050 (29.7)	1,400 (39.6)	1,750 (49.5)	1,100 (31.1)	1,650 (46.7)	2,200 (62.2)	2,750 (77.8)	3,300 (93.4)	3,850 (109.0)
0.50	1,260 (35.6)	1,680 (47.5)	2,100 (59.4)	1,320 (37.3)	1,980 (56.0)	2,640 (74.7)	3,300 (93.4)	3,960 (112.1)	4,620 (130.8)
0.40	1,575 (44.5)	2,100 (59.4)	2,625 (74.3)	1,650 (46.7)	2,475 (70.0)	3,300 (93.4)	4,125 (116.8)	4,950 (140.1)	5,775 (163.5)
0.30	2,100 (59.4)	2,800 (79.2)	3,500 (99.1)	2,200 (62.2)	3,300 (93.4)	4,400 (124.5)	5,500 (155.7)	6,600 (186.8)	7,700 (218.0)
0.20	3,150 (89.1)	4,200 (118.9)	5,250 (148.6)	3,300 (93.4)	4,950 (140.1)	6,600 (186.8)	8,250 (233.6)	9,900 (280.3)	11,550 (327.0)
0.10	6,300 (178.3)	8,400 (237.8)	10,500 (297.3)	6,600 (186.8)	9,900 (280.3)	13,200 (373.7)	16,500 (467.2)	19,800 (560.6)	23,100 (654.1)
0.00	NP	NP	NP	NP	NP	NP	NP	NP	NP

NP = Not Permitted

AIR FOR COMBUSTION AND VENTILATION

Provisions for adequate combustion, ventilation, and dilution air must be provided in accordance with:

- U.S. Installations: Section 9.3 of the NFPA 54/ANSI Z223.1-2012, Air for Combustion and Ventilation and applicable provisions of the local building codes.

⚠ CAUTION

FURNACE CORROSION HAZARD

Failure to follow this caution may result in furnace damage. Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

⚠ WARNING

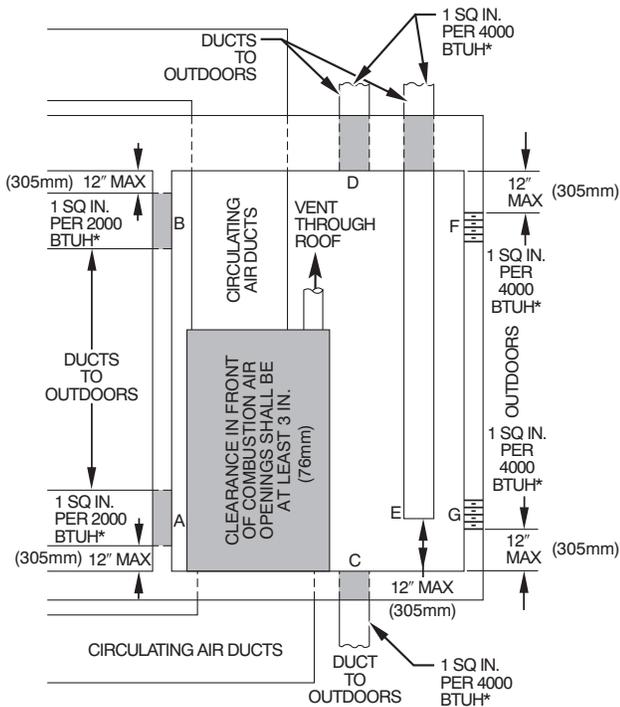
CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death. The operation of exhaust fans, kitchen ventilation fans, clothes dryers, attic exhaust fans or fireplaces could create a **NEGATIVE PRESSURE CONDITION** at the furnace. Make-up air **MUST** be provided for the ventilation devices, in addition to that required by the furnace. Refer to the Carbon Monoxide Poisoning Hazard warning in the venting section of these instructions to determine if an adequate amount of make-up air is available.

The requirements for combustion and ventilation air depend upon whether or not the furnace is located in a space having a volume of at least 50 cubic feet per 1,000 Btu input rating for all gas appliances installed in the space.

- Spaces having less than 50 cubic feet per 1,000 Btu require the **OUTDOOR COMBUSTION AIR METHOD**.

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*Minimum dimensions of 3-in. (76 mm).

NOTE: Use any of the following combinations of openings:
A & B C & D D & E F & G

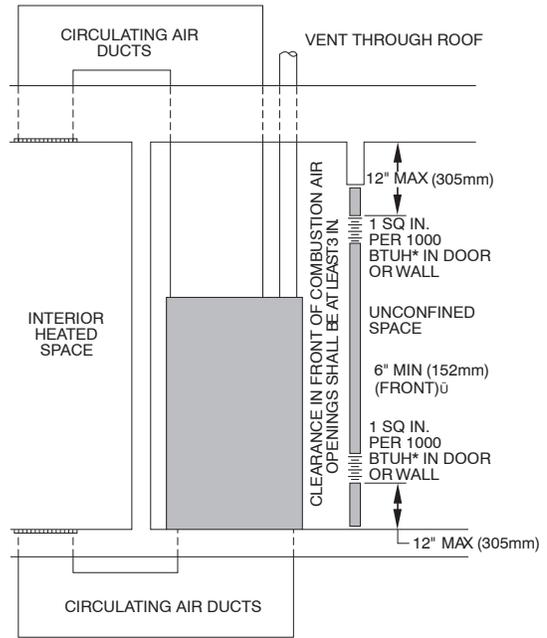
A03174

Fig. 7 - Air for Combustion, Ventilation, and Dilution for Outdoors

- Spaces having at least 50 cubic feet per 1,000 Btuh may use the **INDOOR COMBUSTION AIR, STANDARD or KNOWN AIR INFILTRATION METHOD.**

Outdoor Combustion Air Method

1. Provide the space with sufficient air for proper combustion, ventilation, and dilution of flue gases using permanent horizontal or vertical duct(s) or opening(s) directly communicating with the outdoors or spaces that freely communicate with the outdoors.
2. Fig. 7 illustrates how to provide TWO OUTDOOR OPENINGS, one inlet and one outlet combustion and ventilation air opening, to the outdoors.
 - e. One opening **MUST** commence within 12 in. (300 mm) of the ceiling and the second opening **MUST** commence within 12 in. (300 mm) of the floor.
 - f. Size openings and ducts per Fig. 7 and Table 2.
 - g. TWO HORIZONTAL DUCTS require 1 sq. in. (645 sq. mm) of free area per 2,000 Btuh (1,100 mm²/kW) of combined input for all gas appliances in the space per Fig. 7 and Table 2.
 - h. TWO OPENINGS OR VERTICAL DUCTS require 1 sq. in. (645 sq. mm) of free area per 4,000 Btuh (550 mm²/kW) for combined input of all gas appliances in the space per Fig. 7 and Table 2.
3. ONE OUTDOOR OPENING requires:
 - a. 1 sq. in. (645 sq. mm) of free area per 3,000 Btuh (734 mm²/kW) for combined input of all gas appliances in the space per Table 2 and
 - b. Not less than the sum of the areas of all vent connectors in the space.



* Minimum opening size is 100 sq. in. (64516 sq. mm) with minimum dimensions of 3 in. (76 mm)

† Minimum of 3 in. (76 mm) when type-B1 vent is used.

A03175

Fig. 8 - Air for Combustion, Ventilation, and Dilution from Indoors

The opening shall commence within 12 in. (300 mm) of the ceiling. Appliances in the space shall have clearances of at least 1 in. (25 mm) from the sides and back and 6 in. (150 mm) from the front. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

Indoor Combustion Air © NFPA & AGA

Standard and Known-Air-Infiltration Rate Methods

Indoor air is permitted for combustion, ventilation, and dilution, if the **Standard or Known-Air-Infiltration Method** is used.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.

Many homes require air to be supplied from outdoors for furnace combustion, ventilation, and dilution of flue gases.

The furnace combustion air supply must be provided in accordance with this instruction manual.

The Standard Method:

1. The space has no less volume than 50 cubic feet per 1,000 Btuh of the maximum input ratings for all gas appliances installed in the space and
2. The air infiltration rate is not known to be less than 0.40 air changes per hour (ACH).

The **Known Air Infiltration Rate Method** shall be used, if the infiltration rate is known to be:

1. Less than 0.40 ACH and
2. Equal to or greater than 0.10 ACH

315AAV

Infiltration rates greater than 0.60 ACH shall not be used. The minimum required volume of the space varies with the number of ACH and shall be determined per Table 3 or Equations 1 and 2. Determine the minimum required volume for each appliance in the space and add the volumes together to get the total minimum required volume for the space.

Table 3 - Minimum Space Volumes were determined by using the following equations from the *National Fuel Gas Code ANSI Z223.1-2012/NFPA 54-2012, 9.3.2.2:*

1. For other than fan-assisted appliances, such as a draft hood-equipped water heater:

$$\text{Volume}_{\text{Other}} = \frac{21\text{ft}^3}{\text{ACH}} \left(\frac{I_{\text{other}}}{1000 \text{ Btu/hr}} \right)$$

A04002

2. For fan-assisted appliances such as this furnace:

$$\text{Volume}_{\text{Fan}} = \frac{15\text{ft}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{1000 \text{ Btu/hr}} \right)$$

A04003

If: I_{other} = combined input of all other than fan-assisted appliances in Btuh/hr

I_{fan} = combined input of all fan-assisted appliances in Btuh/hr

ACH = air changes per hour (ACH shall not exceed 0.60.)

The following requirements apply to the **Standard Method** and to the **Known Air Infiltration Rate Method**.

1. Adjoining rooms can be considered part of a space if:
 - a. There are no closeable doors between rooms.
 - b. Combining spaces on same floor level. Each opening shall have free area of at least 1 in.²/1,000 Btuh (2,000 mm²/kW) of the total input rating of all gas appliances in the space, but not less than 100 in.² (0.06 m²). One opening shall commence within 12 in. (300 mm) of the ceiling and the second opening shall commence within 12 in. (300 mm) of the floor. The minimum dimension of air openings shall be at least 3 in. (80 mm). (See Fig. 8.)
 - c. Combining space on different floor levels. The volumes of spaces on different floor levels shall be considered as communicating spaces if connected by one or more permanent openings in doors or floors having free area of at least 2 in.²/1,000 Btuh (4,400 mm²/kW) of total input rating of all gas appliances.
2. An attic or crawlspace may be considered a space that freely communicates with the outdoors provided there are adequate permanent ventilation openings directly to outdoors having free area of at least 1-in.²/4,000 Btuh of total input rating for all gas appliances in the space.
3. In spaces that use the **Indoor Combustion Air Method**, infiltration should be adequate to provide air for combustion, permanent ventilation and dilution of flue gases. However, in buildings with unusually tight construction, additional air **MUST** be provided using the methods described in the **Outdoor Combustion Air Method** section.
4. Unusually tight construction is defined as Construction with:
 - a. Walls and ceilings exposed to the outdoors have a continuous, sealed vapor barrier. Openings are gasketed or sealed and
 - b. Doors and openable windows are weatherstripped and
 - c. Other openings are caulked or sealed. These include joints around window and door frames, between sole

plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, etc.

Combination of Indoor and Outdoor Air

1. Indoor openings shall comply with the **Indoor Combustion Air Method** below and,
2. Outdoor openings shall be located as required in the **Outdoor Combustion Air Method** mentioned previously and,
3. Outdoor openings shall be sized as follows:
 - a. Calculate the Ratio of all Indoor Space volume divided by required volume for **Indoor Combustion Air Method** below.
 - b. Outdoor opening size reduction **Factor** is 1 minus the **Ratio** in a. above.
 - c. Minimum size of Outdoor openings shall be the size required in **Outdoor Combustion Air Method** above multiplied by reduction **Factor** in b. above. The minimum dimension of air openings shall be not less than 3 in. (80 mm).

INSTALLATION

UPFLOW INSTALLATION

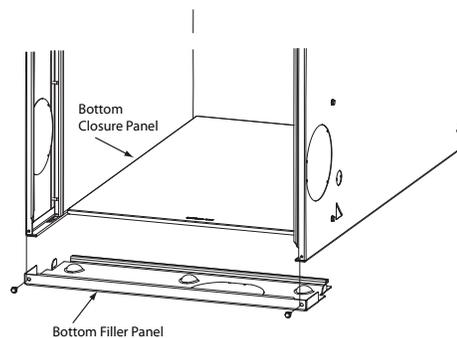
Bottom Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

1. Tilt or raise furnace and remove 2 screws holding bottom filler panel. (See Fig. 9.)
2. Rotate bottom filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall bottom filler panel and screws.

Side Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. This panel **MUST** be in place when only side return air is used.



A10273

Fig. 9 - Removing Bottom Closure Panel

NOTE: Side return-air openings can be used in UPFLOW and most HORIZONTAL configurations. Do not use side return-air openings in DOWNFLOW configuration.

Leveling Legs (If Desired)

In upflow position with side return inlet(s), leveling legs may be used. (See Fig. 10.) Install field-supplied, 5/16 X 1-1/2 in. (8 X 38 mm) (max) corrosion-resistant machine bolts, washers and nuts.

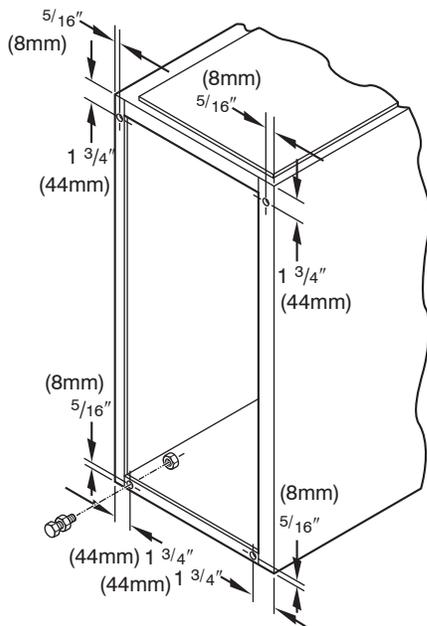


Fig. 10 - Leveling Legs

A89014

NOTE: Bottom closure must be used when leveling legs are used. It may be necessary to remove and reinstall bottom closure panel to install leveling legs. To remove bottom closure panel, see Item 1 in Bottom Return Air Inlet section in Step 1 above.

To install leveling legs:

1. Position furnace on its back. Locate and drill a hole in each bottom corner of furnace. (See Fig. 10.)
2. For each leg, install nut on bolt and then install bolt with nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.
5. Reinstall bottom closure panel if removed.

DOWNFLOW INSTALLATION

NOTE: For downflow applications, this furnace is approved for use on combustible flooring when any one of the following 3 accessories are used:

- Special Base, KGASB
- Cased Coil Assembly Part No. CNPV, CNRV, CAP, or CAR
- Coil Box Part No. KCAKC

1. Determine application being installed from Table 4.
2. Construct hole in floor per Table 4 and Fig. 11.
3. Construct plenum to dimensions specified in Table 4 and Fig. 11.
4. If downflow subbase, KGASB is used, install as shown in Fig. 12. If Coil Assembly Part No. CPVP, CAPMP or CNPVP Coil Box Part No. KCAKC is used, install as shown in Fig. 13.

NOTE: It is recommended that the perforated supply-air duct flanges be completely folded over or removed from furnace when installing the furnace on a factory-supplied cased coil or coil box. To remove the supply-air duct flange, use wide duct pliers or hand seamers to bend flange back and forth until it breaks off. Be careful of sharp edges. (See Fig. 14.)

Bottom Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

1. Tilt or raise furnace and remove 2 screws holding bottom filler panel. (See Fig. 9.)
2. Rotate bottom filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall bottom filler panel and screws.

HORIZONTAL INSTALLATION

⚠ WARNING

FIRE, EXPLOSION, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.

Do not install the furnace on its back or hang furnace with control compartment facing downward. Safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace.

The furnace can be installed horizontally in an attic or crawlspace on either the left-hand (LH) or right-hand (RH) side. The furnace can be hung from floor joists, rafters or trusses or installed on a non-combustible platform, blocks, bricks or pad.

Suspended Furnace Support

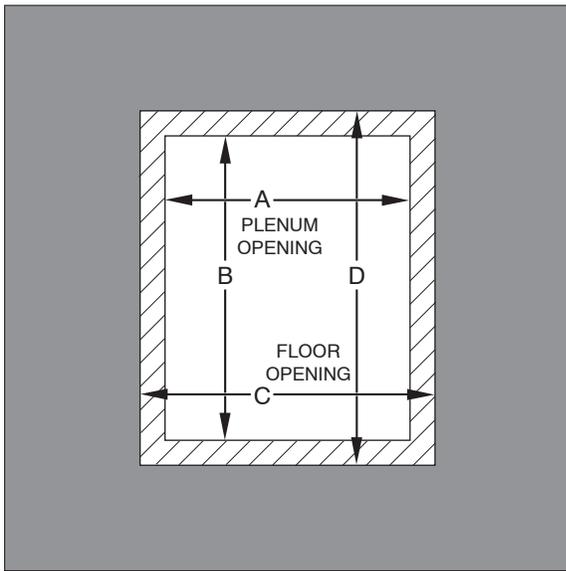
The furnace may be supported under each end with threaded rod, angle iron or metal plumber's strap as shown. (See Fig. 15 and 16.) Secure angle iron to bottom of furnace as shown. Heavy-gauge sheet metal straps (plumber's straps) may be used to suspend the furnace from each bottom corner. To prevent screws from pulling out, use 2 #8 x in. screws into the side and 2 #8 x in. screws in the bottom of the furnace casing for each strap. (See Fig. 15 and 16.)

If the screws are attached to **ONLY** the furnace sides and not the bottom, the straps must be vertical against the furnace sides and not pull away from the furnace sides, so that the strap attachment screws are not in tension (are loaded in shear) for reliable support.

Platform Furnace Support

Construct working platform at location where all required furnace clearances are met. (See Fig. 2 and 17.) For furnaces with 1-in. (25 mm) clearance requirement on side, set furnace on non-combustible blocks, bricks or angle iron. For crawlspace installations, if the furnace is not suspended from the floor joists, the ground underneath furnace must be level and the furnace set on blocks or bricks.

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Fig. 11 - Floor and Plenum Opening Dimensions

Roll-Out Protection

Provide a minimum 17-3/4-in. X 22-in. (451 X 559 mm) piece of sheet metal for flame roll-out protection in front of burner area for furnaces closer than 12-in. (305 mm) above the combustible deck or suspended furnaces closer than 12-in. (305 mm) to joists. The sheet metal **MUST** extend underneath the furnace casing by 1-in. (25 mm) with the door removed.

The bottom closure panel on furnaces of widths 17-1/2-in. (445 mm) and larger may be used for flame roll-out protection when bottom of furnace is used for return air connection. See Fig. 17 for proper orientation of roll-out shield.

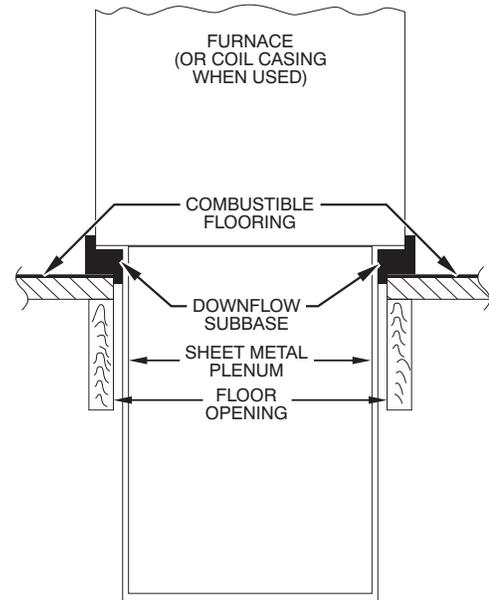
Bottom Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

1. Tilt or raise furnace and remove two screws holding bottom filler panel. (See Fig. 9.)
2. Rotate bottom filler panel downward to release holding tabs.
3. Remove bottom closure panel.
4. Reinstall bottom filler panel and screws.

