



GE APPLIANCES
a Haier company



INSTALLATION INSTRUCTIONS

NF97XV

Warm Air Gas Furnace

Upflow / Horizontal Left and Right Air Discharge

This manual must be left with the homeowner for future reference.



This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

CAUTION

As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

NOTICE

A thermostat is not included and must be ordered separately.
In all cases, setup is critical to ensure proper system operation.
Field wiring is illustrated in diagrams, which begin on Page 37.

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GE Appliances
A Haier Company
Appliance Park
Louisville, KY 40225



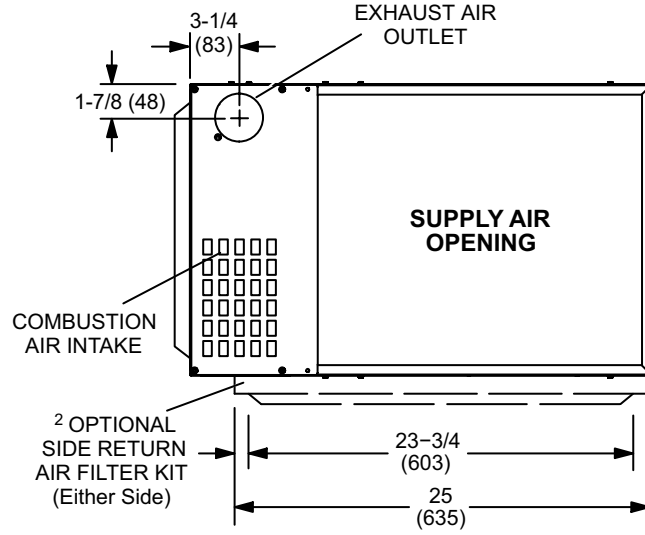
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Unit Dimensions

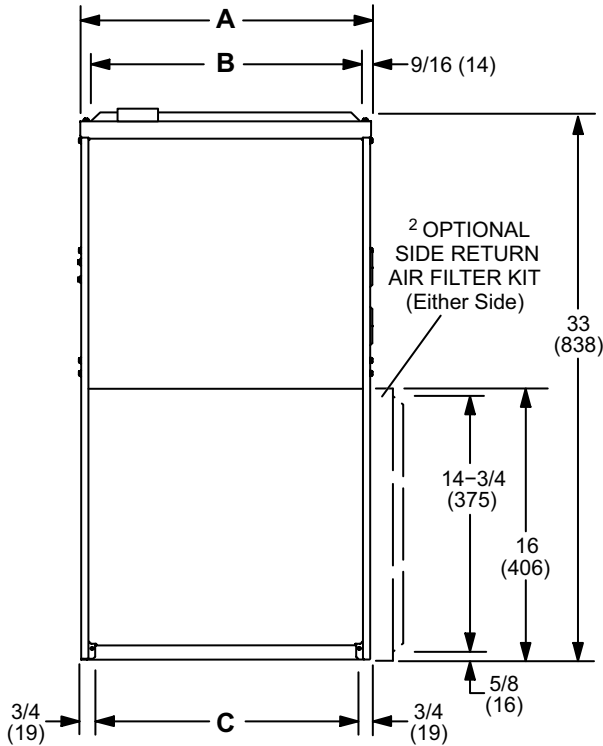
¹ **NOTE** - 5C size units that require second stage air volumes over 1800 cfm must have one of the following:

1. Single side return air with transition, to accommodate 20 x 25 x 1 in. (508 x 635 x 25 mm) air filter.
2. Single side return air with optional RAB Return Air Base
3. Bottom return air.
4. Return air from both sides.
5. Bottom and one side return air.

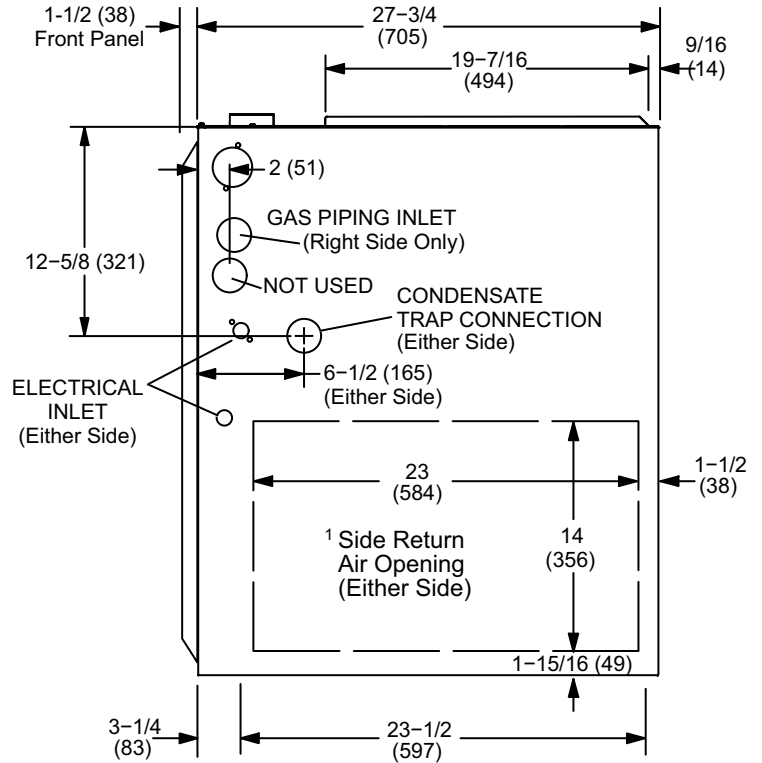
² Optional External Side Return Air Filter kit is not for use with optional Return Air Base.



TOP VIEW



FRONT VIEW



SIDE VIEW

Model	A		B		C	
	in.	mm	in.	mm	in.	mm
040*3B 060*3B	17-1/2	446	16-3/8	416	16	406
080*4C 080*5C	21	553	19-7/8	505	19-1/2	495

Parts Arrangement

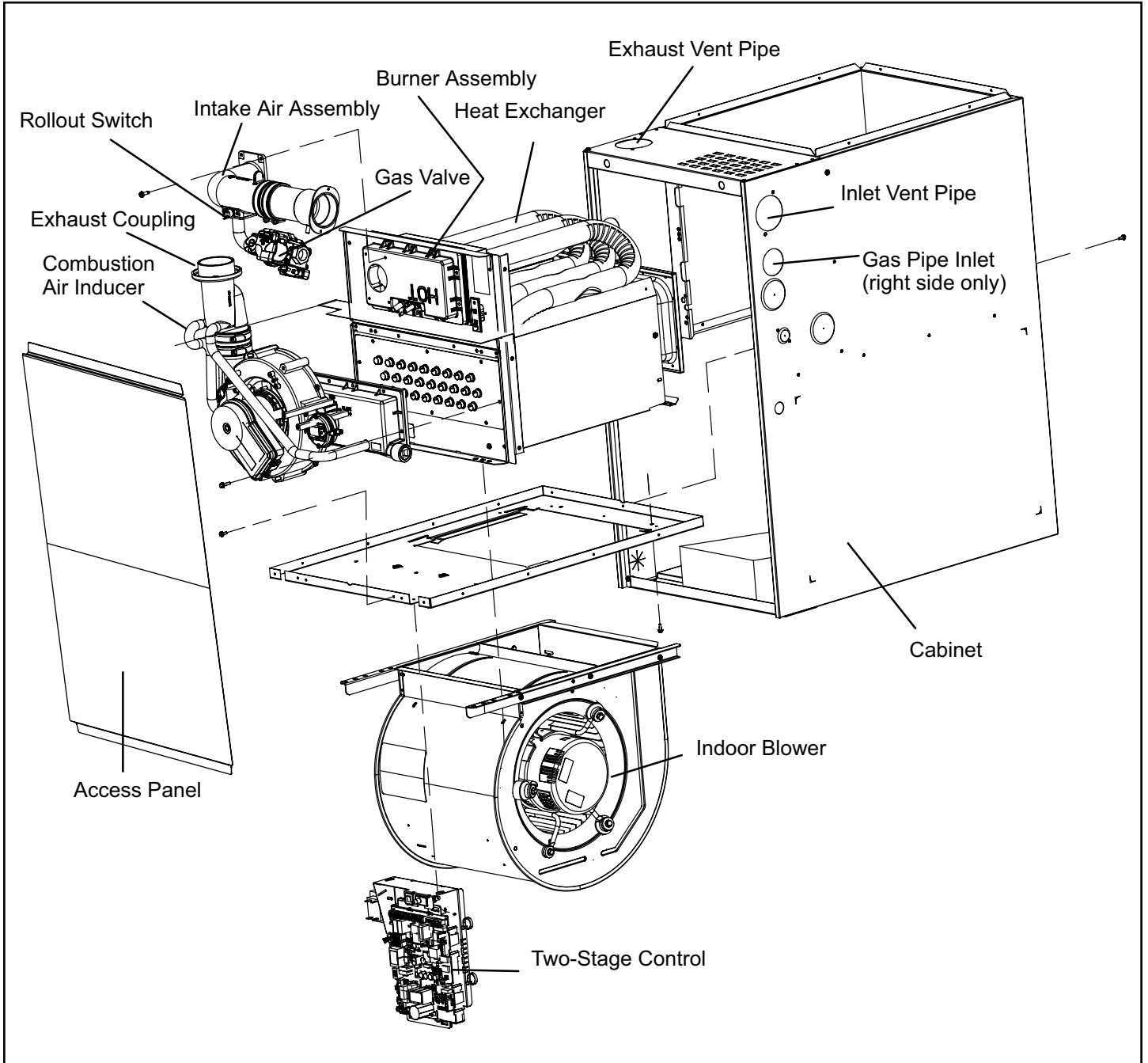


Figure 1.

NF97XV Gas Furnace

The NF97XV Category IV gas furnace is shipped ready for installation in the upflow or horizontal position. The furnace is shipped with the bottom panel in place. The bottom panel must be removed if the unit is to be installed in horizontal or upflow applications with bottom return air.

The NF97XV is to be installed as Direct Vent gas central furnace only.

The furnace is equipped for installation in natural gas applications only.

These furnaces comply with the 14 Ng/J NOx emission required by some Air Quality Management Districts in the State of California.

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.*

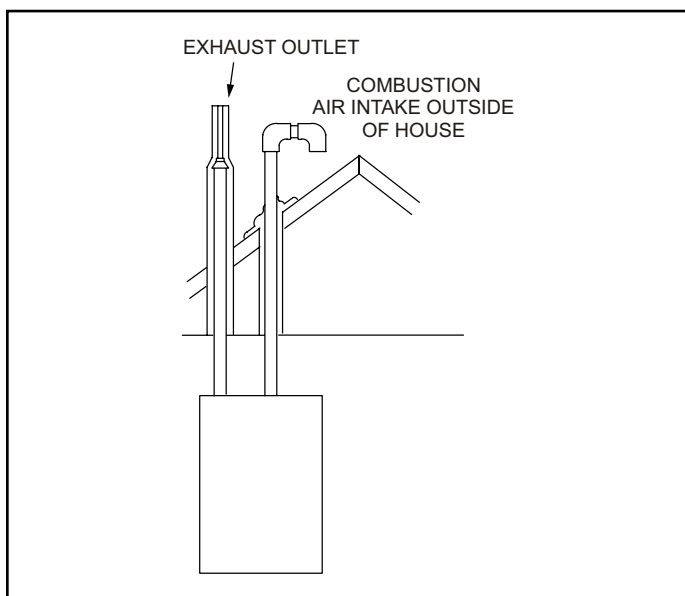


Figure 2. Direct Vent Installation

Shipping and Packing List

Package 1 of 1 contains

- 1 - Assembled NF97XV unit
- 1 - Bag assembly containing the following:
 - 1 - Snap bushing
 - 1 - Snap plug
 - 1 - Wire tie
 - 1 - Condensate trap
 - 1 - Condensate trap cap
 - 1 - Condensate trap clamp
 - 1 - 2" diameter debris screen

1 - 3/4" Threaded street elbow

Check equipment for shipping damage. If you find any damage, immediately contact the last carrier.

The following items may also be ordered separately:

- 1 - Thermostat
- 1 - Return air base kit
- 1 - Horizontal suspension kit

Safety Information

CAUTION

As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

Use only the type of gas approved for use with this furnace. Refer to unit nameplate.

NF97XV units are CSA International certified to ANSI Z21.47 and CSA 2.3 standards.

Building Codes

In the USA, installation of gas furnaces must conform with local building codes. In the absence of local codes, units must be installed according to the current National Fuel Gas Code (ANSI-Z223.1/NFPA 54). The National Fuel Gas Code is available from the following address:

American National Standards Institute, Inc.
11 West 42nd Street
New York, NY 10036

In Canada, installation must conform with current National Standard of Canada CSA-B149 Natural Gas and Propane Installation Codes, local plumbing or waste water codes and other applicable local codes.

In order to ensure proper unit operation, combustion and ventilation air supply must be provided according to the current National Fuel Gas Code or CSA-B149 standard.

Installation Locations

This furnace is CSA International certified for installation clearances to combustible material as listed on the unit nameplate and in the table in Figure 5 or Figure 11. Accessibility and service clearances must take precedence over fire protection clearances.

NOTE: *For installation on combustible floors, the furnace shall not be installed directly on carpeting, tile, or other combustible material other than wood flooring.*

For installation in a residential garage, the furnace must be installed so that the burner(s) and the ignition source are

located no less than 18 inches (457 mm) above the floor. The furnace must be located or protected to avoid physical damage by vehicles. When a furnace is installed in a public garage, hangar, or other building that has a hazardous atmosphere, the furnace must be installed according to recommended good practice requirements and current National Fuel Gas Code or CSA B149 standards.

NOTE: Furnace must be adjusted to obtain a temperature rise within the range specified on the unit nameplate. Failure to do so may cause erratic limit operation and premature heat exchanger failure.

This furnace must be installed so that its electrical components are protected from water.

Installed in Combination with a Cooling Coil

When this furnace is used with cooling coils (Figure 3), it shall be installed in parallel with, or on the upstream side of, cooling coils to avoid condensation in the heating compartment. With a parallel flow arrangement, a damper (or other means to control the flow of air) must adequately prevent chilled air from entering the furnace. If the damper is manually operated, it must be equipped to prevent operation of either the heating or the cooling unit, unless it is in the full HEAT or COOL setting.

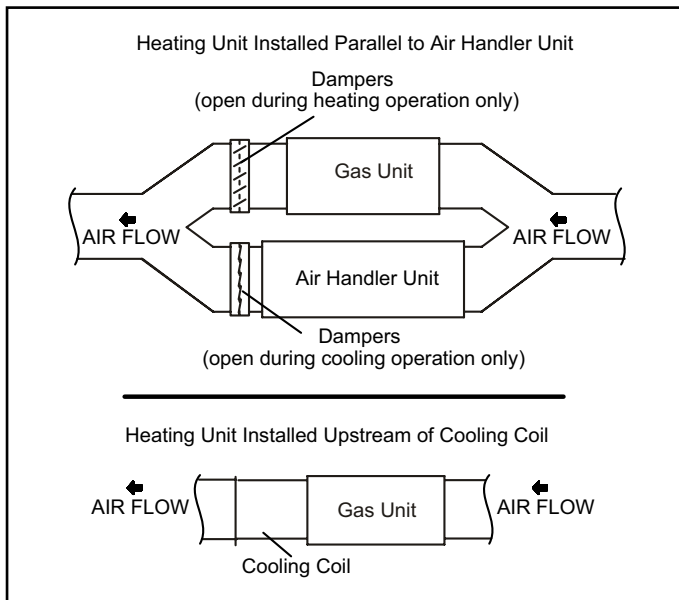


Figure 3.

When installed, this furnace must be electrically grounded according to local codes. In addition, in the United States, installation must conform with the current National Electric Code, ANSI/NFPA No. 70. The National Electric Code (ANSI/NFPA No. 70) is available from the following address:

National Fire Protection Association
1 Battery March Park
Quincy, MA 02269

In Canada, all electrical wiring and grounding for the unit must be installed according to the current regulations of the Canadian Electrical Code Part I (CSA Standard C22.1) and/or local codes.

NOTE: This furnace is designed for a minimum continuous return air temperature of 60°F (16°C) or an intermittent operation down to 55°F (13°C) dry bulb for cases where a night setback thermostat is used. Return air temperature must not exceed 85°F (29°C) dry bulb.

The NF97XV furnace may be installed in alcoves, closets, attics, basements, garages, crawl spaces and utility rooms in the upflow or horizontal position.

This furnace design has not been CSA certified for installation in mobile homes, recreational vehicles, or outdoors.

Use of Furnace as a Construction Heater

Units may be used for heating of buildings or structures under construction, if the following conditions are met to ensure proper operation.

DO NOT USE THE UNIT FOR CONSTRUCTION HEAT UNLESS ALL OF THE FOLLOWING CRITERIA ARE MET:

- Furnace must be in its final location. The vent system must be permanently installed per these installation instructions.
- Furnace must be installed as a two pipe system and one hundred percent (100%) outdoor air must be provided for combustion air requirements during construction.
- A room thermostat must control the furnace. The use of fixed jumpers that will provide continuous heating is prohibited.
- The input rate and temperature rise must be set per the furnace rating plate.
- Supply and Return air ducts must be provided and sealed to the furnace. Return air must be terminated outside of the space where furnace is installed.
- Return air temperature range between 60°F (16°C) and 80°F (27°C) must be maintained.
- MERV 11 or greater air filters must be installed in the system and must be regularly inspected and maintained (e.g., regular static checks and replaced at end of life) during construction.
- Blower and vestibule access panels must be in place on the furnace at all times.
- The furnace heat exchanger, components, duct system, and evaporator coils must be thoroughly cleaned following final construction clean-up.
- Air filters must be replaced upon construction completion.

- k. All furnace operating conditions (including ignition, input rate, temperature rise and venting) must be verified in accordance with these installation instructions.

EQUIPMENT MAY EXPERIENCE PREMATURE COMPONENT FAILURE AS A RESULT OF FAILURE TO FOLLOW THE ABOVE INSTALLATION INSTRUCTIONS. FAILURE TO FOLLOW THE ABOVE INSTALLATION INSTRUCTIONS VOIDS THE MANUFACTURER'S EQUIPMENT LIMITED WARRANTY. GEA DISCLAIMS ALL LIABILITY IN CONNECTION WITH INSTALLER'S FAILURE TO FOLLOW THE ABOVE INSTALLATION INSTRUCTIONS.

NOTWITHSTANDING THE FOREGOING, INSTALLER IS RESPONSIBLE FOR CONFIRMING THAT THE USE OF CONSTRUCTION HEAT IS CONSISTENT WITH THE POLICIES AND CODES OF ALL REGULATING ENTITIES. ALL SUCH POLICIES AND CODES MUST BE ADHERED TO.

General

These instructions are intended as a general guide and do not supersede local codes in any way. Consult authorities having jurisdiction before installation.

In addition to the requirements outlined previously, the following general recommendations must be considered when installing a NF97XV furnace:

- Place the furnace as close to the center of the air distribution system as possible. The furnace should also be located close to the vent termination point.
- When the furnace is installed in an attic or other insulated space, keep insulation away from the furnace.
- When the furnace is installed in an unconditioned space, consider provisions required to prevent freezing of condensate drain system.
- Please consult the manufacturer of your evaporator coil for their recommendations on distance required between the heat exchanger and their drain pan. Adequate space must be provided between the drain pan and the furnace heat exchanger.

CAUTION

NF97XV unit should not be installed in areas normally subject to freezing temperatures.

Shipping Bolt Removal

Units with 1/2 hp blower motor are equipped with three flexible legs and one rigid leg. The rigid leg is equipped with a shipping bolt and a flat white plastic washer (rather

than the rubber mounting grommet used with a flexible mounting leg). See Figure 4. The bolt and washer must be removed before the furnace is placed into operation. After the bolt and washer have been removed, the rigid leg will not touch the blower housing.

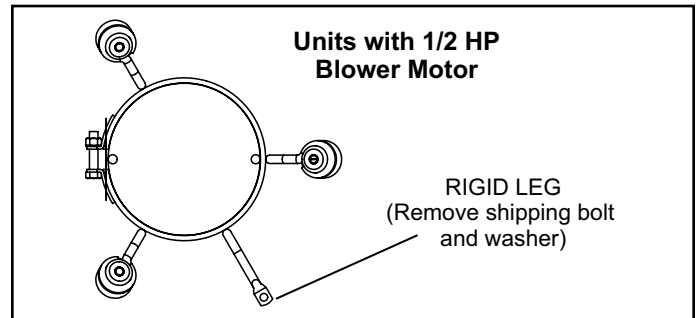


Figure 4.

Installation - Setting Equipment

WARNING

Do not connect the return air duct to the back of the furnace. Doing so will adversely affect the operation of the safety control devices, which could result in personal injury or death.

WARNING

Blower access panel must be securely in place when blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

WARNING

Improper installation of the furnace can result in personal injury or death. Combustion and flue products must never be allowed to enter the return air system or air in the living space. Use sheet metal screws and joint tape to seal return air system to furnace.

In platform installations with furnace return, the furnace should be sealed airtight to the return air plenum. A door must never be used as a portion of the return air duct system. The base must provide a stable support and an airtight seal to the furnace. Allow absolutely no sagging, cracks, gaps, etc.

For no reason should return and supply air duct systems ever be connected to or from other heating devices such as a fireplace or stove, etc. Fire, explosion, carbon monoxide poisoning, personal injury and/or property damage could result.

Upflow Applications

The NF97XV gas furnace can be installed as shipped in the upflow position. Refer to Figure 5 for clearances. Select a location that allows for the required clearances that are listed on the unit nameplate. Also consider gas supply connections, electrical supply, vent connection, condensate trap and drain connections, and installation and service clearances [24 inches (610 mm) at unit front]. The unit must be level from side to side. The unit may be positioned from level to 1/2" toward the front. See Figure 6.

Allow for clearances to combustible materials as indicated on the unit nameplate.

Return Air Guidelines

Return air can be brought in through the bottom or either side of the furnace installed in an upflow application. If the furnace is installed on a platform with bottom return, make an airtight seal between the bottom of the furnace and the platform to ensure that the furnace operates properly and safely. The furnace is equipped with a removable bottom panel to facilitate installation.

Markings are provided on both sides of the furnace cabinet for installations that require side return air. Cut the furnace cabinet at the maximum dimensions shown on Page 2.

Refer to *Product Specifications for additional information.*

Applications that include side return air and a condensate trap installed on the same side of the cabinet (trap can be installed remotely within 5 ft.) require either a return air base or field-fabricated transition to accommodate an

optional IAQ accessory taller than 14.5". See Figure 7.

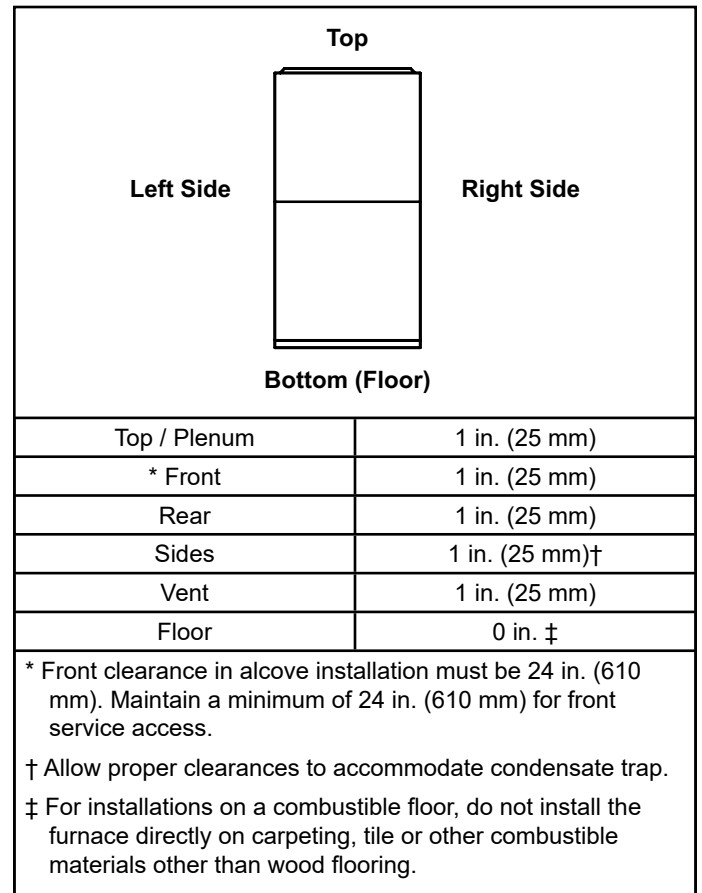


Figure 5. Installation Clearances Upflow Applications

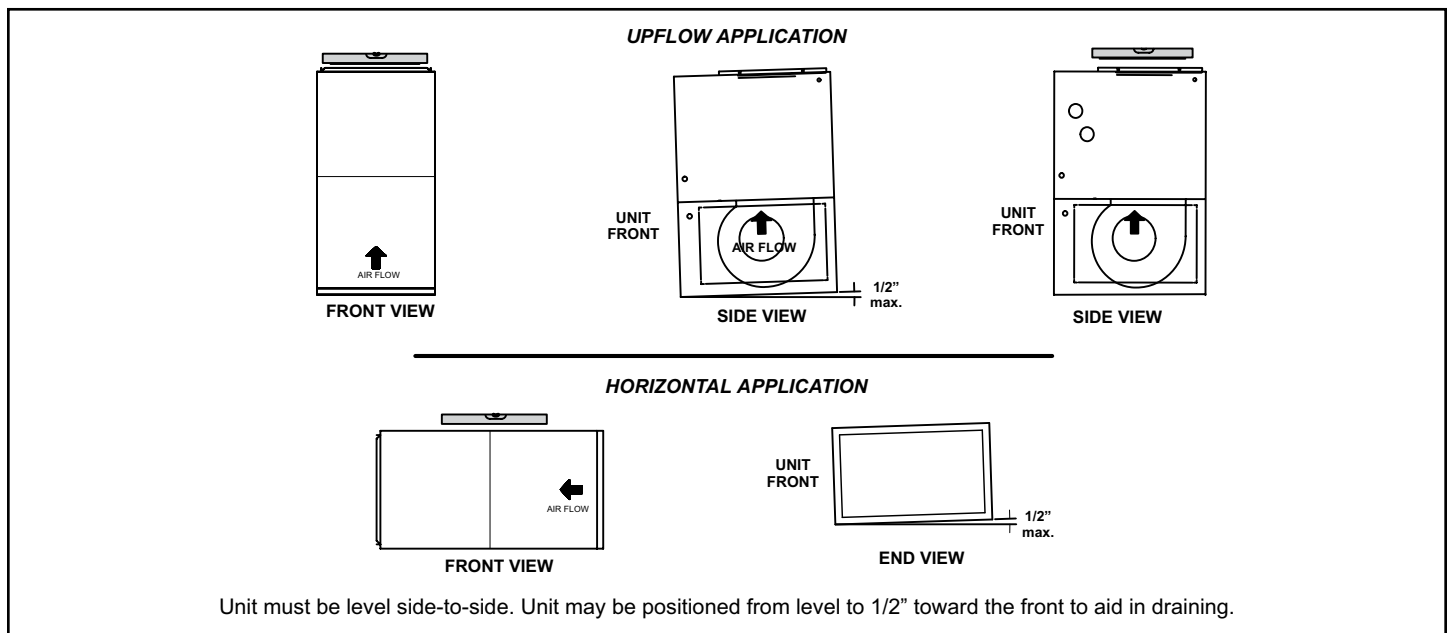


Figure 6. Setting Equipment

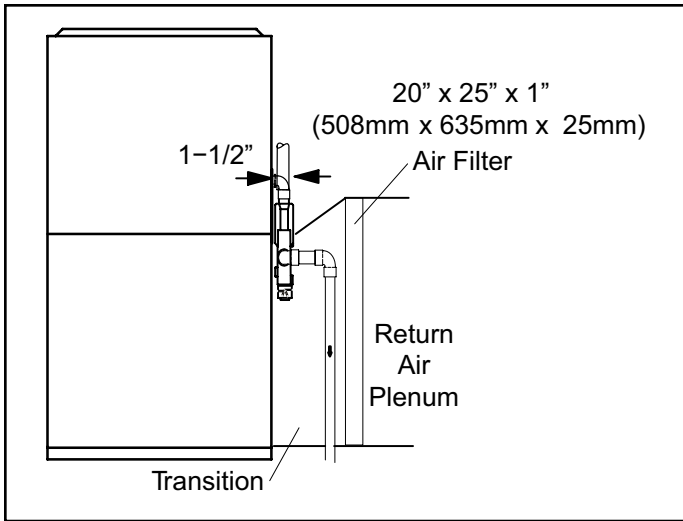


Figure 7. Side Return Air (with transition and filter)

