

## Installation

Applies to: Model CAUA, Gas-Fired,  
Indoor, Vertical (Upflow),  
Power-Vented Heater



### Model CAUA

with Optional Cased Cooling Coil  
and Optional Mixing Box

### **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.

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### 1.0 General

#### 1.2 Hazard Labels and Notices

### 1.1 Application

The instructions in this manual apply to a Model CAUA heater.

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 in this Manual

### HAZARD INTENSITY LEVELS

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. See Hazard Levels, above.**

#### WARNING:

**Should overheating occur, or the gas supply fail to shut off, shut off the manual gas valve to the appliance before shutting off the electrical supply.**

#### WARNING:

**Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and replace any gas control which has been under water.**

### 1.3 General Installation

Model CAUA heaters are design-certified by the Canadian Standards Association (CSA) to ANSI Z83.8 and CSA 2.6 for industrial/commercial installations in the United States and Canada. Heaters are available for use with either natural gas or propane. The type of fuel, the firing rate, and the electrical characteristics are on the unit rating plate.

Installation of this system 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.

A Model CAUA heater requires installation of an inlet air duct or an optional inlet air base and a supply duct or an optional discharge plenum. Installation of an optional mixing box allows for a mixture of return and outside air. If the air entering the blower will ever be below 35°, the unit must have been ordered with factory-installed makeup air Option AD4 which includes required stainless steel components and a condensate drain.

This heater may be installed as a separated-combustion system (taking combustion air from outside) or as a power-vented system (taking combustion air from the space where the heater is installed). Separated-combustion units are designed to separate the air for combustion and the 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 or in buildings with negative pressure (up to .15" w.c.). If installed as a separated-combustion system, the heater must be equipped with both combustion air and exhaust piping to the outdoors. All Model CAUA heaters must be vented to the outdoors.

If ordered with an optional cooling coil, follow the instructions in Form I-CAUA-CC to install the coil and the thermostatic expansion valves. The coil will be operated with R-410A refrigerant. Follow the instructions with the MASA condenser or other matching condenser.

## 1.4 Warranty

Refer to the limited warranty information on the Warranty Form in the "Owner's Envelope".

### Warranty is void if ...

- a. Wiring is not in accordance with the diagram furnished with the heater.
- b. The unit is installed without proper clearance to combustible materials.

## 1.5 Installation Codes

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 ANSI Z223.1a (latest edition). A Canadian installation must be in accordance with the CSA B149.1 and B149.2 Installation Code for Gas Burning Appliances and Equipment. 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.

### California Warning Label

If the unit is being installed in the state of California, the installer MUST attach the warning label on the outside of the access panel. The California Warning label is shipped in the "Literature Bag". If installation is in California, select a dry, clean location on the heat section access panel and adhere the label.

### Massachusetts Requirements

If being installed in the Commonwealth of Massachusetts, this unit must be installed by a licensed plumber or licensed gas fitter.

## 2.0 Heater Location

Check the supporting structure to be used to verify that it has sufficient load-carrying capacity to support the weight of the unit. The heater must be level. Location must comply with clearances in Paragraph 4.2.

TABLE 1 - Heater Weights

Approximate Net Weight (lbs)	Size	150	200	250	300	350	400
	Weight - lbs	288	300	380	394	445	460
	Weight - kg	131	136	172	179	202	209

### WARNING:

Unit must be level for proper operation. See Hazard Levels, page 2.

### 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

## 2.0 Heater Location (cont'd)

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 installing a separated combustion system and/or wise location of the furnace with regard to exhausters or prevailing wind direction. 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 Receiving, Uncrating, and Preparing for Installation

This unit was test operated and inspected at the factory prior to crating and was in operating condition. If the heater has incurred any damage in shipment, document the damage with the transporting agency and contact an authorized Distributor. If you are an authorized Distributor, follow the FOB freight policy procedures.

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

Read this booklet and become familiar with the installation requirements of your particular heater. If you do not have knowledge of local requirements, check with the gas company or any other local agencies who might have requirements concerning this installation.

Before beginning, make preparations for necessary supplies, tools, and manpower. If any of these shipped-separate accessories listed here are part of the installation, check to be sure the required parts are at the installation site.

### Shipped-Separate Accessories

- **Cased Cooling Coil (Option C or Model ACU)** - The optional cooling coil is a cased coil designed for a Model CAUA heater. The coil is shipped separately for installation in the discharge opening of the heater. The thermostatic expansion valve kit for R410A refrigerant and the size of unit is shipped loose for field installation. Verify the coil and valve kit(s) with the list in Form I-CAUA-CC shipped in the literature envelope or with the cooling coil.
- **Vibration Isolators (Option PC)** - If vibration isolators are part of the installation, the four pads are shipped separately and must be field attached to the bottom at each corner of the unit.
- **Concentric Adapter and Vent Terminal (Option CC)** - If the heater is installed as a separated-combustion system, a concentric adapter assembly is required. The concentric adapter and parts are shipped in a separate carton. Be sure that the shipped-separate carton is at the installation site. See Paragraph 6.2.1.
- **Filter Cabinet (Option CW)** - The return air filter cabinet is shipped separately for field installation over the inlet air opening of the heater. The inlet air opening location is determined by the application. A filter cabinet can be attached to the rear, the left side, the right side, or the bottom of the unit. Follow the installation instructions in Form I-CAUA-FC shipped with the cabinet.
- **Mixing Cabinet (Option GA)** - If the application includes bringing in outside supply air, a mixing cabinet must be attached to the unit. The optional mixing cabinet is shipped separately for field attachment to the rear of the unit. Check to be sure that the mixing box is the damper configuration ordered. Follow the installation instructions in Form I-CAUA-MB that is shipped with the mixing box.
- **Inlet Base (Option AVA for Sizes 350 and 400)** - If an optional inlet base is part of the installation, follow the instructions in Form I-CAUA-IB shipped with the inlet base to select the location. A Model CAUA heater ordered with an inlet base mounts on the base and has a bottom inlet air opening.
- **Discharge Plenum (Option CD for Sizes 350 and 400)** - The discharge plenum is shipped separately for installation over the discharge opening of the heater. If the discharge plenum and a cased cooling coil are part of the installation, the discharge plenum is attached to the cooling coil casing at the factory. Refer to the instructions in Form I-CAUA-DP (or both Forms I-CAUA-DP and I-CAUA-CC) shipped with the discharge plenum.

Also, shipped with the heater are the parts needed to install a heat section condensate drain (needed if installing a cooling coil).

Other shipped-separate options could include a gas shutoff valve, a thermostat, a thermostat guard, and/or a vent cap. Make sure all parts are at the site before beginning installation.

## 4.0 Dimensions and Clearances

### 4.1 Dimensions

FIGURE 1 - Dimensions - inches (mm)

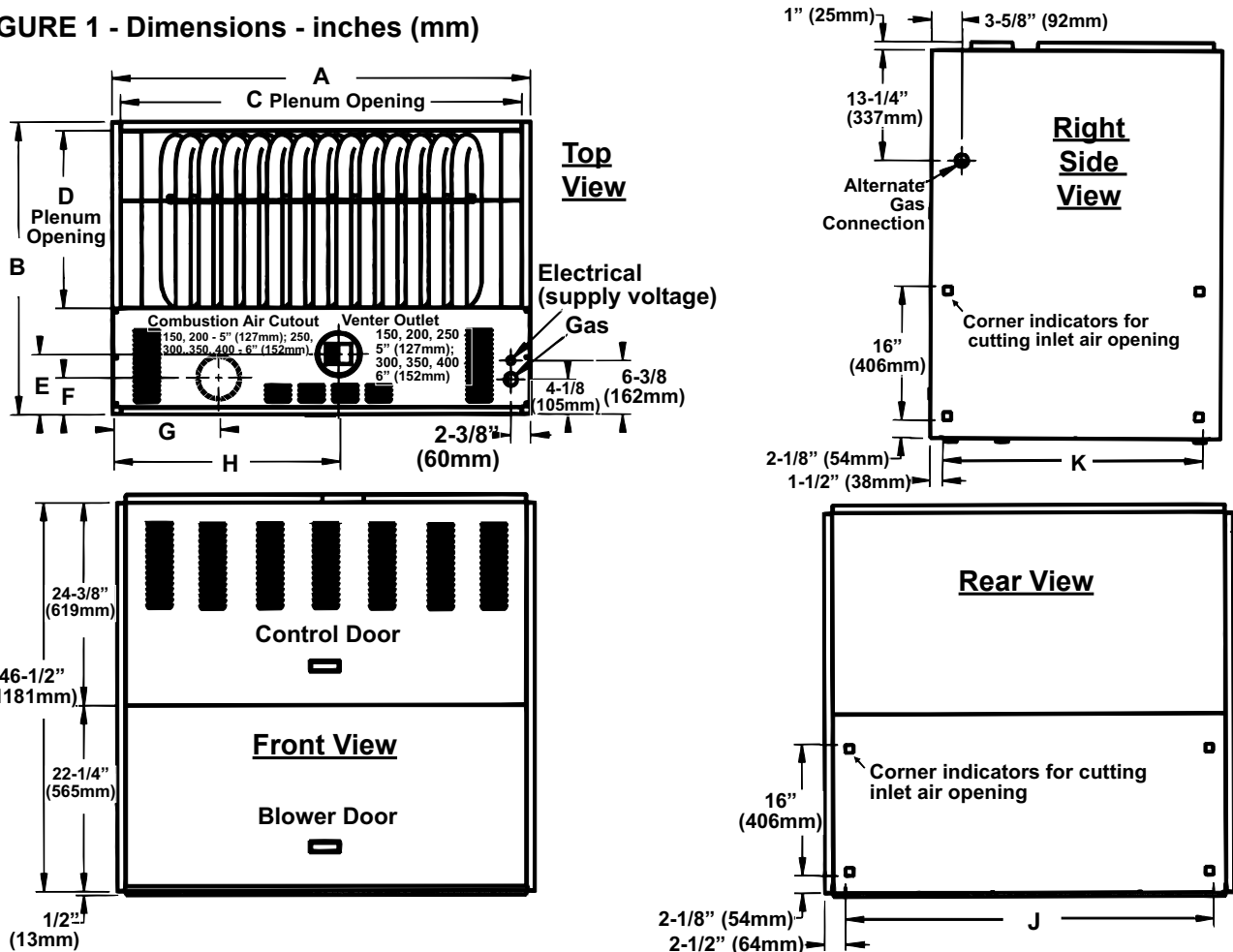
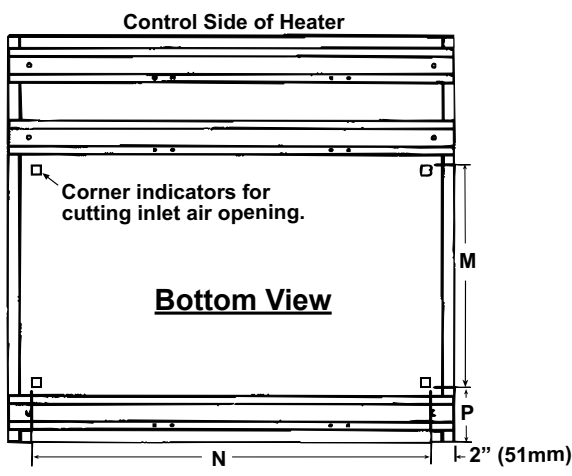


TABLE 3	Size	A	B	C	D	E	F	G	H	J	K	M	N	P
Dimensions (Inches ±1/8)	150, 200	38	34-3/4	36	21	7-1/4	3-3/4	12-1/2	24	33	31	19	34	4-5/8
	250, 300	50	34-3/4	48	21	7-1/4	4-3/8	12-3/4	27-1/4	45	31	16	46	4-3/4
	350, 400	50	49-3/4	48	34	7	4-3/8	14-1/8	26-3/4	45	44	32	46	4-7/8
Dimensions (mm ±3)	150, 200	965	883	914	533	184	95	318	610	838	787	483	864	117
	250, 300	1270	883	1219	533	184	111	324	692	1143	787	406	1168	121
	350, 400	1270	1238	1219	864	178	111	359	679	1143	1118	813	1168	124



#### Air Opening Dimensions

- Supply Air (Discharge with duct flange) = C x D
- Inlet Air Opening (location selected by installer)
  - Right Side of Heater K x 16" (406mm)
  - Left Side\* of Heater K x 16" (406mm)
  - Rear of Heater J x 16" (406mm)
  - Bottom of Heater M x N

\*Right side is illustrated; corner indicators for opening are the same on the left side.

**NOTE:** Composite drawings are not proportional for all sizes.

## 4.0 Clearances and Dimensions (cont'd)

### 4.2 Clearances

The unit must be installed so that the clearances in **TABLE 2** are provided for service and inspection and for proper spacing from combustible construction. 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.

**TABLE 2 - Required Clearances**

Clearances	inches	mm
Right Side	0	0
Left Side	0	0
Front (Service Side)	36	914
Rear	0	0
Bottom	0	0
Flue Connector	6	152
Top	1	25

## 5.0 Positioning and Mounting

Determine the position of the heater with regard to clearances, venting, combustion air, gas supply connection, electrical supply connection, and the inlet air opening. The inlet air opening may be in the right side, in the left side, in the rear, or in the bottom of the cabinet (See **FIGURE 1**) and must be cut by the installer.

**CAUTION: Use tin snips or aviation shears to cut the inlet air opening. Use caution as the cut edges of the metal will be sharp.**

Either cut out the inlet air opening now or when attaching the ductwork, filter cabinet, or mixing box. If the application includes an optional bottom filter cabinet, either lay the heater down (note weight in **TABLE 1**) and cut the opening now or cut it out from the inside after the heater is placed on the bottom filter cabinet. **NOTE:** If ordered with an optional inlet base, the heater is shipped with a factory provided opening in the bottom.

### Vibration Isolation Pads, Option PC4

If the installation includes optional vibration isolation pads, tip the corner of the unit enough to slide a pad underneath. Remove the access panel and secure the pad to the cabinet with the screw provided. Repeat the procedure at all four corners.

## 6.0 Mechanical

### 6.1 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. Supply pressure higher than 1/2 psi requires installation of an additional lockup-type service regulator external to the unit.**

#### **PRESSURE TESTING SUPPLY PIPING**

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

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

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

Unit heaters are orificed for operation with natural gas having a heating value of 1000 (± 50) BTU per cubic ft or propane gas with a heating value of 2550 BTU per cubic ft. If the gas at the installation site does not meet these specifications, consult the factory for proper orificing.

**TABLE 4 - Sizing a Gas Supply Line**

Capacity of Piping - Cubic Feet per Hour based on 0.3" w.c. Pressure Drop												
Specific Gravity for Natural Gas -- 0.6 (Natural Gas -- 1000 BTU/Cubic Ft)												
Specific Gravity for Propane Gas -- 1.6 (Propane Gas -- 2550 BTU/Cubic Ft)												
Length of Pipe	Diameter of Pipe											
	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 Piping Requirements and Connection**

**TABLE 5 - Gas Connection (not supply line size)**

CAUA Sizes	Fuel	Gas Connection
150-200	Natural Gas or Propane	1/2"
250-400		3/4"

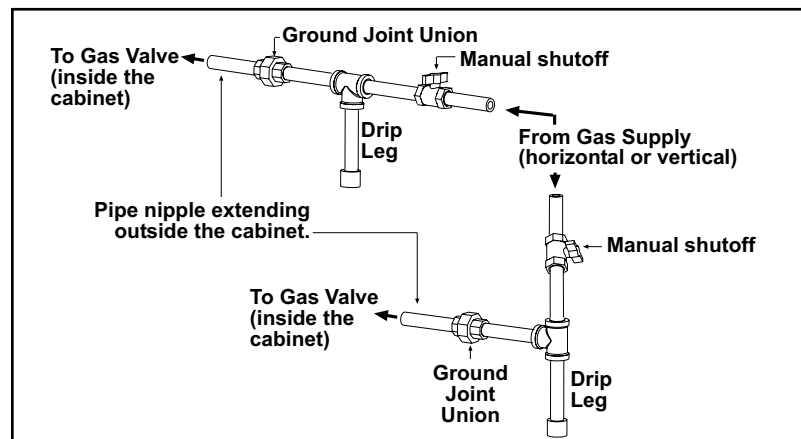
**Pipe joint compounds (pipe dope) shall be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.**

Install a ground joint union and manual shutoff valve upstream of the unit control system as shown in **FIGURE 2**. The 1/8" plugged tapping in the shutoff valve provides connection for a supply line pressure test gauge. The National Fuel Gas Code requires the installation of a trap with a minimum 3" (76mm) drip leg. Local codes may require a minimum drip leg longer than 3", typically 6" (152mm). Bleed gas lines of trapped air.

Gas connection is either 1/2" or 3/4" depending on size and type of gas (See **TABLE 5**).

Leak-test all connections by brushing on a leak-detecting solution.

**FIGURE 2 - Supply Piping Connection**



**WARNING**

**All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage or death.**

**Gas Valve**

The main operating gas valve is powered by the 24-volt control circuit through the thermostat and safety controls. The main control valve is of the diaphragm type providing regulated gas flow preset at the factory.

**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. See Hazard Levels, page 2.**

## 6.0 Mechanical (cont'd)

### 6.1 Gas Piping and Pressures (cont'd)

**Instructions on How  
to Check Valve Outlet  
(Manifold) Pressure  
(can only be done when  
heater is operating):**

#### **WARNING**

**Manifold gas pressure  
must never exceed  
3.5" w.c. for natural  
gas or 10" w.c. for  
propane.**

#### **Manifold or Orifice 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. The following warnings and instructions apply.

**For Natural Gas:** When the heater leaves the factory, the combination gas 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" w.c. Low fire on a two-stage valve is set to 0.9" w.c. Inlet supply pressure to the valve for natural gas must be a minimum of 5" w.c. or as noted on the rating plate and a maximum of 14" w.c.

**For Propane:** When the heater leaves the factory, the combination gas 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 10" w.c. Low fire on a two-stage valve is set to 3.8" w.c. Inlet supply pressure to the valve for propane must be a minimum of 11" w.c. and a maximum of 14" w.c.

Before attempting to measure or adjust valve outlet (manifold) gas pressure, the inlet supply pressure *must* be within the specified range 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. If natural gas supply pressure is too high, install a regulator in the supply line before it reaches the heater. If natural gas supply pressure is too low, contact your gas supplier.

1) With the manual 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 outlet pressure of the gas valve. To measure 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, remove the cap from the adjustment screw(s). Set pressure to correct settings by turning the regulator screw IN (clockwise) to increase pressure. Turn regulator screw OUT (counterclockwise) to decrease pressure.

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**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.**

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## 6.2 Venting and Combustion Air

#### **WARNING**

**The vent must be installed in accordance with national and local regulations. Failure to provide proper venting could result in death, serious injury and/or property damage. This unit must be installed with a vent to the outside of the building. Safe operation of any power-vented, gas-fired equipment requires a properly operating vent system, correct provision for combustion air, and regular maintenance and inspection.**

#### **WARNING**

**Units installed in multiples require individual vent pipe runs and vent caps. Manifolding of vent runs is not permitted due to possible recirculation of combustion products into the building and back pressure effects on the combustion air proving switch.**

Venting must be in accordance with the National Fuel Gas Code Z223.1 or CSA B149.1 and B149.2, Installation Code for Gas Burning Appliances and Equipment, and all local codes. Local requirements supersede national requirements. Combustion air for this heater may be either taken from the space or may be ducted from the outside using the concentric adapter combustion air/vent system. Flue products must always be vented to the outdoors.



Installation should be done by a qualified agency in accordance with these instructions. The qualified service agency installing the vent or vent/combustion air system is responsible for the installation.

The venting or venting/combustion air systems illustrated in this manual are the only ones approved for a Model CAUA heater.

**Decide which Venting System to Install:**

**Separated-Combustion** - A separated-combustion installation **requires** a vent/combustion air system that uses a power venter to **duct combustion air from outdoors** and exhaust flue products to the outdoors. **A vent/combustion air kit, Option CC2 or CC6, is required.** Follow the instructions in Paragraph 6.2.1 beginning below.

**Power-Vented** - A power-vented installation uses a power venter to draw **combustion air from the indoor space** and exhaust flue products to the outdoors. A vent cap, Option CC1 or equivalent, is required. Follow the instructions in Paragraph 6.2.2, beginning on page 20.

**6.2.1. Venting and Combustion Air Requirements for a Separated Combustion Installation (must use either Option CC2 or CC6)**

**1) Type of Pipe**

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

**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 the vent terminal section. The length of 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 combustion air pipe is recommended.

