TABLE 7. FACTORS TO CONVERT $I = B = R$ STEAM RATINGS TO HOT WATER RATINGS AT TEMPERATURES INDICATED

Average Radiator Temperature	Factor	Average Radiator Temperature	Factor	Average Radiator Temperature	Factor
150	0.45	175	0.65	200	0.86
155	0.49	180	0.69	205	0.91
160	0.53	185	0.73	210	0.95
165	0.57	190	0.78	215	1.00
170	0.61	195	0.82	220	1.05

entering and leaving water temperatures is used. These laws may be expressed as correction factors to change from output under standard rating-test conditions, to output under other operating conditions. Such factors are given in Table 6.

When it is desired to change the output under any test conditions to the corresponding output under standard code test conditions, the reciprocal form of correction factor may be derived. The equations for steam units are:

For radiators

$$C_s = \left(\frac{215 - 70}{t_s - t_r}\right)^{1.3} \quad (1)$$

For convectors

$$C_s = \left(\frac{215 - 65}{t_s - t_i}\right)^{1.5} \quad (2)$$

The output under standard conditions will be:

$$H_s = C_s H_t \quad (3)$$

where

C_s = correction factor.
t_s = steam temperature during test, Fahrenheit degrees.
t_r = room temperature during test, Fahrenheit degrees.
t_i = inlet air temperature during test, Fahrenheit degrees.
H_s = heat emission rating under standard conditions, Btu per hour.
H_t = heat output under test conditions, Btu per hour.

The relation between the size of the radiator or convector and the size of the test room will affect the results obtained in a capacity-rating test.[7] The height and location of the radiator and the insulation of the test room are other important factors that are not specifically regulated by the codes.

For a radiator, the finish coat of paint affects the heat output. Oil paints of any color will give about the same results as unpainted black or rusty surfaces, but an aluminum or a bronze paint will reduce the heat emitted by radiation. The net effect may be a reduction of 10 percent or more in the total heat output of the radiator.[8,9,10]

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.[11]

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

temperatures.[12, 13] 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 data[14] 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

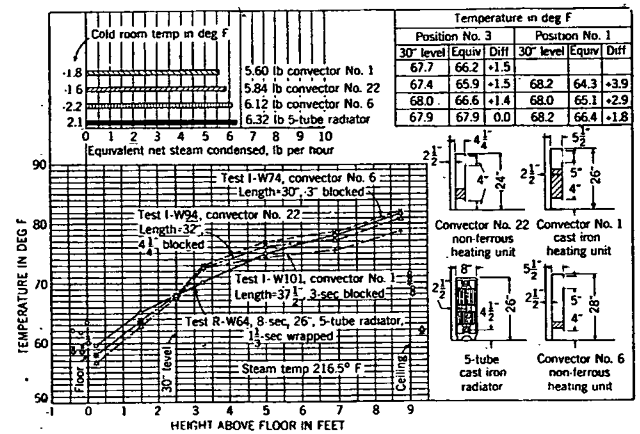

FIG. 2. TEMPERATURE GRADIENTS AND EQUIVALENT TEMPERATURES FOR RADIATOR AND CONVECTORS WITH COMMON 30 IN. LEVEL TEMPERATURE

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,[15] the thermo-integrator,[16, 17] and the globe [18] 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 percent.

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