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# INTERNATIONAL STANDARD



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**Magnetic materials –  
Part 3: Methods of measurement of the magnetic properties of electrical steel  
strip and sheet by means of a single sheet tester**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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### MAGNETIC MATERIALS –

### Part 3: Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester

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IEC 60404-3 has been prepared by IEC technical committee 68: Magnetic alloys and steels. It is an International Standard.

This third edition cancels and replaces the second edition published in 1992, Amendment 1:2002 and Amendment 2:2009. This edition constitutes a technical revision.

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

- a) Annex A was revised. The method of determining the yokes' lamination resistance was added to Annex A;
- b) Annex B of the consolidated version of 2010 referred to calibration of the SST using the Epstein method. It was cancelled;
- c) Annex B (new), Annex C and Annex D were revised, they are for information only;
- d) Annex C was modified taking account of the new situation regarding P and R grades;
- e) Annex D was amended by addition of Clause D.4 on the numerical air flux compensation.

The text of this International Standard is based on the following documents:

Draft	Report on voting
68/699/CDV	68/710/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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## MAGNETIC MATERIALS –

### Part 3: Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester

#### 1 ~~Object and field of application~~ Scope

This part of IEC 60404 is applicable to grain-oriented and non-oriented electrical steel strip and sheet for measurement of AC magnetic properties at power frequencies.

The object of this document is to define the general principles and the technical details of the measurement of the magnetic properties of ~~magnetic sheets~~ electrical steel strip and sheet by means of a single sheet tester (SST).

~~This part of IEC 60404 is applicable at power frequencies to:~~

~~a) grain-oriented magnetic sheet and strip:~~

~~for the measurement between 1,0 T and 1,8 T of:~~

~~— specific total loss;~~

~~— specific apparent power;~~

~~— r.m.s. value of the magnetic field strength;~~

~~for the measurement up to peak values of magnetic field strength of 1 000 A/m of:~~

~~— peak value of the magnetic polarization;~~

~~— peak value of the magnetic field strength.~~

~~b) non-oriented magnetic sheet and strip:~~

~~for the measurement between 0,8 T and 1,5 T of:~~

~~— specific total loss;~~

~~— specific apparent power;~~

~~— r.m.s. value of excitation current;~~

~~for the measurement up to peak values of magnetic field strength of 10 000 A/m of:~~

~~— peak value of the magnetic polarization;~~

~~— peak value of the magnetic field strength.~~

The single sheet tester is applicable to test specimens obtained from ~~magnetic sheets and strips of any quality~~ electrical steel strips and sheets of any grade. The AC magnetic characteristics are determined for sinusoidal induced voltages, for specified peak values of the magnetic polarization, for specific peak values of the magnetic field strength and for a specified frequency.

The measurements are made at an ambient temperature of  $(23 \pm 5)^\circ\text{C}$  on test specimens which have first been demagnetized.

NOTE Throughout this document, the quantity "magnetic polarization" is used as defined in ~~IEC 60050(901)~~ IEC 60050-221. In some standards of the IEC 60404 series, the quantity "magnetic flux density" was used.

In order to support the long-term reliability of the performance of this set up and to understand better the relationship between the Epstein method and the SST method, the informative Annexes B and C, respectively, have been included.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 – Part 121: Electromagnetism*

IEC 60050-221, *International Electrotechnical Vocabulary – Part 221: Magnetic materials and components*

~~IEC 60404-2, *Magnetic materials – Part 2: Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of an Epstein frame*~~

IEC 60404-13, *Magnetic materials – Part 13: Methods of measurement of resistivity, density and stacking factor of electrical steel strip and sheet*

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Magnetic materials –**

**Part 3: Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester**

**Matériaux magnétiques –**

**Partie 3: Méthodes de mesure des caractéristiques magnétiques des bandes et tôles magnétiques en acier à l'aide de l'essai sur tôle unique**





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The object of this document is to define the general principles and the technical details of the measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester (SST).

