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Standards

Irish Standard  
I.S. EN 60404-5:2015

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

**I.S. EN 60404-5:2015**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

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EUROPEAN STANDARD

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Supersedes EN 60404-5:2007

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**Magnetic materials - Part 5: Permanent magnet (magnetically hard) materials - Methods of measurement of magnetic properties  
(IEC 60404-5:2015)**

Matériaux magnétiques - Partie 5: Aimants permanents  
(magnétiques durs) - Méthodes de mesure des propriétés  
magnétiques  
(IEC 60404-5:2015)

Magnetische Werkstoffe - Teil 5: Dauermagnet-  
(hartmagnetische) Werkstoffe - Verfahren zur Messung  
magnetischer Eigenschaften  
(IEC 60404-5:2015)

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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## **Foreword**

The text of document 68/497/FDIS, future edition 3 of IEC 60404-5, prepared by IEC/TC 68 "Magnetic alloys and steels" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60404-5:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-02-21
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-05-21

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IEC 60404-8-1	NOTE	Harmonized as EN 60404-8-1.
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## **Annex ZA**

(normative)

### **Normative references to international publications with their corresponding European publications**

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.

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<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050	series	International electrotechnical vocabulary	-	-

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**IEC 60404-5**

Edition 3.0 2015-04

# **INTERNATIONAL STANDARD**

## **NORME INTERNATIONALE**

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**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**



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**IEC 60404-5**

Edition 3.0 2015-04

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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INTERNATIONAL  
ELECTROTECHNICAL  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### MAGNETIC MATERIALS –

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

#### FOREWORD

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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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## 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  $(23 \pm 5) ^\circ\text{C}$ . 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  $\pm 1 ^\circ\text{C}$  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 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]<sup>1</sup>, 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.

#### 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>)

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-121, IEC 60050-151 and IEC 60050-221 apply.

#### 4 Electromagnet and conditions for magnetization

##### 4.1 General

For permanent magnet materials, this part of IEC 60404 deals with both the coercivity  $H_{CB}$  (the coercivity relating to the magnetic flux density) and the intrinsic coercivity  $H_{cJ}$  (the coercivity relating to the magnetic polarization).

The measurements specified in this part of IEC 60404 are for both the magnetic flux density,  $B$ , and the magnetic polarization,  $J$ , as a function of the magnetic field strength,  $H$ . These quantities are related by the following equation:

$$B = \mu_0 H + J \quad (1)$$

<sup>1</sup> Numbers in square brackets refer to the Bibliography.

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