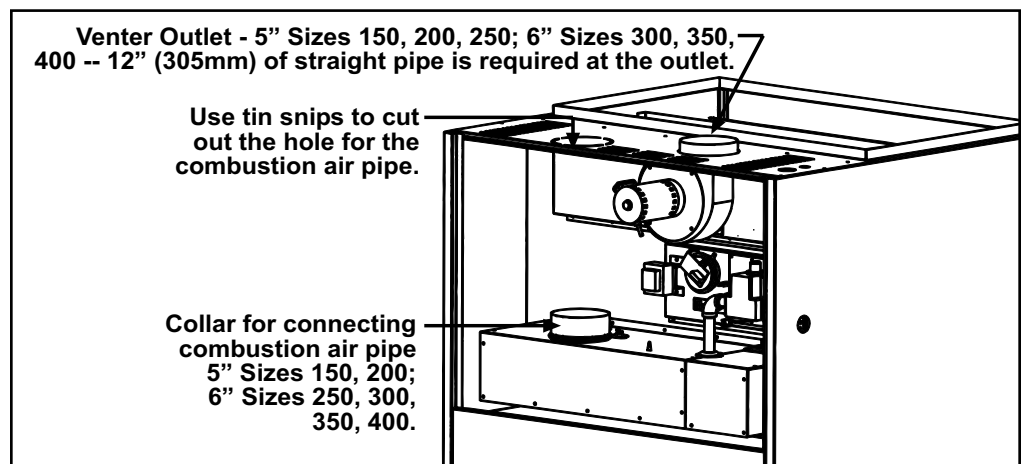
**2) Venter Outlet and Combustion Air Inlet**

**TABLE 6 - Venter and Inlet Collar Sizes**

Size		150	200	250	300	350	400
Venter Outlet	inches	5	5	5	6	6	6
	mm	127	127	127	152	152	152
Combustion Air Inlet	inches	5	5	6	6	6	6
	mm	127	127	152	152	152	152

**FIGURE 3 - Venter Outlet and Combustion Air Pipe Collars**

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



**Combustion Air Inlet Collar**

Use tin snips or aviation shears to cut out the hole in the top of the heater (See **FIGURE 3**). Insert the pipe down through the hole and attach it to the collar inside the heater. Seal the joint. (Larger size heaters have oval collars. If the collar is oval, form the pipe to fit the collar.)

## 6.0 Mechanical (cont'd)

### 6.2 Venting and Combustion Air (cont'd)

#### Vent and Combustion Air Pipes Between the Heater and the Concentric Adapter

**TABLE 7 - Pipe  
Diameter and Length  
from Heater to  
Concentric Adapter Box**

### 3) Pipe Diameter and Length

Pipe diameter and length requirements listed in **TABLE 7** are for the indoor sections of pipe between the heater and the concentric adapter box. The diameters of the outside (terminal) concentric pipes are listed in **TABLE 8**. The outdoor lengths depend on the installation; requirements are listed in the installation instructions for the horizontal and vertical vent/combustion air kits.

Vent pipe diameters and maximum vent lengths in **TABLE 7** 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**. Minimum length is 5 ft (1.5M).

Pipe Diameter and Maximum Pipe Length from Heater to Concentric Adapter										
CAUA	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
150, 200	5	127	5	127	40	12.2	5	1.5	2.5	0.76
250	5	127	6	152	50	15.2	5	1.5	2.5	0.76
300, 350, 400	6	152	6	127	50	15.2	5	1.5	2.5	0.76

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

#### Concentric Pipes

**TABLE 8 - Diameter of  
Outdoor Concentric  
Pipes**

**NOTE:** Length is determined by the installation.

Diameters of Concentric (Outdoor Terminal) Pipes							
Size		150	200	250	300	350	400
Inlet Air Pipe	inches	6	6	8	8	8	8
	mm	203	203	203	203	203	203
Vent Pipe	inches	4	4	5	5	5	5
	mm	152	152	152	152	152	152

### 4) Condensation

Any length of single-wall vent pipe exposed to cold air or run through an unheated area or an area with an ambient temperature of 45°F or less must be insulated along its entire length with a minimum of 1/2" foil-faced fiberglass, 1-1/2# density insulation. Where extreme conditions are anticipated, install a means of condensate disposal.

### 5) Joints and Sealing

Provide pipe as specified in Requirement No. 1 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, 26-gauge or heavier galvanized vent pipe run**, secure slip-fit connections using sheetmetal screws or rivets. Seal all joints with high temperature aluminum tape or silicone sealant.
- **To seal joints in the single-wall combustion air pipe**, secure slip-fit connections using sheetmetal screws or rivets. Seal all joints with aluminum tape or silicone sealant.
- **When joining the terminal section of double-wall vent pipe to the vent cap**, follow the illustrated instructions in **FIGURE 4A, page 11**.

**When joining the terminal section of double-wall vent pipe to a single-wall or Category III vent pipe run**, follow the illustrated instructions in **FIGURE 4B, page 11**.

**When joining two sections of terminal double-wall vent pipe in a vertical vent installation**, follow the pipe manufacturer's instructions for joining pipe sections.

**FIGURE 4A - Follow STEPS to join Double-Wall (Type B) Pipe and the Vent Terminal Cap (horizontal or vertical)**

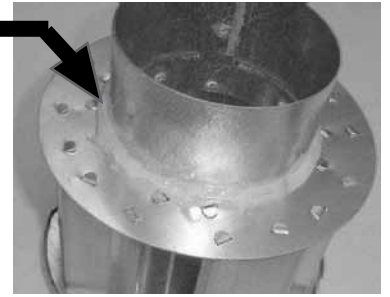
(NOTE: Pipes and vent caps may not look exactly as shown in the illustrations. Instructions apply to both horizontal and vertical vent kits.)

**FIGURE 4B - Follow STEPS when joining the Double-Wall (Type B) Pipe to the Single-Wall or Category III Vent Run**

**Figure 4A - STEP 1**

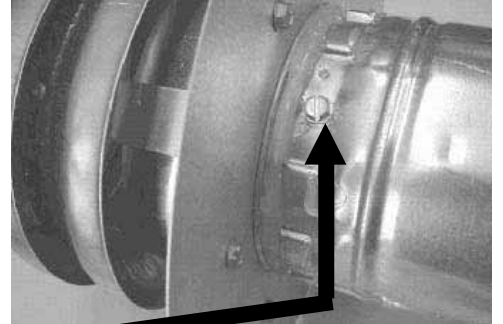
Place a continual 3/8" bead of silicone sealant around the circumference of the vent cap collar. This will prevent any water inside the vent cap from running down the double-wall pipe.

**Do STEP 2 immediately following STEP 1.**



**Figure 4A - 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.



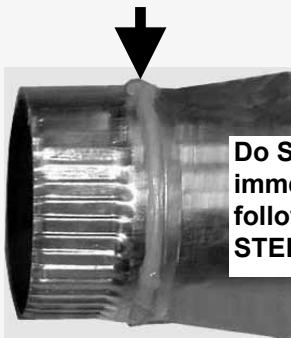
**Figure 4A - STEP 3**

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.

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

**Figure 4B - STEP 1**

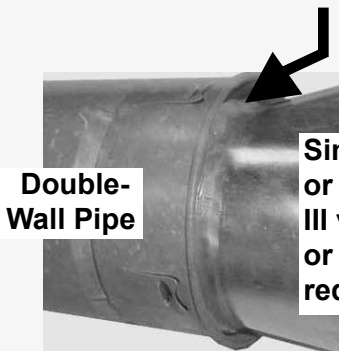
On the single-wall or Category III vent pipe or the taper-type reducer, place a continual 1/4" bead of silicone sealant around the circumference.



**Do STEP 2 immediately following STEP 1.**

**Figure 4B - STEP 2**

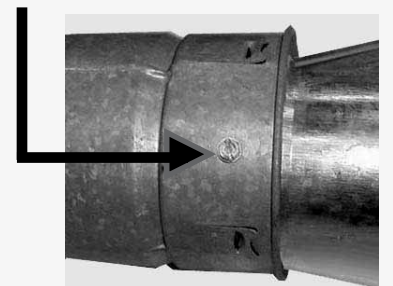
Insert the pipe with the bead of sealant into the inner pipe of the double-wall pipe until the bead of sealant contacts the inner pipe creating a sealed joint.



**Double-Wall Pipe**  
**Single-wall or Category III vent pipe or taper-type reducer**

**Figure 4B - 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) Support**

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

Support horizontal runs every six feet (1.8M). Support vertical runs of Category III vent pipe in accordance with the requirements of the pipe manufacturer. Support vertical single-wall 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.

**7) Clearance**

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

## 6.0 Mechanical (cont'd)

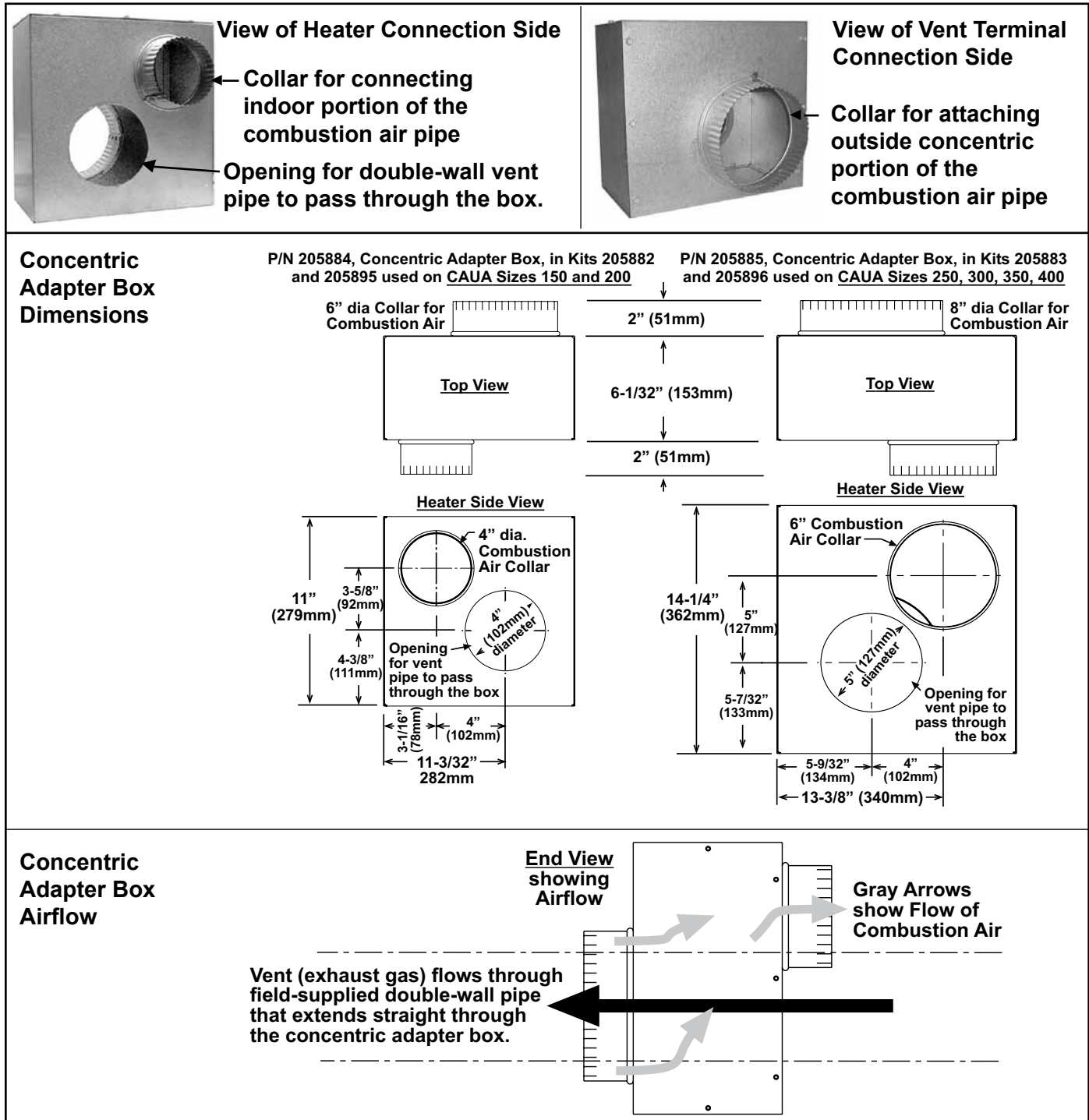
## 6.2 Venting and Combustion Air (cont'd)

## 8) Concentric Adapter Box

All separated combustion installations **require** a concentric adapter box as illustrated in **FIGURE 5**.

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 5 - Concentric Adapter Box Description, Dimensions, and Airflow**



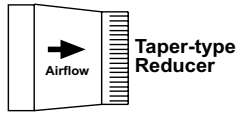
When vent pipe diameters differ, join the pipes with a taper-type reducer. Refer to **FIGURE 6A, 6B, or 6C** for pipe connection requirements at the concentric adapter box.

Do **NOT** make actual connections until after reading the instructions and length requirements for installing the vent/combustion air kit. **The connection requirements are the same for both vertical and horizontal systems, but pipe length requirements vary.**

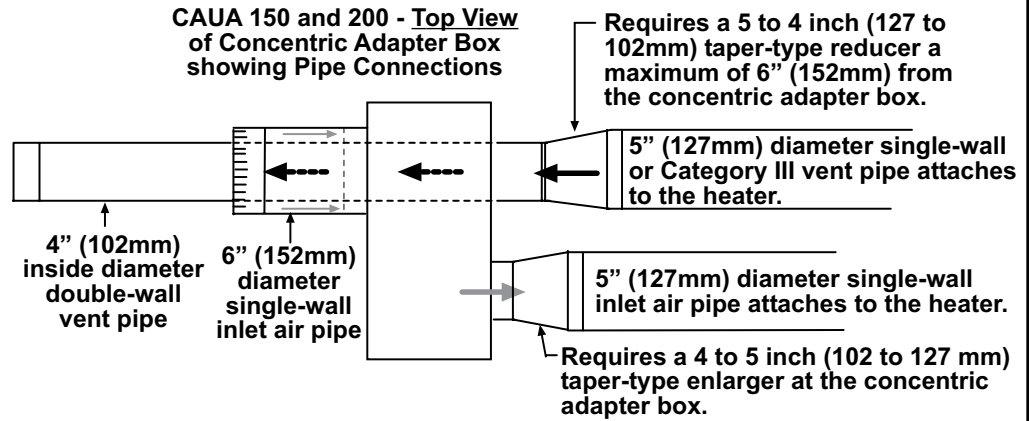
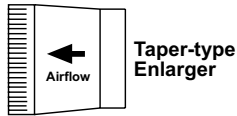
## Pipe Connections at the Concentric Adapter Box

**FIGURE 6A - Concentric Adapter Box Connections for CAUA Sizes 150 & 200**

- CAUA Sizes 150 and 200 always require a 5" to 4" (127 to 102 mm) reducer in the vent pipe.

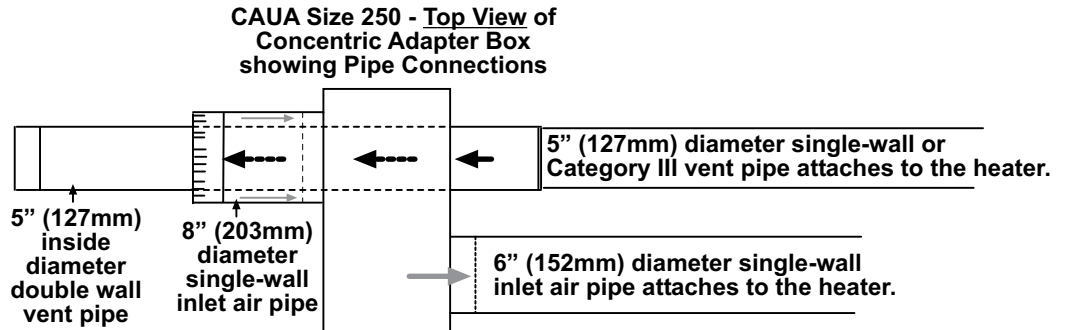


- CAUA Sizes 150 and 200 always require a 4" to 5" (102 to 127mm) enlarger for attaching combustion air pipe.



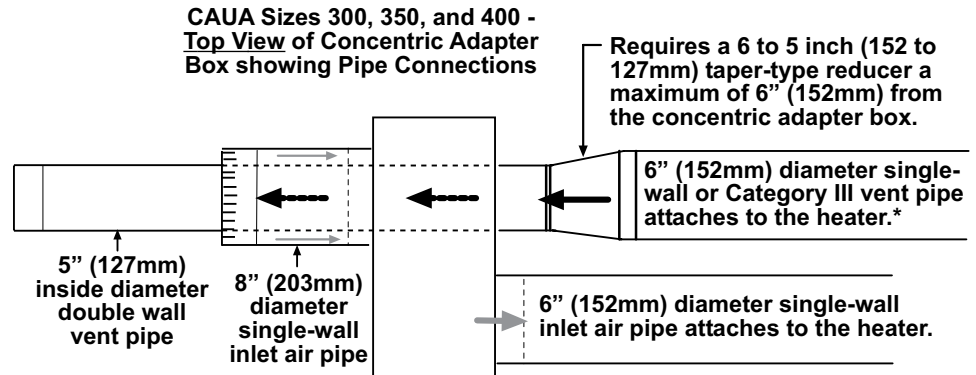
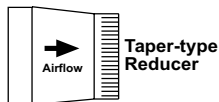
**FIGURE 6B - Concentric Adapter Box Connections for CAUA Size 250**

- Pipe diameters do not differ; no taper-type connectors are required.



**FIGURE 6C - Concentric Adapter Box Connections for CAUA Sizes 300, 350, & 400**

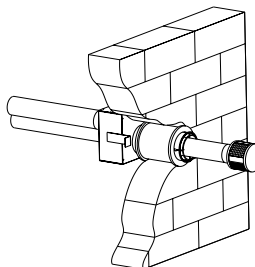
- CAUA Sizes 300, 350, and 400 always require a 6" to 5" (152 to 127 mm) reducer in the vent pipe.



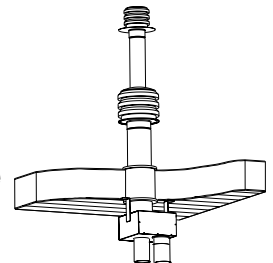
### Horizontal or Vertical?

Is the separated-combustion vent/combustion air system horizontal or vertical?

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



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





## 6.0 Mechanical (cont'd)

## 6.2 Venting and Combustion Air (cont'd)

### 6.2.1 Venting and Combustion Air Requirements for a Separated Combustion (cont'd)

#### 6.2.1.1 HORIZONTAL Vent Instructions Components Required - Factory and Field

**TABLE 9 - Parts in Option CC6, Horizontal Vent Terminal/ Combustion Air Package**

Qty	150, 200	250, 300, 350, 400	Description	Screened Exhaust Assembly
1	205882	205883	Complete Horizontal Vent Kit (Same as Option CC6)	  
1	205884	205885	Concentric Adapter Box Assembly (FIGURE 5, page 12.)	
1	155096	53316	Screened Exhaust Assembly (illustrated below)	
1	205893	205894	Inlet Guard (illustrated below)	
4	37661	37661	#10-16 x 1/2" long Screws to attach the inlet guard	
2	207232	207232	Brackets for attaching Concentric Adapter Box (FIGURE 7, page 15.)	
1	53335	53335	Tube of High Temperature Silicone Sealant	

#### Field-supplied installation requirements:

- Vent pipes - see requirements, page 9.
- Combustion air pipes - see requirements, page 9.
- Taper-type vent pipe diameter reducers and/or increasers as required.
- Thimble (a thimble is 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

**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.**

**TABLE 10 - Clearances to Horizontal Vent Terminal**

**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. Allow 1/4" per foot (6mm per 305mm) 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 8, 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.

Structure	Minimum Clearances for Vent Terminal Location (all directions unless specified)
Forced air inlet within 10 ft (3.1M)*	3 ft (0.9M) above
Combustion air inlet of another appliance	6 ft (1.8M)
Door, window, or gravity air inlet (any building opening)	4 ft (1.2M) horizontally
	4 ft (1.2M) below
	1 ft (305mm) above
Electric meter, gas meter ** and relief equipment	U.S. - 4 ft (1.2M) horizontally; Canada - 6 ft (1.8M)
Gas regulator **	U.S. - 3 ft (0.9M); Canada - 6 ft (1.8M) horizontally
Adjoining building or parapet	6 ft (1.8M)
Adjacent public walkways	7 ft (2.1M) above
Grade (ground level)	3 ft (.9M) 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. The vent must be at least 6" (152mm) higher than anticipated snow depth.

