

by radiation. The net effect may be a reduction of 10 per cent or more in the total heat output of the radiator.^{7,8,9}

Radiator enclosures and convector cabinets of proper design may improve the heat distribution within the room as compared to the heat distribution obtained with an unenclosed radiator.¹⁰

Heating Effect

For several years the term *heating effect* has been used to designate the relation between the *useful output* of a radiator, in the comfort zone of a room, and the total input as measured by steam condensation or water

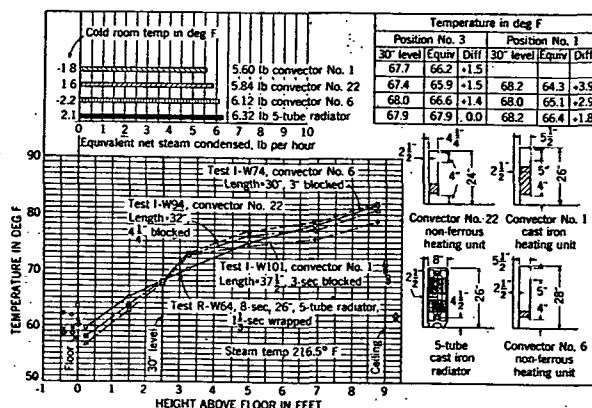


FIG. 2. TEMPERATURE GRADIENTS AND EQUIVALENT TEMPERATURES FOR RADIATOR AND CONVECTORS WITH COMMON 30 IN. LEVEL TEMPERATURE

temperatures.^{11, 12} The application of such a heating effect factor implies that some radiators and convectors use less steam than others for producing equal comfort heating results in the room.

All authorities do not agree that the use of heating effect factors are justified. No standard method for evaluating the heating effect of radiators and convectors and correlating it with comfort has yet been accepted. One method, with test data¹³ on radiators and convectors, and making use of the eupatheoscope for evaluating the environment produced, has been suggested by the University of Illinois. The principle underlying the eupatheoscope involves the measurement of the heat loss from a sizable body by radiation and convection, when the surface is maintained at some constant temperature. Through the use of this instrument and its calibration curve, non-uniform environments may be referred to uniform environments in which the air and all surrounding surfaces are at the same temperature. The temperatures of the uniform environments are referred to as equivalent temperatures.

The Kata thermometer,¹⁴ the thermo-integrator,^{15,16} and the globe¹⁷ thermometer are other instruments which have been used to measure the influence of air temperature, air movement and radiation in an environment.

Data given in Fig. 2 show that while the air temperature at the 30-in.

level is the same for the three convectors and the one large-tube cast-iron radiator, in position No. 3 in the test room, the equivalent temperature is 1.5 deg lower than the air temperature in the case of the three convectors, and the same as the air temperature in the case of the radiator. The difference between the minimum and the maximum amount of heat required to maintain the common air temperature at the 30-in. level is of the order of 13 per cent.

In Fig. 3 are shown the results of tests made with the same three convectors and the one large-tube cast-iron radiator, so adjusted in size that each gave approximately the same equivalent temperature in the No. 3 position in the test room. The difference between the minimum and the maximum

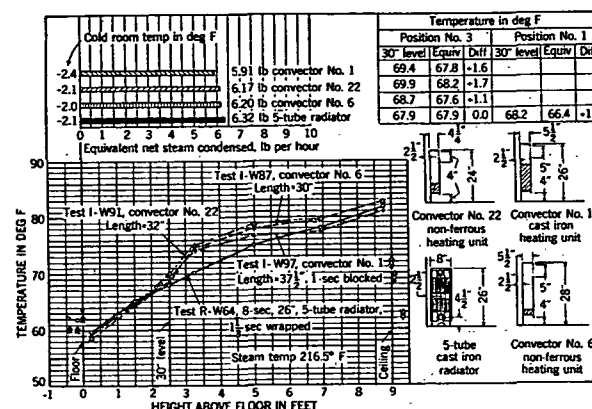


FIG. 3. TEMPERATURE GRADIENTS AND EQUIVALENT TEMPERATURES FOR RADIATOR AND CONVECTORS WITH COMMON EQUIVALENT TEMPERATURE

amount of heat required to maintain the common equivalent temperature is of the order of 7 per cent.

Figs. 2 and 3 show results obtained in cold room tests in which the radiators were continuously filled with steam at 215 F. Under these conditions of operation, air temperature gradients are likely to be exaggerated as compared with those encountered with the intermittent operation usually obtained in actual practice.

The following statements applying to the use of radiators are based on experience and test results:¹²

1. The heating effect of a radiator cannot be judged solely by the amount of steam condensed within the radiator.
2. Smaller floor-to-ceiling temperature differentials can be maintained with long, low, thin, direct radiators, than can be maintained with high, direct radiators.
3. The larger portion of the floor-to-ceiling temperature differential in a room of average ceiling height heated with direct radiators occurs between the floor and the breathing level.
4. The comfort level (approximately 2 ft-6 in. above floor) is below the breathing line level (approximately 5 ft-0 in. above floor), and temperatures taken at the breath-