



## Standard Practice for Sampling and Procurement Testing of Magnetic Materials<sup>1</sup>

This standard is issued under the fixed designation A 34/A34M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice describes sampling procedures and test practices for determination of various magnetic properties of both soft and hard magnetic materials.

1.2 This practice may be used either in conjunction with, or independent of, the standard test methods and materials specifications under the jurisdiction of ASTM Committee A6. In the former situation, the sampling and testing procedures listed herein shall not supersede those found in the individual test methods and materials specifications. In the latter situation, the sampling and testing procedures listed herein shall strictly apply.

1.3 The values stated in either customary (cgs-emu and inch-pound) units or SI units are to be regarded separately as standard. Within this practice, the SI units are shown in brackets except for the sections concerning calculations where there are separate sections for the respective unit systems. 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 practice.

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.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing<sup>2</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions of terms relating to magnetic testing, reference shall be made to Terminology A 340.

### 4. Significance and Use

4.1 This practice defines test lots and describes the selection and preparation of test specimens used in the determination of

magnetic properties of various materials.

4.2 A method of calculating the density of iron-base electrical steels is given and a table of assumed densities for magnetic testing of commercial soft magnetic alloys is provided.

### 5. Test Lots

#### 5.1 Wrought Flat-rolled or Long Products:

5.1.1 A test lot of wrought flat-rolled or long products shall consist of not more than 50 000 lb [23 000 kg] of material.

5.1.2 A test lot may be composed of coils or cut lengths. A test lot of coil product may consist of one or more coils having essentially the same treatment and composition.

#### 5.2 Amorphous Strip and Wire:

5.2.1 A test lot shall consist of a continuously cast strip or wire in one coil without breaks. In practice this may represent quantities up to 2200 lb [1000 kg].

#### 5.3 Powder Metallurgically Produced Parts:

5.3.1 A test lot shall consist of parts of the same geometry and dimensions, made from powder of the same composition, molded and sintered under the same conditions, which have been submitted for inspection at one time.

#### 5.4 Cast Parts:

5.4.1 A test lot shall consist of parts of the same geometry and dimensions, made from the same casting heat, which have been submitted for inspection at one time.

### 6. Sampling

#### 6.1 Electrical Steel Coils:

6.1.1 From test lots in coil form, consisting of only one master coil, prepare the test strips from test sheets cut from one or both ends of the coil.

6.1.2 When a test lot in coil form consists of several coils sheared or slit from a master coil, the test strips shall be prepared from test sheets representing one or both ends of the master coil.

6.1.3 When a test lot in coil form consists of several coils having essentially the same treatment and composition, test strips shall be prepared from test sheets cut from one or both ends of enough master coils to be representative of the lot.

#### 6.2 Electrical Steel Cut Lengths:

6.2.1 When cut lengths are sheared from coil material without subsequent treatments (such as roller leveling or cold rolling), the test on the original coil shall suffice.

6.2.2 Two or more test sheets shall be taken from the same

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee A-6 on Magnetic Properties and is the direct responsibility of Subcommittee A06.01 on Test Methods. Current edition approved Dec. 10, 1996. Published February 1997. Originally published as A 34 – 11. Last previous edition A 34 – 83 (1988)  $\epsilon$ 1.

<sup>2</sup> Annual Book of ASTM Standards, Vol 03.04.

lot of cut length steel that has been cold rolled or leveled. These test sheets shall not lie adjacent to each other, but shall be selected in a manner to assure representative sampling.

6.3 *Wrought Products Other Than Electrical Steels:*

6.3.1 Sampling shall be one sample per each heat applied to the order unless otherwise specified in the appropriate ASTM specification or by mutual agreement between the producer and purchaser.

6.4 *Amorphous Strip and Wire:*

6.4.1 Sampling shall consist of one sample from each end of each continuously cast coil unless otherwise specified in the appropriate ASTM specification or by mutual agreement between the producer and purchaser.

6.5 *Powder Metallurgically Produced Parts:*

6.5.1 Sampling shall consist of one sample per test lot unless otherwise specified in the appropriate ASTM specification or by mutual agreement between the producer and purchaser.