The single sheet tester is applicable to test specimens obtained from electrical steel strips and sheets of any grade. The AC magnetic characteristics are determined for sinusoidal induced voltages, for specified peak values of the magnetic polarization, for specific peak values of the magnetic field strength and for a specified frequency.

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## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

### MATÉRIAUX MAGNÉTIQUES –

#### **Partie 3: Méthodes de mesure des caractéristiques magnétiques des bandes et tôles magnétiques en acier à l'aide de l'essai sur tôle unique**

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L'IEC 60404-3 a été établie par le comité d'études 68 de l'IEC: Matériaux magnétiques tels qu'alliages et aciers. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la première édition parue en 1992, l'Amendement 1:2002 et l'Amendement 2:2009. Cette édition constitue une révision technique.

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

- a) l'Annexe A a été révisée. La méthode de détermination de la résistance des bandes des culasses a été ajoutée à l'Annexe A;
- b) l'Annexe B de l'édition consolidée de 2010 faisait référence à l'étalonnage du SST à l'aide de la méthode Epstein. Elle a été annulée;



- c) l'Annexe B (nouvelle), l'Annexe C et l'Annexe D ont été révisées et sont seulement informatives;
- d) l'Annexe C a été modifiée compte tenu de la nouvelle situation concernant les qualités P et R;
- e) l'Annexe D a été amendée par ajout de l'Article D.4 relatif à la compensation numérique du flux d'air.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
68/699/CDV	68/710/RVC

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

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). Les principaux types de documents développés par l'IEC sont décrits plus en détail sous [www.iec.ch/publications](http://www.iec.ch/publications).

Une liste de toutes les parties de la série IEC 60404, publiées sous le titre général *Matériaux magnétiques*, se trouve sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous [webstore.iec.ch](http://webstore.iec.ch) dans les données relatives au document recherché. A cette date, le document sera

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- amendé.

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## MATÉRIAUX MAGNÉTIQUES –

### Partie 3: Méthodes de mesure des caractéristiques magnétiques des bandes et tôles magnétiques en acier à l'aide de l'essai sur tôle unique

#### 1 Domaine d'application

La présente partie de l'IEC 60404 s'applique aux bandes et tôles magnétiques en acier à grains orientés et à grains non orientés pour le mesurage des caractéristiques magnétiques en courant alternatif aux fréquences industrielles.

Le présent document a pour objet de définir les principes généraux et les détails techniques pour le mesurage des caractéristiques magnétiques des bandes et tôles magnétiques en acier à l'aide de l'essai sur tôle unique (SST, *Single Sheet Tester*).

L'essai sur tôle unique s'applique aux éprouvettes prélevées à partir de bandes et de tôles magnétiques en acier de toute qualité. Les caractéristiques magnétiques en courant alternatif sont déterminées pour des tensions induites sinusoïdales, pour les valeurs de crête spécifiées de la polarisation magnétique, pour les valeurs de crête spécifiques de l'intensité du champ magnétique et pour une fréquence spécifiée.

Les mesurages sont effectués à la température ambiante de  $(23 \pm 5)$  °C sur des éprouvettes qui ont été au préalable désaimantées.

NOTE Dans le présent document, la grandeur "polarisation magnétique" est utilisée conformément à la définition de l'IEC 60050-221. Dans certaines normes de la série IEC 60404, la grandeur "induction magnétique" a été utilisée.

Afin de soutenir la fiabilité à long terme des performances de cette configuration et de mieux comprendre la relation entre la méthode Epstein et la méthode SST, les annexes informatives B et C, ont été respectivement, ajoutées.

#### 2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. 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).

IEC 60050-121, *Vocabulaire Electrotechnique International – Partie 121: Electromagnétisme*

IEC 60050-221, *Vocabulaire Electrotechnique International – Partie 221: Matériaux et composants magnétiques*

IEC 60404-13, *Matériaux magnétiques – Partie 13: Méthodes de mesure de la résistivité, de la masse volumique et du facteur de foisonnement des bandes et tôles en acier électrique*