TABLE 5. FINAL TEMPERATURE OF AIR LEAVING ¾ IN. PIN, CAST-IRON, GRAVITY INDIRECT RADIATORS

Temperature Entering Air Deg. Fahr.	Cubic Feet of Air (at 70 deg.) per Hour per Square Foot Radiation												
	50	75	100	125	150	175	200	225	250	275	300	325	350
−10	132	130	128	126	123	121	119	116	113	111	108	105	103
0	136	134	132	130	127	125	123	120	117	115	112	109	107
10	140	138	136	134	131	129	127	124	121	119	116	113	111
20	144	142	140	138	135	133	131	128	125	123	120	117	115
30	148	146	144	142	139	137	135	132	129	127	124	121	119
40	152	150	148	146	143	141	139	136	133	131	128	125	123
50	156	154	152	150	147	145	143	140	137	135	132	129	127
60	160	158	156	154	151	149	147	144	141	139	136	133	131

1st Floor →

2nd Floor →

3rd Floor →

Note.—Temperature of air entering room shall be assumed lower than temperature of air leaving radiator as follows: 1st Floor 5 deg. lower, 2nd Floor 8 deg. lower, 3rd Floor, 10 deg. lower.

Table 5 is for ¾ in. pin-type radiation using steam at 1 lb. pressure. For 1 in. pin-type the temperature rise of the air is about 95 per cent of the corresponding rise for ¾ in. pin-type and for hot water at 170 deg. fahr. the temperature rise of the air ranges from 80 to 85 per cent of the corresponding temperature rises with steam at 1 lb. pressure.

From Tables 4 and 5 the heat emission of an indirect radiator may be calculated as follows:

Example.—Determine the B.t.u. transmitted per hour per square foot of surface, from a ¾ in. pin-type cast-iron radiator, supplying a first floor register; entering air at 0 deg. and steam at 1 lb. pressure.

Solution.—From Table 4, it will be found that 150 cu. ft. of air will flow per hour per square foot and from Table 5 it is determined that the final temperature of the air is 127 deg. The temperature rise of the air = 127 − 0 = 127 deg. and the B.t.u. transmitted per hour per square foot $= \frac{150}{13.35} \times 0.24 \times 127 = 333$,

where

$$0.24 \doteq \text{B.t.u. required to heat 1 lb. of air 1 deg.}$$
$$13.35 = \text{cubic feet of air per pound at 70 deg.}$$

For a 1 in. pin-type radiator the transmission will be 333 × 0.95 = 316 B.t.u. per square foot per hour and with water at 170 deg. the transmission in either case would be 84 per cent of the respective figures for steam.

For performance data on radiators and heaters where air is forced through them by fans see Chapter XXIV.

LOCATION AND SELECTION OF CAST IRON RADIATORS

It should be made a rule to install radiators beneath or near the space of greatest heat loss. The best place is underneath an outside window. This seems logical for the following reasons:

1. Heat emitted by radiation from the radiator will counteract the effect of heat radiated out through the window from occupants in the room.

2. Cold air leaking in through the window is warmed before it reaches the interior of the room.

3. Air currents from the radiators pass upward, mingling with the cold infiltering air, and form a screen of warm air protecting against cold window drafts.

4. There is less discoloration of walls from dust arising from the radiator.

If the heater cannot be placed underneath the window, then it should be located as near the window as possible, near outside doors, underneath skylights, near to very exposed walls or corners, etc.

Heat emission by a radiator at the ceiling or floor will differ little, provided the surrounding air and objects are at the same temperature. The effect on heating the room or on temperature distribution in the room, however, may be very great. Heat applied near the ceiling will tend to stratify, resulting in a hot ceiling and cold floor, unless there is mechanical disturbance to produce circulation.

As the total heat emitted from the radiator varies with type, height, width, length, steam pressure, etc., the selection of the heater should be done in the following way:

1. Figure the total heat loss of the room as outlined in Chapter I, making proper allowances for exposure, wind velocity, height of ceiling, etc.

2. Next, decide upon the type (design, height, width, etc.) and the number of radiators to be used. Then find in Tables 1 to 3, or in tables of guaranteed performance published by the various manufacturers, the number of sections necessary for each radiator.

Example.—The heat loss from a given room calculated in accordance with Chapter I is estimated to be 14,200 B.t.u. per hour. How many sections are required in a three-column, 38-in., radiator for heating this room?

Solution.—Table 1 indicates that a 3-column, 38-in. radiator emits 211 B.t.u. per square foot per hour for intermediate sections, and 380 B.t.u. per square foot per hour for end sections. Each section has 5 sq. ft. of area. Intermediate sections will emit 5 × 211 = 1055 and each end section will emit 2½ × 211 + 2½ × 380 or 1277.5 B.t.u. per section per hour. The two end sections will emit 2 × 1277.5 = 2555, leaving 14,200 − 2555 = 11,645 B.t.u. per hour to be supplied by the intermediate sections. 11,645 ÷ 1055 = 11. Hence, 11 intermediate and 2 end sections, or a total of 12 sections, will be required.

Example.—How many sections of 5-tube radiation are required to heat a room having an estimated heat loss of 15,000 B.t.u. per hour?

Solution.—Total radiation required under the new ratings is 15,000 ÷ 240 = 62.5 sq. ft. Select the radiator from the manufacturer's catalog.

Example.—How many square feet of radiation are required to heat a room having a heat loss of 15,000 B.t.u. per hour if the pressure of the steam in the radiator is 2 lb. gage and the room temperature is 50 deg. fahr.?

Solution.—The factor from Table 3 for 2 lb. gage and 50 deg. fahr. room temperature is 1.220. Under these conditions 1 sq. ft. will emit 240 × 1.220 = 293 B.t.u. per hour. The number of square feet required is 15,000 ÷ 293 = 51.2. Select from a manufacturer's catalog.

Example.—How many square feet of hot-water radiation are required to heat a room having a heat loss of 15,000 B.t.u. per hour if the mean water temperature is 170 deg. fahr. and the room temperature is 70 deg. fahr.

Solution.—The factor from Table 3 for a temperature of 170 deg. fahr. in the radiator and a room temperature of 70 deg. fahr. is 0.617. Under these conditions 1 sq. ft. will emit 240 × 0.617 = 148 B.t.u. per hour. The number of square feet required is 15,000 ÷ 148 = 101.3. Select from a manufacturer's catalog.