



# Heating and Air Conditioning

## TECHNICAL GUIDE

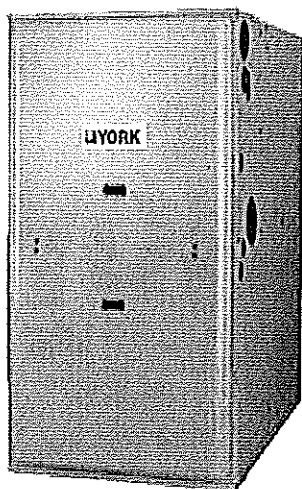
**95.5% AFUE SINGLE STAGE  
RESIDENTIAL GAS FURNACES**

**MULTI-POSITION**

**MODELS: TG9S**

**NATURAL GAS**

**40 - 130 MBH INPUT**



Due to continuous product improvement, specifications are subject to change without notice.

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Additional rating information can be found at [www.ahridirectory.org](http://www.ahridirectory.org)

### WARRANTY SUMMARY

A 20-year limited warranty on heat exchangers in residential applications.

A 10-year warranty on the heat exchanger in commercial applications.

Standard 5-year limited Parts warranty.

Extended lifetime heat exchanger and 10-year limited parts warranty when product is registered online within 90 days of purchase for replacement or closing for new home construction.

See Limited Warranty certificate in Users Information Manual for details.

### DESCRIPTION

These compact units employ induced combustion, reliable hot surface ignition and high heat transfer aluminized tubular heat exchangers. The units are factory shipped for installation in upflow or horizontal applications and may be converted for downflow applications.

These furnaces are designed for residential installation in a basement, closet, alcove, attic, recreation room or garage and are also ideal for commercial applications. All units are factory assembled, wired and tested to assure safe dependable and economical installation and operation.

These units are Category IV listed and may be vented either through side wall or roof applications using approved plastic combustion air and vent piping.

### FEATURES

- Easily applied in upflow, horizontal left or right, or downflow installation with minimal conversion necessary.
- Compact, easy to install, ideal height 33" tall cabinet.
- Blower-off delay for cooling SEER improvement.
- Easy access to controls to connect power/control wiring.
- Built-in, high level self diagnostics with fault code displays standard on integrated control module for reliable operation.
- Low unit amp requirement for easy replacement application.
- Single wire twinning or staging feature available.
- All models are convertible to use propane (LP) gas.
- Electronic Hot Surface Ignition saves fuel cost with increased dependability and reliability.
- 100% shut off main gas valve for extra safety.
- 4 speed, direct drive PSC motor.
- 24V, 40 VA control transformer and blower relay supplied for add-on cooling.
- Hi-tech tubular aluminized steel primary heat exchanger.
- Secondary heat exchanger made of corrosion resistant stainless steel materials.
- Timed on, adjustable off blower capability for maximum comfort.
- Blower door safety switch.
- Solid removable bottom panel allows easy conversion.
- Airflow leakage less than 1% of nominal airflow at duct-blaster conditions.
- No knockouts to deal with, making installation easier.
- Movable duct connector flanges for application flexibility.
- Quiet inducer operation.
- Inducer rotates for easy conversion of venting options.
- Fully supported blower assembly for easy access and removal of blower.
- External air filters used for maximum flexibility in meeting customers IAQ needs.
- Protection included from air intake, exhaust vent, or condensate blockage.
- No special vent termination required.
- 1/4 turn knobs provided for easy door removal.
- Internal condensate trap design (patent pending) provides condensate management options and is self-priming to prevent nuisance problems.
- Venting applications - may be installed as either 2-pipe (sealed combustion) or single-pipe vent (using indoor combustion air).

**FOR DISTRIBUTION USE ONLY - NOT TO BE USED AT POINT OF RETAIL SALE**

## FILTER PERFORMANCE

The airflow capacity data published in the "Blower Performance" tables shown represents blower performance WITH-OUT filters.

All applications of these furnaces require the use of field installed air filters. All filter media and mounting hardware or provisions must be field installed external to the furnace cabinet. DO NOT attempt to install any filters inside the furnace.

