

# INSTALLER'S GUIDE

\*UD-IN-2  
18-CD19D7-1

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Product Section	Unitary
Product	Furnace — Gas
Model	*UD
Literature Type	Installer's Guide
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ALL phases of this installation must comply with  
NATIONAL, STATE AND LOCAL CODES

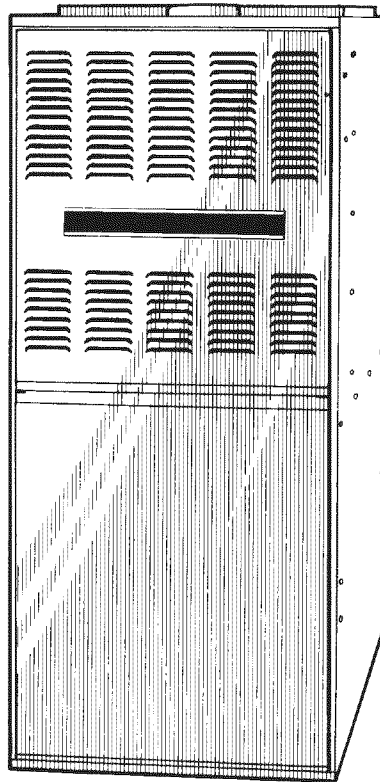
## Model:

\*UD040C924H      \*UD100C945H  
\*UD040C930H      \*UD100C948H  
\*UD060C924H      \*UD100C960H  
\*UD060C936H      \*UD100C961H  
\*UD080C924H      \*UD120C954H  
\*UD080C936H      \*UD120C960H  
\*UD080C948H      \*UD140C960H  
\*UD100C936H

\* — The first letter may be "A" or "T"

## Upflow / Horizontal Gas-Fired Furnaces "Fan Assisted Combustion System"

**IMPORTANT**— This Document is customer property and is to remain with this unit.  
Please return to service information pack upon completion of work.



CONTENTS	PAGE
<b>INSTALLATION</b>	
General Installation Instructions .....	2
Location & Clearances .....	2
Horizontal Installation .....	3
Air for Combustion and Ventilation .....	3&4
Duct Connections .....	5
Return Air — Filters .....	5&6
Venting — General Information .....	6&7
Venting Into a Masonry Chimney .....	7
Single Appliance Venting (with Tables) .....	8-11
Common Venting (with Tables) .....	12-19
Venting Examples .....	20-22
Electrical Connections .....	23
Gas Piping .....	23
<b>START-UP AND ADJUSTMENT</b>	
Preliminary Inspections .....	24
Combustion and Input Check .....	24
High Altitude Derate .....	24
Sequence of Operation .....	25
Lighting Instructions .....	25
Control and Safety Switch Adjustment .....	26
<b>ABNORMAL CONDITIONS</b> .....	26
<b>FIELD WIRING DIAGRAMS</b> .....	27
<b>OUTLINE DRAWING</b> .....	28

## GENERAL

The manufacturer assumes no responsibility for equipment installed in violation of any code or regulation.

It is recommended that Manual J of the Air Conditioning Contractors Association (ACCA) or A.R.I. 230 be followed in estimating heating requirements. When estimating heating requirements for installation at Altitudes above 2000 ft., remember the gas input must be reduced (See GAS INPUT ADJUSTMENT).

**Material in this shipment has been inspected at the factory and released to the transportation agency without known damage. Inspect exterior of carton for evidence of rough handling in shipment. Unpack carefully after moving equipment to approximate location. If damage to contents is found, report the damage immediately to the delivering agency.**

Codes and local utility requirements governing the installation of gas fired equipment, wiring, plumbing, and flue connections must be adhered to. In the absence of local codes, the installation must conform with the National Fuel Gas Code ANSI Z223.1 "latest edition" or CAN/CGA B149 Installation Codes. The latest code may be obtained from the American Gas Association Laboratories, 8501 E. Pleasant Valley Rd., Cleveland, Ohio 44131.

These furnaces have been classified as Fan Assisted Combustion system CATEGORY I furnaces as required by ANSI Z21.47 "latest edition" and CAN/CGA 2.3. Therefore they do not require any special provisions for venting other than what is indicated in these instructions. (Category I defined page 6).

**NOTE: To prevent shortening its service life, the furnace should not be used as a "Construction Heater" during the finishing phases of construction. The low return air temperatures can lead to the formation of condensate even though this is a non-condensing model. Condensate in the presence of chlorides and fluorides from paint, varnish stains, adhesives, cleaning compounds, and cement create a corrosive condition which may cause rapid deterioration of the heat exchanger.**

## LOCATION AND CLEARANCES

The location of the furnace is normally selected by the architect, the builder, or the installer. However, before the furnace is moved into place, be sure to consider the following requirements:

1. Is the location selected as near the chimney or vent and as centralized for heat distribution as practical?
2. Do all clearances between the furnace and enclosure equal or exceed the minimums stated in Table 1.
3. Is there sufficient space for servicing the furnace and other equipment? A minimum of 24 inches front accessibility to the furnace must be provided. Any access door or panel must permit removal of the largest component.
4. Are there at least 3 inches of clearance between the furnace combustion air openings in the front panel and any closed panel or door provided? (See Fig. 1)
5. Are the ventilation and combustion air openings large enough and will they remain unobstructed? If outside air is used, are the openings set above the highest snow accumulation level? (See the Air for Combustion and Ventilation section)
6. Allow sufficient height in supply plenum above the furnace to provide for cooling coil installation, if the cooling coil is not installed at the time of this furnace installation.
7. A furnace shall be installed so electrical components are protected from water.
8. If the furnace is installed in a **residential garage**, it must be installed so that the burners, and the ignition source are located not less than 18 inches above the floor and the furnace must be located or protected to avoid physical damage from vehicles.

**CAUTION: Do not install the furnace in a corrosive or contaminated atmosphere.**

**WARNING: Do not install the furnace directly on carpeting, tile or other combustible material other than wood flooring.**

MINIMUM CLEARANCE TO COMBUSTIBLE MATERIALS			
<b>UPFLOW CLOSET</b>			
LEFT SIDE	0 INCHES	FRONT	3 INCHES (See Note 1)
RIGHT SIDE	0 INCHES (+)	BACK	0 INCHES
FLUE	6 INCHES (#)	TOP	1 INCH
<b>HORIZONTAL CLOSET (See Note 2)</b>			
TOP	2 INCHES (+)	BACK	3 INCH
FLUE	6 INCHES (#)	SIDES	1 INCH
FRONT	3 INCHES (Note 1)		
<b>HORIZONTAL ALCOVE (See Note 2)</b>			
TOP	1 INCH (+)	BACK	0 INCHES
FLUE	6 INCHES (+)	SIDES	0 INCHES
FRONT	18 INCHES		
# - May be 1 inch when TYPE B-1 vent pipe is used. + - For 14-1/2" cabinets, 3 inches when single wall vent pipe is used.  When the 14-1/2" width models are installed in a horizontal position and a single wall vent pipe is used, a 6 inch clearance must be supplied between the vent pipe and combustible flooring.		NOTES: (1) Minimum clearance to the front on the "UD140 model is 6 inches. (2) May be installed on combustible flooring when TYPE B-1 vent pipe is used.  * - First letter may be "A" or "T"	

TABLE 1

**HORIZONTAL INSTALLATION**

This furnace may be installed in an attic or crawl space in the horizontal position by placing the furnace on the left or right side (as viewed from the front in the upright position). The horizontal furnace installation in an attic should be on a service platform large enough to allow for proper clearances on all sides and service access to the front of the furnace, (See Clearance Table and Figure 1). If the furnace is suspended, it must be supported at both ends and in the middle with clearance allowed for removal of both access doors. Line contact is only permissible between lines formed by the intersection of the top and two sides of the furnace casing and the building joists, studs, or framing.

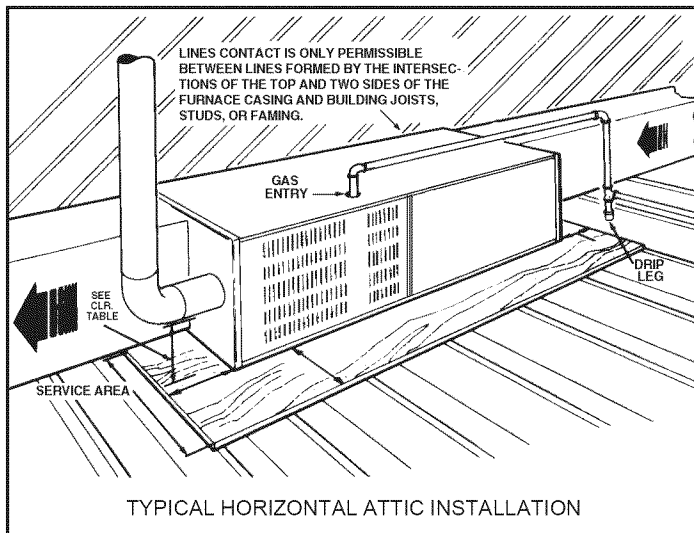


FIGURE 1

**AIR FOR COMBUSTION AND VENTILATION**

Adequate flow of combustion and ventilating air must not be obstructed from reaching the furnace. Air openings provided in the furnace casing must be kept free of obstructions which restrict the flow of air. Airflow restrictions affect the efficiency and safe operation of the furnace. Keep this in mind should you choose to remodel or change the area which contains your furnace. Furnaces must have a free flow of air for proper performance.

Provisions for combustion and ventilation air shall be made in accordance with "latest edition" of 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 Installation Codes, and applicable provisions of the local building codes. Special conditions created by mechanical exhausting of air and fireplaces must be considered to avoid unsatisfactory furnace operation.

Furnace locations may be in "confined space" or "unconfined space". Unconfined space is defined in Table 2 and Figure 2. These spaces may have adequate air by infiltration to provide air for combustion, ventilation, and dilution of flue gases. Buildings with tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.), may need additional air provided as described for confined space.

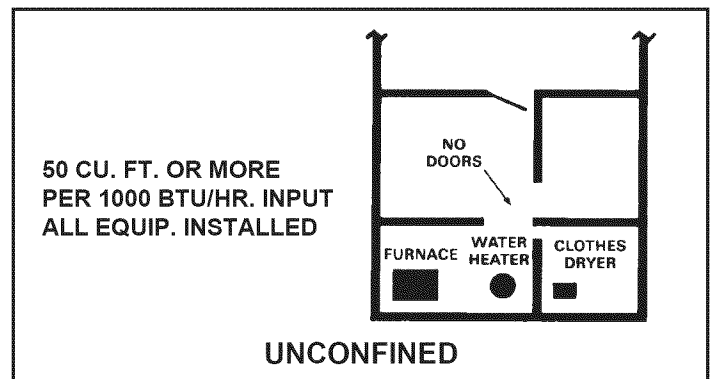


FIGURE 2

TABLE 2

MINIMUM AREA IN SQUARE FEET FOR UNCONFINED SPACE INSTALLATIONS	
FURNACE MAXIMUM BTUH / INPUT RATING	WITH 8 FOOT CEILING MINIMUM AREA IN SQUARE FEET OF UNCONFINED SPACE
40,000	250
60,000	375
80,000	500
100,000	325
120,000	750
140,000	875

# INSTALLER'S GUIDE

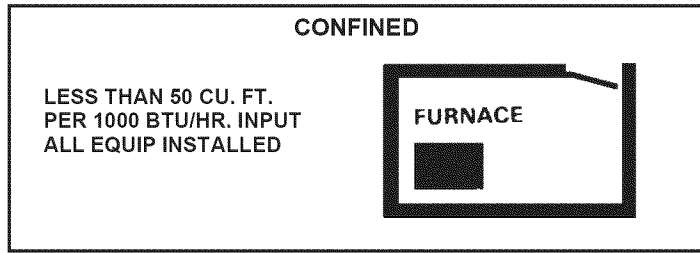


FIGURE 3

Confined spaces are installations with less than 50 cu. ft. of space per 1000 BTU/hr input from all equipment installed. Air for combustion and ventilation requirements can be supplied from inside the building as in Figure 4 or from the outdoors, as in Figure 5.

1. All air from inside the building as in Figure 4, Page 4: The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Refer to Table 3, Page 4, for minimum open areas required.

2. All air from outdoors as in Figure 5, Page 4: The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. Refer to Table 3, Page 4, for minimum open areas required.

3. The following types of installations will **require** use of OUTDOOR AIR for combustion, due to chemical exposures:

- \* Commercial buildings
- \* Buildings with indoor pools
- \* Furnaces installed in commercial laundry rooms
- \* Furnaces installed in hobby or craft rooms
- \* Furnaces installed near chemical storage areas.

Exposure to the following substances in the combustion air supply will also require OUTDOOR AIR for combustion:

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

TABLE 3

MINIMUM FREE AREA IN SQUARE INCHES EACH OPENING (FURNACE ONLY)

Furnace Maximum BTUH/INPUT Rating	Air From Inside	Air From Outside	
		Vertical Duct	Horizontal Duct
40,000	100	10	20
60,000	100	15	30
80,000	100	20	40
100,000	100	25	50
120,000	120	30	60
140,000	140	35	70

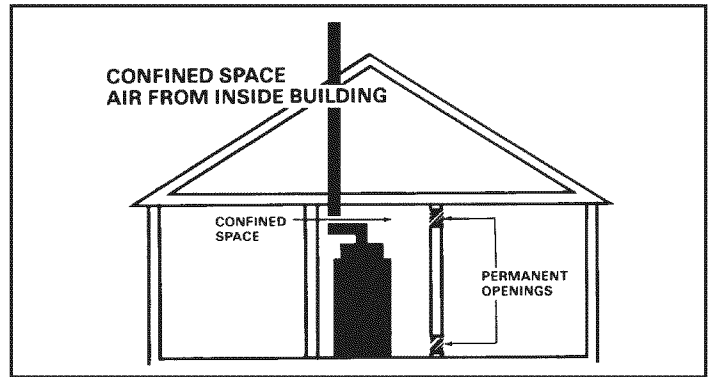


FIGURE 4

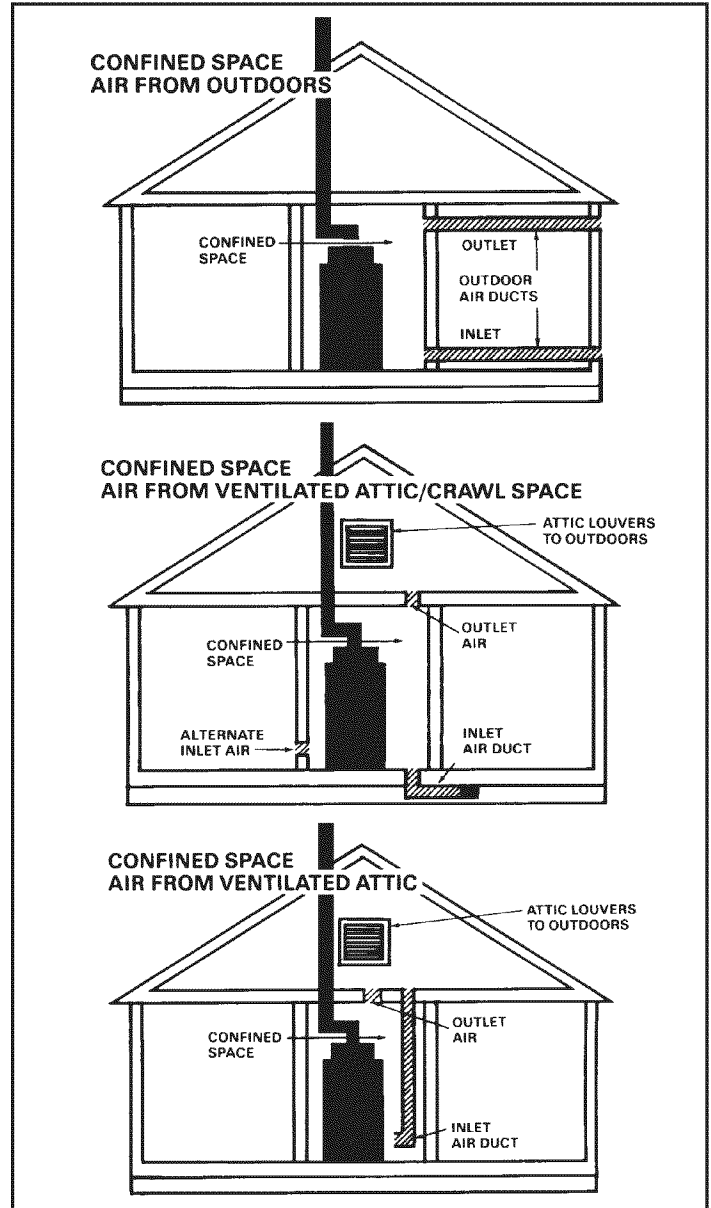


FIGURE 5

The following warning complies with State of California law, Proposition 65.

