INSTALLATION INSTRUCTION

HIGH EFFICIENCY
GAS-FIRED FURNACES
TUBULAR HEAT EXCHANGER SERIES

MODELS: P*UR / G9T-UP / FG9-UP (Upflow)

40 - 140 MBH INPUT

MODELS: P*DH / G9T-DH / FG9-DH (Downflow / Horizontal)

40 - 120 MBH INPUT

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CAUTION: READ ALL SAFETY GUIDES BEFORE YOU START TO INSTALL YOUR FURNACE.

SAVE THIS MANUAL

035-17477-002 Rev. D (1202)

⚠WARNING

IMPROPER INSTALLATION MAY CREATE A CONDITION WHERE THE OPERATION OF THE PRODUCT COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE INJURY OR PROPERTY DAMAGE. REFER TO THIS MANUAL FOR ASSISTANCE OR ADDITIONAL INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

⚠ CAUTION

THIS PRODUCT MUST BE INSTALLED IN STRICT COMPLIANCE WITH THE ENCLOSED INSTALLATION INSTRUCTIONS AND ANY APPLICABLE LOCAL, STATE, AND NATIONAL CODES INCLUDING BUT NOT LIMITED TO, BUILDING, ELECTRICAL AND MECHANICAL CODES.

⚠WARNING

The furnace area must not be used as a broom closet or for any other storage purposes, as a fire hazard bay be created. Never store items such as the following on, near or in contact with the furnace.

1. *Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners or other cleaning tools.*
2. *Soap powders, bleaches, waxes or other cleaning compounds; plastic items or containers; gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids or other volatile fluid.*
3. *Paint thinners and other painting compounds.*
4. *Paper bags, boxes or other paper products*

Never operate the furnace with the blower door removed. To do so could result in serious personal injury and/or equipment damage.

GENERAL INFORMATION

DESCRIPTION

This Category IV, dual certified direct vent and 1-pipe vent furnace is designed for residential or commercial application. It may be installed without modification to the condensate system in a basement, garage, equipment room, alcove, attic or any other indoor location provided the space temperature is 32 °F or higher and where all required clearance to combustibles and other restrictions are met. If the furnace is being installed where the space temperature is below 32°F, refer to “BELOW FREEZING LOCATIONS” on page 4.

This furnace is constructed at the factory for natural gas-fired operation at 0 - 4,500 ft. above sea level, but may be converted to operate on propane (LP) gas and at altitudes up to 10,000 ft. For applications at altitudes between 2,000 - 4,500 ft., see “COMBUSTION AIR AND VENT SYSTEM’ on page 14, for required vent length reductions. For applications at altitudes greater than 4,500 feet, see high altitude instructions 035-14447-000.

High altitude and propane (LP) changes or conversions required in order for the appliance to satisfactory meet the application must be made by an authorized distributor or dealer. In Canada, a certified conversion station or other qualified agency, using factory specified and/or approved parts, must perform the conversion.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill.

A separate request for inspection by the carrier's agent should be made in writing. Also, before installation the unit should be checked for screws or bolts which may have loosened in transit. There are no shipping or spacer brackets which need to be removed.

NOTES, CAUTIONS & WARNINGS

The installer should pay particular attention to the words: NOTE, CAUTION and WARNING. NOTES are intended to clarify or make the installation easier. CAUTIONS are given to prevent equipment damage. WARNINGS are given to alert the installer that personal injury and/or equipment or property damage may occur if installation procedures are not handled properly.

⚠ CAUTION

The cooling coil must be installed in the supply air duct, downstream of the furnace. Cooled air may not be passed over the heat exchanger.

VENT SAFETY CHECK PROCEDURE

⚠ CAUTION

This furnace may not be common vented with any other appliance, since it requires separate, properly-sized air intake and vent lines. The furnace shall not be connected to any type of B, BW or L vent or vent connector, and not connected to any portion of a factory-built or masonry chimney.

If this furnace is replacing a common-vented furnace, it may be necessary to resize the existing vent line and chimney to prevent oversizing problems for the new combination of units. Refer to the National Gas Code (ANSI Z223.1) or CAN/CGA B149.1 or .2 Installation Code (latest editions).

The following steps shall be followed with each appliance connected to the venting system placed in operation, while any other appliances connected to the venting system are not in operation:

1. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1, or the CAN/CGA B149 Installation Codes and these instructions. Determine that there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliance(s) is located and other spaces of the building. Turn on clothes dryers. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so the appliance shall operate continuously.
5. Test for draft hood equipped appliance spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
6. 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 burning appliance to their previous conditions of use.
7. If improper venting is observed during any of the above tests, the venting system must be corrected.
8. Any corrections to the common venting system must be in accordance with the National Fuel Gas Code Z223.1 or CAN/CGA B149.1 or .2 Installation Code (latest editions). If the common vent system must be resized, it should be resized to approach the minimum size as determined using the appropriate tables in Appendix G of the above codes.

SPECIFIC UNIT INFORMATION

LIMITATIONS & LOCATION

This furnace should be installed in accordance with all national and local building/safety codes and requirements, or in the absence of local codes, with the National Fuel Gas Code ANSI Z223.1 or CAN/CGA B149.1 or.2 Installation Code (latest editions), local plumbing or waste water codes, and other applicable codes.

Downflow/horizontal models when installed in a downflow configuration are AGA/CGA listed for application into a manufactured (mobile) home.

Upflow models or horizontal applications are not approved for mobile homes.

CLEARANCES FOR ACCESS

Ample clearances should be provided to permit easy access to the unit. The following minimum clearances are recommended:

1. Twenty-four (24) inches between the front of the furnace and an adjacent wall or another appliance, when access is required for servicing and cleaning.
2. Eighteen (18) inches at the side where access is required for passage to the front when servicing or for inspection or replacement of flue/vent connections.

In all cases, accessibility clearances shall take precedence over clearances for combustible materials where accessibility clearances are greater.

⚠ WARNING

Do not install the furnace in an unconditioned space or garage that could experience ambient temperatures of 32° F (0° C) or lower. For application in below freezing locations, See "BELOW FREEZING LOCATIONS" on page 4.

The furnace is not to be used for temporary heating of buildings or structures under construction.

This unit must be installed in a level (1/4") position side-to-side and front-to-back to provide proper condensate drainage.

Do not allow return air temperature to be below 55°F for extended periods. To do so may cause condensation to occur in the main fired heat exchanger.

Only use natural gas in furnaces designed for natural gas. Only use propane (LP) gas for furnaces that have been properly converted to use propane (LP) gas. Do not use this furnace with butane. Using wrong gas could create a hazard, resulting in damage, injury or death.

⚠ CAUTION

Furnaces shall not be installed directly on carpeting, tile or other combustible material other than wood flooring. An accessory combustible floor base is available to allow direct installation of downflow models on combustible flooring.

Furnace shall be installed so the electrical components are protected from water.

A manufactured (mobile) home installation must conform with the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280, or when this standard is not applicable, the Standard for Manufactured Home Installations (Manufactured Home Sites, Communities and Set-Ups), ANSI A225.1, and/or CAN/CSA-Z240 MH Series, Mobile Homes.

The size of the unit should be based on an acceptable heat loss calculation for the structure. ACCA, Manual J or other approved methods may be used.

Refer to furnace rating plate for the type of gas approved for this furnace - only use those approved gases.

Check the rating plate and power supply to be sure that the electrical characteristics match. All models use nominal 115 VAC, 1 Phase, 60 Hertz power supply.

For installations above 2,000 feet, reduce input 4% for each 1,000 feet above sea level.

For installation between 2000 and 4500 feet, it is not required that the pressure switch be changed, provided the maximum vent/intake pipe lengths are adjusted as shown in the Note from Tables 4, 5 and 7 on Pages 16 & 20. For altitudes above 4,500 feet, refer to instructions 035-14447-000 for correct pressure switch/orifice or other required conversion information.

The furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

A furnace installed in a residential garage shall be located so that all burners and burner ignition devices are located not less that 18" above the garage floor, and located or protected to prevent damage by vehicles.

Allow clearances from combustible materials as listed under Clearances to Combustibles, ensuring that service access is allowed for both the burners and blower.

The furnace shall be located using these guidelines:

1. Where a minimum amount of air intake/vent piping and elbows will be required.
2. As centralized with the air distribution as possible.
3. Where adequate combustion air will be available (particularly when installing as 1-pipe system).
4. In an area where ventilation facilities provide for safe limits of ambient temperature under normal operating conditions. Ambient temperatures must not fall below 32°F (0°C) unless the condensate system is protected from freezing (refer to "BELOW FREEZING LOCATIONS" on page 4).
5. Where it will not interfere with proper air circulation in the confined space.
6. Where the outdoor combustion air/vent terminal will not be blocked or restricted.

CLEARANCES TO COMBUSTIBLES

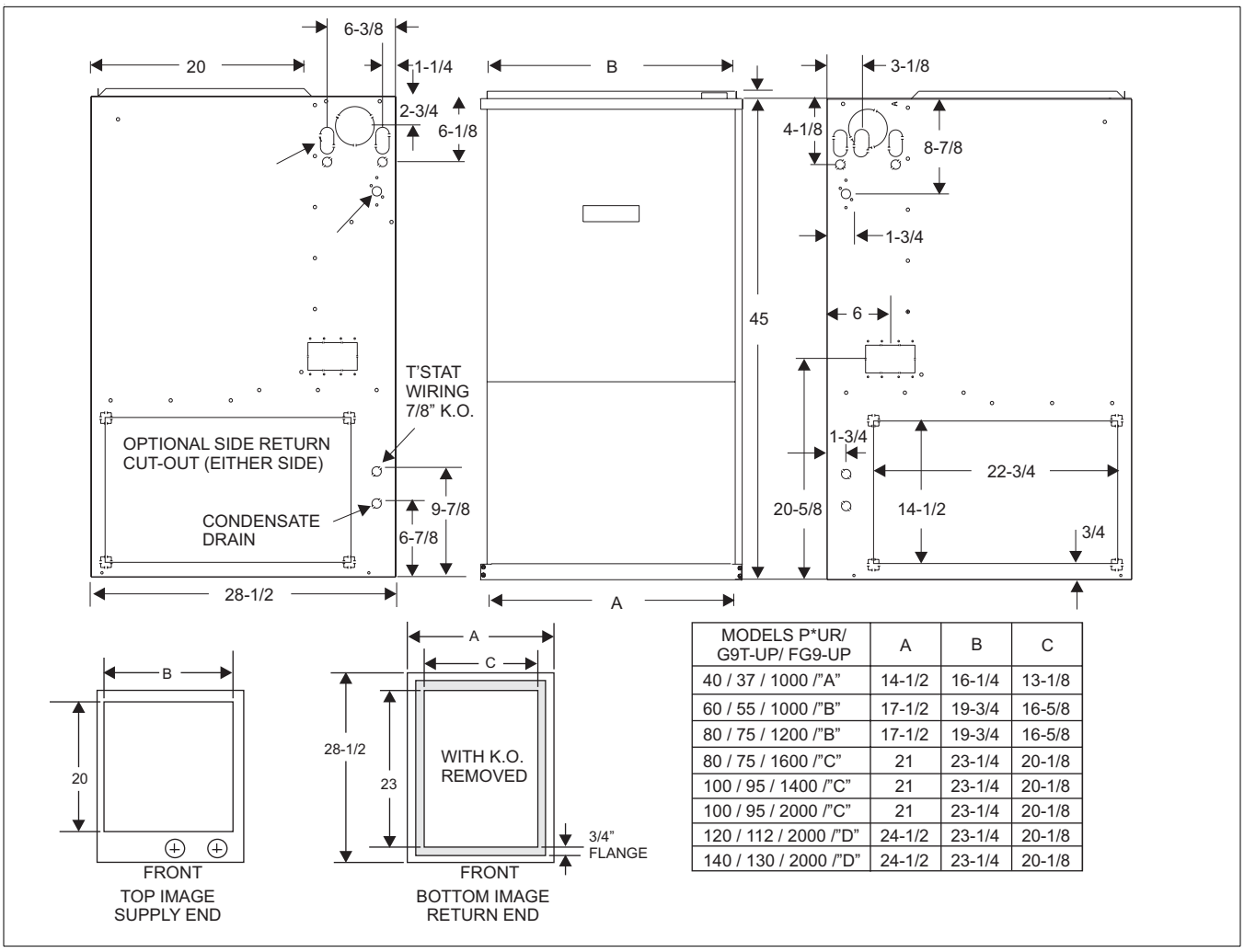
Minimum clearances from combustible construction are shown in Table 3, "UNIT CLEARANCES TO COMBUSTIBLES," on page 7. These minimum clearances must be maintained in the installation.

BELOW FREEZING LOCATIONS

If this furnace is installed in any area where the ambient temperature may drop below 32° F, a UL listed self regulated heat tape must be installed on any condensate drain lines. It is recommended that self regulating heat tape rated at 3 watts per foot be used. This must be installed around the condensate drain lines in the unconditioned space. Always install the heat tape per the manufacturer's instructions. Cover the self-regulating heat tape with fiberglass or other heat resistant, insulating material.

⚠ CAUTION

If this unit is installed in an unconditioned space and an extended power failure occurs, there will be potential damage to the condensate trap, drain lines and internal unit components. Following a power failure situation, **Do Not Operate the Unit Until Inspection and Repair Are Performed.**



MODELS P*UR/ G9T-UP/ FG9-UP	A	B	C
40 / 37 / 1000 /"A"	14-1/2	16-1/4	13-1/8
60 / 55 / 1000 /"B"	17-1/2	19-3/4	16-5/8
80 / 75 / 1200 /"B"	17-1/2	19-3/4	16-5/8
80 / 75 / 1600 /"C"	21	23-1/4	20-1/8
100 / 95 / 1400 /"C"	21	23-1/4	20-1/8
100 / 95 / 2000 /"C"	21	23-1/4	20-1/8
120 / 112 / 2000 /"D"	24-1/2	23-1/4	20-1/8
140 / 130 / 2000 /"D"	24-1/2	23-1/4	20-1/8

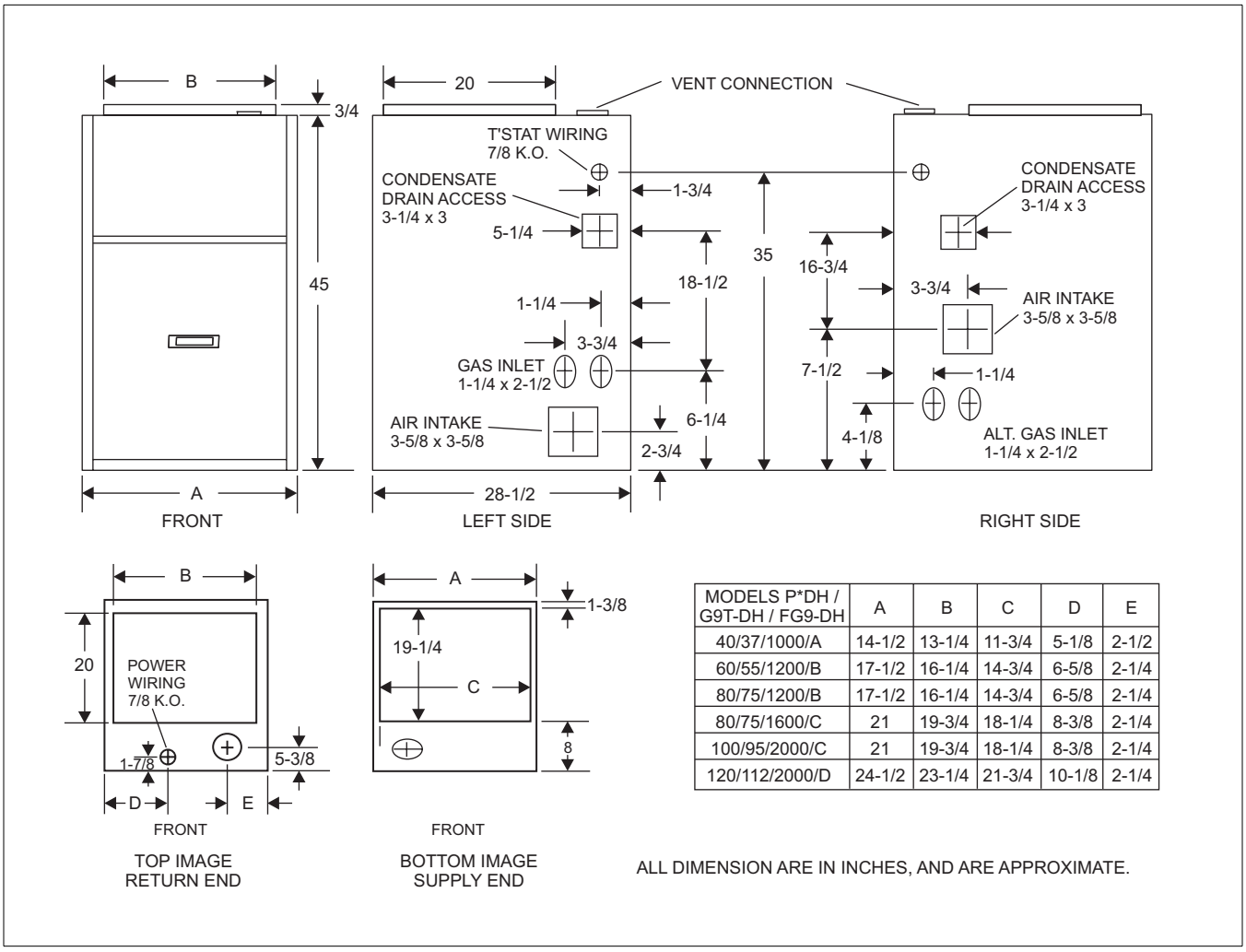
FIGURE 1 : DIMENSIONS - UPFLOW MODELS: P*UR/G9T-UP/FG9-UP

Table 1: RATINGS & PHYSICAL / ELECTRICAL DATA - UPFLOW MODELS

MODELS P*UR / G9T-UP / FG9-UP			CABINET WIDTH	AFUE*	AIR TEMP RISE °F	MAX. OUTLET AIR TEMP. °F	BLOWER			TOTAL UNIT AMPS	MAX OVER-CURRENT PROTECT†	MIN WIRE SIZE (AWG) @ 75 FT. ONE WAY†
INPUT MBH	OUTPUT MBH	NOM. CFM					HP	AMPS	SIZE (IN.)			
40	37	1000	14-1/2	92.4	35 - 65	165	1/3	6.2	10 x 6	9.0	20	14
60	55	1000	17-1/2	92.2	45 - 75	175	1/3	6.2	10 x 6	9.0	20	14
80	74	1200	17-1/2	92.0	35 - 65	165	1/2	7.0	11 x 8	12.0	20	14
80	76	1600	21	94.3	30 - 60	160	3/4	11.5	11 x 8	12.0	20	14
100	93	1400	21	92.2	45 - 75	175	1/2	10.7	10 x 10	12.0	20	14
100	94	2000	21	93.0	30 - 60	160	1	12.2	11 x 10	14.0	20	12
120	111	2000	24-1/2	92.0	45 - 75	175	1	12.2	11 x 10	14.0	20	12
140	130	2000	24-1/2	92.0	45 - 75	175	1	12.2	11 x 10	14.0	20	12

*. AFUE numbers are determined in accordance with DOE test procedures

†. Wire size and overcurrent protection must comply with the National Electrical Code (NFPA-70-latest edition).
For altitudes above 2,000 ft., reduce capacity 4% for each 1,000 ft. above sea level. Refer to instruction 035-14460-000.
Wire size based on copper conductors, 60°C, 3% voltage drop.
Continuous return air temperature must not be below 55°F.



