
British Standard

Magnetic materials

Part 8. Individual materials

Section 8.5 Specification for steel sheet and strip with
specified mechanical properties and magnetic permeability

Matériaux magnétiques
Partie 8. Matériaux particuliers
Section 8. 5 Tôles et bandes en acier à caractéristiques
mécaniques et perméabilité magnétique garanties

Magnetische Werkstoffe
Teil 8. Einzelwerkstoffe
Abschnitt 8.5 Stahlblech und Bandstahl mit vorgeschriebenen
mechanischen Eigenschaften und vorgeschriebener magnetischer
Permeabilität

National foreword

This Section of BS 6404 : Part 8 has been prepared under the direction of the Iron and Steel and Non-ferrous Metals Standards Policy Committees. It is identical with IEC Publication 404-8-5 : 1989 'Magnetic materials : Part 8 : Specifications for individual materials : Section Five – Specification for steel sheet and strip with specified mechanical properties and magnetic permeability', published by the International Electrotechnical Commission (IEC).

High-permeability steel with mechanical properties was previously the subject of BS 601 : Part 3. With the publication of this Section of BS 6404 : Part 8, BS 601 : Part 3 is superseded and withdrawn.

The following Parts of BS 6404 have been published or will shortly be published:

- Part 1. Classification
- Part 2. Methods of measurement of magnetic, electrical and physical properties of magnetic sheet and strip
- Part 3. Methods of measurement of specific total losses of magnetic sheet and strip by means of a single sheet tester
- Part 4. Methods of measurement of the d.c. magnetic properties of solid steels
- Part 5. Methods of measurement of the magnetic properties of magnetically hard (permanent magnet) materials
- Part 6. Methods of measurement of the magnetic properties of isotropic nickel-iron soft magnetic alloys, types E1, E3 and E4
- Part 7. Method of measurement of the coercivity of magnetic materials in an open magnetic circuit
- Part 8. Individual materials
 - Section 8.1 Specification for magnetically hard materials
 - Section 8.2 Specification for cold-rolled, magnetic, non-oriented, alloyed steel strip delivered in the semi-processed state
 - Section 8.3 Specification for cold-rolled, magnetic, non-oriented, non-alloyed steel strip delivered in the semi-processed state
 - Section 8.4 Specification for cold-rolled, non-oriented magnetic steel sheet and strip delivered in the finally annealed state
 - Section 8.6 Specification for soft magnetic metallic materials
 - Section 8.7 Specification for grain-oriented magnetic steel sheet and strip
- Part 9. Methods for determination of the geometrical characteristics of magnetic steel sheet and strip
- Part 10. Methods of measurement of magnetic properties of magnetic steel sheet and strip at medium frequencies

Additional Parts and Sections of IEC Publication 404 will be published and are expected to provide a basis for additional Parts of BS 6404.

Cross-references

International standard	Corresponding British Standard
IEC 50 (901) : 1973	BS 4727 Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms Part 1 Terms common to power, telecommunications and electronics Group 07 : 1973 Magnetism terminology
IEC 404-1 : 1979	BS 6404 Magnetic materials Part 1 : 1984 Classification (Technically equivalent)
IEC 404-2 : 1978	Part 2 : 1985 Methods of measurements of magnetic, electrical and physical properties of magnetic sheet and strip (Technically equivalent)
IEC 404-4 : 1982	Part 4 : 1986 Methods of measurement of the d.c. magnetic properties of solid steels (Identical)
ISO 404 : 1981	BS 3894 Method for converting elongation values for steel Part 1 : 1965 Carbon and low alloy steels

The Technical Committee has reviewed the provisions of ISO 6892, to which reference is made in the text, and has decided it is acceptable for use in conjunction with this standard.

A related British Standard for ISO 6892 is BS 18 'Method for tensile testing of metals (including aerospace materials)'

Compliance with a British Standard does not of itself confer any immunity from legal obligations.

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MAGNETIC MATERIALS

Part 8: Specifications for individual materials Section Five – Specification for steel sheet and strip with specified mechanical properties and magnetic permeability

1. Scope and field of application

This standard defines the grades of steel sheet and strip with specified mechanical properties and magnetic permeability. In particular it gives the technological, mechanical and magnetic properties, the dimensional tolerances as well as the conditions of acceptance.

This standard applies to material used for the poles and rims of rotating electrical machines.

These materials correspond to Clause D2 of IEC Publication 404-1.

2. References

The following publications are quoted in this standard:

IEC Publication 50 (901) (1973): International Electrotechnical Vocabulary (IEV), Chapter 901: Magnetism.

IEC Publication 404-1 (1979): Magnetic materials, Part 1: Classification.

IEC Publication 404-2 (1978): Part 2: Methods of measurement of magnetic, electrical and physical properties of magnetic sheet and strip.