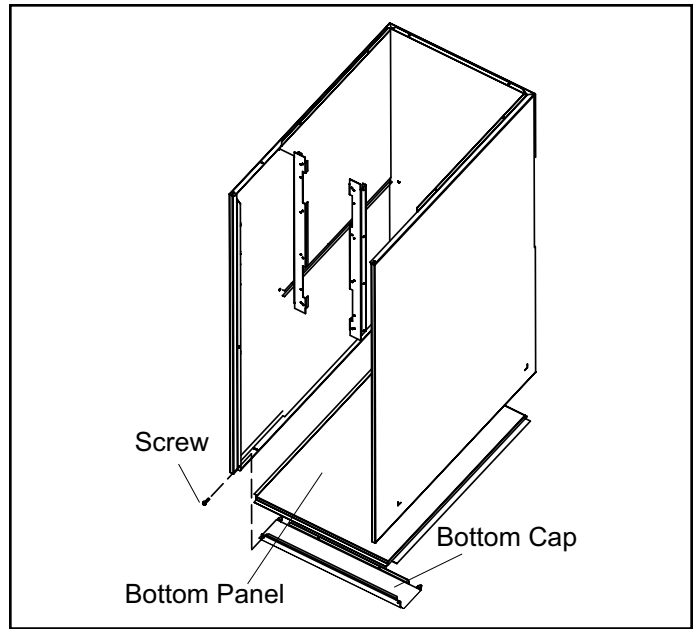


Figure 8. Remove the Bottom Panel

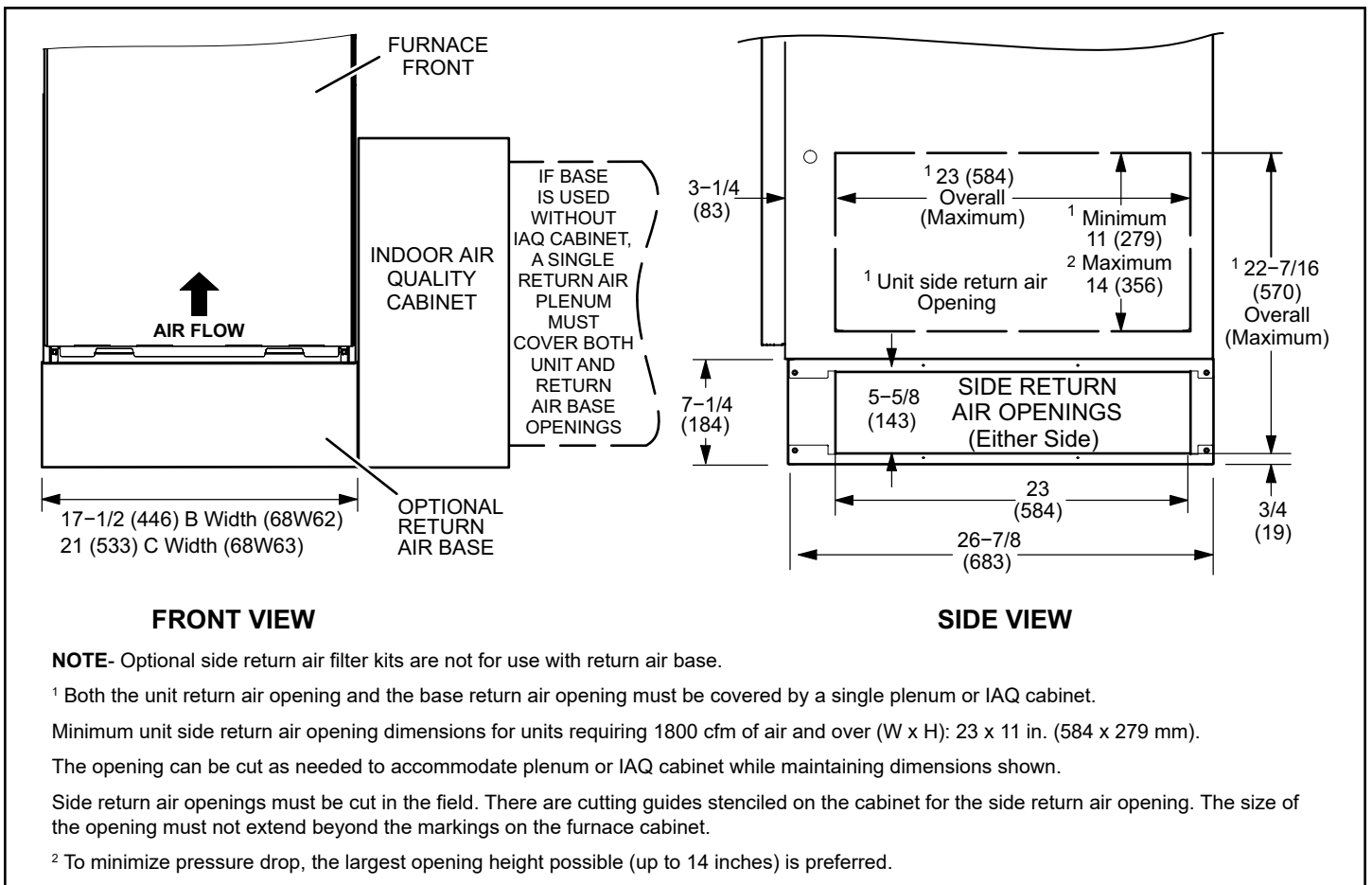


Figure 9. Optional Return Air Base (Upflow Applications Only)

Removing the Bottom Panel

Remove the two screws that secure the bottom cap to the furnace. Pivot the bottom cap down to release the bottom panel. Once the bottom panel has been removed, reinstall the bottom cap. See Figure 8.

Horizontal Applications

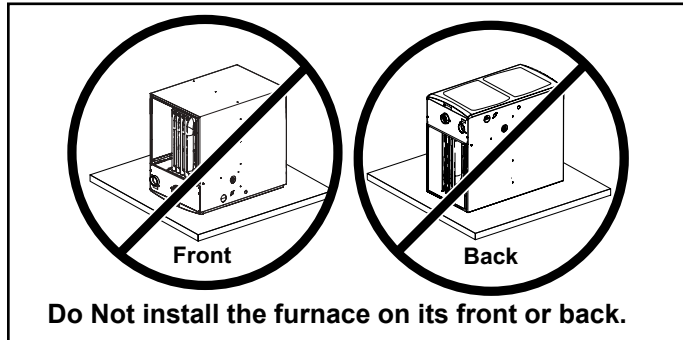


Figure 10.

The NF97XV furnace can be installed in horizontal applications with either right- or left-hand air discharge.

Refer to Figure 11 for clearances in horizontal applications.

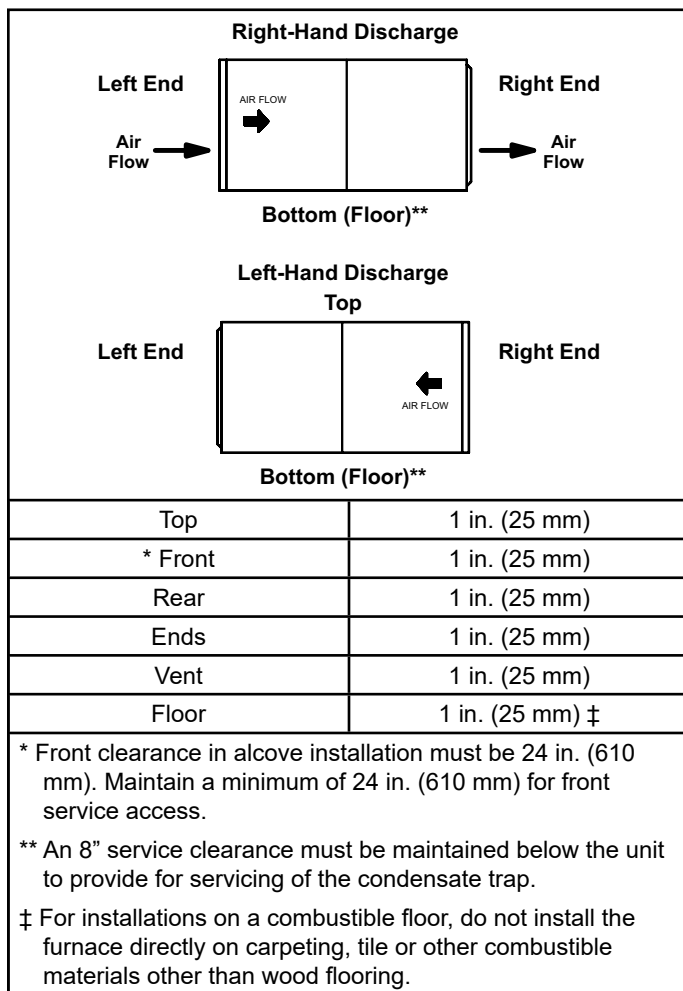


Figure 11. Installation Clearances Horizontal Applications

Suspended Installation of Horizontal Unit

This furnace may be installed in either an attic or a crawlspace. Either suspend the furnace from roof rafters or floor joists, as shown in Figure 12, or install the furnace on a platform, as shown in Figure 13. A horizontal suspension kit (51W10) may be ordered from the distributor or use equivalent.

NOTE: Heavy-gauge sheet metal straps may be used to suspend the unit from roof rafters or ceiling joists. When straps are used to suspend the unit in this way, support must be provided for both the ends. The straps must not interfere with the plenum or exhaust piping installation. **Cooling coils and supply and return air plenums must be supported separately.**

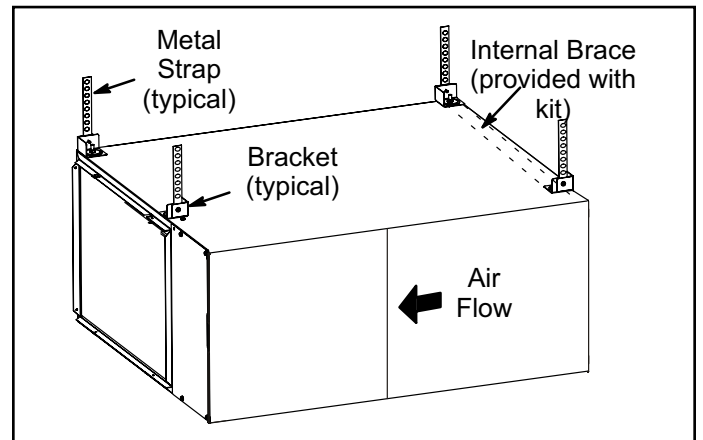


Figure 12. Horizontal Suspension Kit

NOTE: When the furnace is installed on a platform or with the horizontal suspension kit in a crawlspace, it must be elevated enough to avoid water damage, accommodate drain trap and to allow the evaporator coil to drain.

Platform Installation of Horizontal Unit

12. Select location for unit keeping in mind service and other necessary clearances. See Figure 11.
13. Construct a raised wooden frame and cover frame with a plywood sheet. If unit is installed above finished space, install an auxiliary drain pan under unit. Set unit in drain pan as shown in Figure 13. Leave 8 inches for service clearance below unit for condensate trap.
14. Provide a service platform in front of unit. When installing the unit in a crawl space, a proper support platform may be created using cement blocks.
15. Route auxiliary drain line so that water draining from this outlet will be easily noticed by the homeowner.
16. If necessary, run the condensate line into a condensate pump to meet drain line slope requirements. The pump must be rated for use with condensing furnaces. Protect the condensate discharge line from the pump to the outside to avoid freezing.
17. Continue with exhaust, condensate and intake piping installation according to instructions.

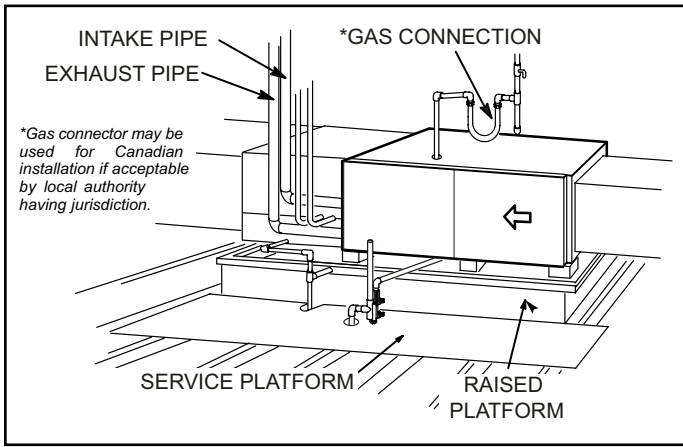


Figure 13. Platform Installation

Return Air -- Horizontal Applications

Return air may be brought in only through the end of a furnace installed in the horizontal position. The furnace is equipped with a removable bottom panel to facilitate installation. See Figure 8.

Filters

This unit is not equipped with a filter or rack. A field-provided high velocity rated filter is required for the unit to operate properly. Table 1 lists recommended filter sizes. A filter must be in place whenever the unit is operating.

Furnace Cabinet Width	Filter Size	
	Side Return	Bottom Return
17-1/2"	16 x 25 x 1 (1)	16 x 25 x 1 (1)
21"		20 x 25 x 1 (1)

Table 1.

IMPORTANT

If a high-efficiency filter is being installed as part of this system to ensure better indoor air quality, the filter must be properly sized. High-efficiency filters have a higher static pressure drop than standard-efficiency glass/foam filters. If the pressure drop is too great, system capacity and performance may be reduced. The pressure drop may also cause the limit to trip more frequently during the winter and the indoor coil to freeze in the summer, resulting in an increase in the number of service calls.

Before using any filter with this system, check the specifications provided by the filter manufacturer against the data given in the appropriate GEA Product Specifications bulletin. Additional information is provided in Service and Application Note ACC002 (August 2000).

Duct System

Use industry-approved standards to size and install the supply and return air duct system. Figure 14 shows the correct supply and return duct installation. Refer to ACCA Manual D. This will result in a quiet and low-static system that has uniform air distribution.

NOTE: *This furnace is not certified for operation in heating mode (indoor blower operating at selected heating speed) with an external static pressure which exceeds 0.8 inches w.c. Operation at these conditions may result in improper limit operation.*

Supply Air Plenum

If the furnace is installed without a cooling coil, a removable access panel should be installed in the supply air duct. The access panel should be large enough to permit inspection of the heat exchanger. The furnace access panel must always be in place when the furnace is operating and it must not allow leaks.

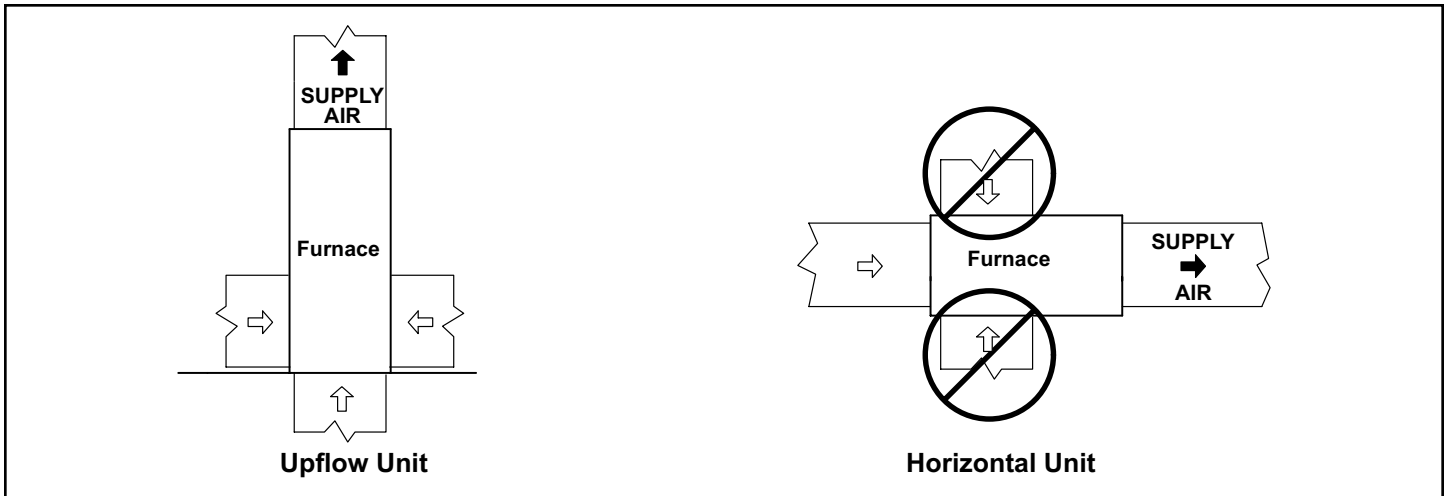


Figure 14. Duct System and Proper Installation

Return Air Plenum

NOTE: Return air must not be drawn from a room where this furnace, or any other gas-fueled appliance (i.e., water heater), or carbon monoxide-producing device (i.e., wood fireplace) is installed.

When return air is drawn from a room, a negative pressure is created in the room. If a gas appliance is operating in a room with negative pressure, the flue products can be pulled back down the vent pipe and into the room. This reverse flow of the flue gas may result in incomplete combustion and the formation of carbon monoxide gas. This raw gas or toxic fumes might then be distributed throughout the house by the furnace duct system.

Return air can be brought in through the bottom or either side of the furnace (return air brought into either side of furnace allowed only in upflow applications). If a furnace with bottom return air is installed on a platform, make an airtight seal between the bottom of the furnace and the platform to ensure that the unit operates properly and safely. Use fiberglass sealing strips, caulking, or equivalent sealing method between the plenum and the furnace cabinet to ensure a tight seal. If a filter is installed, size the return air duct to fit the filter frame.

Pipe & Fittings Specifications

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the Table 2 for approved piping and fitting materials.

CAUTION

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

IMPORTANT

NF97XV exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
PRIMER & SOLVENT CEMENT	ASTM SPECIFICATION
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3138
CANADA PIPE & FITTING & SOLVENT CEMENT	MARKING
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	
POLYPROPYLENE VENTING SYSTEM	ULC-S636
PolyPro® by Duravent	
InnoFlue® by Centrotherm	
ECCO Polypropylene Vent™	ULC-S636

Table 2. Piping and Fittings Specifications

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 2. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended during cooler weather. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

Canadian Applications Only - Pipe, fittings, primer and solvent cement used to vent (exhaust) this appliance must be certified to ULC S636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.

NOTE: The intake coupling on the furnace is ABS material. Use transitional solvent to make connections to PVC pipe.

NOTE: Exhaust coupling must be installed with provided appliance adapter. See Figure 17.

Joint Cementing Procedure

All cementing of joints should be done according to the specifications outlined in ASTM D 2855.



DANGER OF EXPLOSION!

Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation.

1. Measure and cut vent pipe to desired length.
2. Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe

may remove cement from fitting socket and result in a leaking joint.

NOTE: Check the inside of vent pipe thoroughly for any obstruction that may alter furnace operation.

3. Clean and dry surfaces to be joined.
4. Test fit joint and mark depth of fitting on outside of pipe.
5. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

NOTE: Time is critical at this stage. Do not allow primer to dry before applying cement.

6. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.
7. Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. DO NOT turn ABS or cellular core pipe.

NOTE: Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.

Input Size	Vent Pipe Dia. (in.)	STANDARD		CONCENTRIC		
		Flush-Mount Kit	Field Fabricated	1-1/2 in.	2 in.	3 in.
		51W11 (US) 51W12 (CA)		71M80 (US) 44W92 (CA)	69M29 (US) 44W92 (CA)	60L46 (US) 44W93 (CA)
040	2	³ YES	⁵ YES	² YES		
	3	³ YES	⁵ YES	² YES		
060	2	³ YES	⁵ YES	² YES		
	3	³ YES	⁵ YES	² YES		
080	2	³ YES	⁵ YES		YES	YES
	3	³ YES	⁵ YES		YES	YES

NOTE - Standard Terminations do not include any vent pipe or elbows external to the structure. Any vent pipe or elbows external to the structure must be included in total vent length calculations. See vent length tables.

* Kits must be properly installed according to kit instructions.

¹ Requires field-provided outdoor 1-1/2" exhaust accelerator.

² Concentric kits 71M80 and 44W92 include 1-1/2" outdoor accelerator, when used with 040 and 060 input models.

³ Flush mount kits 51W11 and 51W12 includes 1-1/2 in. outdoor exhaust accelerator, required when used with 040, 060 and 080 input models.

⁴ Termination kits 44W92 and 44W93 are certified to ULC S636 for use in Canada only.

⁵ See Table 8 for vent accelerator requirements.

Table 3. Outdoor Termination Kits

8. After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate an improper assembly due to insufficient solvent.
9. Handle joints carefully until completely set.

Venting Practices

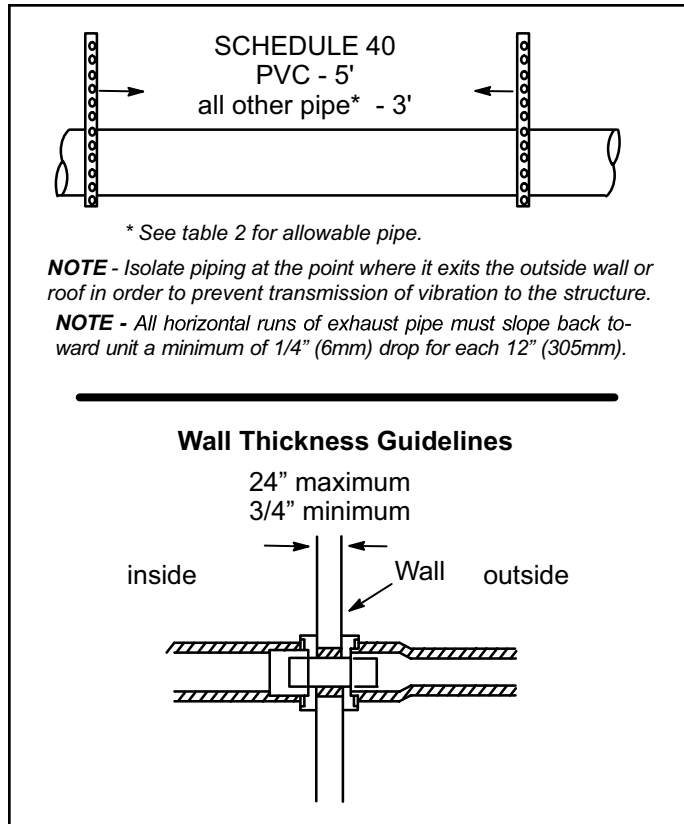


Figure 15. Piping Suspension Guidelines

1. In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
2. When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.

Removal of the Furnace from Common Vent

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.

Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you must correct the system as indicated in the general venting requirements section.

⚠ 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 common venting system.
2. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common 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.
4. Follow the lighting instructions. Turn on the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.
5. After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.
6. After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous mode of operation.
7. If a venting problem is found during any of the preceding tests, the common venting system must be modified to correct the problem.

Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in Appendix G. These are in the current standards of the National Fuel Gas Code ANSI Z223.1.

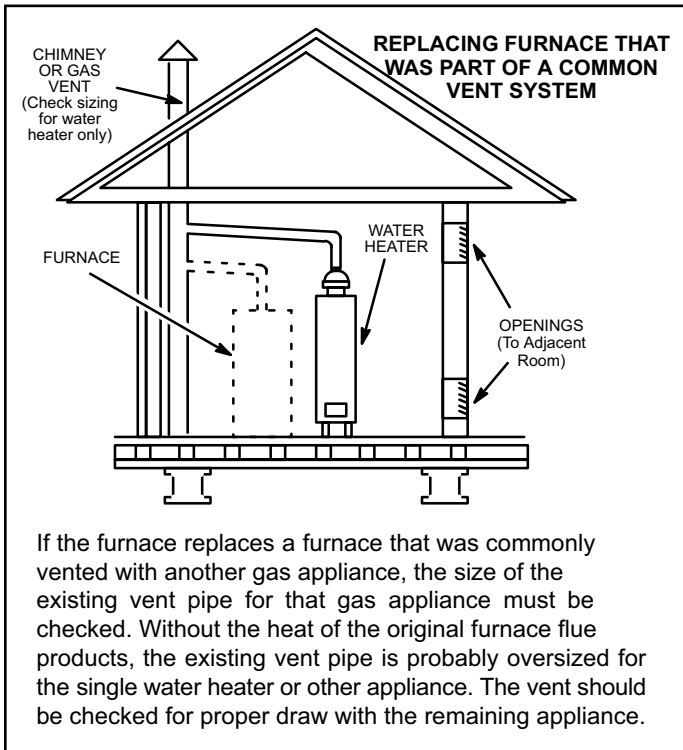


Figure 16.

Exhaust Piping

See Figure 17 through Figure 21

The appliance adapter must be attached to the exhaust coupling on the furnace top panel. Use the provided straps. See steps below.

1. Remove caution tag from vent adapter.
2. Fully insert vent adapter with both bands loosely attached onto furnace exhaust coupling.
3. Insert PVC exhaust pipe through appliance adapter. Ensure vent pipe is fully seated into exhaust coupling.
4. Tighten both top and bottom bands to 40 in-lbs. See Figure 17.

Route piping to outside of structure. Continue with installation following instructions given in piping termination section.

CAUTION

Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.

