



Designation: ~~A976–97~~ Designation: A 976 – 03 (Reapproved 2008)

Standard Classification of Insulating Coatings for Electrical Steels by Composition, Relative Insulating Ability and Application¹

This standard is issued under the fixed designation A 976; 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 document classifies insulating coatings for electrical steels according to their composition, relative insulating ability, and functionality. The purpose of this classification is to assist users of insulating coatings by providing general information about the chemical nature and use of the coatings, as well as to provide important data concerning limits to their use, that is, relative insulating ability, punchability, temperature stability, weldability, and fabricability. Specific surface insulation resistivity values for each coating are not included in this classification. The user is referred to the flat-rolled electrical steel specifications noted in 1.2 should more detailed information concerning surface insulation resistivity values be required.

1.2 This classification is to be used in conjunction with the various specifications for flat-rolled electrical steels under the jurisdiction of Committee ~~A-6, A06~~, including Specifications A 345, A 677, ~~A677M, A 683, A683M, A 726, A726M, A 840, A840M, A876, and A876M~~. However, in those instances in which the coating descriptions and characteristics differ between this classification and any of the specifications, this classification shall supersede the specification:

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1.3 The values stated in customary (cgs-emu and inch-pound) units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units which are provided for information only and are not considered standard.

1.4 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 and health practices and determine the applicability of regulatory limitations prior to use.

~~1.4 The values stated in either customary (cgs-emu and inch-pound) units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.~~

2. Referenced Documents

2.1 ASTM Standards:²

A 345 Specification for Flat-Rolled Electrical Steels for Magnetic Applications

~~A 677 Specification for Nonoriented Electrical Steel Fully Processed Types²~~

~~A677M Specification for Nonoriented Electrical Steel, Fully Processed Types (Metric)²~~ Specification for Nonoriented Electrical Steel Fully Processed Types

A 683 Specification for Nonoriented Electrical Steel, Semiprocessed Types²

~~A683M Specification for Nonoriented Electrical Steel, Semiprocessed Types (Metric)²~~ Specification for Nonoriented Electrical Steel, Semiprocessed Types

A 717/A 717M Test Method for Surface Insulation Resistivity of Single-Strip Specimens

~~A 726 Specification for Cold Rolled Magnetic Lamination Quality Steel, Semiprocessed Types²~~

~~A726M Specification for Cold Rolled Magnetic Lamination Quality Steel, Semiprocessed Types (Metric)²~~ Specification for Cold-Rolled Magnetic Lamination Quality Steel, Semiprocessed Types

¹ This classification is under the jurisdiction of ASTM Committee A-6 on Magnetic Properties and is the direct responsibility of Subcommittee A06.02 on Material Specifications.

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² Annual Book of ASTM Standards, Vol 03.04.

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.

A 840 Specification for Fully Processed Magnetic Lamination Steel²

A 840M Specification for Fully Processed Magnetic Lamination Steel (Metric)² Specification for Fully Processed Magnetic Lamination Steel

A 876 Specification for Flat Rolled, Grain Oriented, Silicon Iron, Electrical Steel, Fully Processed Types²

A 876M Specification for Flat Rolled, Grain Oriented, Silicon Iron, Electrical Steel, Fully Processed Types (Metric)² Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types

A 937/A 937M Test Method for Determining Interlaminar Resistance of Insulating Coatings Using Two Adjacent Test Surfaces

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *interlaminar resistance, n*—the average resistance of two adjacent insulating surfaces in contact with each other, in accordance with Test Method A 937/A 937M.

3.1.2 *quality anneal, n*—heat treatment used for quality control purposes and grading in accordance with the magnetic property requirements of the particular electrical steel grade. The anneal is made under conditions that ensure that the steel reaches a temperature of 1450-1550°F (790-850°C) for approximately 1 h, and with conditions that favor decarburization. The atmosphere shall contain sufficient moisture to be highly decarburizing but should not excessively oxidize the steel strips (Epstein strips for magnetic property evaluation). An atmosphere meeting these conditions approximately 20% hydrogen, 80% nitrogen and has a dew point of +55°F (+13 °C). Care must be taken to ensure that the steel strips retain their flatness and the strip edges have ready access to the heat treatment atmosphere.

3.1.3 *stress-relief anneal, n*—heat treatment that improves the magnetic properties of electrical steel by relieving internal stresses which are introduced during fabrication of magnetic cores.

3.1.4

3.1.3 *surface insulation resistivity, n*— the effective resistivity of a single insulating layer tested between applied bare metal contacts and the base metal of the insulated test specimen, in accordance with Test Method A 717/A 717M.

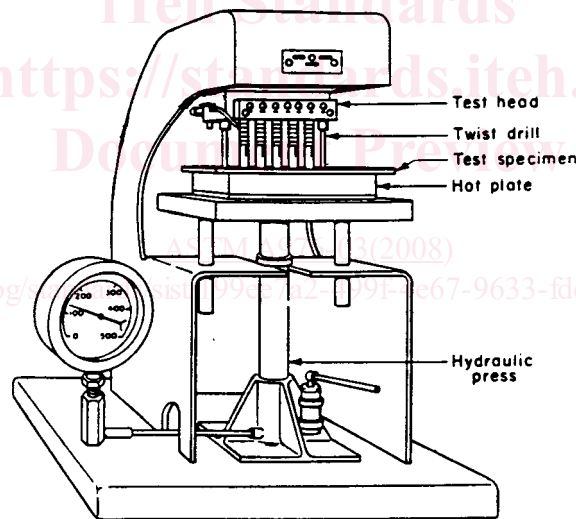


FIG. 1 Apparatus of Surface Insulation Resistivity Measurement for Franklin Test

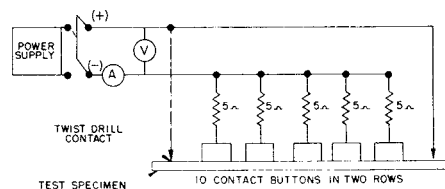


FIG. 2 Diagram of Connections for Contacts and Resistors for Franklin Test

4. Significance and Use

4.1 This classification establishes categories of insulating coatings based on their chemical nature, relative insulating ability, and typical applications. These categories describe general physical and chemical characteristics of the coatings that are useful in making broad estimates of their insulating ability and suitability for various applications.