



Designation: A876 – 17 (Reapproved 2026)

Standard Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types¹

This standard is issued under the fixed designation A876; 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 the detailed requirements to which the specified grades of flat-rolled, grain-oriented, fully processed electrical steels shall conform. These steels are used primarily in transformer cores operating at moderate to high magnetic flux densities at commercial power frequencies (50 Hz and 60 Hz).

1.2 These grain-oriented electrical steels are low-carbon, silicon-iron alloys with a silicon content of approximately 3.2 % in which low core loss and high permeability in the direction of rolling have been achieved by appropriate metallurgical processing.

1.3 The electrical-steel grades described in this specification include (1) conventional grain-oriented electrical steel tested at 1.5 T (15 kG) in accordance with Test Method [A343/A343M](#), (2) conventional grain-oriented electrical steel tested at 1.7 T (17 kG) in accordance with Test Method [A343/A343M](#), (3) high-permeability grain-oriented electrical steel tested at 1.7 T (17 kG) in accordance with Test Method [A343/A343M](#), and (4) laser-scribed high-permeability grain-oriented electrical steel tested at 1.7 T (17 kG) in accordance with Test Methods [A804/A804M](#).

1.4 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.

1.5 *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.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization 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](#)
- [A345 Specification for Flat-Rolled Electrical Steels for Magnetic Applications](#)
- [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](#)
- [A719/A719M Test Method for Lamination Factor of Magnetic Materials](#)
- [A721/A721M Test Method for Ductility of Oriented Electrical Steel](#)
- [A804/A804M Test Methods for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Sheet-Type Test 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](#)

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.

This specification replaces A665, A725, and A843.

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

3. Terminology

3.1 The terms and symbols used in this specification are defined in Terminology [A340](#).

4. Classification

4.1 The ASTM core-loss type designations, formulated in accordance with Practice [A664](#), for grain-oriented electrical steels covered by this specification are listed in [Table 1](#).

5. Condition

5.1 These grain-oriented electrical steels may be purchased in any of the following conditions (which are combinations of material form and surface type or treatment) as desired for the expected end use.

5.1.1 *Condition NF*—An annealed coil form having an inorganic surface coating, Type C-2 ([Note 1](#)). This material is not flattened and so exhibits appreciable coil curvature. The principal application is in spirally wound or formed cores in which the strip curvature is not detrimental to fabricating procedures or device performance.

5.1.2 *Condition F2*—Thermally flattened sheet or coiled strip having an inorganic surface coating, Type C-2, plus a thinner (compared to Condition F5) inorganic coating, Type C-5, applied over the inherent C-2 coating. The principal

application is in spirally wound or formed cores in which strip curvature is not detrimental to fabricating procedures or device performance.

5.1.3 *Condition F5*—Thermally flattened sheet or coiled strip having an inorganic surface coating, Type C-2, plus an inorganic coating, Type C-5, applied over the inherent C-2 coating to provide extra surface insulation resistance. The principal application is in flat sheared laminations for cores of power transformers.

5.1.4 *Condition PQ*—Thermally flattened sheet or coiled strip (sometimes called “punching quality”) with the inherent C-2 coating removed and an inorganic coating, Type C-5, applied for insulative purposes. The principal application is in flat stamped laminations for small stacked cores with only moderate surface insulation requirements.

NOTE 1—Additional description of surface coating Types C-2 and C-5 is presented in Specification [A345](#) and Classification [A976](#).

5.2 Core-loss types having code letters P and Q are available only in Condition F5.

6. Ordering Information

6.1 Orders for material under this specification shall include such of the following information as is required to describe the material adequately:

TABLE 1 Core-Loss Type Designations

Conventional Grain-Oriented Electrical Steel				
Tested at 1.5 T (15 kG) in Accordance with Test Method A343/A343M				
ASTM Core-Loss Type ^A	Aim Thickness, ^B mm (in.)	Maximum Specific Core Loss, ^C W/kg (W/lb)		
		60 Hz	50 Hz	
18G041	0.18 (0.0070)	0.90 (0.41)	0.68 (0.31)	
23G045	0.23 (0.0090)	0.99 (0.45)	0.75 (0.34)	
27G051	0.27 (0.0106)	1.12 (0.51)	0.85 (0.39)	
30G058	0.30 (0.0118)	1.28 (0.58)	0.97 (0.44)	
35G066	0.35 (0.0138)	1.46 (0.66)	1.11 (0.50)	
Conventional Grain-Oriented Electrical Steel				
Tested at 1.7 T (17 kG) in Accordance with Test Method A343/A343M				
ASTM Core-Loss Type ^A	Aim Thickness, ^B mm (in.)	Maximum Specific Core Loss, ^C W/kg (W/lb)		
		60 Hz	50 Hz	
23H070	0.23 (0.0090)	1.54 (0.70)	1.17 (0.53)	
27H074	0.27 (0.0106)	1.63 (0.74)	1.24 (0.56)	
30H083	0.30 (0.0118)	1.83 (0.83)	1.39 (0.63)	
35H094	0.35 (0.0138)	2.07 (0.94)	1.57 (0.71)	
High-Permeability Grain-Oriented Electrical Steel				
Tested at 1.7 T (17 kG) in Accordance with Test Method A343/A343M				
ASTM Core-Loss Type ^A	Aim Thickness, ^B mm (in.)	Maximum Specific Core Loss, ^C W/kg (W/lb)		
		60 Hz	50 Hz	
23P060	0.23 (0.0090)	1.32 (0.60)	1.01 (0.46)	
27P066	0.27 (0.0106)	1.46 (0.66)	1.11 (0.50)	
Laser-Scribed High-Permeability Grain-Oriented Electrical Steel				
Tested at 1.7 T (17 kG) in Accordance with Test Methods A804/A804M				
ASTM Core-Loss Type ^A	Aim Thickness, ^B mm (in.)	Maximum Specific Core Loss, ^D W/kg (W/lb)		
		60 Hz	50 Hz	
23Q054	0.23 (0.0090)	1.19 (0.54)	0.90 (0.41)	
27Q057	0.27 (0.0106)	1.26 (0.57)	0.96 (0.43)	

^A See Practice [A664](#).

^B These shall be the overall thicknesses as measured by contacting micrometre caliper.

^C Based on parallel-grain Epstein specimens, stress-relief annealed after shearing in accordance with [14.1.2](#).

^D Based on as-sheared parallel-grain sheet-type specimens. Stress-relief annealing will nullify the core-loss reduction produced by the laser scribing.