**INSTALLATION/OPERATION/MAINTENANCE**

# Applies to: **Model SC, Separated-Combustion Duct Furnace**


**Model SC**

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

## Table of Contents



# 1.0 General

## 1.1 Hazard Labels and Notices

There are warning labels on the unit and throughout this manual. For your safety, read the definitions below and comply with all boxes labeled CAUTION, WARNING, and DANGER during installation, operation, maintenance, and service of this heater.

### Definitions of HAZARD INTENSITY LEVELS used in this Manual

1. **DANGER: Failure to comply will result in severe personal injury or death and/or property damage.**
2. **WARNING: Failure to comply could result in severe personal injury or death and/or property damage.**
3. **CAUTION: Failure to comply could result in minor personal injury and/or property damage.**

**WARNING**

**Gas-fired appliances 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 silicone substances (refer to Hazard Levels, above).**

**WARNING**

**Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment.**

**WARNING**

**To ensure safety, follow lighting instructions located on the outlet box cover (refer to Hazard Levels, above).**

## 1.2 General Installation Information

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction. The instructions in this manual apply to duct furnace Model SC.

## 1.3 Warranty

Refer to the limited warranty form in the "Literature Bag".

**WARRANTY: Warranty is void if.....**

a. **Furnaces are used in atmospheres containing flammable vapors or atmospheres containing chlorinated or halogenated hydrocarbons or any contaminant (silicone, aluminium oxide, etc.) that adheres to the spark ignition flame sensing probe.**
b. **Wiring is not in accordance with the diagram furnished with the heater.**
c. **Unit is installed without proper clearances to combustible materials.**
d. **Furnace air throughput is not adjusted within the range specified on the rating plate.**
e. **Duct furnace is installed in a process or drying application without factory authorization. Any use in a process or drying application voids agency certification.**

## 1.4 Installation Codes

The indoor duct furnace models in this manual are design-certified to ANSI and CSA standards by the Canadian Standards Association. All models are approved for installation in the United States and in Canada. All furnaces are approved for use with either natural gas or propane. The type of gas for which the furnace is equipped and the correct firing rate are shown on the rating plate attached to the unit. Electrical characteristics are shown on the unit rating plate.

These units must be installed in accordance with local building codes. In the absence of local codes, in the United States, the unit must be installed in accordance with the National Fuel Gas Code NFPA/ANSI Z223.1 (latest edition). A Canadian installation must be in accordance with the CSA B149.1 Natural Gas and Propane Installation Code. These codes are available from CSA Information Services, 1-800-463-6727. Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.

These separated combustion units are designed and manufactured in accordance with the ANSI definition of separated combustion. That definition reads, "Separated Combustion System Appliance: A system consisting of an appliance and a vent cap(s) supplied by the manufacturer, and (1) combustion air connections between the appliance and the outside atmosphere, and (2) flue gas connections between the appliance and vent cap, of a type(s) specified by the manufacturer but supplied by the installer, constructed so that, when installed in accordance with the manufacturer's instructions, air for combustion is obtained from the outside atmosphere and flue gases are discharged to the outside atmosphere."

Separated combustion units are designed to separate air for combustion and flue products from the environment of the building in which the unit is installed. Separated combustion appliances are recommended for use in dust laden and some corrosive fume environments.

### Special Installations (Aircraft Hangars/ Garages)

Installations in aircraft hangars should be in accordance with NFPA No. 409 (latest edition), Standard for Aircraft Hangars; in public garages in accordance with NFPA No. 88A (latest edition), Standard for Parking Structures; and for repair garages in accordance with NFPA No. 88B (latest edition), Standard for Repair Garages. In Canada, installations in aircraft hangars, repair garages, and parking garages should be in accordance with the requirements of the enforcing authorities and in accordance with CSA B149 codes.

### All Installations

These gas-fired products are certified by ANSI Z83 family of standards governing the safe usage of heating equipment in the industrial/commercial marketplace. This includes using the heaters in makeup air applications to supply corridor pressurization in commercial buildings such as office structures and apartment complexes.

## 1.0 General (Continued)

## 1.4 Installation Codes (Continued)

The heaters are not certified as residential heating equipment and should not be used as such.

Clearances from the heater and vent to combustible construction or material in storage must conform with the National Fuel Gas Code ANSI Z223.1a (latest edition) pertaining to gas-burning devices, and such material must not attain a temperature over 160°F by continued operation of the heater.

**WARNING**

**These duct furnaces are not certified or approved for use in drying or process applications. If a duct furnace is to be used in a drying or process application, contact the factory for application guidelines and manufacturer's authorization. Without factory authorization, the warranty is void, and the manufacturer disclaims any responsibility for the duct furnace and/or the application.**

## 2.0 Furnace Location

A duct furnace is designed for connection to an inlet and an outlet duct and depends on an external air handler. Location must comply with the clearances listed in Paragraph 4.1. There are a variety of factors, such as system application, building structure, dimensions, and weight, that contribute to selecting the location. Read the installation information in this manual and select a location that complies with the requirements.

**CAUTION: Do not locate the heater where it may be exposed to water spray, rain or dripping water.**

**Hazards of Chlorine**

The presence of chlorine vapors in the combustion air of gas-fired heating equipment presents a potential corrosion hazard. Chlorine will, when exposed to flame, precipitate from the compound, usually Freon or degreaser vapors, and go into solution with any condensation that is present in the heat exchanger or associated parts. The result is hydrochloric acid which readily attacks all metals including 300 grade stainless steel.

Care should be taken to separate these vapors from the combustion process. This may be done by wise location of the furnace with regard to exhausters or prevailing wind direction. Remember, chlorine is heavier than air. This fact should be kept in mind when determining installation locations of heating equipment and building exhaust systems.

## 3.0 Uncrating and Preparation

### 3.1 Uncrating and Inspecting

This furnace was test operated and inspected at the factory prior to crating and was in operating condition. If the furnace has incurred any damage in shipment, document the damage with the transporting agency and immediately contact an authorized Reznor® distributor. If you are an authorized Distributor, follow the FOB freight policy procedures as published by Reznor for Reznor® products.

Check the rating plate for the gas specifications and electrical characteristics of the furnace to be sure that they are compatible with the gas and electric supplies at the installation site.

The bottom corners are fastened to the crate with angle clips. Remove the lag screws from the shipping clips. Remove the clips and return the bolts to the heater legs to support the corner leg and the heater bottom. **Putting the bolts back in the heater is required.**

## 3.2 Preparing for Installation

### 3.2.1 Shipped-Separate Components

Read this booklet and become familiar with the installation requirements of your particular furnace. If you do not have knowledge of local requirements, check with the local gas company or any other local agencies who might have requirements concerning this installation. Before beginning, make preparations for necessary supplies, tools, and manpower.

**Vent/Combustion Air Terminal Kit: *Required on ALL Installations***

A vent/combustion air kit (Option CC2 or CC6) including a concentric adapter box is required for all installations. See page 14 (Option CC6) or page 17 (Option CC2) for a component list. Be sure all of the factory-supplied and field-supplied parts needed are at the job site.

### Option Parts

Some gas control options will have parts either shipped loose with the heater or shipped separately. If your unit is equipped with any of the gas control options in the table below, be sure these parts are available at the job site.

Other shipped-separate options could include a gas shutoff valve, a vertical vent terminal, a thermostat, an optional control, and/or a disconnect switch.

Check to see if there are any field-installed options that need to be assembled to the furnace prior to installation.

| Application | Option | Shipped Separate Components |
|---|---|---|
| **Heating/Gas Control** | **AG7** | Thermostat, **PN 48033** |
| **Makeup Air/Gas Control**<br>**NOTE:** If an optional remote console is ordered, the control switch and temperature selector may be mounted on the console. | **AG3** | Control Switch, **PN 29054** |
| | **AG8** | Control Switch, **PN 29054** |
| | | Sensor & Mixing Tube, **PN 48041** |
| | **AG9** | Control Switch, **PN 29054** |
| | | Remote Temperature Selector, **PN 48042** |
| | | Sensor & Mixing Tube, **PN 48041** |
| | **AG15** | Control Switch, **PN 29054** |
| | | Remote Temperature Selector, **PN 115848** |
| | | Stage Adder Module, **PN 115849** |
| | | Discharge Air Sensor Holder, **PN 115850** |
| | | Discharge Air Sensor Holder Bracket, **PN 213612** |
| | **AG39** | Remote Temperature Selector, **PN 174849** |
| | | Temperature Sensor, **PN 133228** |
| | | Mixing Tube, **PN 90323** |

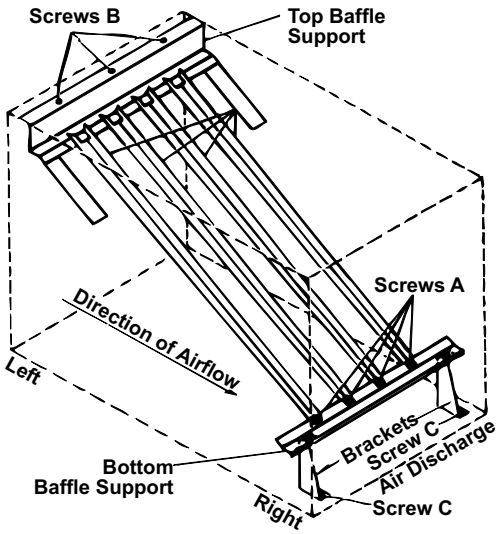
### 3.2.2 Reversing Airflow by Changing Direction of Heat Exchanger Air Baffles

All furnaces are equipped with directional air baffles in the heat exchanger area. Facing the control compartment of the furnace, the standard direction of airflow is from left to right. If the installation requires airflow from right to left (when facing the control compartment), the position of the directional air baffles may be reversed. Refer to **FIGURE 1** and follow the instructions to reverse the direction of the airflow through the furnace.

**FIGURE 1. Model SC Heat Exchanger Baffles**

**Instructions for Reversing Airflow through the Heat Exchanger**

1. Remove screws "A". Lift each baffle slightly and slide forward, removing each completely from the heat exchanger.
2. Remove screws "B" and the rear top baffle support assembly. Re-position the assembly on the opposite end of the heat exchanger and attach.
3. Remove screws "C" and the assembled bottom baffle support and brackets. Plug the holes in the heat exchanger bottom by re-inserting the screws in the holes. Position the assembly on the opposite end of the heat exchanger and attach using field-supplied sheetmetal screws.
4. Re-install all of the individual baffles by reversing Step 1.




## 4.0 Clearances and Dimensions

### 4.1 Clearances

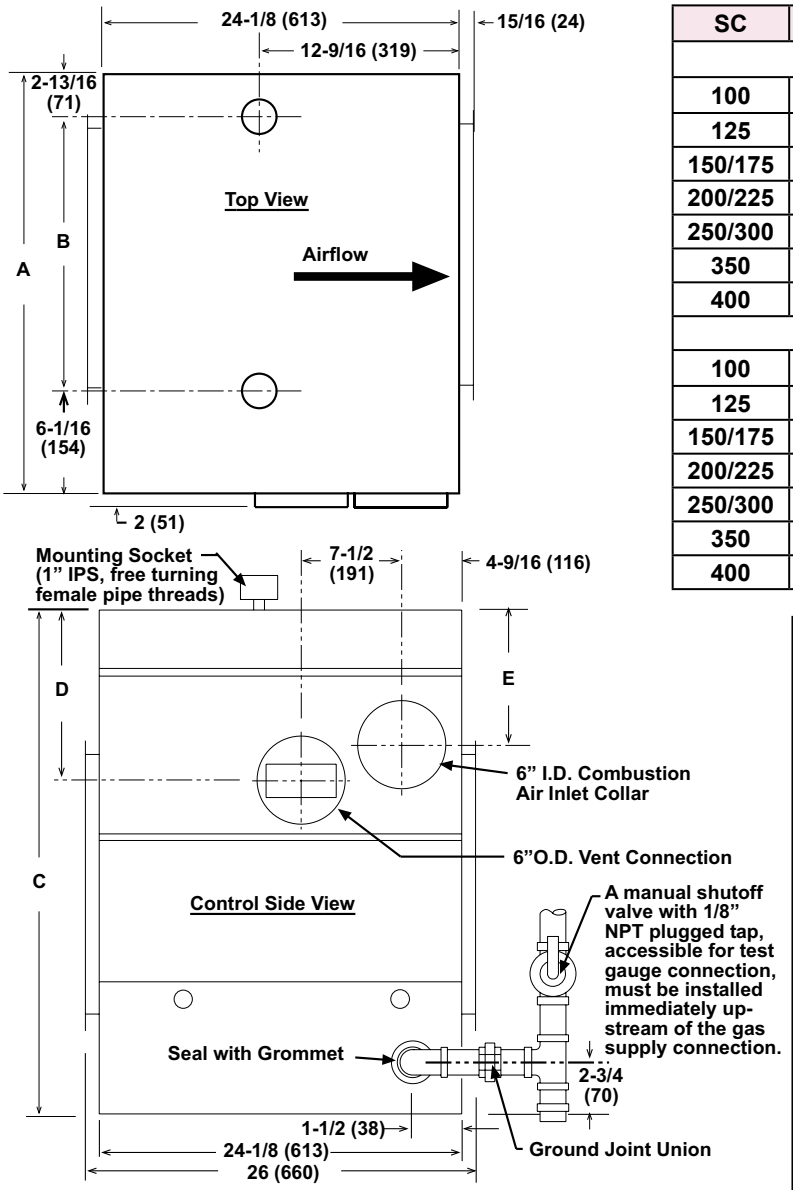
For safety and convenience, provide clearances as shown in the following table. Clearance to combustibles is defined as the minimum distance from the heater to a surface or object that is necessary to ensure that a surface temperature of 90°F above the surrounding ambient temperature is not exceeded. Minimum clearances are also listed on the heater rating plate.

| Minimum Clearances (Inches (Millimeters)) | | | | |
|---|---|---|---|---|
| Top | Sides | | Bottom | |
| | Control Side | Side Opposite Controls | To Combustibles | To Non-Combustibles |
| 6 (152) | 6 (152) plus width of unit | 6 (152) | 6 (152) | 0 (0) |

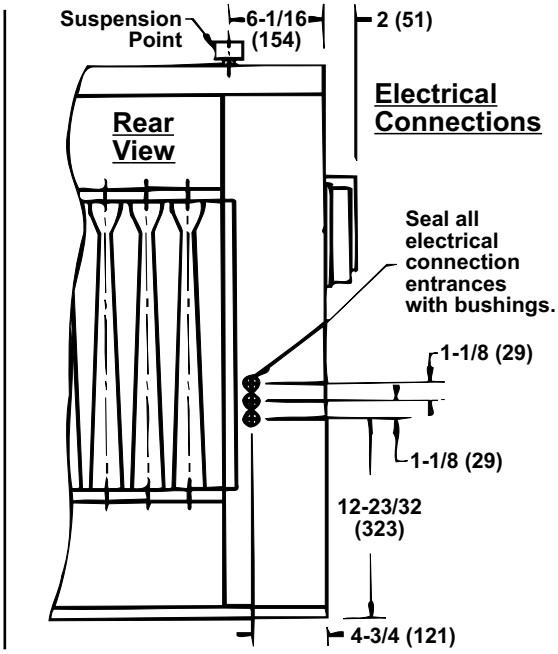
# 4.0 Clearances and Dimensions (Continued)

## 4.2 Dimensions

**FIGURE 2. Model SC Dimensions (Inches ±1/8 (Millimeters ±3))**




| SC | A | B | C | D | E |
|---|---|---|---|---|---|
| **Dimensions (Inches)** | | | | | |
| **100** | 22-15/32 | 13-9/16 | 32-1/4 | 8-1/8 | 6-15/16 |
| **125** | 25-7/32 | 16-5/16 | 32-1/4 | 8-1/8 | 6-15/16 |
| **150/175** | 30-23/32 | 21-13/16 | 32-1/4 | 8-1/8 | 6-15/16 |
| **200/225** | 36-7/32 | 27-5/16 | 35-1/4 | 10-3/4 | 9-15/16 |
| **250/300** | 44-15/32 | 35-9/16 | 35-1/4 | 10-3/4 | 9-15/16 |
| **350** | 49-31/32 | 41-1/16 | 35-1/4 | 10-3/4 | 9-15/16 |
| **400** | 55-15/32 | 46-9/16 | 35-1/4 | 10-3/4 | 9-15/16 |
| **Dimensions (Millimeters)** | | | | | |
| **100** | 571 | 344 | 819 | 206 | 176 |
| **125** | 641 | 414 | 819 | 206 | 176 |
| **150/175** | 780 | 554 | 819 | 206 | 176 |
| **200/225** | 920 | 694 | 895 | 273 | 252 |
| **250/300** | 1130 | 903 | 895 | 273 | 252 |
| **350** | 1269 | 1043 | 895 | 273 | 252 |
| **400** | 1409 | 1183 | 895 | 273 | 252 |




**NOTE:** For duct connection dimensions, see **FIGURE 21**, Paragraph 6.4.4.

# 5.0 Suspension and Mounting

Before installing, check the supporting structure to be sure that it has sufficient load-carrying capacity to support the weight.

### Weights

**Net Weight (lb and kg)**

| Size | 100 | 125 | 150–175 | 200–225 | 250–300 | 350 | 400 |
|---|---|---|---|---|---|---|---|
| lb | 158 | 178 | 203 | 283 | 321 | 350 | 410 |
| kg | 72 | 81 | 92 | 128 | 146 | 159 | 186 |

### Suspension

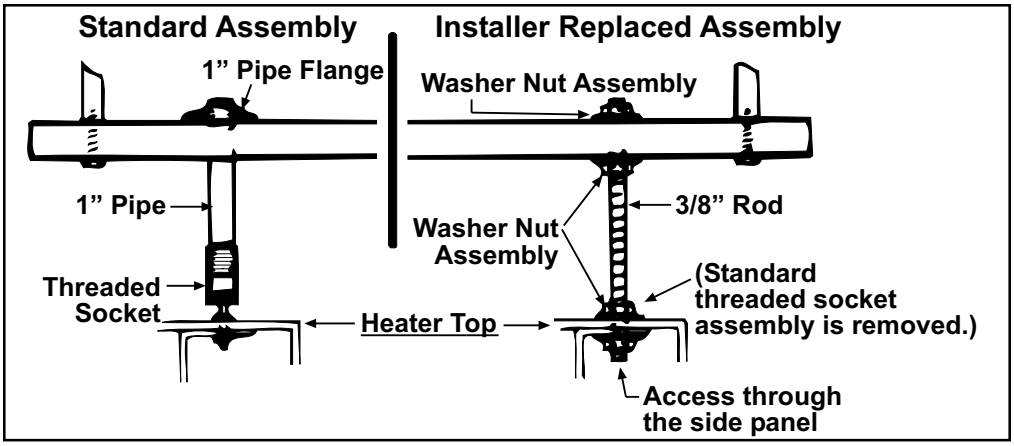
Model SC duct furnaces have two-point suspension. See hanger center line dimensions in **FIGURE 2**, Paragraph 4.2.

At each suspension point, the unit is factory-equipped with a free-turning, female, 1" NPT pipe hanger. Suspend by connecting the pipe hanger to a 1" threaded pipe. See suspension method on the left in **FIGURE 3**. As an alternative method, the factory-installed pipe hanger may be removed and the heater suspended as illustrated on the right in **FIGURE 3**.

**WARNING**

**Units must be supported level for proper operation. Do not place or add additional weight to the suspended unit (refer to Hazard Levels, page 2).**

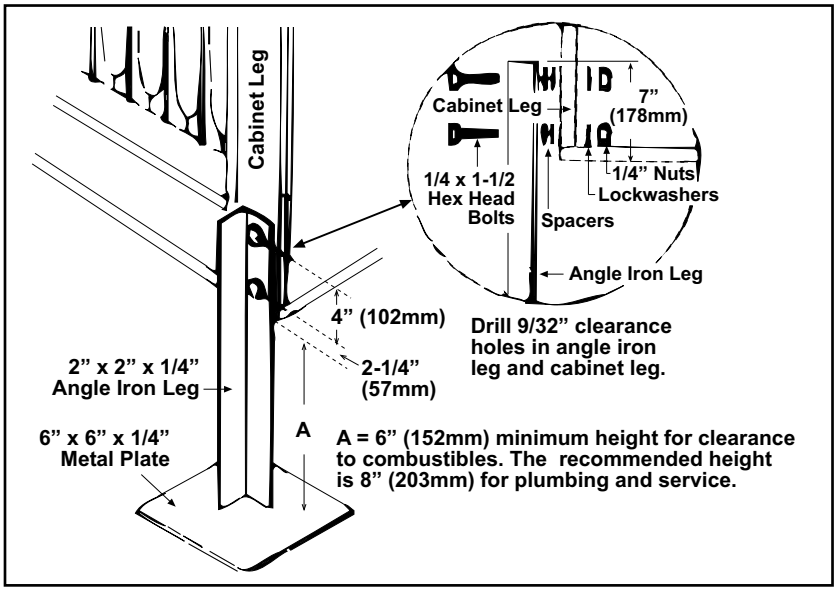
**FIGURE 3. Suspension Methods**




**Mounting Supports**

Most furnaces will be suspended. If the installation requires that the furnace be mounted, **FIGURE 4** illustrates the requirements for field-fabricating support feet.

