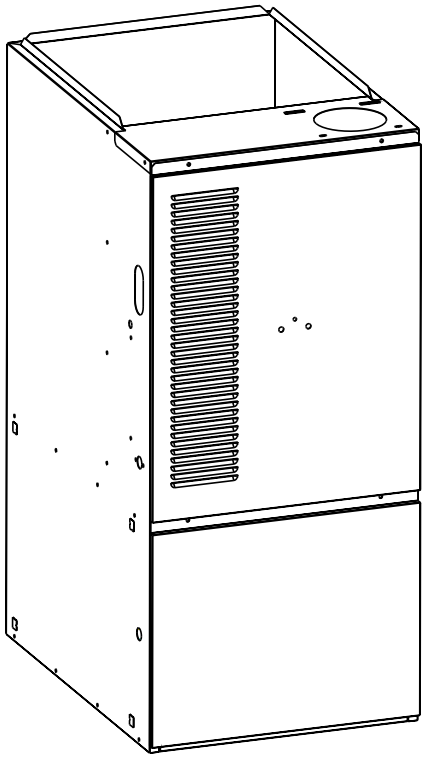
Residential Gas Furnaces

Installation Instructions

***TA Series 80+ High Efficiency Upflow/Horizontal Two-Stage Furnace**



***TA 80+ Upflow/Horizontal**

⚠ WARNING:

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency, or the gas supplier.

⚠ FOR YOUR SAFETY:

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**
- **Extinguish any open flame.**

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Read all instructions carefully before starting the installation.

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FURNACE SPECIFICATIONS - Upflow/Horizontal Models

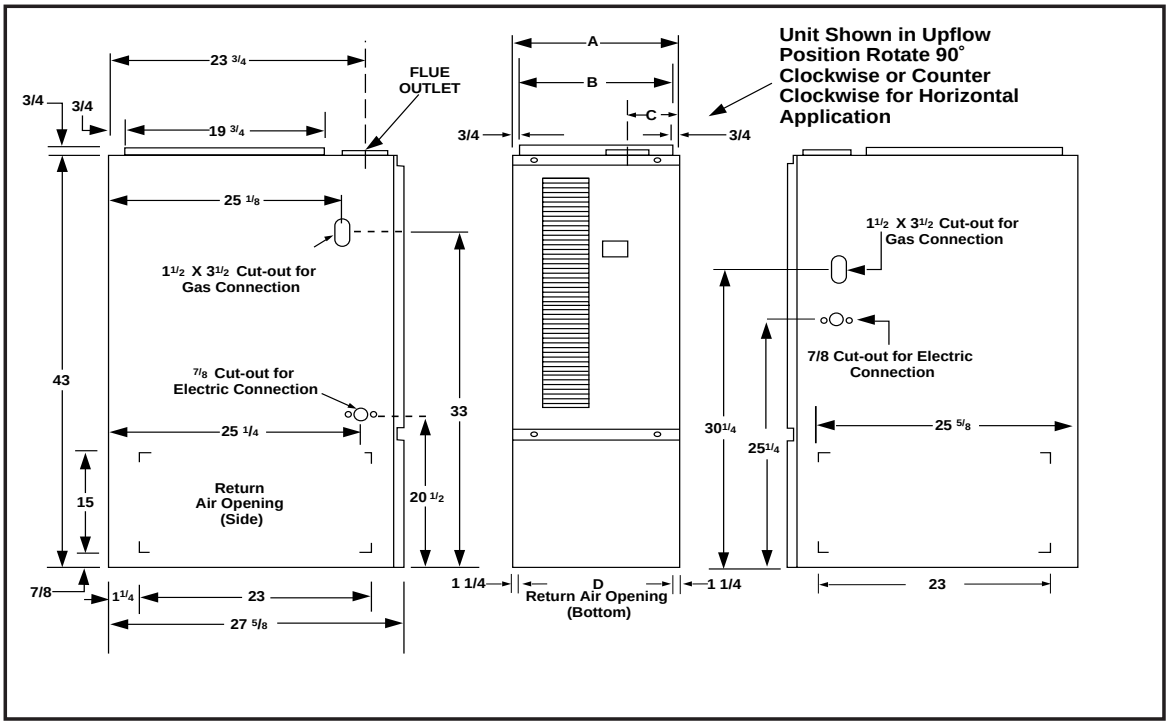


Figure 1. Upflow/Horizontal Unit Dimensions

UPFLOW/HORIZONTAL FURNACE MODELS FURNACE DIMENSIONS AND SHIPPING WEIGHTS								
Model No	High Fire Input	Low Fire Input	Dimensions				Flue Outlet	Shipping Weight
			A	B	C	D		
	Btuh	Btuh	In.	In.	In.	In.	In.	Lbs
*TA 072C-VB	72,000	48,000	19 3/4	18 1/4	3 3/4	17 1/4	4	152
*TA 100C-VB	100,000	60,000	19 3/4	18 1/4	3 3/4	17 1/4	4	174
*TA 120C-VC	120,000	72,000	22 1/2	21	3 3/4	20	4	182

Table 1. Upflow/Horizontal Furnace Model Numbers, Dimensions, and Shipping Weights

CAPACITIES—Furnace Airflow Data

CFM		SWITCH NUMBER							Nominal A/C and HP Capacity
LOW	HIGH	1	2	3	4	*5*	*6*	*7*	
500	720	0	0	0	1				2 TON
550	800	0	0	0	0				2.5 TON
610	880	0	0	1	0				3 TON
650	945	1	0	0	1				3.5 TON
720	1050	1	0	0	0				4 TON
800	1155	1	0	1	0				5 TON
900	1305	0	1	0	1				
1000	1450	0	1	0	0				
1060	1530	1	1	0	1				
1100	1595	0	1	1	0				
1170	1700	1	1	0	0				
1290	1870	1	1	1	0				

Note: O = Off 1 = On

Table 2a. All Cooling/Heat Pump Airflow Settings

Nominal Airflow Rates (CFM) and Temperature Rises (Degree F)													
Switches			*TA 072-VB Models				*TA 100-VB Models				*TA 120-VC Models			
			Low Fire Input		High Fire Input		Low Fire Input		High Fire Input		Low Fire Input		High Fire Input	
5	6	7	48,000		72,000		60,000		100,000		72,000		120,000	
0	**0**	#	660	55	1090	**55**	660	69	1090	70	660	50	1090	84
1	**0**	#	750	49	1240	44	750	61	1240	**60**	750	44	1240	74
0	**1**	#	1220	30	1680	33	1220	37	1680	44	1220	33	1680	**55**
1	**1**	#	1300	28	1880	29	1300	35	1880	39	1300	29	1880	49

Switch not used - Can be 0 or 1.

Notes:

1. Recommended temperature rises are highlighted in bold.
2. Airflow rates of 1800 CFM or more require two return air connections. Data is for operation with filter(s).
3. Temperature rises in the table are approximate. Actual temperature rises may vary.
4. Temperature rises that are shaded grey are for reference only. These conditions are not recommended.
5. For single stage cooling, reference the CFM listed in the high column.

Table 2b. Heating Airflow Settings

SAFETY INFORMATION

1. Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
2. Install this furnace only in a location and position as specified on Table 3 of these instructions.
3. Provide adequate combustion and ventilation air to the furnace space as specified on Pages 8 through 16.
4. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on Pages 11 through 15.
5. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified on Page 17 of these instructions.
6. Always install furnace to operate within the furnace's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, as specified on Table 2b of these instructions. See furnace rating plate.
7. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
8. A gas-fired furnace for installation in a residential garage must be installed as specified on Page 7 of these instructions.
9. The furnace is not to be used for temporary heating of buildings or structures under construction.

INSTALLATION REQUIREMENTS

Requirements and Codes
This furnace must be installed in accordance with these instructions, all applicable local building codes, current revision of the National Fuel Gas Code (ANSI-Z223.1), and in Canada with the CAN/CGA - B149 installation code. The current revision of the National Fuel Gas Code is available from:

American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

Additional helpful publications are:
NFPA-90A - Installation of
Air Conditioning and Ventilating Systems

NFPA-90B - Warm Air Heating
and Air Conditioning Systems

These publications are available from:
National Fire Protection Association, Inc.
Batterymarch Park
Quincy, Massachusetts 02269

⚠ WARNING:

This furnace is not approved for installation in mobile homes. Installation in a mobile home could cause fire, property damage, and/or personal injury.

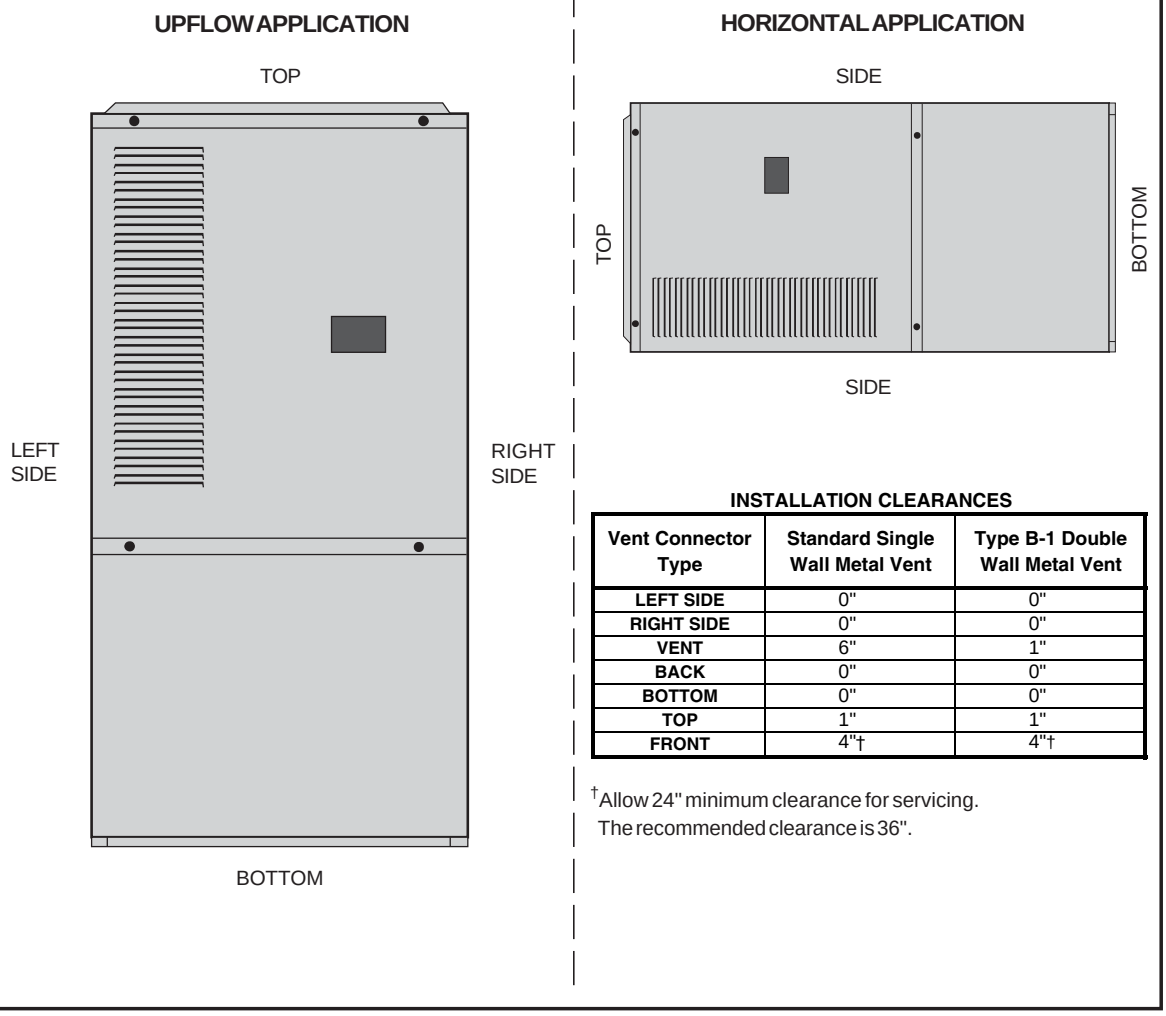
Location
Upflow gas furnaces are shipped ready for installation in the upflow or horizontal right or left positions. The furnace must be installed on a level surface, located as close to the vent (or chimney) and as close to the center of the air distribution system as possible. See Figure 1 and Table 1 for overall dimensions to determine the required clearances in hallways, doorways, stairs, etc. to allow the furnace to be moved to the installation point. The furnace must be installed so that all electrical components are protected from water. The furnace must be installed upstream from a refrigeration system. This furnace is not to be used for temporary heating of buildings or structures under construction.

Clearances to Combustibles
This furnace is Design Certified by CSA International for the minimum clearances to combustible material listed in Table 3. Refer to the furnace rating plate, located inside of the furnace cabinet, for the specific model number and clearance information.

Access for positioning and servicing the unit must be considered when locating unit. 24 inches is the minimum required clearance from the front of the unit for servicing it. 30 inches is the minimum required clearance from the front of the unit for positioning it. **36 inches is the recommended clearance from the front of the unit.** Please note that a panel or door can be located such that the minimum clearance on the rating plate is satisfied, but that panel or door must be removable and allow the appropriate clearance for your installation.