**2) Install the Vent Pipe and Combustion Air Pipe Runs** - Use the type of pipe specified in Requirement No. 1, page 9. Comply with requirements in Requirement No. 2 and No. 4 when attaching pipes to the heater.

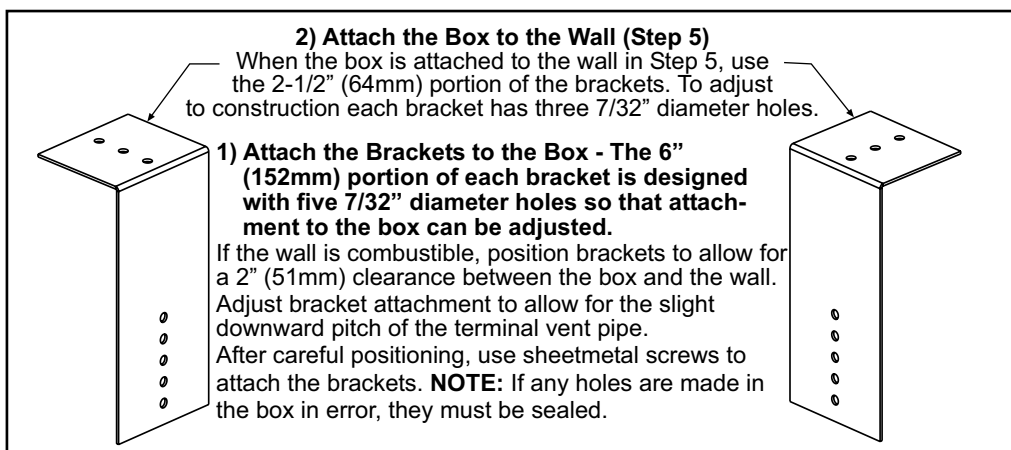
Seal all joints. Due to the high temperature, **do not** enclose the exhaust pipe or place pipe closer than 6" (152 mm) to combustible material. Extend the runs close to the wall location selected in Step 1. Support pipes as required in Requirement No. 6, page 11.

**3) Prepare a hole {6" (152mm) diameter for CAUA Sizes 150 and 200 or 8" (203mm) diameter for CAUA Sizes 250, 300, 350, and 400} through the outside wall for the combustion air pipe.** Outside wall construction thickness should be between 1" (25mm) minimum and 48" (1143mm) maximum. The 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 7**.

**FIGURE 7 - Brackets for Attaching the Concentric Adapter Box to the 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" (51mm).)

Attach the inlet air pipe to the collar of the concentric adapter box 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 7**) to the wall. On the outside, caulk or flash the inlet air pipe. Flashing is field-supplied.

**6) Position the inlet air guard** over the end of the combustion air pipe. See **FIGURE 8**, 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. The vent pipe extending through the box and the inlet air pipe **must be one piece of double-wall vent pipe without joints**. See **FIGURE 8**, to determine lengths of each segment and calculate the total length required. The transition to the single-wall or Category III vent pipe run, must be a maximum of 6" (152mm) 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 between 16" (406mm) and 24" (610mm) past the end of the combustion air pipe and no more that 6" (152mm) out of the box toward the heater.

Follow the instructions in **FIGURE 4B**, page 11, for connecting the double-wall pipe to the single-wall pipe or Category III vent pipe run. For CAUA Sizes 150, 200, 300, 350, and 400, a taper-type reducer is required.

**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 8**). Follow the instructions in **FIGURE 4A**, 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.)

## 6.0 Mechanical (cont'd)

## 6.2 Venting and Combustion Air (cont'd)

**FIGURE 8 - Installation of a Typical Separated-Combustion Unit with Horizontal Vent and Combustion Air Pipes (Option CC6)**

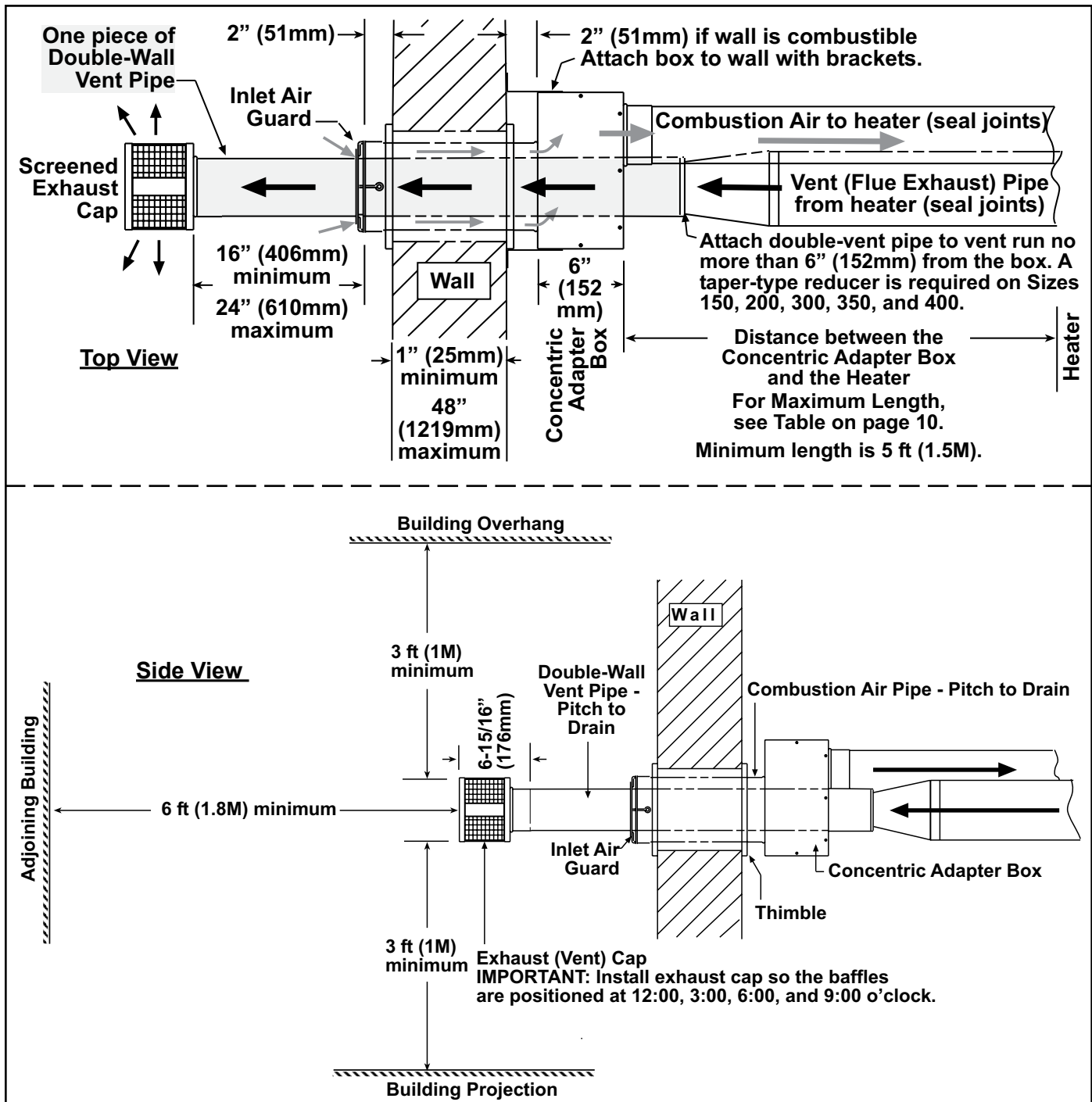
## 6.2.1 Venting and Combustion Air Requirements for a Separated Combustion (cont'd)

### 6.2.1.1 HORIZONTAL Vent Instructions (cont'd)

9) **Seal the vent pipe.** Verify that the double-wall section of vent pipe has a slight downward drop (1/4" per foot/6mm per 305mm) 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.

10) **Attach the indoor combustion air pipe.** On Sizes 150 and 200, install a taper-type enlarger as illustrated in **FIGURE 4A**, page 11. On Sizes 250, 300, 350, and 400, attach the single-wall combustion air pipe run to the collar on the concentric adapter box with sheetmetal screws. 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 **FIGURE 8**.







## 6.2.1.2 VERTICAL Vent Instructions

**TABLE 11 - Parts in Option CC2, Vertical Vent Terminal/ Combustion Air Package**

### Components Required - Factory and Field

Qty	150, 200	250, 300, 350, 400	Description	Exhaust (Vent) Terminal 
1	205895	205896	Complete Vertical Vent Kit (Same as Option CC2)	Combustion Air Inlet 
1	205884	205885	Concentric Adapter Box Assembly (See FIGURE 5, page 12)	
1	110051	110052	Exhaust (Vent) Terminal	
1	155635	53330	Combustion Air	
2	207232	207232	Brackets for attaching Concentric Adapter Box (See FIGURE 9, pg 19)	
1	53335	53335	Tube of High Temperature Silicone Sealant	

### Field-supplied installation requirements:

- Vent pipes - see requirements, page 9.
- Combustion air pipes - see requirements, page 9.
- Taper-type pipe diameter reducers and/or increasers as required.
- Thimble (a thimble is 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 13, page 19.

### 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.**

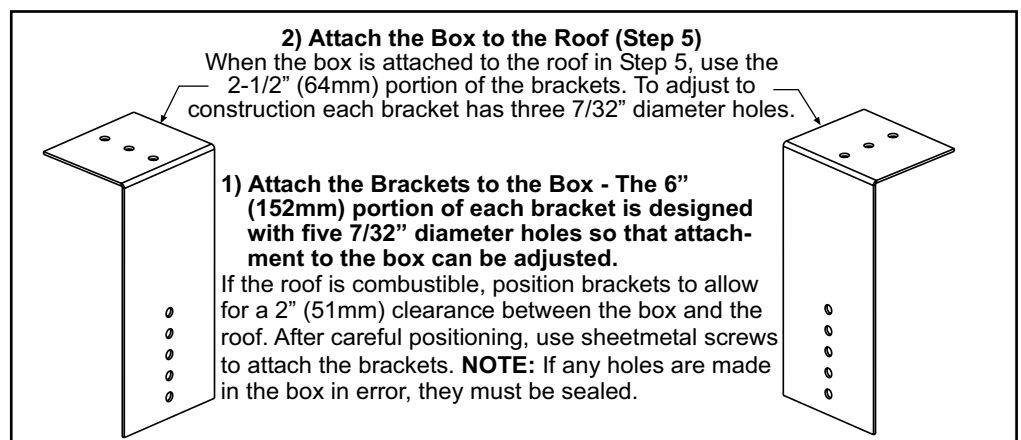
**2) Install the Vent Pipe and Combustion Air Pipe Run** - Use the type of pipe specified (Requirement No. 1, page 9), and comply with the attachment requirements in Requirement No. 2, page 9. Length must comply with Requirement No. 3, page 10. Seal all joints. Due to the high temperature, **do not** 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 No. 1 for the vent terminal.

**3) Prepare a hole [6" (152mm) diameter for CAUA Sizes 150 and 200 or 8" (203mm) diameter for Sizes 250, 300, 350, and 400] through the roof for the combustion air pipe.** A thimble may or may not be required depending on building construction and/or local codes. The 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 9.

**FIGURE 9 - Brackets for Attaching the Concentric Adapter Box to the Roof**



## 6.0 Mechanical (cont'd)

### 6.2 Venting and Combustion Air (cont'd)

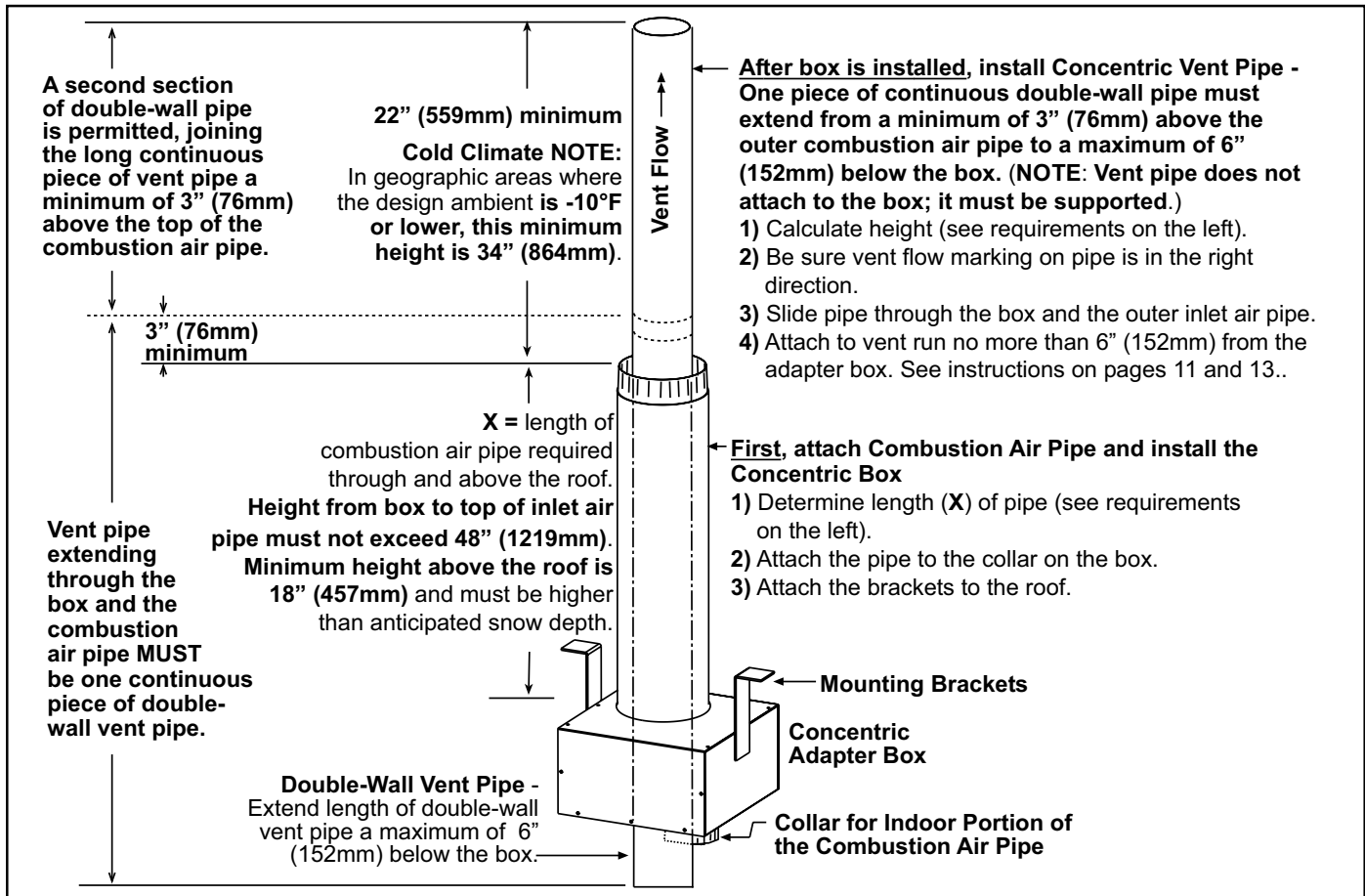
## 6.2.1 Venting and Combustion Air Requirements for a Separated Combustion (cont'd)

### 6.2.1.2 VERTICAL Vent Instructions (cont'd)

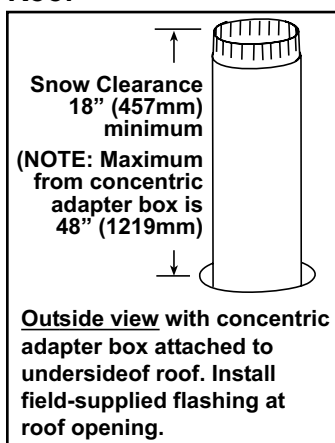
#### Installation Instructions for Vertical Vent/Combustion Air Kit (cont'd)

**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 10** is equal to the bracket length, plus the roof thickness, plus anticipated snow depth, but does not exceed 48" (1219mm) or have less than 18" (457mm) of pipe above the roof. Attach the inlet air pipe to the collar of the concentric adapter box with sheetmetal screws.

**FIGURE 10 - Assemble Concentric Adapter Box, Outdoor Combustion Air Pipe, and Double-Wall Vent Pipe**



**FIGURE 11 - Slide attached Combustion Air Pipe up through the Roof**



**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 10 and 11**.) 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 minimum length of the continuous section of double-wall vent pipe (no joints).** See **FIGURE 10**. 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 length by adding the requirements. Starting at the bottom, the maximum the vent pipe can extend below the box is 6" (152mm); **plus** 6" (152mm) 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" (76mm) 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" (152mm) 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

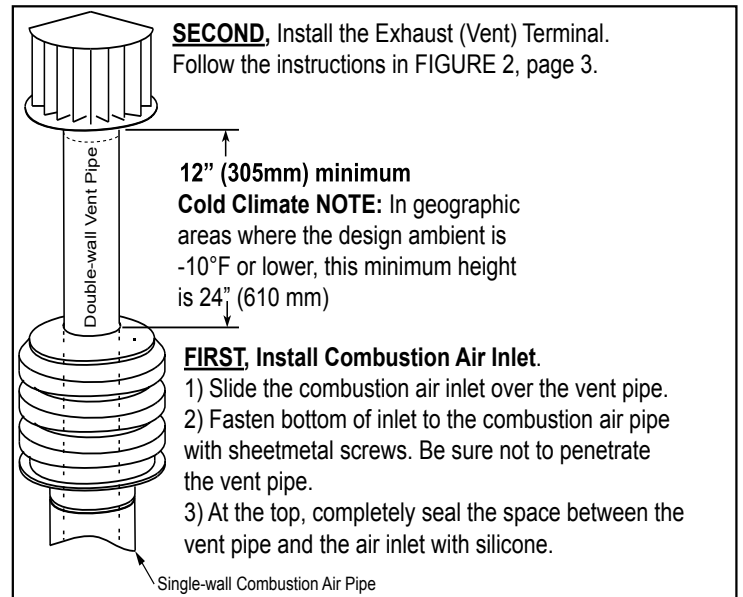
the end is no more than 6" (152mm) below the box. The upper end should extend at least 3" (76mm) above the combustion air pipe. **NOTE:** The double-wall vent pipe does not attach to the box. **The installer must provide support.**

Follow the instructions in **FIGURE 4B**, page 11, for connecting the double-wall pipe to the single-wall pipe or Category III vent pipe run. For CAUA Sizes 150, 200, 300, 350, and 400, 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 12. Seal the opening at the top between the vent pipe and the combustion air inlet with silicone sealant to prevent water leakage.**

**FIGURE 12 - Install Combustion Air Inlet and Vent Terminal**



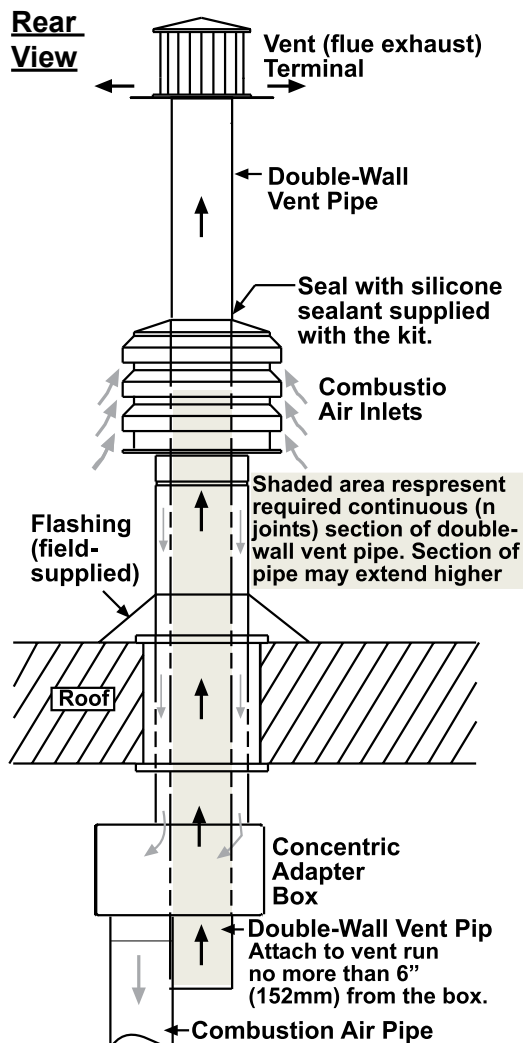
**8) Attach the exhaust (vent) cap.** Follow the illustrated instructions in **FIGURE 4A**, page 11.

