TO MEASURE THE SPECIFIC RESISTANCE OF THE EARTH

If it is desired to obtain a value of the specific resistance of the earth as a guide to putting down an earth plate, this may be done by inserting four spikes in the ground in a straight line at equal intervals "a". (See Figure 5.) The

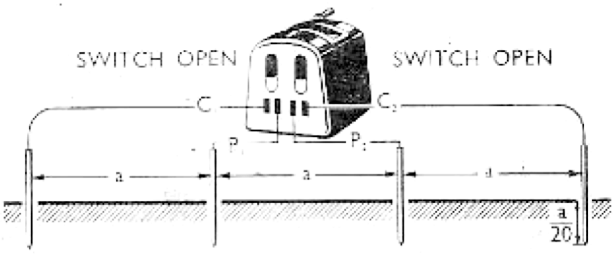

Figure 5

depth of insertion of the spikes should not exceed 1/20th of "a". Open both switches and connect the two outer spikes to the terminals C_1 and C_2 and the two inner ones to the terminals P_1 and P_2. Turn the handle and read the resistance given by the instrument.

If it is suspected that the potential spike resistance is unduly high, disconnect the outer pair of spikes from terminals C_1 and C_2 and close both switches joining P_1 with C_1 and P_2 with C_2. Take a measurement which will then give the combined resistance of spikes P_1 and P_2. Using this combined resistance as the value of the potential earth electrode in the table on page 4, note the correction to be applied.

Alternatively, with a 2-range instrument, connect as in Figure 5 and take readings on both scales, obtaining the true value of R by using the nomogram. (See page 4.)

It is generally taken that in homogeneous soil the formula:—

$$\rho = 2 \pi a R$$

gives the average specific resistance to a depth equal to the spike interval "a".

If R is the resistance, measured in ohms, and "a" is the spacing in centimetres, then the specific resistance ρ is in ohms-per-centimetre-cube.

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MEGGER EARTH TESTER

SERIES 4, 1954 PATTERN

Perry's Patent No. 249,615

INSTRUCTIONS FOR USE

Trade "MEGGER" Mark

E. MET. 464 Printed in England 1000.4.56

Instructions for

Megger Earth Tester.

SERIES 4. 1954 PATTERN

(NOTE.—When carrying out tests with this instrument it is advisable to wear rubber gloves to guard against the danger from accidental high potentials on the structure under test.)

TO MAKE A TEST

Stand the instrument on a steady and approximately level base. Connect up the instrument as shown in Figure 1, *i.e.*, connect together the terminals P_1 and C_1 by closing the switch provided, and connect them to the electrode or metal structure to be tested. Keep the lead used for this connection as short as possible, as its resistance is included in the measurement. Connect terminals marked P_2 and C_2 to two temporary earth spikes driven into the ground as indicated (for spacing of these spikes see Page 3), and turn

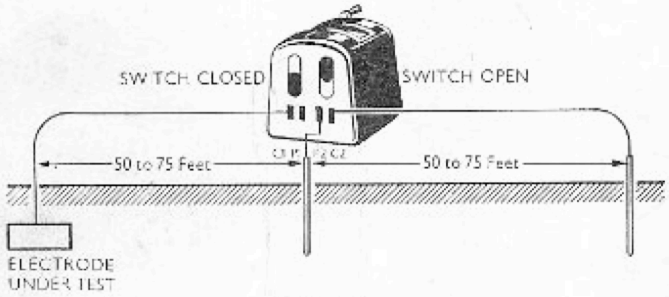

Figure 1
Connections of Megger Earth Tester

the generator handle at about 160 r.p.m., the actual speed being unimportant. With a 2-range instrument set the range switch to "OUTER SCALE" first. If the reading is below the full scale reading on the inner scale, set the range switch to "INNER SCALE" and repeat the test.

STRAY CURRENT IN SOIL

Stray direct current in the soil will produce a movement of the pointer when the generator handle is stationary but, under most practical conditions, the effect on the final

reading will be negligible when the generator is driven at approximately full speed.

Stray alternating current in the soil may cause the pointer to waver at certain handle speeds. In such cases it is only necessary to increase or decrease the speed of the generator handle to obtain a steady reading.

SPACING OF TEMPORARY EARTH SPIKES

When testing a simple earth electrode, such as a single driven pipe or a single earth plate, the temporary current earth spike connected to terminal C_2 should be about 100 feet from the electrode under test and the temporary potential spike connected to terminal P_2, about 50 feet. If the earth electrode is large or consists of several pipes or plates in parallel, these distances should be increased to 150 and 75 feet respectively. Greater distances than these must be used for complex "earths" consisting of, say, a large number of pipes or plates and other metallic structures bonded together. The method of determining whether or not the spacing is adequate is as follows:

Drive the temporary current spike into the ground at any distance from the earth electrode under test, then make three tests of the resistance, one with the potential spike at a point half way between the current spike and the electrode under test, one with the potential spike 10 feet nearer, and one with the potential spike 10 feet further from the electrode under test. If these three readings are practically the same, this value is the true resistance to earth of the electrode under test. If these three readings do not agree, remove the current spike and drive it into the ground again at a greater distance from the electrode under test and repeat the above procedure. Repeat again if necessary until the three readings taken as indicated agree with one another.