This furnace is certified for use on wood flooring. This furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

Upflow/Horizontal Furnace Models



INSTALLATION CLEARANCES

Vent Connector Type	Standard Single Wall Metal Vent	Type B-1 Double Wall Metal Vent
LEFT SIDE	0"	0"
RIGHT SIDE	0"	0"
VENT	6"	1"
BACK	0"	0"
BOTTOM	0"	0"
TOP	1"	1"
FRONT	4"†	4"†

†Allow 24" minimum clearance for servicing. The recommended clearance is 36".

Table 3. Minimum Clearances to Combustible Material

A gas-fired furnace installed in a residential garage must be installed so the burners and the igniter are located not less than 18 inches (457 mm) above the floor, and the furnace must be located or protected to avoid physical damage by vehicles.

⚠ WARNING:

Do not place combustible material on or against the furnace cabinet or within 6 inches of the vent pipe. Do not place combustible materials, including gasoline and any other flammable vapors and liquids, in the vicinity of the furnace.

VENTING AND COMBUSTION AIR REQUIREMENTS

General

Provisions must be made in the installation of this furnace to provide an adequate supply of air for combustion. Detailed instructions for determining the adequacy of an installation can be found in the current revision of the National Fuel Gas Code (ANSI Z223.1 / NFPA54) or in applicable local building codes. **Consult local codes for special requirements**. For Canadian installations consult Canadian Installations Codes and (CAN/CGA B149.1 or .2).

If the furnace is operated with inadequate air for combustion one of the flame roll-out switches located in the burner compartment or the vent switch will open, turning off the gas supply to the burners. These safety devices are manually reset switches. DO NOT install jumper wires across these switches to defeat their function. DO NOT reset a switch without identifying and correcting the fault condition. If a switch must be replaced, use only the correct part specified in the Replacement Parts List.

Air openings in the furnace door, warm air registers, and return air grilles must not be restricted.

Combustion Air Quality

To maximize heat exchanger life, the combustion air must be free of chemicals which form corrosive acidic compounds in the combustion gases. The recommended source of combustion air is to use the outdoor air supply. However, the use of indoor air in most applications is acceptable except as follows:

1. If the furnace is installed in a confined space it is recommended that the necessary combustion air come from the outdoors by way of attic, crawl space, air duct, or direct opening.
2. If outdoor combustion air is used, there must be no exposure to the installations or substances listed in Item 3 below.
3. The following types of installation may require **Outdoor Air** for combustion, due to chemical exposures:
   - Commercial buildings
   - Buildings with indoor pools
   - Furnaces installed in 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 may also require **Outdoor Air** for combustion:
   - Permanent wave solutions
   - Chlorinated waxes and cleaners
   - Chlorine based swimming pool chemicals
   - Water softening chemicals
   - De-icing salts or chemicals
   - Carbon tetrachloride
   - Halogen type refrigerants
   - Cleaning solvents (such as perchloroethylene)
   - Printing inks, paint removers, varnishes, etc.
   - Hydrochloric acid
   - Cements and glues
   - Antistatic fabric softeners for clothes dryers
   - Masonry acid washing materials

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

⚠ WARNING:

Furnace installation using methods other than those described in the following sections must comply with the National Fuel Gas Code and all applicable local codes to provide sufficient combustion air for the furnace.

Installation In An Unconfined Space

An unconfined space is an area including all rooms not separated by doors with a volume greater than 50 cubic feet per 1,000 Btuh of the combined input rates of all appliances which draw combustion air from that space. For example, a space including a water heater rated at 45,000 Btuh input and a furnace rated at 100,000 Btuh requires a volume of 7,250 cubic feet [50 x (45 + 100) = 7,250] to be considered unconfined. If the space has an 8 foot ceiling, the floor area of the space must be 906 square feet (7,250 / 8 = 906). In general, a furnace installed in an unconfined space will not require outside air for combustion. However, in “tight” buildings (with weather stripping and caulk to reduce infiltration), it may be necessary to provide outside air to ensure adequate combustion and venting, even though the furnace is located in an unconfined space.

Installation In A Confined Space

A confined space is an area with volume less than 50 cubic feet per 1,000 Btuh of the combined input rates of all appliances drawing combustion air from that space. Furnace closets, small equipment rooms and garages are confined spaces. Furnaces installed in a confined space which supply heated air to areas outside the space must draw return air from outside the space and must have the return air ducts tightly sealed to the furnace. **A confined space must have two openings into the space for combustion air. One opening must be within 12 inches of the ceiling, and the other must be within 12 inches of the floor**. The required sizing of these openings is determined by whether inside or outside air is used to support combustion, the method by which the air is brought to the space, and by the total input rate of all appliances in the space.

Horizontal Furnace Installation

The *TA series furnaces can be installed horizontally in an attic, basement, crawl space or alcove. It can be suspended from a ceiling in a basement or utility room in either a right to left airflow or left to right airflow. (See Figures 2 and 3.)

If the furnace is to be suspended from the ceiling, it will be necessary to use steel straps around each end of the furnace. These straps should be attached to the furnace with sheet metal screws and to the rafters with bolts. The furnace could also be suspended by an angle iron frame bolted to the rafters. (See Figure 2.)

Access for positioning and servicing must be considered when locating the unit. Refer to Table 3, Minimum Clearances to Combustible Material, for clearance specifications.

Keep all insulating materials away from the louvered door. Insulating materials may be combustible.

The *TA series furnace may be installed directly on combustible wood flooring or supports, if type "B-1" vent pipe is used (See Figure 8). It is recommended for further reduction of fire hazard that cement board or sheet metal be placed between the furnace and the combustible floor and extend 12 inches beyond the front of the louvered door.

⚠ WARNING:

Furnaces installed with combustion air drawn from a heated space which includes exhaust fans, fireplaces, or other devices that may produce a negative pressure should be considered confined space installations.

See the venting section for venting guidelines and specifications.

Air From Inside (See Figure 4)

If combustion air is taken from the heated space, the two openings must *each* have a free area of at least one square inch per 1,000 Btuh of total input of all appliances in the confined space, but **not less than 100 square inches**

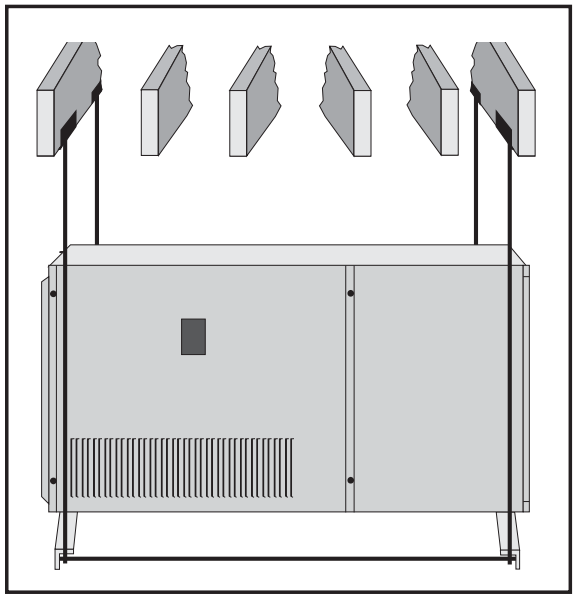


Figure 2. *TA Horizontal Installation Suspended in Attic or Crawl Space

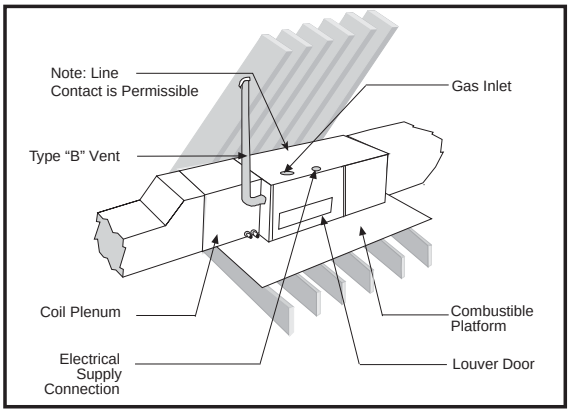
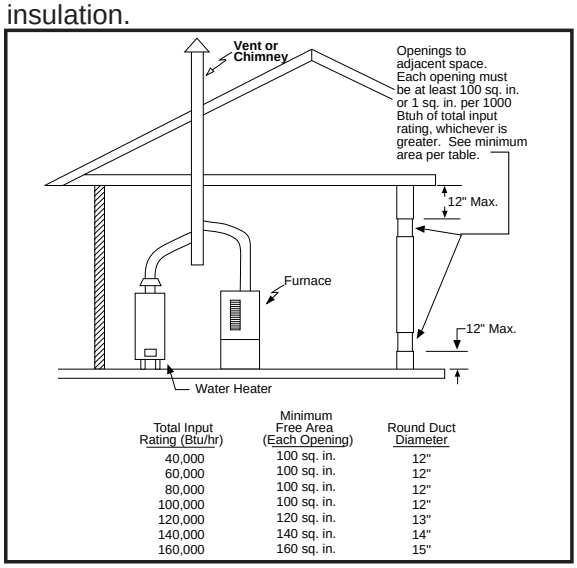


Figure 3. *TA Horizontal installation on a Platform

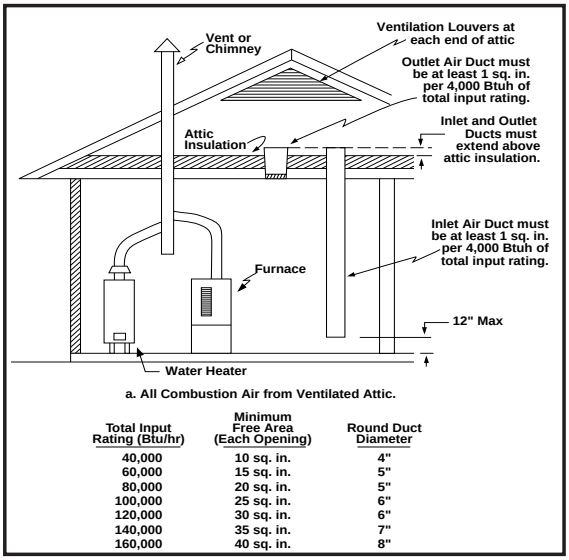
of free area. For example, if the combined input rate of all appliances is less than or equal to 100,000 Btuh, each opening must have a free area of at least 100 square inches. If the combined input rate of all appliances is 120,000 Btuh, each opening must have a free area of at least 120 square inches.

Outdoor Air Using Vertical Ducts
(See Figure 5)
If combustion air is taken from outdoors through vertical ducts, the openings and ducts must have a minimum free area of one square inch per 4,000 Btuh of total appliance input. In installations drawing combustion air from a ventilated attic, both air ducts must extend above the attic insulation.



Total Input Rating (Btu/hr)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	100 sq. in.	12"
60,000	100 sq. in.	12"
80,000	100 sq. in.	12"
100,000	100 sq. in.	12"
120,000	120 sq. in.	13"
140,000	140 sq. in.	14"
160,000	160 sq. in.	15"

Figure 4. Equipment in a Confined Space with all Combustion Air Drawn from the Inside



a. All Combustion Air from Ventilated Attic.

Total Input Rating (Btu/hr)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. in.	4"
60,000	15 sq. in.	5"
80,000	20 sq. in.	5"
100,000	25 sq. in.	6"
120,000	30 sq. in.	6"
140,000	35 sq. in.	7"
160,000	40 sq. in.	8"

Figure 5. Equipment in a Confined Space with all Combustion Air Drawn from the Outside through Vertical Ducts

If the unit is installed in an area with an exhaust fan, provide sufficient ventilation to prevent negative pressures from occurring in the room.

The combustion air openings must not be restricted in any manner.

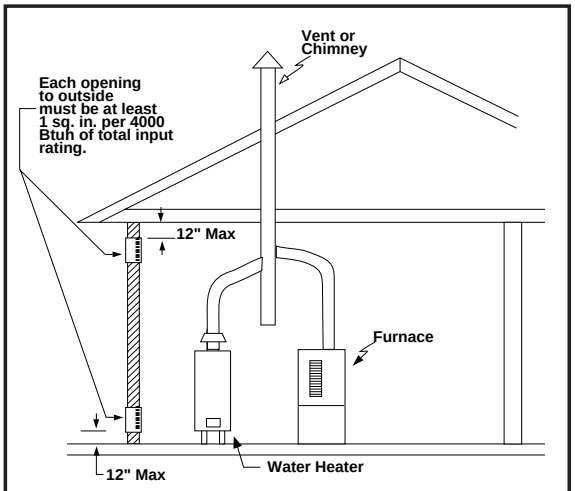
⚠ CAUTION:

Do not supply combustion air from an attic space that is equipped with power ventilation or any other device that may produce a negative pressure.

Air Directly Through An Exterior Wall
(See Figure 6)

If combustion air is provided directly through an exterior wall, the two openings must each have free area of at least one square inch per 4000 Btuh of total appliance input.

