

PROCEDURE FOR DIELECTRIC TESTING OF LIQUIDS FOR
60-CYCLE POWER FACTOR ON TYPE 716-A BRIDGE

Special Equipment:

- (1) 25-ml Balsbaugh cell.
- (2) General Radio Type 1213-B null detector with 60-cycle filter.
- (3) Step-down transformer (to 55 volts) with 5,000 ohms in series with output, for 60 cycle source. This should be located as far as possible from the null detector.
- (4) 1,000 $\mu\mu$ f condenser (of power factor 0.25-0.30% at 60 cycles), plugged into the "UNKNOWN" terminals. This is the balancing condenser.
- (5) Coaxial cable from the Balsbaugh cell to the "PARALLEL" terminals of the bridge.

Procedure:

- (1) The cell is filled to cover the electrodes, placed in the oven and the leads attached. (It may be warmed with a burner before placing in the oven, to speed the attainment of temperature equilibrium.) It should not be left in the oven more than 1 hour before measurement.
- (2) The bridge is balanced, and the capacitance and dissipation factor dial readings recorded as "C" and "D" respectively.
- (3) The "hot" lead is disconnected from the cell, and the bridge balanced again. The readings "C" and "D" (the lead-blank values) should be larger than "C" and "D".
- (4) The coaxial leads are disconnected from the "PARALLEL" terminals, and the bridge balanced again. The reading of the capacitance dial is recorded as "C_b". (This value should be a constant for a particular balancing condenser, and needs to be checked only occasionally.)
- (5) Calculation:

Let C and D be values obtained with cell connected.

Let C' and D' be lead-blank values.

Let C_b = capacitance of balancing condenser.

C_d = capacitance of internal leads of cell.

C_a = capacitance of cell with air dielectric.

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C_a and C_d are constants of the cell, and will be furnished by the Research Laboratory.

$C' - C - C_d = C_x$ = capacitance of cell with unknown dielectric.

$D' - D = \Delta D$

$\Delta D \cdot \frac{C_b}{C_x} \frac{f}{f_0} = D_x$, the dissipation factor of the unknown dielectric.

$\frac{C_x}{C_a}$ = D.K. of the unknown dielectric.

Where f = 60 cycles = the frequency of the applied voltage

f_0 = 1000 cycles = the frequency at which the bridge is set.

(5) Example: (Aroclor 1242 at room temperature)

$C' = 967.2$ $D' = 4.61$

$C = 817.6$ $D = 0.91$

$C_d = 3.8$ $\Delta D = 3.70$

$C_x = 145.8$

$C_b = 1110.8$

$D_x = 3.70 \times \frac{1110.8}{145.8} \times \frac{60}{1000} = 1.69\%$

Reference: "Operating Instructions for Type 716-A Capacitance Bridge" - General Radio Company.

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