### NOTICE

*Single side return above 1800 CFM is approved as long as the filter velocity does not exceed filter manufacturer's recommendation and a transition is used to allow use on a 20x25 filter.*

## Recommended Filter Sizes (High velocity 600 FPM)

CFM	Cabinet Size	Side (in)	Bottom (in)
800	A	16 x 25	14 x 25
1000	A	16 x 25	14 x 25
1200	A	16 x 25	14 x 25
1200	B	16 x 25	16 x 25
1600	B	16 x 25	16 x 25
1600	C	16 x 25	20 x 25
2000	C	(2) 16 x 25	20 x 25
2200	C	(2) 16 x 25	20 x 25
2000	D	(2) 16 x 25	22 x 25

- Air velocity through throwaway type filters may not exceed 300 feet per minute (91.4 m/min). All velocities over this require the use of high velocity filters.
- Do not exceed 1800 CFM using a single side return and a 16x25 filter. For CFM greater than 1800, you may use two side returns or one side and the bottom or one return with a transition to allow use of a 20x25 filter.

## Unit Clearances to Combustibles

Application	Upflow	Downflow	Horizontal
Top	1"	0"	0"
Vent	0"	0"	0"
Rear	0"	0"	0"
Side	0"	0"	1"
Front*	0"	0"	0"
Floor	Combustible	Combustible <sup>1</sup>	Combustible
Closet	Yes	Yes	Yes
Line Contact	No	No	Yes

- For combustible floors only when used with special sub-base.
- \* - 24" clearance in front and 18" on side recommended for service access. All furnaces approved for alcove and attic installation.

## ACCESSORIES

**Propane (LP) Conversion Kit** - This accessory conversion kit may be used to convert natural gas (N) units for propane (LP) operation.

S1-1NP0347 - All Models except 130K Model  
S1-1NP0501 - 130K Model

**Concentric Vent Termination** - For use through rooftop, side-wall. Allows combustion air to enter and exhaust to exit through single common hole. Eliminates unsightly elbows for a cleaner installation.

S1-1CT0302 (2") & S1-1CT0302-636 (2")  
S1-1CT0303 (3") & S1-1CT0303-636 (3")

**Sidewall Vent Termination Kit** - For use on sidewall, two-pipe installations only. Provide a more attractive termination for locations where the terminal is visible on the side of the home.

S1-1HT0901 (3")  
S1-1HT0902 (2")

**Condensate Neutralizer Kit** - Neutralizer cartridge has a 1/2" plastic tube fittings for installation in the drain line. Calcium carbonate refill media is also available from the Source 1 Parts (p/n 026-30228-000).

1NK0301

## Side Return Filter Racks -

S1-1SR0200 - All Models  
S1-1SR0402 - All Models

**Bottom Return Filter Racks** - 1BR05xx series are galvanized steel filter racks. 1BR06xx are pre-painted steel filter racks to match the appearance of the furnace cabinet.

S1-1BR0514 or 1BR0614 - For 14-1/2" cabinets  
S1-1BR0517 or 1BR0617 - For 17-1/2" cabinets  
S1-1BR0521 or 1BR0621 - For 21" cabinets  
S1-1BR0524 or 1BR0624 - For 24-1/2" cabinets

**Combustible Floor Base Kit** - For installation of these furnaces in downflow applications directly onto combustible flooring material. These kits are required to prevent potential overheating situations. Combustible floor base kit provides access for combustible airflow.

S1-1CB0514 - For 14-1/2" cabinets  
S1-1CB0517 - For 17-1/2" cabinets  
S1-1CB0521 - For 21" cabinets  
S1-1CB0524 - For 24-1/2" cabinets

**High Altitude Pressure Switches** - For installation where the altitude is less than 5,000 feet it is not required that the pressure switch be changed. For altitudes above 5,000 feet, see kits below.

S1-1PS3306 - 060  
S1-1PS3307 - 040, 080  
S1-1PS3302 - 100, 120, 130

**Thermostats** - Compatible thermostat controls are available through accessory sourcing. For optimum performance and installation, refer to the UPGNET "Low Voltage Wiring Diagram" document to select and apply controls.