CAUTION

The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

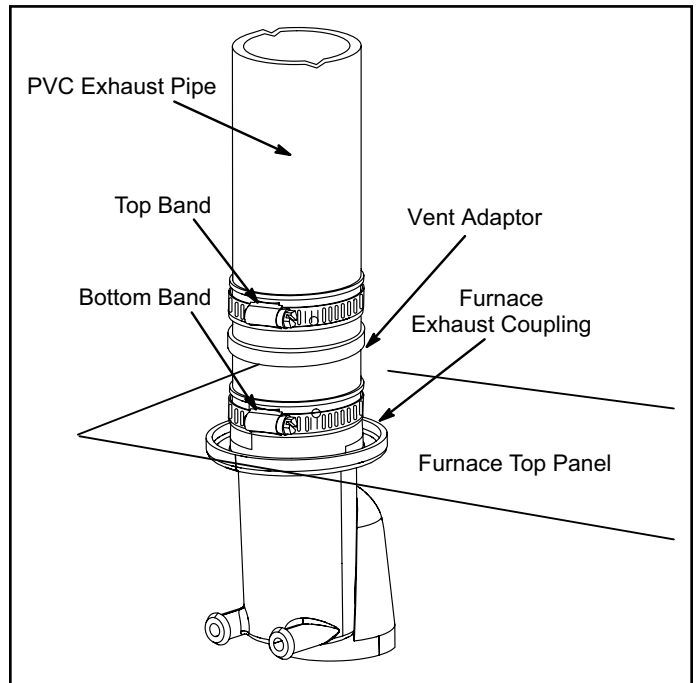


Figure 17. Appliance Adaptor to Exhaust Coupling

Vent Piping Guidelines

NOTE: GEA has approved the use of DuraVent® and Centrotherm manufactured vent pipe and terminations as an option to PVC. When using the PolyPro® by DuraVent or InnoFlue® by Centrotherm venting system the vent pipe requirements stated in the unit installation instruction – minimum & maximum vent lengths, termination clearances, etc. – apply and must be followed. Follow the instructions provided with PolyPro by DuraVent and InnoFlue by Centrotherm venting system for assembly or if requirements are more restrictive. The PolyPro by DuraVent and InnoFlue by Centrotherm venting system must also follow the uninsulated and unconditioned space criteria listed in Table 7.

The NF97XV is to be installed as a Direct Vent gas central furnace.

NOTE: In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.

Intake and exhaust pipe sizing -- Size pipe according to Table 4 and Table 5A through Table 5D. Count all elbows inside and outside the home. Table 4 lists the minimum vent pipe lengths permitted. Table 5A through Table 5D lists the maximum pipe lengths permitted.

Regardless of the diameter of pipe used, the standard roof and wall terminations described in section Exhaust Piping Terminations should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to Table 8.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact GEA for assistance in sizing vent pipe in these applications.

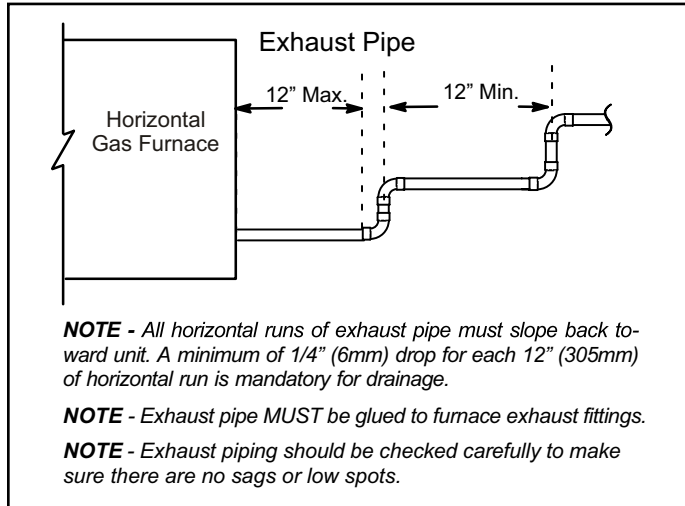


Figure 18. Horizontal Installation Offset Requirements

Model	Min. Vent Length*
040, 060, 080	15 ft. or 5 ft. plus 2 elbows or 10 ft. plus 1 elbow

* Any approved termination may be added to the minimum length listed.

Table 4. Minimum Vent Pipe Lengths

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

Use the following steps to correctly size vent pipe diameter.

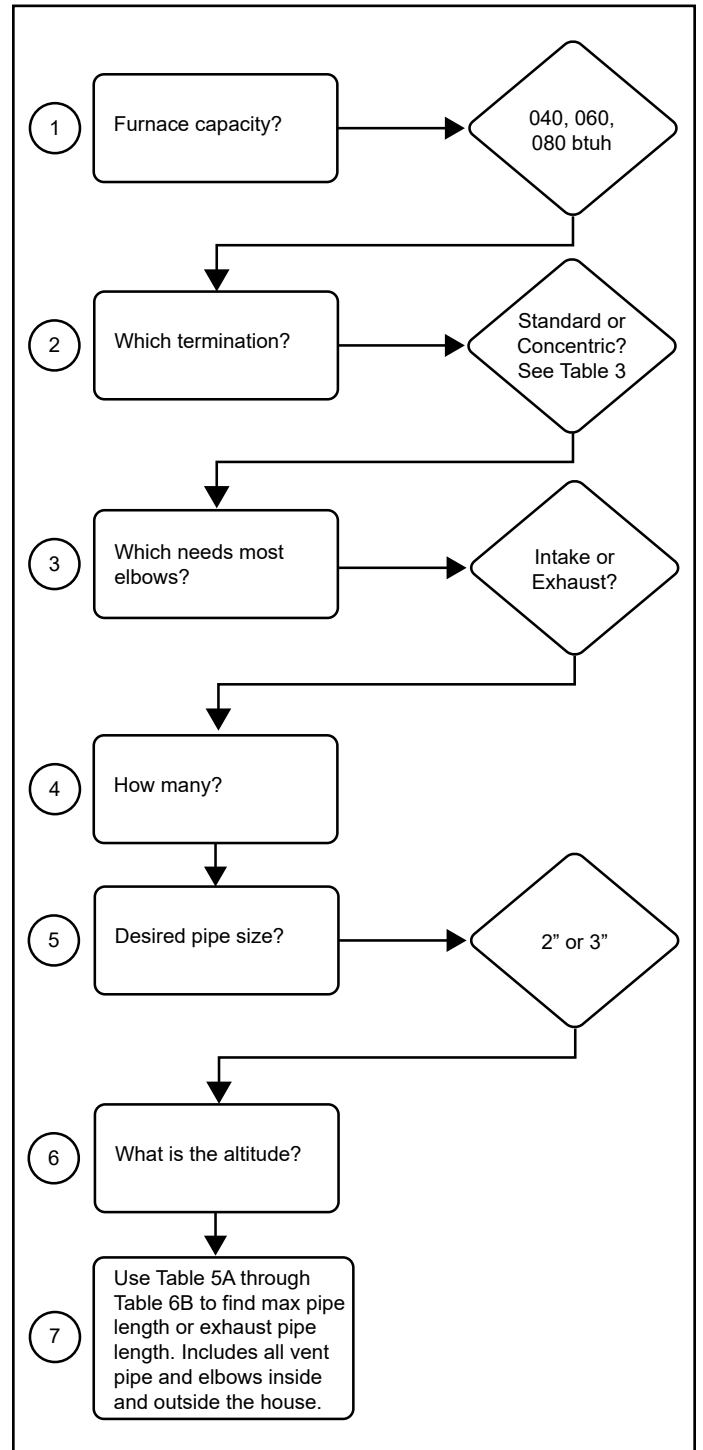


Figure 19.

Maximum Allowable Intake or Exhaust Vent Length in Feet

Standard Termination at Elevation 0 - 4500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	81	66	44	138	137	118
2	76	61	39	133	132	113
3	71	56	34	128	127	108
4	66	51	29	123	122	103
5	61	46	24	118	117	98
6	56	41	19	113	112	93
7	51	36	14	108	107	88
8	46	31	n/a	103	102	83
9	41	26		98	97	78
10	36	21		93	92	73
Standard Termination at Elevation 4501 - 6000 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	n/a	41	34	n/a	105	100
2		36	29		100	95
3		31	24		95	90
4		26	19		90	85
5		21	14		85	80
6		16	9		80	75
7		11	n/a		75	70
8		n/a			70	65
9					65	60
10		60	55			
<p>NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.</p> <p>NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.</p>						

Table 5A.

Maximum Allowable Intake or Exhaust Vent Length in Feet

Standard Termination at Elevation 6001 - 7500 ft							
Number of 90° Elbows Used	2" Pipe			3" Pipe			
	Model			Model			
	040	060	080	040	060	080	
1	n/a	29	24	n/a	105	100	
2		24	19		100	95	
3		19	14		95	90	
4		14	9		90	85	
5		9	n/a		85	80	
6		n/a			n/a	80	75
7						75	70
8						70	65
9						65	60
10			60			55	

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 5B.

Maximum Allowable Intake or Exhaust Vent Length in Feet

Concentric Termination at Elevation 0 - 4500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	73	58	42	121	121	114
2	68	53	37	116	116	109
3	63	48	32	111	111	104
4	58	43	27	106	106	99
5	53	38	22	101	101	94
6	48	33	17	96	96	89
7	43	28	12	91	91	84
8	38	23	n/a	86	86	79
9	33	18		81	81	74
10	28	13		76	76	69
Concentric Termination at Elevation 4501 - 6000 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	n/a	33	32	n/a	89	89
2		28	27		84	84
3		23	22		79	79
4		18	17		74	74
5		13	12		69	69
6	n/a	n/a	n/a	n/a	64	64
7					59	59
8					54	54
9					49	49
10					44	44
<p>NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.</p> <p>NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.</p>						

Table 5C.

Maximum Allowable Intake or Exhaust Vent Length in Feet

Concentric Termination at Elevation 6001 - 7500 ft							
Number of 90° Elbows Used	2" Pipe			3" Pipe			
	Model			Model			
	040	060	080	040	060	080	
1	n/a	27	22	n/a	89	89	
2		22	17		84	84	
3		17	12		79	79	
4		12	7		74	74	
5		7	n/a		69	69	
6		n/a			n/a	64	64
7						59	59
8						54	54
9						49	49
10			44			44	

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 5D.

Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet

Standard Termination at Elevation 0 - 4500 ft							
Number of 90° Elbows Used	2" Pipe			3" Pipe			
	Model			Model			
	040	060	080	040	060	080	
1	71	56	34	118	117	98	
2	66	51	29	113	112	93	
3	61	46	24	108	107	88	
4	56	41	19	103	102	83	
5	51	36	14	98	97	78	
6	46	31	9	93	92	73	
7	41	26	4	88	87	68	
8	36	21	n/a	83	82	63	
9	31	16		78	77	58	
10	26	11		73	72	53	
Standard Termination at Elevation 4501 - 6000 ft							
Number of 90° Elbows Used	2" Pipe			3" Pipe			
	Model			Model			
	040	060	080	040	060	080	
1	n/a	31	24	n/a	85	80	
2		26	19		80	75	
3		21	14		75	70	
4		16	9		70	65	
5		11	n/a		65	60	
6		n/a			n/a	60	55
7						55	50
8						50	45
9						45	40
10						40	35

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 6A.

Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet

Standard Termination at Elevation 6001 - 7500 ft						
Number of 90° Elbows Used	2" Pipe			3" Pipe		
	Model			Model		
	040	060	080	040	060	080
1	n/a	19	14	n/a	85	80
2		14	9		80	75
3		9			75	70
4					70	65
5					65	60
6					60	55
7			n/a		55	50
8					50	45
9					45	40
10					40	35

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Table 6B.

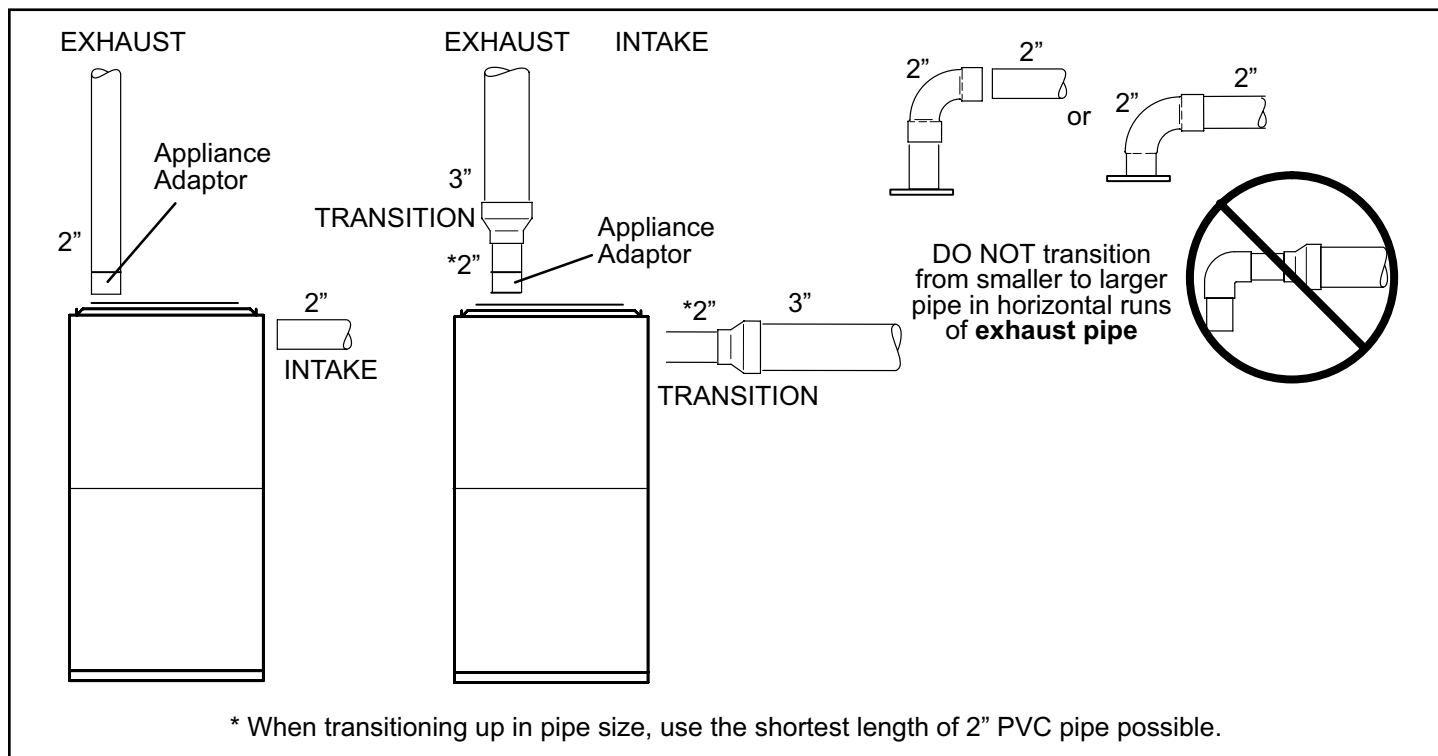


Figure 20. Typical Exhaust and Intake Pipe Connections in Upflow Direct Vent Applications

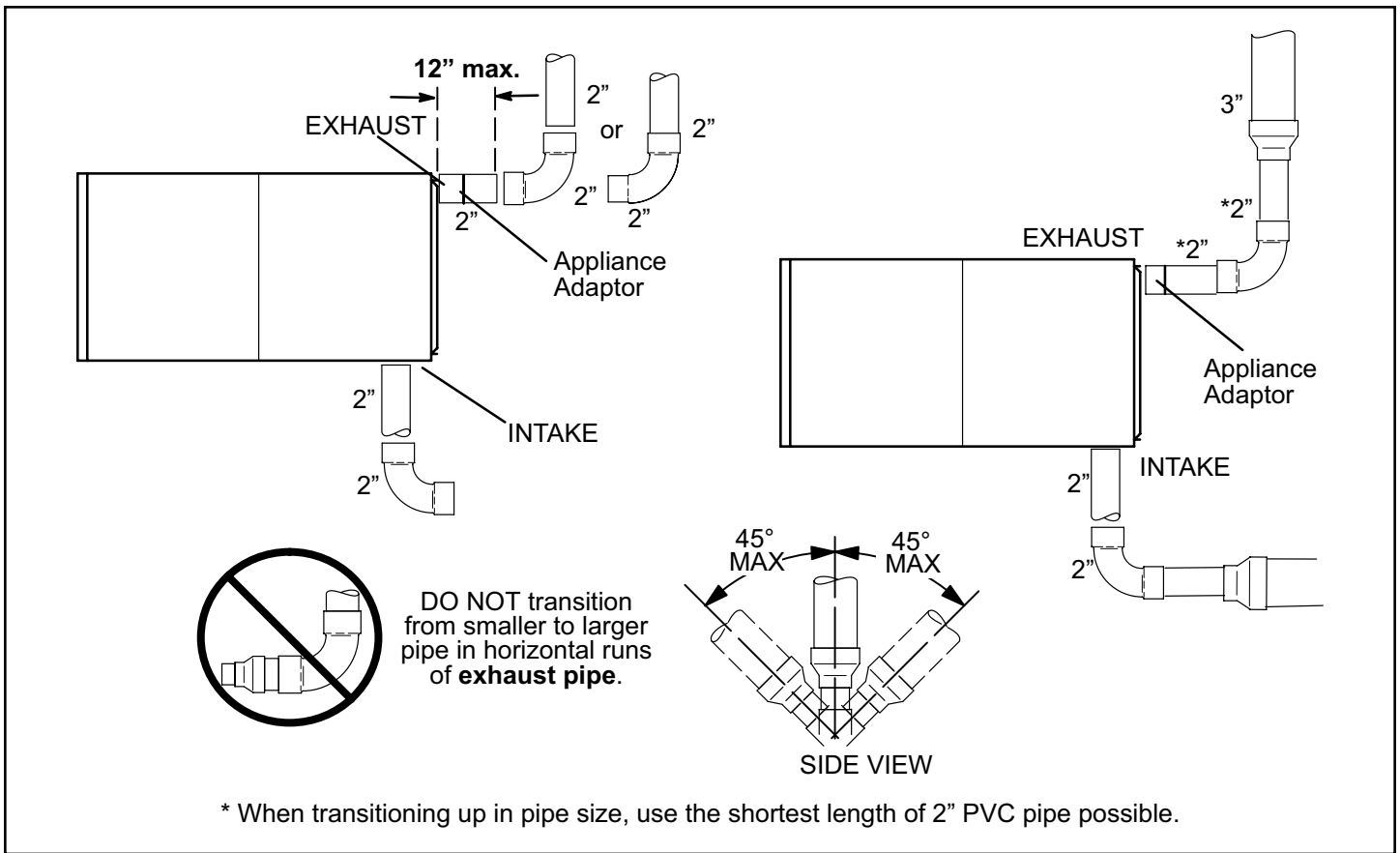


Figure 21. Typical Exhaust and Intake Pipe Connections in Horizontal Direct Vent Applications (Right Hand Discharge Shown)

General Guidelines for Vent Terminations

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The NF97XV is then classified as a direct vent, Category IV gas furnace.

In Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/ NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details.

Position termination according to location given in Figure 23. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of an outdoor AC unit because the condensate can damage the painted coating.

NOTE: See Table 7 for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F (0°C). If required exhaust pipe should be insulated with 1/2" (13mm) ArmaFlex® or equivalent. In extreme cold climate areas, 3/4" (19mm) ArmaFlex® or equivalent may be necessary. Insulation must be protected from deterioration. ArmaFlex® with UV protection is permissible. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32°F (0°C) are to be considered conditioned spaces.

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

Maximum Allowable Exhaust Vent Pipe Length (in ft.) without Insulation in Unconditioned Space for Winter Design Temperatures							
Winter Design Temperatures ¹ °F (°C)	Vent Pipe Diameter	Unit Input Size					
		040		060		080	
		PVC	² PP	PVC	² PP	PVC	² PP
32 to 21 (0 to -6)	2 in.	21	18	33	30	46	42
	3 in.	12	12	21	21	30	30
20 to 1 (-7 to -17)	2 in.	11	9	19	17	28	25
	3 in.	N/A	N/A	9	9	16	16
0 to -20 (-18 to -29)	2 in.	6	4	12	10	19	16
	3 in.	N/A	N/A	N/A	N/A	8	8

¹ Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.

² Poly-Propylene vent pipe (PP) by Duravent and Centrotherm

NOTE - Concentric terminations are the equivalent of 5' and should be considered when measuring pipe length.

NOTE- Maximum uninsulated vent lengths listed may include the termination (vent pipe exterior to the structure) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in Table 5A through Table 5D, or Table 6A through Table 6B, whichever is less.

NOTE - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See Figure 22.

Table 7.

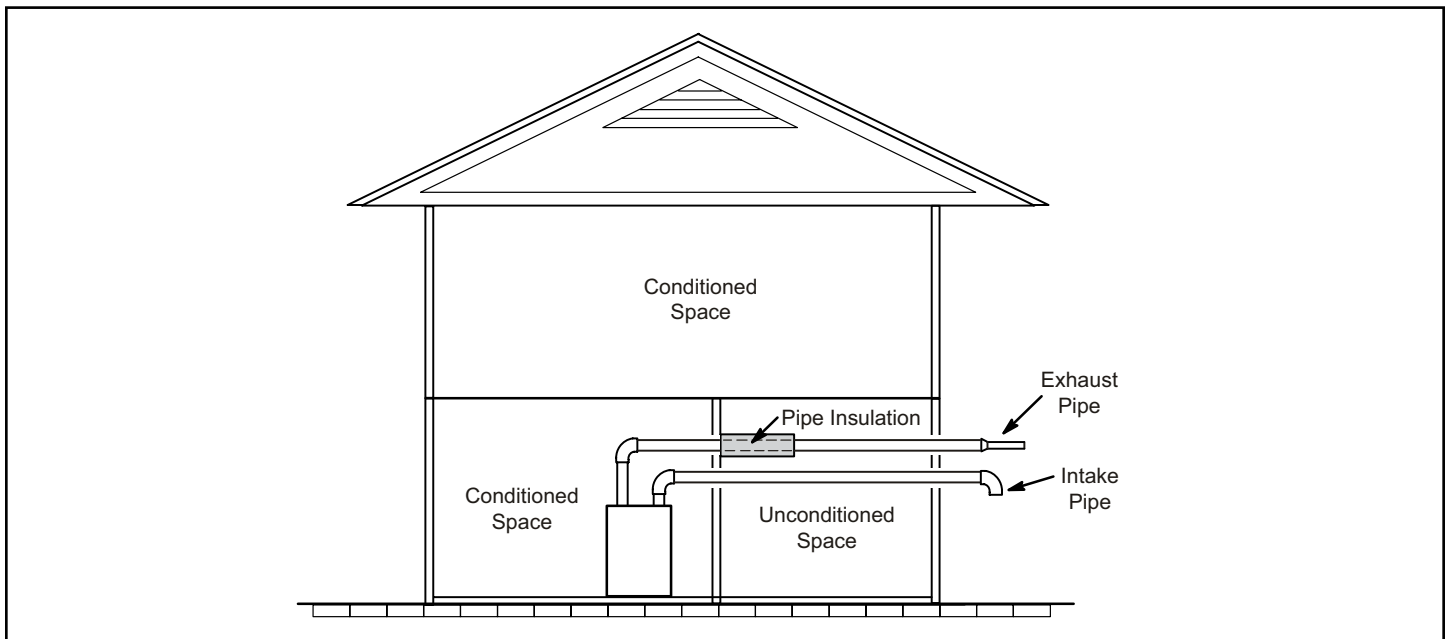
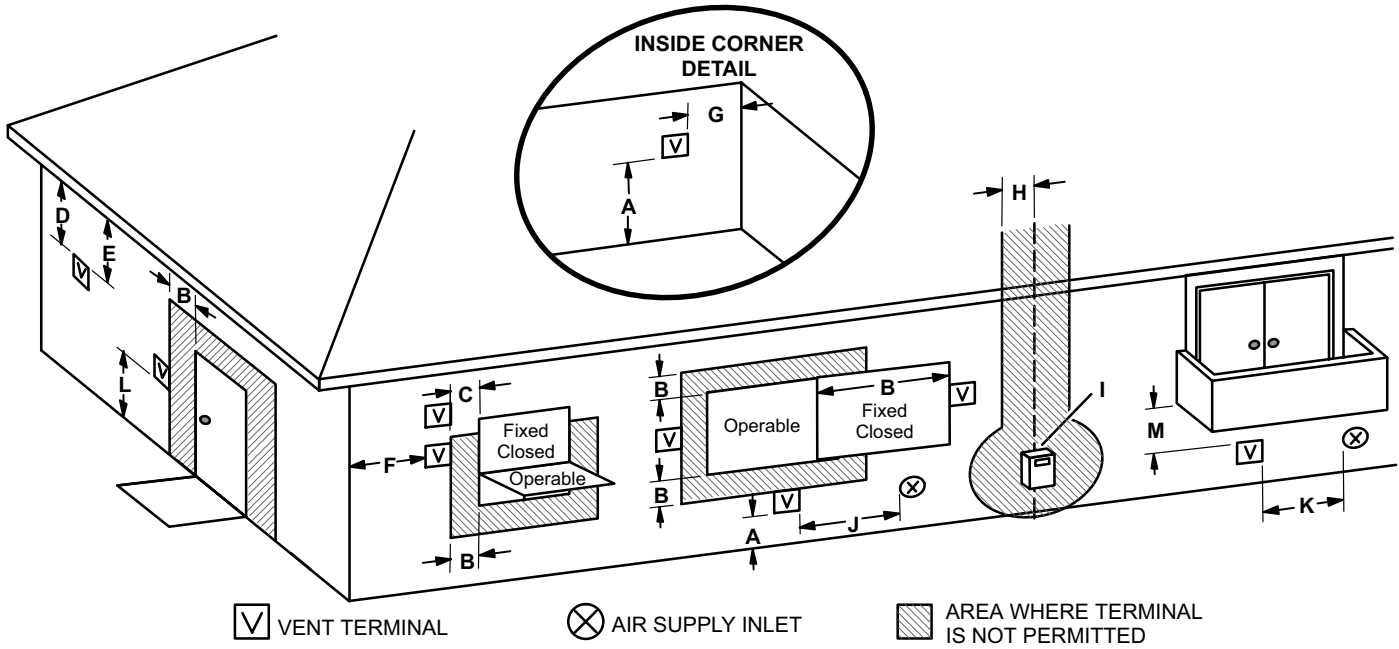


Figure 22. Insulating Exhaust Pipe in an Unconditioned Space

VENT TERMINATION CLEARANCES FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



	US Installations ¹	Canadian Installations ²	
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12"	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

¹ In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

² In accordance with the current CSA B149.1, Natural Gas and Propane Installation 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. Avoiding this location is recommended if possible.

*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions."

Figure 23.

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

NOTE: In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.

NOTE: Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See Figure 32.

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figure 24 through Figure 31 show typical terminations.

1. Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (Figure 25). You may exit the exhaust out the roof and the intake out the side of the structure (Figure 26).
2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Minimum separation is 3" (76MM) on roof terminations and 6" (152MM) on side wall terminations.

NOTE: When venting in different pressure zones, the maximum separation requirement of intake and exhaust pipe DOES NOT apply.

3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (Figure 24).
4. Exhaust piping must terminate straight out or up as shown. A reducer may be required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See Table 8.

NOTE: Care must be taken to avoid recirculation of exhaust back into intake pipe.

