IEC 60404-11

Edition 1.2 2012-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Magnetic materials –
Part 11: Method of test for the determination of surface insulation resistance of magnetic sheet and strip

Matériaux magnétiques –
Partie 11: Méthode d'essai pour la détermination de la résistance d'isolement superficiel des tôles et feuillards magnétiques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MAGNETIC MATERIALS –

Part 11: Method of test for the determination of surface insulation resistance of magnetic sheet and strip

FOREWORD

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This International Standard has been prepared by IEC technical committee 68: Magnetic alloys and steels.

This consolidated version of IEC 60404-11 consists of the first edition (1991) [documents 68(CO)69 and 68(CO)76], its amendment 1 (1998) [documents 68/181/FDIS and 68/186/RVD] and its amendment 2 (2012) [documents 68/434/FDIS and 68/435/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 1.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

MAGNETIC MATERIALS –

Part 11: Method of test for the determination of surface insulation resistance of magnetic sheet and strip

1 Scope and field of application

This International Standard is intended to define a measurement method for the determination of the characteristics of surface insulation resistance of magnetic sheet and strip.

This method is applicable to magnetic sheet and strip insulated on one or both surfaces and is suitable for manufacturing control in the application of insulation coatings.

2 Principle of measurement

The principle of the measurement is based on, and includes, the method originally described by Franklin* which characterizes only one coated surface at a time.

The arrangement of the apparatus is shown in figure 1. Ten metallic contacts of fixed area are applied to one coated surface of the sheet, under specified conditions of voltage and pressure.

The effectiveness of the surface insulation is assessed by the measurement of the currents through the 10 contacts.

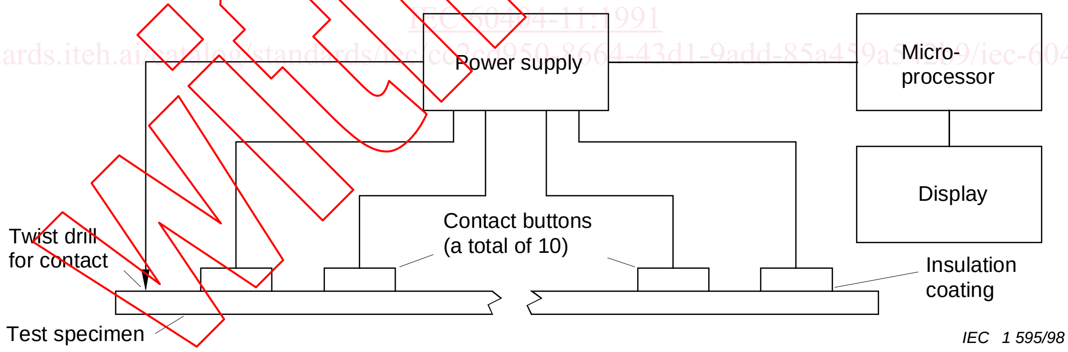

Figure 1 – Arrangement of apparatus for the measurement of surface insulation resistance

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* Franklin, R.F., "Measurement and control of interlaminar resistance of laminated magnetic cores", *ASTM Bulletin,* no. 144, January 1947, p. 57.

Each contact button is individually fed from a d.c. power supply in one of the two ways which constitute the two modes of measurement used in this standard, namely:

a) *Mode A* The voltage between the supply side of the 5 Ω ± 1 % resistors (see figure 2) and the drill contacts is stabilized at 500 mV ± 0,5 % over a current range of 0 to 1 A. The two twist drills perform the function of current return contacts with the substrate.

b) *Mode B* The voltage between each contact button and the drill contacts is stabilized at 250 mV ± 0,5 % over a current range from 0 to 2,5 A for the analysis of individual electrode currents. The two twist drills perform different functions. One drill provides the current return contact with the substrate. The other drill serves as a potential sensor for the voltage feedback control. This method removes the influence of the variable contact resistance between the current return drill and the substrate.

The voltage across subsidiary current sensing resistors of low-value, connected in series with each electrode, but not included within the stabilized voltage, serves to indicate the value of the current, as shown in figures 2 and 3.

Because the current path is between the contacts and the metallic substrate, this is not a true measurement of interlaminar resistance. However, this test provides a useful indication of surface insulation quality.

3 Test specimen

Each test specimen shall be formed from a single sheet or length of strip. The width and length of the test specimen shall be respectively greater than the width and length of the contact assembly described in clause 4. This measurement is destructive; the test specimen can only be used once.

To obtain a representative result, test specimens shall be taken from the full sheet width.

4 Apparatus

4.1 Contact assembly

The test specimen is pressed between a plate and the contact assembly. The contact assembly consists of 10 vertically-mounted metallic rods which move axially against springs in a mounting block. These 10 contact rods are normally arranged in two rows. However, for convenience these 10 contacts can be arranged in one row. Each rod shall be provided with a contact button of bronze or other suitable material (for example, stainless steel) and shall be electrically insulated from the mounting frame.

NOTE Articulation of contact buttons improves contact by compensating for minor misalignments.

Each of the 10 contact buttons shall have a contact area of 64,5 mm² ± 1 %, giving a total area for the 10 buttons of 645 mm² ± 1 %.

Electrical contact with the substrate of the test specimen shall be achieved by means of two spring-loaded twist drills of about 3 mm diameter which pierce the insulation coating.

4.2 Power supply

Mode A: A d.c. power supply capable of maintaining a stabilized voltage of 500 mV across the electrodes at a current of 0,1 A per electrode (1,0 A total) shall be used.