**FIGURE 4. Model SC Mounting Supports**




# 6.0 Mechanical

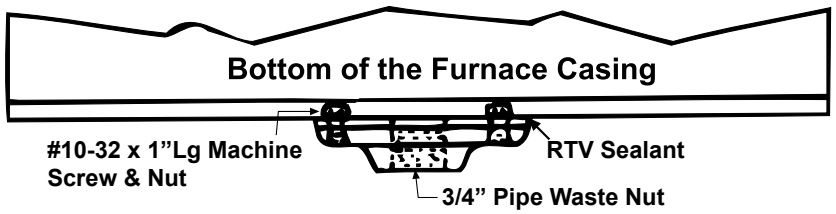
## 6.1 Optional Condensation Drain for Duct Furnaces

Model SC furnaces are certified for installation upstream or downstream from a cooling coil. When installed downstream from a refrigeration system, condensation will form; and therefore, adequate provision must be made to dispose of condensate.

Periodic cleaning of the condensate collection and disposal system is required.

Install drain connection, Option CS1, on the furnace casing; see **FIGURE 5**.

**FIGURE 5. Option CS1, PN 31765, Optional Condensate Drain Connection**




Seal holes in bottom pan with RTV sealant. Terminate drain outside of the building. Provide a trap to prevent air from entering the combustion zone. Periodic cleaning of the condensate collection and disposal system is required. **NOTE:** Requires a four-inch (102 mm) minimum clearance under the furnace if a 90° street elbow is used.

# 6.0 Mechanical (Continued)

## 6.2 Gas Piping and Pressures

**WARNING**

This appliance is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 inches water column. NOTE: Supply pressures higher than 1/2 psi require installation of an additional service regulator external to the unit.

### Pressure Testing Supply Piping

**Test Pressure Above 1/2 PSI**: Disconnect the heater and manual valve from the gas supply which is to be pressure tested. Cap or plug the supply line.

**Test Pressure Below 1/2 PSI:** Before testing, close the manual valve on the heater.

**WARNING**

**Manifold gas pressure must never exceed 3.5 IN WC for natural gas or 10 IN WC for propane gas.**

All piping must be in accordance with requirements outlined in the National Fuel Gas Code ANSI/Z223.1 (latest edition) or CSA B149.1 and B149.2 (refer to Paragraph 1.4). Gas supply piping installation should conform with good practice and with local codes.

These separated-combustion units for natural gas are orificed for gas having a heating value of 1000 (±50) BTU per cubic ft. If the gas at the installation does not meet this specification, consult the factory for proper orificing.

**Seal the opening for the gas supply pipe with the grommet provided.**

Pipe joint compounds (pipe dope) shall be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.

Install a ground joint union and manual shutoff valve upstream of the unit control system. The 1/8" plugged tapping in the shutoff valve provides connection for supply line pressure test gauge. The National Fuel Gas Code requires the installation of a trap with a minimum 3" drip leg. Local codes may require a longer drip leg, typically 6".

**WARNING**

**All components of a gas supply system must be leak tested prior to placing the equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME (refer to Hazard Levels, page 2).**

### Sizing Gas Supply Lines

**Capacity of Piping**
Cubic Feet per Hour based on 0.3 IN WC Pressure Drop
Specific Gravity for Natural Gas: 0.6 (1000 BTU/Cubic Feet)
Specific Gravity for Propane Gas: 1.6 (2550 BTU/Cubic Feet)

| Pipe Length (FT) | Pipe Diameter (IN) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/2 | | 3/4 | | 1 | | 1-1/4 | | 1-1/2 | | 2 | |
| | Natural | Propane | Natural | Propane | Natural | Propane | Natural | Propane | Natural | Propane | Natural | Propane |
| 20 | 92 | 56 | 190 | 116 | 350 | 214 | 730 | 445 | 1100 | 671 | 2100 | 1281 |
| 30 | 73 | 45 | 152 | 93 | 285 | 174 | 590 | 360 | 890 | 543 | 1650 | 1007 |
| 40 | 63 | 38 | 130 | 79 | 245 | 149 | 500 | 305 | 760 | 464 | 1450 | 885 |
| 50 | 56 | 34 | 115 | 70 | 215 | 131 | 440 | 268 | 670 | 409 | 1270 | 775 |
| 60 | 50 | 31 | 105 | 64 | 195 | 119 | 400 | 244 | 610 | 372 | 1105 | 674 |
| 70 | 46 | 28 | 96 | 59 | 180 | 110 | 370 | 226 | 560 | 342 | 1050 | 641 |
| 80 | 43 | 26 | 90 | 55 | 170 | 104 | 350 | 214 | 530 | 323 | 990 | 604 |
| 90 | 40 | 24 | 84 | 51 | 160 | 98 | 320 | 195 | 490 | 299 | 930 | 567 |
| 100 | 38 | 23 | 79 | 48 | 150 | 92 | 305 | 186 | 460 | 281 | 870 | 531 |
| 125 | 34 | 21 | 72 | 44 | 130 | 79 | 275 | 168 | 410 | 250 | 780 | 476 |
| 150 | 31 | 19 | 64 | 39 | 120 | 73 | 250 | 153 | 380 | 232 | 710 | 433 |
| 175 | 28 | 17 | 59 | 36 | 110 | 67 | 225 | 137 | 350 | 214 | 650 | 397 |
| 200 | 26 | 16 | 55 | 34 | 100 | 61 | 210 | 128 | 320 | 195 | 610 | 372 |

**NOTE:** When sizing supply lines, consider possibilities of future expansion and increased requirements.
Refer to National Fuel Gas Code for additional information on line sizing.

### Gas Connection

| Model SC Sizes | 100–250 | 300–400 |
|---|---|---|
| Natural Gas | 1/2" | 3/4" |
| Propane | 1/2" | 1/2" |

**NOTE:** The above are gas connection sizes; not supply line sizes.

After all connections are made, disconnect the pilot supply at the control valve and bleed the system of all air. Reconnect the pilot line and leak test all connections by brushing on a soap solution.

### Manifold or Orifice (Valve Outlet) Pressure Settings

Measuring manifold gas pressure cannot be done until the heater is in operation. It is included in the steps of the "Check-Test-Start" procedure in Paragraph 9.0. The following warnings and instructions apply.

**WARNING**

**Manifold gas pressure must never exceed 3.5 IN WC for natural gas and 10 IN WC for propane.**

**For Natural Gas:** When the heater leaves the factory, the combination valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 3.5 IN WC Low fire on a two-stage valve is set to 1.8 IN WC Inlet supply pressure to the valve must be a minimum of 5 IN WC or **as noted on the rating plate** and a maximum of 14 IN WC **NOTE: Always check the rating plate for minimum gas supply pressure.** Minimum supply pressure requirements vary based on size of burner and the gas control option. Most units require a minimum of 5 IN WC of natural gas as stated above, but sizes 350 and 400 with electronic modulation require a minimum of 6 IN WC natural gas supply pressure.

**For Propane:** When the heater leaves the factory, the combination valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is 10 IN WC Low fire on a two-stage valve is set to 5 IN WC Inlet pressure to the valve must be a minimum of 11 IN WC and a maximum of 14 IN WC

Before attempting to measure or adjust manifold gas pressure, the inlet (supply) pressure must be within the specified range for the gas being used both when the heater is in operation and on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time.

**CAUTION: DO NOT bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure causing excess overfire and heat exchanger failure.**

**Instructions to Check Valve Outlet (Manifold) Pressure:**

**1)** With the manual valve (on the combination valve) positioned to prevent flow to the main burners, connect a manometer to the 1/8" pipe outlet pressure tap in the valve. NOTE: A manometer (fluid-filled gauge) is recommended rather than a spring type gauge due to the difficulty of maintaining calibration of a spring type gauge.

**2)** Open the valve and operate the heater. Measure the gas pressure to the manifold. To measure the low stage pressure on units equipped with a two-stage valve, disconnect the wire from the "HI" terminal on the valve. Be sure to reconnect the wire.

Normally adjustments should not be necessary to the factory preset regulator. If adjustment is necessary, set pressure to correct settings by turning the regulator screw IN (clockwise) to increase pressure. Turn regulator screw OUT (counterclockwise) to decrease pressure. Consult the valve manufacturer's literature provided with the furnace for more detailed information.

## 6.3 Venting and Combustion Air

All separated combustion, power vented units MUST BE equipped with both combustion air and exhaust piping to the outdoors. The unique concentric adapter assembly designed for use with this heater allows for both combustion air and exhaust piping with only one horizontal or vertical penetration hole in the building.

These instructions apply to installation and use of the concentric adapter and vent/combustion air kit (Option CC2 or CC6) designed for use with all Reznor® separated-combustion products. The systems illustrated in this manual are the only venting/combustion air systems approved for these separated combustion units. Do not use this concentric adapter box with any other products.

**WARNING**

**Do not use an existing venting system. This heater *requires* installation of the combustion air/vent system ordered with the unit (either Option CC2 or Option CC6). Vent installation to be any listed vent system manufacturer. Do not intermix different vent system parts from different manufacturers in the same venting system.**

Installation should be done by a qualified agency in accordance with these instructions. The qualified service agency installing this separated-combustion system is responsible for the installation.

**WARNING**

**SC Series separated combustion units are not designed or approved for use in atmospheres containing flammable vapors or atmospheres highly laden with chlorinated vapors (refer to Hazard Levels, page 2, and to Hazards of Chlorine in Paragraph 2.0).**

# 6.0 Mechanical (Continued)

## 6.3 Venting and Combustion Air (Continued)

### 1) Type of Pipe

**Specific Venting Requirements**

**Vent Pipe:** Vent pipe approved for a Category III appliance **OR** single-wall, 26-gauge or heavier galvanized (or a material of equivalent durability and corrosion resistance) vent pipe is **required between the heater and the concentric adapter box.**

Double-wall (Type B) vent pipe is **required** for vent terminal section. The length of vent pipe that extends through the box and runs concentric through the combustion air pipe must be one-piece with no joints.

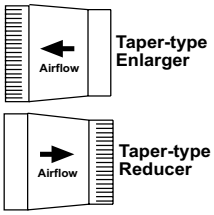
**Combustion Air Pipe:** Sealed, single-wall galvanized pipe is recommended for combustion air.

**WARNING**

**Do not use an existing venting system. This heater *requires* installation of the combustion air/vent system ordered with the unit (either Option CC2 or Option CC6). Vent installation to be any listed vent system manufacturer. Do not intermix different vent system parts from different manufacturers in the same venting system.**

All pipe is field supplied. Requirements are listed for both the vent pipe and the combustion air inlet pipe.

### 2) Venter Outlet and Combustion Air Inlet




**NOTE:** If using 7" pipe, use a taper type enlarger to attach vent pipe and 7" reducer to attach combustion air pipe.

Because all separated combustion units **MUST BE** equipped with both combustion air and exhaust piping to the outdoors, all have inlet and outlet connections. Combustion air inlet has a 6" ID collar. Venter outlet has a 6" OD collar.

A minimum of 12" (305 mm) of straight pipe is required at the venter outlet.

The diameter of the venter outlet and combustion air inlet connections for model SC (all sizes) is 6" (152 mm).

### 3) Pipe Length and Diameter

Pipe diameter and length requirements listed for the indoor sections of pipe (between the heater and the concentric adapter box) are in the table below. Vent pipe diameters and maximum indoor vent lengths apply to both **horizontal** and **vertical** vents. Add **all** straight sections and equivalent lengths for elbows. The total length of the straight sections and elbows must not exceed the **Maximum Length.**

The diameters of the outside (terminal) concentric pipes are shown in the concentric box connection illustrations in **FIGURES 9A and 9B,** page 13. The outdoor lengths depend on the installation. Outdoor vent length requirements are listed in the installation instructions for the horizontal and vertical vent/combustion air kits on pages 14–20.

### Pipe Diameter and Maximum Pipe Length Between the Heater and the Concentric Adapter Box

- Minimum length between the heater and the concentric adapter box is 5 feet (1.5M).

**Pipe Diameter and Maximum Pipe Length from Heater to Concentric Adapter**

| Size | Pipe Diameter | | | | Maximum Length | | Equivalent Straight Length for a | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Vent Pipe | | Inlet Air Pipe | | | | 90° Elbow | | 45° Elbow | |
| | inches | mm | inches | mm | feet | M | feet | M | feet | M |
| **100** | 6 | 152 | 6 | 152 | 40 | 12 | 8 | 2.4 | 4 | 1.2 |
| **125** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| **150** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| **175** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| **200** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |
| **225** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |
| **250** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |
| **300** | 6 | 152 | 6 | 152 | 50 | 15 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |
| **350** | 6 | 152 | 6 | 152 | 30 | 9 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |
| **400** | 6 | 152 | 6 | 152 | 30 | 9 | 8 | 2.4 | 4 | 1.2 |
| | 7 | 178 | 7 | 178 | 70 | 21 | 8 | 2.4 | 4 | 1.2 |

### Diameters of Outdoor Concentric Pipes

| Model SC | All Sizes |
|---|---|
| **Inlet Air Pipe Diameter** | 8" (203 mm) |
| **Vent Pipe Diameter** | 5" (127 mm) |

### 4) Joints and Sealing

Provide pipes as specified in **Requirement No. 1,** pages 9–10, and seal joints as follows:

- **If using Category III vent pipe run,** follow the pipe manufacturer's instructions for joining and sealing Category III vent pipe sections.
- **If using single-wall vent pipe run,** secure slip-fit pipe connections using sheetmetal screws or rivets. Seal all joints with aluminum tape or silicone sealant.
- **To seal joints in the single-wall combustion air pipe,** secure slip fit pipe connections using sheetmetal screws or rivets. Seal all joints with aluminum tape or silicone sealant.
- **To seal joint in the terminal section of double-wall vent pipe (allowed ONLY ABOVE the concentric pipes on a VERTICAL vent,** follow the pipe manufacturer's instructions for joining and sealing double-wall vent pipe sections.
- **When joining the terminal section of double-wall vent pipe to the vent cap,** follow the illustrated step-by-step instructions in **FIGURE 6.**

  **When joining the terminal section of double-wall vent pipe to a single-wall or Category III vent pipe run,** follow the illustrated step-by-step instructions in **FIGURE 7.**

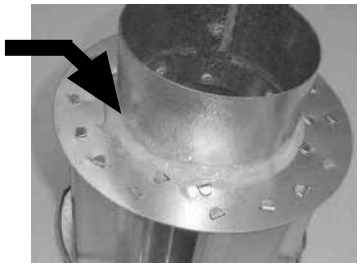
**FIGURE 6. Follow STEPS to join Double-Wall (Type B) Pipe and Vent Terminal Cap (Horizontal or Vertical)**

**NOTE:** Pipes and vent caps may not look exactly as shown in the illustrations. Instructions apply to both horizontal and vertical vent kits.

**STEP 1:**

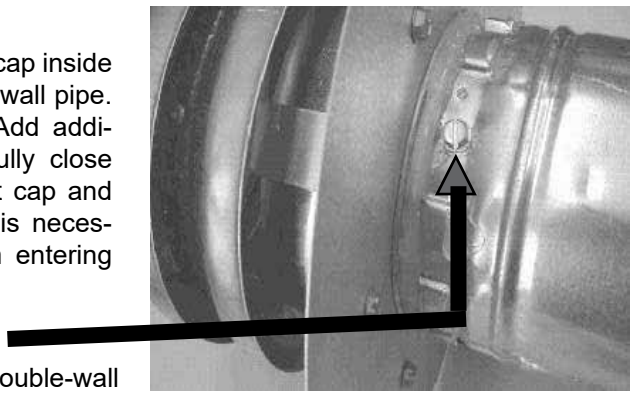
Place a continual 3/8" bead of silicone sealant around the circumference of the vent cap collar. This will prevent any water inside the vent cap from running down the double-wall pipe.

**Perform STEP 2 immediately following STEP 1.**



**STEP 2:**

Insert the collar on the vent cap inside the inner wall of the double-wall pipe. Insert as far as possible. Add additional silicone sealant to fully close any gaps between the vent cap and the double wall pipe. This is necessary to prevent water from entering the double wall pipe.



**STEP 3:**

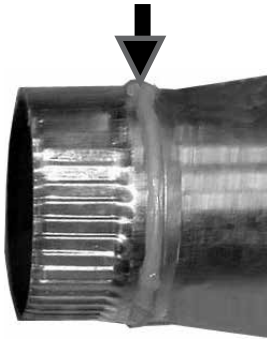
Secure the vent cap to the double-wall pipe by drilling and inserting a 3/4" long sheetmetal screw into the vent cap collar. Do not overtighten screw.

**FIGURE 7. Follow STEPS to Join Double-Wall (Type B) Pipe to Taper-Type Reducer that Joins It to Single-Wall or Category III Vent Run**

Make this connection a maximum of 6" (152 mm) from the concentric adapter box.

**STEP 1:**

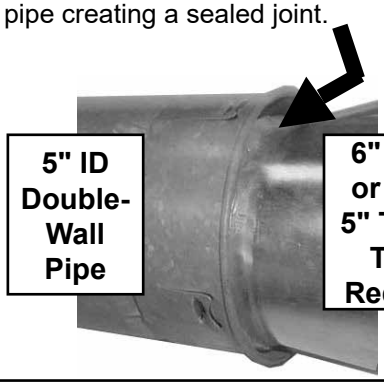
On the taper-type reducer, place a continual 1/4" bead of silicone sealant around the circumference.



**Perform STEP 2 immediately following STEP 1.**

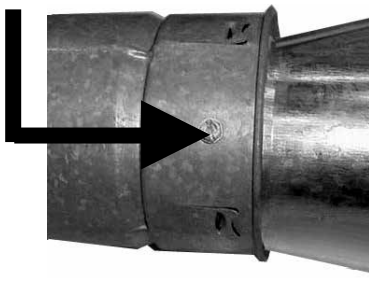
**STEP 2:**

Insert the collar of the reducer into the inner pipe of the double-wall pipe until the bead of sealant contacts the inner pipe creating a sealed joint.




**STEP 3:**

Spaced equally around the double-wall pipe, drill three small holes below the sealant ring. Insert 3/4 inch long sheetmetal screws to secure the joint. Do not overtighten screws.



## 6.3 Venting and Combustion Air (Continued)

### Specific Venting Requirements (Continued)

**5) Support**

Support horizontal runs every 6 feet (1.8M). Support vertical runs of type "B" double-wall or Category III vent pipe in accordance with the requirements of the pipe manufacturer. Support single-wall vertical pipe in accordance with accepted industry practices. Do not rely on the heater or the adapter box for support of either horizontal or vertical pipes. Use non-combustible supports on vent pipe.

**NOTE:** The double-wall vent terminal pipe does not attach to the concentric adapter box and must be supported during installation.

