

INSTALLATION, OPERATION & MAINTENANCE MANUAL

EF SERIES DUCT FURNACE



ANSI Z83.8 (2016) – CSA 2.6(2016) – GAS-FIRED DUCT FURNACES



WARNING:

FIRE OR EXPLOSION HAZARD

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

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause 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
- Leave the building immediately
- Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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

This manual must be kept with the appliance for future reference.



The information provided in this manual applies only to the duct furnace, its installation in duct work or air handler cabinet and to its operation, maintenance, and service. Refer to the air handling unit manufacturer's instructions for information related to all other components.

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I. Inspection on Arrival

Inspect unit on arrival. Report any damage to the transportation company and unit manufacturer. Inspect skids and cartons for signs of poor handling that may have caused damage. If unit is stored prior to installation, make sure unit is protected from rain and snow and stored in a low traffic area.

II. Safety Rules and Precautions

The installation, operation and maintenance instructions in this manual must be followed to provide safe and efficient operation of the furnace. Care must be exercised regarding special precautions noted throughout this manual. Failure to address critical areas and situations noted could result in PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury**
2. **WARNING:** indicates a **potentially** hazardous situation, which, if not avoided, could result in death or serious injury
3. **CAUTION:** indicates a potentially hazardous situation, which, if not avoided, **may result in personal injury**. It is also used to alert to unsafe practices and hazards involving possible property damage.
4. **IMPORTANT:** Indicates a situation which, if not avoided, may result in a potential safety concern.

DANGER !

Gas-fired furnaces are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne substances containing silicone.

WARNING !

This furnace is not listed or suitable for drying or process applications. Use in such applications voids any warranty and manufacturer disclaims any responsibility for the duct furnace and / or application.

WARNING !

Duct furnaces must not be installed where flammable vapors are present or where potentially explosive atmospheres may exist. To prevent premature heat exchanger failure do not locate unit in corrosive atmospheres or where chlorinated, halogenated hydrocarbons or acid vapors are present.

Before Installing

- 1.) Verify that available gas supply, inlet gas pressure, airflow and electrical supply match information on furnace rating plate.
- 2.) The furnace is **not to be used for temporary heating** of buildings or structures under construction.
- 3.) Do not use furnace if any part has been under water. Contact a Qualified Service Agency to inspect the furnace and replace all gas and electronic controls that have been wet.

III. Installation Requirements

All unit installations must be in accordance with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) in the United States and Can/CGA-B149 Installation Code in Canada, and all other applicable local codes and ordinances. These requirements include but are not limited to:

- **Furnace Location and clearances**
- **Circulating airflow and ductwork**
- **Combustion air supply to the heating equipment**
- **Venting of the products of combustion (flue gases)**
- **Gas supply, piping and connections**

Furnace Location

1. When locating the duct furnace, consider general space and heating requirements, availability of gas and electrical supply, and proximity to flue exhaust vent locations and condensate drain lines.
2. Do not install duct furnace vent where flue products can be drawn into adjacent building openings such as windows, doors or fresh air intakes.
3. Equipment access panels and doors must be located to provide easy access for servicing, adjustment and maintenance of the heating units installed.

For Outdoor Units

1. Unit must be installed with combustion air openings located at least one (1) foot above the average snow depth for the location.
2. Combustion air inlet and flue gas outlet must be located in the same pressure zone to minimize effects of wind on burner and heater performance.
3. Do not locate unit near building ventilators or exhausts, or areas where corrosive chemical vapors can be drawn into combustion air supply.
4. Be sure that vent discharge for flue gases is directed away from combustion air inlet and located to prevent flue products from being drawn into combustion air supply.

For Indoor Units

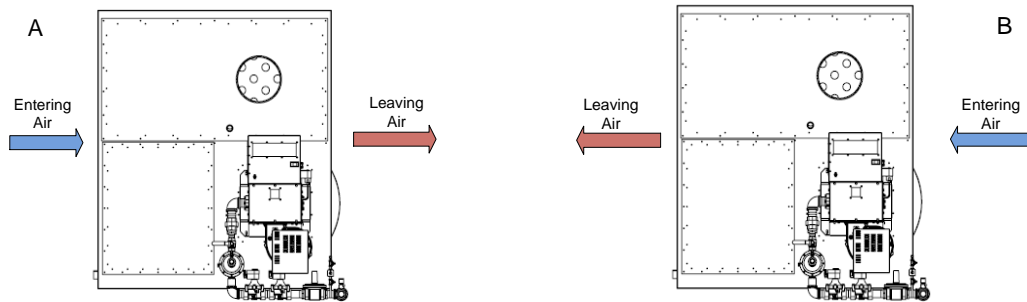
1. Indoor installations use building air for combustion air supply and vent the products of combustion outdoors through a single wall or roof penetration.
2. Locate unit to insure an adequate supply of fresh air to replace air used for combustion and ventilation process.
3. If necessary to insure suitable combustion air supply to unit, provide air openings equal to one square inch of free area per 1000 Btuh of input rating.
4. When locating units, it is important to consider the exhaust vent piping must be connected to the outside atmosphere. See table below for required minimum clearances from vent termination. Location should minimize the number of elbows or turns in vent pipe.

| Structure | Min. Clearances to Vent Terminal (all directions unless specified) |
|--|---|
| Combustion air inlet of another appliance | 6 ft. (1.8m) |
| Forced air inlet within 10 ft. (3.1m) | 3 ft. (0.9m) above |
| Door, window or gravity air inlet | 4ft. (1.2m) horizontally |
| | 4 ft. (1.2m) below |
| | 1ft. (0.3m) above |
| Gas meter and relief equipment, Electric meter | US- 4ft. (1.2m) horizontally |
| | Canada - 6 ft. (1.8m) |
| Gas Regulator | 3 ft. (0.9m) horizontally |
| Adjacent public walkways | 7 ft. (2.1m) above |

Duct Furnace Installation

For a duct furnace connected to a return air duct or mounted in a cabinet, furnace shall be installed on the positive pressure side of the circulating air fan. Furnace can be configured for horizontal airflow only, as shown in Fig. 1

Figure 1 – Airflow Configurations



With return air duct, furnace shall be installed with inlet duct that provides air distribution equivalent to a straight run of duct having the same cross-sectional area as the inlet connection and not less than two (2) equivalent duct diameters in length.

Ductwork should be mechanically fastened to heating unit. Joints should be sealed with high temperature silicone caulking or high temperature tape to prevent leakage of circulating air. All duct connections **MUST** be weather tight to prevent rain and snow from entering ductwork. Support all ductwork securely. **DO NOT** rely solely on heating unit duct connections for support.

Provide removable access panels in ductwork immediately upstream and downstream of duct furnace to allow for inspection of the heat exchanger. These openings should be large enough to observe smoke or reflected light inside the casing to inspect heat exchanger for leaks, and to check for hot spots on the heat exchanger due to poor air distribution or insufficient air volume. Attach covers so as to prevent air leakage.