## SECTION VIII: COMBUSTION AIR AND VENT SYSTEM

### COMBUSTION AIR AND VENT SAFETY

This Category IV, dual certified direct vent furnace is designed for residential application. It may be installed without modification to the condensate system in a basement, garage, equipment room, alcove, attic or any other indoor location where all required clearance to combustibles and other restrictions are met. The combustion air and the venting system must be installed in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code Z223.1/NFPA 54 (latest edition), or Sections 7.2, 7.3 or 7.4 of CSA B149.1, National Gas and Propane Codes (latest edition) or applicable provisions of the local building code and these instructions.

### IMPORTANT

The "VENT SYSTEM" must be installed as specified in these instructions for Residential and non-HUD Modular Homes. The direct vent system is the only configuration that can be installed in a non-HUD Modular Home.

### WARNING

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.

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

### CAUTION

When combustion air pipe is installed above a suspended ceiling or when it passes through a warm and humid space, the pipe must be insulated with 1/2" Armaflex or other heat resistant type insulation if two feet or more of pipe is exposed.

Vent piping must be insulated if it will be subjected to freezing temperatures such as routing through unheated areas or through an unused chimney.

### COMBUSTION AIR/VENT PIPE SIZING

The size of pipe required will be determined by the furnace model, the total length of pipe required and the number of elbows required.

Table 7 lists the maximum equivalent length of pipe allowed for each model of furnace. The equivalent length of elbows is shown in Table 9. The equivalent length of the vent system is the total length of straight pipe PLUS the equivalent length of all of the elbows.

The following rules must also be followed:

1. Long radius (sweep) elbows are recommended. Standard elbows may be used, but since they have a longer equivalent length, they will reduce the total length of pipe that will be allowed. Short radius (plumbing vent) elbows are not allowed. The standard dimensions of the acceptable elbows are shown below.
2. The maximum equivalent length listed in Table 7 is for the vent piping and the air intake piping separately. For example, if the table allows 65 equivalent feet for a particular model, then the vent can have 65 equivalent feet of pipe, AND the combustion air intake can have another 65 equivalent feet of pipe.
3. Three vent terminal elbows (two for the vent and one for the combustion air intake) are already accounted for and need not be included in the equivalent length calculation.

4. All combustion air and vent pipe must conform to American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) standards D1785 (Schedule 40 PVC), D2665 (PVC-DWV), F891 (PVC-DWV Cellular Core), D2261 (ABS-DWV) or F628 (Schedule 40 ABS). Pipe cement and primer must conform to ASTM Standard D2546 (PVC) or D2235 (ABS). If ABS pipe is to be used, any joint where ABS pipe is joined to PVC pipe must be glued with cement that is approved for use with BOTH materials. Metallic materials must not be used for venting or air intake.
5. If a flexible connector is used in the vent system, it must be made of a material that is resistant to acidic exposure and to at least 225°F (107°C) temperature. Flexible connectors are also allowed in the combustion air pipe.
6. All models are supplied with 2" (5.1 cm) vent connections. When the pipe must be increased to 3" (7.6 cm) diameter, the transition from 2" to 3" must be done as close to the furnace as possible. For upflow models, the transition from 2" to 3" should be done immediately above the furnace. For downflow or horizontal models, the transition from 2" to 3" pipe should be done immediately after exiting the furnace.
7. In Canada, vents shall be certified to ULC S636, Standard for Type BH Gas Venting Systems.
8. In Canada, the first three feet (91.4 cm) of the vent must be readily accessible for inspection.
9. For single pipe systems it is recommended to install the combustion air coupling provided and install approximately 18" (46 cm) of PVC pipe on the furnace.
10. Minimum vent length for all models is 5 feet (1.5 m).

