



Standard Specification for Cast and Sintered Alnico Permanent Magnets¹

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1. Scope

1.1 This specification covers technically important, commercially available, magnetically hard, cast and sintered permanent magnets known commonly as Alnico.

1.2 Alnico magnets have approximate magnetic properties of residual magnetic induction, B_r , from 0.52 T (5200 G) to 1.35 T (13500 G) and coercivity, H_{cB} , from 38 kA/m (475 Oe) to 175 kA/m (2200 Oe). Their specific magnetic hysteresis behavior (demagnetization curves) can be characterized using Test Method A977/A977M.

1.3 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.

1.4 *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:²

A340 Terminology of Symbols and Definitions Relating to Magnetic Testing

A977/A977M Test Method for Magnetic Properties of High-Coercivity Permanent Magnet Materials Using Hysteresisgraphs

2.2 Other Standards:

MMPA Standard No. 0100-00 Standard Specifications for Permanent Magnet Materials³

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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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 MMPA Standard No. 0100-00 is now available from the Permanent Magnet Division of the SMAA (www.smaa.org). It was previously available from The International Magnetics Association (IMA). The IMA had been the successor to the MMPA and both organizations no longer exist.

IEC 60404-8-1 Magnetic Materials Part 8: Specifications for Individual Materials Section 1 – Standard Specifications for Magnetically Hard Materials⁴

3. Terminology

3.1 The terms and symbols used in this specification are defined in Terminology A340, except as noted in 3.2.

3.2 Terms that are not defined in Terminology A340 but are in common usage and used herein are as follows.

3.2.1 Recoil permeability, μ_{rec} , is the permeability corresponding to the slope of the recoil line. For reference see incremental, relative, and reversible permeabilities as defined in Terminology A340. In practical use, this is the slope of the normal hysteresis loop in the second quadrant and in proximity to the B-axis. The value of recoil permeability is dimensionless. Note that in producers' product literature recoil permeability is sometimes represented by the symbol μ_r , which is defined by Terminology A340 as relative permeability.

3.2.2 Magnetic characteristics change with temperature. Two key metrics of permanent magnet performance are residual induction, B_r , and intrinsic coercive field strength, H_{cJ} . The change in characteristic over a defined and limited temperature range can be reversible, that is, non-destructive. This change is represented by values called reversible temperature coefficients. The symbol for reversible temperature coefficient of induction is $\alpha(B_r)$ and for (intrinsic) coercivity is $\alpha(H_{cJ})$. They are expressed in percent change per degree Celsius, %/°C, or the numerically equivalent percent per Kelvin, %/K. The changes in magnetic characteristics are non-linear so it is necessary to specify the temperature range over which the coefficient applies.

3.2.3 The maximum recommended working temperature, T_w , of a permanent magnet is a semi-arbitrary value sometimes assigned by magnet manufacturers to their products. T_w is not normative. See Appendix X3 for a more complete discussion.

4. Classification

4.1 The classification of Alnico permanent magnets is given in Table 1, and Appendix X1, Table X1.1, with cross-reference to MMPA Standard No. 0100-00 and IEC 60404-8-1.

⁴ Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, 1st Floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, <http://www.iec.ch>.