

COMBUSTION AIR REQUIREMENTS

To understand why an oil burner needs combustion air, let's review the basics of how things burn. Three conditions must exist in order for combustion to take place:

- A source of fuel, whether it is oil for an oil burner, wood for a wood fire or rocket fuel for a rocket.*
- A source of ignition to start the process of combustion, whether it be a spark, flame or a hot surface. In most cases, once the process is started, the heat of the combustion is adequate to continue combustion.*
- A supply of oxygen to support the combustion process, whether it be room air for oil burners, bottled oxygen for welding torches or liquid oxygen for rockets.*

Take any one away and combustion will not take place.

Air Requirements

In many cases, a burner operating in an unconfined space of a conventional frame, brick or stone building will receive adequate air supply from leakage into the building itself. But, if the burner is located in a confined space, such as a furnace or boiler room, the enclosure must have one permanent opening toward the top of the enclosure and one near the bottom of the enclosure. Each opening must have a free area of not less than one square inch per 1,000 BTU per hour. Another way to measure it is 140 square inches per gallon per hour.

Remember to take the total input of all air-using appliances into consideration when figuring the openings. The openings must connect with the inside of the building, which should have adequate infiltration from the outside.

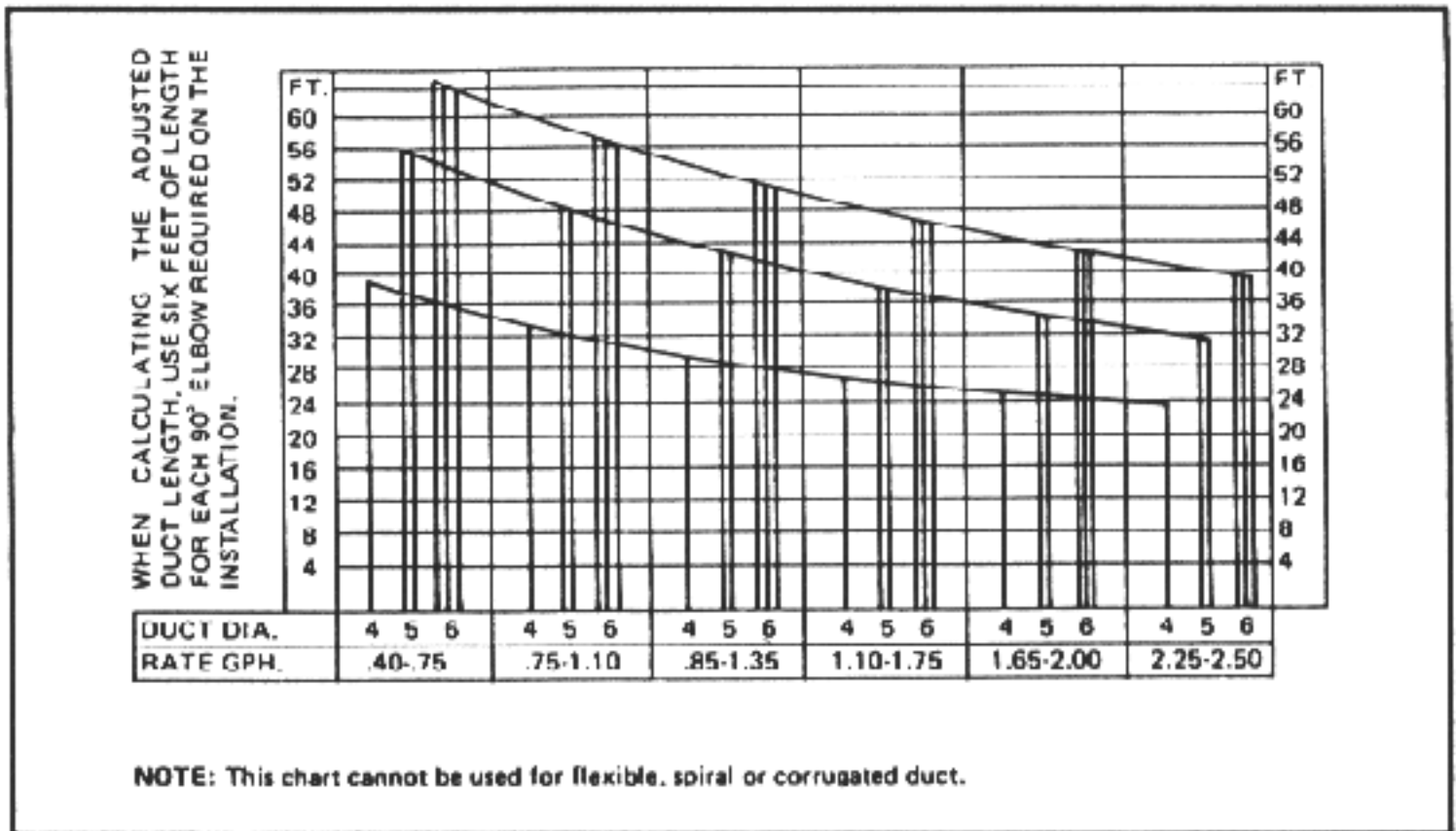
As an example, if an oil burner was firing at 1.25 GPH and a water heater was firing at .50 GPH, each opening in the enclosure should be 245 sq. in. ($1.25 \text{ GPH} + .50 \text{ GPH} = 1.75 \text{ GPH}$, $1.75 \text{ GPH} \times 140 \text{ sq. in.} = 245 \text{ sq. in.}$) A 245 sq. in. opening would typically be 10" x 25" or 16" x 16".