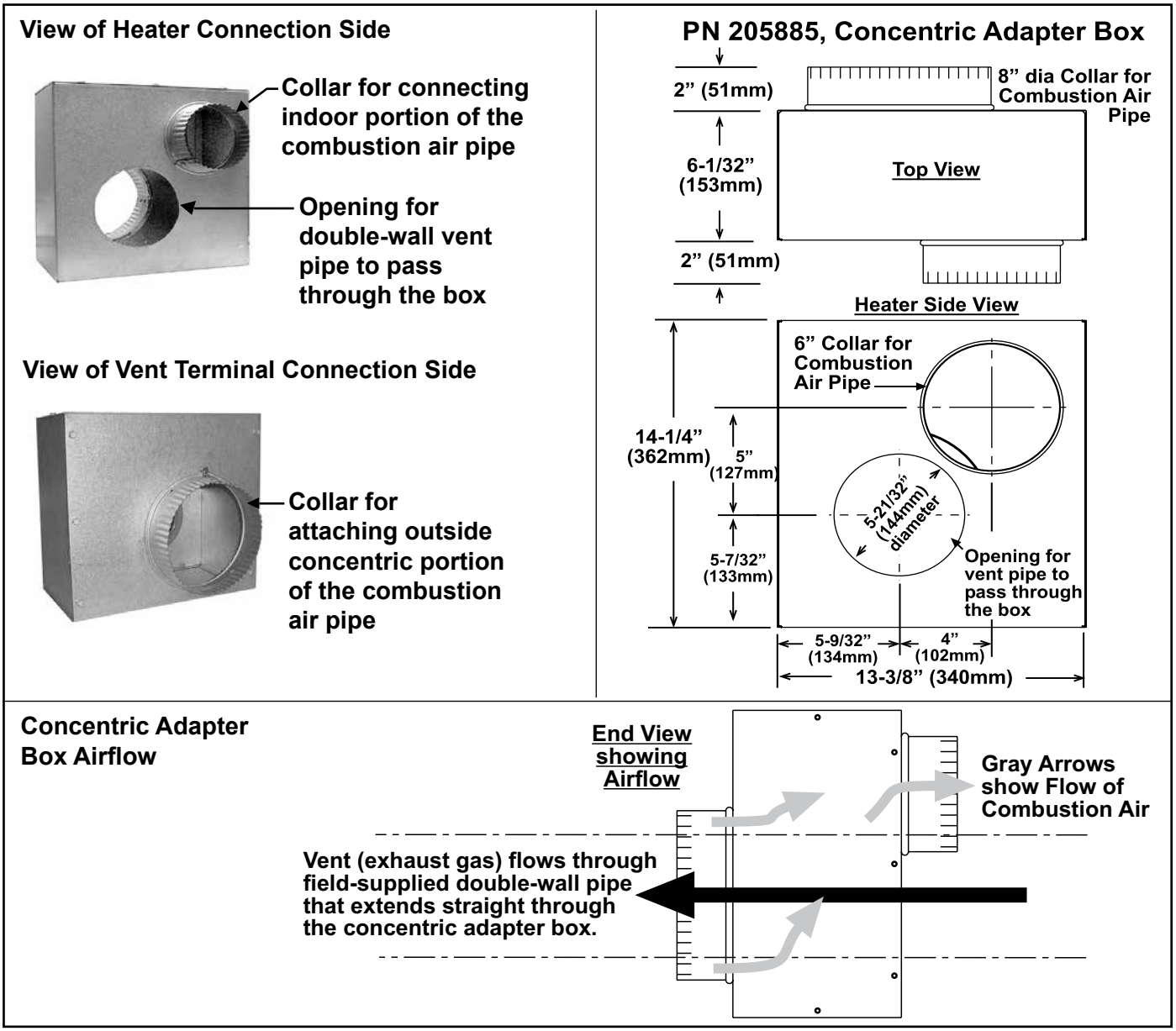
**6) Clearance**

Do not enclose the vent pipe or place pipe closer than 6" (152 mm) to combustible material.

**7) Concentric Adapter Box**

All separated combustion installations **require** a concentric adapter box as illustrated in **FIGURE 8**. The concentric adapter box is included in the vent/combustion air kit. Installation instructions depend on whether the vent system is horizontal (Option CC6) or vertical (Option CC2).

**FIGURE 8. Concentric Adapter Box Is Required Part of All Model SC Installations**



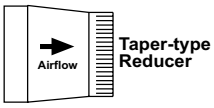
## Pipe Connections at the Concentric Adapter Box

When pipe diameters differ, depending on direction of airflow, join the pipes with either a taper-type reducer or enlarger. Refer to illustrations in **FIGURE 9A and 9B** for pipe connection requirements at the concentric adapter box.

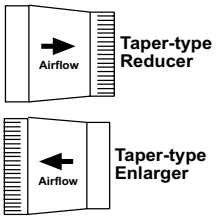
Do **NOT** make actual connections until after reading the instructions and length requirements for installing the vent/combustion air kit. **The box connection requirements are the same for both vertical and horizontal systems, but the length of the double-wall pipe varies by installation.**

**FIGURE 9A. Concentric Adapter Box Connections (6" Pipe)**

- **If using 6" diameter pipes**, Model SC 100–400 always require a 6–5" (152–127 mm) reducer in the vent pipe.




- **If using 7" diameter pipes (allowed on sizes 200–400)**, Models SC 200–400 always require a 7–5" (178–127 mm) reducer in the vent pipe and a 6–7" (152–178 mm) enlarger for attaching the combustion air pipe.



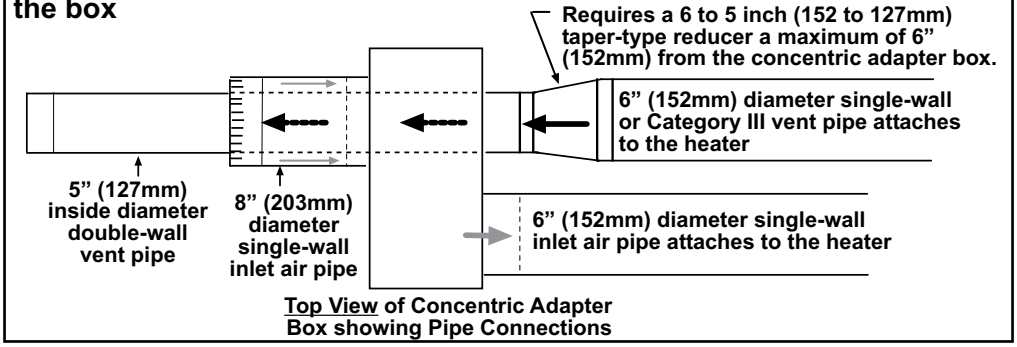
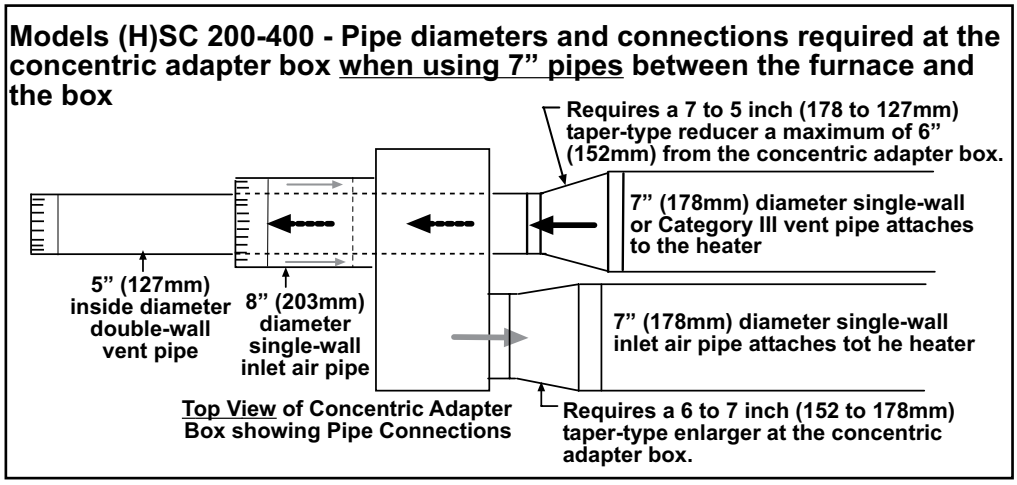
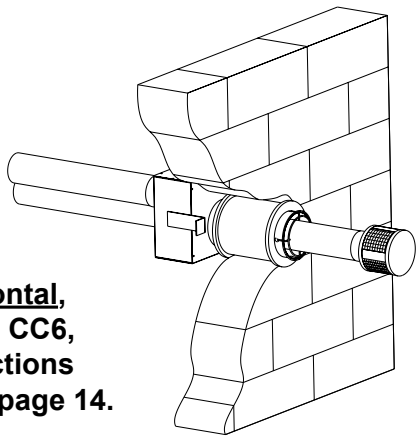




**FIGURE 9B. Concentric Adapter Box Connections (7" Pipe)**



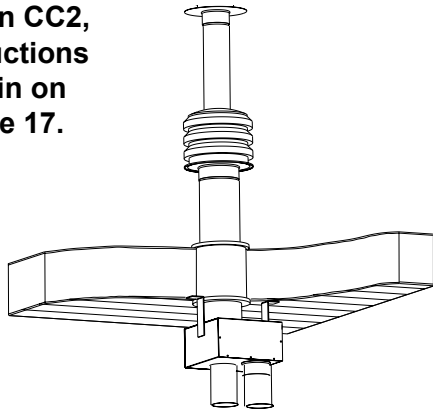

## Is the Vent Terminal HORIZONTAL OR VERTICAL?

**Follow the instructions for the Vent Terminal being installed:**



**Horizontal, Option CC6, instructions begin on page 14.**

**Vertical, Option CC2, instructions begin on page 17.**



## HORIZONTAL VENT INSTRUCTIONS

### Components Required—Factory and Field

| Qty | PN | Description |
|---|---|---|
| 1 | 205883 | Complete Horizontal Vent Kit (same as Option CC6) |
| 1 | 205885 | Concentric Adapter Box Assembly (see **FIGURE 8**, page 12) |
| 1 | 53316 | Screened Exhaust Assembly (illustrated below) |
| 1 | 205894 | Inlet Guard (illustrated below) |
| 4 | 37661 | Screws, #10-16 × 1/2" long, to attach inlet guard |
| 2 | 207232 | Brackets for attaching Concentric Adapter Box (see **FIGURE 11**, page 15) |
| 1 | 53335 | Tube of High Temperature (450°F) Silicone Sealant |

**Screened Exhaust Assembly, PN 53316**

**Inlet Guard, PN 205894**

**FIGURE 10. Parts in Horizontal Vent Terminal/Combustion Air Package (Option CC6)**

**Field-supplied installation requirements:**

- Vent pipes: refer to requirements, page 10
- Combustion air pipes: refer to requirements, page 10
- Taper-type vent pipe diameter reducers and/or increasers as required
- Thimble (not required if wall is of non-combustible construction)
- Flashing
- Sheetmetal screws, tape, and sealant as required

**Installation Instructions for Horizontal Vent Kit Option CC6**

**1. Determine the location on the outside wall for the vent terminal.** Location must comply with vent length requirements, Requirement No. 3 on page 10. In most applications, the terminal would be on a level with the heater mounting height. Allow 1/4" per foot (6 mm per 305 mm) downward pitch for condensate drain.

The distance of the termination of the horizontal vent from adjacent public walkways, adjacent buildings, openable windows, and building openings must be in accordance with local codes or, in the absence of local codes, must conform with National Fuel Gas Code Z223.2. Local codes supersede all provisions in these instructions and in the National Fuel Gas Code. Minimum clearances for the horizontal vent terminal are shown below. Also, select a location that complies with adjoining building clearances as shown in **FIGURE 12,** page 16.

Products of combustion can cause discoloring of some building finishes and deterioration of masonry materials. Applying a clear silicone sealant that is normally used to protect concrete driveways can protect masonry materials. If discoloration is an esthetic problem re-locate the vent or install a vertical vent.

**Clearances to a Horizontal Vent Terminal**

| Structure | Minimum Clearances for Vent Terminal Location, All Directions Unless Specified (Feet (Meters)) | |
|---|---|---|
| | United States | Canada |
| Forced air inlet within 10 feet (3.1 meters)* | 3 (0.9) above | |
| Combustion air inlet of another appliance | 6 (1.8) | |
| Door, window, or gravity air inlet (any building opening) | 4 (1.2) horizontal | |
| | 4 (1.2) below | |
| | 1 (0.305) above | |
| Electric meter, gas meter, and relief equipment** | 4 (1.2) horizontal | 6 (1.8) horizontal |
| Gas regulator** | 3 (0.9) horizontal | 6 (1.8) horizontal) |
| Adjoining building or parapet | 6 (1.8) | |
| Adjacent public walkways | 7 (2.1) above | |
| Grade (ground level)*** | 3 (0.9) above | |
| *Does not apply to the inlet of a direct vent appliance. | | |
| **Do not terminate the vent directly above a gas meter or service regulator. | | |
| ***Consider local snow depth conditions. Vent must be at least 6" (152 mm) higher than anticipated snow depth. | | |

**WARNING**

**All vent terminals must be positioned or located away from fresh air intakes, doors and windows to preclude combustion products from entering occupied space. Failure to comply could result in severe personal injury or death and/or property damage.**

**2. Install the Vent Pipe and Combustion Air Pipe Runs:** Use the type of pipe specified in Requirement No. 1, pages 9–10. Comply with requirements in Requirement No. 2, page 10, when attaching pipes to the heater.

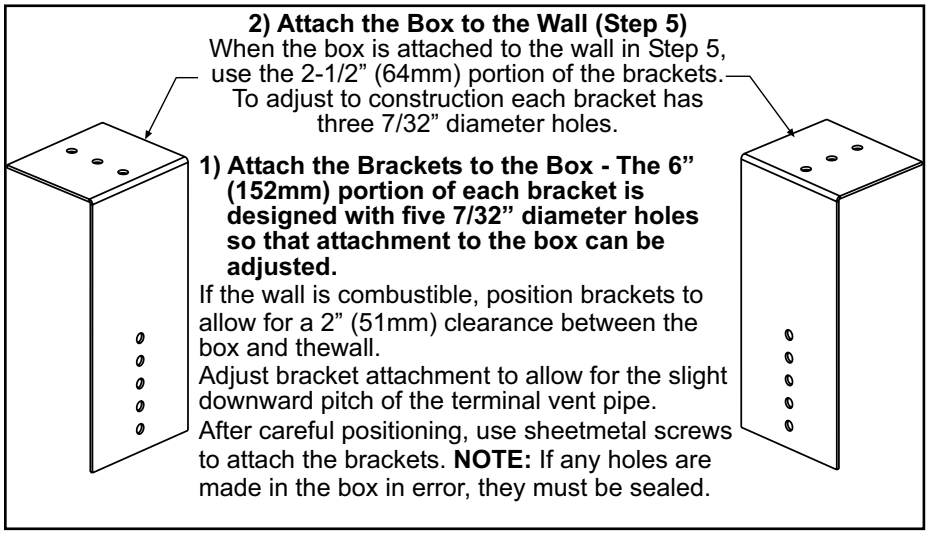
Seal all joints. Due to the high temperature, **do not** enclose the exhaust pipe or place pipe closer than 6" (152 mm) to combustible material. Extend the runs close to the wall location selected in Step 1. Support pipes as required in Requirement No. 5, page 12.

**3. Prepare a hole through the outside wall for the 8" (203 mm) diameter combustion air pipe.** Outside wall construction thickness should be between 1" (25 mm) minimum and 48" (1143 mm) maximum. The larger diameter combustion air pipe serves as clearance for the vent pipe on non-combustible construction. A thimble may be required depending on wall construction and/or local codes.

**4. Prepare the Concentric Adapter Box**

**a) Attach the brackets to the box.** Follow the instructions in **FIGURE 11**.

**FIGURE 11. Brackets for Attaching Concentric Adapter Box to Wall**




**b) Attach the outside portion of the combustion air pipe to the box.** Determine the length by measuring the bracket length from box to wall, plus the wall thickness, plus 2" (51 mm). The inlet air pipe should extend beyond the outside wall approximately 2" (51 mm).

Attach the inlet air pipe to the collar of the concentric adapter with sheetmetal screws and seal.

**5. Attach the concentric adapter box to the wall.** Insert the combustion air pipe through the wall. Attach the brackets (**FIGURE 11**) to the wall. On the outside, caulk or flash the inlet air pipe. Flashing is field-supplied.

**6. Position the inlet guard** over the end of the combustion air pipe. See **FIGURE 12**, page 16. Attach the guard to the inlet air pipe with the four 1/2" long screws provided.

**7. Determine length and install the double-wall terminal vent pipe.**

**a) Determine length of pipe.** The length of the vent pipe is determined by the installation within the maximum and minimum requirements. See **FIGURE 12**, to determine lengths of each segment and calculate the total length required. The vent pipe extending through the box and the inlet air pipe **must be one piece of double-wall vent pipe without joints**. The transition to the single-wall or Category III vent pipe run, must be a maximum of 6" (152 mm) from the heater side of the box.

**b) Install double-wall terminal vent pipe.** Being sure the vent pipe is in the proper flow direction, slide the end through the box. Position the vent pipe so that it will extend

## 6.0 Mechanical (Continued)

## 6.3 Venting and Combustion Air (Continued)

## HORIZONTAL VENT INSTRUCTIONS (Continued)

between 16" (406 mm) and 24" (610 mm) past the end of the combustion air pipe and no more than 6" (152 mm) out of the box toward the heater.

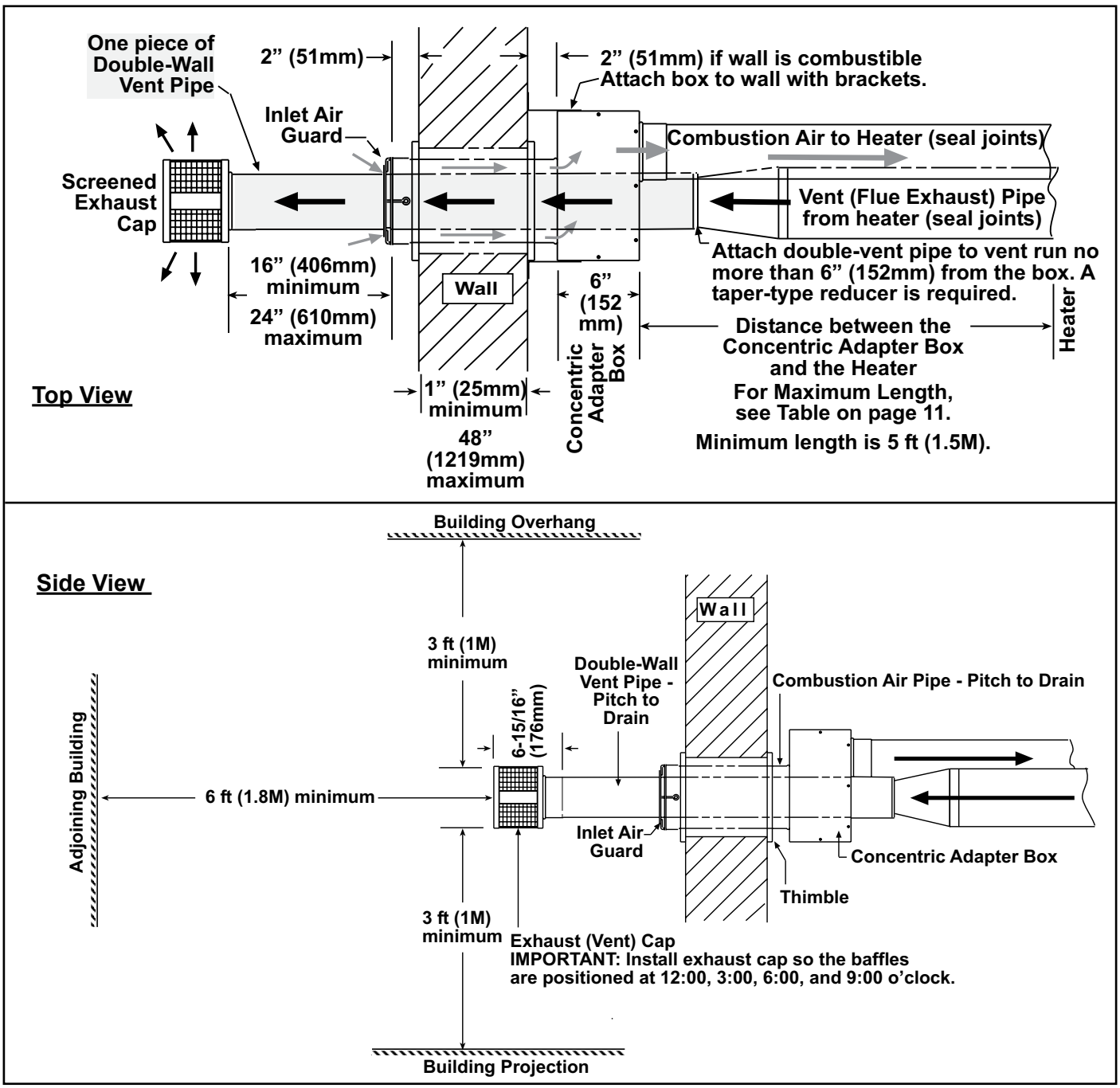
Use a taper-type reducer to attach the 5" double-wall vent pipe to the 6" or 7" single-wall or Category III vent pipe run. Follow the instructions in **FIGURE 7**, page 11.

**8. Attach the exhaust (vent) cap to the end of the vent pipe.** Align the cap so that its baffle strips are positioned on the horizontal and vertical centerlines (see **FIGURE 12**). Follow the instructions in **FIGURE 6**, page 11, to attach the exhaust cap.

