Using the IPC Temperature Charts

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The IPC temperature charts are published as Figure 6-4 in IPC–2221, "General Standard on Printed Board Design." The Figure is reprinted on page 2.

The first observation to be made is that the curves and axes do not line up exactly. This is not a problem in scanning the charts or in reproducing them here! It is a result of the now recognized fact that the originals have been long lost and these copies have been recopied, rescanned, and redrawn countless times during the last 40+ years! It is remarkable (and a testimony to the care that has always been taken) that they are still as faithful to the originals as they are! There is a renewed effort underway by the IPC and interested parties in updating the charts. *UltraCAD* is proud to be making a small contribution in this effort.

The figure is organized as three separate, but coordinated charts. The middle one (Figure B) relates to the dimensions of the trace. You use this chart to determine the cross-sectional area of the trace. The other two charts (Figure A for external traces and Figure C for internal traces) provide the trace/temperature relationship as a function of the cross sectional area (either already known or as determined from Figure B.)

For example, using Figure B (page 3), if the trace is 100 mils wide (left axis) and 2 Oz. thick, you can move right from the left axis from 100 mils to the line labeled 2 Oz., then at that intersection drop the line from there to the horizontal axis to find the cross-sectional area. In this illustration, the cross-sectional area is 250 sq. mils.

Continuing the illustration on page 3, extend the line up to Figure A where it crosses the curves. You can now determine the temperature rise of the trace (the individual curves) as a function of the current through the trace (left axis.) For example, if the current through the trace is 7 Amps, the temperature of the trace is expected to rise about 10^o C above the ambient temperature. If the current through the trace is (almost, not quite) 20 Amps, the temperature of the trace is estimated to rise 100^o C above the ambient temperature. If, for example, we wanted to know what current would cause a 20^o rise in temperature (above the ambient temperature) for this 100 mil wide, 2 Oz. trace, draw a line (green, in this illustration) from the intersection to the left axis to find approximately 10 Amps.

If you want to determine the required trace dimensions for a given temperature rise, proceed in the opposite manner. For example, suppose you wanted to know the required trace width for an external 1 Oz. trace carrying 5 Amps with an allowable 30^o temperature rise above the ambient temperature. Find the intersection of 5 Amps and the 30^o C curve on Figure A (blue line), drop that down to the 1 Oz. trace curve on Figure B, and determine that you need a trace with an approximate 60 mil width (or an approximate 80 square mil cross-sectional area.)

This illustrates the general approach to using these charts. For internal traces, use the identical procedures but drop the line to Figure C (instead of Figure A).

Clean, expanded charts are provided on pages 4 and 5.

(For use in determining current carrying capacity and sizes of etched copper conductors for various temperature rises above ambient.)