Outdoor Air Using a Crawl Space and Ventilated *Attic (See Figure 7)*
When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 Btuh of total



Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. in.	4"
60,000	15 sq. in.	5"
80,000	20 sq. in.	5"
100,000	25 sq. in.	6"
120,000	30 sq. in.	6"
140,000	35 sq. in.	7"
160,000	40 sq. in.	8"

Figure 6. Equipment in a Confined Space with all Combustion Air Drawn from the Outside through Exterior Wall

appliance input. The openings shall communicate directly, or by ducts, with the outdoor spaces (crawl or attic) that freely communicate with the outdoors.

Outdoor Air Using Horizontal Ducts (See Figure 8)
If combustion air is taken from outdoors through horizontal ducts, the openings and ducts must have a minimum free area of one square inch per 2,000 Btuh of total appliance input.

If the unit is installed in an area with an exhaust fan, provide sufficient ventilation to prevent negative pressures from occurring in the room.

The combustion air openings must not be restricted in any manner.

VENTING REQUIREMENTS

General

This furnace must be vented in compliance with, the current revision of the National Fuel Gas Code (ANSI-Z223.1/NFPA54), with the instructions provided below.

In Canada, venting shall conform to the requirements of the current (CAN/CGA B149.1 or .2) installation codes. **Consult local codes for special requirements.**

For Category I furnace installations, 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 acceptance to the authority having jurisdiction. **Venting into an unlined masonry chimney or concrete chimney is prohibited.**

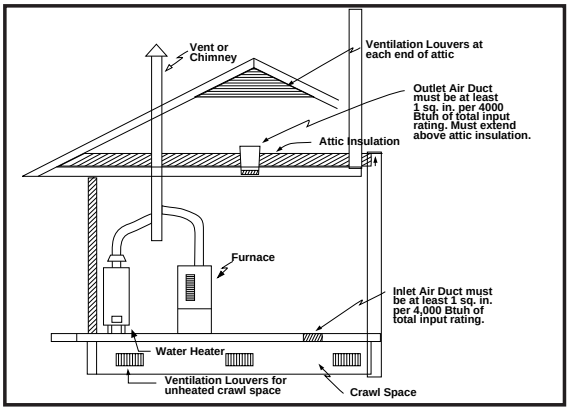


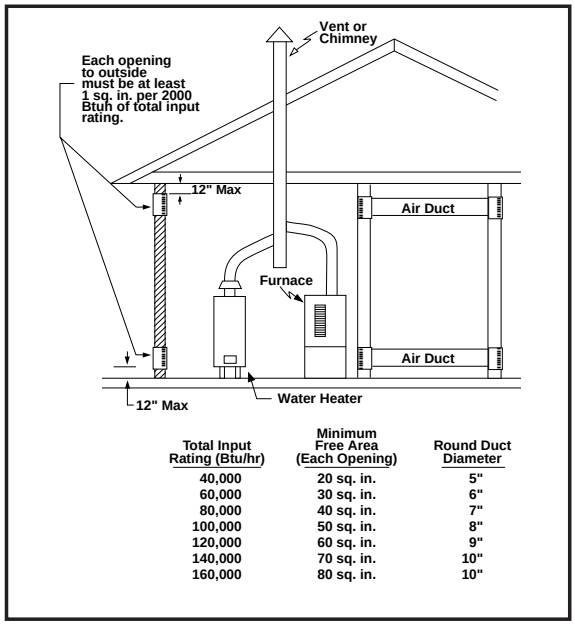
Figure 7. Equipment in a Confined Space with All Combustion Air Drawn from a Crawl Space and Ventilated Attic

This furnace must never be vented to a chimney flue servicing a fireplace or other appliance designed to burn solid fuel. If the furnace vent is to be connected to a chimney serving a fireplace, the fireplace must be sealed off from the chimney. Single wall metal vents shall not be used for Category I venting, Category I furnaces must be vented vertically or near vertically.

The furnace vent, if metal, may be insulated if local codes allow. Any part of the vent system, metal vent only, not exposed to weather, but which are exposed to ambient temperatures below 35° F must be insulated to prevent condensation. All vent insulation shall be foil backed fiberglass of one inch minimum thickness.

Three sheet metal fasteners (field supplied) should be used to secure the vent pipe to the furnace flue. These fasteners should be evenly spaced around the flue diameter, if possible.

Category I - Common Venting
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 appliances. An improperly sized venting system can result in the formation of condensate, leakage, spillage, etc.



Total Input Rating (Btu/hr)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	20 sq. in.	5"
60,000	30 sq. in.	6"
80,000	40 sq. in.	7"
100,000	50 sq. in.	8"
120,000	60 sq. in.	9"
140,000	70 sq. in.	10"
160,000	80 sq. in.	10"

Figure 8. Equipment in a Confined Space with all Combustion Air Drawn from the Outside through Horizontal Ducts

The steps outlined in the warning below shall be followed with each individual appliance connected to the vent system placed in operation, while all other appliances connected to the vent system are not in operation:

⚠ WARNING:

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.
The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. **Seal any unused openings in the venting system.**
2. **Inspect the venting system for proper size and horizontal pitch, as required in the *National Fuel Gas Code, ANSI Z223. 1/NFPA 54 or the CSA B149.1, Natural Gas and Propane Installation Codes* and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.**
3. **As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.**
4. **Close fireplace dampers.**
5. **Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Do not operate a summer exhaust fan.**
6. **Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.**
7. **Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.**
8. **If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Codes*.**
9. **After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.**

The venting system should be designed to have the minimum number of elbows or turns. All horizontal runs shall be sloped upwards from the furnace at 1/4 inch per running foot of vent. Supports for the vent pipe must be installed a minimum of every five feet along the vent run to ensure no displacement after installation.

Under no circumstances shall any portion of the vent system extend into or pass through any return air duct, supply air duct, or plenum.

If the furnace is operated with blocked or restricted venting, the blocked vent switch located in the vent plate will open, turning off the gas supply to the burners. The blocked vent switch is a manually reset device. DO NOT install a jumper wire across this switch to defeat its function. DO NOT reset the switch without identifying and correcting the fault condition which caused the switch to trip. If this switch must be replaced, use only the part specified in the Replacement Parts List.

⚠ WARNING:

Upon completion of the furnace installation, carefully inspect the entire flue system both inside and outside the furnace to assure it is properly sealed. Leaks in the flue system can result in serious personal injury or death due to exposure of flue products, including carbon monoxide.

Category III: Horizontal Venting

Remove the nut and restrictor plate from vent color assembly and discard the restrictor plate. (Figure 9a.)

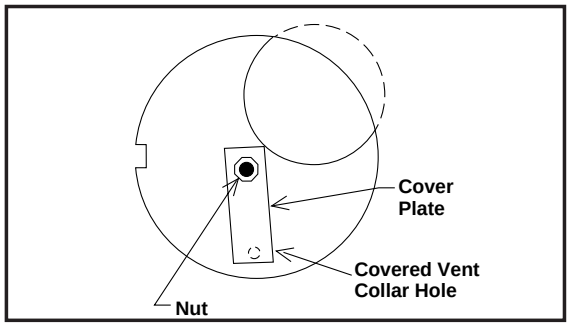


Figure 9a. Vent Collar Detail

NOTE: The reduced NOx models (eighth character N) are not approved as a Category III (Category III) furnace for use with horizontal venting.

The furnaces are approved for use with 3" single wall AL29-4C stainless steel vent pipe in horizontal vent applications. This pipe is available from the following manufacturers:

Z-FLEX Inc. - vent brand name **(Z-VENT)**
Heat-fab Inc. - vent brand name **(Saf-T Vent)**
Flex-L International - vent brand name **(Star-34 Vent)**

This vent pipe must be used for the entire length of the vent run. The installation must be in accordance with all instructions supplied by the vent manufacturer for use on Category III appliances. When venting horizontal, this is defined as a Category III furnace, the vent pressure is positive, and the venting system must be sealed in both horizontal and vertical runs.

⚠ CAUTION:

Do not drill holes through the vent pipe or fittings on a horizontal vented furnace. Do not use sheet metal screws, or rivets. Drilling, screws, or rivets will cause leaks.

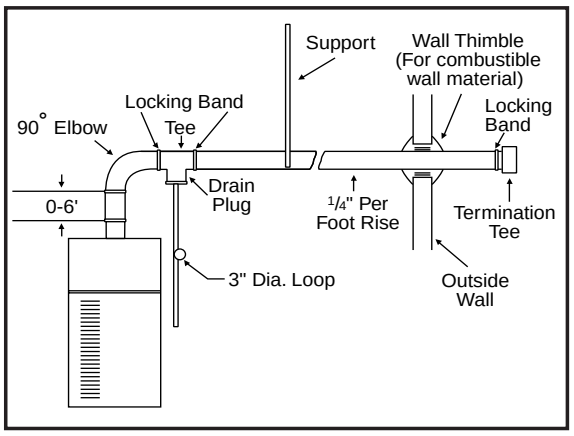


Figure 9b. Typical Horizontal Vent Installation

The components of the horizontal vent system must not be penetrated with screws, rivets, or other devices, either when joining pipes and fittings or using support straps. All joints must be sealed with high temperature silicone before locking bands are installed. If the lengths of pipe must be cut, the joint must still be sealed with silicone and the locking band used. When installing the condensate tube be sure to form a trap by means of a 3" loop filled with water. (See Figure 9b.)

Keep the number of pipe fittings to a minimum. Maintain a minimum of 6 inches of air space between the vent and combustibles at all times, this includes inside and outside the building.

NOTE: The direction of the male-female joints from the drain tee to the termination tee is opposite to standard gas appliance venting. The male end of the pipes point towards the furnace.

1. Apply an adhesive bead around the outside of the pipe approximately 1/4" from the end of the pipe. This includes the first fitting or pipe attached to the furnace.
2. Push the pipe and fitting together while twisting the pipe or fitting. Twisting the pipe or fitting spreads the adhesive completely within the fitting socket.
3. When the pipe is at the socket bottom, inspect the joint. Look for a complete, uninterrupted ring of adhesive material around the pipe at the fitting socket. Additional adhesive or rotation of the pipe or fitting may be required for a complete seal. The complete adhesive material ring provides the seal required for the positive pressure vent.
4. All vent systems must include a tee and drain plug for collection and disposal of condensate. The drain tee must be installed within the first 5 feet of vent run to protect the furnace.
5. All horizontal sections must have a slope toward the drain tee of not less than 1/4" per foot to prevent the collection of condensate at any location other than at the tee.
6. Horizontal runs must be supported with 3/4" pipe strap at a maximum of 5 foot intervals and at each point where an elbow is used.
7. Maintain a 6 inch minimum air space to combustibles from all sections of the stainless steel vent system, except when a wall thimble is used.

Horizontal Power Venting— The Tjerlund GPAK-1TN horizontal kit is certified for use with this furnace. The kit includes a power venter, a side-wall vent hood and a barometric draft control. It has an electrical interlock to assure that the furnace will not operate when the power venter is off.

The kit is for use only when exhaust is through an exterior wall, normally with horizontal vent piping. The power venter establishes negative pressure in the vent piping and the furnace operates as if connected to Category I vertical venting.

Installation Instructions are provided with the kit. Installation must conform to those instructions and applicable requirements of local codes.

⚠ WARNING:

The entire vent system must be sealed with a high temperature sealant which will withstand temperatures of 450°F. Recommended sealants: Dow Corning Sealant 736 RTV; GE 106 RTV; High Tech Ind., High TEMP RED.

Location of Outdoor Terminations

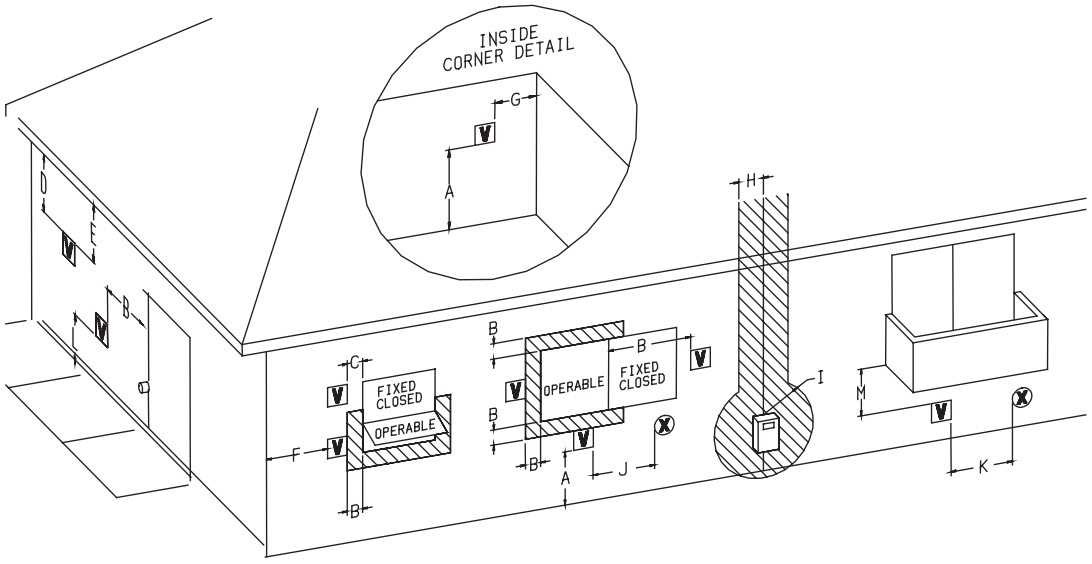
Horizontal Installation

The vent termination tee must be installed with the following minimum clearances. (See Figure 10.) Vent termination clearances shall be con-

Horizontal Venting Requirements

Furnace Model Number *TA	Pipe Size	Reducer Needed	Maximum # Elbows	Max. Feet Vent Pipe
072C-VB	3"	4" to 3"	4	35
100C-VB	3"	4" to 3"	4	35
120C-VB(C)	3"	4" to 3"	4	35

Table 4. Horizontal Venting Requirements



V **VENT TERMINAL** **X** **AIR SUPPLY INLET** **AREA WHERE TERMINAL IS NOT PERMITTED**

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm)	12 inches (30 cm)
B =	Clearance to window or door that may be opened	6 inches (15 cm) for appliances £ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and £ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (300 mm) above opening
C =	Clearance to permanently closed window	*	*
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	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly	*
I =	Clearance to service regulator vent outlet	3 feet (1.83 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances £ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and £ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 feet (1.83 m)	3 feet (91 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)
M =	Clearance under veranda, porch deck, or balcony	12 inches (30 cm) ‡	*

[1] In accordance with the current CSA B149.1 Natural Gas and Propand Installation Code
[2] In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA B149.1, one of the following statement shall be included:
"Clearance in accordance with local installation codes, and the requirements of the gas supplier and the manufacturer's installation instructions."