Alternatively, drive the potential spike into the ground in a position some distance away from the line joining the earth electrode to be tested and the current spike, the three points forming roughly an equilateral triangle. Tests should be taken as before with the potential spike 10 feet nearer to the electrode under test and also 10 feet nearer to the current spike. The three tests should give practically identical readings.

RESISTANCE OF TEMPORARY EARTH SPIKES

A high resistance current earth spike will cause the movement of the instrument pointer to be sluggish and steps should be taken to reduce the resistance by watering the ground round the spike, using salt water if possible. As an alternative, a second spike may be used, spaced at least 10 feet away from and connected in parallel with the first.

The resistance of the potential earth spike forms a part of the potential circuit of the instrument and a definite value for this resistance has been allowed for in calibration.

If the actual resistance is within the limits :—

20 ohms range ..... 0–250 ohms.
500 ohms range ..... 0–1200 ohms.

the instrument reading will be accurate within plus or minus 5%.

Where a higher degree of accuracy is required, the resistance of the potential earth spike should be measured (see below), when the correction shown in the following table can be applied.

Resistance of Potential Earth Electrode		Correction to be applied to Reading of Instrument
Range 0–20 ohms	0 ohms	Subtract 5 per cent.
	125 ,,	none
	250 ,,	Add 5 ,, ,,
Range 0–500 ohms	0 ohms	Subtract 5 per cent.
	300 ,,	,, $2\frac{1}{2}$,, ,,
	600 ,,	none
	900 ,,	Add $2\frac{1}{2}$,, ,,
	1200 ,,	,, 5 ,, ,,

TO MEASURE THE RESISTANCE OF THE POTENTIAL EARTH SPIKE

The resistance of the potential earth spike can be measured quite simply by interchanging the connections to P_1 and C_1 connected together, and P_2 terminals. The potential earth spike then becomes the "earth" under test, while the main earth electrode becomes the potential spike. Thus a test gives directly the resistance to earth of the potential earth spike.

If this resistance is beyond the range of the instrument it can be reduced by watering, as suggested for the current spike.

USE OF NOMOGRAM

With a 2-range instrument, and provided measurement of the earth resistance of the structure under test can be taken on both ranges, the true earth resistance, independent of spike resistance, can be deduced from the nomogram, Figure 2, the procedure being as follows:—

Take two measurements of the earth resistance using each range in turn.

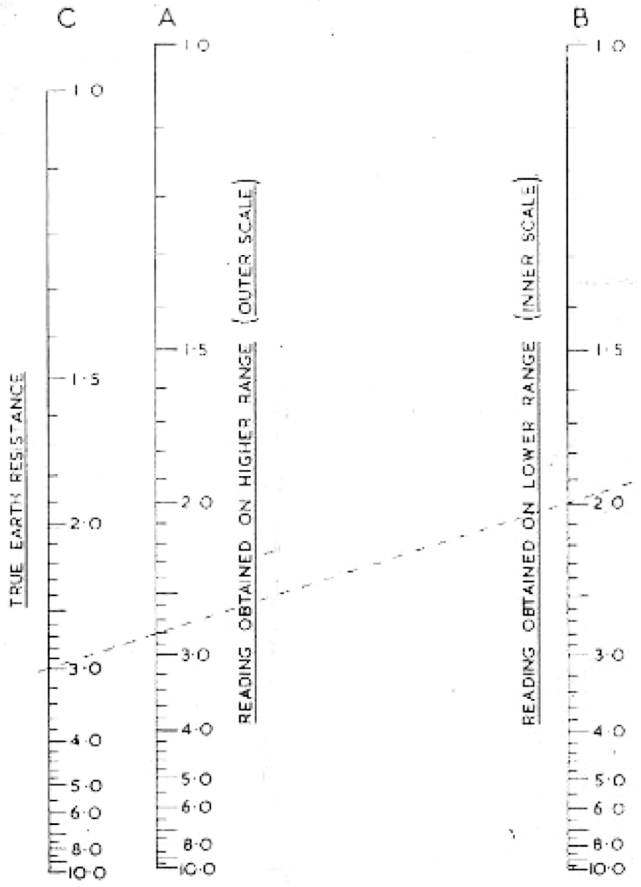

Figure 2

Plot these two values on their respective lines A and B, and join them with a straight-edge; where the straight-edge intersects the line C, read off the true earth resistance.

Example (i)

First Measurement on outer scale	2.8 ohms
Second Measurement on inner scale	2.0 ohms
True Earth Resistance shown on line C	3.0 ohms