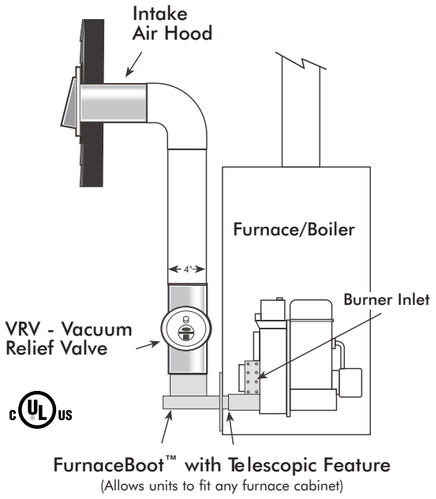
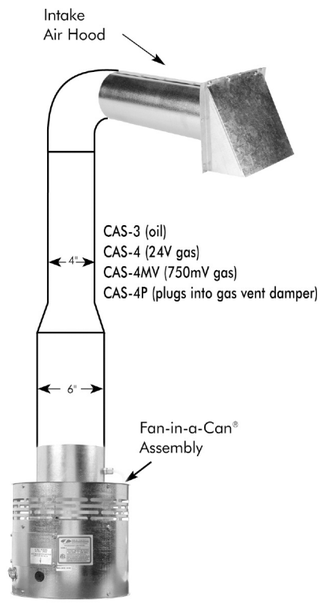
CAS-2 Series

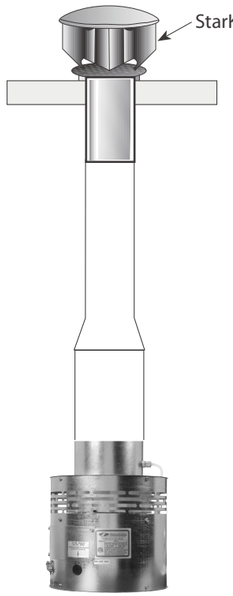


FurnaceBoot™ with Telescopic Feature
(Allows units to fit any furnace cabinet)

CAS-3 & 4 Series

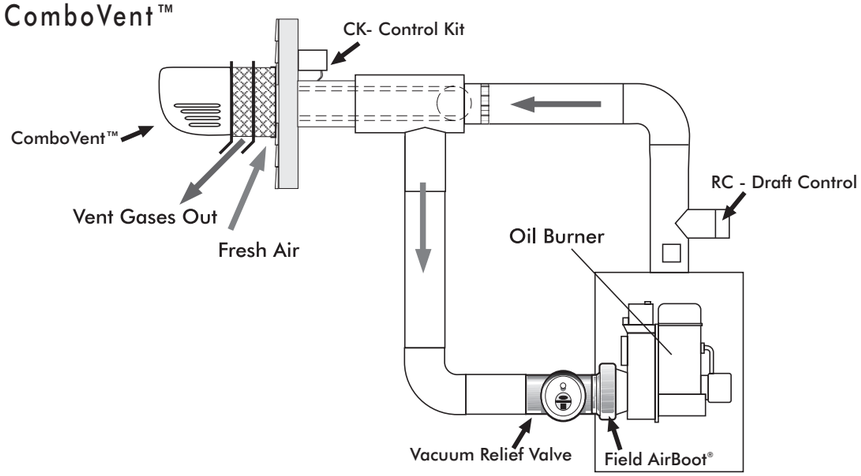


CAS-6 and 7 Series



Fan-in-a-Drum® Assembly

ComboVent™



All New CAS-4Jr.™

FIELDCONTROLS
2630 Airport Road • Kinston, NC 28504
Phone: 252.522.3031 • Fax: 252.522.0214
www.fieldcontrols.com

Form #4278

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FIELDCONTROLS

EFFECTS OF INSUFFICIENT COMBUSTION AIR ON DRAFT AND HEATING SYSTEMS:

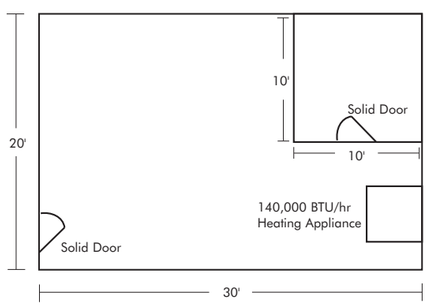
For the proper operation and venting of gas or oil heating appliances, sufficient outside air must be supplied to the structure to make up for the air lost from venting heating appliances, fireplaces, clothes dryers, exhaust fans and other building air losses. Insufficient combustion air can cause major problems for proper draft and operation of both gas and oil heating systems. For years it has been assumed that when a heating appliance was located in an unconfined area, there was sufficient air for both ventilation and combustion. Today, in most cases that is not true! With new construction, standards for building insulation and energy efficient windows and doors have reduced the amount of air changes per hour. The combustion and make up air requirements in the codes are based on ½ air changes per hour. For newer homes and conversion of electrically heated homes, the air changes could be reduced to ⅓ or less air changes per hour. Air problems are most notable on the coldest days when heat loss is the greatest and there is a chance that windows or doors are closed for an extended period of time.