If the burner is located in an unconfined space of a tightly constructed building where inadequate air is infiltrating into the building, outside air must be supplied for combustion.

One method to accomplish this is through a permanent opening, or openings, having a total free area of not less than one sq. in. per 5,000 BTU per hour, or 28 sq. in. per gallon per hour. All appliances must be taken into consideration.

Another method is to supply outside air directly to the oil burner through round, smooth duct work. Some burner manufacturers have, as an accessory, an outside air intake which allows the duct work

to be coupled to the burner. The chart below will help you determine the minimum allowable duct size in relation to the burner input when you use Beckett Kit #5753. (Additional information on the combustion air requirements for setting up an oil burner in different installations can be found in the National Fire Protection Association publication designated NFPA31.)



Causes for Lack of Combustion Air

A house, which has been constructed tightly, often will not allow adequate air flow into the house for combustion. The problem is compounded by multiple air-using appliances, fireplaces and exhaust fans operating at the same time as the oil burner. A tightly sealed furnace room will create the same condition.

Another cause of a lack of combustion air is the environment in which the burner operates. If the burner draws air from an environment, which is laden with dryer lint and animal hair, the air openings, blower wheel and combustion head will clog, restricting the amount of air delivered to the combustion zone.

One of the first noticeable signs of a lack of combustion air could be the odor of combustion products in the building. In the case of a tight building with more than one air-using appliance running simultaneously, the building could be depressurized causing a backdraft in one or more of the appliances. This condition could cause flue products to flow back into the building.

When any type of combustion is deprived of the necessary oxygen, the correct ratio between air and fuel changes to a rich-fuel, lean-air ratio. This causes an oil flame to become lazy, orange and soot-producing. In the case of a tight building, a burner which is operating fine one minute might go into a smoky condition as soon as another air-using appliance is started. This can be detected by looking at the flame. However, the best test is to use a smoke gun and combustion test equipment to check the flue products.

When you are setting up a burner for the first time and the flame doesn't seem to clean up, check for inadequate combustion air. To quickly find out if this is the problem, open an outside door or window and run the combustion and smoke tests again. If the flame cleans up, the problem likely is a lack of air. An audible sign of fuel rich combustion will be the sound of the flame. It will be loud and irregular. The reason for this is that the air and fuel do not mix properly due to lack of air. Not all oil droplets receive enough oxygen to complete the combustion process, resulting in an uneven burning of the fuel.

Summary

Combustion air requirements are probably one of the most important and most neglected aspects of proper oil combustion. An adequate oxygen supply is vital to the performance and continued operation of the heating unit. The next time you take a deep breath, remember to check and see that the oil burner has the capacity to breathe deeply also.