

Tech to Tech March 2007

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Welcome back to another installment of Tech to Tech. This month we are going to focus on combustion air requirements.

Even though all of this material is referenced from the sources listed in the reference section at the end of the article, keep in mind the local inspector is the final authority. Just because something is acceptable in one town is in no way indicative of it being acceptable in another. Therefore, when considering your combustion air options, if you have any doubt, don't hesitate to call and ask the local inspector. Most will appreciate that you made the effort to call.

According to the International Residential Code 2000, *combustion air* is the air provided to fuel burning equipment (gas or oil) including air for fuel combustion (primary, secondary and excess air), draft hood dilution (natural draft appliances) and ventilation of the equipment enclosure or room.

An 80% efficient furnace will need to use the air around it for combustion while a 90% efficient or above can be configured to either use the air around it for combustion (one pipe system) or bring combustion air from the outside (two pipe system). The codes we will discuss today will be for category one, natural draft vented appliances or single pipe 90+ appliances.

Although combustion air is extremely important to the safe and efficient operation of gas utilizing appliances, many contractors never give it a second thought until operational issues occur. These issues can be incomplete combustion (yellowing tipping and possible sooting of the heat exchanger), flame rollout (seeking combustion air), poor venting (negative pressure, vent becomes air intake) and exposing the occupants to the products of incomplete combustion and possibly carbon monoxide.

To prevent these issues from occurring and for the general safety of the buildings occupants, the IRC code and NFPA 54 calls for these minimum combustion air standards.

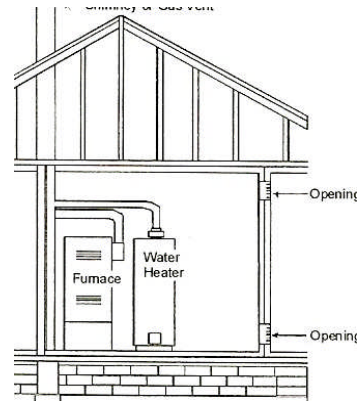
A space that equals a volume of less than 50 *cubic feet* (length x width x height) per 1000 BTU's of total input rating of all appliances installed is considered a *confined space*. Combustion air must be provided by ducting in air from either outdoors or from an unconfined space. *Remember all appliances, not only the one(s) you're installing.

An *unconfined space* must have a volume of at least 50 cu. ft. per 1000 BTU's input total for all appliances located in the space.

If the *unconfined space* is of *unusually tight construction* as set forth in the IRC 2000, section R202: Definitions, then the combustion air must come from outside air or from a space freely communicating with the outdoors. For example: a vented attic or crawl space.

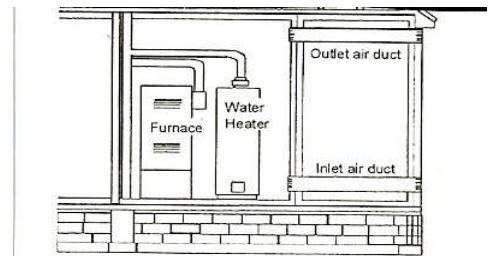
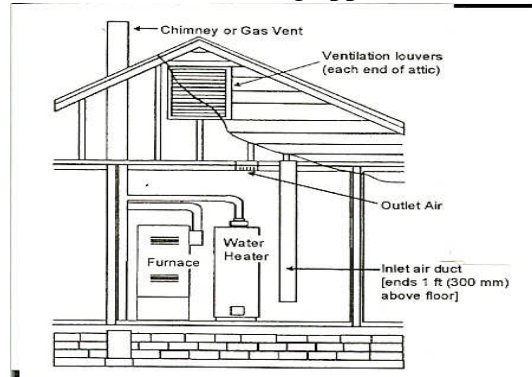
If combustion air is brought in from within the structure there must be 2 openings:

- Each opening must have a minimum **free area* of not less than *one square inch* per 1000 BTU's of total input rating for all appliances in the space, should not be less than 100 square inches or 10 x 10 and one of the openings must be within 12 inches of the top and the other within 12 inches from the bottom of the enclosure. This creates natural (gravity) airflow because of convection.
- Because the upper opening is an air outlet and the lower an inlet, airflow cannot happen if these two openings are duct to a single combustion air opening.
- If construction is unusually tight then air must be brought in from the outside in accordance with local codes.
- * The *free area* of metal louvers shall be considered as 75% of the gross area of the louver and 25% of the gross area for wood louvers unless otherwise stated by the manufacturer.

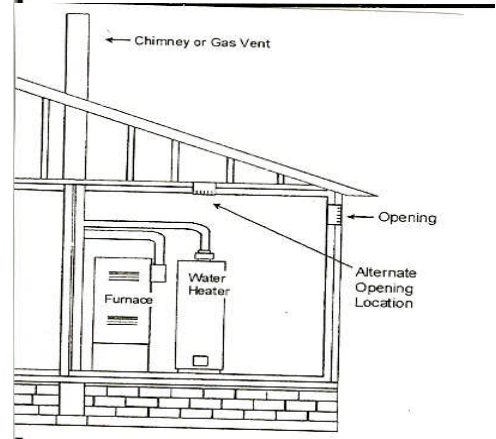


If combustion air is brought from outside the structure the following applies:

- If two vertical ducts are used they must have at least one sq. in. of free area per 4000 BTU's of total input rating for all gas appliances.
- Vertical ducts allow gravity to assist in air movement through the duct while horizontal ducts need to be larger because of the friction losses of the air flowing horizontally through the duct.
- If two horizontal ducts are used they must have at least one sq. in. of free area per 2000 BTU's of total input rating for all gas appliances.
- If combustion air is brought from outside the structure



the following applies: When using a single opening it must have a free area of one sq. in. per 3000 BTU's of total input rating for all appliances. When considering the location of outside air louvers make sure nothing is being vented near enough to allow that unit's products of combustion or possible corrosive when burned fumes to be draw into your openings.



Recirculation of vented combustion products can cause combustion issues due to their lack of oxygen.

When using an unconfined space for combustion air make sure chemicals (paints, cleaners, etc) will not be stored in this area in a manner that will allow their fumes to be drawn into the unit. When these fumes are burned they can cause corrosion of the heat exchanger and unpleasant odors.

For those interested in further research of this topic you can reference NFPA 54, section 9.3 or the International Residential Code 2000, chapter 17: Combustion Air.

We will take an in depth look at compressors in the April edition.

Continue to learn something new about HVAC-R everyday.

Randal

*References: International Residential Code 2000, NFPA 54: National Fuel Gas Code 2006, NATE Reference Manual
Graphics: courtesy of Goodman Manufacturing GMS8 Gas Furnace installation manual*