**NOTE**: If vent pipe is inserted from outside, cap may be attached before the double-wall vent pipe is installed. If cap is attached first, be sure the baffle strips are positioned correctly when attaching the vent terminal pipe to the vent run.

**9. Seal the vent pipe.** Verify that the double-wall section of vent pipe has a slight downward drop (1/4" per foot/6 mm per 305 mm) toward the vent terminal end. Use silicone sealant and seal the circumference of the pipe and the opening of the box. Seal the area around the pipe completely.

**FIGURE 12. Installation of Typical Separated-Combustion Unit with Horizontal Vent and Combustion Air Pipes (Option CC6)**



**10. Attach the indoor combustion air pipe.** If using 6" pipes, attach the single-wall combustion air pipe run to the collar on the concentric adapter box with sheetmetal screws. If using 7" pipe on sizes 200–400, install a taper type enlarger as illustrated In **FIGURE 9B**, page 13.

Seal joints with tape or sealant.

Installation of the horizontal vent and combustion air system on your separated-combustion unit is complete. **Verify compliance with all venting installation requirements, pages 9–13, and illustrated in FIGURE 12.**

## VERTICAL VENT INSTRUCTIONS

### Components Required (Factory and Field)

| Qty | PN | Description |
|---|---|---|
| 1 | 205896 | Complete Vertical Vent Kit (same as Option CC2) |
| 1 | 205885 | Concentric Adapter Box Assembly (see **FIGURE 8**, page 12) |
| 1 | 110052 | Exhaust (Vent) Terminal (illustrated below) |
| 1 | 53330 | Combustion Air (illustrated below) |
| 2 | 207232 | Brackets for attaching Concentric Adapter Box (see **FIGURE 14**, page 18) |
| 1 | 53335 | Tube of High Temperature Silicone Sealant |

**FIGURE 13. Parts in Vertical Vent Terminal/Combustion Air Package (Option CC2)**

**Exhaust (Vent) Terminal, PN 110052**

**Combustion Air Inlet, PN 53330**

### Field-supplied installation requirements:

- Vent pipes: see requirements, page 10
- Combustion air pipes: see requirements, page 10
- Taper-type pipe diameter reducers and/or increasers as required
- Thimble (not required if wall is of non-combustible construction)
- Flashing
- Sheetmetal screws, tape, and sealant as required

### Installation Instructions for Vertical Vent/ Combustion Air Kit (Option CC2)

**1. Determine the location of the vent terminal.**

Select a location away from fresh air intakes, allowing space for the concentric adapter box inside. Vent terminal must be located from adjacent buildings as shown in **FIGURE 18**, page 20.

**WARNING**

**All vent terminals must be positioned or located away from fresh air intakes, doors and windows to preclude combustion products from entering occupied space. Failure to comply could result in severe personal injury or death and/or property damage.**

If more than one vertical concentric vent/combustion air terminal (Option CC2) is being installed, the minimum spacing between vent centerlines is determined by the minimum outdoor design temperature (most extreme outdoor condition at the site).

| Minimum Outdoor Design Temperature | | Minimum Spacing Between Center Lines of Vent Pipes in Vertical Combustion Air/Vent Terminals (Option CC2) | |
|---|---|---|---|
| °F | °C | Inches | Millimeters |
| 31 or warmer | 0 or warmer | 36 | 914 |
| −10 to 30 | −23 to −1 | 60 | 1524 |
| less than −10 | less than −23 | 84 | 2134 |

**2. Install the Vent Pipe and Combustion Air Pipe Run:** Use the type of pipe specified (Requirement No. 1, pages 9–10), and comply with the attachment requirements in Requirement No. 2, page 10. Length must comply with Requirement No. 3, page 10.

Seal all joints. Due to the high temperature, **do not** enclose the exhaust pipe or place pipe closer than 6" (152 mm) to combustible material. Provide supports for the pipes. Extend the runs to close to the roof at the location selected in Step 1 above.

## 6.0 Mechanical (Continued)

## 6.3 Venting and Combustion Air (Continued)

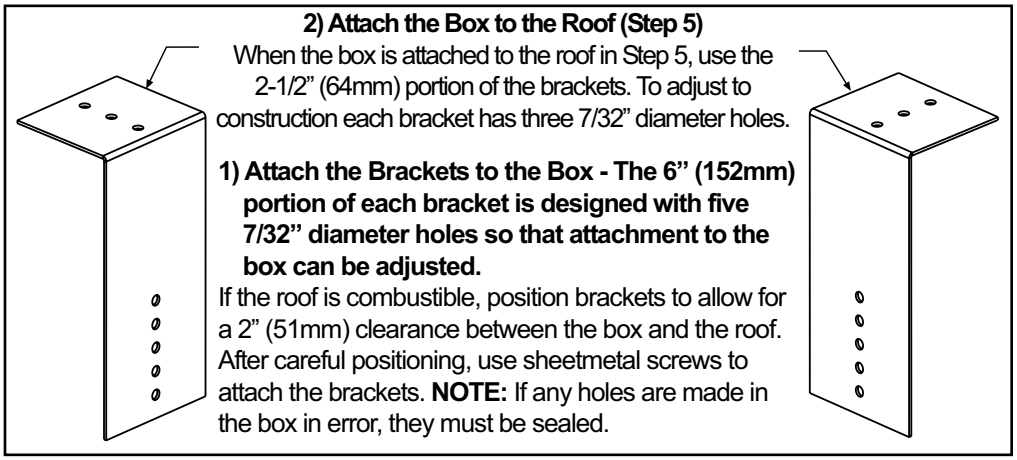
## VERTICAL VENT INSTRUCTIONS (CONTINUED)

**3. Prepare a hole through the roof for the 8" (203 mm) diameter combustion air pipe.** A thimble may or may not be required depending on building construction and/or local codes. The larger diameter combustion air pipe serves as clearance for the vent pipe on non-combustible construction.

**4. Prepare the Concentric Adapter Box**

**a) Attach the brackets to the box.** Follow the instructions in **FIGURE 14**.

**FIGURE 14. Brackets for Attaching Concentric Adapter Box to Roof**




**b) Attach the outside portion of the combustion air pipe to the box.** Determine the length of the combustion air pipe so that dimension "X" in **FIGURE 15** is equal to the bracket length, plus the roof thickness, plus anticipated snow depth, but does not exceed 48" (1219 mm) or have less than 18" (457 mm) of pipe above the roof. Attach the inlet air pipe to the collar of the concentric adapter box with sheetmetal screws.

**5. Attach the concentric adapter box to the roof.** On the inside, insert the combustion air pipe up through the opening and attach brackets to the roof (see **FIGURES 15 and 16**). On the outside, flash the combustion air pipe to the roof. Flashing is field supplied**.**

**6. Determine the length and install the double-wall vent pipe.**

**a) Determine the length.** See **FIGURE 15 to** determine the required length of the vent pipe. The vent pipe extending through the box and the inlet air pipe **must be one piece of double-wall vent pipe without joints**.

Determine the minimum length by adding the requirements. Starting at the bottom, the maximum the vent pipe can extend below the box is 6" (152 mm); ***plus*** 6" (152 mm) through the box; ***plus*** length of bracket extending above the box; ***plus*** the width of the roof; ***plus*** the height of the outside combustion air pipe above the roof; ***plus*** a minimum of 3" (76 mm) beyond the top of the inlet air pipe. Total is the minimum length of the vent pipe section. If the actual piece of vent pipe is longer, extend it further above the combustion air pipe. Do not extend it more than 6" (152 mm) below the box.

**b) Install the pipe.** Being sure the pipe is in the proper flow direction, slide the end into the box and out through the combustion air pipe. Position the vent pipe so that the end is no more than 6" (152 mm) below the box. The upper end should extend at least 3" (76 mm) above the combustion air pipe. **NOTE: The double-wall vent pipe does not attach to the box. The installer must provide support.**

Follow the instructions in **FIGURE 7**, page 11 for connecting the double-wall pipe to the single-wall pipe or Category III vent pipe run. A taper-type reducer is required.

Seal the circumference of the pipe and the opening of the box with silicone sealant. Seal the area around the pipe completely.

**7. On the outside, slide the combustion air inlet** over the vent pipe and fasten the collar to the combustion air pipe with sheetmetal screws (see **FIGURE 17**). Seal the opening at the top between the vent pipe and the combustion air inlet with silicone sealant to prevent water leakage.

**8. Attach the exhaust (vent) cap.** See **FIGURE 17** and follow the illustrated instructions in **FIGURE 6,** page 11.

**FIGURE 15. Assemble Concentric Adapter Box, Outdoor Combustion Air Pipe, and Double-Wall Vent Pipe**

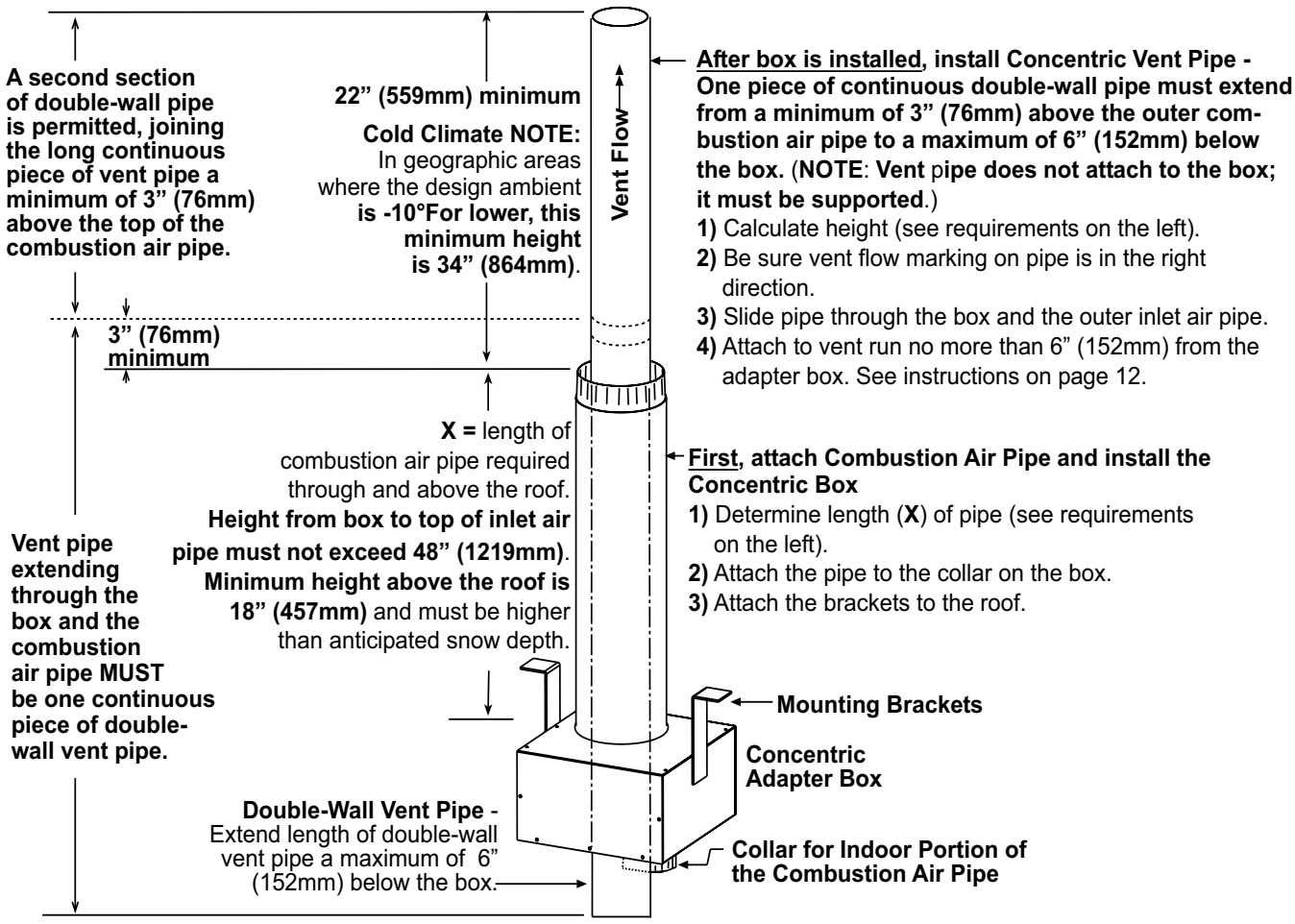



**FIGURE 16. Slide Attached Combustion Air Pipe Up Through Roof**

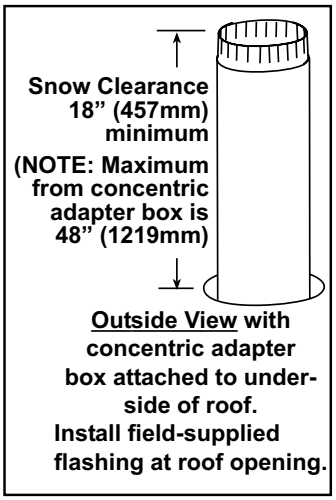
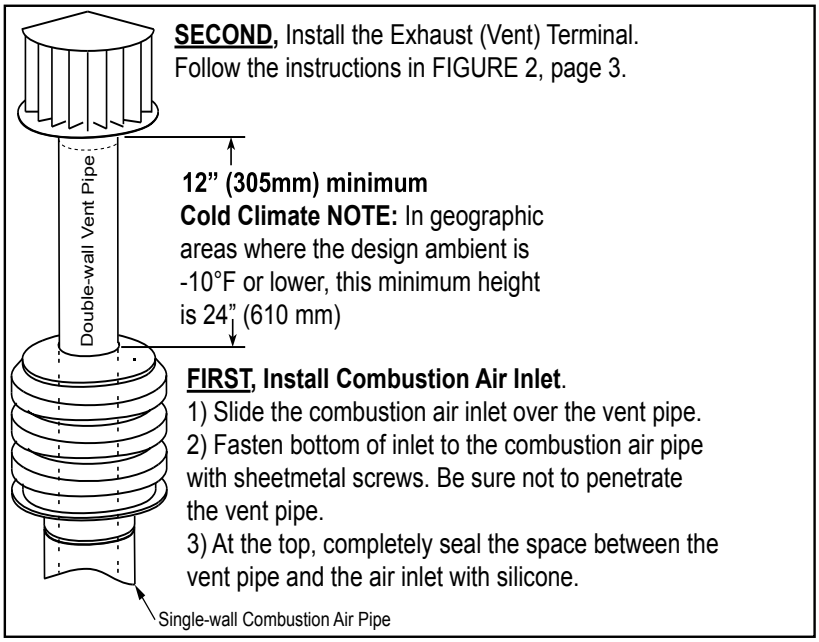
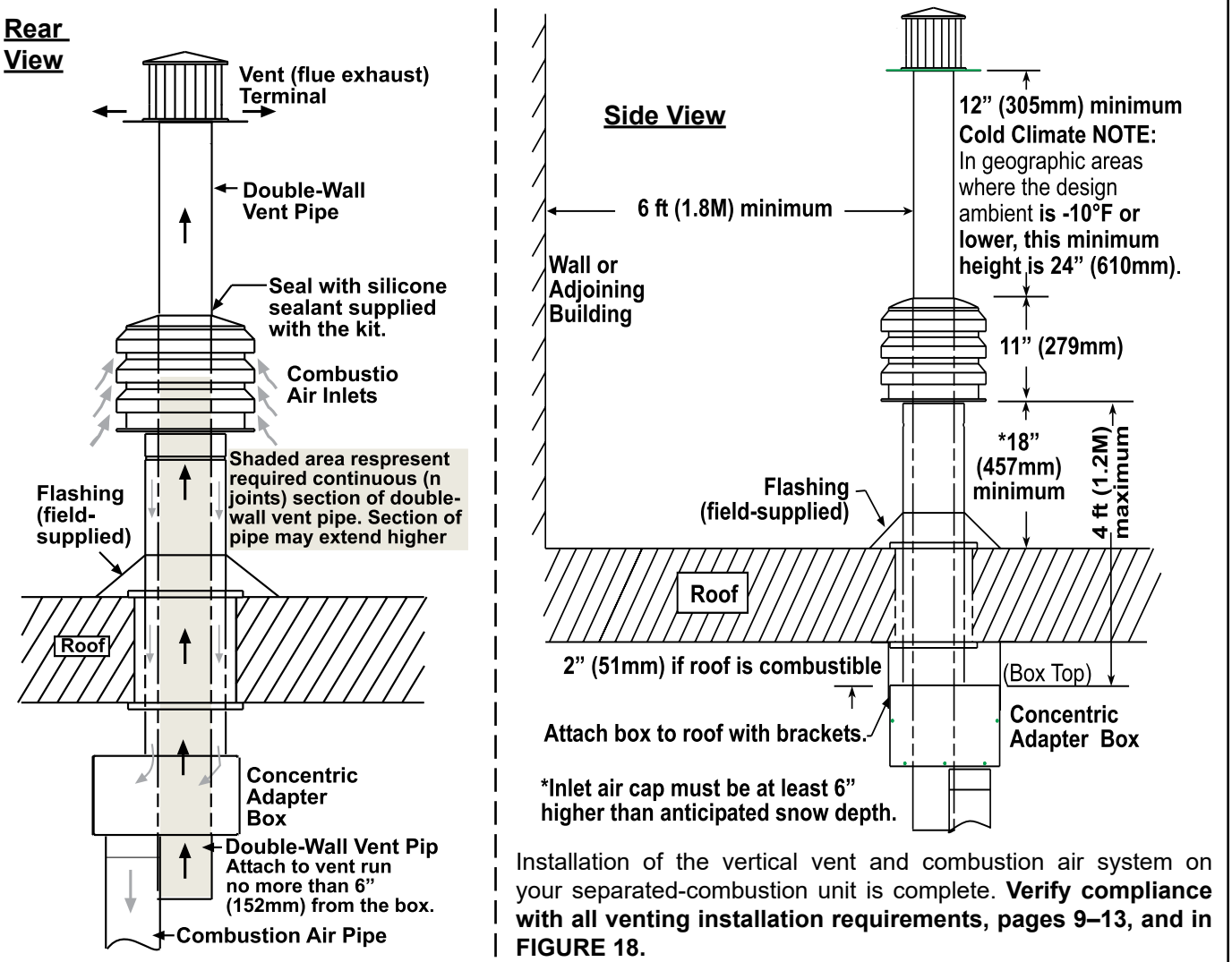



**FIGURE 17. Install Combustion Air Inlet and Vent Terminal**




**9. Attach the indoor combustion air pipe.** Use sheetmetal screws to attach the single-wall combustion air pipe run to the collar on the concentric adapter box. Seal with tape or sealant. If using 7" pipe on sizes 200–400, install a taper type enlarger as illustrated in **FIGURE 9B, page 13**.

**FIGURE 18. Installation of Unit with Vertical Vent Terminal/Combustion Air Inlet (Option CC2)**




Installation of the vertical vent and combustion air system on your separated-combustion unit is complete. **Verify compliance with all venting installation requirements, pages 9–13, and in FIGURE 18.**

## 6.4 Duct Furnace Airflow

### 6.4.1 Pressure Drop and Temperature Rise by Size

The following chart shows the approved temperature rise range with the required CFM and the internal Pressure Drop (PD) for each size. Maximum static pressure is 2 IN WC

To determine temperature rise, measure the inlet and outlet temperatures at points not affected by heat radiating from the heat exchanger.