MODELS P*DH / G9T-DH / FG9-DH	A	B	C	D	E
40/37/1000/A	14-1/2	13-1/4	11-3/4	5-1/8	2-1/2
60/55/1200/B	17-1/2	16-1/4	14-3/4	6-5/8	2-1/4
80/75/1200/B	17-1/2	16-1/4	14-3/4	6-5/8	2-1/4
80/75/1600/C	21	19-3/4	18-1/4	8-3/8	2-1/4
100/95/2000/C	21	19-3/4	18-1/4	8-3/8	2-1/4
120/112/2000/D	24-1/2	23-1/4	21-3/4	10-1/8	2-1/4

FIGURE 2 : DIMENSIONS - DOWNFLOW/HORIZONTAL MODELS: P*DH/G9T-DH/FG9-DH

Table 2: RATINGS & PHYSICAL / ELECTRICAL DATA - DOWNFLOW/HORIZONTAL MODELS

MODELS P*DH/ FG9-DH/G9T—DH			CABINET WIDTH	AFUE*	AIR TEMP RISE °F	MAX. OUTLET AIR TEMP. °F	BLOWER			TOTAL UNIT AMPS	MAX OVER-CURRENT PROTECT†	MIN WIRE SIZE (AWG) @ 75FT. ONE WAY†
INPUT MBH	OUTPUT MBH	NOM. CFM					HP	AMPS	SIZE (IN)			
40	37	1000	14-1/2	91.0	25 - 55	155	1/3	6.2	10 x 6	9.0	20	14
60	55	1200	17-1/2	91.0	35 - 65	165	1/2	7.0	11 x 8	12.0	20	14
80	73	1200	17-1/2	91.0	35 - 65	165	1/2	7.0	11 x 8	12.0	20	14
80	75	1600	21	91.0	30 - 60	160	3/4	11.5	11 x 8	12.0	20	14
100	93	2000	21	91.0	40 - 70	170	1	12.2	11 x 10	14.0	20	12
120	111	2000	24-1/2	91.0	40 - 70	170	1	12.2	11 x 10	14.0	20	12

*. AFUE numbers are determined in accordance with DOE test procedures

†. Wire size and overcurrent protection must comply with the National Electrical Code (NFPA-70-latest edition).
For altitudes above 2,000 ft., reduce capacity 4% for each 1,000 ft. above sea level. Refer to instruction 035-14460-000.
Wire size based on copper conductors, 60°C, 3% voltage drop.
Continuous return air temperature must not be below 55°F.

Table 3: UNIT CLEARANCES TO COMBUSTIBLES

APPLICATION	TOP	FRONT	REAR	LEFT SIDE	RIGHT SIDE	FLUE	FLOOR/ BOTTOM	CLOSET	ALCOVE	ATTIC	LINE CON-TACT
UPFLOW MODELS (P*UR / G9T-UP / FG9-UP)											
UPFLOW	1	3	0	0	0	0	COMBUSTIBLE	YES	YES	YES	NO
DOWNFLOW / HORIZONTAL MODELS (P*DH / G9T-DH / FG9-DH)											
DOWNFLOW	1	3	0	0	0	0	1" *	YES	YES	YES	NO
HORIZONTAL	1	3	0	0†	0†	0	1”	NO	YES	YES	YES‡

*. Special floor base or air conditioning coil required for use on combustible floor.

†. Minimum of 8” clearance required to install condensate removal system.

‡. Line contact only permitted between lines formed by the intersection of the rear panel and side panel (top in horizontal position) of the furnace jacket and building joists, studs or framing.

DUCTWORK

The duct system's design and installation must:

1. Handle an air volume appropriate for the served space and within the operating parameters of the furnace specifications.
2. Be installed in accordance with standards of NFPA (National Fire Protection Association) as outlined in NFPA pamphlets 90A and 90B (latest editions) or applicable national, provincial, local fire and safety codes.
3. Create a closed duct system. The supply duct system must be connected to the furnace outlet and the return duct system must be connected to the furnace inlet. Both supply and return duct systems must terminate outside the space containing the furnace.
4. Complete a path for heated or cooled air to circulate through the air conditioning and heating equipment and to and from the conditioned space.

⚠ CAUTION

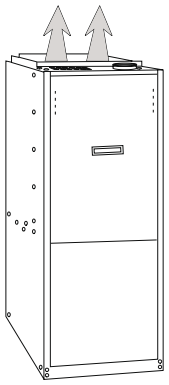
The cooling coil must be installed in the supply air duct downstream of the furnace. Cooled air must not be passed over the heat exchanger.

When the furnace is used in conjunction with a cooling coil, the coil must be installed parallel with, or in the supply air side of the furnace to avoid condensation in the primary heat exchanger.

When a parallel flow arrangement is used, the dampers or other means used to control air flow must be adequate to prevent chilled air from entering the furnace, and if manually operated, must be equipped with means to prevent operating of either unit unless the damper is in the full heat or cool position.

UPFLOW MODELS

SUPPLY PLENUM CONNECTION



Attach the supply plenum to the furnace outlet duct connection flanges. This is typically through the use of S cleat material when a metal plenum is used. The use of an approved flexible duct connector is recommended on all installations. This connection should be sealed to prevent air leakage.

If a matching cooling coil is used, it may be placed directly on the furnace outlet and sealed to prevent leakage. Follow the coil instructions for installing the supply plenum.

On all installations without a coil, a removable access panel is recommended in the outlet duct such that smoke or reflected light would be observable inside the casing to indicate the presence of leaks in the heat exchanger. This access cover shall be attached in such a manner as to prevent leaks.

RETURN DUCT CONNECTION

Return air may enter the furnace through the side(s) or bottom depending on the type of application. **Return air may not be connected into the rear panel of the unit.** Refer to the "Filter Installation" section of this instruction for the type of application desired for specific installation details.

NOTE: In order to achieve the airflow indicated in the table, it is recommended those applications over 1800 CFM use return air from two sides, one side and the bottom or bottom only. For single return application, see data and notes on blower performance data tables in this manual.

FILTER INSTALLATION - UPFLOW

All applications require the use of a filter. A high velocity filter and retainer are provided for field installation on P*UR & G9T-UP models. FG9-UP models must have a field-supplied filter and mounting hardware.

Internal Installation

1. Select desired filter position (left/right side, and/or bottom). Remove the corresponding cabinet cut-outs per instructions provided.
2. Install snap-in retainer clips into the corresponding slots from the outside rear of the cabinet (Refer to Figure 3.) To prevent cabinet air leaks, install snap-in plugs (provided) into the unused slots at the outside rear of the cabinet.

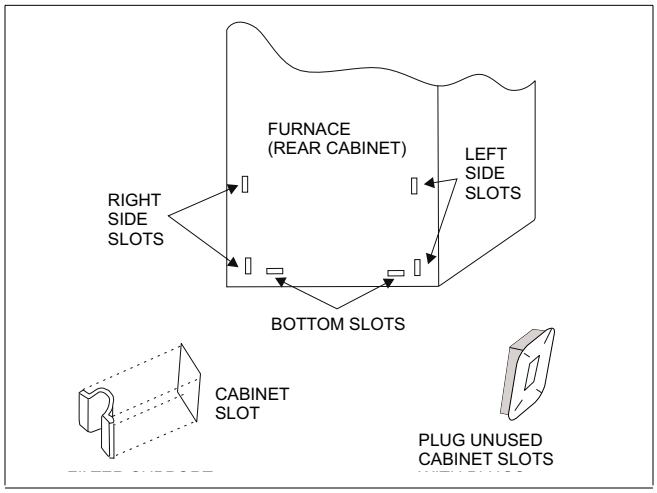


FIGURE 3 : Furnace Filter Slot Locations

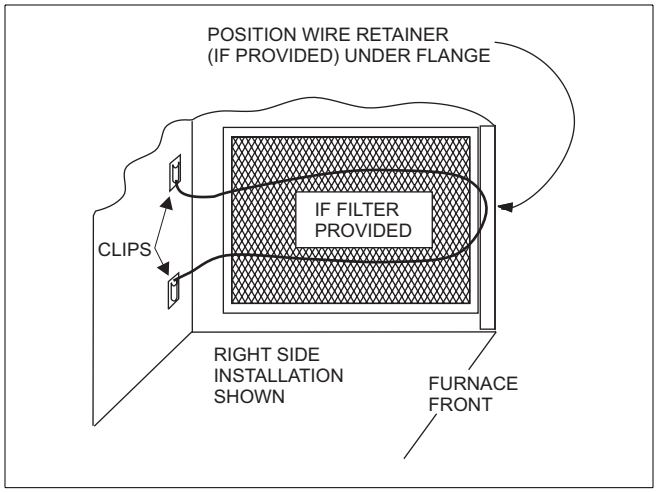


FIGURE 4 : Filter Retainer Placement

3. Install the wire retainer inside the cabinet (if provided). Insert the open ends of the wire retainer into the clip loops at the rear of the blower compartment. The retainer wire should pivot freely like a hinge, on the clips at the rear of the cabinet. (Refer to Figure 4).
4. Install the filter(s) if provided. Cut filter if necessary to match air opening in cabinet. Filter should extend beyond opening edge as much as possible to prevent air from bypassing the filter. DO NOT remove stiffening rods from inside the filter. Shorten the rods, if necessary, to match final filter size.
5. Position the filter between the wire retainer and the cabinet wall (or floor) so it completely covers the cabinet air opening and secure the filter in place at the front of the cabinet by fastening the closed (looped) end of the retainer wire under the flanged edge of the cabinet. When properly installed the filter should fit flush with all four sides of the cabinet wall.

NOTE: Air velocity through throw-away type filters may not exceed 300 feet per minute. All velocities over this require the use of high velocity filters.

Side Return - External Filter

Locate and knock out the square corner locators. These indicate the size of the cutout to be made in the furnace side panel. Refer to Figure 5.

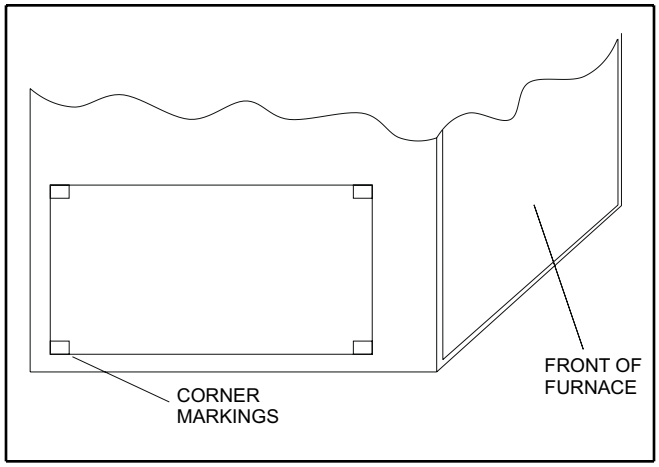


FIGURE 5 : Side Return Cutout Markings

Install the side filter rack following the instructions provided with that accessory. If a filter(s) is provided at another location in the return air system, the ductwork may be directly attached to the furnace side panel.

An accessory filter rack (1SR0302BK) is available for mounting the filter external to the cabinet.

NOTE: Some accessories such as electronic air cleaners and pleated media may require a larger side opening. Follow the instructions supplied with that accessory for side opening requirements.

⚠ CAUTION

All installations must have a filter installed.

The return duct may be attached to the furnace by S-cleat, bend tabs or other approved methods. Be sure to seal the duct to the furnace to prevent air leakage.

Where the return duct system is not complete, the return connection must run full size to a location outside the utility room or basement. For further details, consult Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1, or CAN/CGA B149.1 or .2, Installation Code - latest editions.

Bottom Return

Bottom return applications normally pull return air through a base platform or return air plenum. Be sure the return platform structure is suitable to support the weight of the furnace. Refer to Figure 1 on Page 5, for unit dimensions. Be sure to seal the furnace to plenum connection to prevent air leakage.

The bottom panel is equipped with a perforated opening for easy removal. Tabs must be cut with sheet metal snips to allow removing knock-out. Scribe marks are included for forming flanges for attachment of the return air ductwork.

NOTE: If an external mounted filter rack is being used, see the instructions provided with that accessory for proper hole cut size.

Upflow attic installations must meet all minimum clearances to combustibles and have floor support with required service accessibility.

DOWNFLOW/HORIZONTAL MODELS

COOLING COIL TRANSITION

These furnace models are equipped with perforations in the supply air wrapper flanges that allow for easy application of an air conditioning coil to the furnace without the use of sheet metal transition pieces. These perforations can be bent in either direction depending on the type of application - either downflow or horizontal left and right. Refer to either the "Downflow Application" or "Horizontal Application" section below for specific instructions on how to install the coil.

Downflow Installations

For installation of an air conditioning coil in a downflow application, the perforations in the wrapper flanges must be bent in towards the heat exchanger to allow for the coil duct flange to recess into the furnace. Refer to the installation instructions supplied with the air conditioning coil for additional information and completion of the coil installation.

NOTE: Duct pliers or other suitable tool can be used to bend perforations. To help bend flanges in a straight line, scribe a line between the perforations prior to bending.

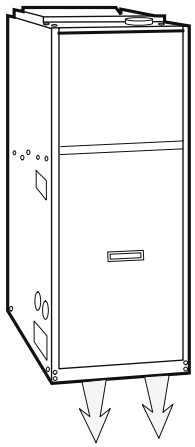
Horizontal Installations

For installation of an air conditioning coil in a horizontal application, the perforations in the wrapper flanges must be bent away from the heat exchanger to create duct flanges so the air conditioning coil can be properly seated on the furnace. Refer to the installation instructions supplied with the air conditioning coil for additional information and completion of the coil installation.

NOTE: Duct pliers or other suitable tool can be used to bend perforations. To help bend flanges in a straight line, scribe a line between the perforations prior to bending.

DOWNFLOW APPLICATION

DOWNFLOW FILTERS



All applications require the use of a filter. A high velocity filter and rack are provided for field installation on P*DH & G9T-DH models. FG9-DH models must have a field-supplied filter and filter rack.

Downflow furnaces typically are installed with the filters located above the furnace, extending into the return air duct.

Any branch duct must attach to the vertical ductwork above the filter height (FH) and for proper installation refer to Figure 6 .

The filter rack should be secured to the center of the front and rear flanges at the furnace top. Drill a hole through the front and rear duct flange into the filter rack and secure it with a sheet metal screw.

NOTE: For easier filter access in a downflow configuration, a removable access panel is recommended in the vertical run of the return air duct immediately above the furnace.

Refer to the unit rating plate for furnace model then see the dimensions page of this instruction for return air plenum dimensions. Install the plenum following instructions under “DUCTWORK” on page 7, in this instruction.

SUPPLY AIR DUCTS

Installations on combustible material or floors must use a combustible floor base (shown in Figure 7 - 1CB0314, 17, 21 & 24) as specified on the rating plate. Follow the instructions supplied with the combustible floor base accessory.

This base can be replaced with a matching cooling coil, properly sealed to prevent leaks. Follow the cooling coil instructions for installing the plenum.

All downflow application supply duct systems must be designed and installed in accordance with the standards of NFPA 90A and 90B, and/or all local codes.

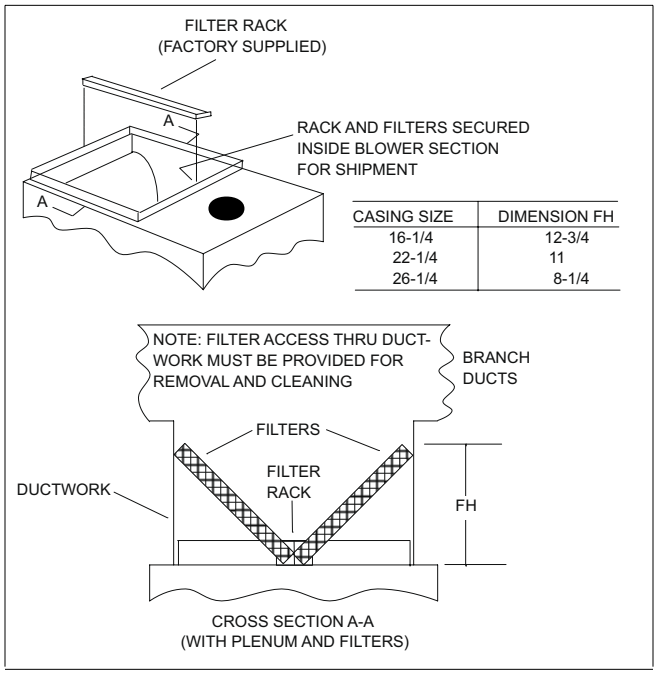


FIGURE 6 : downflow filters

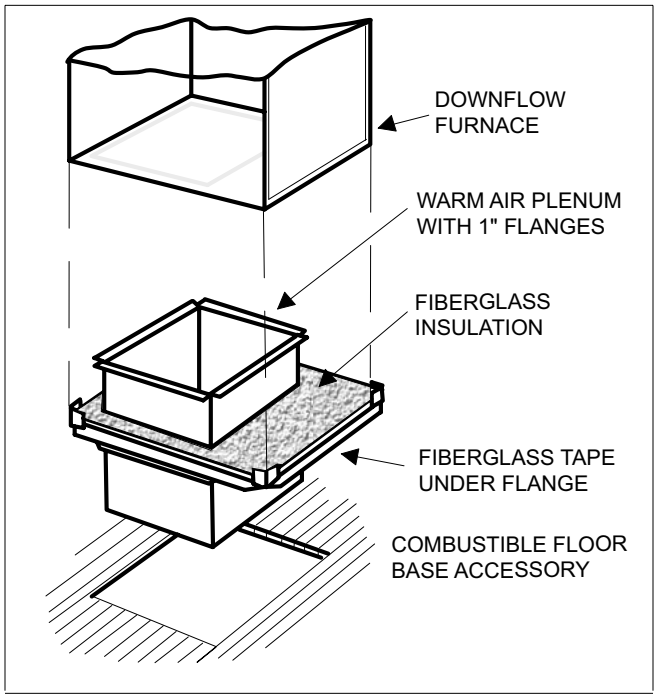
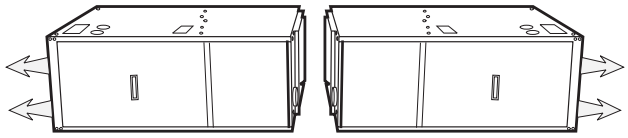


FIGURE 7 : Combustible Floor Base Accessory

DOWNFLOW/HORIZONTAL MODELS

HORIZONTAL APPLICATION



Downflow furnaces may be installed horizontally with the supply airflow toward the left or right by laying the unit on the left or right side panel.

⚠ CAUTION

Do not install the unit on the rear panel.

After determining the best orientation, lay the unit on top of the shipping carton to protect the finish. The appropriate electrical knock-outs for power wiring, control wiring and gas piping should be removed at this time.

For horizontal application, return air must enter through the end only. **Return air may not be connected into the rear or side panels of the unit.**

HORIZONTAL FILTERS

All filters and mounting provision must be field supplied. Filters(s) may be located in the duct system external to the furnace or in a return filter grille(s). Refer to furnace accessories on Page 31 for external filter kit options.

ATTIC INSTALLATION

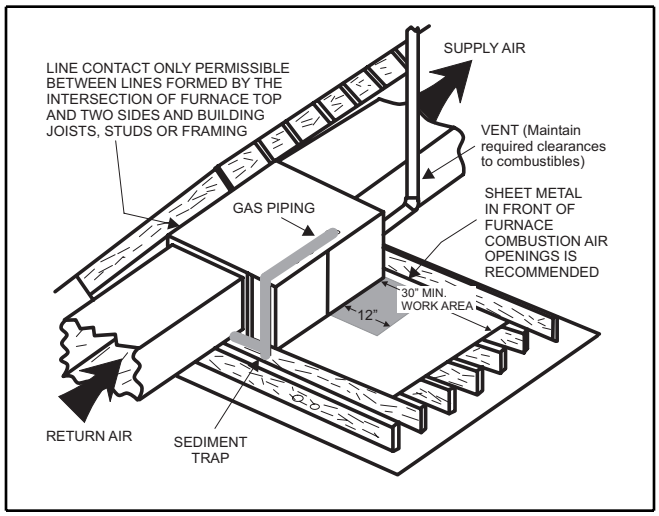


FIGURE 8 : typical attic installation

This appliance is design certified for line contact for furnaces installed horizontally. The intersection of the furnace top and sides form a line. This line may be in contact with combustible material. Refer to the "SPECIFIC UNIT INFORMATION" section of this manual for further information on installation location and limitations.