**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. On Sizes 150 and 200, install a taper type enlarger as illustrated in **FIGURE 6A**, page 13.

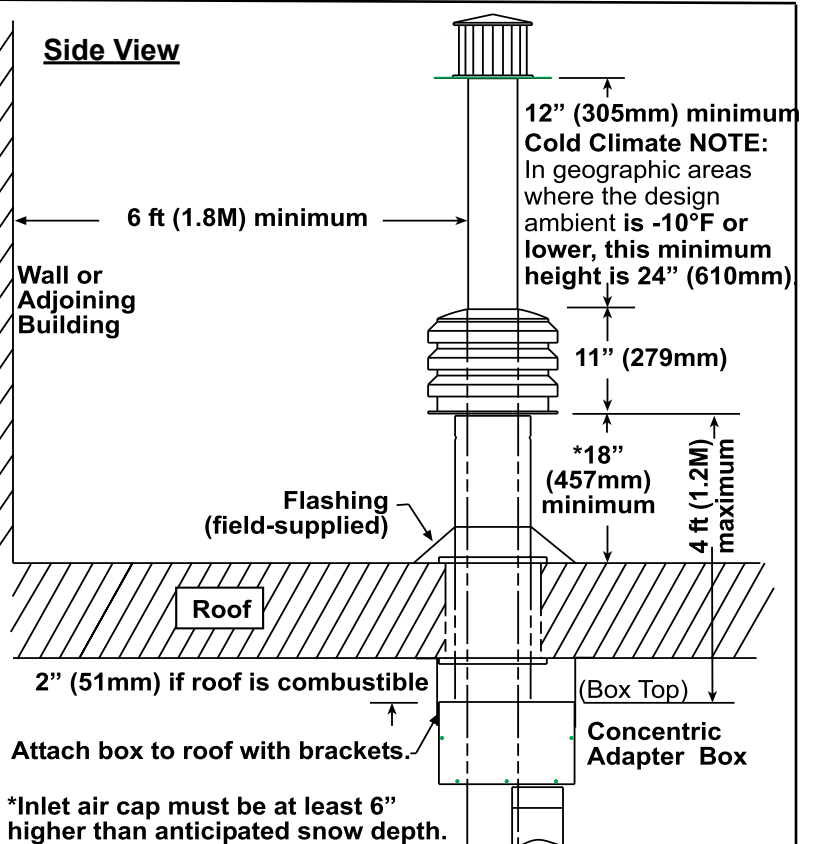
Seal joint with tape or sealant.

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 FIGURE 13.**

**FIGURE 13 - Installation of Unit with Vertical Vent Terminal/Combustion Air Inlet (Option CC2)**



**Side View**



## 6.0 Mechanical (cont'd)

### 6.2 Venting and Combustion Air (cont'd)

#### 6.2.2 Venting and Combustion Air Requirements for Power Vent Drawing Combustion Air from THE INSIDE SPACE and Venting Flue Products to the Outdoors

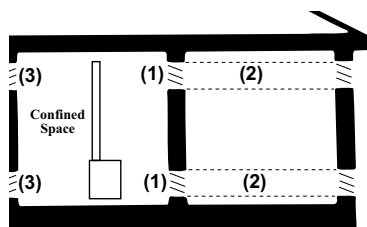
If the environment has a positive pressure and is such that it is not detrimental to combustion air, the power venting system in this section may be installed.

To provide combustion air to the heater, sufficient air must enter the equipment location to replace that exhausted through the heater vent system. In the past, the infiltration of outside air assumed in heat loss calculations (one air change per hour) was assumed to be sufficient. However, current construction methods using more insulation, vapor barriers, tighter fitting and gasketed doors and windows, weather-stripping, and/or mechanical exhaust fans may now require the introduction of outside air through wall openings or ductwork to the equipment room.

The requirements for combustion and ventilation air depend upon whether the unit is located in a confined or unconfined space. An "unconfined space" is defined as a space whose volume is not less than 50 cubic feet per 1000 BTUH of the installed appliance. **Under all conditions**, enough air must be provided to ensure there will not be a negative pressure condition within the equipment room or space. Follow the specific requirements below for a confined space installation.

**Confined Space Installation - Do not** install a unit in a confined space without providing wall openings leading to and from the space. Provide openings near the floor and ceiling for ventilation and air for combustion as shown in **FIGURE 14**, depending on the combustion air source as noted in Items 1, 2, and 3 below.

**FIGURE 14 - Confined Space:**  
A space whose volume is less than 50 cubic feet per 1000 BTUH of the installed appliance input rating



**NOTE:** For further details on supplying combustion air to a confined space, see the National Fuel Gas Code ANSI Z223.1a (latest edition).

Add total BTUH of all appliances in the confined space and divide by figures below for square inch free area size of each (top and bottom) opening.

- 1. Air from inside the building** -- openings 1 square inch free area per 1000 BTUH. Never less than 100 square inches free area for each opening. **See (1) in FIGURE 14.**
- 2. Air from outside through duct** -- openings 1 square inch free area per 2000 BTUH. **See (2) in FIGURE 14.**
- 3. Air direct from outside** -- openings 1 square inch free area per 4000 BTUH. **See (3) in FIGURE 14.**

### Power Venting Requirements

#### 1) Type of Pipe

All pipe is field supplied. Use either 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.

If local code requires, a double-wall terminal section may be installed with a single-wall or Category III vent pipe run.

Or, if at least 1/2 of the equivalent vent length is vertical, vent pipe approved for a Category I heater may be used. Single-wall pipe or double-wall (Type B) vent pipe are suitable for use with a Category I heater.

#### 2) Venter (Flue) Outlet

TABLE 12 - Venter

#### Outlet Size

Model Sizes	Venter Outlet Diameter	
150, 200, 250	5 inches	127 mm
300, 350, 400	6 inches	152 mm

### Venter Outlet Attachment Requirements

- A minimum of 12" of straight pipe is required at the venter outlet before installing an elbow in the vent system. An elbow should never be attached directly to the venter. An elbow attached to the straight pipe can be in any position at or above horizontal. See **FIGURE 15**.
- **Do not** install dampers or any other type of flue restrictor device.

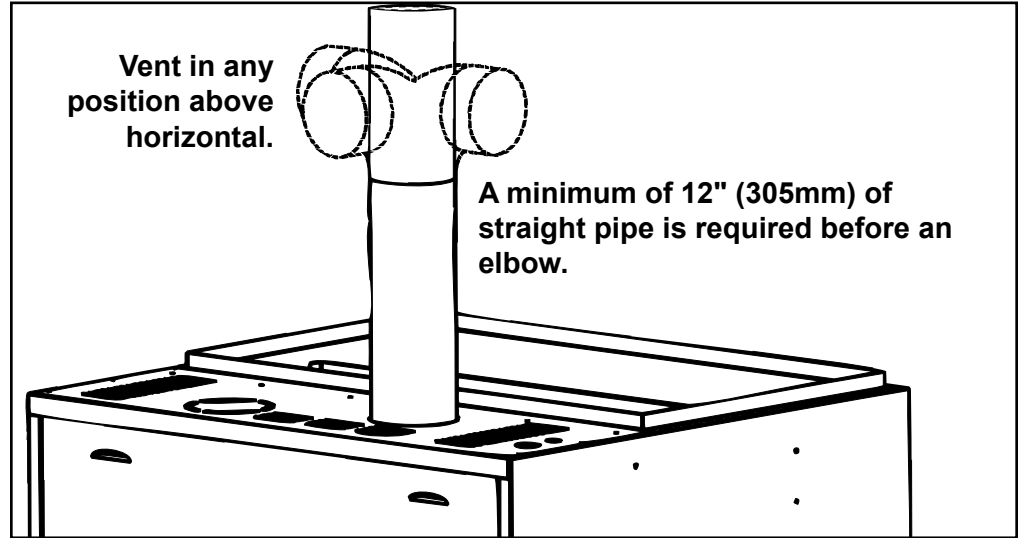
### 3) Vent Pipe Diameter and Length

**NOTE:** If the system contains all vertical pipe or a combination of horizontal and vertical vent pipe, the Maximum Permissible Vent Length may be increased one foot (305mm) for each foot (305mm) of vertical rise up to a maximum increase of ten feet (3M).

**FIGURE 15 - Alternate Vent Directions**

**NOTES:**

- A minimum of 12" (305mm) of straight pipe is required before an elbow.
- If installing a double-wall vent run (allowed if 1/2 of vent length is vertical), see **FIGURE 16A** for attaching the vent pipe to the heater.



**TABLE 13 - Vent Pipe Diameter and Length**

Maximum Vent Length - Minimum length is 5 ft (1.5M).				
CAUA Sizes	Pipe Diameter	Maximum Length	90° Elbow Equals *	45° Elbow Equals *
150, 200, 250	5" (127mm)	50 ft (15.2M)	5 ft (1.5M)	2.5 ft (.8M)
300, 350, 400	6" (152mm)	50 ft (15.2M)	5 ft (1.5M)	2.5 ft (.8M)

\*Reduce by this amount for each elbow.

### 4) Joints and Sealing

Provide field-supplied vent pipe as specified in Requirement No. 1 above.

- If using **single wall**, 26-gauge or heavier galvanized pipe, secure slip-fit connections using sheetmetal screws or rivets. Seal pipe joints either with tape suitable for 550°F (such as Option FA1, P/N 98266) or high-temperature silicone sealant.
- If using **Category III vent pipe**, follow pipe manufacturer's instructions for joining pipe sections. When attaching Category III pipe to the venter outlet or the vent cap, make secure, sealed joints following a procedure that best suits the style of Category III pipe being used.
- If installing a **double-wall (Type B) terminal pipe**, follow the instructions in **FIGURE 16B** to join the double-wall pipe to a single-wall or Category III vent pipe run. To attach the vent cap, follow instructions in **FIGURE 16C**.
- If using **double-wall (Type B) vent pipe** in the vent pipe run (at least 1/2 of the equivalent vent length must be vertical), follow the pipe manufacturer's instructions for joining pipe sections. For attaching double-wall pipe to the heater, see **FIGURE 16A**. To attach the vent cap, see **FIGURE 16C**.

**FIGURE 16A - Attaching Double-Wall (Type-B) Vent Pipe to the Venter Outlet**

A double-wall pipe run is allowed only if at least 1/2 of the vent length is vertical.

**Figure 16A - STEP 1**

Place a continual 1/4" bead of silicone sealant around the circumference of the venter outlet collar.



**Do STEP 2 immediately after STEP 1.**

**Figure 16A - STEP 2**

Slide the double-wall pipe over the collar so that the collar is inside the inner pipe. Push the double-wall pipe tight to the heater cabinet. To secure the connection, spaced equal distance around the pipe, drill and insert three 3/4" long sheetmetal screws through the pipe and into the collar. Do not over tighten the screws.



**6. Mechanical (cont'd)**

**6.2 Venting and Combustion Air (cont'd)**

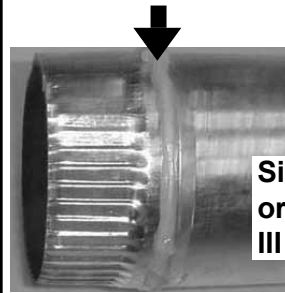
**6.2.2 Venting and Combustion Air Requirements for Power Vent (cont'd)**

**FIGURE 16B - Attaching Double-Wall (Type B) Terminal Pipe to a Single Wall or Category III Vent Pipe Run**

**4) Joints and Sealing (cont'd)**

**Figure 16B - STEP 1**

On the single-wall pipe or Category III pipe, place a continual 1/4 inch bead of silicone sealant around the circumference.

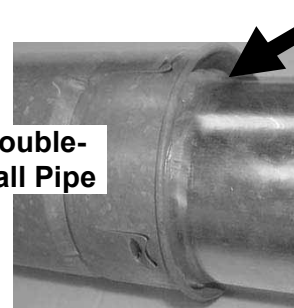


**Do STEP 2 immediately after STEP 1.**

**Single-Wall or Category III Vent Pipe**

**Figure 16B - STEP 2**

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

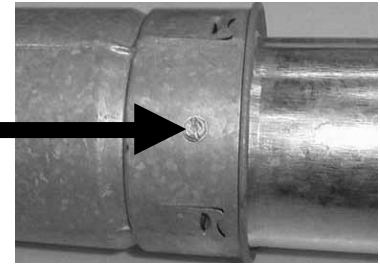


**Double-Wall Pipe**

**Vent Pipe with Sealant from STEP 1**

**Figure 16B - STEP 3**

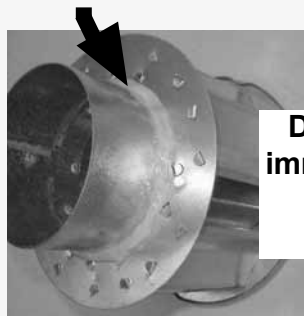
Spaced equally around the double-wall pipe, drill three small holes below the sealant ring. Insert 3/4 inch long sheetmetal screws to secure the joint. Do not over tighten screws.



**FIGURE 16C - Attaching Double-Wall (Type B) Pipe to a Vent Cap**

**Figure 16C - 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.



**Do STEP 2 immediately following STEP 1.**

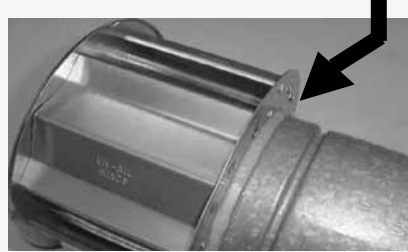
**Figure 16C - STEP 3**

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 over tighten screw.



**Figure 16C - 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.



**5) Vent System Support**

Use non-combustible supports on vent pipe. Support horizontal runs every six 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 vertical single-wall pipe in accordance with accepted industry practices. Do not rely on the heater for support of either horizontal or vertical vent pipe.

**6) Condensation**

Any length of single-wall vent pipe exposed to cold air or run through an unheated area or an area with an ambient temperature of 45°F or less must be insulated along its entire length with a minimum of 1/2" foil-faced fiberglass, 1-1/2# density insulation. Where extreme conditions are anticipated, install a means of condensate disposal.

**7) Vent Terminal (Pipe and Vent Cap)**

The vent system must be terminated with the type of vent cap approved for use with this heater. The vent cap must be the same size as the vent pipe. Use of the vent cap

available with the heater (Option CC1) is recommended. A different style vent cap could cause nuisance problems or unsafe conditions.

See the illustrations in **FIGURES 17 and 18** for requirements of vertical and horizontal vent termination. The vent terminal pipe may be either single-wall or double-wall (Type B). If double-wall pipe is used in the vent terminal with a single-wall vent run, follow the illustrated instructions in **FIGURES 16B and 16C** to attach the vent cap and to connect the double-wall pipe to the single-wall vent pipe run.

**Horizontal Vent Terminal Clearances**

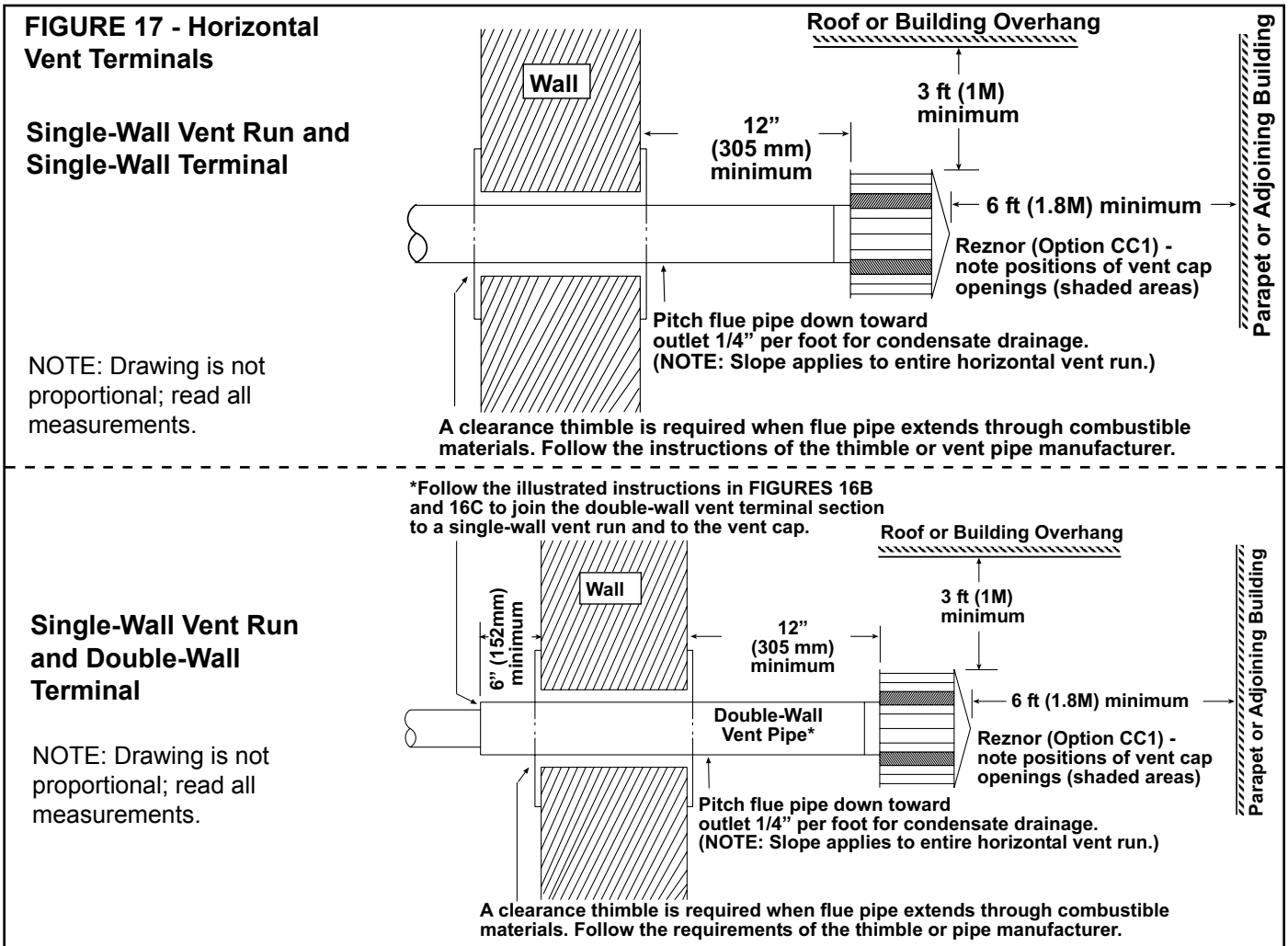
A vent cap is required. Maintain a clearance of 12" (305mm) from the wall to the vent terminal cap for stability under wind conditions.

Products of combustion can cause discoloration 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, relocate the vent or install a vertical vent.

**TABLE 14 - Horizontal Vent Clearances**

Structure	Minimum Clearances for Vent Terminal Location (all directions unless specified)
Forced air inlet within 10 ft (3.1M)*	3 ft (0.9M) above
Combustion air inlet of another appliance	6 ft (1.8M)
Door, window, or gravity air inlet (any building opening)	4 ft (1.2M) horizontally; 4 ft (1.2M) below; 1 ft (305mm) above
Electric meter, gas meter ** and relief equipment	U.S. - 4 ft (1.2M) horizontally; Canada - 6 ft (1.8M)
Gas regulator **	U.S. - 3 ft (0.9M); Canada - 6 ft (1.8M) horizontally
Adjoining building or parapet	6 ft (1.8M)
Adjacent public walkways	7 ft (2.1M) above
Grade (ground level)	3 ft (.9M) 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. The vent must be at least 6" (152mm) higher than anticipated snow depth.