When installing new equipment or troubleshooting problem equipment, the first determination that needs to be made is whether the equipment is located in a confined or unconfined space. In accordance with NFPA 31 and NFPA 54, an unconfined space is defined as follows: Any space whose volume is equal to or greater than 50 cubic feet per 1,000 BTU (or 20 BTU/Cubic Foot). This is calculated on the sum of the total input ratings of all fuel burning appliances installed in that space. Only areas connected to the space that have no doors or with fully louvered doors can be considered part of the unconfined space.

Note: If the actual free area of the louvers is not known, wood louvers are assumed to have a 20% to 25% free opening. Metal louvers or grills are assumed to have 60% to 70% free opening.

UNCONFINED SPACE:

Example:
A room 30' by 20' with an 8' ceiling height.
In that room a 10' by 10' storage room
exists with a door that is not fully louvered.
The heating appliance is 140,000 BTU.



Determine the maximum total input firing rate allowable in a room without modification.
Example: Boiler room 20x30x8 = 4,800cu ft.
4,800 cu. ft. x 1,000BTU/50cu. ft. = 96,000 BTU
96,000 BTU x 1 gph #2 fuel/140,000 BTU = 0.69 GPH
Result: If you fire greater than 0.69 GPH or 96,000 BTU's you will need additional combustion air.
To add air from an adjacent room, two openings between the room could be made 12 inches above the floor and 12 inches below the ceiling. The size of these openings is based on 1 square inch per 1,000 BTU input. To add air directly from the outside of the structure, two openings could be made. The size of these openings is based on 1 square inch per 4,000 BTU input. The above requirements are based on guidelines in NFPA 31 or NFPA 54. Alternately, if operating in a confined space, additional air may be added by a duct to the outside, sized on 1 square inch per 5,000 BTU input.

According to NFPA 54 and NFPA 31, an Engineered system such as a CAS-3, 4, 4Jr., 6 or 7 may be used to overcome a confined space.

CHECKING FOR INSUFFICIENT AIR PROBLEMS:

The above requirements are based on a structure having at least ½ air changes per hour. Since current new construction and energy conservation practices stress tighter building construction, considerations of adding combustion air and make-up air become more important. Likewise, the need to determine if adequate air is supplied to the heating equipment is increased. Procedures to follow are contained in Appendix H of NFPA 54 code book or follow an abbreviated version below:

1. Visually inspect the venting system for proper size and determine that there is no flue gas spillage, blockage, restriction, leakage, corrosion, or other deficiency which could cause an unsafe operation.
2. Insofar as practical, close all building doors, fireplace dampers, windows, and all doors in area in which the appliance is located. Turn on clothes dryers, any exhaust fans, such as range hoods and bathroom exhausters so they operate at maximum speed. Do not operate a summer exhaust fan. If, after completing Steps 3 through 7 it is believed sufficient combustion air is not available, refer to the National Fuel Gas Code A.N.S.I.Z223.1, or any applicable local codes for guidance.
3. Place in operation the appliance being inspected. Follow the lighting instructions and adjust thermostat so appliance will operate continuously.
4. Determine that the pilot or burner is operating properly and that the main burner ignition operates satisfactorily, by interrupting and re-establishing the electrical power of the appliance in any convenient manner. Test the pilot or burner safety device to determine if it is operating properly by extinguishing the pilot or disconnecting the flame safety circuit.
5. Visually determine that the main burner is burning properly; i.e., no floating, lifting, or flashbacks. Perform a smoke test on oil-fired systems, the burner should operate at a zero to trace smoke. This can indicate reduced available combustion air to burner.
6. If appliances are equipped with high and low flame control or flame modulation, check for proper main burner operation at low flame.
7. Test for spillage at draft hood or barometric draft control opening and burner inlet air location after 5 minutes of main burner operation. Use a draft gauge, flame or a match or candle, smoke from a cigarette, cigar or pipe. If spillage occurs, adequate air is not available. Shut off heating appliance thermostat and check for spillage or air flow reversal around the draft hood, barometric draft control or burner inlet air location. If a flow reversal is noticed, house de-pressurization is occuring and make-up air and combustion air is required. For oil fired systems, this may be noticed by oil fume smell after the burner has been off for 5 to 10 minutes.
8. Turn on all fuel burning appliances within the same room so that they will operate at their maximum input. Then repeat Steps 5 through 7.
9. Return doors, windows, exhaust fans, fireplace dampers and any other fuel-burning appliances to their previous condition of use.