**WARNING: Hazardous Gases!**  
Exposure to fuel substances or by-products of incomplete fuel combustion are believed by the State of California to cause cancer, birth defects, or other reproductive harm.

**DUCT CONNECTIONS**

Air duct systems should be installed in accordance with standards for air conditioning systems, National Fire Protection Association Pamphlet No. 90. They should be sized in accordance with ACCA Manual D or whichever is applicable. Check on controls to make certain they are correct for the electrical supply.

Central furnaces, when used in connection with cooling units, shall be installed in parallel or on the upstream side of the cooling units to avoid condensation in the heating element, unless the furnace has been specifically approved for downstream installation. With a parallel flow arrangement, the dampers or other means used to control flow of air shall be adequate to prevent chilled air from entering the furnace, and if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in full heat or cool position.

On any job, flexible connections of nonflammable material may be used for return air and discharge connections to prevent transmission of vibration. Though these units have been specifically designed for quiet, vibration free operation, air ducts can act as sounding boards and could, if poorly installed, amplify the slightest vibration to the annoyance level.

When the furnace is located in a utility room adjacent to the living area, the system should be carefully designed with returns which minimize noise transmission through the return air grille. Although these winter air conditioners are designed with large blowers operating at moderate speeds, any blower moving a high volume of air will produce audible noise which could be objectionable when the unit is located very close to a living area. It is often advisable to route the return air ducts under the floor or through the attic. Such design permits the installation of air return remote from the living area (i.e. central hall).

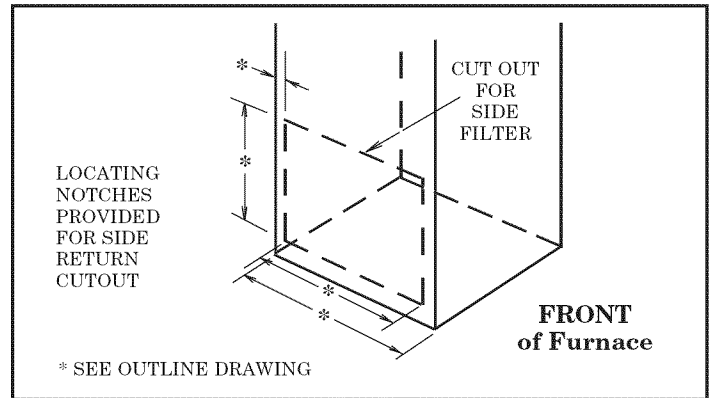
When the furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace and terminating outside the space containing the furnace.

**Where there is no complete return duct system, the return connection must be run full size from the furnace to a location outside the utility room, basement, attic, or crawl space.**

**Do Not** install return air through the back of the furnace cabinet.

**RETURN AIR DUCT CONNECTION**

1. Set the furnace in place.
2. For side return installations, remove the insulation around the opening in the blower compartment.
3. The side panels of this furnace include locating notches that are used as guides for cutting an opening for return air, Refer to Figure 6 and the outline drawing on page 28 for duct connection dimensions for various furnaces.
4. If a 3/4" flange is to be used for attaching the air inlet duct, add to cut where indicated by solid lines in Fig. 6. Cut corners diagonally and bend outward to form flange.
5. If flanges are not required, and a filter frame is installed, cut along knockout guidelines.
6. The filter retainer is factory supplied for bottom return. Use the filter retainer on side or bottom if filter is to be used within the furnace cabinet.



**FIGURE 6**

All return air duct systems should provide for installation of return air filters.

7. Connect duct work to furnace. See Outline Drawing on page 28 for supply and return duct size and location. Flexible duct connectors are recommended to connect both supply and return air ducts to the furnace. If only the front of the furnace is accessible, it is recommended that both supply and return air plenums are removable.

8. When replacing a furnace, old duct work should be cleaned out. Thin cloths should be placed over the registers and the furnace fan should be run for 10 minutes. Don't forget to remove the cloths before you start the furnace.

**RETURN AIR FILTER**

Furnaces are factory supplied with a high velocity cleanable type air filter which may be located within the furnace blower compartment in either a **BOTTOM** or **SIDE** (left side or right side) return air inlet. *Some filters may need to be trimmed for side or bottom filter use. See Outline Drawing.*

To replace filter, remove the blower access door, Push the filter back and up to clear the front filter retaining bracket. The filter will flex (or bow). Gently pull the filter out. Replace the filter in the same manner, making sure that the filter is secured in both front and back brackets. Replace the blower access door. **Use high velocity replacement filter only.**

**TABLE 4**

MODEL NUMBER	CABINET WIDTH	FILTER SIZE
*UD040C924H *UD040C930H *UD060C924H *UD060C936H	14-1/2	1 - 16 X 25 X 1
*UD080C924H *UD080C936H *UD080C948H *UD100C936H *UD100C945H	17-1/2	1 - 17 X 25 X 1
*UD100C948H *UD100C960H *UD120C954H	21	1 - 20 X 25 X 1
*UD100C960H *UD120C960H## *UD140C960H##	24-1/2	1 - 24 X 25 X 1
* - First letter may be "A" or "T" ## - Requires 2 sides; side and bottom; or bottom only return.		

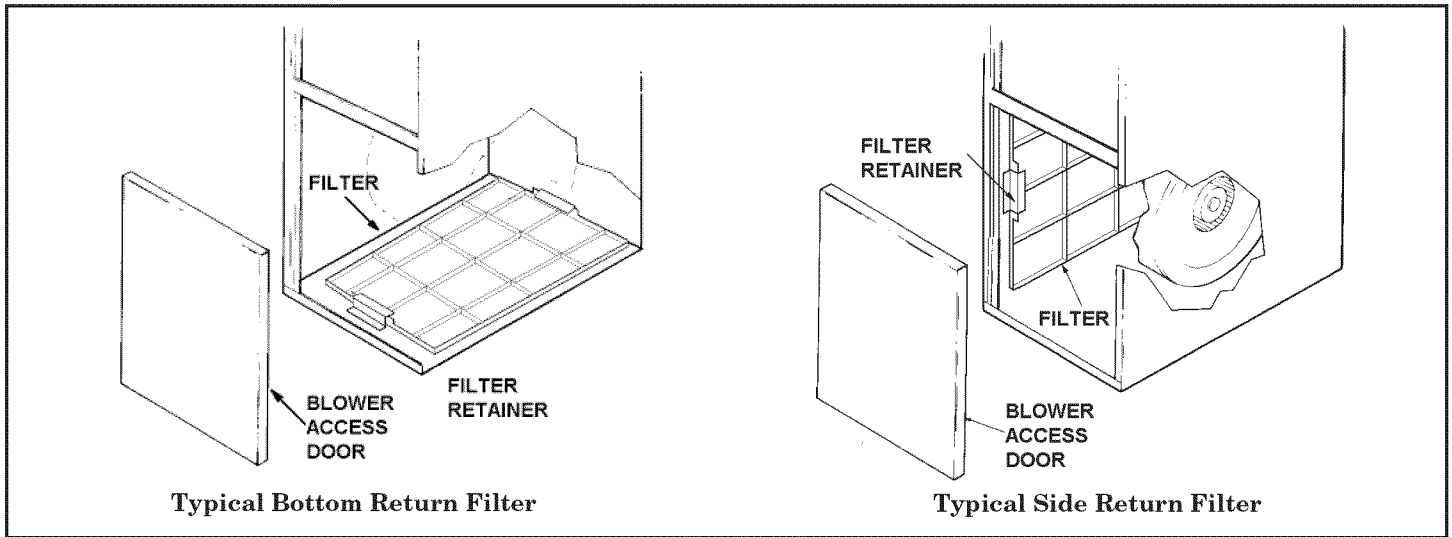


FIGURE 7A

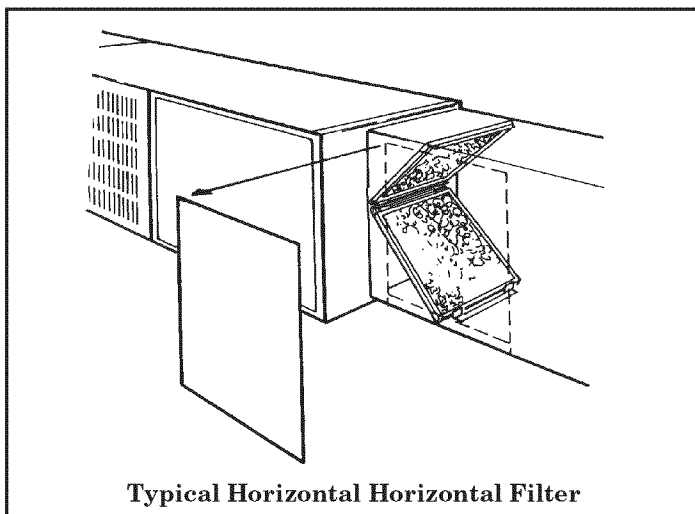


FIGURE 7B

## FILTER RETAINER BRACKETS FOR SIDE AIR RETURN

If side air return is desired, it is necessary to move the 2 filter retainer brackets from the bottom of the furnace and reinstall them on the side. The following instructions should be used:

- a. Remove the front doors.
- b. Remove the filter.
- c. Carefully place the unit on its back.
- d. Using a 5/16" nut driver, remove the 4 screws holding the filter retainer brackets.
- e. Reinstall the filter retainer brackets on the desired side.

(See Figure 7A "Typical Side Return Filter").

## GENERAL VENTING INSTRUCTIONS

### VENT PIPING

These furnaces have been classified as Fan-Assisted Combustion System, Category I furnaces under the "latest edition" provisions of ANSI Z21.47 and CAN/CGA 2.3 standards, which operate with a non-positive vent static pressure and with a flue loss of not less than 17 percent.

**NOTE:** If desired, a sidewall termination can be accomplished through the use of an "add-on" draft inducer. The inducer must be installed according to the inducer manufacturer's instructions. Set the barometric pressure relief to achieve -0.02 inch water column.

**NOTE:** When an existing furnace is removed from a venting system serving other appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.

*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:*

- a. Seal any unused openings in the venting system;
- b. 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 instruc-

tions. Determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition;

c. In so far as is practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers;

d. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so the appliance shall operate continuously;

e. 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;

f. After it has been determined that each appliance remaining 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 condition of use;

g. If improper venting is observed during any of the above tests, the venting system must be corrected.

All vent installations must be in accordance with the "latest edition" provisions of the National Fuel Gas Code, ANSI Z223.1 section 7 and/or CAN/CGA B149 Installation Codes or the Vent Tables.

**The furnace shall be connected to a factory built chimney or vent complying with a recognized standard, or a masonry or concrete chimney lined with a lining material acceptable to the authority having jurisdiction.**

**NOTE: Furnace venting into an unlined masonry chimney or concrete chimney is prohibited.**

**VENTING INTO A MASONRY CHIMNEY**

If the chimney is oversized, the liner is inadequate, or flue-gas condensation is a problem in your area, consider using the chimney as a pathway or chase for type "B" vent or flexible vent liner. If flexible liner material is used, size the vent using the "B" vent tables, then reduce the maximum capacity by 20% (multiply 0.80 times the maximum capacity).

**TABLE 5  
MASONRY CHIMNEY VENTING**

Type Furnace	Tile Lined Chimney		Chimney Lining	
	Internal	External	"B" Vent	Flexible Metal Liner
Single Fan Assist	No	No	Yes	*Yes
Fan Assist + Fan Assist	No	No	Yes	*Yes
Fan Assist + Natural	Yes	No	Yes	*Yes

\* Flexible chimney liner size is determined by using the type "B" vent size for the available BTUH input, then reducing the maximum capacity by 20% (multiply maximum capacity times 0.80). The minimum capacity is the same as shown in the "B" vent tables.

**Internal Masonry Chimneys**

Venting of fan assisted appliances into a lined, internal masonry chimney is allowed only if it is common vented with at least one natural draft appliance; **OR**, if the chimney is lined with type "B", double wall vent or suitable flexible liner material, (See Table 5).

**NOTE:** The chimney liner must be thoroughly inspected to insure no cracks or other potential areas for flue gas leaks are present in the liner. Liner leaks will result in early deterioration of the chimney.

**External Masonry Chimney**

Venting of fan assisted appliances into external chimneys (one or more walls exposed to outdoor temperatures), requires the chimney be lined with type "B", double wall vent or suitable flexible chimney liner material. This applies in all combinations of common venting as well as for fan assisted appliances vented alone.

The following installation practices are recommended to minimize corrosion caused by condensation of flue products in the furnace and flue gas system.

1. Avoid an excessive number of bends.
2. Horizontal runs should pitch upward at least 1/4" per foot.
3. Horizontal runs should be as short as possible.
4. All vent pipe or connectors should be securely supported and must be inserted into, but not beyond the inside wall at the chimney vent.

5. When vent connections must pass through walls or partitions of combustible material, a thimble must be used and installed according to local codes.

6. Vent pipe through the roof should be extended to a height determined by National Fuel Gas Code or local codes. It should be capped properly to prevent rain water from entering the vent. Roof exit should be waterproofed.

7. Use type "B" double wall vent when vent pipe is routed through cool spaces, (below 60°F).

8. Where long periods of airflow are desired for comfort, use long fan cycles instead of continuous airflow.

9. Apply other good venting practices as stated in the venting section of the National Fuel Gas Code ANSI Z223.1 "latest edition".

**10. Vent connectors serving appliance vented by natural draft or non-positive pressure shall not be connected into any portion of a mechanized draft system operating under positive pressure.**

11. Horizontal pipe runs must be supported by hangers, straps or other suitable material in intervals at a minimum of every 3 feet of pipe.

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

13. The flow area of the largest section of vertical vent or chimney shall not exceed 7 times the smallest listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods.