⚠ CAUTION

If this furnace is installed over a finished space, a condensate safety pan must be installed.

⚠ WARNING

When a furnace is installed in an attic or other insulated space, keep all insulating materials at least 12" away from furnace and burner combustion air openings.

Secure a platform constructed of plywood or other building material to the floor joists.

NOTE: In either a horizontal left or right installation, a minimum of 8" clearance is required beneath the furnace to allow for the installation of the condensate trap and drain pipe. Refer to "CONDENSATE PIPING" section of this manual for more information.

NOTE: See crawl space installation for suspending the furnace in attic installations.

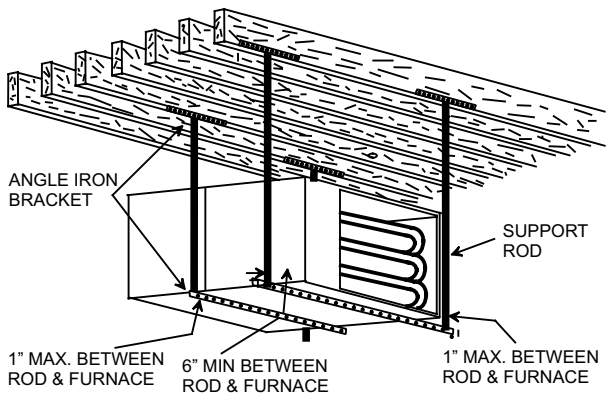


FIGURE 9 : Typical Furnace Installation Using Suspension Materials

CRAWL SPACE INSTALLATION

The furnace can be hung from floor hoists or installed on suitable blocks or pad. Blocks or pad installations shall provide adequate height to ensure the unit will not be subject to water damage.

When suspending the furnace from rafters or floor joists using rod, pipe or straps, refer to the Physical and Rating Data Table for downflow/horizontal furnace weights to determine suitable means of suspension.

Angle supports should be placed at the supply air end and near the blower deck (Refer to Figure 9). **Do not support at return air end of unit.**

Units may also be suspended by using straps or other material at the same location. All four suspension points must be level to ensure quiet furnace operation.

⚠ CAUTION

In any application where temperatures below freezing are possible, see "BELOW FREEZING LOCATIONS" on page 4

GAS PIPING

The gas supply should be a separate line and must be installed in accordance with the National Fuel Gas Code, ANSI Z223.1 (latest edition), or the CAN/CGA B149.1 or .2 Installation Codes (latest edition) and all applicable local and utility requirements.

Some utility companies or local codes require pipe sizes larger than the minimum sizes listed in these instructions and in the codes. Properly sized wrought iron, approved flexible or steel pipe must be used when making gas connections to the unit. The installation of a drop leg and ground union is required (refer to Figure 10).

Gas piping may be connected from either side of the furnace using any of the gas pipe entry knockouts on both sides of the furnace (refer to Figures 1 or 2 for locations and dimensions).

NOTE: Plan your combustion air piping before determining the correct gas pipe entry. Use 90 degree service elbow(s), or short nipples and conventional 90 degree elbow(s) to enter through the cabinet access holes.

⚠ WARNING

An overpressure protection device, such as a pressure regulator, which conforms to the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CAN-B149.1 or.2 (Canada) and acts to limit the downstream pressure to a value that does not exceed 0.5 PSI (14" w.c.), must be installed in the gas piping system upstream of the furnace. Failure to do so may result in a fire or explosion or cause damage to the furnace or some of its components.

INLET GAS PRESSURE RANGE		
	Natural Gas	Propane (LP)
Minimum	4.5 In. W.C.	11 In. W.C.
Maximum	13.9 In. W.C.	13.9 In. W.C.

NOTE: *An accessible manual shutoff valve must be installed upstream of the furnace gas controls and within 6 feet of the furnace.*

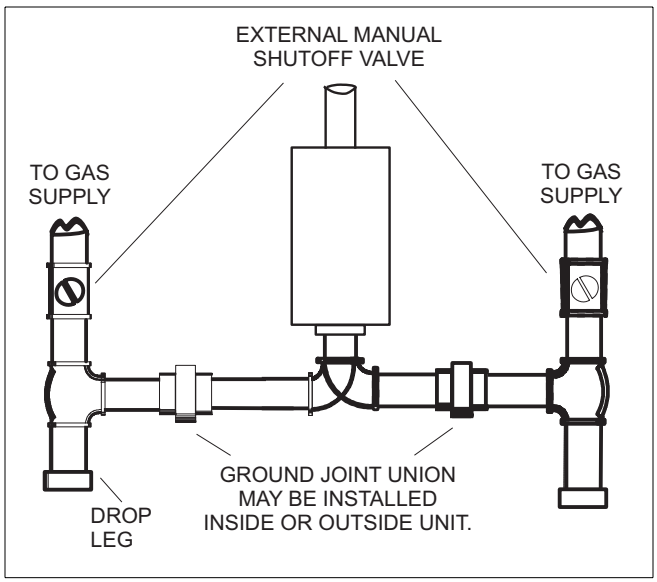


FIGURE 10 : Gas Piping

NOTE: A 1/8" NPT plug is included in the inlet side of the gas valve for measuring incoming gas pressure.

The furnace must be isolated from the gas supply piping system by closing its individual external manual shutoff valve during any pressure testing of the gas supply piping system at pressures equal to or less than 1/2 psig (3.48 kPa).

The furnace and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.48 kPa).

⚠ CAUTION

Compounds used on threaded joints of gas piping must be resistant to the action of liquefied petroleum gases. After connections are made, leak-test all pipe connections.

After all gas piping connections are completed, leak test all joints, fittings and furnace connections with rich soap and water solution, commercially available bubble type leak detection fluid, or other approved means.

Do not use an open flame or other source of ignition for leak testing.

⚠ CAUTION

Never apply a pipe wrench to the body of the combination automatic gas valve. A wrench must be placed on the projection or wrench boss of the valve when installing piping to it.

ELECTRICAL POWER CONNECTION

Field wiring to the unit must conform to and be grounded in accordance with the provisions of the National Electrical Code ANSI/NFPA No. 70-latest edition, Canadian Electric Code C22.1 Part 1 - (latest edition) and/or local codes. Electric wires which are field installed shall conform with the temperature limitation for 63°F/35°C rise wire when installed in accordance with instructions. Refer the rating plate or Physical and Rating Data Tables in these instructions for specific furnace electrical data.

Provide a power supply separate from all other circuits. Install overcurrent protection and disconnect switch per local/ national electrical codes. The switch should be close to the unit for convenience in servicing. With the disconnect switch in the OFF position, check all wiring against the unit wiring label. Also, see the wiring diagram in this instruction.

NOTE: The furnace's control system depends on correct polarity of the power supply and a proper ground connection. Refer to the "FURNACE CONTROL DIAGNOSTICS" on page 36 for symptoms of reversed power supply polarity.

⚠ CAUTION

Use copper conductors only.

Connect the power supply as shown on the unit wiring label on the inside of the blower compartment door. The black furnace lead must be connected to the L1 (hot) wire from the power supply. The white furnace lead must be connected to neutral. Also, the green equipment ground wire must be connected to the power supply ground.

Remove the screws retaining the wiring box cover. Route the power wiring through the opening in the unit into the junction box with a conduit connector or other proper connection. Make wiring connections and replace the wiring box cover and screws. Refer to Figures 11or 12.

An alternate wiring method is to use a field provided 2 x 4 box and cover on the outside of the furnace. Route the furnace leads into the box using a protective bushing where the wires pass through the furnace pane.

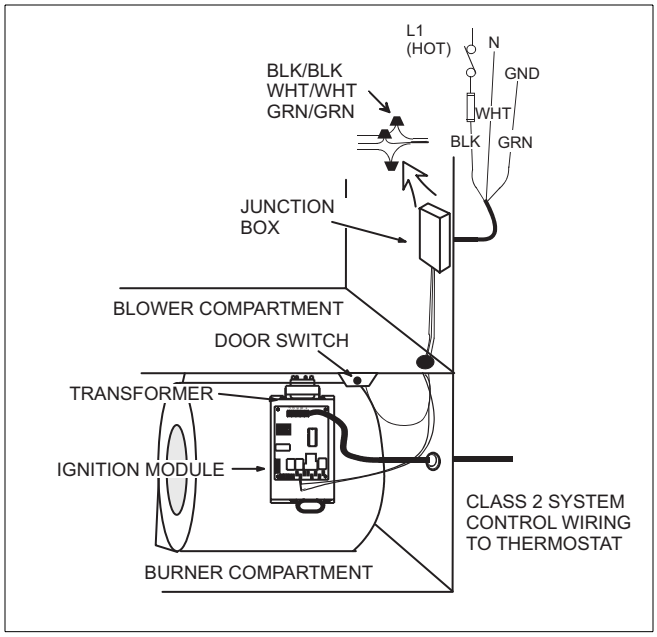


FIGURE 11 : Electrical Wiring - Upflow Models

NOTE: The power connection leads and wiring box on upflow units may be relocated to the left side of the furnace. Remove the screws and cut wire tie holding excess wiring. Reposition on the left side of the furnace and fasten using holes provided.

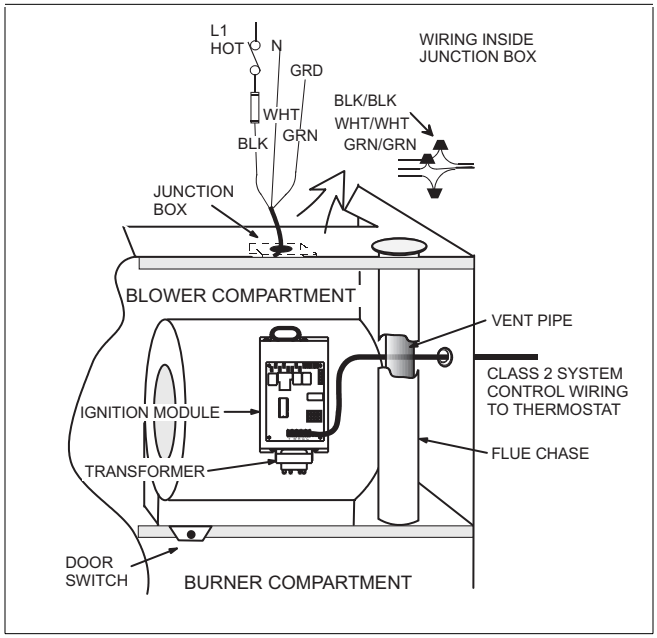


FIGURE 12 : Electrical Wiring - Downflow / Horizontal Models

ELECTRICAL CONTROL CONNECTIONS

Install the field-supplied thermostat. The thermostat instructions for wiring are packed with the thermostat. With the thermostat set in the OFF position and the main electrical source disconnected, complete the low-voltage wiring from the thermostat to the terminal board on the ignition module. Connect Class 2 control wiring as shown in Figure 14. Electronic thermostats may require a common connection as shown dashed in Figure 14.

Apply strain relief to thermostat wires passing through cabinet.

Set the heat anticipator in the room thermostat to .45 amps. Setting it lower will cause short cycles. Setting it higher will cause the room temperature to exceed the setpoints

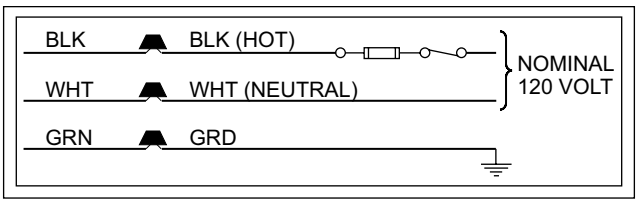


FIGURE 13 : Power Wiring Connections

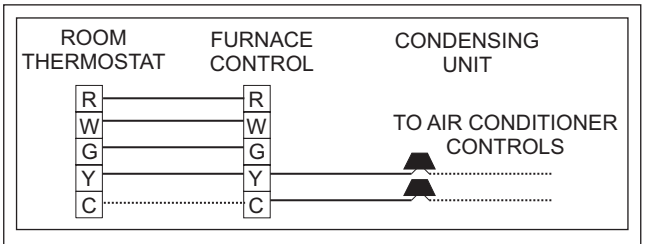


FIGURE 14 : Typical Heating and Cooling

NOTE: Some electronic thermostats do not have adjustable heat anticipators. They may have other type cycle rate adjustments. Follow the thermostat manufacturer's instructions.

The 24-volt, 40 VA transformer is sized for the furnace components only, and should not be connected to power auxiliary devices such as humidifiers, air cleaners, etc. The transformer may provide power for an air conditioning unit contactor.

ACCESSORY CONNECTIONS

The furnace control will allow power switching control of various accessories. Refer to Figure 15, for connection details.

ELECTRONIC AIR CLEANER CONNECTION

Two 1/4" spade terminals (EAC and EAC N) for electronic air cleaner connections are located on the control board. The terminals provide 115 VAC (1.0 amp maximum) during circulating blower operation.

HUMIDIFIER CONNECTION

Two 1/4" spade terminals (HUM and HUM N) for humidifier connections are located on the control board. The terminals provide 115 VAC (1.0 amp maximum) during heating system operation.

TWINNING

When two furnaces are installed using the same duct system, it is very important that the two furnace circulating air blowers operate simultaneously. If one blower starts before the second blower, the duct system will become pressurized with air and the second blower will be made to turn backwards. During heating operation, this will cause overheating of the second furnace, possibly causing an unsafe condition and damage to the furnace. If twinning of two furnaces is desired, it is necessary to use the accessory twinning kit that is designed for use with these furnaces.

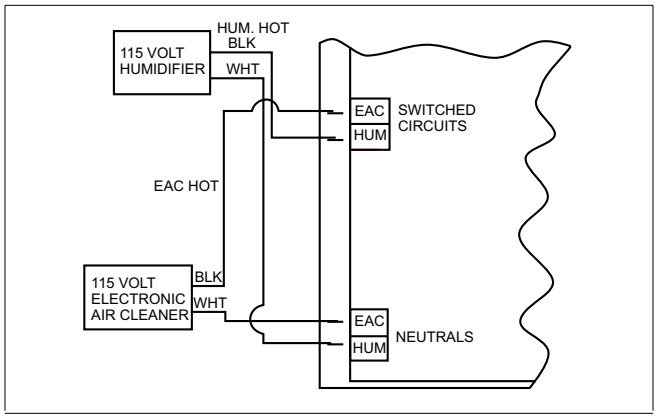


FIGURE 15 : Accessory Connections

COMBUSTION AIR AND VENT SYSTEM

This furnace is certified to be installed with one of three possible intake/vent configurations.

1. Two-pipe with a sealed combustion intake/vent system using outdoor combustion air.
2. Single pipe vent system using combustion air from the area surrounding the furnace.
3. Two-pipe intake/vent system using combustion air from a ventilated attic space and a vent pipe to the outside.

Be sure to follow the appropriate venting section details, related information and limitations for your type of installation.

Furnace Intake / Vent Connection Size (All Models)		
	40 - 100 MBH	120 - 140 MBH
Intake	2”	3"
Vent	2”	2"*

*. Vent must be increased to 3" on this model.

Note 1: Any vent pipe size change must be made outside furnace casing in a vertical pipe section to allow proper drainage of condensate.

Note 2: An offset using two 45 degree elbows will be required for plenum clearance when the vent is increased to 3”.

METHOD ONE: TWO PIPE SEALED COMBUSTION AIR & VENT SYSTEM

COMBUSTION AIR INTAKE/VENT CONNECTIONS

This type installation requires outdoor combustion air. Two separate, properly-sized pipes must be used. One bringing air from the outdoors to the furnace combustion air intake collar on the burner box, and a second pipe from the furnace vent connection (top right of unit) back to the outdoors.Figure 16 or 17.

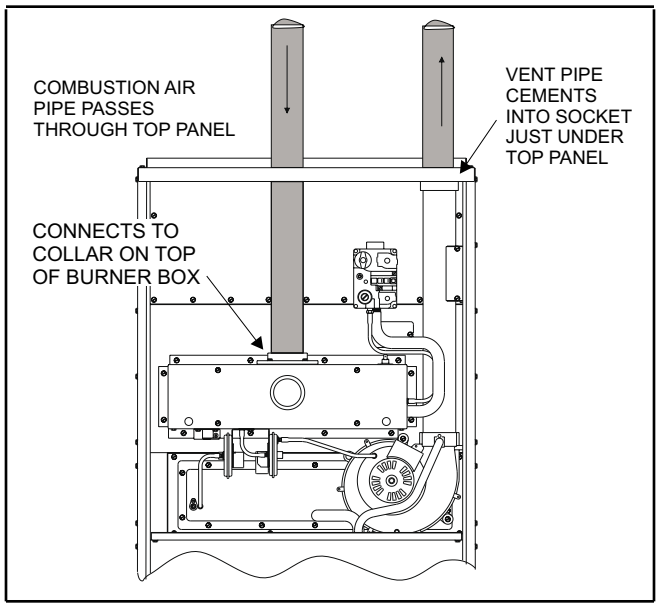


FIGURE 16 : Air Intake and Vent Locations - Upflow

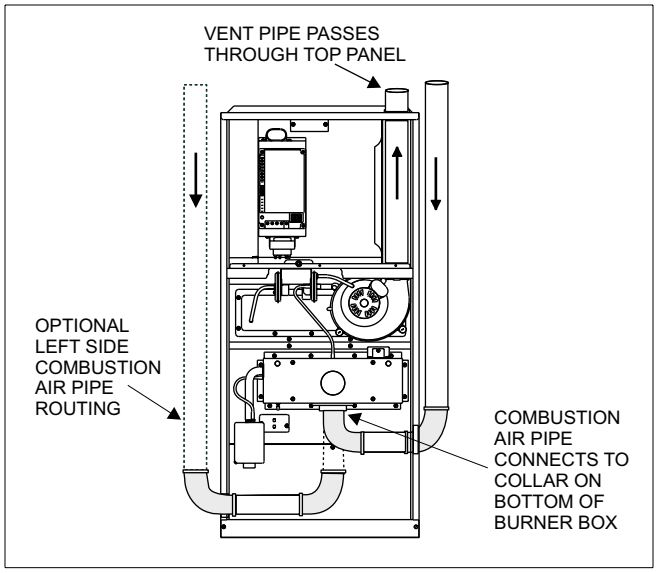


FIGURE 17 : Air Intake and Vent Locations - Downflow/Horizontal

The intake/vent should be located either through the wall (horizontal or side vent) or through the roof (vertical vent). Care should be taken to locate side vented systems where trees or shrubs will not block or restrict supply air from entering or combustion products from leaving the terminal.

Also, the terminal assembly should be located as far as possible from a swimming pool or a location where swimming pool chemicals might be stored. Be sure the terminal assembly follows the outdoor clearances listed in Table 3 for U.S. installations. In Canada, refer to CAN/CGA-B149.1 or.2 Installation Code (latest edition-Venting Systems and Air Supply).

COMBUSTION AIR/VENT PIPE SIZING

To select the propeTable 4 or Table 5. The size will be determined by a combination of furnace model, total length of run, and the number of elbows required. The following rules must also be observed.Long radius elbows are required for all units.

1. Long radius elbows are required for all units.
2. Elbows are assumed to be 90 degrees. Two 45 degree elbows count as one 90 degree elbow.
3. Elbow count refers to combustion air piping and vent piping separately. For example, if the table allows for 5 elbows, this will allow a maximum of 5 elbows in the combustion air piping and a maximum of 5 elbows in the vent piping.
4. Three vent terminal elbows (two for vent pipe and one for air intake pipe) are already accounted for and should not be counted in the allowable total indicated in the table (see vent termination section). These parts are shown shaded.

   For downflow/horizontal models, the two additional elbows required for the air intake pipe entry into the burner box are also accounted for and should not be counted. These parts are shown shaded.

