

DRAFT REQUIREMENTS

The draft required to effect a given rate of burning the fuel is dependent on the following factors: (1) kind and size of fuel; (2) grate area; (3) thickness of fuel bed; (4) type and amount of ash and clinker accumulation; (5) amount of excess air present in the gases; (6) resistance offered by the boiler passes to the flow of the gases; and (7) accumulation of soot in the passes.

Insufficient draft will necessitate additional manipulation of the fuel bed, and more frequent cleanings to keep its resistance down. Insufficient draft also restricts the control that can be accomplished by adjustment of the dampers. For draft requirements see Chapter 16.

The quantity of excess air present has a marked effect on the draft required to produce a given rate of burning. If the excess is caused by holes in the fuel bed, or an extremely thin fuel bed, it is often possible to produce a higher rate of burning by increasing the thickness of the bed.

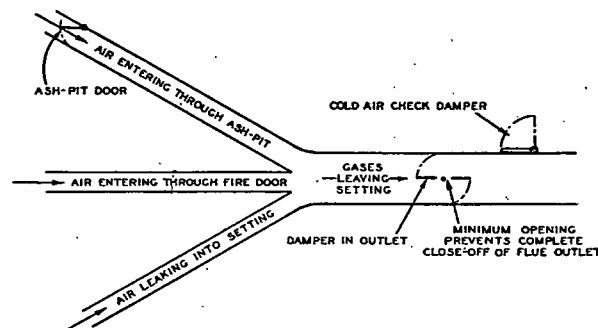


FIG. 4. METHODS OF DRAFT REGULATION IN A HAND-FIRED FURNACE

The thickness of the fuel bed should not, however, be increased too much, because the increased draft resistance will reduce the rate of primary air supply and the rate of burning.

DRAFT REGULATION

Because of the varying heating load demands present in most installations, it is necessary to vary the rate of fuel burning. The maintenance of the proper air supply for the various rates of burning is accomplished by regulation of the drafts. Methods of draft regulation used for solid fuel are shown in Fig. 4. The air enters through the ashpit draft door, firing door, and by leaks in the setting, whereas the gases leave only through the outlet. By throttling the gases with the damper in the outlet all the air entering by each of the three intakes is reduced in the same proportion, thus maintaining about the same percent of excess air. If inlet air is controlled by the ashpit draft door, the air admitted through the ashpit is reduced, while it is increased through the other two intake openings, resulting in an increase of excess air. A considerable increase in the efficiency of hand-fired furnaces and boilers can be realized by regulating the air supply by means of the damper in the outlet instead of the ashpit

damper. Use of the ashpit damper is required, of course, for low rates of combustion. The cold air check damper is to be used only when chimney draft is excessive. It is normally closed unless closing of the outlet damper and ashpit damper is unable to control the rate of combustion.

Methods of control of draft conditions, when burning oil or gas, are noted in Chapter 14, Automatic Fuel Burning Equipment.

FURNACE VOLUME

The principal requirements for a *hand-fired furnace* are that it shall have enough grate area and correctly proportioned combustion space. The amount of grate area required is dependent upon the desired combustion rate.

The furnace volume is influenced by the kind of coal used. Bituminous coals, on account of their long-flaming characteristic, require more space in which to burn the gases of combustion completely than do the coals low in volatile matter. For burning high volatile coals, provision should be made for mixing the combustible gases thoroughly, so that combustion

TABLE 9. AVERAGE FLUE GAS DEW-POINT FOR VARIOUS FUELS^a

TYPE OF FUEL	AVERAGE DEW-POINT TEMPERATURE, F
Anthracite	68
Semi-Bituminous Coal	84
Bituminous Coal	93
Oil	111
Natural Gas	127
Manufactured Gas	137

is complete before the gases come in contact with the relatively cool heating surfaces. An abrupt change in the direction of flow tends to mix the gases of combustion more thoroughly. Anthracite requires comparatively little combustion space.

COMBUSTION OF GAS

The majority of gas burners utilized in central domestic heating plants are of the Bunsen type and operate with a non-luminous flame. In this type of burner part of the air required for combustion is mixed with the gas as primary air, the air and gas mixture being fed to the burner ports. Additional secondary air is introduced around the flame by draft inspiration inherent in the appliance. In the luminous flame burner, which is sometimes used, all of the air for combustion is brought in contact with the flame as secondary air. This secondary air should be brought into intimate contact with the gas.

Some makes of burners use radiants or refractories to convert some of the energy in the gas to radiant heat. The radiants also serve as baffles in directing the flow of the products of combustion.

With a properly designed and installed conversion burner, the excess air can be kept low. Gas designed furnaces and boilers approved by the A.G.A. should have no changes made on them which would change excess