Clearances to Combustibles

Duct furnace is for installation on non-combustible floor or base. Provide suitable clearances to combustible construction as follows:

Sides / back: 6 inches (152mm) Top: 6 in. (152mm) Front: 36 in. (635mm) Vent Pipe: 2" (50mm)

For applications where unit is to be mounted above combustible flooring, an insulated cabinet base must be specified. Clearance above combustible flooring is 2 in. (50mm), with this base.

Airflow Distribution

Uniform air distribution over the heat exchanger is essential to proper operation and optimum unit efficiency. Use of baffles and/or turning vanes may be required to provide uniform air flow through the heating unit. Observe recommended spacing from circulating air blower to heating unit. Locating the circulating air blower too close to the unit creates uneven airflow over the heat exchanger resulting in poor performance and possible damage to heat exchanger or components from localized overheating.

Never exceed the listed maximum rise temperatures for heaters. The rise limits are established based on maintaining temperatures below the material maximum scaling temperatures during operation. Airflow rates less than the listed minimums, or over-firing heater can result in excessive temperatures which can also shorten heat exchanger life. A High Limit switch is provided that will shut-off the gas burner if the circulating air temperature exceeds the maximum allowable. This limit switch is preset. **DO NOT ADJUST** limit setting.

Combustion Air Supply

The duct furnace needs an ample supply of air for proper and safe combustion of the fuel gas. **Do not block or obstruct air openings to the area where the heating unit is installed.** Locate unit to insure an adequate supply of fresh air to replace air used in the combustion and ventilation process.

For outdoor applications and for indoor applications where the combustion air is drawn from the surrounding space, **openings for combustion air must be provided in a panel or door** with direct access to the vestibule area where the burners and draft inducer are located. This **air opening(s)** must be sized to provide a suitable supply of air for combustion to the burner compartment and have a **minimum free area of 1 sq. in. (625mm²) per 4,000 Btuh (2,345 W)** of rated input for total input. The minimum dimension of any air opening should not be less than 3 inches. The air handling unit must be installed so that access to air inlet openings is unobstructed. For louvered doors be sure to provide a suitable windbreak to prevent wind driven rain and snow from collecting in the vestibule area and on electrical components.

For indoor installations, locate heating unit to insure an adequate supply of fresh air to replace air used in the combustion and ventilation process. Air must also enter the appliance location to replace the air exhausted through the vent system. Refer to installation codes for specific requirements and guidelines.

Condensate Drain Lines

Condensate is produced in furnace sections during heating operation. The furnace has two collector box drain fittings and one vent connector drain connection. Both indoor and outdoor furnaces must have condensate piped to a sanitary sewer for disposal, using ¾" PVC pipe and fittings. Condensate drain piping is provided by others except as noted.

Installation requires **individual condensate drain systems** for each duct furnace section.

WARNING !

Failure to connect condensate drains can result in accumulation of condensate during heater operation and result in damage to the heat exchanger and hazardous operation.

The condensate drain system **must** include a **trap** for each furnace for proper system performance. Condensate trap kits are provided with each duct furnace. All joints must be watertight to prevent leakage. Heat exchanger assembly includes a threaded elbow oriented parallel to cabinet base. A male threaded PVC adapter is included in the EZ Trap kit provided with the furnace to connect to the threaded elbows from the flue collector boxes. PVC materials used for condensate drain pipe and fittings must conform to ASTM D1785 / CSA B137.3.

WARNING !

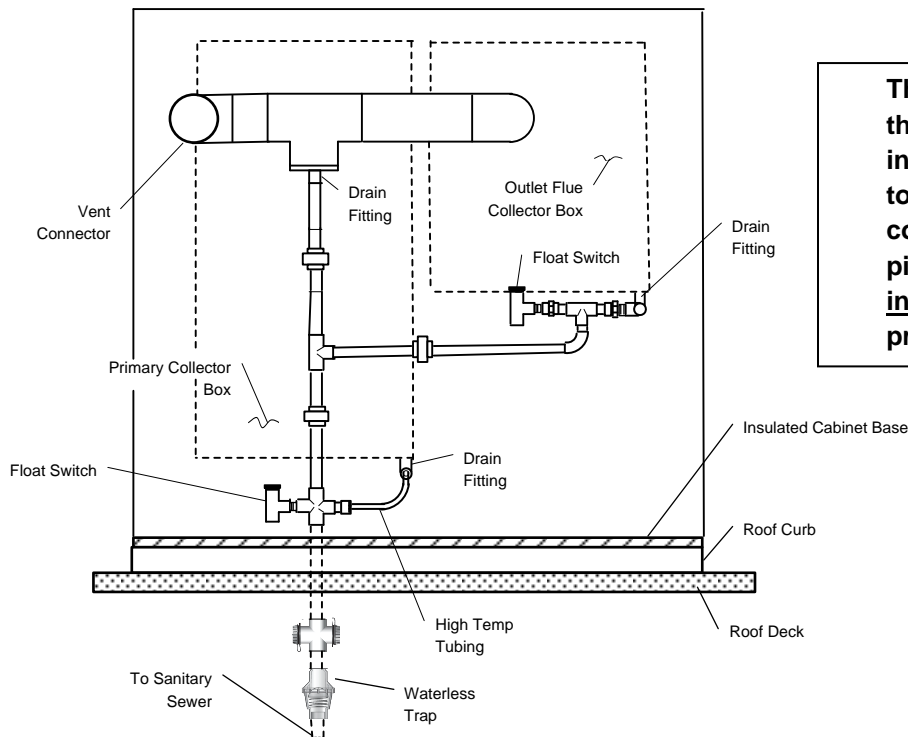
Failure to connect and properly install condensate drains can result in water flow into building, structural damage, injury or death.

WARNING !

For outdoor installations, the condensate drain line must be routed through a heated space. DO NOT DRAIN ON ROOF. Failure to properly connect condensate drain can result in significant amounts of ice build-up, causing building damage, injury or death.

For outdoor installations run condensate drain from duct furnace into building (See Figure 2)

Figure 2 – Condensate Drain Piping



The drains must be extended through the heater base and into the heated space below to prevent freezing of condensate in the drain piping. Trap must be located in a heated space or protected to avoid freezing.

Before the Air Handling Unit (AHU) or Duct Furnace is placed on roof or curb, provide an opening for the condensate drain through the roof structure to line up with drain connection opening in base of AHU / Duct Furnace cabinet. Place unit on roof / curb and open front access panel.

Extend drain pipe(s) from inside the building up through the hole in the roof and cabinet, and into the 3/4" fitting provided on the condensate drain connection(s). Connect waterless condensate trap(s) included in kit to drain pipe inside the building. **Traps must be installed in the vertical position only**, with the float located above the spring. **Never install horizontally.** See instructions provided with trap. **Never connect condensate drain directly into a sewer line.** If connection to a sewer is permitted by code, drain line must terminate in an open sewer tap (separated from sewer pipe with an air gap).

To insure piping is leak free, pipe sections must be solvent welded (glued) consistent with industry standards and applicable codes. Installation of a union ahead of the trap is recommended to permit maintenance of drains and accommodate service of the heater.