   For downflow/horizontal models only two additional elbows are also accounted for and also should not be counted. These parts are shown shaded.
5. Combustion air and vent piping must be of the same diameter.
6. All combustion air/vent pipe and fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785 (Schedule 40 PVC), D2665 (PVC-DWV), F891 (PVC-DWV Cellular Core). D2241 (SDR-21 and SDR-26 PVC), D2261 (ABS-DWV), or F628 (Schedule 40 ABS. Pipe cement and primer must conform to ASTM Standards D2564 (PVC) or D2235 (ABS).
7. The use of flexible connectors or no hub connectors in the vent system is not allowed. This type connection is allowed in the combustion air pipe near the furnace for air conditioning coil accessibility.

Table 4: INTAKE/VENT PIPING - 2 PIPE SYSTEM

Models P*UR/ FG9-UP/G9T-UP	Pipe Size	Max. Elbows vs. One Way Vent Length (Ft.)*			
		5 - 40	45	50	75
40 / 37 / 1000 / A	2”	6	5	4	N/A
60 / 55 / 1000 / B					
80 / 75 / 1200 / B					
80 / 75 / 1600 / C					
100 / 95 / 1400 / C					
100 / 95 / 2000 / C					
40 / 37 / 1000 / A	3”	8	7	6	5
60 / 55 / 1000 / B					
80 / 75 / 1200 / B					
80 / 75 / 1600 / C					
100 / 95 / 1400 / C					
100 / 95 / 2000 / C					
120 / 112 / 2000 / D	3" Only	6	5	4	N/A
140 / 130 / 2000 / D					

*. Elbow count does not include the elbows required for the termination. See Step 4 under Combustion Air/Vent Pipe Sizing

Table 5: INTAKE/VENT PIPING 2-PIPE SYSTEM

Models P*DH/ FG9-DH/G9T-DH	Pipe Size	Max. Elbows vs. One Way Vent Length (Ft.)*			
		5-30	35	40	60
40 /37 / 1000 / A	2”	6	5	4	N/A
60 /55 / 1200 / B					
80 /75 / 1200 / B					
80 /75 / 1600 / C					
100 /95 / 2000 / C					
40 /37 / 800 / A	3”	8	7	6	5
60 /55 / 1200 / B					
80 /75 / 1200 / B					
80 /75 / 1600 / C					
100 /95 / 2000 / C					
120 /112 / 2000 / D	3" Only	6	5	4	N/A

*. Elbow count does not include (2) 90 ° elbows required to pipe intake into burner box or those required for the termination. See Step 4 under Combustion Air/Vent Pipe Sizing

NOTE: If installing furnace at altitudes between 2000 - 4500 ft., intake and vent pipe length must be reduced by 10 ft. If the installation requires the maximum allowable intake and vent pipe length, the furnace must be converted for high altitude operation. Refer to the proper high altitude application instruction for details.

VENT TERMINATION (2-PIPE)

Side wall horizontal vent terminals and roof mounted vertical terminals may be field fabricated. Standard PVC/SRD fittings may be used. Terminal configuration must comply as detailed in this section.

NOTE: Combustion air and vent pipes must terminate together in the same atmospheric zone, either through a roof or sidewall.

NOTE: Accessory concentric intake/vent terminations, models 1CT0302 and 1CT0303 are available and approved for use with these furnaces. Refer to Form 650.75-N2.4V for installation details.

When selecting the location for combustion air/vent termination the following should be considered:

1. Comply with all clearance requirements as listed below.
2. Termination should be positioned where vent vapors will not damage plants or shrubs or air conditioning equipment.
3. Termination should be located where it will not be affected by wind gusts, light snow, airborne leaves or allow recirculation of flue gases.
4. Termination should be located where it will not be damaged or exposed to flying stones, balls, etc.
5. Termination should be positioned where vent vapors are not objectionable.

VENT CLEARANCES (2-PIPE) U.S. ONLY

Dryer Vent . . . . . 3 ft.

Plumbing Vent Stack . . . . . 3 ft.

Gas Appliance Vent Terminal . . . . . 3 ft.*

From any mechanical fresh air intake . . . . . 1 ft.

From any door, window or non-mechanical fresh air or combustion air intake . . . . . 1 ft.

Above grade and anticipated snow depth . . . . . 1 ft.

Above grade when adjacent to public walkway . . . . . 7 ft.

From electric, gas meters, regulators and relief equipment - min. horizontal distance . . . . . 4 ft.

* Does not apply to multiple installations of this furnace model. Refer to “VENTING MULTIPLE UNITS" Section on page 18 .

In Canada, refer to CAN/CGA-B149.1 or .2 Installation Code (latest edition - Venting Systems and Air Supply)

NOTE: Consideration must be given for degradation of building materials by flue gases.

NOTE: Shaded components of the combustion air/vent system shown in Figures 18 to Figure 23 are considered to be part of the termination. These components should not be counted when determining piping limitations. Sidewall termination may require sealing or shielding of building surfaces with a corrosive resistance material to protect against combustion product corrosion.

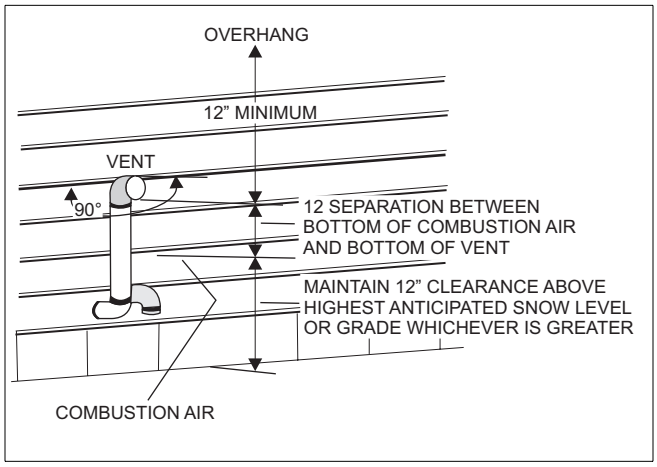


FIGURE 18 : Horizontal Termination Configuration with 12" Minimum Clearance

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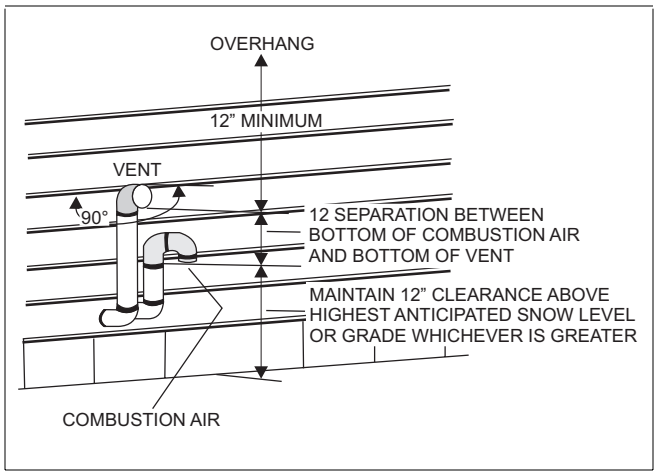


FIGURE 19 : Horizontal Termination Raised Configuration for Additional Clearance

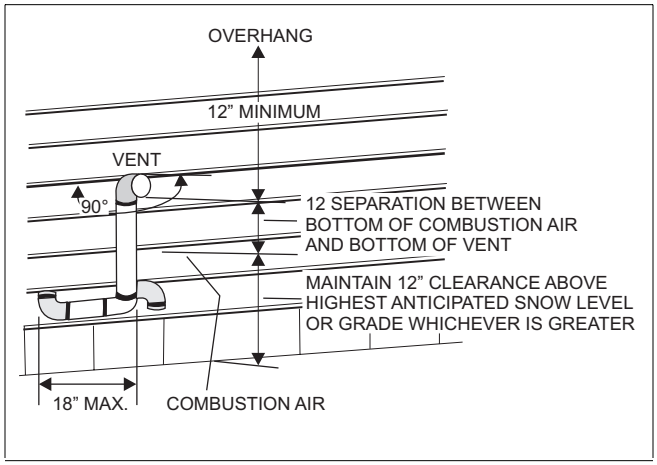


FIGURE 20 : Horizontal Termination Configuration with Horizontal Extension

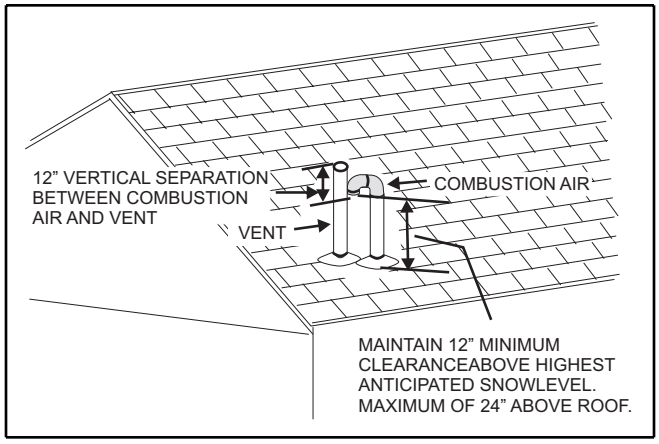


FIGURE 21 : Vertical Termination

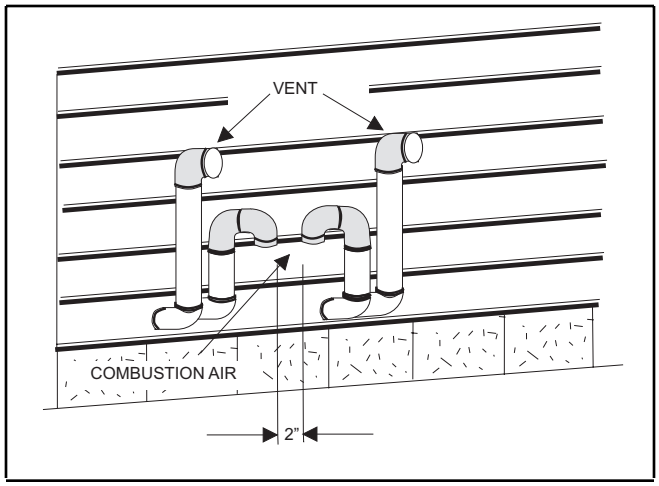


FIGURE 22 : Double Sidewall Termination

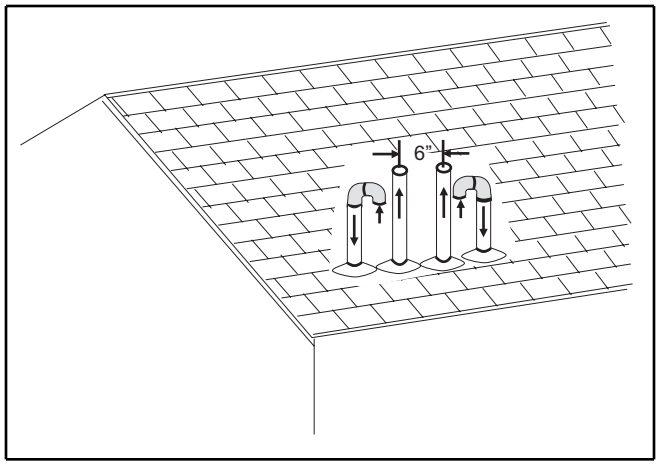


FIGURE 23 : Double Rooftop Termination

VENTING MULTIPLE UNITS

Each unit must have its own intake/vent piping and termination. Do not use common pipes for combustion air or venting. The vent terminals must be located as shown in Figure 22 or Figure 23.

PIPING ASSEMBLY

The final assembly procedure for the vent/combustion air piping is as follows:

1. Cut piping to the proper length, beginning at the furnace.
2. Deburr the piping inside and outside.
3. Chamfer the outer edges of the piping.
4. Dry-fit the entire vent/combustion air piping assembly.
5. Disassemble the piping and apply cement primer and cement per the cement manufacturer's instructions. Primer and cement must conform to ASTM D2564 for PVC, or ASTM D2235 for ABS piping.

> **⚠ CAUTION**
>
> *Solvent cements are flammable and must be used in well-ventilated areas only. Keep them away from heat, sparks and open flames (including pilots). Do not breathe vapors and avoid contact with skin and eyes.*

6. All joints must be made to provide a permanent, air-tight, water-tight seal.
7. Support the combustion air and vent piping such that it is angled 1/4" per linear foot so that condensate will flow back toward the furnace. Piping should be supported with pipe hangers to prevent sagging. Maximum spacing between hangers is five (5) feet, except SDR-PVC piping, where maximum spacing is three (3) feet.
8. Seal around the openings where the combustion air and vent piping pass through the roof of side wall.

> **⚠ CAUTION**
>
> *Vent piping must be insulated with 1/2" Armaflex insulation if it will be subjected to freezing temperatures such as routing through unheated areas or through an unused chimney.*
>
> *When combustion air pipe is installed above a suspended ceiling, the pipe must be insulated with 1/2" Armaflex type insulation. The combustion air pipe should also be insulated when it passes through a warm, humid space.*

NOTE: Vent pipe must be sloped 1/4" per foot to allow condensate to flow back to the furnace.

METHOD TWO: ONE PIPE SYSTEM

This type installation will use combustion air from within the space surrounding the furnace. This may be from within the space in a non-confined location or it may be brought into the furnace area from outdoors. It is not directly ducted into the furnace. A single, properly sized pipe from the furnace vent connector to the outdoors must be provided.

For upflow models combustion air is brought into the furnace through the unit top panel opening. Do not install a pipe into the intake collar on top of the burner box. Figure 24 .

For downflow/horizontal models, remove a minimum of two gas piping knockouts for combustion air access. Do not install a pipe into the intake collar on bottom of the burner box. For details, refer to Figure 25.

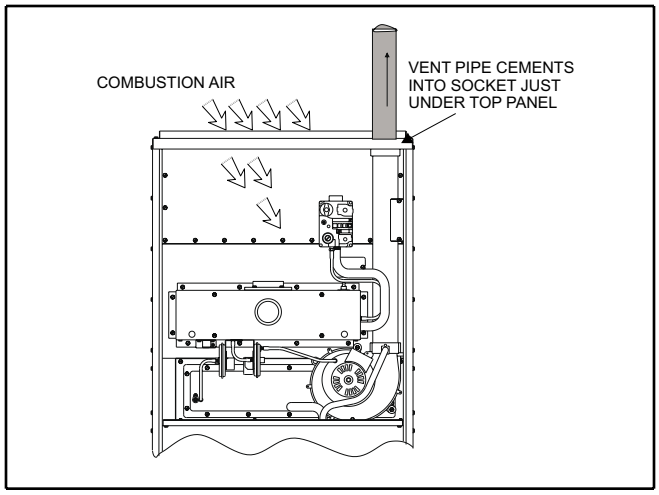


FIGURE 24 : Vent Pipe Connection - Upflow

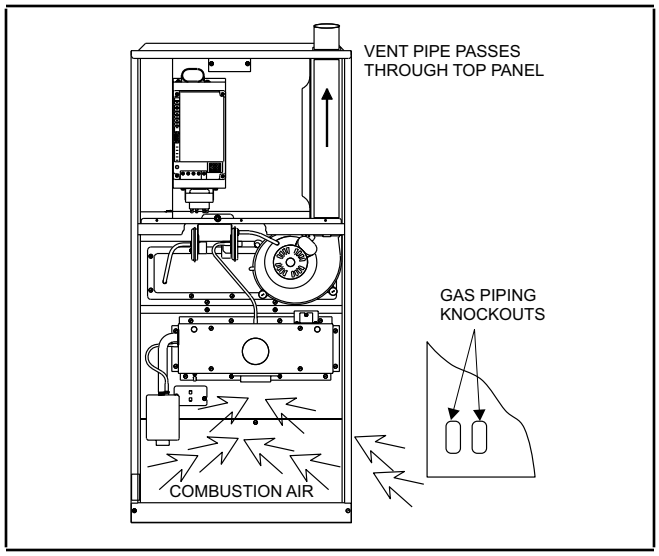


FIGURE 25 : Vent Pipe Connection - Downflow/Horizontal

COMBUSTION AIR

All installations must comply with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 or Sections 7.2, 7.3 or 7.4 of CAN/CGA B149.1 or .2 Installation Code - latest editions.

An unconfined space is not less than 50 cubic feet per 1000 Btu/hr input rating for all appliances installed in that area.

Rooms communicating directly with the space containing the appliances are considered part of the unconfined space, if openings are not furnished with doors.

A confined space is an area with less than 50 cubic feet per 1000 Btu/hr input rating for all appliances installed in that area.

The following must be considered to obtain proper air for combustion and ventilation in confined spaces.

Air Source from Inside the Building

Two permanent openings, one within 12 inches of the top of the confined space and one within 12 inches of the bottom, shall each have a free area of not less than one square inch per 1,000 Btuh of total input rating of all appliances located in the space. The openings shall communicate freely with interior areas having adequate infiltration from the outside.

NOTE: At least 100 square inches free area shall be used for each opening.

Air Source from Outdoors

1. Two permanent openings, one within 12 inches of the top of the confined space and one within 12 inches of the bottom, shall communicate directly, or by means of ducts, with the outdoors or to such crawl or attic spaces that freely communicate with the outdoors.
   a. **Vertical Ducts -** Each opening must have a free area of not less than one square inch per 4,000 Btuh of total input of all appliances located in the space.

EXAMPLE:

$$\frac{\text{Total Input of All Appliances}}{4000} = \text{Square Inches Free Area}$$

   b. **Horizontal Ducts -** Each opening must have a free area of not less than one square inch per 2,000 Btuh of total input of all appliances located in the space.

NOTE: Ducts must have the same cross-sectional area as the free area in the opening to which they are connected. The minimum dimension of rectangular ducts shall be three inches.

2. One permanent opening, commencing within 12 inches of the top of the enclosure shall be permitted where the equipment has clearances of at least 1 inch from the sides and back and 6 inches from the front of the appliance. The opening shall communicate through a vertical or horizontal duct to the outdoors, or spaces (crawl or attic) that freely communicate with the outdoors and shall have a minimum free area of:
   a. 1 sq. in. per 3000 Btu per hr of the total input rating of all equipment located in the enclosure.
   b. Not less than the sum of the areas of all vent connectors in the confined space.
3. Louvers, Grilles and Screens
   a. In calculating free area, consideration must be given to the blocking effects of louvers, grilles and screens.
   b. If the free area of a specific louver or grille is not known, refer to Table 6, to estimate free area.

NOTE: *If mechanically operated louvers are used, a means to prevent main burner ignition and operation must be provided should louvers close during startup or operation.*

Table 6: ESTIMATED FREE AREA

Wood or Metal Louvers or Grilles	Wood 20-25%* Metal 60-70%*
Screens†	1/4 in. mesh or larger 100%

*. Do not use less than 1/4 in. mesh

†. Free area or louvers an grilles varies widely; installer should follow louver or grille manufacturer's instructions.

Special Combustion and Ventilation Considerations

Operation of a mechanical exhaust, such as an exhaust fan, kitchen ventilation system, clothes dryer or fireplace may create conditions requiring special attention to avoid unsatisfactory operation of gas appliances.

Specially Engineered Installations

The above requirements shall be permitted to be waived where special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation and dilution of flue gases.

Combustion Air Quality

The recommended source of combustion air is to use the outdoor air supply. Excessive exposure to contaminated combustion air will result in safety and performance related problems. However, the use of indoor air in most applications is acceptable, except as follows:

1. If the furnace is installed in a confined space it is recommended that the necessary combustion air come from the outdoors by way of attic, crawl space, air duct or direct opening.
2. If indoor combustion air is used, there must be no exposure to the installations or substances listed in 3 below.

3. The following types of installations may require OUTDOOR AIR for combustion, due to chemical exposure.
   a. Commercial buildings
   b. Buildings with indoor pools
   c. Furnaces installed in laundry rooms
   d. Furnaces installed in hobby or craft rooms
   e. Furnaces installed near chemical storage areas
   f. Permanent wave solutions
   g. Chlorinated waxes and cleaners
   h. Chlorine based swimming pool chemicals
   i. Water softening chemicals
   j. De-icing salts or chemicals
   k. Carbon tetrachloride
   l. Halogen type refrigerants
   m. Cleaning solvents (such as perchloroethylene)
   n. Printing inks, paint removers, varnishes, etc.
   o. Hydrochloric acids
   p. Cements and glues
   q. Antistatic fabric softeners for clothes dryers
   r. Masonry acid washing chemicals

VENT PIPE SIZING (1-PIPE SYSTEM)

Refer to Table 7 to select the proper size piping for venting. The size will be determined by a combination of furnace model, total length of run, and the number of elbows required. The following rules must also be observed.