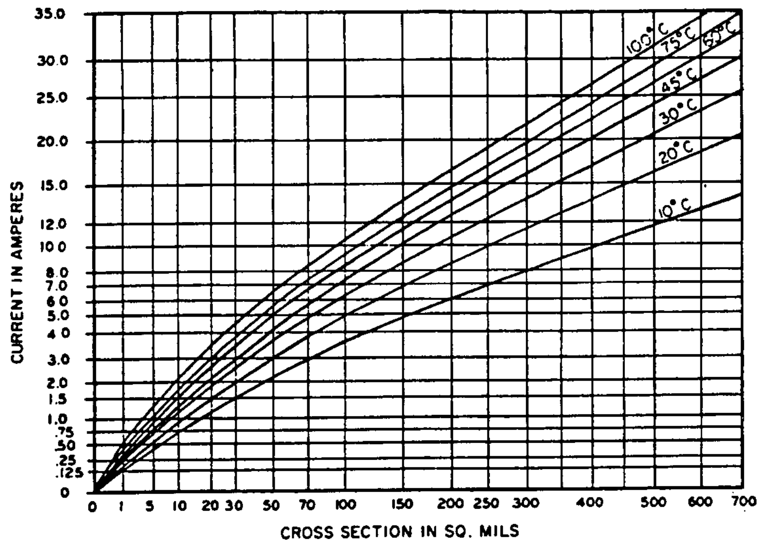

Figure A External Conductors

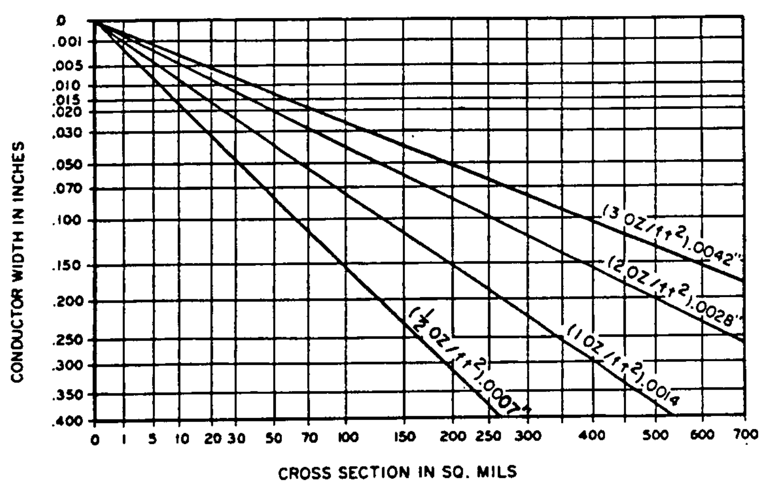

Figure B Conductor width to cross-section relationship

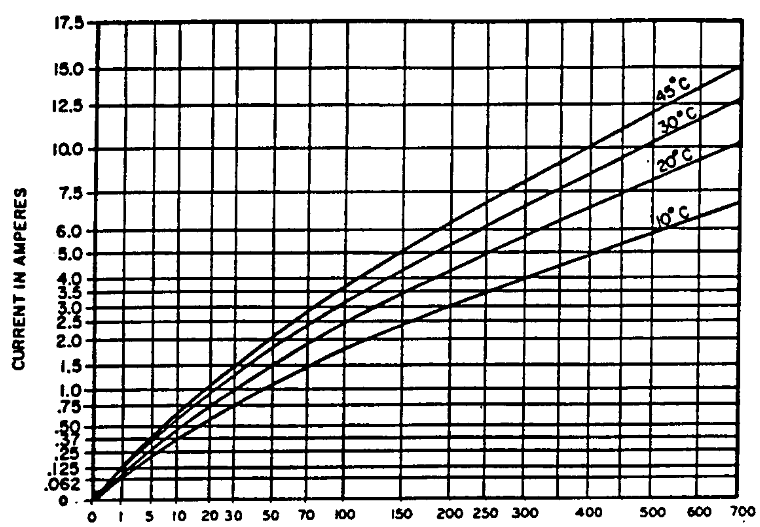

Figure C Internal Conductors

Figure 6-4 Conductor thickness and width for internal and external layers

(For use in determining current carrying capacity and sizes of etched copper conductors for various temperature rises above ambient.)