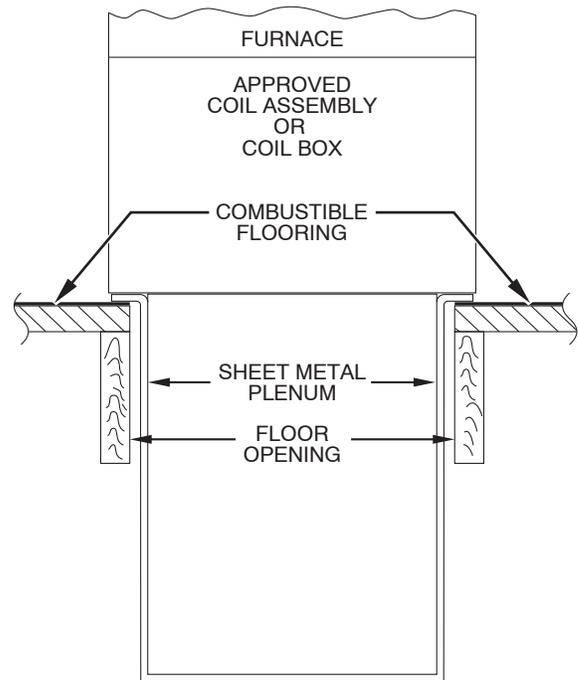
Side Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. This panel **MUST** be in place when side return air inlet(s) are used without a bottom return air inlet.



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Fig. 12 - Furnace, Plenum, and Subbase Installed on a Combustible Floor



A08556

Fig. 13 - Furnace, Plenum, and Coil Assembly or Coil Box Installed on a Combustible Floor

Not all horizontal furnaces are approved for side return air connections (See Fig. 20.)

Table 4 – Opening Dimensions - In. (mm)

FURNACE CASING WIDTH IN. (mm)	APPLICATION	PLENUM OPENING		FLOOR OPENING	
		A	B	C	D
14-3/16 (360)	Upflow Applications on Combustible or Noncombustible Flooring (KGASB subbase not required)	12-11/16 (322)	21-5/8 (549)	13-5/16 (338)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring (KGASB subbase not required)	12-9/16 (319)	19 (483)	13-3/16 (335)	19-5/8 (498)
	Downflow applications on combustible flooring (KGASB subbase required)	11-13/16 (284)	19 (483)	13-7/16 (341)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with CNPV, CNRV, CAR or CAP Coil Assembly or KCAKC coil box (KGASB subbase not required)	12-5/16 (319)	19 (483)	13-5/16 (338)	20 (508)
17-1/2 (445)	Upflow Applications on Combustible or Noncombustible Flooring (KGASB subbase not required)	16 (406)	21-5/8 (549)	16-5/8 (422)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring (KGASB subbase not required)	15-7/8 (403)	19 (483)	16-1/2 (419)	19-5/8 (498)
	Downflow applications on combustible flooring (KGASB subbase required)	15-1/8 (384)	19 (483)	16-3/4 (425)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with CNPV, CNRV, CAR or CAP Coil Assembly or KCAKC coil box (KGASB subbase not required)	15-1/2 (394)	19 (483)	16-1/2 (419)	20 (508)
21 (533)	Upflow Applications on Combustible or Noncombustible Flooring (KGASB subbase not required)	19-1/2 (495)	21-5/8 (549)	20-1/8 (511)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring (KGASB subbase not required)	19-3/8 (492)	19 (483)	20 (508)	19-5/8 (498)
	Downflow applications on combustible flooring (KGASB subbase required)	18-5/8 (473)	19 (483)	20-1/4 (514)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with CNPV, CNRV, CAR or CAP Coil Assembly or KCAKC coil box (KGASB subbase not required)	19 (483)	19 (483)	20 (508)	20 (508)
24-1/2 (622)	Upflow Applications on Combustible or Noncombustible Flooring (KGASB subbase not required)	23 (584)	21-1/8 (537)	23-5/8 (600)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring (KGASB subbase not required)	22-7/8 (581)	19 (483)	23-1/2 (597)	19-5/8 (498)
	Downflow applications on Combustible flooring (KGASB subbase required)	22-1/8 (562)	19 (483)	23-3/4 (603)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with CNPV, CNRV, CAR or CAP Coil Assembly or KCAKC coil box (KGASB subbase not required)	22-1/2 (572)	19 (483)	23-1/2 (597)	20 (508)

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Filter Arrangement

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury, or death.

Never operate a furnace without a filter or with filter access door removed.

There are no provisions for an internal filter rack in these furnaces. A field-supplied accessory external filter rack is required.

Refer to the instructions supplied with the external filter rack for assembly and installation options.

AIR DUCTS

General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by: Air Conditioning Contractors Association (ACCA), Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) or consult *The Air Systems Design Guidelines* reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design external static pressure. The furnace airflow rates are provided in Table 5-Air Delivery-CFM (With Filter). When a furnace is installed so that

the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

Secure ductwork with proper fasteners for type of ductwork used. Seal supply- and return-duct connections to furnace with code approved tape or duct sealer.

NOTE: Flexible connections should be used between ductwork and furnace to prevent transmission of vibration.

Ductwork passing through unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapor barrier is recommended.

Maintain a 1-in. (25 mm) clearance from combustible materials to supply air ductwork for a distance of 36-in. (914 mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.

Ductwork Acoustical Treatment

NOTE: Metal duct systems that do not have a 90 degree elbow and 10 ft. (3 M) of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.

Supply Air Connections

For a furnace not equipped with a cooling coil, the outlet duct shall be provided with a removable access panel. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for possible openings using light assistance or a probe can be inserted for sampling the air stream. The cover attachment shall prevent leaks.

Upflow and Horizontal Furnaces

Connect supply-air duct to flanges on furnace supply-air outlet. Bend flange upward to 90° with wide duct pliers. (See Fig. 14.) The supply-air duct must be connected to ONLY the furnace supply-outlet-air duct flanges or air conditioning coil casing (when used). DO NOT cut main furnace casing side to attach supply air duct, humidifier, or other accessories. All accessories MUST be connected to duct external to furnace main casing.

NOTE: For horizontal applications, the top most flange may be bent past 90° to allow the evaporator coil to hang on the flange temporarily while the remaining attachment and sealing of the coil are performed.

Downflow Furnaces

Connect supply-air duct to supply-air outlet on furnace. Bend flange inward past 90° with wide duct pliers (See Fig. 14.) The supply-air duct must be connected to ONLY the furnace supply outlet or air conditioning coil casing (when used). When installed on combustible material, supply-air duct must be connected to ONLY the factory-approved accessory subbase, or a factory-approved air conditioning coil casing. DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected to duct external to furnace casing.

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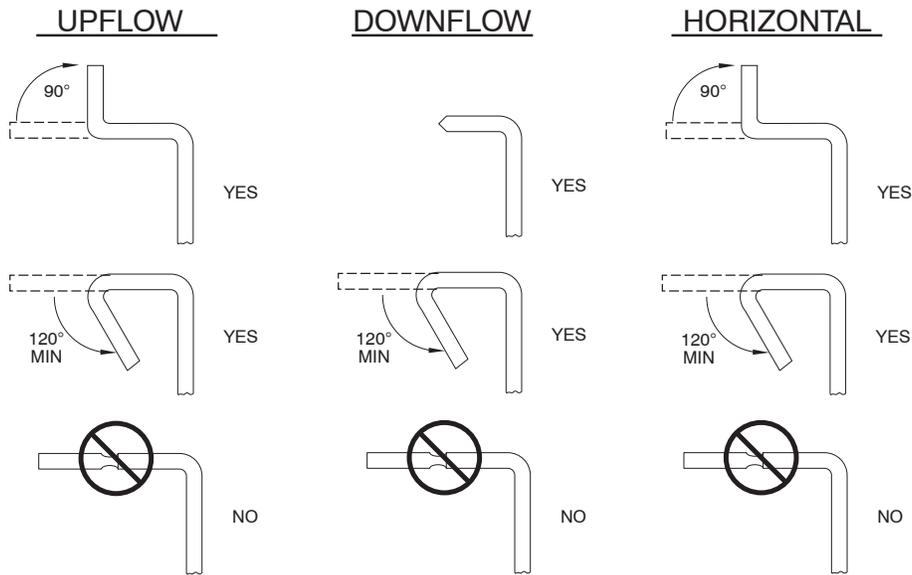


Fig. 14 - Duct Flanges

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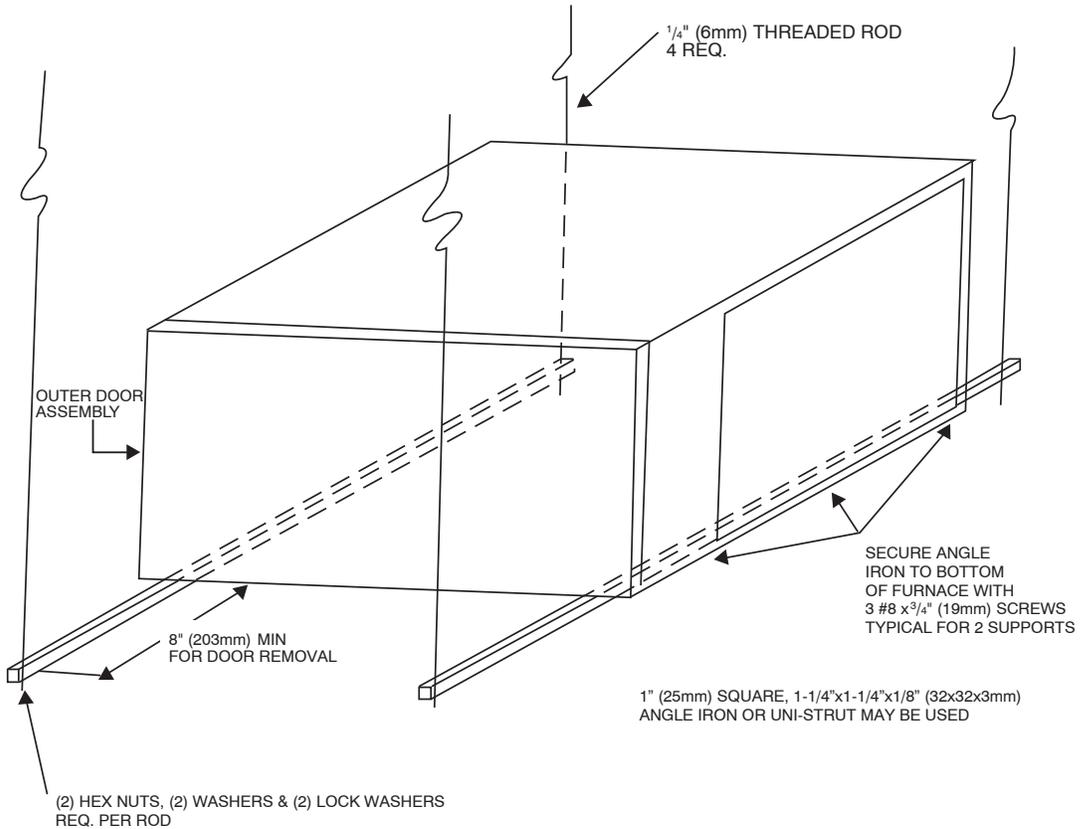


Fig. 15 - Horizontal Unit Suspension

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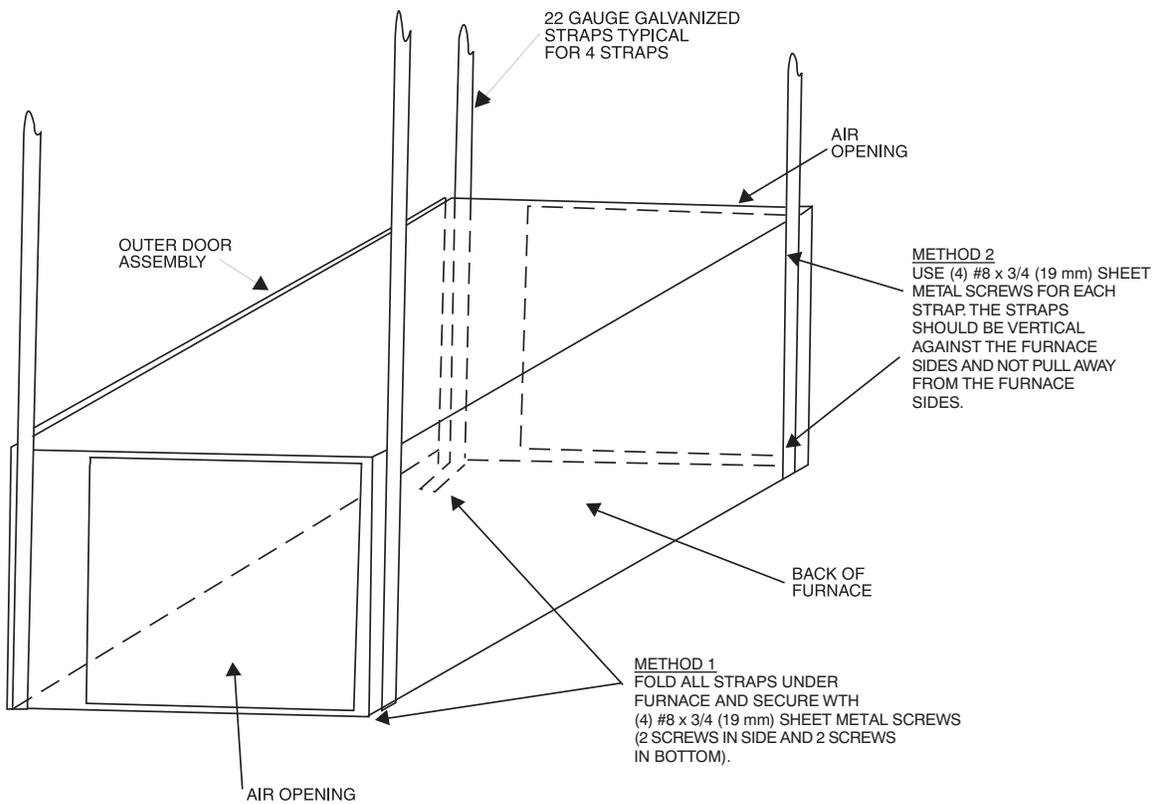


Fig. 16 - Horizontal Suspension with Straps

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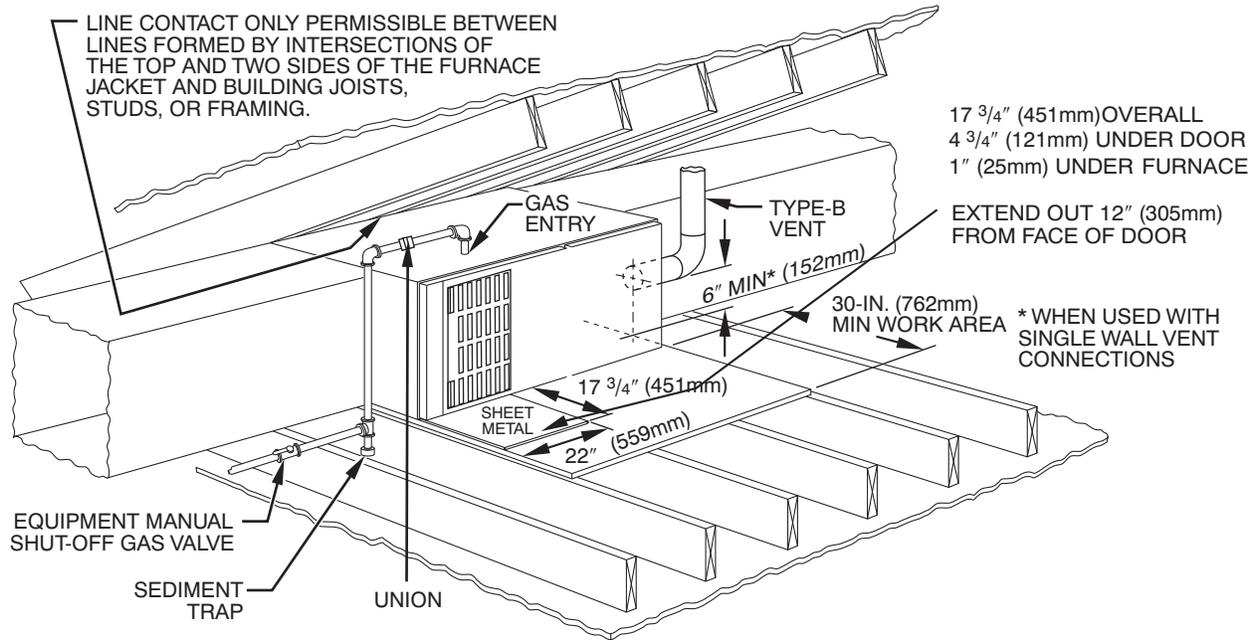


Fig. 17 - Typical Attic Installation

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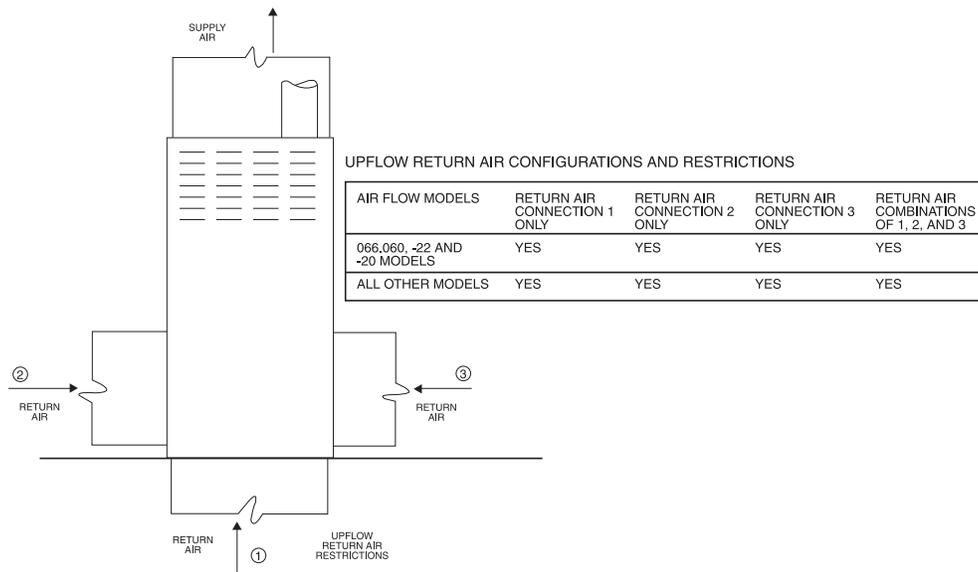
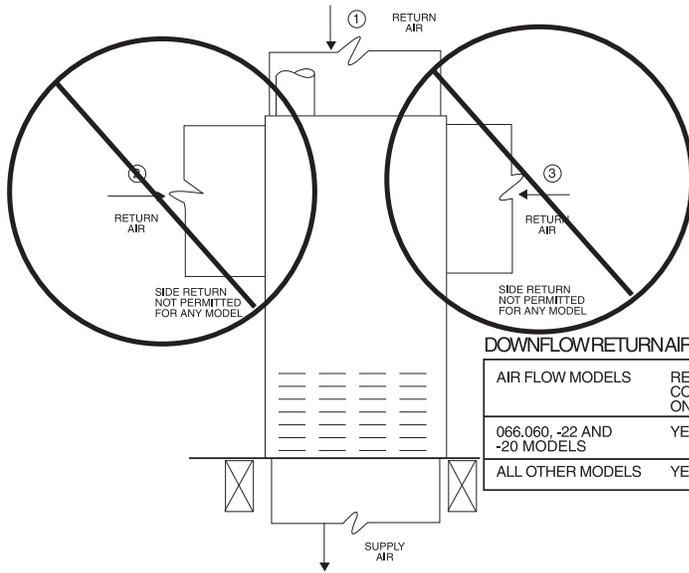


