GRAPHICAL DETERMINATION OF INPUT IMPEDANCE OF REPEATING COIL WITH ANY TERMINATING IMPEDANCE

94F COIL

1.01 This section contains transmission characteristics of 94F repeating coils and explains the method of graphically adding the effect of a 94F repeating coil to, or subtracting it from, any given positive impedance.

1.02 The 94F repeating coil has an impedance ratio of 1.5:1 and low impedance windings identical with the 94E coil. Thus the 94F coil is equivalent to a 94E coil plus an ideal 1.5:1 ratio transformer, as shown in Fig. 1. This makes it possible to obtain the input impedance of the 94F coil from the charts for the 94E coil in Section 304-200-101. For a general discussion of the method of using the charts, refer to Section 304-200-100.

1.03 The input impedance Z_X looking into the low side of the 94F coil, as indicated in Fig. 2, is obtained by entering the appropriate chart with the value of terminating impedance $Z_T' = \frac{2}{3} Z_T$. The input impedance looking into the high side, as indicated in Fig. 3, is given by $Z_X = 1.5\ Z_X'$ where Z_X' is the value of input impedance obtained from the chart for a terminating impedance Z_T.

1.04 Figs. 1, 2, and 3 show, for purposes of computation, the equivalent location of capacitors normally associated with the repeating coil, and for convenience a table of reactances of 1 mf and 4 mf at various frequencies is given in 1.03 of Section 304-200-101.

1.05 The following examples illustrate the computations for two conditions. Determine the impedance at 1000 cps looking into (1) the low side, and (2) the high side of a 94F repeating coil terminated in half section 22-gauge H88 cable, with a 4 mf capacitor on the line side and a 1 mf capacitor on the drop side.

<u>Example (1) - Looking into low side of 94F coil.</u> (See Fig. 2)

Midsection impedance 22 H88	1035 -j 177
4 mf capacitor	-j 40
Terminating impedance, Z_T	1035 -j 217
$Z_T' = \frac{2}{3} Z_T$	690 -j 145
From Chart 4 (304-200-101) N =	.8
+ 1 unit, N =	1.8
Input impedance of coil, Z_X	775 +j 80
1 mf capacitor	-j 159
Required impedance	775 -j 79

<u>Example (2) - Looking into high side of 94F coil.</u> (See Fig. 3)

Midsection impedance 22 H88	1035 -j 177
4 mf capacitor	-j 40
Terminating impedance, Z_T	1035 -j 217
From Chart 4 (304-200-101) N =	.7
+ 1 unit, N =	1.7
Input impedance of coil, Z_X'	1110 +j 190
$Z_X = 1.5\ Z_X'$	1665 +j 285
1 mf capacitor	-j 159
Required impedance	1665 +j 126