TABLE 7: Maximum Equivalent Pipe Length

Model Input BTUH (kW)	Pipe Size Inches (cm)	Maximum Equivalent length feet (m)
40,000 (11.7)	2 (5.1)	65 (19.8)
40,000 (11.7)	3 (7.6)	90 (27.4)
60,000 (17.6)	2 (5.1)	65 (19.8)
60,000 (17.6)	3 (7.6)	90 (27.4)
80,000 (23.4)	2 (5.1)	65 (19.8)
80,000 (23.4)	3 (7.6)	90 (27.4)
100,000 (29.3)	2 (5.1)	30 (9.2)
100,000 (29.3)	3 (7.6)	90 (27.4)
120,000 (35.1)	2 (5.1)	30 (9.2)
120,000 (35.1)	3 (7.6)	90 (27.4)
130,000 (38.1)	3 (7.6)	85 (25.9)

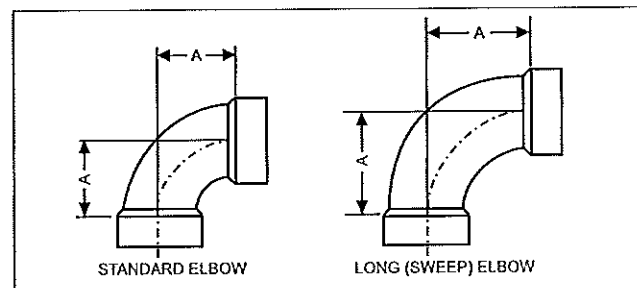


FIGURE 29: Dimensions

TABLE 8: Elbow Dimensions

Elbow "A" Dimension	
2" Standard	2-5/16"
3" Standard	3-1/16"
2" Sweep	3-1/4"
3" Sweep	4-1/16"

Dimensions are those required in Standard ASTM D-3311.

TABLE 9: Equivalent Length of Fittings

Fitting	Equivalent Length
2" 90° sweep elbow	5 feet of 2" pipe
2" 45° sweep elbow	2-1/2 feet of 2" pipe
2" 90° standard elbow	7 feet of 2" pipe
2" 45° standard elbow	3-1/2 feet of 2" pipe
3" 90° sweep elbow	5 feet of 3" pipe
3" 45° sweep elbow	2-1/2 feet of 3" pipe
3" 90° standard elbow	7 feet of 3" pipe
3" 45° standard elbow	3-1/2 feet of 3" pipe
2" corrugated connector	10 feet of 2" pipe
3" corrugated connector	10 feet of 3" pipe

Example:

An 80,000 BTUH furnace requires 32 feet of pipe and five 90° elbows. Using 2" pipe and standard elbows, the total equivalent length will be:

$$\begin{array}{rcl}
 32 \text{ feet of 2" pipe} & = & 32 \text{ equivalent feet} \\
 5 - 90^\circ \text{ standard 2" elbows} & = (5 \times 7) = & 35 \text{ equivalent feet} \\
 \text{Total} & = & 67 \text{ equivalent feet of 2" pipe}
 \end{array}$$

This exceeds the 65 foot maximum equivalent length of 2" pipe allowed for that model and is thus not acceptable.

By using sweep elbows, the total equivalent length will be:

$$\begin{array}{rcl}
 32 \text{ feet of 2" pipe} & = & 32 \text{ equivalent feet} \\
 5 - 90^\circ \text{ sweep 2" elbows} & = (5 \times 5) = & 25 \text{ equivalent feet} \\
 \text{Total} & = & 57 \text{ equivalent feet of 2" pipe}
 \end{array}$$

This is less than the 65 foot maximum equivalent length of 2" pipe allowed for that model and is thus acceptable.

Alternatively, using 3" pipe and standard elbows, the total equivalent length will be:

$$\begin{array}{rcl}
 32 \text{ feet of 3" pipe} & = & 32 \text{ equivalent feet} \\
 5 - 90^\circ \text{ standard 3" elbows} & = (5 \times 7) = & 35 \text{ equivalent feet} \\
 \text{Total} & = & 67 \text{ equivalent feet of 3" pipe}
 \end{array}$$

This is less than the 90 foot maximum equivalent length of 3" pipe allowed for that model and is thus acceptable.