5. On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305MM) for 2" PVC and 20 inches (508MM) for 3" (76MM) PVC beyond the outside wall. Intake piping should be as short as possible. See Figure 32.
6. On field-supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow. See Figure 32.
7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6" from the top of the

elbow and then every 24" (610mm) as shown in Figure 32, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per Table 8. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.

8. A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in Figure 30.

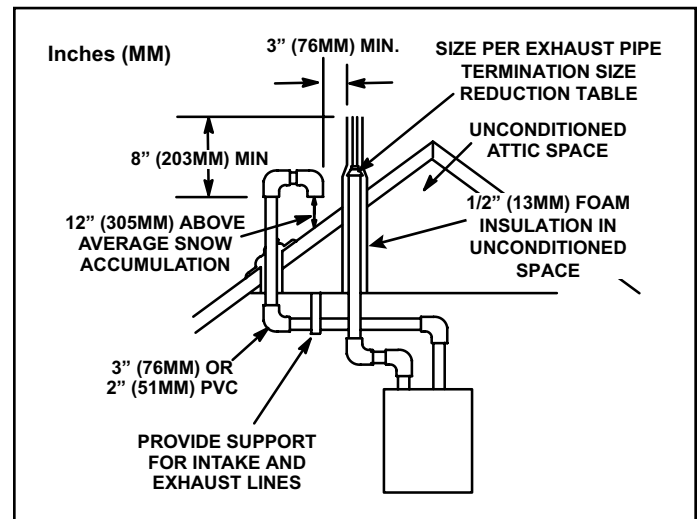


Figure 24. Direct Vent Roof Termination Kit (15F75 or 44J41)

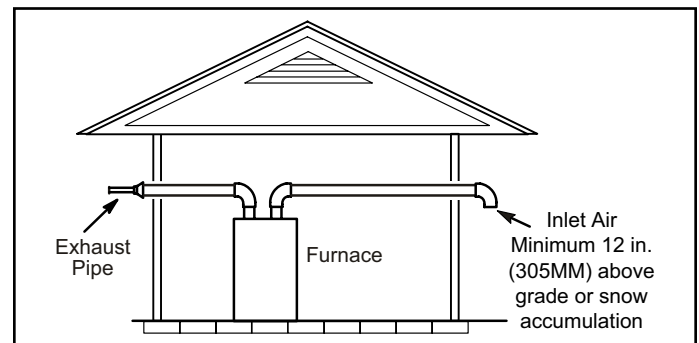


Figure 25. Exiting Exhaust and Intake Vent (no common pressure zone)

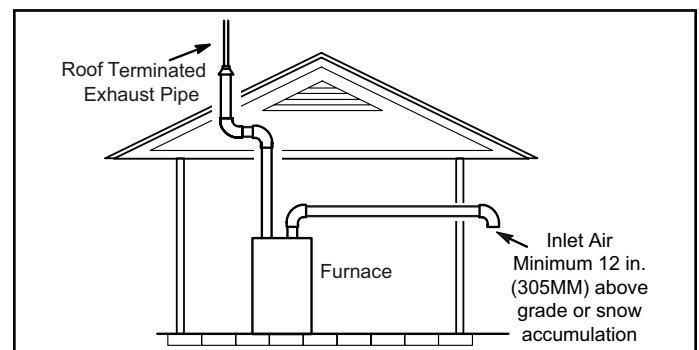


Figure 26. Exiting Exhaust and Intake Vent (no common pressure zone)

Model	Termination Pipe Size
040 and 060	1-1/2" (38 mm)
080	2" (51 mm)

* Units with the flush mount termination must use the 1-1/2" accelerator supplied with the kit

Table 8. Exhaust Pipe Termination Size Reduction

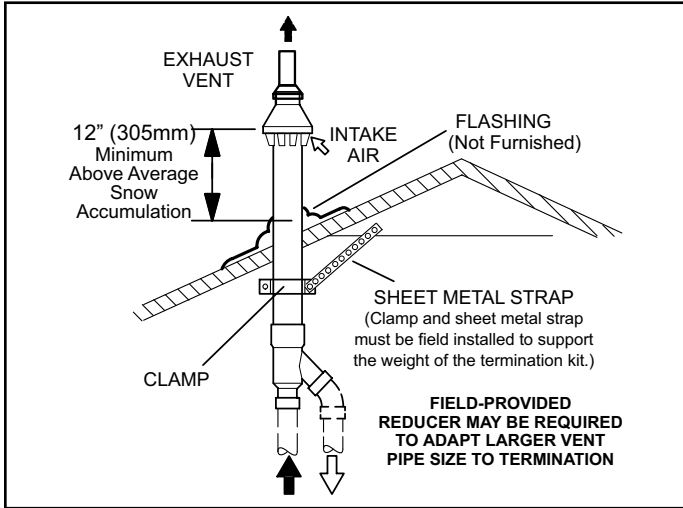


Figure 27. Direct Vent Concentric Rooftop Termination
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)

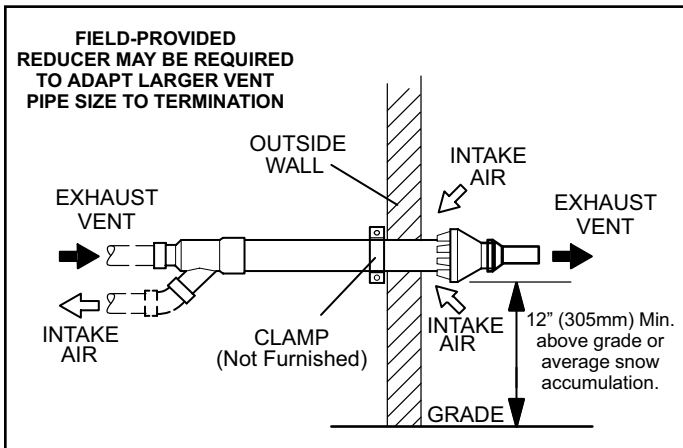


Figure 28. Direct Vent Concentric Wall Termination
71M80, 69M29 or 60L46 (US)
41W92 or 41W93 (Canada)

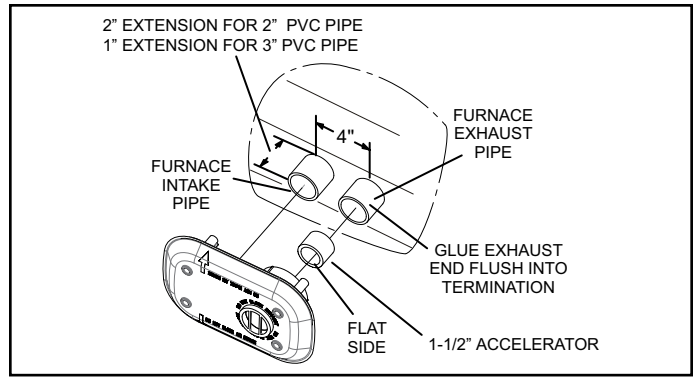


Figure 29. Flush-Mount Side Wall Termination 51W11

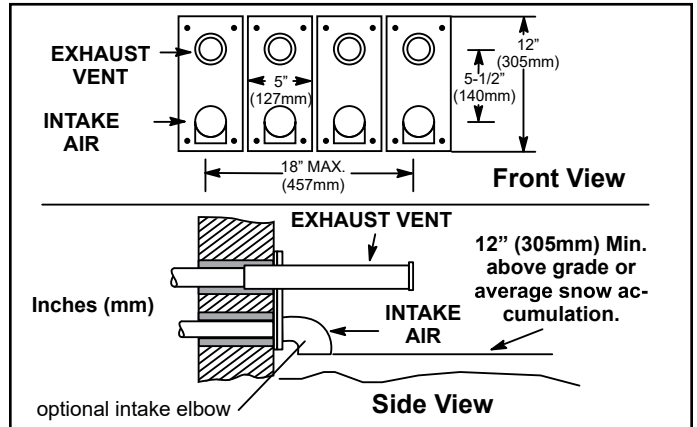
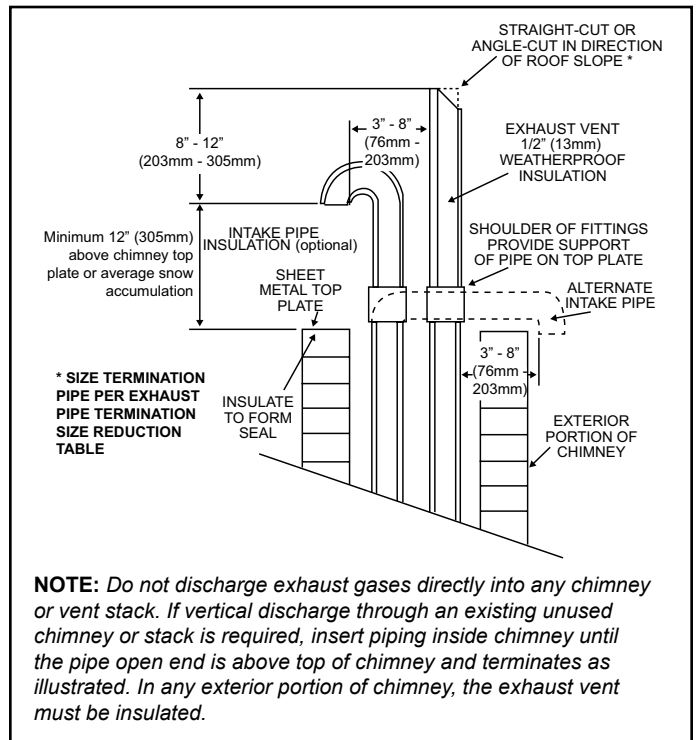


Figure 30. Optional Vent Termination for Multiple Unit Installation of Direct Vent Wall Termination

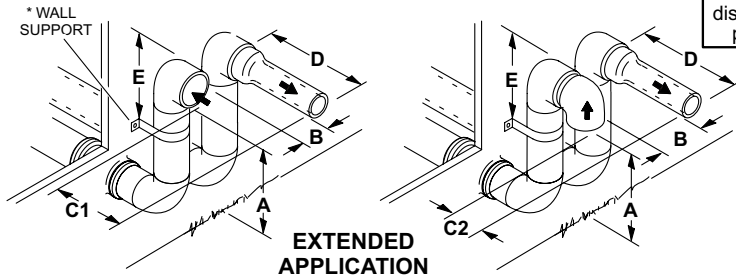
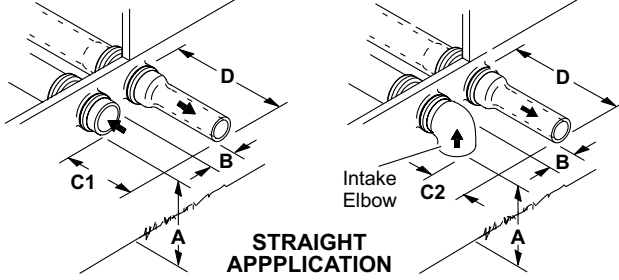


NOTE: Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminates as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.

Figure 31. Direct Vent Application Using Existing Chimney

FIELD FABRICATED WALL TERMINATION

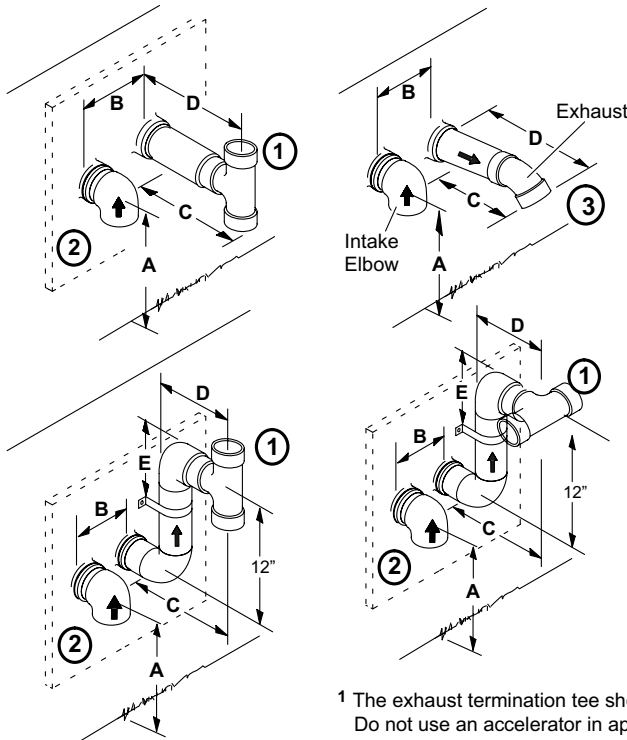
NOTE - FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION



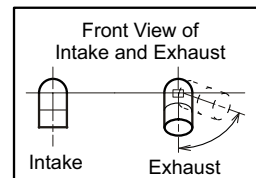
	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
A - Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
B - Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
C1 -Minimum from end of exhaust to inlet of intake	8" (203 mm)	8" (203 mm)
C2 -Minimum from end of exhaust to inlet of intake	6" (152 mm)	6" (152 mm)
D - Maximum exhaust pipe length	12" (305 mm)	20" (508 mm)
E - Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152 mm)	6" (152 mm)

* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).
NOTE - One wall support must be within 6" (152 mm) from top of each pipe (intake and exhaust) to prevent movement in any direction.

ALTERNATE TERMINATIONS (TEE & FORTY-FIVE DEGREE ELBOWS ONLY)



	2" (51MM) Vent Pipe	3" (76MM) Vent Pipe
A - Clearance above grade or average snow accumulation	12" (305 mm) Min.	12" (305 mm) Min.
B - Horizontal separation between intake and exhaust	6" (152 mm) Min. 24" (610 mm) Max.	6" (152 mm) Min. 24" (610 mm) Max.
C - Minimum from end of exhaust to inlet of intake	9" (227 mm) Min.	9" (227 mm) Min.
D - Exhaust pipe length	12" (305 mm) Min. 16" (405 mm) Max.	12" (305 mm) Min. 20" (508 mm) Max.
E - Wall support distance from top of each pipe (intake/exhaust)	6" (152 mm) Max.	6" (152 mm) Max.



- 1 The exhaust termination tee should be connected to the 2" or 3" PVC flue pipe as shown in the illustration. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.
- 2 As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.
- 3 Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

Figure 32.

Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping in upflow applications. In horizontal applications, the condensate trap must extend below the unit. An 8" service clearance is required for the condensate trap. Refer to Figure 33 and Figure 35 for condensate trap locations. Figure 41 shows trap assembly using 1/2" PVC or 3/4" PVC.

NOTE: If necessary the condensate trap may be installed up to 5' away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

1. Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
2. Use a large flat head screw driver or a 1/2" drive socket extension and remove plug (Figure 33) from the cold end header box at the appropriate location on the side of the unit. Install provided 3/4 NPT street elbow fitting into cold end header box. Use Teflon tape or appropriate pipe dope.

NOTE: Cold end header box drain plugs are factory installed. Check the unused plug for tightness to prevent leakage.

3. Install the cap over the clean out opening at the base of the trap. Secure with clamp. See Figure 41.
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in Figure 41. Route the condensate line to an open drain. Condensate line must maintain a 1/4" downward slope from the furnace to the drain.
5. Figure 36 and Figure 37 show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See Figure 38 through Figure 40.

Upflow furnace (Figure 39) - In upflow furnace applications the field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection. Any length above 2" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

Horizontal furnace (Figure 40) - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

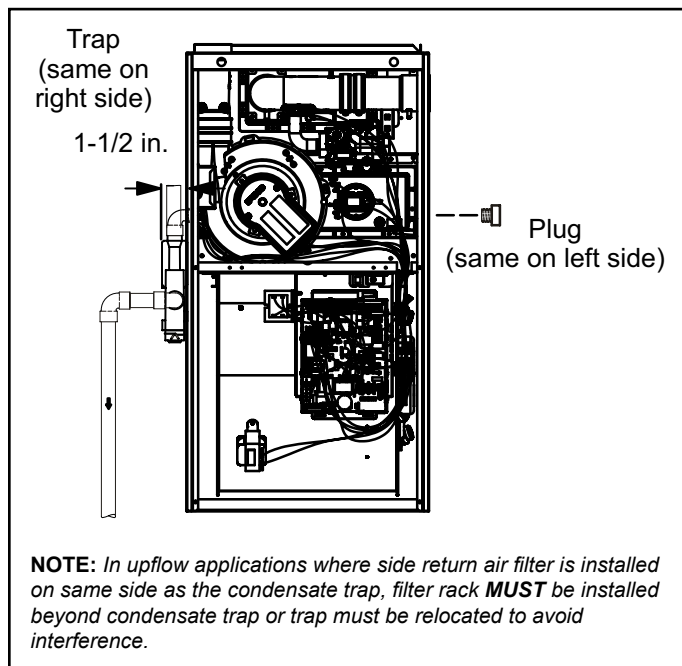


Figure 33. Condensate Trap and Plug Locations (unit shown in upflow position)

NOTE: In horizontal applications it is recommended to install a secondary drain pan underneath the unit and trap assembly.

NOTE: Appropriately sized tubing and barbed fitting may be used for condensate drain. Attach to the drain on the trap using a hose clamp. See Figure 34.

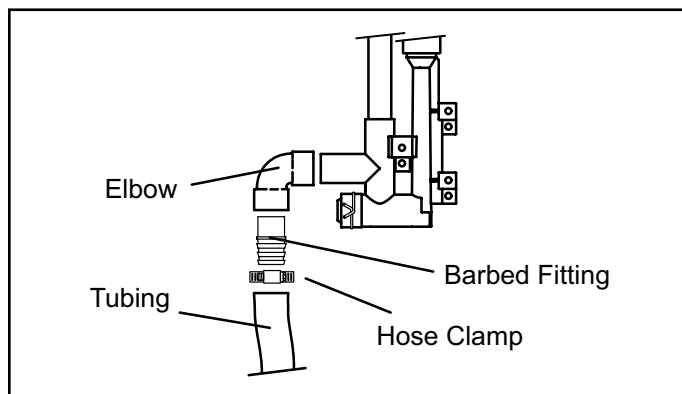


Figure 34. Field-Provided Drain Components

CAUTION

Do not use copper tubing or existing copper condensate lines for drain line.

6. If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.

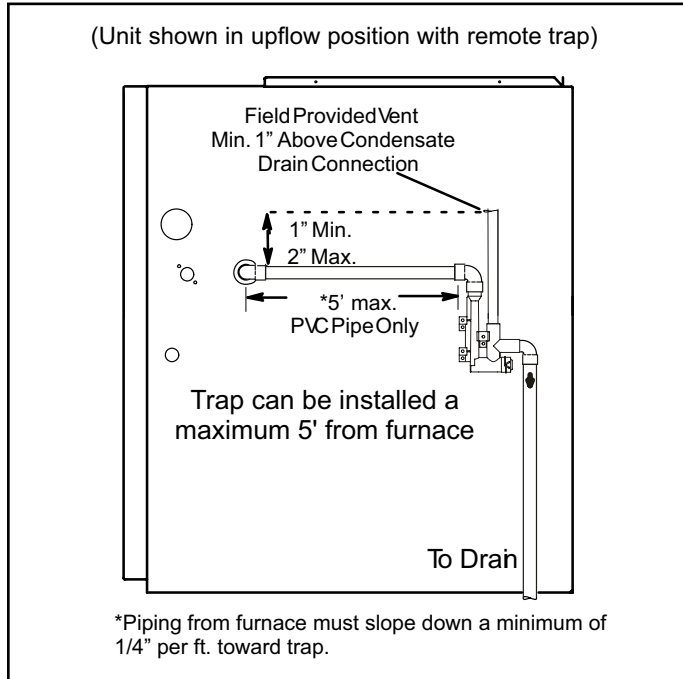


Figure 35. Condensate Trap Locations

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line. Heating cable kit is available from GEA in various lengths; 6 ft. (1.8m) - kit no. 26K68; 24 ft. (7.3m) - kit no. 26K69; and 50 ft. (15.2m) - kit no. 26K70.

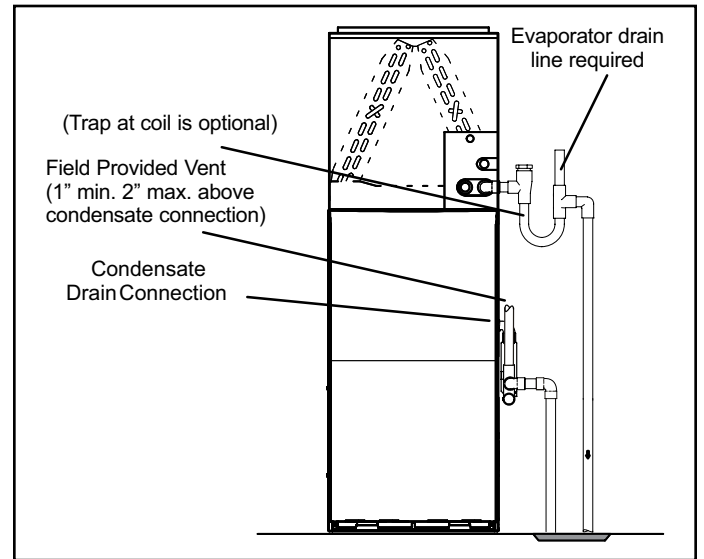


Figure 36. Furnace with Evaporator Coil Using a Separate Drain

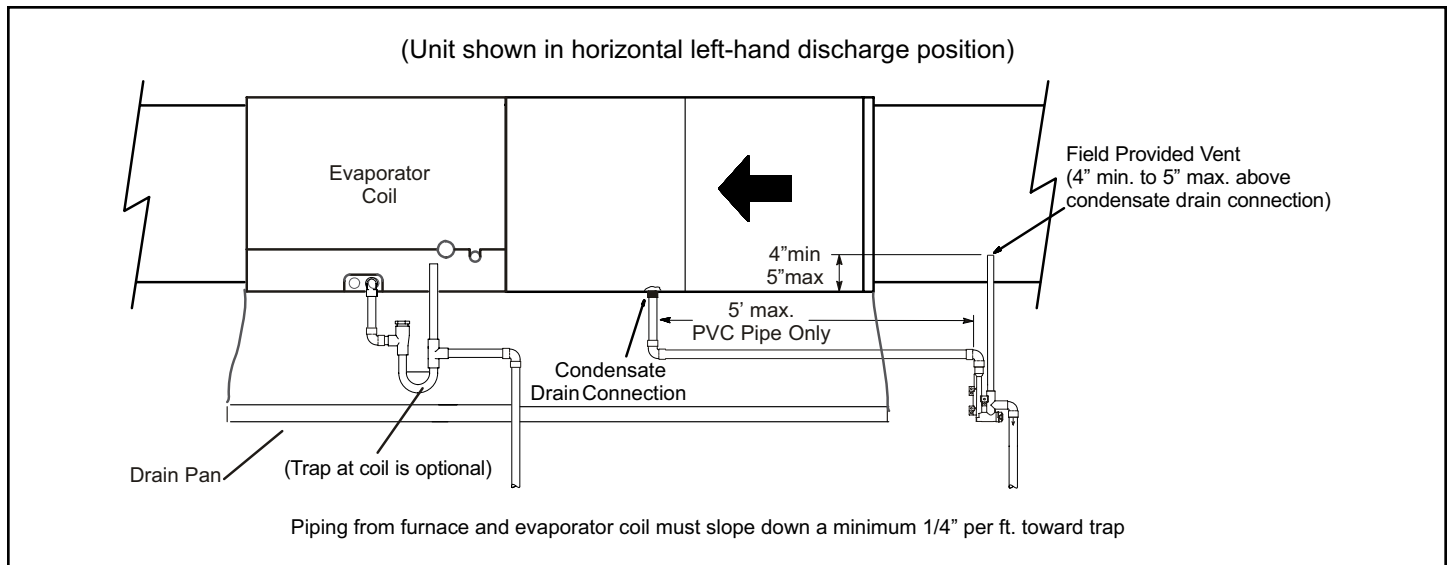


Figure 37. Furnace with Evaporator Coil Using a Separate Drain

⚠ IMPORTANT

When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.