IEC Publication 404-4 (1982): Part 4: Methods of measurement of the d.c. magnetic properties of solid steels.

ISO Standard 404 (1981): Steel and steel products – General technical delivery requirements.

ISO Standard 2566-1 (1984): Steel – Conversion of elongation values – Part 1: Carbon and low alloy steels.

ISO Standard 6892 (1984): Metallic materials – Tensile testing.

3. Definitions

The definitions of the principal terms relative to magnetic characteristics employed in this standard are given in IEC Publication 50 (901).

In addition for the purpose of this standard, the following definitions apply:

3.1 Flatness

3.1.1 In the case of a sheet, the flatness is characterized by the maximum height of any point of the sheet above a flat horizontal surface, the sheet resting freely on this surface.

3.1.2 In the case of a coil, the flatness is characterized by the wave factor which is the relation of the height of the wave to its length.

3.2 Edge camber

Edge camber is characterized by the greatest distance between a longitudinal edge of the sheet and the line joining the two extremities of the measured length of this edge.

4. Classification

The grades covered by this standard are classified according to the minimum value of the 0.2% proof stress in newtons per square millimetre* and according to the minimum value of the magnetic flux density for a magnetic field strength of 15 kA/m.

The grades are classified in two groups according to their manufacturing process: hot-rolled materials and cold-rolled materials.

5. Designation

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

- 1) the specified minimum value of the 0.2% proof stress of the material in newtons per square millimetre;
- 2) one hundred times the nominal thickness of the product in millimetres;
- 3) the characteristic letters: TF for the cold-rolled material and TG for the hot-rolled material;
- 4) one hundred times the specified minimum value of the magnetic flux density in Teslas for a magnetic field strength of 15 kA/m.

Example: 350–100 – TF 181 for a cold-rolled material with a minimum magnetic flux density of 1.81 T for a magnetic field strength of 15 kA/m, a specified minimum 0.2% proof stress of 350 N/mm², and a nominal thickness of 1.0 mm.

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 sheets which make up each bundle shall be stacked so that their edges are superimposed in a regular manner.

The strip shall be of constant width, and wound in such a way that the edges are superimposed in a regular manner and the end faces of the coil are substantially flat.

The coils shall be sufficiently tightly wound that they do not collapse under their own weight.

The coils may occasionally exhibit welds or interleaves resulting from the junction made after removal of defective zones or from the joining of several lengths to obtain the sizes of the coils required by the user. In the absence of prior agreement, the form of repair is left to the discretion of the manufacturer. The welds or interleaves shall be marked.

For coils containing repair welds or interleaves, each part of the strip shall be of the same quality. The edges of parts welded together shall not be so much out of alignment that their ability to be worked is affected.

*1 N/mm² = 1 MPa.

Material supplied in sheets shall not contain any welds.

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

6.3 *Delivery condition*

The materials are normally supplied without an insulating coating. By agreement, the materials can be supplied with an insulating coating on one or both sides. In this case, the nature of the insulating coating, its properties and their verification shall be subject to special agreement when ordering.

Materials produced by hot-rolling are normally supplied with an oxide scale coating unless they have been ordered pickled.

By agreement, the products can be supplied lightly coated with oil.

Coils supplied with trimmed edges and sheets shall not contain burrs or cutting distortions which are prejudicial to the method of working of the material.

6.4 *Surface condition*

Unless indicated otherwise, the surfaces shall be smooth and clean, free from grease and rust as well as all other defects such as scratches, blisters, cracks etc. (see Clause 10). However, dispersed defects can be tolerated if they are within the tolerance limits for thickness and if they are not detrimental to the correct use of the finished product.

6.5 *Suitability for cutting*

The material shall be capable of being 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 precise working with appropriate tools in good condition. If there are special requirements for an acceptance test for punching or shearing, these shall be established between the supplier and the purchaser.

6.6 *Suitability for welding*

The suitability for welding of the material can be the subject of agreement when ordering.

7. **Technical requirements**

7.1 *Mechanical properties*

The minimum specified values of the 0.2% proof stress ($R_{p0.2}$), of the tensile strength (R_m) and of the percentage elongation after fracture (A_{80mm}) are given in Tables I and II.

7.2 *Magnetic properties*

The minimum specified values for the magnetic flux density for magnetic field strengths of 5 000 and 15 000 A/m are given in Tables I and II.

7.3 *Geometrical characteristics and tolerances*

7.3.1 *Thickness*

The recommended nominal thicknesses are the following:

- *hot-rolled materials*: 1.6 mm, 1.8 mm, 2.0 mm, 2.5 mm, 3.0 mm, 3.2 mm and 4.5 mm;
- *cold-rolled materials*: 0.5 mm, 1.0 mm, 1.6 mm, 1.8 mm et 2.0 mm.