TABLE 10: Combustion Air Intake and Vent Connection Size at Furnace (All Models)

FURNACE VENT CONNECTION SIZES	
Furnace Input	All
Intake Pipe Size	2" (5.1 cm)
Vent Pipe Size	2" (5.1 cm)

**IMPORTANT**

Furnace vent pipe connections are sized for 2" (5.1 cm) pipe. Any pipe size change must be made outside the furnace casing in a vertical pipe section to allow proper drainage of condensate. An offset using two 45° (degree) elbows will be required for plenum clearance when the vent is increased to 3" (7.6 cm).

**IMPORTANT**

Accessory concentric vent / intake termination kits 1CT0302 and 1CT0303, and for Canadian applications 1CT0302-636 and 1CT0303-636 are available and approved for use with these furnaces. Horizontal sidewall vent terminations kits 1HT0901 & 1HT0902 are also approved for use with these furnaces.

**COMBUSTION AIR AND VENT PIPING ASSEMBLY**

The final assembly procedure for the combustion air and 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 (bevel) the outer edges of the piping.
4. Dry-fit the vent piping assembly from the furnace to the outside termination checking for proper fit support and slope.
5. Dry-fit the combustion air piping assembly checking for proper fit, support and slope on the following systems:
  - a. Sealed combustion air systems from the furnace to the outside termination.
  - b. Ventilated combustion air systems from the furnace to the attic or crawl space termination.

**CAUTION**

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

6. Disassemble the combustion air and vent piping, apply cement primer and the cement per the manufactures instructions. Primer and cement must conform to ASTM D2564 for PVC, or ASTM D2235 for ABS piping.
7. All joints must provide a permanent airtight and watertight seal.
8. Support the combustion air and vent piping such that it is angled a minimum of 1/4" per foot (21 mm/m) so that condensate will flow back towards the furnace. Piping should be supported with pipe hangers to prevent sagging.
9. Seal around the openings where the combustion air and / or vent piping pass through the roof or sidewalls.

**COMBUSTION AIR / VENTING****IMPORTANT**

The vent must be installed with the minimum required clearances, and must comply with local codes and requirements.