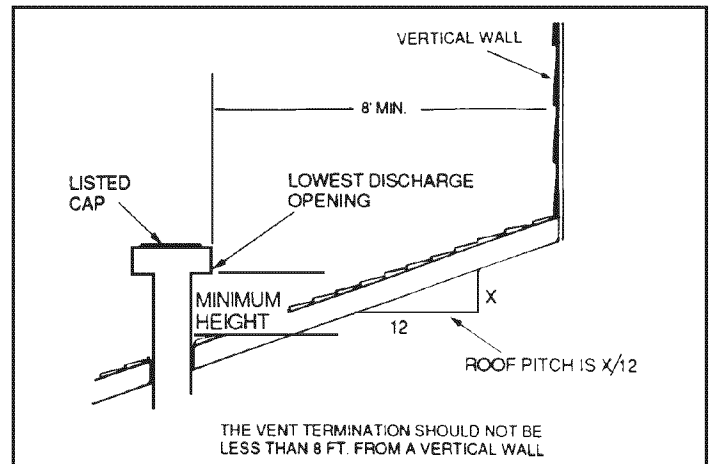
$$\text{Maximum Vent or Tile Lined Chimney Flow Area} = \frac{\pi(D^*)^2}{4} \times 7$$

\*Drafthood outlet diameter, flue collar diameter, or listed appliance categorized vent diameter.

**TABLE 6  
GAS VENT TERMINATION**

ROOF PITCH	MINIMUM HEIGHT
FLAT TO 7/12	1.0 FEET *
OVER 7/12 TO 8/12	1.5 FEET
OVER 8/12 TO 9/12	2.0 FEET
OVER 9/12 TO 10/12	2.5 FEET
OVER 10/12 TO 11/12	3.25 FEET
OVER 11/12 TO 12/12	4.0 FEET
OVER 12/12 TO 14/12	5.0 FEET
OVER 14/12 TO 16/12	6.0 FEET
OVER 16/12 TO 18/12	7.0 FEET
OVER 18/12 TO 20/12	7.5 FEET
OVER 20/12 TO 22/12	8.0 FEET

\* THIS REQUIREMENT COVERS MOST INSTALLATIONS



**FIGURE 8**

# INSTALLER'S GUIDE

## SIZING OF VENTING SYSTEMS SERVING APPLIANCES EQUIPPED WITH DRAFT HOODS AND APPLIANCES LISTED FOR USE WITH TYPE B VENTS

**Definitions.** The following definitions apply to tables in the venting portion of this Installer's Guide:

**Fan-Assisted Combustion System** - An appliance equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber and/or heat exchanger.

**FAN Min.** - The minimum appliance input rating of a Category I appliance with a fan-assisted combustion system that could be attached to the vent.

**FAN Max.** - The maximum appliance input rating of a Category I appliance with a fan-assisted combustion system that could be attached to the vent.

**NAT Max.** - The maximum input rating of a Category I appliance equipped with a draft hood that could be attached to the vent. There are no minimum appliance input ratings for draft hood equipped appliances.

**FAN+FAN** - The maximum combined appliance input rating of one or more fan-assisted appliances attached to the common vent.

**FAN+NAT** - The maximum combined appliance input rating of one or more fan-assisted appliances attached to the common vent.

**NAT+NAT** - The maximum combined input rating of two or more draft hood equipped appliances attached to the common vent.

**NR** - Vent configuration is **not recommended** due to potential for condensate formation and/or pressurization of the venting system.

**NA** - Vent configuration is **not applicable** due to physical or geometric constraints.

### Notes for Single Appliance Vents: (See Tables J-1 to J-5)

1. If the vent size determined from the tables is smaller than the appliance draft hood outlet or flue collar, the smaller size shall be permitted to be used, provided:
  - (a) The total vent height ("T") is at least 10 feet;
  - (b) Vents for appliance draft hood outlets or flue collars 12 inches in diameter or smaller are not reduced more than one table size;
  - (c) Vents for appliance draft hood outlets or flue collars above 12 inches in diameter are not reduced more than two table sizes;
  - (d) The maximum capacity listed in the tables for a fan-assisted appliance is reduced by 10 percent (.09 x maximum table capacity);
  - (e) The draft hood outlet is greater than 4 inches in diameter. Do not connect a 3 inch diameter vent to a 4 inch diameter draft hood outlet. This provision ("e") shall not apply to fan-assisted appliances.
2. Single appliance venting configurations with zero (0") lateral lengths in Tables J-1, J-2 and J-5 shall have no

elbows in the venting system. For vent configurations with lateral lengths, the venting tables include allowance for two 90 degree (1.57 rad) elbows. For each additional 90 degree (1.57 rad) elbow, or equivalent beyond two, the maximum capacity listed in the venting table should be reduced by 10 percent (0.90 x maximum table capacity).

Note: Two 45 degree (0.79 rad) elbows are equivalent to one 90 degree (1.57 rad) elbow.

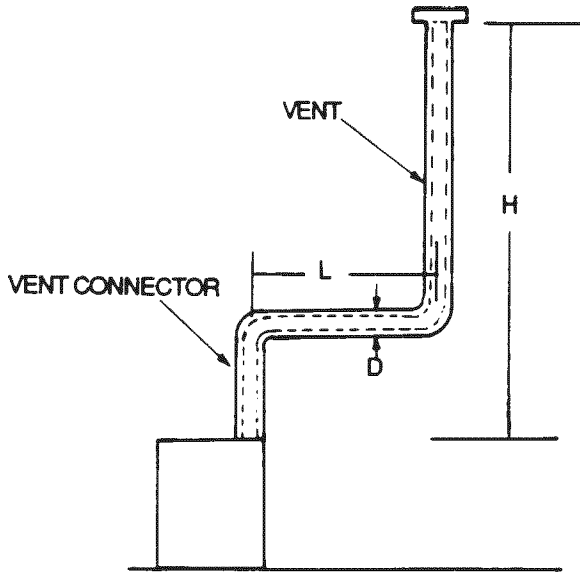
3. Zero (0") lateral ("L") shall apply only to a straight vertical-vent attachment to a top outlet draft hood or flue collar.
4. Sea-level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used to determine minimum capacity for high altitude installation.
5. Numbers followed by asterisk (\*) in Tables J-3, J-4 and J-5 indicate the possibility of continuous condensation, depending on locality. Consult local serving gas supplier or local codes.
6. For appliances with more than one input rate, the minimum vent capacity determined from the tables shall be greater than the highest appliance input rating.
7. Listed corrugated chimney-liner systems in masonry chimneys shall be sized by using Tables J-1 or J-2 for Type B vents with the maximum capacity reduced by 20 percent (0.80 maximum table capacity) and the minimum capacity as shown in Tables J-1 and J-2. Corrugated metal venting systems installed with bends or offsets shall have their maximum capacity reduces. (See Note 2).
8. If the vertical vent has a larger diameter than the vent connector, use the vertical vent-connector diameter to determine the minimum vent capacity and the connector diameter to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed seven times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area, unless designated in accordance with approved engineering methods.
9. The tables included in this part shall be used for chimneys and vents not exposed to the outdoors below the roof line. Exterior chimneys or vents exposed to the outdoors below the roof line may experience continuous condensation depending on locality. Consult local serving gas suppliers, or the authority having jurisdiction. A Type B vent or listed chimney lining system passing through an otherwise unused masonry chimney flue shall be considered to be an interior vent system.
10. Vent connectors shall not be sized upward more than two sizes greater than the appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter.
11. In a single run of vent or vent connector, more than one diameter and type shall be permitted to be used provided that all the sizes and types are permitted by the tables.
12. Interpolation shall be permitted in calculating capacities for vent dimensions which fall between table entries.
13. Extrapolation beyond the table entries shall not be permitted.

**SEE EXAMPLES ON PAGES 20 TO 22.**



TYPICAL VENTING APPLICATIONS

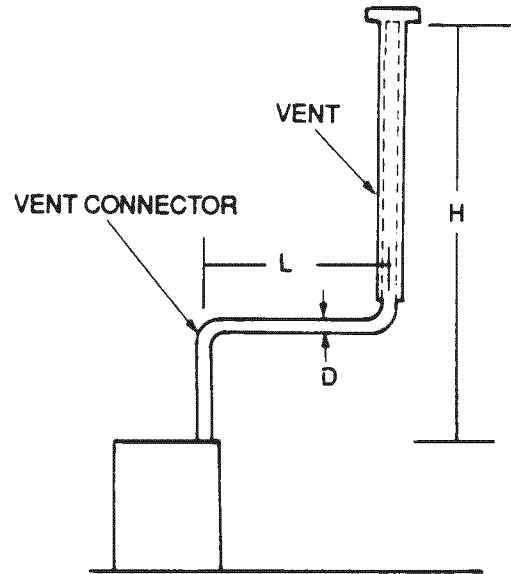
Table J-1 shall be used when Type B Double-Wall Vent Pipe is used for both the vent connector and the vent.



Note: The appliance may be either Category I Draft Hood equipped or Fan-assisted type.

FIGURE J-1

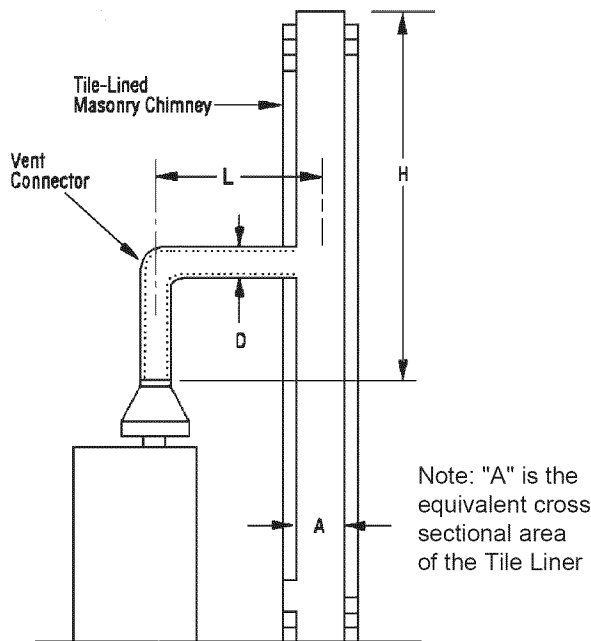
Table J-2 shall be used when a Single Wall Metal Vent Connector is attached to Type B Double-wall Vent.



Note: The appliance may be either Category I Draft Hood equipped or Fan-assisted type.

FIGURE J-2

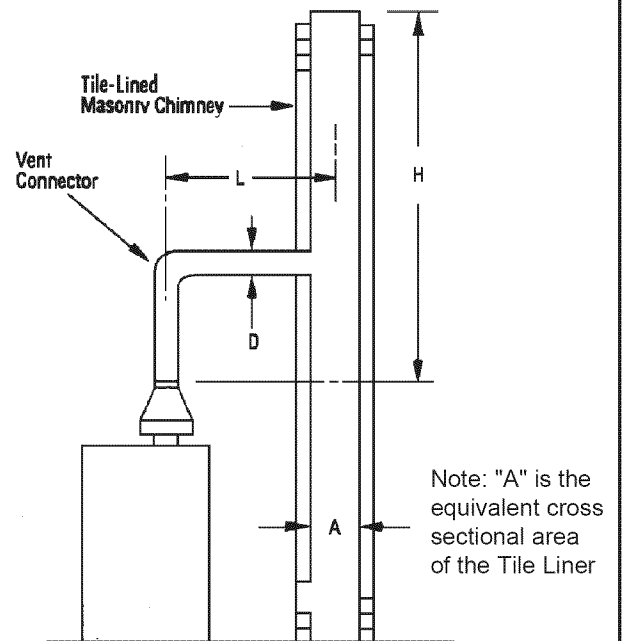
Table J-3 shall be used when a Type B Double-Wall Vent Connector is attached to a Tile Lined Masonry Chimney.



Note: The appliance may be either Category I Draft Hood equipped or Fan-assisted type.

FIGURE J-3

Table J-4 shall be used when a Single-wall Metal Vent Connector is attached to a Tile Lined Masonry Chimney.



Note: The appliance may be either Category I Draft Hood equipped or Fan-assisted type.

FIGURE J-4



Table J-5

**Capacity of Single-Wall Metal Pipe or Type B Asbestos Cement Vents Serving a Single Draft Hood Equipped Appliance**

Height "H" (ft.)	Lateral L (ft.)	Vent Diameter - D (inches)							
		3"	4"	5"	6"	7"	8"	10"	12"
Maximum Appliance Input Rating in Thousands of Btu Per Hour									
6	0	39	70	116	170	232	312	500	750
	2	31	55	94	141	194	260	415	620
	5	28	51	88	128	177	242	390	600
8	0	42	76	126	185	252	340	542	815
	2	32	61	102	154	210	281	451	680
	5	29	56	95	141	194	264	430	648
	10	24	49	86	131	180	250	406	625
10	0	45	84	138	202	279	372	606	912
	2	35	67	111	168	233	311	505	760
	5	32	61	104	153	215	289	480	724
	10	27	54	94	143	200	284	455	700
	15	NR	46	82	130	186	258	432	666
15	0	49	91	151	223	312	420	684	1040
	2	39	72	122	186	260	350	570	865
	5	35	67	110	170	240	325	540	825
	10	30	58	103	158	223	308	514	795
	15	NR	50	93	144	207	291	488	760
	20	NR	NR	82	132	195	273	466	726
20	0	53	101	163	252	342	470	770	1190
	2	42	80	136	210	286	392	641	990
	5	38	74	123	192	264	364	610	945
	10	32	65	115	178	246	345	571	910
	15	NR	55	104	163	228	326	550	870
	20	NR	NR	91	149	214	306	525	832
30	0	56	108	183	276	384	529	878	1370
	2	44	84	148	230	320	441	730	1140
	5	NR	78	137	210	296	410	694	1080
	10	NR	68	113	177	258	366	625	1000
	15	NR	NR	99	163	240	344	596	960
	20	NR	NR	NR	NR	192	295	540	890
50	0	NR	120	210	310	443	590	980	1550
	2	NR	95	171	260	370	492	820	1290
	5	NR	NR	159	234	342	474	780	1230
	10	NR	NR	146	221	318	456	730	1190
	15	NR	NR	NR	100	292	407	705	1130
	20	NR	NR	NR	185	276	384	670	1080
30	NR	NR	NR	NR	222	330	605	1010	

# INSTALLER'S GUIDE

**Notes for Multiple Appliance Vents:** (See Tables J-6 to J-10)

1. The maximum vent connector horizontal length inch of vent-connector diameter as follows:

Connector Diameter		Maximum Connector Horizontal Length	
(Inches)	(mm)	(Feet)	(m)
3	(76.2)	4½	(1.37)
4	(102)	6	(1.83)
5	(127)	7½	(2.29)
6	(152)	9	(2.74)
7	(178)	10½	(3.20)
8	(203)	12	(3.65)
9	(229)	13½	(4.11)
10	(254)	15	(4.57)
12	(305)	18	(5.49)
14	(356)	21	(6.40)
16	(406)	24	(7.32)
18	(457)	27	(8.22)
20	(508)	30	(9.14)
22	(559)	33	(10.06)
24	(610)	36	(10.97)

2. The vent connector shall be routed to the vent utilizing the shortest possible route. Longer connectors than those listed above are permitted under the following conditions:

- (a) The maximum capacity of the vent connector shall not be reduced more than 10 percent for each additional multiple of the length listed above. For example, the maximum length listed above for a 4 inch (102 mm) connector is 6 feet (1.83 m). With a connector length greater than 12 feet (3.66 mm) but not exceeding 18 feet (5.49 m), the maximum capacity must be reduced by 20 percent (0.80 x maximum vent capacity);
- (b) The minimum capacity shall be determined by referring to the corresponding single appliance table (Tables J-1 to J-2). In this case, for each appliance the entire vent connector and common vent from the appliance to the vent termination shall be treated as a single appliance vent, as if the other appliances were not present.