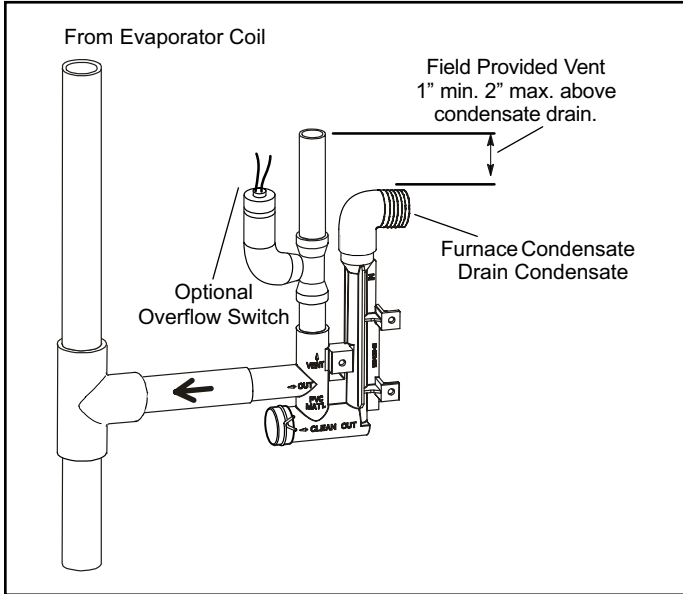


Figure 38. Condensate Trap With Optional Overflow Switch

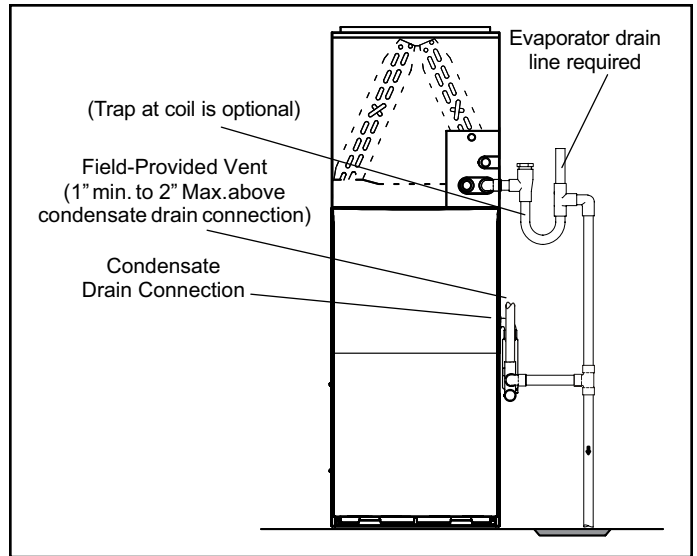


Figure 39. Furnace with Evaporator Coil Using a Common Drain

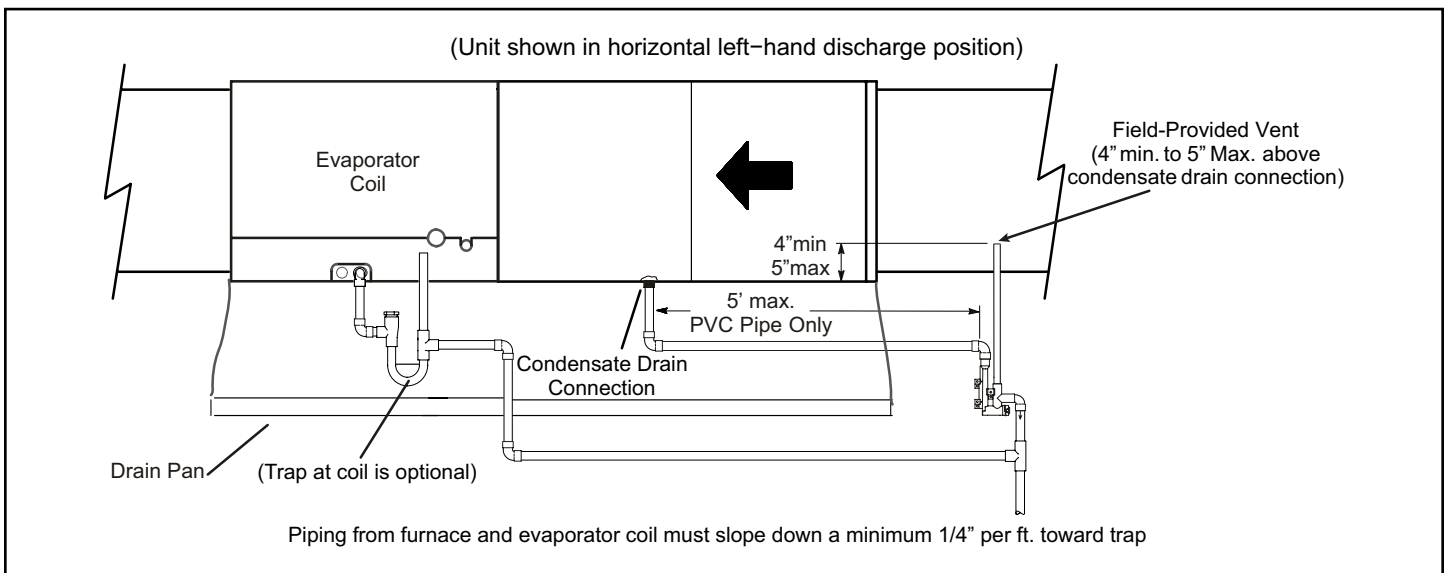
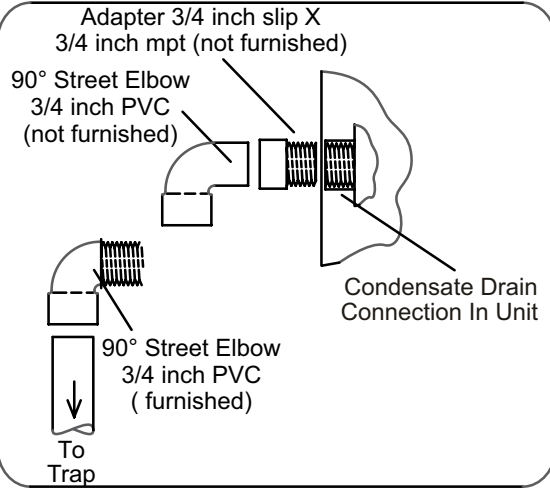
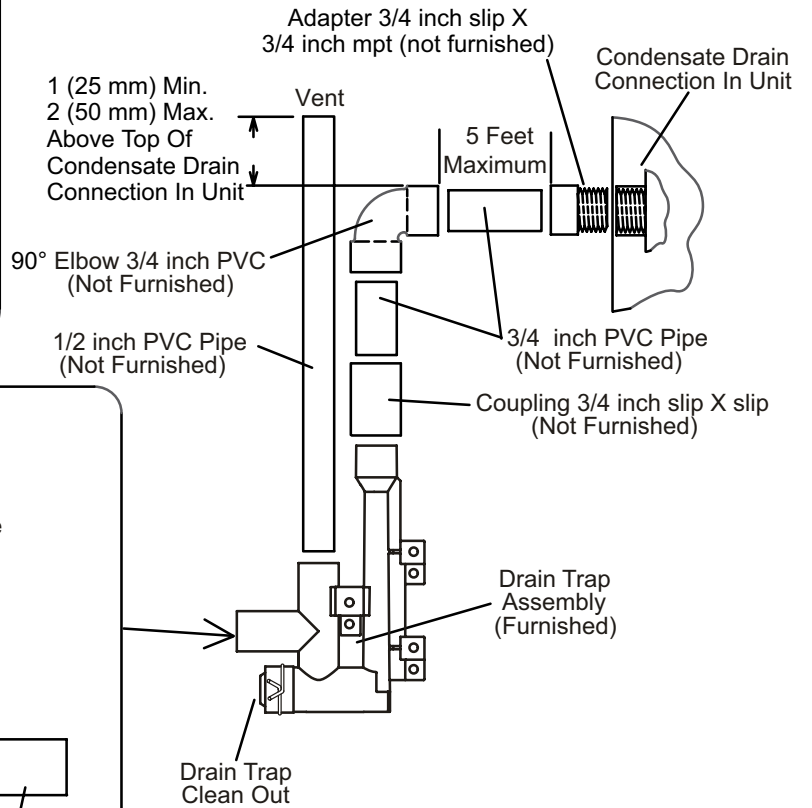
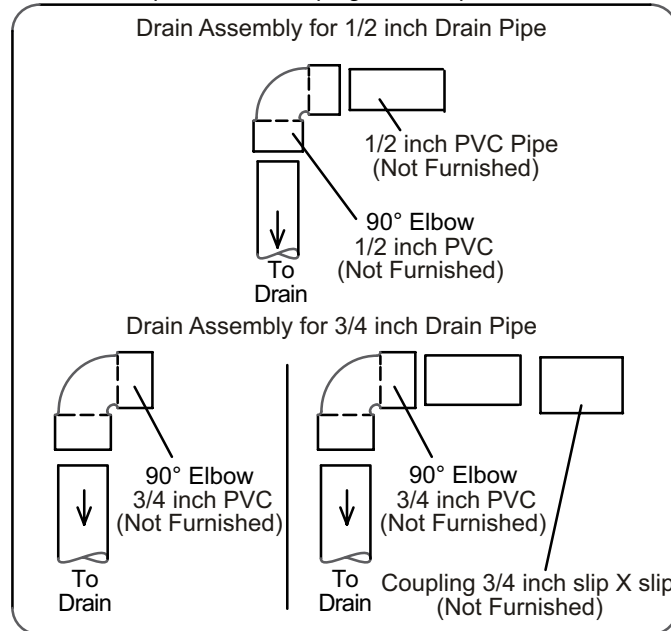


Figure 40. Furnace with Evaporator Coil Using a Common Drain

Optional Condensate Drain Connection

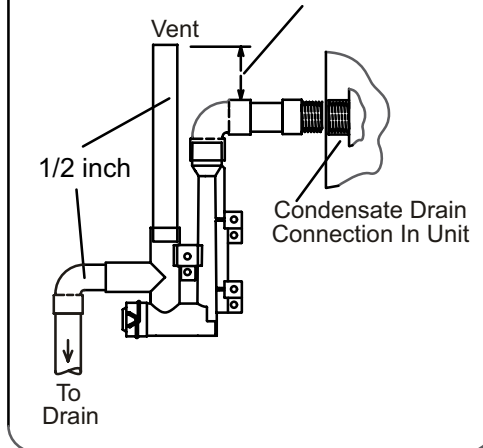


Optional Drain Piping from Trap



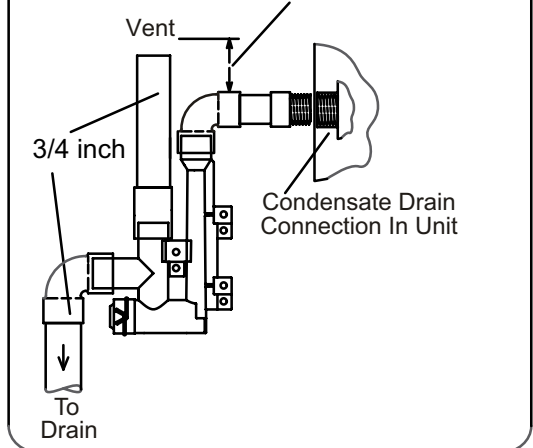
Drain Trap Assembly with 1/2 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



Drain Trap Assembly with 3/4 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



Drain Trap Assembly (Furnished)

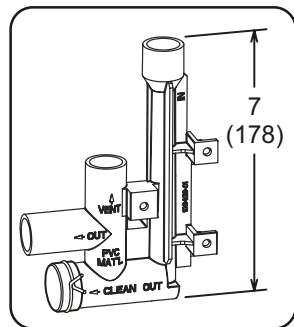


Figure 41. Trap / Drain Assembly Using 1/2" PVC or 3/4" PVC

Gas Piping

Gas supply piping should not allow more than 0.5" w.c. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet. The flexible connector can then be added between the black iron pipe and the gas supply line.

⚠ WARNING

Do not over torque (800 in-lbs) or under torque (350 in-lbs) when attaching the gas piping to the gas valve.

1. Gas piping may be routed into the unit through the right-hand side only. Supply piping enters into the gas valve from the side of the valve as shown in Figure 43. Connect the gas supply piping into the gas valve. The maximum torque is 800 in lbs and minimum torque is 350 in lbs when attaching the gas piping to the gas valve.

2. When connecting gas supply, factors such as length of run, number of fittings and furnace rating must be considered to avoid excessive pressure drop. Table 9 lists recommended pipe sizes for typical applications.

NOTE: Use two wrenches when connecting gas piping to avoid transferring torque to the manifold.

3. Gas piping must not run in or through air ducts, clothes chutes, chimneys or gas vents, dumb waiters or elevator shafts. Center gas line through piping hole. Gas line should not touch side of unit. See Figure 43 and Figure 44.

4. Piping should be sloped 1/4 inch per 15 feet (6mm per 5.6m) upward toward the gas meter from the furnace. The piping must be supported at proper intervals, every 8 to 10 feet (2.44 to 3.05m), using suitable hangers or straps. Install a drip leg in vertical pipe runs to serve as a trap for sediment or condensate.

5. A 1/8" N.P.T. plugged tap or pressure post is located on the gas valve to facilitate test gauge connection. See Figure 48.

6. In some localities, codes may require installation of a manual main shut-off valve and union (furnished by installer) external to the unit. Union must be of the ground joint type.

⚠ IMPORTANT

Compounds used on threaded joints of gas piping must be resistant to the actions of liquified petroleum gases.

Leak Check

After gas piping is completed, carefully check all field-installed piping connections for gas leaks. Use a commercially available leak detecting solution specifically manufactured for leak detection. Never use an open flame to test for gas leaks.

The furnace must be isolated from the gas supply system by closing the individual manual shut-off valve during any gas supply system at pressures greater than or equal to 1/2 psig (3.48 kPa, 14 inches w.c.). This furnace and its components are designed, manufactured and independently certified to comply with all applicable ANSI/CSA standards. A leak check of the furnace and its components is not required.

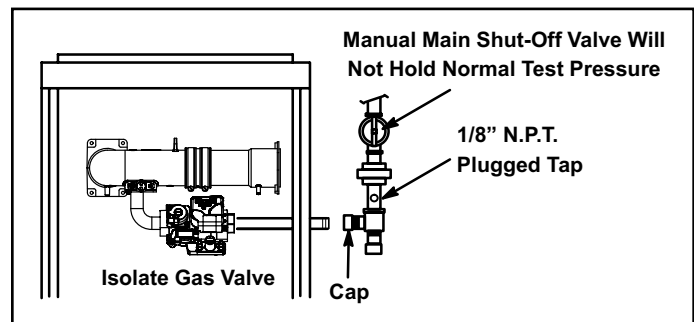


Figure 42.

⚠ IMPORTANT

When testing pressure of gas lines, gas valve must be disconnected and isolated. See Figure 42. Gas valves can be damaged if subjected to pressures greater than 1/2 psig (3.48 kPa).

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage. Never use an open flame to test for gas leaks. Check all connections using a commercially available soap solution made specifically for leak detection. Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed.

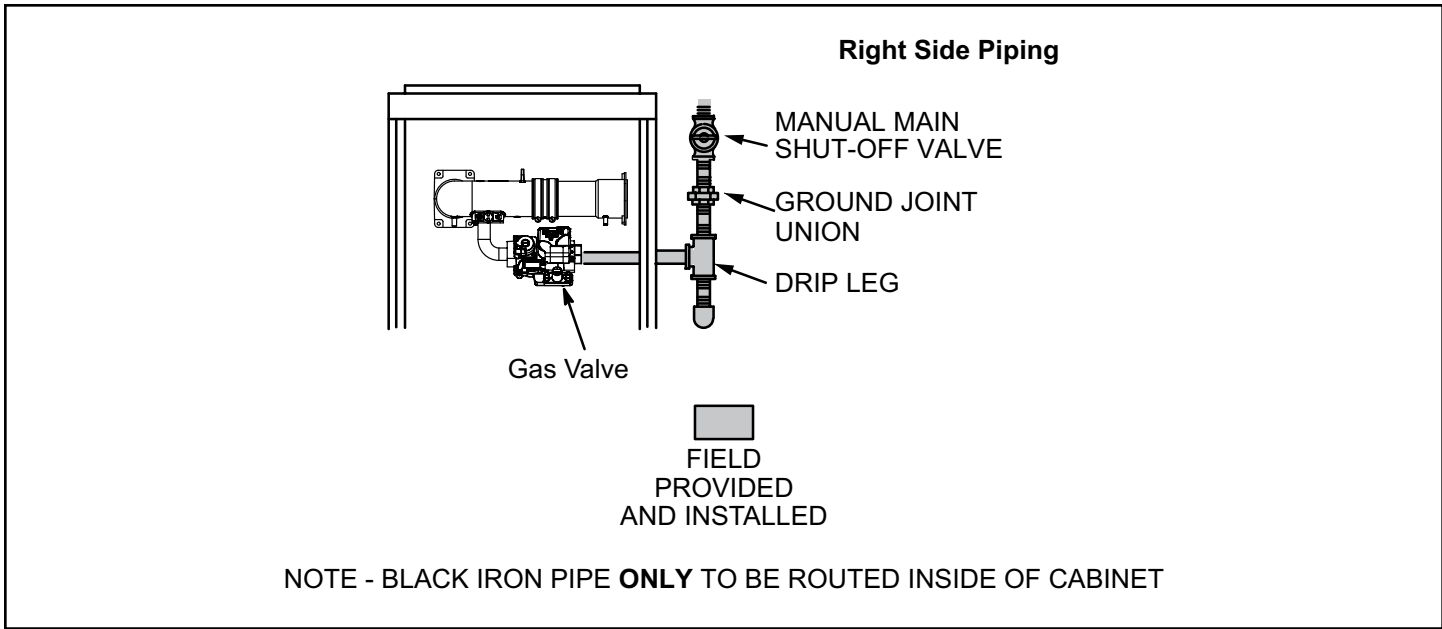


Figure 43. Possible Gas Piping Configurations - Upflow Applications

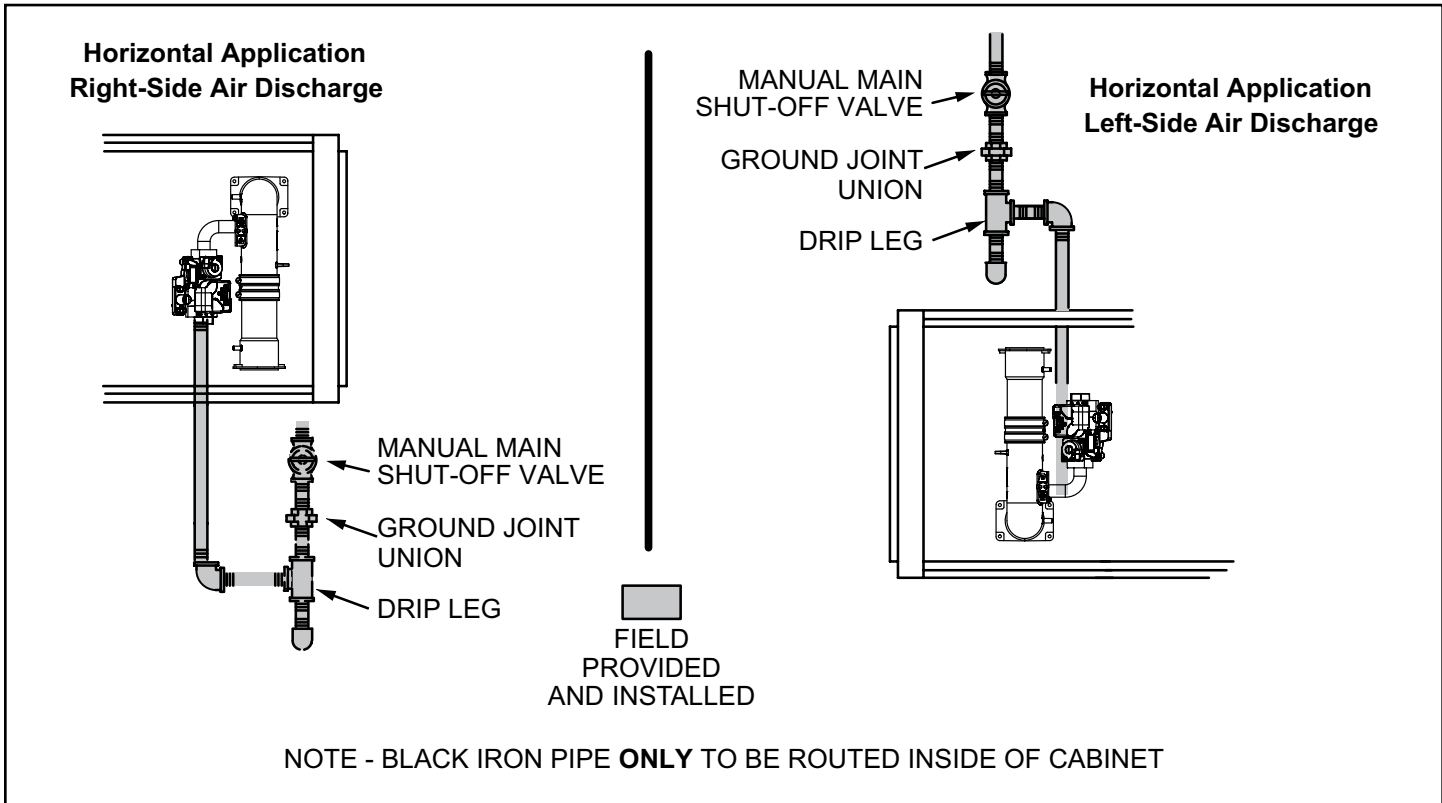


Figure 44. Possible Gas Piping Configurations - Horizontal Applications

Gas Pipe Capacity - FT ³ /HR (kL/HR)											
Nominal Iron Pipe Size - inches (mm)	Internal Diameter - inches (mm)	Length or Pipe - feet (m)									
		10 (3.048)	20 (6.096)	30 (9.144)	40 (12.192)	50 (15.240)	60 (18.288)	70 (21.336)	80 (24.384)	90 (27.432)	100 (30.480)
1/2 (12.7)	.622 (17.799)	172 (4.87)	118 (3.34)	95 (2.69)	81 (2.29)	72 (2.03)	65 (1.84)	60 (1.69)	56 (1.58)	52 (1.47)	50 (1.42)
3/4 (19.05)	.824 (20.930)	360 (10.19)	247 (7.00)	199 (5.63)	170 (4.81)	151 (4.28)	138 (3.87)	126 (3.56)	117 (3.31)	110 (3.11)	104 (2.94)
1 (25.4)	1.049 (26.645)	678 (19.19)	466 (13.19)	374 (10.59)	320 (9.06)	284 (8.04)	257 (7.27)	237 (6.71)	220 (6.23)	207 (5.86)	195 (5.52)
1-1/4 (31.75)	1.380 (35.052)	1350 (38.22)	957 (27.09)	768 (22.25)	657 (18.60)	583 (16.50)	528 (14.95)	486 (13.76)	452 (12.79)	424 (12.00)	400 (11.33)
1-1/2 (38.1)	1.610 (40.894)	2090 (59.18)	1430 (40.49)	1150 (32.56)	985 (27.89)	873 (24.72)	791 (22.39)	728 (20.61)	677 (19.17)	635 (17.98)	600 (17.00)
2 (50.8)	2.067 (52.502)	4020 (113.83)	2760 (78.15)	2200 (62.30)	1900 (53.80)	1680 (47.57)	1520 (43.04)	1400 (39.64)	1300 (36.81)	1220 (34.55)	1160 (32.84)
2-1/2 (63.5)	2.469 (67.713)	6400 (181.22)	4400 (124.59)	3530 (99.95)	3020 (85.51)	2680 (75.88)	2480 (70.22)	2230 (63.14)	2080 (58.89)	1950 (55.22)	1840 (52.10)
3 (76.2)	3.068 (77.927)	11300 (319.98)	7780 (220.30)	6250 (176.98)	5350 (151.49)	4740 (134.22)	4290 (121.47)	3950 (111.85)	3670 (103.92)	3450 (97.69)	3260 (92.31)

NOTE: Capacity given in cubic feet of gas per hour (kilo liters of gas per hour) and based on 0.60 specific gravity gas.


Table 9.

Electrical

ELECTROSTATIC DISCHARGE (ESD)


Precautions and Procedures

CAUTION



Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

WARNING



Electric Shock Hazard. Can cause injury or death. Unit must be properly grounded in accordance with national and local codes.

The unit is equipped with a field make-up box on the left hand side of the cabinet. The make-up box may be moved to the right side of the furnace to facilitate installation. If

the make-up box is moved to the right side, clip the wire ties that bundle the wires together. The excess wire must be pulled into the blower compartment. Secure the excess wire to the existing harness to protect it from damage.

WARNING

Fire Hazard. Use of aluminum wire with this product may result in a fire, causing property damage, severe injury or death. Use copper wire only with this product.

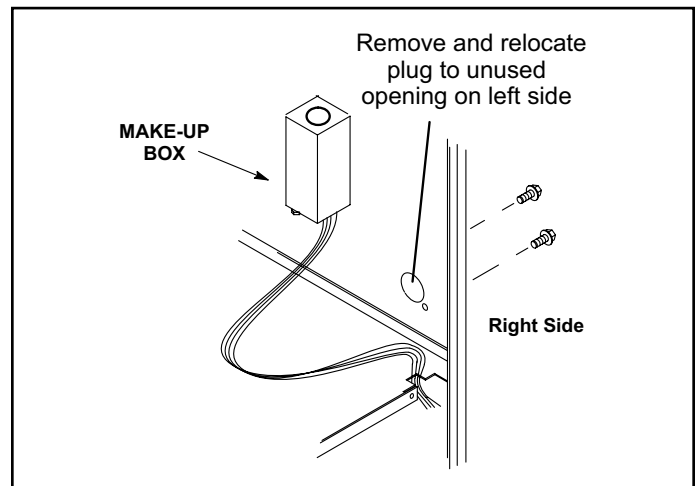


Figure 45. Interior Make-Up Box Installation

Refer to Figure 46 for unit schematic and field wiring. Table 11 show DIP switch and on-board link settings for 24V thermostat applications.

The power supply wiring must meet Class I restrictions. Protected by either a fuse or circuit breaker, select circuit protection and wire size according to unit nameplate.

⚠ CAUTION

Failure to use properly sized wiring and circuit breaker may result in property damage. Size wiring and circuit breaker(s) per Product Specifications and unit rating plate.

NOTE: Unit nameplate states maximum current draw. Maximum over-current protection allowed is shown in Table 10.

Model	Maximum Over Current Protection (Amps)
040*3B, 060*3B, 080*4C	15
080*5C	20

Table 10.

Holes are on both sides of the furnace cabinet to facilitate wiring.

Install a separate (properly sized) disconnect switch near the furnace so that power can be turned off for servicing.

Before connecting the thermostat or the power wiring, check to make sure the wires will be long enough for servicing at a later date. Remove the blower access panel to check the length of the wire.

Complete the wiring connections to the equipment. Use the provided unit wiring diagram and the field wiring diagrams shown in Table 11 and Figure 46. Use 18-gauge wire or larger that is suitable for Class II rating for thermostat connections.

Electrically ground the unit according to local codes or, in the absence of local codes, according to the current National Electric Code (ANSI/NFPA No. 70). A green ground wire is provided in the field make-up box.

NOTE: The NF97XV furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

One line voltage “ACC” 1/4” spade terminal is provided on the furnace integrated control. Any electronic air cleaner or other accessory rated up to one amp can be connected to this terminal with the neutral leg of the circuit being connected to the one of the provided neutral terminals. See Figure 47 for control configuration. This terminal is energized when the indoor blower is operating.

An unpowered, normally open (dry) set of contacts with a 1/4” spade terminal “HUM” are provided for humidifier connections and may be connected to 24V or 120V. Any humidifier rated up to one amp can be connected to these terminals. In 120V humidifier applications the neutral leg of the circuit can be connected to one of the provided neutral terminals. This terminal is energized in the heating mode.

Install the room thermostat according to the instructions provided with the thermostat. See Table 11 for field wiring connections in varying applications. If the furnace is being matched with a heat pump, refer to the instruction packaged with the dual fuel thermostat.

Thermostat Selection

⚠ CAUTION

Field wiring is illustrated in diagrams, which begin on Page 37.

The NF97XV is designed to operate in a SINGLE-STAGE mode or TWO-STAGE mode using a conventional thermostat.

For optimal performance, GEA recommends use of a conventional high quality electronic digital thermostat or any other with adjustable settings for 1st stage / 2nd stage on / off differentials and adjustable stage timers.

Indoor Blower Speeds

- When the thermostat is set to “FAN ON,” the indoor blower will run continuously at a field selectable percentage of the second-stage cooling speed when there is no cooling or heating demand. The factory default setting is 38% of cool speed. See Table 18 for allowable continuous circulation speeds.
- When the NF97XV is running in the heating mode, the indoor blower will run on the heating speed designated by the positions of DIP switches 11, 12 and 13. See Table 17 for allowable heating speeds.
- When there is a cooling demand, the indoor blower will run on the cooling speed designated by the positions of DIP switches 5 and 6. First stage cooling will run at 70% cool speed.

