

<b>STN</b>	<b>Magnetické materiály</b> <b>Časť 12: Skúšobné metódy na posúdenie tepelnej</b> <b>odolnosti povrchových izolačných povlakov</b> <b>oceľových pásov a plechov pre elektrotechniku</b>	<b>STN</b> <b>EN IEC 60404-12</b>  34 5884
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Magnetic materials - Part 12: Methods of test for the assessment of the thermal endurance of surface insulation coatings on electrical steel strip and sheet

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. 05/23

Obsahuje: EN IEC 60404-12:2023, IEC 60404-12:2023

**136846**

EUROPEAN STANDARD

**EN IEC 60404-12**

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2023

ICS 29.030; 17.220.01

English Version

**Magnetic materials - Part 12: Methods of test for the assessment  
of the thermal endurance of surface insulation coatings on  
electrical steel strip and sheet  
(IEC 60404-12:2023)**

Matériaux magnétiques - Partie 12: Méthodes d'essai pour  
l'évaluation de l'endurance thermique des revêtements  
isolants superficiels des bandes et tôles en acier électrique  
(IEC 60404-12:2023)

Magnetische Werkstoffe - Teil 12: Prüfverfahren zur  
Bewertung der thermischen Beständigkeit von  
Oberflächenisolierbeschichtungen auf Elektroband und -  
blech  
(IEC 60404-12:2023)

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**EN IEC 60404-12:2023 (E)****European foreword**

The text of document 68/698/CDV, future edition 2 of IEC 60404-12, prepared by IEC/TC 68 "Magnetic alloys and steels" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60404-12:2023.

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IEC 60216-1 NOTE Approved as EN 60216-1



IEC 60404-12

Edition 2.0 2023-02

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Magnetic materials –**

**Part 12: Methods of test for the assessment of the thermal endurance of surface insulation coatings on electrical steel strip and sheet**

**Matériaux magnétiques –**

**Partie 12: Méthodes d'essai pour l'évaluation de l'endurance thermique des revêtements isolants superficiels des bandes et tôles en acier électrique**



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IEC 60404-12

Edition 2.0 2023-02

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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## **Magnetic materials –**

**Part 12: Methods of test for the assessment of the thermal endurance of surface insulation coatings on electrical steel strip and sheet**

## **Matériaux magnétiques –**

**Partie 12: Méthodes d'essai pour l'évaluation de l'endurance thermique des revêtements isolants superficiels des bandes et tôles en acier électrique**

INTERNATIONAL  
ELECTROTECHNICAL  
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INTERNATIONALE

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ICS 17.220.01; 29.030

ISBN 978-2-8322-6445-4

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## CONTENTS

FOREWORD.....	3
INTRODUCTION .....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 General principles .....	7
4.1 General.....	7
4.2 Preparation of clamped stacks of test specimens .....	7
4.2.1 Procedure of stacking test specimens.....	7
4.2.2 Clamping stacks for temperature ratings up to 500 °C .....	7
4.2.3 Clamping stacks for temperature ratings above 500 °C.....	8
4.3 Heat treatment.....	8
4.3.1 For time ratings up to 2 500 h.....	8
4.3.2 For continuous exposure .....	9
5 Standard temperature/time performance designations <i>T/t</i> .....	9
6 Method of the test for adhesion .....	9
6.1 General.....	9
6.2 Test specimens.....	9
6.3 Procedure of test .....	9
6.4 Test report .....	10
7 Method of the test for surface insulation resistance .....	10
7.1 General.....	10
7.2 Test specimens.....	10
7.3 Procedure of test .....	10
7.4 Test report .....	11
8 Method of the test for stacking factor.....	11
8.1 General.....	11
8.2 Test specimen .....	11
8.3 Procedure of test .....	11
8.4 Test report .....	11
Annex A (informative) Method of test for the assessment of the thermal endurance for continuous exposure to elevated temperatures .....	12
A.1 General.....	12
A.2 Procedure of test .....	12
A.3 Temperature/time performance designations <i>T/t</i> for continuous exposure .....	12
Bibliography.....	13
Figure 1 – Example of clamped stack for 100 mm square test specimens .....	8

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IEC 60404-12 has been prepared by IEC technical committee 68: Magnetic alloys and steels. It is an International Standard.

This second edition cancels and replaces the first edition published in 1992. This edition constitutes a technical revision.

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

- a) the method of test for adhesion has been modified to match to the method of bend test specified in ISO 1519 using a cylindrical mandrel of 32 mm in diameter instead of the 30 mm diameter mandrel specified in the first edition;
- b) the method of test for interlaminar insulation resistance has been modified to match to the method specified in IEC 60404-11 and the modified Franklin test has been removed;
- c) the method of test for compressibility has been modified to match to the method of test for stacking factor specified in IEC 60404-13;



- d) the concept of "resistance grades" has been removed;
- e) the clamping pressure to be used at temperature ratings above 500 °C has been reduced to  $(0,01 \pm 0,001)$  N/mm<sup>2</sup>;
- f) the testing for continuous exposure has been made a subject to an agreement between the manufacturer and the purchaser and the procedure has been moved to an informative Annex A.

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

Draft	Report on voting
68/698/CDV	68/720/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).

A list of all parts in the IEC 60404 series, published under the general title *Magnetic materials*, can be found on the IEC website.

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

## INTRODUCTION

The surface insulation coatings on electrical steel strip and sheet are sometimes exposed to elevated temperatures in service or during processing by the purchaser. Therefore, the thermal endurance of the surface insulation coating is important.

Physicochemical models postulated for the aging processes lead to the almost universal assumption of the Arrhenius equations to describe the rate of aging (see Annex A of this document and IEC 60216-1).

Since the measurement of the properties of surface insulation coatings at elevated temperatures is expensive and time-consuming, the thermal endurance of a coating is usually assessed by evaluating the change of a specified coating property, at an ambient temperature, due to a heat treatment.

## MAGNETIC MATERIALS –

### Part 12: Methods of test for the assessment of the thermal endurance of surface insulation coatings on electrical steel strip and sheet

#### 1 Scope

This part of IEC 60404 is applicable to surface insulation coatings on electrical steel strip and sheet classified in IEC 60404-1-1.

This document defines the general principles and technical details of the tests for the assessment of the thermal endurance of surface insulation coatings on electrical steel strip and sheet.

The assessment is made by evaluating the change of a specified property of the surface insulation coating due to a heat treatment at a specified temperature up to 850 °C for a specified duration time up to 2 500 h. The specified property is measured at an ambient temperature of  $(23 \pm 5)$  °C both without heat treatment and after heat treatment.

This document is applicable to the following properties of surface insulation coatings:

- adhesion;
- surface insulation resistance;
- stacking factor.

This document is not applicable to other properties of surface insulation coatings, e.g. welding properties, or to other effects, e.g. discoloration and off-gassing, which can be caused by exposure to elevated temperatures.

NOTE Some of the tests take a very long time to perform and therefore they are often not appropriate for acceptance tests of material supplied on a specific order.

#### 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 60404-1-1, *Magnetic materials – Part 1-1: Classification – Surface insulations of electrical steel sheet, strip and laminations*

IEC 60404-11, *Magnetic materials – Part 11: Methods of measurement of the surface insulation resistance of electrical steel strip and sheet*

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

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– 7 –

ISO 1519, *Paints and varnishes – Bend test (cylindrical mandrel)*

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