NOTE: Furnace vent pipe connections are sized for 2-in. pipe. Any pipe size change must be made outside the furnace casing in a vertical pipe section to allow proper drainage of vent connections.

NOTE: An offset using two 45 degree elbows may be required for plenum clearance when the vent is increased to 3".

1. Long radius elbows are required for all units.
2. Elbows are assumed to be 90 degrees. Two 45 degree elbows count as one 90 degree elbow.
3. One Vent terminal elbow is already accounted for and should not be counted in the allowable total indicated in the table. See "VENT TERMINAL LOCATION CLEARANCES" Section on page 21 . This part is shown shaded.
4. All vent pipe and fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785 (Schedule 40 PVC), D2665 (PVC-DWV), F891 (PVC-DWV Cellular Core), D2241 (SDR-21 and SDR-26 PVC), D2261 (ABS-DWV), or F628 (Schedule 40 ABS. Pipe cement and primer must conform to ASTM Standards D2564 (PVC) or D2235 (ABS).
5. The use of flexible connectors or no hub connectors in the vent system is not allowed.

Table 7: VENT PIPING / 1-PIPE SYSTEM (ALL MODELS)

Model	Pipe Size	Max. Elbows vs. One Way Vent Length (Ft.)			
		5-40	45	50	75
All Models Except: 120 / 112 / 2000 / D 140 / 130 / 2000 / D	2"	6	5	4	N/A
All Models Except: 120 / 112 / 2000 / D 140 / 130 / 2000 / D	3"	8	7	6	5
120 / 112 / 2000 / D 140 / 130 / 2000 / D	3" Only	6	5	4	N/A

NOTE: If installing furnace at altitudes between 2000 - 4500 ft., intake and vent pipe length must be reduced by 10 ft. If the installation requires the maximum allowable intake and vent pipe length, the furnace must be converted for high altitude operation. Refer to the proper high altitude application instruction for details.

VENT TERMINATION (1-PIPE SYSTEM)

Side wall horizontal vent terminals and roof mounted vertical terminals may be field fabricated. Standard PVC/SRD fittings may be used. Terminal configuration must comply as detailed in this section.

When selecting the locations for vent termination, the following should be considered:

1. Comply with all clearance requirements. Refer to Figure 26 on page 21.
2. Termination should be positioned where vent vapors will not damage plants or shrubs or air conditioning equipment.
3. Termination should be located where it will not be affected by wind gusts, light snow, airborne leaves or allow recirculation of flue gases.
4. Termination should be located where it will not be damaged or exposed to flying stones, balls, etc.
5. Termination should be positioned where vent vapors are not objectionable.

In Canada, refer to CAN/CGA-B149.1 or .2 Installation Code (latest edition - Venting Systems and Air Supply).

VENT TERMINAL LOCATION CLEARANCES

The vent must be installed with the following minimum clearances (refer to Figure 26), and complying with local codes or utility requirements or other authority having jurisdiction.

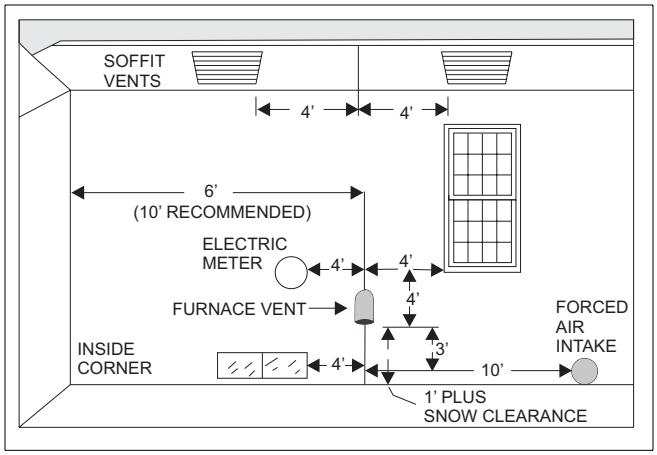


FIGURE 26 : Minimum Vent Terminal Clearances (1-Pipe System) - U.S. Only

1. 1 foot above grade and above normal snow levels.
2. Not above any walkway.
3. 4 feet below, 4 feet horizontally from, or 1 foot above any door/window or gravity air inlet to the building, or from gas or electric meters.
4. 6 feet from any inside corner formed by two exterior walls. 10 feet is recommended where possible.
5. At least 4 feet horizontally from any soffit or undereave vent.
6. 10 feet from any forced air inlet to the building. Any fresh air or make up inlet as for a dryer or furnace area is considered to be a forced air inlet.
7. Avoid areas where condensate drippage may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.

NOTE: Consideration must be given for degradation of building materials by flue gases.

NOTE: Shaded components of the vent system shown in Figures 27 through 29 are considered to be part of the termination. These components should not be counted when determining piping limitations. Sidewall termination may require sealing or shielding of building surfaces with a corrosive resistant material to protect against combustion product corrosion.

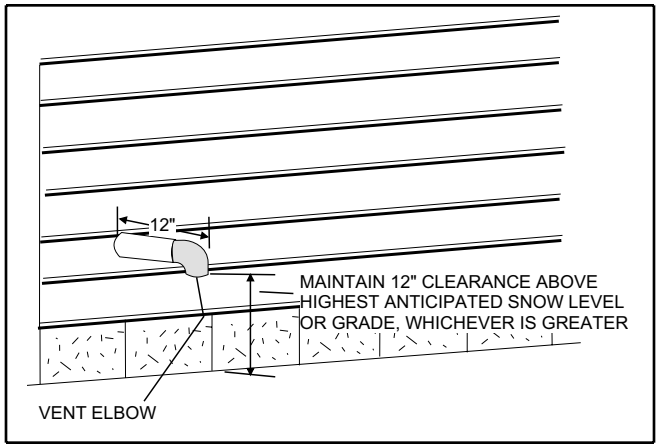


FIGURE 27 : Horizontal Termination Configuration with 12” Minimum Clearance

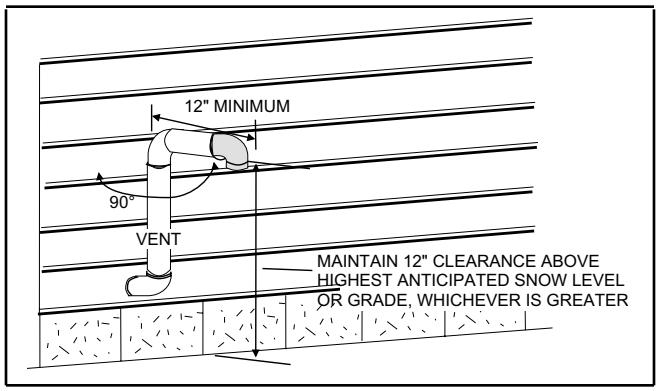


FIGURE 28 : Horizontal Termination Raised Configuration for Additional Clearance

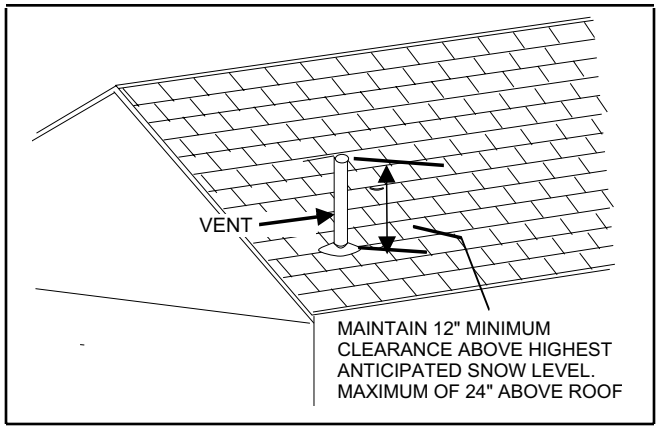


FIGURE 29 : Rooftop Termination

PIPING ASSEMBLY

The final assembly procedure for the vent piping is as follows:

1. Cut piping to the proper length, beginning at the furnace.
2. Deburr the piping inside and outside.
3. Chamfer the outer edges of the piping.
4. Dry-fit the entire vent piping system.
5. Disassemble the piping and apply cement primer and cement per the cement manufacturer's instructions. Primer and cement must conform to ASTM D2564 for PVC, or ASTM D2235 for ABS piping.

⚠ CAUTION

Solvent cements are flammable and must be used in well-ventilated areas only. Keep them away from heat, sparks and open flames (including pilots). Do not breathe vapors and avoid contact with skin and eyes.

6. All joints must be made to provide a permanent, air tight. water tight seal.
7. Support the vent piping such that it is angled 1/4" per linear foot so that condensate will flow back towards the furnace. Piping should be supported with pipe hangers to prevent sagging. Maximum spacing between hangers is 5 feet, except SDR-PVC piping, where maximum spacing is 3 feet.
8. Seal around the openings where the vent piping passes through the roof or side wall.

⚠ CAUTION

Vent piping must be insulated with 1/2" Armaflex insulation if it will be subjected to freezing temperatures such as routing through unheated areas or through an unused chimney.

NOTE: Vent pipe must be sloped 1/4" per foot to allow condensate to flow back to the furnace.

METHOD THREE: TWO PIPE SYSTEM USING COMBUSTION AIR FROM A VENTILATED ATTIC SPACE

This type installation requires two properly sized pipes. One brings combustion air from a properly ventilated attic space and a second pipe from the furnace vent connection (top right of unit) exits to the outdoors.

In Canada, refer to CAN/CGA-B149.1 or .2 Installation Code (latest edition - Venting Systems and Air Supply)

COMBUSTION AIR INTAKE

Table 4 on page 15, for intake pipe sizing, allowable length and elbow usage. Follow all notes, procedures and required materials in the Two-Pipe Sealed Combustion section (Method 1) when installing the combustion air pipe within the unit and into the ventilated attic space.

COMBUSTION AIR TERMINATION

Refer to Figure 30 for required termination method and configuration for the intake pipe. For attic termination, use two 90 elbows with the open end in a downward position. Be sure to maintain 12" clearance above any insulation, flooring or other material.

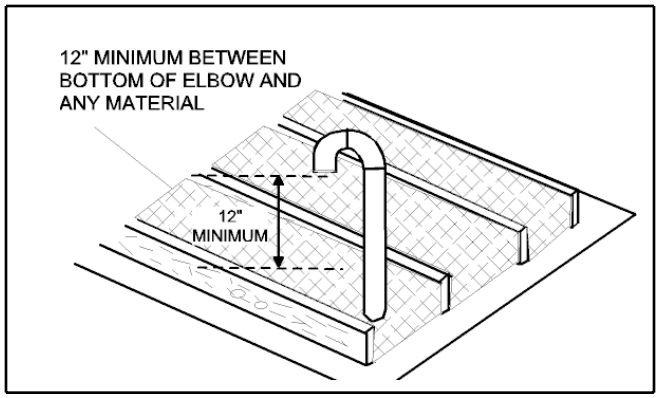


FIGURE 30 : Attic Combustion Air Termination

⚠WARNING

Be sure to instruct the owner not to block this intake pipe.

COMBUSTION AIR REQUIREMENTS

The ventilated attic space from which the combustion air is taken must comply with the requirements shown on page 19 in this instruction or in Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (latest edition).

VENT PIPE

For vent pipe sizing, allowable length and elbow usage, see Table 7 on Page 20. Follow all notes, installation procedures and required materials in the “METHOD TWO ONE PIPE SYSTEM, on page 18” to install the vent pipe from the unit to the outdoors.

VENT TERMINATION

The vent pipe termination must be installed within the allowable locations shown in Figure 26 and Section 7.8 in the National Fuel Gas Code, ANSI Z223.1 (current edition). Follow all local agency and utility requirements if more restrictive than those shown. Vent termination must be as shown in Figures 27 through 29.

In Canada, refer to CAN/CGA-B149.1 or .2 Installation Code (latest edition - Venting Systems and Air Supply).

HORIZONTAL VENT APPLICATIONS

If installing a horizontal venting system through any unconditioned space such as an attic or crawl space, it is recommended, that a vent drain be added to the vent pipe to prevent the accumulation of excess condensate in the inducer motor during operational cycles, refer to Figures 31 or 32.

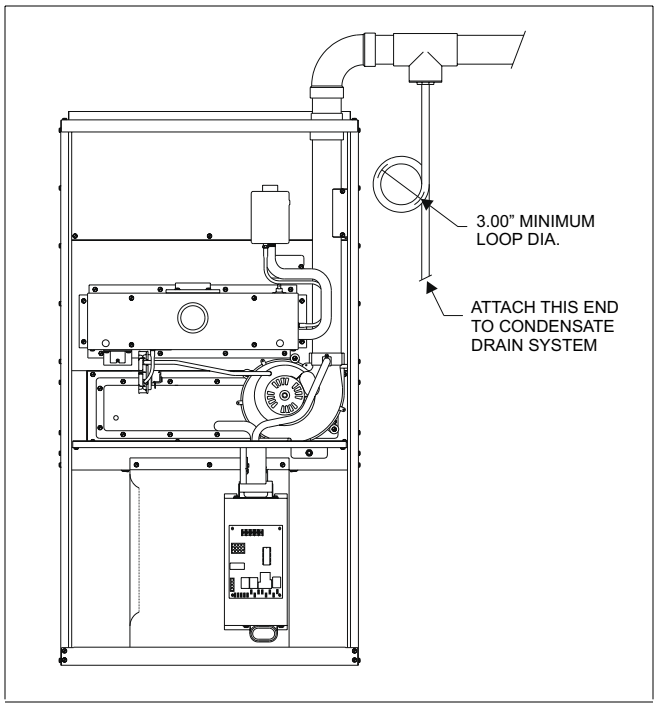


FIGURE 31 : Horizontal Vent Drain - Upflow Models

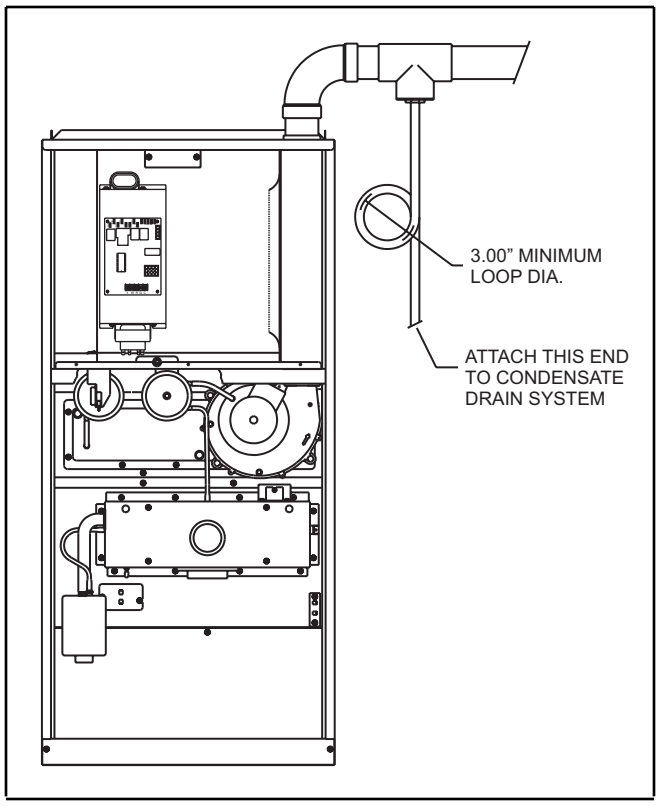


FIGURE 32 : Horizontal Vent Drain - Downflow/Horizontal Models

To install the vent drain, complete the following steps:

1. Place a tee of the proper diameter for the vent system being installed (2" or 3") in the horizontal run closest to the furnace.
2. Place a reducer bushing of proper diameter in the stem portion of the tee. The recommended size for the reducer is 5/8”.
3. Place a piece of 5/8” diameter or other selected size pipe a minimum of 3" long into the reducer to serve as a nipple.

NOTE: Tee, reducer and nipple must be properly cemented together using the appropriate method and materials specified in the Combustion Air Intake/Vent Connections section of these instructions.

4. Connect a piece of flexible drain tubing such as EPDM rubber, Vinyl or PVC to the nipple.
5. Loop the drain tubing to provide a trap.
6. Connect the discharge end of the drain tube to the condensate disposal system externally to the furnace.

CONDENSATE PIPING

The condensate drain connection is packed in the furnace for field installation. It consists of a formed hose with a 1/2" NPT male connection. A 1/2" FM x 3/4" PVC slip coupling is provided.

This drain hose may be installed to allow left or right side condensate drain connection, refer to Figures 33 and 34. Cut the hose to allow for proper fit for left or right exit.

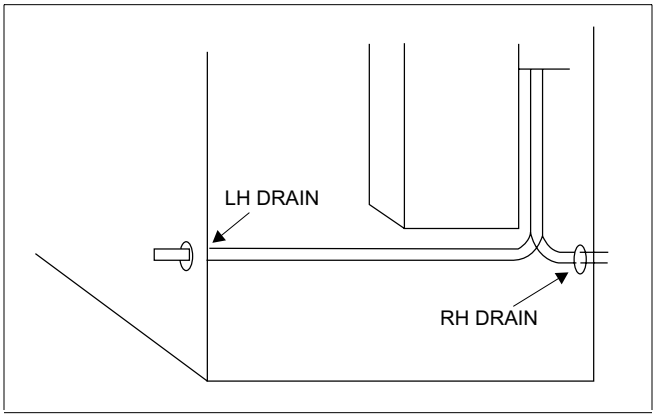


FIGURE 33 : Condensate Piping - Upflow Models

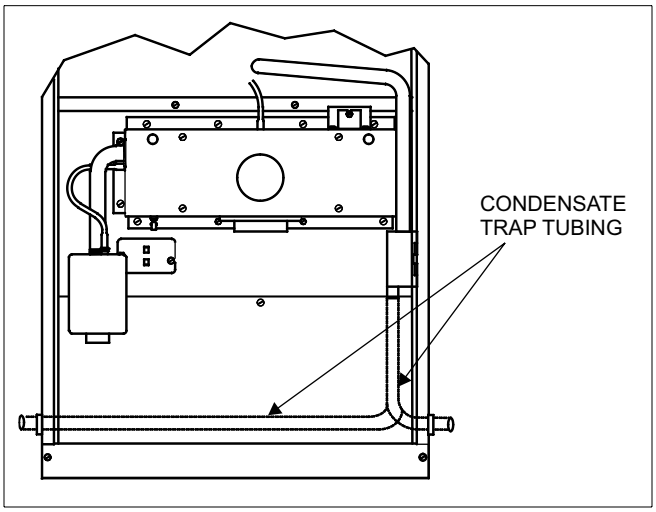


FIGURE 34 : Downflow/Horizontal Models

To install the drain hose assembly, remove the 7/8" knockout in the side panel. Remove the conduit nut from the 1/2" male fitting. Push the male fitting through the hole and reinstall the nut. The use of the 3/4" PVC coupling is optional.

CONVERSION FOR HORIZONTAL APPLICATIONS (DOWNFLOW MODELS ONLY)

Remove the condensate trap and its mounting bracket from the unit side panel. Remove all drain hoses.

Reinstall the trap/bracket on the side panel which will be on the bottom when the unit is located horizontally. Use the original mounting screws.

Refer to Figure 35 for hose locations and Table 8 for hose cut lengths. All hoses are identified as shown in Figure 35.

For horizontal left airflow (inducer and vent low) or horizontal right airflow (inducer and vent high), install condensate drain hoses as follows:

RIGHT AIRFLOW (Inducer High) - Three hoses are required. Hoses are supplied with furnace. Refer to Figure 35 and Table 8 for application.

LEFT AIRFLOW (Inducer Low) - Two hoses are required. Inducer outlet to trap is supplied. Condensate pan to trap must be field supplied using 5/8" I.D. hose material. Refer to Figure 35 and Table 8, for hose placement and sizing..