Mode B: A d.c power supply capable of maintaining a stabilized voltage of 250 mV at a current of 2,5 A for an individual electrode shall be used. A single supply and a current-sensing resistor, R_s, can be used and switched to each contact button in turn, or a 10-outlet system can be used with each electrode fed simultaneously and independently.

4.3 Current measurement

The current flowing through the contact buttons shall be measured with an uncertainty of ± 2% or better. This can be achieved by inserting a low value (e.g. 0,2 Ω) resistor in the supply to the contact buttons, at a point outside the connection to the stabilizing circuit, and measuring the voltage drop across the low value resistor by means of a suitable voltmeter.

The electrical arrangements of the stabilizing circuit and current measurement system are shown in figures 2 and 3 for modes A and B respectively.

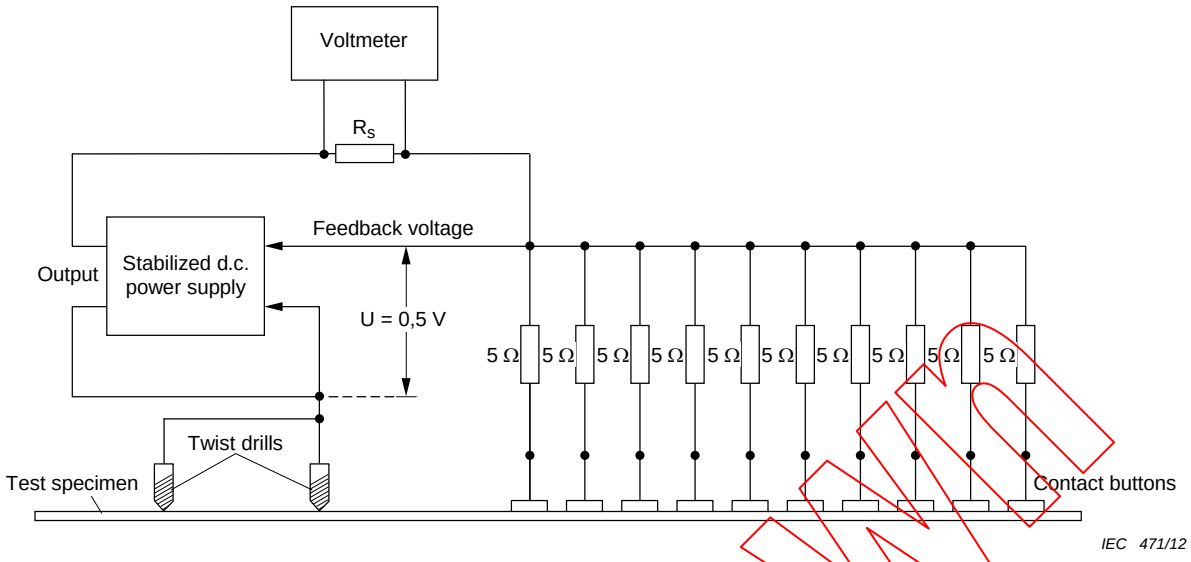

Figure 2 – Arrangement of stabilizing circuit: mode A

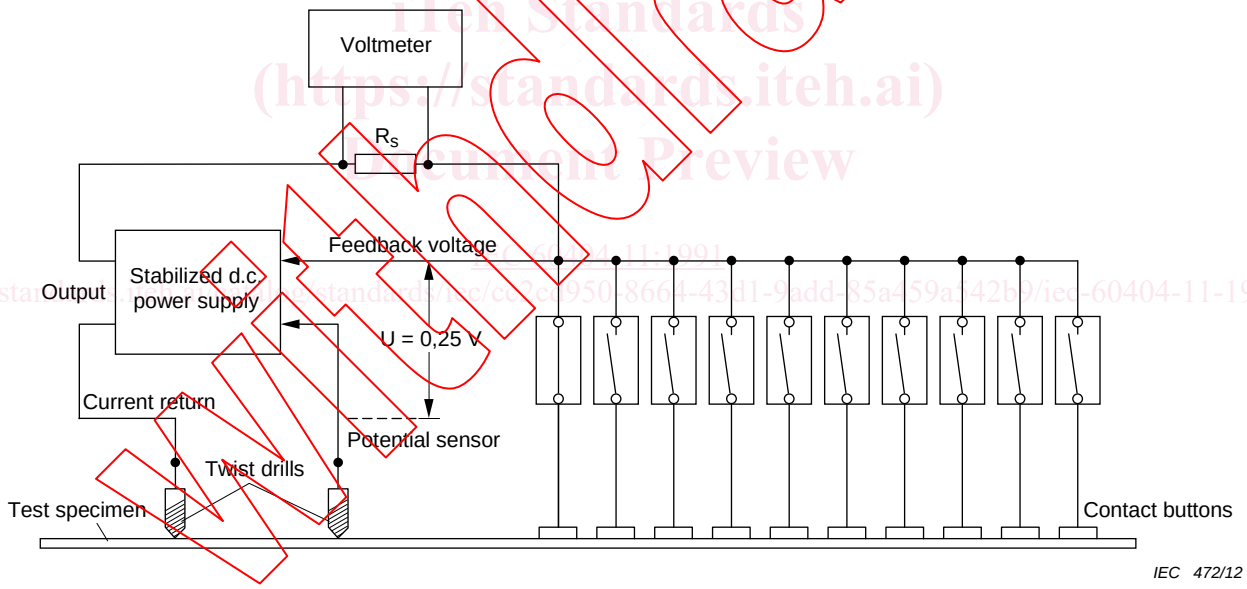

Figure 3 – Arrangement of stabilizing circuit: mode B

4.4 Determination of applied force

The total force applied by all of the contacts pressing on the test specimen shall be determined by any suitable means with an uncertainty of ±5 % or better.