3. If vent connectors are combined prior to entering the common vent, the maximum common vent capacity listed in the common venting tables shall be reduced by 10 percent (0.90 x maximum vent capacity). (See Figure J-9). The length of the common vent connector manifold ( $L_c$ ) shall not exceed 1½ feet (18 inches) (457 mm) for each inch (25.4 mm) of common vent connector manifold diameter (D).

4. If the common vertical vent is offset as shown in Figure J-10, the maximum common vent capacity listed in the common venting tables shall be reduced by 20 percent (0.80 x maximum vent capacity), the equivalent of two 90 degree (1.57 rad) elbows. The horizontal length of the common vent offset shall not exceed 1½ feet (457 mm) for each inch (25.4 mm) of common vent diameter.

5. Excluding elbows counted in (4) above, for each additional elbow in excess of two, the maximum capacity of that portion of the venting system shall be reduced by 10 percent.

Note: Two 45 degree (0.79 rad) elbows are equivalent to one 90 degree (1.57 rad) elbow.

6. The common vent diameter shall be at least as large as the largest vent connector diameter.

7. Interconnection fittings must be the same size as the common vent.
8. Sea-level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used to determine minimum capacity for high-altitude installation.
9. For multiple units of gas utilization equipment all located on one floor, available total height ("H") shall be measured from the highest draft hood outlet or flue collar up to the level of the cap or terminal. Connector rise ("R") shall be measured from the draft hood outlet or flue collar to the level where the vent gas streams come together. (Not applicable to multi-story).
10. For multistory installations, available total height ("H") shall be the vertical distance between the highest draft hood outlet or flue collar entering that segment and the center line of the next higher interconnection tee. (See Figure J-11).
11. The size of the lowest connector and of the vertical vent leading to the lowest interconnection of the multistory system shall be in accordance with Table J-1 or J-2 for available total height ("H") up to the lowest interconnection. (See Figure J-11).
12. Vertical common vents shall have no offsets when used in multistory systems.
13. When two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent shall not exceed seven times the flow area of the smallest flue collar area or draft hood outlet area unless designed in accordance with approved engineering methods.
14. For appliances with more than one input rate, the minimum vent capacity determined from the tables shall be less than the lowest appliance input rating and the maximum vent capacity determined from the tables should be greater than the highest appliance input rating.
15. Listed corrugated metallic chimney liner systems in masonry chimneys should be sized by using Tables J-6 or J-7 for Type B vents with the maximum capacity reduced by 20 percent (0.80 x maximum table capacity) and the minimum capacity as shown in Tables J-6 or J-7. Corrugated metal venting systems installed with bends or offsets require additional reduction of the vent maximum capacity. (See Note 5)
16. The tables included in this part shall be used for chimneys and vents not exposed to the outdoors below the roof line. Exterior chimneys or vents exposed to the outdoors below the roof line may experience continuous condensation depending on the locality. Consult local serving gas suppliers, to the authority having jurisdiction. A Type B vent or listed chimney lining system passing through an otherwise unused chimney flue shall be considered to be an interior vent system.
17. Vent connectors shall not be sized upward more than two size greater than the appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter.
18. All combinations of pipe sizes, single-wall, and double-wall metal pipe shall be allowed within any connector run(s) or within the common vent provided all of the appropriate tables permit all of the desired sizes and types, as if they were used for the entire length of the subject connector or vent. If a single-wall and Type B double-wall metal pipe are used for vent connectors, the common vent must be sized

using Table J-7 or J-9 as appropriate.

- 19. The draft hood outlet or flue collar of the smallest input appliance shall be located closest to, or under, the common vent.
- 20. When a table permits more than one diameter of pipe to be used for a connector or vent, all the permitted sizes shall be permitted to be used.

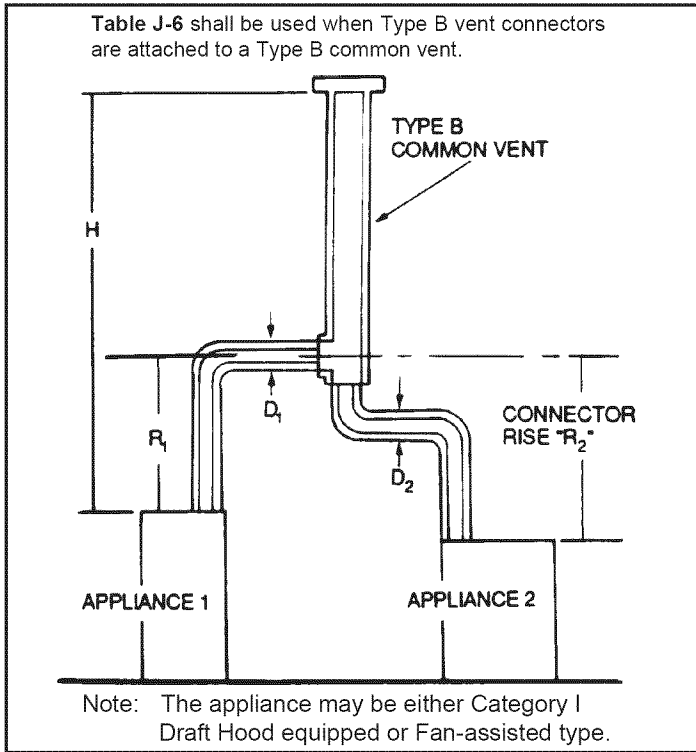
Note: In general, it is preferable to use the smallest

diameter permitted to minimize heat loss.

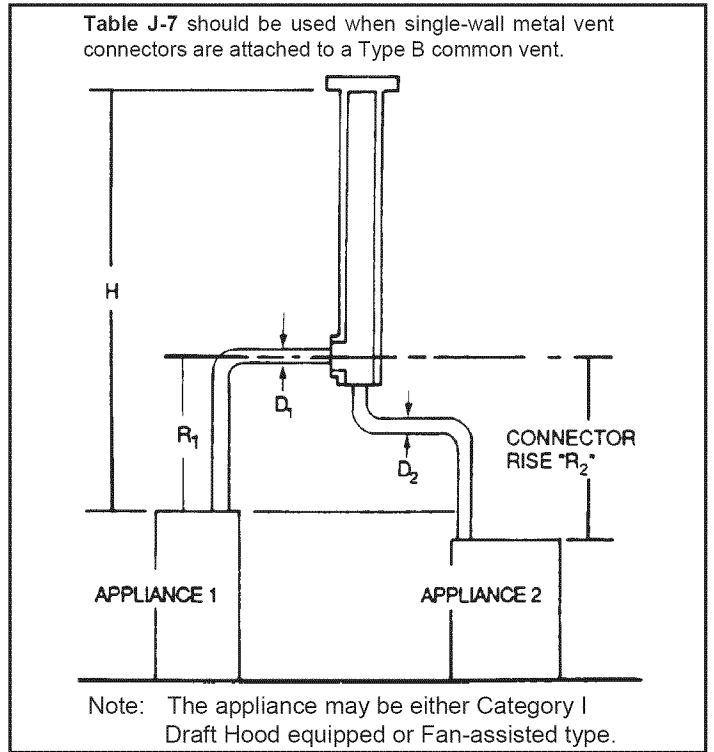
- 21. Interpolation shall be permitted in calculating capacities for vent dimensions which fall between table entries.
- 22. Extrapolation beyond the table entries shall not be permitted.

**SEE EXAMPLES ON PAGES 20 TO 22.**

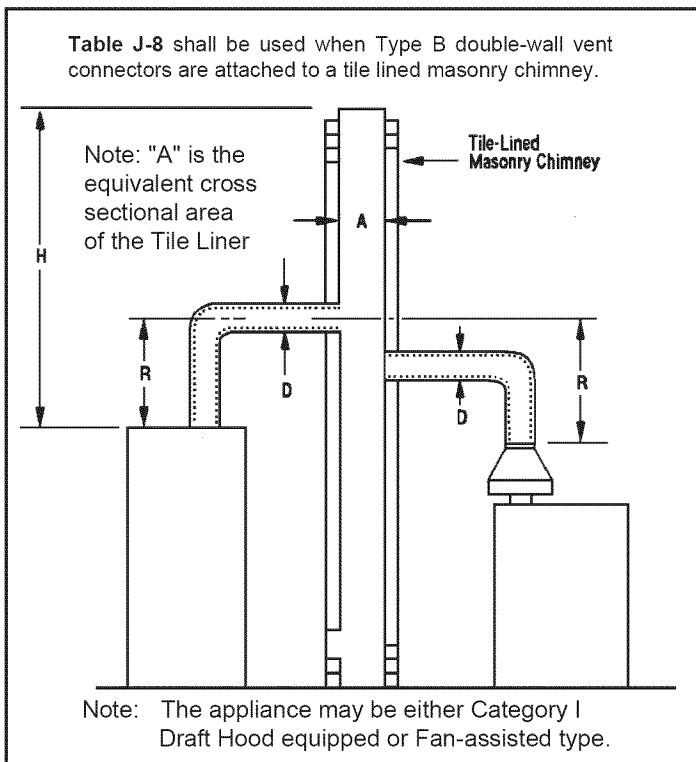
**TYPICAL COMMON VENTING APPLICATIONS**



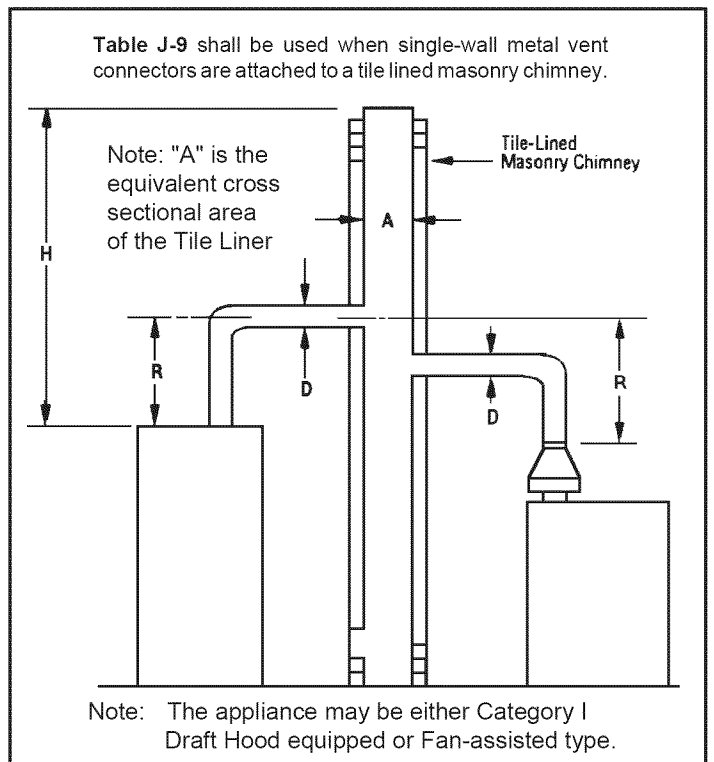
**FIGURE J-5**



**FIGURE J-6**



**FIGURE J-7**



**FIGURE J-8**

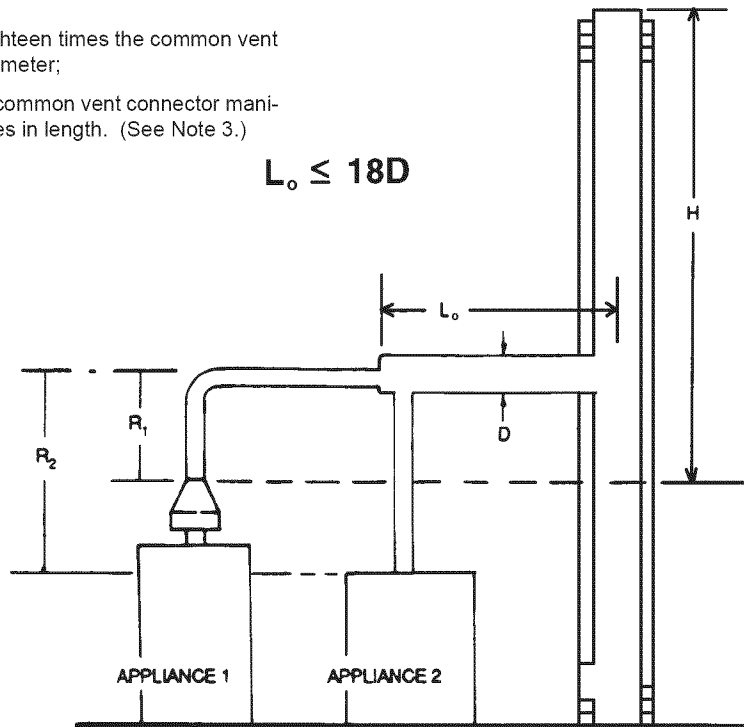
**TYPICAL COMMON VENTING APPLICATIONS (Cont.)**

**EXAMPLE A: Manifold Common Vent Connector**

L shall be no greater than eighteen times the common vent connector manifold inside diameter;

i.e. a 4-inch inside diameter common vent connector manifold shall not exceed 72 inches in length. (See Note 3.)

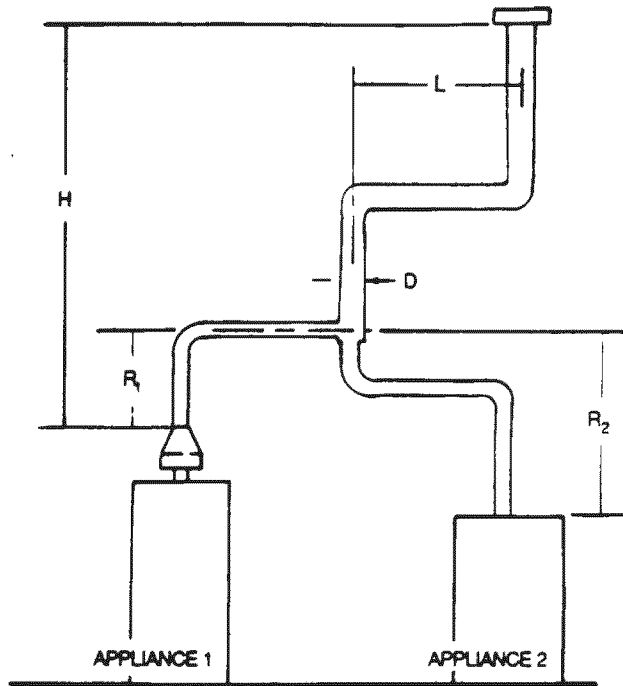
$$L_o \leq 18D$$



Note: This is an illustration of a typical manifold vent connector. Different appliance, vent connector, or common vent types are possible. Consult the notes for Common Venting.

**FIGURE J-9**

**EXAMPLE B: Offset Common Vent**



Note: This is an illustration of a typical Offset Vent. Different appliance, vent connector, or vent types are possible. Consult the notes for Single Appliance and Common Venting.

