Designation: A721/A721M – 02 (Reapproved 2016)

Standard Test Method for Ductility of Oriented Electrical Steel[1]

This standard is issued under the fixed designation A721/A721M; 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 determination of the ductility of grain-oriented silicon steel by use of an apparatus known variously as a tinner's brake, hand folder, or an apron brake.

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

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

A876 Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types

E290 Test Methods for Bend Testing of Material for Ductility

3. Summary of Test Method

3.1 A test specimen representing the full width of grain-oriented steel to be tested is bent through an angle of about 160° in a tinner's brake. The number of breaks, or fractures, occurring along the bend determines the ductility class rating.

4. Significance and Use

4.1 This is a specialized bend test for grain-oriented steel not covered under the provisions of Test Methods E290.

4.2 This test is applicable to grain-oriented silicon steel such as covered in Specification A876 in commercial thicknesses and widths up to 36 in. [910 mm].

5. Apparatus

5.1 The machine required to perform this test is known variously as a tinner's brake, hand folder, or an apron brake.

5.2 The brake shall be at least 36 in. [910 mm] wide with an opening capacity of approximately 0.035 in. [0.9 mm].

5.2.1 The nose bar shall have a 0.031-in. [0.8-mm] radius.

5.2.2 The bending bar must be movable through an angle of at least 160°.

5.2.3 The movable table or apron shall move around the end of the nose bar at a distance of approximately 0.25 in. [6.35 mm].

6. Test Specimen

6.1 Two specimens are required and they shall be selected from the same general location as that of the magnetic test specimens in accordance with Practice A34/A34M.

6.2 The specimens shall be cut transversely to the rolling direction and have a length equal to the sheet or strip width and a minimum dimension of 3 in. [80 mm] in the direction of rolling.

6.3 The specimens shall be free of rust, ripples, and scratches.

7. Procedure

7.1 The test specimen shall be at a temperature of 25 ± 5°C at the start of the test.

7.2 Insert the test specimen into the brake and clamp with the direction of rolling perpendicular to the nose bar and 0.5 to 1.5 in. [12 to 40 mm] under the nose bar thereby allowing the balance of the specimen width to rest against the bending bar.

7.3 Bend the specimen around the nose bar at a uniform rate by rotating the bending bar through an angle of 160°.

7.4 Remove the specimen from the machine and without straightening the bend, examine the outside face of the bend for surface breaks, without magnification.

7.5 Count the breaks and measure for length.

[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.

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[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.

8. Interpretation of Results

8.1 Classify each test specimen according to length of number of breaks as shown in the following table which is based on giving a larger numerical class rating corresponding to the larger number of breaks and poorer ductility.

Class Rating	Condition of Bend
Class 1	no breaks
Class 2	not more than two breaks with total length not exceeding 0.5 in. [12.7 mm]
Class 3	three to eight breaks, all sizes or fewer breaks with a total length exceeding 0.5 in. [12.7 mm]
Class 4	nine to fifteen breaks, all sizes
Class 5	more than fifteen breaks, all sizes

8.2 The class ratings shown are based on strip widths of 24 to 36 in. [610 to 910 mm].

8.3 When the evaluating steel narrower than 24 in. [610 mm], the number of breaks should be multiplied by the ratio of 24 over the strip width in inches. This converted number of breaks will then determine the class rating.

8.4 The class rating assigned to a test lot shall be the higher numerical class number of the two specimens.

9. Precision and Bias

9.1 It is not practicable to specify the precision of the procedure in this test method because the test result is a classification (not a numeric value). The procedure in this test method has no bias because the ductility classification is defined only in terms of this test method.

10. Keywords

10.1 ductility; electrical; grain-oriented; silicon; steel