**6.0 Mechanical (cont'd)**

**6.2 Venting and Combustion Air (cont'd)**

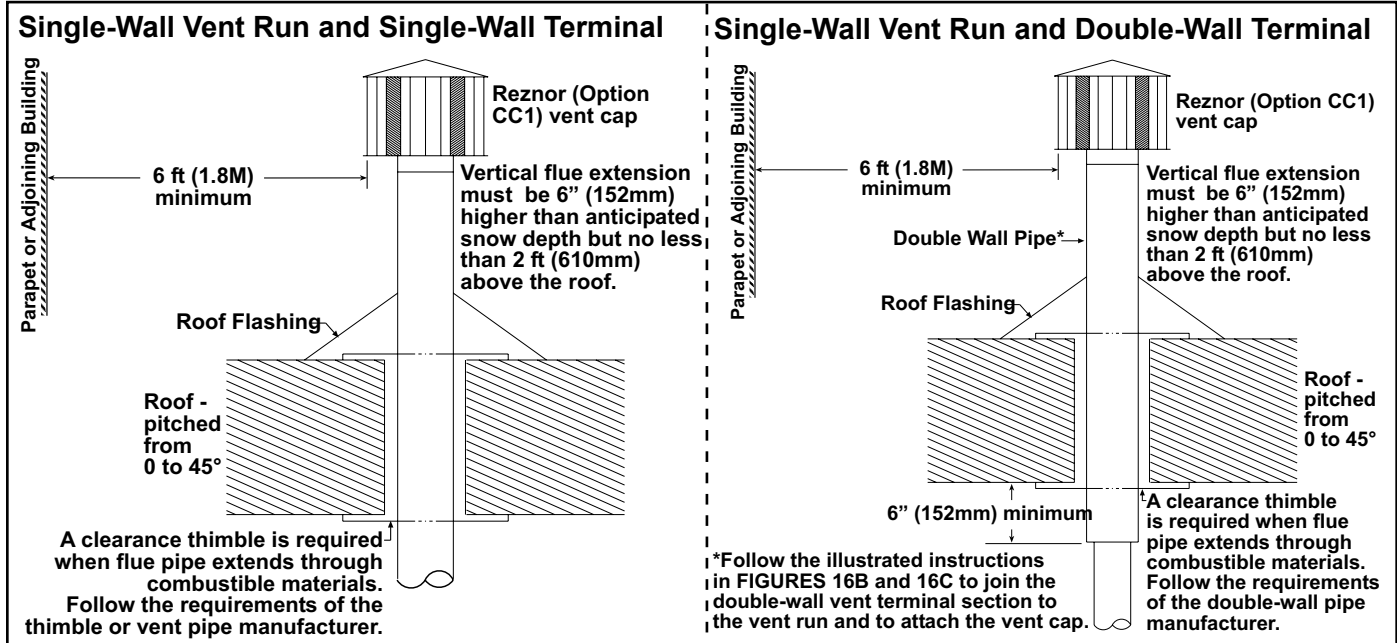
**Vertical Vent Terminals**

**6.2.2 Venting and Combustion Air Requirements for Power Vent Drawing Combustion Air from THE INSIDE SPACE and Venting Flue Products to the Outdoors (cont'd)**

**7) Vent Terminal (Pipe and Vent Cap) (cont'd)**

**FIGURE 18 - Vertical Vent Terminals**

NOTE: Drawings are not proportional; read all measurements.



**6.3 Inlet Air**

Inlet air ductwork is **required** unless equipped with inlet base Option AVA2. Filters are recommended when a cooling coil is part of the installation. Inlet air may be 100% return air, a mixture of return and outside air (air entering the blower must be 35°F or higher unless equipped with makeup air Option AD4), or 100% outside air if equipped with makeup air Option AD4.

**TABLE 15 - Inlet Air Opening Dimensions**

**Inlet Air Opening Dimensions**

Sizes	150, 200		250, 300		350, 400	
	inches	mm	inches	mm	inches	mm
<b>Without Optional Filter or Mixing Cabinet (actual cutout opening on heater)</b>						
Right Side	31 x 16	787 x 406	31 x 16	787 x 406	44 x 16	1118 x 406
Left Side	31 x 16	787 x 406	31 x 16	787 x 406	44 x 16	1118 x 406
Rear	33 x 16	838 x 406	45 x 16	1143 x 406	45 x 16	1143 x 406
Bottom	25-1/2 x 32	648 x 813	37-1/2 x 32	953 x 813	37-1/2 x 46	953 x 1168
<b>With Optional Side or Rear Filter Cabinet (duct opening in top or rear of cabinet)</b>						
Attached to Heater Side	32 x 16	813 x 406	32 x 16	313 x 406	45-1/8 x 16	1146 x 406
Attached to Heater Rear	32 x 16	813 x 406	45-1/8 x 16	1146 x 406	45-1/8 x 16	1146 x 406
<b>With Optional Bottom Filter Cabinet (duct opening in bottom of cabinet)</b>						
Under Heater	25-1/2 x 32	618 x 813	37-1/2 x 32	953 x 813	37-1/2 x 46	953 x 1168
<b>With Optional Mixing Box (duct opening in top, bottom, or rear of cabinet)</b>						
Attached to Heater Rear	22 x 19-1/2	578 x 495	36-1/2 x 19-1/2	927 x 495	36-1/2 x 19-1/2	927 x 495

**Inlet Air Ductwork**

The location of the inlet air duct connection depends on the installation. Corner indicators for the opening are provided on the right side, the left side, the rear, and the bottom of the heater. (See Dimensions in **FIGURE 1**, page 5.) Determine where the inlet air opening(s) should be and cut out using tin snips or aviation shears.

**CAUTION: The cut edges of the metal will be sharp.**

If installing an optional filter or filter/mixing cabinet shipped with the heater, attach the cabinet at the "cutout" opening. Attach the ductwork to the heater or to the inlet cabinet.



### 6.3.1 Filter Cabinet, Option CW (return air only)

#### Filter Cabinet NOTES (apply to FIGURES 19A, 19B, 19C, and 19D):

- \* Requires 2" permanent filters.
- \*\* If using side inlets, two cabinets must be installed, one on each side.

A side or rear filter cabinet designed for 2" pleated disposable or permanent metal filters is shipped separately for field assembly and installation. A bottom filter cabinet is factory assembled and is available with 2" disposable filters in addition to the pleated or permanent filters. Depending on the option selected, filters are either shipped with the cabinet or are field-supplied.

To adapt to a variety of applications, the heater cabinet is designed so that the filter cabinet can be positioned on either the right side, the left side, the rear, or the bottom of the heater. The larger filter cabinets (**FIGURES 19B and 19C**) are uniquely designed so that the same cabinet can be field-assembled and installed with either a horizontal or vertical air inlet. The smaller filter cabinet in **FIGURE 19A** is limited to Sizes 150 and 200 and is available with a horizontal inlet only. The bottom filter cabinet **FIGURE 19D** allows air to enter from below the heater. All cabinets have door panels for easy filter removal for changing or cleaning.

All of the filter cabinets have a duct flange for attaching the inlet air duct. For inlet duct dimensions, see **TABLE 15**.

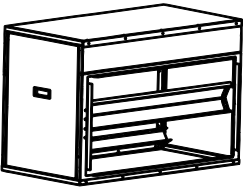
Follow the installation instructions included with the filter cabinet package.

### FIGURES 19A-19D - Filter Cabinets with Filter Arrangements and Filter Sizes

**FIGURE 19A - Small Filter Cabinet for Sizes 150 and 200 only -- Horizontal Air Inlet Only**

Option CW8 with 2" Pleated Filters  
Option CW9 with 2" Permanent Filters  
Option CW10 for Field-Supplied Filters

- Horizontal Inlet Opening
- "V" Filter Rack Arrangement
- Attaches on *either Side or the Rear* of a Size 150 or 200 Heater



**TABLE 16 - Filters for Options CW8, CW9, CW10**

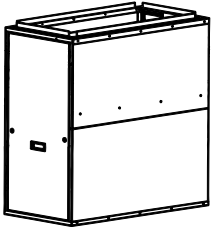
CAUA Size	CFM	FPM	2" Filters	
			Pleated	Permanent
150	1800	375	(2) 12 x 32	(4) 12 x 16
	2400	500	(2) 12 x 32	(4) 12 x 16
	*3000	625	--	(4) 12 x 16
200	2400	500	(2) 12 x 32	(4) 12 x 16
	*3000	625	--	(4) 12 x 16

\*Requires permanent filters.

**FIGURE 19B - Assembled with Vertical Air Inlet Opening**

Opt CW4 w/2" Pleated Filters  
Opt CW5 w/2" Permanent Filters  
Opt CW6 for Field-Supplied Filters

- Attaches on *Either Side* of the Heater
- Vertical (Top) or Horizontal Inlet Opening
- "V" Filter Rack Arrangement



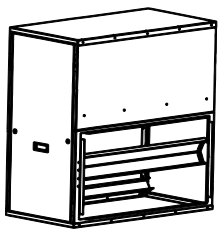
**TABLE 17 - Sizes of Permanent or Pleated 2" Filters for Options CW4, CW5, or CW6**

Size	CFM	FPM	Filters	Size	CFM	FPM	Filters
150	1800	281	(4) 16 x 16	300	3000	469	(4) 16 x 16
	2400	375	(4) 16 x 16		*4000	625	(4) 16 x 16
	3000	469	(4) 16 x 16		**5000	781	(4) 16 x 16 (4) 16 x 16
200	2400	375	(4) 16 x 16	350	4300	448	(6) 16 x 16
	3000	469	(4) 16 x 16		5000	521	(6) 16 x 16
	3000	469	(4) 16 x 16		*6000	625	(6) 16 x 16
250	*4000	625	(4) 16 x 16	400	4300	448	(6) 16 x 16
	**5000	781	(4) 16 x 16 (4) 16 x 16		5000	521	(6) 16 x 16
					*6000	625	(6) 16 x 16

**FIGURE 19C - Assembled with Horizontal Air Inlet Opening**

Opt CW7 w/2" Pleated Filters  
Opt CW12 w/2" Permanent Filters  
Opt CW11 for Field-Supplied Filters

- Attaches on *the Rear* of the Heater
- Vertical (Top) or Horizontal Inlet Opening
- "V" Filter Rack Arrangement



**TABLE 18 - Sizes of Permanent or Pleated 2" Filters for Options CW7, CW12, or CW11**

Size	CFM	FPM	Filters	Size	CFM	FPM	Filters
150	1800	281	(4) 16 x 16	300	3000	313	(6) 16 x 16
	2400	375	(4) 16 x 16		4000	417	(6) 16 x 16
	3000	469	(4) 16 x 16		5000	521	(6) 16 x 16
200	2400	375	(4) 16 x 16	350	4300	448	(6) 16 x 16
	3000	469	(4) 16 x 16		5000	521	(6) 16 x 16
	-	-	-		*6000	625	(6) 16 x 16
250	3000	313	(6) 16 x 16	400	4300	448	(6) 16 x 16
	4000	417	(6) 16 x 16		5000	521	(6) 16 x 16
	5000	521	(6) 16 x 16		*6000	625	(6) 16 x 16

\* Requires permanent filters. \*\*If filter cabinet attaches to heater side (CW 4,5,6), install 2 cabinets (1 on each side).

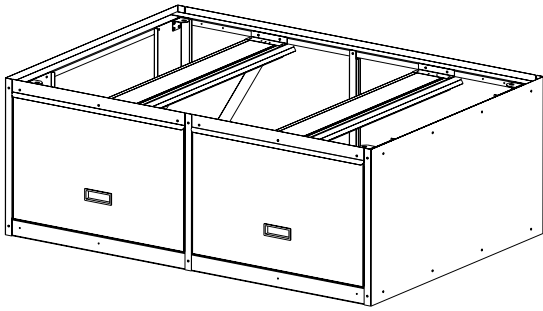
Form I-CAUA, P/N 164771 R11, Page 25

## 6.0 Mechanical (cont'd)

## 6.3 Inlet Air (cont'd)

### 6.3.1 Filter Cabinet, Option CW (cont'd)

**FIGURE 19D - Bottom Filter Cabinet**



**Option CW13 with 2" Disposable Filters**

**Option CW14 with 2" Pleated Filters**

**Option CW15 with 2" Permanent Filters**

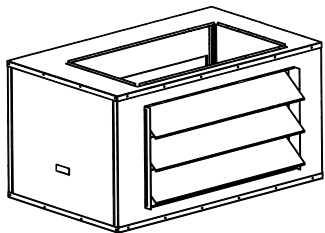
**Option CW16 for Field-Supplied Filters**

- Adds 18" (457mm) to height of the heater
- Shipped factory assembled for field installation
- "V" Filter Rack Arrangement

**TABLE 19 - Sizes of Disposable, Permanent or Pleated 2" Filters for Options CW13, CW14, CW15, or CW16**

Size	CFM	FPM	Filters
150	1800	281	(6) 16 x 16
	2400	375	(6) 16 x 16
	3000	469	(6) 16 x 16
200	2400	375	(6) 16 x 16
	3000	469	(6) 16 x 16
250	3000	313	(8) 16 x 16
	4000	417	(8) 16 x 16
	5000	521	(8) 16 x 16
300	3000	313	(8) 16 x 16
	4000	417	(8) 16 x 16
	5000	521	(8) 16 x 16
350	4300	448	(12) 16 x 16
	5000	521	(12) 16 x 16
	*6000	625	(12) 16 x 16
400	4300	448	(12) 16 x 16
	5000	521	(12) 16 x 16
	*6000	625	(12) 16 x 16

### 6.3.2 Outside Air and Return Air Mixing Box, Option GA



The optional mixing box for the Model CAUA heater is designed to provide the system with a supply air mixture of return air and outside air. Any percentage of outside air can be supplied to a standard unit as long as the air temperature entering the blower is 35°F or above. Only a unit equipped with factory-installed makeup air Option AD4 is permitted to operate with entering air below 35°F.

The mixing box is available in an assortment of configurations with a selection of actuators and controls. All mixing boxes are completely assembled at the factory for field attachment to the rear of a Model CAUA heater.

Follow the instructions packed with the mixing box to cut out the opening and attach the mixing box. If the mixing box has dampers, follow the instructions for routing the damper motor wires, and connect the wires according to the wiring diagram. If there are both return air and outside air dampers, follow the directions to adjust the damper linkage.

All mixing box inlet air openings have duct flanges for attachment of ductwork. Ductwork must be attached to the outside air opening. Removable door panels provide for filter access from either end of the cabinet. If the mixing box was ordered with optional filters, it is shipped with the filters installed.

### Mixing Box Configurations by Option Code

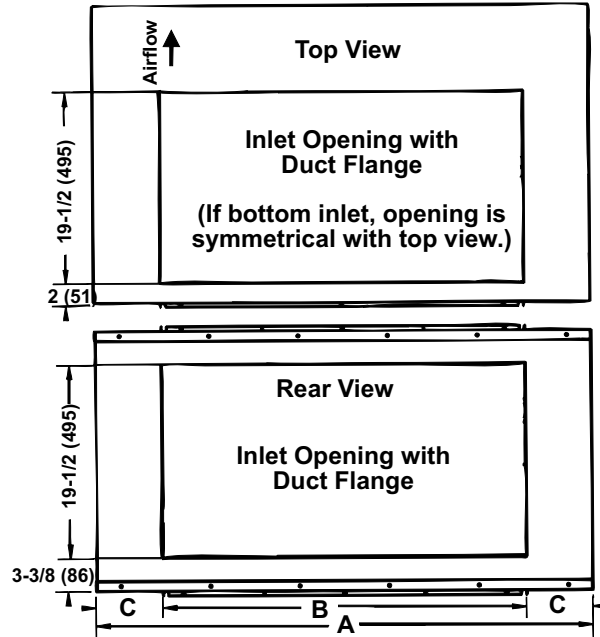
#### Configurations/Accessories

Before installing, check to be sure that the configuration of the mixing box matches the order and that any accessories ordered are part of the cabinet. Factory-installed optional accessories could include a damper motor, potentiometer, return air controller, mixed air controller, and/or filters. **NOTE:** If the potentiometer is to be field-installed, it is shipped in a separate carton.

Option	Mixing Box Configuration
GA1	Top Outside Air Opening <i>with</i> Dampers/Rear or Bottom Return Air Opening <i>without</i> Dampers
GA2	Rear Outside Air Opening <i>with</i> Dampers/Top or Bottom Return Air Opening <i>without</i> Dampers
GA3	Bottom Outside Air Opening <i>with</i> Dampers/Top or Rear Return Air Opening <i>without</i> Dampers
GA4	Bottom Outside Air Opening <i>with</i> Dampers/Rear Return Air Opening <i>with</i> Dampers
GA5	Bottom Outside Air Opening <i>with</i> Dampers/Top Return Air Opening <i>with</i> Dampers
GA6	Rear Outside Air Opening <i>with</i> Dampers/Top Return Air Opening <i>with</i> Dampers
GA7	Rear Outside Air Opening <i>with</i> Dampers/Bottom Return Air Opening <i>with</i> Dampers
GA8	Top Outside Air Opening <i>with</i> Dampers/Rear Return Air Opening <i>with</i> Dampers
GA9	Top Outside Air Opening <i>with</i> Dampers/Bottom Return Air Opening <i>with</i> Dampers

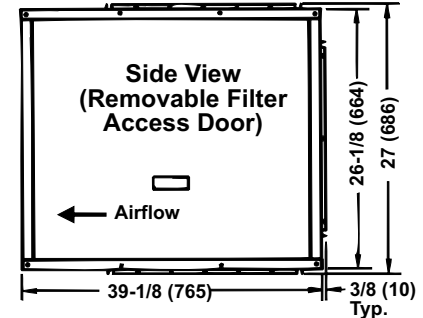
**FIGURE 20 - Dimensions of Optional Mixing Box - inches (mm)**

**Note:** Damper frame fits in the inlet opening.

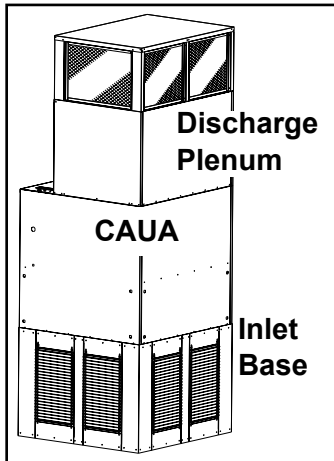


**TABLE 20 - Mixing Box Dimensions - inches (mm)**

CAUA Size	150, 200	250, 300, 350, 400
A	38 (965)	50 (1270)
B	22-3/4 (578)	36-1/2 (927)
C	7-5/8 (194)	6-3/4 (171)



**FIGURE 21 - Inlet Base and Discharge Plenum Options**



### 6.3.3 Inlet Base, Option AVA (Sizes 350 and 400 only)

A discharge plenum adds 49-15/16" (1268mm) to the height of the heater. (If installing Option CD62, this height includes the cooling coil.)

The optional mounting base is designed to support a Model CAUA 350 or The optional mounting base is designed to support a Model CAUA 350 or 400 heater while providing an inlet for return air. The mounting base is designed to be used with an optional discharge plenum (Paragraph 6.4.1) creating a "packaged stand-alone" heating or heating/cooling upflow system which can be used in an air turnover application.

However, if the installation requires it, the mounting base may also be used with discharge ductwork.

The mounting base has guarded openings on all four sides and is available with optional 1" flat disposable, 1" permanent aluminum, or 1" pleated disposable filters.

The base is designed for a fairly open area and must have at least three of the four sides open.

The base adds 36-1/2" (927mm) to the overall height.

## 6.4 Discharge Air

**Installation NOTE:** If being installed as a makeup air unit with two-stage control (Option AG3), see Paragraph 6.4.3 for instructions on installing the duct sensor.

### 6.4.1 Discharge Duct Connection

The discharge duct connects to the top of the heater or to the outlet of the optional cooling coil cabinet. See **FIGURES 22A and 22B**. Connect the ductwork plenum to the duct flange as illustrated in **FIGURE 22B**.

- 1) The duct connection on the top of the heater has a 90° flange.
- 2) The duct may either have no flange or a 90° flange.
- 3) Position ductwork around the outside of the heater flange.
- 4) If the ductwork has a flange, drill holes vertically through duct flange into the top of the heater and secure with sheetmetal screws. If the ductwork does not have a flange, drill holes horizontally through the ductwork and the heater flange; secure with sheetmetal screws.