Figure 10. Vent Termination Clearances

sistent with the ***National Fuel Gas Code, ANSI 2223.1/NFPA 54 and/or the CSA B149.1, Natural Gas and Propane Installation Code.***

All minimum clearances specified must be maintained to protect building materials from degradation by flue gases.

1. The termination tee must be 12 inches above snow level or grade level which ever is higher. See Figure 22 for alternate method to achieve 12" above snow level.
2. The minimum distance from any door, (openable) window, or gravity air inlet is 4 ft. below, 4 ft. horizontally, or 1 ft. above.
3. The vent termination shall be a minimum of 3 ft. above any forced air inlet within 10 ft. (See Figure 10.)
4. Recommended minimum distance from an inside corner formed by two exterior walls is 6 ft., but is not required.
5. The minimum distance from gas or electric meter(s) is 4 ft.
6. Avoid areas where condensate drainage may cause problems such as above planters, patios, or adjacent to windows where the steam from the flue gases may cause fogging. Do not terminate above any public walkway.
7. Select the point of wall penetration where the minimum 1/4 inch per foot of upward slope can be maintained.
8. When penetrating a noncombustible wall, the hole through the wall must be large enough to maintain the pitch, pipe clearance for passage, and provide for proper sealing. Penetrating a combustible wall requires the use of a wall thimble. (See Figure 11.) A 6-1/2 inch square framed opening is required to insert the thimble halves. The thimble is adjustable to varying wall thickness and is held in place by applying sealant to the male sleeve before assembly. Also run a bead of sealant around the outer wall thimble.
9. The vent pipe must extend 1-1/4 inches through the outer thimble half for a combustible wall. Be sure to check this carefully before cutting the vent pipe.
10. Attach a 3 inch coupling to the end of the pipe that extends through the wall or thimble. This prevents the vent pipe from being pushed inward.
11. Cut an 8 inch minimum piece of vent pipe and connect the coupling to the termination tee. The inside of the tee must be a minimum of 12 inches from the outside of the wall. (See Figure 12.)

Flexible Vent Systems

Flexible gas vent is approved for use in vertical single vent or common vent installations only. The minimum distance to combustibles is 1" for type B insulated and 6" for single wall. The venting system must be installed in accordance with the local authorities, the vent manufacturer's instructions and the instructions listed below.

The flexible vent must be installed in accordance with the venting tables for vertical or common venting only. The vent system must be supported in horizontal runs with 3/4" pipe strap at a maximum of 5 foot intervals. All horizontal sections must have a slope toward the furnace of not less than 1/4" per foot. The vent must not sag, or have any bends greater than 90 degrees.

CIRCULATING AIR SUPPLY

General

Plenums and air ducts must be installed in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems (NFPA No. 90A) or the Standard for the Installation of Warm Air Heating and Air Conditioning Systems (NFPA No. 90B).

It is recommended that the outlet duct be provided with a removable access panel. This opening should be accessible when the furnace is installed in service and shall be of a size that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in

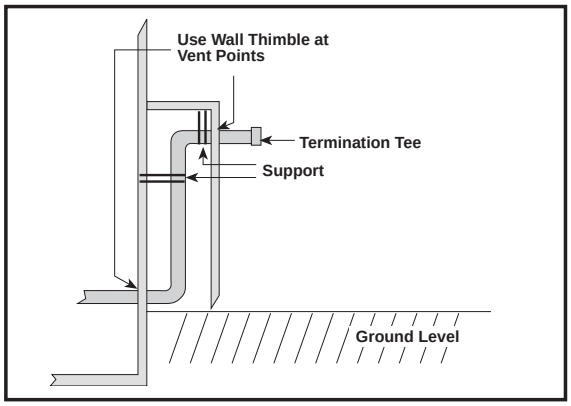


Figure 11. Alternate Horizontal Vent Installation

the heat exchanger. The cover for the opening shall be attached in such a manner as to prevent leaks.

If outside air is used as return air to the furnace for ventilation or to improve indoor air quality, the system must be designed so that the return air is not less than 50° F (10° C) during operation. If a combination of indoor and outdoor air is used, the ducts and damper system must be designed so that the return air supply to the furnace is equal to the return air supply under normal, indoor return air applications.

When a cooling system is installed which uses the furnace blower to provide airflow over the indoor coil, the coil must be installed downstream (on the outlet side) of the furnace or in parallel with the furnace.

If a cooling system is installed in parallel with the furnace, a damper must be installed to prevent chilled air from entering the furnace and condensing on the heat exchanger. If a manually operated damper is installed, it must be designed so that operation of the furnace is prevented when the damper is in the cooling position and operation of the cooling system is prevented when the damper is in the heating position.

Return Air

In applications where the supply ducts carry heated air to areas outside the space in which the furnace is installed, the return air must be delivered to the furnace by duct(s) sealed to the furnace casing, running full size and without interruption.

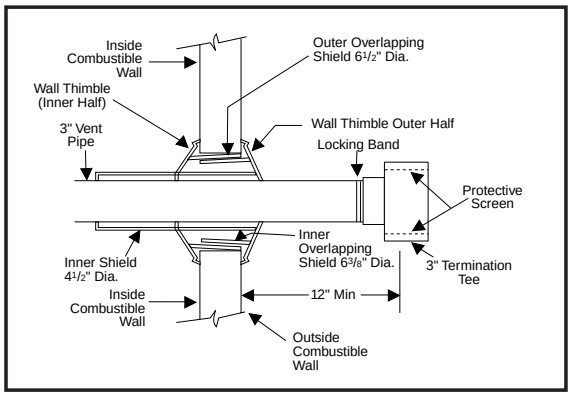


Figure 12. Typical Termination

⚠ WARNING:

The solid base of the furnace must be in place when the furnace is installed with side return air ducts. Removal of all or part of the base could cause products of combustion to be circulated into the living space and create potentially hazardous conditions, including carbon monoxide poisoning that could result in personal injury or death.

For upflow/horizontal installations: The return air ductwork may be connected to any or all of the following: left side return, right side return, or bottom return. NOTE: Do not use the back of the furnace for return air. Table 2a and 2b, in the front pages of these instructions, contains the airflow data for each furnace model. Where maximum airflow is 1800 CFM or more, two openings must be used for return air.

⚠ WARNING:

Products of combustion must not be allowed to enter the return air ductwork or the circulating air supply. Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

All return ductwork must be secured to the furnace with sheet metal screws. For installations in confined spaces, all return ductwork must be adequately sealed and joints must be taped. When return air is provided through the bottom of the furnace, the joint between the furnace and the return air plenum must be air tight.

The floor or platform on which the furnace is mounted must provide sound physical support of the furnace with no gaps, cracks, or sagging between the furnace and the floor or platform.

Return air and circulating air ductwork must not be connected to any other heat producing device such as a fireplace insert, stove, etc. Doing so may result in fire, explosion, carbon monoxide poisoning, personal injury, or property damage.

GAS SUPPLY AND PIPING

General

This furnace may be installed for either left or right side gas entry. A typical gas service hookup is shown in Figure 13. When making the gas connection provide clearance between the gas supply line and the entry hole in the furnace casing to avoid unwanted noise and/or damage to the furnace.

All gas piping must be installed in compliance with local codes and utility regulations. Some local regulations require the installation of a manual main shut-off valve and ground joint union external to the furnace. The shut-off valve should be readily accessible for service and/or emergency use. Consult the local utility or gas supplier for additional requirements regarding placement of the manual main gas shut-off. In the absence of local codes the gas line installation must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1) or (CAN/CGA B149.1 or .2) Installation Codes.

If desirable an 1/8 inch NPT tap must be installed in the gas line to the unit for use when measuring the gas supply pressure. The tap should be readily accessible for service use. A drip leg should be installed in the vertical pipe run to the unit. Table 5 lists gas flow capacities for standard pipe sizes as a function of length in typical applications based on nominal pressure drop in the line.

IMPORTANT NOTES:

1. Gas piping must not be run in or through air ducts, chimneys, gas vents, elevator shafts, etc.
2. Compounds used on threaded joints of gas piping must be resistant to the actions of liquefied petroleum gases.
3. The main manual gas valve and main power disconnect to the furnace must be properly labeled by the installer in case emergency shutdown is required.

Leak Check

After the gas piping to the furnace is complete, all connections must be tested for gas leaks. To check for leaks in gas piping systems, use only a soap and water solution or other approved method.

⚠ CAUTION:

Do not use matches, lighters, candles, or other sources of open flame to check for gas leaks.

IMPORTANT NOTE:
When pressure testing the gas supply lines at pressures greater than 1/2 psig (14 inch W.C.), the furnace must be disconnected from the gas supply piping system to prevent damage to the gas control valve. If the test pressure is less than or equal to 1/2 psig (14 inch W.C.), the furnace must be isolated from the gas supply line by closing the manual shut-off valve.

⚠ WARNING:

FIRE OR EXPLOSION HAZARD
Failure to follow the safety warnings exactly could result in serious injury, death or property damage.

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

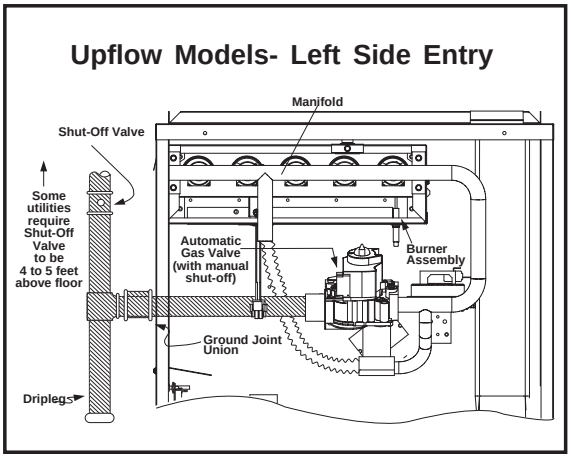


Figure 13. Typical Gas Service Connection

Conversion

Conversion of this furnace to use LP/propane gas must be made by qualified service personnel, using only approved parts.

IMPORTANT NOTE: When converting a low NOx furnace from Natural to LP/Propane Gas, it is necessary to remove the NOx baffles from the furnace.

⚠ WARNING:

This furnace was equipped at the factory for use with natural gas only. A special kit, supplied by the manufacturer, is required to convert the furnace to operate on LP/propane gas. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

CAPACITY OF BLACK IRON GAS PIPE (CU. FT. PER HOUR) FOR NATURAL GAS (SPECIFIC GRAVITY - 0.60)								
NOMINAL BLACK IRON PIPE DIAMETER (in.)	LENGTH OF PIPE RUN (feet)							
	10	20	30	40	50	60	70	80
1/2	130	90	75	65	55	50	45	40
3/4	280	190	150	130	115	105	95	90
1	520	350	285	245	215	195	180	170
1 1/4	1050	730	590	500	440	400	370	350
1 1/2	1600	1100	890	760	670	610	560	530

The cubic feet per hour listed in the table above must be greater than the cubic feet per hour of gas flow required by the furnace.

