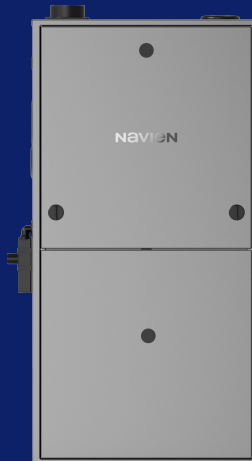


Installation and Operation Manual

NDF Forced Air Gas Furnace

Model | NDF600-050M2V3B
NDF600-070M2V3B
NDF600-070M2V4C
NDF600-090M2V5C
NDF600-105M2V5C



ALWAYS read and follow this manual completely before using the furnace. Save for future reference.

WARNING

FIRE OR EXPLOSION HAZARD

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

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

WHAT TO DO IF YOU SMELL GAS

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

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

The installation must conform with local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.

This furnace must be installed in accordance with the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 or when such standard is not applicable, the Standard for Model Manufactured Home Installation, NFPA 225, or the Canadian Standard for Manufactured Homes, CSA Z240 MH.

NOT FOR INSTALLATION IN LOW-NOx REGULATED AREAS

This furnace is not certified for installation in jurisdictions requiring NOx emissions of 40 ng NOx/J or lower. Check local air district requirements before installation.

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Product Installation Information	
Model	
Date Purchased	
Gas Type	
Serial Number	

Important Safety Information



The following Safety Alert Symbols are used in this manual. They are used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible serious injury or death. This Safety Alert Symbol precedes any safety message about risk of personal injury. It may also be accompanied by one of the following signal words.

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

DANGER

Indicates a hazardous situation that if not avoided will result in death or serious injury.

WARNING

Indicates a hazardous situation that if not avoided could result in death or serious injury.

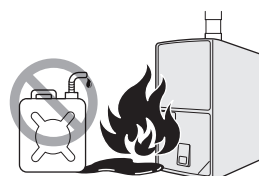
CAUTION

Indicates a potentially hazardous situation that if not avoided could result in minor or moderate injury.

NOTICE

Indicates information considered important but not hazard-related (such as property damage).

DANGER



If you smell gas:

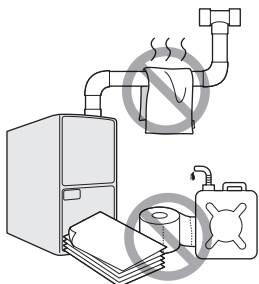
- Do not try to light any appliance.
- Do not touch any electrical switches or use landline phones.
- From a neighbor's phone, call your gas provider and follow their instructions.
- If you cannot reach your gas provider, call the fire department.
- Do not return to your home until authorized by your gas supplier or the fire department.

Do not use or store flammable products, such as gasoline, solvents, or adhesives in the same room or area as the furnace.

- The furnace has a main burner flame that can turn on at any time and can ignite flammable vapors. Vapors from flammable liquids can explode and catch fire, causing death or severe burns.
- Vapors cannot be seen and can be heavier than air. They can travel long distances along the ground and can be carried from other rooms to the furnace's main burner by air current.
- Keep all flammable products far away from the furnace and store them in approved containers. Keep the containers closed tightly and out of the reach of children and pets.

WARNING

To prevent death, serious injury, or property damage:



- **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**

Failure to do so may result in property damage; personal injury; or death from fire, explosion, smoke, soot, condensation, electric shock, or carbon monoxide leakage.

- **Do not install the furnace in a mobile home, trailer, or recreational vehicle.**

Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.

- **Do not operate the furnace without a filter installed in the product.**

Doing so may clog the heat exchanger with dust and reduce the furnace's performance.

- **Do not operate the heating function unless the doors are installed.**

Doing so may introduce exhaust gas into the room during operation.

- **Do not store or use gasoline or other flammable liquids near this furnace.**

Doing so may result in fire or explosion.

- **Do not place combustibles, such as newspapers or laundry, near the furnace or venting system.**

Doing so may result in a fire.

- **Do not place or use hair sprays, spray paints, or any other compressed gases near the furnace or venting system, including the vent termination.**

Doing so may result in fire or explosion.

WARNING

- The furnace contains foil covered fiberglass insulation. Inhalation of fiberglass particles is associated with respiratory disease including cancer. Natural gas and propane are normally odorized by the fuel supplier. In some cases, the odorant may not be perceivable. Installation of UL and ULC recognized fuel gas detectors installed in accordance with their manufacturer's instructions is recommended as an additional margin of safety.
- The exhaust gases from this furnace contain chemicals which on some occasions may include carbon monoxide. Carbon monoxide is an odorless, tasteless, clear colorless gas which is highly toxic. Even low concentrations are suspected of causing birth defects and other reproductive harm.
- UL and ULC recognized CO detectors are recommended for all buildings equipped with fossil fuel burning appliances. All CO detectors should be installed in accordance with their manufacturer's instructions and applicable local building codes.
- Fire, explosion or carbon monoxide poisoning hazard! Failure to replace with proper control could result in fire, explosion or carbon monoxide poisoning. Replace gas valve only with the same model number or as specified by the manufacturer.
- **Do not operate the furnace with the front cover opened.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not operate the furnace without proper venting.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not touch the power supply or internal components of the furnace with wet hands.**
Doing so may result in electric shock.

California law requires the following Prop 65 warning to be provided:

**WARNING**

This product can expose you to chemicals including Di(2-ethylhexyl) phthalate, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

SAVE THESE INSTRUCTIONS	
 DANGER	Indicates a hazardous situation that if not avoided will result in severe injury or death.
 WARNING	Indicates a hazardous situation that if not avoided could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation that if not avoided could result in minor or moderate injury.
NOTICE	Indicates information considered important but not hazard-related (such as property damage).

WARNING

To prevent death, serious injury, or property damage:

- **Do not turn on the furnace unless the gas supply is fully open, the inlet and exhaust air are not blocked, and the duct is clear of any obstructions.**
Doing so may damage the furnace.
- **Do not use this furnace for anything other than its intended purpose, as described in this manual.**
- **Do not remove the front cover unless the power to the furnace is turned off or disconnected.**
Failure to do so may result in electric shock.
- **When servicing the controls, label all wires prior to disconnecting them.**
Failure to do so may result in wiring errors, which can lead to improper operation. Verify proper operation after servicing.
- **Do not use unapproved replacement or accessory parts.**
Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.
- **Do not place anything in or around the vent terminals that could obstruct the airflow in or out of the furnace.**
- **This furnace has been approved for use in the USA and Canada only.**
Using the furnace in any other country will void the manufacturer's warranty.

WARNING

Carbon-Monoxide Poisoning Hazard

- To prevent severe personal injury or death due to carbon-monoxide poisoning:
 - Check that all openings in the outside wall around the vent (and air intake) pipes are sealed to prevent combustion products from infiltrating the building.
 - Check that the furnace vent (and air intake) terminals are not obstructed in any way.

Codes and Standards

Follow all national and local codes and standards, including the guidelines below. Installation must comply with the regulations set forth by the serving gas supplier, local building, plumbing, and other regulations. In the absence of local regulations, installations must comply with the national regulations listed below and those of all authorities having jurisdiction. In the United States and Canada, follow all regulations and standards below.

Safety

- US: Latest edition of National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B
- Canada: Latest edition of National Standard of Canada, Natural Gas and Propane Installation Code (NSCNGPIC) CAN/CSA B149.1

General Installation

- US: Latest edition of ANSI Z223.1 (NFPA 54) National Fuel Gas Code
- Canada: Latest edition of CAN/CGA -B149.1 and .2 Natural Gas and Propane, and the National Electric Code (NEC) NFPA 70

Combustion and Ventilation Air

- US: "Air for Combustion and Ventilation" section of the latest edition of the NFPA54/ANSI Z223.1
- Canada: "Venting Systems and Air Supply for Appliances" section of the latest edition of CAN/CSA B149.1

Duct Systems

US and Canada: Latest edition of Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

Acoustical Lining and Fibrous Glass Duct

US and CANADA: Current edition of SMACNA, NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts

Gas Piping and Gas Pipe Pressure Testing

- US: NFPA 54/ANSI Z223.1
- Canada: As required by the latest edition of CAN/CSA-B149.1
- In the state of Massachusetts: - This product must be installed by a licensed plumber or gas fitter. When flexible connectors are used, the maximum length should not exceed 36 in. (914 mm). When lever-type gas shutoffs are used, they should be the T-handle type. Using copper tubing for gas piping is not allowed in the state of Massachusetts.

Electrical Connections

Must be made in accordance with any applicable local codes, bylaw and regulations.

- US: Latest edition of ANSI/NFPA 70, National Electrical Code
- Canada: Latest edition of CAN/CSA C22.1 and C22.2, Canadian Electrical Code (Part 1 and 2)

Condensate Drain Connection

- US: National Standard Plumbing Code
- Canada: National Plumbing Code of Canada

Auxiliary Drain Pan Installation

In accordance with approved regulations, installing an auxiliary drain pan under the evaporator coil installed in all areas of the furnace and structure.

- Furnace condensate treatment system
- Overflow by coil drain pan
- Where the main condensate pipeline can become clogged and cause damage to the building

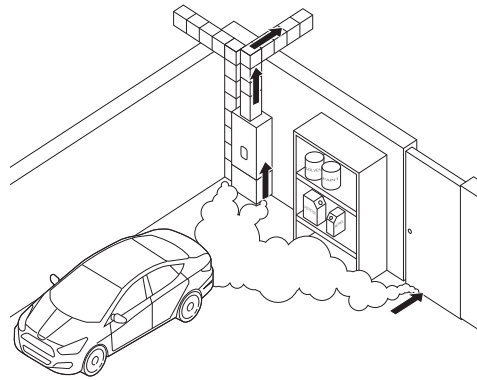
Codes and additional information may be obtained from:

- American Gas Association
 - Address: 400 North Capitol Street, NW, Suite 450 Washington DC, 20001
 - Phone: (202) 824-7000
 - Website: <https://www.aga.org>
- National Fire Protection Association
 - Address: 1 Batterymarch Park Quincy, MA, 02169-7471
 - Phone: (617) 770-3000
 - Website: <https://www.nfpa.org/>
- Canadian Standards Association
 - Address: 5060 Spectrum Way Mississauga, Ontario, L4W 5N6
 - Phone: (416) 747-4000
 - Website: <https://www.csa.ca>

Important Information About Efficiency and Indoor Air Quality

Central cooling and heating equipment, such as a furnace, can be efficient when a duct system can carry cooled or heated air properly. To improve efficiency, comfort and good indoor air quality, read the following guidelines:

- Maintain the proper balance between the air supplied to each room and the air returned to the cooling and heating units.
- Maintaining proper balance and tightness of the duct systems maximizes the efficiency of heating and air conditioning systems and improves indoor air quality by reducing the amount of pollutants contained in the air entering from the space where the ducts and equipment are located.
- Make sure that dangerous substances, fumes, and odors do not enter living spaces.
- The front covers of the furnace always must be closed properly. Always check if the quarter turn on the front covers are fully engaged.



Note

Manufacturers and the US Environmental Protection Agency's Energy Star program recommend that central duct systems be inspected by qualified contractors for proper balance and tightness.

Receiving

Immediately upon receipt, all cartons and contents should be inspected for transit damage. Units with damaged cartons should be opened immediately. If damage is found, it should be noted on the delivery papers, and a damage claim filed with the last carrier.

- After the unit has been delivered to the job site, remove the carton taking care not to damage the unit.
- Check the unit rating plate to be sure equipment matches job specifications.
- Read the entire instructions before starting the installation.

1. About the Furnace

1.1 Introduction

This high efficient gas fired two stage condensing furnace is an upflow, downflow, horizontal left and right warm air furnace suitable for residential and light commercial heating applications with inputs of 53,000 to 105,000 Btu/hr.

This high efficient furnace series is CSA certified as a Category IV indirect or direct vent central forced air furnace. When installed as a direct vent furnace, all combustion air is supplied to the furnace burners through the air intake system. See "6. Venting and Combustion Piping".

All models may be fired by natural or LP gas (propane), and may be field converted from natural gas to LP gas using a Conversion Kit. See "21. Replacement Parts List".

The furnace is shipped completely assembled except for the condensate drain trap assembly. Please inspect for damage when the furnace is unpacked.

1.2 Product Application

WARNING

Do not install the furnace in an unconditioned space that is susceptible to freezing or a mobile home, trailer, or recreational vehicle. Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.

- When a furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. (Furnace for heating the home located in the attached garage, for example).
- A gas-fired furnace for installation in a residential garage must be installed so that the burners and ignitor are no less than 18" (457 mm) above the floor. The furnace must be located, or protected to avoid physical damage by vehicles. (See safety warning).
- Furnaces may be used as a construction heater provided that the furnace installation and operation of the appliance complies with the items listed below:
 - The vent system must be permanently installed per manufacturer's instructions. One hundred percent (100%) outdoor air must be provided for combustion air requirements during construction. This is to minimize the corrosive effects of adhesives, sealers and other construction materials. It also prevents the entrainment of drywall dust into combustion air, which can cause fouling and plugging of furnace components.
 - Furnace must be operating under thermostatic control. The use of fixed jumpers that will provide continuous heating is not allowed.
 - Air filters (MERV 8 or better) must be installed in the system and replaced or maintained daily during construction.
 - The return air duct must be provided and sealed to the furnace.
 - Return air temperature range between 55°F (13°C) and 80°F (27°C) must be maintained with no evening setback or shutdown.
 - The input rate and temperature rise must be set per the furnace rating plate.
 - The furnace (including heat exchanger and blower assembly), ductwork, components, and filters must be cleaned as necessary to remove dust and construction debris from all HVAC system components and verify furnace operating conditions including ignition, input rate, temperature rise, and venting, according to the manufacturer's instructions after construction is completed.
 - Furnace doors must be in place on the furnace while the furnace is operating in any mode.
- Install this furnace only in dry indoor locations (protected from weather).
- Provide adequate combustion and ventilation air to the furnace space as specified in "6. Venting and Combustion Piping".
- Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in "6. Venting and Combustion Piping".
- Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections as specified in "11. Gas Supply and Piping".
- Always install a furnace to operate within the furnace's intended temperature-rise range with a duct system, which has an external static pressure within the allowable range, listed on the furnace rating plate, and as specified in "2. Furnace Sizing," "5. Ductwork," and "17. Air Flow".

The furnace must be installed indoors (i.e., attic space, crawl space, or garage area provided that the garage area is enclosed with an operating door). The furnace can be used in non-industrial commercial applications, such as schools, office buildings, churches, retail stores, nursing homes, hotels/motels, common areas, or offices; in such applications, the furnace must be installed with the following conditions:

- It must be installed according to the installation instructions provided and local and national codes.
- It must be installed indoors in a building constructed on site.
- It must be part of a ducted system and not used in a free air delivery application.
- It must not be used as a "make-up" air unit.

- Non-direct vent central forced air furnace in which combustion air is taken from the installation area or a direct vent central forced air furnace in which all combustion air supplied directly to the furnace burners through a special air intake system outlined in these instructions.
- All other warranty exclusions and restrictions apply as this furnace is an appliance and is appropriate for use with natural or propane gas.
- When this furnace is installed in a storage garage, it must be installed so the burners and ignition source are located no less than 18" (457 mm) above the floor to prevent the risk of igniting flammable vapors which may be present in the garage.
- The furnace must be located or protected to avoid physical damage by vehicles.

Note
Use this furnace only with the type of gas approved for this furnace. Refer to the furnace rating plate.

1.3 Dimensions

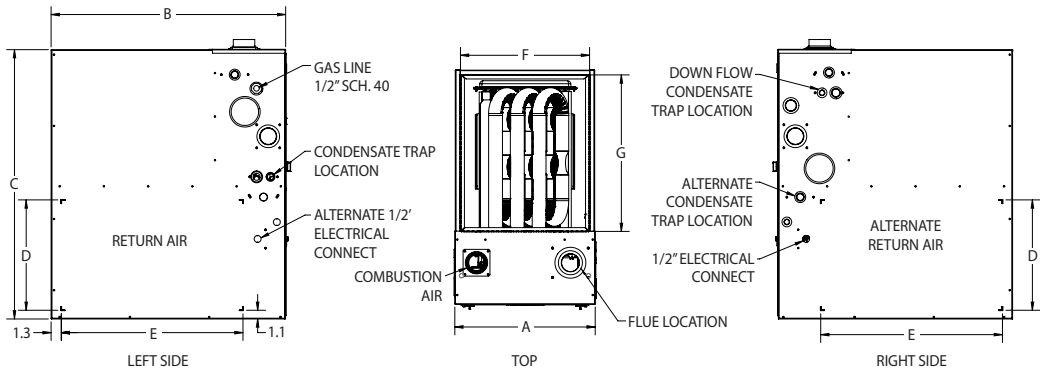
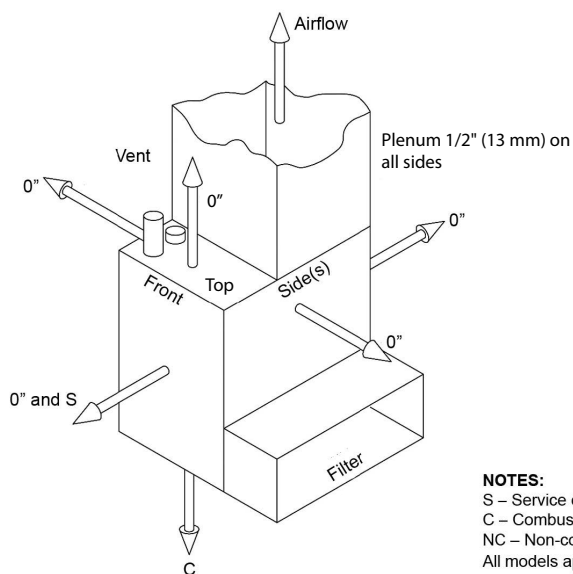


Figure 1. Furnace Dimensions

Input (kBtu/hr)	Width (A)	Depth (B)	Height (C)	Supply Air (F X G)	Return Air (D X E)
50	17 ½" (445 mm)	29 ½" (749 mm)	34" (864 mm)	16 ¼" X 19 ⅝" (413 mm X 499 mm)	14" X 23" (356 mm X 584 mm)
70-3					
70-4	22 ½" (572 mm)			21 ¼" X 19 ⅝" (540 mm X 499 mm)	
90					
105					

Table A. Furnace Dimensions



NOTES:
 S – Service clearance 24 inches or more.
 C – Combustible floor (but not carpet or non-ceramic tile.)
 NC – Non-combustible floor.
 All models approved for closet installation.

Location	Upflow	Downflow	Horizontal
Top	0	0	0
Plenum Top	½" (13 mm)	0	½" (13 mm)
Front	0*	0*	0*
Back	0	0	0
Sides	0	0	0**
Bottom	0***	0	0
Flue Pipe	0	0	0
Enclosure	Closet	Closet	Closet

Table B. Minimum Clearances to Combustible Materials

* 24" (610 mm) required for service.

** Supply air outlet/½" (13 mm) return air inlet.

*** Certified for closet installation on combustible flooring.

2. Furnace Sizing

The maximum hourly heat loss for each heated space shall be calculated using a recognized method suitable for local conditions.

In the United States, “Manual J – Residential Load Calculation,” published by the Air Conditioning Contractors of America (ACCA), provides an acceptable method.

In Canada, the procedures published by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) provide an acceptable method.

If the installation is a retrofit application, do not rely on the capacity of the existing heating equipment as a method to size the new furnace. Many of the heat transfer multiples listed in earlier versions of load calculation manuals were much higher than those listed in more recent editions. It is possible that energy saving measures have been completed since the installation of the existing furnace. This might include additional insulation in the attic or walls, the application of sprayed foam insulation, the addition of storm windows and doors, weather-stripping, caulking, etc.

Many of the older furnaces were equipped with large belt drive blower systems, operating at low RPM's. If replacing an existing furnace, be sure that the existing ductwork can handle the amount of airflow necessary for a reasonable temperature rise. Most older gas furnaces operated with a system temperature rise of 70–100°F (39–56°C). This furnace is designed to be operated with a system temperature rise (ΔT) as illustrated in “2.1 Model Input and Temperature Rise”. If the furnace selected has an identical output capacity as the original furnace, a substantial increase in system air flow will be necessary. See “3.1 General Guidelines” and the airflow characteristics in “18. Maintenance and Troubleshooting” of this manual.

Existing ductwork should be assessed for its air handling capabilities.

The “Equal Friction Chart,” as published by ASHRAE and HRAI, is the basis for the various air duct calculators available through heating supply companies. Following the air velocity guide lines, according to the “Equal Friction Chart,” or a slide rule air duct calculator, a typical 6” (152 mm) round duct has a capacity of approximately 100 cfm.

Note The return air system is equally as important as the supply air system. An under-sized return air system will prevent sufficient quantities of air from reaching the supply air system and will consequently reduce the service life of the furnace and its components.

2.1 Model Input and Temperature Rise

Model	Fire Rate	Input	Output	Delta T (°F)
NDF600-050M2V3B	High Fire	53,000	50,000	40–70
	Low Fire	37,000	35,000	35–65
NDF600-070M2V3B	High Fire	70,000	67,000	40–70
	Low Fire	49,000	47,000	35–65
NDF600-070M2V4C	High Fire	70,000	67,000	40–70
	Low Fire	49,000	47,000	35–65
NDF600-090M2V5C	High Fire	88,000	84,000	40–70
	Low Fire	61,000	59,000	35–65
NDF600-105M2V5C	High Fire	105,000	101,000	40–70
	Low Fire	74,000	71,000	35–65

3. Location of Unit

3.1 General Guidelines

- Select a location where the exhaust and combustion air piping can be routed between the furnace and their terminations with a minimum of lengths and fittings. Be sure to check that the proposed termination location will meet code requirements with respect to location and minimum clearances. (See venting section for minimum and maximum limits.)
- Select a location as near as possible to the existing or proposed duct system.
- The furnace location must have provisions for condensate drainage. If a suitable drain is unavailable near the furnace, a condensate pump must be used. The condensate pump drain tubing must not terminate outdoors. Be sure to select a condensate pump that has been approved for furnace condensate applications.
- The furnace location must permit access for servicing and be within the clearance to combustibles guidelines as marked on the appliance rating plate.
- The furnace must be installed on a level surface. It is required that the rear of the furnace be elevated 1/4" (6 mm) higher than the front to facilitate proper condensate drainage.
- If the furnace is being installed so that the return air will enter through the bottom, the perimeter of the furnace must be properly supported.
- When installed in the horizontal position, the furnace may be supported from the bottom, or suspended. (Figure 3)
- In the upflow right venting configuration, the furnace must drain on the left side.

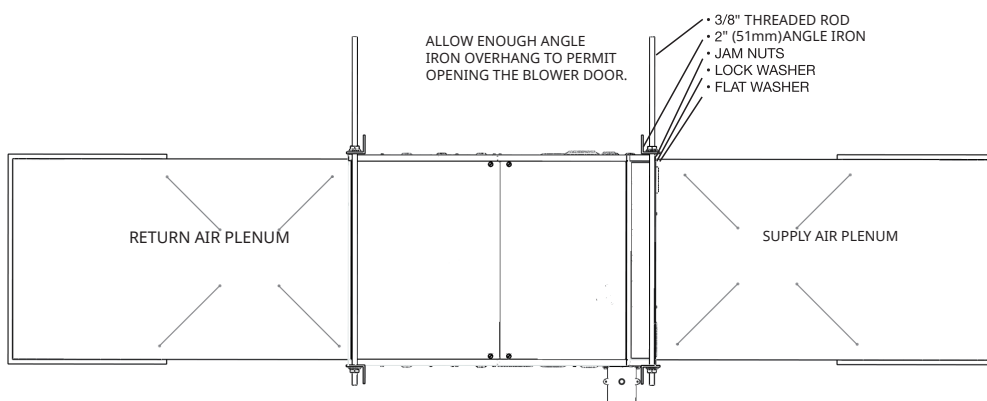


Figure 3. Suggested Method For Suspending Horizontal Furnace

3.2 Other Considerations

- If the furnace is to be located in an area where the combustion air is laden with chemical compounds such as bromine, chlorine or fluorine, as may be found in swimming pool chemicals, laundry detergents, etc., use outdoor air for combustion. These compounds, when exposed to flame, form acids which attack the heat exchanger and other components.

Exposure to the following substances in the combustion air supply (but not limited to the following) will also require outdoor air for combustion:

- Aerosols, particularly CFC based or propelled aerosols
 - Air fresheners
 - "Airplane Glue" and similar adhesives and cements
 - Ammonia, as commonly found in permanent wave solutions used in hair dressing salons
 - Anti-static fabric softeners used in clothes dryers
 - Carbon tetrachloride
 - Chlorinated cleaners and waxes
 - Chlorine and bromine based swimming pool chemicals
 - De-icing salts or chemicals (rock salt, etc.)
 - Dry cleaning fluids such as perchloroethylene
 - Fumes from curing polyurethane and similar substances
 - Halogen based refrigerants including R-12 and R-22
 - Hydrochloric acid, muriatic acid and other acid based masonry washing and curing materials
 - Printer's inks, paint removers, varnishes, varsol, toluene, etc.
 - Water softener salt and chemicals
- If this furnace is to be installed in an area over a finished ceiling or living area, install a field fabricated auxiliary drain pan under the furnace to protect that area from accidental condensate spills. The auxiliary pan should be large enough to collect accidentally spilled condensate from the air conditioning evaporator coil assembly if applicable.

- If the furnace is installed in an area where freezing may occur, a garage, an attic, a crawl space or any unconditioned space, steps must be taken to protect the condensate trap and drain line from freezing.
- This furnace is approved for installation in attics, alcoves, utility rooms, closets and crawl spaces. If this furnace is to be installed in a utility room, be sure that it is located in such a way as to allow access for servicing or the removal of other appliances installed in the room (hot water heater, for example). It is not permissible to use a rear return on this appliance. Use only side and bottom returns.