Where condensate drains are located outside a heated space or in a space where temperatures may fall below freezing, **the drain line must be protected.** Use a 2.5 to 5 watt per foot (0.003 to 0.005 kW per meter) at 115 VAC, 40 °F (4.4 °C) self-regulating, shielded and waterproof heat tape. Wrap the drain trap and drain line with heat tape and secure with ties. Follow the heat tape manufacturer's installation recommendations.

Disposal of condensate is subject to local codes and ordinances. In some locals the condensate drain system may be connected to a sanitary drain within the building. Some municipalities require that the acidic condensate produced be neutralized before being discharged into the sanitary sewer. A condensate neutralizer kit is available. Refer to installation instructions provided with the kit. Locate neutralizer where it is readily accessible for inspection and maintenance.

Where a floor drain is not accessible or available, a condensate pump may be used to pump condensate to sanitary sewer above the unit. A condensate pump kit is available for these applications.

IV. Venting

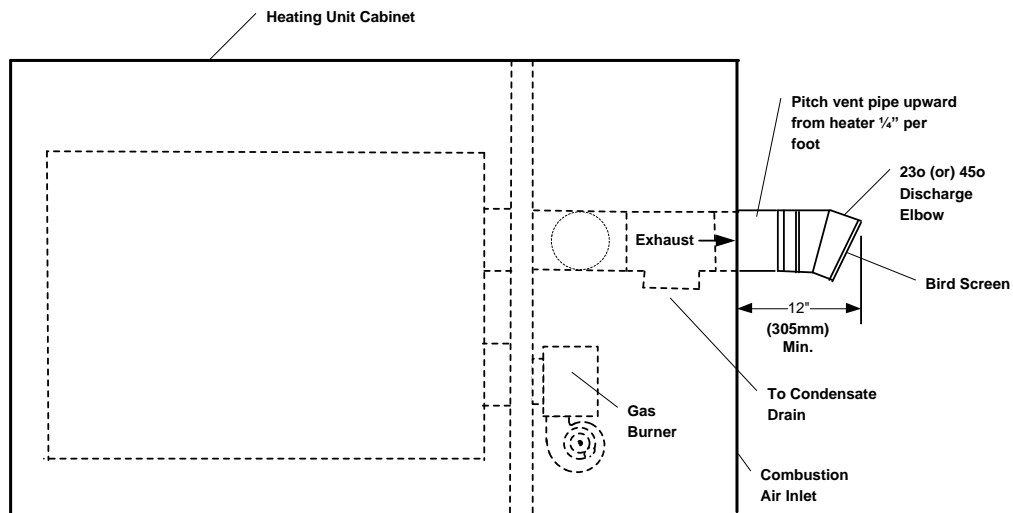
Installation of venting system must conform to local building codes and / or the National Fuel Gas Code (ANSI Z223.1) or in Canada the Canadian Installation Code (CAN/CGA-B149).

Outdoor Installation

Flue gases (products of combustion) must be vented outside of the appliance. The vent discharge must be at least the same diameter as the vent connector provided on the heating unit. For horizontal discharge, and animal screen and rain cover are recommended. Care should be taken in final vent discharge location to prevent recirculation of flue gases into combustion air supply.

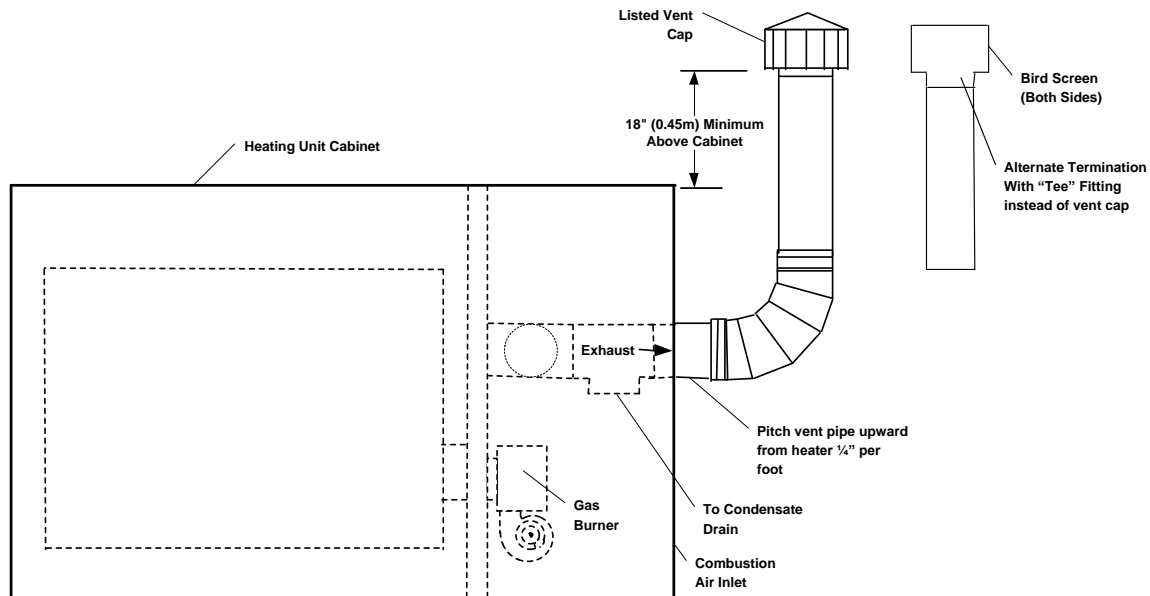
Figure 3 –Outdoor Venting

Horizontal Vent



Vertical Vent

A vertical exhaust stack may be required to provide necessary clearances in some installations.



Indoor Installations

All duct furnaces must be connected to a venting system to convey flue gases outside of the heated space. Duct furnaces for indoor installation are listed as Category II or IV vented appliances.

Vent pipe used must be certified to UL1738 / ULC S636 for a Category II, III and IV appliances. Joints must be gas tight and watertight.

Vent pipe used must be of at least the same diameter as the furnace vent connector / collar provided (See Table 1). All field installed vent pipe and fittings must be from the same manufacturer. **DO NOT** intermix vent system parts from different vent manufacturers. Follow instruction provided with approved venting materials used. Provide a minimum of 12 inches of straight vent pipe after the discharge connection before elbows.

Vent system and terminations shall be in accordance with requirements of authority having jurisdiction.

Do not connect the vent to any portion of a mechanical draft system that is under positive pressure. Do not install dampers or other restrictive devices in vent.

Vent piping must be exclusive to a single furnace.

WARNING !

Duct furnaces for indoor installation are equipped with a blocked vent switch to shut-off gas supply to the main burner in the event that a blockage occurs in the venting system. Do not disable or bypass this switch. Disabling switch may result in hazardous operation.