To determine the cubic feet per hour of gas flow required by the furnace, divide the input rate of the furnace by the heating value of the gas:

$$\text{Cubic Feet Per Hour Required} = \frac{\text{Input To Furnace (Btu/hr)}}{\text{Heating Value of Gas (Btu/Cu. Ft.)}}$$

Table 5. Capacity of Black Iron Gas Pipe (cu. ft. per hour) for Natural Gas (specific gravity = .60)

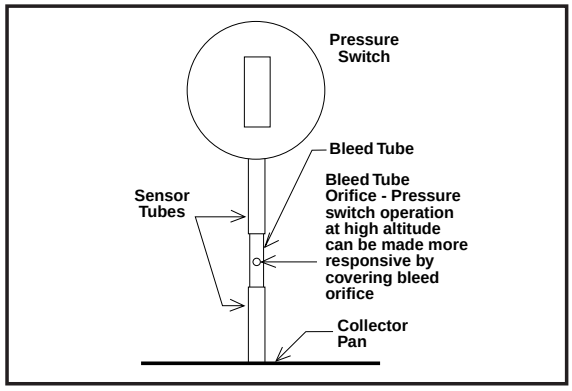


Figure 14. *TA Bleed Tube

High Altitude Application

High altitude application with this furnace can be field performed by a simple adjustment of manifold pressure, and if necessary changing the orifices. The changes required depend on the installation altitude and the heating value of the gas. The gas heating value based on sea level can be obtained from your local gas utility. The heating value of gas at high altitude is always lower than the sea level heating value. The heating values used in Tables 6 & 7 are based on sea level values.

Natural Gas High Altitude Conversion

All factory shipped furnaces are ready to operate between zero and 4999 ft. above sea level. For higher altitudes (between 5000 and 10,000 ft. above sea level), conversion can be achieved simply by adjusting the furnace manifold pressure as shown in Table 6.

LP/Propane Gas Sea Level and High Altitude Conversion

Conversion of this furnace to utilize LP/propane gas must be made by qualified service personnel, using factory authorized or approved parts. Conversion to LP/propane gas can be accomplished by first replacing the natural gas orifices with the appropriate LP/propane orifices shown in Table 8 or 9. Note: for installations between zero and 5000 ft. above sea level, a #54 or #55 drill size orifice should be used depending upon the rated firing rate of the unit (see Table 8 or 9). However for installations above 5000 ft. above sea level, a # 55 or #56 drill size orifice should be used. After changing the orifices, use Table 7 to determine the appropriate manifold pressure for your installation.

Conversion to LP/propane, sea level, and high altitude is detailed in the installation instructions provided with the conversion kit. Approved conversion kits are listed below.

United States LP/Propane Gas Sea Level and High Altitude Conversion Kit - P/N 903848.
This kit is for LP/propane conversion in the United States at altitudes between zero and 10,000 ft. above sea level. Follow the installation instructions supplied with the kit for proper installation.

Canadian LP/Propane Gas Sea Level and High Altitude Conversion Kit - P/N 903617

This kit is for LP/propane conversions in Canada at altitudes between zero and 4500 ft. above sea level. Follow the installation instructions supplied with the kit for proper installation.

⚠ WARNING:

To avoid electric shock, personal injury, or death, turn off the electric power at the disconnect or the main service panel before making any electrical connections.

Pressure Switch Adjustment for High Elevation Furnace Operation

Because air and combustion product density decreases with the barometric pressure at high elevations, the pressure signals from the combustion system also fall. The pressure switch in the *TA furnace can be "adjusted" to accommodate this effect. As shown in Figure 14, the furnace is shipped with a bleed orifice device in the tube to the pressure switch. Pressure switch operation can be made more responsive by covering the bleed hole. This can be done by sliding the tubing over the hole.

For a Natural Gas Sea Level Heating Value of 800 to 899 Btu/cu.ft.					
	Elevation (feet above sea level)				
	zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	3.5	3.5	3.5	3.5	3.0

For a Natural Gas Sea Level Heating Value of 900 to 999 Btu/cu.ft.					
	Elevation (feet above sea level)				
	zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	3.5	3.5	3.5	3.2	2.8

For a Natural Gas Sea Level Heating Value of 1,000 to 1,100 Btu/cu.ft.					
	Elevation (feet above sea level)				
	zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	3.5	3.5	3.0	2.8	2.5

Table 6. Manifold Pressure (in WC) for Natural Gas at Various Altitudes

	Elevation (feet above sea level)				
	0 to 1,999	2,000 to 4,999	5,000 to 5,999	6,000 to 7,999	8,000 to 10,000
Manifold Pressure in (WC) for an LP Gas Heating Value of 2,500 Btu/hr.	10.0	8.5	10.0	9.0	8.5

Table 7. Manifold Pressure (in WC) for LP/Propane Gas at Various Altitudes

Furnace Rating Plate Input (Btu/h)	Orifice Drill Size	
	Nat	LP
72000	43	54
100000	44	55
120000	43	54

Table 8. Natural and LP Gas Orifice Sizes for Elevations between zero and 4999 ft. Above Sea Level

Furnace Rating Plate Input (Btu/h)	Orifice Drill Size	
	Nat	LP
72000	43	55
100000	44	56
120000	43	55

Table 9. Natural and LP gas Orifice Sizes for Elevations between 5000 and 10,000 ft. Above Sea Level

Pressure switch operation can be made more responsive by covering the bleed hole. This can be done by sliding the tubing over the hole.

ELECTRICAL WIRING

Electrical connections must be made in accordance with all applicable local codes and ordinances, and with the current revision of the National Electric Code (ANSI/NFPA 70).

For Canadian installations electrical connections and grounding must be done in accordance with the current Canadian Electrical Code (CSA C22.1 Part 1) and/or local codes. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wire having a minimum temperature rating of 105°C. Refer to the furnace nameplate and Table 10 for electrical requirements.

Line Voltage Wiring

The line voltage (115 volt) to the furnace must be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the furnace. See Table 10. An electrical switch should be readily accessible from and within sight of the furnace. (See the Wiring Diagram label in the furnace and Figure 15.)

The furnace cabinet must have an uninterrupted, unbroken ground to minimize injury should an electrical fault condition occur. The controls used in this furnace require an earth ground to operate properly. Acceptable methods for grounding are electrical wire or conduit approved for electrical ground service. Do not use gas piping as an electrical ground.

NOTE: Proper line voltage polarity must be maintained in order for the control system to operate correctly. Verify that the incoming neutral line is connected to the white wire and the incoming "hot" line is connected to the black wire in the junction box. These furnaces will not operate unless polarity and ground are properly connected. See Figure 15.

⚠ CAUTION:

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

NOTE: The following procedure describes how to connect the furnace for a two-stage application.

Low Voltage Wiring

Staging Configurations

These furnaces are factory configured to operate on high fire only, but can be field converted to operate as two-stage furnaces.

NOTE: To achieve full rated capacity and efficiency, the furnace should be operated in the factory configuration (high fire only as described in part 2.)

1. *Two stage thermostat configuration* – For this installation a two stage heating thermostat is used. **CAUTION:** Disconnect yellow wire with black stripe from primary gas valve. Remove female connector from yellow/black wire and strip insulation from end. Connect stripped yellow wire with black stripe to (W2) from the thermostat. (See Figure 16a). The first stage bulb (W1) is connected to W on the furnace control board. On a call for first stage heat, the furnace will operate at low fire and the blower will run at a lower speed. On a call for second stage heat, the furnace will operate at high fire and the blower will run at a higher speed. The furnace will stage between low fire, high fire, and off depending on the thermostat signal.
2. *High fire only configuration* – As shipped from the factory, the primary and secondary gas valves are connected in parallel (See Figure 16b). This defeats the staging feature and the furnace operates on high fire only. All of the burners will operate on a call for heat and the variable speed blower will operate at a higher speed.
3. *Low fire only configuration* – For this installation, the secondary gas valve is disconnected (See Figure 16c). This defeats the staging feature and the furnace operates on low fire only. All but two of the burners will operate on a call for heat and the variable speed blower will operate at a lower speed.

4. *Outdoor ambient dependent configuration* – For this installation, the primary and secondary gas valves are connected in parallel with an outdoor thermostat (open on rise style) in series with the secondary gas valve (See Figure 16d). **CAUTION:** DO NOT CONNECT W2 from thermostat to the furnace wiring when using the outdoor ambient dependent configuration. When the outdoor temperature is above the set point, the outdoor thermostat opens keeping the secondary gas valve closed. The furnace operates in the low fire mode at a lower blower speed. When the outdoor thermostat closes, the secondary gas valve opens with the primary gas valve and the furnace operates in the high fire mode at higher blower speed.
5. *Timed staging configuration* – For this installation, the primary and secondary gas valves are connected in parallel with a delay on make timer (two wire style) in series with the secondary gas valve (See Figure 16e). **CAUTION:** DO NOT CONNECT W2 from thermostat to the furnace wiring when using timed staged configuration. When the primary gas valve is energized, the furnace operates in the low fire mode at a lower blower speed and the timer begins its delay function. If the room thermostat is not satisfied before the timer activates, the furnace will stage to high fire and the blower will operate at a higher speed until the room thermostat is satisfied.

Install the thermostat per the manufacturer's instructions. The low voltage (24 volt) connections from the thermostat are made at the terminal strip on the control board in the furnace. See Figures 16a-16e for the proper