3.3 General Installation Requirements

In all installation orientations, vent positioning, pressure switch location, and drain locations shall be **installed** in accordance with instructions in the appropriate sections of this manual.

Non-suspended Installation

Maintain clearances to combustibles as outlined in Table B. The furnace must be supported in such a way as to not allow twisting or sagging of the cabinet.

Suspended Installation

Maintain clearances to combustibles as outlined in Table B. The furnace may be suspended by field fabricating a cradle of angle iron and threaded rod. Secure the furnace with 2" (51 mm) minimum slotted angle or equivalent as shown in Figure 3. The furnace must be supported in such a way as to not allow twisting or sagging of the cabinet. Position the supports so as to not interfere with accessing the burner and blower compartments.

Downflow Installation

The opening in the floor must provide adequate clearances to the combustible material according to the clearance to combustible as outlined in Table B.

NOTICE

- The furnace must be installed on a level surface. It is required that the rear of the furnace be elevated $\frac{1}{4}$ " (6 mm) higher than the front to facilitate proper condensate drainage.
- If the furnace and air conditioner is located above a finished space, install a drain pan underneath the unit.

3.4 Air Conditioning

This furnace may be used as part of an air conditioning system. The furnace wiring and control system is "air conditioning ready." There are the following factors to consider:

- The air conditioning evaporator coil must be downstream of the heat exchanger. The cooled air passing over the warmer heat exchanger tubes can cause condensation inside the tubes, resulting in corrosion and premature failure.

4. Combustible Clearances

Table B provides the certified clearances to combustibles information. Also see the appliance rating plate affixed to the furnace for specific model number, serial number and clearance to combustibles information.

WARNING

- This furnace is certified for installation on combustible floors. This shall be interpreted as a wood floor only. Failure to comply with these instructions can result in fire, causing property damage, personal injury or death.
- The furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.
- The area around the furnace must be kept clear and free of all combustible materials including gasoline and other flammable vapors and liquids.
- The homeowner should be cautioned that the furnace area must not be used as a closet or for any other storage purpose.

NOTICE

This furnace requires a minimum of 24" (610 mm) of front clearance for service purposes. For this purpose, service clearance takes precedence over clearance to combustibles.

5. Ductwork

Proper airflow is required for the correct operation of this furnace. Insufficient airflow may cause erratic operation, could cause the furnace to cycle on the high temperature limit, and may damage the heat exchanger. Excessive airflow may result in an excessively noisy duct system and may result in undesirable consequences such as creating uncomfortable drafts.

If air conditioning is to be used with the furnace, the duct system must be capable of delivering the correct amount of airflow for each system.

The ductwork should be sized and constructed in accordance with accepted industry standards.

Duct sizing and construction information may be obtained from:

- A.C.C.A. (Air Conditioning Contractors of America)
- A.S.H.R.A.E. (American Society of Heating, Refrigeration and Air Conditioning Engineers)
- H.R.A.I. (Heating, Refrigerating and Air Conditioning Institute (Canada))
- S.M.A.C.N.A. (Sheet Metal and Air Conditioning Contractors' National Association (United States))

Note

- All of the above professional organizations have duct sizing manuals available.
- The total static pressure drop of the air distribution system (including filters) should not exceed 1.0" w.c. or that specified on the product rating plate.

WARNING

- Do not allow gas piping to be routed through joist spaces that are used for return air purposes. Do not use joist spaces for return air purposes if the joist space already contains plumbing stacks, chimney components, etc. unless the portion used for return air purposes can be completely isolated from portions with other usages.
- Never allow the products of combustion from the flue to enter the return air or supply air ductwork.
- All return air ductwork must be adequately sealed and secured to the furnace with sheet metal screws. Tape the sheet metal seams in the vicinity of the furnace with duct tape or similar material.
- When the furnace is mounted on a platform with return air through the bottom, it must be sealed air tight between the furnace and the return air plenum. The floor or platform must provide sound physical support of the furnace without sagging or gaps around the base. It must also be sealed between the support and the base.
- Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions, including carbon monoxide poisoning that could result in personal injury or death.

5.1 Ductwork Steps

1. Position the furnace to minimize ductwork length and fittings.
2. Cut open a return air inlet. The choices are furnace bottom, either side, or any combination thereof (i.e., two sides or a side and the bottom). In all cases, cut the return air opening the full width of the return air markers on the side panel.

For upflow orientation, the return air duct may be connected to either side of the cabinet or the bottom return opening.

For horizontal and downflow orientations, the return air duct must be connected to the designated return air opening located opposite the supply air outlet.

WARNING

- Do not use the rear panel as a return air inlet. there is insufficient room to permit adequate airflow.
- Damages, defects or failures caused by conditioned air (return air) supplied to the furnace being greater than 20% from outdoors (55°F/13°C min. return air temperature).
- Some heating air flow values may be higher than those required for cooling. Be sure to size the duct system for highest possible values.

3. Connect the return air duct or filter fitting to the furnace. The connection should be sealed air tight to prevent entraining combustion gases from an adjacent fuel burning appliance, or entraining combustion air for this furnace or adjacent fuel burning appliances.
4. Ensure that there is adequate space and accessibility for air filter removal.
5. If an air conditioning evaporator coil is required, position it on the supply air side of the furnace. Ensure that no air can bypass the evaporator coil.

Note

Furnace must not be installed downstream of the coil.

6. Connect the supply air plenum to the supply air outlet.

Note

- Flexible duct connectors are an effective device to prevent the telegraphing of mechanical noise from the furnace to other parts of the home via the ductwork. If using flexible connectors, ensure that the adjoining duct is independently supported.
- If the airflow requirements exceed 1,800 cfm, models will require air openings and filters on:
 - Both sides
 - One side and the bottom
 - Just the bottom

6. Venting and Combustion Piping

WARNING

- Read, understand and follow all instructions in this section. Failure to properly vent or supply combustion air to this furnace can cause carbon monoxide poisoning, or an explosion or fire, resulting in property damage, personal injury or loss of life.
- No 'B' vent applications allowed.

6.1 Acceptable Materials in the United States

Furnace venting may be comprised of:

- Schedule 40 PVC, ASTM D1785 or CSA B137.3
- PVC-DWV, ASTM D2665 or CSA B181.2
- Schedule 40 CPVC, ASTM F441 or CSA B137.6
- PVC PRIMER AND SOLVENT CEMENT: ASTM D2564
- PPE ULC S636 Manufactured by M&G Duravent - must terminate using 45 and 90 degree elbows, or a tee.

Follow piping manufacturers instructions on proper installation of piping and fittings including cutting, deburring, priming, cementing, curing and supporting.

6.2 Acceptable Materials in Canada

Effective August 1, 2007, all vent piping materials and fittings for flue gas venting must be ULC S636 listed and identified as such on the material. The first 3 ft (900 mm) of venting must be readily available for visual inspection. Specified primers and glues of the certified vent system must be from a single system manufacturer, and not intermixed with other system manufacturers' vent system parts. The components of the certified vent system must not be interchanged with other vent systems, or unlisted pipe, and or fittings. Follow the venting manufacturer's instructions on installation, cutting, deburring, cementing, curing and supporting of the venting system.

- The furnace must be vented with ULC S636 PVC manufactured by IPEX, Royal Build Products (GVS65 & GVS90), M&G Duravent (PPE) or Centrotherm (InnoFlue®).
- PVC vent terminations may use concentric kits listed in "10.3 Inducer Rotation Instructions & Pressure Switch Mounting" or terminate using 45 and 90 degree elbows, or a tee.
- PPE venting must terminate using 45 and 90 degree elbows.
- Minimum rating of 149°F (65°C).

6.3 Vent Drain Option

A vent drain is recommended when vent passes through any unconditioned space such as an attic or crawl space in order to prevent the accumulation of excess condensate in the inducer housing during operational cycles, refer to images for Vent Drain Option.

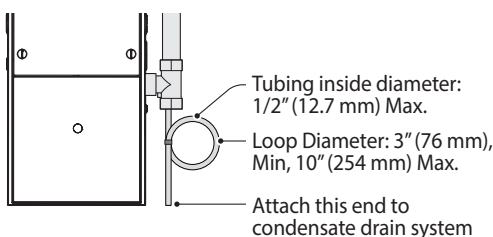
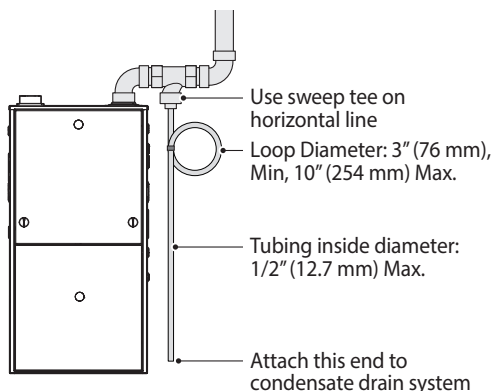
To install the vent drain, complete the following steps:

NOTICE

Tee, reducer and nipple must be properly cemented together using the appropriate method and materials specified in section "6. Venting and Combustion Piping", "6.1 Acceptable Materials in the United States" and "6.2 Acceptable Materials in Canada".

1. Place a tee of the proper diameter for the vent system being installed 2" (51 mm) or 3" (76 mm) in the horizontal run or vertical riser closest to the furnace.
2. Place a reducer bushing of proper diameter in the stem portion of the tee. The recommended size for the reducer is 5/8" (15.9 mm).
3. Place a piece of 5/8" (15.9 mm) diameter pipe that has a minimum length of 3" (76 mm) long into the reducer to serve as a nipple.
4. Connect a piece of flexible drain tubing such as EPDM rubber or PVC to the nipple.
5. Loop the drain tubing to provide a trap.

6. Connect the discharge end of the drain tube to the condensate disposal system externally to the furnace.



NOTICE



Elbows with drain ports are not recommended, as condensate can bypass the drain on the curve.

7. Non-Direct Vent Furnace Installations Using Indoor Combustion Air (One Pipe System)

The furnace, although designed as a direct vent type appliance, may be installed with the intake vent inside the structure.

WARNING

This furnace and any other fuel burning appliance must be provided with enough fresh air for proper combustion and ventilation of the flue gases. Most homes will require that outside air be brought to the furnace area. Failure to do so can cause personal injury, or death from carbon monoxide poisoning.

Adequate provisions for combustion and ventilation air must be in accordance with CAN/CGA-B149 in Canada, and ANSI Z223.1, section "Air for Combustion and Ventilation" in the United States. Check with local authorities for any additional building code bylaws or regulations.

CAUTION

Air for combustion and ventilation purposes must not originate from a corrosive atmosphere. Any furnace failure caused by corrosive elements is excluded from warranty coverage.

The following types of installation sites (but not limited to the following) will require outdoor air for combustion because of chemical exposures:

- Commercial buildings
- Buildings with indoor swimming pools
- Furnaces installed in laundry rooms
- Furnaces in hobby or craft rooms
- Furnaces installed near chemical storage areas

Combustion air must be free of acid forming chemicals such as sulphur, fluorine and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint and varnish removers, refrigerants, and many other commercial and household products. When burned in a gas flame, vapors from these products form acid compounds. Acid compounds increase the dew point temperature of the flue products and are highly corrosive after they condense.

7.1 Determining Combustion Air

7.1.1 Case 1: Furnace Located in an Unconfined Space

Unconfined space does not necessarily mean that ventilation will not have to be introduced from the outdoors, particularly in airtight homes. The minimum requirement for unconfined space is a volume of 50 cubic feet (1.42 m³) for each 1,000 Btu/hr for all fuel burning appliances located within the unconfined area.

If the amount of combustion and ventilation air is insufficient to properly operate the furnace and other fuel burning appliances within the unconfined area, it will be necessary to supply it from the outdoors based on the criteria used when calculating the air supply for a confined space.

Note

If planning to use the inside air in an unconfined space, remember to test for proper furnace operation (as well as other fuel burning appliances located within the unconfined space) with respect to adequate combustion and ventilation air with fireplace dampers open, clothes dryer running, bathroom exhaust fans on, kitchen range hood on, etc.

7.1.2 Case 2: Furnace Located in a Confined Space

A confined space (any space smaller than the minimums discussed in “7.1.1 Case 1: Furnace Located in an Unconfined Space”, must have two air openings; one within 12” (305 mm) of the ceiling and the other within 12” (305 mm) of the floor. The air openings must be sized considering the method outside air is introduced, whether the combustion and ventilation air is being taken from indoors or outdoors and taking into account any other fuel burning appliances in the confined space.

If sufficient indoor combustion and ventilation air is available for the furnace and all other fuel burning appliances, size each opening on the basis of one square inch (645 mm²) of free area per 1,000 Btu/hr. (Figure 4)

Note Be sure to consider all clothes dryers, bathroom fans, range hoods, etc., when making this calculation.

The minimum requirement for these openings is 100 square inches (645 mm²), even for the furnace models under 100,000 Btu/hr.

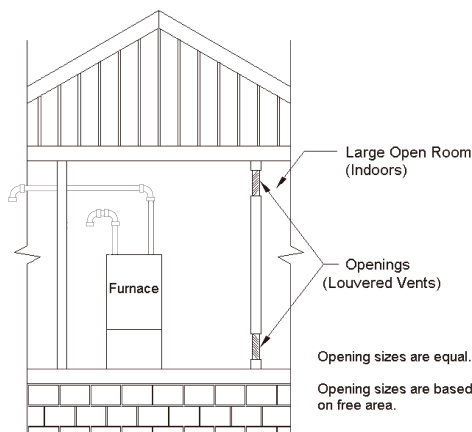


Figure 4. Combustion/Dilution Air from Heated Inside Sources

Note

- If using grills to cover the two openings, factor in the free area of the grill. Typically, a sidewall grill will have a free area approximately 50% of its nominal size. Consequently, if the required opening is 10" X 10" (254 mm X 254 mm), it will have to be doubled if using a sidewall grill with 50% free area.
- If an exhaust fan, fireplace, clothes dryer or any similar device is present in the indoor area from which the combustion and ventilation air will be drawn, negative pressure could be a problem if natural infiltration from the outdoors does not match the rate at which air is exhausted.

7.1.3 Case 3: Furnace Located in a Confined Space, Outdoor Air from Attic or Crawl Space

In this circumstance, the free area of each of the two combustion and ventilation air openings is based on a minimum of 1 square inch (645 mm²) per 4,000 Btu/hr. In this configuration, one opening can originate from the floor drawing combustion and ventilation air from the ventilated crawl space.

The other opening may communicate freely with the ventilated attic. If using the attic air, ensure that the opening is ducted from the ceiling high enough to be above the insulation. The attic must be adequately vented with soffit vents or gable vents. (Figure 5)

As an alternative to creating an opening in the floor to draw air from a crawl space, a duct may be dropped from the attic terminating 12" (305 mm) above the floor.

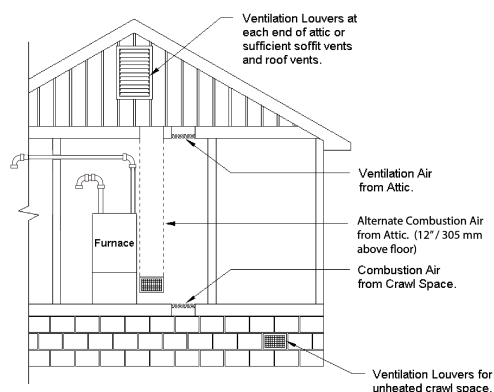


Figure 5. Outside Air for Combustion, Attic or Crawl Space (Case 3)

The following table shows minimum free areas and round pipe sizes when drawing combustion air vertically from the attic or crawl space for the furnace only. If other fuel burning appliances are present, their combustion air and ventilation air requirements must be added to those of the furnace.

Input kBTU/hr	Free Area Ea. Opening	Round Pipe Size
50	15 in. ² (97 cm ²)	5 in. (127 mm)
70	20 in. ² (129 cm ²)	6 in. (152 mm)
90	25 in. ² (161 cm ²)	
105	30 in. ² (194 cm ²)	7 in. (178 mm)

Table 2. Vertical Air Supply (Case 3)

Note If the attic has an exhaust fan (power vent), it may create a negative pressure sufficiently large enough to prevent the attic from being an effective source of combustion and ventilation air. Powered attic fans do not customarily run during the heating season; however, some are controlled by a humidistat as well as a thermostat, which may allow some operation during the heating season. The choices are (A) use the direct vent option; (B) obtain outdoor air from elsewhere; or (C) interlock the attic exhaust fan with the furnace such that the two cannot operate simultaneously.

7.1.4 Case 4: Furnace Located in a Confined Space, Outdoor Air Ducted Horizontally

Similar to Case 3, outdoor air for combustion and ventilation may be drawn through horizontal ducting. The free area for each opening is calculated on the basis of a minimum of 1 square inch (645 mm²) per 2,000 Btu/hr input.

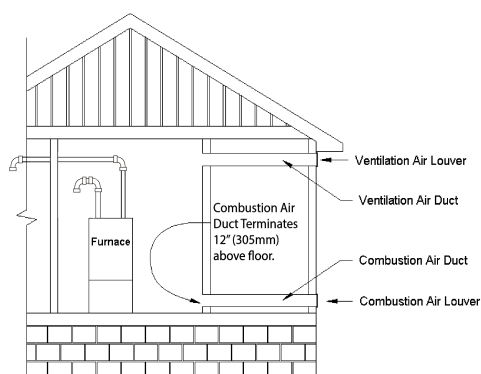


Figure 6. Outdoor Air for Combustion, Horizontal (Case 4)

The following table shows minimum free areas and round pipe sizes when drawing combustion air horizontally from the outdoors for the furnace only. If other fuel burning appliances are present, their combustion air and ventilation air requirements must be added to those of the furnace.

Input kBTU/hr	Free Area Ea. Opening	Round Pipe Size
50	30 in. ² (194 cm ²)	7 in (178 mm)
70	40 in. ² (258 cm ²)	8 in (203 mm)
90	50 in. ² (323 cm ²)	
105	60 in. ² (387 cm ²)	9 in (229 mm)

Table 3. Horizontal Air Supply (Case 4)

CAUTION

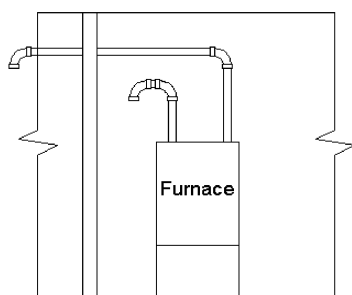
The outdoor grills must be installed in a location where they will not be obstructed in any manner.

NOTICE

If grills are used on the outside wall, they must be sized properly. Most sidewall grills have only 50% free area. In the case of a unit with 100,000 Btu/hr input, which requires a pair of 8" (203 mm) round pipes to obtain sufficient combustion and ventilation air, the duct could be an equivalent rectangular duct; 8" X 7" (203 mm X 178 mm) for example. Based on 50% free area for the inlet grills, the actual grill size would have to be 14" X 8" (356 mm X 203 mm) or its equivalent. A transition may be used to reduce the smaller duct size if necessary.

7.1.5 Connection to Furnace Non-Direct Vent

When using indoor air or the non-direct vent configuration, the combustion air inlet to the furnace must be protected from blockage. Use a double elbow arrangement if supplying combustion air through the top, or a downward pointing single elbow if supplying combustion air through the side. (Figure 7)



**Figure 7. Non-Direct Important:
Combustion Air Inlet**

8. Venting Guidelines

WARNING

Read and follow all instructions in this section. Failure to properly vent this furnace can cause carbon monoxide poisoning or an explosion or fire resulting in property damage, personal injury or loss of life.

CAUTION

Failure to follow all venting guidelines may result in erratic furnace operation, freeze-up of the exhaust air piping, or sooting of the furnace.

NOTICE

- Clean and deburr all pipe cuts (including uncut vent lengths). The shavings must not be allowed to block the exhaust, combustion air inlet or condensate drain lines.
- If the pipe and fittings are to be other than PVC, use the proper cleaner, primer and cement for the dissimilar materials.
- The exhaust vent must be supported appropriately prior to it being fitted to the inducer. Under no circumstances shall the inducer bear any weight of the venting system.

Note

- Any increase of venting diameter must be done on the vertical sections not horizontal sections.
- For 70KBTU small cabinet and 105KBTU large cabinet furnaces, it is strongly recommended to install the air intake on the side of the furnace for ideal supply of combustion air and ignition.
- Combustion air intake and exhaust termination should be inspected periodically to ensure they are clear of obstructions. i.e. vegetation, debris, snow, etc.
- Accumulation of snow around the combustion air intake and exhaust termination may have negative effects on appliance operation and/or performance. Snow accumulation should be considered when locating combustion air intake and exhaust terminations.
- Venting may be vertical or horizontal.
- Minimum vent length - 15 total equivalent feet (4.6 m). (See Venting Table)
- Horizontal piping must slope back towards the furnace at a minimum rate of $\frac{1}{4}$ " to the foot (18 mm per meter), so that condensate drains towards the furnace.
- Horizontal runs must be supported at least every 5 feet (1.524 m). Horizontal sections must not dip or sag.
- All vent runs through unconditioned space where freezing might occur should be insulated with "arm-a-flex", "rub-a-tex" or equivalent as long as there is no heat tape applied to the vent pipe. For horizontal runs where water may collect, wrap the vent pipe with self regulating 3 or 5 watt heat tape. The heat tape must be CSA, UL, or ULC listed and installed per the manufacturer's instructions. This includes travel through unconditioned attic space.
- Do not common vent with any other appliance.
- If venting vertically, do not vent up a chimney serving another appliance or install in a chase with a metal or high temperature plastic pipe from another gas or fuel burning appliance unless the required clearances to combustibles can be maintained between the furnace venting system and other pipes.

It is recommended that an offset is created (2 X 45°s) in the vertical exhaust vent piping to reduce the risk of flooding the inducer with excessive vent condensate run down.

All exhaust piping must be installed in accordance with CAN/CGA-B149 in Canada; the latest edition of National Fuel Gas Code, NFPA 54/ANSI Z223.1 in the United States, as well as in accordance with local codes.

Size the combustion air and exhaust piping in accordance with Table 4. When calculating allowable vent lengths, be sure to count all termination fittings in addition to counting the concentric vent as a straight pipe.

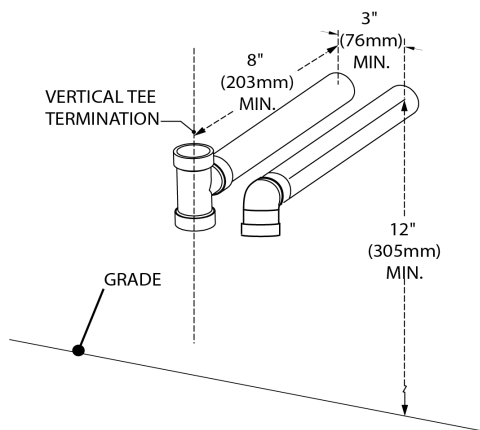


Figure 8A. Standard (Straight) Horizontal Vent Detail

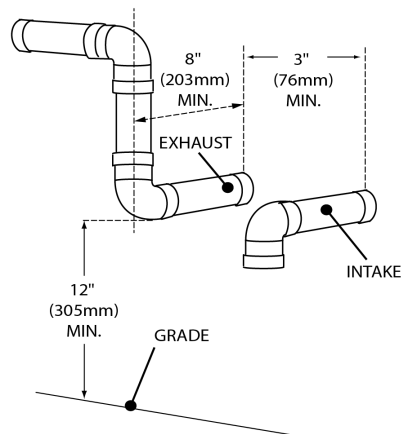


Figure 8B. Standard (Straight) Horizontal Vent Detail

The periscope vent (Figure 9), must be used in extreme cold climates defined as; -22°F (-30°C) sustained for 48 hours or more.

Take the building orientation and the presence of other buildings or other nearby structures into consideration when planning the venting system location. Certain external structures could create air turbulence around the vent termination leading to downdrafts and similar venting problems. In windy and hill locations, roof venting may improve operations. Maximum venting length is based on 30 mph (48 km) winds, areas where higher gusts are dominant it is suggested to shorten the horizontal vent length.

When installing the furnace with direct venting, the vent and combustion air intake shall be installed so that both are located in the same wind pressure zone.

⚠ WARNING

Do not connect the furnace to a chimney or flue serving other appliances or a solid fuel burning appliance.

8.1 Vent Termination

Horizontal vents should pass through the exterior wall. Figure 8 shows a standard horizontal vent detail. Terminate the vent 8" (203 mm) or more from the wall.

Exterior vent pipes greater than 24" (610 mm) should be insulated with ½" (13 mm) insulation to prevent moisture from freezing within the pipe and accumulating.

Size the exhaust pipe as specified in Table 4 - Direct and Non-Direct Vent Lengths. This table lists the maximum allowable length of pipe with respect to the number of 90° elbows used. For the purposes of this calculation, one 90° elbow is equivalent to two 45° elbows.

Input kBtu/hr	Pipe Size	Number of 90° Elbows						
		0	1	2	3	4	5	6
50	1½	60*	55	50	45	40	35	30
	2, 2½	75*	70	65	60	55	50	45
	3	100*	95	90	85	80	75	70
70	2, 2½	75*	70	65	60	55	50	45
	3	100*	95	90	85	80	75	70
90	2, 2½	75*	70	65	60	55	50	45
	3	100*	95	90	85	80	75	70
105	2, 2½	75*	70	65	60	55	50	45
	3	100*	95	90	85	80	75	70

Table 4. Direct And Non-Direct Vent Lengths

* Maximum allowable vent (intake and exhaust) length.

