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INTERNATIONAL STANDARD

Magnetic materials –
Part 8-5: Specifications for individual materials – Electrical steel strip and sheet with specified mechanical properties and magnetic polarization

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MAGNETIC MATERIALS –

Part 8-5: Specifications for individual materials – Electrical steel strip and sheet with specified mechanical properties and magnetic polarization

FOREWORD

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International Standard IEC 60404-8-5 has been prepared by IEC technical committee 68: Magnetic alloys and steels.

This second edition cancels and replaces the first edition published in 1989. This edition constitutes a technical revision.

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

a) extension of the range of products to include the improved grades;

b) division of "flatness" into "edge wave (wave factor)" and "residual curvature" in consistent with IEC 60404-9;

c) change length of test specimen for determinations of geometrical characters from 2 m to 1 m.

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

CDV	Report on voting
68/648/CDV	68/662/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- withdrawn,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

The first edition of IEC 60404-8-5, "*Magnetic materials – Part 8: Specifications for individual materials – Section Five – Specification for steel sheet and strip with specified mechanical properties and magnetic permeability*", was published in April 1989 and has not been revised for more than 30 years. Since then, new grades of cold-rolled material of minimum proof strength $R_{p0,2}$ greater than 400 MPa were developed and widely used. Thus, IEC TC 68 decided in 2017 at their meeting in Paris to revise this document. This revision also includes corrections to the first edition in order to improve consistency with the other parts of the IEC 60404-8 subseries.

MAGNETIC MATERIALS –

Part 8-5: Specifications for individual materials – Electrical steel strip and sheet with specified mechanical properties and magnetic polarization

1 Scope

This part of IEC 60404 defines the grades of electrical steel strip and sheet with specified mechanical properties and magnetic polarization. In particular, it gives general requirements, mechanical properties, magnetic polarization, geometric characteristics, tolerances and technological characteristics, as well as inspection procedures.

This document applies to electrical steel strip and sheet intended for the construction of poles and rims of rotating electrical machines.

The grades are grouped into two classes according to their manufacturing process:

– hot-rolled grades;
– cold-rolled grades.

They correspond to Class D21 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 60404-2, *Magnetic materials – Part 2: Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of an Epstein frame*

IEC 60404-4, *Magnetic materials – Part 4: Methods of measurement of d.c. magnetic properties of iron and steel*

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

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

ISO 2566-1, *Steel – Conversion of elongation values – Part 1: Carbon and low alloy steels*

ISO 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

ISO 10474, *Steel and steel products – Inspection documents*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-121, IEC 60050-221, IEC 60404-9 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
edge wave
wave factor
variations of flatness of a length of strip or a sheet taking a form of waves at the slit edge of the product

Note 1 to entry: Edge wave is characterized by the wave factor which is the relation of the height of the wave to its length, expressed as a percentage.

[SOURCE: IEC 60404-9: 2018, 3.1]

3.2
residual curvature
variations of flatness of a length of strip or a sheet taking a permanent curvature in the rolling direction of the product

[SOURCE: IEC 60404-9: 2018, 3.2]

3.3
edge camber
greatest distance between a longitudinal edge of a length of strip or a sheet and the line joining the two extremities of the measured length of this edge

[SOURCE: IEC 60404-9: 2018, 3.3]

4 Classification

The grades covered by this document are classified according to the specified value of minimum proof strength $R_{p0,2}$, in MPa[1], according to the specified value of minimum magnetic polarization at a DC magnetic field strength of 15 000 A/m, in T, and according to the nominal thickness of the product[2], in mm.

5 Designation

The steel name comprises the following in the order given:

a) the characteristic letters
   – "TG" for hot-rolled grades;
   – "TF" for cold-rolled grades;

[1] 1 MPa =1 N/mm^2.

[2] In the rest of the document, the word "product" is used to mean "strip and sheet".

b) the specified value of minimum proof strength $R_{p0,2}$, in MPa;

c) one hundred times the nominal thickness of the product, in mm;

d) one hundred times the specified value of minimum magnetic polarization at a DC magnetic field strength of 15 000 A/m, in T.

EXAMPLE: TF350-100-181 for cold-rolled electrical steel strip and sheet with a minimum proof strength $R_{p0,2}$ of 350 MPa, a nominal thickness of 1,0 mm, and a minimum magnetic polarization of 1,81 T at a DC magnetic field strength of 15 000 A/m.

6 General requirements

6.1 Production process

The production process of the steel and its chemical composition are left to the discretion of the manufacturer.

6.2 Form of supply

The product is supplied in coils in the case of strip and in bundles in the case of sheets.

The mass of the coils or bundles of sheets shall be agreed between the manufacturer and the purchaser at the time of enquiry and order.

The internal diameter of coils shall be agreed between the manufacturer and the purchaser at the time of enquiry and order. The recommended value for the internal diameter of coils is approximately 610 mm for hot-rolled grades, and approximately 508 mm for cold-rolled grades.

Strip shall be of constant width and wound in such a manner that the edges are superimposed in a regular manner and the side faces of the coil are substantially flat.

Coils shall be sufficiently tightly wound in order that they do not collapse under their own weight.

Strip may exhibit welds or interleaves resulting from the removal of defective zones or from the joining of several lengths to obtain the sizes of the coils required by the purchaser, if agreed between the manufacturer and the purchaser at the time of enquiry and order. If necessary, the marking of welds or interleaves may be agreed between the manufacturer and the purchaser at the time of enquiry and order.

For coils containing repair welds or interleaves, each part of the strip shall be of the same grade.

The edges of parts welded together shall not be so much out of alignment as to affect the further processing of the product.

Sheets which make up each bundle shall be stacked so that the side faces are substantially flat and approximately perpendicular to the top face.

Products supplied in sheets shall not contain any welds.

6.3 Delivery condition

The product is normally supplied without insulation. By agreement between the manufacturer and the purchaser at the time of enquiry and order, the product may be supplied with insulation on one or both sides. If the product is supplied with insulation, the nature of the insulation, its properties and their verification shall be agreed between the manufacturer and the purchaser at the time of enquiry and order.