Fig. 18 - Upflow Return Air Configurations and Restrictions

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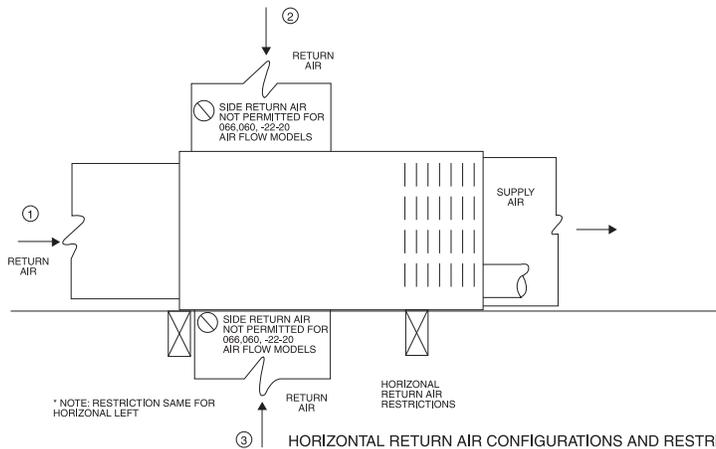
DOWNFLOW RETURN AIR CONFIGURATIONS AND RESTRICTIONS

AIR FLOW MODELS	RETURN AIR CONNECTION 1 ONLY	RETURN AIR CONNECTION 2 ONLY	RETURN AIR CONNECTION 3 ONLY	RETURN AIR COMBINATIONS OF 1, 2, AND 3
066.060, -22 AND -20 MODELS	YES	NO	NO	NO
ALL OTHER MODELS	YES	NO	NO	NO

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Fig. 19 - Downflow Return Air Configurations and Restrictions



HORIZONTAL RETURN AIR CONFIGURATIONS AND RESTRICTIONS

AIR FLOW MODELS	RETURN AIR CONNECTION 1 ONLY	RETURN AIR CONNECTION 2 ONLY	RETURN AIR CONNECTION 3 ONLY	RETURN AIR COMBINATIONS OF 1, 2, AND 3
066.060, -22 AND -20 MODELS	YES	NO	NO	NO
ALL OTHER MODELS	YES	YES	YES	YES

A02162

Fig. 20 - Horizontal Return Air Configurations and Restrictions

Table 5 – Air Delivery - CFM (With Filter)*

Unit Size	Operating Mode	CFM Airflow Setting	External Static Pressure Range* (In. W.C.)	External Static Pressure (ESP) (IN. W.C.)										
				0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	
070-12/ 036070	AIRFLOW (CFM)													
††	Low Heat	735 (615)†	0-0.50	735	735	735	735	725						
	High Heat	1180 (1060)†	0-1.0	1160	1165	1175	1180	1180	1180	1180	1180	1180	1180	1175
††	1-1/2-Ton Cooling	525	0-0.50‡	515	500	500	490	485						
††	2-Ton A/C Cooling	700	0-0.50‡	690	680	675	680	675						
	2-1/2-Ton A/C Cooling	875	0-1.0‡	875	875	875	870	865	855	850	835	825	820	
	3-Ton A/C Cooling	1050	0-1.0‡	1050	1050	1050	1050	1050	1050	1045	1035	1020	1000	
	3-1/2-Ton A/C Cooling	1225	0-1.0	1220	1225	1225	1225	1225	1220	1205	1190	1185	1170	
	Maximum	1400	0-1.0	1395	1400	1400	1400	1395	1385	1370	1340	1300	1245	
090-16 048090														
	Low Heat	985 (825)†	0-1.0	950	970	985	985	985	985	985	985	985	985	980
	High Heat	1210 (1090)†	0-1.0	1190	1205	1210	1210	1210	1210	1210	1210	1210	1210	1200
††	1-1/2-Ton A/C Cooling	525	0-0.50‡	525	520	525	495	475						
††	2-Ton A/C Cooling	700	0-0.50‡	680	680	680	675	670						
	2-1/2-Ton A/C Cooling	875	0-1.0‡	815	845	845	855	850	850	845	835	820	805	
	3-Ton A/C Cooling	1050	0-1.0‡	1005	1005	1015	1035	1040	1040	1035	1030	1025	1010	
	3-1/2-Ton A/C Cooling	1225	0-1.0	1190	1200	1200	1205	1205	1215	1205	1200	1185	1170	
	4-Ton A/C Cooling	1400	0-1.0	1350	1370	1390	1390	1400	1390	1380	1380	1360	1340	
	Maximum	1600	0-1.0	1595	1600	1600	1600	1595	1555	1505	1465	1430	1390	
110-20/ 060110***														
	Low Heat	1320 (1110)†	0-1.0	1275	1295	1315	1320	1320	1320	1320	1320	1320	1315	
	High Heat	1475 (1330)†	0-1.0	1460	1465	1475	1475	1475	1475	1475	1475	1465	1465	
††	2-Ton A/C Cooling	700	0-0.50‡	700	700	700	700	700						
††	2-1/2-Ton A/C Cooling	875	0-0.50‡	875	875	875	875	875						
††	3-Ton A/C Cooling	1050	0-0.50‡	1050	1050	1050	1050	1050						
	3-1/2-Ton A/C Cooling	1225	0-1.0‡	1225	1225	1225	1225	1225	1225	1225	1225	1225	1225	
	4-Ton A/C Cooling	1400	0-1.0‡	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	
	5-Ton A/C Cooling	1750	0-1.0‡	1750	1750	1750	1750	1750	1750	1750	1750	1740	1725	
	6-Ton A/C Cooling	2100	0-1.0	2100	2100	2100	2100	2090	2075	2055	2040	2005	1970	
	Maximum	2200	0-1.0	2200	2190	2190	2180	2155	2145	2125	2100	2080	2020	
135-22/ 066135														
	Low Heat	1700 (1430)†	0-1.0	1700	1700	1700	1700	1700	1695	1700	1695	1685	1670	
	High Heat	1915 (1725)†	0-1.0	1900	1905	1915	1915	1915	1915	1915	1915	1915	1915	
††	2-Ton A/C Cooling	700	0-0.50‡	700	700	700	700	665						
††	2-1/2-Ton A/C Cooling	875	0-0.50‡	870	870	865	865	865						
††	3-Ton A/C Cooling	1050	0-0.50‡	1010	1030	1050	1050	1050						
	3-1/2-Ton A/C Cooling	1225	0-1.0‡	1155	1180	1200	1210	1220	1225	1225	1225	1225	1225	
	4-Ton A/C Cooling	1400	0-1.0‡	1395	1400	1400	1400	1400	1400	1400	1390	1375	1355	
	5-Ton A/C Cooling	1750	0-1.0‡	1740	1750	1750	1750	1735	1740	1735	1730	1715	1700	
	6-Ton A/C Cooling	2100	0-1.0	2075	2085	2090	2100	2100	2100	2090	2080	2055	2025	
	Maximum	2200	0-1.0	2180	2195	2200	2200	2200	2200	2185	2165	2140	2095	
155-22/ 066155														
	Low Heat	1715 (1440)†	0-1.0	1715	1715	1715	1715	1715	1705	1710	1705	1705	1695	
	High Heat	1970 (1775)†	0-1.0	1955	1965	1965	1970	1970	1970	1970	1970	1970	1960	
††	2-Ton A/C Cooling	700	0-0.50‡	700	700	700	700	680						
††	2-1/2-Ton A/C Cooling	875	0-0.50‡	865	875	875	865	865						
††	3-Ton A/C Cooling	1050	0-0.50‡	1015	1020	1035	1045	1050						
	3-1/2-Ton A/C Cooling	1225	0-1.0‡	1160	1185	1215	1225	1225	1225	1225	1225	1225	1225	
	4-Ton A/C Cooling	1400	0-1.0‡	1385	1400	1400	1400	1400	1400	1395	1395	1380	1360	
	5-Ton A/C Cooling	1750	0-1.0‡	1745	1750	1750	1750	1745	1740	1745	1745	1740	1735	
	6-Ton A/C Cooling	2100	0-1.0	2055	2070	2080	2085	2095	2100	2100	2100	2090	2065	
	Maximum	2200	0-1.0	2175	2190	2200	2200	2200	2200	2200	2200	2180	2160	

*Actual external static pressure (ESP) can be determined by using the fan laws (CFM 2 proportional to ESP); such as, a system with 1180 CFM at 0.5 ESP would operate at cooling airflow of 1050 CFM at 0.4 ESP and low-heating airflow of 735 CFM at 0.19 ESP.

†Comfort airflow values are shown in parenthesis. Comfort airflow is selected when the low-heat rise adjustment switch (SW1-3) is OFF and the comfort/efficiency switch (SW1-4) is ON.

‡Ductwork must be sized for high-heating CFM within the operational range of ESP.

††Operation within the blank areas of the chart is not recommended because high-heat operation will be above 1.0 ESP.

***All airflow on 110 size furnace are 5% less on side return only installations.

Return Air Connections

⚠ WARNING

FIRE HAZARD

A failure to follow this warning could cause personal injury, death and/or property damage.

Never connect return-air ducts to the back of the furnace. Follow instructions below.

Downflow Furnaces

The return-air duct must be connected to return-air opening (bottom inlet) as shown in Fig. 3. DO NOT cut into casing sides (left or right). Side opening is permitted for only upflow and certain horizontal furnaces. Bypass humidifier connections should be made at ductwork or coil casing sides exterior to furnace. (See Fig. 19.)

Upflow and Horizontal Furnaces

The return-air duct must be connected to bottom, sides (left or right), or a combination of bottom and side(s) of main furnace casing as shown in Fig. 3. Bypass humidifier may be attached into unused return air side of the furnace casing. (See Fig. 18 and 20.) Not all horizontal furnace models are approved for side return air connections. (See Fig. 20.)

GAS PIPING

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Use proper length of pipe to avoid stress on gas control manifold and a gas leak.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Gas valve inlet and/or inlet pipe must remain capped until gas supply line is permanently installed to protect the valve from moisture and debris. Also, install a sediment trap in the gas supply piping at the inlet to the gas valve.

Gas piping must be installed in accordance with national and local codes. Refer to current edition of NFGC in the U.S.

Installations must be made in accordance with all authorities having jurisdiction. If possible, the gas supply line should be a separate line running directly from meter to furnace.

NOTE: In the state of Massachusetts:

1. Gas supply connections **MUST** be performed by a licensed plumber or gas fitter.
2. When flexible connectors are used, the maximum length shall not exceed 36 in. (915 mm).
3. When lever handle type manual equipment shutoff valves are used, they shall be T-handle valves.
4. The use of copper tubing for gas piping is **NOT** approved by the state of Massachusetts.

Refer to Table 6 for recommended gas pipe sizing. Risers must be used to connect to furnace and to meter. Support all gas piping with appropriate straps, hangers, etc. Use a minimum of 1 hanger every 6 ft. (1.8 M). Joint compound (pipe dope) should be applied sparingly and only to male threads of joints. Pipe dope must be resistant to the action of propane gas.

Table 6 – Maximum Capacity of Pipe

NOMINAL IRON PIPE SIZE IN. (MM)	INTERNAL DIA. IN. (MM)	LENGTH OF PIPE – FT (M)				
		10 (3.0)	20 (6.0)	30 (9.1)	40 (12.1)	50 (15.2)
1/2 (12.7)	0.622(158)	175	120	97	82	73
3/4 (19.0)	0.824 (20.9)	360	250	200	170	151
1 (25.4)	1.049 (26.6)	680	465	375	320	285
1-1/4 (31.8)	1.380 (35.0)	1400	950	770	660	580
1-1/2 (38.1)	1.610 (40.9)	2100	1460	1180	990	900

* Cubic ft of gas per hr for gas pressures of 0.5 psig (14–In. W.C.) or less and a pressure drop of 0.5–In. W.C. (based on a 0.60 specific gravity gas). Ref: Table 6 and 9.2 NFGC.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

A failure to follow this warning could result in personal injury, death, and/or property damage.

If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector which has previously served another gas appliance. Black iron pipe shall be installed at the furnace gas control valve and extend a minimum of 2-in. (51 mm) outside the furnace.

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in furnace damage.

Connect gas pipe to furnace using a backup wrench to avoid damaging gas controls and burner misalignment.

An accessible manual equipment shutoff valve **MUST** be installed external to furnace casing and within 6 ft. (1.8 M) of furnace. A 1/8-in. (3 mm) NPT plugged tapping, accessible for test gauge connection, **MUST** be installed immediately upstream of gas supply connection to furnace and downstream of manual equipment shutoff valve.

NOTE: The furnace gas control valve inlet pressure tap connection is suitable to use as test gauge connection providing test pressure **DOES NOT** exceed maximum 0.5 psig (14-In. W.C.) stated on gas control valve. (See Fig. 50.)

Some installations require gas entry on right side of furnace (as viewed in upflow). (See Fig. 21.)

315AAV

Install a sediment trap in riser leading to furnace as shown in Fig. 22. Connect a capped nipple into lower end of tee. Capped nipple should extend below level of furnace gas controls. Place a ground joint union between furnace gas control valve and exterior manual equipment gas shutoff valve.

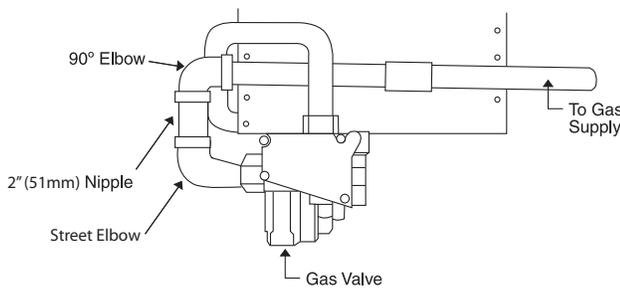
A 1/8-in. (3 mm) NPT plugged tapping, accessible for test gauge connection, **MUST** be installed immediately upstream of gas supply connection to furnace and downstream of manual equipment shutoff valve.

Piping should be pressure and leak tested in accordance with the current addition of the NFGC in the United States, local, and national plumbing and gas codes before the furnace has been connected. After all connections have been made, purge lines and check for leakage at furnace prior to operating furnace.

If pressure exceeds 0.5 psig (14-In. W.C.), gas supply pipe must be disconnected from furnace and capped before and during supply pipe pressure test. If test pressure is equal to or less than 0.5 psig (14-In. W.C.), turn off electric shutoff switch located on furnace gas control valve and accessible manual equipment shutoff valve before and during supply pipe pressure test. After all connections have been made, purge lines and check for leakage at furnace prior to operating furnace.

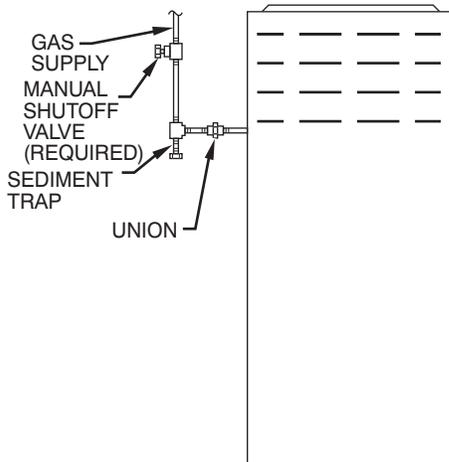
The gas supply pressure shall be within the maximum and minimum inlet supply pressures marked on the rating plate with the furnace burners ON and OFF.

TOP VIEW OF BURNER AND MANIFOLD ASSEMBLY



A08551

Fig. 21 - Burner and Manifold



A02035

Fig. 22 - Typical Gas Pipe Arrangement

ELECTRICAL CONNECTIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Blower access panel door switch opens 115-v power to control. No component operation can occur. Do not bypass or close switch with panel removed.

See Fig. 25 for field wiring diagram showing typical field 115-v wiring. Check all factory and field electrical connections for tightness.

Field-supplied wiring shall conform with the limitations of 63°F (33°C) rise.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.

The cabinet **MUST** have an uninterrupted or unbroken ground according to NEC ANSI/NFPA 70-2011 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire, conduit approved for electrical ground or a listed, grounded power cord (where permitted by local code) when installed in accordance with existing electrical codes. Refer to the power cord manufacturer's ratings for proper wire gauge. Do not use gas piping as an electrical ground.

⚠ CAUTION

FURNACE MAY NOT OPERATE HAZARD

Failure to follow this caution may result in intermittent furnace operation.

Furnace control must be grounded for proper operation or else control will lock out. Control must remain grounded through green/yellow wire routed to gas valve and manifold bracket screw.

115-V Wiring

Verify that the voltage, frequency, and phase correspond to that specified on unit rating plate. Also, check to be sure that service provided by utility is sufficient to handle load imposed by this equipment. Refer to rating plate or Table 7 for equipment electrical specifications.

U.S. Installations: Make all electrical connections in accordance with National Electrical Code (NEC) ANSI/NFPA 70-2011 and any local codes or ordinances that might apply.

Table 7 – Electrical Data

FURNACE SIZE	VOLTS–HERTZ–PHASE	OPERATING VOLTAGE RANGE*		MAX. UNIT AMPS	UNIT AMPACITY #	MAX. WIRE LENGTH – FT (M)‡	MAX. FUSE OR CKT BKR AMPS †	MIN. WIRE GAUGE
		Max.	Min.					
070–12/036070	115–60–1	127	104	9.0	11.99	30 (9.0)	15	14
090–16/048090	115–60–1	127	104	9.6	12.56	29 (8.8)	15	14
110–20/060110	115–60–1	127	104	15.1	19.33	29 (8.8)	20	12
135–22/066135	115–60–1	127	104	14.9	19.13	30 (9.0)	20	12
155–22/066155	115–60–1	127	104	15.0	19.23	29 (8.8)	20	12

* Permissible limits of the voltage range at which the unit operates satisfactorily.

Unit ampacity = 125 percent of largest operating component’s full load amps plus 100 percent of all other potential operating components’ (EAC, humidifier, etc.) full load amps.

†Time–delay type is recommended.

‡Length shown is as measured 1 way along wire path between furnace and service panel for maximum 2 percent voltage drop.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.

Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire.

Use a separate, fused branch electrical circuit with a properly sized fuse or circuit breaker for this furnace. See Table 7 for wire size and fuse specifications. A readily accessible means of electrical disconnect must be located within sight of the furnace.

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control LED status indicator light will flash rapidly and furnace will NOT operate.

J-Box Relocation

NOTE: If factory location of J-Box is acceptable, go to next section (ELECTRICAL CONNECTION to J-Box).

NOTE: On 14-in. (356 mm) wide casing models, the J-Box shall not be relocated to other side of furnace casing when the vent pipe is routed within the casing.

