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INTERNATIONAL STANDARD

colour inside

Magnetic materials –
Part 5: Permanent magnet (magnetically hard) materials – Methods of measurement of magnetic properties

INTERNATIONAL
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MAGNETIC MATERIALS –

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International Standard IEC 60404-5 has been prepared by IEC technical committee 68: Magnetic alloys and steels.

This third edition cancels and replaces the second edition published in 1993 and Amendment 1:2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- adaption of the measurement methods and test conditions to newly introduced magnetically hard materials with coercivity values H_{cJ} higher than 2 MA/m;
- update of the temperature conditions to allow the measurement of new materials with high temperature coefficients.

The text of this standard is based on the following documents:

FDIS	Report on voting
68/497/FDIS	68/505/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60404 series, published under the general title *Magnetic materials*, can be found on the IEC website.

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INTRODUCTION

The previous edition of IEC 60404-5 was issued in October 1993 and amended in 2007. Since then, new applications of NdFeB sintered magnetic materials with intrinsic coercivity, H_{cJ}, higher than 2 MA/m for hybrid electric vehicles and fully electric vehicles have appeared. Thus, IEC TC68 decided in 2011 at their meeting in Ghent to revise IEC 60404-5.

For the measurement of the coercivity relating to polarization, H_{cJ}, at values higher than 2 MA/m and the measurement of magnetic properties at elevated temperatures, the methods described in the non-normative Technical Reports IEC TR 61807 and IEC TR 62331 can be considered.

The ambient temperature previously recommended was (23 ± 5) °C. However, for permanent magnet materials such as NdFeB and hard ferrites that have large temperature coefficients, it is strongly recommended that the ambient temperature should be controlled within this range to ± 1 °C or better. It is desirable to apply this temperature recommendation for other hard magnet materials. This recommendation was already included in IEC 60404-5:1993/AMD1:2007.

MAGNETIC MATERIALS –

Part 5: Permanent magnet (magnetically hard) materials – Methods of measurement of magnetic properties

~~1 General~~

1 Scope

The purpose of this part of IEC 60404 is to define the method of measurement of the magnetic flux density, magnetic polarization and the magnetic field strength and also to determine the demagnetization curve and recoil line of permanent magnet materials, such as those specified in IEC 60404-8-1 [1][1], the properties of which are presumed homogeneous throughout their volume.

The performance of a magnetic system is not only dependent on the properties of the permanent magnet material but also on the dimensions of the system, the air-gap and other elements of the magnetic circuit. The methods described in this part of IEC 60404 refer to the measurement of the magnetic properties in a closed magnetic circuit ~~simulating a ring~~.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at http://www.electropedia.org)

[1] Numbers in square brackets refer to the Bibliography.

IEC 60404-5

Edition 3.0 2015-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Magnetic materials –
Part 5: Permanent magnet (magnetically hard) materials – Methods of measurement of magnetic properties

Matériaux magnétiques –
Partie 5: Aimants permanents (magnétiques durs) – Méthodes de mesure des propriétés magnétiques

IEC 60404-5:2015-04(en-fr)

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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MATÉRIAUX MAGNÉTIQUES –

Partie 5: Aimants permanents (magnétiques durs) – Méthodes de mesure des propriétés magnétiques

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La Norme internationale IEC 60404-5 a été établie par le comité d'études 68 de l'IEC: Matériaux magnétiques tels qu'alliages et aciers.

Cette troisième édition annule et remplace la deuxième édition parue en 1993 et l'Amendement 1:2007. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- adaptation des méthodes de mesure et des conditions d'essai aux matériaux magnétiquement durs récemment introduits possédant un champ coercitif H_{cJ} supérieur à 2 MA/m;

- mise à jour des conditions de température, afin de permettre la mesure de nouveaux matériaux avec des coefficients de température élevés.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
68/497/FDIS	68/505/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

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INTRODUCTION

L'édition précédente de l'IEC 60404-5 a été publiée en octobre 1993 et modifiée en 2007. Depuis, de nouvelles applications des matériaux magnétiques au NdFeB fritté présentant un champ coercitif intrinsèque, H_{cJ}, supérieur à 2 MA/m destinés aux véhicules électriques hybrides et aux véhicules entièrement électriques sont apparues. Ainsi, lors de la réunion de Gand en 2011, le CE 68 de l'IEC a décidé de réviser l'IEC 60404-5.

Pour la mesure du champ coercitif se rapportant à la polarisation, H_{cJ}, de valeur supérieure à 2 MA/m et pour la mesure des propriétés magnétiques à des températures élevées, on peut utiliser les méthodes décrites dans les rapports techniques non normatifs IEC TR 61807 et IEC TR 62331.

Auparavant, la température ambiante recommandée était (23 ± 5) °C. Toutefois, pour les matériaux pour aimants permanents tels que le NdFeB et les ferrites dures de coefficients de température élevés, il est fortement recommandé que la température ambiante soit contrôlée dans les limites de cette plage avec une précision de ± 1 °C ou plus. Il est souhaitable d'appliquer cette recommandation de température pour d'autres matériaux pour aimants durs. Cette recommandation figurait déjà dans l'IEC 60404-5:1993/AMD1:2007.

MATÉRIAUX MAGNÉTIQUES –

Partie 5: Aimants permanents (magnétiques durs) – Méthodes de mesure des propriétés magnétiques

1 Domaine d'application

La présente partie de l'IEC 60404 a pour objectif de définir la méthode de mesure de l'induction magnétique, de la polarisation magnétique et l'intensité du champ magnétique, mais aussi de déterminer la courbe de désaimantation et la droite de recul des matériaux pour aimants permanents, comme ceux qui sont spécifiés dans l'IEC 60404-8-1 [1][1], dont les propriétés sont supposées homogènes dans tout leur volume.

Les performances d'un système magnétique ne dépendent pas seulement des propriétés du matériau pour aimant permanent, mais aussi des dimensions du système, de l'entrefer et des autres éléments du circuit magnétique. Les méthodes décrites dans la présente partie de l'IEC 60404 se rapportent aux mesures des propriétés magnétiques en circuit magnétique fermé.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

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