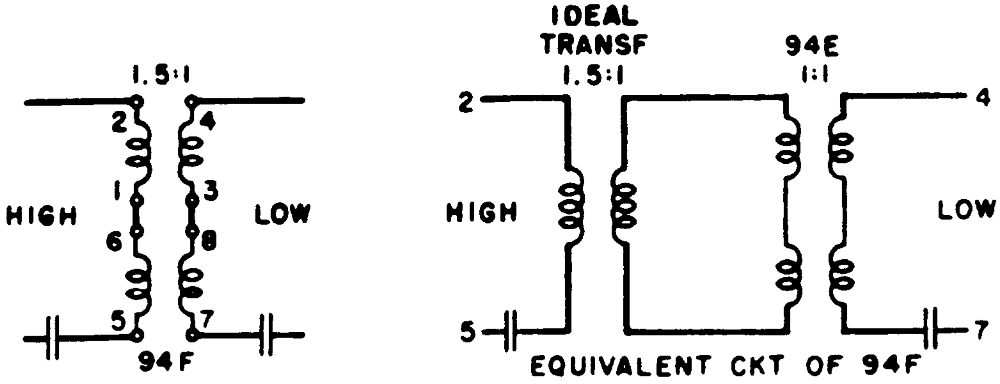


FIG. 1

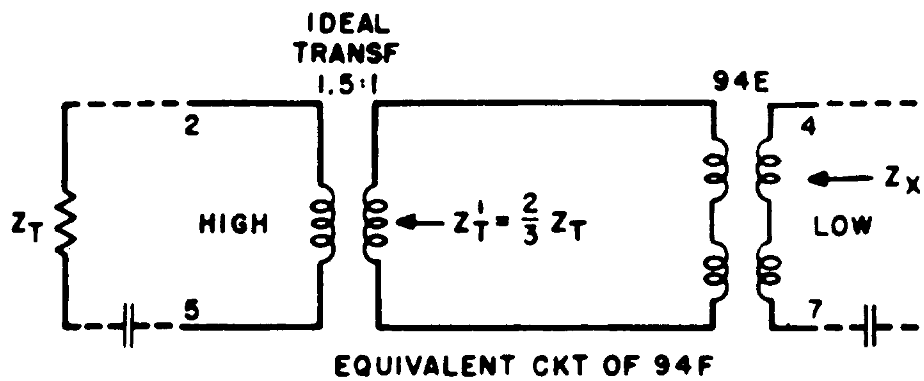


FIG. 2

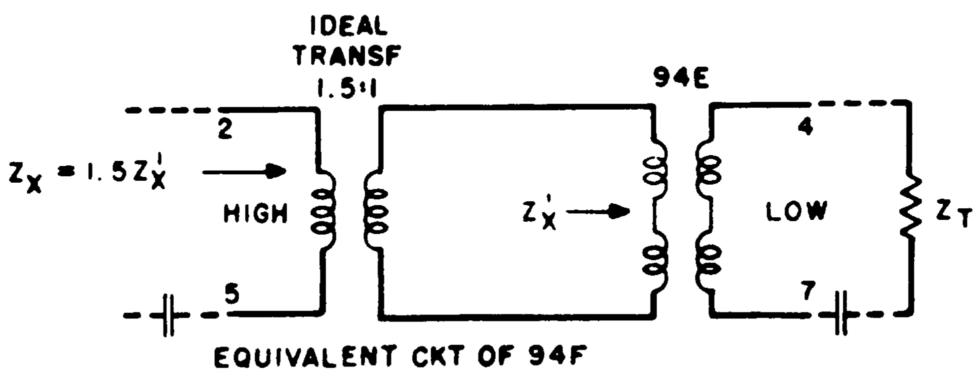


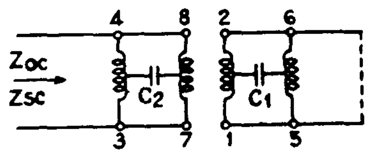
FIG. 3

TRANSMISSION CHARACTERISTICS OF 94F REPEATING COILS

Miscellaneous Data

Inner windings (2-1) and (6-5), parallel wound, each 890 turns #31EC - 30Ω ± 15%.
Outer windings (4-3) and (8-7), parallel wound, each 725 turns #29EC - 20Ω ± 15%.
Silicon steel core with 30 mil equivalent series air gap.
Impedance ratio (4-3) (8-7) to (2-1) (6-5) = 1:1.5 (±4%).
Inductance of (4-3) (8-7) at 900 cps, 3v., = 0.55h. min., 0.90h. max.
Inductance unbalance: (2-1) and (6-5) = 0.3% max.; (4-3) and (8-7) = 0.3% max.

Basic Impedance Measurements



Z_{oc} = Open Circuit Impedance

Z_{sc} = Short Circuit Impedance = 21+jω 0.00295

C_1 = .0064 μf

C_2 = .0104 μf

Freq. CPS	Z_{OC} (0.375V. A-C. 0-400 MA D-C)
200	23 +j 217
300	31 +j 316
500	42 +j 463
1000	69 +j 817
1500	106 +j 1168
2000	150 +j 1530
2500	200 +j 1887
3000	262 +j 2240

Equivalent Unity Ratio T Network - 1:1.5 Repeating Coil

Freq.	Z_A	Z_C*
200	42 +j 7	50 +j 864
300	42 +j 11	82 +j 1260
500	42 +j 19	132 +j 1890
1000	42 +j 37	289 +j 3590
1500	42 +j 56	620 +j 5850
2000	42 +j 74	1440 +j 9600
2500	42 +j 92	4200 +j 17100
3000	42 +j 111	24700 +j 37200

* 0.75v. a-c, 0-200 ma. d-c on (4-3) (8-7)