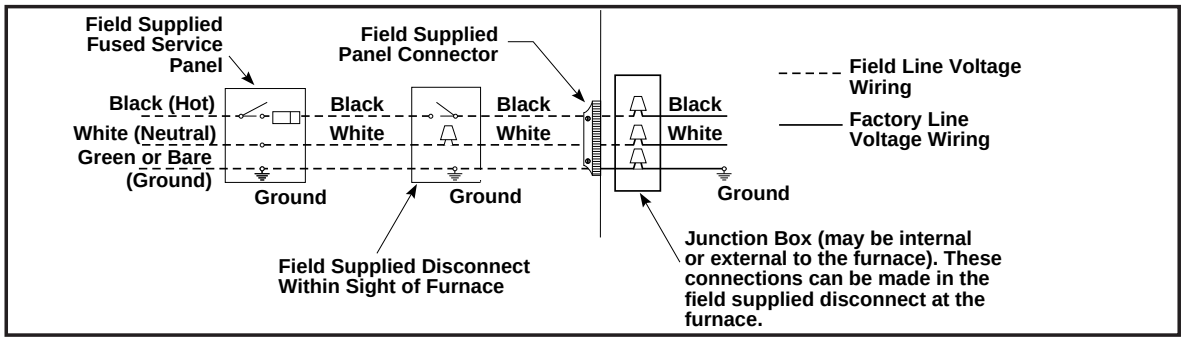


Figure 15. Line Voltage Field Wiring

Low Voltage Field, Five-wire Heating/Cooling Applications

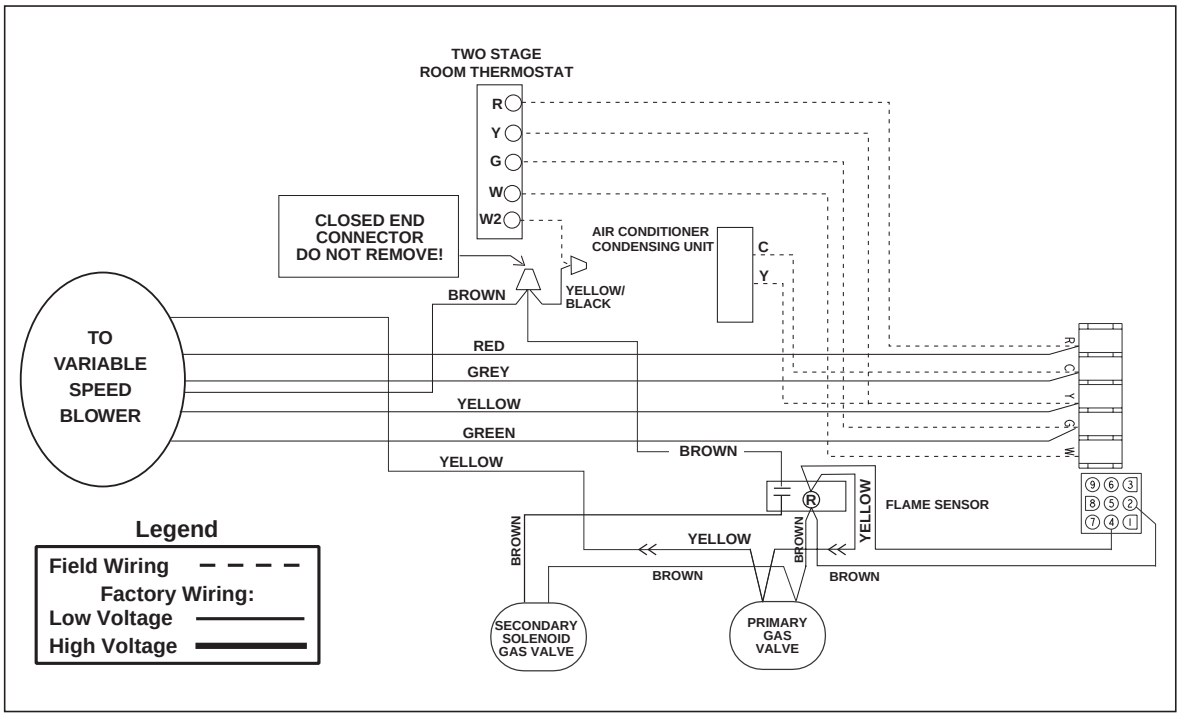


Figure 16a. Two Stage Configuration

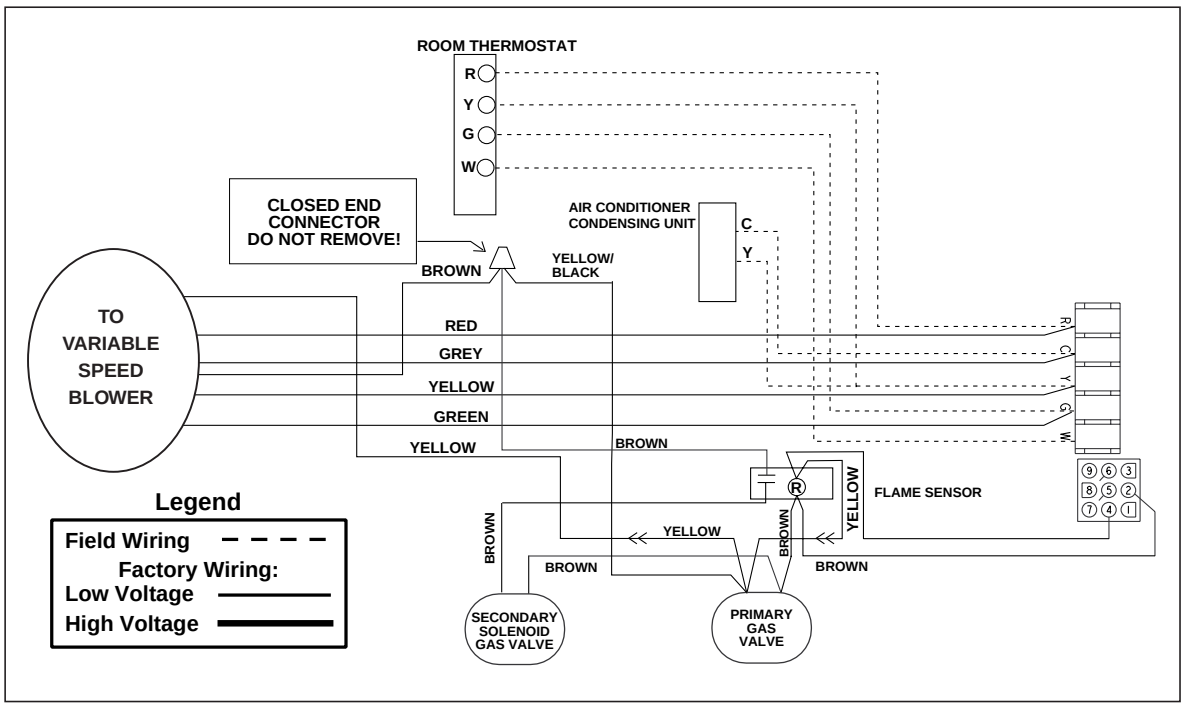


Figure 16b. High Fire Only Configuration

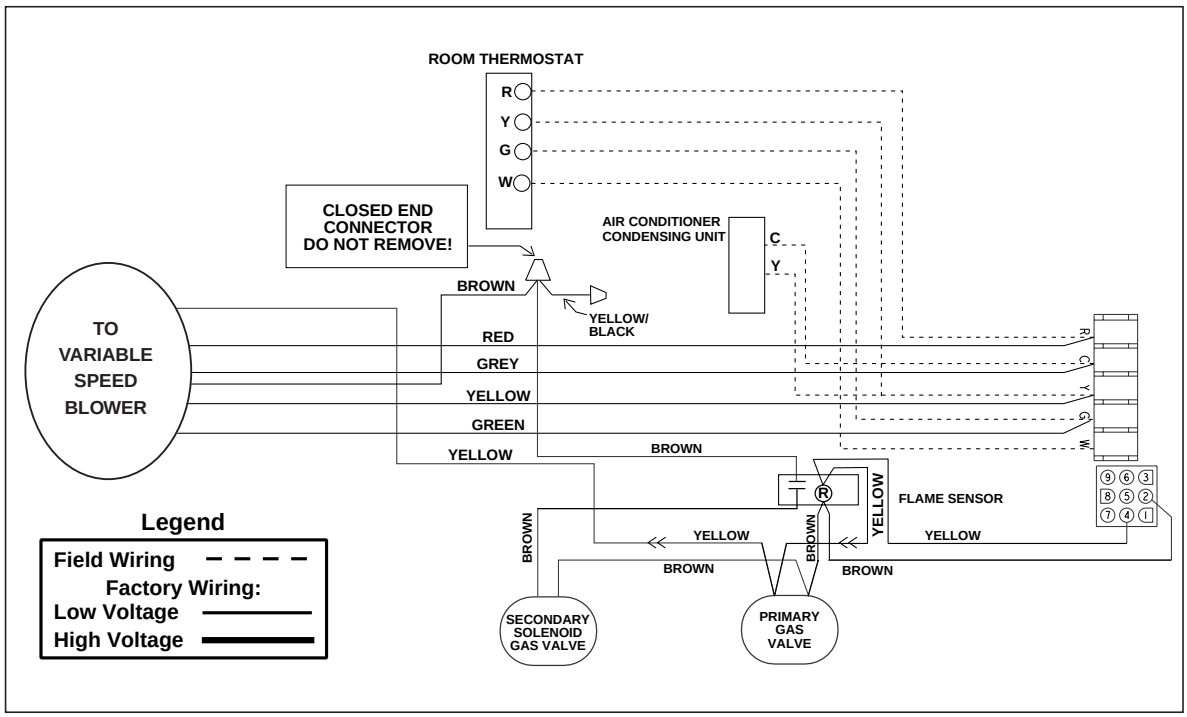


Figure 16c. Low Fire Only Configuration

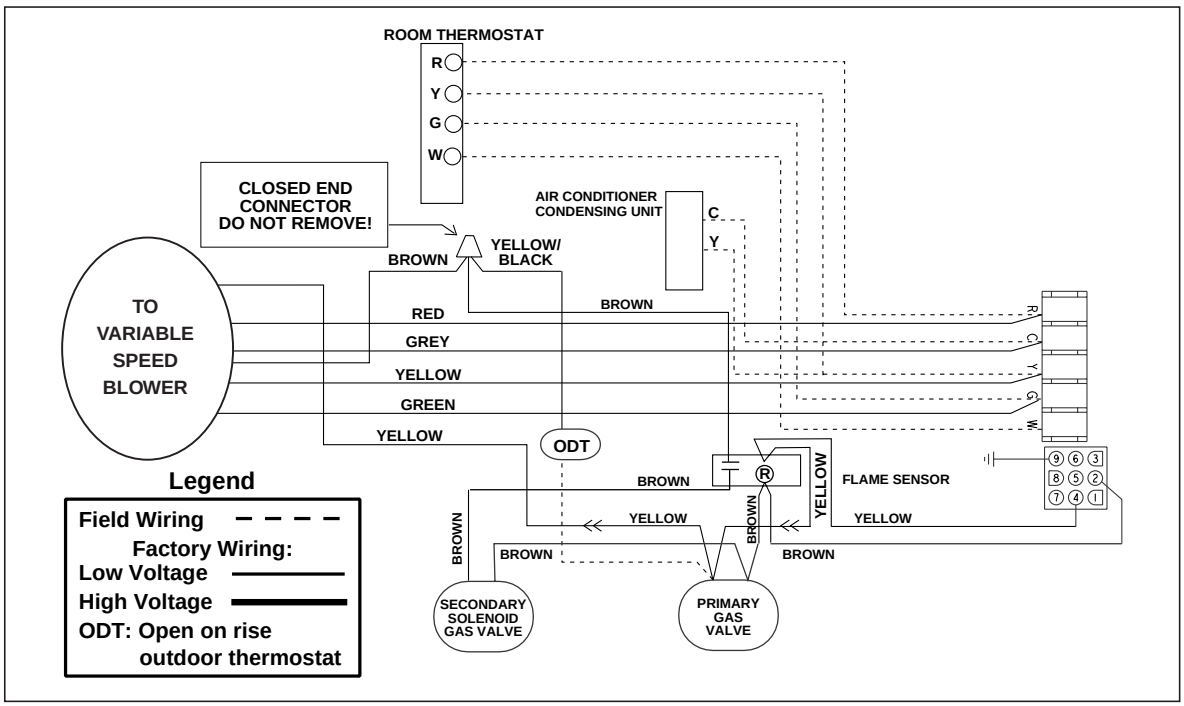


Figure 16d. Outdoor Ambient Dependent

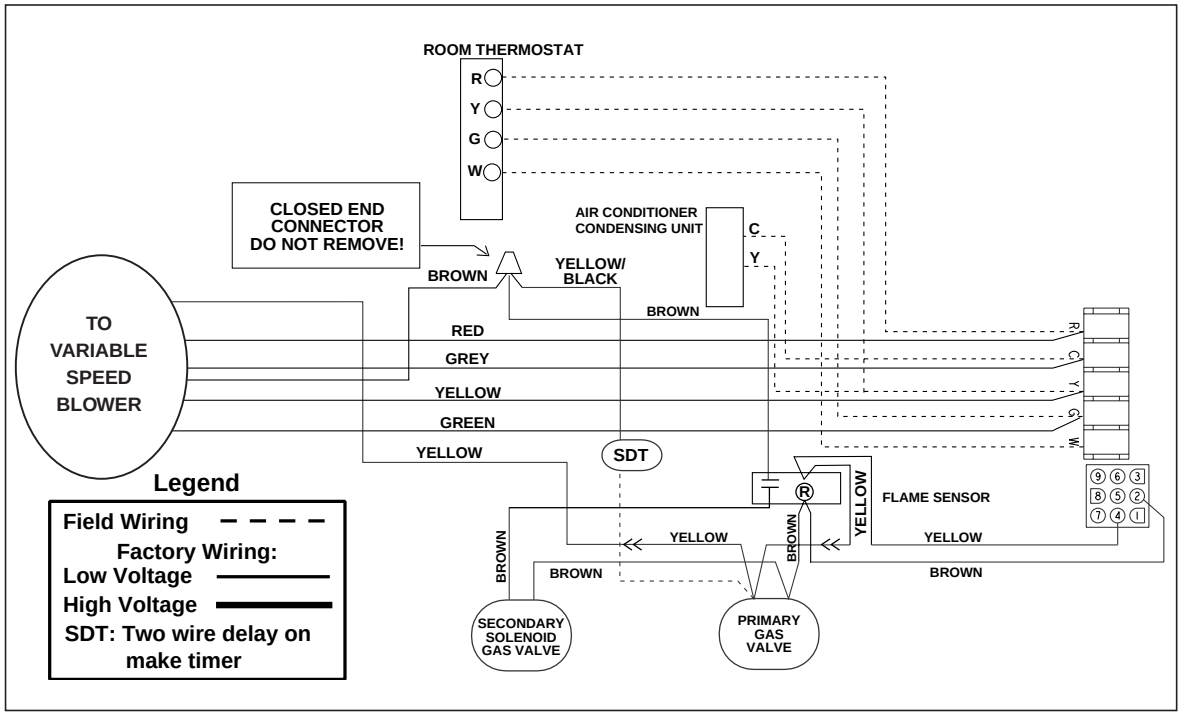


Figure 16e. Timed Two Stage Configuration

connections for heating only (four wire) and heating/cooling (five wire) applications. The recommended minimum wire gauge for thermostat wiring is shown in Table 10.

The thermostat must not be installed on an outside wall or any other location where its operation may be adversely affected. Adverse affects include radiant loading from fireplaces, sunlight, or lighting fixtures, and convective loading from warm air registers or electrical appliances.

To check the heat anticipator setting either:

1. Add the current draw of the system components; or
2. Measure the current flow on the thermostat R-W circuit after the circulating blower motor has started.

Set the heat anticipator according to the thermostat manufacturer's instructions for heat anticipator settings.

START-UP AND ADJUSTMENTS

Prior to start-up, verify that:

1. The line voltage power leads are securely connected, that the polarity of the connections is correct, and that the furnace is properly grounded.
2. The thermostat wires (R, W, Y, and G) are securely connected to the correct leads on the terminal strip of the circuit board.
3. The gas line service pressure does not exceed 10.0 in. water column (0.36 psig), and is not less than 4.5 in. water column (0.16 psig) for natural gas. For LP gas the line service pressure must not exceed 14 in. water column (0.51 psig), and must not be less than 11.0 in. W.C. (0.40 psig).
4. The roll-out and vent safety manual reset switches are closed. If necessary, press the red button to reset a switch. See Figure 28 for location. DO NOT install a jumper wire across a switch to defeat its function. If a switch reopens on start-up, DO NOT reset the switch without identifying and correcting the fault condition which caused the switch to trip.
5. The blower door is in place, closing the door switch in the line voltage circuit.
6. The gas line has been purged and all connections are leak tight.

Start-up Procedures

After all of the above checks have been made:

1. Set the thermostat to the lowest setting.
2. Close the disconnect(s) to provide line voltage to the furnace.
3. Follow the procedures given on the operating instruction label attached to the furnace.
4. Set the thermostat above room temperature and verify the operating sequence. (See the **Sequence of Operation)**.
5. After the furnace has run for approximately five minutes, set the thermostat below room temperature and verify steps (9) through (11) of the **Sequence of Operation.**

Furnace Model Number *TA	Furnace Input (Btuh)	Cabinet Width (in.)	Nominal Electrical Supply	Maximum Operating Voltage	Minimum Operating Voltage	Maximum Furnace Amperes	Minimum Wire Gauge	Maximum Fuse or Circuit Breaker Amps*
072C-VB	72,000	14.25	115-60-1	127	103	15.94	14	20
100C-VB	100,000	19.75	115-60-1	127	103	15.94	14	20
120C-VB	120,000	19.75	115-60-1	127	103	15.94	14	20
120C-VC	120,000	22.50	115-60-1	127	103	15.94	14	20

*** Time-delay fuses or HACR-type circuit breakers are required.**

Thermostat Wire Gauge	Recommended Maximum Thermostat Wire Length	
	2-wire (heating)	4 or 5-wire (cooling)
24	55 ft.	25 ft.
22	90 ft.	45 ft.
20	140 ft.	70 ft.
18	225 ft.	110 ft.