## 6.0 Mechanical (cont'd)

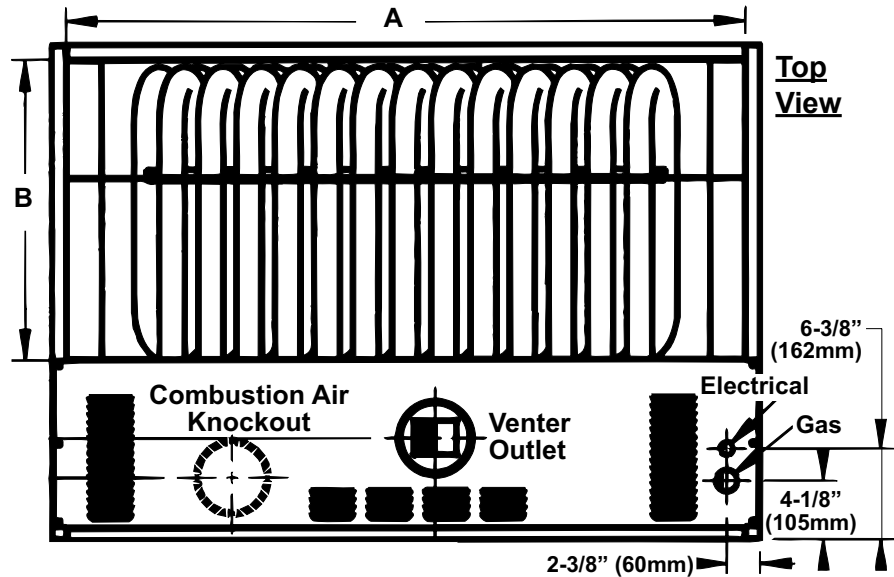
## 6.4 Discharge Air (cont'd)

### 6.4.1 Discharge Duct Connection (cont'd)

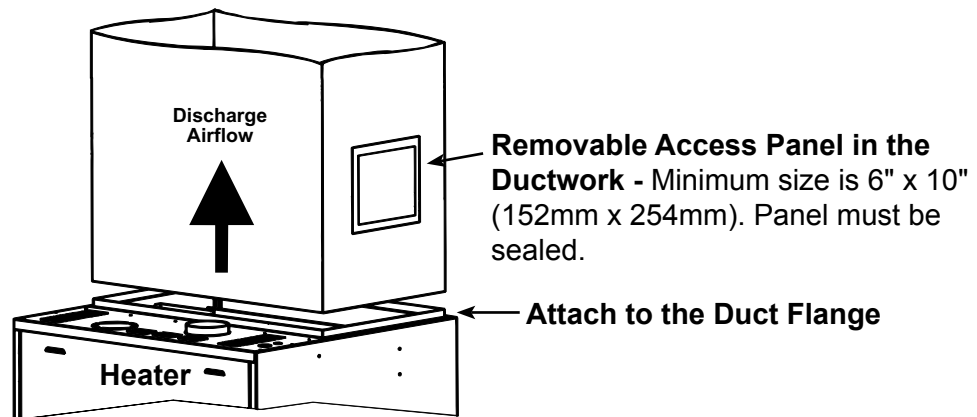
**FIGURE 22A - Top View**  
showing Discharge Duct  
Connection Dimensions

**TABLE 21 - Discharge Duct  
Dimensions**

Size	A	B
150, 200	36" (914mm)	21" (533mm)
250, 300	48" (1219mm)	21" (533mm)
350, 400	48" (1219mm)	34" (864mm)



**FIGURE 22B -  
Connecting Discharge  
Ductwork**



### Requirements and Suggestions for Connecting and Installing Ducts

**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. See Hazard Levels, page 2.**

- **Type of Ductwork** - The type of duct installation to be used depends in part on the type of construction of the building.
- **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 unheated space with at least 1/2" (1" recommended) of insulation.
- **Duct Supports** - Suspend all ducts securely from 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, Arlington, VA 22206 ([www.acca.org](http://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" x 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.

### 6.4.2 Discharge, Plenum, Option CD (Sizes 350 and 400 only)

The optional discharge plenum is designed to be used with a screened mounting base (Paragraph 6.3.3) to create a "packaged stand-alone" upflow system that circulates building air. However, the discharge plenum may also be used in place of ductwork in applications that do not have an optional mounting base.

The discharge plenum is available in three types. Option CD60 and CD61 are for a heater without a cooling coil; Option CD60 is designed for an open area and Option CD61 includes field-installed blockoff plates to block off one or two sides. Option CD62 can only be ordered with a cooling coil and includes blockoff plates to provide higher velocity required for cooling.

### 6.4.3 Ductstat Installation - Two-Stage, Makeup Air, Option AG3

FIGURE 23 - Ductstat with Capillary Tubing in Option AG3



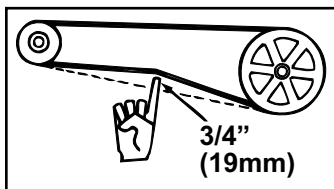
Two-stage makeup air units are equipped with a two-stage gas valve, but instead of control from a two-stage room thermostat, the outlet air temperature is monitored and controlled by a two-stage ductstat. (**NOTE:** This option is available only when the heater is equipped with makeup air Option AD4.)

The ductstat is factory mounted in the control compartment of the heater and has a capillary that must be field installed. To complete the installation, uncoil the tubing, extend the capillary, and mount it in the ductwork. Follow the instructions provided by the ductstat manufacturer.

The ductstat is set to 70°F and has an adjustable range with a fixed differential of 2-1/2°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.

### 6.5 Blower, Motor, and Drive

FIGURE 24 - Check Belt Tension



Model CAUA units are equipped with either direct drive motor(s) and blower(s) or adjustable belt-drive blower(s) and motor.

**Direct Drive** - All direct drive blower motors are 1 horsepower. Sizes 150-200 have a single motor. Size 150 has a 12-9 blower; Size 200 has a 12-12 blower. Sizes 250-400 have dual motors with dual 12-9 blowers.

**Belt Drive** - The motor horsepower on a belt drive unit is whatever was specified on the order ranging in size from 1/3 HP to 5 HP. Check the heater rating plate and the motor rating plate.

As part of the startup procedure, check belt tension. Proper belt tension is important to the long life of the belt and motor. A loose belt will cause wear and slippage. Too much tension will cause excessive motor and blower bearing wear. Adjust the belt tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4". (See **FIGURE 24.**) After correct tension is achieved, re-tighten the locknut on the adjustment screw. Be sure that the belt is aligned in the pulleys.

Most blower motors are equipped with thermal overload protection of the automatic, reset type. If the motor is not equipped with thermal overload protection, the unit will be equipped with a starter. The adjustable setting on the starter will be factory set to match the amp draw of the motor and sealed. No change should be made to the starter setting unless the original motor is replaced. Starters are equipped with a manual reset. If an overload condition is experienced, the condition must be corrected and the starter must be manually reset.

### Adjusting Blower Speed

The blower speed may be adjusted to achieve the desired outlet temperature, as long as the adjustment is within the temperature rise and the static pressure limits shown on the heater rating plate. Direct drive motors are factory set at medium speed for heating and high speed for optional cooling (if ordered). Belt drive motors are factory set between maximum and minimum blower speeds. Belt drives may also be ordered with an optional variable frequency drive that changes motor speed by changing the electrical frequency to the motor.

## 6.0 Mechanical (cont'd)

### 6.5 Blower, Motor, and Drive (cont'd)

#### Direct Drive Motors

**TABLE 22 - Direct Drive  
Motor Wiring**

CAUA Sizes	Speed	Use these two motor wires:
150, 200, 250, and 350	High	White and Black
	Medium	White and Black
300 and 400	High	White and Black
	Medium	White and Black

#### Belt Drive Motors

### Adjusting Blower Speed (cont'd)

If the duct resistance is low, the blower may deliver too high an air volume. If the resistance is very low, the blower may deliver excess air to overload the motor, causing the overload protector to activate. Reducing the blower speed will correct these conditions. If ductwork is added to an installation, it may be necessary to increase the blower speed.

After the installation is complete including all ductwork, the amp draw of the motor should be checked with an amp meter to verify that the motor amp rating on the motor nameplate is not being exceeded. Amps may be adjusted downward by reducing the blower speed or by increasing the duct system static pressure. The temperature rise must be within the range specified on the unit rating plate.

**Direct drive motors** have multi-speed taps for speed adjustment. If your installation requires an adjustment of the blower speed, the motor may be re-wired to an alternate tap by following these instructions.

1. Turn off the gas and electric power.
2. Remove the blower door panel.
3. Consult the wiring diagram on the heater and follow the chart in **TABLE 22** to choose the wiring for the desired adjustment. Units are wired at high speed for cooling (if ordered) and medium speed for heating.
4. Cut the crimped cap for the end of the wire that you intend to use and strip the insulation.
5. Disconnect the factory-wired connection and rewire using the newly stripped wire.
6. Put a wire nut on the end of the blower motor wire that was disconnected.
7. Replace the heater door panel. Turn on the gas and electric. Check for proper operation.

**Belt drives** have an adjustable pulley which permits adjustment of the blower speed. Follow these instructions to adjust blower speed of a belt drive motor. (**NOTE:** These instructions apply only to a belt drive motor that is not equipped with an optional variable frequency drive.)

1. Turn off the gas and the electric power.
2. Loosen belt tension and remove the belt.
3. Loosen the set screw on the side of the pulley away from the motor.
4. **To increase the blower speed**, turn the adjustable half of the pulley inward. **To decrease the blower speed**, turn the adjustable half of the pulley outward. One turn of the pulley will change the speed 8-10%.
5. Tighten the set screw on the flat portion of the pulley shaft.
6. Replace the belt and adjust the belt tension. Adjust tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4". (See **FIGURE 23**.) Re-tighten the lock nut on the adjusting screw. Be sure that the belts are aligned in the pulley grooves properly and are not angled from pulley to pulley.
7. Turn on the gas and electric. Light the heater following the instructions on the lighting instruction plate.
8. Check the motor amps with an amp meter. The maximum motor amp rating on the motor nameplate must not be exceeded.

When service is complete, check for proper operation.

#### Belt Drive with Optional Variable Frequency Drive

When an optional variable frequency drive is ordered, the motor operates on two speeds as determined by the electrical frequency. High speed is used for cooling and low speed for heating. 60 hertz is the maximum high speed. Maximum speed for low speed heating is the frequency that will provide the maximum temperature rise of the heater. Allowable temperature rise range for a Model CAUA heater is 45-75°F.

Follow the variable frequency controller manufacturer's instructions that are packaged with the heater (in the owner's envelope) to program the variable frequency drive settings.

## 6.6 Cased Cooling Coil, Model ACUA, ACUB, or ACUC or Option C

This cased cooling coil is designed for use with the Model CAUA upflow heater. It is shipped separately for field installation over the discharge opening of the heater. Before installing, verify that the coil cabinet is the same size as the heater cabinet.

Follow the installation instructions shipped with the cooling coil (Installation Form I-CAUA-CC), the wiring diagram, and the instructions provided by the condenser unit manufacturer.

The cased cooling coil is for use with R-410A refrigerant and requires field installation of the shipped-loose thermostatic expansion valves and reducers (if required). (**NOTE:** A coil installed prior to 12/09 most likely is charged with R22 refrigerant; check the rating plate. Due to higher pressures, do not use tools designed for R22 refrigerant with R410A refrigerant.)

Depending on size and option selection, coils may have a single circuit (Sizes 060 and 072 only), have two 50/50 circuits, or have two circuits that are 1/3-2/3 designed to match the Model MASA condensing unit.

**TABLE 23 - Heater/Coil Cross-Reference by Cabinet Size**

Heater Model CAUA					
150	200	250	300	350	400
ACUA or Opt C		ACUB or Opt C		ACUC or Opt C	
060		090		120	
072		120		150	
090		150		180	

**TABLE 24 - Cased Cooling Coil Technical Data**

Model	ACUA			ACUB			ACUC			
Size	60	72	90	90	120	150	120	150	180	
Nominal Cooling Capacity (MBH)	60	72	90	90	120	150	120	150	180	
Refrigerant Type	R-410A. ( <b>NOTE:</b> Prior to 12/09, refrigerant type may be R22.)									
Thermostatic Expansion Valves	Shipped loose for field installation; see Form I-CAUA-CC.									
Approximate Weight (lbs)	83	86	105	110	122	140	176	180	188	
Face Area (sq ft)	7.79	7.79	9.38	14.04	11.67	13.7	17.13	15.38	17.13	
Airflow (cfm)	Low	1800			3000			4000		
	Nominal	2400			4000			5000		
	High	3000*			5000*			6000*		
* Airflow in excess of maximum values shown may result in blow-off of condensation.										

### Thermostatic Expansion Valves

Verify the thermostatic expansion valves and reducers shipped with the coil with the appropriate list in Form I-CAUA-CC. Follow the instructions provided to install the thermostatic expansion valve(s) and reducer(s), if required.

**CAUTION: The thermostatic expansion valve must be for the right refrigerant and must be sized to match the circuit. Failure to properly select and install the thermostatic expansion valve will prevent the system from operating properly and will void the manufacturer's warranty.**

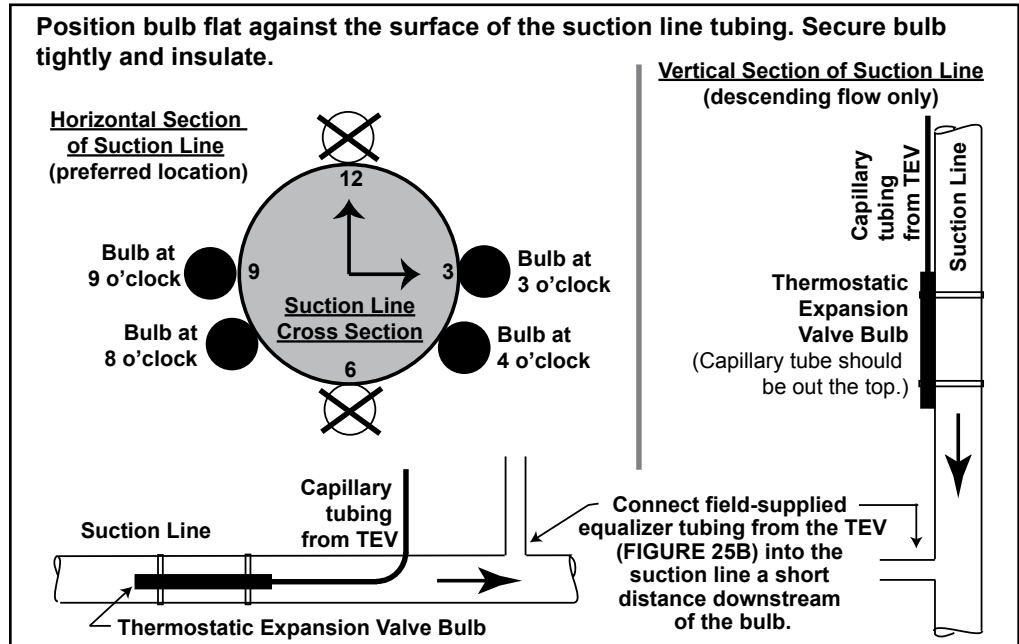
After the refrigerant lines are installed and before charging, extend the thermostatic expansion valve bulb from the valve to the suction line. If there are two circuits, be sure to match the liquid line with the corresponding suction line. Comply with the valve manufacturer's instructions on bulb placement. General recommendations are listed below.

- Place bulb on suction line as close to the evaporator coil outlet as possible.
- Place the bulb on a straight horizontal section of suction line (if bulb must be vertical, line must be descending).
- Never place bulb in a trap or downstream of a trap.
- Position bulb as shown in **FIGURE 25A**.
- Bulb must have 100% contact with tubing.
- Secure the bulb tightly.
- Cover bulb with waterproof insulation.

## 6.0 Mechanical (cont'd)

**FIGURE 25A - Suction Line showing Orientation and Location of the Thermostatic Expansion Valve Bulb and the Equalizer Tubing (applies to each circuit)**

## 6.6 Cased Cooling Coil, Model ACUA, ACUB, or ACUC or Option C (cont'd)

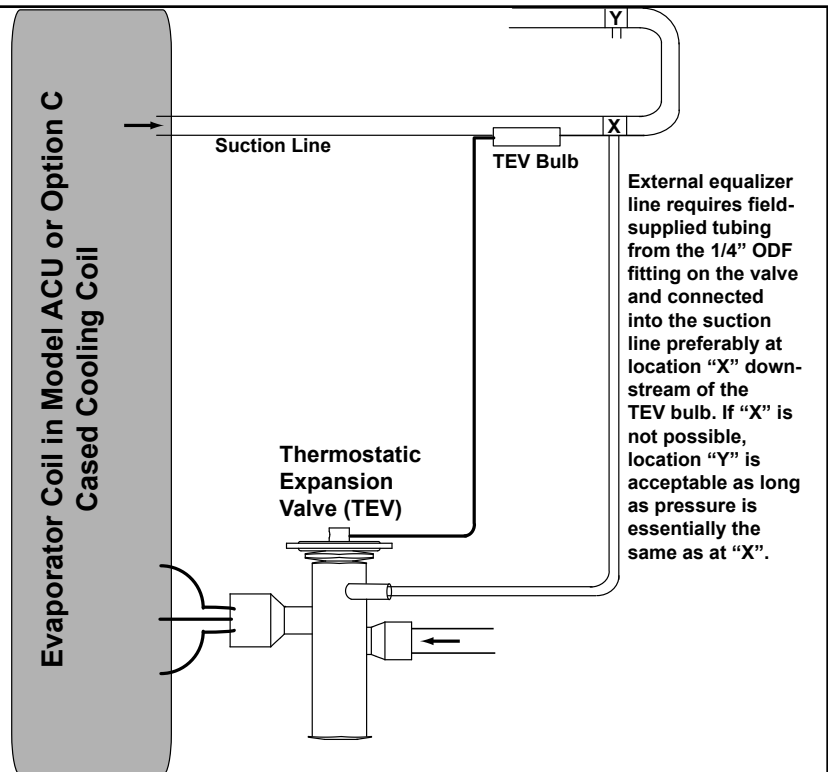


In addition, an external equalizer line must be installed from the stem on the valve to a location on the suction line that is downstream of the bulb. Follow the instructions in **FIGURE 25B** to install the field-provided tubing.

**FIGURE 25B - Thermostatic Expansion Valve with External Equalizer Line Fitting (required for each circuit)**

**Thermostatic Expansion Valve Equalizer Line** - To ensure that the correct pressure is signaled to the valve, an external equalizer line must be connected into the suction line downstream of the thermostatic expansion valve bulb. (See location indicated in **FIGURES 25A** and **25B**.)

Connect the other end of the equalizer tubing to the 1/4" ODF stem on the thermostatic expansion valve as shown in **FIGURE 25B**.



## Cased Cooling Coil Drain Line

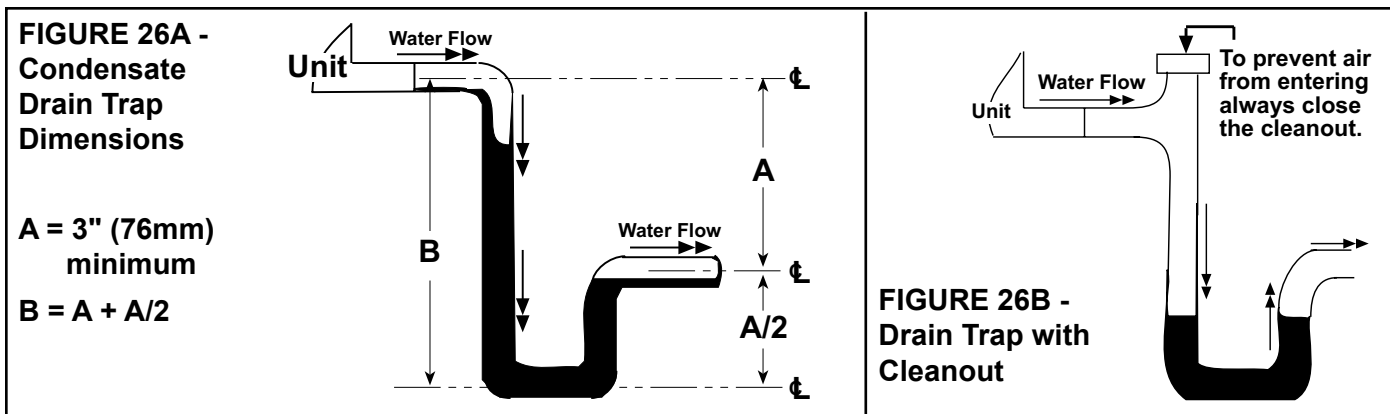
The cased coil has a 3/4" FPT drain connection. Install a trap (see below) and pitch the drain line downward at least 1/2" (13mm) for every 10 feet (3M) of horizontal run. Drain lines must not interfere with access panels. An obstruction in the drain or a poorly designed drain can cause an overflow. Overflow could result in unit or building damage.

Connect the burner condensate tubing into the cooling coil drain line and continue into a sanitary drain system.



## Condensate Drain Trap

The design of the drain trap is important. If dimension "B" in **FIGURE 26A** is not tall enough, the water seal will not hold, and air will be drawn through the drain pipe into the system. If the outlet leg of the trap is too tall, water will back up into the drain pan. As condensate forms during normal operation, the water level in the trap rises until there is a constant outflow. **FIGURE 26B** illustrates the appropriate dimensions.



## Coil Condensate Drain Use

Improper trap design accounts for some condensate drainage system failures, but incorrect use and maintenance of condensate drain traps can also cause problems. The combination of airborne particles and moisture in the air handler can result in algae formation in the drain pan and traps. The traps must be cleaned regularly to avoid blockage that can slow or stop water flow, resulting in backup into the system. If drains have a cleanout opening (**FIGURE 26B**), be sure to close the opening after cleaning.