Note

- Maximum allowable length of exhaust or intake. Minimum vent length 15 ft (4.6 m) or equivalent.
- Count concentric vent fitting as straight pipe.
- Use medium or long sweep elbows where possible.
- One 90° elbow is equivalent to two 45° elbows.
- For direct vent, the listed lengths are allowed for each vent (intake and exhaust).
- For non-direct vent, the listed lengths are allowed for exhaust. The intake should have a 1½" or 2" snorkel fitting. (Figure 7)
- When 1½", 2½" or 3" pipe is used, exit the cabinet with 2" pipe. Reduce or increase immediately after exiting the cabinet on both intake and exhaust.

The vent for this appliance must not terminate: a) over public walkways; or b) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or c) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Equivalents

- Short Radius Elbow = 7 ft (2.13 m)
- Standard Radius Elbow = 5 ft (1.52 m)
- Long Radius Elbow = 3 ft (0.91 m)
- 45 Degree Elbow = 2.5 ft (0.76 m) Tee

Vent lengths that require more than 6–90° elbows, add listed equivalents for every elbow up to the maximum allowable vent length.

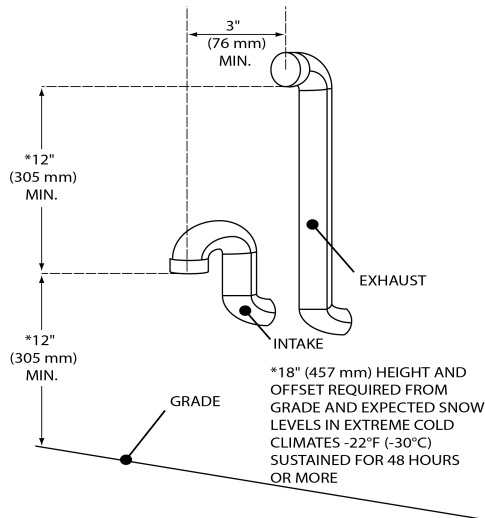


Figure 9. Periscoped Vent Detail

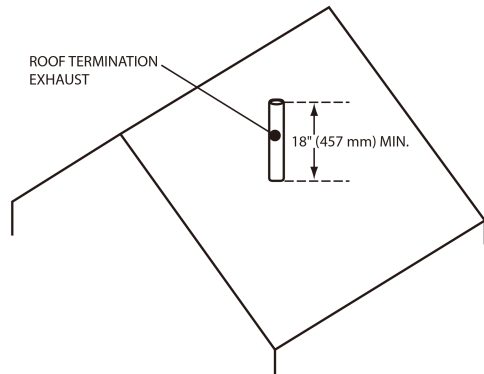


Figure 10. Vertical Venting

CAUTION

Moisture in the flue gases condenses as it leaves the terminal. This moisture can freeze on exterior walls, on soffits, and other nearby objects. Some discoloration is to be expected; however, improper location or installation can cause structural or exterior finish damage to the building.

Caulk all cracks, seams or joints within a 6 foot (1.8 m) radius of the termination.

Do not terminate under a deck unless there is adequate clearance to prevent damage from the flue gases. A termination may be located at the end of a patio deck. Piping running beneath the deck must be suitably insulated and suspended in a manner to prevent condensate from collecting and freezing.

When locating vent terminations, consideration must be given to prevailing winds, location and other conditions. These conditions may cause recirculation of the combustion products of adjacent vents. Do not locate the terminal on the side of the building facing the prevailing winter winds.

8.2 In the United States

In addition to the general guidelines, in the United States, the vent exhaust shall be installed in accordance with the following:

- The clearance from the bottom of the terminal to grade shall be 12" (305 mm).
- The vent shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard.
- The vent terminal shall be installed 4 feet (1.2 m) below, 4 feet (1.2 m) horizontally from, or 1 foot (305 mm) above any door, window, soffit, under eave vent or gravity air inlet to the building.
- The vent terminal shall have a minimum horizontal clearance of 4 feet (1.2 m) from electric meters, gas meters, regulators and relief equipment.
- Locate the vent terminal 3 feet (0.91 m) above any mechanical air inlet located within 10 feet (3 m). Any fresh air or make-up air inlet, such as for a dryer or furnace area is considered a forced air inlet.
- The vent terminal should be located no fewer than 3 feet (0.91 m) from an inside corner formed by two exterior walls.
- Recommended clearance from overhangs is a minimum of 1 foot (0.3 m) vertically for each foot horizontally up to 6 feet (1.8 m).

8.3 In Canada

In addition to the general guidelines, in Canada, the vent exhaust shall not terminate:

- Directly above a paved sidewalk or paved driveway which is located between two single-family dwellings and serves both dwellings.
- Less than 7 feet (2.1 m) above a paved sidewalk or paved driveway located on public property.
- Within 6 feet (1.8 m) of a mechanical air supply inlet to any building;
- Above a meter/regulator assembly within 3 feet (0.91 m) horizontally of the center line of the regulator;
- Within 3 feet (0.91 m) of any service regulator vent outlet;
- Less than 12" (305 mm) above grade level or anticipated snow level;
- Within 12" (305 mm) of any door, window, or non-mechanical air supply inlet to any building;
- Within 12" (305 mm) of the combustion air inlet of any other appliance;
- Underneath a veranda, porch or deck, unless (a) the veranda, porch or deck is fully open on a minimum of two sides beneath the floor, and (b) the distance between the top of the vent termination and the underside of the veranda, porch or deck is greater than 12" (305 mm).

8.4 Furnace Venting Installations

WARNING

Read and follow all instructions in this section. Failure to properly vent this furnace can cause carbon monoxide poisoning or an explosion or fire resulting in property damage, personal injury or loss of life.

8.4.1 Non-Direct Vent Installation Using Indoor Combustion Air (One Pipe System)

Non-direct vent installations require only a vent pipe. This may be desirable when using outdoor combustion air is not practical.

- Provisions are not made for routing of combustion air;
- The outdoor environment may contain contaminants undesirable for combustion.
- Install and secure a 8" (20 cm) piece of intake air pipe with a 90° elbow to prevent objects from entering burner area, and or objects from blocking combustion air intake.

8.4.2 Direct Vent Installation Using Outdoor Combustion Air (Two Pipe System)

The direct vent configuration is the preferred installation method. The primary advantages are:

- No special kit or modifications are required for direct vent installations
- Dedicated combustion air and vent piping eliminates the need to use already heated air for combustion purposes;
- The probability of corrosive contaminants being present in the combustion air is greatly reduced;
- The direct vent configuration is unaffected by any other appliances, exhaust fans, or other devices that tend to create negative pressure conditions while operating.
- No vents for combustion and ventilation air are required in confined spaces.

8.4.3 Combustion Air

This furnace is certified as a Category IV Type FSP Non-Direct and Direct Vent Furnace. When installed as a direct vent furnace, all combustion air is supplied from the outdoors via the plastic piping system. All components are field supplied, except for the 2" PVC connector used to connect the combustion air piping to the furnace.

The combustion air piping, like the exhaust piping, must be air tight throughout the system. The adapter joining the combustion air to the furnace is supplied with one gasket.

NOTICE

- If planning to use abs pipe for air intake, use an all-purpose cleaner and abs to PVC transition cement. If planning to use a CPVC pipe, use an all-purpose cleaner, a clear or purple primer and all-purpose cement approved for the purpose.
- If the furnace is to be installed in the vicinity of other fuel burning appliances, adequate combustion air must be available for the non-direct vent appliances. See "7.1 Determining Combustion Air".

Note

Additional information about cleaners, primers, solvents and cements may be obtained from their manufacturers.

9. Terminations

9.1 Combustion Air

Horizontal

The combustion air termination is made up of a medium or long sweep 90° elbow pointing downward to prevent rain from readily entering the combustion air intake piping. If the required clearance to grade cannot be obtained with the “straight through” configuration, the combustion air intake pipe may be “periscoped” up to 24” (610 mm) to gain extra height. (Figure 9)

Vertical

The combustion air termination is made up of a pair of medium or long sweep 90° elbow pointing downward to prevent rain from entering the combustion air intake piping.

The combustion air inlet must be located a minimum of 12” (305 mm) above grade or expected snow level, and 12” (305 mm) below the exhaust outlet. (Figure 11)

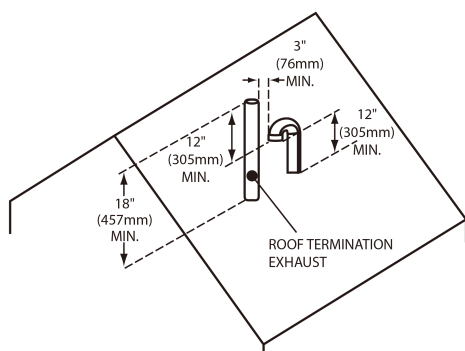


Figure 11. Standard Vertical Venting Detail

9.2 Exhaust

Horizontal

The exhaust termination can terminate with a tee, 45° elbow or a medium or long sweep 90° elbow pointing within 45° of the downward position, away from the combustion air intake terminal. Useful for installation in locales with wind load exceeding extreme (high) wind loads.

If the required clearance to grade cannot be obtained with the “straight through” configuration, the exhaust pipe may be “periscoped” up to 24” (610 mm) to gain extra height. (Figure 9) In this case, the flue gases may be expelled horizontally. Use the same size pipe as the interior run and count the fittings and length as part of the total vent length.

If winter prevailing wind conditions are variable and likely to occasionally blow flue gases back in on the combustion air intake, the exhaust termination may be raised 18–24” (457 mm X 610 mm) above the combustion air intake terminal to take advantage of the natural buoyancy of the flue gases to help prevent re-circulation of the exhaust. (Figure 9)

Vertical

No termination fitting is required if venting vertically through a roof. The end of the exhaust pipe must be 12” (305 mm) higher than the entrance of the combustion air intake terminal. (Figure 11)

The exhaust pipe extending through the roof must extend a minimum of 18” (457 mm) above any obstruction within an 18” (457 mm) horizontal distance.

Insulate all venting that extends 24” (610 mm) or more to the outside.

Note

Always clean out inducer collar after installation. Vent pipe shavings from initial installation can cause blockage in the inducer collar drain.

9.3 Concentric Venting Kit

Concentric venting terminal kits may be used for this series furnace. They provide a means of obtaining combustion air and exhausting products of combustion utilizing a single penetration through the exterior wall. This can be useful when there is limited wall space available. The following terminations are approved for use with this appliance:

- 2" IPEX vent kit #196005
- 3" IPEX vent kit #196006
- Terminals are made by IPEX Inc. See installation instructions for details.

If venting with 1½" vent material, and a concentric vent kit is necessary, a increase coupling may be used to connect to the 2" concentric venting kit. Read the instructions supplied with the kit for additional installation instructions and details. Straight vertical runs should have offset to push condensate against vent walls.

9.4 Concentric Vent Termination Installation Instructions

Follow the concentric vent termination manufacturer instructions for installation of the concentric vent termination kit.

9.5 Location

Avoid locating the terminals where the flue gas could become stagnant and allow recirculation into the combustion air intake.

Avoid locating the terminal in locations where dripping condensate may cause problems such as sidewalks, patios, above planters, near windows where exhaust gases may cause fogging, icing, etc.

Avoid locating the termination too close to shrubs and other vegetation. The condensate may stunt or kill them. Caulk all cracks, seams or joints within a 6 foot (1.8 m) radius of the termination.

Do not terminate under a deck unless there is adequate clearance to prevent damage from the flue gases. A termination may be located at the end of a patio deck. Piping running beneath the deck must be suitably insulated and suspended in a manner to prevent condensate from collecting and freezing.

When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions. These conditions may cause recirculation of the combustion products of adjacent vents. Do not locate the terminal on the side of the building facing the prevailing winter winds.

CAUTION

- Improper location or installation can result in structural damage to the building, damage to the exterior finish of the building, or may allow recirculation or freezing of the flue gases onto or into the combustion air intake.
- Moisture in the flue gases condenses as it leaves the terminals. This moisture can freeze on exterior walls, soffits, and other nearby objects. Some discoloration is to be expected.

The vent terminal should be located no fewer than 3 feet (0.9 m) from an inside corner formed by two exterior walls.

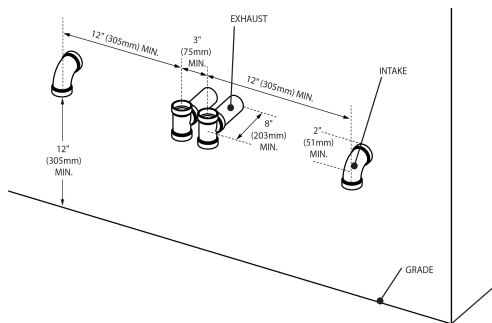
Recommended clearance for overhangs is a minimum of 1 foot (0.3 m) vertically for each foot horizontally up to 6 feet (1.8 m).

Any adjacent painted surfaces should be in good condition; no cracks, peeling paint, etc. If wooden surfaces that may be periodically exposed to flue gases are present, consider treating with a sealer.

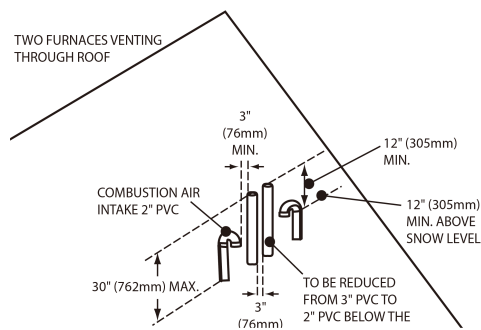
9.6 Multiple Venting

NOTICE

- When installing multiple furnaces in close proximity, each requires dedicated combustion air and exhaust venting.
- Common venting is prohibited! If two of these furnaces are to be installed in close proximity, the combustion air intake and exhaust terminations may be installed as shown in Figures 12 and 13.



**Figure 12. Multiple Venting
(Standard Horizontal)**



**Figure 13. Multiple Venting
(Standard Vertical)**

If more than two furnaces are being installed in close proximity, each additional combustion air intake and exhaust termination set shall not terminate less than 12 in (305 mm) apart.

Note

Canadian installation of 105,000 Btu/hr requires 3 ft (915 mm).

! WARNING

Recirculation of flue gases may occur causing the intake pipe to freeze shut during cold weather operation if the venting system is not installed per these guidelines.

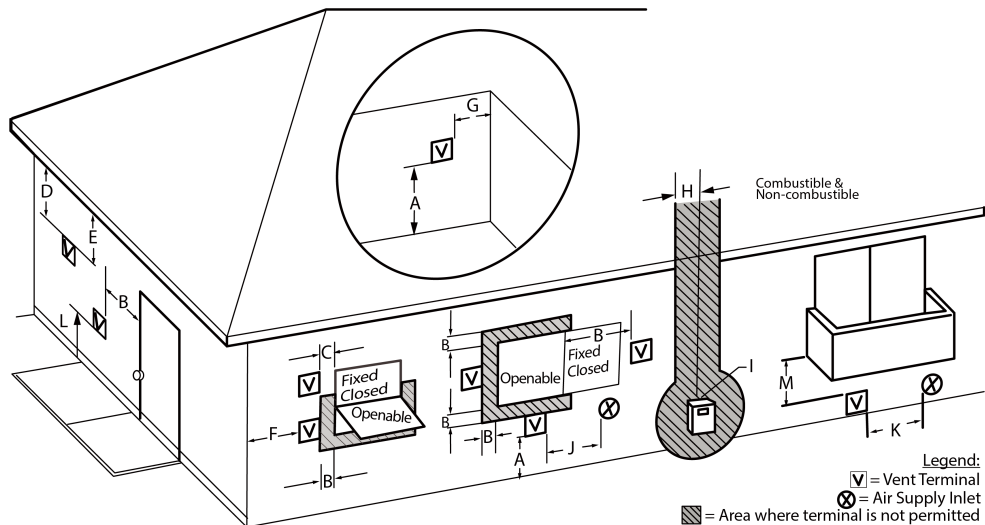


Figure 14A. Direct Vent Terminal Clearances

Ref	Description	US Installations*	Canadian Installations**
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	
B	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 9 in (23 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 50,000 Btu/hr (15 kW), 12 in (30 cm) for appliances > 50,000 Btu/hr (15 kW)	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 12 in (30 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 100,000 Btu/hr (30 kW), 36 in (91 cm) for appliances > 100,000 Btu/hr (30 kW)
C	Clearance to permanently closed window	12 in (30 cm)	12 in (30 cm)
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	18 in (46 cm)	18 in (46 cm)
E	Clearance to unventilated soffit	12 in (30 cm)	12 in (30 cm)
F	Clearance to outside corner	6 in (15 cm)	6 in (15 cm)
G	Clearance to inside corner	6 in (15 cm)	6 in (15 cm)
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft (4.5 m) above the meter/regulator assembly	
I	Clearance to service regulator vent outlet	3 ft (91 cm)	

Ref	Description	US Installations*	Canadian Installations**
J	Clearance to non mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 9 in (23 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 50,000 Btu/hr (15 kW), 12 in (30 cm) for appliances > 50,000 Btu/hr (15 kW)	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 12 in (30 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 100,000 Btu/hr (30 kW), 36 in (91 cm) for appliances > 100,000 Btu/hr (30 kW)
K	Clearance to a mechanical air supply inlet	3 ft (30 cm) above if within 10 ft (3 m) horizontally	6 ft (1.83 m)
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)***	
M	Clearance under veranda, porch, deck, or balcony	> 12 in (30 cm)****	

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

** 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.

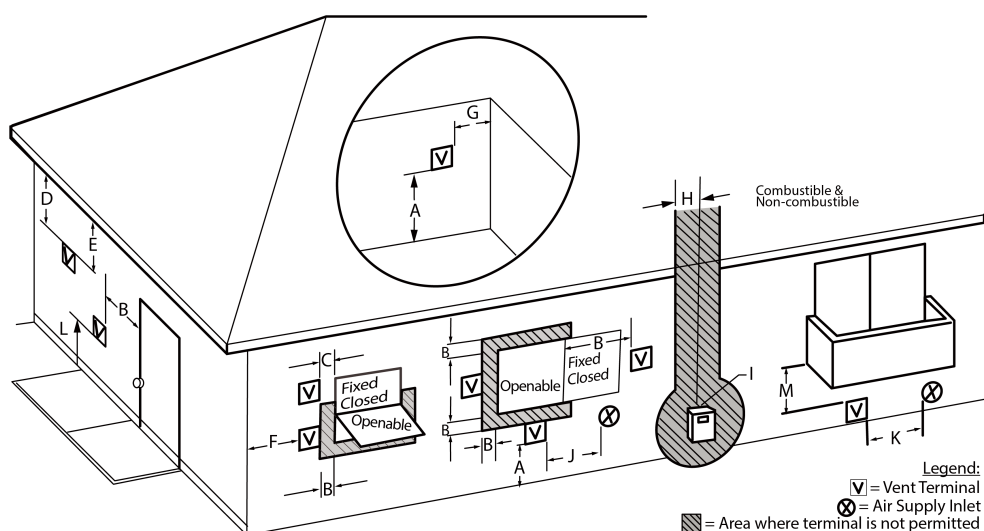


Figure 14B. Non-Direct Vent Terminal Clearances

Ref	Description	US Installations*	Canadian Installations**
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	
B	Clearance to window or door that may be opened	4 ft (1.2 m) below or to side of opening; 1 ft (300 m) above opening	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 12 in (30 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 100,000 Btu/hr (30 kW), 36 in (91 cm) for appliances > 100,000 Btu/hr (30 kW)
C	Clearance to permanently closed window	12 in (30 cm)	12 in (30 cm)
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	18 in (46 cm)	18 in (46 cm)
E	Clearance to unventilated soffit	12 in (30 cm)	12 in (30 cm)
F	Clearance to outside corner	6 in (15 cm)	6 in (15 cm)
G	Clearance to inside corner	6 in (15 cm)	6 in (15 cm)
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft (4.5 m) above the meter/regulator assembly	
I	Clearance to service regulator vent outlet	3 ft (91 cm)	
J	Clearance to non mechanical air supply inlet to building or the combustion air inlet to any other appliance	4 ft (1.2 m) below or to side of opening; 12 in (30 cm) above opening	6 in (15 cm) for appliances ≤ 10,000 Btu/hr (3 kW), 12 in (30 cm) for appliances > 10,000 Btu/hr (3 kW) and ≤ 100,000 Btu/hr (30 kW), 36 in (91 cm) for appliances > 100,000 Btu/hr (30 kW)
K	Clearance to a mechanical air supply inlet	3 ft (91 cm) above if within 10 ft (3 m) horizontally	6 ft (1.83 m)
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)***	
M	Clearance under veranda, porch, deck or balcony	>12 in (30 cm)****	

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

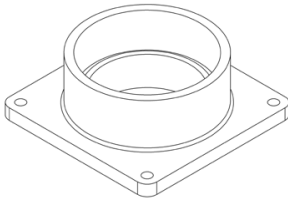
** In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.

*** 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.

10. Routing Options

Figure 16 to 19 on the following pages show the allowable installation positions with correct inducer orientation, condensate drainage, and pressure switch locations. The installer must also consider the following services: gas pipe, electrical power, drain trap, intake and exhaust vents, the air conditioning connections and drain, access to filter(s) and access to furnace and a/c for repair. Drains and traps of furnaces installed in spaces subjected to freezing temperature must also be protected against freezing.



The combustion air inlet fitting is a 2" PVC Socket to Flange adapter. Choose the intake location and remove the appropriate plastic cap. Install the adapter to the outside of the exterior panel using the screws provided (ensure gasket is properly placed between the adapter and the outside of the exterior panel for proper sealing). Failure to apply gasket on cabinet exterior voids the warranty.

10.1 Condensate Drains

The furnace may condense as much as 4-½ pounds of water per hour (approximately 2 imperial quarts, 2-½ U.S. quarts or 2-¼ liters). It is necessary to make provisions for draining the condensate away. The furnace is supplied with a drain trap assembly. See Figure 16–19 for possible locations of the drain trap.

Affix the condensate trap assembly to the exterior of the side panel of the blower compartment for upflow positions. For horizontal positions affix the condensate trap assembly to the exterior side panels. See Figure 16–19.

Four plastic drain hose clamps are provided in the parts bag. The large ones are used for securing the drain hose to the front manifold cover drain outlet, and securing the drain hose to the 5/8" barbed fitting on the condensate trap assembly. The small one is used to secure the drain hose to the inducer drain collar and the 1/2" barbed fitting on the condensate trap assembly.

The drain coupling on the inducer will work better if the drain holes are pointed down about 15 degrees. The drain hose supplied with the furnace is long enough to reach either side panel; however, it must be cut to fit each application. This is to prevent kinking in the drain lines.

Note

- It is recommended that pliers be used to firmly clamp the plastic hose clamps.
- The hoses comes connected to the inducer and FMC from the manufacturer. Installer must connect hoses to barbed fittings on condensate trap.

10.2 Preparations for Vent and Draining Option

1. Determine the most suitable vent and drain options for installation, see "10.3 Inducer Rotation Instructions & Pressure Switch Mounting".
2. Remove the 3-1/2" plastic exhaust vent cap (if required), and cover vent hole not in use. Install rubber grommet (in parts bag) for 2" vent pipe. Connect vent pipe (field supplied). If using 1-1/2" or 3" vent, make transition as close as possible to the unit and on a vertical section. The exhaust vent must be supported appropriately prior to it being fitted to the inducer. Under no circumstances shall the inducer bear any weight of the venting system.
3. Remove air inlet cap (if applicable) and attach air intake fitting with gasket to furnace panel. Connect 2" air intake pipe (field supplied).
4. Remove the two plastic caps attached to the blower division, and the one attached to the side panel if applicable.
5. Affix the condensate trap assembly to the interior or exterior of the side panel in the blower compartment for upflow and downflow positions using the two screws provided in the parts bag. For horizontal positions, affix the condensate trap assembly to the exterior side panels.

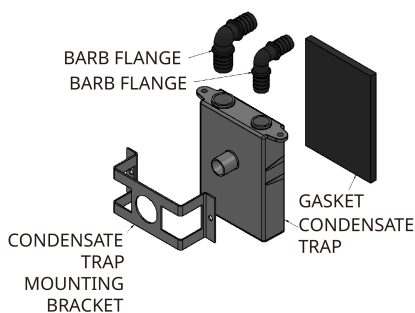


Figure 15

Note

- Condensate drain tubing must be cut to appropriate length and slopping towards condensate trap, ensuring that drain hoses do not create traps prior to the condensate trap assembly.
- Condensate traps must be primed with water prior to initial furnace start up.
- Barbed fittings must be fully inserted into condensate trap and drain hoses, seated to barb flange. hose clamps to be used on drain hose connections.

10.3 Inducer Rotation Instructions & Pressure Switch Mounting

1. Loosen collar clamp and pull up exhaust pipe for adequate clearance (if applicable).
2. Disconnect inducer wire connection.
3. Remove the 4 inducer screws.
4. Remove pressure switch assembly (switches) and pressure sensing hoses.
5. Remove inducer.
6. Reverse the bands on the rubber drain coupling so the screws are accessible if necessary. (Do not reverse the drain coupling.) Confirm that directional arrow on drain coupling points away from inducer.
7. Remove the appropriate plastic cap on the side panel. Install cap on vent opening not in use.
8. Reinstall the inducer and the pressure switch assembly in the correct orientation with the (4) inducer screws removed in step 2. Do not use power tool. Reinstall the pressure switches so that they are above the front manifold drain, to eliminate the chance of condensate draining into the pressure switch sensing hose causing erratic furnace operation. See Figure 16–19 for reference.

9. Rotate the drain coupling so the drain holes are angled downward 15° and tighten the coupling band to inducer.
10. Complete the venting as installation requires, mounting the exhaust pipe and tightly securing to the collar.

Always secure or support the vent and intake to the floor joists or rafters to avoid sagging and possible fatigue of venting materials. This ensures proper drainage and prevents spilling the products of combustion into the building.

The blower compartment should be completely isolated from the burner compartment, and in tight rooms with other combustion devices, be completely isolated from the room. Ensure that the combustion door gasket is in good condition.

