
Magnetic materials - Part 14: Methods of measurement of the magnetic dipole moment of a ferromagnetic material specimen by the withdrawal or rotation method (IEC 60404-14:2002)

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English version

Magnetic materials
Part 14: Methods of measurement of the magnetic dipole moment
of a ferromagnetic material specimen
by the withdrawal or rotation method
(IEC 60404-14:2002)

Matériaux magnétiques
Partie 14: Méthode de mesure du moment
magnétique coulombien d'une éprouvette
de matériau ferromagnétique
par la méthode du retrait
ou la méthode par rotation
(CEI 60404-14:2002)

Magnetische Werkstoffe
Teil 14: Verfahren zur Messung
des magnetischen Dipolmomentes
einer Probe aus ferromagnetischem
Werkstoff mit dem Abzieh-
oder dem Drehverfahren
(IEC 60404-14:2002)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 68/254/FDIS, future edition 1 of IEC 60404-14, prepared by IEC TC 68, Magnetic alloys and steels, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60404-14 on 2002-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-10-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A, B and C are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

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The text of the International Standard IEC 60404-14:2002 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-121	- ¹⁾	International Electrotechnical Vocabulary Part 121: Electromagnetism	-	-
IEC 60050-151	- ¹⁾	Part 151: Electrical and magnetic devices	-	-
IEC 60050-221	- ¹⁾	Chapter 221: Magnetic materials and components	-	-
IEC 60404-4	- ¹⁾	Magnetic materials Part 4: Methods of measurement of d.c. magnetic properties of magnetically soft materials	EN 60404-4	1997 ²⁾
IEC 60404-5	- ¹⁾	Part 5: Permanent magnet (magnetically hard) materials - Methods of measurement of magnetic properties	-	-
IEC 60404-7	- ¹⁾	Part 7: Method of measurement of the coercivity of magnetic materials in an open magnetic circuit	-	-
ISO Guide	- ¹⁾	Guide to the expression of uncertainty in measurement	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

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Matériaux magnétiques –

Partie 14:

**Méthode de mesure du moment magnétique
coulombien d'une éprouvette de matériau
ferromagnétique par la méthode du retrait
ou la méthode par rotation**

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Part 14:

**Methods of measurement of the magnetic dipole
moment of a ferromagnetic material specimen
by the withdrawal or rotation method**

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International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MAGNETIC MATERIALS –

**Part 14: Methods of measurement of the magnetic
dipole moment of a ferromagnetic material specimen
by the withdrawal or rotation method**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 60404-14 has been prepared by IEC technical committee 68: Magnetic alloys and steels.

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

FDIS	Report on voting
68/254/FDIS	68/257/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 3.

Annexes A, B and C are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2009. At this date, the publication will be

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

INTRODUCTION

The magnetic dipole moment j of a ferromagnetic material specimen is a useful parameter for comparing properties, particularly of permanent magnet materials. The measurement of the saturation magnetic dipole moment per unit mass (specific saturation magnetic polarization σ_s) is a special case widely used to characterize cemented carbide metals. Whilst these materials are essentially non-magnetic in character, cobalt or nickel is used as the binder and it is required to achieve an optimum composition and geometrical arrangement of the binder phase with high reproducibility. The determination of the specific saturation magnetic polarization has gained acceptance in the carbide metal industry as a simple, fast and non-destructive measurement method.

The measurement of magnetic moment is, within broad limits, independent of the shape and size of the test specimen. If the material, as in the case of cemented carbide metal, contains only one ferromagnetic component (cobalt or nickel), it is possible to determine its percentage proportion with high resolution.

Another useful parameter which can be derived from the measurement of the magnetic dipole moment of a test specimen and its volume V is the magnetic polarization J . The value of saturation magnetic polarization is of particular interest for certain magnetic materials. Spherical, ellipsoidal and cylindrical reference specimens of nickel of measured saturation magnetic polarization are used in the calibration of vibrating sample magnetometers.

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MAGNETIC MATERIALS –

Part 14: Methods of measurement of the magnetic dipole moment of a ferromagnetic material specimen by the withdrawal or rotation method

1 Scope

This part of IEC 60404 is applicable to all ferromagnetic materials. It is particularly aimed at the measurement of the magnetic dipole moment of permanent magnet (magnetically hard) materials and the measurement of the specific saturation magnetic polarization of cemented carbide materials having a ferromagnetic binder.

The object of this part is to describe the general principles of the determination of the magnetic dipole moment of a ferromagnetic material specimen using a detection coil in an open magnetic circuit. By including a means of magnetizing the material to saturation, the saturation magnetic dipole moment can also be determined. In addition, the average magnetic polarization of a test specimen can be derived from the measurement of its magnetic dipole moment and volume. The calibration of magnetic moment coil systems and the measurement of the magnetic dipole moment of feebly magnetic materials can also be determined using this method.

Measurements are normally performed at room temperature but measurements at other temperatures can be conducted by heating or cooling the volume occupied by the test specimen within the detection coil.

The measurement of remanence, coercivity, maximum energy product and other parameters can be made in a closed magnetic circuit as described in IEC 60404-4 and IEC 60404-5. Measurement of the coercivity H_{cJ} of soft and semi-hard materials can also be performed in an open circuit as described in IEC 60404-7.

2 Normative references

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

IEC 60050(121), *International Electrotechnical Vocabulary (IEV) – Part 121: Electromagnetism*

IEC 60050(151), *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050(221), *International Electrotechnical Vocabulary (IEV) – Chapter 221: Magnetic materials and components*

IEC 60404-4, *Magnetic materials – Part 4: Methods for the measurement of d.c. magnetic properties of magnetically soft materials*