Generator Use - Voltage Requirements

The following requirements must be kept in mind when specifying a generator for use with this equipment:

- The furnace requires 120 volts (Range: 102 volts to 132 volts)
- The furnace operates at 60 Hz + 5% (Range: 57 Hz to 63 Hz)
- The furnace integrated control requires both correct polarity and proper ground. Both polarity and proper

grounding should be checked before attempting to operate the furnace on either permanent or temporary power

- Generator should have a wave form distortion of less than 5% THD (total harmonic distortion)

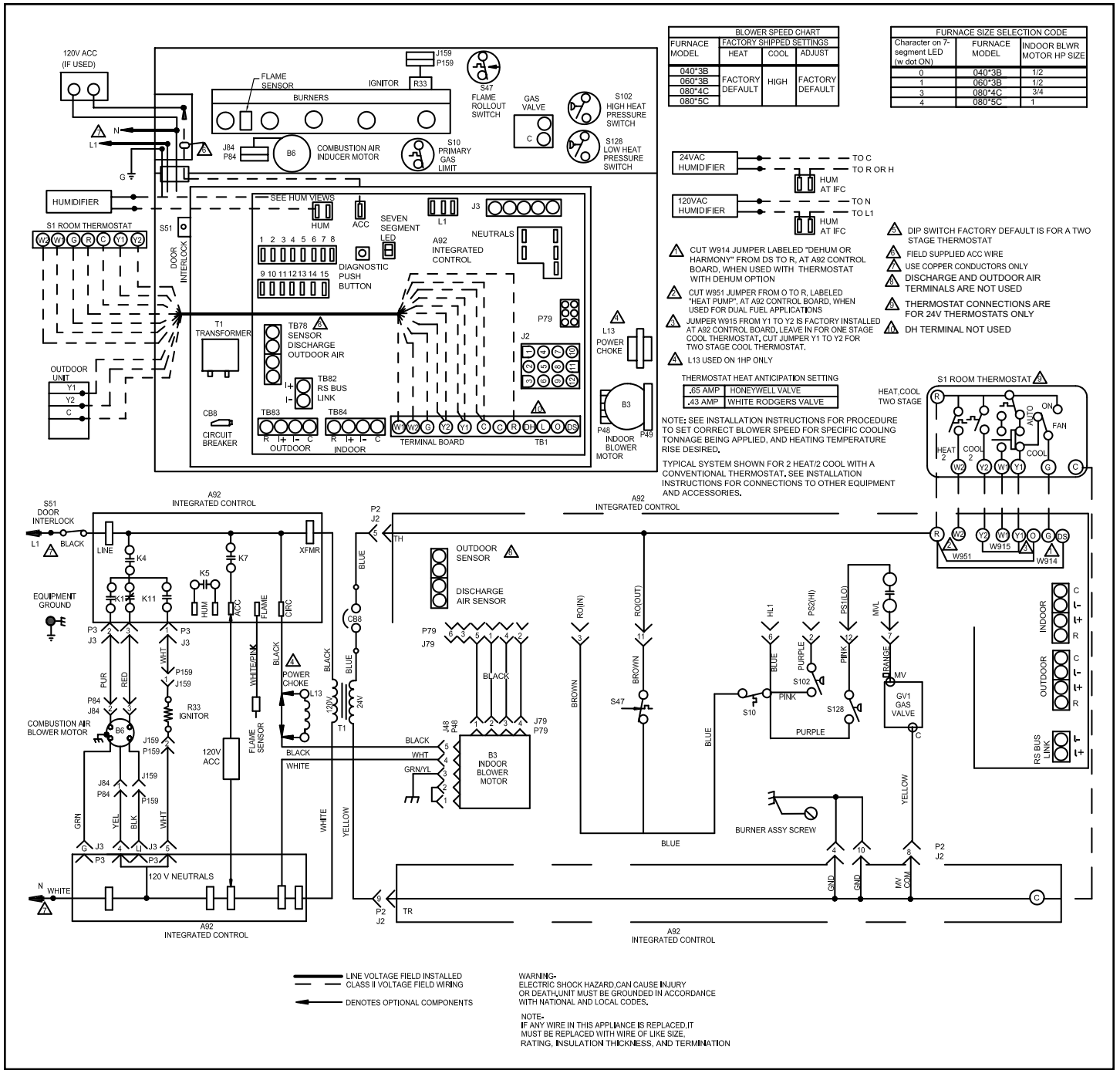
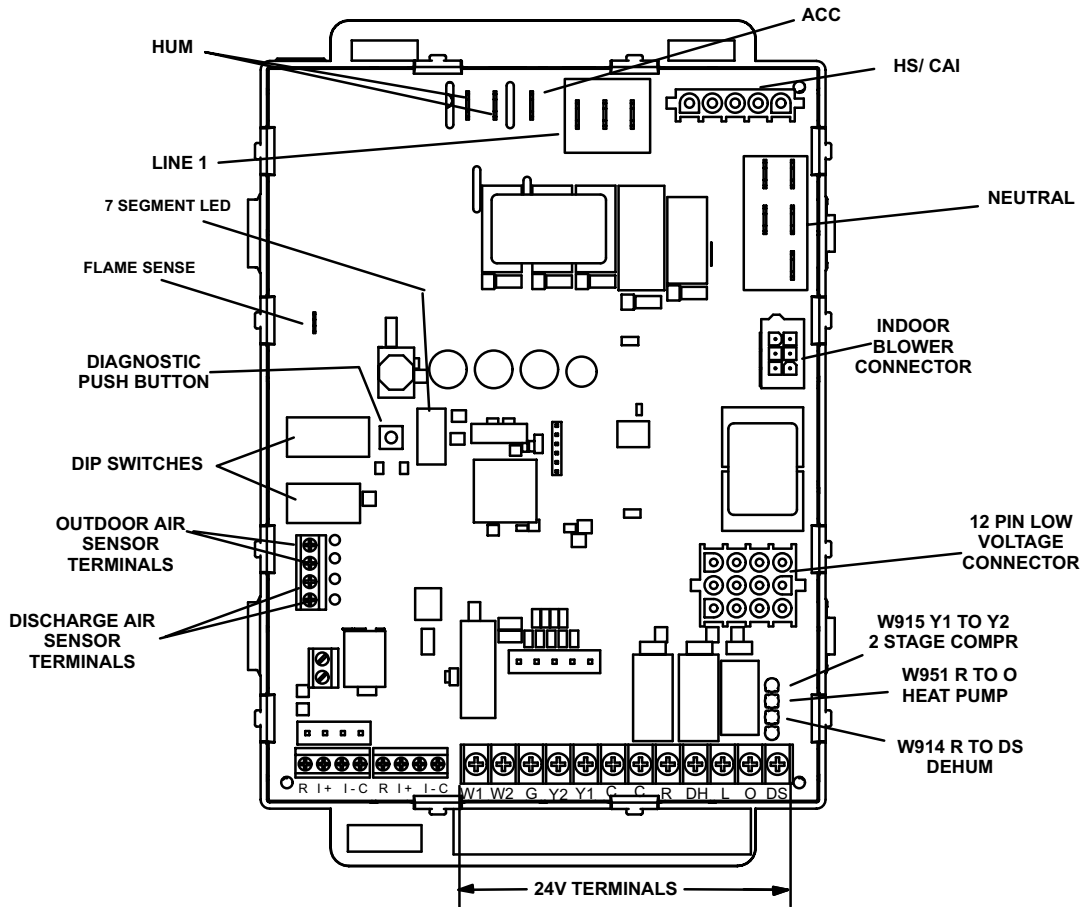


Figure 46. Wiring Diagram



RS-BUS LINK (TB82, not used)

I+ = DATA HIGH CONNECTION
I- = DATA LOW CONNECTION

RS-BUS OUTDOOR (TB83, not used)

R = 24VAC
I+ = DATA HIGH CONNECTION
I- = DATA LOW CONNECTION
C = 24VAC COMMON

RS-BUS INDOOR (TB84, not used)

R = 24VAC
I+ = DATA HIGH CONNECTION
I- = DATA LOW CONNECTION
C = 24VAC COMMON

1/4" QUICK CONNECT TERMINALS

HUM = UNPOWERED NORMALLY OPEN (DRY) CONTACTS
XMFR = 120 VAC OUTPUT TO TRANSFORMER
LI = 120 VAC INPUT TO CONTROL
ACC = 120 VAC OUTPUT TO OPTIONAL ACCESSORY
NEUTRALS = 120 VAC NEUTRAL

THERMOSTAT CONNECTIONS (TB1)

DS = DEHUMIDIFICATION SIGNAL
W2 = HEAT DEMAND FROM 2ND STAGE THERMOSTAT
W1 = HEAT DEMAND FROM 1ST STAGE THERMOSTAT
R = CLASS 2 VOLTAGE TO THERMOSTAT
G = MANUAL FAN FROM THERMOSTAT
C = THERMOSTAT SIGNAL GROUND CONNECTED TO TRANSFORMER GRD (TR) & CHASSIS GROUND (GRD)
Y1 = THERMOSTAT 1ST STAGE COOL SIGNAL
Y2 = THERMOSTAT 2ND STAGE COOL SIGNAL
O = THERMOSTAT SIGNAL TO HEAT PUMP REVERSING VALVE

Figure 47. Integrated Control

Thermostat	DIP Switch Settings and On-Board Links			Wiring Connections	
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification		W951 (Oto R) Heat Pumps
1 Heat / 1 Cool NOTE: Use DIP switch 3 to set second-stage heat ON delay. OFF - 7 minutes ON - 12 minutes	ON	Intact	Intact	Intact	<p>*Not required on all units $\text{\textcircled{O}}$</p>
1 Heat / 2 Cool NOTE: Use DIP switch 3 to set second-stage heat ON delay. OFF - 7 minutes ON - 12 minutes	ON	Cut	Intact	Intact	<p>*Not required on all units $\text{\textcircled{O}}$</p>
1 Heat / 2 Cool with t'stat with dehumidification mode NOTE: Use DIP switch 3 to set second-stage heat ON delay. OFF - 7 minutes ON - 12 minutes	ON	Cut	Cut	Intact	<p>*Not required on all units $\text{\textcircled{O}}$</p>

NOTE - Do NOT make a wire connection between the room thermostat L terminal and the L terminal of the integrated control.

Table 11. Field Wiring

Thermostat	DIP Switch Settings and On-Board Links			Wiring Connections	
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification		W951 (Oto R) Heat Pumps
2 Heat / 2 Cool	OFF	Cut	Intact	Intact	<p>T'STAT FURNACE TERM. STRIP OUTDOOR UNIT</p> <p>DS DS</p> <p>H H</p> <p>W2 --- W2</p> <p>W1 --- W1</p> <p>R --- R --- * --- R</p> <p>G --- G</p> <p>C --- C --- C</p> <p>Y2 --- Y2 --- Y2</p> <p>Y1 --- Y1 --- Y1</p> <p><i>*Not required on all units</i> O</p>
2 Heat / 2 Cool with t'stat with dehumidification mode	OFF	Cut	Cut	Intact	<p>T'STAT FURNACE TERM. STRIP OUTDOOR UNIT</p> <p>DS --- DS</p> <p>H H</p> <p>W2 --- W2</p> <p>W1 --- W1</p> <p>R --- R --- * --- R</p> <p>G --- G</p> <p>C --- C --- C</p> <p>Y2 --- Y2 --- Y2</p> <p>Y1 --- Y1 --- Y1</p> <p><i>*Not required on all units</i> O</p>
2 Heat / 1 Cool	OFF	Intact	Intact	Intact	<p>T'STAT FURNACE TERM. STRIP OUTDOOR UNIT</p> <p>DS DS</p> <p>H H</p> <p>W2 --- W2</p> <p>W1 --- W1</p> <p>R --- R --- * --- R</p> <p>G --- G</p> <p>C --- C --- C</p> <p>Y2</p> <p>Y --- Y1 --- Y1</p> <p><i>*Not required on all units</i> O</p>

NOTE - Do NOT make a wire connection between the room thermostat L terminal and the L terminal of the integrated control.

Table 11. Field Wiring

Thermostat	DIP Switch Settings and On-Board Links			Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification	
Dual Fuel Single-Stage Heat Pump Thermostat w/dual fuel capabilities Capable of 2-stage gas heat control	OFF	Intact	Intact	
Dual Fuel Two-Stage Heat Pump Thermostat w/dual fuel capabilities Capable of 2-stage gas heat control	OFF	Cut	Intact	

NOTE - Do NOT make a wire connection between the room thermostat L terminal and the L terminal of the integrated control.

Table 11. Field Wiring

Thermostat	DIP Switch Settings and On-Board Links			Wiring Connections	
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification		W951 (Oto R) Heat Pumps
Dual Fuel Single-Stage Heat Pump Thermostat w/dual fuel capabilities Capable of 2-stage gas heat control with dehumidification mode	OFF	Intact	Cut	Cut	
Dual Fuel Two-Stage Heat Pump Thermostat w/dual fuel capabilities Capable of 2-stage gas heat control with dehumidification mode	OFF	Cut	Cut	Cut	

NOTE - Do NOT make a wire connection between the room thermostat L terminal and the L terminal of the integrated control.

Table 11. Field Wiring

Integrated Control DIP Switch Settings - Conventional Thermostat

NF97XV units are equipped with a two-stage, variable speed integrated control. This control manages ignition timing, heating mode fan off delays and indoor blower speeds based on selections made using the control dip switches and jumpers. The control includes an internal soft lockout feature which automatically resets the ignition control when it has been locked out. After one hour of continuous thermostat demand for heat, the soft lockout feature will break and remake thermostat demand to the furnace and automatically reset the control to relight the furnace.

Heating Operation DIP Switch Settings

Switch 1 -- Thermostat Selection -- This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. The DIP switch is factory-positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the DIP switch must be repositioned.

- a. Select "OFF" for two-stage heating operation controlled by a two-stage heating thermostat (factory setting);
- b. Select "ON" for two-stage heating operation controlled by a single-stage heating thermostat. This setting provides a timed delay before second-stage heat is initiated.

Switch 2 -- Second Stage Delay (Used with Single-Stage Thermostat Only) -- This switch is used to determine the second stage on delay when a single-stage thermostat is being used. The switch is factory-set in the OFF position, which provides a 7-minute delay before second-stage heat is initiated. If the switch is toggled to the ON position, it will provide a 12-minute delay before second-stage heat is initiated. This switch is only activated when the thermostat selector jumper is positioned for single-stage thermostat use.

Switches 3 and 4 -- Blower-Off Delay -- The blower-on delay of 30 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 3 and 4 on the integrated control. The unit is shipped from the factory with a blower-off delay of 90 seconds. The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. Table 12 provides the blower off timings that will result from different switch settings.

Blower Off Delay (Seconds)	Switch 3	Switch 4
60	On	Off
90 (Factory)	Off	Off
120	Off	On
180	On	On

Table 12. Blower Off Delay Switch Settings

Indoor Blower Operation DIP Switch Settings

Switches 5 and 6 -- Cooling Mode Blower Speed -- The unit is shipped from the factory with the dip switches positioned for high speed (4) indoor blower motor operation during the cooling mode. Table 13 provides the cooling mode blower speeds that will result from different switch settings. Switches 5 and 6 set the blower cfm for second-stage cool. The integrated control automatically ramps down to 70% of the second-stage cfm for first-stage cfm. Refer to tables for corresponding cfm values. See Product Specifications for more detailed blower cfm tables.

Speed	Switch 5	Switch 6
Low	On	On
Medium Low	Off	On
Medium High	On	Off
High (Factory)	Off	Off

Table 13. Cooling Mode Blower Speeds

Switches 7 and 8 -- Cooling Blower Speed Adjustment -- The unit is shipped from the factory with the dip switches positioned for NORMAL (no) adjustment. The dip switches may be positioned to adjust the blower speed by +10% or -10% to better suit the application. Table 14 provides blower speed adjustments that will result from different switch settings. Refer to tables for corresponding cfm values. See Product Specifications for more detailed blower cfm tables.

Adjustment	Switch 7	Switch 8
+10% (approx.)	On	Off
Factory Default	Off	Off
-10% (approx.)	Off	On

Table 14. Cooling Blower Speed Adjustment

Switches 9 and 10 -- Cooling Mode Blower Speed Ramping -- Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on dehumidification performance. Table 15 provides the cooling mode blower speed ramping options that will result from different switch settings.

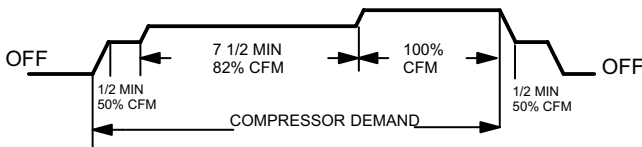
NOTE: The off portion of the selected ramp profile also applies during heat pump operation in dual fuel applications.

Ramping Option	Switch 9	Switch 10
A (Factory)	Off	Off
B	Off	On
C	On	Off
D	On	On

Table 15. Cooling Mode Blower Speed Ramping

Ramping Option A (Factory Selection)

- Motor runs at 50% for 30 seconds.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 50% for 30 seconds then ramps down to stop.



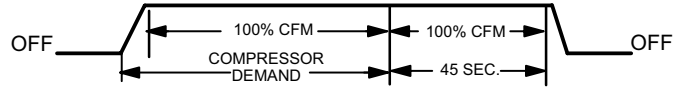
Ramping Option B

- Motor runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



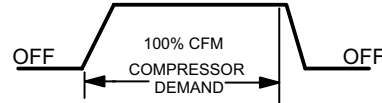
Ramping Option C

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 100% for 45 seconds then ramps down to stop.



Ramping Option D

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



Switches 11, 12 and 13 -- Heating Mode Blower Speed

-- The switches are factory set to the OFF position which provides factory default heat speed. Refer to Table 16 for switches 11, 12 and 13 that provided the corresponding increases or decrease to both high and low heat demand. See Table 17 for allowable heating speeds.

Heat Speed	Switch 11	Switch 12	Switch 13
Increase 24%	On	On	On
Increase 18%	On	On	Off
Increase 12%	On	Off	On
Increase 6%	On	Off	Off
Factory Default	Off	Off	Off
Decrease 6%	Off	Off	On
Decrease 12%	Off	On	Off
Decrease 18%	Off	On	On

Table 16. Heating Mode Blower Speeds

Blower Performance

NF97X040V3B BLOWER PERFORMANCE (less filter)

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
¹ Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1151				1153			
+18%	1101				1099			
+12%	816				1041			
+6%	771				999			
Factory Default	704				944			
-6%	651				887			
-12%	578				826			
-18%	542				757			
COOLING								
¹ Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	² High	Low	Medium-Low	Medium-High	² High
+	549	732	862	970	907	1072	1233	1373
Factory Default	521	637	760	873	830	975	1117	1268
-	441	560	684	784	736	574	1014	1142

NF97X060V3B BLOWER PERFORMANCE (less filter)

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
¹ Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1106				1234			
+18%	1047				1158			
+12%	989				1110			
+6%	940				1054			
Factory Default	886				999			
-6%	837				947			
-12%	780				882			
-18%	722				826			
COOLING								
¹ Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	² High	Low	Medium-Low	Medium-High	² High
+	611	739	843	949	879	1046	1212	1380
Factory Default	554	681	783	883	816	952	1107	1254
-	486	630	712	802	739	876	1006	1132

¹ Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

² Factory default setting.

NOTES - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - minimum 250 cfm.
- Zoning System Applications - Minimum blower speed is 250 cfm.

NF97X080V4C BLOWER PERFORMANCE (less filter)

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
¹ Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1499				1640			
+18%	1427				1546			
+12%	1361				1472			
+6%	1294				1399			
Factory Default	1219				1315			
-6%	1176				1242			
-12%	1090				1173			
-18%	1007				1077			
COOLING								
¹ Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	² High	Low	Medium-Low	Medium-High	² High
+	797	954	1071	1241	1102	1304	1508	1713
Factory Default	713	873	969	1147	1006	1186	1392	1588
-	623	767	880	1025	911	1068	1252	1422

NF97X080V5C BLOWER PERFORMANCE (less filter)

0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

HEATING								
¹ Heating Speed DIP Switch Settings	First Stage Heating Speed - cfm				Second Stage Heating Speed - cfm			
+24%	1477				2011			
+18%	1403				1883			
+12%	1323				1782			
+6%	1249				1697			
Factory Default	1178				1578			
-6%	1103				1477			
-12%	1033				1388			
-18%	965				1291			
COOLING								
¹ Cooling Speed DIP Switch Settings	First Stage Cooling Speed - cfm				Second Stage Cooling Speed - cfm			
	Low	Medium-Low	Medium-High	² High	Low	Medium-Low	Medium-High	² High
+	943	1,090	1277	1465	1346	1594	1814	2081
Factory Default	839	993	1156	1317	1225	1434	1644	1896
-	732	876	1035	1186	1083	1278	1490	1706

¹ Cooling and heating speeds are based on a combination of DIP switch settings on the furnace control. Refer to Installation Instructions for specific DIP Switch Settings.

² Factory default setting.

NOTES - The effect of static pressure is included in air volumes shown.

- First stage HEAT is approximately 91% of the same second stage HEAT.
- First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
- Continuous Fan Only speed is 38% of the selected second stage cooling speed - 080*4C minimum 380 cfm, 080*5C minimum 450 cfm.
- Zoning System Applications - 080C16X minimum blower speed is 380 cfm, 080*5C is 450 cfm.

Allowable Heating Speeds								
Model	-18%	-12%	-6%	Default	+6%	+12%	+18%	+24%
040*3B	Allowed	Allowed	Allowed	Factory Setting	Allowed	Allowed	Allowed	Allowed
060*3B	Allowed	Allowed	Allowed	Factory Setting	Allowed	Allowed	Allowed	Allowed
080*4C	Allowed	Allowed	Allowed	Factory Setting	Allowed	Allowed	Allowed	Not Allowed
080*5C	Allowed	Allowed	Allowed	Factory Setting	Allowed	Allowed	Allowed	Allowed

Table 17.

Allowable Circulation Speeds	
Model	38% of Second Stage Cooling
All Models	Factory Setting

Table 18.

Operating Sequence		System Demand						System Response		
System Condition	Step	Thermostat Demand				Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		Y1	O	G	W1	Status	D			
NO CALL FOR DEHUMIDIFICATION										
Normal Operation	1	On	On	On		Acceptable	24 VAC	High	100%	Compressor and indoor blower follow thermostat demand
BASIC MODE (only active on a Y1 thermostat demand)										
Normal Operation	1	On	On	On		Acceptable	24 VAC	High	100%	Thermostat energizes Y1 and de-energizes D on a call for dehumidification
Dehumidification Call	2	On	On	On		Demand	0 VAC	High	70%*	
PRECISION MODE (operates independent of a Y1 thermostat demand)										
Normal Operation	1	On	On	On		Acceptable	24 VAC	High	100%	Dehumidification mode begins when humidity is greater than set point
Dehumidification Call	2	On	On	On		Demand	0 VAC	High	70%*	
Dehumidification Call ONLY	1	On	On	On		Demand	0 VAC	High	70%*	Thermostat will try to maintain room humidity set point by allowing the room space to maintain a cooler room thermostat set point**
	Jumpers at indoor unit with a single stage outdoor unit With condensing unit - Cut W914 (R to DS) on furnace control With heat pump - Cut W914 (R to DS) & W951 (R to O) on furnace control									
*Dehumidification blower speed is 70% of COOL speed for all units.										
**In Precision mode, thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.										

Table 19. Operating Sequence
24V Thermostat with Humidity Control Feature and Single-Speed Outdoor Unit

Operating Sequence		System Demand								System Response		
System Condition	Step	Thermostat Demand						Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		Y1	Y2	O	G	W1	W2	Status	D			
NO CALL FOR DEHUMIDIFICATION												
Normal Operation - Y1	1	On		On	On			Acceptable	24 VAC	Low	70%*	Compressor and indoor blower follow thermostat demand
Normal Operation - Y2	2	On	On	On	On			Acceptable	24 VAC	High	100%	
ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING												
BASIC MODE (only active on a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Thermostat energizes Y2 and de-energizes D on a call for dehumidification
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	70%**	
PRECISION MODE (operates independent of a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Dehumidification mode begins when humidity is greater than set point
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	70%**	
Dehumidification Call ONLY	1	On	On	On	On			Demand	0 VAC	High	70%**	Thermostat will try to maintain room humidity set point by allowing the room space to maintain a cooler room thermostat set point***
ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING												
BASIC MODE (only active on a Y1 thermostat demand)												
Normal Operation	1	On	On	On	On			Acceptable	24 VAC	High	100%	Thermostat energizes Y2 and de-energizes D on a call for dehumidification
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	70%**	
PRECISION MODE (operates independent of a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	70%*	Dehumidification mode begins when humidity is greater than set point
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	70%**	
Dehumidification Call ONLY	1	On	On	On	On			Demand	0 VAC	High	70%**	Thermostat will try to maintain room humidity set point by allowing the room space to maintain a cooler room thermostat set point***
	Jumpers at indoor unit with a two stage outdoor unit Cut factory jumper from Y1 to Y2 or cut W915 (Y1 to Y2) With condensing unit - Cut W914 (R to DS) on furnace control With heat pump - Cut W914 (R to DS) & W951 (R to O) on furnace control											
*Normal operation first stage cooling blower speed is 70% COOL speed.												
**Dehumidification blower speed is, reduced to 70% of COOL.												
***In Precision mode, thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.												

**Table 20. Operating Sequence
24V Thermostat with Humidity Control Feature and Two-Speed Outdoor Unit**

On-Board Links

WARNING

Carefully review all configuration information provided. Failure to properly set DIP switches, jumpers and on-board links can result in improper operation!

On-Board Link W914 Dehum (R to DS)

On-board link W914, is a clippable connection between terminals R and DS on the integrated control. W914 must be cut when the furnace is installed with a thermostat that features humidity control. If the link is left intact, the PMW signal from the control will be blocked and also lead to control damage. Refer to Table 19 for operation sequence in applications including NF97XV, a thermostat which features humidity control and a single-speed outdoor unit. Table 20 gives the operation sequence in applications with a two-speed outdoor unit.

On-Board Link W951 Heat Pump (R to O)

On-board link W951 is a clippable connection between terminals R and O on the integrated control. W951 must be cut when the furnace is installed in applications which include a heat pump unit and a thermostat which features dual fuel use. If the link is left intact, terminal "O" will remain energized eliminating the HEAT MODE in the heat pump.

On-Board Link W915 2 Stage Compr (Y1 to Y2)

On-board link W915 is a clippable connection between terminals Y1 and Y2 on the integrated control. W915 must be cut if two-stage cooling will be used. If the Y1 to Y2 link is not cut the outdoor unit will operate in second-stage cooling only.

Unit Start-Up

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING

Do not use this furnace if any part has been underwater. A flood-damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. Immediately call a qualified service technician to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet or to replace the furnace, if deemed necessary.

WARNING



Danger of explosion. Can cause injury or product or property damage. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.

CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

BEFORE LIGHTING the unit, smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on the NF97XV is equipped with a gas control switch (lever). Use only your hand to move switch. Never use tools. If the switch will not move by hand, do not try to repair it. Force or attempted repair may result in a fire or explosion.

Placing the Furnace into Operation

NF97XV units are equipped with an automatic hot surface ignition system. Do not attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light. The ignitor does not get hot when there is no call for heat on these units.

Priming Condensate Trap

The condensate trap should be primed with water prior to start-up to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

1. Follow the lighting instructions to place the unit into operation.
2. Set the thermostat to initiate a heating demand.
3. Allow the burners to fire for approximately 3 minutes.
4. Adjust the thermostat to deactivate the heating demand.
5. Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.
6. Adjust the thermostat to deactivate the heating demand and wait for the combustion air inducer to stop. At this

point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or death.

Gas Valve Operation

See Figure 48

1. **STOP!** Read the safety information at the beginning of this section.
2. Set the thermostat to the lowest setting.
3. Turn off all electrical power to the unit.
4. This furnace is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
5. Remove the access panel.
6. Move gas valve switch to OFF. See Figure 48.
7. Wait five minutes to clear out any gas. If you then smell gas, **STOP!** Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.
8. Move gas valve switch to ON. See Figure 48.