NOTICE

Keep pressure switch hoses above the front manifold drain, and cut to appropriate length to prevent any sags or traps forming in the hoses.

! WARNING

There must not be any openings between the blower division panel and the combustion compartment. The blower compartment is under greater suction than the combustion compartment and can pull combustion air from the burners and cause incomplete combustion and erratic furnace operation.

Orientation		Rotate Inducer (Y/N)
Furnace	Flue*	
Upflow	Top Panel	N
	Left Panel	Y
	Right Panel	Y
Horizontal Left	Top Panel	N
	Right Panel	Y
Horizontal Right	Top Panel	N
	Left Panel	Y
Downflow	Left Panel	Y
	Right Panel	Y

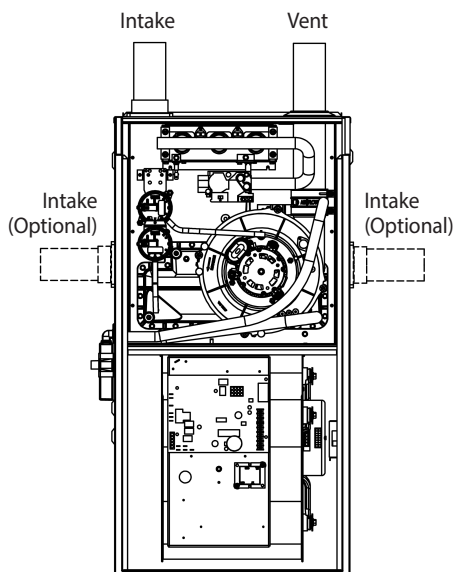
* Panel references are relative to standard Upflow orientation.

Ex) When configured for Horizontal Right, the Top Panel is on the right side of the unit.

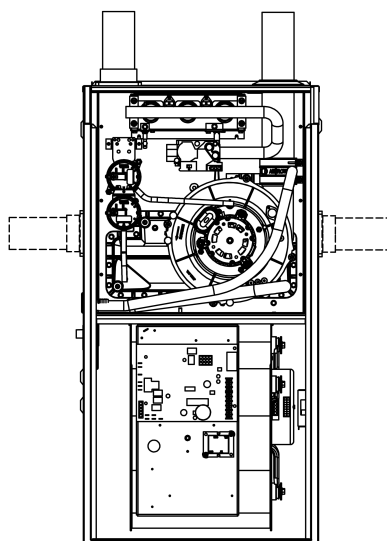
Table 5. Inducer Orientation

Note

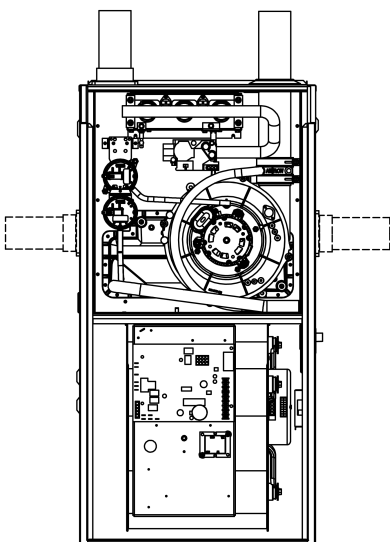
See Figure 16 for recommended mounting.



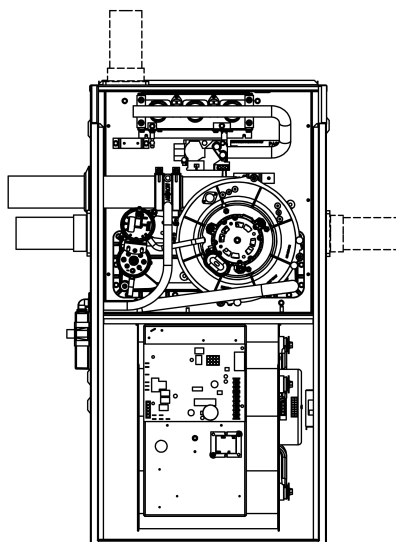
Top Vent - Left Drain Installation (External)



Top Vent - Left Drain Installation (Internal)

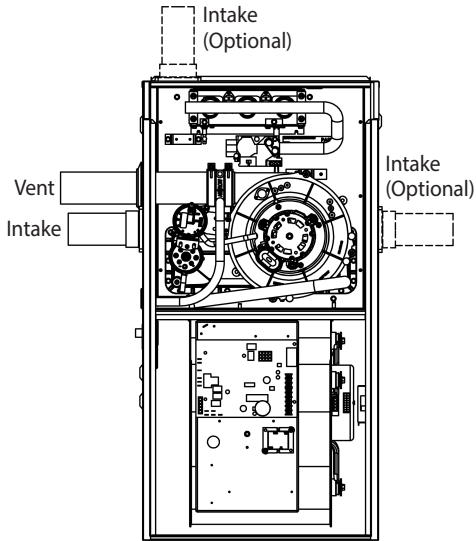


Top Vent - Right Drain Installation (Internal)

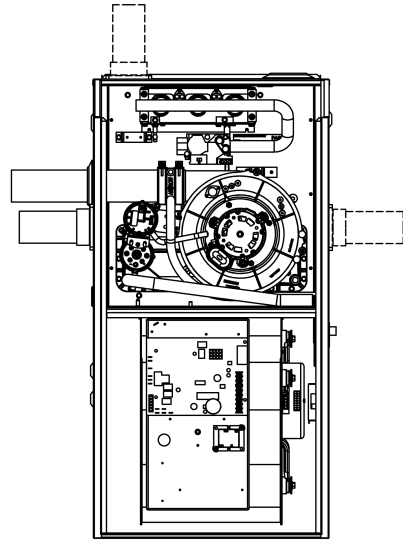


Left Vent - Left Drain Installation (External)

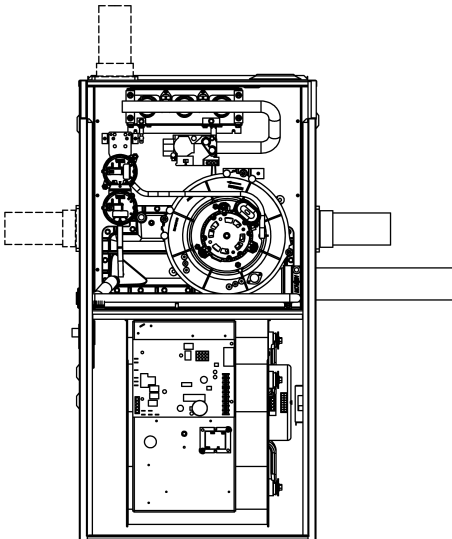
Figure 16. Upflow Vent and Draining Option



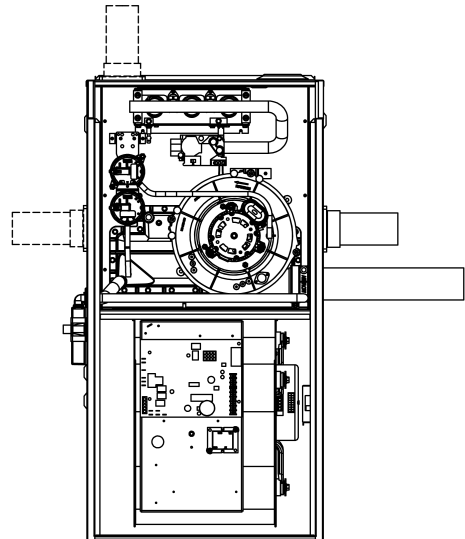
Left Vent - Left Drain Installation (Internal)



Left Vent - Right Drain Installation (Internal)



Right Vent - Left Drain Installation (Internal)

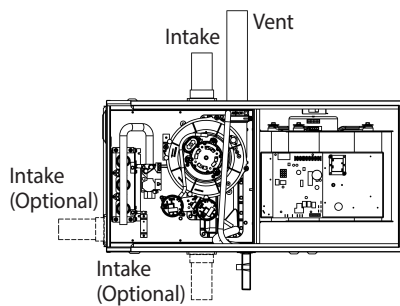


Right Vent - Left Drain Installation (External)

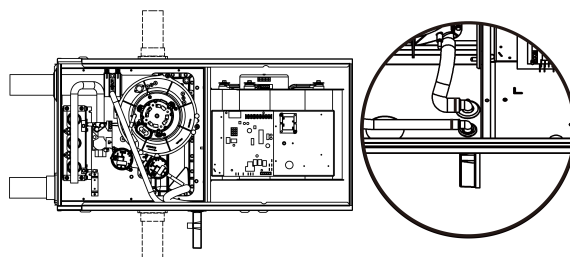
Figure 16. Upflow Vent and Draining Option

NOTICE

- Ensure the drain hose is sloped down towards the condensate trap.
- Prime condensate trap with water and cut drain hoses to proper length.
- Cut pressure switch tubing to proper length.
- Do not submerge termination of drain hose.



Right (Panel) Vent Installation

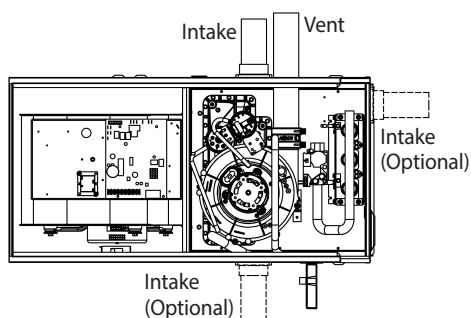


Top (Panel) Vent Installation

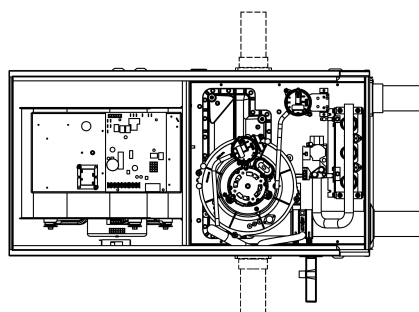
Figure 17. Horizontal Left Vent and Draining Option

NOTICE

- Prime condensate trap with water and cut drain hoses to proper length.
- Cut pressure switch tubing to proper length.
- Do not submerge termination of drain hose.



Left (Panel) Vent Installation



Top (Panel) Vent installation

Figure 18. Horizontal Right Vent and Draining Option

NOTICE

- Prime condensate trap with water and cut drain hoses to proper length.
- Cut pressure switch tubing to proper length.
- Do not submerge termination of drain hose.

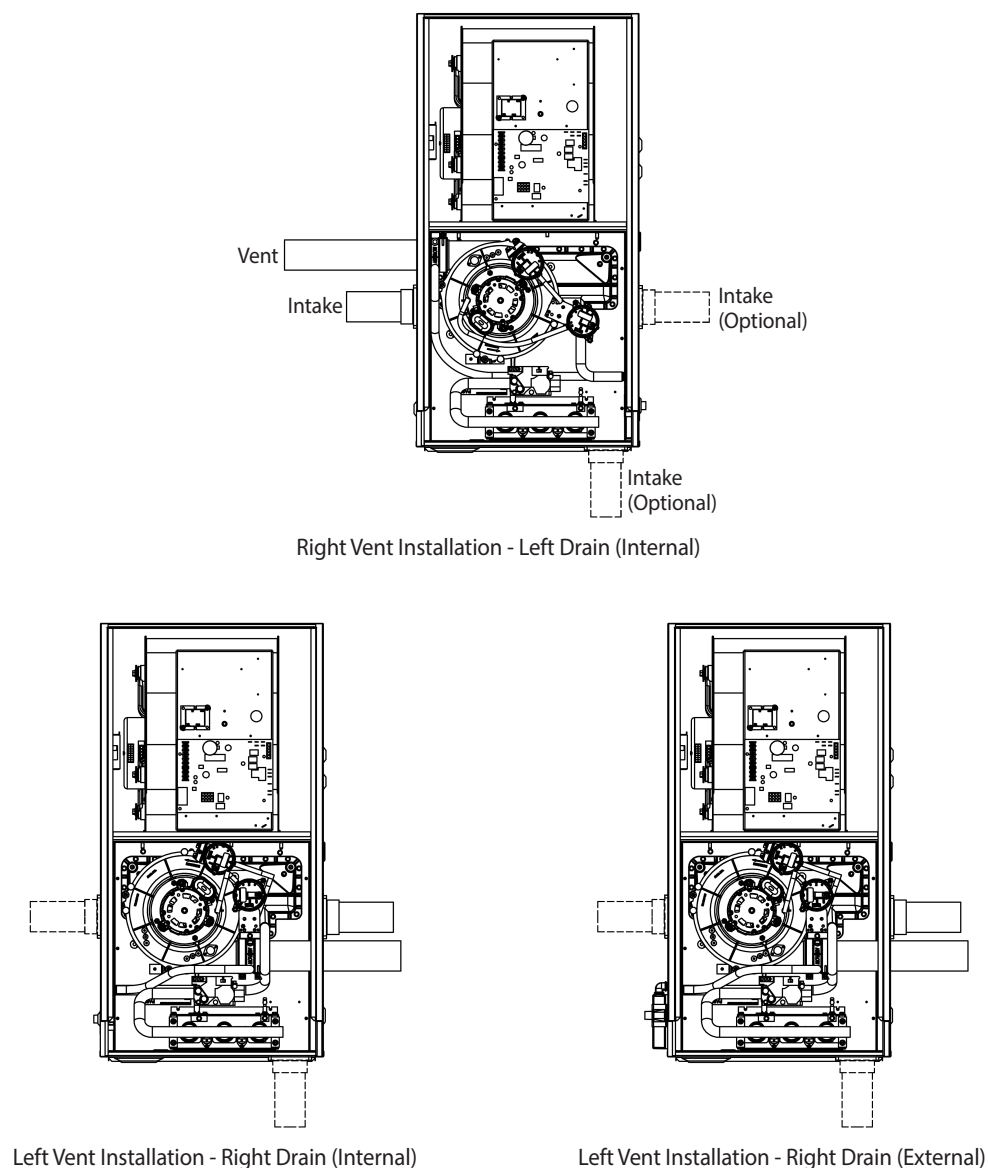
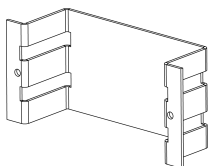


Figure 19. Downflow Vent and Draining Option

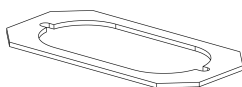
NOTICE

- Prime condensate trap with water and cut drain hoses to proper length.
- Cut pressure switch tubing to proper length.
- Do not submerge termination of drain hose.
- Air intake inlet and exhaust outlet cannot be located on the furnace top panel for downflow installations.

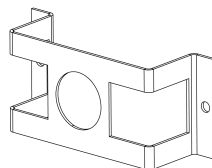
Brackets Used for Installation



Internal Trap Bracket



Horizontal Orientation Bracket



External Trap Brackets

CAUTION

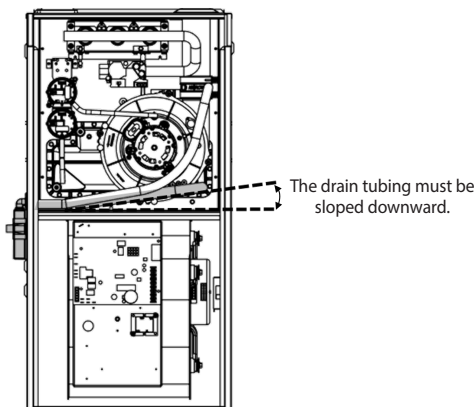
The two inlets to the drain trap are for vent pipe and condensate collection. The vent pipe inlet is smaller than the condensate collection inlet. Ensure that the drain hoses are properly cut to the required length connected and secured.

10.4 Drain Hose Installation

- Ensure one end of the $\frac{5}{8}$ " tubing is connected to the most direct drain outlet on the front manifold cover, and the other end to the larger elbow on the condensate trap assembly. Cut excess tubing if necessary and hold it in place with the supplied plastic hose clamps (in parts bag).
- Ensure one end of the $\frac{1}{2}$ " tubing is connected to the drain outlet on the inducer, and the other end to the smaller elbow on the condensate trap assembly. Cut excess tubing if necessary.

Note

All condensate drain tubing must slope towards the condensate trap, ensuring that the drain hoses do not create traps or kinks in the hose prior to the condensate trap assembly.



10.4.1 Drain Piping

Condensate from the outlet of the drain trap assembly must be conveyed to a floor drain, sump pit, or, if these are unavailable, to a condensate pump. If using a condensate pump, be sure that it is approved for furnace condensate.

CAUTION

The two inlets to the drain trap are for vent pipe and condensate collection. The vent pipe inlet is smaller than the condensate collection inlet. Ensure that the drain hoses are properly cut to the required length connected and secured.

A typical configuration would be to connect the side branch of a $\frac{1}{2}$ " CPVC tee to the drain trap assembly outlet, with the end branches oriented vertically (see the following figures).

A 1" (25 mm) piece of $\frac{1}{2}$ " CPVC pipe connected to the upper end branch will serve as a vent, which will prevent the creation of a vapor lock, and serve as an overflow in the event that the drain line becomes blocked. A similarly sized piece of pipe connected to the lower end branch will permit connection to the condensate outlet with $\frac{5}{8}$ " ID / $\frac{7}{8}$ " OD flexible tubing, or the condensate may be piped entirely in CPVC to the floor drain/sump/condensate pump.

Note

It is recommended that the condensate drain assembly not be cemented to the condensate trap outlet, if removal of the condensate trap is required in the future. Use a piece of the provided $\frac{1}{2}$ " drain hose if removal of the condensate trap is anticipated.

NOTICE

If an air conditioning evaporator coil drain is to share the furnace drain line, it should be connected with a tee fitting downstream from the trap. Do not connect the evaporator coil condensate drain upstream of the furnace drain trap assembly.

Connect ½" tee fitting (field supplied) to the outlet of the condensate trap (Figure 20 and 21).

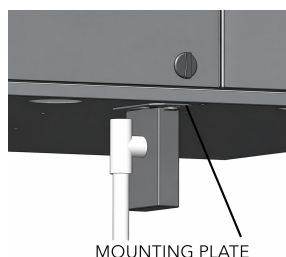


Figure 20. Horizontal

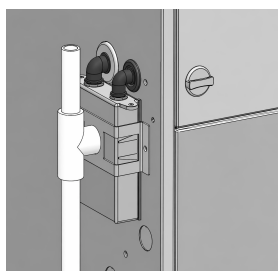


Figure 21. Upflow and Downflow

10.4.2 Priming Condensate Trap

The condensate drain trap assembly should be full of water (primed) before starting the furnace. To fill the condensate drain trap assembly, temporarily remove the vent drain hose from the inducer assembly elbow/drain fitting, and pour approximately one cup of water down the hose. Water will begin running out the condensate drain trap outlet when it is full. Refasten the vent drain hose to the inducer assembly elbow/drain fitting.

The condensate drainage configuration requires a vent. It takes less than a one inch rise anywhere along the horizontal route of the drain tube to create a vapor lock, which will prevent condensate from draining away freely, and result in erratic furnace operation.

Note

- The furnace, condensate trap and condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of the drain line. Special precautions must be made if installing a condensing furnace in an area which may drop below 32°F (0°C). This can cause improper operation or damage to the equipment. If the furnace environment has the potential of freezing, the drain trap and drain lines must be protected. In areas where the temperature may be below 32°F (0°C) a self-regulating, shielded and waterproof heat tape rated at 3 to 6 watt per foot (10 to 20 watt per meter) at 115 volt, 40°F (4°C) may be used to provide freeze protection of the remaining condensate drain line. RV antifreeze can be used to protect the drain trap if unit is going to be off for extended periods of cold weather. Wrap the drain trap and drain line with the heat tape and secure with appropriate plastic ties. Follow the heat tape manufacturer's recommendations. Prime the trap before the furnace operation. The use of accessory drain trap heaters, electric heat tape and/or RV antifreeze is recommended for these installations.
- Locate the furnace so condensate flows downwards to the drain. Do not locate the furnace or its condensate drainage system in any area subject to below freezing temperatures without proper freeze protection. If the drain line is routed through an area which may see temperatures near or below freezing, precautions must be taken to prevent condensate from freezing within the drain line.

10.5 Alternate Condensate Drain Piping Installation Using PVC or CPVC

1. Install the condensate trap according to instructions included in this manual. $\frac{1}{2}$ " and $\frac{5}{8}$ " rubber hoses shown are pre-installed inside the furnace from the factory.

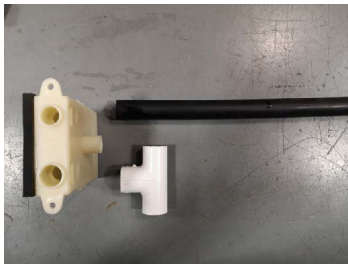


Figure 22



Figure 23

2. If installing with $\frac{1}{2}$ " PVC, use the $\frac{1}{2}$ " hose. If installing with $\frac{3}{4}$ " CPVC, use the $\frac{5}{8}$ " hose. Slide the appropriate hose over the condensate trap outlet and cut it flush with the end of the outlet. The remaining rubber should be flush with the end of the outlet on the condensate trap. The remaining hose is sufficient length to accommodate all furnace orientations.



Figure 24

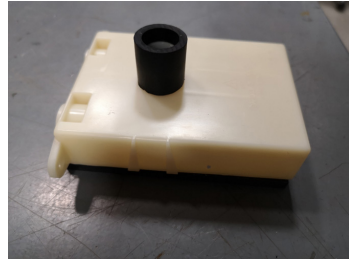


Figure 25

3. A $\frac{1}{2}$ " PVC coupling or bushing will fit snugly over the $\frac{1}{2}$ " rubber hose. A $\frac{3}{4}$ " CPVC coupling or bushing will fit snugly over the $\frac{5}{8}$ " rubber hose. This method ensures a water tight seal and also allows the condensate trap to be easily removed for service.



Figure 26

4. If extra security is desired, it is recommended to secure a strip of strapping around the drain. Utilize the existing condensate trap screws to secure the strapping.

10.6 Condensate Neutralizers

Some local codes may require the use of a condensate neutralizer. If the furnace condensate is to be routed to a septic system, it may be advisable to use a condensate neutralizer.

When condensate neutralizers are used, it is advisable to install it with an overflow bypass tube.

11. Gas Supply and Piping

11.1 Gas Supply

⚠ WARNING

- This furnace is factory equipped to burn natural gas only.
- Conversion to LP gas requires a natural gas to LP conversion kit.
- Failure to use the proper conversion kit can cause fire, explosion, carbon monoxide poisoning, property damage, personal injury or loss of life.

⚠ CAUTION

Connect this furnace only to gas supplied by a commercial utility or supplier. Private gas wells do not generally provide gas with consistent, uniform and predictable heating values and densities. Many non-commercial wells contain impurities such as sulphur, which may damage the furnace. This furnace cannot operate properly or safely using fuels outside normal commercial standards.

NOTICE

Conversion of this furnace requires specialized equipment. Conversion must be completed by a trained and qualified installer, service agency or gas supplier.

11.2 Gas Piping

In the United States, the gas piping should be installed in accordance with (NFGC) NFPA 54/ANSI Z223.1 and any local codes.

In Canada, the gas piping should be installed in accordance with CAN/CSA-B149.1 and 2, and in accordance with any local codes.

If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector, which has previously serviced another gas appliance.

To maintain a good seal in the burner area, the gas piping through the side panel into the furnace must be ½" Schedule 40 black iron pipe. The pipe passes through a special rubber grommet that is custom manufactured to seal tightly around the gas pipe. (Figure 27)



**Figure 27. Furnace Gas Pipe Connections
(Note Rubber Grommet)**

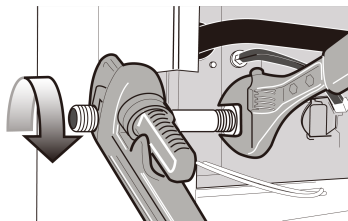
The gas piping may enter the furnace from either side. Once the routing of the gas pipe is determined, select and remove the plastic cap if necessary and install on another panel, and install the grommet within the hole.

Note

We recommend a union between the gas valve and the side panel to allow easy removal of the burner for service purposes.

⚠ CAUTION

- Ensure that the gas valve is not subjected to high pressures.
- Always use a backup wrench to prevent twisting of the gas valve. Any strains on the gas valve can affect positioning of the orifices relative to the burners. This could result in faulty burner operation.



Install a manual gas shut-off valve and dirt pocket as close to the furnace as possible. Some local codes call for the manual gas shut-off valve to be located between 4 feet (1.2 m) to 5 feet (1.5 m) above floor level to prevent tampering by small children. Ensure that the valve is readily accessible.

⚠ WARNING

Disconnect the manual shut-off valve and gas valve during any pressure testing that exceeds $\frac{1}{2}$ p.s.i.g. (3.45 kpa).

11.3 Gas Inlet Pressure

The natural gas inlet supply pressure should be 5" to 10.5" w.c. (7" w.c. recommended). The LP gas inlet supply pressure should be 11" to 13" w.c. (12" w.c. recommended). These pressures must be maintained while all other gas fired appliances are operating at maximum conditions

⚠ CAUTION

Do not exceed 13" w.c. Inlet pressure with either fuel.

Gas piping that has not been pressure tested, from the manual shut-off valve to the furnace gas valve for example, should be leak tested using an electronic combustible gas detector, a commercially prepared leak detector, or other locally approved method.

11.4 Leak Testing

All new gas piping installations should be pressure tested as specified by CAN/CSA-B149.1 & 2, or NFPA 54, ANSI Z223.1 or ANSI/NFPA 58, "Standard for the Storage and Handling of Liquefied Petroleum Gases."

Gas piping that has not been pressure tested, from the manual shut-off valve to the furnace gas valve for example, should be leak tested using an electronic combustible gas detector, a commercially prepared leak detector, or other locally approved method.