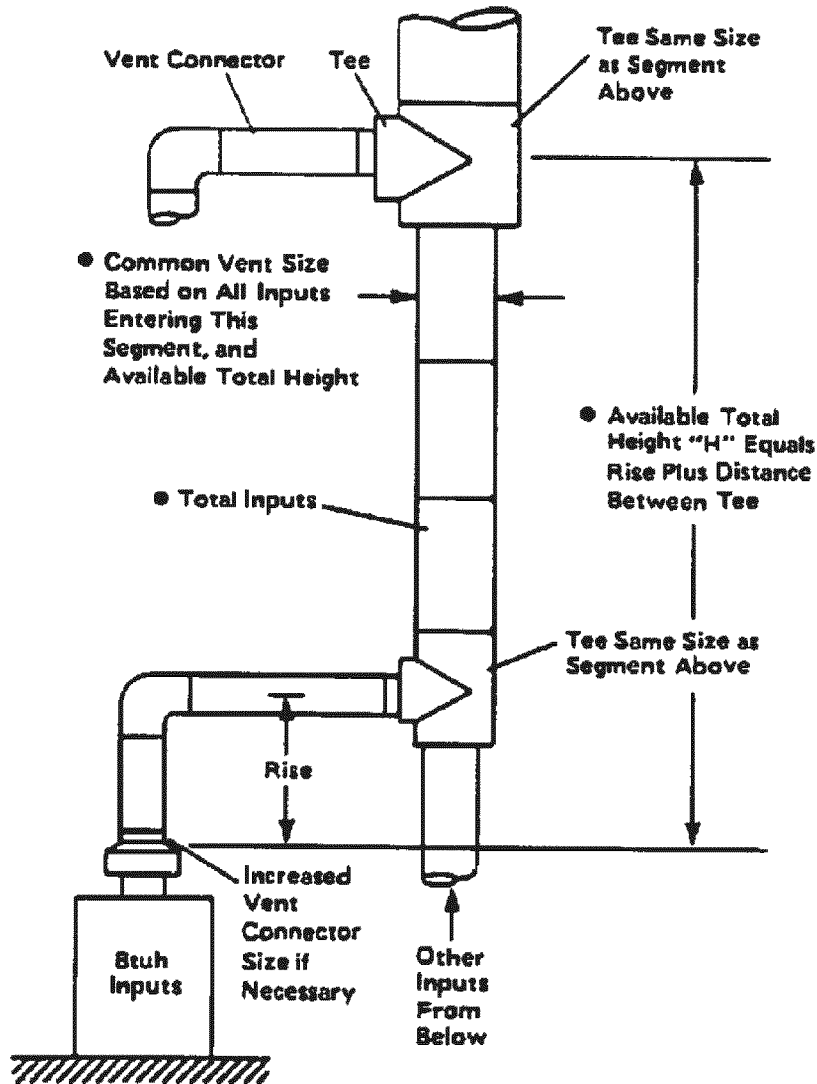
**FIGURE J-10**

TYPICAL VENTING APPLICATIONS (Cont.)

Figure J-11

Multistory Gas Vent Design Procedure for Each Segment of System

(See Notes: 9, 10, 11, 12 and 13)



Multistory Gas Vent Design Procedure for Each Segment of System

Vent Connector Size Depends on:

- Input
- Rise
- Available Total Height "H"
- Table J-6 Connectors

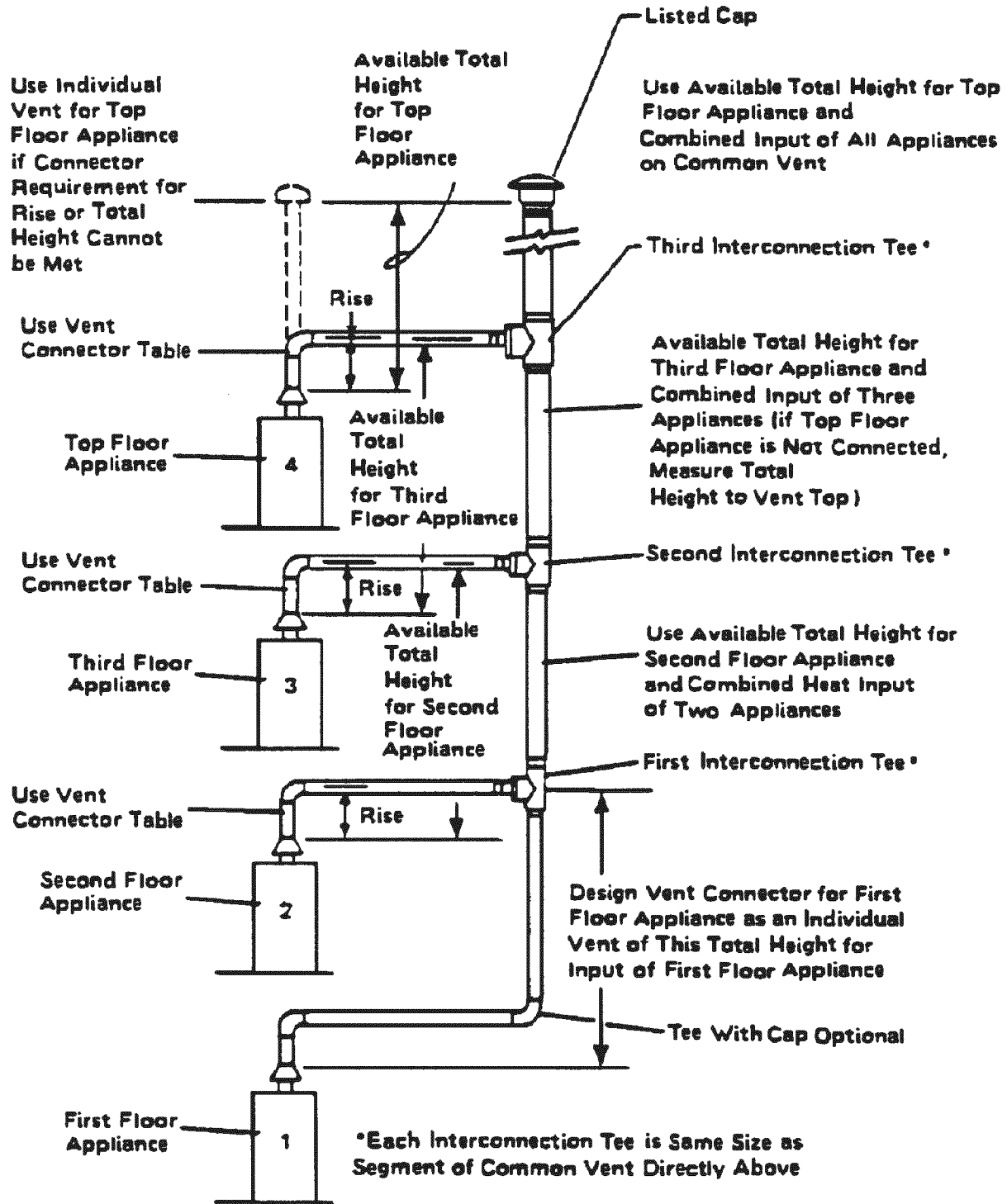
Common Vent Size Depends on:

- Combined Inputs
- Available Total Height "H"
- Table J-6 Common Vent
- Vertical Common Vent with no Offsets

**Figure J-12**

**Multistory Vent Systems**

(See Notes: 9, 10, 11, 12 and 13)



**Principles of Design of Multistory Vents Using Vent Connector and Common Vent Design Tables**



TABLE J-6A

Capacity of Type B Double-Wall Vents with Type B Double-wall Connectors Serving Two or more Category I Appliances

Table with columns for Vent Height H (ft), Connector Rise R (ft), Vent Connector Diameter - D (inches) (3", 4", 5", 6", 7", 8", 9", 10"), and Appliance Input Rating in Thousands of Btu Per Hour. Data is provided for vent heights of 6, 8, 10, 15, 20, 30, 50, and 100 feet.

TABLE J-6B

Common Vent Capacity

Table with columns for Vent Height H (ft), Common Vent Diameter - D (4", 5", 6", 7", 8", 9", 10"), and Combined Appliance Input Rating in Thousands of Btu Per Hour. Data is provided for vent heights of 6, 8, 10, 15, 20, 30, 50, and 100 feet.

TABLE J-7A

Capacity of Type B Double-Wall Vent with Single-Wall Connectors Serving Two or more Category I Appliances

Table with columns for Vent Height H (ft), Connector Rise R (ft), Vent Connector Diameter - D (inches) (3", 4", 5", 6", 7", 8", 9", 10"), and Appliance Input Rating in Thousands of Btu Per Hour. Data is provided for vent heights of 6, 15, 30, and 50 feet.

TABLE J-7B

Common Vent Capacity

Vent Height H (ft)	Common Vent Diameter - D																				
	4"			5"			6"			7"			8"			9"			10"		
	Combined Appliance Input Rating in Thousands of Btu Per Hour																				
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT
6	89	78	64	136	113	100	200	158	144	304	244	196	398	310	257	541	429	332	665	515	407
8	98	87	71	151	126	112	218	173	159	331	269	218	436	342	285	592	473	373	730	569	460
10	106	94	76	163	137	120	237	189	174	357	292	236	467	369	309	638	512	398	787	617	487
15	121	108	88	189	159	140	275	221	200	416	343	274	544	434	357	738	599	456	905	718	553
20	131	118	98	208	177	155	305	247	223	463	383	302	606	487	395	824	673	512	1013	808	626
30	145	132	113	236	202	179	250	286	257	533	446	349	703	570	459	958	790	593	1183	952	723
50	159	145	128	268	233	204	406	337	296	622	529	410	833	686	535	1139	954	689	1418	1157	838

Capacity of Masonry Chimney with Type B Double-Wall Connectors Serving two or more Category I Appliances

TABLE J-8A Vent Connector Capacity

Vent Connector Height H (ft)	Connector Rise R (ft)	Vent Connector Diameter - D (inches)																							
		3"			4"			5"			6"			7"			8"			9"			10"		
		Appliance Input Rating in Thousands of Btu Per Hour																							
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	
6	1	24	NR	21	39	62	40	52	106	67	65	194	101	87	274	141	104	370	201	124	479	253	145	599	319
	2	26	43	28	41	79	52	53	133	85	67	230	124	89	324	173	107	436	232	127	562	330	148	694	378
	3	27	49	34	42	92	61	55	155	97	69	262	143	91	369	203	109	491	270	129	633	349	151	795	439
15	1	24	48	23	38	93	44	54	154	74	72	277	114	100	384	174	125	511	229	153	658	297	184	824	375
	2	25	55	31	39	105	55	56	174	89	74	299	134	103	419	192	128	558	263	156	718	339	187	900	432
	3	26	59	35	41	115	64	57	189	102	76	319	153	105	448	215	131	597	292	159	760	382	190	960	486
30	1	24	54	25	37	111	48	52	192	82	69	357	127	96	504	187	119	680	255	145	883	337	175	1115	432
	2	25	60	32	38	122	58	54	208	95	72	376	145	99	531	209	122	715	287	149	928	378	179	1171	484
	3	26	64	36	40	131	66	56	221	107	74	392	163	101	554	233	125	746	317	152	968	418	182	1220	535
50	1	23	52	26	36	116	49	51	209	82	67	405	133	92	582	198	115	798	271	140	1049	362	168	1334	462
	2	24	59	31	37	127	58	53	225	96	70	421	152	95	604	222	118	827	304	143	1085	400	172	1379	510
	3	26	64	37	39	135	66	55	237	108	72	435	170	98	624	247	121	854	334	147	1118	439	176	1421	558

TABLE J-8B Common Vent Capacity

Vent Height H (ft)	Minimum Internal Area of Chimney, Square Inches																								
	12			19			28			38			50			63			78			113			
	Combined Appliance Input Rating in Thousands of Btu Per Hour																								
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	
6	NR	74	25	NR	119	46	NR	178	71	NR	257	103	NR	351	143	NR	458	188	NR	582	246	NR	853	NR	
8	NR	80	28	NR	130	53	NR	193	82	NR	279	119	NR	384	163	NR	501	218	NR	636	278	NR	937	408	
10	NR	84	31	NR	138	56	NR	207	90	NR	299	131	NR	403	177	NR	538	236	NR	686	302	NR	1010	454	
15	NR	90	36	NR	152	67	NR	233	106	NR	334	152	NR	477	212	NR	611	283	NR	781	365	NR	1156	546	
20	NR	92	41	NR	159	75	NR	250	122	NR	368	172	NR	512	243	NR	668	325	NR	858	419	NR	1286	648	
30	NR	NR	NR	NR	NR	NR	NR	270	137	NR	404	198	NR	543	278	NR	747	381	NR	969	496	NR	1473	749	
50	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	278	328	NR	831	461	NR	1089	606	NR	1692	922

**Capacity of Masonry Chimney with Single-Wall Connectors Serving two or more Category I Appliances**

**TABLE J-9A Vent Connector Capacity**

Vent Connector Height H (ft)		Rise R (ft)		Vent Connector Diameter - D (inches)																							
				3"		4"		5"		6"		7"		8"		9"		10"									
				Appliance Input Rating in Thousands of Btu Per Hour																							
		FAN		NAT		FAN		NAT		FAN		NAT		FAN		NAT		FAN		NAT		FAN		NAT			
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max		
6	1	NR	NR	21	NR	NR	39	NR	NR	66	179	191	100	231	271	140	292	366	200	362	474	252	499	594	283		
	2	NR	NR	28	NR	NR	52	NR	NR	84	186	227	123	239	321	172	301	432	231	373	557	299	509	696	331		
	3	NR	NR	34	NR	NR	61	134	153	97	193	258	142	247	365	202	309	491	269	381	634	348	519	793	375		
15	1	NR	NR	23	NR	NR	43	129	151	73	199	271	112	268	376	171	349	502	225	445	646	291	623	808	360		
	2	NR	NR	30	92	103	54	135	170	88	207	295	132	277	411	189	359	548	256	456	706	334	634	884	402		
	3	NR	NR	34	96	112	63	141	185	101	215	315	151	286	439	213	368	586	289	466	755	378	646	945	437		
30	1	NR	NR	24	86	108	47	126	187	80	193	347	124	259	492	183	338	665	250	430	864	330	600	1089	455		
	2	NR	NR	31	91	119	57	132	203	93	201	366	142	269	518	205	348	699	282	442	908	372	613	1145	490		
	3	NR	NR	35	95	127	65	138	216	105	209	381	160	277	540	229	358	729	312	452	946	412	626	1193	521		
50	1	NR	NR	25	85	113	48	124	204	80	188	392	130	252	567	194	328	778	265	417	1022	355	582	1302	537		
	2	NR	NR	31	89	123	57	130	218	94	196	408	149	262	588	218	339	806	298	429	1058	393	596	1346	567		
	3	NR	NR	35	94	131	65	136	231	106	205	422	167	271	607	243	349	831	328	440	1090	431	610	1386	595		

**TABLE J-9B Common Vent Capacity**

Vent Height H (ft)		Minimum Internal Area of Chimney, Square Inches																							
		12		19		28		38		50		63		78		113									
		Combined Appliance Input Rating in Thousands of Btu Per Hour																							
		FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT	FAN	FAN	NAT
		+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT
6	NR	73	25	NR	118	45	NR	176	71	NR	255	102	NR	348	142	NR	455	187	NR	579	245	NR	846	NR	
	8	NR	79	25	NR	128	52	NR	190	81	NR	276	118	NR	380	162	NR	497	217	NR	633	277	NR	928	405
10	NR	83	31	NR	136	56	NR	205	89	NR	295	129	NR	405	175	NR	532	234	NR	680	300	NR	1000	450	
	15	NR	88	16	NR	149	66	NR	230	105	NR	335	150	NR	460	210	NR	602	280	NR	772	360	NR	1139	540
20	NR	90	40	NR	157	74	NR	247	120	NR	362	170	NR	503	240	NR	661	321	NR	849	415	NR	1264	640	
	30	NR	NR	NR	NR	NR	NR	266	135	NR	398	195	NR	558	275	NR	739	377	NR	957	490	NR	1447	710	
50	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	612	325	NR	821	456	NR	1076	600	NR	1672	910	

