TABLE 4. THERMAL RESISTANCE OF FLOOR COVERINGS

DESCRIPTION	RESISTANCE, r_{uc} (Fdeg)(hr)(sq ft)/Btu
Bare concrete, no covering	0.00
Asphalt tile	0.05
Rubber tile	0.05
Light carpet	0.6
Light carpet with rubber pad	1.0
Light carpet with light pad	1.4
Light carpet with heavy pad	1.7
Heavy carpet	0.8
Heavy carpet with rubber pad	1.2
Heavy carpet with light pad	1.6
Heavy carpet with heavy pad	1.9

Step 7. Design Mean Water Temperature

Select a single design mean water temperature (t_{dmw}) for each group of rooms which is to comprise a zone, choosing the highest mean water temperature (t_{mw}) of the group. In the example, 116.5 F is chosen.

Step 8. Design Panel Output

From Figure 16 find the panel output (q_u) for design mean water temperature (t_{dmw}), room air temperature (t_a), and panel resistance (r_u). Also from Figure 16 find the design panel surface temperature. If it exceeds 85 F (see Step 3) in a room, go back to Step 5 and choose a wider spacing or smaller pipe or tube for that room.

ROOM	(q_u)	t_p
A	25.	85. (unchanged)
B	24.0	84.5
C	26.1	85.3 (unchanged)

Step 9. Design Panel Area

Divide the room heat loss found in Step 1 by the design panel output found in Step 8.

ROOM	A_p
A	132. (unchanged)
B	104.
C	306. (unchanged)

Step 10. Total Panel Output

Add the apportioned downward and edgewise heat flow (q_{de}) to the design panel output (q_u) and multiply by the design panel area to obtain the total panel output. If the design panel output is appreciably different from the panel output (q_u) used in Steps 3 and 4, the apportioned downward and edgewise heat flow (q_{de}) should be redetermined.

ROOM	q_u	q_{de}	$q_u + q_{de}$	A_p	$A_p(q_u + q_{de})$
A	25.0*	17.7*	42.7	132	5636
B	24.0	11.6**	35.6	104	3702
C	26.1*	7.1*	33.2	306	10159

* Unchanged. ** Redetermined.

Step 11. Fluid Circuit

Design the fluid circuit (panel piping and mains) for a temperature drop of 10 to 20 F deg between the water inlet (t_i) and outlet (t_o) of the panel (see Chapter 21 Hot Water Heating Systems).

Step 12. Boiler Size

Select the size of the boiler according to method contained in Chapter 16 Heating Boilers, Furnaces, and Space Heaters. The net Btu rating of the boiler should equal or exceed the total output of all panels plus any other loads on the boiler.

Procedure for Hot Water Concrete Floor Panels (Intermediate Slab)[12]

The procedure for designing a hot water concrete floor panel of intermediate slab type is given in the following 12 steps.

Step 1. Heat Loss

Follow the procedure for slab-on-grade construction, Step 1.

Step 2. Required Panel Output

Follow the procedure for slab-on-grade construction, Step 2.

Step 3. Panel Surface Temperature

Follow the procedure for slab-on-grade construction, Step 3.

Step 4. Downward Heat Flow Estimate

A. Follow the procedure for slab-on-grade construction, Step 4, part 1.

B. Estimate the heat flow downward as follows:

1. If the underside of the concrete slab is exposed to form a ceiling, find the heat output downward (q_d) from Fig. 15, using the slab surface temperature (t_s) found in Step 3 as the panel surface temperature (t_p), and the air temperature of the space below.

2. If the underside of the concrete slab is not exposed, use the equation:

$$q_d = C_2(t_s - t_b) \tag{14}$$

Step 5. Upward and Downward Panel Resistance

Follow the procedure for slab-on-grade construction, Step 5, using Table 3 to find both resistances (r_{us} and r_{ds}).

Step 6. Mean Water Temperature and Downward Heat Flow

a. Follow the procedure for slab-on-grade construction, Step 6.

b. Use Fig. 15 to find the downward heat flow (q_d). Add to the slab resistance to downward heat flow, (r_{ds}), the resistance to heat flow, (r_{dc}), of any material between the underside of the slab and the ceiling surface, to find the total resistance to downward heat flow (r_d) to be used in Fig. 15. The water temperature (t_{mw}) found above and the air temperature (t_b) of the space below the ceiling are the other two factors to be used.

If the heat flow downward (q_d) differs appreciably from the estimate made in Step 4, repeat Steps 5 and 6 using the calculated value.

Step 7. Design Mean Water Temperature

Follow the procedure for slab-on-grade construction, Step 7.

Step 8. Design Panel Output

Follow the procedure for slab-on-grade construction, Step 8.

Step 9. Design Panel Area

Follow the procedure for slab-on-grade construction, Step 9.