11.5 Purging Gas Lines

⚠ WARNING

- Never use a match, taper, cigarette lighter, flame or any other ignition source to check for leaks in a gas line.
- Failure to adhere to this warning can cause a fire or explosion resulting in property damage, personal injury, or loss of life.

12. Conversions

12.1 High Altitude Conversion

Natural Gas (USA & Canada)

This furnace does not need to be converted for high altitude installations from 0 to 5,400 ft (1,646 m), when the fuel source is natural gas. For installations above this altitude, follow local codes. In the absence of local codes, refer to CSA B149.1 (Canada) or ANSI Z223.1/NFPA 54 (USA).

Propane/LPG (USA & Canada)

For installations above 2,000 ft, the certified input rating must be reduced by 4% for every 1,000 ft (305 m) above sea level. Orifice selection For high-altitude installations above certified altitude, refer to "Table 6. Orifice Size for High Altitude Installation" for sizing information.

Model	Altitude ft (m)	Orifice Sizes (DMS) (USA and Canada)*	
		Natural	LP
NDF600 (50/70/90/105)	0–2,000 (0–610)	47	1.25 mm**
	2,000–3,000 (610–914)		56
	3,000–4,000 (914–1,219)		57
	4,000–4,500 (1,219–1,372)		
	4,500–5,400 (1,372–1,646)		
	5,400–6,000 (1,646–1,829)	49	50
	6,000–7,000 (1,829–2,134)	58	
	7,000–8,000 (2,134–2,438)	59	
	8,000–9,000 (2,438–2,743)		
	9,000–10,000 (2,743–3,048)		

* As per ANSI Z223.1 (USA) or CSA B149.1 (Canada).

** Included in the conversion kit.

Table 6. Orifice Size for High Altitude Installation

12.2 Natural to LP Gas

This series furnace is manufactured as a natural gas appliance that may be converted to LP gas through use of the Conversion Kit. This kit contains the conversion kit instructions, orifices needed for all models, the regulator spring for the gas valve, and a label to affix adjacent to the appliance rating plate to alert subsequent service technicians of the conversion. The parts removed for this conversion must remain with the furnace for any future conversion back to natural gas.

When converting for LP operation the installation of a low pressure cut off switch is required, which is included in the LP Conversion Kit.

12.3 Conversion Steps

Refer to Conversion NG to LP Kit for complete instruction.

12.4 Checking the Inlet Gas Pressure

Two Stage Gas Valve

1. Turn off the gas and electrical supply to the furnace.
2. Back inlet pressure test screw (inlet pressure boss, see Figure 31) counterclockwise out one turn maximum, with a $\frac{3}{32}$ " Allen wrench. Attach a hose and calibrated U-tube or digital manometer to the inlet pressure boss. The hose should overlap the boss $\frac{3}{8}$ ". The manometer must have a scale range of at least 0" to 15" of water column.
3. Turn on the gas and electrical supply and operate the furnace and all other gas consuming appliances on the same gas supply line. Using a leak detection solution, check for leaks around the gas valve/manifold connection and the burner orifices. Repair any leaks before continuing.
4. Measure furnace gas inlet pressure with burners firing. Inlet pressure must be within the range specified on the furnace rating plate. 5–10.5" w.c. (Natural Gas) or 11–13" w.c. (LP). If the inlet pressure differs from the rating plate, make the necessary adjustments to the pressure regulator, gas piping size, etc. and/or consult with the local gas utility.
5. Turn off gas and electrical supply to furnace, remove the manometer hose from the inlet pressure tap boss, and tighten the inlet pressure tap screw using the $\frac{3}{32}$ " Allen wrench. (Clockwise, 7 in-lb minimum).
6. Turn on the gas supply and electrical power to the furnace.
7. Using a leak detection solution, check for leaks at the pressure boss screw. Bubbles forming indicate a leak. Shut off gas and fix all leaks immediately.
8. Turn gas back on and test the inlet pressure boss with a leak detector.
9. If working on a natural gas system, contact the gas utility. They may insist on any service regulator adjustments being made by their own staff.

If problems were encountered with obtaining enough pressure, first examine the gas piping system to ensure that it is correctly sized. Pipe sizing is specified in CAN/CSA-B-149.1 & 2, and in NFPA 54/ANSI Z223.1. Be sure to check for restrictions, partially closed valves, etc.

In some circumstances, high inlet pressure can be remedied with the use of an in line appliance regulator. If an in line appliance regulator is used, ensure that it has the capacity to adequately handle the gas volume required by the furnace and any other appliances receiving gas from the header serving the furnace.

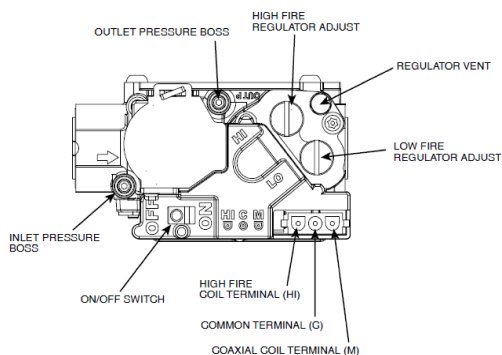


Figure 28. Gas Valve

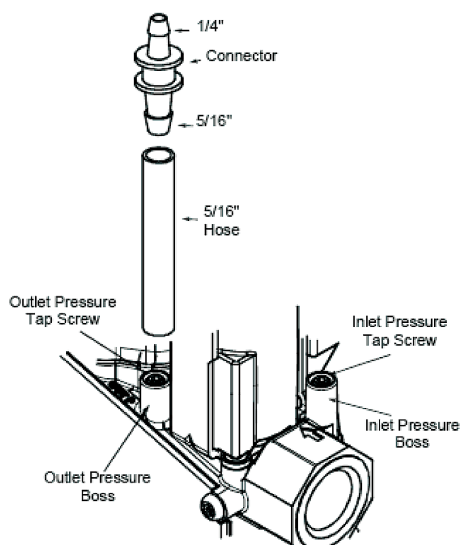


Figure 29. Valve Pressure Check Kit

12.5 Setting the Manifold Gas Pressure

Two Stage Gas Valve

When the installation is completed to the "Start-up & Setup" stage, test the gas manifold pressure by following these steps:

1. Turn off the gas and electrical supply before proceeding.
2. Back outlet pressure test screw (outlet pressure boss, see Figure 31) counterclockwise out one turn maximum, with a $\frac{3}{32}$ " Allen wrench. Attach a hose and calibrated U-tube or digital manometer to the outlet pressure boss. The hose should overlap the boss $\frac{3}{8}$ ". The manometer must have a scale range of at least 0" to 15" of water column.
3. Turn on the gas supply and electrical power to the furnace and energize the main solenoid by connecting R to W1 on the integrated control board. Do not energize the HI solenoid.
4. Remove regulator adjustment cover screw from the low outlet pressure regulator adjust tower (Figure 31) and turn the plastic regulator adjustment screw clockwise to increase manifold pressure or counterclockwise to reduce manifold pressure. Always adjust the regulator according to the original equipment manufacturer's specifications listed on the appliance rating plate. Replace regulator cover screw.
5. Energize main solenoid as well as the HI terminal by connecting R/W1 and W1/W2 on the integrated furnace control. Remove regulator cover screw from the high outlet pressure regulator adjust tower (Figure 31) and turn the plastic regulator adjustment screw clockwise to increase manifold pressure or counterclockwise to reduce manifold pressure. Always adjust the regulator according to the original equipment manufacturer's specifications listed on the appliance rating plate. When the correct pressure has been established, securely replace the regulator cover screw.
6. Turn off the gas and electrical supply to the furnace.

7. Remove the manometer hose from the outlet pressure tap boss, and tighten the outlet pressure tap screw using the $\frac{3}{32}$ " Allen wrench. (Clockwise, 7 in-lb minimum).

WARNING

All regulator adjustments must be done by a trained, qualified technician. Improper modifications or adjustments can result in fire or explosion causing property damage, severe personal injury or loss of life.

8. Turn on the gas supply and electrical power to the furnace.
9. Turn on system power and energize the valve.
10. Using a leak detection solution or soap suds, check for leaks at the pressure boss screw. Bubbles forming indicate a leak. Shut off gas and fix all leaks immediately.

12.6 Checking Furnace Input

The natural gas supply pressure should be a maximum of 10.5" w.c. and minimum of 5" w.c. (recommended 7" w.c.). The LP gas inlet supply pressure should be 11" to 13" w.c. The input rating of the furnace is based on 1,000 Btu/ft.³ gas with a specific gravity of 0.6.

Since heating values for the gas vary geographically, the actual furnace input and output will vary accordingly. For example, natural gas with a 900 Btu/ft.³ heating value will reduce the input to 90% of the rated input.

Natural gas with a 1,100 Btu/ft.³ heating value will increase the input to approximately 110% of the rated input. This is not usually a problem; however, adjustments to compensate for this can be made by minor adjustments to the burner manifold pressure or by changing the burner orifice size. Contact the fuel supplier for specific heating content values.

Any adjustments to the burner manifold pressure should be carried out with the use of a manometer or calibrated Magnehelic® gauge. Do not adjust the gas valve pressure regulator more than ± 0.3 " w.c. from that specified on the rating label. Refer to Figure 30.

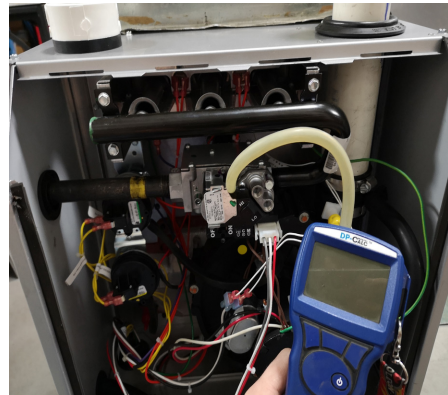


Figure 30. Manometer Measuring Gas Manifold Pressure

$$\text{Input} = \frac{\text{Heating Value of Gas} \times 3600}{\text{Time in Sec. for 1 cu. ft.}}$$

where:

- input is expressed in Btu/hr
- heating value of the gas is expressed in Btu/ft³
- and time is the number of seconds required for the test dial to indicate 1 cubic foot.

If using a gas meter with SI (metric) units:

- 1 cubic foot = 0.0283 cubic meters
- 1 cubic meter = 35.315 cubic feet
- 0.01 cubic meter = 0.3531 cubic feet
- 0.5 cubic meter = 1.766 cubic feet

CAUTION

Never adjust the input of the furnace to exceed the input shown on the rating plate.

13. Electrical Specifications

13.1 Electrical Wiring and Connections

Before proceeding with the electrical connections, ensure that the available electrical supply is compatible with the voltage, frequency and phase listed on the appliance rating plate.

All furnaces are rated 120 VAC, 60 Hz, 1 Ø. The amperage rating is 12 amps or less.

Each furnace requires a dedicated 15 amp over-current device, either a 15 amp circuit breaker or a 15 amp Type D time delay fuse. It is permissible to connect furnace accessories such as humidifier transformers, condensate pumps and electronic air cleaners. If adding accessory equipment to the furnace circuit, ensure that the combined amperages listed on the appliance rating plates does not exceed the rating of the over-current device.

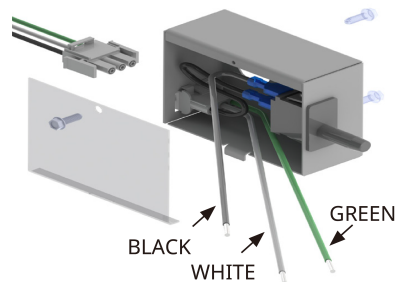
WARNING

- Shut off electrical power at the fuse box or service panel before making any electrical connections. Failure to do so can cause Electrical shock resulting in personal injury or loss of life.
- The furnace cabinet must have an uninterrupted ground.
- A ground wire is provided in the electrical junction box.
- Do not use gas piping as a ground.
- Failing to ground the furnace properly can result in electric shock resulting in personal injury or death.

In the United States, all electrical work must be in accordance with the latest edition of the National Electrical Code, ANSI/NFPA 70.

In Canada, all electrical work must be in accordance with the latest edition of CSA-C22.1, Canadian Electrical Code Part 1, and any applicable local code.

Although a suitably located circuit may serve as a service switch, a separate service switch is recommended. A separate service switch is necessary if the circuit breaker is in a location where accessing it would require getting close to the furnace, or if the furnace is located between the main electrical panel and the entry to the furnace room. The furnace switch (service switch) should be clearly labeled, and installed in a location where it is not likely to be mistaken as being a light switch or similar control.



**Figure 31. Electrical Connections/
Molex Connector**

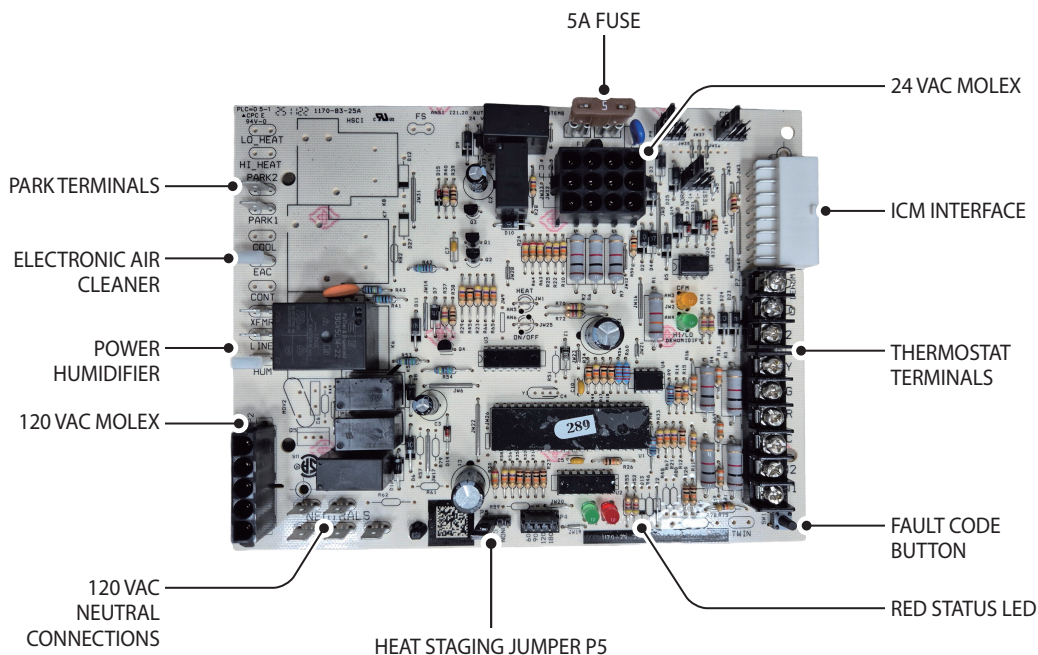


Figure 32. Integrated Furnace Ignition Control

13.2 Furnace Connection

The furnace is shipped fully wired except for the connections to the house wiring. The furnace power connections are made in a junction box inside the blower compartment. The junction box contains a black wire to be connected with L1 (hot), a white wire to be connected with L2 (neutral), and a green wire to be connected to the ground.

Note

- Use good quality wire nuts such as Marrette® connectors, Ideal® wire nuts, etc.
- Use copper conductors only.

If the junction box must be moved from its original location to the other side of the unit.

1. Remove the appropriate plastic cap from the desired left or right side panel, and place it on the panel not being serviced.
2. Fasten the junction box to the selected panel.
3. Secure power line connection into junction box, following above reference.
4. Use only ground screws for junction enclosure.

⚠ WARNING

This furnace is equipped with a blower door safety switch. Do not disable this switch. Failure to follow this warning can result in electrical shock, personal injury, or loss of life.

14. Low Voltage Wiring

The thermostat and control wiring should be a minimum of 18 AWG copper. Excessive lengths of wire may result in enough voltage drop to impair the proper functioning of the furnace. For thermostat wires in excess of 25 feet (7.6 m), use 16 AWG; 50 feet (15.2 m), use 14 AWG.

14.1 Single Stage Thermostat

The automatic heat staging option allows a single stage thermostat to be used with a two stage furnace. The control provides a movable jumper (P5) to select between 5 minute and *10 minute automatic staging. Automatic staging time begins when the blower is energized after the heat blower delay period. If the jumper is in the 5 minute position, the control will automatically start high heat after 5 minutes of continuous low heat operation. If the jumper is in the *10 minute position, the control will automatically start high heat after 10 minutes of continuous low heat operation. Once high heat is started from automatic staging, the demand for high heat remains until the heat call is satisfied.

*Factory Setting

Heat Anticipator and Cycle Rate Settings

Install the thermostat per the manufacturer's instructions. For mechanical thermostats, set the heat anticipator to match the furnace's amp draw of 0.9 amps. For electronic thermostats, set the cycle rate to 3–4 cycles per hour.

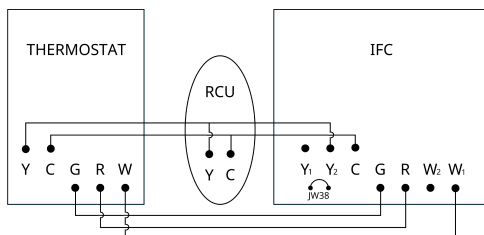


Figure 33A. Single Stage Thermostat Connection Diagram

14.2 Two Stage Thermostat

When connecting a two stage thermostat, the jumper (P5) must be in the "NONE" position. The control runs high heat from the thermostat W2 demand.

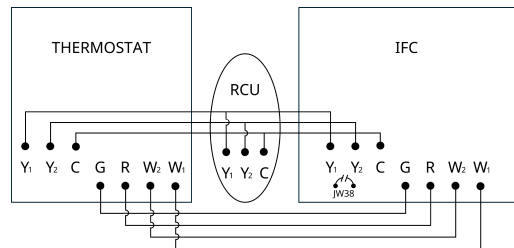


Figure 33B. Two Stage Thermostat Connection Diagram

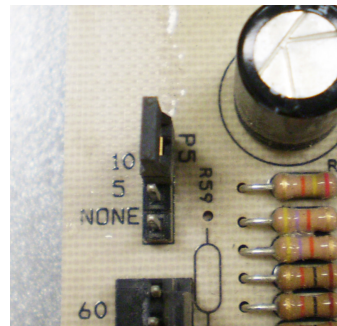


Figure 34A. Jumper P5

14.3 Thermostat Location

The thermostat should be located approximately 5 feet (1524 mm) above the floor, on an inside wall where there is good natural air circulation, and where the thermostat will be exposed to average room temperatures. Avoid locations where the thermostat will be exposed to cold drafts, heat from nearby lamps or appliances, exposure to sunlight, heat from inside wall stacks, etc. Automatic changeover thermostats must include a deadband to prevent cycling between cooling and heating modes.

14.4 Furnace Paired with Heat Pump

With installation applications that combine a furnace and a heat pump in conjunction with a thermostat which features dual fuel use, the JW39 jumper on the furnace control board must be cut. If the jumper is left intact, terminal "O" will remain energized effectively eliminating the cooling mode of the heat pump.

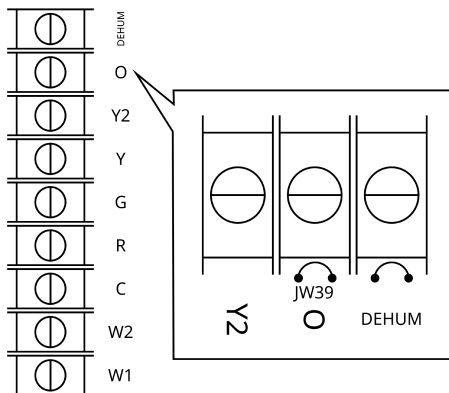


Figure 34B. Cut JW39 for Heat Pump

14.5 Furnace Paired with Air Conditioner

- If installing a two stage air conditioning system, clip the JW38 jumper wire between Y (low cool) and Y2 (high cool) on the furnace control board.
- Control defaults to Y2 (high cool) if JW38 jumper wire is not cut.

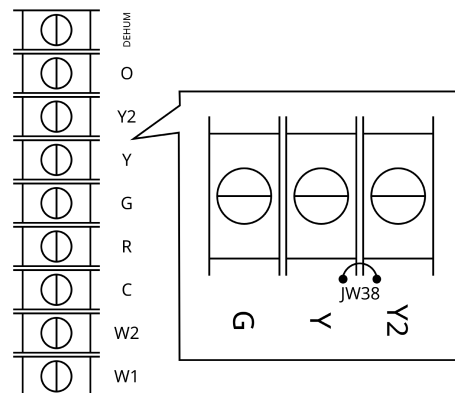


Figure 34C. Cut JW38 for 2-Stage Air Conditioning

15. Optional Accessories (Field Supplied/Installed)

15.1 Electronic Air Cleaner

The integrated furnace control has provisions to supply power and control an electronic air cleaner rated at 120VAC, 1.0 amp max. 120V power will be available at these terminals whenever the circulating fan is operating in the heating or cooling fan modes.

15.2 Power Humidifier

The integrated furnace control has provisions to supply power and control a line voltage humidifier or the primary of a 120/24V humidifier step down transformer, rated at 120VAC, 1.0 amp max.

Note All HUM and EAC terminals are 120V. Do not directly connect 24V equipment to these terminals.

16. Startup Procedures

This furnace is equipped with a HSI (Hot Surface Ignition) device. Each time that the room thermostat calls for heat, the HSI lights the main burners directly. See the lighting instructions on the furnace.

When the gas supply is initially connected to the furnace, the gas piping may be full of air. Follow the instructions contained in the natural gas and LP installation codes to properly purge the gas supply line. Test the affected joints to ensure there are no leaks. Allow five minutes for any gas to dissipate before continuing with the start-up procedure. Be sure proper ventilation is available to dilute and carry away any vented gas.

During initial start-up, it is not unusual for odor to come out of any room register. To ensure proper ventilation, it is recommended to open windows and doors, before initial firing.

The furnace has a negative pressure switch that is a safety during a call for heat. The induced draft blower must pull a negative pressure on the heat exchanger to close the negative pressure switch. The induced draft blower must maintain at least the negative pressure switch set point for the furnace to operate. If the induced draft blower fails to close or maintain the closing of the negative pressure switch, a "no heat call" would result.

Note

It is required/mandatory that the drain trap assembly be primed before the initial startup. Refer to the instructions on how to prime the condensate trap on the drain piping section in this manual. A dry trap will allow flue gases to flow through the secondary heat exchanger drain, which will prevent the condensate from draining from the secondary heat exchanger. If enough condensate accumulates in the secondary heat exchanger, the secondary heat exchanger pressure switch will sense this condition and break its electrical contacts, and extinguish combustion. If this takes place, the induced blower will stop after a brief post-purge cycle, the condensate will drain out and fill the trap. If the thermostat is still calling for heat, the ignition sequence will start again after a 5 minute wait.

16.1 To Start the Furnace

1. Shut off the electrical power to the furnace and set the room thermostat to its lowest setting.
2. Remove the burner compartment access door.

NOTICE

Ensure that the manual gas valve switch has been in the "OFF" position for at least 5 minutes. Do not attempt to manually light the main burners.

3. Turn the gas valve switch to the "ON" position.
4. Replace the burner compartment access door.
5. Turn on the furnace appliance and shut off the valve.
6. Restore electrical power to the furnace.
7. Set the room thermostat to a point above room temperature to light the furnace.
8. After the burners are lit, set the room thermostat to the desired temperature.

16.2 To Shut Down the Furnace

1. Set the room thermostat to below set point.
2. Remove the burner compartment access door.
3. Turn the gas valve switch to the "OFF" position.
4. The furnace appliance shut-off valve may be closed if desired.
5. Power to the furnace must remain on for the air conditioner to work.

! WARNING

- Should overheating occur or the gas burners fail to shut off, close the manual gas valve for the furnace before shutting off the electrical power to the furnace. Failure to do so can cause an explosion or fire resulting in property damage, personal injury or loss of life.
- Before restarting the furnace, check all plastic vents and wires for damage.

16.3 Sequence of Operation

1. Room temperature drops causing the room thermostat call for first stage heat by connecting "W1" to "R". The control verifies the limit switch is closed and both low and high pressure switches are open. The control energizes the inducer motor at high speed and waits for the low pressure switch to close. The inducer remains at high speed and begins a 15 second pre-purge period. The high pressure switch is ignored. If the low pressure switch does not close within 60 seconds, the control will flash "2" on the Red Status LED, and de-energize the inducer for 60 minutes.
2. When the 15 second pre-purge time has elapsed, the control energizes the HSI output for a 15 second warm-up period (15 seconds on retries). The control energizes the low main gas valve. 4 seconds after the gas is energized, the control de-energizes the HSI output and leaves the gas energized another 1 second for flame proving. If flame is present at the end of trial for ignition time, the control leaves the gas valve energized, inducer on high speed, and begins heat blower on delay. The control always ignites on high inducer/low gas and ignores second stage call for heat until low fire is established for 15 seconds.
3. Blower on delay time begins when the gas valve is energized. The control provides the motor low heat speed signal when flame is proven, and starts a 30 second blower delay before full capacity blower level.
4. When there is a demand for 2nd stage heat from thermostat W2 or automatic staging, the control changes the inducer from low to high speed. When the high pressure switch closes, the control changes indoor blower speed from low heat to high heat and energizes high gas output. If the high pressure switch is open the Green LED will flash. If the high pressure switch is closed the Green LED will be on. The high gas valve drops out while the high pressure switch is open because it is directly in series with the high pressure switch.

5. When the thermostat W2 call ends and W1 remains (two stage thermostat), the control de-energizes the high gas output and immediately changes inducer speed from high to low. With the thermostat heating contacts open (single stage thermostat), the flames extinguish immediately and the inducer blower stops after a 5 second post purge time.
6. Blower off delay is handled by the motor. The control de-energizes the motor heat signal when the gas valve de-energizes, and starts a programmed delay period.