Typical Vertical and Horizontal Vent Arrangements

Fig. 4 - Vertical Vent (Category II)

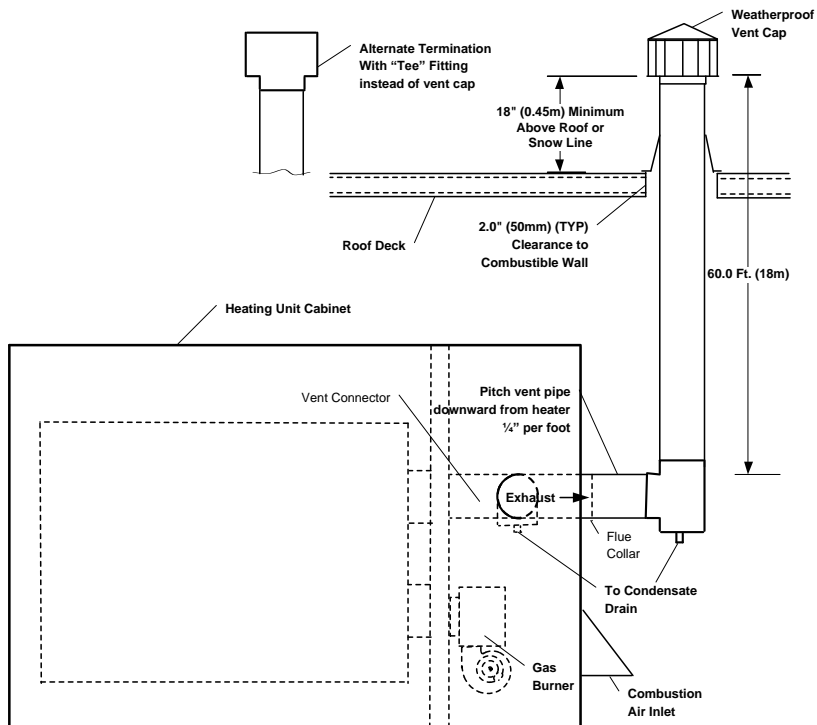


Figure 5 – Horizontal Vent (Category IV)

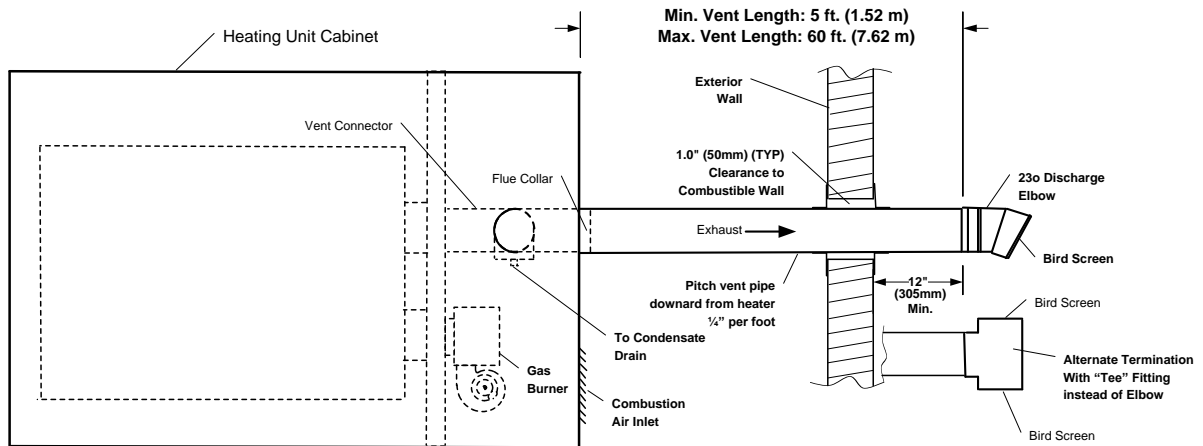


Table 1 – Vent Connector Size

| Model Size | Input (Btuh) | Flue Exhaust (Diameter – in.) | Max. Vent Length (ft.) |
|------------|--------------|-------------------------------|------------------------|
| EF0250 | 275,000 | 5 | 60 |
| EF0400 | 450,000 | 6 | 60 |
| EF0550 | 600,000 | 8 | 60 |
| EF0750 | 835,000 | 10 | 60 |
| EF0900 | 1,000,000 | 10 | 60 |
| EF1000 | 1,120,000 | 10 | 60 |
| EF1250 | 1,400,000 | 12 | 60 |
| EF1500 | 1,650,000 | 12 | 60 |

The maximum vent length is the equivalent length of pipe including any elbows and fittings. The equivalent length for elbows based on pipe diameter are as follows: up to 6" diameter 5 ft., for 8" diameter 7.5 ft. and for 10 to 12" diameter 10 ft.

Separated Combustion - Installations with Outdoor Combustion Air Supply

For installations requiring outside air for combustion, this duct furnace requires a two (2) pipe separated combustion vent system with separate air intake and vent pipes terminating in the same pressure zone.

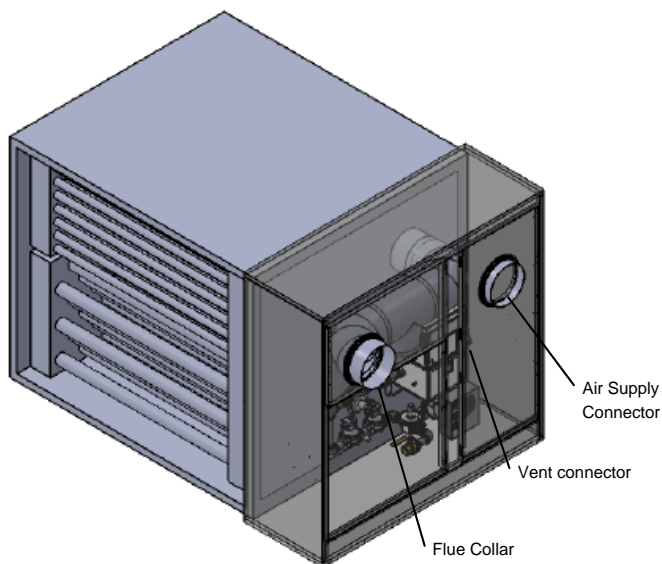
Use only Category II, III, IV vent materials listed to UL1738 / ULC S636 for vent pipe and fittings. All field installed vent pipe and fittings must be from the same manufacturer. DO NOT intermix vent system parts from different vent manufacturers. Follow instruction provided with approved venting materials used.

Combustion air is supplied from outdoors into the furnace burner compartment through a properly sized pipe attached to the air intake collar. Single wall galvanized pipe may be used for air supply pipes. Joints must be sealed with silicone sealant or metallic tape.

Proper venting of the heating units is the responsibility of the installer. Vent and air piping materials are supplied by others. Collars for connection of air pipe and listed vent piping are provided.

The venting and combustion air supply must be exclusive to a single furnace. Separated combustion systems may not be common vented

Figure 6 – Vent and Air Pipe Connections



Vent pipe and air inlet pipe size depends on input rating of the furnace. See Table 2 for sizing and materials based on model size and input rating. Minimum vent length is 5 ft.

