POWER PROBLEMS

The first point to determine is the cost of the power which is available for electric heating. Unlike fuels, there is no uniform cost for electric power because of the unequal cost of distribution to large and small users. The fact that electricity cannot be economically stored, but must be used as fast as it is generated, makes it impossible to operate power plants at uniform loads; hence, even the time of use may affect the cost of power.

Special low rates are sometimes available during certain prescribed hours of use, but wherever the use of power is unrestricted a demand charge based upon the rated connected load of each heating device must form part of the basic rate structure, so that unlike fuel heating, the cost of operating electric heating systems depends not only upon the actual energy used but also upon the demand charge for the available electrical service.

Homes are almost universally supplied with lighting current of 115 volts, which can only be used economically for small heaters. Usually the service lines will not permit more than plug-in devices. The Underwriters permit approved heaters of 1320 watts or less to be plugged into approved baseboard receptacles. Where homes have 230 volt service for cooking and water heating, and rates are favorable, larger heaters can be installed. For industrial purposes, heaters should be designed to use polyphase power, which is usually supplied at 220, 440 or 550 volts. All polyphase heaters should be balanced between phases.

INSULATION

The value of building construction which incorporates built-in insulation to reduce the outward heat loss in winter and the inward heat gain in summer has been placed in the spotlight by the increasing adoption of complete air conditioning. With electric heating, adequate insulation is very important and will pay even better returns on the investment than for less expensive fuels.

Chapter 42

RADIANT HEATING

Physical and Physiological Factors, Control of Heat Losses, Rate of Heat Production, British Equivalent Temperature, Application Methods, Calculation Principles, Mean Radiant Temperature, Measurement of Radiant Heating

FOR health and comfort, the rate of heat loss from the human body must be controlled, by the aggregate effect of the conditions surrounding the body, so that the physiological reactions result in a feeling of comfort. Generally, any heating system serves not to add heat to the individual, but to reduce the net rate at which the body loses heat by radiation, convection and evaporation. In convection heating, the heating medium serves to maintain such an air temperature as will give comfort, under existing conditions of humidity and of surrounding surface temperatures. The primary object of radiant heating, on the other hand, is to maintain such an average temperature of the surrounding surfaces, as will give comfort without needlessly heating the air. The difference between convection heating and radiant heating is therefore partly physical and partly physiological.

On a cool spring day while standing in the sunshine, one may feel perfectly comfortable, but when a cloud passes over the sun, one will feel much cooler. A shielded thermometer will show no immediate reduction in air temperature, so one actually feels a cooling effect which an ordinary thermometer cannot register. This is because light and heat waves travel at the same speed and are both interrupted by a cloud, or other shield. This proves that radiant heat affects the comfort of the body as definitely as does air temperature.

Comfort requires that heat escape from the body at the same rate as it is generated, by the oxidation of food-stuffs in the body, and in a manner suitable to physiological requirements. Furthermore, the surrounding conditions, themselves, cause changes both in the rate of heat generation in the body, and in the operation of the several methods by which the body loses heat. The feeling of heat or cold results not only from the rate at which the body loses heat, but also from the manner in which the heat is abstracted from the body, and the ease with which the body's heat regulating mechanisms can operate.

CONTROL OF HEAT LOSSES

Heat is transferred from any warm dry object to cooler surroundings principally by convection and by radiation, the total loss is substantially the sum of these two. Where the surface is moist, as with the human