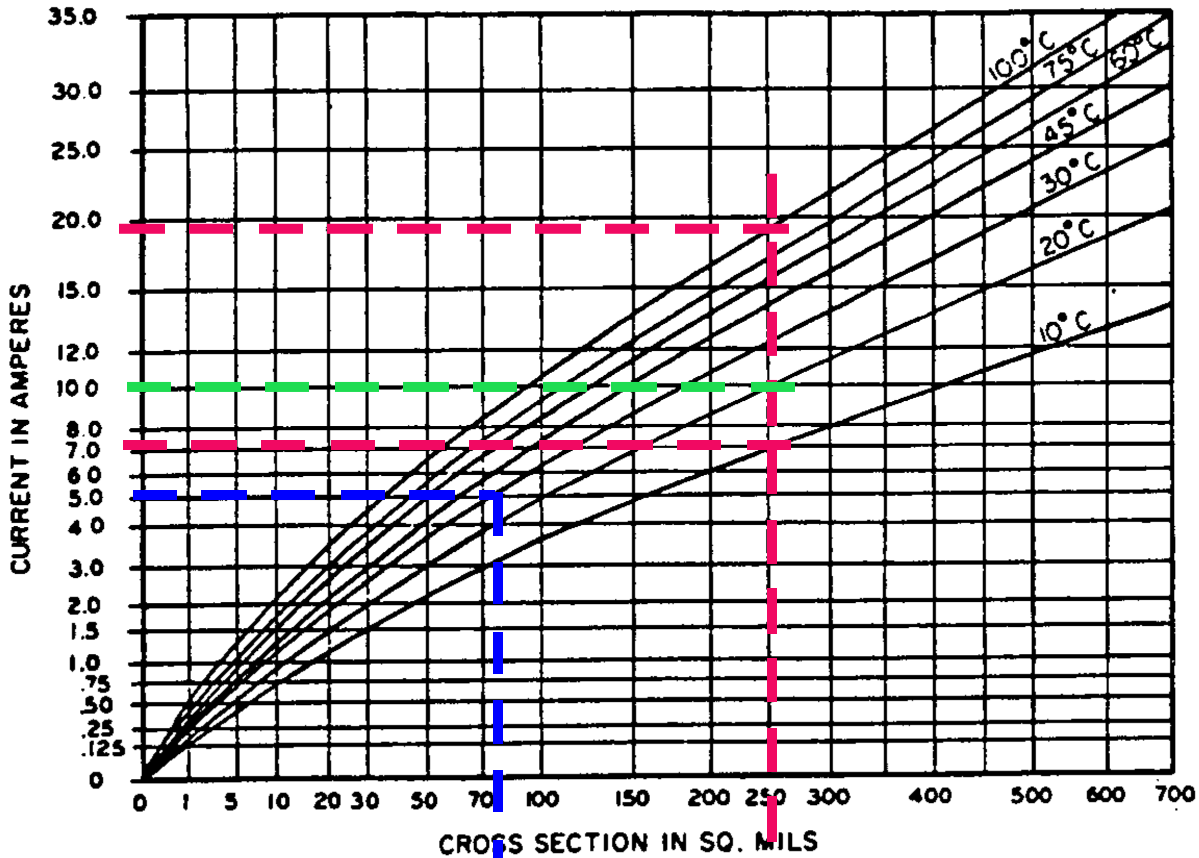

Figure A External Conductors

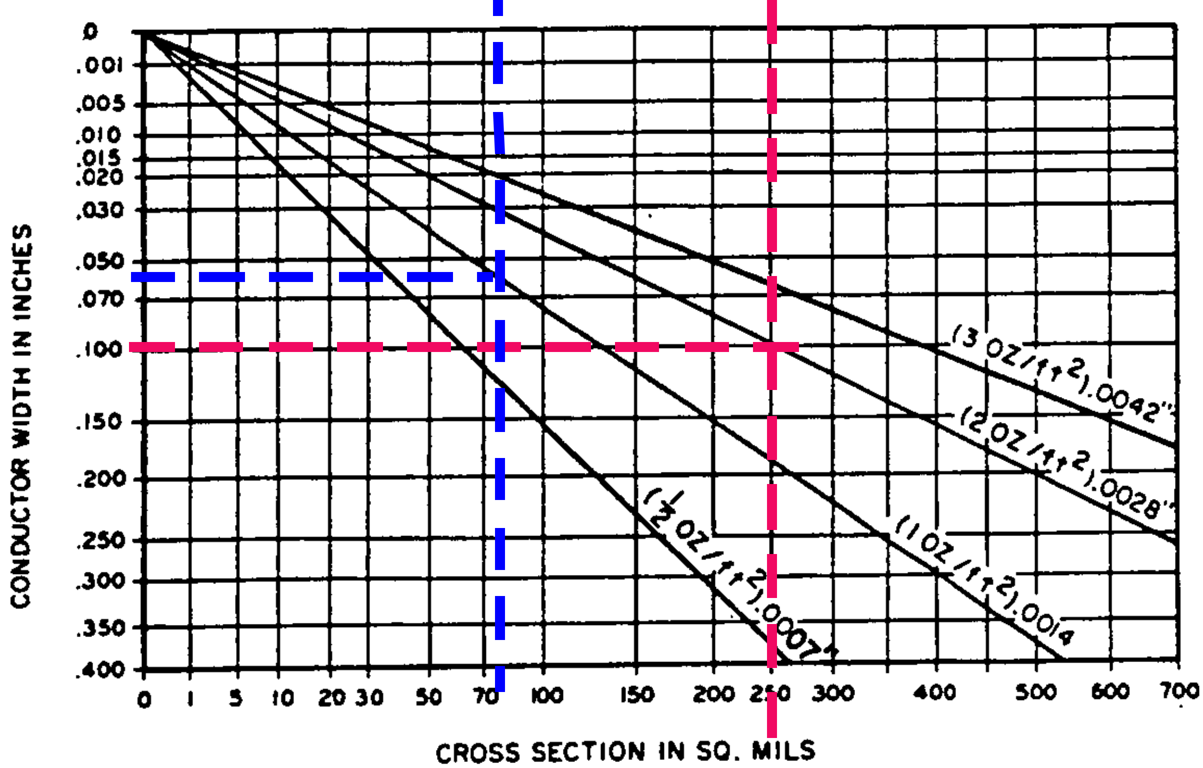

Figure B Conductor width to cross-section relationship

(For use in determining current carrying capacity and sizes of etched copper conductors for various temperature rises above ambient.)

