Two or more chimneys, either large or small, should never be connected together. If connected at the bottom, hot gases in the inverted U-tube thus formed would be in unstable equilibrium. Cold air would descend through one such chimney, from the top, and drive the hot gases out of the other and thus annul the draft.

More than one device can be served by one chimney. Batteries of boilers are commonly connected to a single chimney in power plants. However, if two or more chimneys are used, each chimney should be used separately for part of the boilers, and not connected in manifold with another chimney, in order to avoid the difficulty described previously.

In domestic installations it is sometimes necessary to serve a space heater or cooking stove and a water heater with the same chimney flue. This is not desirable, especially for low chimneys, since doors left open on one device while it is un-fired will tend to annul the draft on another device. Gas burning devices, with their draft hoods and lack of draft dampers, are especially bad in this respect. The traditional method of avoiding this with brick chimneys has been to construct multiple-flue chimneys, so that each fuel-burning device could be served by a separate opening. If two devices must be served by one flue-opening in a chimney, their connections to the chimneys should not be located opposite each other. The connection from the larger device should be reasonably low down and that from the smaller, up near the ceiling, so that each device can be serviced as well as possible, regardless of the treatment of the other.

Excessive height in a chimney does no harm but means for controlling the draft are more than ordinarily essential if the chimney is too large in capacity. Coal-burning devices often have air leaks around the fire-box and the draft doors sometimes fit poorly so that the fire cannot be controlled at a low rate. Perhaps the simplest remedy for such cases is the barometric damper which admits air into the flue pipe and thus reduces the draft.

Directions for building chimneys for fireplaces are contained in Department of Agriculture Farmers' Bulletin No. 1889.

It is considered bad practice to connect any heating device to a fireplace flue unless the fireplace is effectively sealed.

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Chapter 20

ESTIMATING FUEL CONSUMPTION FOR SPACE HEATING

Fuel Consumption Records, Calculated Heat Loss Method, Degree-Day Method, Estimating Fuel Consumption, Degree-Day as an Operating Unit, Maximum Demands and Load Factors, Seasonal Efficiency

MANY methods are in use for estimating in advance of actual operation the anticipated heat or fuel consumption of heating plants over long or short periods. With suitable modification in procedure these same general methods are frequently useful in checking the degree of effectiveness with which heat or fuel is utilized during plant operation.

In applying any of these estimating methods to the consumption of a particular building plant it should be noted that (*a*) reliable records of past heat or fuel consumptions of the building under consideration will usually produce more trustworthy estimates of future consumptions than will any data obtained by averages or from other similar buildings; (*b*) where no past records exist useful data can sometimes be obtained from records of similar types of buildings with similar plants *in the same locality;* (*c*) records of consumption, which are averages from many types of plants in many types of buildings in various localities, can produce no better than an average estimate which may be far from accurate; (*d*) estimates based on computed heat losses without the benefit of operating data are wholly dependent on how well the computation represents the actual facts.

Estimates based on computed heat losses alone are especially necessary where unusual operating conditions are encountered such as excessive ventilation, abnormal inside temperatures, heat gains from external sources, etc., or where no information is available as to former consumption as in the case of proposed buildings of unusual design.

In interpreting and evaluating heat or fuel consumption estimates as well as in their preparation, it is well to realize that any estimating method used will produce a more reliable result over a long period operation than over a short period. Nearly all of the methods in common use will give trustworthy results over a full *annual* heating season, and in some cases such estimates will prove consistent within themselves for monthly periods. As the period of the estimate is shortened there is more chance that some factor not allowed for in the estimating method will become controlling and thus give discrepant and even ridiculous results.

Of the various estimating methods in use attention is directed in this discussion to but two as they are illustrative of all, viz: (1) calculated heat loss method, and (2) degree-day method.

CALCULATED HEAT LOSS METHOD

This method is theoretical and assumes constant temperatures for very definite hours each day throughout the entire heating season. It does not take into account factors which are difficult to evaluate such as opening of windows, abnormal heating of the building, poor heating systems, winter heat gains, such as sun effect, and many others. In order to apply this method the hourly heat loss from the building under maximum load,