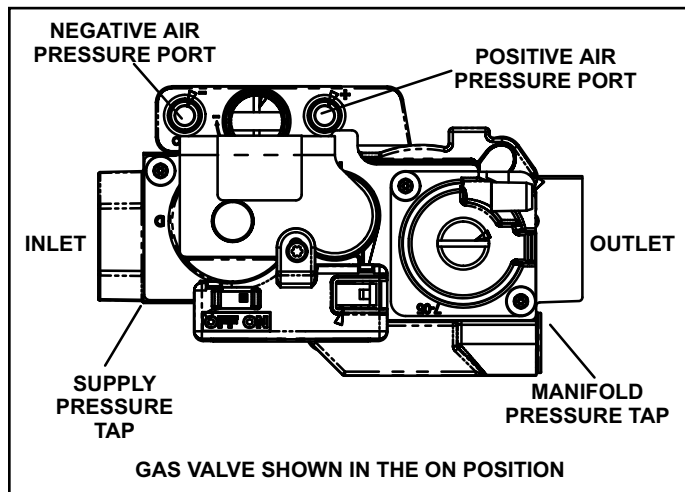


Figure 48. Gas Valve

9. Replace the access panel.
10. Turn on all electrical power to the unit.
11. Set the thermostat to desired setting.
NOTE: When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.
12. If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

Turning Off Gas to Unit

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the unit if service is to be performed.
3. Remove the access panel.
4. Move gas valve switch to OFF.
5. Replace the access panel.

Failure to Operate

If the unit fails to operate, check the following:

1. Is the thermostat calling for heat?
2. Are access panels securely in place?
3. Is the main disconnect switch closed?
4. Is there a blown fuse or tripped breaker?
5. Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
6. Is gas turned on at the meter?
7. Is the manual main shut-off valve open?
8. Is the internal manual shut-off valve open?
9. Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.

Heating Sequence of Operation

1. When thermostat calls for heat, combustion air inducer starts.
2. Combustion air pressure switch proves blower operation. Switch is factory set and requires no adjustment.
3. After a 15-second pre-purge, the hot surface ignitor energizes.
4. After a 20-second ignitor warm-up period, the gas valve solenoid opens. A 4-second trial for ignition period begins.
5. Gas is ignited, flame sensor proves the flame, and the combustion process continues.
6. If flame is not detected after first ignition trial, the ignition control will repeat steps 3 and 4 four more times before locking out the gas valve (soft lockout flame failure mode). The ignition control will then automatically repeat steps 1 through 6 after 60 minutes. To interrupt the 60-minute soft lockout period, move thermostat from "Heat" to "OFF" then back to "Heat." Heating sequence then restarts at step 1.

Gas Pressure Adjustment

Gas Flow (Approximate)

Model	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
040	90	180	-	-
060	60	120	150	300
080	45	90	112	224
Natural - 1000 btu/cu ft			LP - 2500 btu/cu ft	

Table 21. Gas Meter Clocking Chart

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for two revolutions of gas through the meter. (Two revolutions assures a more accurate time.) Divide by two and compare to time in Table 21. If manifold pressure matches Table 22 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

NOTE: To obtain accurate reading, shut off all other gas appliances connected to meter.

Supply Pressure Measurement

A threaded plug on the inlet side of the gas valve provides access to the supply pressure tap. Remove the threaded plug, install a field-provided barbed fitting and connect a manometer to measure supply pressure. Replace the threaded plug after measurements have been taken.

Altitude	Unit	Natural	
		High Fire in. w.c.	Low Fire in. w.c.
0 - 4,500 ft.	040	3.5	1.7
	060		
	080		
4,501 - 7,500 ft.	040	n/a	n/a
	060	2.3	1.2
	080	2.4	1.2

Table 22. Supply Line and Manifold Pressure (inches w.c.)

Manifold Pressure Measurement

To correctly measure manifold pressure, follow the steps below:

1. Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect measuring device "+" connection to barbed fitting to measure manifold pressure.
2. Start unit on low heat and allow 5 minutes for unit to reach steady state.
3. After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in Table 22.
4. Repeat on high heat.
5. Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.
6. Start unit and perform leak check. Seal leaks if found.

Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue outlet and compare to Table 23.

Model	CO ₂ % for Nat		CO ₂ % for LP	
	Low Fire	High Fire	Low Fire	High Fire
040	6.3 - 7.8	6.3 - 7.8	-	-
060	6.5 - 8.2	6.5 - 8.2	9.3 - 10.0	9.3 - 10.0
080	7.2 - 8.4	7.2 - 8.4	9.5 - 10.2	9.5 - 10.2
The maximum carbon monoxide reading should not exceed 100 ppm.				

Table 23.

High Altitude Information

Maximum altitude for -040 units is 4,500 ft. above sea level. Maximum altitude for -060 and -080 units is 7,500 ft. above sea level. See Table 22 for de-rate manifold values.

Other Unit Adjustments

NOTE: See troubleshooting flow charts if any safety switches are found to be open.

Primary Limit

The primary limit is located on the heating compartment vestibule panel. This limit is factory set and requires no adjustment.

Roll Out Switch

This auto-reset switch is located on the front of the intake air elbow.

Pressure Switch

The pressure switch is located in the heating compartment on the cold end header box. This switch checks for proper combustion air inducer operation before allowing ignition trial. The switch is factory-set and must not be adjusted.

Temperature Rise

Place the unit into operation with a second-stage heating demand. After supply and return air temperatures have stabilized, check the temperature rise. If necessary, adjust the heating blower speed to maintain the temperature rise within the range shown on the unit nameplate. See Table 17 for allowable heating speeds. Increase the blower speed to decrease the temperature rise. Decrease the blower speed to increase the temperature rise. Failure to properly adjust the temperature rise may cause erratic limit operation.

Electrical

1. Check all wiring for loose connections.
2. Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC + 10%.
3. Check amp-draw on the blower motor with blower access panel in place.

Unit Nameplate _____ Actual _____

Exhaust and Air Intake Pipe

1. Check exhaust and air intake connections for tightness and to make sure there is no blockage.
2. Is pressure switch closed? Obstructed exhaust pipe will cause unit to shut off at pressure switch. Check termination for blockages.
3. Obstructed pipe or termination may cause rollout switch to open. Check termination for blockages.

Heating Sequence of Operation

Electronic Ignition

The two-stage, variable speed integrated control used in NF97XV units has an added feature of an internal soft lockout control. The feature serves as an automatic reset device for ignition control lockout caused by ignition failure. After one hour of continuous thermostat demand for heat, the soft lockout feature will break and remake thermostat demand to the furnace and automatically reset the control to begin the ignition sequence.

NOTE: The ignition control thermostat selection DIP switch is factory-set in the "TWO-STAGE" position.

Applications Using a Two-Stage Thermostat

See Figure 49 for ignition control sequence

A - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 OFF in "Two-Stage" Position (Factory Setting)

1. On a call for heat, thermostat first-stage contacts close sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at low speed.
2. Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.
NOTE: If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.
3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.
4. After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30-second ON-delay. When the delay ends, the indoor blower motor is energized on the low fire heating speed, the HUM contacts close energizing the humidifier and 120V ACC terminal is energized. The furnace will continue this operation as long as the thermostat has a first-stage heating demand.
5. If second-stage heat is required, the thermostat second-stage heat contacts close and send a signal to the integrated control. The integrated control initiates a 30-second second-stage recognition delay.

6. At the end of the recognition delay, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire (second stage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.
7. When the demand for high fire (second stage) heat is satisfied, the combustion air inducer is switched to the low-fire heating speed and the high-fire (second stage) gas valve is de-energized. The low-fire (first stage) gas valve continues operation. The indoor blower motor is switched to the low-fire heating speed.
8. When the thermostat demand for low-fire (first stage) heat is satisfied, the gas valve is de-energized and the field-selected indoor blower off delay begins. The combustion air inducer begins a 5-second post-purge period.
9. When the combustion air post-purge period is complete, the inducer and the HUM contacts are de-energized. The indoor blower is de-energized at the end of the off delay as well as the 120V ACC terminals.

Applications Using A Single-Stage Thermostat
See Figure 50 for ignition control sequence

B - Heating Sequence -- Integrated Control Thermostat Selection DIP Switch 1 ON in "Single-Stage" Position

NOTE: In these applications, two-stage heat will be initiated by the integrated control if heating demand has not been satisfied after the field adjustable period (7 or 12 minutes).

1. On a call for heat, thermostat first-stage contacts close sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at low speed.
2. Once the control receives a signal that the low pressure switch has closed, the combustion air inducer begins a 15-second pre-purge in low speed.

NOTE: If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch

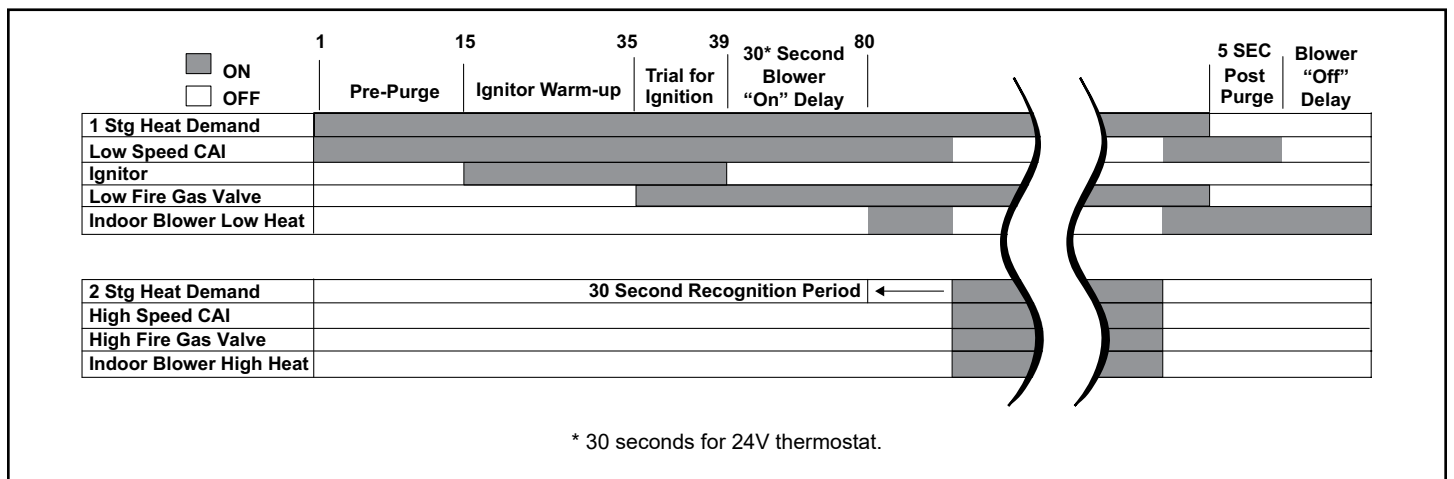


Figure 49. Heating Operation with Two Stage Thermostat

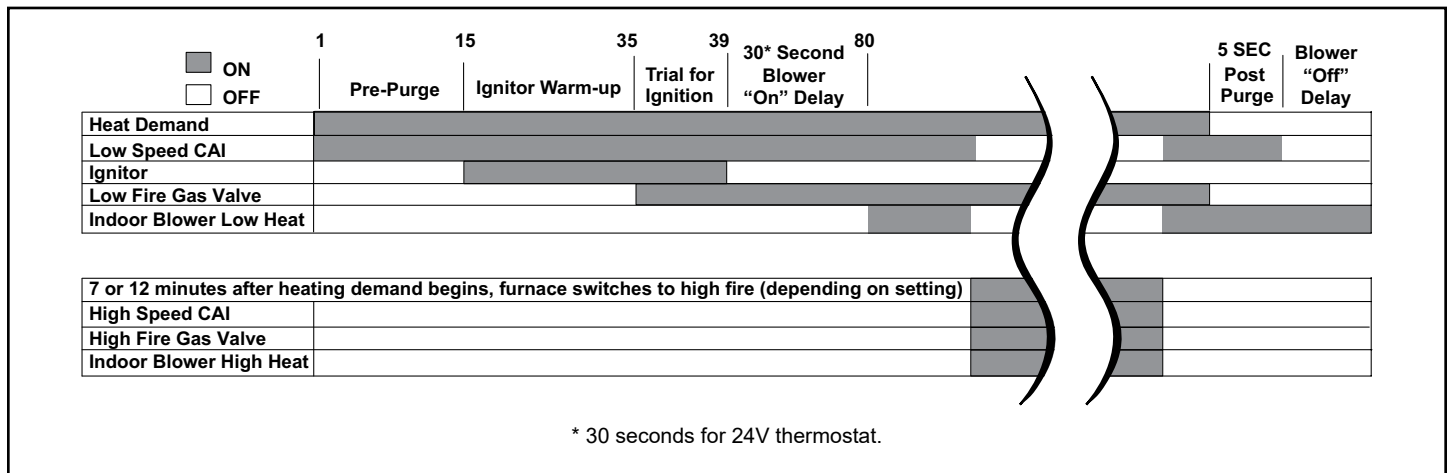


Figure 50. Heating Operation with Single Stage Thermostat

will close and the unit will begin operation on high fire. After 10 to 20 seconds of high fire operation the unit will switch to low fire.

3. After the pre-purge is complete, a 20-second initial ignitor warm-up period begins. The combustion air inducer continues to operate at low speed.
4. After the 20-second warm-up period has ended, the gas valve is energized on low fire (first stage) and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30-second ON-delay. When the delay ends, the indoor blower motor is energized on the low fire heating speed and the HUM contacts are energized. The integrated control also initiates a second-stage on delay (factory-set at 7 minutes; adjustable to 12 minutes).
5. If the heating demand continues beyond the second-stage on delay, the integrated control energizes the combustion air inducer at high speed. The control also checks the high fire (second stage) pressure switch to make sure it is closed. The high fire (second stage) gas valve is energized and the indoor blower motor is energized for operation at the high fire heating speed.
6. When the thermostat heating demand is satisfied, the combustion air inducer begins a 5-second low speed post-purge. The field-selected indoor blower off delay begins. The indoor blower operates at the low-fire heating speed.
7. When the combustion air post-purge period is complete, the inducer and the HUM contacts are de-energized. The indoor blower is de-energized at the end of the off delay as well as the 120V ACC terminals.

Service

WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage.

Before servicing, disconnect all electrical power to furnace.

When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly. Verify proper operation after servicing.

WARNING

The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

Annual Furnace Maintenance

At the beginning of each heating season, and to comply with the GEA Limited Warranty, your system should be checked as follows:

1. Check wiring for loose connections, voltage at indoor unit and amperage of indoor motor.
2. Inspect all gas pipe and connections for leaks.
3. Check the cleanliness of filters and change if necessary (monthly).
4. Check the cleanliness of blower assembly and clean the housing, blower wheel and blower motor if necessary.
5. Inspect the condensate drain and trap for leaks and cracks. Check any additional traps such as in the crawl space exhaust. The drain and trap must also be cleaned and the trap must be primed with water.
6. Remove the rubber hoses from the cold end header box and inspect for any blockage, clean as needed. If strainers are installed in the hoses remember to remove and clean before reinstalling the hoses.
7. Evaluate the heat exchanger and combustion chamber integrity by inspecting the heat exchanger per the AHRI heat exchanger inspection procedure. This procedure can be viewed at www.ahrinet.org. See Induced-draft Furnace Heat Exchanger Inspection Procedure.

8. Ensure sufficient combustion air is available to the furnace. Fresh air grilles and louvers (on the unit and in the room where the furnace is installed) must be properly sized, open and unobstructed to provide combustion air.
9. Inspect the furnace intake and exhaust pipes to make sure they are in place, structurally sound, without holes, blockage or leakage and the exhaust pipe is sloped toward the furnace. Inspect terminations to ensure they are free of obstructions and are structurally sound. If applicable, inspect and clean air intake screen. Inspect the furnace return air duct connection to ensure the duct is sealed to the furnace.
10. Inspect the furnace return air duct connection to ensure the duct is sealed to the furnace. Check for air leaks on supply and return ducts and seal where necessary.
11. Check the condition of the furnace cabinet insulation and repair if necessary.
12. Perform a complete combustion analysis during the furnace inspection to ensure proper combustion and operation. Consult Service Literature for proper combustion values.
13. Verify operation of smoke detectors and CO detectors and replace batteries as required.


Perform a general system test. Turn on the furnace to check operating functions such as the start-up and shut-off operation.

1. Check the operation of the ignition system, inspect and clean flame sensor. Check micro amps before and after. Check controls and safety devices (gas valve, flame sensor, temperature limits). Consult Service Manual for proper operating range. Thermal Limits should be checked by restricting airflow and not disconnecting the indoor blower. For additional details, please see Service and Application Note H049.
2. Verify that system total static pressure and airflow settings are within specific operating parameters.
3. Clock gas meter to ensure that the unit is operating at the specified firing rate. Check the supply pressure and the manifold pressure. **If manifold pressure adjustment is necessary, consult the Service Literature for unit specific information on adjusting gas pressure. Not all gas valves are adjustable.** Verify correct temperature rise.

Winterizing and Condensate Trap Care

1. Turn off power to the furnace.
2. Have a shallow pan ready to empty condensate water.
3. Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

Integrated Control Diagnostic Modes

Display	Action (when button released)
No change (idle)*	Remain in idle mode
Solid "E"	Enter diagnostic recall mode
Solid "D"	Discharge air installed
Solid "F"	Enter flame signal mode
Solid "P" (variable speed only)	Program unit capacity / size (Unit Code)**
Two horizontal bars 	Soft disable
* No change implies the display will continue to show whatever is currently being displayed for normal operation (blinking decimal, active error code, heat state, etc.).	

Diagnostic LED

See Figure 47

The seven-segment diagnostic LED displays operating status, target airflow, error codes and other information.

Diagnostic Push Button

See Figure 47

The diagnostic push button is located adjacent to the seven-segment diagnostic LED. This button is used to enable the Error Code Recall "E" mode and the Flame Signal "F" mode. Press the button and hold it to cycle through a menu of options. Every five seconds a new menu item will be displayed. When the button is released, the displayed item will be selected. Once all items in the menu have been displayed, the menu resumes from the beginning until the button is released.

Error Code Recall Mode

Select "E" from the menu to access the most recent 10 error codes. Select "c" from the Error Code Recall menu to clear all error codes. Button must be pressed a second time while "c" is flashing to confirm command to delete codes. Press the button until a solid "≡" is displayed to exit the Error Code Recall mode.

Flame Signal Mode

Select "F" from the menu to access the flame signal mode. The integrated control will display the flame current on 7 segment LED in micro amps (uA).

Flame signal mode is exited after any of the following:

- Power is reset
- Pressing and holding push button until 3 horizontal lines "≡" are displayed
- 10 minutes after entering the flame sense mode

Program Unit Capacity/Size Mode

After the "P" is selected (by releasing the push button) the integrated control will start flashing the "P" on display for 90 seconds. If push button is pressed again and held during that time, the control will start to display characters corresponding to different variable speed furnace models for 3 seconds each. While the wanted character-model is displayed push button has to be released. Selected option will flash display for 10 seconds and during that time push button has to be pressed and held for 5 seconds. Once control accepts new setting it will store data in non-volatile memory and reset itself. If 10 seconds expires or push button is held less than 5 seconds, control will exit field test mode and go into idle without changing programming the unit size.

Soft Disable

Soft disabling is when thermostat finds a device on the BUS that it does not recognize and the thermostat sends a the device a message to be in soft disabling mode until properly configured. Two horizontal bars will display.

Steps to follow if the damper control module is displaying the soft disable code.

1. Confirm proper wiring between all devices (thermostat, damper control module, indoor and outdoor).
2. Cycle power to the control that is displaying the soft disable code.
3. Put the room thermostat through setup.
4. Go to setup / system devices / thermostat / edit / then push reset.
5. Go to setup / system devices / thermostat / edit / then push reset All.

Repair Parts List

The following repair parts are available through GEA dealers. When ordering parts, include the complete furnace model number listed on the CSA nameplate. All service must be performed by a licensed professional installer (or equivalent), service agency, or gas supplier.

Cabinet Parts

- Outer access panel
- Blower access panel
- Top cap

Control Panel Parts

- Transformer
- Integrated control board
- Door interlock switch

Blower Parts

- Blower wheel
- Motor
- Motor mounting frame
- Blower housing cutoff plate

Heating Parts

- Flame sensor
- Heat exchanger assembly
- Gas manifold assembly
- Combustion air inducer
- Gas valve
- Burner assembly
- Pressure switches
- Ignitor
- Primary limit control
- Rollout switch

Integrated Control Diagnostic Codes

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
•	Idle mode (Decimal blinks at 1 Hertz - 0.5 seconds ON, 0.5 seconds OFF).	
A	Cubic feet per minute (cfm) setting for indoor blower (1 second ON, 0.5 seconds OFF) / cfm setting for current mode displayed.	
C	Cooling stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes.	
d	Dehumidification mode (1 second ON, 1 second OFF) / cfm setting displayed / Pause / Repeat codes.	
h	Heat pump stage (1 second ON, 0.5 seconds OFF) / % of input rate displayed / Pause / cfm setting / Pause / Repeat codes.	
H	Gas Heat stage (1 second ON, 0.5 seconds OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes. Blinking during ignition.	
dF	Defrost mode.	
U	Discharge Air Temperature	
E110	Low line voltage.	Line Voltage low (Voltage lower than nameplate rating). Check power line voltage and correct. Alarm clears 5 seconds after fault recovered.
E111	Line voltage polarity reversed.	Reverse line power voltage wiring. System resumes normal operation 5 seconds after fault recovered.

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E112	Ground not detected.	System shuts down. Provide proper earth ground. System resumes normal operation 5 seconds after fault recovered.
E113	High line voltage.	Line Voltage high (Voltage higher than nameplate rating). Provide power voltage within proper range. System resumes normal operation 5 seconds after fault recovered.
E114	Line voltage frequency out-of-range.	No 60 Hertz power. Check voltage and line power frequency. Correct voltage and frequency problems. System resumes normal operation 5 seconds after fault recovered.
E115	Low 24V - Control will restart if the error recovers.	24 Volt Power high (Range is 18 to 30 Volts). Check and correct voltage. Check for additional power robbing equipment connected to system. May require installation of larger VA transformer to be installed in furnace/air handler. Clears after fault recovered.
E116	High 24V.	24 Volt Power high (Range is 18 to 30 Volts) Check and correct voltage. Check for proper line voltage (120V 240V etc) to equipment. Clears when control senses proper voltage.
E117	Poor ground detected (Warning only).	Provide proper grounding for unit. Check for proper earth ground to the system. Warning only will clear 30 seconds after fault recovered.
E125	Control failed self-check, internal error, failed hardware. Will restart if error recovers, Integrated control not communicating Covers hardware errors (flame sense circuit faults, pin shorts, etc).	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.
E126	Control internal communication problem.	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.
E200	Hard Lock out - Rollout circuit open or previously open	Correct cause of rollout trip or replace flame rollout switch. Test furnace operation. Cleared after fault recovered.
E201	Indoor blower/communication failure - Unable to communicate with blower motor	Indoor blower communication failure including power outage. Lost communication with indoor blower motor. Possible causes: motor not powered, loose wiring. Problem may be on control or motor side. Cleared after fault recovered.
E202	Indoor blower motor mis-match - indoor motor horsepower does not match unit capacity	Incorrect appliance capacity code selected. Check for proper configuring under Unit Size Code for Furnace/Air Handler on configuration guide or in installation instructions. Cleared after the correct match is detected following a reset. (Remove thermostat from system while applying power and reprogramming)
E203	Appliance capacity size is NOT programmed. Invalid unit codes. Refer to configuration flow chart.	No appliance capacity code selected. Check for proper configuring under Unit Size Codes for Furnace on configuration guide or in installation instruction. Critical Alert Cleared after valid unit code is read following a reset (remove thermostat from system while applying power and reprogramming)
E204	Gas valve mis-wired	Check gas valve operation and wiring. Clears when repaired.
E205	Gas valve control relay contact shorted	Check wiring on control and gas valve. If wiring is correct replace control.
E206	Gas valve second-stage relay failure	Furnace will operate on 1st stage for remainder of the heating demand. Will clear after fault recovered. If unable to operate 2nd stage replace control.

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E207	Hot surface igniter sensed open - Refer to troubleshooting	Measure resistance of hot surface igniter. Replace if open or not within specified range found in 10M. Resumes normal operation after fault is cleared.
E223	Low pressure switch failed open	Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E224	Low pressure switch failed closed -Refer to troubleshooting	Check pressure(inches W.C) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E225	High pressure switch failed open -Refer to troubleshooting	Check pressure(inches W.C) of high pressure switch closing on heat call. Measure operating pressure (inches w.c. Inspect vent and combustion air inducer for correct operation and restriction Resumes normal operation after fault is cleared.
E226	High pressure switch failed closed -Refer to troubleshooting	Check operation of high pressure closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E227	Low pressure switch open during trial for ignition or run mode. Refer to troubleshooting	Check operation of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Resumes normal operation after fault is cleared.
E228	Combustion air inducer calibration failure	Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. Resumes normal operation after fault is cleared.
E229	Ignition on high fire	IFC switched to high fire ignition because low fire pressure switch did not close in allowed time. No action is needed.
E240	Low flame current - Run mode- Refer to troubleshooting	Check micro-amperes of flame sensor using control diagnostics or field installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat all has been completed.
E241	Flame sensed out of sequence-Flame still present.	Shut off gas. Check for gas valve leak. Replace if necessary. Alert clears when fault is recovered.
E250	Limit switch circuit open - Refer to troubleshooting.	Check for proper firing rate on furnace. Ensure there is no blockage in heater. Check for proper air flow. If limit not closed within 3 minutes unit will go into 1 hour soft lockout. Resumes normal operation after fault is cleared.
E252	Discharge air temperature too high (gas heat only).	Check temperature rise airflow and input rate. Clear when heat call is finished.
E270	Soft lockout - Exceeded maximum number of retries. No flame current sensed.	Check for proper gas flow. Ensure that igniter is lighting burners. Check flame sensor current. Clears when heat call finishes successfully.
E271	Soft lockout - Exceeded maximum number of retries. Last retry failed due to the pressure switch opening.	Check pressure (inches w.c.) of low pressure switch closing on heat call. Measure operating pressure (inches w.c.). Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.
E272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening	Check operation of low pressure to see if it is stuck closed on heat call. Check pressure (inches w.c.) of high pressure switch closing on heat call. Measure operating pressure. Inspect vent and combustion air inducer for correct operation and restriction. Clears when heat call finishes successfully.