**Table J-10**

**Capacity of a Single-Wall Metal Pipe or Type B Asbestos Cement Vent Serving Two or More Draft Hood Equipped Appliances**

**Vent Connector Capacity and Common Vent Capacity are the Exact Same Values**

Total Vent Connector Height "H" "R" (ft.)		Vent Connector Diameter - D (inches)					
		3"	4"	5"	6"	7"	8"
		Maximum Appliance Input Rating in Thousands of Btu Per Hour					
6 to 8	1	21	40	68	102	146	205
	2	28	53	86	124	178	235
	3	34	61	98	147	204	275
15	1	23	44	77	117	179	240
	2	30	56	92	134	194	265
	3	35	64	102	155	216	298
30 and up	1	25	49	84	129	190	270
	2	31	58	97	145	211	295
	3	36	68	107	164	232	321

TABLE J-11

**MASONRY CHIMNEY LINEAR DIMENSIONS  
WITH CIRCULAR EQUIVALENTS**

NOMINAL LINEAR SIZE INCHES	INSIDE DIMENSION IN LINEAR INCHES	INSIDE DIAMETER OR EQUIVALENT DIAMETER INCHES	EQUIVALENT AREA SQUARE INCHES
4 X 8	2-1/2 X 6-1/2	4	12.2
		5	19.6
		6	28.3
		7	38.3
8 X 8	6-3/4 X 6-3/4	7.4	42.7
		8	50.3
8 X 12	6-1/2 X 10-1/2	9	63.6
		10	78.5
12 X 12	9-3/4 X 9-3/4	10.4	83.3
		11	95
12 X 16	9-1/2 X 13-1/2	11.8	107.5
		12	113
		14	153.9
16 X 16	13-1/4 X 13-1/4	14.5	162.9
		15	176.7
16 X 20	13 X 17	16.2	206.1
		18	254.4
20 X 20	16-3/4 X 16-3/4	18.2	260.2
		20	314.1
20 X 24	16-1/2 X 20-1/2	20.1	314.2
		22	380.1
24 X 24	20-1/4 X 20-1/4	22.1	380.1
		24	452.3
24 X 28	20-1/2 X 24-1/4	24.1	456.2
28 X 28	24-1/2 X 24-1/4	26.4	543.3
		27	572.5
30 X 30	25-1/2 X 25-1/2	27.9	607
		30	706.8
30 X 36	25-1/2 X 31-1/2	30.9	749.9
		33	855.3
36 X 36	31-1/2 X 31-1/2	34.4	929.4
		36	1017.9

When liner sizes differ dimensionally from those shown in this table, equivalent diameters may be determined from published tables for square and rectangular ducts of equivalent carrying capacity or by other engineering methods.

**EXAMPLES USING SINGLE APPLIANCE VENTING TABLES**

**EXAMPLE 1: Single Draft Hood-equipped Appliance**

**Problem:** An installer has a 120,000 Btu/hr input appliance with a 5-inch diameter draft-hood outlet that needs to be vented into a 10-foot high Type B vent system.

**Question:** What size vent should be used assuming:  
(a) a 5-foot lateral single-wall metal vent connector is used with two 90-degree elbows, or  
(b) a 5-foot lateral single-wall metal vent connector is used with three 90-degree elbows in the vent system?

**Solution:** Table J-2 should be used to solve this problem because single-wall metal vent connectors are being used with a Type B vent.

(a) Read down the first column in Table J-2 until the row associated with a 10-foot height and 5-foot lateral is found. Read across this row until a vent capacity greater than 120,000 Btu/hr is located in the shaded columns labelled "NAT Max" for draft hood-equipped appliances. In this case, a 5-inch diameter vent has a capacity of 122,000 Btu/hr and may be used for this application.

(b) If three 90-degree elbows are used in the vent system, then the maximum vent capacity listed in the tables must be reduced by 10 percent (See note 2 for Single Appliance Vents in Exhibit J, Sizing of

Venting Systems Serving Appliances Equipped with Draft Hoods, Category I Appliances, and Appliances Listed for Use with Type B Vents - Venting Tables, Category I, Central Furnaces). This implies that the 5-inch diameter vent has an adjusted capacity of only 110,000 Btu/hr. In this case, the vent system must be increased to 6 inches in diameter. See calculations below:

$$122,000 \times 0.90 = 110,000 \text{ for 5-inch Vent}$$

From Table J-2, Select 6-inch Vent:

$$186,000 \times 0.90 = 167,000; \text{ This is greater than the required } 120,000, \text{ therefore, use a 6-inch Vent when three elbows are used.}$$

**EXAMPLE 2 - SINGLE FAN-ASSISTED APPLIANCE**

**Problem:** An installer has an 80,000 Btu/hr input fan-assisted appliance that must be installed using 10 feet of lateral connector to a 30-Ft high Type B vent. Two 90° elbows are needed for the installation.

**Question:** Can a single-wall metal vent connector be used for this application?

**Solution:** Table J-2 refers to the use of single-wall metal vent connectors with Type B vent. In the first column find the row associated with a 30-foot height and a 10-foot lateral. Read across this row, looking at the "FAN Min" and "FAN Max" columns, to find that a 3 inch diameter single-wall metal connector vent is not recommended. Moving to the next larger size single-wall connector (4-inch), we find that a 4-inch diameter single-wall metal connector has a recommended minimum vent capacity of 91,000 Btu/hr and a recommended maximum vent capacity of 144,000 Btu/hr. The 80,000 Btu/hr fan-assisted appliance is outside this range, so we conclude that a single-wall metal vent connector cannot be used to vent this appliance using 10 feet of lateral for the connector.

However, we see that if the 80,000 Btu/hr input appliance could be moved to within 5 feet of the vertical vent, then a 4-inch single-wall metal connector could be used to vent the appliance. Table J-2 shows the acceptable range of vent capacities for a 4-inch vent with 5 feet of lateral to be between 72,000 Btu/hr and 157,000 Btu/hr.

If the appliance cannot be moved closer to the vertical vent, then Type B vent could be used as the connector material. In this case, Table 8 shows that for a 30-Ft vent with 10 feet of lateral, the acceptable range of capacities for a 4 inch diameter vent attached to a fan-assisted appliance is between 37,000 Btu/hr and 150,000 Btu/hr.

**EXAMPLE 3: Interpolating Between Table Values**

**Problem:** An installer has an 80,000 Btu/hr input appliance with a 4-inch diameter draft hood outlet that needs to be vented into a 12-foot high Type B vent. The vent connector has a 5-foot lateral length and is also Type B.

**Question:** Can this appliance be vented using a 4-inch diameter vent?

**Solution:** Table J-1 is used in the case of an all Type B vent system. However, since there is no entry in Table J-1 for a height of 12 feet, interpolation must be used.

Read down the 4-inch diameter "NAT Max" column to the row associated with 10-foot height and 5-foot lateral to find the capacity value of 77,000 Btu/hr. Read down further to the 15-foot height, 5-foot lateral row to find the capacity value of 87,000 Btu/hr. The difference between the 15-foot height capacity value and the 10-foot height capacity value is 10,000 Btu/hr.

The capacity for a vent system with a 12-foot height is equal to the capacity for a 10-foot height plus 2/5 of the difference between the 10-foot and 15-foot height values, or  $77,000 + 2/5 \times 10,000 = 81,000$  Btu/hr.

Therefore, a 4-inch diameter vent may be used in the installation.

**EXAMPLES USING COMMON VENTING TABLES**

**EXAMPLE 4: Common Venting Two Draft Hood-equipped Appliances**

**Problem:** A 35,000 Btu/hr water heater is to be common vented with a 150,000 Btu/hr furnace, using a common vent with a total height of 30 feet. The connector rise is 2 feet for the water heater with a horizontal length of 4 feet. The connector rise for the furnace is 3 feet with a horizontal length of 8 feet. Assume single-wall metal connectors will be used with Type B vent.

**Question:** What size connectors and combined vent should be used in this installation?

**Solution:** Table J-7 should be used to size single-wall metal vent connectors attached to Type B vertical vent. In the vent connector capacity portion of Table J-7, find the row associated with a 30-foot vent height. For a 2-foot rise on the vent connector for the water heater, read the shaded columns for draft hood-equipped appliances to find that a 3-inch diameter connector has a capacity of 37,000 Btu/hr. Therefore, a 3-inch single-wall metal vent connector may be used with the water heater.

For a draft hood-equipped furnace with a 3-foot rise, read across the appropriate row to find that a 5-inch diameter vent connector has a maximum capacity of 120,000 Btu/hr (which is too small for the furnace), and a 6-inch diameter vent connector has a maximum vent capacity of 172,000 Btu/hr. Therefore, a 6-inch diameter vent connector should be used with the 150,000 Btu/hr furnace.

Since both vent connector horizontal lengths are less than the maximum lengths listed in Note 1, the table values may be used without adjustments.

In the common vent capacity portion of Table J-7, find the row associated with a 30-foot vent height and read over to the NAT+NAT portion of the 6-inch diameter column to find a maximum-combined capacity of 257,000 Btu/hr. Since the two appliances total only 185,000 Btu/hr, a 6-inch common vent may be used.

**EXAMPLE 5A: Common Venting a Draft Hood-equipped Water Heater with a Fan-assisted Furnace into a Type B Vent**

**Problem:** In this case, a 35,000 Btu/hr input draft hood-equipped water heater with 2 feet of connector rise and 4 feet of horizontal length is to be common vented with a 100,000 Btu/hr fan-assisted furnace with 3 feet of connector rise and 6 feet of horizontal length. The common vent consists of a 30-foot rise of Type B vent. The installer would like to use a single-wall metal vent connector.

**Question:** What are the recommended vent diameters for each connector and the common vent?

**Solution:** - (Table J-7) **Water Heater Vent Connector Diameter** - Since the water heater vent connector horizontal length of 4 feet is less than the maximum value listed in Note 1, the venting table values may be used without adjustments. Using Table J-7 (Vent Connector Capacity), read down the Total Vent Height "H" column to 30 feet and read across the 2-foot Connector Rise "R" row to the first Btu/hr rating in the "NAT Max" column that is equal to, or greater than, the water heater input rating. The table shows that a 3-inch vent connector has a maximum input rating of 37,000 Btu/hr. Since this is greater than the water heater input rating, a 3-inch vent connector is adequate. Furthermore, since the water heater is equipped with a draft hood, there are no minimum input rating restrictions.

**Furnace Vent Connector Diameter** - Using Table J-7 (Vent Connector Capacity), read down the Total Vent Height "H" column to 30 feet and read across the 3-foot Connector Rise "R" row. Since the furnace has a fan-assisted combustion system, find the first "FAN Max" column with a Btu/hr rating greater than the furnace input rating. The 4-inch vent connector has a maximum input rating of 119,000 Btu/hr and a minimum input rating of 85,000 Btu/hr. The 100,000 Btu/hr furnace in this example falls within this range, so a 4-inch connector is adequate. Since the furnace vent connector horizontal length of 6 feet is less than the maximum value listed in Note 1, the venting table values may be used without adjustment. If the furnace had an input rating of 80,000 Btu/hr, then a Type B vent connector (See Table J-6) would be needed in order to meet the minimum capacity limit.

## INSTALLER'S GUIDE

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**Common Vent Diameter** - The total input to the common vent is 135,000 Btu/hr. Using Table J-7, (Common Vent Capacity) read down the Total Vent Height "H" column to 30 feet and across this row to find the smallest vent diameter in the "FAN+NAT" column that has a Btu/hr rating equal to, or greater than 135,000 Btu/hr. The 4-inch common vent has a capacity of 132,000 Btu/hr and the 5-inch common vent has a capacity of 202,000 Btu/hr. Therefore, the 5-inch common vent should be used in this Example.

**Summary** - In this Example, the installer may use a 3-inch diameter, single-wall metal vent connector for the water heater and a 4-inch diameter, single-wall metal vent connector for the furnace. The common vent should be a 5-inch diameter Type B vent.

### EXAMPLE 5B - Common Venting Into a Masonry Chimney

**Problem:** In this case, a 35,000 Btu/hr input draft hood-equipped water heater with 2 feet of connector rise and 4 feet of horizontal length is to be common vented with a 100,000 Btu/hr fan-assisted furnace with 3 feet of connector rise and 6 feet of horizontal length. The common vent is a clay tile lined masonry chimney with a 30 foot height. The internal dimensions of the clay tile liner are nominally 8 inches X 12 inches.

**Question:** Assuming the same vent connector heights, laterals, and materials found in Example 5A, what are the recommended vent connector diameters and is this an acceptable installation?

**Solution:** Table J-9 is used to size common venting installations involving single wall connectors into masonry chimneys.

**Water Heater Vent Connector Diameter.** Using Table J-9 (Vent Connector Capacity), read down the Total Vent Height "H" column to 30 feet and read across the 2-foot Connector Rise "R" row to the first Btu/hr rating in the "NAT Max" column that is equal to or greater than the water heater input rating. The table shows that a 3 inch vent connector has a maximum input of only 31,000 Btu/hr, while a 4-inch vent connector has a maximum input of 57,000 Btu/hr. A 4-inch vent connector must therefore be used.

**Furnace Vent Connector Diameter.** Using Table J-9 (Vent Connector Capacity), read down the Total Vent Height "H" column to 30 feet and across the 3-foot Connector Rise "R" row. Since the furnace has a fan-assisted combustion system, find the first "FAN Max" column with a Btu/hr rating greater than the furnace input rating. The 4-inch vent connector has a maxi-

imum input rating of 127,000 Btu/hr and a minimum input rating of 95,000 Btu/hr. The 100,000 Btu/hr furnace in this example falls within this range, so a 4-inch connector is adequate.

**Masonry Chimney.** From Table J-11, the Equivalent Area for a Nominal Liner size of 8 inches X 12 inches is 63.6 square inches. Using Table J-9 (Common Vent Capacity), read down the "Fan+Nat" column under the Minimum Internal Area of Chimney value of 63, to the row for 30 foot height, to find a capacity value of 739,000 Btu/hr. The combined input rating of the furnace and water heater, 135,000 Btu/hr, is less than the table value, so this is an acceptable installation.

**ELECTRICAL CONNECTIONS**

**NOTE:** *The integrated furnace control is polarity sensitive. The hot leg of the 115 VAC power must be connected to the BLACK field lead.*

Make wiring connections to the unit as indicated on enclosed wiring diagram. As with all gas appliances using electrical power, this furnace shall be connected into a permanently live electric circuit. It is recommended that it be provided with a separate "circuit protection device" electric circuit. The furnace must be electrically grounded in accordance with local codes or in the absence of local codes with the National Electrical Code, ANSI/NFPA 70 "latest edition", if an external electrical source is utilized.

Field wiring diagrams are provided on Page 27. All field supplied wiring must conform with the temperature limitation for Type T wire [63° F (35° C)], when installed in accordance with these instructions and wiring diagrams supplied with the furnace.

Refer to the SERVICE FACTS literature for unit wiring diagrams in addition to the diagram inside the blower door.

**GAS PIPING**

This unit is shipped standard for left side installation of gas piping. A piping knockout is also provided in the right side for an alternate piping arrangement. The installation of piping shall be in accordance with piping codes and the regulations of the local gas company. Pipe joint compound must be resistant to the chemical reaction with liquefied petroleum gases.