Table 8: HORIZONTAL CONDENSATE DRAIN HOSE SIZES - MODELS P*DH / FG9-DH / G9T-DH

DIMEN.	CABINET SIZE (IN.)			
	RIGHT AIRFLOW (INDUCER HIGH)			
	14-1/2	17-1/2	21	24-1/2
A	4-1/2	4-3/4	3-1/2	5-1/4
B	7-1/2	10-1/2	14	17-1/2
C	13-1/2	16-1/2	20	23-1/2
	LEFT AIRFLOW (INDUCER LOW)			
D	3-3/8	3-1/4	3-1/4	3-1/4

⚠ CAUTION

Plug all unused condensate trap, condensate pan and inducer drain connection points using plugs provided.

Drain Connection: The following steps apply to all models. For horizontal application, also follow the procedure for relocating the trap assembly and installing drain hoses.

1. It is recommended that either 1/2" or 3/4" PVC or equivalent pipe be field installed as drain pipe. The condensate piping may be tied together with the air conditioning condensate drain if the air conditioning condensate drain line is trapped upstream of the tie-in and the combined drains are constructed of the same material.
2. All pipe joints must be cleaned, de-burred and cemented using PVC primer and cement.
3. The furnace contains an internal trap. Therefore, no external trap should be used.
4. If a condensate pump is used, it must be suitable for use with acidic water.
5. Where required, a field-supplied neutralizer can be installed in the drain line, external to the furnace.

NOTE: The condensate drain from the furnace may be connected in common with the drain from an air conditioning coil if allowed by local code. Follow the instructions with the coil for trapping the drain.

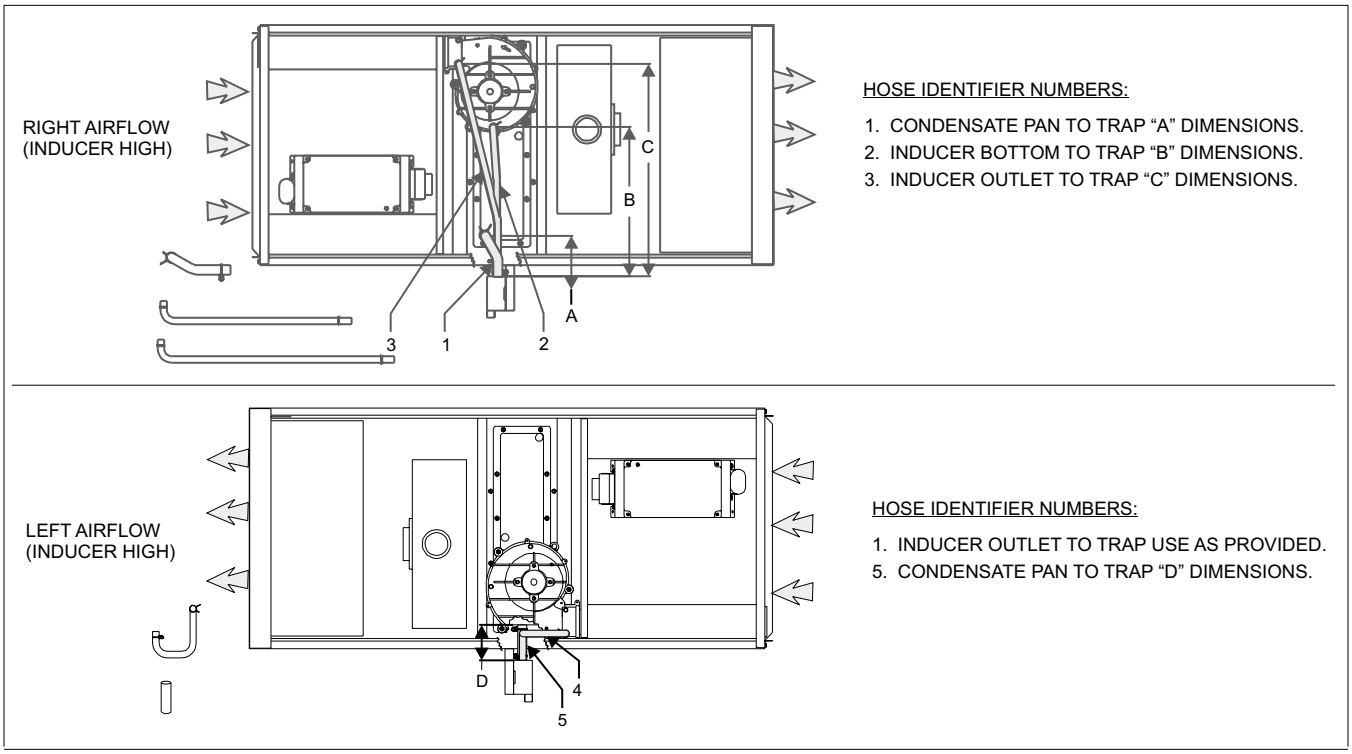


FIGURE 35 : Horizontal Application Condensate Drain Connection (Models P*DH / FG9-DH / G9T-DH)

SAFETY CONTROLS

Control Circuit Fuse: A 3 amp. fuse is provided to protect the 24 volt transformer from overload caused by control circuit wiring errors. This is an ATO 3, automotive type fuse and is located on the ignition control module.

Blower Door Safety Switch: This unit is equipped with an electrical interlock switch mounted in the blower compartment. This switch interrupts all power at the unit when the panel covering the blower compartment is removed.

⚠ CAUTION

Blower and burner must never be operated without the blower panel in place.

Electrical supply to this unit is dependent upon the panel that covers the blower compartment being in place and properly positioned.

⚠ CAUTION

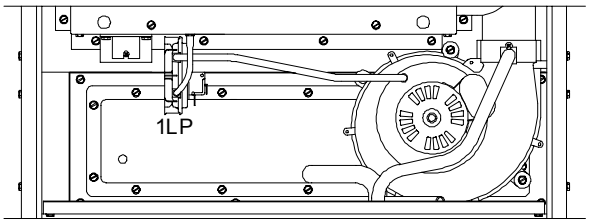
Main power to the unit must still be interrupted at the main power disconnect switch before any service or repair work is to be done to the unit. Do not rely upon the interlock switch as a main power disconnect.

Rollout Switch Controls: These controls are mounted on the burner box assembly. If the temperature in the burner compartment exceeds its set point, the igniter control and the gas valve are de-energized. The operation of this control indicates a malfunction in the combustion air blower, heat exchanger or a blocked vent pipe connection. Corrective action is required. This is a manual reset control and must be reset before operation can continue.

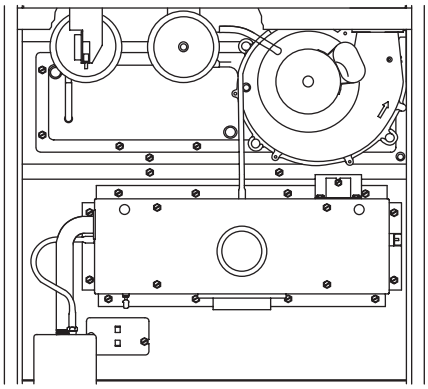
Pressure Switches: This furnace is supplied with pressure switches which monitor the flow through the combustion air/ vent piping system. These switches de-energize the ignition control module and the gas valve if any of the following conditions are present. Refer to Figure 36 for tubing connections.

1. Blockage of combustion air piping or terminal. (1LP)
2. Blockage of vent piping or terminal (1LP).
3. Failure of combustion air blower motor (1LP).
4. Blockage of condensate drain piping:
   - Upflow units (1LP)
   - Downflow/Horizontal Units
   - Downflow (1LP)
   - Horizontal Left (1LP)
   - Horizontal Right (2LP).

Limit Controls: There is high temperature limit control located on the furnace vestibule panel near the gas valve. This is a automatic reset control that provide over temperature protection due to reduced airflow, such as a dirty filter.



UPFLOW



DOWNFLOW / HORIZONTAL

FIGURE 36 : Pressure Switch Tubing Routing

Auxiliary Limit Controls: Downflow/horizontal units have a single limit switch mounted on the blower assembly. This is a manual reset control and gives high temperature protection in the event of a blower motor failure.

START-UP AND ADJUSTMENTS

The initial start-up of the furnace requires the following additional procedures:

1. When the gas supply is initially connected to the furnace, the gas piping may be full of air. In order to purge this air, it is recommended that the ground union be loosened until the odor of gas is detected. When gas is detected, immediately retighten the union and check for leaks. Allow five minutes for any gas to dissipate before continuing with the start-up procedure.

⚠ CAUTION

Be sure proper ventilation is available to dilute and carry away any vented gas.

⚠ CAUTION

Perform the following procedures only after the condensate trap has been properly piped to a drain connection using the procedure in this instruction.

2. The condensate trap must be filled with water before putting the furnace into operation. The recommended procedure is as follows:
   a. Disconnect the condensate drain hose from the induced draft blower discharge.
   b. Elevate this hose and fill with water using a funnel.
   c. Replace the condensate drain hose and clamps.

NOTE: *If this procedure is not followed, the unit may not properly drain on initial start up.*

3. All electrical connections made in the field and in the factory should be checked for proper tightness.

IGNITION SYSTEM SEQUENCE

1. Turn the gas supply ON at external valve and main gas valve.
2. Set the thermostat above room temperature to call for heat.
3. System start-up will occur as follows:
   a. The induced draft blower motor will start and come up to speed. Shortly after venter start-up, the hot surface igniter will glow for about 17 seconds.
   b. After this warm up, the ignition module will energize (open) the main gas valve for seven seconds.
   c. After flame is established, the supply air blower will start in about 30 seconds.

NOTE: Burner ignition may not be satisfactory on first startup due to residual air in the gas line or until gas manifold pressure is adjusted. The ignition control will make 3 attempts to light before locking out.

4. With furnace in operation, paint the pipe joints and valve gasket lines with a rich soap and water solution, Bubbles indicate a gas leak. Take appropriate steps to stop the leak. If the leak persists, replace the component.

⚠ CAUTION

DO NOT omit this test! Never use a flame to check for gas leaks.

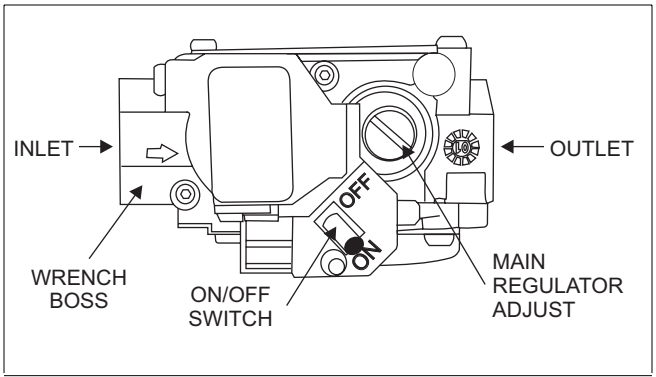


FIGURE 37 : White Rodgers 36G Gas Valve

CHECKING GAS INPUT (NATURAL GAS)

NOTE: Front door of burner box must be secured when checking gas input.

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical domestic gas meter usually has a 1/2 or 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour, (Table 9 on Page 27).

NOTE: To find the Btuh input, multiply the number of cubic feet of gas consumed per hour by the BTU content of the gas in your particular locality. Contract your gas company for this information, as it varies widely from city to city.

EXAMPLE: It is found by measurement that it takes 26 seconds for the hand to turn on the 1 cubic foot dial to make a revolution with only a 120,000 Btuh furnace running. Using this information, locate 26 seconds in the first column of.

Read across to the column headed **1 Cubic Foot** where you will see that 138 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 138 by 850 (the BTU rating of the gas obtained from the local gas company). The result is 117,300 Btuh, which is close to the 120,000 Btuh rating of the furnace.

If the actual input is not within ±2% of the furnace rating, with allowance being made for the permissible range of the regulator setting (0.3 inches W.C.), replace the orifice spuds with spuds of the proper size.

⚠ CAUTION

Be sure to relight any gas appliances that were turned off at the start of this input check.

Table 9: GAS RATE (CUBIC FEET PER HOUR)

SECONDS FOR ONE REVOLUTION	SIZE OF TEST DIAL	
	1/2 CUBIC FOOT	1 CUBIC FOOT
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

ADJUSTMENT OF MANIFOLD GAS PRESSURE

Manifold gas pressure may be measured by two different procedures. It may be measured with the burner box cover in place or it may be measured with the burner box cover removed. Follow the appropriate section, 2a or 2b in the instructions below.

1. Turn gas off at main gas valve. Remove 1/8" NPT plug from the outlet pressure tap in the main gas valve body and install a proper manometer tube adapter fitting (refer to Figure 37). Connect line from gas valve tap to a manometer.
2. Read the inlet gas pressure using either of the two methods below.
   a. **Reading the gas pressure with the burner box cover in place** - Disconnect the pressure reference hose from the right side of the burner box. Using a tee fitting and a short piece of hose, connect the negative side of the manometer to the burner box pressure reference port. Connect the positive side of the manometer to the adapter previously installed in the gas valve Refer to Figures 38 and 39 on page 29 for connection details.
   b. **Reading the gas pressure with the burner box cover removed** - Remove the screws securing the burner box front cover plate. Remove the cover. It is gasketed and may stick in place. Connect the positive side of the manometer to the adapter previously installed in the gas valve. There will be no second connection to the manometer as it will reference atmospheric pressure.

NOTE: The screw-off cap for the pressure regulator must be removed entirely to gain access to the adjustment screw. Loosening or tightening the cap does not adjust the flow of gas.

3. Refer to Figure 37 on page 27, for location of pressure regulator adjustment cap and screw on main gas valve.
4. Turn gas and electrical supplies ON. Start furnace and observe manifold pressure on manometer.
5. Adjust manifold pressure by adjusting gas valve regulator screw for the appropriate gas per the following:

Nominal Manifold Pressure	
Natural Gas	3.5” w.c.
Propane (LP) Gas	10.0” w.c.

   If gas valve regulator is turned in, or clockwise, manifold pressure is increased. If screw is turned out, or counterclockwise, manifold pressure will decrease.
6. Once the correct gas pressure to the burners has been established, turn the gas valve to OFF and turn the electrical supply switch to OFF; then remove th pressure tap at the gas valve and reinstall the plug, using a compound (on the threads) resistant to teh action of LP gases. Replace the burner box front cover or the pressure reference hose.
7. Turn the electrical and gas supplies back on, and with the burners in operation, check for gas leakage around the plug with a soap and water solution.

⚠WARNING

The manifold pressure must be checked with the screw-off cap for the gas valve pressure regulator in place. If not, the nominal manifold pressure setting will result in an over-fire condition.

If manifold pressure is too high, an over-fire condition exists which could cause heat exchanger failure. If the manifold pressure is too low, sooting and eventual clogging of the heat exchanger could occur.

Be sure that gas valve regulator cap is replaced and burner box to gas valve pressure reference hose is reconnected.

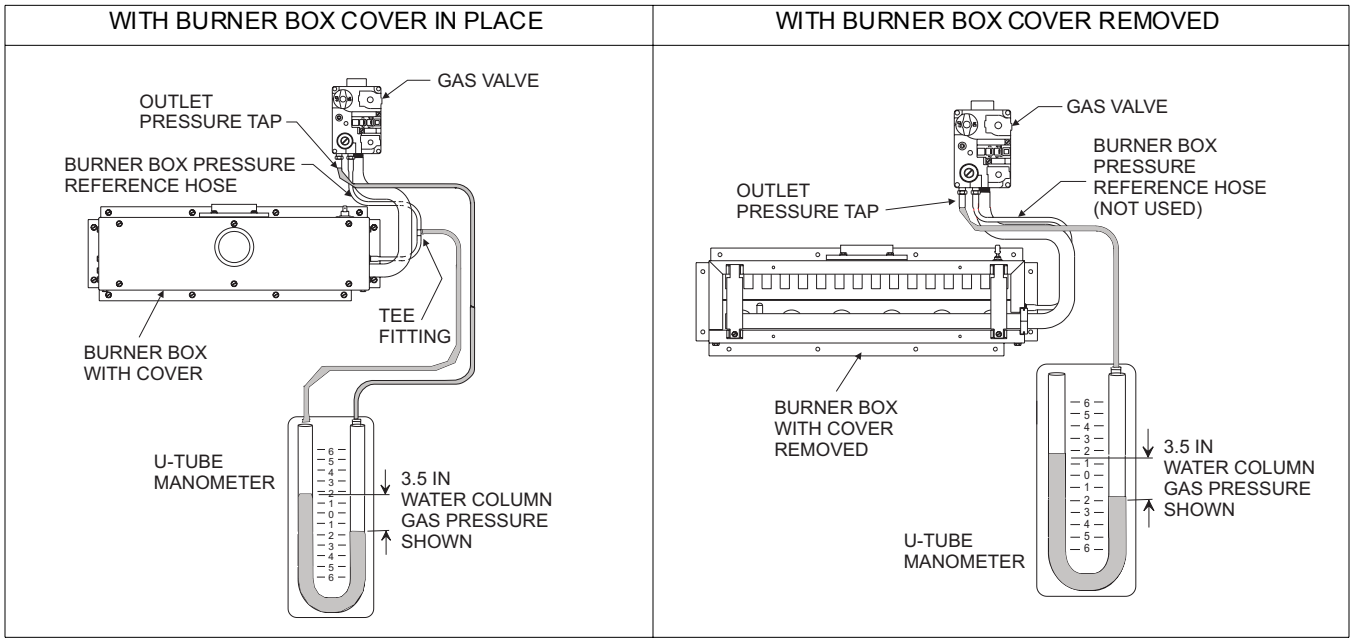


FIGURE 38 : Upflow Models (P*UR/ FG9-UP / G9T-UP) - Reading Gas Pressure

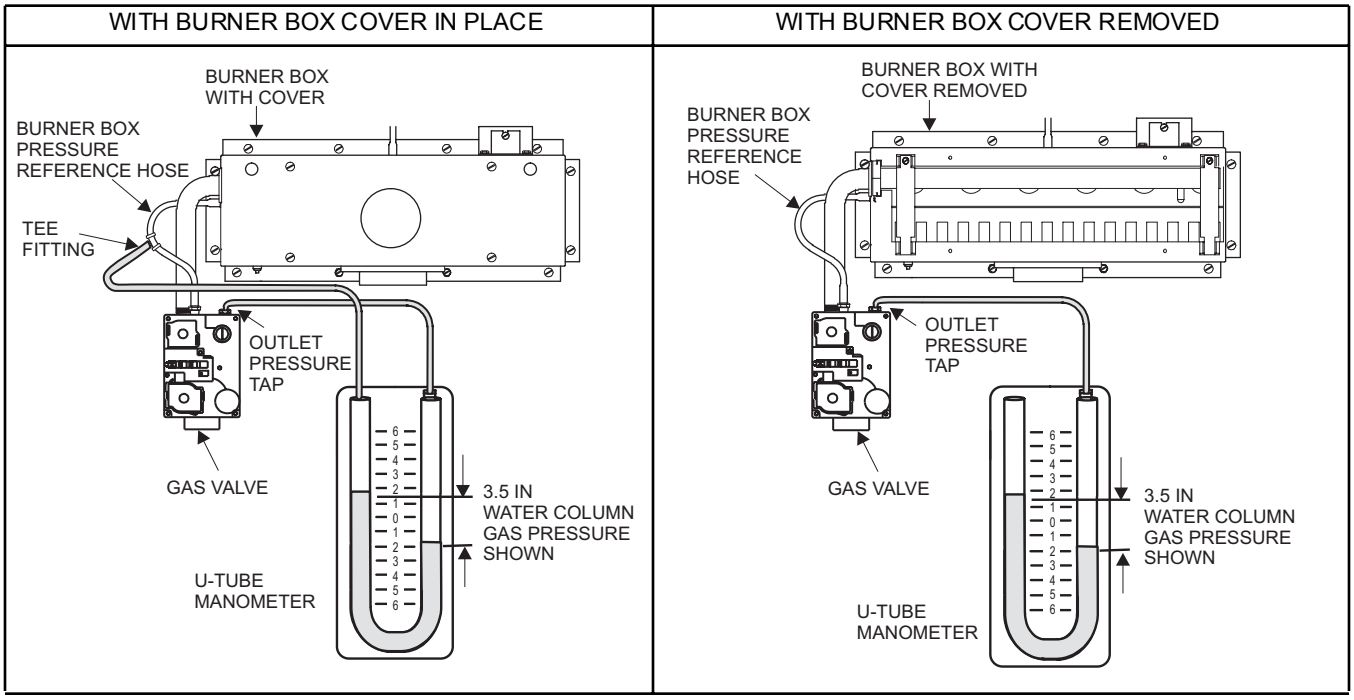


FIGURE 39 : downflow/Horizontal Models (P*DH/ FG9-DH / G9T-DH) - Reading Gas Pressure

ADJUSTMENT OF TEMPERATURE RISE

The temperature rise, or temperature difference between the return air and the heated air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations are shown in Tables 1 or 2. After the temperature rise has been determined, the airflow (cfm) can be calculated.

