



Designation: A726 – 18

Standard Specification for Cold-Rolled Magnetic Lamination Quality Steel, Semiprocessed Types¹

This standard is issued under the fixed designation A726; 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 specification covers cold-rolled carbon sheet steel used for magnetic applications. These products, commonly called “cold-rolled magnetic lamination steel” (CRML) are usually intended for applications in which the stamped laminations or assembled core structures for electrical equipment are annealed to develop the desired core loss and permeability characteristics.

1.2 This steel is produced to maximum specific core-loss values and is intended primarily for commercial power frequency (50- and 60-Hz) applications in magnetic devices. Specific core-loss and permeability characteristics in conformance with this specification are developed through heat treatment by the user.

1.3 Non-guaranteed core-loss types, usually made to controlled chemical compositions, are available but are not covered by this specification.

1.4 Higher quality core-loss types are low carbon, silicon-iron, or silicon-aluminum-iron alloys containing up to about 2.5 % silicon and less than 1 % aluminum. These steels are usually given a critical reduction on a temper-mill to yield specified magnetic properties after a suitable lamination anneal. These products, typically called semiprocessed magnetic lamination steel, are classified by the ASTM Code Letter D in accordance with Practice A664.

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

1.6 *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 This specification is under the jurisdiction of ASTM Committee A06 on Magnetic Properties and is the direct responsibility of Subcommittee A06.02 on Material Specifications.

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1.7 *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
- A340 Terminology of Symbols and Definitions Relating to Magnetic Testing
- A343/A343M Test Method for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame
- A370 Test Methods and Definitions for Mechanical Testing of Steel Products
- A664 Practice for Identification of Standard Electrical Steel Grades in ASTM Specifications
- A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment
- A717/A717M Test Method for Surface Insulation Resistivity of Single-Strip Specimens
- A937/A937M Test Method for Determining Interlaminar Resistance of Insulating Coatings Using Two Adjacent Test Surfaces
- A976 Classification of Insulating Coatings for Electrical Steels by Composition, Relative Insulating Ability and Application
- E18 Test Methods for Rockwell Hardness of Metallic Materials
- E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

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.

3. Terminology

3.1 *Definitions*—See Terminology [A340](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cold-rolled sheet*—sheet manufactured from hot-rolled descaled coils by cold reducing to the desired thickness, generally followed by annealing to recrystallize the grain structure. In the case of magnetic lamination steels, particularly semiprocessed lamination steels, temper rolling is used after annealing to enhance flatness and optimize magnetic properties during the user's lamination anneal.

3.2.2 *magnetic lamination steels*—specialty cold-rolled carbon sheet steel melted to controlled levels of carbon with additions of manganese, phosphorus, silicon, and aluminum. Residual elements are generally held as low as possible. The appropriate chemical composition combined with controlled mill processing results in a carbon sheet steel having mechanical properties and magnetic properties (after a quality development anneal) desired for electrical applications.

4. Classification

4.1 The cold-rolled magnetic lamination steel types described by this specification are shown in [Table 1](#).

5. Ordering Information

5.1 Orders for material under this specification shall include the following information, as required, to describe the required material adequately:

5.1.1 ASTM specification number and date of issue.

5.1.2 Core-loss type number.

5.1.3 Surface texture (indicate typical profilometer range, as required) (see [11.2](#)).

5.1.4 Specify not oiled or oiled, as required (see [11.4](#)).

5.1.5 Dimensions (nominal thickness and coil width) and tolerances, if not standard (see [10.1](#)).

5.1.6 Coil size (must include limitations on inside diameter and maximum weight).

5.1.7 Application (the user shall disclose as much pertinent information as possible about the intended application to enable the producer to provide material characteristics most suitable for specific fabricating practices).

5.1.8 Special requirements or exceptions to the provisions of this specification.

5.1.9 Cast or heat analysis and magnetic test report (request if required).

NOTE 1—A typical description is as follows: Cold-Rolled Sheet, Magnetic Lamination Steel, ASTM A726 64D480, Surface Roughness 1.3- to 2.0- μm (50- to 80- $\mu\text{in.}$) arithmetic average (R_A), Not Oiled, 0.64 by 1245 mm (0.025 by 49 in.) by coil, 610-mm (24-in.) inside diameter, 9000 kg (20 000 lb) maximum, for fractional horsepower motors.

6. Materials and Manufacture

6.1 *Melting Practice*—These steels are typically made by the basic-oxygen or electric-furnace process.

6.1.1 These steels are characterized by low carbon, usually less than 0.060 %. For higher quality core-loss types, the

TABLE 1 Core-Loss Types and Maximum Specific Core-Loss Values at 1.5 T (15 Kilogauss) and 60 Hz

NOTE 1— Specific core-loss values are developed after quality development anneal (QDA) per the recommended practices in [13.3](#) of this specification Epstein test specimens (with one half cut parallel and the other half cut perpendicular to the direction of rolling).

NOTE 2—Maximum specific core-loss values at 50 Hz are $0.79 \times$ maximum core-loss values at 60 Hz.

Sheet Thickness, mm (in.)	Core-Loss Type	Maximum Core Loss, W/kg	Maximum Core Loss, W/lb
0.36 (0.0140)	36D145	3.20	1.45
	36D155	3.42	1.55
0.47 (0.0185)	47D165	3.64	1.65
	47D175	3.86	1.75
	47D190	4.19	1.90
	47D215	4.74	2.15
	47D270	5.95	2.70
	47D330	7.28	3.30
	47D380	8.38	3.80
0.56 (0.022)	56D230	5.07	2.30
	56D260	5.73	2.60
	56D310	6.84	3.10
	56D380	8.38	3.80
	56D440	9.70	4.40
0.64 (0.025)	64D260	5.73	2.60
	64D290	6.40	2.90
	64D360	7.94	3.60
	64D430	9.48	4.30
	64D490	10.8	4.90
0.71 (0.028)	71D410	9.04	4.10
	71D480	10.6	4.80
	71D550	12.1	5.50
0.79 (0.031)	79D450	9.92	4.50
	79D540	11.9	5.40
	79D610	13.5	6.10