The duct furnace must be installed on the positive pressure side of the field supplied blower. The air throughput must be within the CFM range stated on the heater rating plate. The air distribution must be even over the entire heat exchanger. Turning vanes

**Model SC Series 6 (80% Thermal Efficient)**

| Size | 100 | | 125 | | 150 | | 175 | | 200 | | 225 | | 250 | | 300 | | 350 | | 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp Rise | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD | CFM | PD |
| 30°F | 2465 | 1.38 | 3085 | 1.39 | 3700 | 1.00 | 4320 | 1.49 | 4935 | 1.14 | 5555 | 1.48 | 6170 | 1.17 | 7400 | 1.61 | 8640 | 1.87 | 9875 | 1.87 |
| 40°F | 1850 | 0.78 | 2310 | 0.78 | 2775 | 0.56 | 3240 | 0.81 | 3700 | 0.64 | 4165 | 0.83 | 4630 | 0.66 | 5555 | 0.91 | 6480 | 1.05 | 7400 | 1.05 |
| 50°F | 1480 | 0.50 | 1850 | 0.50 | 2220 | 0.36 | 2590 | 0.52 | 2960 | 0.41 | 3330 | 0.53 | 3700 | 0.42 | 4440 | 0.58 | 5185 | 0.67 | 5925 | 0.67 |
| 55°F | 1345 | 0.34 | 1680 | 0.41 | 2020 | 0.30 | 2355 | 0.43 | 2690 | 0.34 | 3030 | 0.44 | 3365 | 0.35 | 4040 | 0.48 | 4710 | 0.55 | 5385 | 0.55 |
| 60°F | 1235 | 0.29 | 1540 | 0.34 | 1850 | 0.26 | 2160 | 0.36 | 2465 | 0.28 | 2775 | 0.37 | 3085 | 0.30 | 3700 | 0.40 | 4320 | 0.46 | 4935 | 0.46 |
| 70°F | 1055 | 0.21 | 1320 | 0.25 | 1585 | 0.19 | 1850 | 0.26 | 2115 | 0.21 | 2380 | 0.27 | 2645 | 0.22 | 3175 | 0.30 | 3700 | 0.34 | 4230 | 0.34 |
| 80°F | 925 | 0.16 | 1155 | 0.19 | 1385 | 0.14 | 1620 | 0.20 | 1850 | 0.17 | 2080 | 0.21 | 2315 | 0.20 | 2775 | 0.23 | 3240 | 0.26 | 3700 | 0.26 |
| 85°F | 870 | 0.14 | 1085 | 0.18 | 1305 | 0.13 | 1525 | 0.18 | 1740 | 0.15 | 1960 | 0.19 | 2175 | 0.20 | 2610 | 0.22 | 3050 | 0.23 | 3485 | 0.23 |
| 90°F | 820 | 0.12 | 1025 | 0.16 | 1235 | 0.12 | 1440 | 0.16 | 1645 | 0.13 | 1850 | 0.17 | 2055 | 0.18 | 2465 | 0.20 | 2880 | 0.21 | 3290 | 0.21 |

should be used in elbows or turns in the air inlet to ensure proper air distribution (refer to Paragraph 6.4.2).

If it is determined that the blower CFM is greater than allowed or desirable, refer to Paragraph 6.4.3 for instructions on determining the correct size of bypass duct required.

Or, if a higher CFM is required through the furnace within the limits in the chart on the right, install the high CFM conversion kit, **PN 263309**, that was shipped with the unit.

| Model SC Size | High Air Throughput (CFM) with Kit, PN 263309 | |
|---|---|---|
| | Maximum | Minimum |
| 100 | 3700 | 980 |
| 125 | 4630 | 1230 |
| 150 | 5555 | 1480 |
| 175 | 6480 | 1725 |
| 200 | 7405 | 1975 |
| 225 | 8330 | 2220 |
| 250 | 9255 | 2465 |
| 300 | 11110 | 2960 |
| 350 | 12900 | 3455 |
| 400 | 14815 | 3950 |

### 6.4.2 Duct Furnace Blower Connection

Proper air arrangement of blower and duct furnace with respect to angle of approach of the duct connection and the arrangement of the discharge opening of the blower are shown in **FIGURE 19.** Blowers should be bottom horizontal discharge when coupled to the duct furnace. When a top horizontal discharge blower is connected to the duct furnace, be sure that sufficient length of duct is provided to permit an even flow of air at the furnace. Or, insert baffles between the blower and the heater to assure an even flow of air across the heat exchanger.

**WARNING**

**The furnace must be installed on the positive pressure side of the air-circulating blower.**

**CAUTION: Abrupt angle approaches such as shown in FIGURES 19B and 19C can be detrimental to unit life. Be certain that ample air is directed at the base of the tube section by using turning vanes as shown (refer to Hazard Levels, page 2).**

**FIGURE 19A. Straight Through Air**

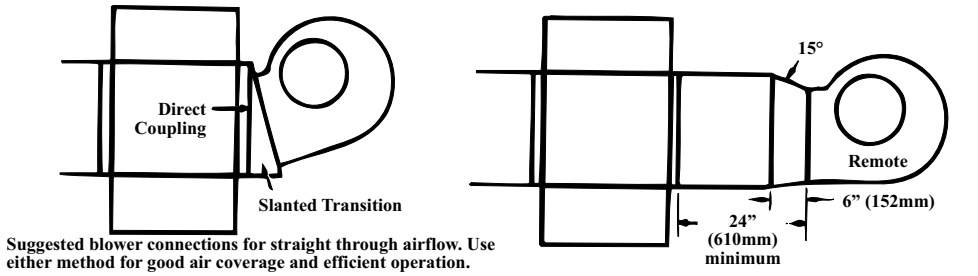



**FIGURE 19B. With Elbows Up or Down**

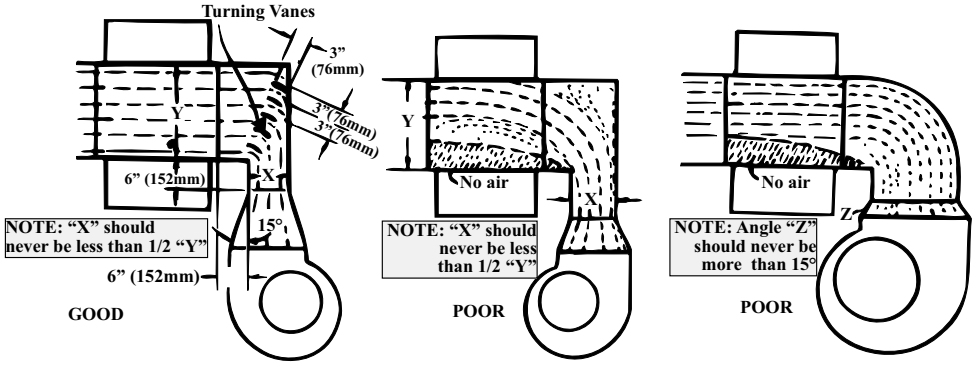
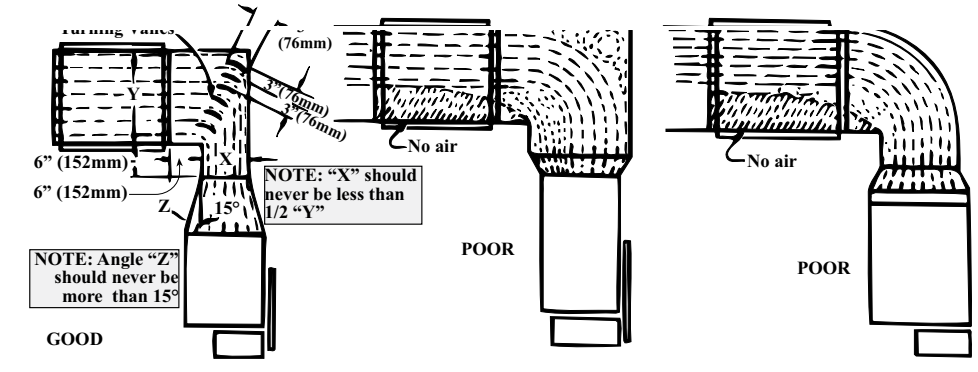



**FIGURE 19C. With Elbows Left or Right**



## 6.0 Mechanical (Continued)

## 6.4 Duct Furnace Airflow (Continued)

### 6.4.3 Constructing a Bypass Duct

When the CFM of air throughput is greater than desirable or permissible for the unit, a bypass duct may be constructed. Follow these instructions to determine the correct size of the bypass duct.

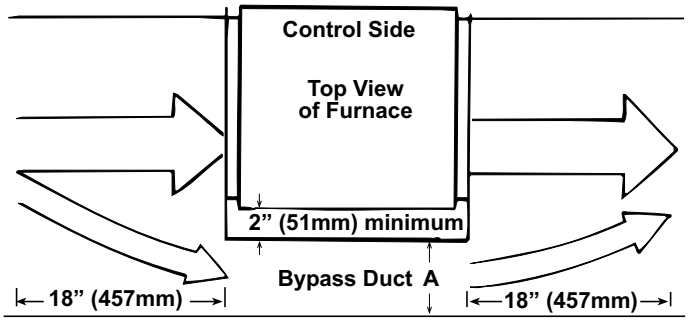
**1)** From the tables in Paragraph 6.4.1, find the Pressure Drop (PD) and the allowable CFM for the duct furnace that is being installed.
**EX: Std Size SC250 @ 50°F Temperature Rise; PD 36; CFM 2220**

**2)** Subtract the allowable CFM from the actual CFM of the installation to determine how much air must be diverted through the bypass duct.
**EX: Actual Blower CFM is 3000; 3000 minus allowable CFM of 2220 = 780**

**3)** Go to the column in the bypass CFM chart that is closest to the pressure drop through the heater. Move down in that column until you find the CFM closest to the answer in Step 2).
**EX: Go to PD column 0.35; move down to 830**

**4)** Move to the left column to find out the required size of the bypass duct.
**EX: Bypass Duct should be 3" (76 mm).**

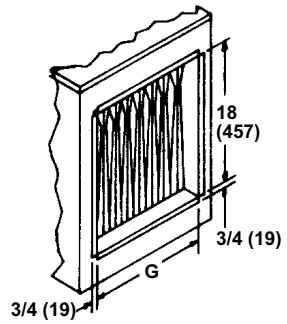
**FIGURE 20. Bypass Duct**




| A | Bypass CFM<br>Pressure Drop through the Furnace | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 |
| 3 (76) | 490 | 530 | 610 | 700 | 780 | 830 | 900 | 960 | 1010 |
| 4 (102) | 630 | 750 | 870 | 980 | 1090 | 1160 | 1250 | 1310 | 1400 |
| 5 (127) | 850 | 1010 | 1190 | 1300 | 1410 | 1520 | 1640 | 1730 | 1810 |
| 6 (152) | 1050 | 1290 | 1480 | 1650 | 1800 | 1940 | 2090 | 2200 | 2320 |
| 7 (178) | 1250 | 1510 | 1760 | 1960 | 2180 | 2320 | 2500 | 2650 | 2800 |
| 8 (203) | 1490 | 1810 | 2100 | 2350 | 2560 | 2760 | 2940 | 3110 | 3290 |
| 9 (229) | 1700 | 2100 | 2400 | 2700 | 2970 | 3200 | 3400 | 3600 | 3800 |
| 10 (254) | 1920 | 2350 | 2760 | 3090 | 3650 | 4020 | 4300 | 4550 | 4800 |

### 6.4.4 Duct Connection

**FIGURE 21. Duct Connection Dimensions (Inches (Millimeters))**




| Size | G |
|---|---|
| **100** | 12-1/2 (318) |
| **125** | 15-1/4 (387) |
| **150, 175** | 20-3/4 (527) |
| **200, 225** | 26-1/4 (667) |
| **250, 300** | 34-1/2 (876) |
| **350** | 40 (1016) |
| **400** | 45-1/2 (1156) |

Make adjustments required to obtain a temperature rise and static pressure within the ranges specified on the heater rating plate. Blower connection and airflow requirements for Model SC duct furnaces are shown in Paragraphs 6.4.1 and 6.4.2.

### Requirements and Suggestions for Connecting and Installing Ducts

- **Type of Ductwork:** The type of duct installation to be used depends in part on the type of construction of the roof (whether wood joist, steel bar joist, steel truss, precast concrete) and the ceiling (whether hung, flush, etc.).
- **Ductwork Material:** Rectangular duct should be constructed of not lighter than No. 26 U.S. gauge galvanized iron or No. 24 B&S gauge aluminum.
- **Ductwork Structure:** All duct sections 24 inches or wider, and over 48 inches in length, should be cross broken on top and bottom and should have standing seams or angle-iron braces. Joints should be S and drive strip, or locked.
- **Through Masonry Walls:** No warm air duct should come in contact with masonry walls. Insulate around all air duct through masonry walls with not less than 1/2" (1" is recommended) of insulation.
- **Through Unheated Space:** Insulate all exposed warm air ducts passing through an unheated space with at least 1/2" (1" is recommended) of insulation.
- **Duct Supports:** Suspend all ducts securely from adjacent buildings members. Do not support ducts from unit duct connections.
- **Duct Sizing:** Proper sizing of the supply air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for such information is the Air Conditioning Contractors Association, 2800 Shirlington Road, Suite 300,

**CAUTION: An external duct system static pressure not within the limits shown on the rating plate, or improper motor pulley or belt adjustment, may overload the motor (refer to Hazard Levels, page 2).**

Arlington, VA 22206 (www.acca.org). A manual covering duct sizing in detail may be purchased directly from them.

- **Removable Panels:** The ducts should have removable access panels on both upstream and downstream sides of the furnace. These openings must be accessible when the furnace is in service and should be a minimum of 6" × 10" in size so smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The covers for the openings must be attached in such a manner as to prevent leakage (see **FIGURE 22A**).
- **Horizontal Discharge Duct Length:** A minimum horizontal duct run of 24" is **recommended** before turns or branches are made in the duct system to reduce losses at the furnace outlet.
- **Supply Air Duct/Furnace Horizontal Connection:** The seal between the furnace and the duct must be mechanical. Duct connection should be made with "U" type flanges on the top and bottom of the connecting duct. Slide the duct over the flanges of the heater giving an airtight fit. Provide "U" type channels for the side flanges to ensure tight joints. Use sheetmetal screws to fasten ducts and "U" channels to the furnace flange (see **FIGURE 22B**).

**CAUTION: Joint where supply air duct attaches to the furnace must be sealed securely to prevent air leakage into the burner rack area. Leakage can cause poor combustion, pilot problems, shorten heat exchanger life, and poor performance (refer to Hazard Levels, page 2).**

- **Return Air Duct/Furnace Connection:** All return air ducts should be attached and sealed to return air flanges to provide airtight connection.
- **Return Air Duct/Grill Size:** Make certain that return air ducting or grills have a free area equal to the return duct size connection.

**FIGURE 22A. Connecting Ductwork to the Furnace**

(1) Flanges on the furnace (heat exchanger) turn out as shown; (2) shape duct connection as shown: "U" on top and bottom, "L" on sides; (3) slide "U" channels over furnace top and bottom flanges making connection; (4) form "U" channels to seal sides. **Drill and lock with sheetmetal screws.**

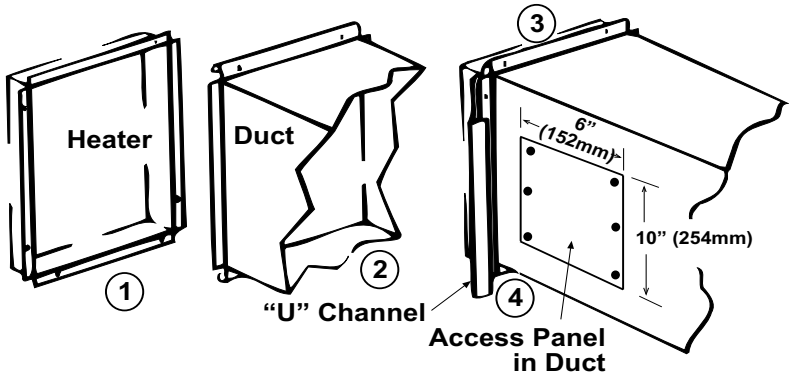
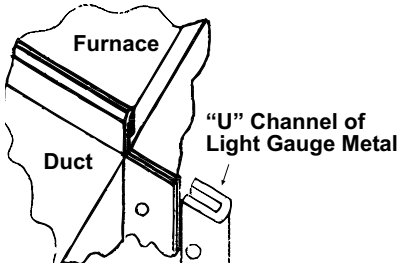



**FIGURE 22B. Install "U" Channel on Sides of Duct Connection**




## 6.4.5 Discharge Air Sensor for Makeup Air Application

Makeup air Option AG3 has a unit mounted ductstat with a capillary sensor that is factory-installed in the unit discharge (refer to Paragraph 8.4.3).

Makeup air Options AG15, AG8, AG9, AG39, and AG40 require field installation of the sensor in the discharge ductwork. Option AG15 uses the box and sensor holder in **FIGURE 23A**. Options AG8, AG9, and AG39 include a sensor and mixing tube like the one illustrated in **FIGURE 23B**. Option AG40 requires a field-supplied sensor.

Follow the instructions below to install the sensor in the ductwork.

For control information, refer to Paragraph 8.4.

### Instructions for Installing Discharge Air Sensor in the Ductwork

1. Depending on the option, the sensor will be as shown in **FIGURE 23A,** in **FIGURE 23B,** or field-supplied for Option AG40. Refer to Paragraph 3.2 for a list of shipped-separate components by option code.
2. Determine a location in the ductwork to install the sensor.

   Select a location a sufficient distance from the outlet to provide a good mixture of discharge air temperature. According to the latest edition of AMCA Standard 201, in straight ducts, the air is typically well mixed a minimum of five equivalent duct diameters from the discharge of the unit with equivalent duct diameter defined

# 6.0 Mechanical (Continued)

## 6.4 Duct Furnace Airflow (Continued)

**FIGURE 23A. Discharge Air Sensor Holder, PN 115850, Used in Makeup Air Option AG15**

Secure sensor in clip. Position holder so that it shields sensor from direct airflow.

**FIGURE 23B. Discharge Air Sensor and Mixing Tube Used in Electronic Modulation Options AG8, AG9, and AG39**

# 7.0 Electrical Supply and Connections

**WARNING**

**If you turn off the power supply, turn off the gas (refer to Hazard Levels, page 2).**

## 6.4.5 Discharge Air Sensor for Makeup Air Application (Continued)

### Instructions for Installing Discharge Air Sensor in the Ductwork (Continued)

as equal to the square root of 4AB/3.14. "A" and "B" are the duct cross-sectional dimensions.

**Example**: **Supply ductwork cross-sectional dimension is 24" × 12" (610 mm × 305 mm).**

$$5 \times \sqrt{\frac{4 \times 12 \times 24}{3.14}} = 96" \qquad 5 \times \sqrt{\frac{4 \times 305 \times 610}{3.14}} = 2435 \text{ mm}$$

**Solution: Locate the sensor a minimum of 96" (2435 mm) from the outlet of the unit.**

**NOTE:** If the length of the discharge duct is less than 8 ft (2.4M), a mixing vane is recommended for mixing the discharge air.

Do not mount the sensor in the ductwork after a split in the supply as that will cause loss of control in the duct that does not house the sensor.

3. The position of the sensor holder or mixing tube is important. The holder in **FIGURE 23A** will extend 9-3/16" (233 mm) into the ductwork. The mixing tube in **FIGURE 23B** is 12" (305 mm) long.

   In horizontal ductwork, locate the sensor assembly in the top, middle of the duct with the sensor probe extending vertically down into the center of the airstream.

   In vertical ductwork, locate the sensor assembly in the middle of the side of the duct that corresponds with the top middle of the discharge outlet.

   Turn the holder so that the element will be shielded from direct airflow and will sense the air temperature as it flows through the holes in the holder.

   At the selected location in the ductwork, mark the diamond-shaped hole (approximately 1" × 1" (25 mm × 25 mm)) required for the sensor holder or the round hole needed for the mixing tube. Cut the hole no larger than required.

4. **Option AG15:** Push the element into the clip in the holder. Determine where the sensor wire should enter the box and remove the knockout. Slide the holder into the ductwork. Using four field-supplied No. 6 sheetmetal screws, attach the box portion of the holder to the ductwork. Attach a field-supplied cable connector to the box, connect the sensor wire, and attach the box cover.
   **Options AG8, AG9, and AG39:** Slide the mixing tube into the ductwork and attach the sensor. Connect the wires as shown on the wiring diagram.
   **Option AG40:** Follow the instructions provided with the field-supplied sensor. Refer to the wiring diagram with the unit and the field-supplied sensor to connect the wires.

## 7.1 General

All electrical wiring and connections including electrical grounding must be made in accordance with the National Electric Code ANSI/NFPA No. 70 (latest edition) or, in Canada, the Canadian Electrical Code, Part I-C.S.A. Standard C22.I. Check any local ordinances or gas company requirements that apply.