Table 2 – Vent and Combustion Air Pipe Sizing – Separated Combustion

| Model Size | Input (Btuh) | Flue Exhaust - Diameter (inches) | Air Intake - Diameter (inches) | Max. Vent Eq. Length (ft.) |
|------------|--------------|----------------------------------|--------------------------------|----------------------------|
| EF0250 | 275,000 | 5 | 5 | 30 |
| EF0400 | 450,000 | 6 | 6 | 30 |
| EF0550 | 600,000 | 8 | 8 | 30 |
| EF0750 | 835,000 | 10 | 10 | 30 |
| EF0900 | 1,000,000 | 10 | 10 | 30 |
| EF1000 | 1,120,000 | 10 | 10 | 30 |
| EF1250 | 1,400,000 | 12 | 12 | 30 |
| EF1500 | 1,650,000 | 12 | 12 | 30 |

Vent and combustion air pipes must terminate in the same pressure zone. The maximum vent length is the equivalent length of pipe including any elbows and fittings. Combustion air pipe should be approximately the same length as the vent pipe and should not exceed 30 ft. in length. The vent and combustion air piping must be properly supported. Horizontal vent sections must be installed with an upward pitch of not less than ¼ in/ft. (21 mm/m) and securely supported every 3ft.

Both the furnace and vent system must be connected to a condensate removal system. The vent drip leg must use reducers from the outlet to the drain connection to meet requirements for Canadian installations (OLC S636). This method is also acceptable in the US.

Do not use dampers in vent or combustion air pipes. **Vent and air pipe runs through unheated spaces must be insulated or use double wall pipe.**

Indoor Vertical Venting

Vertical vent systems terminate vertically up. Install a Tee fitting with condensate drain connection as shown in Figure 7. Vent and combustion air piping must be terminated as shown in Figure 8.

Figure 7 – Vertical Vent Pipe Connections

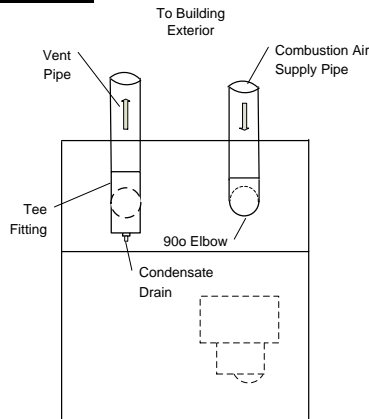
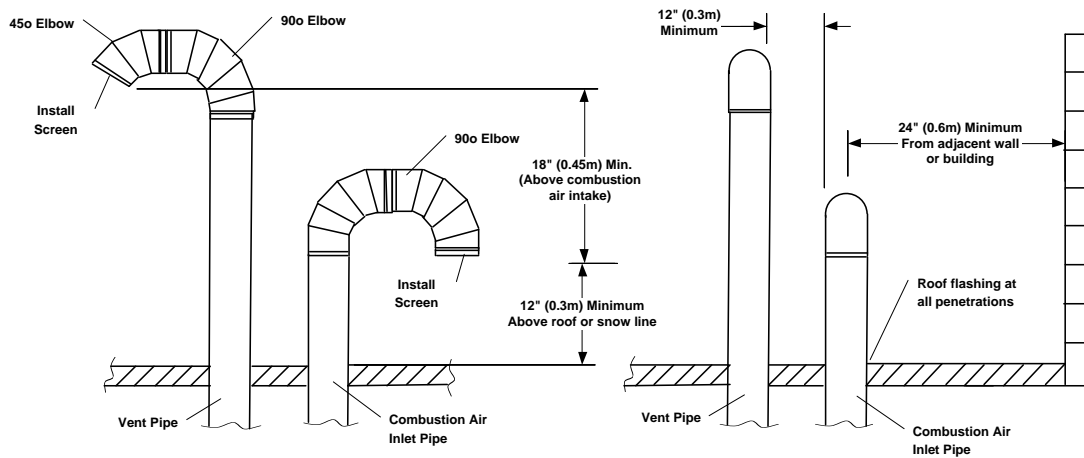


Figure 8 – Vertical Terminations



Indoor Horizontal Venting

Horizontal vent systems terminate horizontally. Install a Tee fitting with drip leg and cleanout trap as shown in Figure 9. Vent and combustion air piping must be terminated as shown in Figure 10. All pipe openings external to building must have a protective screen installed.

Figure 9 – Horizontal Vent Pipe Connections

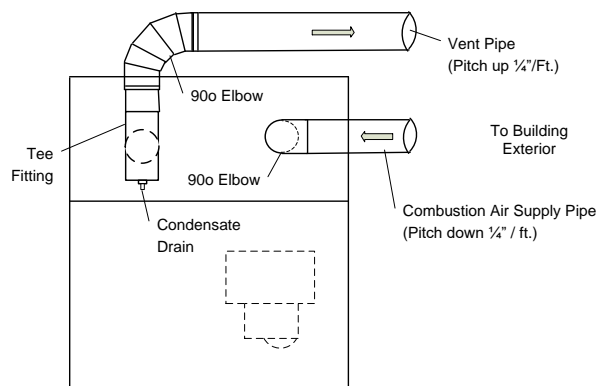
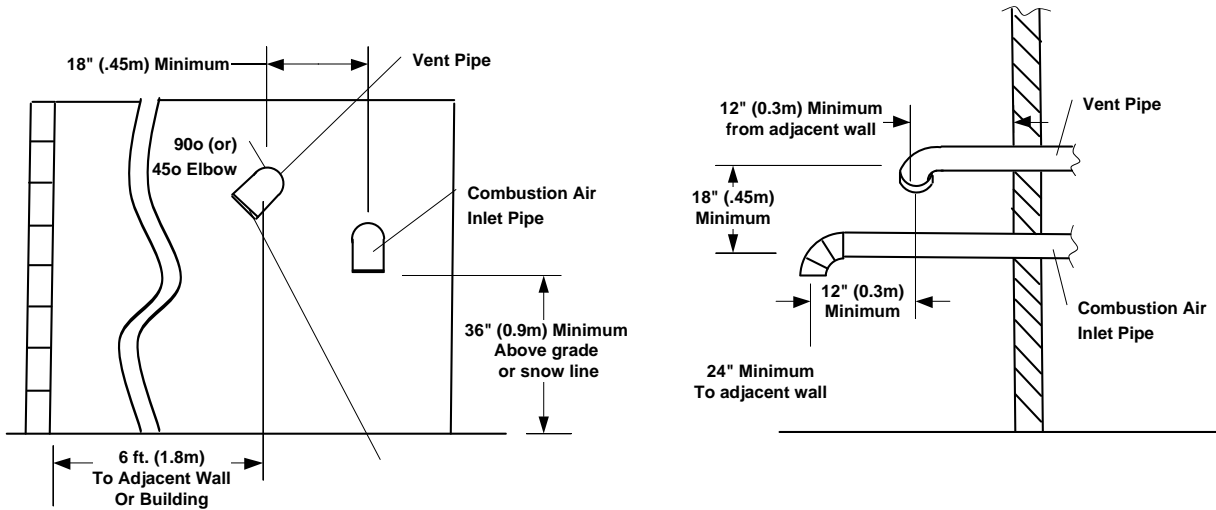


