



SLOVENSKI STANDARD
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Cold rolled electrical non-alloyed steel sheet and strip delivered in the semi-processed state

Kaltgewalztes Elektroblech und -band aus unlegierten Stählen im nicht schlußgeglühten Zustand

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Tôles magnétiques en acier non allié laminées a froid et livrées a l'état semi-fini

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EUROPEAN STANDARD

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English version

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This European Standard was approved by CEN on 1995-11-23. CEN 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 Central Secretariat or to any CEN member.

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CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword.....	3
Introduction	4
1 Scope	4
2 Normatives references	4
3 Definitions	5
4 Classification	5
5 Designation	5
6 General requirements.....	6
6.1 Production process.....	6
6.2 Form of supply.....	6
6.3 Delivery condition	6
6.4 Surface condition	6
6.5 Suitability for cutting	7
7 Technical requirements.....	7
7.1 Magnetic properties.....	7
7.2 Geometric characteristics and tolerances.....	8
7.3 Technological characteristics	10
8 Inspection and testing.....	10
8.1 General	10
8.2 Selection of samples	10
8.3 Preparation of test specimens	10
8.4 Test methods.....	11
8.5 Retests	12
9 Marking, labelling and packaging.....	12
10 Complaints	12
11 Information to be supplied by the purchaser.....	12
Annex A (informative) Non-specified magnetic properties.....	15



Foreword

This European Standard has been prepared by the Technical Committee ECISS/TC 24 "Electrical steel and strip qualities - Qualities, dimensions, tolerances and specific tests" of which the secretariat is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 1996, and conflicting national standards shall be withdrawn at the latest by June 1996.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

As the final annealing of cold-rolled magnetic non alloyed steel sheet and strip delivered in the semi-processed state is the responsibility of the purchaser, attention is drawn to the importance of this treatment for the properties of the material.

For this reason, the magnetic properties in Table 2 are given for a reference condition (see 7.1.1) obtained by suitable heat treatment. To ensure that the properties in use are equivalent to those specified, it is important that the industrial treatment carried out by the user is equivalent to that used to define the reference condition (see 7.1.1).

1 Scope

This European Standard defines the grades of cold-rolled electrical non-oriented non-alloyed¹⁾ steel sheet and strip delivered in the semi-processed condition, that is without final heat treatment, of 0,50 mm and 0,65 mm nominal thickness. It specifies general requirements, the magnetic properties, the geometric characteristics and tolerances, technological characteristics as well as the inspection procedure.

This European Standard applies to material intended for the construction of magnetic circuits. These magnetic materials corresponds to Clause B2 of IEC 404-1.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

IEC 50 (121)	International Electrotechnical Vocabulary (IEV) - Chapter 121 : Electromagnetism
IEC 50 (221)	International Electrotechnical Vocabulary (IEV) - Chapter 221 : Magnetic materials and components
IEC 404-2	Magnetic materials - Part 2 : Methods of measurement of magnetic, electrical and physical properties of magnetic sheet and strip
IEC 404-3	Magnetic materials - Part 3 : Methods of measurement of the magnetic properties of magnetic sheet and strip by means of a single sheet tester
EN 10020	Definition and classification of grades of steel
EN 10021	General technical delivery requirements for steel and steel products
EN 10027-1	Designation systems for steel - Part 1 : Steel name principal symbols
EN 10027-2	Designation systems for steel - Part 2 : Numerical system
EN 10204	Metallic products - Types of inspection documents

¹⁾ Non-alloyed steel is that steel the basic constituent of which is iron containing alloying elements in amounts smaller than the values fixed by EN 10020.

- EN 10251 **Magnetic materials - Methods of determination of the geometrical characteristics of magnetic steel sheet and strip**
- EURONORM 118 ²⁾ **Methods for determination of magnetic characteristics of magnetic sheets by means of the 25 cm Epstein frame.**

3 Definitions

The definitions of the principal terms relative to magnetic properties employed in this European Standard are given in IEC 50 (121) and IEC 50 (221).

In addition, for the purposes of this European Standard, the following definitions apply :

- 3.1 edge camber :** The greatest distance between a longitudinal edge of a length of strip and the line joining the two extremities of the measured length of this edge.
- 3.2 flatness :** The property of a sheet or a length of strip which is characterized by the wave factor i.e. by the relation of the height of the wave to its length.
- 3.3 residual curvature :** The permanent curvature in the direction of rolling present in the coil in the delivery condition.

4 Classification

The grades covered by this European Standard are classified according to the value of the maximum specific total loss in watts per kilogramme at 1,5 T, and according to the nominal thickness of the material (0,50 mm or 0,65 mm).