Seasonal Usage - At the beginning of the cooling season, inspect and clean the entire cooling coil cabinet including the condensate drain pan. Thoroughly clean dirt, algae, grease, and other contaminants. Inspect condensate drain pans, traps, and piping; fill traps with water to ensure proper operation. During a wintertime shutdown of the cooling system it may be desirable to disconnect and remove all water from the traps and drains to prevent freeze damage. If local building codes permit, traps may be filled with an antifreeze solution. Or, piping may be designed with freeze plugs or other freeze protection methods (such as a heat tape).

Year Round Usage - Climates or applications with cooling requirements year round require more frequent inspections of the cooling coil cabinet and condensate drains. Depending on climate, freeze protection of traps may be required during non-cooling hours.

## 6.7 Burner Condensate Drain

If an optional cooling coil is installed on a Model CAUA heater (either now or at a later time), a burner condensate drain line **must** be installed.

The parts to install the drain line are packaged and shipped with all Model CAUA heaters.

Qty	P/N	Description
1	165955	6-ft length of 3/8" I.D. Tubing
1	165952	90° Nylon Fitting, 1/4" NPT x 3/8" tubing
1	110628	1/4" NPT Brass Nut
1	171527	1/4" Locknut, Hex, T& B 139
1	165953	Sealing Washer
2	20913	Nylon Wire Ties, T&B #TY-24M
1	87556	Snap Bushing, Heyco SB 625-8

## Instructions for Installing Burner Condensate Drain

1. Remove the burner compartment door.
2. The burner box cover is in two or three sections. On the left side of the burner box cover, disconnect the flame sensor wire and the flame rollout switch wires. Disconnect the silicone tubing from the static tap. Remove the left section of the burner box cover.
3. Determine which side of the cabinet will be most convenient for the drain line. On that side, remove the hole plug. Insert the snap bushing provided.

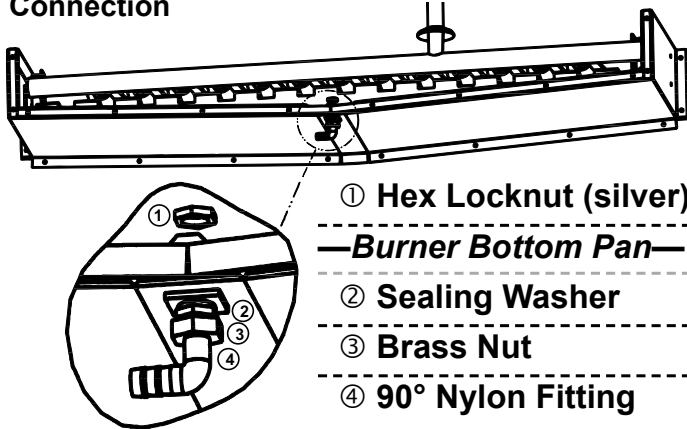
## 6.0 Mechanical (cont'd)

## 6.7 Burner Condensate Drain (cont'd)

### Instructions for Installing Burner Condensate Drain (cont'd)

4. Locate the hole in the bottom center of the burner pan and remove the plug. Follow the instructions in **FIGURE 27** to install the drain. Complete all steps as listed in the illustration. When installation of the burner condensate drain is complete, re-assemble the heater.

**FIGURE 27 - Burner Condensate Drain Connection**

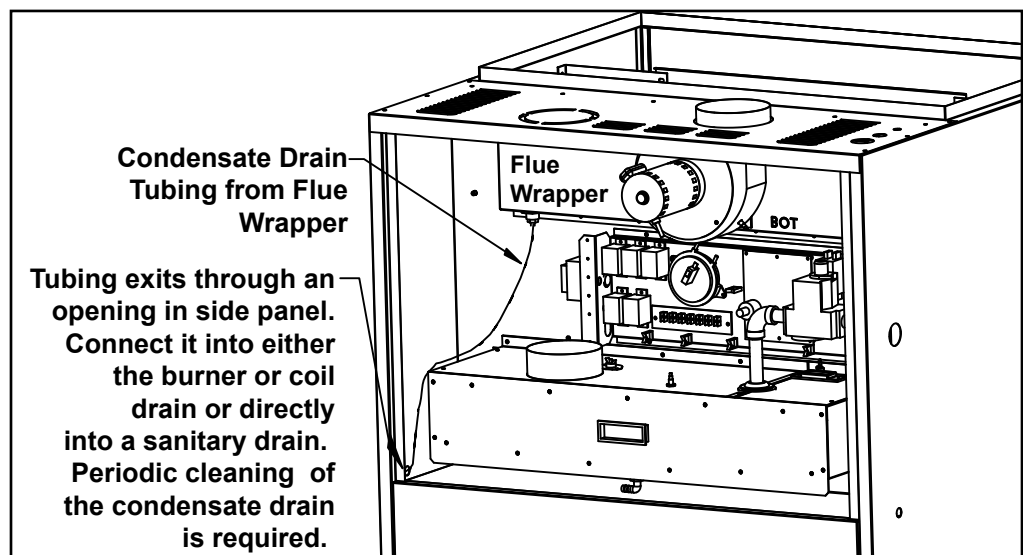


- a) Assemble the brass nut, the sealing washer, and the 90° fitting.
- b) Position the threaded fitting up through the hole so that the hose barb is toward the bushing in the side of the cabinet. Attach using the silver-colored locknut.
- c) Under the burner, push the tubing onto the hose barb, being sure that it is secure. Maintaining a downward slope, extend the hose out through the cabinet side.
- d) Just after exiting the cabinet, **create a trap in the line by making a loop in the hose**. Secure the loop with the wire ties.
- e) Continue downward with the tubing, connecting it into the coil drain pipe.

## 6.8 Flue Wrapper Condensate Drain

If equipped with a makeup air option to allow inlet air less than 35°F (Option AD4), the flue wrapper will have a condensate drain. Follow the instructions in **FIGURE 28**. Periodic cleaning of the condensate drain is required.

**FIGURE 28 - Unit with Option AD4 which includes a Condensate Drain on the Flue Wrapper**



## 7.0 Electrical and Wiring

### WARNING

If you turn off the power supply, turn off the gas. See Hazard Levels, page 2.

All electrical wiring and connections, including electrical grounding, **MUST** be completed in accordance with local, state and national codes and regulations and with the National Electric Code (ANSI/NFPA No. 70) or in Canada, the Canadian Electrical Code Part 1 CSA C.22.1. In addition, the installer should be aware of and comply with any local ordinances or gas company requirements.

### 7.1 Wiring

Check the rating plate on the heater for the supply voltage and current requirements. A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the heater. All external wiring must be within approved conduit and have a minimum temperature rise rating of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the heater.

Use an amp meter to check motor amps. **TABLE 26** lists full load amps for all HP's and voltages. Amps may be adjusted downward by reducing blower RPM or increasing duct system static pressure.

The amps listed in **TABLE 26** can be used for sizing line wiring but should not be inter-

## Motor Amps

preted as the exact motor amps. See the motor rating plate for exact motor specifications. At final adjustment, amperes should not exceed motor nameplate amp rating. The installation must be adjusted to obtain a temperature rise within the range specified on the heater rating plate.

The electrical supply and control wiring enter at the top of the heater (See **FIGURE 1**,

**TABLE 26- Motor Amps**

**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 or cause the limit control to activate. See Hazard Levels, page 2.**

Full Load Amps (per motor) - Blower Motors								
HP	1/3	1/2	3/4	1	1-1/2	2	3	5
<b>Direct Drive Motors</b>								
208/230V 1 PH	--	--	--	6.3	--	--	--	--
<b>Optional Belt Drive OPEN Motor</b>								
208V 1PH	3.0	5.1	5.5	7.5	7.8	12.3	13.7	28.0
230V 1PH	3.0	4.4	5.4	6.5	7.5	12.3	12.4	26.0
208V 3PH	1.9	2.5	2.9	3.4	5.6	7.0	9.0	13.4
230V 3PH	1.6	3.0	2.6	3.7	5.0	6.6	8.6	13.2
480V 3PH	0.8	1.5	1.3	2.0	2.8	3.5	4.3	6.6
575V 3PH	--	0.9	1.0	1.4	2.0	2.6	3.6	5.4
<b>Optional Belt Drive TEFC Motor</b>								
208V 1PH	2.3	3.5	5.4	6.2	9.5	--	--	--
230V 1PH	2.4	3.6	5.5	6.0	8.2	8.3	15.0	20.2
208V 3PH	1.2	2.3	2.0	3.3	4.8	6.1	7.7	12.6
230V 3PH	1.2	2.0	2.2	3.1	4.6	5.6	7.0	11.4
480V 3PH	0.6	1.0	1.1	1.6	2.3	2.8	3.5	5.7
575V 3PH	--	0.7	0.8	1.4	1.7	2.2	2.9	4.7

page 5) and connect to the supply voltage terminal strip located above the contactor(s) or starter(s) (See **FIGURE 28**).

Consult the wiring diagram supplied with your 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 wires which must be 150°C. See Hazard Levels, page 2.**

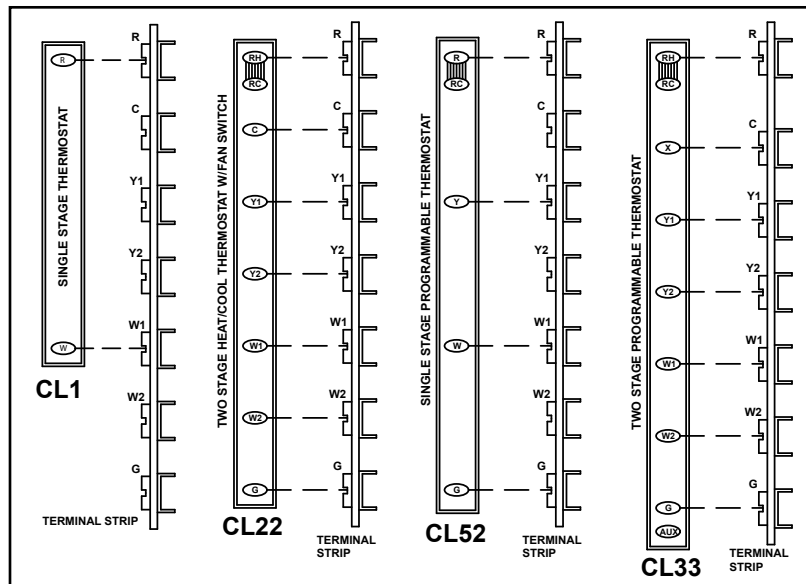
## 7.2 Thermostat and Connections

A thermostat is not standard equipment but is an installation requirement. Use either an optional thermostat available with the heater or a field-supplied 24-volt thermostat. Install according to the thermostat manufacturer's instructions. Control wiring enters on the right side of the heater and connects to the terminal strip in the control compartment; see **FIGURE 30**, page 38.

Make sure that the heat anticipator setting on the thermostat is in accordance with the amperage value noted on the wiring diagram of your heater.

For cooling unit connections, refer to the wiring diagram or the cased cooling coil installation instructions, Form I-CAUA-CC. Follow the thermostat manufacturer's instructions.

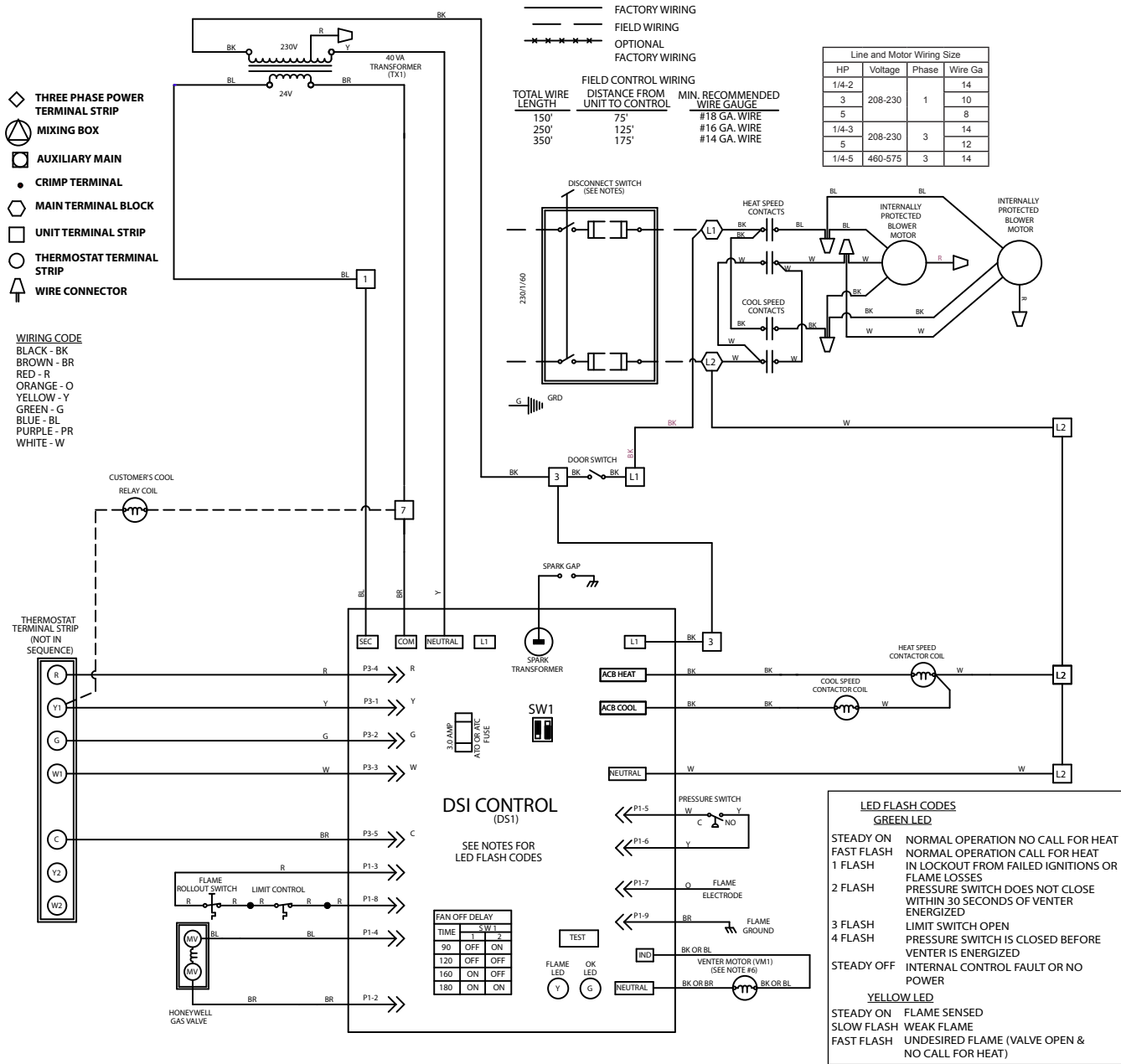
**FIGURE 29A - Wiring Connections for Option CL1, CL22, CL52, and CL33 Thermostats**



# 7.0 Electrical and Wiring (cont'd)

# 7.3 Typical Wiring Diagrams

## FIGURE 29B - Wiring Diagram with Single-Stage Gas Control and Direct Drive Blower Motor



CAUA: AG1-AK3-DR1

WD #280695

**NOTES**

- THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT: THERMOSTAT
- DOTTED WIRING INSTALLED BY OTHERS.
- CAUTION: IF ANY OF THE ORIGINAL WIRING 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.
- USE #18 GA. WIRE FOR CONTROL WIRING ON THE UNIT.
- LINE AND FAN MOTOR BRANCH WIRE SIZES SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROPS BEYOND 5% OF SUPPLY LINE VOLTAGE.
- VENTER MOTOR ON 350-400 UNITS HAS BROWN AND BLUE WIRES.
- 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.

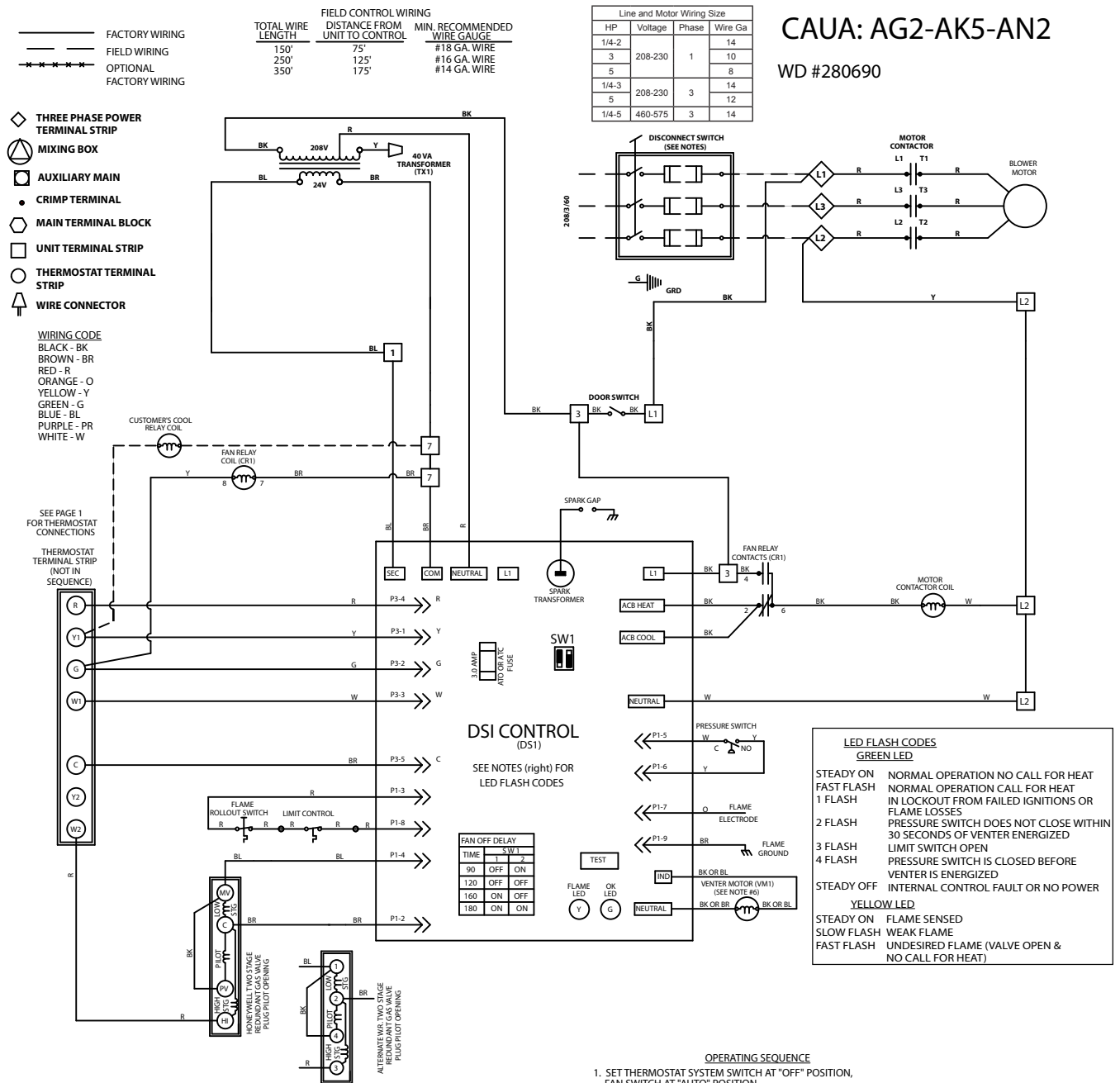
**OPERATING SEQUENCE**

- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION, FAN SWITCH AT "AUTO" POSITION.
- TURN ON MANUAL GAS VALVE.
- TURN ON POWER TO UNIT.
- SET THERMOSTAT SYSTEM SWITCH AT "AUTO" POSITION, FAN SWITCH AT "AUTO" POSITION.
  - THERMOSTAT CALLS FOR LOW HEAT, ENERGIZING THE VENTER MOTOR.
  - VENTER PRESSURE SWITCH CLOSURES, FIRING UNIT AT LOW RATE.
  - BURNER FLAME IS SENSED, AND IN 30 SECONDS THE BLOWER MOTOR IS ENERGIZED.
  - ON CALL FOR HIGH HEAT THE UNIT FIRES AT FULL RATE.
  - ON CALL FOR COOLING THE BLOWER IS ENERGIZED AND CUSTOMER'S COOLING CIRCUIT IS ENERGIZED.
  - IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE INTEGRATED CONTROL SYSTEM CLOSURES THE MAIN VALVE AND MUST BE RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT (SEE LIGHTING INSTRUCTIONS).
- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION FOR SHUTDOWN.
  - WHEN BLOWER DOOR IS OPENED, THE UNIT IS SHUTDOWN.