Figure 10 – Horizontal Terminations



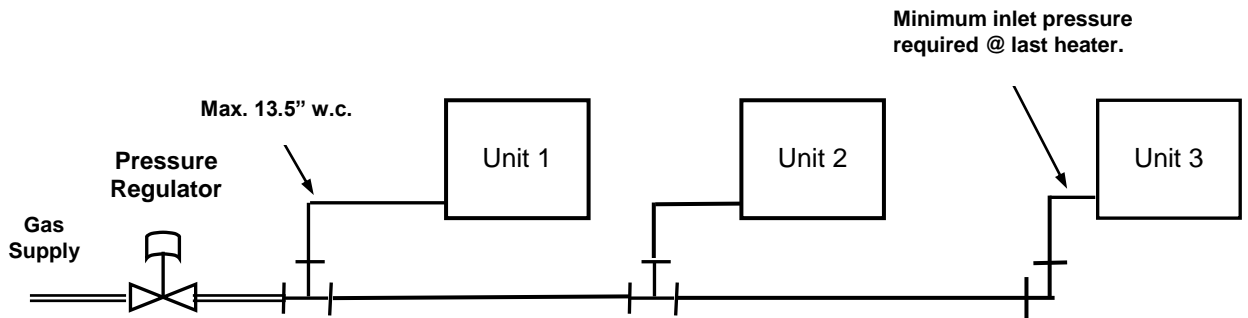
WARNING !

Duct furnaces are equipped with a float switch to shut-off gas supply to the main burner in the event that a blockage occurs in the condensate drain system resulting in back-up of condensate into the flue collector box. Do not disable or bypass this level switch. Disabling switch may result in hazardous operation.

V. Gas Supply, Piping and Connections

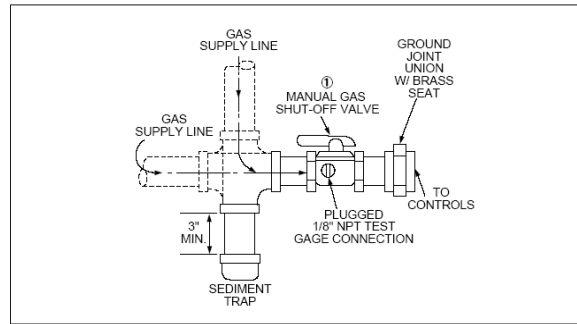
1. Installation of piping must conform with local building codes and ordinances, or in the absence of local codes with ANSI Z223.1 the National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA – B149.1 for Natural gas and B149.2 for propane units.
2. Pipe joint compounds must be resistant to the action of liquefied petroleum (LP) gas.
3. The duct furnace requires a **minimum** inlet gas pressure of **7.0" w.c.** and a **maximum** inlet gas pressure of **13.5" w.c.**, with the furnace operating.
4. On multiple heater installations, a fitting suitable for connection to a pressure gauge capable of measuring gas pressure should be connected to each heater serviced by a single regulator so that gas pressure at each heater can be measured with all heaters in operation. Be sure that gas regulators servicing more than one heater have the proper pipe and internal orifice size for the total input of all heaters serviced by the regulator. (See Figure 11.)

Figure 11 – Multiple Heater Installation



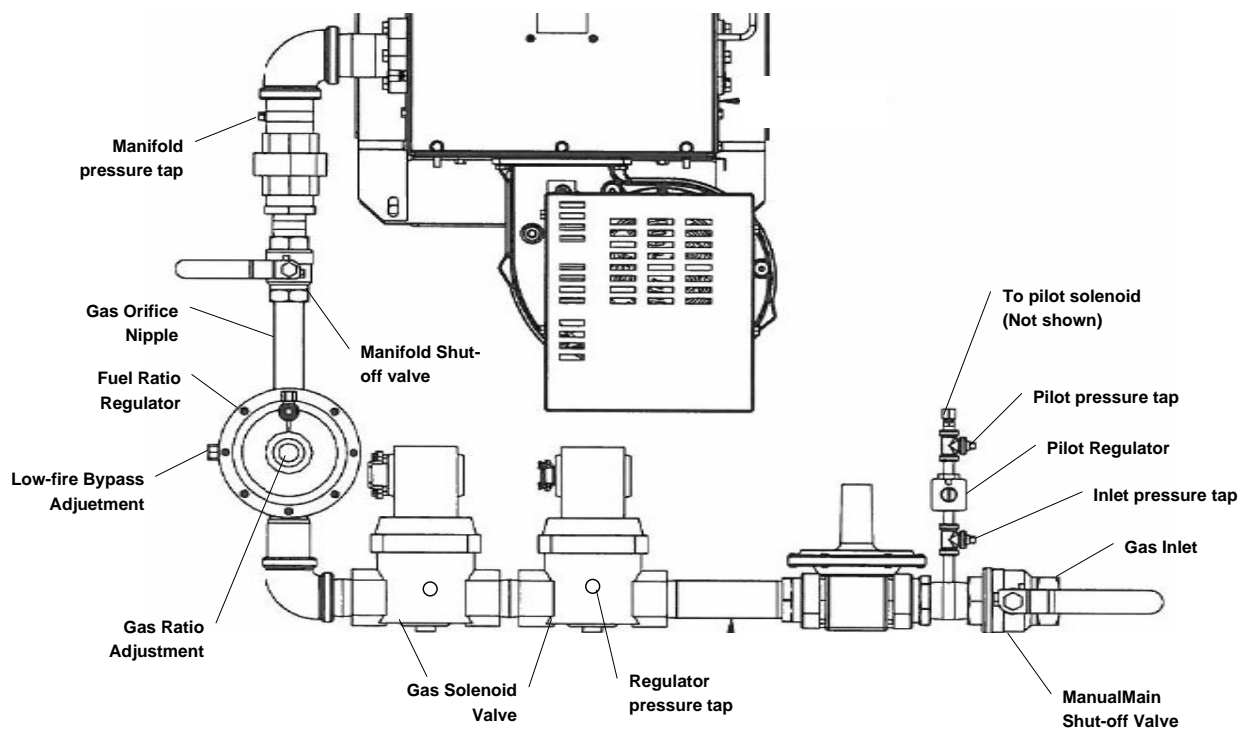
5. A **drip leg** (sediment trap) and an external manual shut off valve must be provided upstream of the burner supply piping on the heating unit. To facilitate servicing of unit, **installation of a union** is recommended. (See Fig. 12)

Figure 12



6. Typical valve train and pressure measuring locations are shown in Figure 12.

Figure 13- Typical Gas Piping



WARNING !

1. All field gas piping must be pressure / leak tested prior to operation. NEVER use an open flame to check for leaks. Use a soap solution or other leak detecting solution for testing.
2. Gas pressure to appliance controls must never exceed 13.5" w.c. (1/2 PSI)

WARNING !