## VENT CLEARANCES

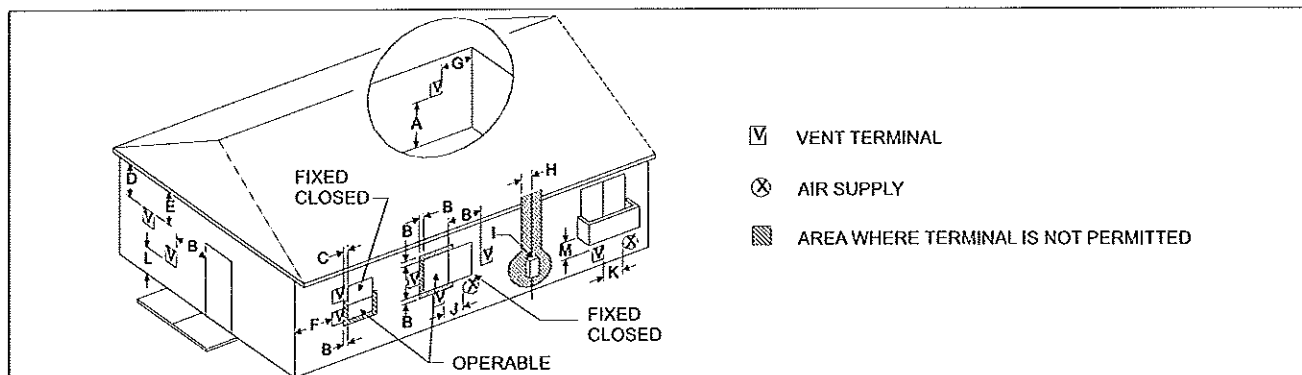


FIGURE 30: Home Layout

Direct Vent Terminal Clearances	Canadian Installations <sup>1,3</sup>	US Installation <sup>2,3</sup>
A. Clearance above grade, veranda, porch, deck, or balcony	12" (30.5 cm)	12" (30.5 cm)
B. Clearance to window or door that may be opened	12" (30.5 cm) for models ≤100,000 BTUH (30 kW), 36" (91.4 cm) for models >100,000 BTUH (30 kW).	Two-pipe (direct vent) applications: 12" (30.5 cm)†† Single-pipe applications: 4 feet (1.2 m).
C. Clearance to permanently closed window	12" (30.5 cm)	12" (30.5 cm)
D. Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
E. Clearance to unventilated soffit	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
F. Clearance to outside corner	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
G. Clearance to inside corner	3 feet (91.4 cm)	3 feet (91.4 cm)
H. Clearance to each side of center line extended above meter/regulator assembly	Above a meter/regulator assembly within 3 feet (91.4 cm) horizontally of the vertical center-line of the regulator vent outlet to a maximum vertical distance of 15 feet (4.5 m) above the meter/regulator assembly.	Above a meter/regulator assembly within 3 feet (91 cm) horizontally of the vertical center-line of the regulator vent outlet to a maximum vertical distance of 15 feet (4.5 m) above the meter/regulator assembly.
I. Clearance to service regulator vent outlet	3 feet (91.4 cm)	3 feet (91.4 cm) or in accordance with local installation codes and the requirements of the gas supplier.
J. Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	12" (30.5 cm) for models ≤100,000 BTUH (30 kW), 36" (91 cm) for models >100,000 BTUH (30 kW).	Two-pipe (direct vent) applications: 12" (30.5 cm) Single-pipe applications: 4 feet (1.2 m).
K. Clearance to a mechanical supply inlet	6 feet (1.83 m)	3 feet (91.4 cm) above if within 10 feet (3 m) horizontally.
L. Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m)†	7 feet (2.13 m) or in accordance with local installation codes and the requirements of the gas supplier.
M. Clearance under veranda, porch, deck, or balcony	12" (30.5 cm)‡	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.

1. In accordance with the current CSA B149.1-00, Natural Gas and Propane Installation Code.

2. In accordance with the current ANSI Z223.1 / NFPA 54, National Gas Code.

3. In accordance with the current ANSI Z21.47 \* CSA 2.3 American National Standard.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

†† 12" (30.5 cm) up from the bottom edge of the structure for Two-pipe (direct vent) applications per ANSI Z223.1 / NFPA 54, National Gas Code.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 12" (30.5 cm) as specified in CSA B149.1-00.

A vent shall not terminate less than 12" (30.5 cm) above a grade level.

Any fresh air or make up inlet for dryer or furnace area is considered to be forced air inlet.

Avoid areas where condensate drippage may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.

A terminus of a vent shall be fitted with a cap in accordance with the vent manufacturer's installation instructions, or in accordance with the installation instructions for a special venting system.

Responsibility for the provision of proper adequate venting and air supply for application shall rest with the installer.

Vent shall extend high enough above building, or a neighboring obstruction, so that wind from any direction will not create a positive pressure in the vicinity of the vent.

## IMPORTANT

Consideration must be given for degradation of building materials by flue gases. Sidewall termination may require sealing or shielding of building surfaces with a corrosion resistant material to protect against combustion product corrosion. Consideration must be given to wind direction in order to prevent flue products and/or condensate from being blown against the building surfaces. If a metal shield is used it must be a stainless steel material at a minimum dimension of 20 inches (51 cm). It is recommended that a retaining type collar be used that is attached to the building surface to prevent movement of the vent pipe.

## VENT SYSTEM

This furnace is certified to be installed with one of two possible vent configurations.

1. Horizontal vent system. This vent system can be installed completely horizontal or combinations of horizontal, vertical, or offset using elbows.
2. Vertical vent system. This vent system can be installed completely vertical or a combination of horizontal, vertical, or offset using elbows.

## NOTICE

*On 130K BTU models, there is no provision for the vent to exit the top of the cabinet, the vent must always exit one of the sides.*

## VENT APPLICATIONS AND TERMINATION

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

1. Observe all clearances listed in vent clearances in these instructions.
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.
6. Horizontal portions of the vent system must slope upwards and be supported to prevent sagging.
7. Direct vent systems must be installed so the vent and the combustion air pipes terminate in the same atmospheric zone. Refer to Figures 32 or 33.

