



SLOVENSKI STANDARD

SIST EN 10331:2003

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Magnetni materiali – Specifikacija za sintrane mehkomagnetne materiale

Magnetic materials - Specification for sintered soft magnetic materials

Magnetische Werkstoffe - Anforderungen an weichmagnetische Sintermetalle

Matériaux magnétiques - Spécification des matériaux magnétiques doux frittés

Ta slovenski standard je istoveten z: **EN 10331:2003**

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Magnetni materiali

Magnetic materials

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EUROPEAN STANDARD

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English version

Magnetic materials - Specification for sintered soft magnetic materials

Matériaux magnétiques - Spécification des matériaux magnétiques doux frittés

Magnetische Werkstoffe - Anforderungen an weichmagnetische Sintermetalle

This European Standard was approved by CEN on 21 February 2003.

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 Management Centre or to any CEN 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 CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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

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Foreword

This document (EN 10331:2003) has been prepared by Technical Committee ECISS/TC 24, "Electrical steel sheet and strip qualities - Qualities dimensions, tolerances and specific tests", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This document is equivalent to IEC 60404-8-9.

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

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EN 10331:2003 (E)**1 Scope**

This European Standard specifies some magnetic and mechanical properties of sintered soft magnetic metals which are used for components made by a powder metallurgical process only.

This standard does not apply to magnetically soft castings or to semi-finished products.

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 of these 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 (including amendments).

prEN 10281, *Magnetic materials – Methods of measurement of the magnetic properties of isotropic nickel-iron soft magnetic alloys, types E1, E3 and E4.*

EN 24498-1, *Sintered metal materials, excluding hardmetals - Determination of apparent hardness - Part 1: Materials of essentially uniform section hardness (ISO 4498-1:1990)*

IEC 60050-121:1998, *International Electrotechnical Vocabulary (IEV) – Chapter 121: Electromagnetism.*

IEC 60050-221:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 221: Magnetic materials and components.*

EN ISO 2738, *Sintered metal materials, excluding hardmetals - Permeable sintered metal materials – Determination of density, oil content and open porosity (ISO 2738:1999).*

ISO 3369, *Impermeable sintered metal materials and hardmetals – Determination of density.*

ISO 4498-2, *Sintered metal materials, excluding hardmetals – Determination of apparent hardness – Part 2: Case-hardened ferrous materials, surface enriched by carbon or carbon and nitrogen*

ISO 5755, *Sintered metal materials – Specifications.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in IEC 60050-121:1998 and IEC 60050-221:1990, and the following apply:

3.1**sintered density, ρ_s**

quotient of mass m and volume V of the sintered structural part (including pores) :

$$\rho_s = \frac{m}{V} \quad (1)$$

NOTE The sintered density ρ_s , given in equation (1) in grammes per cubic centimetres, is calculated from m in grammes and V in cubic centimetres.

3.2**porosity, P_s**

content of pores relative to the total volume of the part in volume per cent

NOTE 1 Porosity of the sintered metal with the sintered density is calculated as follows:

$$P_s = (1 - \rho_s / \rho) \times 100 \% \quad (2)$$

Where

ρ is the density of the solid (theoretical density) of the same composition.

NOTE 2 The porosity P_s of a sintered metal consists of open, interconnected and closed pores. In the case of high sintered densities (corresponding to a porosity of approximately 6 %) isolated (closed) pores become predominant.

4 Symbols

For the purposes of this standard, the following symbols apply:

H Magnetic field strength;

J Magnetic polarization;

P_s Porosity;

ρ_s Sintered density.

5 General requirements

5.1 Manufacturing process

The magnetically soft structural parts defined by this standard are manufactured by a powder metallurgical process. Unless otherwise agreed, the manufacturing process is left to the discretion of the manufacturer.

5.2 State of delivery

Unless otherwise agreed, the products are delivered in the finally annealed state.

5.3 Properties

The maximum values of coercivity and the minimum values of sintered density shall be as given in Table 1. Table 2 includes typical values for additional properties.