## 7.2 Supply Voltage and Wiring

Check the rating plate on the heater for the supply voltage and the current requirements. A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the unit, making connections in the junction box. Refer to **FIGURE 2**, Paragraph 4.2. **Seal all electrical entrance openings with field-supplied bushings.**

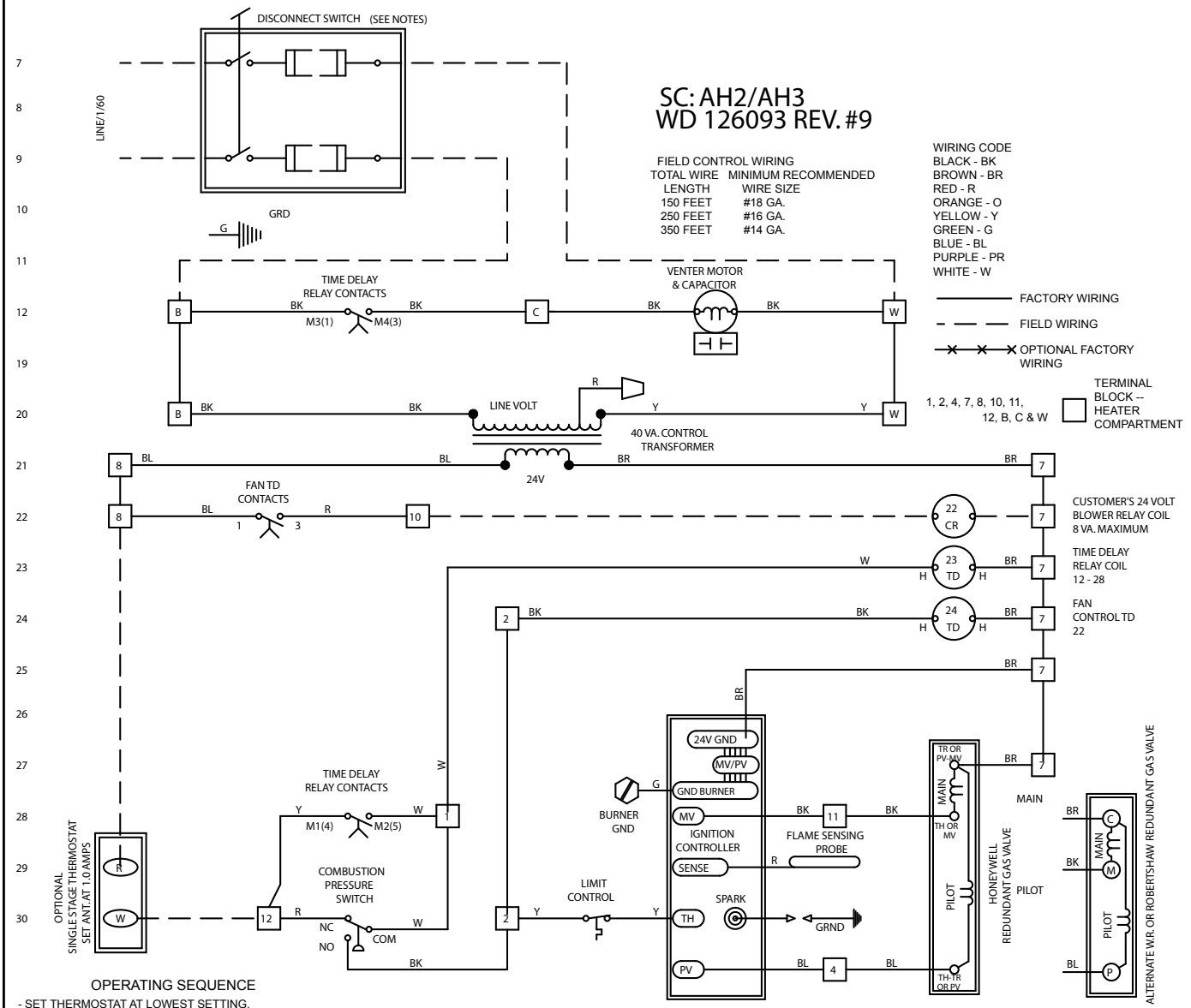
A disconnect switch is available as optional equipment or may be supplied locally. When installing the disconnect switch, be careful that the conduit and switch housing are clear of all service panels. Allow at least four feet (1.2M) of service room between the disconnect switch and any removable service panels. When providing or replacing fuses in a fusible disconnect switch, use dual element time delay fuses and size 1.25 times the maximum total input amps.

See typical wiring diagram in **FIGURE 24 or 25.** A specific wiring diagram can be found in the heater junction box. See separate instruction sheets for any optional equipment provided. Electrical options are identified on the wiring diagram on the heater.

**CAUTION: If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for sensor lead and optional bypass damper combustion air safety circuit (Option AG39 or AG40) wires which must be 150°C (refer to Hazard Levels, page 2).**

## 7.3 Typical Wiring Diagrams

### FIGURE 24. Model SC with Single-Stage Gas Control




OPERATING SEQUENCE

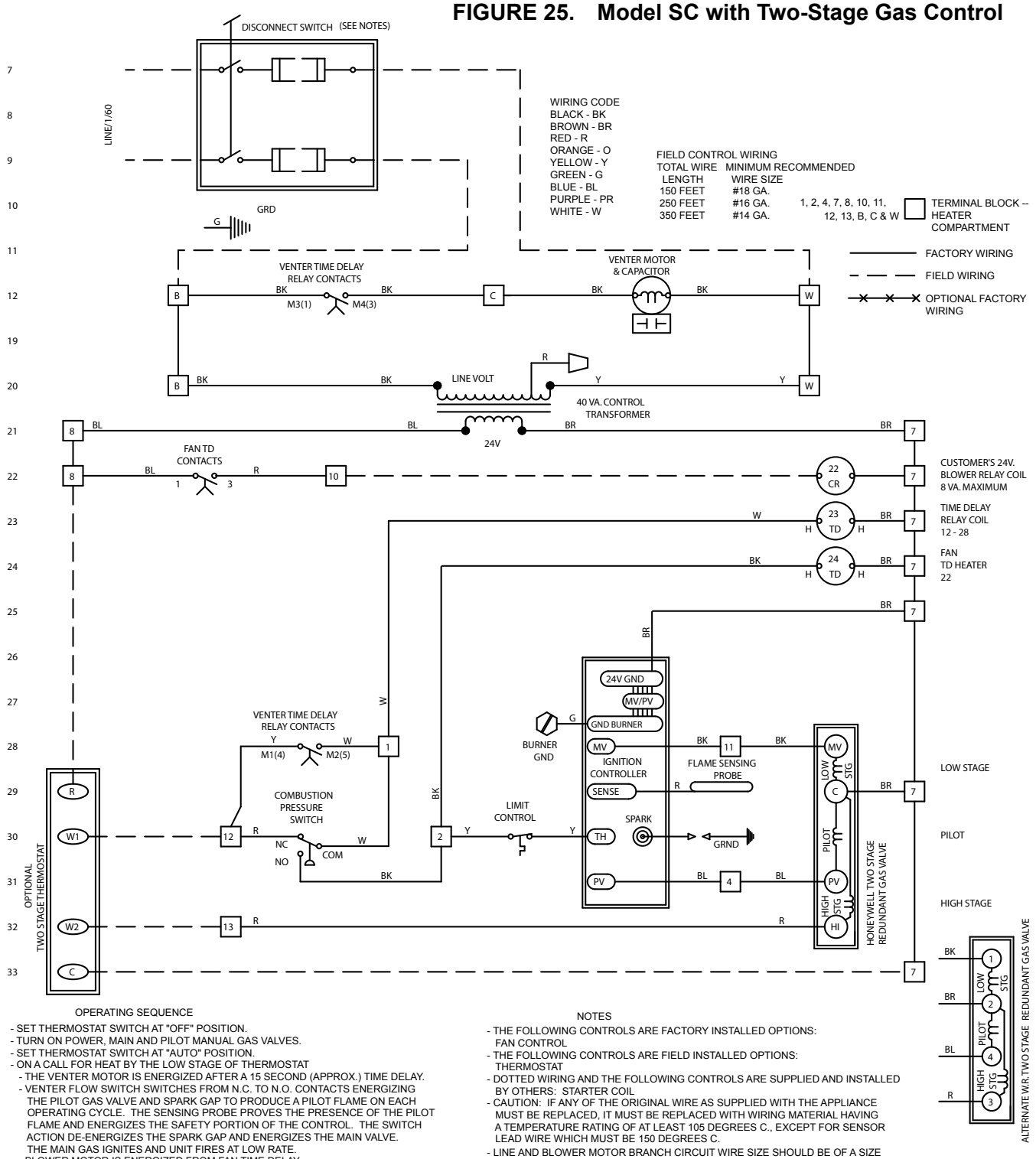
- SET THERMOSTAT AT LOWEST SETTING.
- TURN ON POWER, MAIN AND PILOT MANUAL GAS VALVES.
- SET THERMOSTAT AT DESIRED SETTING.
- ON A CALL FOR HEAT BY THE THERMOSTAT
  - THE VENTER MOTOR IS ENERGIZED AFTER A 15 SECOND (APPROX.) TIME DELAY.
  - VENTER FLOW SWITCH SWITCHES FROM N.C. TO N.O. CONTACTS ENERGIZING THE PILOT GAS VALVE AND SPARK TO PRODUCE A PILOT FLAME ON EACH OPERATING CYCLE. THE SENSING PROBE PROVES THE PRESENCE OF THE PILOT FLAME AND ENERGIZES THE SAFETY PORTION OF THE CONTROL. THE SWITCH ACTION DE-ENERGIZES THE SPARK GAP AND ENERGIZES THE MAIN VALVE. THE MAIN GAS IGNITES AND UNIT FIRES AT LOW RATE.
  - BLOWER MOTOR OPERATES FROM FAN TIME DELAY.
- IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE SAFETY SWITCH CLOSES THE MAIN VALVE AND RECYCLES THE SPARK GAP.

  ON UNITS EQUIPPED WITH LOCKOUT CONTROL, IF PILOT IS NOT ESTABLISHED WITHIN 120 SEC. THE UNIT LOCKS OUT FOR ONE HOUR, UNLESS IT IS RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT. (SEE LIGHTING INSTRUCTIONS)
- SET THERMOSTAT AT LOWEST SETTING FOR SHUTDOWN.
  - BLOWER MOTOR REMAINS ON AS DETERMINED BY FAN TIME DELAY.

NOTES

- THE FOLLOWING CONTROLS ARE FACTORY INSTALLED OPTIONS: FAN CONTROL
- THE FOLLOWING CONTROLS ARE FIELD INSTALLED OPTIONS: THERMOSTAT
- DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: STARTER COIL
- CAUTION: IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105°C, EXCEPT FOR SENSOR LEAD WIRE WHICH MUST BE 150°C.
- LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
- USE #14 GA. WIRE FOR LINE WIRING ON UNIT.
- USE #18 GA. WIRE FOR 24 VOLT CONTROL WIRING ON UNIT.
- ON 208/230V. UNITS THE CONTROL TRANSFORMER HAS A DUAL VOLTAGE PRIMARY. FOR 230V. UNITS USE BLACK AND YELLOW LEADS (CAP RED). FOR 208V. UNITS USE BLACK AND RED LEADS (CAP YELLOW). ON 115/460V. UNITS THE CONTROL TRANSFORMER IS A SINGLE VOLTAGE PRIMARY. FOR 115/460V. UNITS USE BLACK AND YELLOW LEADS.
- WHEN PROVIDING OR REPLACING FUSES IN THE FUSIBLE DISCONNECT SWITCH USE DUAL ELEMENTS TIME DELAY FUSES AND SIZE ACCORDING TO 1.25 TIMES THE MAXIMUM TOTAL INPUT AMPS.
- DISCONNECT SWITCH IS FIELD FURNISHED OR AVAILABLE FROM FACTORY AS AN OPTION.

**FIGURE 25. Model SC with Two-Stage Gas Control**




OPERATING SEQUENCE

- SET THERMOSTAT SWITCH AT "OFF" POSITION.
- TURN ON POWER, MAIN AND PILOT MANUAL GAS VALVES.
- SET THERMOSTAT SWITCH AT "AUTO" POSITION.
- ON A CALL FOR HEAT BY THE LOW STAGE OF THERMOSTAT
  - THE VENTER MOTOR IS ENERGIZED AFTER A 15 SECOND (APPROX.) TIME DELAY.
  - VENTER FLOW SWITCH SWITCHES FROM N.C. TO N.O. CONTACTS ENERGIZING THE PILOT GAS VALVE AND SPARK GAP TO PRODUCE A PILOT FLAME ON EACH OPERATING CYCLE. THE SENSING PROBE PROVES THE PRESENCE OF THE PILOT FLAME AND ENERGIZES THE SAFETY PORTION OF THE CONTROL. THE SWITCH ACTION DE-ENERGIZES THE SPARK GAP AND ENERGIZES THE MAIN VALVE. THE MAIN GAS IGNITES AND UNIT FIRES AT LOW RATE.
  - BLOWER MOTOR IS ENERGIZED FROM FAN TIME DELAY.
- ON A CALL FOR HEAT BY THE HIGH STAGE OF THERMOSTAT, THE UNIT FIRES AT FULL RATE.
- IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE SAFETY SWITCH CLOSES THE MAIN VALVE AND RECYCLES THE SPARK GAP.

  ON UNITS EQUIPPED WITH LOCKOUT CONTROL, IF PILOT IS NOT ESTABLISHED WITHIN 120 SEC. THE UNIT LOCKS OUT FOR ONE HOUR, UNLESS IT IS RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT. (SEE LIGHTING INSTRUCTIONS)
- SET THERMOSTAT SWITCH AT "OFF" POSITION FOR SHUTDOWN.
  - BLOWER MOTOR REMAINS ON AS DETERMINED BY FAN TIME DELAY.

NOTES

- THE FOLLOWING CONTROLS ARE FACTORY INSTALLED OPTIONS: FAN CONTROL
- THE FOLLOWING CONTROLS ARE FIELD INSTALLED OPTIONS: THERMOSTAT
- DOTTED WIRING AND THE FOLLOWING CONTROLS ARE SUPPLIED AND INSTALLED BY OTHERS: STARTER COIL
- CAUTION: IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105 DEGREES C., EXCEPT FOR SENSOR LEAD WIRE WHICH MUST BE 150 DEGREES C.
- LINE AND BLOWER MOTOR BRANCH CIRCUIT WIRE SIZE SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROP BEYOND FIVE PERCENT OF SUPPLY LINE VOLTAGE.
- USE #14 GA. WIRE FOR LINE WIRING ON UNIT.
- USE #18 GA. WIRE FOR 24 VOLT CONTROL WIRING ON UNIT.
- ON 208/230V. UNITS THE CONTROL TRANSFORMER HAS A DUAL VOLTAGE PRIMARY. FOR 230V. UNITS USE BLACK AND YELLOW LEADS (CAP RED). FOR 208V. UNITS USE BLACK AND RED LEADS (CAP YELLOW). ON 115/460V. UNITS THE CONTROL TRANSFORMER IS A SINGLE VOLTAGE PRIMARY. FOR 115/460V. UNITS USE BLACK AND YELLOW LEADS.
- WHEN PROVIDING OR REPLACING FUSES IN THE FUSIBLE DISCONNECT SWITCH USE DUAL ELEMENTS TIME DELAY FUSES AND SIZE ACCORDING TO 1.25 TIMES THE MAXIMUM TOTAL INPUT AMPS.
- DISCONNECT SWITCH IS FIELD FURNISHED OR AVAILABLE FROM FACTORY AS AN OPTION.

SC: AH2/AH3-AG2-CL22 WD 126687 REV. #8

## 7.4 Thermostat and Control Wiring

**CAUTION: Control circuit amps should be within the anticipator amp rating of the thermostat used.**

The heater is equipped with a low voltage (24V) control circuit.
A thermostat is not supplied with the furnace. Use either an optional or a field-provided low-voltage (24V) thermostat. Install the thermostat according to the manufacturer's instructions.
If the low voltage thermostat is equipped with a heat anticipator which levels out unit cycling for optimum temperature control, set the anticipator at 1.0 amps for standard controls. See chart below for amp ratings of 24-volt controls.

| | | | | |
|---|---|---|---|---|
| **Ampere Ratings of 24-Volt Controls** | Fan Control Coil | 0.12 amps | Spark Ignition System | 0.1 amps |
| | Time Delay Heater | 0.14 amps | Maxitrol Gas Control System | 0.51 amps |
| | RBM Relay Coil | 0.12 amps | Honeywell Gas Valve | 0.5 amps |
| | Contactor Coil | 0.45 amps | White-Rodgers Gas Valve | 0.6 amps |

| | Total Wire Length (Feet (Meters)) | Distance from Unit to Control (Feet (Meters)) | Minimum Recommended Wire Gauge |
|---|---|---|---|
| **Field Control Wiring (Length and Gauge)** | 150 (46) | 75 (23) | #18 gauge |
| | 250 (76) | 125 (38) | #16 gauge |
| | 350 (107) | 175 (53) | #14 gauge |

# 8.0 Controls

## 8.1 Combustion Air Proving Switch

The combustion air proving switch ensures that proper combustion airflow is available. The switch is a single-pole, double-throw switch, which senses pressure caused by the flow of combustion air from the venter. The switch is designed to close when a decreasing pressure is sensed in the outlet duct of the gas collection box.

On startup when the furnace is cold, the sensing pressure is at the most negative level, and as the furnace and the flue system warm-up, the sensing pressure becomes less negative. After the system has reached equilibrium (approximately 20 minutes), the sensing pressure levels off. If a restriction or excessive flue length or turns cause the sensing pressure to become less than the switch setpoint, the pressure switch will function to shut off the main burners. The main burners will remain off until the system has cooled and/or the flue system resistance is reduced. The table below gives approximate water column negative pressure readings and switch setpoints for sea level operating conditions.

| Startup Cold | Equilibrium | Factory Setpoint |
|---|---|---|
| −1.0 IN WC | −0.70 IN WC | −0.58 ± 0.05 IN WC |

**NOTE:** These settings apply to furnaces that are **not** equipped with gas modulation Option AG39 or AG40. For pressure switch settings for units equipped with Option AG39 or AG40 (refer to Paragraph 8.4.4).

**DANGER**

**Safe operation requires proper venting flow. Never bypass the combustion air proving switch or attempt to operate the unit without the venter running and proper flow in the vent system. Hazardous condition could result (refer to Hazard Levels, page 2).**

## 8.2 Fan Control

**Service NOTES:** To replace the fan control on units manufactured *before* NOV 2004, a replacement kit is required—order **PN 209184**. *Before* OCT 2003, the fan control was optional. Check the wiring diagram on the furnace.

1. A fan control provides for the following control of the field-supplied blower.
   (a) After the gas valve opens, there is a time delay of blower operation to prevent the discharge of cold air.
   (b) Blower operation continues after the thermostat is satisfied as determined by the fan time delay.
2. To be sure that the blower can continue to operate, the power supply to the furnace **MUST NOT** be interrupted **except** when servicing the unit.
3. If the customer wants the furnace off at night, the gas valve circuit SHOULD BE OPENED by a single pole switch wired in series with the thermostat. Some thermostats are provided with this feature. Multiple units controlled from a single thermostat are shut off in the same manner. For proper operation, be sure the fan control wiring is observed.

## 8.3 Limit Control

All models are equipped with an automatic, non-adjustable reset limit control that acts to interrupt the electric supply to the redundant main operating valve in case of motor failure or lack of airflow due to restrictions at the inlet or outlet.

## 8.0 Controls (Continued)

## 8.4 Gas Controls

### 8.4.1 Operating Valve

All furnaces are equipped with a 24-volt combination valve which includes the automatic electric on-off valve controlled by the room thermostat, the pressure regulator, the safety pilot valve, and the manual shutoff valve. The standard gas valve allows for single-stage control from a single-stage, 24-volt thermostat.

**WARNING**

**The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting the unit to ensure positive closure (refer to Hazard Levels, page 2).**

### 8.4.2 Optional Two-Stage Operation—Heating Only Application

The standard combination control valve is replaced with a two-stage combination gas control valve providing for low fire or high fire operation controlled by a two-stage thermostat. First stage (low fire) is factory set (not field adjustable). Both high and low stages are controlled by a Servo regulator, maintaining constant gas input under wide variations in gas supply pressure. See instructions packed with the unit for specific gas valve specifications, wiring, and operating instructions.

### 8.4.3 Optional Two-Stage Operation—Makeup Air Application

Two-stage makeup air units are equipped with a two-stage gas valve, but instead of control from a two-stage room thermostat, the outlet air temperature is monitored and controlled by a two-stage ductstat. When the discharge air temperature drops to the setpoint, low fire is energized. If low fire cannot satisfy the ductstat setting, high fire is energized.

Makeup air applications are usually adjusted to discharge an outlet air temperature between 65°F and 75°F. In all applications, the allowable temperature rise of the furnace in the installation dictates the limits of the ductstat temperature setting.

Depending on the option selection, the sensor is either connected by capillary tubing to the unit-mounted ductstat (**FIGURES 26A and 26B**) or electrically connected to a remote electronic temperature selector (**FIGURE 27**). Refer to Paragraph 6.4.5 for instructions on locating the sensor in the ductwork.