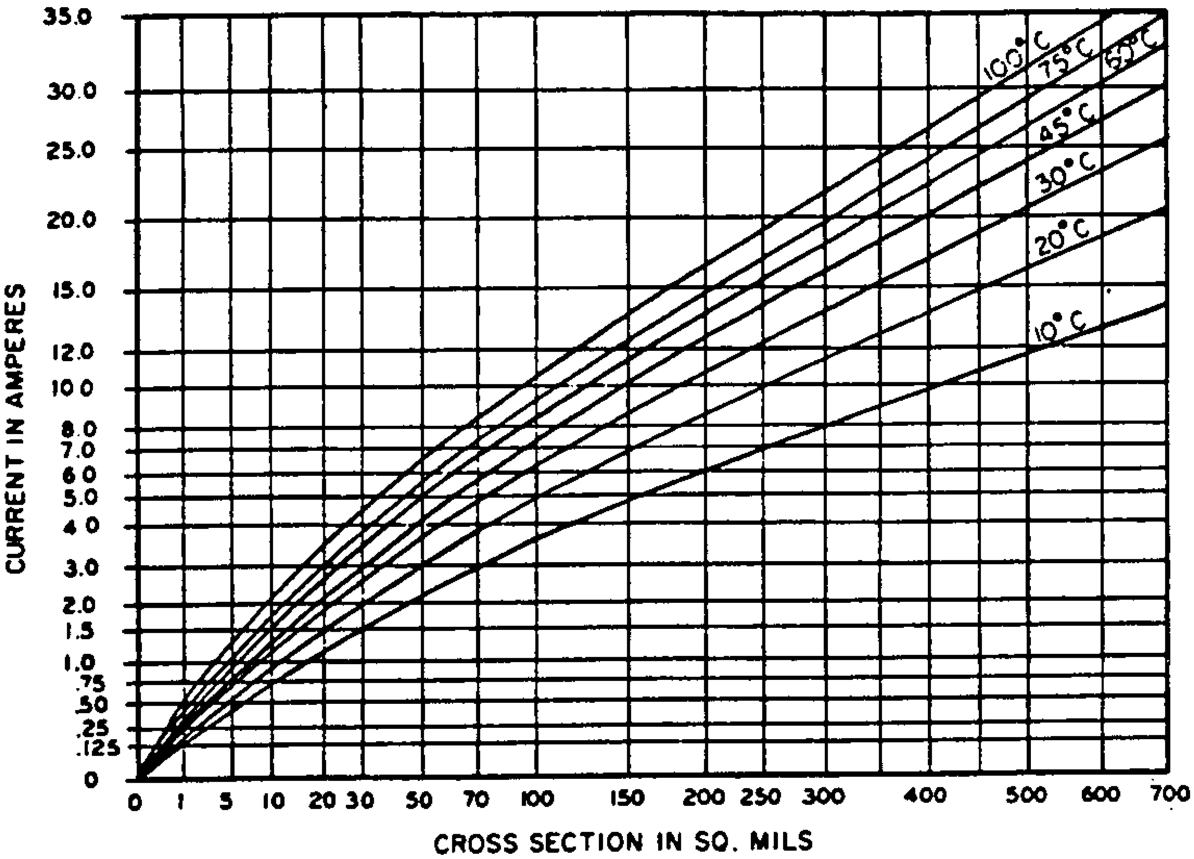

Figure A External Conductors

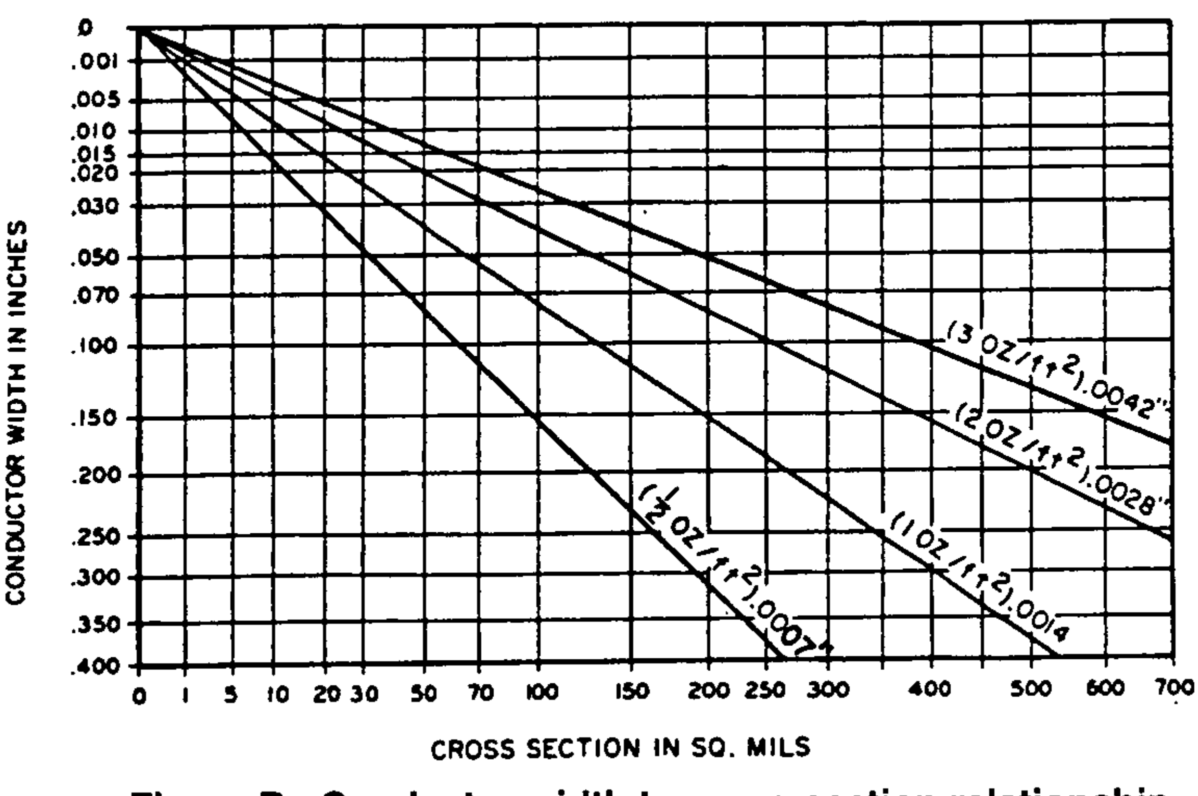