In the Event of Flame Failure

If flame is lost, the control de-energizes the gas valve within 2 seconds, switches the inducer motor to high speed (if not already on high), and begins timing the inter-purge delay. The indoor blower motor will be energized and/or remain energized on heat speed for the programmed delay off time. When the inter-purge delay is over, the control will re-cycle up to 5 flame losses (4 re-cycles) within a single call for heat before going into lockout. The control flashes "8" on the Red LED if lockout is due to too many flame dropouts (1 hour lockout).

17. Air Flow

For proper furnace operation, air flow over the heat exchanger is of utmost importance. Insufficient airflow accelerates metal fatigue and possible failure in the heat exchanger, as well as decreased efficiency.

Excessive airflow promotes accelerated corrosion of the heat exchanger.

Note Do not bypass this step of the start-up procedures.

Model	Fire Rate	Input	Output	Delta T (°F)
NDF600-050M2V3B	High Fire	53,000	50,000	40–70
	Low Fire	37,000	35,000	35–65
NDF600-070M2V3B	High Fire	70,000	67,000	40–70
	Low Fire	49,000	47,000	35–65
NDF600-070M2V4C	High Fire	70,000	67,000	40–70
	Low Fire	49,000	47,000	35–65
NDF600-090M2V5C	High Fire	88,000	84,000	40–70
	Low Fire	61,000	59,000	35–65
NDF600-105M2V5C	High Fire	105,000	101,000	40–70
	Low Fire	74,000	71,000	35–65

Table 7. Range of Temperature Rise

17.1 Temperature Rise Check

When the duct system is complete and the air filter or filters are in place, determine if the airflow is correct for both low and high fire input rates.

1. Insert a duct thermometer in the supply air duct. The thermometer should be placed as close as practical to the furnace, but out of the “line of sight” of the heat exchanger (this prevents false readings owing to radiant heat). Ensure that the thermometer location is within the duct air stream. Avoid locations such as the inside radius of an elbow, etc.
2. Insert a duct thermometer in the return air duct as close to the furnace as practical. Ensure that the thermometer location will be unaffected by humidifier bypass ducts, etc. Choose a location well within the main air stream.

3. Operate the furnace long enough to obtain steady state conditions at both input rates (high fire and low fire).
4. When the two thermometers have stabilized, usually within 5–8 minutes, compare the two readings. Subtract the return air temperature from the supply air temperature. The difference is the temperature rise, also called ΔT .
5. Compare the measured ΔT to the temperature rise range shown on the rating plate for both high and low fire.

When adjusting the temperature rise, see “17.3 Blower Airflow”. The ideal temperature is approximately mid-range on the rating plate.

- Note**
- Prior to adjusting Heat airflow, ensure ductwork is sufficient for application.
 - If the measured ΔT is above the approved temperature range, there is too little air flow.
 - It must be increased by removing restrictions in the ductwork, adding supply or return ductwork, or by selecting a higher motor speed.
 - If the measured ΔT is too low, there is too much air flow.

17.2 Calculating Air Flow

There are circumstances where it may be desirable to know the air flow delivery through the duct system, such as when estimating the amount of air flow available for air conditioning. This can be done by direct measurement with electronic or sloped manometers and velometers, or use the formula in the next column. CFM can also be estimated by counting the number of flashes of the amber CFM led on the control board. Each flash signifies 100 CFM.

$$\text{CFM} = \frac{\text{Output}}{1.085 \times \Delta T}$$

where:

- CFM is airflow in cubic feet per minute;
- ΔT is the temperature rise; and
- Output is the furnace output capacity from the rating plate.

Note Make sure to install all the doors/access panels on the equipment prior to measuring delta t.

17.3 Blower Airflow

WARNING

- Disconnect the electrical supply to the furnace before attempting to change the blower speed.
- Failure to do so could result in electrical shock resulting in personal injury or loss of life.

This unit is factory set to run at the middle of the heating temperature rise range as listed on the rating plate. The cooling speed is set to the maximum airflow designated in the model number.

Three sets of 4 position moveable jumpers are provided for heat, cool, and adjust taps for a variable speed motor. These tap jumpers apply signals to the ECM motor without other interaction with the control board.

If the blower speeds require adjustment, follow these steps:

1. Remove the blower compartment door.
2. To adjust the airflow, remove the cool or heat jumper from position A, and place it on the corresponding letter B, C, or D.
3. To adjust listed Cool and Heat airflows by $\pm 15\%$, position the ADJUST jumper on the corresponding (+) or (-) pins.
The test position on the adjust tap is not used.

NOTICE

- If any adjustment is made to the airflow Tap or ADJUST pin, the Temperature Rise must be checked again.
- Airflow must not go above specified maximum in tables below.

NDF600-050M2V3B																
Airflow	W1 - Low Heat				W2 - High Heat				Y1 - Low Cool				Y2 - High Cool			
Tap	A (Max)	B	C	D	A (Max)	B	C	D	A	B	C	D	A	B	C	D
ESP (In W.C.)/ Tons (Cooling)	-	-	-	-	-	-	-	-	3T	2.5T	2T	1.5T	3T	2.5T	2T	1.5T
1*	637	N/A	554	527	808	N/A	719	696	817	701	607	430	1081	1032	838	675
0.9*	656		558	536	811		731	702	823	705	610	440	1143	1041	841	678
0.8*	658		564	542	813		738	708	827	710	615	450	1198	1055	846	680
0.7*	659		569	548	815		745	715	832	715	619	460	1253	1069	850	682
0.6*	661		577	556	824		751	718	835	718	621	468	1268	1072	861	675
0.5	663		585	565	833		756	722	838	722	623	476	1283	1076	871	669
0.4	665		586	566	841		767	732	850	732	624	487	1282	1075	877	675
0.3	668		587	567	849		778	743	862	743	625	497	1282	1074	883	680
0.2	671		598	578	844		773	738	860	740	635	508	1278	1069	879	684
0.1	675		608	589	839		767	732	857	738	645	520	1273	1064	874	688

* Values for ESP above 0.5" W.C. are provided for reference only and above the certification design parameters of this appliance. Always refer to and follow the rating plate for allowable installation parameters.

NDF600-070M2V3B																
Airflow	W1 - Low Heat				W2 - High Heat				Y1 - Low Cool				Y2 - High Cool			
Tap	A (Max)	B	C	D	A (Max)	B	C	D	A	B	C	D	A	B	C	D
ESP (In W.C.)/ Tons (Cooling)	-	-	-	-	-	-	-	-	3T	2.5T	2T	1.5T	3T	2.5T	2T	1.5T
1*	782	N/A	700	737	984	N/A	887	944	766	584	497	324	1193	992	790	538
0.9*	811		716	754	997		896	958	779	634	515	342	1194	998	800	557
0.8*	809		703	748	997		893	960	772	636	512	337	1195	997	792	562
0.7*	807		690	741	997		889	963	765	638	509	332	1197	995	784	566
0.6*	793		687	734	988		877	948	760	629	499	331	1193	987	776	560
0.5	779		683	727	979		866	934	755	620	489	329	1189	980	767	554
0.4	775		672	718	965		856	925	747	608	473	311	1183	967	762	537
0.3	772		661	709	952		847	916	740	596	458	293	1177	953	758	520
0.2	765		652	704	946		845	907	735	589	451	281	1170	948	750	512
0.1	758		644	699	941		843	898	731	583	445	269	1163	943	741	504

* Values for ESP above 0.5"W.C. are provided for reference only and above the certification design parameters of this appliance. Always refer to and follow the rating plate for allowable installation parameters.

NDF600-070M2V4C																
Airflow	W1 - Low Heat				W2 - High Heat				Y1 - Low Cool				Y2 - High Cool			
Tap	A (Max)	B	C	D	A (Max)	B	C	D	A	B	C	D	A	B	C	D
ESP (In W.C.)/ Tons (Cooling)	-	-	-	-	-	-	-	-	3T	2.5T	2T	1.5T	3T	2.5T	2T	1.5T
1*	743	N/A	665	630	1028	N/A	964	857	1020	739	602	425	1641	1172	956	760
0.9*	763		684	652	1044		975	873	1033	755	623	440	1621	1188	970	777
0.8*	777		701	669	1057		991	890	1049	771	642	459	1638	1195	986	793
0.7*	791		718	687	1069		1007	907	1064	787	660	479	1655	1201	1001	809
0.6*	808		735	704	1077		1016	923	1074	802	677	501	1664	1208	1013	822
0.5	824		753	722	1084		1025	939	1085	818	694	523	1673	1215	1024	834
0.4	830		756	732	1089		1030	945	1085	830	705	548	1670	1222	1028	847
0.3	836		759	743	1094		1036	951	1085	842	716	573	1668	1229	1032	860
0.2	842		757	736	1094		1034	951	1085	842	709	603	1666	1229	1033	861
0.1	849		756	729	1094		1031	950	1086	842	701	634	1664	1229	1033	863

* Values for ESP above 0.5"W.C. are provided for reference only and above the certification design parameters of this appliance. Always refer to and follow the rating plate for allowable installation parameters.

NDF600-090M2V5C																
Airflow	W1 - Low Heat				W2 - High Heat				Y1 - Low Cool				Y2 - High Cool			
Tap	A (Max)	B	C	D	A (Max)	B	C	D	A	B	C	D	A	B	C	D
ESP (In W.C.)/ Tons (Cooling)	-	-	-	-	-	-	-	-	3T	2.5T	2T	1.5T	3T	2.5T	2T	1.5T
1*	991	N/A	865	898	1292	N/A	1158	1191	1407	1106	806	656	1946	1706	1257	1044
0.9*	995		883	910	1293		1172	1199	1410	1114	823	669	1991	1712	1245	1052
0.8*	1006		891	920	1304		1181	1214	1412	1123	835	686	2045	1719	1256	1065
0.7*	1017		898	929	1314		1190	1229	1415	1131	847	703	2098	1727	1267	1077
0.6*	1030		909	934	1318		1194	1233	1419	1138	851	715	2151	1728	1273	1084
0.5	1043		919	938	1323		1197	1236	1424	1146	855	727	2203	1729	1279	1091
0.4	1040		917	945	1330		1200	1239	1426	1154	861	723	2201	1729	1277	1091
0.3	1038		915	952	1337		1202	1242	1428	1163	868	719	2199	1729	1275	1091
0.2	1040		917	952	1337		1201	1239	1429	1151	854	701	2196	1729	1275	1085
0.1	1041		918	953	1336		1200	1236	1431	1139	841	684	2194	1729	1275	1080

* Values for ESP above 0.5" W.C. are provided for reference only and above the certification design parameters of this appliance. Always refer to and follow the rating plate for allowable installation parameters.

NDF600-105M2V5C																
Airflow	W1 - Low Heat				W2 - High Heat				Y1 - Low Cool				Y2 - High Cool			
Tap	A (Max)	B	C	D	A (Max)	B	C	D	A	B	C	D	A	B	C	D
ESP (In W.C.)/ Tons (Cooling)	-	-	-	-	-	-	-	-	3T	2.5T	2T	1.5T	3T	2.5T	2T	1.5T
1*	1162	N/A	1049	1098	1595	N/A	1451	1490	1394	1085	801	660	2058	1666	1239	1070
0.9*	1204		1061	1115	1611		1452	1491	1390	1101	819	676	2111	1671	1246	1042
0.8*	1214		1076	1125	1617		1460	1499	1397	1099	836	694	2124	1677	1255	1062
0.7*	1225		1091	1135	1623		1467	1507	1403	1097	852	711	2136	1682	1264	1081
0.6*	1226		1100	1149	1626		1474	1514	1411	1111	862	723	2137	1687	1271	1090
0.5	1227		1110	1163	1629		1481	1522	1418	1125	871	735	2138	1692	1279	1098
0.4	1235		1114	1164	1640		1490	1530	1429	1143	876	737	2135	1698	1288	1101
0.3	1243		1118	1165	1651		1499	1537	1439	1161	882	738	2132	1704	1296	1104
0.2	1246		1117	1164	1648		1501	1543	1442	1162	871	728	2132	1701	1300	1110
0.1	1248		1116	1163	1645		1504	1548	1445	1163	861	718	2133	1698	1303	1115

* Values for ESP above 0.5" W.C. are provided for reference only and above the certification design parameters of this appliance. Always refer to and follow the rating plate for allowable installation parameters.

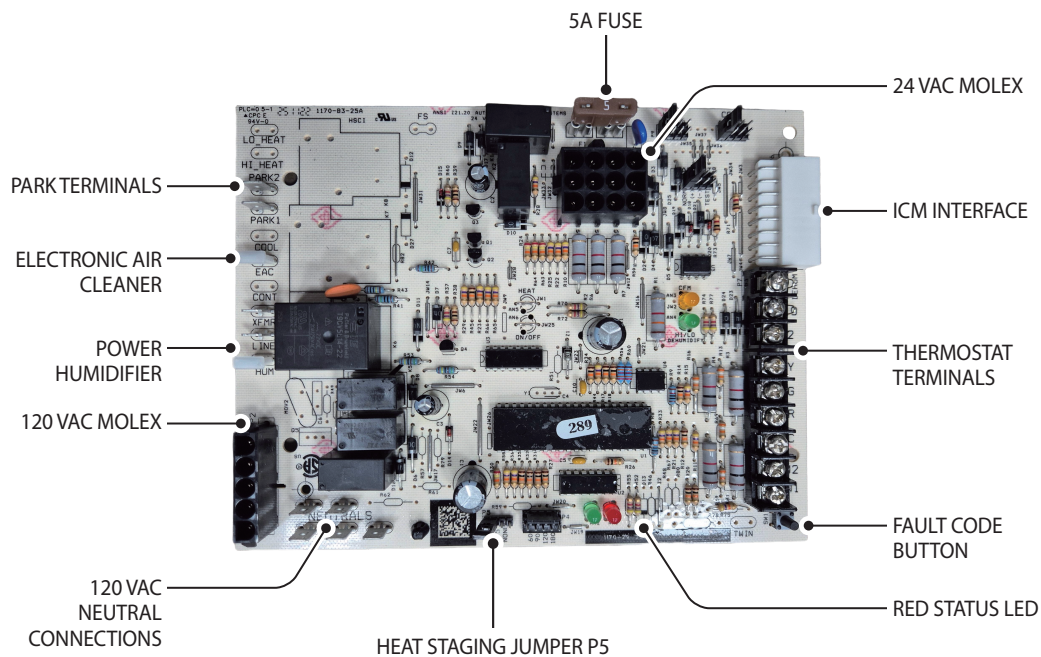


Figure 35A. Integrated Furnace Ignition Control

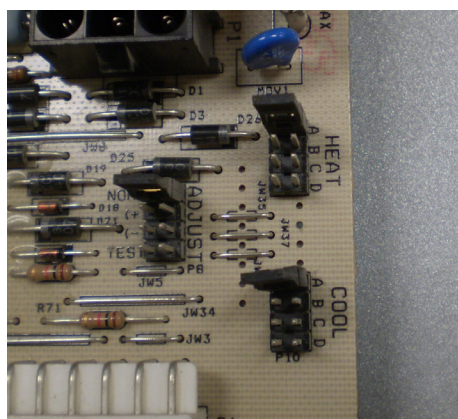


Figure 35B. Heat/Cool Speed Tap

17.4 Dehumidification

For situations where humidity control is a problem, a dehumidification feature has been built into the variable speed motor. At the start of each cooling cycle, the variable speed motor will run at 82% of the rated airflow for 7.5 minutes. After 7.5 minutes has elapsed, the motor will increase to 100% of the rated airflow.

There are three jumper wires in front of the thermostat input terminal block that are used in different applications. These jumper wires may be cut or clipped when the option is not desired.

- The JW40 jumper, not clipped, connects DEHUM to R for dehumidification active all the time. With the JW40 jumper clipped, the thermostat, or humidistat controls dehumidification.

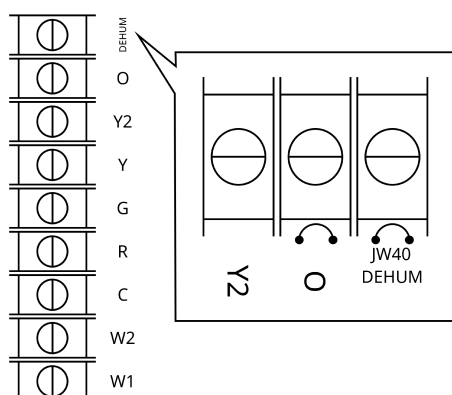


Figure 36. Cut JW40 for Thermostat/Humidistat Integrated Dehumidification

17.5 Blower On and Off Timings

Blower on/off delays are handled by ECM motor programming. The control de-energizes the ECM heat signal when the gas valve de-energizes.

Features of this ECM variable speed motor are that it will deliver a constant airflow within a wide range of external static pressures, and also includes:

Soft start

- This ECM variable speed motor will slowly ramp up to the required operating speed.
- This feature in the heating cycle allows the heat exchanger to reach operating temperature before the set heat speed, which minimizes noise and increases comfort.

Soft stop

- At the end of the heating or cooling cycle, the ECM variable speed motor will slowly ramp down.
- This feature allows for increased energy efficiency, and reduced noise levels.

17.6 Continuous Fan Operation

When the thermostat continuous fan (G) switch is on without a call for heat or cooling, the indoor fan is immediately energized up to 50% of the cooling speed. The fan remains energized as long as the call for the fan remains without a call for heat or cooling. This feature allows continuous circulation of air between calls for heating or cooling.

- If a call for heat (W) occurs during continuous fan, the blower will remain energized, the call for heat overrides the call for fan.
- If a call for cool (Y) occurs simultaneously with the call for fan (G), the call for cool overrides the call for fan.

See air flow data table.

18. Maintenance and Troubleshooting

WARNING

Disconnect the electrical power supply to the furnace before attempting any maintenance. Failure to do so can cause electrical shock resulting in personal injury or loss of life.

CAUTION

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

18.1 Air Filter

The air filter should be inspected frequently and cleaned or replaced as necessary. We recommend a monthly inspection at first, perhaps coinciding with the arrival of the monthly fuel bill as a reminder. The frequency may be increased or decreased depending on experience and conditions.

Dirty filters result in higher than normal operating temperatures, and lower efficiency.

Some paper media high efficiency filters, sometimes identified as HEPA filters can do an effective and excellent filtration of the air; however, some models may also cause a large pressure drop across the filter. The contractor should assess the capabilities of the duct system to deliver sufficient air flow if this type of filter is considered.

Note

- If two return air inlets are used, both must be equipped with filters.
- Electronic air cleaners using electrostatic precipitation to remove dust are an excellent filtration device when used in conjunction with a pre-filter. A 16" x 25" (406 mm x 635 mm) model is an ideal fit with this furnace in the case of a side mounted return air inlet. The integrated furnace control is supplied with an electrical terminal for use with electronic air cleaners.

CAUTION

Do not operate the furnace for prolonged periods of time without an air filter. A portion of the dust entrained in the air may lodge in the supply air ductwork and registers. Any recirculated dust particles will be heated and charred by contact with the furnace heat exchanger. This residue will soil ceilings, walls, drapery, carpets, and other household articles.

18.2 Lubrication

Both the inducer motor and circulating fan motor are sealed bearing type motors. Neither requires routine lubrication. Excess lubrication will void the warranty, shorten the service life of the motors, and will attract the buildup of dust and dirt.

18.3 Cleaning

NOTICE

- Your furnace should be cleaned and inspected annually by a trained and qualified service technician. Your service technician has the knowledge and the equipment to determine the condition of your furnace.
- Routine cleaning of the interior of the secondary heat exchanger should not be necessary. If evidence develops indicating that a cleaning is necessary, it should be done by a trained and qualified service technician. Evidence may induce large amounts of dirt or debris building up in the condensate drain line.

It is advisable to keep dust build-up on warm surfaces to a minimum, since dust, in some cases, can be combustible.

Dust build-up in the circulating fan can impair blower performance; therefore, reduce efficiency.

The secondary heat exchanger is located immediately above the blower assembly. Over time, it may become coated with dust. To clean the secondary heat exchanger:

1. Turn off electrical power to the furnace.
2. Remove the heat exchanger access door and the blower access door.

WARNING

Always disconnect the electrical supply to the furnace before removing the burner compartment access door.

3. Remove the screw thread covers of the screws attaching the heat exchanger to the division panel and blower assembly.
4. Remove the screws fastening the blower assembly to the division panel and heat exchanger assembly using a 1/4" hex drive.
5. Remove the drain hoses from the condensate trap and ensure any spillage is cleaned up.
6. Unplug wire harness connectors and remove the upper harness from the division panel by rotating the twist-lock grommet counter-clockwise and pulling the connector through the clearance hole (Figure 37 & 38).

CAUTION

- Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.
- Always verify operation after servicing.

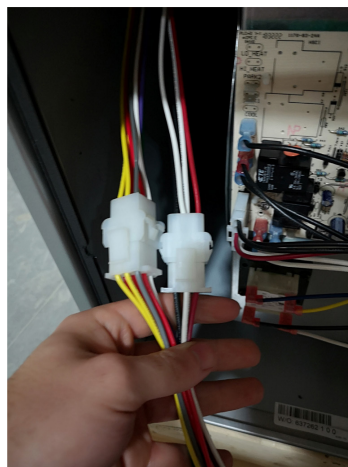


Figure 37

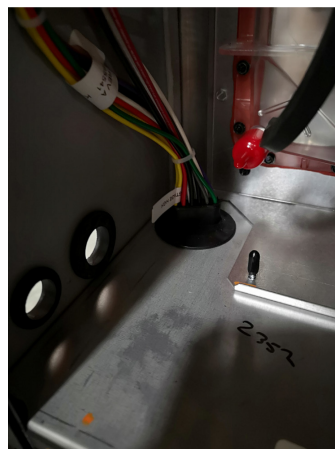


Figure 38

7. Pull the heat exchanger assembly out.

8. Once the heat exchanger assembly has been removed, the coils may be vacuumed with the soft brush attachment. (Figure 39)

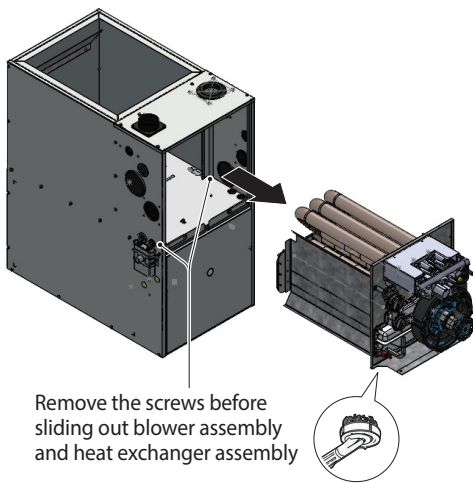


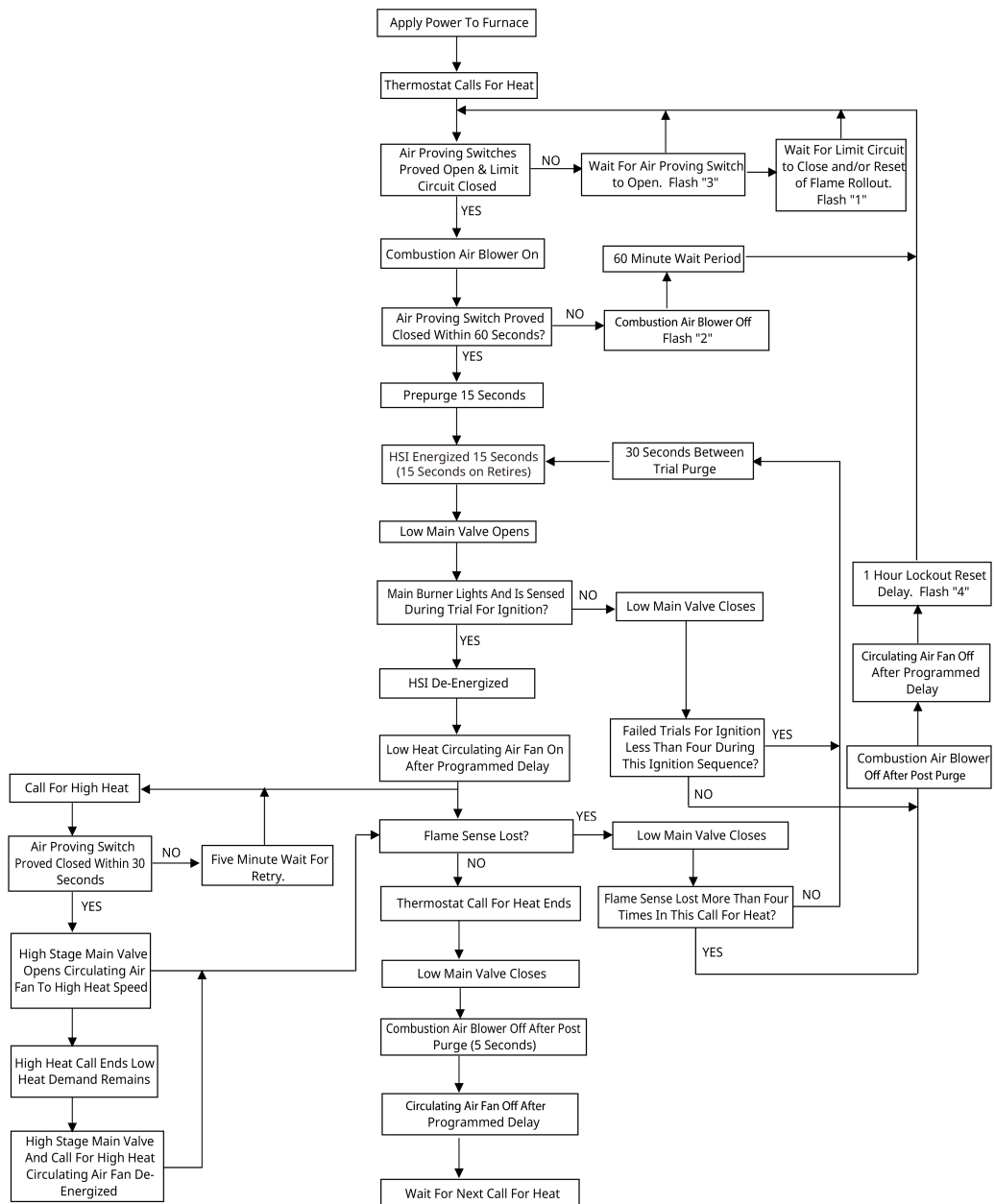
Figure 39

9. Once cleaning is complete, slide the heat exchanger back into its original position using the screw holes on the division panel for alignment.
10. Re-fasten the screws to attach the blower assembly to the division panel and the heat exchanger assembly (screws fastened from lower vestibule through to the upper vestibule) and place thread covers.
11. Feed the wire connectors through to the lower vestibule, secure to the division panel using the twist-lock grommet and re-connect the connectors to the harness in the lower vestibule.
12. Hook up the condensate drain lines for proper drainage.
13. Replace the blower access and heat exchanger access doors.
14. Restore electrical power to the furnace.

