IEC 60404-16

Edition 1.0 2018-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Magnetic materials –
Part 16: Methods of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester

Matériaux magnétiques –
Partie 16: Méthodes de mesure des propriétés magnétiques des bandes en alliage amorphe à base de fer à l'aide de l'essai sur tôle unique

IEC 60404-16:2018-03(en-fr)

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Part 16: Methods of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester

FOREWORD

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International Standard IEC 60404-16 has been prepared by IEC technical committee 68: Magnetic alloys and steels.

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

CDV	Report on voting
68/570/CDV	68/583A/RVC

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

INTRODUCTION

A method of measuring the magnetic properties of Fe-based amorphous strip is required to grade what is regarded as a promising material to reduce energy loss in transformer cores and, consequently, to reduce global warming.

Fe-based amorphous strip is produced by a rapidly-solidifying, direct-casting process. The strip is intended primarily for the construction of wound cores of distribution transformers for commercial power frequency (50 Hz and 60 Hz) applications.

After appropriate heat treatment, the strip exhibits a significantly lower value of specific total loss compared to grain-oriented electrical steel strip. It is associated with low hysteresis loss due to low magnetic anisotropy and low eddy current loss due to high resistivity and reduced thickness. However, significant deterioration can occur by applying stress on the strip due to the large magnetostriction and low magnetic anisotropy characteristics of the material.

Therefore, a method of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester (SST) is required, independent of IEC 60404-3 [1][1], which is specified for electrical steel sheets.

The almost exclusively applied wattmeter method is used also in this standard. However, the widely used version with the determination of the magnetic field strength from the magnetizing current (“MC method”) is not applicable to this kind of material, because the influence of the yokes on the loss measurement is significantly greater for the thinner and magnetically softer test specimen of this material. Thus, the wattmeter method with H coil mode (“H coil method”) has been included for the magnetic field determination. International round robin tests of SST and Fe-based amorphous test specimens have been carried out, resulting in a suitable configuration of the SST for amorphous material. The single-yoke concept was adopted in order to avoid the effect of the impact of the upper yoke caused by the high magneto-elastic sensitivity of the material.

1 Numbers in square brackets refer to the Bibliography.

MAGNETIC MATERIALS –

Part 16: Methods of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester

1 Scope

This part of IEC 60404 is applicable to Fe-based amorphous strips specified in IEC 60404-8-11 for the measurement of AC magnetic properties at frequencies up to 400 Hz.

The object of this part is to define the general principles and technical details of the measurement of the magnetic properties of Fe-based amorphous strips by means of a single sheet tester.

The single sheet tester is applicable to test specimens obtained from Fe-based amorphous strips of any quality. The AC magnetic characteristics are determined for a sinusoidal induced voltage, for specified peak values of magnetic polarization and for a specified frequency.

The measurements are made at an ambient temperature of (23 ± 5) °C on test specimens which have first been demagnetized.

NOTE 1 The single sheet tester specified in this document is appropriate for other materials which have magnetic properties and physical characteristics similar to those of Fe-based amorphous strip, such as nano-crystalline soft magnetic strip. The single sheet tester for electrical steel sheets is specified in IEC 60404-3.

NOTE 2 Throughout this document the term “magnetic polarization” is used as described in IEC 60050-121. In some standards of the IEC 60404 series, the term “magnetic flux density” is used.

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 – Chapter 221: Magnetic materials and components*

IEC 60404-8-11, *Magnetic materials – Part 8-11: Specifications for individual materials – Fe-based amorphous strip delivered in the semi-processed state*

3 Terms and definitions

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

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