**FIGURE 29C - Wiring Diagram with Two-Stage Gas Control and Belt-Driven Blower Motor**

**CAUA: AG2-AK5-AN2**

WD #280690



Line and Motor Wiring Size			
HP	Voltage	Phase	Wire Ga
1/4-2			14
3	208-230	1	10
5			8
1/4-3	208-230	3	14
5			12
1/4-5	460-575	3	14

Wiring Type	FIELD CONTROL WIRING		
	TOTAL WIRE LENGTH	DISTANCE FROM UNIT TO CONTROL	MIN. RECOMMENDED WIRE GAUGE
FACTORY WIRING	150'	75'	#18 GA. WIRE
FIELD WIRING	250'	125'	#16 GA. WIRE
OPTIONAL FACTORY WIRING	350'	175'	#14 GA. WIRE

- ◇ THREE PHASE POWER TERMINAL STRIP
- ⊗ MIXING BOX
- AUXILIARY MAIN
- CRIMP TERMINAL
- ⬡ MAIN TERMINAL BLOCK
- UNIT TERMINAL STRIP
- THERMOSTAT TERMINAL STRIP
- ⤴ WIRE CONNECTOR

**WIRING CODE**  
 BLACK - BK  
 BROWN - BR  
 RED - R  
 ORANGE - O  
 YELLOW - Y  
 GREEN - G  
 BLUE - BL  
 PURPLE - PR  
 WHITE - W

SEE PAGE 1 FOR THERMOSTAT CONNECTIONS  
 THERMOSTAT TERMINAL STRIP (NOT IN SEQUENCE)

**DSI CONTROL (DS1)**

SEE NOTES (right) FOR LED FLASH CODES

TIME	SW1	SW2
90	OFF	ON
120	OFF	OFF
160	ON	OFF
180	ON	ON

LED FLASH CODES	
GREEN LED	
STEADY ON	NORMAL OPERATION NO CALL FOR HEAT
FAST FLASH	NORMAL OPERATION CALL FOR HEAT
1 FLASH	IN LOCKOUT FROM FAILED IGNITIONS OR FLAME LOSSES
2 FLASH	PRESSURE SWITCH DOES NOT CLOSE WITHIN 30 SECONDS OF VENTER ENERGIZED
3 FLASH	LIMIT SWITCH OPEN
4 FLASH	PRESSURE SWITCH IS CLOSED BEFORE VENTER IS ENERGIZED
STEADY OFF	INTERNAL CONTROL FAULT OR NO POWER
YELLOW LED	
STEADY ON	FLAME SENSED
SLOW FLASH	WEAK FLAME
FAST FLASH	UNDESIRABLE FLAME (VALVE OPEN & NO CALL FOR HEAT)

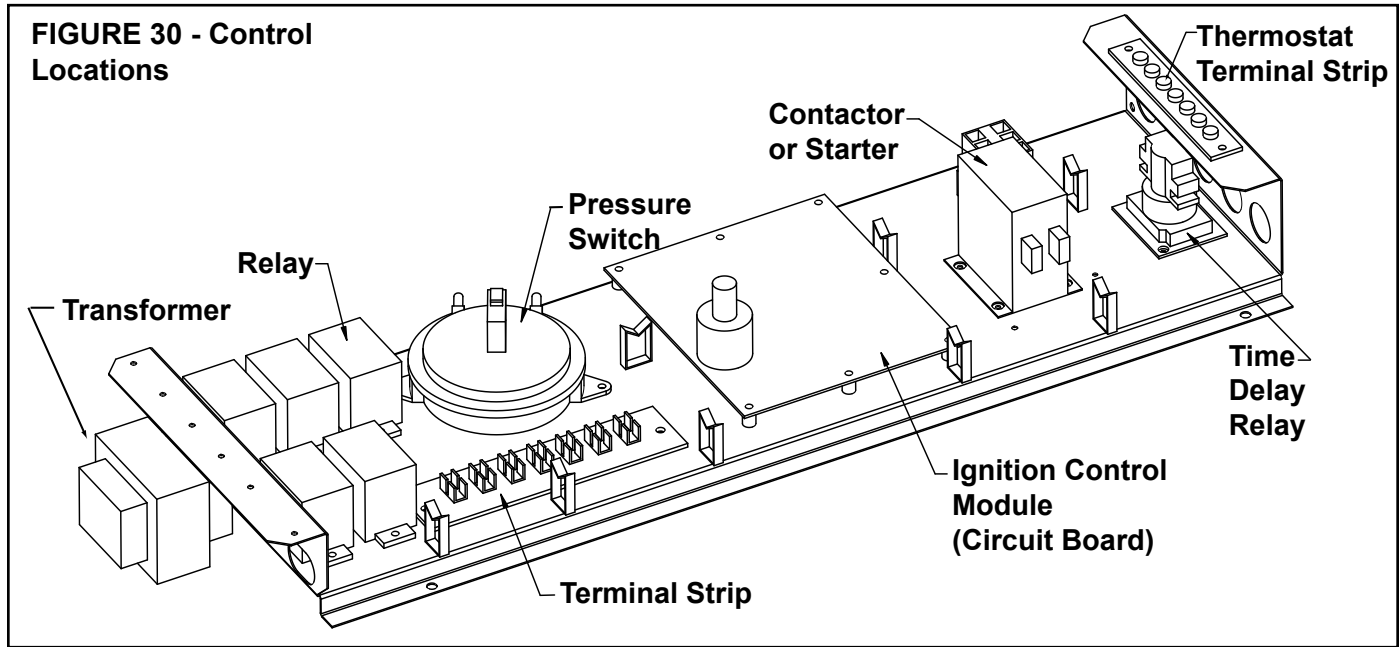
- NOTES**
- THE FOLLOWING CONTROLS ARE SUPPLIED AS OPTIONAL EQUIPMENT: THERMOSTAT
  - DOTTED WIRING INSTALLED BY OTHERS.
  - CAUTION: IF ANY OF THE ORIGINAL WIRING AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED. IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105° C. EXCEPT FOR SENSOR LEAD WIRE WHICH MUST BE 150° C.
  - USE #18 GA. WIRE FOR CONTROL WIRING ON THE UNIT.
  - LINE AND FAN MOTOR BRANCH WIRE SIZES SHOULD BE OF A SIZE TO PREVENT VOLTAGE DROPS BEYOND 5% OF SUPPLY LINE VOLTAGE.
  - VENTER MOTOR ON 350-400 UNITS HAS BROWN AND BLUE WIRES.
  - 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.

**OPERATING SEQUENCE**

- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION, FAN SWITCH AT "AUTO" POSITION.
- TURN ON MANUAL GAS VALVE.
- TURN ON POWER TO UNIT.
- SET THERMOSTAT SYSTEM SWITCH AT "AUTO" POSITION, FAN SWITCH AT "AUTO" POSITION.
  - THERMOSTAT CALLS FOR LOW HEAT, ENERGIZING THE VENTER MOTOR.
  - VENTER PRESSURE SWITCH CLOSURES, FIRING UNIT AT LOW RATE.
  - BURNER FLAME IS SENSED, AND IN 30 SECONDS THE BLOWER MOTOR IS ENERGIZED.
  - ON CALL FOR HIGH HEAT THE UNIT FIRES AT FULL RATE.
  - ON CALL FOR COOLING THE BLOWER IS ENERGIZED AND CUSTOMER'S COOLING CIRCUIT IS ENERGIZED.
  - IF THE FLAME IS EXTINGUISHED DURING MAIN BURNER OPERATION, THE INTEGRATED CONTROL SYSTEM CLOSURES THE MAIN VALVE AND MUST BE RESET BY INTERRUPTING POWER TO THE CONTROL CIRCUIT (SEE LIGHTING INSTRUCTIONS).
- SET THERMOSTAT SYSTEM SWITCH AT "OFF" POSITION FOR SHUTDOWN.
  - WHEN BLOWER DOOR IS OPENED, THE UNIT IS SHUTDOWN.

## 7.0 Electrical and Wiring (cont'd)

### 7.4 Control Locations and Controls



#### 7.4.1 Combustion Air Proving Switch

The combustion air proving switch is a pressure sensitive switch that monitors air pressure to ensure that proper combustion air is available. The switch is single pole/double throw with the normally open contacts closing when the proper airflow is sensed in the system.

On start-up when the heater is cold, the sensing pressure is at the most negative level, and as the heater and flue system warm up, the sensing pressure becomes less negative. After the system has reached equilibrium (about 20 minutes), the sensing pressure levels off.

If a restriction or excessive flue length or turns cause the sensing pressure to be outside 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 lists the approximate water column negative pressure readings and switch setpoints for sea level operating conditions

#### **DANGER**

**Safe operation of this unit requires proper venting flow. NEVER bypass the combustion air proving switch or attempt to operate the unit without the venter running and the proper flow in the vent system. Hazardous conditions could result. See Hazard Levels, page 2.**

**TABLE 27A - Combustion Air Pressure Switch Settings - standard settings apply to 0-4000 ft elevation (US); 0-2000 ft elevation (Canada)**

Size	Startup Cold	Equilibrium	Setpoint "OFF"	Setpoint "ON"
150	1.45	1.05	.75	.90
200	1.50	1.05	.75	.90
250	1.55	1.10	.75	.90
300	1.60	1.15	.75	.90
350	1.30	1.05	.75	.90
400	1.20	1.00	.75	.90

Units ordered with High Altitude Options AB4 - AB8 have a high altitude combustion air proving switch with an "OFF" Setpoint of .70.

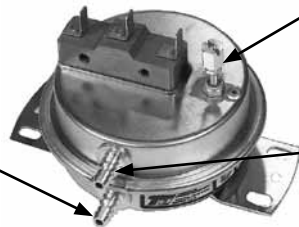
### 7.4.2 Dirty Filter Switch

If there is a remote console (Option RC\_) and there is a dirty filter indicator light on the console, there is a dirty filter switch either in the optional mixing box or in the main electrical compartment. After the unit is started, before continuous operation, the dirty filter switch must be set.

**Instructions for Setting Dirty Filter Switch (FIGURE 31)** - With clean filters in place; all doors closed (except electrical compartment); and the blower opening, increase the pressure setting by adjusting the setscrew on the switch clockwise until the filter light is energized or the screw is bottomed out. At that point, adjust the setscrew three full turns counter clockwise or until the screw is top ended. At that setpoint, the filter light will be activated at approximately 50% filter blockage.

**FIGURE 31 - Dirty Filter Switch, P/N 105507 (must be set prior to continuous operation)**

Positive pressure connection is toward the “back or bottom” of the switch (senses air inlet side of filters)



Set screw (on front of switch) must be manually adjusted after the system is in operation.

Negative pressure connection is toward the “front or top” of the switch (senses blower side of filters)

## 8.0 Ignition System

A Model CAUA heater is equipped with a direct spark integrated control system. The system monitors the safety devices and controls the operation of the blower and venter motors and the gas valve.

### Ignition System Operating Sequence

On a call for heat from the thermostat, the system energizes the venter motor and goes through a 10-second prepurge. The system verifies that the pressure switch has changed states closing the normally open contactor and that the high limit is in the closed state.

The gas valve is then energized, and the ignition system provides the high voltage spark to the electrode to ignite the main burner gas. Burner flame is electronically sensed by the control (minimum 1.0 microamps) upon carryover of all burners. (A separate solid metal probe is used as the flame sensing function. A low voltage electrical signal is imposed on the metal probe which is electrically isolated from ground. When the flame impinges on the flame sensing probe, the flame acts as a conduction path to ground. The flame rectifies and completes the DC circuit, and the ignition system acknowledges the flame.)

The blower motor is energized by the system after 30 seconds of flame sensing.

After the thermostat has been satisfied, the system de-energizes the gas valve, the venter motor goes through a 45-second post-purge, and the blower motor remains energized for an additional 135 seconds.

**NOTE:** This is a three trial system. The unit will lockout for one hour before initiating another trial for ignition. If the unit fails after one recycle interval, the unit will go into hard lockout and must be reset by interrupting power or resetting the thermostat. To initiate another trial for ignition before the one hour interval, either reset the thermostat or interrupt power to the unit for 30 seconds.

## 9.0 Check Installation and Startup

### 9.1 Check the installation prior to startup:

- Check clearances from combustibles. Requirements are in Paragraph 4.
- If installed as a separated combustion unit, verify that the vent/combustion air system is installed according to the instructions in Paragraph 6.2.1.
- Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air. See Paragraph 6.1.
- Check the blower compartment to be sure that all shipping supports have been removed.  
**IMPORTANT:** Before applying power, check the blower pulley, blower wheel, and motor pulley to be sure they are secure to the shaft. Check blower and pulleys for free movement.  
Check belt tension and alignment.  
Close the blower compartment door securely. Heater will not operate if the blower compartment door is not closed.
- Check electrical wiring. Be sure all wire gauges are as recommended. A service disconnect switch should be used. Verify that fusing or circuit breakers are adequate for the load use.
- If equipped with a mixing box with both return and outside air dampers, verify that the damper linkage has been adjusted. (If adjustment is needed, see the mixing box installation instructions.)
- If equipped with a condensate drain (either cooling coil, flue wrapper, and or burner), verify that the condensate lines are connected and the drain traps are filled with clean water.
- If equipped with a cooling coil, verify that thermostatic expansion valves are installed properly. (See the cooling coil installation instructions.)  
Verify that the refrigerant circuits are charged with the appropriate refrigerant and leak tested according to the condensing unit instructions.

## 9.2 Startup

---

**WARNINGS: For your safety, read before operating. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.**

- **This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.**
- **Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.**
  - If you smell gas:**
    1. **Open windows.**
    2. **Don't touch electrical switches.**
    3. **Extinguish any open flame.**
    4. **Immediately call your gas supplier.**
- **Use only your hand to turn the gas control ON/OFF knob on the gas valve. Never use tools. If the valve ON/OFF knob will not turn by hand, do not try to repair it. Call a qualified service technician. Force or attempted repair may result in a fire or explosion.**
- **Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.**

- 
1. Set thermostat at lowest setting.
  2. Turn off all electric power to the appliance.
  3. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand. Open the access door and locate the gas valve.

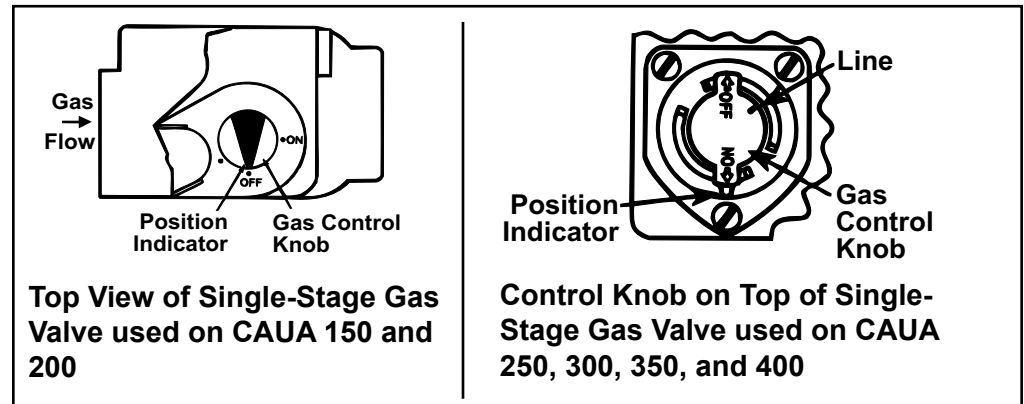


## Operating Instructions and Operating Sequence

### FIGURE 32 - Gas Valve Controls

**NOTE:** Single-stage valves are illustrated; optional two-stage valves are similar.

4. **Models CAUA 150 and 200** - Locate the gas control (ON/OFF) knob on the gas valve. Turn the gas control knob clockwise to "OFF".  
**Models CAUA 250, 300, 350, and 400** - Locate the gas control (ON/OFF) knob on the gas valve. Turn knob clockwise to align the line on the knob with the position indicator. Depress knob and continue rotation to the "OFF" position.
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. **If you smell gas, STOP!** and follow the steps in the **WARNINGS** printed on the previous page or on the Operating Label on the heater. If you do not smell gas, proceed to the next step.
6. **Models CAUA 150 and 200** - Turn the gas control knob counterclockwise to "ON".  
**Models CAUA 250, 300, 350, and 400** - Turn knob counterclockwise to align the line on the knob with the position indicator. Allow knob to "pop up", and continue rotation to the "ON" position.



7. Close the access door.
  8. Turn on the electric power to the heater.
  9. Set the thermostat to the desired setting.
- NOTE:** If the appliance does not operate, follow the instructions "To Turn Off Gas to the Appliance" printed below (and on the Operating Label on the heater). Call your service technician.
10. Thermostat calls for heat, energizing the venter motor.
  11. Venter pressure switch closes, allowing the unit to fire.
  12. Burner flame is sensed and in 30 seconds, the blower motor is energized.
  13. If the flame is extinguished during the main burner operation, the integrated control system closes the main valve and must be reset by interrupting power to the control circuit. (See lighting instructions on heater.)

#### Vent System Testing Procedure - Power Vent Units (does not apply to separated-combustion installation - Option CC2 or CC6)

1. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1 or CAN/CSA B149.1 and B149.2, Installation Code for Gas Burning Appliances and Equipment, and this manual. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. In so far as practical, close all building doors and windows and all doors between the space where the heater is and other spaces of the building. Turn on clothes dryers and exhaust fans, such as range hoods and bathroom

### TO TURN OFF GAS TO THE APPLIANCE

- 1) Set thermostat to lowest setting
- 2) If service is to be performed, turn off electric power to the appliance.
- 3) Open the access door.
- 4) Turn the gas control knob to "OFF" (follow instructions in No. 4 above). Do not force control knob.
- 5) Close the access door.

## 9.0 Check Installation and Startup (cont'd)

### 9.3 Check Installation after Startup

exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

4. Light the heater following the lighting instructions. Adjust the thermostat for continued operation. Verify that combustion products are venting properly. After determining that the heater vents properly, return doors, windows, exhaust fans, and fireplace dampers to their previous conditions. If improper venting is observed, the venting system must be corrected.
- With the unit in operation, measure manifold gas pressure. Manifold pressure for natural gas should be 3.5" w.c. and 10" w.c. for propane. See Paragraph 6.1.
  - Turn the unit off and on, pausing two minutes between each cycle. Observe for smooth ignition.
  - If equipped with a dirty filter switch, set the switch (See Paragraph 7.4).
  - Place the "Owner's Envelope" containing the Limited Warranty, this booklet, the operation/maintenance/service manual, and any control or optional information in an accessible location near the heater. Follow the instructions on the envelope.
  - IMPORTANT:** After at least 8 hours but no longer than a week of operation, recheck the blower wheel, all set screws, blower pulley, motor pulley, and belt tension. Make any required adjustments.

### **DANGER**

**The gas burner in this gas-fired equipment is designed and equipped to provide safe, 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 indirect-fired gas burning equipment requires a 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.**

**If installed as a separated-combustion unit, install either the horizontal or vertical combustion air/vent system illustrated in Paragraph 6.2.1 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 VENT SYSTEM FOR SOUNDNESS AND FUNCTION; MAINTAIN IT IN PROPER OPERATING CONDITION.**

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# REFERENCES

<b>Description</b> .....	<b>Form</b>
Model CAUA Operation/ <b>Service/Maintenance Manual</b> .....	O-CAUA
Model ACU or Option C <b>Cased Cooling Coil Installation</b> .....	I-CAUA-CC
Optional <b>Discharge Plenum Installation Instructions</b> .....	I-CAUA-DP
Optional <b>Filter Cabinet Installation Instructions</b> .....	I-CAUA-FC
Optional <b>Inlet Air Mounting Base Installation Instructions</b> .....	I-CAUA-IB
Optional <b>Mixing Box Installation Instructions</b> .....	I-CAUA-MB
<b>Gas Conversion Instructions</b> .....	CP-CAUA-GC
<b>Ignition Control Replacement Kit Instructions</b> .....	CP-CAUA-IGN
<b>Replacement Parts</b> .....	P-CAUA

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

### Installer:

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

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

Contact \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_ Date of Installation \_\_\_\_\_

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

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### **BUILDING OWNER OR MAINTENANCE PERSONNEL:**

For service or repair

- Contact the installer listed above.
- If you need additional assistance, contact the local Distributor listed above.

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