Boiler Room Air Supply

The proper operation of any boiler is dependent on the systems that support and connect to it. These include, but are not limited to; the boiler room fresh air supply, flue gas exhaust system, fuel delivery system, power distribution grid, and the steam or hot water distribution system.

The starting point in any combustion system is the supply of fresh air. To avoid serious combustion problems, the boiler must have an adequate supply of fresh air and a supply system that does not affect the boilers operation.

HOW MUCH AIR IS REQUIRED? In general, the following formulas have been developed to determine the amount of air required for any boiler room with a package firetube boiler firing gas or oil fuels.

1. Combustion Air = HP* x 8 CFM/HP =
2. Ventilation Air = HP* x 2 CFM/HP =
3. Total Air Required = HP* x 10 CFM/HP =

*HP refers to the total maximum boiler HP located in the boiler room.

The above calculations are adequate for installations up to 1000 feet above sea level (fasl). For installation above 1000 fasl, add 3% additional air for each 1000 fasl (or portion thereof) to allow for the density change in air at higher altitudes.

WHAT SIZE OF OPENING TO THE OUTSIDE IS REQUIRED IN A BOILER ROOM? The size of the fresh air inlet openings and their location are very important. There should be a minimum of two permanent air supply openings in the outer walls of the boiler room. Whenever possible, they should be at opposite ends of the boiler room and no higher than seven feet above the floor. This will promote thorough mixing with the air already in the boiler room, proper cooling of the boilers and tempering of potentially colder outside air prior to its entering the burner for combustion.

The air inlets should be provided with some type of weather protection, but they should never be covered with a fine mesh wire screen. This type of covering results in poor air flow characteristics and is subject to clogging by dust, dirt, paper and other small items.

To determine the net free open area of the opening, divide the total CFM required in the boiler room by the allowable velocity at the opening (see table below).

ACCEPTABLE AIR VELOCITIES IN BOILER ROOM

0-7 ft. above floor 250 FPM
Above 7 ft. high 500 FPM

When sizing an opening to the outside, it should be a minimum of one square foot.

Care should be taken to ensure that no water, oil or steam lines are run in the direct path of cold fresh air entering from any of the outside air opening. Heated heavy oil lines should be protected from cold air and they should be electrically or steam heat traced and insulated.

WHAT ABOUT AIR DUCTING? In some applications the boiler room is located in a building such that it has no outside walls. Many of these applications do not have sufficient excess makeup air in the factory to allow for combustion air requirements. In these cases there are two solutions:

The first is ducting fresh air to the boiler room. Where this is required, the general rules for the size of wall opening for fresh outside air can be used. The duct size to the outside and its free open area inlet must never be smaller than the wall opening in the boiler room. In addition, the pressure drop through the duct at maximum flow must never exceed 0.05" w.c.

The second is ducting fresh air directly to the boiler. In general, this method of air supply should be avoided whenever possible. The disadvantages of this type of system far exceed any perceived advantages. If used, the ducting becomes a part of the boiler system and can effect the stability of combustion due to varying weather conditions, wind direction and velocity, humidity and temperature. An outside temperature variation of -10EF in the winter to 80EF in the summer (many areas of the country are wider) can cause a burner adjusted for 15% excess air combustion on the coldest winter day to be 5% short of air on a warm day. This can lead to massive CO production, soot formation, plus unstable and unsafe combustion.

If direct ducting must be used, we suggest the following minimum steps be followed:

1. Each boiler has its own, completely separate fresh air ducting and exhaust stack. Shared air supplies and exhaust stacks will lead to combustion problems and unsafe operating conditions.

2. Boilers directly connected to fresh outside air ducts must be checked for proper combustion adjustment and operation every three months by a certified package firetube boiler specialist.

3. The duct work supplying the fresh air to the boiler must be sized so that it has a maximum pressure drop at maximum flow of 0.05"wc.

4. The fresh air supply duct should have an electric, hot water, or steam heater to temper cold outside air to at least 50EF.

5. If the application is utilizing a low emission with flue gas recirculation, do not use direct ducted outside air. The potential problems associated with a standard burner are intensified with a low emission burner.

SAMPLE CALCULATIONS - Determine the net free open area of the boiler room supply openings for one 300 HP boiler and one 800 HP boiler, both in the same boiler room. Boiler room located 1800 fasl and its direct outside air inlets are to be five feet above the floor level.

Total maximum HP = 300 + 800 = 1,100 HP

Total air required = (1,100) (10) = 11,000 CFM

Altitude correction = (11,000 CFM) (1.03) = 11,330 CFM

$$\text{Net free open area required} = \frac{11{,}330}{250} = 45.32 \text{ sq. ft.}$$

The boiler room will require a minimum of two fresh air opening of 22.66 sq. ft. (45.32 sq. ft) 2) net free open area.

NOTE: For all applications, the above is a general minimum requirement for fresh air supply. Always consult local codes which may supersede the above recommendations.

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