**Optional Ductstat with Capillary Tubing (Option AG3):** The control illustrated in **FIGURE 26A** has an adjustable range from 0–100°F with a fixed differential of 3°F. Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting exactly. After the installation is complete, adjust the setpoint of the ductstat to achieve the desired average outlet air temperature.

**FIGURE 26A. Ductstat Control in Option AG3**

Adjustable range 0–100°F with a fixed differential of 3°F.

**Factory-set at 70°F**

**FIGURE 26B. Ductstat Bulb (Factory-Installed)**

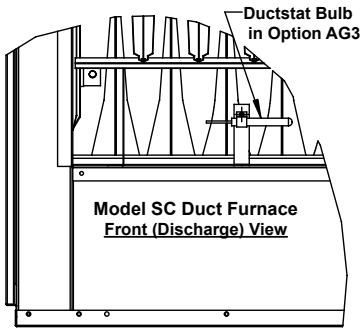



**FIGURE 27. Remote Temperature Selector (A) and Stage-Adder Module (B) in Two-Stage Makeup Air Control Option AG15**

**CAUTION: Be sure heat/cool selector switch is set at "Heat" position.**


**Optional Ductstat with Electronic Remote Setpoint Module (Option AG15):** The sensing probe is field-wired to a remote temperature selector. The temperature selector has an operating range to 120°F. The remote modules are shipped separately for field installation.

Follow the wiring diagram with the unit and the manufacturer's instructions for wiring and installation.

There will be one module for selecting temperature and one-stage adder module as illustrated in **FIGURE 27**.

## 8.4.4 Optional Electronic Modulation

The type and capability of the electronic modulation system, depends on the option selected.

**Installation NOTE**: Sizes 350 and 400 with electronic modulation require a minimum of 6 IN WC natural gas supply pressure.

**FIGURE 28. Amplifier in Options AG7, AG8, and AG9**

### Electronic Modulation between 50% and 100% Firing Rate (Options AG7, AG8, AG9)

Depending on the heat requirements as established by the thermistor sensor, the burner modulates between 100% and 50% firing. The thermistor is a resistor that is temperature sensitive in that as the surrounding temperature changes, the Ohms resistance changes through the thermistor. This change is monitored by the solid state control center (amplifier) which furnishes varying DC current to the modulating valve to adjust the gas input.

Each modulating valve is basically a regulator with electrical means of raising and lowering the discharge pressure. When no DC current is fed to this device, it functions as a gas pressure regulator, supplying 3.5 IN WC pressure to the main operating valve.

Refer to the wiring diagram supplied with the furnace for proper wiring connections. Electronic modulation for heating controlled by a specially designed room thermostat (60–85°F) is identified as Option AG7. Electronic modulation control systems for makeup air applications controlled by a field-installed duct sensor (refer to Paragraph 6.4.5) and temperature selector (55–90°F) are identified as either Option AG8 or Option AG9. The temperature selector setting for Option AG8 is on the amplifier; Option AG9 has a remote temperature selector. Both systems are available with an override thermostat.

**FIGURE 29. Maxitrol Signal Conditioner in Options AG21 and AG40**

### Computer Controlled Electronic Modulation between 50% and 100% Firing Rate (Option AG21)

With this option the furnace is equipped with a Maxitrol signal conditioner which operates much the same way as the amplifier above to control the regulator valve. The conditioner accepts an input signal of either 4–20 milliamps or 0–10 volts from a customer-supplied control device such as a computer. With the dip switches on the conditioner in the "on" positions, the conditioner accepts a 4–20 milliamp signal. In the "off" positions, the conditioner accepts a 0–10V signal. The conditioner converts the signal to the 0–20V DC current required to control the modulating valve.

### Electronic Modulation between 20 and 28% and 100% Firing Rate (U.S. Patent 6,109,255), Option AG39 not available on size 350 (available with natural gas only)

Depending on the size, furnaces equipped with electronic modulation Option AG39 have a 20–28% turndown ratio. The furnace will ignite at any input rate in the available range and will maintain average thermal efficiencies equal to or greater than the thermal efficiency at full fire.

| Model SC with AG39 or AG40 | Maximum Turndown | MBH Input Range | Inlet Pressure to Modulating Valve (Factory-Set) | Gas Supply Pressure Required |
|---|---|---|---|---|
| SC 100 | 20% | 20–100 | 3.8 IN WC | 5 IN WC |
| SC 125 | 20% | 25–125 | 3.9 IN WC | 5 IN WC |
| SC 150 | 27% | 40.3–150 | 3.7 IN WC | 5 IN WC |
| SC 175 | 23% | 40.3–175 | 3.7 IN WC | 5 IN WC |
| SC 200 | 26% | 51.8–200 | 3.9 IN WC | 5 IN WC |
| SC 225 | 23% | 51.8–225 | 3.9 IN WC | 5 IN WC |
| SC 250 | 28% | 69–250 | 4.0 IN WC | 5 IN WC |
| SC 300 | 23% | 69–300 | 4.0 IN WC | 5 IN WC |
| SC 400 | 25% | 100–400 | 4.4 IN WC | 6 IN WC |

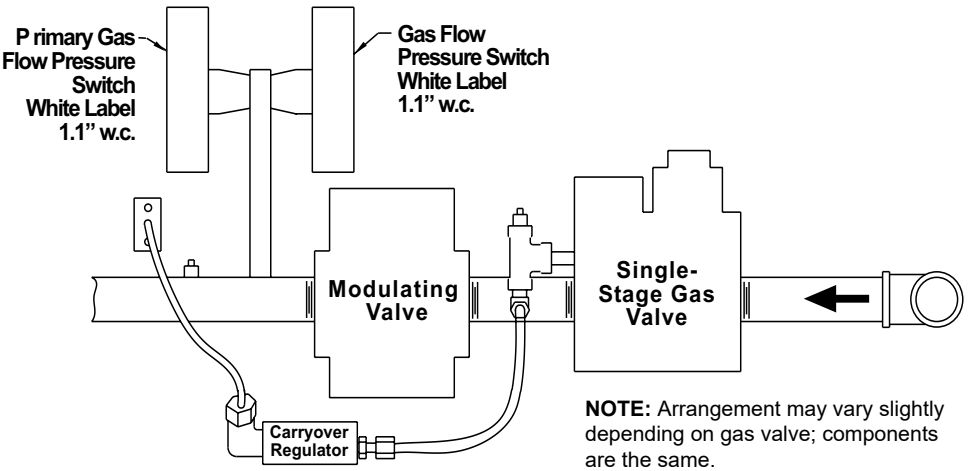
The gas train includes a single-stage gas valve, a modulating valve, and two gas pressure switches. The burner rack is equipped with one flash carryover and a regulated gas lighter tube system. The carryover lighter tube receives its gas supply through the regulator, simultaneously with the gas to the burner. Control of the system is through a Maxitrol amplifier with a corresponding remote temperature dial.

## 8.0 Controls (Continued)

## 8.4 Gas Controls (Continued)

### 8.4.4 Optional Electronic Modulation (Continued)

**FIGURE 30. Option AG39 Manifold Arrangement**




**Description of Operation of Option AG39**

The gas supply (see pressure requirements in the table above) connects to the single-stage gas valve. To compensate for additional pressure loss through the modulating valve, the single-stage gas valve has a custom outlet pressure setting higher than when it is used on a standard gas manifold. The pilot tubing connects to the pilot port on the single-stage gas valve. When the valve receives a call for heat from the amplifier and pilot is established, gas flow from the single-stage valve goes to both the modulating valve and the regulated lighter tube system. When the signal from the amplifier to the modulating valve requires less-than-high fire operation, the modulating valve functions to lessen the gas flow to the burner to reduce the input rate to that required to maintain the desired temperature. When the input rate is reduced enough to decrease the gas pressure to 1.1 IN WC, the primary gas pressure switch in the manifold activates the gear motor that controls the bypass damper in the venter/combustion air system. The bypass damper opens diverting some of the incoming air directly into the flue duct, reducing airflow through the burner. Safety switches monitor the position of the bypass damper. When the gas pressure increases above 1.1 IN WC, the bypass damper closes.

**Combustion Air Pressure Switch Settings (Options AG39 and AG40)**

This uniquely designed modulation system requires combustion air pressure settings different from the standard system. The approximate settings for the combustion air proving switch at sea-level operation are:

| Sizes with AG39 & 40 | Startup Cold | Equilibrium at Full Rate | Factory Setting |
|---|---|---|---|
| 100–225 | −1.3 IN WC ± 0.2 | −1.05 IN WC ± 0.1 | −1.0 IN WC ± 0.02 |
| 250–400 | −1.2 IN WC ± 0.2 | −0.95 IN WC ± 0.1 | −0.70 IN WC ± 0.05 |

**Sensor Location (Options AG39)**

The duct temperature sensor is shipped loose for field installation. Refer to Paragraph 6.4.5 for determining the sensor location.

**Wiring and Service (Options AG39 and AG40)**

For wiring, consult the wiring diagram attached to the furnace. All wires in the electrical box connecting the modulation controls must have a temperature rating of 150°C. This is a unique system which includes custom-built components and custom settings. If service is required, follow the general troubleshooting guide on page 37 and the special troubleshooting guides in **FIGURE 31**.

**Computer Controlled Electronic Modulation between 20–28% and 100% Firing Rate, Option AG40 not available on size 350** (natural gas only)

With this option the furnace is equipped with a Maxitrol signal conditioner (see **FIGURE 29B**), which accepts an input signal of either 4–20 milliamps or 0–10 volts from a customer-supplied control device such as a computer. With the dip switches on the conditioner in the "on" positions, the conditioner accepts a 4–20 milliamp signal. In the "off" positions, the conditioner accepts a 0–10V signal. The conditioner converts the signal to the 0–20V DC current required to control the modulating valve. The heater functions and is equipped in the same way as described for Option AG39 except that with computer control, the temperatures are selected through the software and there is no temperature selector or duct sensor.

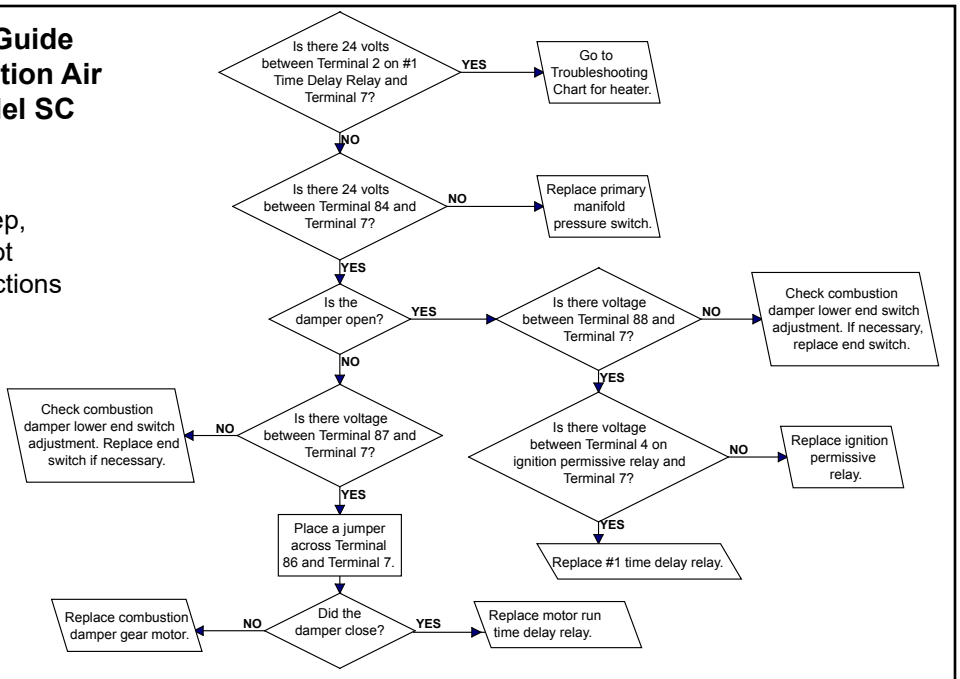
**FIGURE 31- Troubleshooting Guide for Checking Bypass Combustion Air Damper Safety Circuit on Model SC with Option AG39 or AG40**

**General Instructions:** For each step, check to ensure that the wiring is not defective and that the wiring connections are secure.

**Symptom 1:**

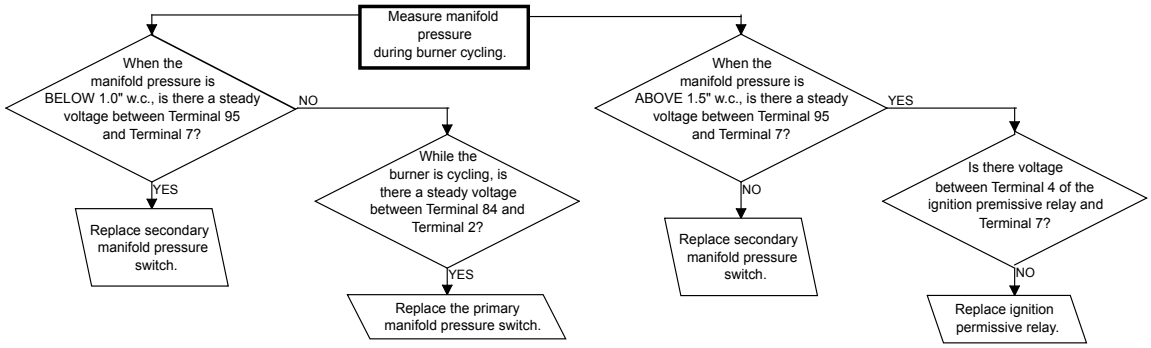
**Main burners are inoperative.**

**Assumes that 24 volts is available between Terminal 2 and Terminal 7.**




**Symptom 2: Steady call for heat—burner cycles.**

**Assumes that 24 volts is available between Terminals 11 and 7 and Terminals 2 and 7.**




## 8.5 Pilot Ignition Systems

**CAUTION: Due to high voltage on pilot spark wire and pilot electrode, do not touch when energized.**

**Ignition System:** Natural gas units are equipped with a spark ignited intermittent safety pilot system that shuts off the pilot gas flow between heat cycles. Propane units (or as an option on natural gas units) require a lockout device that stops the gas flow to the pilot if the pilot fails to light in 120 seconds. The lockout device has a 1-hour retry or can be manually reset by interruption of the thermostat circuit. Refer to the wiring diagram supplied with the unit for pilot system identification and proper wiring. Pilot with lockout is Option AH3; spark pilot without lockout is Option AH2.

**Ignition Controller:** As part of the intermittent safety pilot systems, the ignition controller provides the high voltage spark to ignite the pilot gas and also acts as the flame safety device. After ignition of the pilot gas, the ignition controller electronically senses the pilot flame. A low voltage DC electrical signal is imposed on the separate metal probe in the pilot assembly. The metal probe is electrically insulated from ground. The pilot flame acts as a conduction path to ground completing the DC circuit and proving pilot flame. Proper operation of the electronic spark ignition system requires a minimum flame signal of 0.2 microamps as measured by a microampmeter. With pilot flame proven, the ignition controller energizes the main gas valve.

**Pilot:** All pilots are vertical, target type with lint-free feature. Pilot flame should be approximately 1-1/4" in length. Pilot gas pressure should be the same as the supply line pressure. Pilot gas is supplied through the combination valve; the pilot gas flow is controlled by an adjustment screw located in the valve body. For maintenance, refer to Paragraph 10.2.

## 8.0 Controls (Continued)

## 8.6 Burners, Orifices, and Carryover System

**Burners:** Individually formed steel burners capable of operating on either natural or propane gas are used in this heater. These burners have accurate, machine-formed ports to give controlled flame stability and operation without lifting or flashback. All burners are lightweight and factory mounted in an assembly which permits all of the burners to be removed as a unit for inspection or service.

**Burner Carryover Systems:** All natural gas burners (except when equipped with electronic modulation Option AG39 or AG40) are equipped with two flash carryover systems, one on each end of the burner rack.

**NOTE:** A natural gas burner rack on furnaces manufactured prior to Series 6 had a gas lighter tube carryover and one flash carryover.

**FIGURE 32A. Natural Gas Burner Rack (does not apply to furnaces with Option AG39 or AG40)**

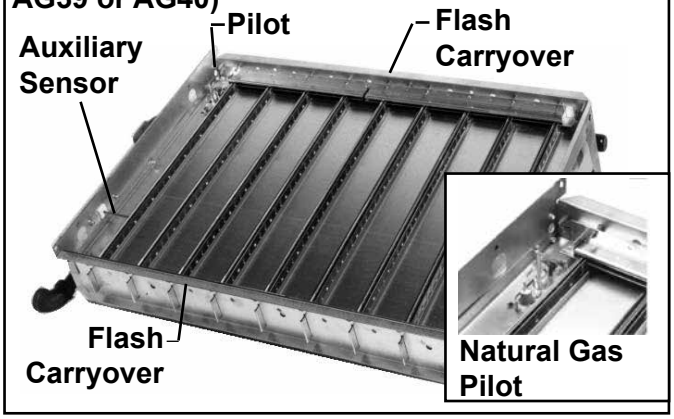
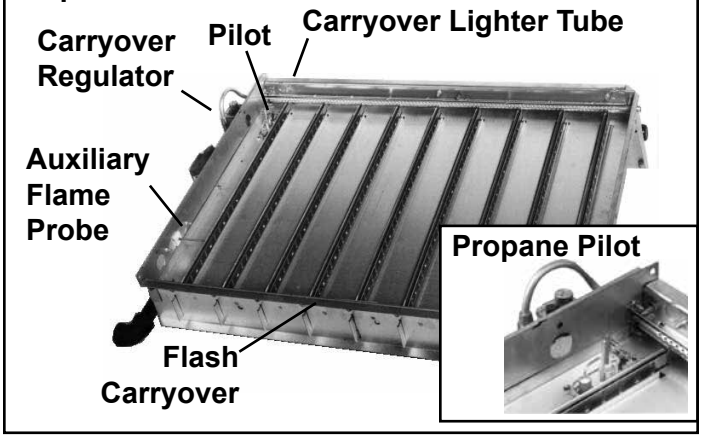



**FIGURE 32B. Burner Rack with Pilot for Propane**




All propane gas burners are equipped with one flash carryover and a regulated gas lighter tube system. The carryover lighter tube receives its gas supply through a regulator, simultaneously with the gas to the burner orifices.

| Model SC Size | | | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Burner Orifice | | Qty | 4 | 5 | 7 | 7 | 9 | 9 | 12 | 12 | 14 | 16 |
| | Natural Gas | Drill Size | #41 | #42 | #44 | #42 | #43 | #42 | #44 | #42 | #42 | #42 |
| | | PN | **11792** | **84437** | **11833** | **84437** | **11828** | **84437** | **11833** | **84437** | **84437** | **84437** |
| | Propane | Drill Size | 1.45 mm | 1.45 mm | #55 | 1.45 mm | #55 | 1.45 mm | #55 | 1.45 mm | 1.45 mm | 1.45 mm |
| | | PN | 61652 | 61652 | 11830 | 61652 | 11830 | 61652 | 11830 | 61652 | 61652 | 61652 |
| Carryover Orifice | Propane | Drill Size | #70 | #70 | #65 | #65 | #65 | #65 | #59 | #59 | #56 | #56 |
| | | PN | **9870** | **9870** | **9680** | **9680** | **9680** | **9680** | **10370** | **10370** | **9791** | **9791** |

During regular service, check the main burner ports, the carryover assemblies, and the orifices for cleanliness.

**Burner Orifices:** Heaters are shipped with orifices of proper size and type for gas specified.

**NOTE:** Natural gas units have a dual flash carryover system and do not require a carryover orifice.

**Burner Air Shutters:** Air shutters are required on propane units, optional on natural units. A slotted screw on the end of the manifold bracket moves air shutters and adjusts all burners simultaneously (see **FIGURE 33**). Turning the screw clockwise opens the air shutter; counterclockwise closes shutter.

After the furnace has been in operation for 15 minutes, close air shutter until the flame turns yellow. Open shutter until yellow disappears.