Table 10. Electrical Data

Verifying and Adjusting Firing Rate

The firing rate must be verified for each installation to prevent over-firing the furnace.

IMPORTANT NOTE:
The firing rate must not exceed the rate shown on the furnace rating plate. At altitudes above 2000 feet it must not exceed that on the rating plate less 4% for each 1000 feet.

Follow the procedure below to determine the firing rate.

1. Shut off all other gas fired appliances.
2. Start the furnace and allow it to run for at least three minutes.
3. Measure the time (in seconds) required for the gas meter to complete one revolution.
4. Convert the time per revolution to cubic feet of gas per hour using Table 11.
5. Multiply the gas flow rate in cubic feet per hour by the heating value of the gas in Btu per cubic foot to obtain the firing rate in Btu per hour. Example:

    - Time for 1 revolution of a gas meter with a 1 cubic foot dial = 40 seconds.
    - From Table 11 read 90 cubic feet per hour of gas.
    - Heating value of the gas (obtained from gas supplier) = 1040 Btu per cubic foot.
    - Firing rate = 1040 x 90 = 93,600 Btuh.

6. Adjustments to the firing rate can be made by adjusting the gas manifold pressure. See the High Altitude Application section for additional information of firing rate at elevations above 2000 ft.

The manifold pressure must be set to the appropriate value for your installation. Refer to either Table 6 for natural gas or Table 7 for LP/propane gas to verify the manifold pressure setting required for your particular installation. To adjust the manifold pressure, remove the regulator cap and turn the adjusting screw clockwise to increase pressure or counterclockwise to reduce pressure. Replace the regulator cap after adjustments are complete.

⚠ CAUTION:

Do not re-drill the burner orifices. If the orifice size must be changed, use only new orifices.

⚠ WARNING:

To avoid electric shock, personal injury, or death, disconnect the electric power before performing any maintenance.

Configuring the Blower

The variable speed blower kit is equipped with a microprocessor-controlled variable speed motor that is pre-programmed to deliver optimum airflow in a variety of conditions and system configurations. Before operation, the variable speed blower kit must be configured to match the unit with the system, system options, and climatic conditions. With the variable speed blower kit installed and configured properly, the furnace will respond directly to gradually change speed in response to changes in system variables such as the thermostat settings, duct static, filter, etc. The variable speed blower kit is configured by setting the 7 switches located on the motor control board as described below.

Verifying and Adjusting Temperature Rise

Verify the temperature rise through the furnace is within the range specified on the furnace rating plate. Temperature rises outside the specified range could result in premature heat exchanger failure.

Place thermometers in the return and supply air stream as close to the furnace as possible. The thermometer on the supply air side must be shielded from direct radiation from the heat exchanger to avoid false readings. Adjust all registers and duct dampers to the desired position and run the furnace for ten to fifteen minutes before taking any temperature readings. The temperature rise is the difference between the supply and return air temperatures.

⚠ IMPORTANT:

The variable speed blower has been designed to give the installer maximum flexibility to optimize system performance, efficiency, and comfort. Because there are so many ways to configure, it is important to read and follow these instructions carefully.

Selecting Heat Airflow

The heating airflow is selected by setting switches 5, 6 , and 7, refer to Table 2b and select a nominal rise based on the furnace nominal efficiency and input. Follow the table column up to find the switch setting and nominal air-flow. Be sure that the selected rise is within the specification of the furnace as shown on the furnace rating label.

Selecting The Cooling/Heat Pump Airflow

In order to select the appropriate airflow for AC and HP operation the nominal system capacity must be known. The nominal system capacity is ALWAYS the nominal capacity of the outdoor unit. In some cases the nominal system capacity is not the same as the nominal capacity of the indoor coil.

The cooling/heat pump airflow is selected by setting switches 1 through 4 on the motor control board located in the blower control panel. All airflows for other modes of operation (except gas heat) are determined by this setting. Table 2a shows the airflow values versus the airflow selector switch settings, and the range of airflow settings recommended for each nominal system capacity.

NOTE: The CFM values listed on Table 2b are not dependent on duct static pressure. The motor automatically compensates for changes in duct static pressure (within the limits of the motor).

For maximum capacity and energy efficiency, generally, a selection at or near the top of the CFM range for that nominal capacity is best. For maximum dehumidification, select an airflow near the middle or bottom of the CFM range for that nominal capacity.

NOTE: If coil icing is observed, the cooling/heat pump airflow selected may be too low. Double-check to be sure the setting selected is within the range shown in Table 2a. Also check to be sure the system is properly charged (see outdoor unit installation instructions). If icing continues to occur, raise the selected airflow one or two steps.

Verifying Burner Operation

To verify operation of the burners, make sure that the blower compartment door is in place and that there is power to the furnace. Set the thermostat above room temperature and observe the ignition sequence. The flame can be observed through the small clear window on the burner box. The burner flame should carry over between all burners on high fire. Note that when operating on low fire, the left two burners will not operate on upflow models and the right two burners on downflow models. The flames should be blue, without yellow tips. Flames should extend from each burner without lifting, curling, or floating. After verifying ignition, set the thermostat below room temperature and verify that the burner flame extinguishes completely.

Verifying Operation of the Supply Air Limit Switch

To verify operation of the supply air limit switch, make sure that the blower door is in place and that there is power to the furnace. Completely block the return airflow to the furnace by installing a close-off plate in place of or upstream of the filter(s). Set the thermostat above room temperature and verify that the Sequence of Operation is as described in these instructions. The supply air limit switch should function to turn off the gas valve within approximately five minutes. The circulating air and combustion blowers should continue to run when the supply air limit switch opens. Remove the close-off plate immediately after the supply air limit switch opens. If the furnace operates for more than five minutes with no return air, set the thermostat below room temperature, shut off the power to the furnace, and replace the supply air limit switch.

DESCRIPTION OF COMPONENTS

Figure 19 shows the location of each of the functional components described below. If any component of the furnace must be re-

placed, use only factory authorized replacement parts. See the Replacement Parts List for each component.

Flame Sensor – The flame sensor acts to prove that flame has carried over from the igniter to the opposite end burner. If no flame is sensed, the furnace will be shut down automatically.

Primary Gas Valve – The gas valve controls the flow of gas to all of the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Secondary Gas Valve – The gas valve controls the flow of gas to the high fire burners only.

Pressure Switch – The pressure switch verifies that the inducer is drawing the combustion gases through the heat exchanger. The pressure switch reacts to blockage in the vent or combustion air piping.

Supply Air Limit Switch – The supply air limit switch prevents the air temperature leaving the furnace from exceeding the maximum outlet air temperature.

Flame Roll-Out Switch – The flame roll-out switch verifies that the burner flames are drawn into the heat exchanger tubes. If the burner flames are not properly drawn into the heat exchanger, the flame roll-out switch will open. The combustion blower will continue to operate and the circulation air blower shuts off in two minutes if the flame roll-out switch opens.

MAINTENANCE

It is recommended that the furnace be checked yearly. At a minimum, this check should include the following items.

⚠ WARNING:

To avoid electric shock, personal injury, or death, disconnect the electric power before performing any maintenance.

⚠ WARNING:

Holes in the vent pipe or heat exchanger can cause products of combustion to enter the home. Replace the vent pipe or heat exchanger if leaks are found. Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

Combustion Air and Vent System

Check the combustion air and vent pipe to ensure that it is not damaged, corroded or blocked by debris. Any damaged section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

Air Filter(s)

⚠ WARNING:

Never operate the furnace without a filter in place. Dust and lint in the return air can build up on internal components, resulting in loss of efficiency, equipment damage, and possible fire.

Air filter(s) are not supplied with the furnace as shipped from the factory. Filters for side return and bottom return applications are available from your local distributor.

The installer should provide a filter rack for a high velocity type filter in the return air duct adjacent to the furnace. Filters should be changed or cleaned monthly during the heating season. New or newly renovated homes may require more frequent changing until the construction dust has been removed.