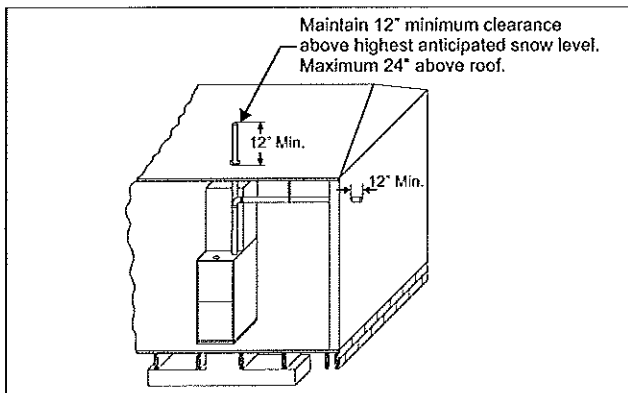


FIGURE 31: Termination Configuration - 1 Pipe

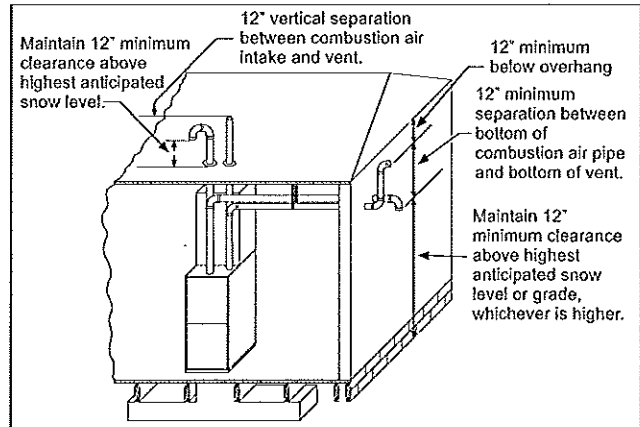


FIGURE 32: Termination Configuration - 2 Pipe

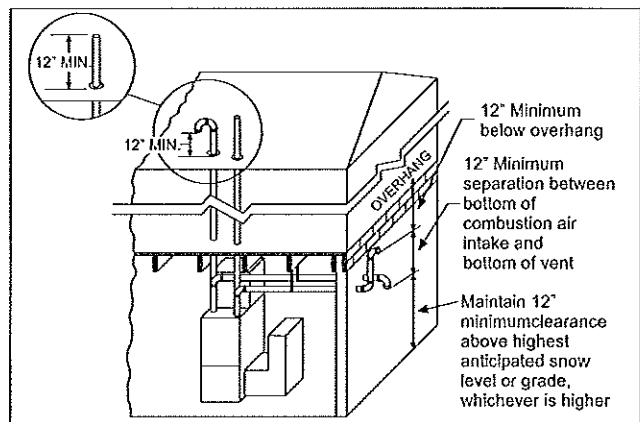


FIGURE 33: Termination Configuration - 2 Pipe Basement

## VENTING MULTIPLE UNITS

Multiple units can be installed in a space or structure as either a single pipe configuration or a two-pipe configuration.

The combustion air side of the single pipe configuration shown in Figure 31 is referred to in these instructions as ambient combustion air supply. Follow the instructions for ambient combustion air installations, paying particular attention to the section on air source from inside the building. The vent for a single pipe system must be installed as specified in the venting section of these instructions with the vent terminating as shown in Figure 31. Each furnace must have a separate vent pipe. Under NO circumstances can the two vent pipes be tied together.

The combustion air side of the two-pipe configuration shown in Figure 32 can be installed so the combustion air pipe terminates as described in outdoor combustion air or ventilated combustion air sections in these instructions. Follow the instructions for outdoor combustion air or ventilated combustion air and the instructions for installing the vent system with the vent terminating as shown in Figures 34 or 35. The two-pipe system must have a separate combustion air pipe and a separate vent pipe for each furnace. Under NO circumstances can the two combustion air or vent pipes be tied together. The combustion air and vent pipes must terminate in the same atmospheric zone.