Designation: A717/A717M – 12 (Reapproved 2022)

Standard Test Method for Surface Insulation Resistivity of Single-Strip Specimens[1]

This standard is issued under the fixed designation A717/A717M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a means of testing the surface insulation resistivity of single strips or punchings of flat-rolled electrical steel under predetermined conditions of voltage, pressure, and temperature.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A34/A34M Practice for Sampling and Procurement Testing of Magnetic Materials

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *surface insulation resistivity*—refers to the effective resistivity of a single insulative layer tested between applied bare metal contacts and the base metal of the insulated test specimen. It is not the same as the terms interlaminar resistivity and stack resistivity, which refer to the average resistivity of two adjacent insulative surfaces in contact with each other.

3.1.2 The apparatus is popularly known as a Franklin tester.

4. Summary of Test Method

4.1 Ten metallic contacts of fixed area are applied to one of the surfaces of the specimen and electrical contact is made with the base metal by two drills. The effectiveness of the surface insulation is then indicated by a measurement of average electrical current flowing between the contacts and the base metal under specified applied voltage. This measurement can be used directly as an indicator of insulation quality or may be converted to an apparent surface insulation resistivity value.

5. Significance and Use

5.1 This test method is particularly suitable for quality control in the application of insulating coatings.

5.2 Surface insulation resistivity is evaluated from a dc current that can range from 0 (perfect insulator) to 1 A (perfect conductor).

5.3 Single readings should not be considered significant since the nature of the test device and specimen are such that successive measurements of a specimen often yield different values.

6. Apparatus

6.1 The apparatus, as shown in Fig. 1 and Fig. 2, shall consist of a contact unit or test head which is attached to the head of a hydraulic press. Its associated measuring equipment, which may be remotely located, includes an ammeter, voltmeter, and voltage regulated dc power supply. When measurements are to be made at elevated temperatures, the platen beneath the specimen is heated and controlled. Detailed descriptions of the various components are given in Annex A1.

7. Sampling

7.1 Samples shall be representative of the steel and shall be cut in a manner to assure representative sampling as described in Practice A34/A34M.

[1] This test method is under the jurisdiction of ASTM Committee A06 on Magnetic Properties and is the direct responsibility of Subcommittee A06.01 on Test Methods.

Current edition approved Oct. 1, 2022. Published October 2022. Originally approved in 1975. Last previous edition approved in 2018 as A717/A717M – 12 (2018). DOI: 10.1520/A0717_A0717M-12R22.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

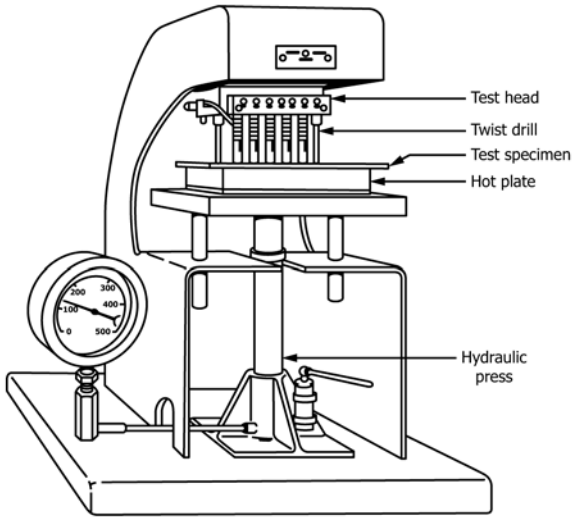

FIG. 1 Apparatus of Surface Insulation Resistivity Measurement

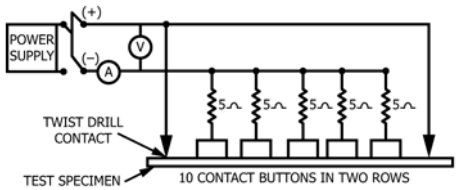

FIG. 2 Diagram of Connections for Contacts and Resistors

8. Test Specimen

8.1 The width and length of a specimen strip shall be greater than the width and length respectively of the assembly of contacts. The suggested minimum specimen size is 2 by 5 in. [50 by 130 mm].

8.2 A minimum of five specimen strips is recommended.

8.3 By mutual agreement between the producer and the user, tests may be run on Epstein test strips. The Epstein specimens may be less satisfactory than the minimum size specimen suggested in 8.1 because of the tilting effect due to burrs, shearing strains, and disturbances in the coating.

9. Procedure

9.1 To ensure correct contact button conditions, make a short circuit test occasionally by testing a bare metal surface. When the short circuit current is less than 0.99 A, clean the contacts. The use of solvents for cleaning is preferred to abrasives because the latter can result in rounded tips with reduced contact areas.

9.2 The recommended standard pressure for purpose of comparative tests shall be 300 psi [2.1 MPa]. Other pressures, depending upon the application, may be agreed upon by the producer and the user. If more than one test pressure is to be used, apply the pressures in ascending order. During testing, apply the pressures only once, but an applied pressure may be increased to a higher value.

9.3 If both sides of the specimen are coated, do not use the same area to test both sides.

9.4 The recommended standard test temperatures are room temperature and 300 °F [150 °C]. Other temperatures and the sequence of temperatures, depending upon the application, may be agreed upon by the producer and the user.

9.5 When tests are made at elevated temperatures allow sufficient time (usually 30 s) to heat the specimen to the specified temperature.

9.6 When the insulation may be hygroscopic, a conditioning procedure immediately prior to testing should be mutually agreed upon by the producer and the user.

9.7 Place the specimen on the platen beneath the test head and position it so that all contacts are within the test area when the test head is brought in contact with the specimen. Apply the specified pressure. Check that the voltage is 0.50 V and read the ammeter.

10. Calculations

10.1 The average of electrical current measurements is usually acceptable for evaluating surface insulation. Average the current readings for each surface. The reported value for a sample shall be the average of both surfaces.

10.2 The two surface insulation resistivity of the test sample (two surfaces in series), R_i, may be calculated from I, the average ammeter reading in A, as follows:

$$R_i = 6.45\left((1/I) - 1\right) \text{in}\,\Omega\cdot\text{cm}^2/\text{lamination}, \quad (1)$$

or

$$R_i = 645\left((1/I) - 1\right) \text{in}\,\Omega\cdot\text{mm}^2/\text{lamination}.$$

10.3 The equations in 10.2 may be derived as shown in Annex A2.

11. Precision and Bias

11.1 Even with the best practices in design, instrumentation, maintenance, and operation, the repeatability and reproducibility of the test method are greatly influenced by the nature of the surfaces of the test specimens. Hence it is not considered