1. Remove and save two screws holding J-Box. (See Fig. 23.)

NOTE: The J-Box cover need not be removed from the J-Box in order to move the J-Box. Do NOT remove green ground screw inside J-Box. (See Fig. 23.)

2. Cut wire tie on loop in furnace wires attached to J-Box.
3. Move J-Box to desired location.
4. Fasten J-Box to casing with the two screws removed in Step 1.
5. Route J-Box wires within furnace away from sharp edges, rotating parts and hot surfaces.

Electrical Connection to J-Box

Electrical Box on Furnace Casing Side (See Fig. 24.)

⚠ WARNING

FIRE OR ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.

If field-supplied manual disconnect switch is to be mounted on furnace casing side, select a location where a drill or fastener cannot damage electrical or gas components.

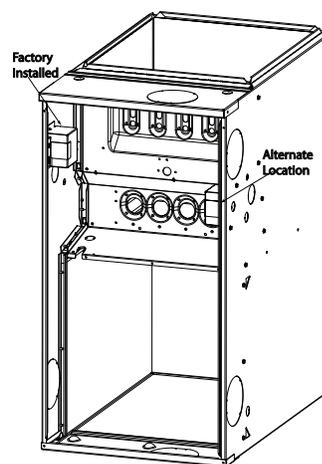


Fig. 23 - Relocating J-Box

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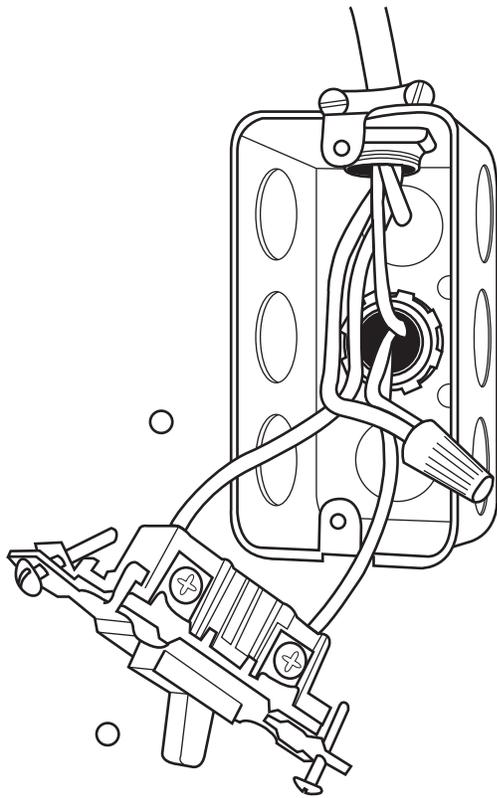
1. Select and remove a hole knockout in the casing where the electrical box is to be installed.

NOTE: Check that duct on side of furnace will not interfere with installed electrical box.

2. Remove the desired electrical box hole knockout and position the hole in the electrical box over the hole in the furnace casing.
3. Fasten the electrical box to casing by driving two field-supplied screws from inside electrical box into casing steel.
4. Remove and save two screws holding J-Box. (See Fig. 23.)
5. Pull furnace power wires out of 1/2-in. (12 mm) diameter hole in J-Box. Do not loosen wires from strain-relief wire-tie on outside of J-Box.
6. Route furnace power wires through holes in casing and electrical box and into electrical box.
7. Pull field power wires into electrical box.
8. Remove cover from furnace J-Box.
9. Route field ground wire through holes in electrical box and casing, and into furnace J-Box.
10. Reattach furnace J-Box to furnace casing with screws removed in Step 4.

11. Secure field ground wire to J-Box green ground screw.
12. Complete electrical box wiring and installation. Connect line voltage leads as shown in Fig. 24. Use best practices (NEC in U.S. for wire bushings, strain relief, etc.)
13. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

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Fig. 24 - Field-Supplied Electrical Box on Furnace Casing

Power Cord Installation in Furnace J-Box

NOTE: Power cords must be able to handle the electrical requirements listed in Table 6. Refer to power cord manufacturer's listings.

1. Remove cover from J-Box.
2. Route listed power cord through 7/8-in. (22 mm) diameter hole in J-Box.
3. Secure power cord to J-Box bracket with a strain relief bushing or a connector approved for the type of cord used.
4. Secure field ground wire to green ground screw on J-Box bracket.
5. Connect line voltage leads as shown in Fig. 25.
6. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

BX Cable Installation in Furnace J-Box

1. Remove cover from J-Box.

2. Route BX cable into 7/8-in. (22 mm) diameter hole in J-Box.
3. Secure BX cable to J-Box bracket with connectors approved for the type of cable used.
4. Secure field ground wire to green ground screw on J-Box bracket.
5. Connect line voltage leads as shown in Fig. 25.
6. Reinstall cover to J-Box. Do not pinch wires between cover and bracket.

24-V Wiring

Make field 24-v connections at the 24-v terminal strip. (See Fig. 25 - 34.) Connect terminal Y/Y2 as shown in Fig. 27-34 for proper cooling operation. Use only AWG No. 18, color-coded, copper thermostat wire.

The 24-v circuit contains an automotive-type, 3-amp. fuse located on the control. Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp. fuse of identical size.

ACCESSORIES

1. Electronic Air Cleaner (EAC)

Connect an accessory Electronic Air Cleaner (if used) using 1/4-in female quick connect terminals to the two male 1/4-in quick-connect terminals on the control board marked EAC-1 and EAC-2. The terminals are rated for 115VAC, 1.0 amps maximum and are energized during blower motor operation. (See Fig. 26.)

2. Humidifier (HUM)

Connect an accessory 24 VAC, 0.5 amp. maximum humidifier (if used) to the 1/4-in male quick-connect HUM terminal and COM-24V screw terminal on the control board thermostat strip. The HUM terminal is energized when blower is energized in heating. (See Fig. 26.)

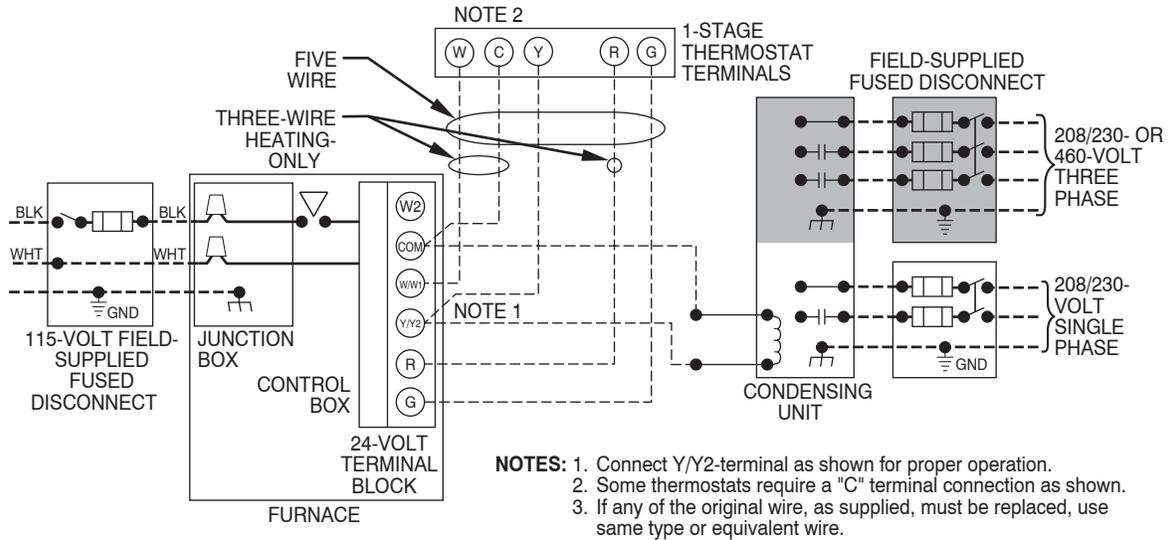
NOTE: DO NOT connect furnace control HUM terminal to HUM (humidifier) terminal on Thermidistat, Zone Controller or similar device. See Thermidistat®, Zone Controller, thermostat, or controller manufacturer's instructions for proper connection.

VENTING

The furnace shall be connected to a listed factory built chimney or vent, or a clay-tile lined masonry or concrete chimney. Venting into an unlined masonry chimney or concrete chimney is prohibited.

When an existing Category I furnace is removed or replaced, the original venting system, may no longer be sized to properly vent the attached appliances. An improperly sized Category I venting system could cause the formation of condensate in the furnace and vent, leakage of condensate and combustion products, and spillage of combustion products into the living space.

---- FIELD 24-VOLT WIRING
 - - - - FIELD 115-, 208/230-, 460-VOLT WIRING
 ——— FACTORY 24-VOLT WIRING
 ——— FACTORY 115-VOLT WIRING



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Fig. 25 - Field Wiring Diagram

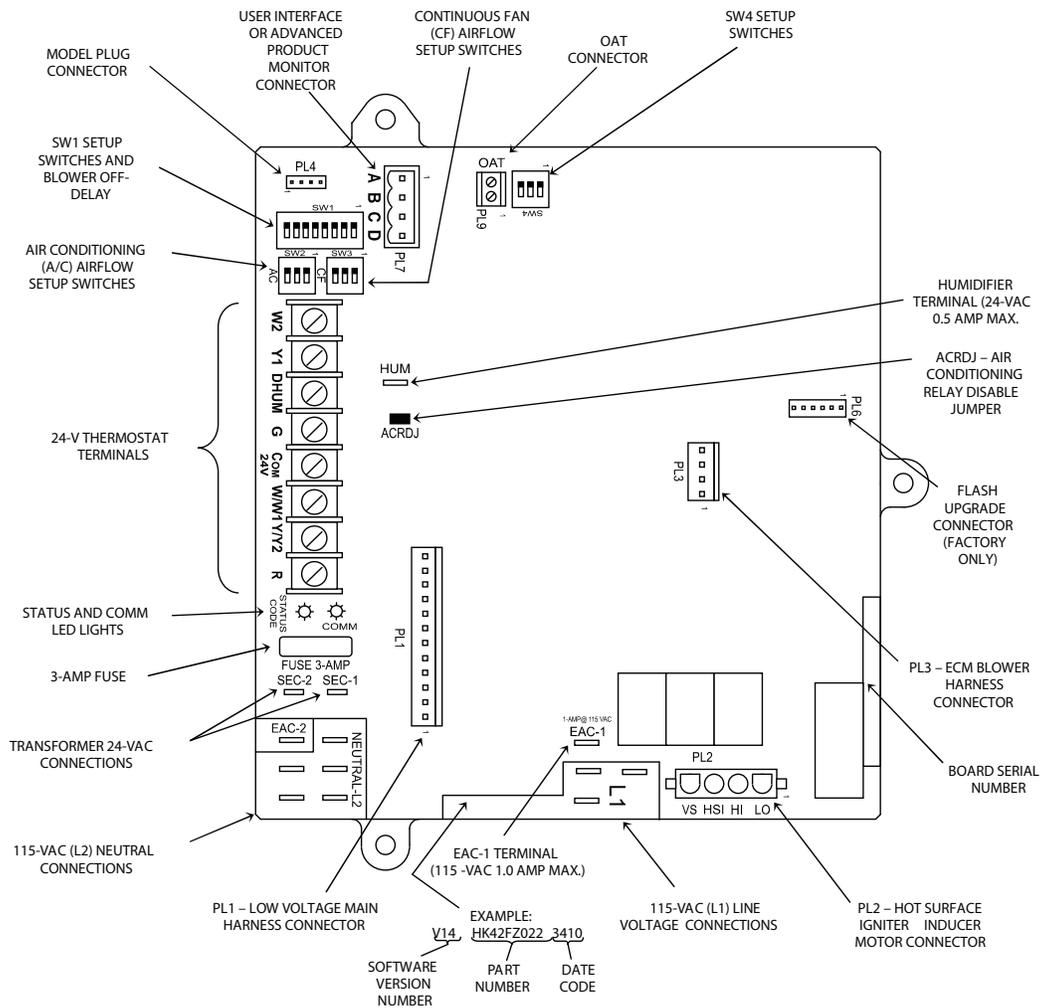


Fig. 26 - Variable Speed Furnace Control for ECM Blower Motor

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⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.

The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Seal any unused openings in venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, NFPA 54/ANSI Z223.1-2012 and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition.
3. As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.
7. Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
8. If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the National Fuel Gas Code, NFPA 54/ANSI Z223.1-2012.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.

Vent system or vent connectors may need to be resized. Vent systems or vent connectors must be sized to approach minimum size as determined using appropriate table found in the current edition of NFGC.

General Venting Requirements

Follow all safety codes for proper vent sizing and installation requirements, including local building codes, the National Fuel Gas Code NFPA 54/ANSI Z223.1-2012 (NFGC), Parts 12 and 13 in the United States, the local building codes, and furnace and vent manufacturers' instructions.

The following information and warning must be considered in addition to the requirements defined in the NFGC.

THERMIDISTAT

TWO-STAGE
FURNACE

SINGLE-SPEED
AIR CONDITIONER

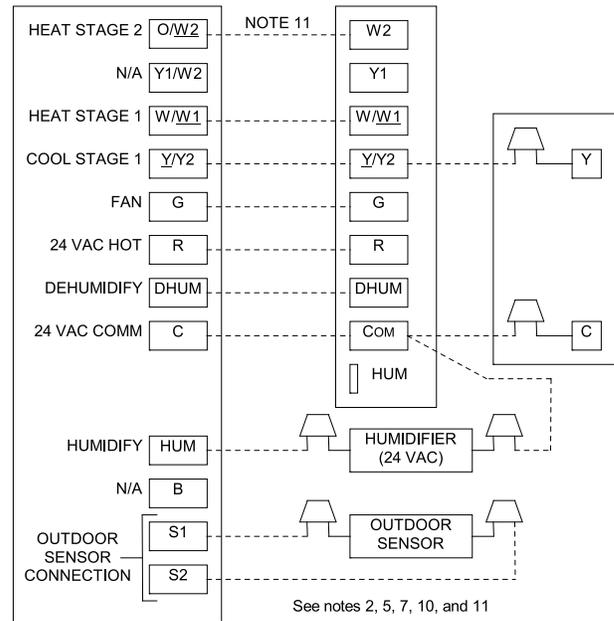


Fig. 27 - Two-Stage Furnace with Single-Speed Air Conditioner

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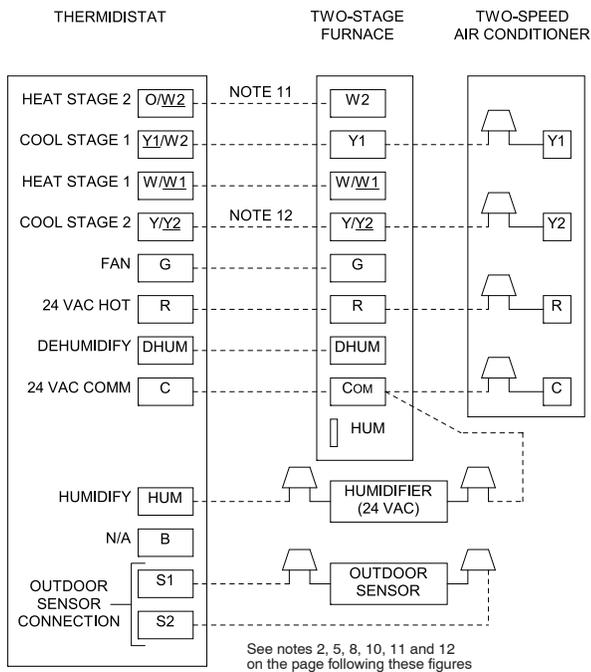
⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

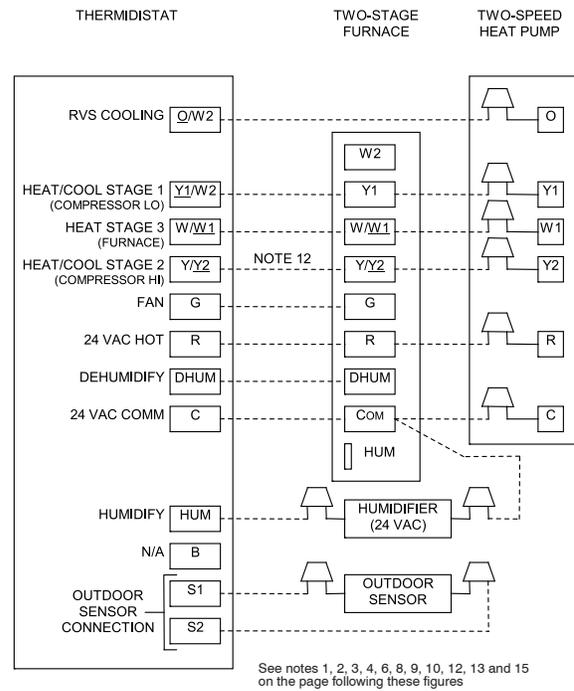
Failure to follow this warning could result in personal injury or death.

Do not bypass the draft safeguard switch, as an unsafe condition could exist which must be corrected.

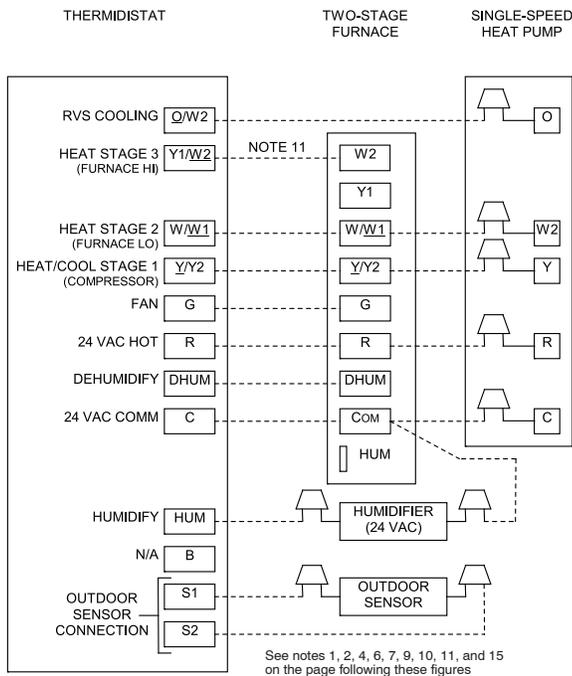
1. If a vent (common or dedicated) becomes blocked, the furnace will be shut off by the draft safeguard switch located on the vent elbow.
2. Two-stage furnaces require Type B vent connectors outside the casing in all configurations. Single wall vent connector may be used inside the furnace casing with the transition to Type B vent outside the furnace casing. Size the connector so that the FAN-Min vent connector capacity is equal to or lower than the low fire rate of the furnace and the FAN-Max vent connector capacity is equal to or higher than the furnace high fire rate.
3. Do not vent this Category I furnace into a single wall dedicated or common vent. The dedicated or common vent is considered to be the vertical portion of the vent system that terminates outdoors.
4. Vent connectors serving Category I furnaces shall not be connected into any portion of a mechanical draft system operating under positive pressure.
5. Do not vent this appliance with any solid fuel burning appliance.
6. Category I furnaces must be vented vertically or nearly vertically unless equipped with a listed mechanical venter. See SIDEWALL VENTING section.
7. Do not vent this appliance into an unlined masonry chimney. Refer to Chimney Inspection Chart, Fig. 35.