Figure B Conductor width to cross-section relationship

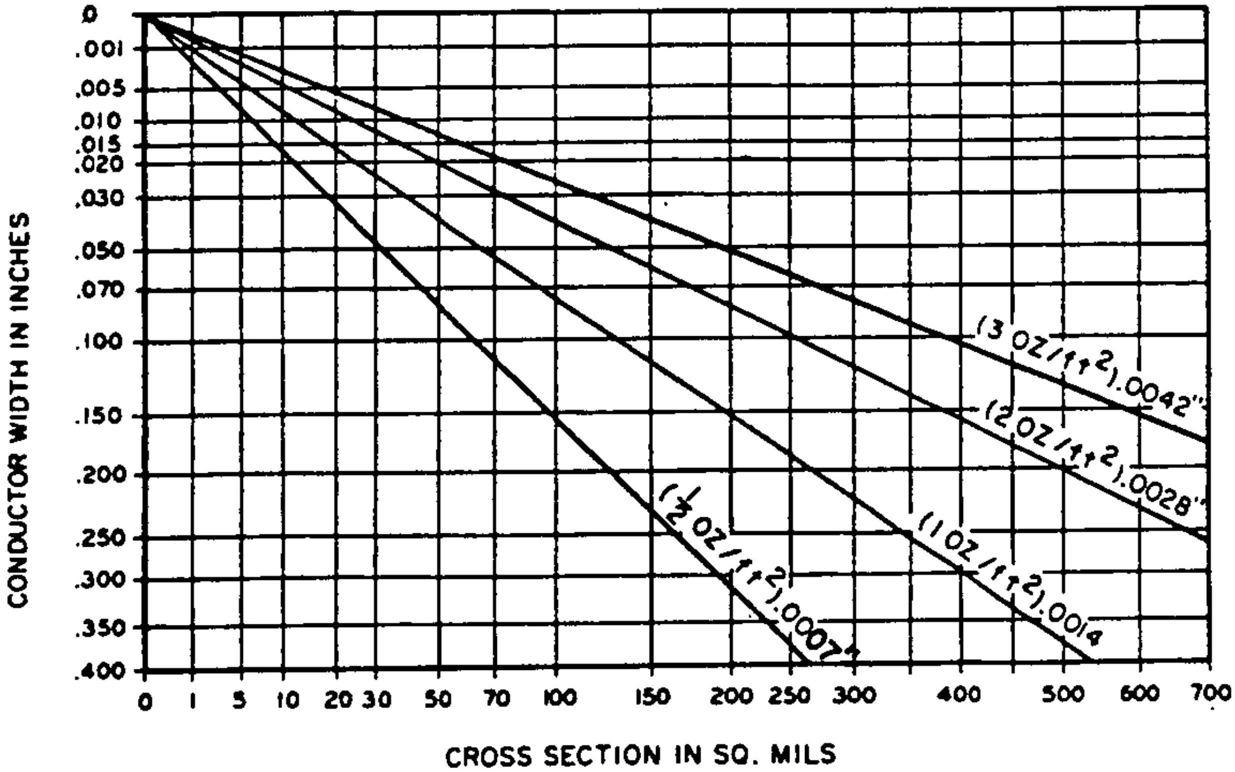