6.6 *Cast Parts:*

6.6.1 Sampling shall consist of one sample per test lot unless otherwise specified in the appropriate ASTM specification or by mutual agreement between the producer and purchaser.

7. Test Specimens

7.1 The test specimens used for the determination of properties of magnetic materials will vary in form, depending upon the test equipment and the dimensions of the material to be tested. Prepare the test specimens in a manner to adequately represent the areas being sampled. Standard forms include flat strips, rings, bars, and links in accordance with the following practices.

7.1.1 *Flat Strips:*

7.1.1.1 Except when otherwise established by mutual agreement between the producer and the purchaser, the Epstein test specimen shall be the standard specimen for determination of the magnetic properties of flat-rolled electrical steels.

7.1.1.2 Standard Epstein test specimens shall be composed of test strips preferably cut from test sheets in a manner shown in Fig. 1 (a) or (b). One half of the strips are cut parallel to and the other half cut perpendicular to the direction of rolling.

7.1.1.3 If the width of the material does not permit cutting of strips perpendicular to the rolling direction, or, if the

material has preferred properties in any one direction with respect to the direction of rolling, or, if the material is to be used with the flux in any one direction, all of the strips may be cut in a specified direction which shall be agreed upon by the producer and the purchaser. All lengthwise strips may be selected as shown in Fig. 1 (c).

7.1.1.4 When fewer than the total number of strips obtained from the sampled area are needed for the test specimen, the excess strips should be discarded equally from all locations in the sampled area. For instance, if approximately 1/4 of the total strips obtained is excess, every fourth strip should be discarded.

7.1.1.5 The Epstein test specimen shall consist of strips sheared or punched in a width of 3.00 cm [30.0 mm] and not less than 28.0 cm [280 mm] long. If for ease of assembling the specimen in the test frame, it is desired to use strips slightly longer than 28.0 cm [280 mm], a length of 30.5 cm [305 mm] is recommended.

7.1.1.6 Test strips shall be nearly rectangular as possible and shall conform to the specified dimensions within plus or minus 0.08 cm [0.8 mm].

7.1.1.7 Test strips shall be cut with sharp shears or dies to avoid excessive burring or distortion.

7.1.1.8 Reports of test shall state specifically the manner in which the test strips were cut, if other than one half parallel and the other half perpendicular to the direction of rolling.

7.1.2 *Rings:*

7.1.2.1 Ring specimen may be punched, laser cut, spirally wound, forged, machined, sintered, or cast. The specimens shall be of uniform radial width and cross-sectional area. They shall be continuous, having no joints or welds except where specified or established by mutual agreement.

7.1.2.2 The ratio of mean diameter to radial width shall not be less than 10:1.

7.1.2.3 Sharp dies or shears shall be used in the preparation of ring specimens of flat-rolled sheet material.

7.1.2.4 If the radial width of punched rings is less than 3.0 cm [30 mm], work-hardened portions shall be removed before testing by a heat treatment practice acceptable to both the producer and the purchaser. Spirally wound cores must also be heat treated prior to testing.

7.1.3 *Bars:*

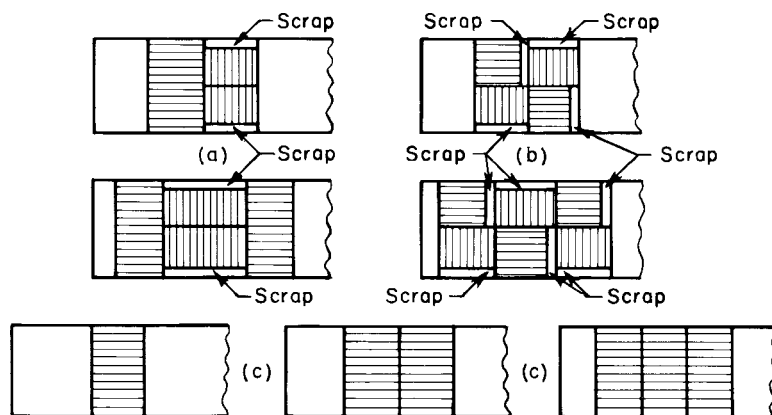


FIG. 1 Suggested Distribution of Strips to Be Cut from Sheets for Magnetic Tests