TIP SHEET:
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CleaverBrooks

Combustion Air Requirements for Boilers

Not often do people realize that combustion in a boiler is really a chemical reaction wherein carbon is blended with air then heat oxidized, ultimately releasing exothermic heat while forming carbon dioxide and water.

Optimal combustion in a boiler requires adequate air supply in the boiler room.

Simply stated, to begin the combustion process requires fuel, heat and (air) oxygen with the make-up of the air being about 21% oxygen, 78% nitrogen, and approximately 1% miscellaneous gases. So it is only the oxygen that is used in combustion, and the balance of the air is along for the ride. This is why it is important to limit the amount of excess air, but still have enough to complete oxidation leaving enough excess to keep the combustion process safe.

To do this, we need a sufficient air supply to support combustion while keeping the boiler room positive relative to atmospheric pressure. We don't want the room to go negative as this could impact the chemical reaction, not allowing for full oxidation, resulting in considerable carbon monoxide (CO) formation rather than the formation of carbon dioxide (CO_2) referenced above.

When determining boiler room air requirements, the size of the room, air flow, and velocity of the air must be reviewed as follows:

1. Size (area) and location of air supply in the boiler room
   a) Two (2) permanent air supply openings in the outer walls of the boiler room are recommended. Locate one (1) at each end of the boiler room, preferably below a height of 7 feet. This allows air to sweep the l length of the boiler.
   b) Air supply openings can be louvered for weather protection, but they should not be covered with fine mesh wire as this type of covering has poor air flow qualities and is subject to clogging with dust or dirt.
   c) Under no circumstances should the total area of air supply be less than one (1) square foot.
   d) Size the openings by using the formula [Area (sq. ft.) = CFM/FPM]
2. Amount of air required (cfm)
   a) Combustion air = Rated boiler horsepower x 8 cfm/bhp
   b) Ventilation air = Maximum b oiler horsepower x 2 cfm/bhp
   c) Total recommended air = 10 cfm/bhp up to 1,000 feet elevation. Add 3% per 1,000 feet of added elevation.
3. Acceptable air velocity in boiler room (fpm)
   a) From floor to 7-foot height -- 250 fpm
   b) Above 7-foot height -- 500 fpm

Example: Determine the area of the boiler room air supply openings for a 300-hp boiler at 800 foot elevation. The air openings are 5 feet above the floor level.

- Air required: 300 x 10 = 3,000 cfm
- Air velocity: up to 7 feet = 250 fpm
- Area required: Area = cfm = 3,000/250 = 12 sq. ft. total
- Area opening: 12/2 = 6 sq. ft./opening (2 required)

Applying these simple guidelines ensures that your boiler room is properly constructed for optimal combustion.

Note: The information expressed above is general in nature and must be verified against specific local code requirements.