⚠ CAUTION

The furnace gas train is designed to operate as a sealed unit. Be sure that the burner compartment access door is properly in place before attempting to restart the furnace.

18.4 Troubleshooting Flowchart



18.5 Diagnostic Codes for Status Led

Status LED	Fault Condition
Red LED (AN1) indicates following codes:	
LED Off	No power to control or control hardware fault detected
LED ON	Normal operation
1 Flash	High limit switch open
2 Flashes	Pressure switch open with inducer on
3 Flashes	Pressure switch closed with inducer off
4 Flashes	Control in 1 hour lockout
5 Flashes	L1/Neutral Polarity problem
6 Flashes	Too many limit trips within one call for heat
7 Flashes	Pressure switch cycle lockout
8 Flashes	Lockout due to too many flame dropouts
9 Flashes	Not used
10 Flashes	Flame present with gas valve off

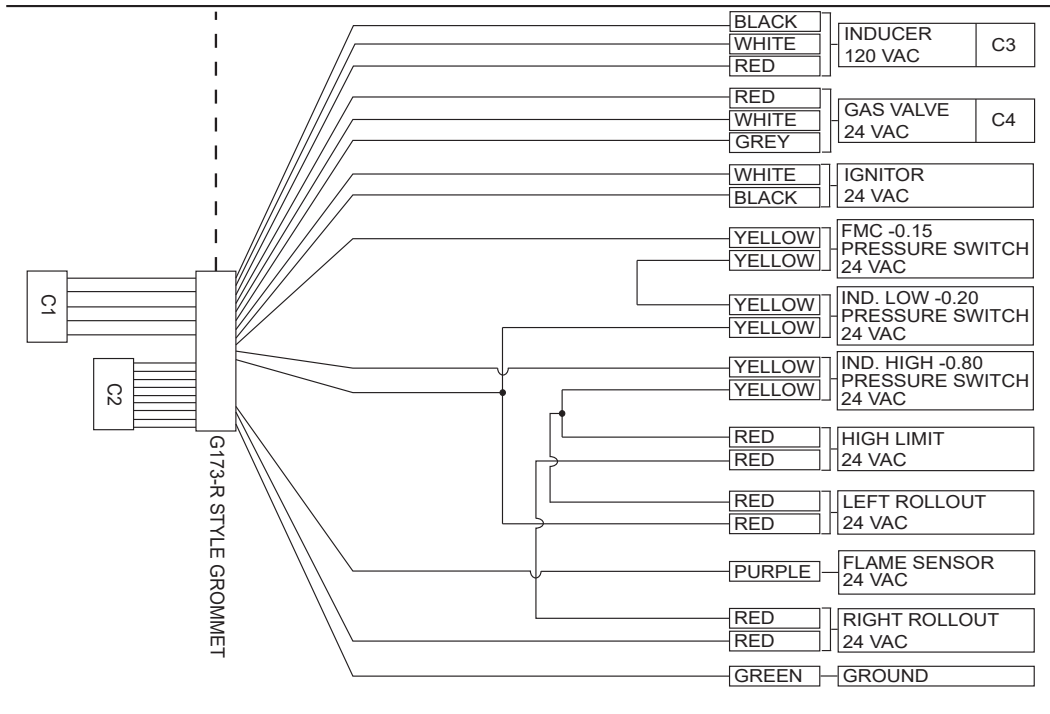
Green LED (AN2) is provided to indicate high heat state	
LED Off	No demand for high heat
LED On	High heat demand, operating normally
LED Flashing	High heat demand, high pressure switch not closed

18.6 Fault Code History

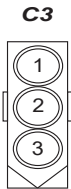
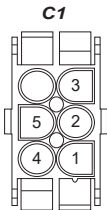
The control stores the last 5 fault codes in memory. When the push button switch is pressed, the control will flash the stored fault codes when the switch is released. The most recent fault code is flashed first, the oldest last.

Fault history may be cleared by holding the push button switch for more than 5 seconds.

19. Wiring Diagram for Two Stage Furnace

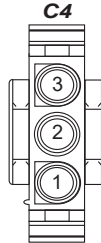
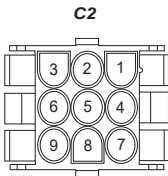


C1		
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END		
PLASTIC 6-PIN HOUSING AMP 1-480705-0		
METAL CONTACT TERMINAL MALE PIN AMP# 350218-1 5 REQUIRED		
POSITION	COLOUR	LEAD NUMBER
1	BLACK	1
2	WHITE	2
3	RED	3
4	BLACK	4
5	WHITE	5
6	EMPTY	

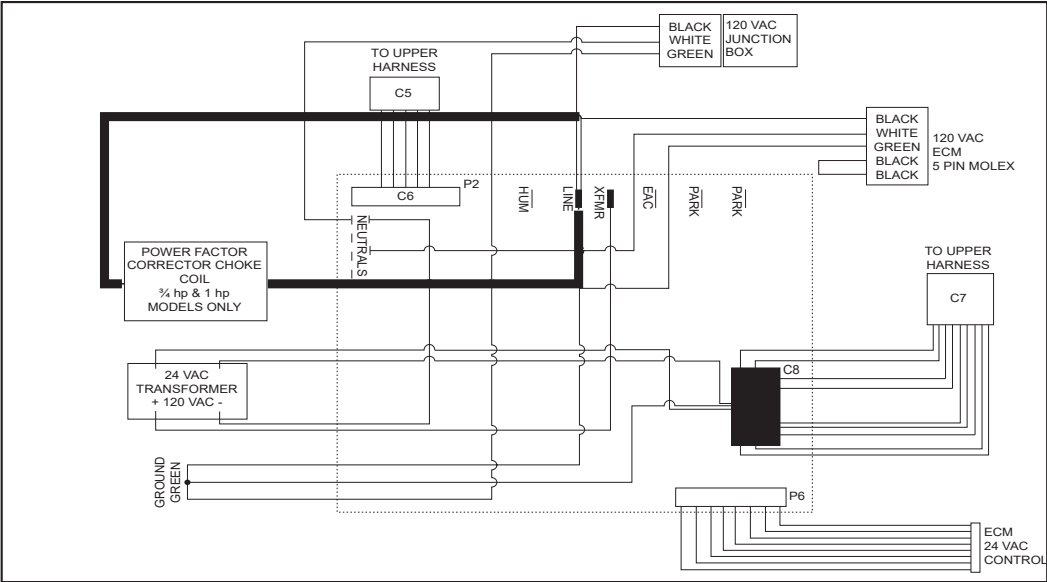


C3			
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END			
PLASTIC 3-PIN HOUSING AMP 440070-1			
METAL CONTACT TERMINAL FEMALE SOCKET AMP# 350415-1 3 REQUIRED			
	POSITION	COLOUR	LEAD NUMBER
HIGH	1	BLACK	1
COMMON	2	WHITE	2
LOW	3	RED	3

C2		
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END		
PLASTIC 14-PIN HOUSING AMP 1-480707-0		
METAL CONTACT TERMINAL MALE PIN AMP# 350218-1 9 REQUIRED		
POSITION	COLOUR	LEAD NUMBER
1	GREY	6
2	YELLOW	7
3	YELLOW	8
4	RED	9
5	RED	10
6	RED	11
7	WHITE	12
8	GREEN	13
9	VIOLET	14

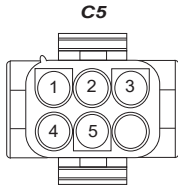


C4			
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END			
PLASTIC 3-PIN HOUSING AMP 480700			
TERMINAL HOUSING FEMALE SOCKET AMP# 350536-1 3 REQUIRED			
	POSITION	COLOUR	LEAD NUMBER
LOW	1	RED	9
COMMON	2	WHITE	12
HIGH	3	GREY	6



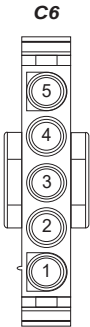
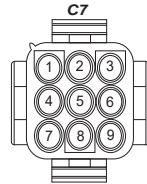
C5
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END
PLASTIC 6-PIN HOUSING
AMP 1-480704-0
METAL CONTACT TERMINAL FEMALE SOCKET
AMP# 350536-1
5 REQUIRED

POSITION	COLOUR	LEAD NUMBER
1	BLACK	1
2	WHITE	2
3	RED	3
4	BLACK	4
5	WHITE	5
6	EMPTY	



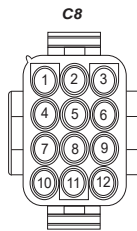
C7
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END
PLASTIC 9-PIN HOUSING
AMP 1-480706-0
METAL CONTACT TERMINAL FEMALE SOCKET
AMP# 350536-1
9 REQUIRED

POSITION	COLOUR	LEAD NUMBER
1	GREY	6
2	YELLOW	7
3	YELLOW	8
4	RED	9
5	RED	10
6	RED	11
7	WHITE	12
8	GREEN	13
9	VIOLET	14



C6
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END
PLASTIC 5-PIN HOUSING
AMP 350809-1
METAL CONTACT TERMINAL FEMALE SOCKET
AMP# 350536-1
5 REQUIRED

POSITION	COLOUR	LEAD NUMBER
1	BLACK	4
2	BLACK	1
3	RED	3
4	WHITE	2
5	WHITE	5



C8
HOUSING VIEW FROM OPPOSITE OF WIRE INSERTION END
PLASTIC 12-PIN HOUSING
AMP 1-480708-0
METAL CONTACT TERMINAL FEMALE SOCKET
AMP# 350536-1
12 REQUIRED

POSITION	COLOUR	LEAD NUMBER
1	GREY	6
2	YELLOW	8
3	VIOLET	14
4	GREEN	15
5	YELLOW	16
6	RED	10
7	RED	9
8	WHITE	12
9	YELLOW	17
10	GREEN	13
11	RED	11
12	YELLOW	7

20. Navien NDF Limited Lifetime Warranty

Effective

Navien products come with a limited warranty covering labor, parts and the combustion heat exchanger. The following warranty periods begin from the date of original installation. The date of original installation must be provided to Navien, and upon request, proof of the original installation date must also be provided to Navien. When the product is installed in new construction, the commencement date shall be dated upon which the end-user takes title to the property. If proof of the installation date is unavailable, then six months after the unit's manufacture date will be used.

If the product is registered online within sixty (60) days of the Commencement Date, the base limited warranty term shall be extended from "Non-Registered"⁴ to "Registered"³ terms in the table that follows. Any Product not properly registered online within sixty (60) days of the Commencement Date shall be subject to the "Non-Registered"⁴ base limited warranty. To register the unit online, go to: <https://www.navieninc.com/register> to register the unit and to receive an email confirmation for your records.

This Warranty runs from date of installation and extends to the original purchaser, with limited transferability to subsequent owners, but only while the Product remains at the site of the original installation.

What is Covered?

Subject to the foregoing terms, Navien's only responsibility and the Purchaser's only remedy under this limited warranty, Company will furnish a replacement part for installation by qualified HVAC service provider, without charge for the part only, to replace any Product part that fails due to a manufacturing defect under normal use and maintenance. The Purchaser must pay for any and all shipping and handling charges and other costs of warranty service for the replacement part. Navien will repair or replace the covered Product or any Part¹ or component, if it is available, that is defective in materials or workmanship for a period of up to ten (10) years in regard to parts and up to a limited lifetime warranty in regard to the Combustion heat-exchanger. Otherwise, if the Product part is not available, Navien will, at its option, a) provide a free suitable part or b) provide a credit in the amount of the then factory selling price for a new suitable substitute part to be used by the Purchaser towards the retail purchase price of a new Navien product.

Any new Product purchase shall be at Purchaser's sole cost and expense including, but not limited to, all shipping, removal, and installation costs and expenses. Navien will pay labor charges for the repair subject to Navien's prior written approval and in accordance with Navien's schedule of approved labor allowances for a period of ninety (90) days from the date of installation. All repair parts must be genuine Navien parts unless otherwise authorized by Navien. All repairs and replacements must be performed by an individual or servicing company that is licensed and qualified to do the type of repair.

During the applicable warranty period, replacement of the Product or components must be approved by Navien. Navien does not authorize any person or company to assume any obligation or liability in connection with approving replacement of the Product or its components on behalf of Navien. The replacement component or product will be warranted only for the unexpired portion of the applicable warranty period for the original component or Product.

Transfer of Warranty to Subsequent Owners

When ownership is transferred to a subsequent owner, warranties are reduced to the "Non-Registered⁴" terms in the table below.

NDF- Coverage Table for Labor and Parts Only			
Residential ²			Commercial
Parts ¹	Registered ³	10 Years	1 Year
	Non-Registered ⁴	5 Years	
Labor	90 Days		

NDF- Coverage Table for Combustion Heat Exchanger Only			
Residential ²			Commercial
Registered ³	Limited Lifetime	10 Years	
Non-Registered ⁴	20 Years		

Definitions:

Parts¹ – refers to all internal functional components of the unit, except for the Combustion Heat Exchanger
 Residential² – Applies only to a single-family dwelling that services one (1) living unit. Any property converted or utilized to service two or more separate dwelling units, regardless of the municipal address, is automatically classified as a Commercial application and is subject to the reduced warranty period.

Registered³ – Refers to coverages for units registered within 60 days of the Commencement date.

Non-Registered⁴ – Refers to coverages for units registered 61 days or more after the Commencement Date

Residents of certain jurisdictions, including California, Georgia, and Quebec, may have warranty rights that differ from those described in this Limited Warranty. Where applicable law prohibits warranty coverage, warranty duration, transferability, or other warranty benefits from being conditioned on product registration or other requirements, those legal rights will apply and will not be diminished by this Limited Warranty.

For HVAC products installed in Georgia, failure to register the product will not diminish warranty rights or reduce the applicable warranty term where prohibited by Georgia law. In addition, any transfer rights required by Georgia law shall apply notwithstanding any contrary provision of this Limited Warranty.

How do I get service?

You must contact the original installer of your Product. Your installer will need to contact Navien to report the issue. If the original installer cannot be identified or you no longer choose to use that service provider, you may choose any service provider who is qualified to complete the necessary repair. Your service provider will need to contact Navien's Technical Support team at 800-519-8794 prior to commencing any warranty service.

The installer and/or service provider must comply with Navien's warranty service and return policy procedures as available on Navien's website.

At Navien's request, the defective Product or part must be returned to Navien.

What is not covered?

Navien's Limited Warranty shall be void in the event of an occurrence of any of the following.

- Improper installation, including but not limited to, installation in violation of applicable rules, laws or building codes, condensate damage, improper venting, incorrect gas type, absence of a drain pan, improper conversion from Natural Gas source to Propane or vice versa, reinstallation at another location, etc.
- Failure to install the unit by a qualified HVAC installer.
- Accident, abuse or misuse including but not limited to installation for non-recommended uses, failure to follow or comply with the Installation and Operation or User's Manual, etc.
- Improper maintenance including but not limited to, vent blockage, failure to maintain, failure to clean and/or replace air filters, etc.
- Modification, alteration, addition of non-approved components, or misapplication of the Product in any manner.
- Any damage caused by local adverse conditions including but not limited to operating in corrosive atmospheric elements, damaging chemicals causing deterioration of components, or other conditions beyond the control of Navien.

- Damage or problems caused by gas flow issues, electrical surges, flooding, fire, freezing, abnormal external temperature, force majeure, riot, act of war, or any acts of God.
- Performance problems caused by improper sizing of the furnace, the gas supply line, the venting connection, combustion air openings, electric service voltage, wiring, fusing or any other components, parts or specifications.
- Subjecting the heat exchanger to pressures or firing rates greater or lesser than those shown on the rating plate or removal of or alteration to the rating plate.
- Installation at any location outside the 50 States of the United States, the District of Columbia, and Canada.
- Improper conversion from natural gas to liquid propane gas or liquid propane gas to natural gas or attempt to operate with a type of gas not specified for the furnace.
- Accidental or intentional damage.
- Failure to perform normal maintenance as described in the Installation and Operation manual, such as cleaning of the coils, filter cleaning and/or replacement, and lubrication.
- Use of components or accessories not supplied, compatible, or designated by the manufacturer.
- Any damage, or the need for any repairs, caused by frozen or broken water pipes, water damage, moisture intrusion, mold or other biological growth.
- Damages, defects or failures caused by the furnace being installed downstream from a cooling coil.
- Changes in the appearance of the unit that do not affect its performance.
- Replacement of fuses and replacement or resetting of circuit breakers.
- Purchasing the unit Online or through an unauthorized distributor.

In addition, the following are not covered under this Limited Warranty:

- Any and all maintenance, including replacement of filters, refrigerant, etc.
- Changes in the unit that do not affect its performance.
- Vibration and noise caused by anything other than normal operation of the product.
- Incidental, consequential or indirect damages.

Warranty Limitations

EXCEPT AS EXPRESSLY PROVIDED HEREIN, THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE WARRANTY HEREIN AND FURTHER NAVIEN SHALL NOT BE LIABLE FOR INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL, PUNITIVE OR OTHER SIMILAR DAMAGES THAT MAY ARISE, INCLUDING LOST PROFITS, DAMAGE TO A PERSON OR PROPERTY, LOSS OF USE, INCONVENIENCE, OR LIABILITY ARISING FROM IMPROPER INSTALLATION, SERVICE OR USE OF THE PRODUCT. ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS ARISING UNDER STATE LAW ARE LIMITED IN DURATION TO THE PERIOD OF COVERAGE PROVIDED BY THIS WARRANTY, UNLESS THE PERIOD PROVIDED BY STATE LAW IS LESS.

No one is authorized to make any other warranties on behalf of Navien. Some states do not allow the exclusion or limitation of incidental or consequential damages, or how long an implied warranty lasts, so the above limitation may not apply to you. This Limited Warranty gives you specific legal rights and you may also have other rights which vary from state to state. If this Product is considered a consumer product, please be advised that some local laws do not allow exclusions or limitations on incidental or consequential damages, or limitations on how long a warranty lasts; or how long an implied warranty lasts, so that the above limitations may not apply to you. Refer to your local laws for your specific rights under this limited warranty. If you have any questions regarding this limited warranty, please contact your original installation dealer, or any participating dealer, should your original installation dealer no longer be available. No action arising out of any claimed breach of this limited warranty may be brought by the Purchaser (or any subsequent purchaser retaining the balance of a properly transferred limited warranty) more than one (1) year after the cause of action or claim has arisen.

Revised 09.01.2026

21. Replacement Parts List

Contact your dealer or the factory for questions concerning prices and policies on replacement parts. Normally all parts can be ordered through your Authorized dealer/distributor. For warranty replacement parts, a photocopy of the original invoice will be required to honor the claim.

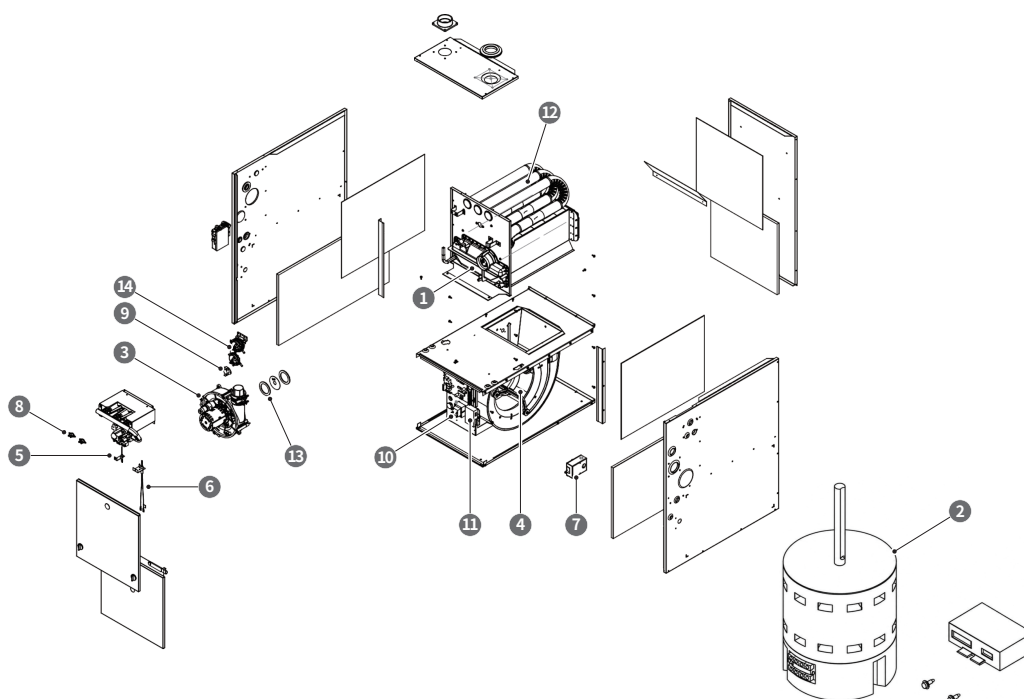
When ordering replacement parts always give the following information:

- Model & serial number of appliance
- Installation date of appliance
- Part number
- Description of part
- Finish

For further information, contact your authorized dealer.

WARNING

Failure to position the parts in accordance with this manual or failure to use only parts specifically approved with this appliance may result in property damage or personal injury.



Applicable Unit	Model
50	NDF600-050M2V3B
70-3	NDF600-070M2V3B
70-4	NDF600-070M2V4C
90	NDF600-090M2V5C
105	NDF600-105M2V5C

Ref. No	Part Description	Part Number	Navien Service Code*	Applicable Unit
1	Service KIT - Small FMC w/o chokes	W010-3494	30043614A	50, 70-3, 70-4
	Service KIT - Large FMC w/o chokes	W010-3495	30043615A	90, 105
2	Service KIT - Motor kit 1/2HP	W010-5076	30043616A	50
		W010-5078	30043617A	70-3
	Service KIT - Motor kit 1HP	W010-5079	30043618A	70-4
		W010-5082	30043619A	90
		W010-5084	30043620A	105
3	Inducer, Two speed	W062-0080-SER	30043621A	All
4	Blower, 112-8R DD Housing	W062-0079-SER	30043622A	50, 70-3
	Blower, 112-10R DD Housing	W062-0083-SER	30043623A	70-4, 90, 105
5	Sensor, Flame – replacement	W010-2562	30043624A	All
6	Igniter, HSI – replacement	W357-0019-SER	30043625A	All
7	Switch, Blower door	W010-2565	30043626A	All
8	Switch, Burner rollout 350°F	W010-2568	30043627A	All
9	Switch, 170°F high heat limit	W010-2993	30043628A	70-4
	Switch, 180°F high heat limit	W010-2994	30043629A	50, 70-3, 90, 105
10	Transformer, 120V 24V 40VA	W707-0031-SER	30043630A	All
11	Control, Integrated ECM	W190-0173-SER	30043659A	All
12	Service KIT - Heat exchanger 3-tube	W010-4563-SER	30043641A	50
	Service KIT - Heat exchanger 4-tube 17.5 in	W010-4554-SER	30043642A	70-3
	Service KIT - Heat exchanger 4-tube 22.5 in	W010-4573-SER	30043643A	70-4
	Service KIT - Heat exchanger 5-tube	W010-4468-SER	30043644A	90
	Service KIT - Heat exchanger 6-tube	W010-4677-SER	30043645A	105
13	Gasket choke	W290-0385-SER	30043656A	All
14	Switch, Triple pressure unit 0.8 in-WC	W660-0234-SER	30043661A	50, 70-3, 70-4
	Switch, Triple pressure unit 1 in-WC	W660-0233-SER	30043662A	90, 105
-	Service KIT - Conversion NG to LP (#47)	W370-0258	30043636A	All
-	Service KIT - Conversion LP to NG (#47)	W370-0259	30043684A	All
-	Burner box, 3-tube (#47)	W100-0318-SER	30043637A	50
	Burner box, 4-tube (#47)	W100-0319-SER	30043638A	70-3, 70-4
	Burner box, 5-tube (#47)	W100-0320-SER	30043639A	90
	Burner box, 6-tube (#47)	W100-0321-SER	30043640A	105

* Refer to the Navien Service Code for replacement part ordering.

