The d.c. winding resistance for an average winding can be calculated by:

$$R_{dc} = \frac{l_w N r}{12000}$$

l_w = mean length of turn (in.)
N = number of turns
r = resistance of wire in ohms per 1000 feet
(see wire table on page 8.)

In addition to the normal d.c. resistance of a winding, there exists an incremental change in the winding resistance due to the skin effects of a.c. current.* This can be approximated by:

$$\frac{R_{ac}}{R_{dc}} = .96 + .0035\ x^2 - .00038\ x^3$$

$$x = d\sqrt{\frac{f}{(1 + .00393\quad (^\circ C - 20\ ))}}$$

d = wire diameter (inches)
f = frequency (HZ)
°C = operating temperature

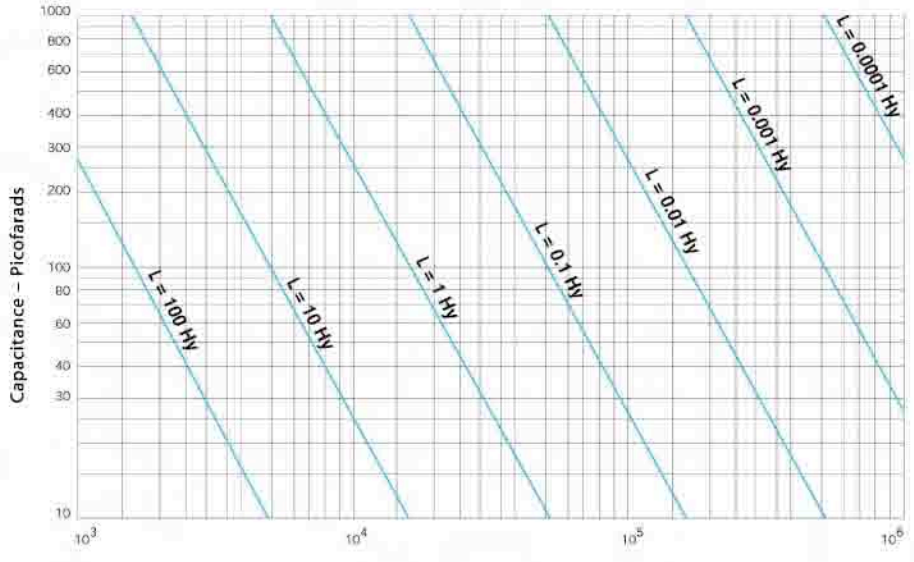
Minimizing distributed capacitance is an important core winding consideration. A toroidal winding has an effective capacitance which may be considered to be in parallel with the inductance. This is the result of the summation of capacitances from turn to turn, layer to layer, and from parts of the winding to the core. (The effect of this capacitance on the Q and the inductance of the component is discussed in the section "Notes on Molypermalloy Q Curves".) The graph below is useful for estimating self-resonant frequency. By selecting a winding technique which minimizes the voltage between turns, the distributed capacitance may be reduced. Several winding techniques are available. Dividing the winding into a number of sections, such as 2, 4, or more, or the use of a bankwound coil is effective in reducing the capacitance. In any case, the winding and inter-sector connecting technique should carefully avoid placing the first and last turns adjacent to each other - as they have the highest turn to turn potential, and thus contribute the most to the effective capacitance. Both the moisture content in the dielectric of the winding and the dielectric constant of potting and encapsulating materials increase the effective distributed capacitance.

Precision wound cores - stable with time and having reproducible temperature characteristics - must have winding strains relieved by temperature cycling. The wound cores must be cycled from room temperature to 125° C., repeating the cycle as many times as necessary to achieve reproducible results. At least one cycle should include a temperature lower than the wound core will be exposed to under operating conditions. This cycling will not only relieve strains, but also remove moisture that is present. Final adjustment of inductance value should be made after the temperature cycling process has been completed.

The wound cores should be kept dry until they are dipped, potted, or hermetically sealed. Potting and encapsulating compounds should be carefully selected as some may shrink with age or temperature change, and thus affect stability. Cushioning material on the wound cores can minimize this effect.

**Reference Data for Radio Engineers. ITT Corp. New York, NY, 4th Edition, 1956, pp. 128-132*

Inductance – Capacitance Resonance Chart



Heavy Film Magnet Wire Table (Reference NEMA MW1000)

AWG Size	Maximum Outside Diameter Over Insulation in Inches	Nominal Resistance, Ω/1000 ft. at 20°C (68°F)	Nominal Bare Wire Diameter in Mils[1]	Nominal Bare Wire Cross Sectional Area in Circular Mils[2]
10	0.1061	0.9988	101.9	10380
11	0.0948	1.26	90.7	8230
12	0.0847	1.59	80.8	6530
13	0.0757	2.00	72.0	5180
14	0.0682	2.52	64.1	4110
15	0.0609	3.18	57.1	3260
16	0.0545	4.02	50.8	2580
17	0.0488	5.05	45.3	2050
18	0.0437	6.39	40.3	1620
19	0.0391	8.05	35.9	1290
20	0.0351	10.1	32.0	1020
21	0.0314	12.8	28.5	812
22	0.0281	16.2	25.3	640
23	0.0253	20.3	22.6	511
24	0.0227	25.7	20.1	404
25	0.0203	32.4	17.9	320
26	0.0182	41.0	15.9	253
27	0.0164	51.4	14.2	202
28	0.0147	65.3	12.6	159
29	0.0133	81.2	11.3	128
30	0.0119	104	10.0	100
31	0.0108	131	8.9	79.2
32	0.0098	162	8.0	64.0
33	0.0088	206	7.1	50.4
34	0.0078	261	6.3	39.7
35	0.0070	331	5.6	31.4
36	0.0063	415	5.0	25.0
37	0.0057	512	4.5	20.2
38	0.0051	648	4.0	16.0
39	0.0045	847	3.5	12.2
40	0.0040	1080	3.1	9.61
41	0.0036	1320	2.8	7.84
42	0.0032	1660	2.5	6.25
43	0.0029	2140	2.2	4.84
44	0.0027	2590	2.0	4.00

[1]A mil is 0.001 inch.
[2]A circular mil is the area of a circle which is 1 mil in diameter.