

water accumulators may be used for this purpose by storing heat in water to be fed to the boilers, in water to be used for domestic hot water service, in water to be used in a hot water heating system, in water to be used for process work, or for some combination of these purposes.

Another method is to adjust the quantity of exhaust produced somewhat in concordance with the heating demand. A bleeder turbine from which the exhaust may be taken for the lower heating demands and additional higher pressure steam from its successive stages as this demand goes up is frequently a satisfactory solution for a case where the normal exhaust is deficient. If such a turbine is also arranged to run condensing under various controllable degrees of vacuum and arrangements are made for either circulating the exhaust through the heating system under various pressures above and below atmospheric pressure or for similarly using the exhaust for heating water, such an arrangement may adjust the exhaust to a wide variation of heating demands.

With such an arrangement, the exhaust supply may be automatically adjusted to the demand by having automatic control of the vacuum in the turbine from an outdoor thermostat operating on the flow of cooling water on the condenser and remote control valves in the bleeder steam supplies controlled from the same or a coordinate thermostat. This arrangement has certain advantages over that in which exhaust steam is discharged to the atmosphere when it is in excess of the demand and where live steam at boiler pressure is used to make up the deficit when the exhaust is insufficient. For example, the condensing of the excess exhaust steam increases the efficiency of the turbine so that the total heat rejected to the condenser is less than would otherwise be thrown away, while the use of the bleeder steam conserves heat by allowing a certain amount of power to be generated from this steam before it is fed to the heating system.

A modification of this method of adjustment, especially as between the heating and non-heating seasons, is to use engines or turbines which may be run condensing throughout the non-heating season and non-condensing throughout the heating season. Another modification is to have non-condensing engines or turbines for use during the heating season and low pressure exhaust condensing turbines for using the exhaust steam from these during the non-heating season. This latter arrangement affords a high efficiency since each unit operates under conditions for which it may be best designed. The low pressure turbine in this case may even be made a bleeder turbine and be arranged to operate on various degrees of vacuum with automatic control as previously stated. While this arrangement of units generally shows a high overall economy there is some disadvantage in installing condensing units which have to be frequently started up or shut down and by-passed and hence a straight bleeder turbine is frequently used as a matter of simplicity.

Still another method is to adjust the heating demand so that it will balance as nearly as possible the exhaust heat produced. The use of hand operated or automatic remote control sectional, or zone, regulating valves for separately controlling the various sides and vertical sections of a building in accordance with the exposures, wind velocities, sunshine, etc., the use of automatic temperature control, fractional distribution of steam, distribution of steam under varying degrees of vacuum and the use of

forced hot water with temperature control, all tend to keep the demand commensurate with the actual weather requirements, thereby reducing the maximum demand and at the same time the amount of fluctuation by supplying heat only where it is needed.

HEATING LOAD AND AMOUNT OF EXHAUST STEAM AVAILABLE

In all of these adjustments the question of relative economies and the cost to produce them must necessarily enter into the problem. The efficiencies of engines and turbines vary with the types, sizes, speeds, load conditions and with the steam pressure, temperature, back pressure or vacuum under which they operate. Actual guaranteed water rates for the units and conditions to be employed on any particular operation should be obtained from several reputable makers before endeavoring to estimate the exhaust.

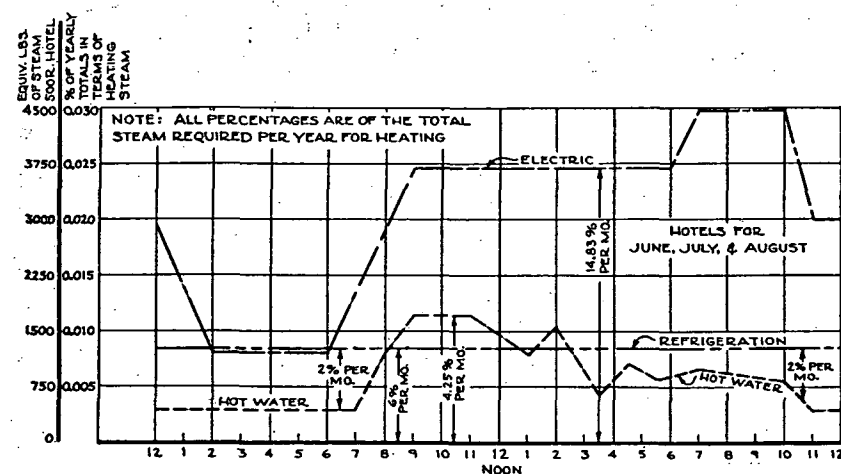


FIG. 1. HOTEL LOAD CURVE FOR JUNE, JULY AND AUGUST

Load conditions and heating requirements must then be computed for the various hours of the day and night and for the various days of the year. Generally, a 24-hour day load and heating requirement chart for each of the four seasons of the year will be sufficient although in many cases the load may be different for some days of each week and of course over holidays and other non-operating periods.

Typical load curves are shown by Figs. 1, 2 and 3. In the hotel diagram (Fig. 1) it will be noted that the steam required for generating the refrigeration power is shown separately and is not included in the steam required to generate the remaining electric current or power. This is for the purpose of comparing it with the hot water load, which it practically equals in all of these charts. For this reason the refrigerating apparatus in this class of building may frequently be steam driven and the exhaust thus produced be used with good economy for heating the domestic hot water even where the remainder of the electric current is purchased