Values of the other properties of components, such as mechanical strength and surface finish (including protection against corrosion), can be agreed upon between manufacturer and purchaser.

5.4 Chemical composition

Data relating to the typical content of characteristic alloying elements of sintered metals are given in Table 2. The values of chemical composition are not specified for acceptance.

5.5 Dimensions

The permissible dimensional values of components and their tolerances form an integral part of the agreement between manufacturer and purchaser.

6 Measurements

6.1 Scope of test and sampling

For the purpose of delivery the scope of tests and the method of sampling to verify the properties shall be agreed when the order is placed.

EN 10331:2003 (E)**6.2 Determination of magnetic properties****6.2.1 General**

It shall be ensured that specimen is in the finally annealed state and not in the cold worked state. The values given in this standard are specified for ring-shaped samples.

Magnetic properties measured on components may be different due to geometry or to test method.

NOTE If required these properties may be subject to agreement between manufacturer and purchaser.

6.2.2 Method for the determination of coercivity

Coercivity as specified in Table 1 shall be measured in accordance with prEN 10281. EN 10330 may be used for other shapes.

6.2.3 Method for the determination of magnetic polarization

The typical values as given in Table 2 have been determined on ring-shaped samples. Other samples (for example strips or rods) may lead to different results.

The test method is described in prEN 10281.

6.3 Determination of density

For the determination of density, the components shall be weighed and their volume determined on the basis of geometric dimensions or by means of the immersion method in accordance with EN ISO 2738 or ISO 3369.

6.4 Determination of hardness

Hardness of the components, as given in Table 2, is determined according to the Vickers method in accordance with EN 24498-1 and ISO 4498-2. The Brinell method in accordance with EN ISO 6506-1 may also be used.

7 Classification

The materials covered by this standard are classified according to the maximum value of their coercivity.

8 Designation

The conventional designation of the different grades comprises the following in the order given :

- 1) the identification letter S (sintered metal) ;
- 2) a dash ;
- 3) letters characterising the alloying elements (Fe = plain iron, FeP = phosphorous iron alloys, FeSi = silicon iron alloys, FeNi = nickel iron alloys, FeCo = cobalt iron alloys) ;
- 4) a code number equal to the maximum value of coercivity, corresponding to Table 1. In this Table, reference is also made to corresponding material defined in ISO 5755.

9 Ordering information

For materials to comply adequately with the requirements of this standard, the purchaser shall include the following information in his enquiry or order:

- a) nature of the product and the designation of the material in accordance with clause 8 ;
- b) where applicable, its dimensions (see 5.5) ;
- c) quantity required ;
- d) scope of tests and method of sampling (see 6.1) ;
- e) following additional requirements shall be specified at the time of enquiry and order. If nothing is specified the manufacturer shall assume that there are no particular requirements on these points :
- other properties (see 5.3) ;
 - other shapes of test specimen (see 6.2) ;
 - other methods of test (see 6.2.3).

Table 1 — Minimum sintered densities and maximum coercivities

Material symbolic designation	Material designation according to ISO 5755	Density ρ_s g/cm ³ min.	Coercivity H_c A/m max.
S-Fe-175	P 1024 Z	6,4	175
S-Fe-170	P 1025 Z	6,8	170
S-Fe-165	-	7,1	165
S-Fe-150 ^a	-	7,3	150
S-FeP-150	-	6,8	150
S-FeP-130	-	7,1	130
S-FeP-110 ^a	-	7,3	110
S-FeSi-80	-	7,2	80
S-FeSi-50	-	7,4	50
S-FeNi-20	-	7,6	20
S-FeNi-15	-	7,9	15
S-FeNi-8	-	8,3	8
S-FeCo-100	-	7,7	100
S-FeCo-200	-	7,7	200

^a With special precautions in the processing a lower coercivity is possible :
100 A/m for S-Fe-150 and 60 A/m for S-FeP-110.