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E273	Soft lockout - Exceeded maximum number of recycles. Last recycle due to flame failure	Check micro-amperes of flame sensor using control diagnostics or field installed mode. Clean or replace sensor. Measure voltage of neutral to ground to ensure good unit ground. Alert clears after current heat call has been completed.
E274	Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or limit remained open longer than 3 minutes.	Shut down system 1-hour soft lockout. Check firing rate and air flow. Check for blockage. Clears when heat call finishes successfully.
E275	Soft lockout - Flame sensed out of sequence. Flame signal is gone.	Shut off gas. Check for gas valve leak. 1-hour soft lockout. Clears when flame has been proven stable.
E276	Soft lockout calibration failure.	Unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections. 1-hour soft lockout. Clears when calibration has finished successfully.
E290	Ignitor circuit fault - Failed ignitor or triggering circuitry.	Measure resistance of hot surface igniter. Replace if open or not within specifications. 1-hour soft lockout. Clears when flame has been proven stable.
E291	Heat airflow restricted below the minimum.	Check for dirty filter and airflow restriction. Check blower performance. 1-hour soft lockout. Cleared when heat call finishes successfully.
E292	Indoor blower motor unable to start due to obstructed wheel seized bearings.	Indoor blower motor unable to start (seized bearing, stuck wheel, etc.) Replace motor or wheel if assembly does not operate or meet performance standards. 1-hour soft lockout. Clears after circulator successfully starts.
E294	Combustion air inducer over current.	Check combustion blower bearings wiring and amps. Replace if does not operate or does not meet performance standards. Clears after inducer current is sensed to be in-range after the ignition following the soft lockout or reset.
E295	Indoor blower motor temperature is too high.	Indoor blower motor over temperature (motor tripped on internal protector). Check motor bearings and amps. Replace if necessary. Cleared after blower demand is satisfied.
E310	Discharge error temperature sensor failure. Only shown if shorted or out of range.	Compare discharge sensor resistance to temperature resistance charts in installation instructions.. Replace sensor if necessary. Cleared after the current heat call is completed.
E311	Heat rate reduced to match indoor blower airflow.	Warning Only. Furnace blower in cutback mode due to restricted airflow. Reduce firing rate every 60 seconds to match available CFM. Check filter and duct system. To clear replace filter if needed or repair/add duct. 2-stage controls will reduce firing rate to 1-stage. Clears when heat call finished successfully.
E312	Restricted airflow in cooling or continuous fan mode is lower than CFM setting.	Warning Only. Restricted airflow - Indoor blower is running at a reduced CFM (Cutback Mode - The variable speed motor has preset speed and torque limiters to protect the motor from damage caused by operating outside of design parameters (0 to 0.8" W.C. total external static pressure). Check filter and duct system. To clear, replace filter if needed or repair/add duct. Cleared after the current service demand is satisfied.
E344	Relay "Y1" stuck on integrated control.	Replace integrated control.
E347	No 24 Volt output on Y1 of "integrated control" with non-communicating outdoor unit.	Operation stopped. Y1 relay/Stage 1 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.

Code	Diagnostic Codes / Status of Equipment	Action Required to Clear and Recover
E348	No 24 Volt output on Y2 of "integrated control" with outdoor unit.	Y2 relay/Stage 2 failed. (Pilot relay contacts did not close or the relay coil did not energize; no input back to IFC chip.) Critical Alert. Cleared after reset and Y1 input sensed.
E349	No 24 Volts between R & O on "integrated control" with outdoor unit (dual fuel model required for heat pump application).	Configuration link R to O needs to be restored. Replace link or hardware. Critical Alert.
E370	Interlock switch sensed open for 2 minutes.	Control sees the loss of 24VAC for 2 minutes. Terminate all services and wait for interlock switch to close. The alarm will clear when 24VAC is continuously sensed on DS terminal for a minimum of 10 seconds or on a power reset.

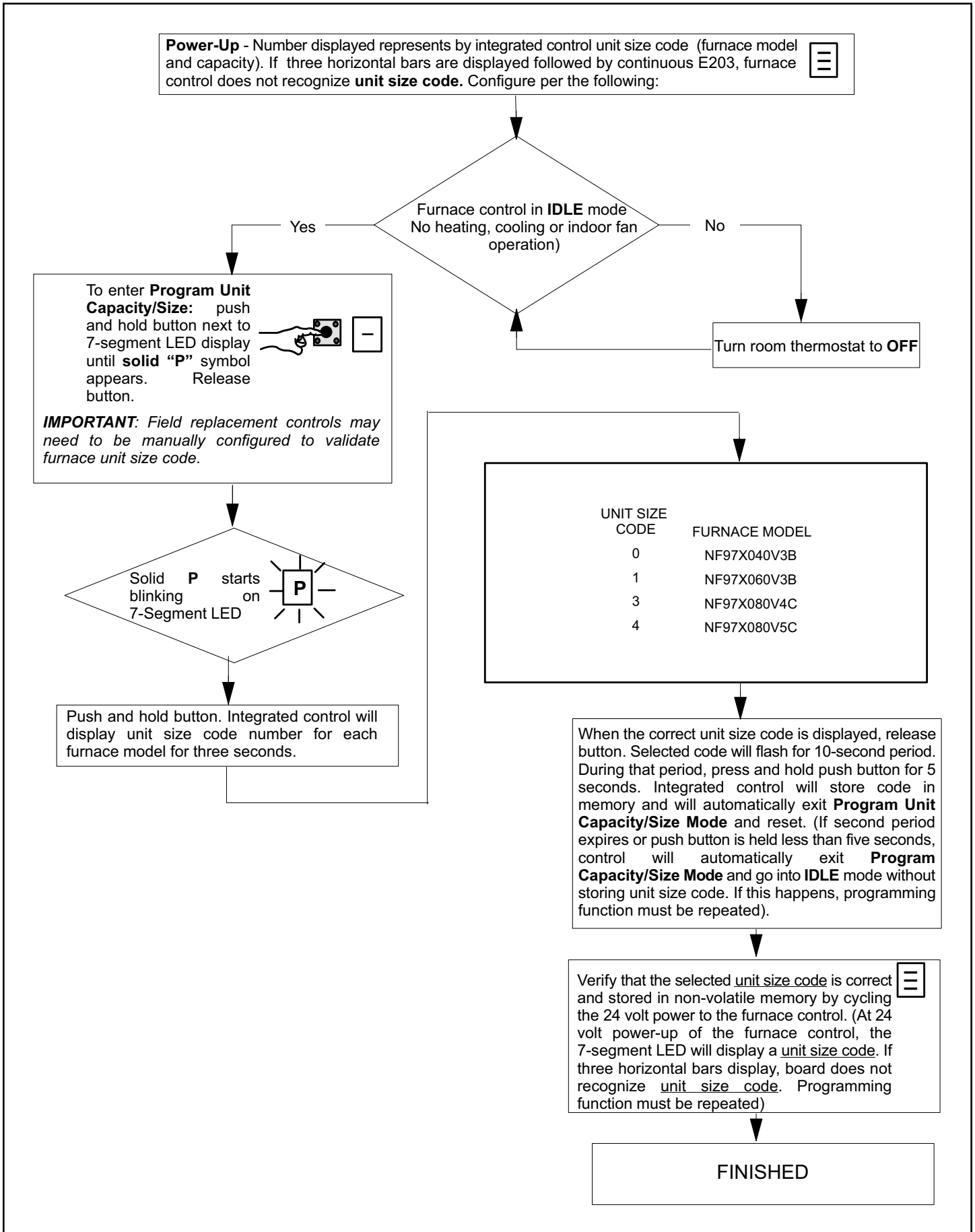


Figure 51. Program Unit Capacity/Size Mode

CALL FOR FIRST-STAGE HEAT

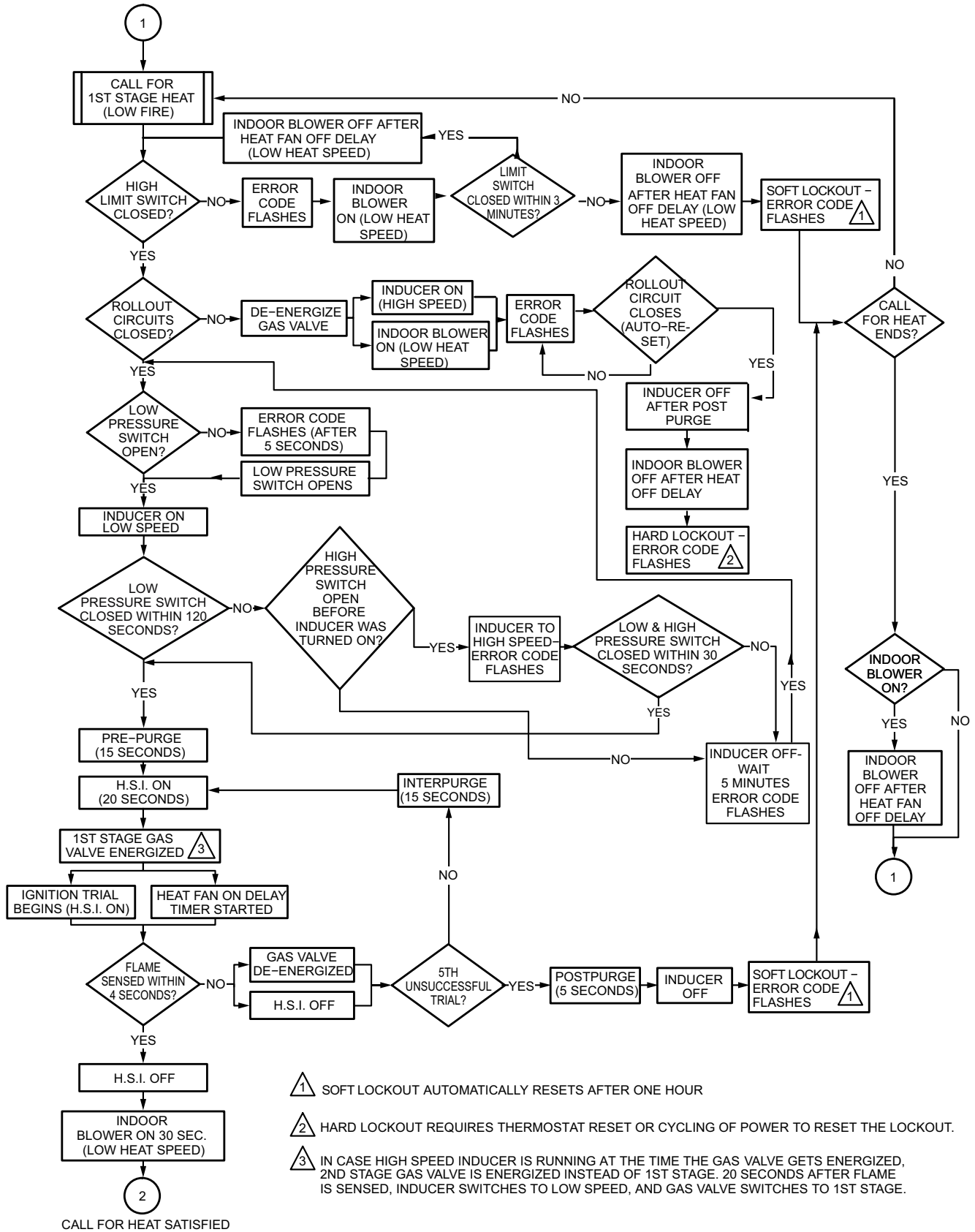
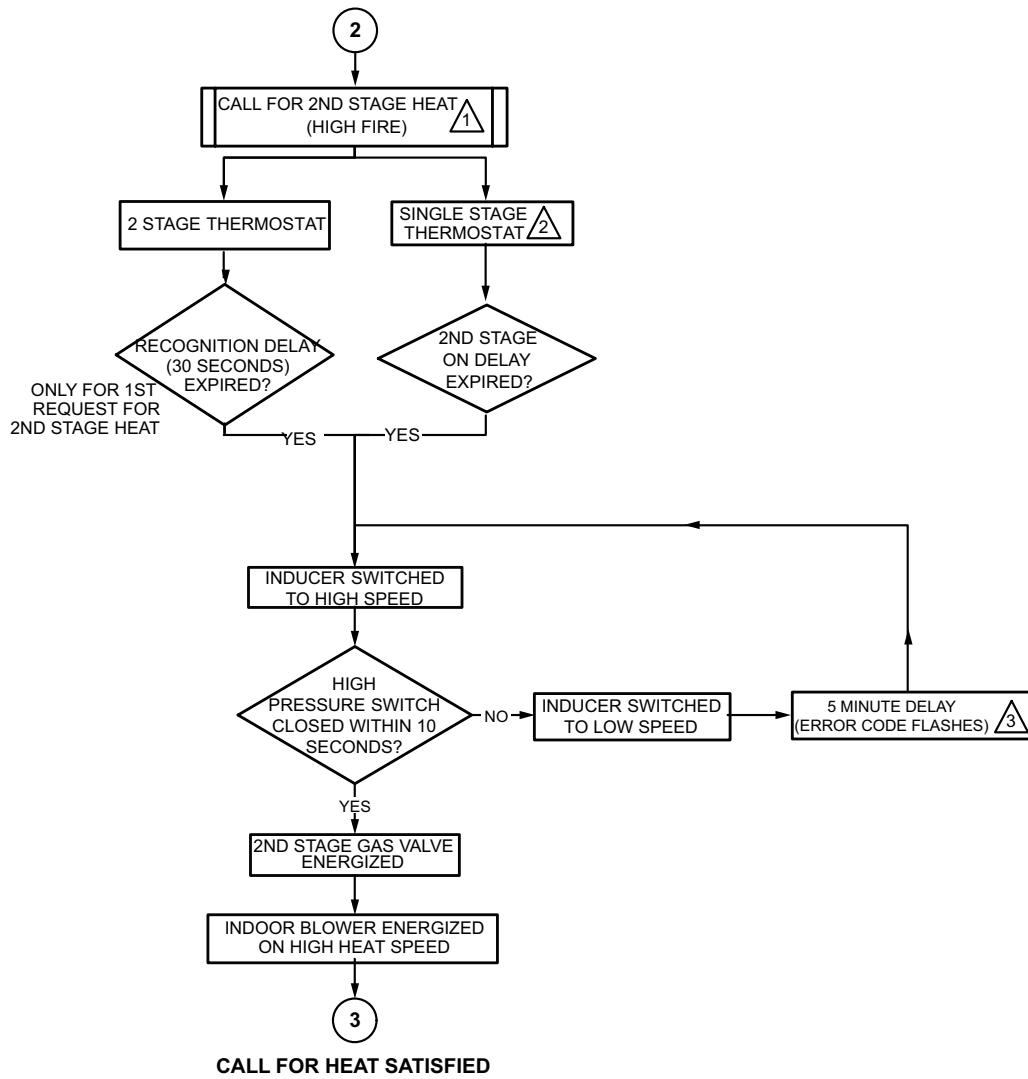


Figure 52. Troubleshooting: Heating Sequence of Operation

CALL FOR SECOND-STAGE HEAT

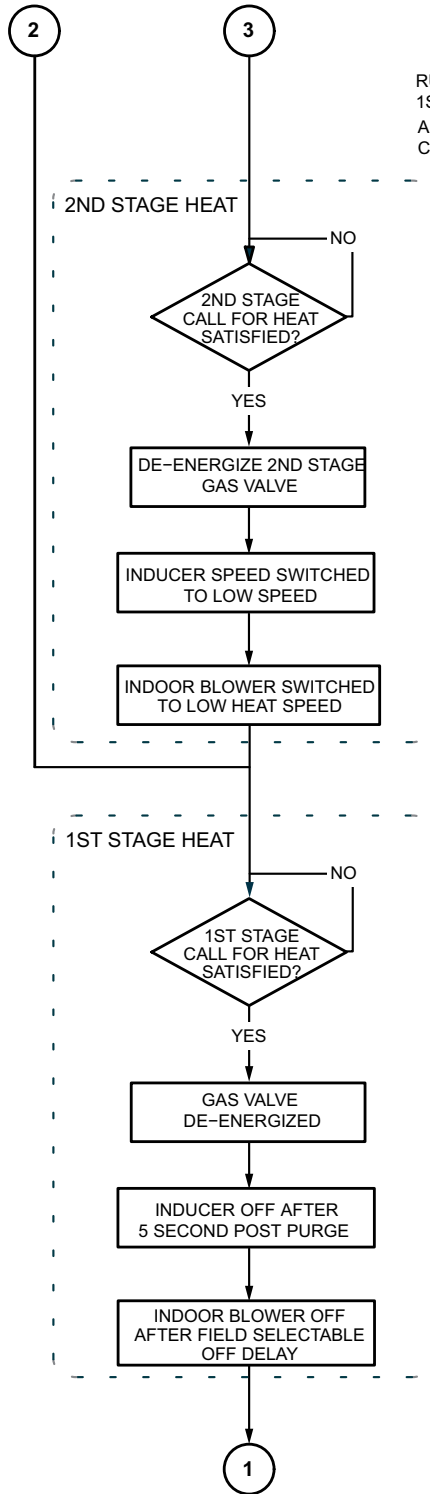


- 1 SYSTEM WILL ALWAYS LIGHT ON LOW FIIRE, EVEN IF 2ND STAGE HEAT IS IN PLACE.
- 2 WHEN USED WITH A SINGLE STAGE THERMOSTAT, SET SW1 TO THE ON POSITION IN DIP SWITCH S4.
- 3 IF THE HIGH FIRE PRESSURE SWITCH DOES NOT CLOSE WITHIN 5 ATTEMPTS, THE SYSTEM WILL OPERATE AT LOW FIRE FOR THE REMAINDER OF THE CALL FOR HEAT REQUEST.

Figure 53. Troubleshooting: Heating Sequence of Operation

CALL FOR HEAT SATISFIED

FIRST-STAGE HEAT SECOND-STAGE HEAT



RUN MODE:
1ST OR 2ND STAGE CALL FOR HEAT.
ALL INPUTS MONITORED (LIMIT, PRESSURE,
CALL FOR HEAT/COOL, FLAME LEVEL)

Figure 54. Troubleshooting: Heating Sequence of Operation

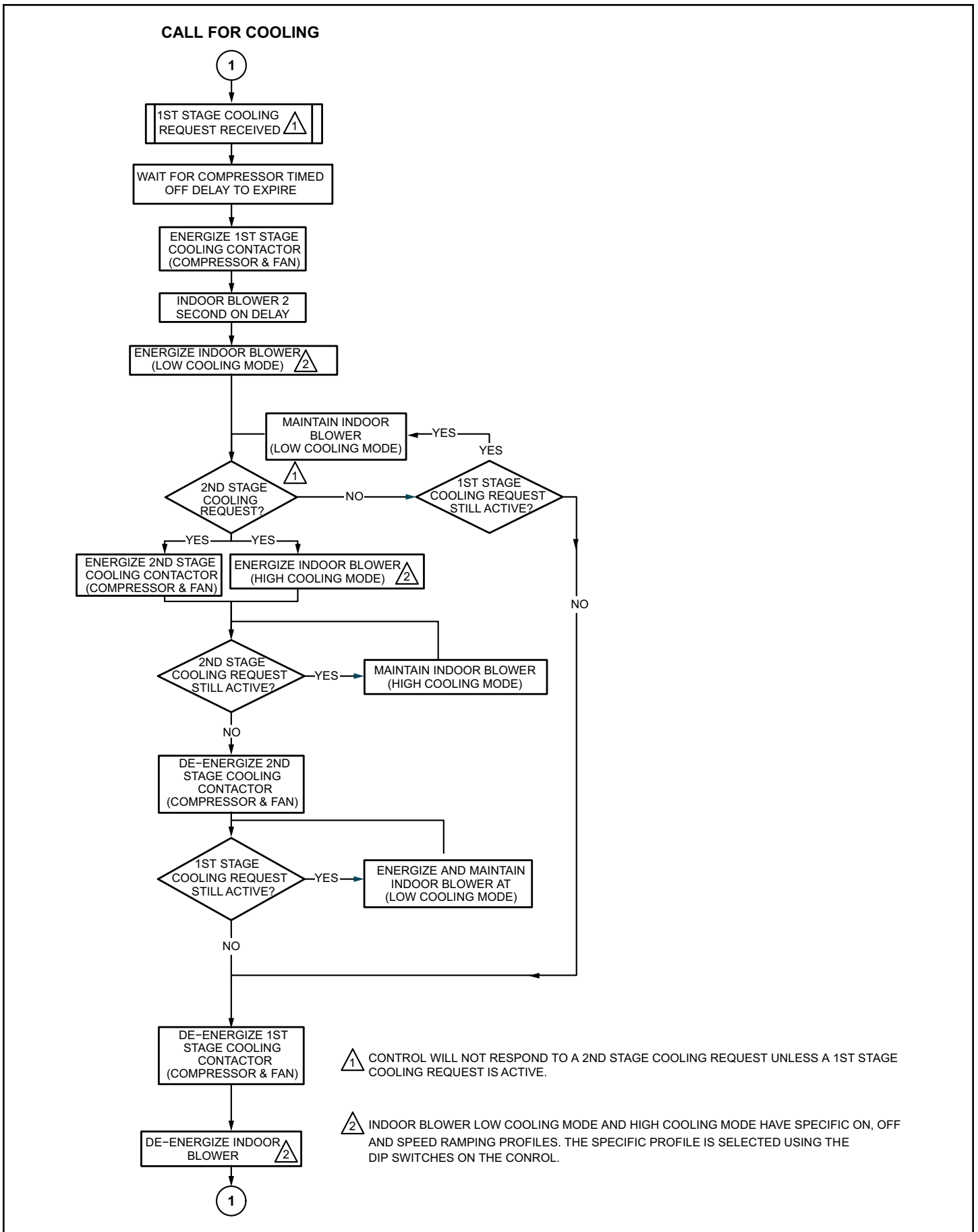


Figure 55. Troubleshooting: Cooling Sequence of Operation

CALL FOR FAN

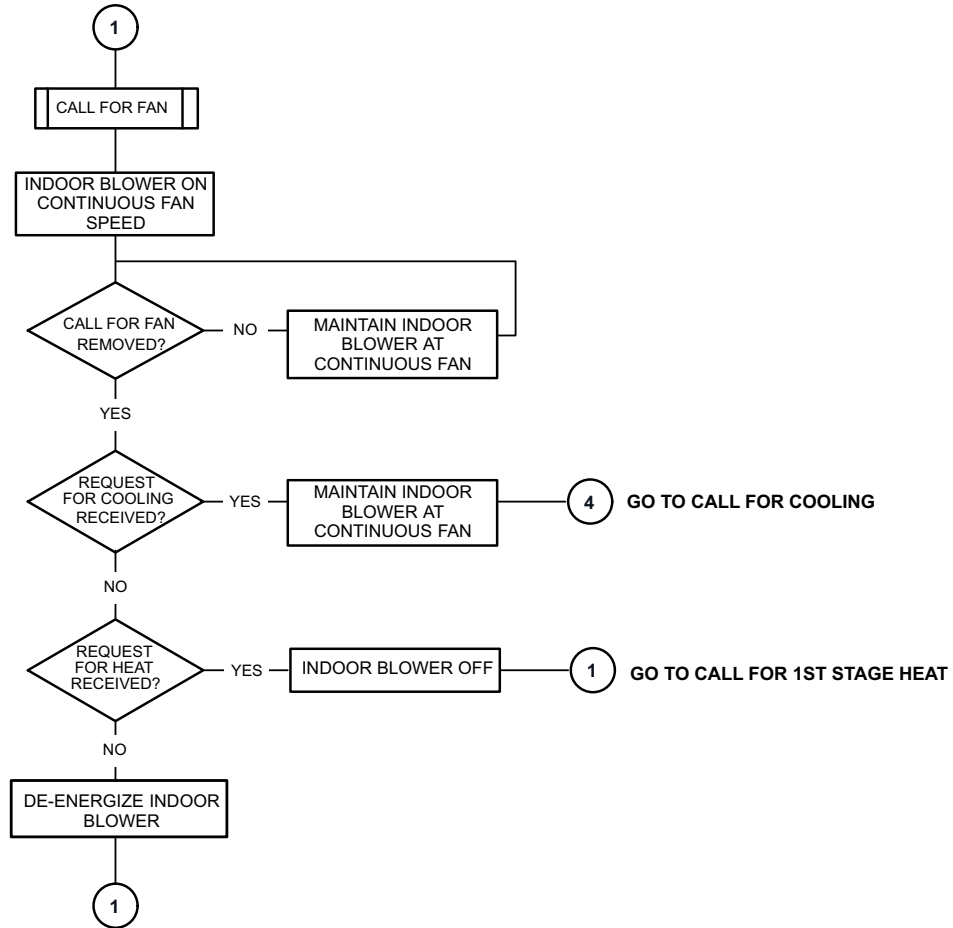


Figure 56. Troubleshooting: Continuous Fan Sequence of Operation

Requirements for Commonwealth of Massachusetts

Modifications to NFPA-54, Chapter 10

Revise NFPA-54 section 10.8.3 to add the following requirements:

For all side wall, horizontally vented, gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above the finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall, horizontally vented, gas-fueled equipment, the installing plumber or gas fitter shall observe that a hard-wired carbon monoxide detector with an alarm and battery backup is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery-operated or hard-wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall, horizontally vented, gas-fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard-wired carbon monoxide detectors.
 - a. In the event that the side wall, horizontally vented, gas-fueled equipment is installed in a crawl space or an attic, the hard-wired carbon monoxide detector with alarm and battery backup may be installed on the next adjacent floor level.
 - b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery-operated carbon monoxide detector with an alarm shall be installed.
2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented, gas-fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS."**

4. **INSPECTION.** The state or local gas inspector of the side wall, horizontally vented, gas-fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1 through 4.

EXEMPTIONS: The following equipment is exempt from 24 CMR 5.08(2)(a) 1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required to Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
2. Product Approved side wall, horizontally vented, gas-fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.

When the manufacturer of Product Approved side wall, horizontally vented, gas-fueled equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components: and
2. A complete parts list for the venting system design or venting system.

MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.

When the manufacturer of Product Approved sidewall, horizontally vented, gas-fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems," the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

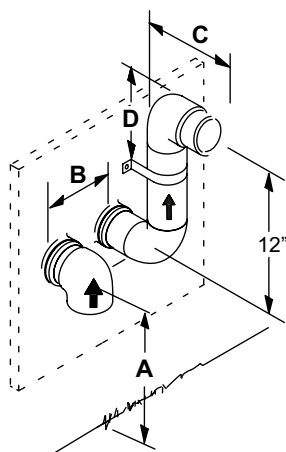
A copy of all installation instructions for all Product Approved side wall, horizontally vented, gas-fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

For the Province of Ontario, Horizontal Sidewall Vent Applications Only

For exterior horizontal venting applications, the 2" X 1.5" reducer for 2" venting at the point where the exhaust pipe exits the structure is not required in direct or nondirect vent applications in the Province of Ontario. In these applications, the vent should be oriented such that the exhaust plume is unobjectionable. If the installation requires more separation between the flue gases and the building structure, a reducer may be installed on the exhaust pipe to increase the flue gas velocity.

Addendum for All Provinces of Canada

See below for venting for all provinces of Canada. GEA approves the following termination for use in all provinces of Canada.



	2" (51MM) Vent Pipe	3" (76MM) Vent Pipe
A – Clearance above grade or average snow accumulation	12" (305 mm) Min.	12" (305 mm) Min.
B – Horizontal separation between intake and exhaust	6" (152 mm) Min. 24" (610 mm) Max.	6" (152 mm) Min. 24" (610 mm) Max.
C – Exhaust pipe length	Per: Saskatchewan Code of Practice	
D – Wall support distance from top of each pipe (intake/exhaust)	6" (152 mm) Max.	6" (152 mm) Max.

NOTE – Flue gas may be acidic and may adversely affect some building materials. If flue gases impinge on the building materials, a corrosion-resistant shield should be used to protect the wall surface. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.