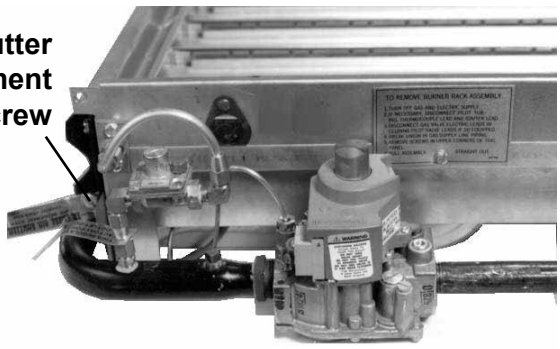



**FIGURE 33. Propane Burner Rack Showing Burner Air Shutter Adjustment Screw**

**DANGER**

**Failure to adjust air shutters according to directions could cause property damage, personal injury, and or death.**

# 9.0 Commissioning and Startup

## 9.1 Check the installation *prior to* startup

☐ Verify suspension/mounting methods and clearances (refer to Paragraphs 4.1 and 5.0).

☐ Verify that the bolts removed from the shipping clips were returned to the heater cabinet (refer to Paragraph 3.1).

☐ Check duct connections (refer to Paragraph 6.4.4).

☐ Check venting (refer to Paragraph 6.3). Be sure that flue discharge and combustion air openings are free of obstructions.

☐ Be sure electrical entrance and gas supply pipe openings are sealed.

☐ **If equipped, b**e sure that the condensate drain is open (refer to Paragraph 6.1).

**Electrical Checks:**

☐ Be certain the electrical supply matches voltage rating of the furnace. Refer to the rating plate.

☐ Check all field wiring against the wiring diagram. Be sure that wire gauges are as required for the electrical load.

☐ Check that fuses or circuit breakers are in place and sized correctly.

**Gas Supply Checks:**

☐ Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air (refer to Paragraph 6.2).

a) Turn manual shutoff valve to off position.

b) Turn gas supply on.

c) Observe gas meter for movement, or

d) Attach pressure gauge readable to 0.1 IN WC and after turning gas on for ten seconds, turn gas supply off. No change in pressure should occur over a three-minute period.

e) If either c) or d) above indicate a leak, locate leak by brushing a soapy solution on all fittings. Bubbles will appear at a leak. Repair and repeat tests.

## 9.2 Startup

☐Close all panels tightly. Turn electric and gas supply on to the furnace. Adjust the thermostat or ductstat so that a call for heat exists. Observe for complete sequencing of safety pilot and ignition.

**Operating Sequence**

1. Set the thermostat switch at its lowest setting.
2. Turn on power.
3. Turn on the manual gas valves.
4. Set thermostat at desired setting.
5. Thermostat calls for heat
   - **(a)** The venter motor is energized after 15-second (approximate) time delay.
   - **(b)** Venter flow switches from N.C. to N.O. contacts, energizing the pilot gas valve and spark gap to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires at full rate.
   - **(c)** If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap. On unit equipped with a controller with lockout, if the pilot is not established within 120 seconds (approximately), the unit locks out for one hour or must be reset by interrupting the power to the control circuit (see Lighting Instructions).
6. Blower motor operates from fan time delay.
7. Thermostat is satisfied.
   - **(a)** Solenoid gas valve de-energized.
   - **(b)** Pilot gas valve de-energized.
   - **(c)** Ignition controller de-energized.
   - **(d)** Time delay relay keeps venter motor on for approximately one minute (post purge).
8. To shut down, set thermostat to lowest setting. Blower motor remains on as determined by fan time delay.

## 9.0 Commissioning and Startup (Continued)

### 9.3 Check Installation *after* Startup

- ☐ Observe burner flame at full fire. Natural gas flame should be about 1-1/2" in height with blue coloring. Propane gas flame should be approximately the same length with blue coloring. Yellow tipping may appear on propane gas. If yellow extends beyond 1/2" to 3/4", adjust air shutters (refer to Paragraph 8.6). If shutter adjustment will not reduce yellowing, check for gas leaks at the control manifold or orifice fitting.
- ☐ Turn the unit off and on, pausing two minutes between each cycle. Observe for smooth ignition. On two-stage or modulating burner systems, manipulate temperature adjustment slowly up and down to see if control is sequencing or modulating properly. Raising temperature setting drives burner on or to full fire.
- ☐ Using a manometer or slant gauge readable up to 14 IN WC, check orifice manifold for operating pressure on full fire. Natural gas should be 3.5 IN WC at this point. Propane should be 10 IN WC at this point. Variations from these pressures are not recommended, as ignition and efficiency performance can be adversely affected by improper pressure adjustment (refer to Paragraph 6.2).
- ☐ Place "Owner's Envelope" containing Limited Warranty Card, this booklet, and any optional information in an accessible location near the heater. Follow the instructions on the envelope.

**DANGER**

**The gas burner in this gas-fired equipment is designed and equipped to provide safe, controlled complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion which produces carbon monoxide, a poisonous gas that can cause death. Safe operation of separated-combustion, indirect-fired gas burning equipment requires a sealed, properly operating vent system which vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH. Install either the horizontal or vertical combustion air/vent system illustrated in Paragraph 6.3 using the concentric adapter supplied. Always comply with the combustion air requirements in the installation codes and instructions. Combustion air at the burner should be regulated only by manufacturer-provided equipment. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER. CHECK THE COMBUSTION AIR/VENT SYSTEM FOR SOUNDNESS AND FUNCTION; MAINTAIN IT IN PROPER OPERATING CONDITION.**

## 10.0 Maintenance and Service

**WARNING**

**If you turn off the power supply, turn off the gas (refer to Hazard Levels, page 2).**

This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a furnace that is operating under normal conditions should be inspected every four months. If the furnace is operating in an area where an unusual amount of dust or soot or other impurities are present in the air, more frequent inspection is recommended.

### 10.1 Maintenance Schedule

The following procedures should be carried out at least annually (refer to Paragraphs 10.2.1 through 10.2.7 for instructions).

- ☐ Check the gas valve to ensure that gas flow is being shut off completely.
- ☐ Clean the heat exchanger both internally and externally.
- ☐ Check the pilot burner and main burners for scale, dust, or lint accumulation. Clean as needed.
- ☐ Check the vent/combustion air system; inspect all joints. Replace any parts that do not appear sound.
- ☐ Check the wiring for any damaged wire. Replace damaged wiring (refer to Paragraph 7.0 for wiring requirements).

**CAUTION: When cleaning, wearing eye protection is recommended.**

**NOTE: Use only factory-authorized replacement parts.**

## 10.2 Maintenance Procedures

### 10.2.1 Gas Valve

**WARNING**

**The operating valve is the prime safety shutoff. All gas supply lines must be free of dirt or scale before connecting to the unit to ensure positive closure (refer to Hazard Levels, page 2).**

Remove external dirt accumulation and check wiring connections. The combination gas valve must be checked annually to ensure that the valve is shutting off gas flow completely.

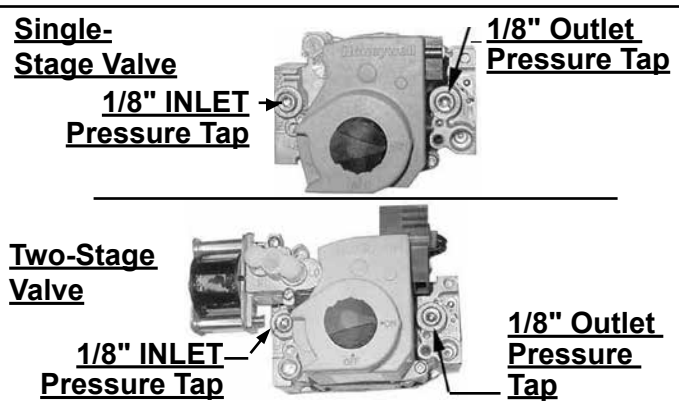
**Instructions**:

**1)** Locate the 1/8" FPT **INLET** pressure tap on the combination valve (**FIGURE 34**).

**2)** With the manual valve turned off to prevent flow to the gas valve, connect a manometer to the 1/8" inlet pressure tap in the valve. **NOTE:** A manometer (fluid-filled gauge) with an inches water column scale is recommended.

**CAUTION: DO NOT bottom out the gas valve regulator adjusting screw. This can result in unregulated manifold pressure causing excess overfire and heat exchanger failure.**

**FIGURE 34. Top View of Gas Valves**




**3)** With the field-installed manual valve remaining closed, turn the thermostat up to fire the unit and allow the unit to go through one trial for ignition. Reset the thermostat to shut the unit off. Observe the manometer for two to three minutes for an indication of gas pressure. No pressure should be indicated on the manometer. **If the manometer indicates a gas pressure**, the field-installed manual gas valve must be replaced or repaired before the combination gas valve can be checked.

**4)** **If the manometer does not indicate gas pressure**, slowly open the field-installed manual gas valve. After the manometer's indicated gas pressure has reached equilibrium, close the manual shutoff valve. Observe the gas pressure. There should be no loss of gas pressure on the manometer. If the manometer indicates a loss of pressure, replace the combination gas valve before placing the heater in operation.

**NOTE:** Operational pressure settings and instructions for checking pressure settings are in Paragraph 6.2.

### 10.2.2 Vent/ Combustion Air System

Check at least once a year. Inspect all joints, seams, and terminal caps. Clean grills and screens.

Replace any parts that need to be replaced.

### 10.2.3 Burner Rack Removal Instructions

1. Turn off the gas supply.
2. Turn off the electric supply.
3. Remove control access side panel.
4. Disconnect the pilot tubing and flame sensor lead.
5. Mark and disconnect electric valve leads.
6. Uncouple the union in the gas supply.
7. Remove sheetmetal screws in the top corners of the burner rack assembly.
8. Pull "drawer-type" burner rack out of the furnace.

**To disassemble the burner rack:**

1. Remove Carryover System

   **Natural Gas:** Remove the flash carryover system from the "manifold end" of the burner rack.

   **NOTE:** Natural gas burner racks manufactured prior to Series 6 have a lighter tube carryover system. Break the lighter tube connection at the orifice and remove the supply tubing, the drip shield and the lighter tube.

## 10.0 Maintenance and Service (Continued)

## 10.2 Maintenance Procedures (Continued)

### 10.2.3 Burner Rack Removal Instructions (Continued)

**Propane:** Break the lighter tube connection at the regulator and remove the lighter tube orifice supply tubing; remove the retaining screws in the drip shield and the shield; remove the retaining screws and slide out the lighter tube.

2. Pull main burners horizontally away from injection opening and lift out.
3. Remove manifold bracket screws and remove manifold.
4. Remove the main burner orifices.
5. Remove screws and lift out pilot burner.

Follow the instructions in Paragraph 10.2.3 to clean. To re-assemble and replace, reverse the above procedures being careful not to create any unsafe conditions.

**CAUTION: When cleaning, wearing eye protection is recommended.**

**Cleaning Pilot and Main Burners**

In the event the pilot flame is short and/or yellow, check the pilot orifice for blockage caused by lint or dust accumulation. Remove the pilot orifice and clean with air pressure. DO NOT REAM THE ORIFICE. Check and clean the aeration slot in the pilot burner.

Clean the metal sensing probe and the pilot hood with an emery cloth and wipe off the ceramic insulator. Check the spark gap; spark gap should be maintained to 7/64". After the pilot is cleaned, blow any dirt away with compressed air.

Clean main burners and burner orifices using air pressure. Use an air nozzle to blow out scale and dust accumulation from the burner ports. Alternately blow through the burner ports and the venturi. Use a fine wire to dislodge any stubborn particles in the burner ports. Do not use anything that might change the port size.

Clean the burner rack carryover systems with air pressure.

### 10.2.4 Spark Ignition System

The ignition controller provides the high voltage spark to ignite the pilot service and also acts as the flame safety device. After ignition of the pilot gas, the controller electronically senses the pilot flame. A separate solid metal probe in the pilot burner assembly is used to sense the flame. A low voltage DC electrical signal is imposed on the metal probe which is electrically insulated from ground. When the pilot flame impinges on the sensing probe, the flame acts as a conduction path to ground. This completes the DC circuit; the ignition controller responds by energizing the main gas valve. **Proper operation of the electronic spark ignition system requires a minimum flame signal of 0.2 micro-amps as measured by a micro-ampmeter.**

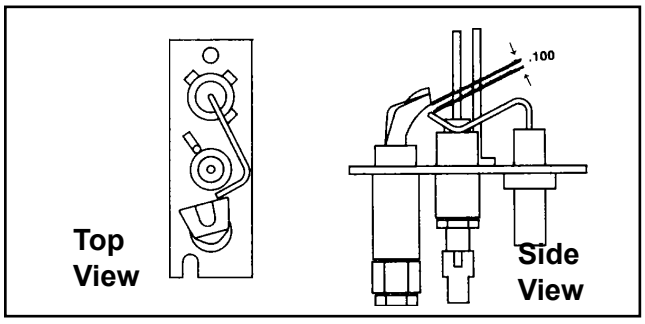
**CAUTION: Due to high voltage on pilot spark wire and pilot electrode, do not touch when energized (refer to Hazard Levels, page 2).**

If no spark occurs, check the following:

a) Voltage between Terminals TH and 7 should be at least 20 volts and no higher than 32 volts. Refer to Troubleshooting (Paragraph 10.3) if no voltage is observed.
b) Short to ground in the high tension lead and/or ceramic insulator.
c) Pilot spark gap should be approximately 0.100" (see **FIGURE 35**).

**NOTE:** When checking for spark with the pilot burner assembly removed from the burner rack, the pilot assembly must be grounded to the heater for proper spark.

**FIGURE 35. Spark Gap**




If the above conditions are normal and no spark occurs, replace the ignition controller.

If the main gas valve fails to open with a normal full size pilot flame established, check for the following:

**Service NOTE:** If replacing an earlier model of ignition controller, order replacement kit **PN 257472** for a unit with recycling gas control Option AH2 or **PN 257473** for Option AH3 gas control with lockout. Option codes are listed on the unit wiring diagram.

**Ignition Controller with Lockout, UTEC 1003-514, PN 257010, for Option AH3 Gas Control**

**Recycling Ignition Controller, UTEC 1003-638A, PN 257009, for Option AH2 Gas Control**

a) If voltage between black and brown leads on the main gas valve is 20 to 32 VAC and there is no main gas flow with the built-in manual valve in FULL OPEN position, the main valve is defective.
b) If there is no voltage between black and brown leads on the main gas valve, check for disconnected or shorted flame sensor lead or flame sensor probe.

When the above conditions are normal and the main gas flow is still off, the ignition controller is probably defective. Do not attempt to service the ignition controller; it does not contain any replaceable components.

### 10.2.5 Cleaning the Heat Exchanger

**Outer Surfaces (Circulating Air Side):** To clean the outer surfaces of the heat exchanger, gain access by removing the inspection panels in the ductwork or remove the ductwork.

Remove the baffles between the heat exchanger tubes; see **FIGURE 1**, page 5.

**NOTE**: If the heater has been converted to high CFM (look for conversion label on the unit), these baffles will have already been removed.

To remove the baffles, remove the screws marked "A" in **FIGURE 1**, and slide each baffle forward. Use a brush and/or an air hose to remove accumulated dust and grease deposits from the heat exchanger tubes and the baffles. Re-install the baffles by sliding them into the slot in the other end of the heat exchanger and replacing the screws. Secure ductwork as necessary.

**Inner Surfaces (Combustion Gas Side):** The inner surfaces of the heat exchanger can be reached for cleaning with the burner rack removed (refer to Paragraph 10.2.3). An air hose; a long (18–24"), 1/2" diameter stiff brush; a flashlight; and a mirror are needed. Clean the inner surface of the heat exchanger from beneath using the brush to "scrub" the tube walls to remove any accumulated dust, rust, and/or soot.

Re-assemble the furnace. Check for proper operation.

### 10.2.6 Venter Motor

Power venter motors are permanently lubricated. No oiling is required.

### 10.2.7 Limit Control Check

With the heater on, completely block off the distribution air. The limit control should open within a few minutes, shutting off gas supply to the main burners.

## 10.3 Troubleshooting

**Reference:** If the furnace is equipped with electronic modulation Option AG39 or AG40, consult the troubleshooting chart, **FIGURE 31**, page 31.

| Symptom | Probable Cause | Remedy |
|---|---|---|
| **Venter motor will not start** | **1.** No power to furnace | **1.** Turn on power and check supply fuses or circuit breaker |
| | **2.** No 24-volt power to venter relay | **2.** Turn up thermostat and check control transformer output; check for loose or improper wire connections |
| | **3.** Venter relay defective | **3.** Replace relay |
| | **4.** Defective motor or capacitor | **4.** Replace defective part |
| **Pilot will not light (venter operating)** | **1.** Manual valve not open | **1.** Open manual valve |
| | **2.** Air in gas line | **2.** Bleed gas line |
| | **3.** Dirt in pilot orifice | **3.** Remove and clean with compressed air or solvent |
| | **4.** Gas pressure too high or too low | **4.** Adjust supply pressure (refer to Paragraph 6.2) |
| | **5.** Kinked pilot tubing | **5.** Replace tubing |
| | **6.** Pilot valve does not open | **6.** If 24-volt power is available at valve, replace valve |

# 10.0 Maintenance and Service (Continued)
## 10.3 Troubleshooting (Continued)

| Symptom | Probable Cause | Remedy |
|---|---|---|
| **Pilot will not light (venter operating) (continued)** | **7.** No spark | **7.** Proceed as follows: |
| | **a)** Loose wire connections | **a)** Ensure that all wires connections are solid |
| | **b)** Transformer failure | **b)** Ensure that 24-volt power is available |
| | **c)** Incorrect spark gap | **c)** Maintain spark gap at 0.1" |
| | **d)** Spark cable shorted to ground | **d)** Replace worn or grounded spark cable |
| | **e)** Spark electrode shorted to ground | **e)** Replace pilot if ceramic spark electrode is cracked or grounded |
| | **f)** Drafts affecting pilot | **f)** Ensure that all panels are in place and tightly secured to prevent drafts at pilot |
| | **g)** Ignition control not grounded | **g)** Ensure that ignition control is grounded to furnace chassis |
| | **h)** Faulty ignition controller | **h)** If 24 volt is available to the ignition controller and all other causes have been eliminated, replace ignition control |
| | **8.** Optional lockout device interrupting control circuit by above causes | **8.** Reset lockout by interrupting control at thermostat |
| | **9.** Faulty combustion air proving switch | **9.** Replace combustion air proving switch |
| **Pilot lights (main valve will not open)** | **1.** Manual valve not open | **1.** Open manual valve |
| | **2.** Main valve not operating | **2.** Proceed as follows: |
| | **a)** Defective valve | **a)** If 24-volt power is available at valve connections and valve remains closed, replace valve |
| | **b)** Loose wire connections | **b)** Check and tighten all wiring connections |
| | **3.** Ignition control does not power main valve | **3.** Proceed as follows: |
| | **a)** Loose wire connections | **a)** Check and tighten all wiring connections |
| | **b)** Flame sensor grounded (pilot lights; spark continues) | **b)** Ensure that flame sensor lead is not grounded or that insulation or ceramic is not cracked; replace as required |
| | **c)** Gas pressure incorrect | **c)** Adjust gas pressure (refer to Paragraph 6.2) |
| | **d)** Cracked ceramic at sensor | **d)** Replace sensor |
| | **e)** Faulty ignition controller | **e)** Refer to Paragraph 10.2.4: if all checks indicate no other cause, replace ignition controller; d**o not** attempt to repair ignition controller, which has no field replaceable parts |
| **No heat (heater operating)** | **1.** Dirty filters in blower system | **1.** Clean or replace filters |
| | **2.** Incorrect manifold pressure or orifices | **2.** Check manifold pressure (refer to Paragraph 6.2) |
| | **3.** Cycling on limit control | **3.** Check air throughput (refer to Paragraph 6.4) |
| | **4.** Improper thermostat location or adjustment | **4.** Refer to thermostat manufacturer's instructions |
| | **5.** Belt slipping on blower | **5.** Adjust belt tension |
| | **6.** Fan control improperly wired | **6.** Connect as per wiring diagram |
| | **7.** Defective fan control | **7.** Replace fan control |
| | **8.** Blower set for too low temperature rise | **8.** Slow down blower or increase static pressure |

# INDEX

## INSTALLATION RECORD—to be completed by the installer:

**Installer:**

Name _____

Company _____

Address _____

_____

_____

Phone _____

**Distributor (company from which the unit was purchased):**

Company _____

Contact _____

Address _____

_____

_____

Phone _____

**Model _____ Serial No._____Date of Installation _____**

SPECIFIC INSTALLATION NOTES: (i.e., Location, Amps, Gas Pressure, Temperature, Voltage, Adjustments, Warranty, etc.)

_____

_____

_____

_____

_____

## BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair

- Contact the installer listed above.
- If you need additional assistance, contact the Reznor® Distributor listed above.
- For more information, contact your Reznor® Representative by calling 800-695-1901.

Reznor®
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Mercer, PA 16137