5 Designation

SIST EN 10126:1997

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5.1 For the steel grades covered by this European Standard, the steel names are allocated in accordance with EN 10027-1 ; the steel numbers are allocated in accordance with EN 10027-2.

5.2 The steel name comprises the following in the order given:

- 1) the letter M for electrical steel,
- 2) one hundred times the specified value of maximum specific total loss at 1.5 T and 50 Hz in watts per kilogram and corresponding to the nominal product thickness ,
- 3) one hundred times the nominal thickness of the material, in millimetres,
- 4) the characteristic letter D for unalloyed electrical sheet or strip delivered in the semi-processed state.

EXAMPLE : M660-50D for electrical unalloyed steel sheet or strip with a maximum specific total loss at 1,5 T of 6,60 W/kg at 50 Hz and a nominal thickness of 0,50 mm, supplied in a semi-processed state.

²⁾ Until this EURONORM is transformed into European Standard, it can either be implemented or reference made to the corresponding national standards.

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

The mass of bundles of sheets or of coils shall be agreed at the time of ordering.

The most usual values for the internal diameter of coils are approximately 500 mm and 600 mm. The recommended value is approximately 500 mm. The external diameter shall be the subject of agreement when ordering.

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

Strip shall be of constant width and wound in such a way that the edges are superimposed in a regular manner and that 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 can occasionally exhibit welds or interleaves resulting from the removal of defective zones, subject to prior agreement between the parties. If necessary, marking of welds or interleaves may be agreed at the time of ordering.

For coils containing 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 material.

6.3 Delivery condition

Material supplied with trimmed edges shall not have any burrs which will adversely affect its further application or use.

As a result of the method of manufacture and delivery in the form of coils, material may, in the delivery condition, exhibit residual curvature in the rolling direction as well as certain internal stresses. Precautions shall be taken by the user to reduce or eliminate the effect of these factors on the application or use of the material.

The material is usually supplied without an insulating coating.

6.4 Surface condition

The surfaces shall be uniform and clean. Dispersed defects such as scratches, blisters, cracks, etc, are permitted if they are within the limits of tolerance on thickness and if they are not detrimental to the correct use of the supplied material.

The surface condition and in particular the roughness of the material can be the subject of agreement when ordering.

6.5 Suitability for cutting

The material shall be able to be cut or punched without causing premature wear of tools ; it shall be able to be cut at any point and in the usual shapes, thus ensuring accurate working with correct cutting tools. If there are special requirements with regard to a suitability test for punching or cutting, these shall be established by agreement between manufacturer and purchaser.

7 Technical requirements

7.1 Magnetic properties

7.1.1 Reference condition

The magnetic properties (magnetic polarization and specific total loss) only apply to test specimens in the reference condition which is obtained by the following heat treatment.

Test strips shall be subjected to a heat treatment in a decarburizing atmosphere at $790\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ and shall be maintained for 2 h at this temperature. The heating rate shall not exceed $200\text{ }^{\circ}\text{C}/\text{h}$. The cooling rate from $790\text{ }^{\circ}\text{C}$ to $550\text{ }^{\circ}\text{C}$ shall not exceed $120\text{ }^{\circ}\text{C}/\text{h}$. The gas necessary for decarburization shall consist of 20 vol. % H_2 , 80 vol. % N_2 , with water vapour, the dew-point being $+ 35\text{ }^{\circ}\text{C}$ at atmospheric pressure.

The establishment of the decarburizing atmosphere requires the removal of air from the annealing furnace before raising the temperature. This removal is effected by continuously purging the furnace with an inert protective gas. The flow and pressure of the decarburizing gas shall be regulated to ensure good decarburization at any point on the test specimen and a complete renewal of the atmosphere in the furnace several times during the heat treatment.

SIST EN 10126:1997

It is desirable that the test strips do not have any contact with each other.

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7.1.2 Magnetic polarization

The minimum specified values for the magnetic polarization for magnetic field strengths H of 2 500 A/m, 5 000 A/m and 10 000 A/m shall be as given in table 2.

The magnetic polarization shall be determined in an alternating magnetic field (expressed as a peak value) at 50 Hz.

7.1.3 Specific total loss

The specified values of maximum specific total loss in watts per kilogram shall be as given in table 2.

The values of specific total loss are specified for a magnetic polarization of 1,5 T.

The test shall be made in an alternating magnetic field at 50 Hz.

Annex A gives for guidance only, the maximum specific total loss for a magnetic polarization of 1,0 T at 50 Hz and for a magnetic polarization of 1,5 T at 60 Hz.

7.1.4 Anisotropy of loss and magnetizing field

The anisotropy of loss and of magnetizing field can be the subject of special agreement between the parties when ordering.