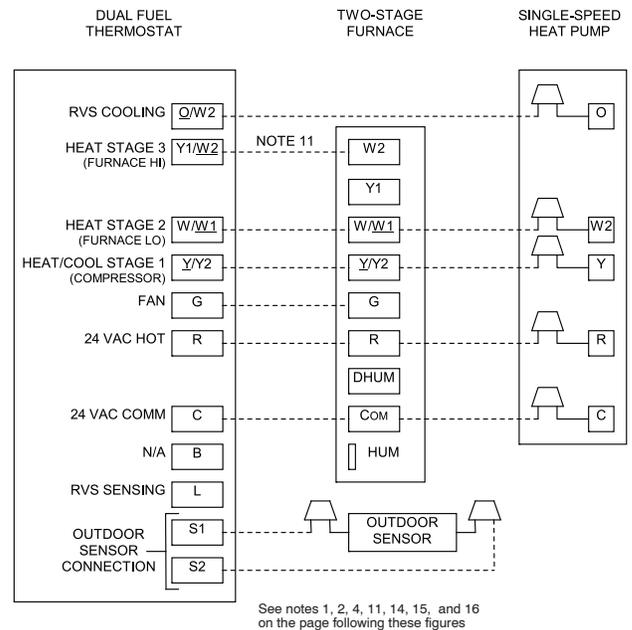
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Fig. 28 - Two-Stage Furnace with Two-Speed Air Conditioner



A03178
Fig. 30 - Two-Stage Furnace with Two-Speed Heat Pump (Dual Fuel)



A03180
Fig. 29 - Two-Stage Furnace with Single-Speed Heat Pump (Dual Fuel)



A03181
Fig. 31 - Dual-Fuel Thermostat with Two-Stage Furnace and Single-Speed Heat Pump

315AAV

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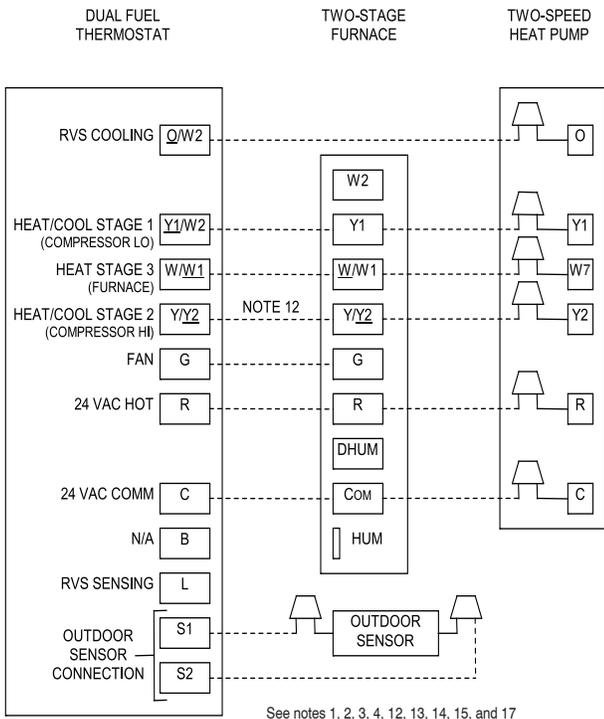


Fig. 32 - Dual-Fuel Thermostat with Two-Stage Furnace and Two-Speed Heat Pump

A03182

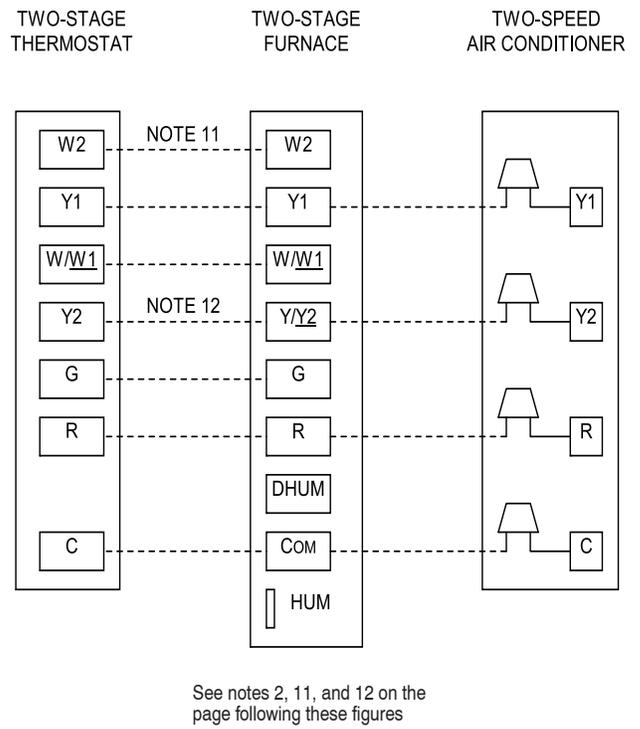


Fig. 33 - Two-Stage Thermostat with Two-Stage Furnace and Two-Speed Air Conditioner

A03183

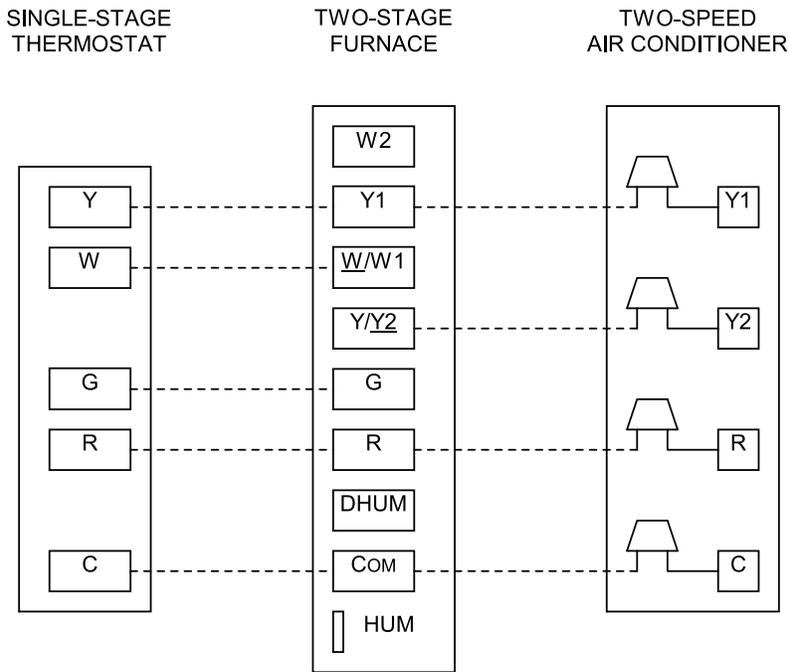


Fig. 34 - Single-Stage Thermostat with Two-Stage Furnace and Two-Speed Air Conditioner

A03184

NOTES FOR FIGURES 27 - 34

1. Heat pump **MUST** have a high pressure switch for dual fuel applications.
2. Refer to outdoor equipment Installation Instructions for additional information and setup procedure.
3. If the heat pump date code is 1501E or earlier, select the “ZONE” position on the two-speed heat pump control. Heat pumps having date codes 1601E and later do not have or require a “ZONE” selection.
4. Outdoor Air Temperature Sensor must be attached in all dual fuel applications.
5. Dip switch No. 1 on Thermidistat should be set in OFF position for air conditioner installations. This is factory default.
6. Dip switch No. 1 on Thermidistat should be set in ON position for heat pump installations.
7. Dip switch No. 2 on Thermidistat should be set in OFF position for single-speed compressor operation. This is factory default.
8. Dip switch No. 2 on Thermidistat should be set in ON position for two-speed compressor operation.
9. Configuration Option No. 10 “Dual Fuel Selection” must be turned ON in all dual fuel applications.
10. NO connection should be made to the furnace HUM terminal when using a Thermidistat.
11. Optional connection: If wire is connected, dip switch SW1-2 on furnace control should be set in ON position to allow Thermidistat/Thermostat to control furnace staging.
12. Optional connection: If wire is connected, ACRDJ jumper on furnace control should be removed to allow Thermidistat/Thermostat to control outdoor unit staging.
13. Furnace must control its own high-stage heating operation via furnace control algorithm.
14. The RVS Sensing terminal “L” should not be connected. This is internally used to sense defrost operation.
15. **DO NOT SELECT** the “FURNACE INTERFACE” or “BALANCE POINT” option on the two-speed heat pump control board. This is controlled internally by the Thermidistat/Dual Fuel Thermostat.
16. Dip switch D on Dual Fuel Thermostat should be set in OFF position for single-speed compressor operation. This is factory default.
17. Dip switch D on Dual Fuel Thermostat should be set in ON position for two-speed compressor operation.

CHIMNEY INSPECTION CHART

For additional requirements refer to the National Fuel Gas Code NFPA 54/ANSI Z223.1 and ANSI/NFPA 211 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances

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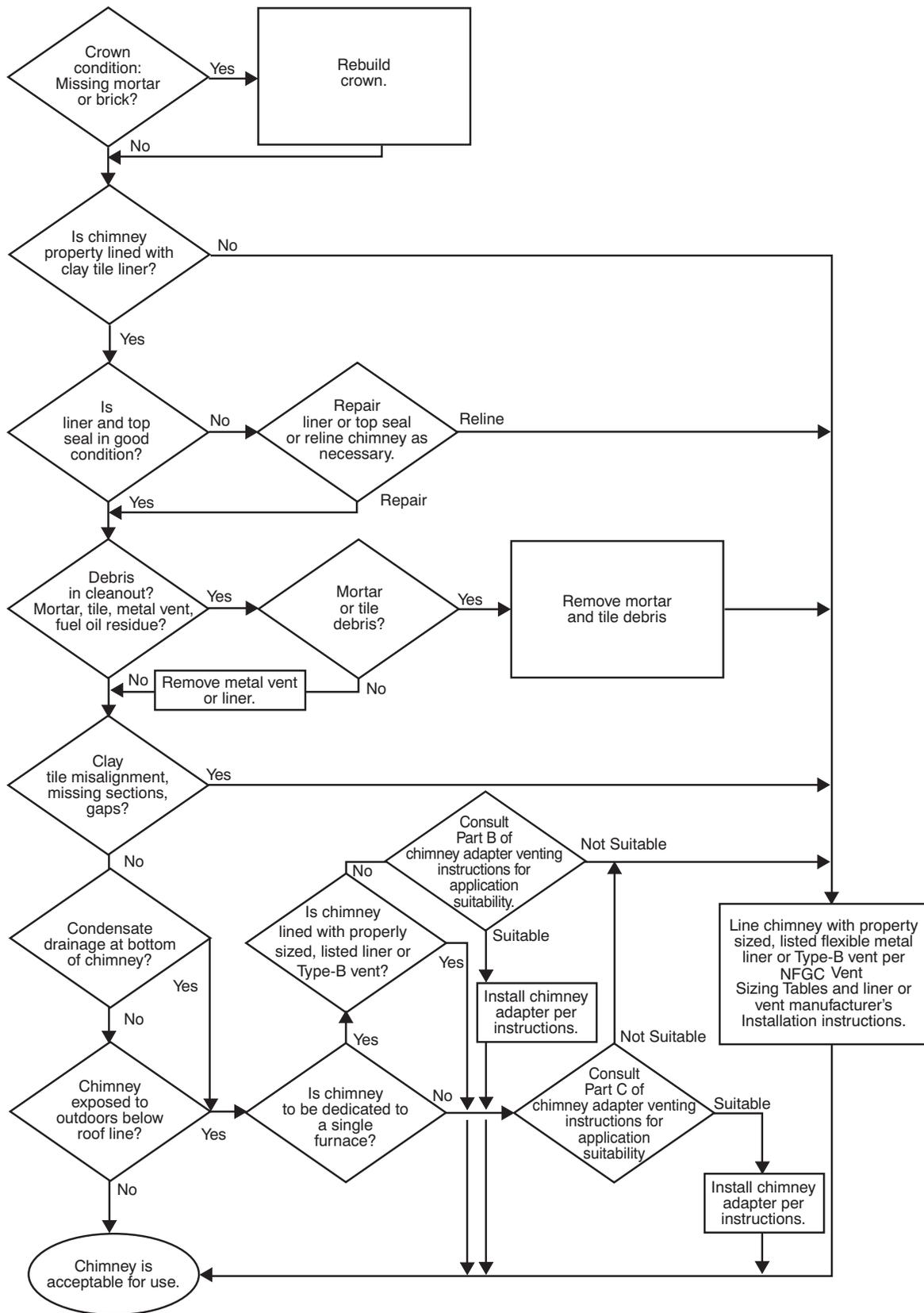


Fig. 35 - Chimney Inspection Chart

Masonry Chimney Requirement

NOTE: These furnaces are CSA design-certified for use in exterior tile-lined masonry chimneys with a factory accessory Chimney Adapter Kit. Refer to the furnace rating plate for correct kit usage. The Chimney Adapter Kits are for use with ONLY furnaces having a Chimney Adapter Kit number marked on the furnace rating plate.

If a clay tile-lined masonry chimney is being used and it is exposed to the outdoors below the roof line, relining might be required. Chimneys shall conform to the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances ANSI/NFPA 211-2012 in the United States and must be in good condition.

U.S.A.-Refer to Sections 13.1.8 and 13.2.20 of the NFPA 54/ANSI Z223.1-2012 or the authority having jurisdiction to determine whether relining is required. If relining is required, use a properly sized listed metal liner, Type-B vent, or a listed alternative venting design.

NOTE: See the NFPA 54/ANSI Z223.1-2012 13.1.9 and 13.2.20 regarding alternative venting design and the exception, which cover installations such as our Chimney Adapter Kits which are listed for use with these furnaces. See Product Data Sheet for accessory listing.

The Chimney Adapter Kit is a listed alternative venting system for these furnaces. See the kit instructions for complete details.

This furnace is permitted to be vented into a clay tile-lined masonry chimney that is exposed to the outdoors below the roof line, provided:

1. Vent connector is Type-B double-wall, and
2. This furnace is common vented with at least 1 draft hood equipped appliance, and
3. The combined appliance input rating is less than the maximum capacity given in Table 8, and
4. The input rating of each space heating appliance is greater than the minimum input rating given in Table 9 for the local 99% Winter Design Temperature. Chimneys having internal areas greater than 38 sq. in. (24516 sq. mm) require furnace input ratings greater than the input ratings of these furnaces. See footnote at bottom of Table 9, and
5. The authority having jurisdiction approves.

If all of these conditions cannot be met, an alternative venting design shall be used, such as the listed chimney adapter kit with a furnace listed for use with the kit, a listed chimney-lining system, or a Type-B common vent.

Inspections before the sale and at the time of installation will determine the acceptability of the chimney or the need for repair and/or (re)lining. Refer to the Fig. 33 to perform a chimney inspection. If the inspection of a previously used tile-lined chimney:

- a. Shows signs of vent gas condensation, the chimney should be relined in accordance with local codes and the authority having jurisdiction. The chimney should be relined with a listed metal liner, Type-B vent, or a listed chimney adapter kit shall be used to reduce condensation. If a condensate drain is required by local code, refer to the NFPA 54/ANSI Z223.1-2012, Section 12.10 for additional information on condensate drains.
- b. Indicates the chimney exceeds the maximum permissible size in the tables, the chimney should be rebuilt or relined to conform to the requirements of the equipment being installed and the authority having jurisdiction.

A chimney without a clay tile liner, which is otherwise in good condition, shall be rebuilt to conform to ANSI/NFPA 211 or be lined with a UL listed metal liner or UL listed Type-B vent.

Relining with a listed metal liner or Type-B vent is considered to be a vent-in-a-chase.

If a metal liner or Type-B vent is used to line a chimney, no other appliance shall be vented into the annular space between the chimney and the metal liner.

**Exterior Masonry Chimney FAN + NAT
Installations with Type-B Double-Wall Vent
Connectors ©NFPA & AGA**

**Table 8 – Combined Appliance Maximum Input
Rating in Thousands of Btuh per Hour**

VENT HEIGHT FT (M)	INTERNAL AREA OF CHIMNEY SQ. IN. (SQ. MM)			
	12 (7741)	19 (12258)	28 (18064)	38 (24516)
6 (1.8)	74	119	178	257
8 (2.4)	80	130	193	279
10 (3.0)	84	138	207	299
15 (4.5)	NR	152	233	334
20 (6.0)	NR	NR	250	368
30 (9.1)	NR	NR	NR	404

Appliance Application Requirements

Appliance operation has a significant impact on the performance of the venting system. If the appliances are sized, installed, adjusted, and operated properly, the venting system and/or the appliances should not suffer from condensation and corrosion. The venting system and all appliances shall be installed in accordance with applicable listings, standards, and codes.

The furnace should be sized to provide 100 percent of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air-Conditioning Engineers; or other approved engineering methods. Excessive oversizing of the furnace could cause the furnace and/or vent to fail prematurely.

When a metal vent or metal liner is used, the vent must be in good condition and be installed in accordance with the vent manufacturer's instructions.

To prevent condensation in the furnace and vent system, the following precautions must be observed:

1. The return-air temperature must be at least 60°F db except for brief periods of time during warm-up from setback at no lower than 55°F (13°C) db or during initial start-up from a standby condition.
2. Adjust the gas input rate per the installation instructions. Low gas input rate causes low vent gas temperatures, causing condensation and corrosion in the furnace and/or venting system. Derating is permitted only for altitudes above 2000 Ft. (610 M).
3. Adjust the air temperature rise to the midpoint of the rise range or slightly above. Low air temperature rise can cause low vent gas temperature and potential for condensation problems.
4. Set the thermostat heat anticipator or cycle rate to reduce short cycling.

⚠ CAUTION

BURN HAZARD
Failure to follow this caution may result in personal injury.
Hot vent pipe is within reach of small children when installed in downflow position.
See the following instruction.

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Table 9 – Minimum Allowable Input Rating of Space-Heating Appliance in Thousands of Btuh per Hour

VENT HEIGHT FT. (M)	INTERNAL AREA OF CHIMNEY SQ. IN. (SQ. MM)			
	12 (7741)	19 (12258)	28 (18064)	38 (24516)
Local 99% Winter Design Temperature: 17 to 26 degrees F				
6	0	55	99	141
8	52	74	111	154
10	NR	90	125	169
15	NR	NR	167	212
20	NR	NR	212	258
30	NR	NR	NR	362
Local 99% Winter Design Temperature: 5 to 16 degrees F*				
6	NR	78	121	166
8	NR	94	135	182
10	NR	111	149	198
15	NR	NR	193	247
20	NR	NR	NR	293
30	NR	NR	NR	377
Local 99% Winter Design Temperature: –10 to 4 degrees F*				
6	NR	NR	145	196
8	NR	NR	159	213
10	NR	NR	175	231
15	NR	NR	NR	283
20	NR	NR	NR	333
30	NR	NR	NR	NR
Local 99% Winter Design Temperature: –11 degrees F or lower				
Not recommended for any vent configuration.				

*The 99.6% heating (db) temperatures found in the 1997 or 2001 ASHRAE Fundamentals Handbook, Climatic Design Information chapter, Table 1A (United States) and 2A (Canada) or the 2005 ASHRAE Fundamentals handbook, Climatic Design Information chapter, and the CD-ROM included with the 2005 ASHRAE Fundamentals Handbook.

Air for combustion must not be contaminated by halogen compounds which include chlorides, fluorides, bromides, and iodides. These compounds are found in many common home products such as detergent, paint, glue, aerosol spray, bleach, cleaning solvent, salt, and air freshener, and can cause corrosion of furnaces and vents. Avoid using such products in the combustion-air supply. Furnace use during construction of the building could cause the furnace to be exposed to halogen compounds, causing premature failure of the furnace or venting system due to corrosion.