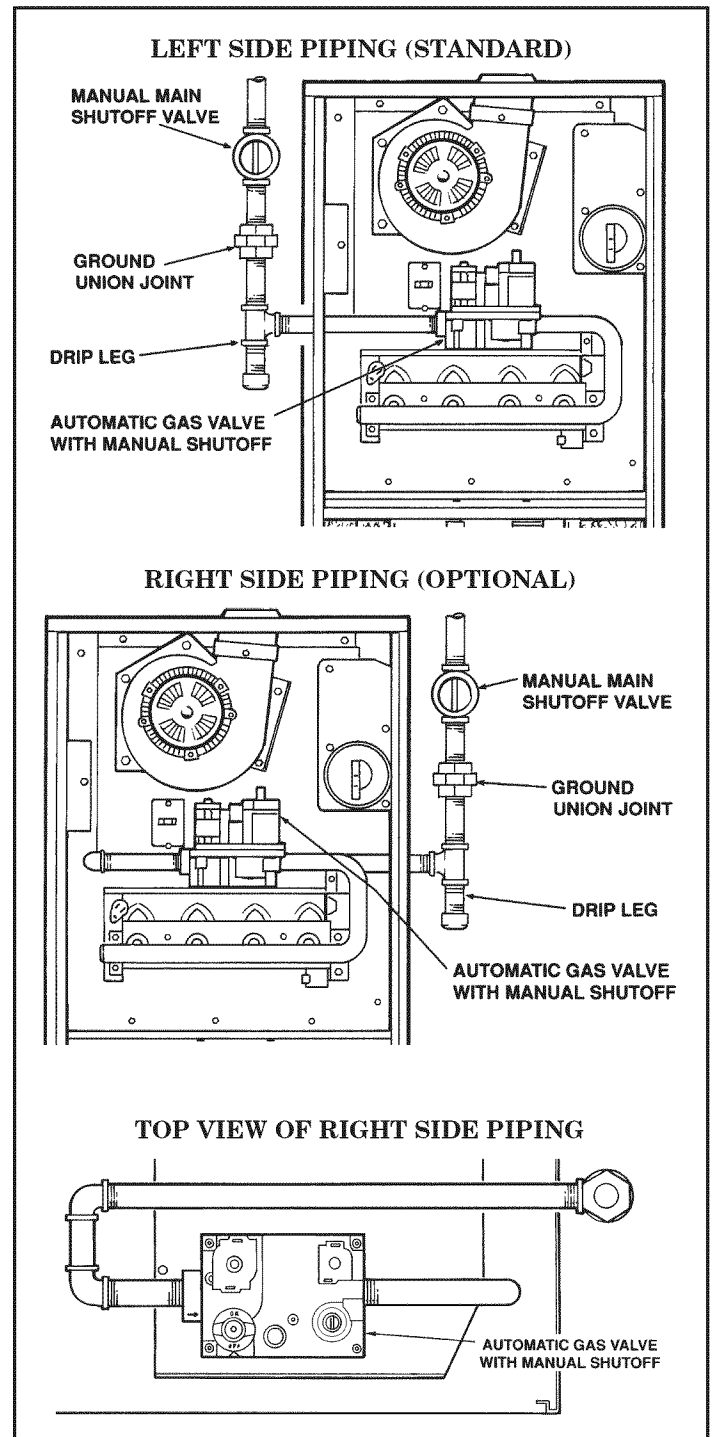
Refer to piping Table 7, Page 24, for delivery sizes. Connect gas supply to the unit, using a ground joint union and a manual shut-off valve as shown in Figure 9. National codes require a condensation drip leg to be installed ahead of the controls as shown in Figure 9.

The furnace and its individual shut-off 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.

The furnace must be isolated from the gas supply piping by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig.

**NOTE:** *Maximum pressure to the gas valve for natural gas is 10.5" W.C. Minimum pressure is 5.0" W.C. Maximum pressure to the gas valve for propane is 13.0" W.C. Minimum pressure is 11.0" W.C.*

*All gas fittings must be checked for leaks using a soapy solution before lighting the furnace. **DO NOT CHECK WITH AN OPEN FLAME!***



**FIGURE 9**

# INSTALLER'S GUIDE

## START UP AND ADJUSTMENT

### PRELIMINARY INSPECTIONS

#### With gas and electrical power "OFF"

1. Duct connections are properly sealed
2. Filters are in place
3. Venting is properly assembled
4. Blower door is in place

Turn knob on main gas valve within the unit to the "OFF" position. Turn the external gas valve to "ON". Purge the air from the gas lines. After purging, Check all gas connections for leaks with a soapy solution -- **DO NOT CHECK WITH AN OPEN FLAME**. Allow 5 minutes for any gas that might have escaped to dissipate. LP Gas, being heavier than air, may require forced ventilation. Turn the knob on the gas valve in the unit to the "ON" position.

### COMBUSTION AND INPUT CHECK

1. Make sure all gas appliances are off except the furnace.
2. Clock the gas meter with the furnace operating (determine the dial rating of the meter) for one revolution.
3. Match the "Sec" column in the gas flow (in cfh) Table 10 with the time clocked.

4. Read the "Flow" column opposite the number of seconds clocked.

5. Use the following factors *if necessary*:

$$\text{For 1 Cu. Ft. Dial Gas Flow CFH} = \frac{\text{Chart Flow Reading}}{2}$$

$$\text{For 1/2 Cu Ft. Dial Gas Flow CFH} = \frac{\text{Chart Flow Reading}}{4}$$

$$\text{For 5 Cu. Ft. Dial Gas Flow CFH} = \frac{10X \text{ Chart Flow Reading}}{4}$$

6. Multiply the final figure by the heating value of the gas obtained from the utility company and compare to the nameplate rating. This must not exceed the nameplate rating.

7. Changes can be made by adjusting the manifold pressure or changing orifices (orifice change may not always be required).

- a. Attach a manifold pressure gauge.
- b. Remove the slot screw on top of the gas valve for manifold pressure adjustment.
- c. Turn the adjustment nut in to increase the gas flow rate, and out to decrease the gas flow rate using a 3/32" hex wrench.
- d. The final manifold pressure setting shall be no less than 3.5" W.C. and no more than 4.0" W.C. with an input of no more than nameplate rating and no less than 93 % of the nameplate rating, unless the unit is derated for high altitude.

For LP gases, the final manifold pressure (outlet) shall be no less than 10.5" W.C. and no more than 11.0" W.C. with an input of no more than the nameplate rating and no less than 93% of the nameplate rating, unless the unit is derated for altitude.

Table 8 lists the main burner orifices shipped with the furnace, If a change of orifices is required to correct the input rate, refer to Table 9.

Table 7

#### NATURAL GAS ONLY

TABLE OF CUBIC FEET PER HOUR OF GAS FOR VARIOUS PIPE SIZES AND LENGTHS							
PIPE SIZE	LENGTH OF PIPE						
	10	20	30	40	50	60	70
1/2	132	92	73	63	56	50	46
3/4	278	190	152	130	115	105	96
1	520	350	285	245	215	195	180
1-1/4	1050	730	590	520	440	400	370

THIS TABLE IS BASED ON PRESSURE DROP OF 0.3 INCH W.C. AND 0.6 SP.GR. GAS

Table 8

#### ORIFICE SIZES

INPUT RATING BTUH	NUMBER OF BURNERS	MAIN BURNER ORIFICE DRILL SIZE	
		NAT. GAS	LP GAS
40,000	2	45	56
60,000	3	45	56
80,000	4	45	56
100,000	5	45	56
120,000	6	45	56

Table 9

#### PART NUMBERS FOR REPLACEMENT ORIFICES

DRILL SIZE	PART NUMBER	DRILL SIZE	PART NUMBER
31	ORF0384	45	ORF0694
32	ORF0499	46	ORF0909
33	ORF0387	47	ORF0910
34	ORF0386	49	ORF0503
35	ORF0488	50	ORF0493
36	ORF0500	51	ORF0494
37	ORF0385	52	ORF0495
38	ORF0497	53	ORF0504
39	ORF0517	54	ORF0492
40	ORF0408	55	ORF0693
41	ORF0502	56	ORF0907
44	ORF0501	57	ORF0908

#### HIGH ALTITUDE DERATE

It may be necessary to change burner orifices due to the altitude of the installation. Ratings of these furnaces are based on sea level operation and should not be changed at elevations up to 2,000 ft. If the installation is 2,000 ft. or above, refer to National Fuel Gas Code 8.1.2, and Appendix F, Table F4, for proper orifice sizing at high altitudes.

Installations above 4,000 feet may require a pressure switch change. If required, use the BAYHALT\*\*\* Kit (High Altitude Accessory Kit) listed in PRODUCT DATA.



TABLE 10

GAS FLOW IN CUBIC FEET PER HOUR 2 CUBIC FOOT DIAL							
Sec.	Flow	Sec.	Flow	Sec.	Flow	Sec.	Flow
8	900	29	248	50	144	82	88
9	800	30	240	51	141	84	86
10	720	31	232	52	138	86	84
11	655	32	225	53	136	88	82
12	600	33	218	54	133	90	80
13	555	34	212	55	131	92	78
14	514	35	206	56	129	94	76
15	480	36	200	57	126	96	75
16	450	37	195	58	124	98	73
17	424	38	189	59	122	100	72
18	400	39	185	60	120	104	69
19	379	40	180	62	116	108	67
20	360	41	176	64	112	112	64
21	343	42	172	66	109	116	62
22	327	43	167	68	106	120	60
23	313	44	164	70	103	124	58
24	300	45	160	72	100	128	56
25	288	46	157	74	97	132	54
26	277	47	153	76	95	136	53
27	267	48	150	78	92	140	51
28	257	49	147	80	90	144	50

TABLE 11

Correction Table for Burner Orifice Drill Sizes for Furnaces Installed at Altitudes 2000 Feet and More Above Sea Level

Orifice Twist Drill Size If Installed At Sea Level	ALTITUDE ABOVE SEA LEVEL						
	2000	3000	4000	5000	6000	7000	8000
36	37	38	38	39	40	41	41
37	38	39	39	40	41	42	42
38	39	40	41	41	42	42	43
39	40	41	42	42	42	43	43
40	41	42	42	42	43	43	44
41	42	42	42	43	43	44	44
42	42	43	43	43	44	44	45
43	44	44	44	45	45	46	47
44	45	45	45	46	47	47	48
45	46	47	47	47	48	48	49
50	51	51	51	51	52	52	52
51	51	52	52	52	52	53	53
52	52	53	53	53	53	53	54
53	54	54	54	54	54	54	55
54	54	55	55	55	55	55	56
55	55	55	55	56	56	55	56
56	56	56	57	57	57	58	59
57	58	59	59	60	60	61	62
58	59	60	60	61	62	62	63
59	60	61	61	62	62	63	64
60	61	61	62	63	63	64	64

SEQUENCE OF OPERATION

Thermostat call for heat

R and W thermostat contacts close signaling the control module to run its self-check routine. After the control module has verified that the pressure switch contacts are open and the limit switch(es) contacts are closed, the draft blower will be energized.

As the induced draft blower comes up to speed, the pressure switch contacts will close and the ignitor warm up period will begin. The ignitor will heat for approx. 17 seconds, then the gas valve is energized to permit gas flow to the burners. The flame sensor confirms that ignition has been achieved within the 6 second ignition trial period.

After the flame sensor confirms that ignition has been achieved, the delay to fan ON period begins timing and after approx. 45 seconds the indoor blower motor will be energized and will continue to run during the heating cycle.

When the thermostat is satisfied, R and W thermostat contacts open, the gas valve will close, the flames will extinguish, and the induced draft blower will be de-energized after a 5 second post purge. The indoor blower motor will continue to run for the fan off period (Field selectable at 90, 120, 150\* or 210 seconds), then will be de-energized by the control module.

\* = Factory Setting

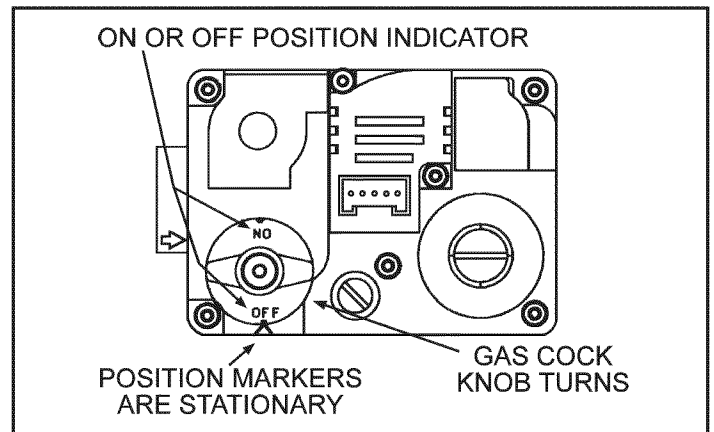


FIGURE 10

LIGHTING INSTRUCTIONS

**WARNING: DO NOT** attempt to manually light the burner.

Lighting instructions appear on each unit. Each installation must be checked out at the time of initial start up to insure proper operation of all components. Check out should include putting the unit through one complete cycle as outlined below.

Turn on the main electrical supply and set the thermostat above the indicated temperature. The ignitor will automatically heat, then the gas valve is energized to permit the flow of gas to the burners. After ignition and flame is established, the flame control module monitors the flame and supplies power to the gas valve until the thermostat is satisfied.

TO SHUT OFF

For complete shutdown: Turn the gas cock knob on the main gas valve to the "OFF" position (See Figure 10). Disconnect the electrical supply to the unit.

**CAUTION: If this is done during the cold weather months, provisions must be taken to prevent freeze-up of all water pipes and water receptacles.**

# INSTALLER'S GUIDE

Whenever your house is to be vacant, arrange to have someone inspect your house for proper temperature. This is very important in below freezing weather. If for any reason your furnace should fail to operate damage could result, such as frozen water pipes.

## LIMIT SWITCH CHECK OUT

The limit switch is a safety device designed to close the gas valve should the furnace become overheated. Since proper operation of this switch is important to the safety of the unit, it **must be checked out on initial start up by the installer.**

To check for proper operation of the limit switches, set the thermostat to a temperature higher than the indicated temperature to bring on the gas valve. Restrict the airflow by blocking the return air or by disconnecting the blower. When the furnace reaches the maximum outlet temperature as shown on the rating plate, the burners must shut off. If they do not shut off after a reasonable time and overheating is evident, a faulty limit switch is probable and the limit switch must be replaced. After checking the operation of the limit control, be sure to remove the paper or cardboard from the return air inlet, or reconnect the blower.

## NOTE TO INSTALLER

Review the following warnings with the owner. Review the contents of the OWNER'S INFORMATION MANUAL with the owner.

## AIRFLOW ADJUSTMENT

Check inlet and outlet air temperatures to make sure they are within the ranges specified on the furnace rating nameplate. If the airflow needs to be increased or decreased, see the wiring diagram for information on changing the speed of the blower motor.

**WARNING: Disconnect power to the unit before removing the blower door.**

This unit is equipped with a blower door switch which cuts power to the blower and gas valve causing shutdown when the door is removed. Operation with the door removed or ajar can permit the escape of dangerous fumes. All panels must be securely closed at all times for safe operation of the furnace.

**NOTE:** Direct drive motors have bearings which are permanently lubricated and under normal use, lubrication is not recommended.