OIL FIRED EQUIPMENT:

Symptoms	Possible Cause or Effect	Correction
1) Flue gas or sulfur smells after burner shuts off.	A) Air flow reversal through the vent system causing increased nozzle drip.	Add combustion and/or make-up air.
	B) Sidewall Venting: Slight air flow reversal, causing short post purge time and minimal nozzle cooling. Typically 3 to 5 minutes needed. *(NOTE: Can happen on boilers with domestic hot water systems.)*	Increase post purge time. Add combustion and/or make-up air.
2) Air flow reversal through the vent system when burner is not operating.	A) Causes sulfur smells in building.	Add combustion and/or make-up air.
	B) Sidewall Venting: 1) After power venter stops, flue gas or sulfur smells in the building. 2) Moisture build up causing freeze up of motor or blower wheel. Freeze up of the end of the pressure sensing tube.	Add combustion and/or make-up air.
3) Wetting of the air tube of the burner and coking of the nozzle.	After drip causing air flow reversal through vent system.	Add combustion and/or make-up air.
4) Signs of soot around barometric draft control or other openings into the vent system.	High negative pressure can cause spillage of flue gases from opening in the vent system.	Add combustion and/or make-up air.
5) Repeated and frequent soot up of heat exchanger.	Changes in the combustion characteristic of the burner during operation caused by changes in available air to the burner.	Add combustion and/or make-up air.
6) High amounts of corrosion in vent system.	A) Reduced or minimal air flow through the vent system causing high condensation.	Add combustion and/or make-up air.
	B) System operating in an environment with corrosive materials.	Adjust or increase air flow through vent system. Add combustion and/or make-up air.

SYMPTOMS OF OPERATION WITH INSUFFICIENT AIR AND CORRECTIONS.

The assumption is made that the Chimney (Vent System) or Sidewall Venting System is sized normally and operating correctly.

GAS FIRED EQUIPMENT:

Symptoms	Possible Cause or Effect	Correction
1) Flue gas spillage out of draft hood during operation.	A) Leaks or an opening in the return air plenum or duct on forced air systems. Furnace fan drawing air from room.	Seal return air plenum or ducting in room.
	B) Operates fine unless an exhaust fan or fireplace is operating.	Add make-up air and/or combustion air.
	C) Venting problems occur after building has had the entry door closed for a prolonged period of time. Typically during overnight operation.	Add make-up air and/or combustion air.
2) Increased moisture levels in room, sooting of the burner and/or flue gas smells while burner is operating.	A) Spillage from draft hood or burner area during operation.	Add combustion air.
3) Spillage from draft hood causing spill switches to trip.	A) If it happens during operation, refer to symptoms (Item #1).	Add make-up air and/or combustion air.
	B) If it happens during shutdown period of the equipment cycle.	Add combustion air and/or make-up air. For Sidewall Venting System: Also add a post purge timer to allow for 1 to 2 minutes purging of the flue gases.
4) Spillage and/or incoming outside air flow through vent during off-cycle.	A) Chimney System: Spillage on start up and prolonged spillage due to cold stack (i.e., downdrafts).	Add combustion air and/or make-up air.
	B) Sidewall Venting Systems: 1) After power venter stops an air flow reversal begins.	Field StarKap® vent termination. Add combustion air and/or make-up air.
	2) Moisture accumulation on blower wheel, vent terminal and in pressure sensing tube which might freeze from incoming air chilling the system. This can cause premature failure of the motor or inoperation of the pressure sensing switch.	Add a post purge timer to allow for 1 to 2 minutes purging of the flue gases. Add combustion air and/or make-up air.
5) High amounts of corrosion in vent system.	A) Reduced or minimal air flow through the vent system causing high condensation.	Add combustion air and/or make-up air. Replace draft hood with barometric damper. Adjust or increase air flow through vent system.
	A) Reduced or minimal air flow through the vent system causing high condensation.	Add combustion air and/or make-up air.
	B) System operating in an environment with corrosive materials.	

TYPICAL COMBUSTION/MAKE-UP AIR DUCT AREA AND PIPE DIAMETER FOR UNCONFINED SPACES

(Based on 1 square inch per 5,000 BTU/28 square inches per 1 gallon.)

GAL/HR INPUT	BTU/HR INPUT	CALCULATED AREA (Sq. Inches)	PIPE DIA/AREA (Sq. Inches)
.65	91,000	18	5"/19
.75	105,000	21	6"/28
1.00	140,000	28	6"/28
1.35	189,000	38	7"/38
1.75	245,000	49	8"/50
2.25	315,000	63	9"/63