1. When pressure testing at 1/2 PSI or less, close the manual shut-off valve on the appliance before testing.
2. When pressure testing gas supply line at 1/2 PSI or higher, close manual gas valve and disconnect heater from supply line to be tested. Cap or plug the supply line.

7. Gas piping must be sized for the total Btu input of all units (heaters) serviced by a single supply. Refer to unit manufacturer's instructions for proper sizing.

VI. Electrical Requirements

All electrical equipment must be grounded and wired in accordance with the National Electric Code (ANSI/NFPA 70) in the United States, and the Canadian Electric Code (CSA C22.1), in Canada. The installer / equipment manufacturer is responsible for final compliance with these requirements.

The furnace control system requires both line voltage and low voltage circuits with correct polarity, and clean neutral and ground. Line voltage readings between L1 and Neutral as well as L1 and Ground should be within +/- 3 volts.

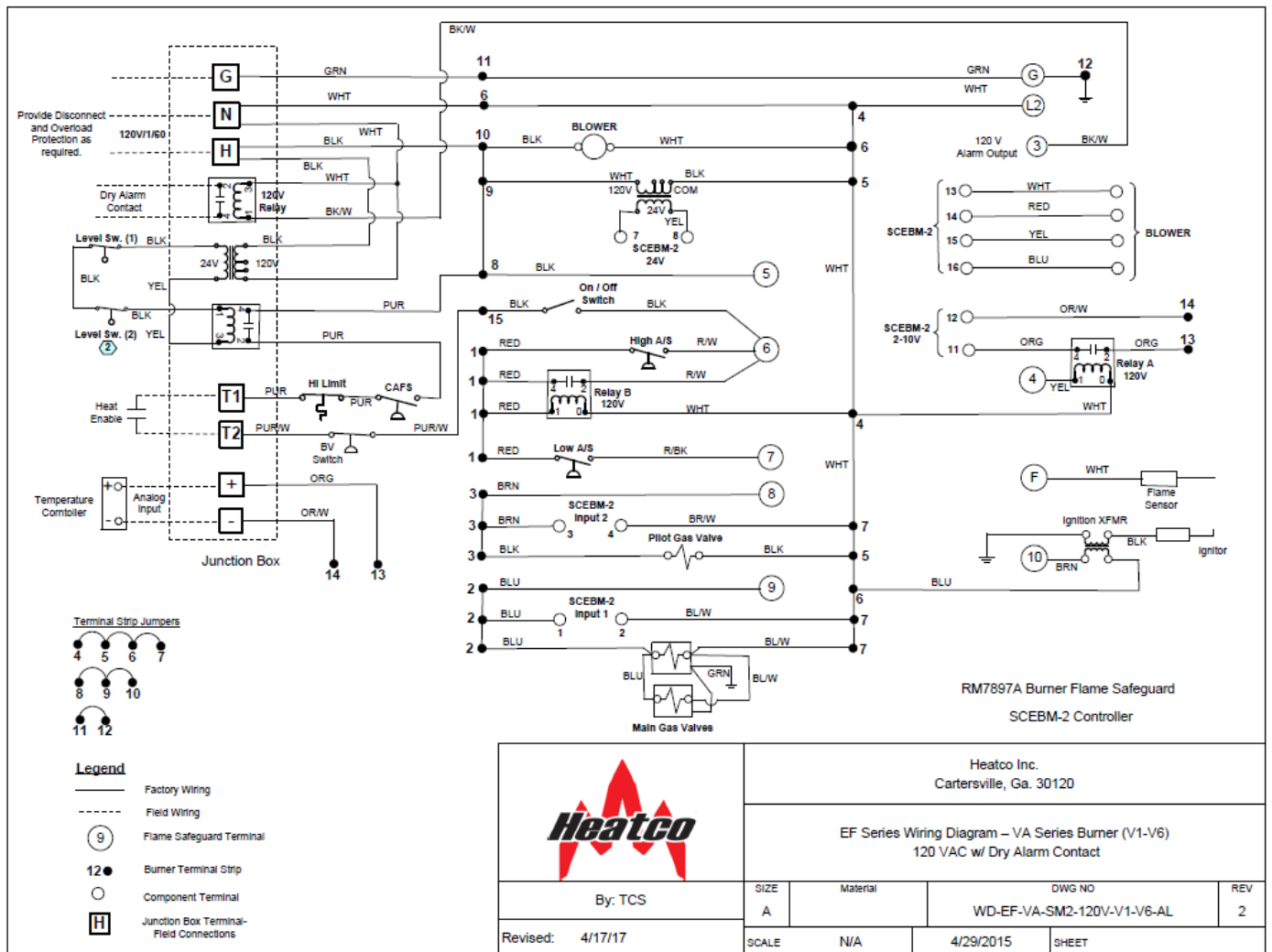
A junction box for field connections is provided in the duct furnace vestibule.

The duct furnace is equipped with an automatic reset high limit switch (set at 170°F) and a circulating airflow switch to insure that circulating air flow is present during main burner operation. See separate instruction sheet for proper adjustment of airflow switch.

A **manual reset auxiliary limit switch** placed downstream of the duct furnace is recommended to avoid overheating due to low airflow conditions.

A **2 to 10 VDC analog input** from the temperature controller or BMS is required for system operation and modulation of burner input rate.

Wiring Diagram



Electrical Ratings

| Furnace Model Number | Burner Model Number | Supply Voltage (VAC) | Amps (Max) |
|----------------------|---------------------|----------------------|------------|
| EF0250 | V1 | 115 | 3.5 |
| EF0400 | V1 | 115 | 3.5 |
| EF0550 | V2 | 115 | 5.2 |
| EF0750 | V2 | 115 | 5.2 |
| EF1000 | V2 | 115 | 5.2 |
| EF1000 | V4 | 115 | 10.5 |
| EF1250 | V4 | 115 | 10.5 |
| EF1500 | V4 | 115 | 10.5 |

WARNING !

Failure to follow these instructions may result in a fire or explosion, causing property damage, personal injury, and / or loss of life.

Installer Safety Instructions

1. **BEFORE OPERATING**, Check both the supply lines and factory piping for leaks. Apply a soap and water solution to all joints and watch for bubbles indicating a leak. **NEVER test for gas leaks with an open flame.**
2. Do not attempt to operate unit, if there is indication that any part or control has been under water. Any control or component that has been under water must be replaced prior to trying to start the unit.
3. Verify gas supply and electrical supply provided match those listed on duct furnace rating plate
4. Before attempting start up, thoroughly familiarize yourself with the Honeywell Flame Safeguard (FSG) control being used and its sequence of operation. Refer to documents provided with the burner. A Keyboard Display Module is available to provide for annunciation of current system status and diagnosis during start-up and adjustment.