## INDOOR BLOWER TIMING

The control module controls the indoor blower. The blower starts approximately 45 seconds after ignition. The FAN-OFF period is approximately 90 seconds from the interruption of gas flow.

## ROOM AIR THERMOSTAT HEAT ANTICIPATOR ADJUSTMENT

Set the thermostat heat anticipator according to the current flow measured, or the settings found in the notes on the furnace wiring diagram, (found inside the furnace casing).

## INSTRUCTIONS TO THE OWNERS

**In the event that electrical, fuel, or mechanical failures occur, the owner should immediately turn the gas supply off at the manual gas valve, located in the burner compartment (See Figure 9). Also turn off electrical power to the furnace and contact the service agency designated by your dealer.**

## OPERATING INFORMATION

### FLAME ROLL-OUT DEVICE

All models are equipped with a fusible link on the burner cover. In case of flame roll-out, the link will fail and cause the circuit to open which shuts off all flow of gas.

### ABNORMAL CONDITIONS

#### 1. EXCESSIVE COMBUSTION VENT PRESSURE OR FLUE BLOCKAGE

If pressure against induced draft blower outlet becomes excessive, the pressure switch will shut off the gas valve until acceptable combustion pressure is again available.

#### 2. LOSS OF FLAME OR GAS SUPPLY FAILURE

If loss of flame occurs during a heating cycle, when flame is not present at the sensor, the control module will recycle the ignition sequence after the sensor cools, then if ignition is not achieved, it continues to recycle the ignition sequence until flame is established, the thermostat is satisfied, or power is interrupted.

#### 3. POWER FAILURE

If there is a power failure during a heating cycle, the system will restart the ignition sequence automatically when power is restored, if the thermostat still calls for heat.

#### 4. INDUCED DRAFT BLOWER FAILURE

If pressure is not sensed by the pressure switch, it will not allow the gas valve to open, therefore the unit will not start. If failure occurs during a running cycle, the pressure switch will cause the gas valve to close and shut the unit down.

The following warning complies with State of California law, Proposition 65.

**▲WARNING:** This product contains fiberglass wool insulation! Fiberglass dust and ceramic fibers are believed by the State of California to cause cancer through inhalation. Glasswool fibers may also cause respiratory, skin, or eye irritation.

### PRECAUTIONARY MEASURES

- Avoid breathing fiberglass dust.
- Use a NIOSH approved dust/mist respirator.
- Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.
- Wash clothes separately from other clothing: rinse washer thoroughly.
- Operations such as sawing, blowing, tear-out, and spraying may generate fiber concentrations requiring additional respiratory protection. Use the appropriate NIOSH approved respirator in these situations.

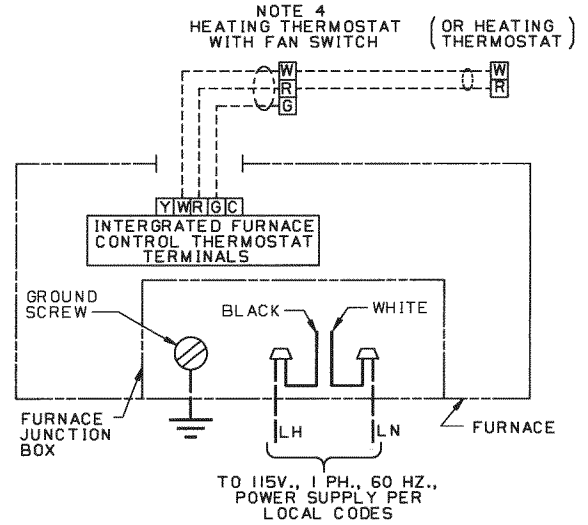
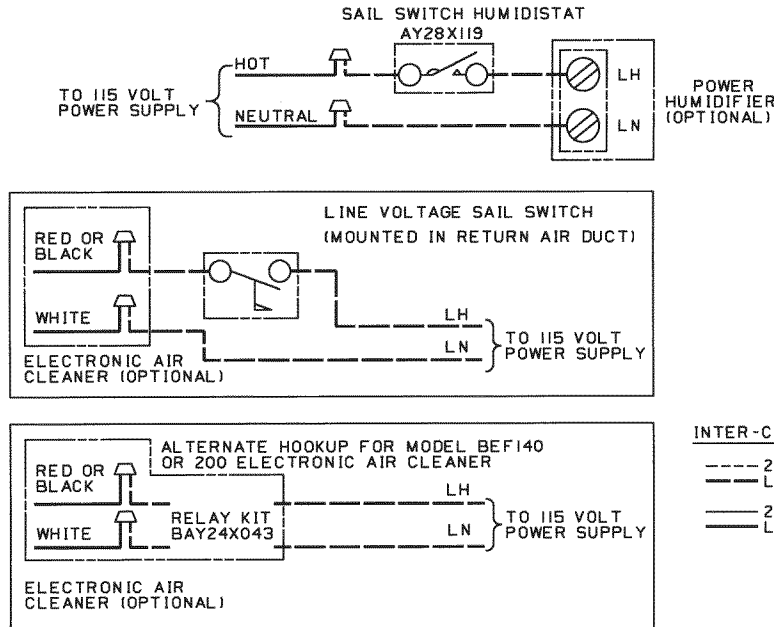
### FIRST AID MEASURES

- Eye Contact** - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.
- Skin Contact** - Wash affected areas gently with soap and warm water after handling.

FIELD WIRING DIAGRAM FOR HEATING ONLY

NOTES

1. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE(S).
2. LOW VOLTAGE (24V.) WIRING TO BE NO. 18 A. W. G. MIN.
3. GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
4. SET THERMOSTAT HEAT ANTICIPATOR PER UNIT WIRING DIAGRAM.



INTER-COMPONENT WIRING

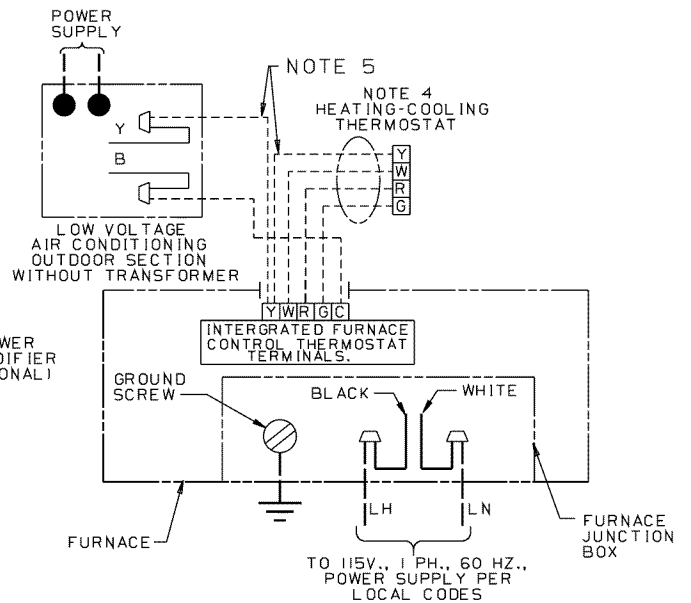
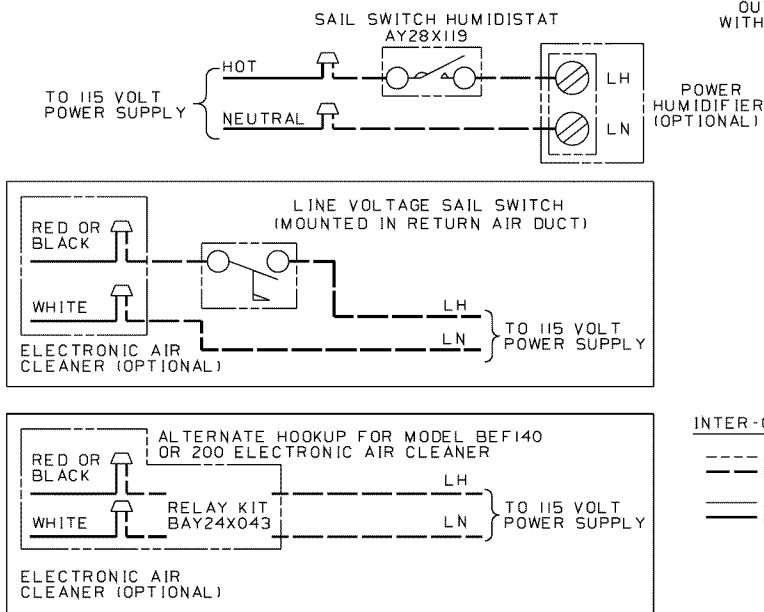
- 24 V. LINE V. } FIELD WIRING
- 24 V. LINE V. } FACTORY WIRING

From Dwg. 21B340433 Rev. 0

FIELD WIRING DIAGRAM FOR HEATING/COOLING (OUTDOOR SECTION WITHOUT TRANSFORMER)

NOTES:

1. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE(S).
2. LOW VOLTAGE (24V.) WIRING TO BE NO. 18 A.W.G. MIN.
3. GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
4. SET THERMOSTAT HEAT ANTICIPATOR PER UNIT WIRING DIAGRAM.
5. THE "Y" TERMINAL FROM THE THERMOSTAT MUST BE WIRED TO THE "Y" TERMINAL OF THE FURNACE CONTROL FOR PROPER BLOWER OPERATION DURING COOLING.



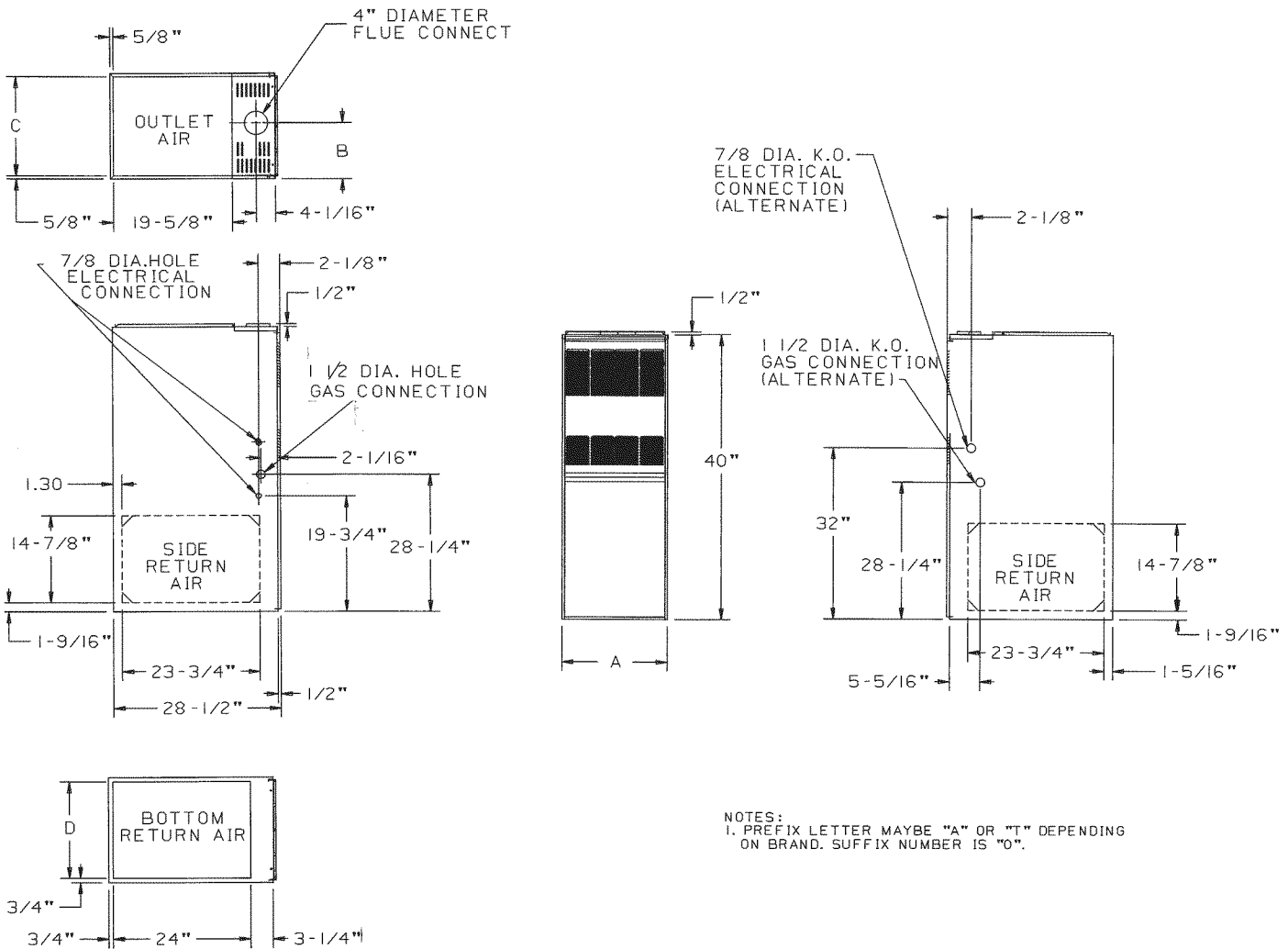
INTER-COMPONENT WIRING

- 24 V. LINE V. } FIELD WIRING
- 24 V. LINE V. } FACTORY WIRING

From Dwg. 21B330432 Rev. 0

## \*UD-C OUTLINE DRAWING

(ALL DIMENSIONS ARE IN INCHES)



NOTES:  
1. PREFIX LETTER MAYBE "A" OR "T" DEPENDING ON BRAND. SUFFIX NUMBER IS "0".

MODEL	A	B	C	D
*UD040C924H	14-1/2"	9-5/8"	13-1/4"	13"
*UD040C930H				
*UD060C924H				
*UD060C936H	17-1/2"	9-5/8"	16-1/4"	16"
*UD080C924H				
*UD080C936H				
*UD080C948H	21"	13-1/16"	19-3/4"	19-1/2"
*UD100C936H				
*UD100C945H				
*UD100C948H	24-1/2"	15-5/16"	23-1/4"	23"
*UD100C960H				
*UD120C954H				
*UD100C961H	24-1/2"	15-5/16"	23-1/4"	23"
*UD120C960H				
*UD140C960H				

\* - First Letter May Be "A" or "T"

MINIMUM CLEARANCE TO COMBUSTIBLE MATERIALS			
<b>UPFLOW CLOSET</b>			
LEFT SIDE	0 IN.	FRONT	3 IN. (Note 1)
RIGHT SIDE	0 IN. (+)	BACK	0 IN.
FLUE	6 IN. (#)	TOP	1 IN.
<b>HORIZONTAL CLOSET (Note 2)</b>			
TOP	2 IN. (+)	BACK	3 IN.
FLUE	6 IN. (#)	SIDES	1 IN.
FRONT	3 IN. (Note 1)		
<b>HORIZONTAL ALCOVE (Note 2)</b>			
TOP	1 IN. (+)	BACK	0 IN.
FLUE	6 IN. (#)	SIDES	0 IN.
FRONT	18 IN.		
# - May be 1" when TYPE B-1 vent pipe is used.			
+ - For 14-1/2" cabinets 3" when single wall vent pipe is used.			
When the 14-1/2" width models are installed in a horizontal position and a single wall vent pipe is used, a 6" clearance must be supplied between the vent pipe and combustible flooring.			
Notes: 1) Minimum clearance to front on UD140 models is 6 inches.			
2) May be installed on combustible floor when Type B1 vent is used.			
* - FIRST LETTER MAY BE "A" OR "T"			

From Dwg. 21C340781 Rev. 1