

<b>STN</b>	<b>Magnetické materiály</b> <b>Časť 8-11: Špecifikácia jednotlivých materiálov</b> <b>Amorfne pásy na báze železa dodávané v</b> <b>čiasťočne spracovanom stave</b>	<b>STN</b> <b>EN IEC</b> <b>60404-8-11</b>  34 5884
------------	--	---

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

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 10/18

Obsahuje: EN IEC 60404-8-11:2018, IEC 60404-8-11:2018

**127381**

EUROPEAN STANDARD

**EN IEC 60404-8-11**

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2018

ICS 17.220.20; 29.030

English Version

**Magnetic materials - Part 8-11: Specifications for individual materials - Fe-based amorphous strip delivered in the semi-processed state  
(IEC 60404-8-11:2018)**

Matériaux magnétiques - Partie 8-11: Spécifications pour matériaux particuliers - Bandes en alliage amorphe à base de fer livrées à l'état semi-fini  
(IEC 60404-8-11:2018)

Magnetische Werkstoffe - Teil 8-11: Anforderungen an einzelne Werkstoffe - eisenbasiertes, amorphes Band in nicht schlussgeglühtem Zustand  
(IEC 60404-8-11:2018)

This European Standard was approved by CENELEC on 2018-04-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

**EN IEC 60404-8-11:2018****European foreword**

The text of document 68/571/CDV, future edition 1 of IEC 60404-8-11, prepared by IEC/TC 68 "Magnetic alloys and steels" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60404-8-11:2018.

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) 2019-01-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-04-12

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

**Endorsement notice**

The text of the International Standard IEC 60404-8-11:2018 was approved by CENELEC as a European Standard without any modification.

## Annex ZA (normative)

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

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-121	-	International Electrotechnical Vocabulary (IEV) - Part 121: Electromagnetism	-	-
IEC 60050-221	-	International Electrotechnical Vocabulary (IEV) - Chapter 221: Magnetic materials and components	-	-
IEC 60404-1	-	Magnetic materials - Part 1: Classification	EN 60404-1	-
IEC 60404-9	-	Magnetic materials - Part 9: Methods of determination of the geometrical characteristics of electrical steel sheet and strip	EN 60404-9	-
IEC 60404-16	-	Magnetic materials - Part 16: Methods of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester	EN IEC 60404-16	-
ISO 404	-	Steel and steel products - General technical delivery requirements	-	-
ISO 10474	-	Steel and steel products - Inspection documents	-	-



IEC 60404-8-11

Edition 1.0 2018-03

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

**Matériaux magnétiques –  
Partie 8-11: Spécifications pour matériaux particuliers – Bandes en alliage  
amorphe à base de fer livrées à l'état semi-fini**



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2018 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
 3, rue de Varembe  
 CH-1211 Geneva 20  
 Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

#### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

#### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

#### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).



IEC 60404-8-11

Edition 1.0 2018-03

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

---

**Magnetic materials –**

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

**Matériaux magnétiques –**

**Partie 8-11: Spécifications pour matériaux particuliers – Bandes en alliage amorphe à base de fer livrées à l'état semi-fini**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 17.220.20; 29.030