VII. Initial Start-up

1. The gas burner has been factory tested and adjusted prior to shipping.
2. Start-up should be performed by a qualified burner technician to verify proper gas pressures and combustion characteristics.
3. Refer to Rating Plate on **Duct Furnace** for input rating, manifold pressure and airflow information for this furnace. Burner has been orificed for the maximum input rate marked at the manifold pressure indicated on the rating plate.
4. Required test instruments include:
 - a. Combustion analyzer to measure CO₂ (O₂), CO
 - b. Temperature gage for measuring flue gas temperature (up to 550 oF) and outlet air temperature
 - c. Manometer or digital pressure gauge suitable for gaseous fuels
 - d. Volt-Ohm-Amp Meter
 - e. DC Volt generator analog input signal from temperature controller

WARNING !

The power burner provided with this furnace requires a Qualified Burner Technician for initial start-up. A flue gas analyzer must be used when making any adjustments to insure proper combustion. Improper set-up may result in hazardous operation.

Start-up Procedure

1. Install shut-off type pressure fittings in following tap locations shown in Figure 5; Inlet gas pressure, pilot gas pressure, regulator outlet tap and manifold pressure tap.
2. Open external manual gas valve and verify that the inlet pressure is less than the maximum inlet pressure marked on furnace rating plate.
3. **Close manifold** gas shut-off valve.
4. Open burner manual main shut-off valve
5. The following are required to initiate burner operation
 - a. 120 VAC power supply
 - b. On/Off switch on burner access door in "On" position
 - c. An analog input of at least 2.0 VDC from temperature control or DC Volt generator
 - d. A heat enable signal (binary)
6. Burner enters the pre-purge mode.
7. After a 30 to 90 second purge as determined by the burner controller, the burner will attempt to ignite the pilot.
8. After the pilot is established, the control will enter the run mode.
9. Use a manometer to check the pilot pressure at the tap provided.
 - a. Pilot gas pressure should be 3.2" to 3.5" W.C
10. **Open the Manifold** gas shut-off valve. With an analog input of 2.0 VDC burner will run at low fire.
11. Using the observation window on the burner back plate look at the low fire condition. If light is visible through all the holes in the burner plate, low fire is set within range. If flame is not visible through all holes, then low fire setting is too low.
 - a. Locate the low fire bypass adjustment on the side of the Fuel Ratio Regulator.
 - b. Increase gas flow (turn adjusting screw counter-clockwise) until flame is visible through all holes.
12. Using a combustion analyzer, sample the flue gases at the vent discharge of the furnace. Verify that readings range as follows:

| | <u>Natural Gas</u> | <u>Propane Gas</u> |
|-----------------------|--------------------|--------------------|
| CO ₂ | 1.5 to 2.8% | 2.0 to 3.2% |
| O ₂ | 16.0 to 18.5% | 16.0 to 18.0% |
| CO | <100 ppm | <100 ppm |
| Flue Gas Temp | < 100°F | < 100°F |

13. Modulate the burner to high fire by applying a 10 VDC analog input signal.
14. Verify the main regulator gas pressure setting as follows and adjust regulator if necessary:
 - a. Natural Gas – Regulator outlet pressure 6.0" W.C.
 - b. Propane Gas – Regulator outlet pressure 9.0" W.C.
15. Verify that the manifold pressure is the same as marked on the **Furnace rating plate**.

Note: Burners are not always set-up to their maximum capacity. The manifold pressure marked on furnace rating plate or in the "Firing Rate" portion of the burner rating label, provides the correct fuel input rating for the appliance.

WARNING !

Never adjust burner for an input rate exceeding the maximum input marked on the FURNACE rating plate. Damage to the furnace and hazardous operation can result.

16. Using a combustion analyzer, sample the flue gases at the vent discharge of the furnace. Verify that readings range as follows:

| | <u>Natural Gas</u> | <u>Propane Gas</u> |
|-----------------------|--------------------|--------------------|
| CO ₂ | 8.5 to 10.0% | 9.0 to 11.0% |
| O ₂ | 3.0 to 5.0% | 4.0 to 6.0% |
| CO | <100 ppm | <100 ppm |
| Flue Gas Temp | < 150°F | < 150°F |

17. A **Start-Up Data sheet** is included with these instructions. Please complete this sheet and return the top half to address shown. **Keep bottom portion with instructions** for future service reference.
18. Refer to the Burner Manufacturer's instructions provided with this information package if any adjustments need to be made to obtain correct manifold pressure or combustion characteristics.

Shutdown

1. Remove call for heat (Open heat enable contact)
2. Close main manual shut-off gas valve.
3. Turn off main power disconnect and burner control panel switch
4. Remove pressure tap fittings and gauges used for pressure measurements. Replace pipe plugs.
5. Open main manual shut-off valve and check for leaks where pipe plugs were replaced.
6. Close main manual shut-off gas valve.
7. Reinstall caps to the pilot regulator, main regulator, low-fire bypass and ratio regulator that may have been removed during start-up.

VIII. Normal Operation

1. Open all manual gas valves
2. Turn on power at disconnect switch
3. Turn on power switch on burner control panel door
4. Set heat enable and temperature controller to desired operating condition and temperature
5. Burner will start and operate based on 2 to 10 VDC analog input provided.

IX. Annual Maintenance and Inspection

The duct furnace should be inspected annually by a **qualified service agency**. The condition of the burners, heat exchanger, vent system, operating controls, wiring and condensate removal system should be determined. Check for obvious signs of deterioration, accumulation of dirt and debris and any heat or water related damage. Any damaged or deteriorated parts should be replaced before the unit is put back into service. A combustion analysis should be completed to be sure that system is performing as originally set-up.

Additionally, periodic maintenance inspections should be conducted to insure that combustion air openings are clean and clear of any dirt or debris that might restrict combustion air. Inspect vent stack for any deterioration. Inspect condensate drains to insure there are no blockages.

CAUTION !

If any of the original wiring needs to be replaced it must be replaced with wiring materials suitable for 105°C.

Duct Furnace and Burner Inspection & Maintenance

Turn off all electrical power and gas supply to the unit before inspection and servicing.

1. Inspect and clean burner head, igniter, flame sensor and combustion air fan, removing any loose debris.
2. Inspect heat exchanger for any blockage or loose materials, deterioration, corrosion or cracks. If any are present, replace heat exchanger before putting unit back into service. Inspect secondary tubes and clean as necessary.
3. Check vent pipe and vent terminal for deterioration or debris. Clean or replace as necessary. Check joints for tightness and ensure all connections are sealed.
4. Inspect condensate drain lines to be sure they are free of debris and free flowing. **Clean condensate drain trap(s).**
5. If condensate neutralizer is installed, recharge per instructions.
6. Check condensate level switch for cleanliness and proper function.
7. Check the attachment point of the duct furnace to the cabinet or ducts to verify that they are airtight.
8. Inspect wiring for any loose connections, deterioration, abrasion or brittleness. Replace any wiring or terminal connections that show signs of damage. Label all wires prior to disconnection when servicing unit. Wiring errors can cause improper or dangerous operation. Verify proper operation after servicing.
9. Check the automatic gas valve(s) to insure that the gas valve seat is not leaking.
10. Complete all safety and maintenance checks recommended by burner and flame safeguard manufacturers.
11. See "Normal Operation" on Pg. 15