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts, about six feet from the furnace where they will not be affected by radiant heat.

Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

All direct-drive blowers have multi-speed motors. The blower motor speed taps are located in the control box in the blower compartment. Refer to Figure 40, and the unit wiring label to change the blower speed.

You may select a heating speed and a cooling speed. They may be the same speed or a different speed.

To use the same speed tap for heating and cooling, the heat terminal and cool terminal must be connected using a jumper wire and connected to the desired motor lead. Place all unused motor leads on Park terminals. Two are provided.

⚠ CAUTION

Do not energize more than one motor speed at a time or damage to the motor will result.

ADJUSTMENT OF FAN-OFF CONTROL SETTINGS

This furnace is equipped with a time-on/time-off heating fan control. The fan on delay is fixed at 30 seconds. The fan off delay is field adjustable from 60 to 180 seconds. The fan off delay is factory set to 120 seconds.

The fan-off setting must be long enough to adequately cool the furnace, but not so long that cold air is blown into the heated space.

The fan-off timing may be adjusted by positioning the jumper located on the control board. Refer to Figure 40.

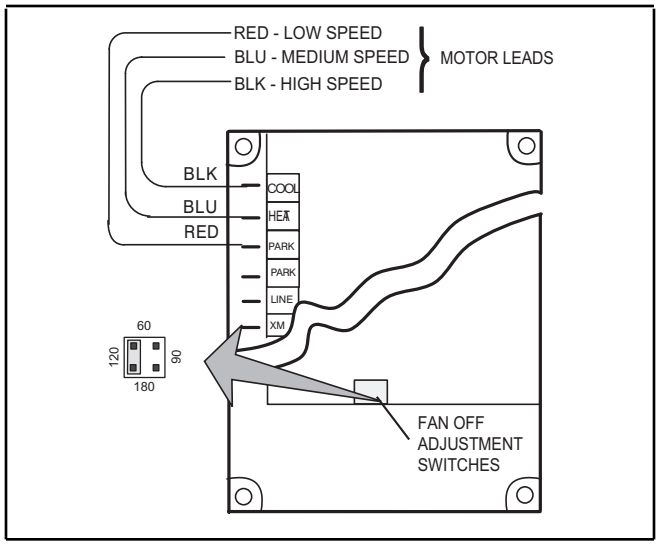


FIGURE 40 : Typical Heat/Cool Speed Tap Connections

FURNACE ACCESSORIES

ELECTRICAL	
*ET03700324	Single Stage Thermostat, One-Stage Heat/One-Stage Cool, Non-Programmable
*ET03700124	Deluxe Single Stage Theromstat, One Stage Heat /One Stage Cool, Programmable
2TH13700424	Single Stage Thermostat, One Stage Heat, Round - 2TB17700424 Heat/Cool Subbase
6TH13701024	Single Stage Thermostat, One Stage Heat, Round - 2TB17700424 Heat/Cool Subbase
2TC03700124	Twinning Control
NON-ELECTRICAL	
1NP0347	Propane (LP) Conversion Kit
1NP0349	Propane (LP) Conversion Kit
1PS0306	High Altitude Pressure Switch (See instruction 035-14447-000 for proper application)
1PS0307	
1PS0308	
1PS0309	
1PS0310	
1SR0302BK	External Side Filter Rack (6-Pack)
1BR0314	External Bottom or Horizontal Filter Rack - Cabinet “A”
1BR0317	External Bottom or Horizontal Filter Rack - Cabinet “B”
1BR0321	External Bottom or Horizontal Filter Rack - Cabinet “C”
1BR0324	External Bottom or Horizontal Filter Rack - Cabinet “D”
1CT0302	Concentric Vent Termination - 2” Vent Pipe
1CT0303	Concentric Vent Termination - 3” Vent Pipe
1CB0314	Combustible Floor Base - Cabinet “A”
1CB0317	Combustible Floor Base - Cabinet “B”
1CB0321	Combustible Floor Base - Cabinet “C”
1CB0324	Combustible Floor Base - Cabinet “D”

* Substitute 2 for York brands and 6 for non York brands.

BLOWER PERFORMANCE CFM - UPFLOW (WITHOUT FILTER)

MODELS Input/Output/Airflow/ cabinet	SPEED TAP	EXTERNAL STATIC PRESSURE, INCHES WC									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
40/37/1000/"A"	HIGH	1330	1260	1210	1150	1090	1025	955	880	775	645
	MED-HIGH	985	970	965	935	900	860	800	740	665	535
	MED-LOW	790	780	760	740	715	685	635	575	485	365
	LOW	635	625	610	590	565	535	490	435	360	250
60/55/1000/"B"	HIGH	1360	1330	1290	1250	1190	1130	1055	970	865	735
	MED-HIGH	980	970	960	945	920	870	830	775	685	575
	MED-LOW	765	755	740	725	710	680	645	590	510	405
	LOW	635	625	610	590	565	540	500	440	375	290
80 / 75 / 1200 / "B"	HIGH	1465	1440	1390	1365	1315	1255	1190	1125	1055	940
	MED	1085	1075	1060	1045	1030	1000	960	910	830	755
	LOW	805	795	785	770	755	730	700	655	615	565
80 / 75 / 1600 / "C"	HIGH	1940	1905	1870	1815	1760	1700	1620	1555	1460	1305
	MED	1400	1390	1380	1370	1355	1320	1285	1255	1210	1135
	LOW	1245	1225	1205	1185	1165	1145	1125	1095	1050	970
100 / 95 / 1400 / "C"	HIGH	1785	1720	1650	1575	1495	1405	1315	1190	1050	880
	MED	1430	1405	1375	1340	1290	1220	1130	1025	885	730
	LOW	1150	1135	1120	1080	1045	1000	925	825	700	575
100/95/2000/"C"	HIGH	2355	2285	2205	2145	2080	1995	1905	1820	1715	1610
	MED	1950	1915	1870	1830	1780	1710	1640	1560	1475	1375
	LOW	1575	1555	1540	1505	1470	1430	1380	1315	1245	1150
120 / 112 / 2000 / "D"	HIGH	2375	2315	2245	2175	2100	2020	1935	1840	1755	1650
	MED	1990	1955	1920	1875	1835	1775	1715	1630	1550	1450
	LOW	1565	1550	1530	1505	1480	1445	1405	1350	1280	1200
140 / 130 / 2000 / "D"	HIGH	2410	2340	2265	2200	2125	2035	1960	1860	1775	1670
	MED	2020	1975	1940	1895	1855	1790	1725	1655	1570	1470
	LOW	1580	1565	1550	1520	1495	1460	1420	1360	1295	1210
NOTE: Data below reflects airflows with two return openings - two sides or one side and bottom.											
100/95/2000/"C"	HIGH	2365	2295	2215	2155	2090	2005	1915	1830	1725	1620
	MED	1965	1930	1885	1845	1795	1725	1655	1575	1490	1390
	LOW	1595	1575	1560	1525	1490	1450	1400	1335	1265	1170
120 / 112 / 2000 / "D"	HIGH	2385	2325	2255	2185	2110	2030	1945	1850	1765	1660
	MED	2005	1970	1935	1890	1850	1790	1730	1645	1565	1465
	LOW	1585	1570	1550	1525	1500	1465	1425	1370	1300	1220
140 / 130 / 2000 / "D"	HIGH	2420	2350	2275	2210	2135	2045	1970	1870	1785	1680
	MED	2035	1990	1955	1910	1870	1805	1740	1670	1585	1485
	LOW	1600	1585	1570	1540	1515	1480	1440	1380	1315	1230

Airflow expressed in standard cubic feet per minute.

Notes:
1. Return air is through side opposite motor (left side).
2. Air flows above 1800 CFM require either return from two sides or one side plus bottom.
3. Motor voltage at 115 V.

AIRFLOW DATA - DOWNFLOW/HORIZONTAL MODELS: P*DH/G9T-DH/FG9-DH

MODELS Input/Output/Airflow/ cabinet	SPEED TAP	EXTERNAL STATIC PRESSURE, INCHES WC									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
40 / 37 / 1000 / "A"	HIGH	1400	1350	1300	1250	1200	1135	1060	970	880	765
	MED-HIGH	970	955	945	935	915	885	840	780	705	600
	MED-LOW	770	760	750	735	710	680	640	595	535	450
	LOW	595	585	575	560	540	520	485	455	400	270
60/55/1200/"B" 80 / 75 / 1200 / "B"	HIGH	1605	1590	1570	1545	1510	1470	1415	1360	1285	1205
	MED	1260	1245	1225	1205	1180	1150	1110	1065	1005	930
	LOW	930	915	895	880	860	835	810	770	695	620
80 / 75 / 1600 / "C"	HIGH	2030	1980	1925	1870	1830	1755	1675	1600	1515	1435
	MED	1505	1490	1475	1460	1440	1420	1380	1340	1280	1215
	LOW	1295	1285	1260	1240	1215	1190	1160	1130	1080	1000
100 / 95 / 2000 / "C"	HIGH	2330	2270	2200	2130	2060	1985	1890	1810	1710	1625
	MED	2005	1965	1920	1870	1820	1750	1680	1600	1500	1395
	LOW	1580	1560	1535	1510	1480	1440	1390	1325	1255	1175
120 / 112 / 2000 / "D"	HIGH	2335	2280	2215	2145	2065	2000	1905	1820	1720	1620
	MED	1975	1930	1885	1830	1775	1720	1655	1580	1500	1400
	LOW	1515	1495	1475	1450	1415	1380	1330	1275	1210	1135

Airflow expressed in standard cubic feet per minute.

Notes: 1. Air filter installed. All filters must be high velocity, cleanable type.
2. Motor voltage at 115 V.

FILTER PERFORMANCE

The airflow capacity data published in Tables 8 & 9 represents blower performance WITHOUT filters. To determine the approximate blower performance of the system, apply the filter drop value for the filter being used or select an appropriate value from the Table 10.

NOTE: The filter pressure drop values in Table 10 are typical values for the type of filter listed and should only be used as a guideline. Actual pressure drop ratings for each filter type vary between filter manufacturer.

Table 10: FILTER PERFORMANCE - PRESSURE DROP INCHES W.C.

Airflow Range	Minimum Opening Size ($in.^2$)		Filter Type					
			Disposable		Hogs Hair*		Pleated	
	1 Opening	2 Openings	1 Opening	2 Openings	1 Opening	2 Openings	1 Opening	2 Openings
0 - 750	230		0.01		0.01		0.15	
751 - 1000	330		0.04		0.03		0.20	
1001 - 1250	330		0.08		0.07		0.20	
1251 - 1500	330		0.08		0.07		0.25	
1501 - 1750	380	658	0.14	0.08	0.13	0.06	0.30	0.17
1751 - 2000	380	658	0.17	0.09	0.15	0.07	0.30	0.17
2001 & Above	463	658	0.17	0.09	0.15	0.07	0.30	0.17

*. Hogs Hair Filters are the type supplied with furnace (if supplied).

APPLYING FILTER PRESSURE DROP TO DETERMINE SYSTEM AIRFLOW

To determine the approximate airflow of the unit with a filter in place, follow the steps below:

1. Select the filter type.
2. Select the number of return air openings or calculate the return opening size in square inches to determine the proper filter pressure drop.
3. Determine the External System Static Pressure (ESP) without the filter.
4. Select a filter pressure drop from the table based upon the number of return air openings or return air opening size and add to the ESP from Step 3 to determine the total system static.
5. If total system static matches a ESP value in the airflow table (i.e. 0.20, 0.60, etc,) the system airflow corresponds to the intersection of the ESP column and Model/ Blower Speed row.
6. If the total system static falls between ESP values in the table (i.e. 0.58, 0.75, etc.), the static pressure may be rounded to the nearest value in the table determining the airflow using Step 5 or calculate the airflow by using the following example.

Example: For a 130,000 Btuh furnace with 2 return openings and operating on high speed blower, it is found that total system static is 0.58" w.c. To determine the system airflow, complete the following steps:

1. Obtain the airflow values at 0.50" & 0.60" ESP.

   Airflow @ 0.50": 2125 CFM
   Airflow @ 0.60": 2035 CFM

2. Subtract the airflow @ 0.50" from the airflow @ 0.60" to obtain airflow difference.

   2035 - 2125 = -90 CFM

3. Subtract the total system static from 0.50" and divide this difference by the difference in ESP values in the table, 0.60" - 0.50", to obtain a percentage.

   (0.58 - 0.50) / (0.60 - 0.50) = 0.8

4. Multiply percentage by airflow difference to obtain airflow reduction.

   (0.8) x (-90) = -72

5. Subract airflow reduction value to airflow @ 0.50" to obtain actual airflow @ 0.58" ESP.

   2125 - 72 = 2053

OPERATION AND MAINTENANCE

SEQUENCE OF OPERATION

The following describes the sequence of operation of the furnace. Refer to the schematic wiring diagrams in the back of this manual for component location.

CONTINUOUS BLOWER

On cooling/heating thermostats with fan switch, when the fan switch is set in the ON position, a circuit is completed between terminals R and G of the thermostat. The blower motor is energized through the cool terminal and runs on the selected speed. This allows constant air circulation at lower flow rate.

INTERMITTENT BLOWER - COOLING

On cooling/heating thermostats with fan switch, when the fan switch is set in the auto position and the thermostat calls for cooling, a circuit is completed between the R, Y and G terminals.

The motor is energized through the cool fan terminal and runs on the selected speed. The fan off setting is fixed at 60 seconds for SEER enhancement.

HEATING CYCLE

⚠ CAUTION

Label all wires prior to disconnecting when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

When the system switch is set on HEAT and the fan is set on AUTO, and the room thermostat calls for heat, a circuit is completed between terminals R and W of the thermostat. When the proper amount of combustion air is being provided, a pressure switch activates the ignition control.

The ignition control provides a 17-second warm-up period. The gas valve then opens for 10 seconds.

As the gas starts to flow and ignition occurs, the flame sensor begins its sensing function. If a flame is detected during the 10 second flame stabilization period the circulating blower will energize 30 seconds after the gas valve opens (20 seconds after the flame stabilization period ends). Normal furnace operation will continue until the thermostat circuit between R and W is opened. When the thermostat circuit opens, the ignition control is de-energized. When the ignition control is de-energized, the gas flow stops, and the burner flames are extinguished. The ventor continues to operate for 15 seconds after the gas flow stops.

The blower motor continues to operate for the amount of time set by the fan-off delay "Jumper" located on the ignition control board (Figure 16). The heating cycle is complete, and the furnace is ready for the start of the next heating cycle.

If the flame is not detected within 2 seconds of the gas valve opening, the gas valve is shut off and a retry operation begins. If the flame is lost for 2 seconds during the 10 second stabilization period, the gas valve is shut off and a retry operation begins. During a retry operation the ventor starts a 15 second inter-purge and the ignitor warm-up time is extended to 27 seconds. If the flame is established for more than 10 seconds after ignition, during a retry, the control will clear the ignition attempt (retry) counter. If three retries occur during a call for heat, the furnace will shut down for one hour. If at the end of the one hour shut down there is a call for heat, the furnace will initiate a normal start cycle. If the problem has not been corrected the furnace will again lockout after three retries.

A momentary loss of gas supply, flame blowout, or a faulty flame probe circuit will result in a disruption in the flame and be sensed within 0.8 seconds. The gas valve will de-energize and the control will begin a recycle operation. A normal ignition sequence will begin after a 15 second inter-purge. If during the five recycles the gas supply does not return, or the fault condition is not corrected the ignition control will lock-out for 60 minutes.

During burner operation, a momentary loss of power for 50 milliseconds or longer will de-energize the gas valve. When the power is restored, the gas valve will remain de-energized and the ignition sequence will immediately restart.

HOT SURFACE IGNITION SYSTEM

⚠WARNING

Do not attempt to light this furnace by hand (with a match or any other means). There may be a potential shock hazard from the components of the hot surface ignition system. The furnace can only be lit automatically by its hot surface ignition system.

MAINTENANCE

AIR FILTERS

The filters must be checked periodically for dirt accumulation. Dirty filters greatly restrict the flow of air and may cause damage to the system.

Clean the filters at least every three months. On new construction, check the filters every week for the first four weeks. Inspect the filters every three weeks after that, especially if the system is running constantly.

All filters used with the furnace are the high-velocity, cleanable type. Clean these filters by washing in warm water. Make sure to shake all the water out of the filter and have it reasonably dry before installing it in the furnace. When replacing filters, be sure to use the same size and type as originally supplied.

FILTER REMOVAL - UPFLOW MODELS

To remove a filter from the side or bottom location, push the closed end of the filter retainer to the left until it clears the lip on the front of the furnace base, which acts as a catch for the retainer. When the retainer is clear of the flange, it will pivot in the loops.

Swing the retainer toward the center of the furnace. This will expose the filter to allow removal. To reinstall the filter, simply reverse this procedure.

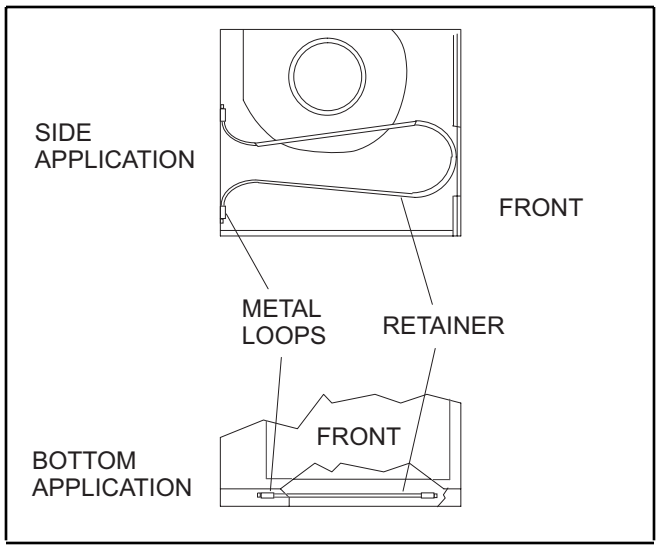


FIGURE 41 : Upflow Filter Retainer

FILTER REMOVAL - DOWNFLOW MODELS

1. Turn off electrical power supply to the furnace at disconnect switch. Remove access doors.
2. Filters are installed in the plenum area above the blower assembly. Filters rest against the side of the plenum wall and are supported in the middle by a frame. Lift filter slightly to dislodge and remove for service.
3. Remove the filter and follow the cleaning instructions above. DO NOT remove the filter stiffener rods, if provided. When reinstalling the filter(s) be sure it completely covers the plenum opening.

To reinstall the filters, simply reverse this procedure.

HORIZONTAL APPLICATIONS

In most horizontal applications the filter is located in the return air duct near the furnace or in a filter grille.

⚠WARNING

When replacing filters, DO NOT use a type with excessively high pressure drop. Some high efficiency filters available will cause the furnace to operate improperly and could result in a safety hazard.

LUBRICATION

Blower motors in these furnaces are permanently lubricated and do not require periodic oiling.