ISBN 978-2-8322-5437-0

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Classification.....	8
5 Designation .....	8
6 General requirements .....	8
6.1 Production process .....	8
6.2 Form of supply.....	9
6.3 Delivery condition .....	9
6.4 Surface condition .....	9
6.5 Suitability for cutting .....	9
7 Technical requirements .....	10
7.1 Magnetic properties .....	10
7.1.1 Reference condition.....	10
7.1.2 Magnetic polarization.....	10
7.1.3 Specific total loss .....	10
7.2 Geometrical characteristics and tolerances .....	12
7.2.1 Thickness .....	12
7.2.2 Width.....	13
7.2.3 Length .....	13
7.2.4 Edge camber .....	13
7.2.5 Edge wave (wave factor) .....	13
7.2.6 Residual curvature.....	13
7.2.7 Burr height.....	13
7.3 Technological characteristics .....	13
7.3.1 Density .....	13
7.3.2 Stacking factor.....	14
7.3.3 Strip tear ductility .....	14
7.3.4 Internal stresses.....	14
7.3.5 Surface insulation resistance .....	14
8 Inspection and testing.....	14
8.1 General.....	14
8.2 Selection of test samples .....	15
8.3 Preparation of test specimens.....	15
8.3.1 Magnetic properties .....	15
8.3.2 Geometrical characteristics and tolerances.....	15
8.3.3 Technological characteristics.....	16
8.4 Test methods .....	16
8.4.1 General .....	16
8.4.2 Magnetic properties .....	16
8.4.3 Geometrical characteristics and tolerances.....	16
8.4.4 Technological characteristics.....	17
8.5 Retests .....	17
9 Marking, labelling and packaging.....	17



10	Complaints .....	17
11	Information to be supplied by the purchaser .....	18
12	Information to be supplied by the manufacturer .....	18
	Annex A (informative) Non-specified magnetic properties .....	19
	Annex B (normative) Test method of determination of the stacking factor for Fe-based amorphous strips .....	20
	B.1 General.....	20
	B.2 Test specimen .....	20
	B.3 Measurement procedure .....	20
	B.4 Reproducibility .....	22
	Figure B.1 – Schematic diagram of a stacking specimen and a linear measuring device on side view (a) and on top view (b).....	21
	Table 1 – Technological properties and magnetic properties of the conventional grades of Fe-based amorphous strip .....	11
	Table 2 – Technological properties and magnetic properties of the high permeability grades of Fe-based amorphous strip .....	12
	Table 3 – Tolerances on the nominal width of Fe-based amorphous strip.....	13
	Table 4 – Ductility code and number of brittle spots of Fe-based amorphous strip.....	14
	Table A.1 – Non-specified magnetic properties of Fe-based amorphous strip.....	19

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MAGNETIC MATERIALS –****Part 8-11: Specifications for individual materials –  
Fe-based amorphous strip delivered in the semi-processed state**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). 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. 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 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60404-8-11 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
68/571/CDV	68/585A/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

Fe-based amorphous strip is regarded as a promising material to reduce energy loss in transformer cores and, consequently, to help mitigate global warming.

The 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 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 in comparison with grain-oriented electrical steel strip for the same applications. It is associated with low hysteresis loss due to low magnetic anisotropy and with low eddy current loss due to high resistivity and reduced thickness.

## MAGNETIC MATERIALS –

### Part 8-11: Specifications for individual materials – Fe-based amorphous strip delivered in the semi-processed state

#### 1 Scope

This part of IEC 60404 defines the grades of Fe-based amorphous strip delivered in the semi-processed state, i.e. without final heat treatment, of nominal thickness 0,025 mm. Other nominal thicknesses in the range from 0,020 mm to 0,030 mm can be specified by agreement between the manufacturer and the purchaser at the time of enquiry and order. In particular, it gives general requirements, magnetic properties, geometric characteristics, tolerances and technological characteristics, as well as inspection procedures.

This document applies to the rapidly-solidified Fe-based amorphous strip supplied in coils with as-cast edges and intended for the construction of magnetic circuits.

The grades are grouped into two classes:

- conventional grades;
- high permeability grades.

They correspond to Class I1 of IEC 60404-1.

#### 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 60404-1, *Magnetic materials – Part 1: Classification*

IEC 60404-9, *Magnetic materials – Part 9: Methods of determination of the geometrical characteristics of magnetic steel sheet and strip*

IEC 60404-16, *Magnetic materials – Part 16: Methods of measurement of the magnetic properties of Fe-based amorphous strip by means of a single sheet tester*

ISO 404, *Steel and steel products – General technical delivery requirements*

**koniec náhľadu – text ďalej pokračuje v platenej verzii STN**