Vent dampers on any appliance connected to the common vent can cause condensation and corrosion in the venting system. Do not use vent dampers on appliances common vented with this furnace.

Additional Venting Requirements

A 4-in. (102 mm) round vent elbow is supplied with the furnace. A 5-in. (127 mm) or 6-in. (152 mm) vent connector may be required for some model furnaces. A field-supplied 4-in. (102 mm) to 5-in. (127 mm) or 4-in. (102 mm) to 6-in. (152 mm) sheet metal increaser fitting is required when 5-in. (127 mm) or 6-in. (152 mm) vent connector is used. See Fig. 36 - 48, Venting Orientation for approved vent configurations.

NOTE: Vent connector length for connector sizing starts at furnace vent elbow. The 4-in. (102 mm) vent elbow is shipped for upflow configuration and may be rotated for other positions. Remove the three screws that secure vent elbow to furnace, rotate furnace vent elbow to position desired, reinstall screws. The factory-supplied vent elbow does NOT count as part of the number of vent connector elbows.

The vent connector can exit the furnace through one of five locations on the casing.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

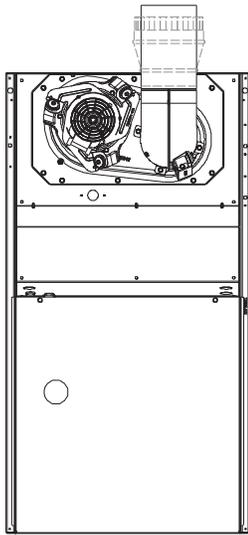
1. Attach the single wall vent connector to the furnace vent elbow, and fasten the vent connector to the vent elbow with at least two field-supplied, corrosion-resistant, sheet metal screws located 180° apart.

NOTE: An accessory flue extension is available to extend from the furnace elbow to outside the furnace casing. See Product Data Sheet for accessory listing. If flue extension is used, fasten the flue extension to the vent elbow with at least two field-supplied, corrosion-resistant, sheet metal screws located 180° apart. Fasten the vent connector to the flue extension with at least two field-supplied, corrosion resistant sheet metal screws located 180° apart.

2. Vent the furnace with the appropriate connector as shown in Fig. 36 - 48.
3. Determine the correct location of the knockout to be removed.
4. Use a hammer and screwdriver to strike a sharp blow between the tie points and work the slug back and forth until the slug breaks free.

An accessory Vent Guard Kit is REQUIRED for downflow applications for use where the vent exits through the lower portion of the furnace casing. Refer to the Vent Guard Kit Instructions for complete details. See Product Data Sheet for accessory listing.

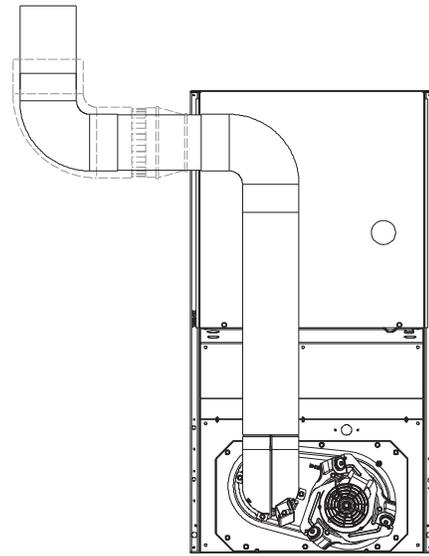
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SEE NOTES: 1,2,4,7,8,9
on the page following
these figures

Fig. 36 - Upflow Application - Vent Elbow Up

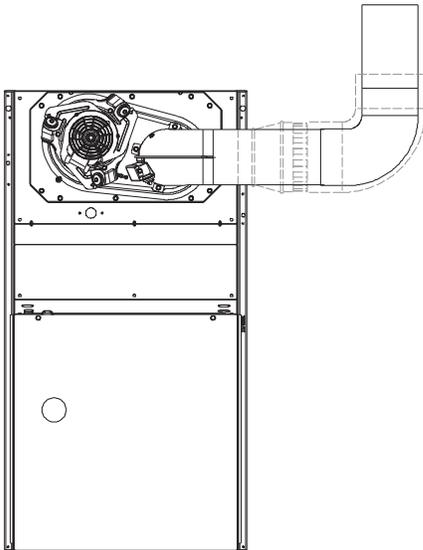
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SEE NOTES:1,2,3,4,5,7,8,9
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Fig. 38 - Downflow Application - Vent Elbow Up then Left

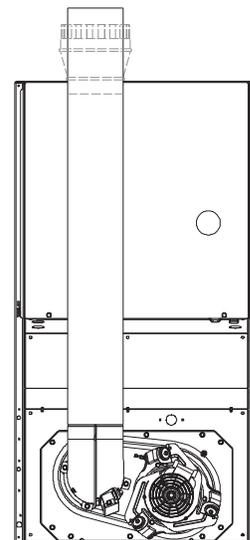
A03210



SEE NOTES: 1,2,3,4,7,8,9
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Fig. 37 - Upflow Application - Vent Elbow Right

A03209



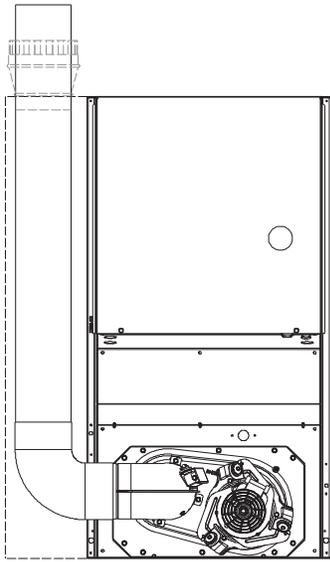
SEE NOTES: 1,2,4,5,7,8,9
on the page following
these figures

Fig. 39 - Downflow Application - Vent Elbow Up

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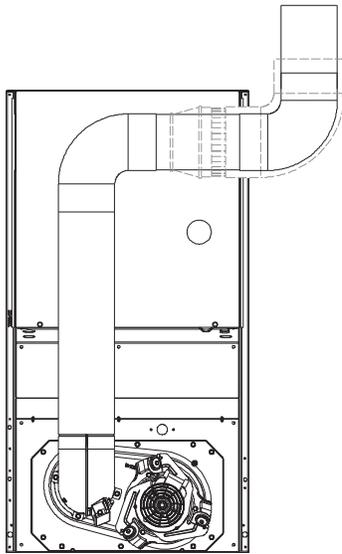
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SEE NOTES: 1,2,4,5,6,7,8,9,10 on the page following these figures

A03207

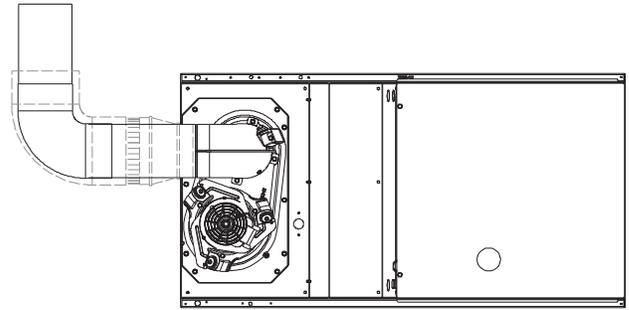
Fig. 40 - Downflow Application - Vent Elbow Left then Up



SEE NOTES: 1,2,3,4,5,7,8,9 on the page following these figures.

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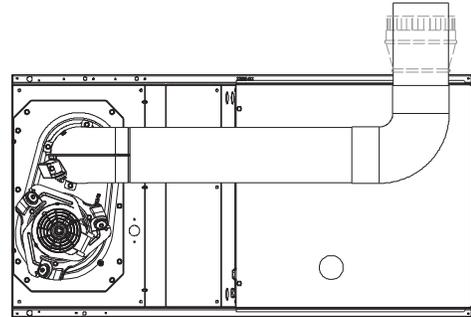
Fig. 41 - Downflow Application - Vent Elbow Up then Right



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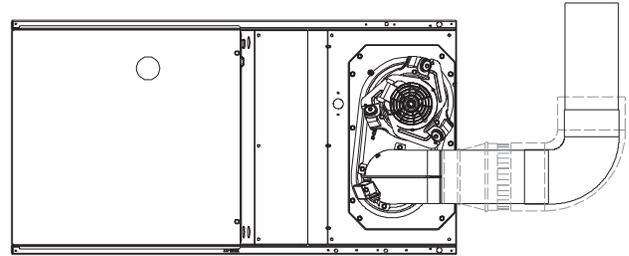
Fig. 42 - Horizontal Left Application - Vent Elbow Left



SEE NOTES: 1,2,4,5,7,8,9 on the page following these figures

A03214

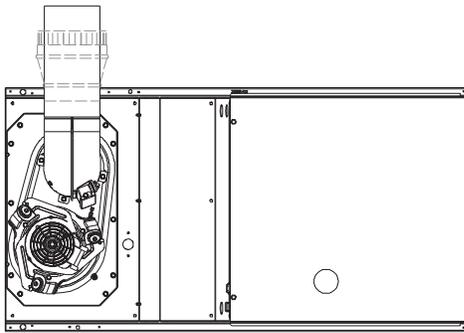
Fig. 43 - Horizontal Left Application - Vent Elbow Right then Up



SEE NOTES: 1,2,4,7,8,9 on the page following these figures

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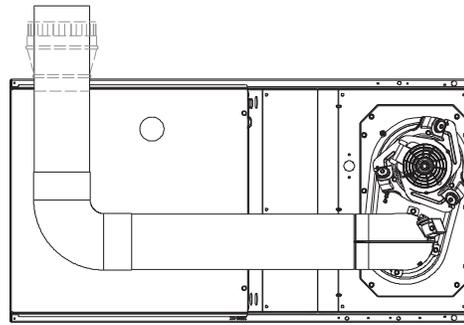
Fig. 44 - Horizontal Right Application - Vent Elbow Right



SEE NOTES: 1,2,4,5,7,8,9 on the page following these figures

Fig. 45 - Horizontal Left Application - Vent Elbow Up

A03215

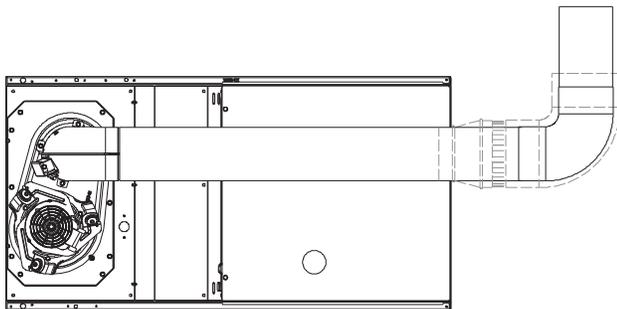


SEE NOTES: 1,2,4,5,7,8,9 on the page following these figures

Fig. 47 - Horizontal Right Application - Vent Elbow Left then Up

A03219

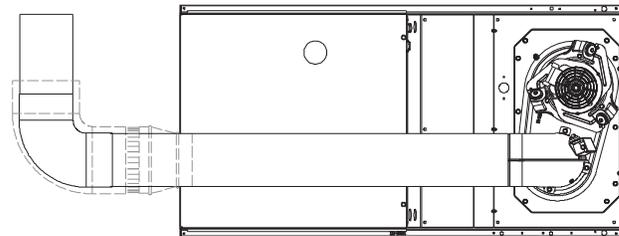
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SEE NOTES: 1,2,4,5,7,8,9 on the page following these figures

Fig. 46 - Horizontal Left Application - Vent Elbow Right

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SEE NOTES: 1,2,4,5,7,8,9

Fig. 48 - Horizontal Right Application-Vent Elbow Left

A02068

VENTING NOTES FOR FIG. 36 - 48

1. For common vent, vent connector sizing and vent material: United States--use the NFGC.
2. Immediately increase to 5-in. (102 mm) or 6-in. (152 mm) vent connector outside furnace casing when 5-in. (127 mm) vent connector is required, refer to Note 1 above.
3. Side outlet vent for upflow and downflow installations must use Type B vent immediately after exiting the furnace, except when factory-approved Downflow Vent Guard Kit is used in the downflow position. See Product Data Sheet for accessory listing.
4. Type-B vent where required, refer to Note 1 above.
5. A 4-in.(102 mm) single-wall (26 ga. min.) vent must be used inside furnace casing and when the factory-approved Downflow Vent Guard Kit is used external to the furnace. See Product Data Sheet for accessory listing.
6. Accessory Downflow Vent Guard Kit required in downflow installations with lower vent configuration. See Product Data Sheet for accessory listing.
7. Chimney Adapter Kit may be required for exterior masonry chimney applications. Refer to Chimney Adapter Kit for sizing and complete application details. See Product Data Sheet for accessory listing.
8. Secure vent connector to furnace elbow with (2) corrosion-resistant sheet metal screws, spaced approximately 180° apart.
9. Secure all other single wall vent connector joints with (3) corrosion resistant screws spaced approximately 120° apart. Secure Type-B vent connectors per vent connector manufacturer's recommendations.
10. The total height of the vent and connector shall be at least seven feet for the 154,000 Btuh gas input rate model when installed in a downflow application with furnace elbow turned to left side with the connector elbow outside furnace casing pointing upward. (See Fig. 38.)

**Caution!! For the following applications, use the minimum vertical heights as specified below.
For all other applications, follow exclusively the National Fuel Gas Code.**

FURNACE ORIENTATION	VENT ORIENTATION	FURNACE INPUT (BTUH/HR)	MIN. VENT DIAMETER IN. (mm)*	MIN. VERTICAL VENT HEIGHT FT. (M)**
Downflow	Vent elbow left, then up Fig. 36	154,000 132,000 110,000	5 (127)	12 (3.6)
Horizontal Left	Vent elbow right, then up Fig. 39	154,000 132,000	5 (127)	7 (2.1)
Horizontal Left	Vent Elbow up Fig. 40	154,000 132,000	5 (127)	7 (2.1)
Horizontal Left	Vent elbow right Fig. 41	154,000	5 (127)	7 (2.1)
Downflow	Vent elbow up then left Fig. 34	110,000	5 (127)	10 (3.0)
Downflow	Vent elbow up, then right Fig. 37	110,000	5 (127)	10 (3.0)

NOTE: All vent configurations must also meet National Fuel Gas Code venting requirements NFGC.

*4-in. (102 mm) inside casing or vent guard

**Including 4 in. (102 mm) vent section(s)

The horizontal portion of the venting system shall slope upwards not less than 1/4-in. per linear ft. (21 mm/m) from the furnace to the vent and shall be rigidly supported every 5 ft. (1.5 M) or less with metal hangers or straps to ensure there is no movement after installation.

Sidewall Venting

This furnace is not approved for direct sidewall horizontal venting.

Per section 12.4.3 of the NFPA 54/ANSI Z223.1-2012, any listed mechanical venter may be used, when approved by the authority having jurisdiction.

Select the listed mechanical venter to match the Btuh input of the furnace being vented. Follow all manufacturer's installation requirements for venting and termination included with the listed mechanical venter.

START-UP, ADJUSTMENT, AND SAFETY CHECK

General

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death or property damage.

This furnace is equipped with manual reset limit switches in the gas control area. The switches open and shut off power to the gas valve, if a flame rollout or overheating condition occurs in the gas control area. **DO NOT** bypass the switches. Correct problem before resetting the switches.

1. Maintain 115-v wiring and ground. Improper polarity will result in rapid flashing LED and no furnace operation.
2. Make thermostat wire connections at the 24-v terminal block on the furnace control. Failure to make proper connections will result in improper operation. (See Fig. 25 - 34.)

3. Gas supply pressure to the furnace must be greater than 4.5-In. W.C. (0.16 psig) but not exceed 14-In. W.C. (0.5 psig).
4. Check all manual-reset switches for continuity.
5. Replace blower compartment door. Door must be in place to operate furnace.
6. Setup switch descriptions The variable speed furnace control has DIP switches to select thermostat staging, blower off delay timings, air flow selection and other operational or service related functions. (See Fig. 26, 53 and Table 10.)

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

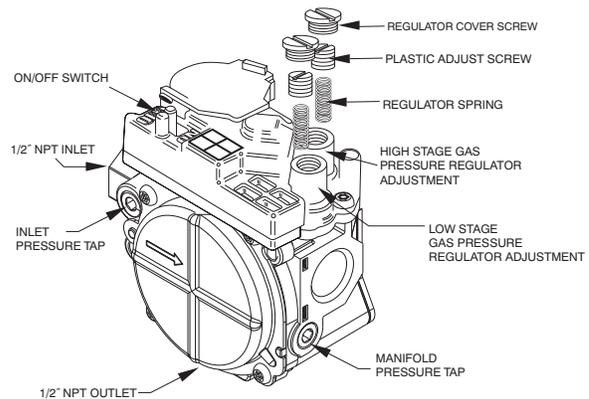


Fig. 49 - Redundant Automatic Gas Control Valve

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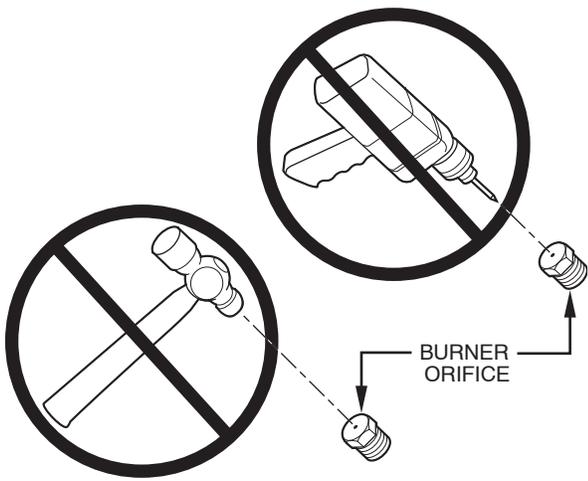
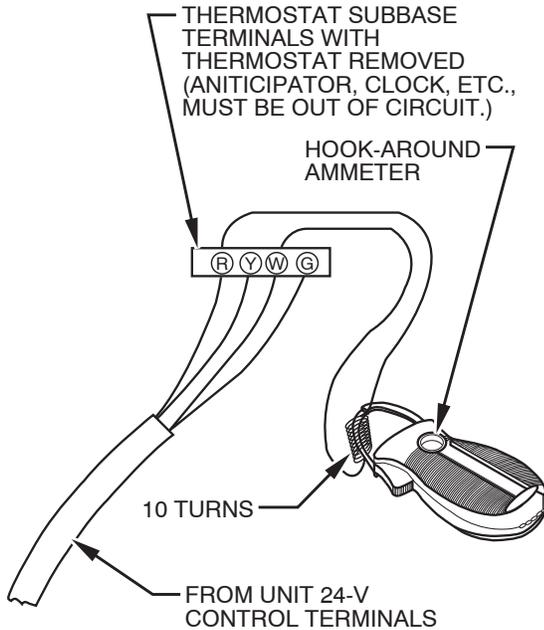


Fig. 50 - Orifice Hole

A93059



EXAMPLE: $\frac{5.0 \text{ AMPS ON AMMETER}}{10 \text{ TURNS AROUND JAWS}} = 0.5 \text{ AMPS FOR THERMOSTAT ANTICIPATOR SETTING}$

Fig. 51 - Amp. Draw Check with Ammeter

A96316

Start-Up Procedures

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death.