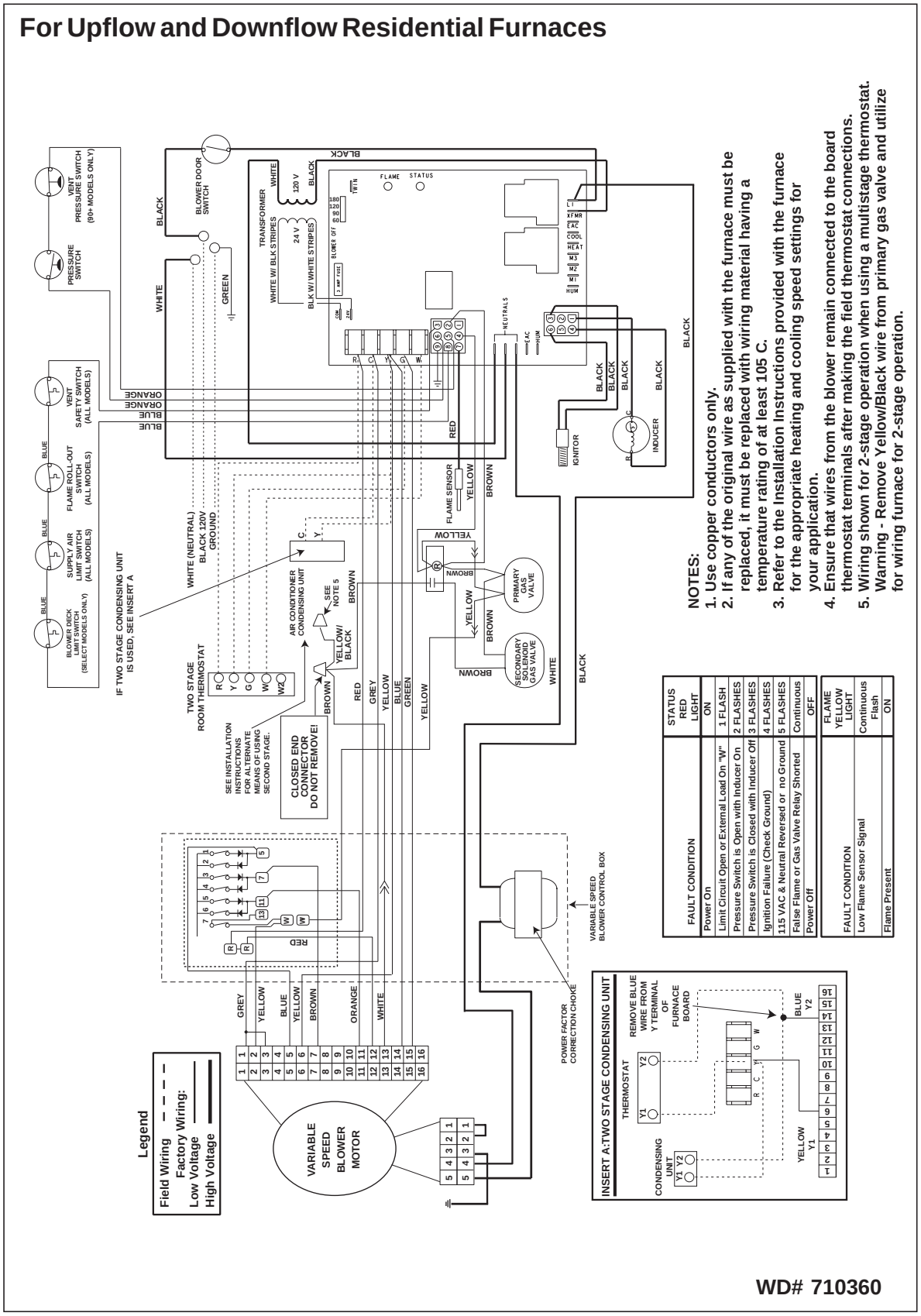


Figure 17. Upflow and Downflow Wiring Diagram

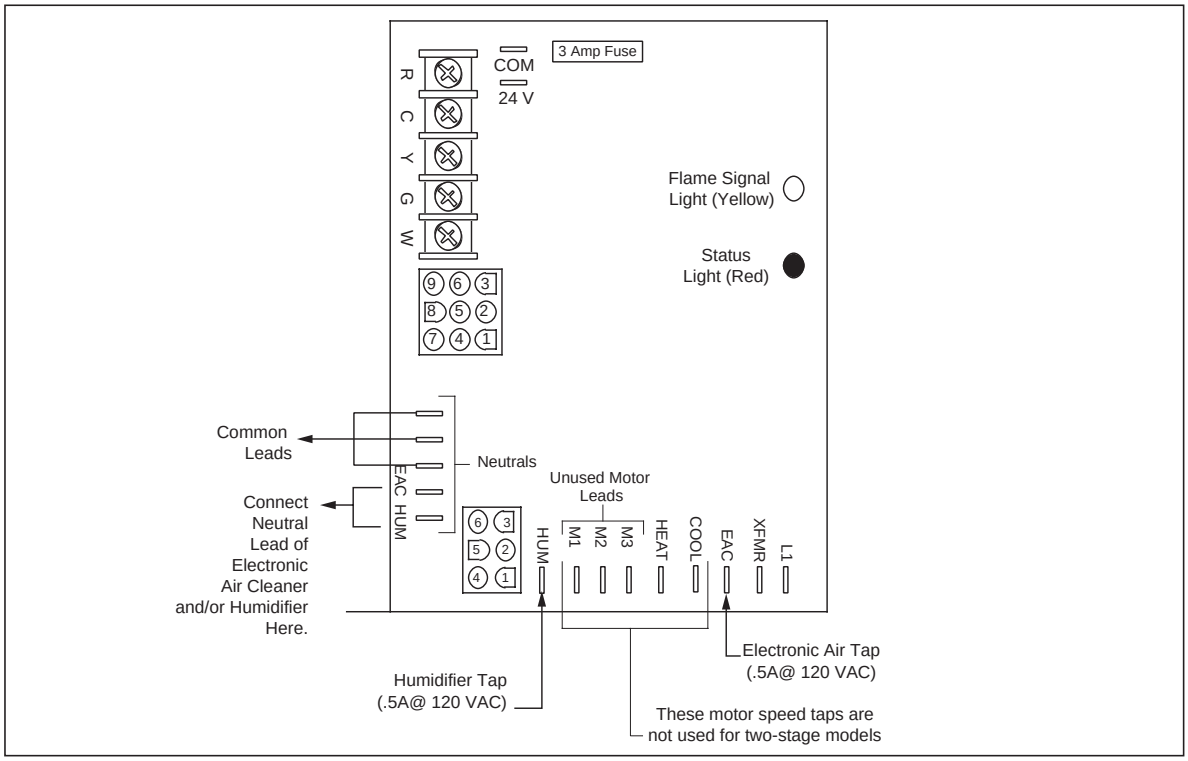


Figure 18. Blower Speed Tap Location

Lubrication

The bearings in the circulating air blower motors are pre-lubricated and sealed at the factory. No further oiling of the bearings is required for the life of the motor.

Blower Compartment

The blower compartment should be cleaned monthly during the heating and cooling seasons to remove any dirt and lint that may have accumulated in the compartment or on the blower and motor. Dirt and lint can create excessive loads on the motor resulting in higher than normal operating temperatures and shortened service life.

Heat Exchanger and Burner Maintenance

The furnace should operate for many years without excessive soot buildup in the flue passageways, however, the flue passageways, the vent system, and the burners should be inspected and cleaned (if required) by a qualified serviceman annually to ensure continued safe operation. Particular attention must be given to identify deterioration from corrosion or other sources.

SYSTEM OPERATION INFORMATION

Proper maintenance is most important to achieve the best performance from a furnace. Follow these instructions for years of safe, trouble free operation.

- **Do not place combustible materials on or against the furnace cabinet or the vent pipe.**
- **Do not store gasoline or any other flammable vapors and liquids in the vicinity of the furnace.**
- **Change or replace the air filters monthly during any period when the circulating blower is operating regularly.**
- **Always replace the doors on the furnace after servicing. Do not operate the furnace without all doors and covers in place.**
- **Avoid operating the furnace when windows and doors are open.**
- **Be sure that the thermostat is properly installed and is not being affected by drafts or heat from lamps or other appliances.**

Sequence of Operation

The operating sequences for the heating, cooling, and fan modes are described below. Refer to the field and furnace wiring diagrams; Figures 15, 16a,b,c,d,e, 17, and 18.

Heating Mode:

1. On a call for heat the thermostat closes, applying 24 VAC to the W terminal on the control board.
2. The control board checks for continuity on the 24 VAC limit control circuit (over-temperature limit switch, flame rollout switches and blocked vent switch in series). If an open limit is detected the control board will energize the inducer blower. All other system functions will be inoperable until the limit circuit closes. While the limit is open, the red LED will pulse at a rate of 1 blink per unit time.
3. The furnace control checks for continuity across the pressure switch (24 VAC). If the pressure switch is closed the heat mode sequence will not continue. If it remains closed for 10 seconds the red LED will blink 3 times repetitively until the fault condition clears.
4. The inducer is energized.
5. The pressure switch will close. If the pressure switch does not close after 10 seconds the fault LED will blink 2 times repetitively and the inducer will continue to run until the switch is closed.
6. The inducer will pre-purge for 30 seconds and then the igniter will start its warm-up as follows: Initial Power up: After 30 seconds of igniter warm-up the gas valves (24 VAC) will then open. The igniter circuit will stay energized for 3 seconds after the gas valve opens.
   After Initial Power up: The control has a programmed adaptive ignition feature which varies the warm-up period as follows: If ignition is successful the warm-up is *reduced* by 3-seconds on each subsequent call for heat until ignition failure occurs. Upon ignition failure, the warm-up is *increased* by 3-seconds on the next try. If successful, the timing remains fixed at this level. In general, whenever ignition failure occurs the warm-up interval is increased by 3-seconds on the next try. And if successful, it remains there. Minimum and maximum warm-up time limits are set at 6 and 54 seconds, respectively.
7. The furnace control must prove flame via the flame sensor 5 seconds after the gas valves open. If flame is sensed, all burners are on and the igniter cools off. If no flame is sensed, the gas valve closes immediately and the inducer continues to run. A second trial for ignition (step 6) begins if no flame is sensed on the fifth try for ignition, the furnace control is locked and the red LED will blink 4 times repetitively. The thermostat must be opened for at least ten seconds to

GAS FLOW RATE (CUBIC FEET PER HOUR)							
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF METER			TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF METER		
	1	5	10		1	5	10
24	150	750	1500	74	49	243	486
26	138	692	1385	76	47	237	474
28	129	643	1286	78	46	231	462
30	120	600	1200	80	45	225	450
32	113	563	1125	82	44	220	439
34	106	529	1059	84	43	214	429
36	100	500	1000	86	42	209	419
38	95	474	947	88	41	205	409
40	90	450	900	90	40	200	400
42	86	429	857	92	39	196	391
44	82	409	818	94	38	191	383
46	78	391	783	96	38	188	375
48	75	375	750	98	37	184	367
50	72	360	720	100	36	180	360
52	69	346	692	102	35	176	353
54	67	333	667	104	35	173	346
56	64	321	643	106	34	170	340
58	62	310	621	108	33	167	333
60	60	300	600	110	33	164	327
62	58	290	581	112	32	161	321
64	56	281	563	114	32	158	316
66	55	273	545	116	31	155	310
68	53	265	529	118	31	153	305
70	51	257	514	120	30	150	300
72	50	250	500				

Table 11. Gas Flow Rate

Upflow/Horizontal Furnace Models

1 Ignitor
2 Flame Sensor
3 Gas Valve
4 Flame Roll-out Switch(s)
5 Pressure Switch
6 Control Board
7 Blower Door Switch
8 Vent Assembly (Upflow Only)
9 Low Voltage Transformer
10 Burner Assembly
11 Supply Air Limit Switch
12 Blower Assembly
13 Induced Draft Blower

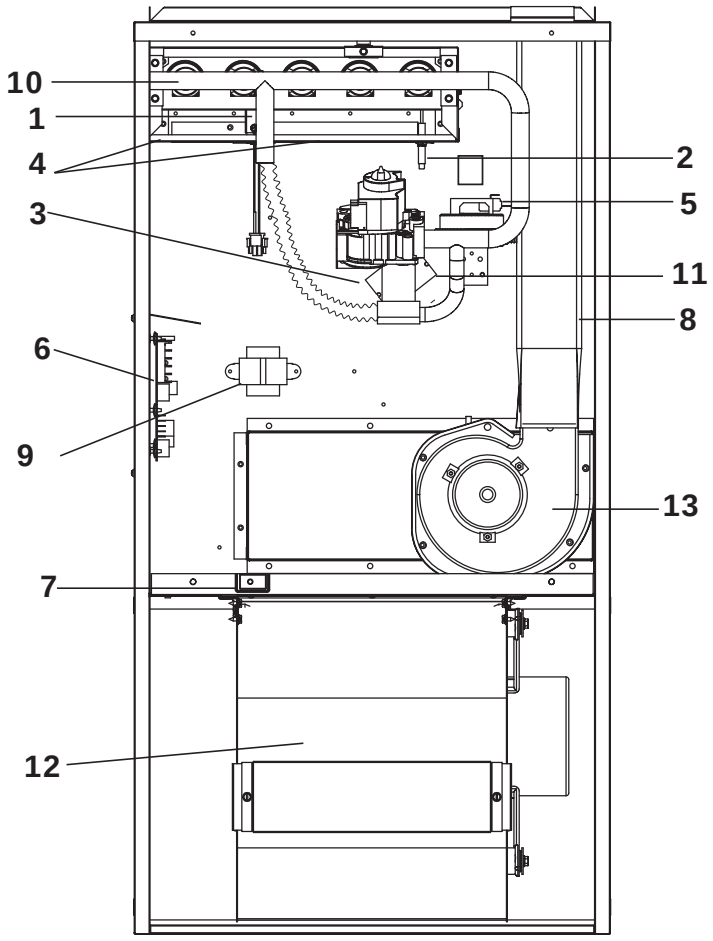


Figure 20. Location of Major Components

reset the furnace control after a lock out. Otherwise, the furnace will attempt another ignition sequence in 1 hour.

8. The furnace control energizes the circulating air blower at a very low speed. After 30 seconds, the blower will ramp to the airflow selected for heating.
9. When the thermostat has been satisfied, gas valve is de-energized.
10. The inducer is de-energized after a 30 second postpurge.
11. The circulating air blower remains on for 120 seconds.
12. Abnormal conditions: If a limit opens during operation, the inducer blower continues to operate. The gas valve is de-energized immediately. The inducer blower continues to operate until the limit closes, then is de-energized.

Cooling Mode:

1. On a call for cooling the thermostat closes, applying 24 VAC to the G and Y terminals on the furnace control. This closes the compressor contactor.
2. The furnace control energizes the circulating blower to 1/3 of the selected airflow for approximately 30 seconds.
3. The circulating blower will then ramp to approximately 3/4 of the selected airflow for another 30 seconds before adjusting to full airflow until the thermostat is satisfied.
4. When the thermostat is satisfied, the G and Y terminals on the control board are de-energized opening the compressor contactor.
5. The circulating air blower will operate at 1/2 of the selected speed for 60 seconds, and de-energize.

Fan Mode:

1. On a call for fan operation, the thermostat applies 24 VAC to the G terminal on the furnace control board.
2. The circulating air blower ramps to 1/2 of the selected airflow.

Furnace Fails to Operate

If the furnace does not operate check the following:

1. Is the thermostat operating properly?
2. Are the blower compartment door(s) in place?
3. Is the furnace disconnect closed?
4. Has the circuit breaker tripped or the control board fuse burned open?
5. Is the gas turned on?
6. Are any manual reset switches open?
7. Is the filter dirty or plugged?
8. Is the flame sensor coated? (Remove and clean with emery cloth.)

If the furnace locks out after 5 attempts for ignition, it will try again every hour if a call for heat remains. If the inducer and circulating air blowers are operating, and items 1 through 8 have been checked, press the red reset button on the vent safety switch. (See Figure 20.) If the furnace operates after depressing the reset button, contact a qualified serviceman to identify and repair the problem.

If the furnace continues to not operate, depress the red reset buttons on the flame rollout switches. (See Figure 20.) If the furnace operates after depressing the reset buttons, contact a qualified servicemen to identify and repair the problem.

INSTALLATION/PERFORMANCE CHECK LIST

LOCATION _____ CITY _____ STATE _____

INSTALLER _____ CITY _____ STATE _____

UNIT MODEL # _____ UNIT SERIAL # _____

Minimum Clearances per Table 3? _____

Electrical Connections tight? _____

Line Voltage Polarity correct? _____

Supply Voltage: _____ Volts

Blower Motor HP: _____

FUEL TYPE:

Natural Gas _____ LP/Propane _____

Gas Piping Connections leak-tested? _____

Gas Line Pressure: _____
(in. water column, with furnace operating)

Manifold Pressure: _____
(in. water column, with furnace operating)

Is there adequate fresh air supply for combustion and ventilation? _____

Furnace Input: _____ (Btuh)

Supply Air Temperature: _____ (° F)

Return Air Temperature: _____ (° F)

Temperature Rise: _____ (° F)

Are Flue Connections tight? _____

Is there Proper Draft? _____

Is Vent free from restrictions? _____

Is the Filter(s) secured in place? _____

Is the Filter(s) clean? _____

Has the Thermostat been calibrated? _____

Is the Thermostat level? _____

Is the Heat Anticipator Setting correct? ____

Has the Owner's Information been reviewed with the home-owner? _____

Has the Literature Package been left near the furnace? _____

O'Fallon, MO NORDYNE

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