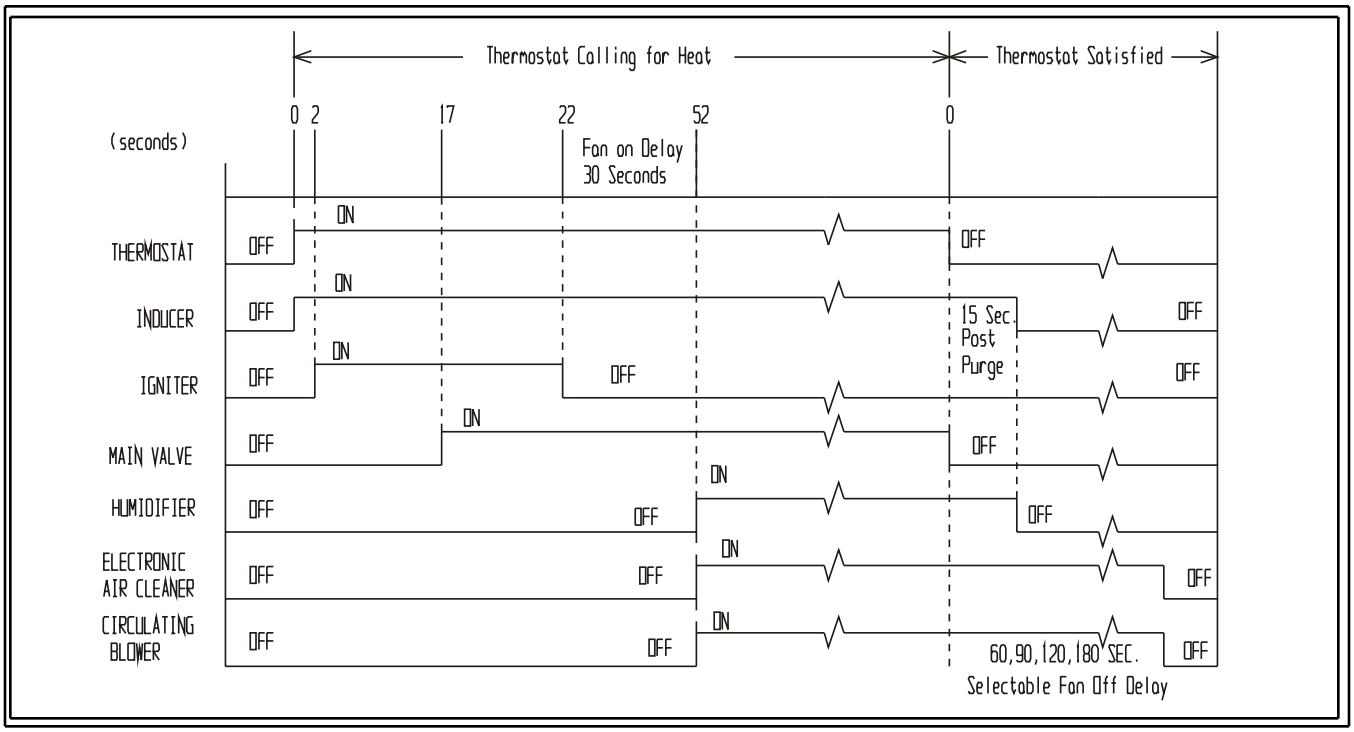


FIGURE 42 : Furnace Control Event Schedule

BLOWER CARE

Even with good filters properly in place, blower wheels and motors will become dust laden after long months of operation. The entire blower assembly should be inspected annually. If the motor and wheel are heavily coated with dust, they can be brushed and cleaned with a vacuum cleaner.

The procedure for removing the direct drive blower assembly for cleaning is as follows:

1. Disconnect the electrical supply to the furnace and remove remove the access doors.
2. On downflow/horizontal models only, remove the two wires leading to the auxiliary limit mounted on the blower housing.
3. On downflow/horizontal models only, remove four top panel screws and lift the top panel enough to disengage and remove the flue chase assembly.
4. Remove blower assembly mounting screws and slide the blower assembly out of the slots in the deck. If the two shipping screws were not previously removed, also remove and discard these two screws located on each front corner of the blower assembly.
5. On downflow models only, note the wire/terminal location and then remove the blower wiring from the furnace control. Remove the protective boot and disconnect run capacitor wires. Remove the screws securing the electrical panel to the blower housing. Pull blower assembly out of the unit. When cleaning or servicing the blower assembly, DO NOT remove or change the balance clips on the blower wheel.
6. To reassemble, reverse the procedure, restore power to the furnace and verify operation.

BURNER REMOVAL/CLEANING

The main burners should be checked periodically for dirt accumulation.

If cleaning is required, follow this procedure:

1. Turn off the electrical power to the unit.
2. Turn off the gas supply at the external manual shutoff valve and loosen the ground union joint.
3. Remove the upper access panel and remove the burner box cover.
4. Remove the screws that hold the burner box assembly to the vest panel and remove the assembly.
5. Remove burners from the burner assembly.
6. Burners may be cleaned by rinsing in hot water.
7. Reassemble the burners in the reverse order.

CLEANING THE HEAT EXCHANGER

1. Turn off the main manual gas valve external to the furnace.
2. Turn off electrical power to the furnace.
3. Remove the upper access panel and remove the burner box cover.
4. Disconnect wires from flame sensor, rollout switch and HSI igniter. Remove igniter carefully, as it is easily broken.

> **⚠ CAUTION**
>
> *Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.*

5. Remove the screws that hold the burner box assembly to the vestibule panel and remove the assembly. The upper portion of the heat exchanger will now be exposed.
6. Remove the upper cover plate at the top of the furnace. Remove the internal baffle.
7. The upper portion of the heat exchanger is now exposed.
8. With a long flexible wire brush, clean inside each tube at both the top and bottom. The brush must pass around the rear heat exchanger tubes. Vacuum loose scale and dirt from each tube.
9. Clean - vacuum all burners.
10. Replace all components in reverse order. Reconnect all wiring.
11. Restore electrical power and gas supply to the furnace.
12. Check furnace operation.

CLEANING THE SECONDARY HEAT EXCHANGER

1. Follow steps 1 thru 10 under Cleaning the Primary Heat Exchanger.
2. Remove the vent piping from the venter housing. Disconnect the drain lines from the venter and from the condensate drain pan. Remove the venter blower and the condensate pan. The turbulators can then be gently removed from the secondary heat exchanger.
3. With a stiff wire brush, brush out loose scale or soot.
4. Vacuum the secondary heat exchanger.
5. Finish the cleaning procedure by following steps 10 thru 12 under Cleaning the Primary Heat Exchanger.

VENT/AIR INTAKE

Should it be necessary to service the vent/air intake system, the manufacturer recommends this service be conducted by a qualified service agency.

The operation of this appliance requires the reassembly and resealing of the vent/air intake system as specified on Page 11.

TROUBLESHOOTING

The following visual checks should be made before troubleshooting:

1. Check to see that the power to the furnace and the ignition control module is ON.
2. The manual shutoff valves in the gas line to the furnace must be open.
3. Make sure all wiring connections are secure.
4. Review the sequence of operation.

Start the system by setting the thermostat above the room temperature. Observe the system's response. Then use the troubleshooting section in this manual to check the system's operation.

FURNACE CONTROL DIAGNOSTICS

The furnace has built-in, self diagnostic capability. If a system problem occurs, a fault code is shown by a blinking red LED. It is located behind a clear view port in the blower compartment door. DO NOT remove the furnace blower compartment panel OR turn off furnace power as either action will clear the control's memory of the fault.

The control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate the failure code. If the failure is internal to the control, the light will stay on continuously. In this case, the entire control should be replaced as the control is not field repairable.

Flash sequence codes 1 through 11 are as follows: LED will turn “on” for one second and “off” for one second. This pattern will be repeated the number of times equal to the code. For example, six “on” flashes equals a number 6 fault code.

All flash code sequences are broken by a 2 second “off” period.

IGNITION CONTROL (P/N 031-01267-001)

Normal flame sense current is approximately

3.7 microamps DC (υa)

Low flame signal control lockout point is

0.9 microamps DC (υa)

CONTINUOUS FLASH: This indicates that flame was sensed when there was not a call for heat. With this fault code the control will turn on both the inducer motor and supply air blower. This fault would typically be caused by a gas valve that leaks through or is slow closing.

2 FLASH: This indicates that the normally open pressure switch contacts are stuck in the closed position. The control confirms these contacts are open at the beginning of each heat cycle. This would indicate a faulty pressure switch or mis-wiring.

3 FLASH: This indicates the normally open pressure switch contact did not close at the beginning of the heat cycle. This could be caused by a number of problems; faulty inducer, blocked vent pipe, broken pressure switch hose or faulty pressure switch.

4 FLASH: This indicates that a primary or auxiliary limit switch has opened its normally closed contacts. With this fault code the control will operate the supply air blower and inducer. This condition may be caused by: dirty filter, improperly sized duct system, incorrect blower speed setting, incorrect firing rate or faulty blower motor.

5 FLASH: This fault is indicated if the normally closed contacts in the rollout switch opens. The rollout control is manually reset. If it has opened, check for proper combustion air, proper inducer operation, primary heat exchanger failure or burner problem. Be sure to reset the switch after correcting the failure condition.

6 FLASH: This indicates that after the unit was operating, the pressure switch opened 4 times during the call for heat. If the main blower is in a "Delay on" mode it will complete it, and any subsequent delay off period. The ventor continues to operate until the pressure switch re-closes or a call for heat is removed.

7 FLASH: This fault code indicates that the flame could not be established. This no-light condition occured 3 times (2 retries) during the call for heat before locking out. This may be caused by low gas pressure, faulty gas valve, faulty hot surface ignitor or burner problem.

8 FLASH: This fault is indicated if the flame is lost 5 times (4 recycles) during the heating cycle. This could be caused by low gas pressure or faulty gas valve.

9 FLASH: Indicates reversed line voltage polarity. Both heating and cooling operations will be affected. Check polarity at furnace and branch.

11 FLASH: This fault will be indicated if the rollout jumper wire connection soldered into the board, is broken. If this fault occurs the control will have to be replaced. This fault may also occur in installations where an improper ground is present. Prior to replacing control, verify that unit is properly grounded.

STEADY ON: This fault occurs if the gas valve is energized when there is no call for heat. If this happens the ventor is energized and will remain energized for 5 seconds or until the fault clears itself at which point the ventor de-energizes. This failure is counted as a recycle. Check the gas valve and control for proper operation.

60 MINUTE AUTOMATIC RESET FROM LOCKOUT: This control includes a "watchdog" type circuit that will reset from a lockout condition after 60 minutes. Operational faults 1,6,7,8 and Steady On will be reset. This provides protection to an unoccupied structure if a temporary condition exists causing a furnace malfunction. An example would be a low incoming gas supply pressure preventing unit operation. When the gas pressure is restored , at some point the "watchdog" would restart the unit and provide heat for the house.

NOTE: If a flame is detected the control flashes the LED for 1/8 of a second and then enters a flame stabilization period.

⚠WARNING

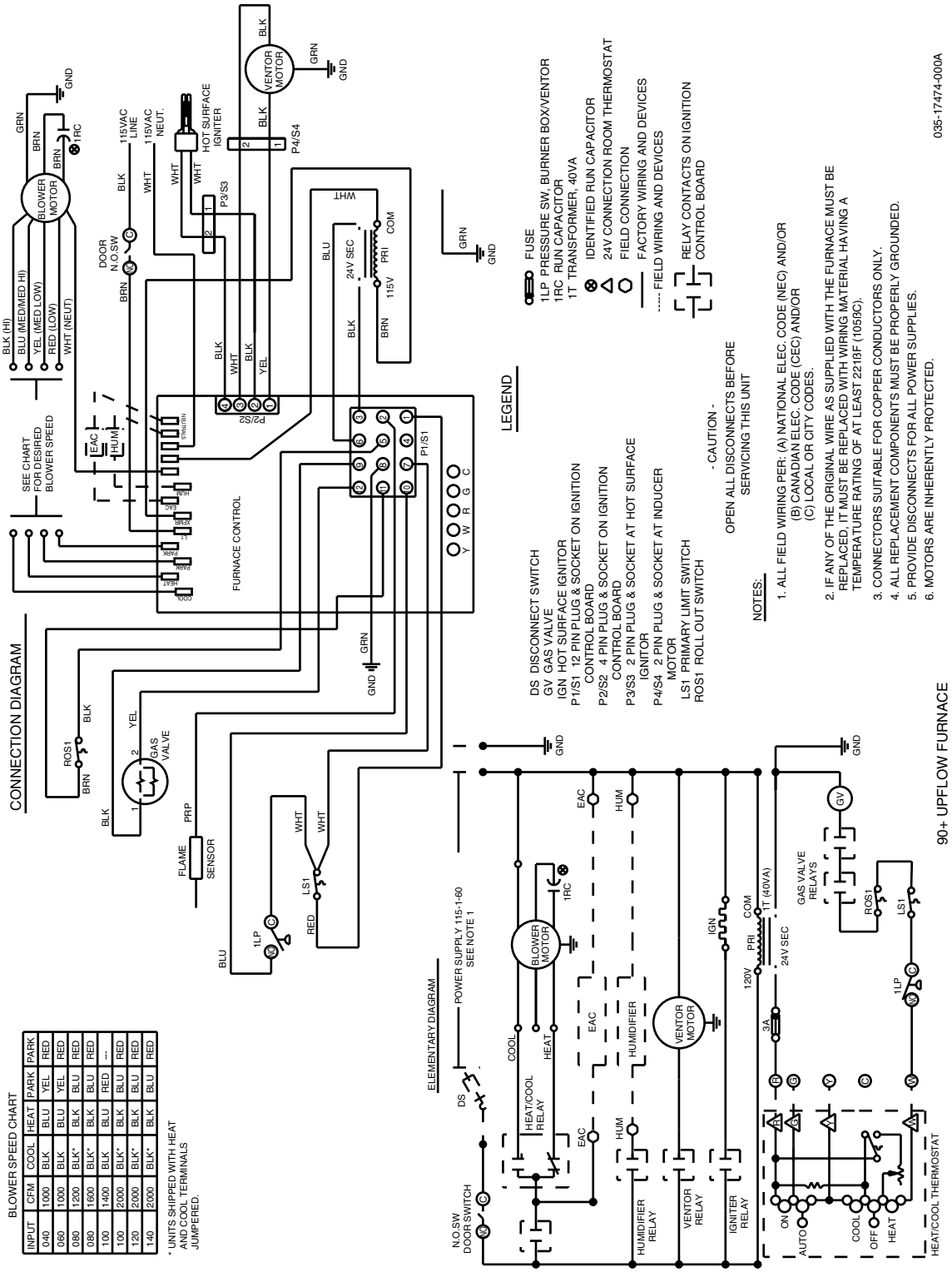
Never jump pressure switch to allow furnace operation. To do so will allow furnace to operate under potentially hazardous conditions.

Do not try to repair controls. Replace defective controls with UPG Source 1 Parts.

Never adjust pressure switch to allow furnace operation.

WIRING DIAGRAM - UPFLOW MODELS: P*UR / FG9-UP / G9T-UP

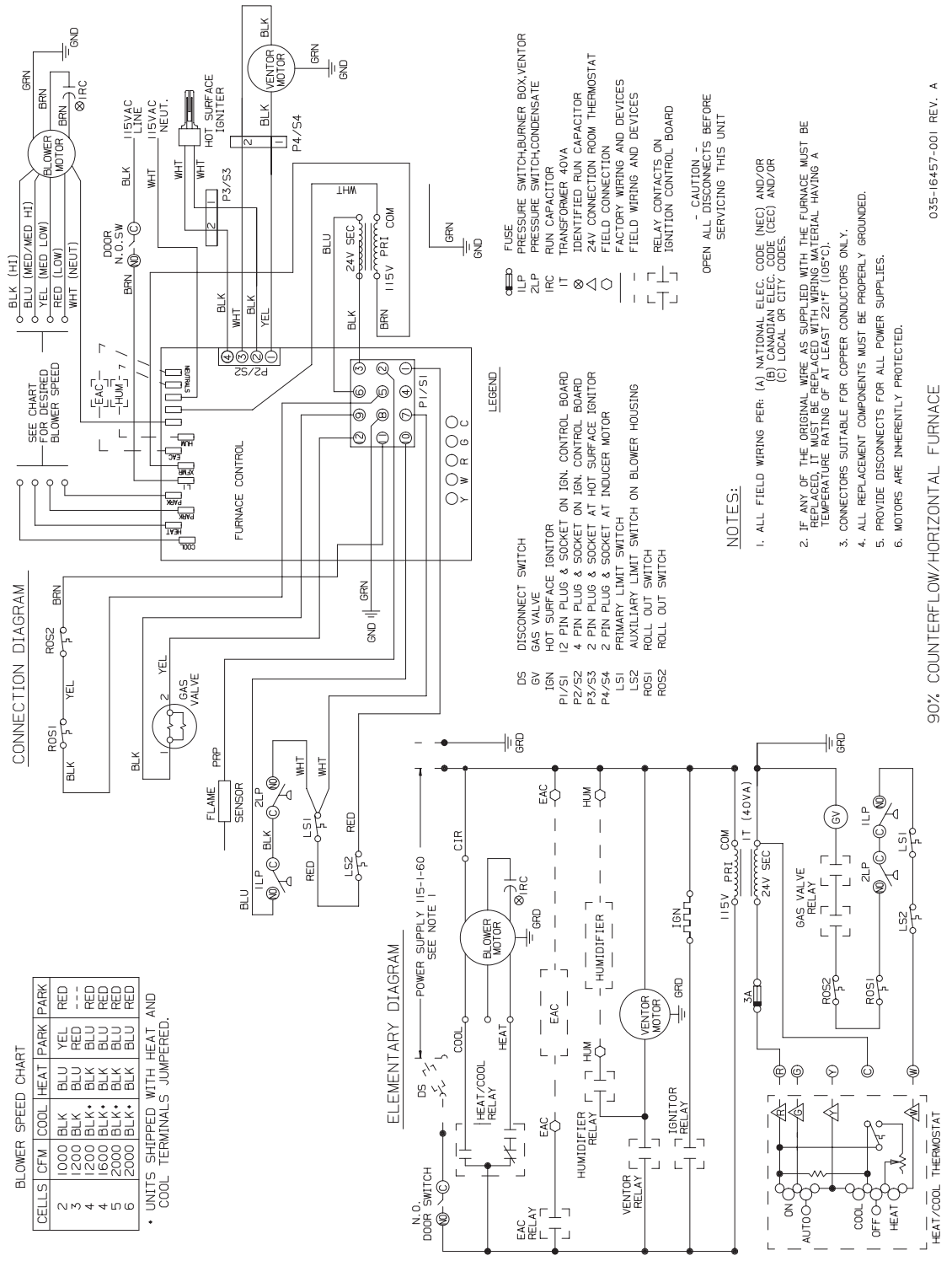
NOTE: THE FURNACE'S CONTROL SYSTEM REQUIRES CORRECT POLARITY OF THE POWER SUPPLY.



BLOWER SPEED CHART					
INPUT	CFM	COOL	HEAT	PARK	PARK
040	1000	BLK	BLU	YEL	RED
060	1000	BLK	BLU	YEL	RED
080	1200	BLK*	BLK	BLU	RED
080	1600	BLK*	BLK	BLU	RED
100	1400	BLK	BLU	RED	---
100	2000	BLK*	BLK	BLU	RED
120	2000	BLK*	BLK	BLU	RED
140	2000	BLK*	BLK	BLU	RED

WIRING DIAGRAM - DOWNFLOW/HORIZONTAL MODELS: P*DH / FG9-DH / G9T-DH

NOTE: THE FURNACE'S CONTROL SYSTEM REQUIRES CORRECT POLARITY OF THE POWER SUPPLY.



CELLS	CFM	COOL	HEAT	PARK	PARK
2	1000	BLK	BLU	YEL	RED
3	1200	BLK	BLU	RED	---
4	1200	BLK•	BLK	BLU	RED
4	1600	BLK•	BLK	BLU	RED
5	2000	BLK•	BLK	BLU	RED
6	2000	BLK•	BLK	BLU	RED

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Unitary Product Group

5005 York Drive

Norman OK 73069