Blower access door switch opens 115-v power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

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1. Purge gas lines after all connections have been made.
2. Check gas lines for leaks.
3. To Begin Component Self-Test:
Remove Blower Access Door. Disconnect the thermostat R lead from furnace control board. Manually close blower door switch. Turn Setup DIP switch SW1-6 ON. (See Fig. 26, 53 and Table 10.)

NOTE: The furnace control allows all components, except the gas valve, to be run for short period of time. This feature helps diagnose a system problem in case of a component failure. Component test feature will not operate if any thermostat signal is present at the control.

Refer to service label attached to furnace or See Fig. 52.

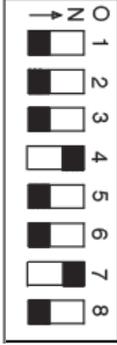
Component test sequence is as follows:

- a. Inducer motor starts on high-speed and continues to run until Step d. of component test sequence.
- b. Hot surface igniter is energized for 15 sec., then off.
- c. Blower motor operates for 15 sec.
- d. Inducer motor goes to low-speed for 10 sec., then stops.
- e. After component test is completed, one or more status codes (11, 25, or 41) will flash. See component test section of service label (Fig. 52) in furnace for explanation of status codes.

NOTE: To repeat component test, turn setup switch SW1-6 OFF, then back ON.

4. Turn setup DIP switch SW1-6 OFF. Reconnect R lead to furnace control board, release blower door switch and re-install blower access door.
5. Operate furnace per instruction on inner door.
6. Verify furnace shut down by lowering thermostat setting below room temperature.
7. Verify furnace restarts by raising thermostat setting above room temperature.

Table 10 – Furnace Setup Switch Description

Furnace Setup Switch Description				
SETUP SWITCH	SWITCH NAME	NORMAL POSITION	DESCRIPTION OF USE	
	SW1-1	Status Code Recovery	OFF	Turn ON to retrieve up to 7 stored status codes for troubleshooting assistance when R thermostat lead is disconnected.
	SW1-2	Low Heat Only (Adaptive Heat Mode when SW1-2 is OFF)	OFF	When SW1-2 is OFF allows 2-stage operation with a single stage thermostat. Turn ON when using 2-stage thermostat to allow Low Heat operation when R to W/W1 closes and High Heat operation when R to W/W1 and W2 close.
	SW1-3	Low Heat Rise Adjustment	OFF	Turn ON to increase Low Heat airflow by 18%. This compensates for increased return air temperature caused with bypass humidifier.
	SW1-4	Comfort/Efficiency Adjustment	ON	Turn ON to decrease low heat airflow 20% for 90% models or 16% for 80% models & high heat airflow 15% for 90% models or 10% for 80% models.
	SW1-5	CFM per ton adjust	OFF	Turn ON for 400 CFM per ton, Turn OFF for 350 CFM per ton. See also SW4.
	SW1-6	Component Self Test	OFF	Turn ON to initiate Component Self Test for troubleshooting assistance when R thermostat lead is disconnected. Turn OFF when Self Test is completed.
	SW1-7 & SW1-8	Blower OFF delay	ON or OFF	Blower Off Delay time – adjustable 90 seconds to 180 seconds. See table in Adjustments section or refer to unit wiring diagram.
		SW4-3	CFM per ton Adjust	OFF

AIR CONDITIONING (A/C) SETUP SWITCHES

 <p>AC</p>	<p>SW 2, AC (Cooling Airflow) SETUP SWITCHES</p> <p>The AC setup switch selects desired cooling or high stage cooling (two stage units) airflow.</p> <p>See Air Delivery Tables for specific switch settings</p>
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CONTINUOUS FAN (CF) SETUP SWITCHES

 <p>CF</p>	<p>SW 3, CF (Continuous Fan) SETUP SWITCHES</p> <p>The CF setup switch selects desired Continuous Fan Airflow</p> <p>The CF switch position is the low cooling airflow selection for two stage cooling units.</p> <p>The CFM values in the Air Delivery Tables for SW 3 settings are the same as SW 2 settings.</p> <p>SW 3 cannot be set for airflow higher than SW 2</p> <p>See Air Delivery Tables for specific switch settings</p>
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SERVICE															
<p>LED CODE STATUS</p> <p>CONTINUOUS OFF - Check for 115VAC at L1 and L2, and 24VAC at SEC-1 and SEC-2.</p> <p>CONTINUOUS ON - Control has 24VAC power.</p> <p>RAPID FLASHING - Line voltage (115VAC) polarity reversed.</p> <p style="text-align: center; font-size: small;">EACH OF THE FOLLOWING STATUS CODES IS A TWO DIGIT NUMBER WITH THE FIRST DIGIT DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND DIGIT BY THE NUMBER OF LONG FLASHES.</p> <p>11 NO PREVIOUS CODE - Stored status codes are erased automatically after 72 hours or as specified above.</p> <p>12 BLOWER ON AFTER POWER UP (115 VAC or 24 VAC) - Blower runs for 90 seconds, if unit is powered up during a call for heat (R/W/W1 closed) or (R/W/W1 opens) during blower on-delay period.</p> <p>13 LIMIT CIRCUIT LOCKOUT - Lockout occurs if a limit, draft safeguard, flame rollout, or blocked vent switch (if used) is open longer than 3 minutes or 10 successive limit trips occurred during high-heat. Control will auto reset after three hours. Refer to status code #33.</p> <p>14 IGNITION LOCKOUT - Control will auto-reset after three hours. Refer to status code #34.</p> <p>15 BLOWER MOTOR LOCKOUT - Indicates the blower failed to reach 250 RPM or the blower failed to communicate within 30 seconds after being turned ON in two successive heating cycles. Control will auto reset after 3 hours. Refer to status code #41.</p> <p>21 GAS HEATING LOCKOUT - Control will NOT auto reset. Check for: - Mis-wired gas valve - Defective control (valve relay)</p> <p>22 ABNORMAL FLAME-PROVING SIGNAL - Flame is proved while gas valve is de-energized. Inducer will run until fault is cleared. Check for: - Leaky gas valve - Stuck-open gas valve</p> <p>23 PRESSURE SWITCH DID NOT OPEN Check for: - Obstructed pressure tubing - Pressure switch stuck closed</p> <p>24 SECONDARY VOLTAGE FUSE IS OPEN Check for: - Short circuit in secondary voltage (24VAC) wiring.</p> <p>25 INVALID ID MODEL SELECTION OR SETUP ERROR - Indicates either the model plug is missing or incorrect or, setup switch "SW1-1" or "SW1-6" is positioned improperly. If code flashes 4 times on power-up control is defaulting to model selection stored in memory. Check for: -Thermostat call with SW1-1, SW1-6 or both SW1-1 & SW1-6 ON - Board date code 2103 or later required to recognize model plug 007. - Proper model plug number and resistance values per wiring diagram</p> <p>31 HIGH-HEAT PRESSURE SWITCH OR RELAY DID NOT CLOSE OR REOPENED - Control relay may be defective. Refer to status code #32.</p> <p>32 LOW-HEAT PRESSURE SWITCH DID NOT CLOSE OR REOPENED - If open longer than five minutes, inducer shuts off for 15 minutes before retry. If opens during blower on-delay period, blower will come on for the selected blower off-delay. Check for: - Excessive wind - Restricted vent - Proper vent sizing</p>	<p>If status code recall is needed disconnect the "R" thermostat lead, reset power, and put setup switch "SW1-1" in the ON position. To clear the status code history put setup switch "SW1-1" in the ON position and jumper thermostat terminals "R", "WWW1", and "YYZ" simultaneously until status code #11 is flashed.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center; background-color: #f2f2f2;">COMPONENT TEST</th> </tr> </thead> <tbody> <tr> <td colspan="2">To initiate the component test sequence, shut OFF the room thermostat or disconnect the "R" thermostat lead. Reset power and then put setup switch "SW1-6" in the ON position to start the component test sequence. Once initiated the furnace control will turn the inducer ON at high-heat speed. The inducer motor will run for the entire test. The hot surface igniter and blower motor will be turned ON for 15 seconds each. When the blower is turned OFF the inducer will be switched to low-speed for 10 seconds. When the component test is completed one or more of the following codes will flash.</td> </tr> <tr> <th style="text-align: left;">CODE</th> <th style="text-align: left;">DESCRIPTION</th> </tr> <tr> <td>11</td> <td>Indicates the blower motor tested OK. Visual check of inducer motor and hot surface igniter required.</td> </tr> <tr> <td>25</td> <td>SETUP ERROR - Same as code 25 above.</td> </tr> <tr> <td>41</td> <td>BLOWER MOTOR FAULT - Indicates blower motor failed test. Check blower, wiring, and furnace control.</td> </tr> <tr> <td colspan="2">To repeat component test turn setup switch "SW1-6" OFF and then back ON. After component test is completed put setup switch "SW1-6" in the OFF position and reconnect the "R" thermostat lead.</td> </tr> </tbody> </table>	COMPONENT TEST		To initiate the component test sequence, shut OFF the room thermostat or disconnect the "R" thermostat lead. Reset power and then put setup switch "SW1-6" in the ON position to start the component test sequence. Once initiated the furnace control will turn the inducer ON at high-heat speed. The inducer motor will run for the entire test. The hot surface igniter and blower motor will be turned ON for 15 seconds each. When the blower is turned OFF the inducer will be switched to low-speed for 10 seconds. When the component test is completed one or more of the following codes will flash.		CODE	DESCRIPTION	11	Indicates the blower motor tested OK. 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Fig. 52 - Service Label

Adjustments

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

DO NOT bottom out gas valve regulator adjusting screw. This can result in unregulated manifold pressure and result in excess overfire and heat exchanger failures.

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in reduced furnace life.

DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of heat exchangers, causing failures. (See Fig. 50.)

- a. Obtain average yearly gas heat value (at installed altitude) from local gas supplier.
- b. Obtain average yearly gas specific gravity from local gas supplier.
- c. Find installation altitude in Table 14 or 15.
- d. Find closest natural gas heat value and specific gravity in Table 14 or 15.
- e. Follow heat value and specific gravity lines to point of intersection to find orifice size and low-and high-heat manifold pressure settings for proper operation.
- f. Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

NOTE: If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.

- g. Replace orifice with correct size, if required by Table 14 or 15. Use only factory-supplied orifices. See EXAMPLE 1.

Table 11 – Altitude Derate Multiplier for U.S.A.

ALTITUDE FT. (M)	PERCENT OF DERATE	DERATE MULTIPLIER FACTOR*
0–2000 (0–610)	0	1.00
2001–3000 (610–914)	8–12	0.90
3001–4000 (914–1219)	12–16	0.86
4001–5000 (1219–1524)	16–20	0.82
5001–6000 (1524–1829)	20–24	0.78
6001–7000 (1829–2134)	24–28	0.74
7001–8000 (2134–2438)	28–32	0.70
8001–9000 (2438–2743)	32–36	0.66
9001–10,000 (2743–3048)	36–40	0.62

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 Ft. (610 M). Furnace input rate must be within +/-2 percent of furnace rating plate input. For altitudes above 5500 Ft. (1676 M), a field-supplied high altitude pressure switch is required.

1. Determine the correct gas input rate.
The input rating for altitudes above 2,000 ft. (610 M) must be reduced by 4 percent for each 1,000 ft. (305 M) above sea level.
For installations below 2000 Ft. (610 M), refer to the unit rating plate. For installations above 2000 Ft. (610 M), multiply the input on the rating plate by the de-rate multiplier in Table 10 for the correct input rate.
2. Determine the correct orifice and manifold pressure adjustment. All models in all positions except Low NOx models in downflow and horizontal positions use Table 14 (22,000 Btu/h per burner.) Low NOx models in downflow or horizontal positions must use Table 15 (21,000 Btu/h per burner.) See input listed on rating plate.

Table 12 – Blower Off Delay Setup Switch

DESIRED HEATING MODE BLOWER OFF DELAY (SEC.)	SETUP SWITCH (SW-7 AND -8) POSITION	
	SW1-7	SW1-8
90	OFF	OFF
120	ON	OFF
150	OFF	ON
180	ON	ON

EXAMPLE 1: 0–2000 ft. (0–610 M) altitude

For 22,000 Btuh per burner application use Table 14.

Heating value = 1000 Btuh/cu ft.

Specific gravity = 0.62

Therefore: Orifice No. 43*

Manifold pressure: 3.7-In. W.C. for high-heat

1.6-In. W.C. for low-heat

* Furnace is shipped with No. 43 orifices. In this example all main burner orifices are the correct size and do not need to be changed to obtain proper input rate.

3. Adjust manifold pressure to obtain low fire input rate. (See Fig. 49.)

- a. Turn gas valve ON/OFF switch to OFF.
- b. Remove manifold pressure tap plug from gas valve.
- c. Connect a water column manometer or similar device to manifold pressure tap.
- d. Turn gas valve ON/OFF switch to ON.
- e. Move setup SW1—2 on furnace control to ON position to lock furnace in low-heat operation. (See Table 10 and Fig. 24.)
- f. Manually close blower door switch.
- g. Jumper R and W/W1 thermostat connections on control to start furnace. (See Fig. 24.)
- h. Remove regulator adjustment cap from low heat gas valve pressure regulator (See Fig. 49.) and turn low-heat adjusting screw (3/16 or smaller flat-tipped screwdriver) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

NOTE: DO NOT set low-heat manifold pressure less than 1.4-In. W.C. or more than 1.7-In. W.C. for natural gas. If manifold pressure is outside this range, change main burner orifices.

- i. Install low-heat regulator adjustment cap.
 - j. Move setup switch SW1-2 to off position after completing low-heat adjustment.
 - k. Leave manometer or similar device connected and proceed to Step 4.
4. Adjust manifold pressure to obtain high fire input rate. (See Fig. 49.)

- a. Jumper R to W/W1 and W2 thermostat connections on furnace control. This keeps furnace locked in high-heat operation.
- b. Remove regulator adjustment cap from high-heat gas valve pressure regulator (See Fig. 49) and turn high heat adjusting screw (3/16-in. or smaller flat-tipped screwdriver) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

NOTE: DO NOT set high-heat manifold pressure less than 3.2-In. W.C. or more than 3.8 In. W.C. for natural gas. If manifold pressure is outside this range, change main burner orifices to obtain manifold pressure in this range.

- c. When correct input is obtained, replace caps that conceal gas valve regulator adjustment screws. Main

burner flame should be clear blue, almost transparent (See Fig. 55.)

d. Remove jumpers R to W/W1 and R to W2.

5. Verify natural gas input rate by clocking meter.

NOTE: Gas valve regulator adjustment caps must be in place for proper input to be clocked.

- a. Turn off all other gas appliances and pilots served by the meter.
 - b. Move setup switch SW1-2 to ON position. This keeps furnace locked in low-heat operation.
 - c. Jumper R to W/W1.
 - d. Run furnace for 3 minutes in low-heat operation.
 - e. Measure time (in sec) for gas meter to complete 1 revolution and note reading. The 2 or 5 cubic feet dial provides a more accurate measurement of gas flow.
 - f. Refer to Table 13 for cubic ft. of gas per hr.
 - g. Multiply gas rate cu ft./hr by heating value (Btuh/cu ft.) to obtain input. If clocked rate does not match required input from Step 1, increase manifold pressure to increase input or decrease manifold pressure to decrease input. Repeat steps b through e until correct low-heat input is achieved. Re-install low heat regulator seal cap on gas valve.
 - h. Move setup switch SW1-2 to OFF position and jumper R to W/W1, and W2. This keeps furnace locked in high-heat operation. Repeat items d through g for high-heat operation.
6. Set Temperature Rise

NOTE: Blower access door must be installed when taking temperature rise reading. Leaving blower access door off will result in incorrect temperature measurements.

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in shorten furnace life.

Set air temperature rise within limits specified on the rating plate to prevent reduced life of furnace components. Operation is within a few degrees of the mid-point of rise range when setup switch SW1-4 is OFF.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in overheating the heat exchangers or condensing flue gases in heat exchanger areas not designed for condensate.

Temperature rise must be within limits specified on unit rating plate. Operation is within a few degrees of midpoint of rise range when setup switch SW1-4 is OFF.

When setup switch SW1-4 is ON, operation will be near the high end of the rise range for improved comfort.

Furnace must operate within ranges of temperature rise specified on the furnace rating plate. Determine air temperature rise as follows:

- a. Place thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not see heat exchanger so that radiant heat does not affect readings. This practice is particularly important with straight-run ducts.

- b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine air temperature rise.

NOTE: Temperature rise can be determined for low-heat operation by placing setup switch SW1-2 on furnace control in ON position. For high-heat operation, place setup switch SW1-2 in OFF position and jumper R-W2 on furnace control. DO NOT forget to return setup switch to OFF position and remove R-W2 jumper upon completion of testing.

- c. This furnace is capable of automatically providing proper airflow to maintain the temperature rise within the range specified on furnace rating plate. If temperature rise is outside this range, proceed as follows:
 - (1.) Check gas input for low- and high-heat operation.
 - (2.) Check derate for altitude if applicable.
 - (3.) Check all return and supply ducts for excessive restrictions causing static pressure greater than 0.5-In. W.C..
 - (4.) Ensure Low Heat Rise Adjust switch SW1-3 on furnace control is in ON position when a bypass humidifier is used. (See Fig. 26 for switch location.)
 - (5.) Make sure proper model plug is installed.
- d. Remove thermostat jumpers and release blower access door switch.
- e. Repeat Steps a through c as required to adjust for high heat temperature rise.
- f. When correct high heat input rate and temperature rise is achieved, turn gas valve ON/OFF switch to OFF.
- g. Release blower access door switch.
- h. Remove manometer or similar device from gas valve.
- i. Re-install manifold pressure tap plug in gas valve. (See Fig. 49.)

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Reinstall manifold pressure tap plug in gas valve to prevent gas leak.

- j. Remove thermostat jumper wire from furnace control board.
- k. Turn gas valve ON/OFF switch to ON.

⚠ CAUTION

FURNACE OVERHEATING HAZARD

Failure to follow this caution may result in reduced furnace life.

Recheck temperature rise. It must be within limits specified on the rating plate. Recommended operation is at the mid-point of rise range or slightly above.

- l. Proceed to Step 6, “Set Blower Off Delay” before installing blower access door.

7. Set Blower Off Delay

- a. Remove blower access door if installed.
- b. Turn Dip switch SW-7 or SW-8 ON or OFF for desired blower off delay. (See Table 10 and Fig. 26 and 53.)

8. Set thermostat heat anticipator.

- a. Mechanical thermostat. Set thermostat heat anticipator to match the amp. draw of the electrical components in the R-W/W1 circuit. Accurate amp. draw readings can be obtained at the wires normally connected to thermostat subbase terminals, R and W. The thermostat anticipator should NOT be in the circuit while measuring current.

- (1.) Set SW1-2 switch on furnace control board to ON.
- (2.) Remove thermostat from subbase or from wall.
- (3.) Connect an amp. meter as shown in Fig. 51. across the R and W subbase terminals or R and W wires at wall.
- (4.) Record amp. draw across terminals when furnace is in low heat and after blower starts.
- (5.) Set heat anticipator on thermostat per thermostat instructions and install on subbase or wall.
- (6.) Turn SW1-2 switch OFF.
- (7.) Install blower access door.

- b. Electronic thermostat: Set cycle rate for 3 cycles per hr.