Ref. No	Part Description	Part Number	Navien Service Code*	Applicable Unit
-	Assy, Condensate trap	W010-2768	30043655A	All
-	Valve, Two stage	W010-2573	30043663A	All
-	Fuse, 5 AMP	W010-2563	30043660A	All
-	Transformer, Choke coil	W010-2571	30043664A	70-4, 90, 105
-	Harness, Board to Upper vestibule	W750-0232	30043665A	All
-	Harness, Power board to motor	W750-0231	30043667A	All
-	Harness, Signal board to motor	W750-0233	30043668A	All
-	Baggie - Navien NDF	W020-10010524	30044233A	All
-	Clamp, Nylon HC672 black	W155-0009	30044234A	All
-	Clamp, Nylon HC875 black	W155-0010	30044235A	All
-	Fitting, Air intake flange	W255-0062	30044236A	All
-	Fitting, 1/2 in Tooled 90° barb	W255-0050	30044237A	All
-	Fitting, 1/2 in, slip, CPVC	W255-0054	30044238A	All
-	Fitting, 5/8 in Tooled 90° barb XL	W255-0070	30044239A	All
-	Gasket, Air inlet adaptor	W290-0912	30044240A	All
-	Gasket, Condensate trap	W290-0879	30044241A	All
-	Grommet, Pass through 2 in EP	W315-0106	30044242A	All
-	Grommet, Pass through 4 in EP	W315-0107	30044243A	All
-	Hose, Sq. NS 0.35 in X 0.35 in EPDM 60D black	W345-0011	30044244A	All
-	Tube, 5/8 ID manifold cover drain	W345-0019	30044245A	All
-	Cap - BP 7/8 in	W120-0068	30044246A	All
-	Screw #8 X 3/4 in Hex drive TEKS	W570-0056	30044247A	All
-	Plastic, Condensate trap	W497-0004	30044248A	All
-	Screw, #8 X 1/2 in Hex HD	W570-0010	30044249A	All
-	Leaflet, Installation checklist Navien	W415-10010525	30044250A	All
-	Bracket, Trap-horizontal mount	W080-1971	30044251A	All
-	Bracket, Condensate trap	W080-1972	30044252A	All
-	Gasket, Condensate trap	W290-0160	30044258A	All
-	Gasket, Downflow Mnt. Condensate	W290-0172	30044253A	All
-	Bracket - Condensate trap mount	W080-1240	30044254A	All
-	Label, Conversion identification	W385-0921	30044255A	All
-	Card, QA checklist	W122-0435	30044256A	All
-	Label, Barcode	W386-10010526	30044257A	All

* Refer to the Navien Service Code for replacement part ordering.

User's Information Manual

NDF Forced Air Gas Furnace

Model | NDF600-050M2V3B
NDF600-070M2V3B
NDF600-070M2V4C
NDF600-090M2V5C
NDF600-105M2V5C



QUALIFIED ONLY IN

U.S. SOUTH: AL, AZ, AR,
CA, DC, DE, FL, GA, HI,
KY, LA, MD, MS, NV, NM,
NC, OK, SC, TN, TX, VA



ALWAYS read and follow this manual completely before using the furnace. Save for future reference.

WARNING

FIRE OR EXPLOSION HAZARD

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

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

WHAT TO DO IF YOU SMELL GAS

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

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

The installation must conform with local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.

This furnace must be installed in accordance with the Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 or when such standard is not applicable, the Standard for Model Manufactured Home Installation, NFPA 225, or the Canadian Standard for Manufactured Homes, CSA Z240 MH.

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Product Installation Information	
Model	
Date Purchased	
Gas Type	
Serial Number	

Important Safety Information



The following Safety Alert Symbols are used in this manual. They are used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible serious injury or death. This Safety Alert Symbol precedes any safety message about risk of personal injury. It may also be accompanied by one of the following signal words.

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

DANGER

Indicates a hazardous situation that if not avoided will result in death or serious injury.

WARNING

Indicates a hazardous situation that if not avoided could result in death or serious injury.

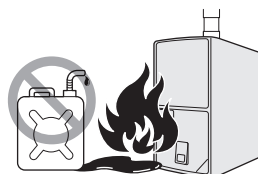
CAUTION

Indicates a potentially hazardous situation that if not avoided could result in minor or moderate injury.

NOTICE

Indicates information considered important but not hazard-related (such as property damage).

DANGER



If you smell gas:

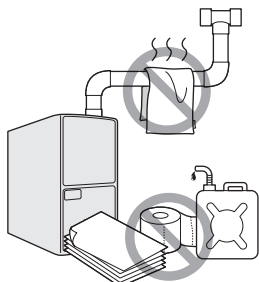
- Do not try to light any appliance.
- Do not touch any electrical switches or use landline phones.
- From a neighbor's phone, call your gas provider and follow their instructions.
- If you cannot reach your gas provider, call the fire department.
- Do not return to your home until authorized by your gas supplier or the fire department.

Do not use or store flammable products, such as gasoline, solvents, or adhesives in the same room or area as the furnace.

- The furnace has a main burner flame that can turn on at any time and can ignite flammable vapors. Vapors from flammable liquids can explode and catch fire, causing death or severe burns.
- Vapors cannot be seen and can be heavier than air. They can travel long distances along the ground and can be carried from other rooms to the furnace's main burner by air current.
- Keep all flammable products far away from the furnace and store them in approved containers. Keep the containers closed tightly and out of the reach of children and pets.

WARNING

To prevent death, serious injury, or property damage:



- **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**

Failure to do so may result in property damage; personal injury; or death from fire, explosion, smoke, soot, condensation, electric shock, or carbon monoxide leakage.

- **Do not install the furnace in a mobile home, trailer, or recreational vehicle.**

Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.

- **Do not operate the furnace without a filter installed in the product.**

Doing so may clog the heat exchanger with dust and reduce the furnace's performance.

- **Do not operate the heating function unless the doors are installed.**

Doing so may introduce exhaust gas into the room during operation.

- **Do not store or use gasoline or other flammable liquids near this furnace.**

Doing so may result in fire or explosion.

- **Do not place combustibles, such as newspapers or laundry, near the furnace or venting system.**

Doing so may result in a fire.

- **Do not place or use hair sprays, spray paints, or any other compressed gases near the furnace or venting system, including the vent termination.**

Doing so may result in fire or explosion.

WARNING

- The furnace contains foil covered fiberglass insulation. Inhalation of fiberglass particles is associated with respiratory disease including cancer. Natural gas and propane are normally odorized by the fuel supplier. In some cases, the odorant may not be perceivable. Installation of UL and ULC recognized fuel gas detectors installed in accordance with their manufacturer's instructions is recommended as an additional margin of safety.
- The exhaust gases from this furnace contain chemicals which on some occasions may include carbon monoxide. Carbon monoxide is an odorless, tasteless, clear colorless gas which is highly toxic. Even low concentrations are suspected of causing birth defects and other reproductive harm.
- UL and ULC recognized CO detectors are recommended for all buildings equipped with fossil fuel burning appliances. All CO detectors should be installed in accordance with their manufacturer's instructions and applicable local building codes.
- Fire, explosion or carbon monoxide poisoning hazard! Failure to replace with proper control could result in fire, explosion or carbon monoxide poisoning. Replace gas valve only with the same model number or as specified by the manufacturer.
- **Do not operate the furnace with the front cover opened.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not operate the furnace without proper venting.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not touch the power supply or internal components of the furnace with wet hands.**
Doing so may result in electric shock.

California law requires the following Prop 65 warning to be provided:

WARNING

This product can expose you to chemicals including Di(2-ethylhexyl) phthalate, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

SAVE THESE INSTRUCTIONS	
DANGER	Indicates a hazardous situation that if not avoided will result in severe injury or death.
WARNING	Indicates a hazardous situation that if not avoided could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation that if not avoided could result in minor or moderate injury.
NOTICE	Indicates information considered important but not hazard-related (such as property damage).

WARNING

To prevent death, serious injury, or property damage:

- **Do not turn on the furnace unless the gas supply is fully open, the inlet and exhaust air are not blocked, and the duct is clear of any obstructions.**
Doing so may damage the furnace.
- **Do not use this furnace for anything other than its intended purpose, as described in this manual.**
- **Do not remove the front cover unless the power to the furnace is turned off or disconnected.**
Failure to do so may result in electric shock.
- **When servicing the controls, label all wires prior to disconnecting them.**
Failure to do so may result in wiring errors, which can lead to improper operation. Verify proper operation after servicing.
- **Do not use unapproved replacement or accessory parts.**
Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.
- **Do not place anything in or around the vent terminals that could obstruct the airflow in or out of the furnace.**
- **This furnace has been approved for use in the USA and Canada only.**
Using the furnace in any other country will void the manufacturer's warranty.

WARNING

Carbon-Monoxide Poisoning Hazard

- To prevent severe personal injury or death due to carbon-monoxide poisoning:
 - Check that all openings in the outside wall around the vent (and air intake) pipes are sealed to prevent combustion products from infiltrating the building.
 - Check that the furnace vent (and air intake) terminals are not obstructed in any way.

Codes and Standards

Follow all national and local codes and standards, including the guidelines below. Installation must comply with the regulations set forth by the serving gas supplier, local building, plumbing, and other regulations. In the absence of local regulations, installations must comply with the national regulations listed below and those of all authorities having jurisdiction. In the United States and Canada, follow all regulations and standards below.

Safety

- US: Latest edition of National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B
- Canada: Latest edition of National Standard of Canada, Natural Gas and Propane Installation Code (NSCNGPIC) CAN/CSA B149.1

General Installation

- US: Latest edition of ANSI Z223.1 (NFPA 54) National Fuel Gas Code
- Canada: Latest edition of CAN/CGA -B149.1 and .2 Natural Gas and Propane, and the National Electric Code (NEC) NFPA 70

Combustion and Ventilation Air

- US: "Air for Combustion and Ventilation" section of the latest edition of the NFPA54/ANSI Z223.1
- Canada: "Venting Systems and Air Supply for Appliances" section of the latest edition of CAN/CSA B149.1

Duct Systems

US and Canada: Latest edition of Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

Acoustical Lining and Fibrous Glass Duct

US and CANADA: Current edition of SMACNA, NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts

Gas Piping and Gas Pipe Pressure Testing

- US: NFPA 54/ANSI Z223.1
- Canada: As required by the latest edition of CAN/CSA-B149.1
- In the state of Massachusetts: - This product must be installed by a licensed plumber or gas fitter. When flexible connectors are used, the maximum length should not exceed 36 in. (914 mm). When lever-type gas shut-offs are used, they should be the T-handle type. Using copper tubing for gas piping is not allowed in the state of Massachusetts.

Electrical Connections

Must be made in accordance with any applicable local codes, bylaw and regulations.

- US: Latest edition of ANSI/NFPA 70, National Electrical Code
- Canada: Latest edition of CAN/CSA C22.1 and C22.2, Canadian Electrical Code (Part 1 and 2)

Condensate Drain Connection

- US: National Standard Plumbing Code
- Canada: National Plumbing Code of Canada

Auxiliary Drain Pan Installation

In accordance with approved regulations, installing an auxiliary drain pan under the evaporator coil installed in all areas of the furnace and structure.

- Furnace condensate treatment system
- Overflow by coil drain pan
- Where the main condensate pipeline can become clogged and cause damage to the building

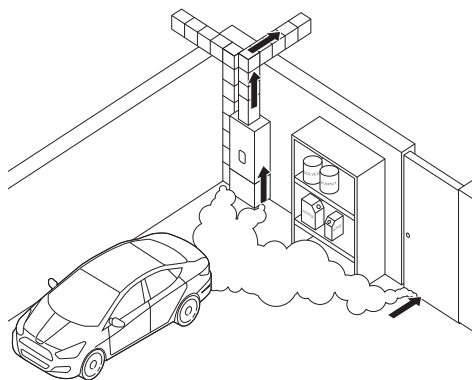
Codes and additional information may be obtained from:

- American Gas Association
 - Address: 400 North Capitol Street, NW, Suite 450 Washington DC, 20001
 - Phone: (202) 824-7000
 - Website: <https://www.aga.org>
- National Fire Protection Association
 - Address: 1 Batterymarch Park Quincy, MA, 02169-7471
 - Phone: (617) 770-3000
 - Website: <https://www.nfpa.org/>
- Canadian Standards Association
 - Address: 5060 Spectrum Way Mississauga, Ontario, L4W 5N6
 - Phone: (416) 747-4000
 - Website: <https://www.csa.ca>

Important Information About Efficiency and Indoor Air Quality

Central cooling and heating equipment, such as a furnace, can be efficient when a duct system can carry cooled or heated air properly. To improve efficiency, comfort and good indoor air quality, read the following guidelines:

- Maintain the proper balance between the air supplied to each room and the air returned to the cooling and heating units.
- Maintaining proper balance and tightness of the duct systems maximizes the efficiency of heating and air conditioning systems and improves indoor air quality by reducing the amount of pollutants contained in the air entering from the space where the ducts and equipment are located.
- Make sure that dangerous substances, fumes, and odors do not enter living spaces.
- The front covers of the furnace always must be closed properly. Always check if the quarter turn on the front covers are fully engaged.



Note

Manufacturers and the US Environmental Protection Agency's Energy Star program recommend that central duct systems be inspected by qualified contractors for proper balance and tightness.

Receiving

Immediately upon receipt, all cartons and contents should be inspected for transit damage. Units with damaged cartons should be opened immediately. If damage is found, it should be noted on the delivery papers, and a damage claim filed with the last carrier.

- After the unit has been delivered to the job site, remove the carton taking care not to damage the unit.
- Check the unit rating plate to be sure equipment matches job specifications.
- Read the entire instructions before starting the installation.

1. Introduction

This furnace has been designed to deliver many years of efficient, dependable service. With regular maintenance, some of which requires the attention of a qualified installer, service agency or gas supplier, some of which you may do yourself, the furnace will operate satisfactorily over many heating seasons.

Please read this manual to familiarize yourself with safety procedures, operation, and routine maintenance procedures. Figure 1 is provided to help identify the components of your furnace.

⚠ WARNING

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

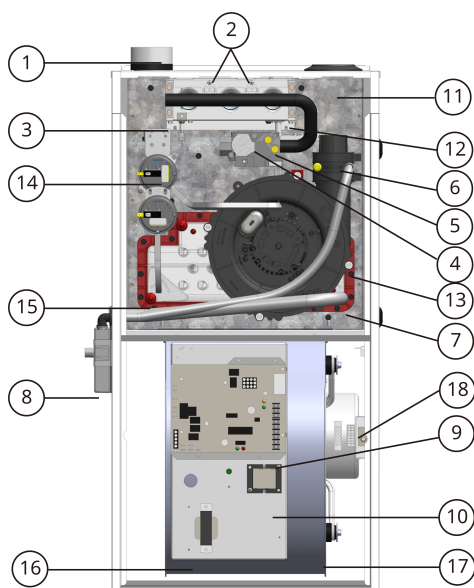


Figure 1. Furnace Components

Part Number	Part Description
1	Combustion air intake fitting
2	Flame roll-out switch (2)
3	Flame sensor
4	Two stage gas valve
5	Air high temperature limit (behind gas valve)
6	Vent drain assembly coupling
7	Drain for secondary heat exchanger (3)
8	Condensate trap
9	Two stage integrated furnace control (IFC)
10	Transformer for 24 VAC / 40VA
11	Burner assembly
12	Hot surface igniter (HSI)
13	Two speed inducer
14	Pressure switch assembly
15	Front manifold cover pressure tap (3)
16	PFC "Choke Coil" (required on ¾ and 1 Hp units)
17	Door switch and junction box
18	Blower motor
19	Circulating air blower

Most natural gas systems and all LP gas systems have a service regulator located near the point where the gas piping enters the building.

The propane tank will normally have an additional first stage regulator located at the tank outlet valve. All of these regulators (located outdoors) will have a vent. (Figure 2)

It is important for these vents to remain clear. Do not allow moisture, which could freeze, to build up in the vent. If you see moisture building up in the regulator vent, contact your gas supplier.

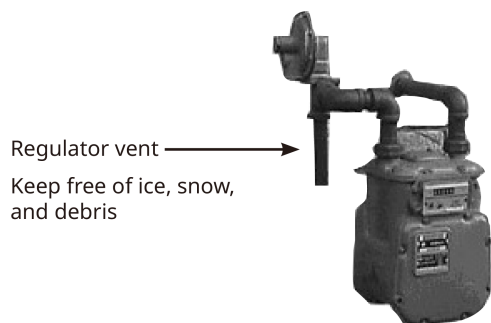


Figure 2. Gas Regulator Vent

⚠ WARNING

- Obstruction of the air vent on an LP (propane) cylinder or tank regulator can cause explosion or fire resulting in property damage, severe personal injury or death.
- Your gas supplier should periodically inspect and clean the air vent screen to prevent any obstruction.
- Keep protective regulator cover in place, as exposure to the elements can cause ice buildup and regulator failure.

2. Furnace Operation Information

2.1 Starting the Furnace

During the heating season, the operation of the furnace is fully automatic.

1. First read these instructions and safety notices thoroughly.
2. Set the thermostat to below the current set point.
3. Ensure that all supply air registers and return air grills are open.
4. Turn off the electric power to the furnace.
5. Remove the burner access door.
6. Ensure that the furnace manual shut-off gas valve is in the "ON" position. The valve handle is normally in-line with the gas pipe and valve body when it is in the "ON" position; perpendicular to the gas piping and valve body when it is in the "OFF" position.
7. Turn the manual gas valve switch to the "OFF" position. (Figure 3)
8. Wait 5 minutes to clear out any gas. If, after this time you smell gas, STOP. Turn the appliance manual shut-off valve to the "OFF" position. If burning LP gas, smell for gas near the floor since propane and butane are both heavier than air. If after this time you do not smell gas, continue to the next step.
9. Turn the manual gas valve switch to the "ON" position.
10. Replace the burner access door, ensuring that it is properly in place.
11. Restore the electric power to the furnace.
12. Adjust the thermostat to the desired setting. If the thermostat also controls an air conditioning system, ensure that the thermostat system switch is in the "HEAT" or "AUTO" mode.

If this is the first time that the furnace has undergone a trial ignition since installation, or if there has been work done on the gas lines, the furnace might not light because of air trapped in the gas supply line.

Simply turn the thermostat down to below the current set point, wait 5 minutes, then adjust the thermostat to the desired setting. If the problem persists, proceed to "Furnace Shut-Down Procedure" and call your Installer, service agency or gas supplier.

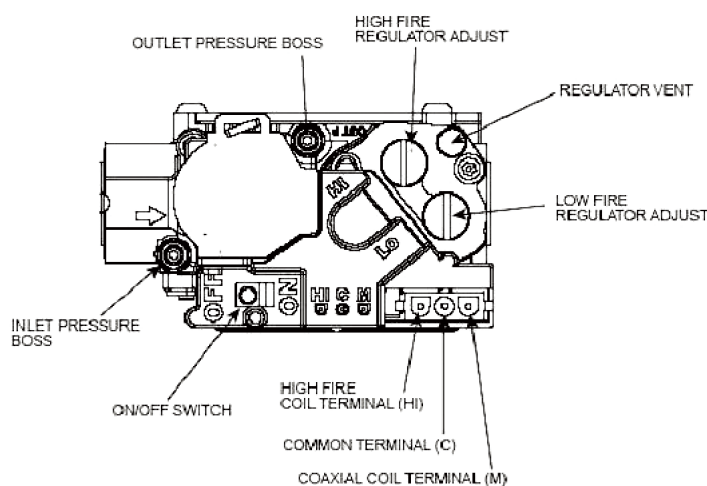


Figure 3

2.2 Shutting Down the Furnace

1. Set the thermostat to its lowest setting.
2. Shut off electric power to the furnace.
3. Turn the furnace manual shut-off valve to the "OFF" position.
4. Remove the burner access door, turn the manual gas valve switch to the "OFF" position, then re-install the burner access door.

Note If you intend to be away from home for lengthy periods of time during the non-heating season, it is advisable to follow the furnace shut down procedure.

7. Keep combustible articles at least 3 feet (0.91 m) away from the furnace. Do not block access for servicing the furnace. Do not use the combustion air or exhaust piping as a hanger for clothes or anything else.

CAUTION

Never attempt to operate the furnace without the blower door and combustion compartment door in place or when the blower has failed.

2.3 Operating Tips

1. Clean air filters maximize efficiency, and reduce heating costs.
2. During the heating season, keep windows and doors closed to reduce the heating load on the system.
3. Avoid excessive use of kitchen exhaust hoods and other exhaust fans to reduce the heating load on the system.
4. Arrange the furniture and drapes so that the supply air registers and return air grills are unobstructed.
5. If you have a perimeter duct system, ideally, the warm air should bathe the interior walls. Avoid the use of plastic deflectors on the supply air registers which tend to short circuit the warm air straight into the return air grills.
6. Avoid placing heat producing appliances such as televisions, radios, lamps, etc. in a location to influence the thermostat.

3. Routine Maintenance by Homeowner

3.1 Air Filter

WARNING

Disconnect the electrical power supply to the furnace before attempting any maintenance. Failure to do so can cause electrical shock resulting in personal injury or loss of life.

CAUTION

- Do not operate your furnace or air conditioner for extended periods of time without an air filter.
- A portion of the dust entrained in the air may temporarily lodge in the air duct runs and the supply registers. Any recirculated dust particles will be heated and charred by coming into contact with the heat exchanger. This residue will soil ceilings, walls, drapes, carpets, furniture, and other household articles.
- Be sure that the filter is re-installed with the airflow direction identical to its previous use. Reversing the filter will cause dust trapped within the filter to break free and recirculate within the duct system.

Consult your installation contractor or service technician if you have any questions on instructions for removing the air filter.

3.2 Routine Examination

Note We recommend that your furnace and exhaust/combustion air vents be checked by a qualified service technician once a year.

It is good practice to give a quick inspection of your furnace each time you inspect or clean the air filter. Things to check:

- Check the furnace for obvious signs of deterioration.
- Check the venting and combustion air piping to ensure that it is still fastened to the furnace. It should not sag, and should have a 1/4" (6 mm) per foot (305 mm) slope upwards, to the outside wall or termination.
- There should be no water marks on the floor under the venting. Water marks may indicate a leaking pipe joint.
- All ductwork should be secured to the furnace, and all ductwork should be solidly supported throughout the heating system.
- Water should flow easily through the condensate drain line. You may be able to observe this while the furnace is operating if your condensate drain line from the drain trap assembly terminates at a floor drain or sump pit. If clear plastic was used, it may yellow with age; however, the contents should be reasonably clear. Excess debris in the drain line may indicate a problem which should be referred to your service contractor. If the drain lines are opaque, your service technician will check them during the annual servicing.
- The gas burner should be observed from time to time during the heating season to ensure that the flames are clean and blue. A bit of orange color in the flame is not likely to be a problem and is probably dust particles burning. If you observe lazy yellow flames, call your heating or service contractor immediately. The yellow flames inevitably lead to soot-ups.
- The combustion air and exhaust terminals should be inspected occasionally to ensure that they are free of obstructions and debris.

3.3 Annual Inspection/Service

It is recommended that the furnace be inspected annually by a qualified installation contractor, service agency or fuel supplier. Your annual inspection will normally cover the following:

Heat Exchanger

The heat exchanger should be inspected for corrosion. The flue passages (heat exchanger tubes) should be free of scale or excessive corrosion.

Burners

The burners should be inspected to ensure that they are free of deterioration.

CAUTION

Be careful when working on the burner assembly. The hot surface igniter is fragile and can break easily.

The flame sensor should be inspected and cleaned with fine steel wool or Scotch-Brite™ scrubbing pad. The wiring connection should be checked to ensure that it is tight and corrosion free.

Drainage

The condensate drainage system should be inspected and cleaned if necessary. If the drain trap assembly, or any other component becomes blocked, condensate may back up into the secondary or primary heat exchanger causing nuisance trip-outs of the pressure switch(s) or roll out switch(s). The condensate should be observed for signs of dirt, carbon, debris, etc.

Circulating Fan

The condition of the circulating fan should be checked to ensure that it is free of excessive dust buildup, debris, etc. The mechanical fasteners should be inspected and checked for proper tightness and parts alignment. The motor ventilation ports should be cleaned if necessary to prevent restriction to cooling by air over the motor.

Electrical

All electrical connections should be examined to ensure that they are tight and corrosion free. Repair any connections that have become loose or corroded.

Furnace Operation

The furnace should be cycled during the annual inspection and servicing to:

1. Test all safety related controls.
2. Determine that the temperature rise falls within the range shown on the appliance rating plate.
3. Ensure that the burner ignition is smooth and that the flames are smooth soft blue, and not impinging on the heat exchanger.
4. Ensure the gas meter is timed, and/or furnace manifold pressure checked to confirm the furnace is operating at the input listed on the rating plate.

3.4 Furnace Appearance

The furnace exterior finish is a durable automotive like coating. It may be washed with mild soap if necessary. Galvanized metal surfaces require no maintenance.

3.5 Variations

If your system includes air conditioning, your thermostat will likely have two switches. The first switch is the system switch. The switch settings usually include HEAT, COOL, and OFF. Some thermostats have system switches which include HEAT, COOL, AUTO, and OFF. The system switch must be in the HEAT or AUTO position for the furnace to run.

The second switch is the fan switch. It usually has settings of ON and AUTO. The fan switch may be in either position when using the furnace. If the fan switch is set to ON, the main blower will run continuously.

3.6 Terminations

The combustion air and exhaust terminals should be inspected occasionally to ensure that they are free of obstructions and debris. If screens were used in either terminal, ensure that they are free of debris, corrosion, or anything preventing the free flow of air.

4. Homeowner's Reference

Homeowner's Reference Table
Model No.
Serial No. (serial number located on bottom of inside door)
Date Installed
Contractor
Contact
Address
Postal Code/Zip Code
Telephone No.
After Hours No.
If different from Installation Contractor:
Service Tech.
Telephone No.
After Hours No.
Fuel Supplier:
Gas Supplier
Contact
Telephone No.
After Hours No.

Notes

Installation and Operation Manual

NDF Forced Air Gas Furnace

Getting Service

All repairs require pre-authorization by Technical Support.

- Request for your installer or any licensed professional to contact Technical Support at 1-800-519-8794 Option 2 once at the installation site.
- A list of independent service providers in your area can be found on the website: www.navieninc.com/installers.

When seeking service, have the following information at hand:

- Model number
- Serial number
- Date purchased
- Installation location and type
- Error code, if any appears on the front control panel display.

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800.519.8794 | www.navieninc.com

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