Figure B   Conductor width to cross-section relationship

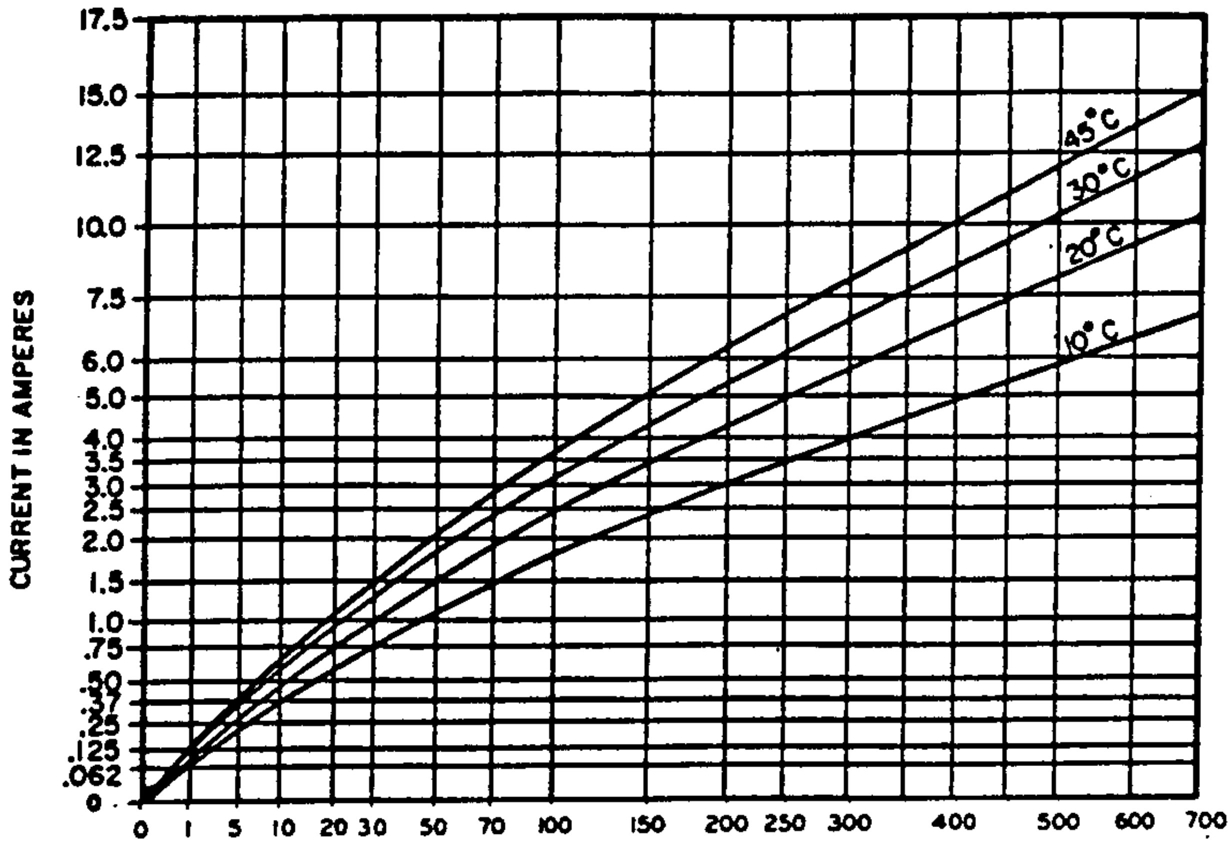

Figure C   Internal Conductors