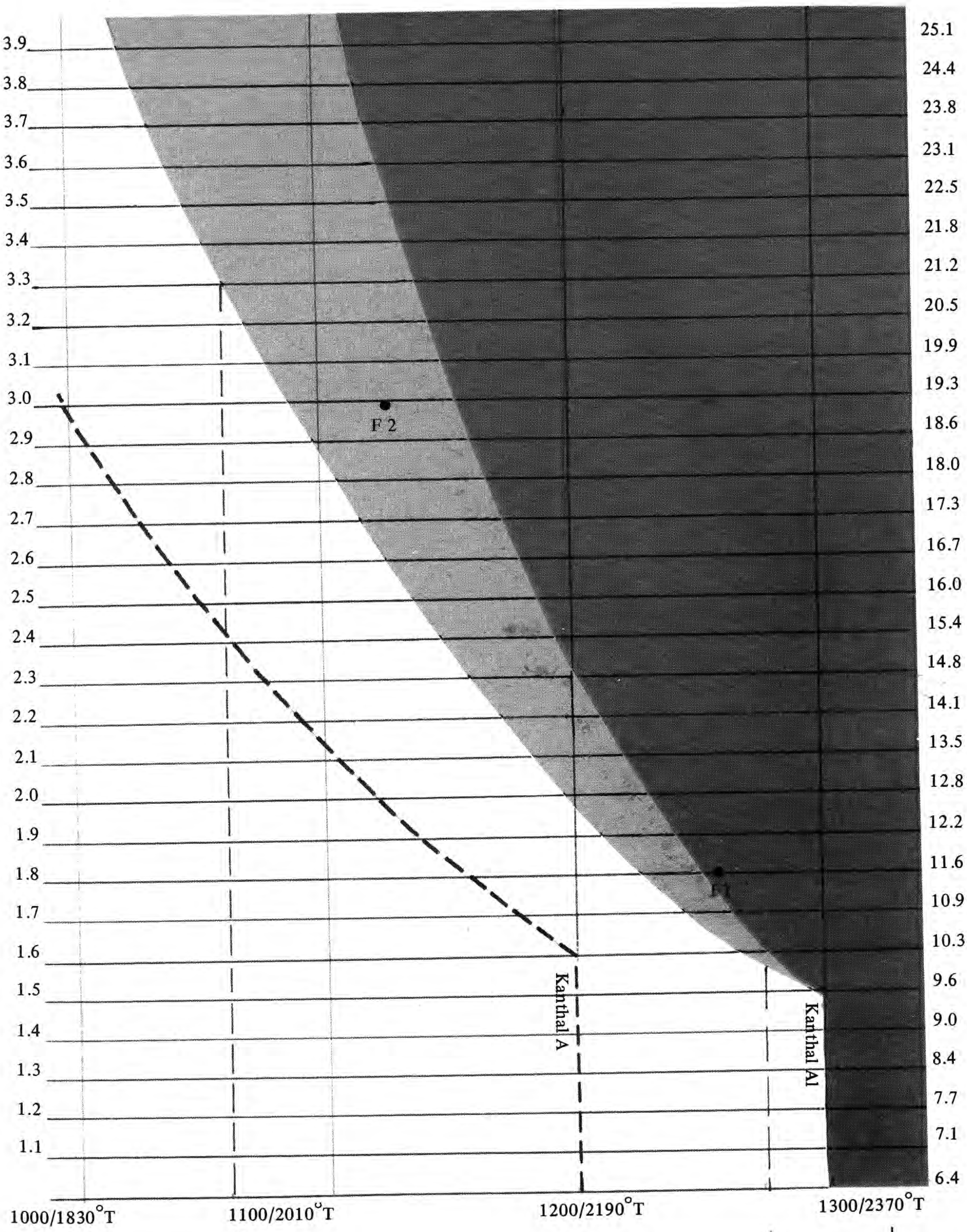

3.9
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25.1
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23.8
23.1
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21.8
21.2
20.5
19.9
19.3
18.6
18.0
17.3
16.7
16.0
15.4
14.8
14.1
13.5
12.8
12.2
11.6
10.9
10.3
9.6
9.0
8.4
7.7
7.1
6.4
F 2
F1
Kanthal A
Kanthal Al
1000/1830°T
1100/2010°T
1200/2190°T
1300/2370°T

this is not always convenient and one may have to put double the load on one phase compared with the others. The principles of calculation are still those outlined above. For instance a kiln taking 27 kW could be powered by six circuits, two on a phase, each of 4500 watts. The wire length for 13 swg, as worked out in Example 4 is 124/38 m, thus the total wire required would be 124 X 6 = 744/227 m.

TABLE 8
Surface Area of Kanthal Wire for Watt-loss Calculations

Gauge	No.	in^2/ft	cm^2/m (approx.)
SWG	11	4.37	91.00
AWG	9	4.31	90.00
SWG	12	3.92	83.00
AWG	10	3.84	81.00
SWG	13	3.47	73.00
AWG	11	3.42	72.00
AWG	12	3.05	63.00
SWG	14	3.02	63.00
AWG	13	2.71	57.00
SWG	15	2.71	57.00
AWG	14	2.42	51.00
SWG	16	2.41	51.00
AWG	15	2.15	45.00
SWG	17	2.11	44.00
AWG	16	1.92	40.00

Divide total wattage of a circuit by feet or meters of wire used, and the resultant figure by the appropriate surface area figure in the table. This gives watts per in^2 or cm^2 which can be checked against Graph 7.

which will balance the input, otherwise heat will build up until the material melts. This balance is worked out by reference to the surface area of the wire or rod which is, of course, that part of the material which radiates the heat into the surrounding air, or kiln brick in contact with it. Since the heat relates to the electrical power applied to the material as expressed in watts, the process is known as watt-loss. The surface area of a wire or rod is arrived at by multiplying the diameter by 3.14 (pi) and by a unit of length of the wire or rod. Table 8 presents figures for cm^2 per meter, and in^2 per foot.

The limits of power which Kanthal wire will stand without damage are summed up in Graph 7 which is derived from that in the Kanthal Handbook.

To use the diagram, draw a vertical line from the temperature at which you wish to fire, and a horizontal line from the surface area figure arrived at through the equations discussed in the previous section. The point where they cross should lie within the white area. It will be seen that the higher the temperature, the greater is the surface area needed to dissipate the heat. This is because the difference between the element temperature and that of the surrounding air and brick in the firing chamber becomes smaller as the firing temperature rises. We can personally experience this phenomenon in the difficulty of getting rid of body heat in midsummer compared with midwinter.

To return to Graph 7, the vertical line X from 1060/1940°T intersects the limit curve at 15: W/in^2 (watts per square inch) for Kanthal A, and at 21.2 for A1 (stressing the superior heat-resisting properties of the latter). Vertical line Y at 1275/2320°T, falls completely outside the range of A and reduces the limit of A1 to 10 W/in^2. Line Z from 1325/2410°T lies outside the limits of either.

By reversing the sums shown in the earlier section of this chapter you can work back to wire lengths and so to power limits.

EXAMPLE 6.
We can see in Graph 7 that a suitable rating for a 1250/2280°T firing would be 10.3 W/in^2. Using 14 swg A1, then: $W/in^2 \times in^2/ft = w/ft$. In this case: $10.3 \times 3.02 = 31.1$. Thus 100 feet of wire can dissipate $100 \times 31.1 = 3110$ watts of power.

Graph 7. Watt-loss graphs by kind permission Kanthal Ltd.