9. Set Airflow for Air Conditioning -Single Stage and High Stage Cooling

The ECM blower can be adjusted for a range of airflow for Low Speed or High Speed cooling. See Table 5-Air Delivery - CFM (With Filter). Depending on the model size, the cooling airflow can be adjusted from 1. tons nominal cooling to 3 ., to 4 or to 6 tons of nominal cooling based on 350 cfm ton.

The cooling airflow is adjusted by turning Setup switches SW2-1, SW2-2 and SW2-3 either ON or OFF. Select the required airflow from Fig. 57. Fig. 57 is based on 350 CFM per ton. For airflow at 400 CFM per ton, turn Setup SW1-5 ON (See Table 10 and Fig. 26 and 53.)

NOTE: 6 ton airflow will truncate at 2200 cfm on applicable models. For a complete explanation of cooling airflow, refer to the section titled “Sequence of Operation.”

- 10. Set Airflow For Continuous Fan/Low Speed Cooling Airflow The ECM blower motor can be adjusted for continuous fan speeds different than heating or cooling fan speed. See Table 5 - Air Delivery - CFM (With Filter). Select the required continuous fan airflow from Fig. 57.

The continuous fan speed is also the fan speed for low speed cooling when furnace is used with a 2-speed cooling unit. Adjust the Continuous Fan CFM to match the airflow required for low speed cooling. Select the required airflow from Fig. 55. For airflow at 400 CFM per ton, turn Setup SW1-5 ON (See Fig. 57.) The airflow selected for low speed cooling will also be the airflow used for continuous fan.

The continuous fan speed can be further adjusted at the thermostat using the “Comfort Fan” select function. Changing the continuous fan speed at the thermostat DOES NOT change the low speed cooling airflow selected at the control board.

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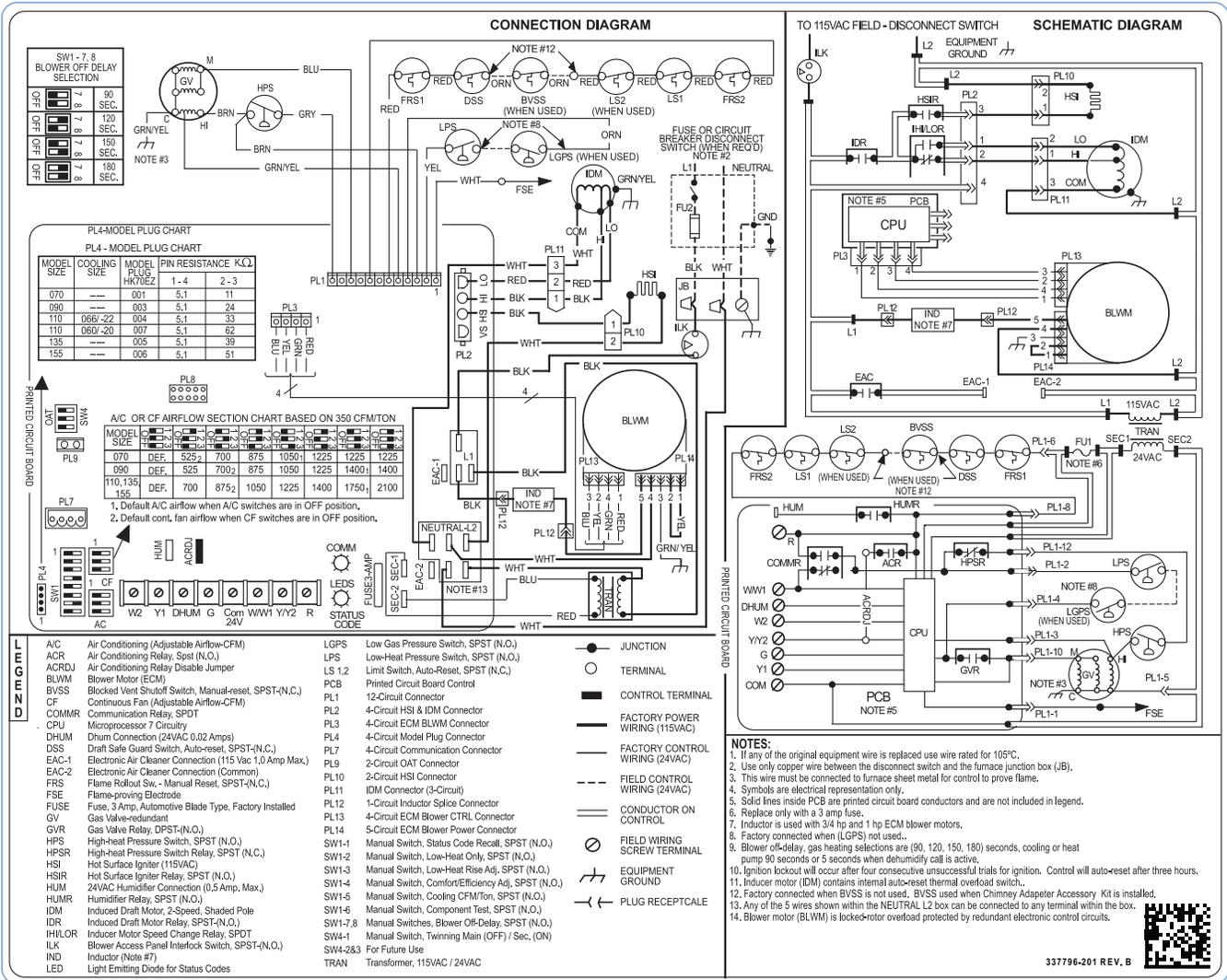


Fig. 53 - Wiring Diagram

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Table 13 – Gas Rate (CU ft./hr)

SECONDS G FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL		
	1 Cu Ft.	2 Cu Ft.	5 Cu Ft.		1 Cu Ft.	2 Cu Ft.	5 Cu Ft.
10	360	720	1800	50	72	144	360
11	327	655	1636	51	71	141	355
12	300	600	1500	52	69	138	346
13	277	555	1385	53	68	136	340
14	257	514	1286	54	67	133	333
15	240	480	1200	55	65	131	327
16	225	450	1125	56	64	129	321
17	212	424	1059	57	63	126	316
18	200	400	1000	58	62	124	310
19	189	379	947	59	61	122	305
20	180	360	900	60	60	120	300
21	171	343	857	62	58	116	290
22	164	327	818	64	56	112	281
23	157	313	783	66	54	109	273
24	150	300	750	68	53	106	265
25	144	288	720	70	51	103	257
26	138	277	692	72	50	100	250
27	133	267	667	74	48	97	243
28	129	257	643	76	47	95	237
29	124	248	621	78	46	92	231
30	120	240	600	80	45	90	225
31	116	232	581	82	44	88	220
32	113	225	563	84	43	86	214
33	109	218	545	86	42	84	209
34	106	212	529	88	41	82	205
35	103	206	514	90	40	80	200
36	100	200	500	92	39	78	196
37	97	195	486	94	38	76	192
38	95	189	474	96	38	75	188
39	92	185	462	98	37	74	184
40	90	180	450	100	36	72	180
41	88	176	439	102	35	71	178
42	86	172	429	104	35	69	173
43	84	167	419	106	34	68	170
44	82	164	409	108	33	67	167
45	80	160	400	110	33	65	164
46	78	157	391	112	32	64	161
47	76	153	383	116	31	62	155
48	75	150	375	120	30	60	150
49	73	147	367				

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Table 14 – Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate
 (Tabulated Data Based on 22,000 Btuh High-Heat/14,500 Btuh for Low-Heat per Burner, Derated 4 Percent for Each 1000 Ft.
 (305 M) Above Sea Level)

ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	0 to 2000 (0 to 610)	900	42	3.5/1.5	42	3.6/1.6	42	3.7/1.6	41	3.5/1.5
		925	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5	42	3.7/1.6
		950	43	3.8/1.7	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5
		975	43	3.6/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4
		1000	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		1025	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		1050	44	3.6/1.6	43	3.2/1.4	43	3.4/1.5	43	3.5/1.5
		1075	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4
		1100	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	2001 to 3000 (610 to 914)	800	42	3.4/1.5	42	3.5/1.5	42	3.6/1.6	42	3.7/1.6
		825	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5
		850	43	3.7/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4
		875	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6	43	3.8/1.7
		900	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6
		925	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5
		950	44	3.4/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4
		975	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		1000	45	3.7/1.6	45	3.8/1.7	44	3.2/1.4	44	3.4/1.5
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	3001 to 4000 (914 to 1219)	775	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5	42	3.5/1.5
		800	43	3.6/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4
		825	43	3.4/1.5	43	3.5/1.5	43	3.7/1.6	43	3.8/1.6
		850	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.6/1.5
		875	44	3.5/1.5	44	3.6/1.6	43	3.3/1.4	43	3.4/1.5
		900	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4
		925	45	3.8/1.6	44	3.2/1.4	44	3.3/1.5	44	3.4/1.5
		950	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	4001 to 5000 (1219 to 1524)	750	43	3.6/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4
		775	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.8/1.6
		800	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5
		825	44	3.4/1.5	44	3.6/1.5	43	3.2/1.4	43	3.3/1.4
		850	44	3.2/1.4	44	3.4/1.5	44	3.5/1.5	44	3.6/1.6
		875	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5
		900	46	3.7/1.6	46	3.8/1.7	45	3.7/1.6	44	3.2/1.4
		925	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7

* Orifice numbers 43 are factory installed

Table 14 - Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate (Con't.)
 (Tabulated Data Based on 22,000 Btuh High-Heat/14,500 Btuh for Low-Heat per Burner, Derated 4 Percent for Each 1000 Ft. Above Sea Level)

ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	5001 to 6000 (1524 to 1829)	725	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6
		750	43	3.2/1.4	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5
		775	44	3.4/1.5	44	3.5/1.5	43	3.2/1.4	43	3.3/1.4
		800	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		825	46	3.8/1.7	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4
		850	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7	45	3.8/1.6
		875	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6
		900	47	3.6/1.6	47	3.8/1.6	46	3.4/1.5	46	3.5/1.5
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	6001 to 7000 (1829 to 2134)	675	43	3.4/1.5	43	3.5/1.5	43	3.6/1.6	43	3.7/1.6
		700	44	3.6/1.6	43	3.3/1.4	43	3.4/1.5	43	3.5/1.5
		725	44	3.4/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4
		750	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5	44	3.5/1.5
		775	46	3.7/1.6	45	3.7/1.6	45	3.8/1.7	44	3.2/1.4
		800	46	3.5/1.5	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6
		825	47	3.7/1.6	46	3.4/1.5	46	3.5/1.5	46	3.6/1.6
		850	47	3.5/1.5	47	3.6/1.6	47	3.8/1.6	46	3.4/1.5
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	7001 to 8000 (2134 to 2438)	650	44	3.6/1.6	43	3.2/1.4	43	3.4/1.5	43	3.5/1.5
		675	44	3.3/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4
		700	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5
		725	46	3.7/1.6	46	3.8/1.7	45	3.7/1.6	44	3.2/1.4
		750	46	3.4/1.5	46	3.6/1.5	46	3.7/1.6	46	3.8/1.6
		775	47	3.6/1.6	47	3.8/1.6	46	3.4/1.5	46	3.6/1.5
		800	47	3.4/1.5	47	3.5/1.5	47	3.7/1.6	47	3.8/1.6
		825	48	3.7/1.6	48	3.8/1.6	47	3.4/1.5	47	3.6/1.5
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	8001 to 9000 (2438 to 2743)	625	44	3.3/1.5	44	3.5/1.5	44	3.6/1.6	43	3.2/1.4
		650	45	3.7/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5
		675	46	3.6/1.6	46	3.8/1.6	45	3.7/1.6	45	3.8/1.7
		700	47	3.8/1.7	46	3.5/1.5	46	3.6/1.6	46	3.7/1.6
		725	47	3.6/1.6	47	3.7/1.6	47	3.8/1.7	46	3.5/1.5
		750	48	3.8/1.7	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6
		775	48	3.6/1.5	48	3.7/1.6	48	3.8/1.7	47	3.5/1.5
USA	9001 to 10,000 (2743 to 3048)	600	45	3.7/1.6	45	3.8/1.7	44	3.3/1.4	44	3.4/1.5
		625	46	3.6/1.6	46	3.7/1.6	46	3.8/1.7	45	3.8/1.6
		650	47	3.8/1.6	46	3.4/1.5	46	3.6/1.5	46	3.7/1.6
		675	47	3.5/1.5	47	3.6/1.6	47	3.7/1.6	46	3.4/1.5
		700	48	3.7/1.6	48	3.8/1.7	47	3.5/1.5	47	3.6/1.6
		725	48	3.5/1.5	48	3.6/1.6	48	3.7/1.6	48	3.8/1.7

* Orifice numbers 43 are factory installed

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Table 15 – Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate
 (Tabulated Data Based on 21,000 Btuh High-Heat/14,500 Btuh for Low-Heat Per Burner, Derated 4 Percent for Each 1000 Ft.
 (305 M) Above Sea level)

ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	0 to 2000 (0 to 610)	900	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6	42	3.5/1.7
		925	43	3.7/1.8	43	3.8/1.8	42	3.2/1.5	42	3.3/1.6
		950	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	43	3.8/1.8
		975	43	3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.7/1.7
		1000	44	3.6/1.7	43	3.3/1.6	43	3.4/1.6	43	3.5/1.7
		1025	44	3.4/1.6	44	3.6/1.7	43	3.2/1.5	43	3.3/1.6
		1050	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	43	3.2/1.5
		1075	45	3.8/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6
		1100	46	3.8/1.8	45	3.7/1.8	44	3.2/1.5	44	3.3/1.6
SPECIFIC GRAVITY OF NATURAL GAS										
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	2001 to 3000 (610 to 914)	800	43	3.8/1.8	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6
		825	43	3.5/1.7	43	3.7/1.7	43	3.8/1.8	42	3.2/1.5
		850	43	3.3/1.6	43	3.5/1.6	43	3.6/1.7	43	3.7/1.8
		875	43	3.2/1.5	43	3.3/1.6	43	3.4/1.6	43	3.5/1.7
		900	44	3.4/1.6	44	3.5/1.7	43	3.2/1.5	43	3.3/1.6
		925	44	3.2/1.5	44	3.3/1.6	44	3.5/1.6	44	3.6/1.7
		950	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6
		975	46	3.7/1.8	46	3.8/1.8	45	3.8/1.8	44	3.2/1.5
		1000	46	3.5/1.7	46	3.6/1.7	46	3.8/1.8	45	3.7/1.8
SPECIFIC GRAVITY OF NATURAL GAS										
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	3001 to 4000 (914 to 1219)	775	43	3.5/1.7	43	3.7/1.7	43	3.8/1.8	42	3.2/1.5
		800	43	3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.7/1.7
		825	44	3.6/1.7	43	3.2/1.5	43	3.3/1.6	43	3.4/1.6
		850	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7	43	3.2/1.5
		875	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7
		900	46	3.8/1.8	45	3.8/1.8	44	3.2/1.5	44	3.3/1.6
		925	46	3.6/1.7	46	3.7/1.8	45	3.7/1.8	45	3.8/1.8
		950	46	3.4/1.6	46	3.5/1.7	46	3.7/1.7	46	3.8/1.8
SPECIFIC GRAVITY OF NATURAL GAS										
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	4001 to 5000 (1219 to 1524)	750	43	3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7
		775	44	3.6/1.7	43	3.2/1.5	43	3.3/1.6	43	3.4/1.6
		800	44	3.3/1.6	44	3.4/1.6	44	3.6/1.7	43	3.2/1.5
		825	45	3.8/1.8	44	3.2/1.5	44	3.4/1.6	44	3.5/1.6
		850	46	3.8/1.8	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6
		875	46	3.5/1.7	46	3.7/1.7	46	3.8/1.8	45	3.7/1.8
		900	47	3.8/1.8	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8
		925	47	3.6/1.7	47	3.7/1.8	47	3.8/1.8	46	3.5/1.7

* Orifice numbers 43 are factory installed

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Table 15 - Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate (Con't.)
 (Tabulated Data Based on 21,000 Btuh High-Heat/14,500 Btuh for Low-Heat Per Burner, Derated 4 Percent for Each 1000 Ft.
 (305 M) Above Sea level)

ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	5001 to 6000 (1524 to 1829)	725	44	3.5/1.7	43	3.2/1.5	43	3.3/1.6	43	3.4/1.6
		750	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	43	3.2/1.5
		775	45	3.7/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6
		800	46	3.7/1.8	46	3.8/1.8	45	3.8/1.8	44	3.2/1.5
		825	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8
		850	47	3.7/1.8	47	3.8/1.8	46	3.5/1.7	46	3.6/1.7
		875	47	3.5/1.7	47	3.6/1.7	47	3.7/1.8	46	3.4/1.6
		900	48	3.8/1.8	47	3.4/1.6	47	3.5/1.7	47	3.7/1.7
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	6001 to 7000 (1829 to 2134)	675	44	3.5/1.7	43	3.2/1.5	43	3.3/1.6	43	3.4/1.6
		700	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	43	3.2/1.5
		725	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6
		750	46	3.6/1.7	46	3.8/1.8	45	3.7/1.8	45	3.8/1.8
		775	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.8/1.8
		800	47	3.6/1.7	47	3.8/1.8	46	3.4/1.6	46	3.5/1.7
		825	47	3.4/1.6	47	3.5/1.7	47	3.6/1.7	47	3.8/1.8
		850	48	3.7/1.7	48	3.8/1.8	47	3.4/1.6	47	3.5/1.7
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	7001 to 8000 (2134 to 2438)	650	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	43	3.2/1.5
		675	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6
		700	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8	45	3.8/1.8
		725	47	3.8/1.8	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8
		750	47	3.5/1.7	47	3.7/1.8	47	3.8/1.8	46	3.5/1.6
		775	48	3.8/1.8	47	3.4/1.6	47	3.6/1.7	47	3.7/1.7
		800	48	3.6/1.7	48	3.7/1.8	48	3.8/1.8	47	3.4/1.6
		825	48	3.3/1.6	48	3.5/1.6	48	3.6/1.7	48	3.7/1.8
ALTITUDE RANGE FT. (M)		AVG. GAS HEAT VALUE AT ALTITUDE (BTUH/CU FT.)	SPECIFIC GRAVITY OF NATURAL GAS							
			0.58		0.60		0.62		0.64	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
USA	8001 to 9000 (2438 to 2743)	625	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6
		650	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8	45	3.8/1.8
		675	47	3.8/1.8	46	3.4/1.6	46	3.5/1.7	46	3.7/1.7
		700	47	3.5/1.7	47	3.6/1.7	47	3.7/1.8	46	3.4/1.6
		725	48	3.7/1.8	48	3.8/1.8	47	3.5/1.7	47	3.6/1.7
		750	48	3.5/1.7	48	3.6/1.7	48	3.7/1.8	48	3.8/1.8
		775	49	3.8/1.8	48	3.4/1.6	48	3.5/1.7	48	3.6/1.7
USA	9001 to 10,000 (2743 to 3048)	600	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8	45	3.7/1.8
		625	47	3.7/1.8	47	3.8/1.8	46	3.5/1.7	46	3.6/1.7
		650	47	3.4/1.6	47	3.6/1.7	47	3.7/1.8	47	3.8/1.8
		675	48	3.6/1.7	48	3.8/1.8	47	3.4/1.6	47	3.5/1.7
		700	48	3.4/1.6	48	3.5/1.7	48	3.6/1.7	48	3.7/1.8
		725	49	3.7/1.8	49	3.8/1.8	48	3.4/1.6	48	3.5/1.7

* Orifice numbers 43 are factory installed

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