Standard Procedure SP 0010:2005

Method for measuring changes in resistance with size

1 Scope

This procedure is an extension of SP 0009:2005. It can be used for wires with no joins or kinks, and with a resistance of at least 0.2 ohms over a length of 1 metre.

2 Definitions

resistance
the ability of a material to resist or obstruct the flow of electricity. It causes some of the electrical energy to be transformed into heat. According to Ohm's Law, the current I flowing through a conductor is proportional to the voltage V. That is, V/I is constant, and is called the resistance R. Resistance varies with the size and shape of the test specimen.

3 Principle

A low voltage is applied across the ends of the sample. The voltage and the resulting current flowing are measured between contact points at various distances apart. The resistance for each distance is calculated as the voltage divided by the current.

4 Apparatus

- 1.5 V cell
- voltmeter capable of measuring 1.5 V DC
- ammeter capable of measuring 10 A DC
- metre rule
- connecting wires

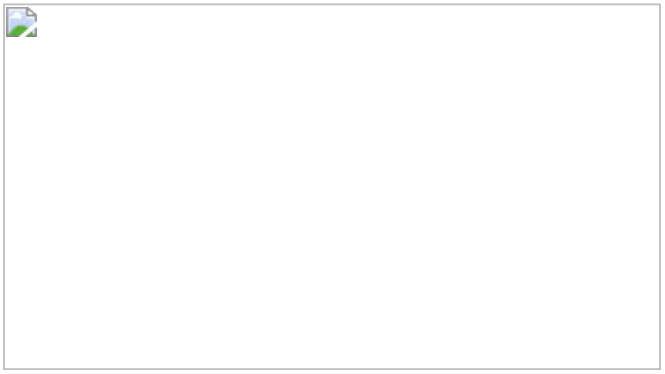
5 Test Specimens

Specimens must have a resistance of at least 0.2 Ω (ohms) between contacts 1 m apart. For good conductors, such as copper the wires must be thin. For metals with higher resistivity, such as iron, brass or nichrome, thicker wires may be used.
At least four wires of the same metal with different thicknesses should be tested. The diameter of each wire must be known, or measured with a micrometer.

6 Procedure

- Pull the specimen wire out straight and fix it firmly to a metre rule. (Alternatively, a ready-made resistance board or potentiometer may be available.)
- Set up the circuit shown in figure 1, connecting the cell and ammeter across the ends of the specimen. Figure 1Note to
  • Connect the voltmeter to the specimen at 0 on the metre rule, leaving a flying lead on the other side.
- Close the switch and press the flying lead contact onto the specimen wire at 10 cm. Record the meter readings of voltage and current.
- Open the switch. (Leaving the circuit 'on' may cause the specimen to heat up and the current to change, since resistance increases with temperature.)
- Take further pairs of readings with the flying contact at 20 cm, 30 cm etc. up to 1 m.
- Replace the specimen wire with a different thickness of the same metal. Take readings at 1 m only.
- Repeat this last step for each thickness wire of the same metal. If the wire's diameter is not known, measure it using a micrometer.

Figure 1



7 Expression of Results

Record the results in a table showing the voltage and current at each distance (length of wire). Leave space in the table to add figures for resistance.

Calculate the resistance R for each length using the formula:

R = V/I

where
R is the resistance, in ohms;

V is the voltage, in volts;

I is the current, in amps.

Plot a graph of resistance (y-axis) against length (x-axis).

Similarly, record the results of voltage and current for 1 m of each diameter wire.

Calculate the resistances in the same way as above.

Plot a graph of resistance (y-axis) against diameter (x-axis).

8 Test Report

Your test report should include:

(a) reference to this Standard Procedure;

(b) a graph of resistance against length of the wire;

(c) a graph of resistance against diameter of the wires;

(d) an interpretation of the graphs, describing how resistance varies with length and thickness.