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(JEMA/JSA)

**Cold-rolled grain-oriented electrical steel
strip and sheet delivered in the fully-
processed state**

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In the event of any doubts arising as to the contents,
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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 2553:2012** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Cold-rolled grain-oriented electrical steel strip and sheet delivered in the fully-processed state

Introduction

This Japanese Industrial Standard has been prepared based on **IEC 60404-8-7 : 2017**, Edition 4, with some modifications of the technical contents to correspond to the mainstream technique in Japan.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JC. Annex JA and Annex JB are unique to **JIS** and not given in the corresponding International Standard.

1 Scope

This Standard defines the grades of cold-rolled grain-oriented electrical steel strip and sheet in nominal thicknesses of 0.23 mm, 0.27 mm, 0.30 mm and 0.35 mm, ~~having insulation coating on both surfaces~~. In particular, it gives general requirements, magnetic properties, geometrical characteristics and tolerances, technological characteristics, and inspection procedures.

This Standard applies to Goss textured grain-oriented electrical steel strip and sheet supplied in the final annealed condition in coils or sheets (hereafter referred to as steel strips), and intended for the construction of magnetic circuits.

This Standard covers the following three grades :

- conventional grades;
- high permeability grades;
- ~~— domain-refined grades.~~

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 60404-8-7 : 2017 *Magnetic materials — Part 8-7 : Specifications for individual materials — Cold-rolled grain-oriented electrical steel strip and sheet delivered in the fully-processed state* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS C 2550-1 *Test methods for electrical steel strip and sheet — Part 1 : Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of an Epstein frame*

NOTE Corresponding International Standard : 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*

JIS C 2550-2 *Test methods for electrical steel strip and sheet — Part 2 : Methods of determination of the geometrical characteristics of electrical steel strip and sheet*

NOTE Corresponding International Standard : IEC 60404-9 *Magnetic materials. Part 9 : Methods of determination of the geometrical characteristics of magnetic steel sheet and strip*

JIS C 2550-5 *Test methods for electrical steel strip and sheet — Part 5 : Methods of measurement of density, resistivity and stacking factor of electrical strip and sheet*

NOTE Corresponding International Standard : IEC 60404-13 *Magnetic materials — Part 13 : Methods of measurement of density, resistivity and stacking factor of electrical steel sheet and strip*

JIS C 2556 *Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester*

NOTE Corresponding International Standard : IEC 60404-3 *Magnetic materials — Part 3 : Methods of measurement of the magnetic properties of electrical steel strip and sheet by means of a single sheet tester*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS C 2550-1, and the following apply.

3.1

edge camber

greatest distance between a longitudinal edge of a length of steel strip and the line joining the two extremities of the measured length of this edge

NOTE See JIS C 2550-2.

3.2

edge wave

form of waves at the slit edge of steel strip, characterized by the wave factor

NOTE The edge wave shall be expressed as a percentage.

3.2A

wave factor

ratio of the height of wave to the wavelength

3.3

number of bends

number of alternate bends at 90° in opposite directions possible before the appearance of the first crack in the base metal detectable by the naked eye, the cracking noise, etc.

NOTE The number of bends constitutes an indication of the ductility of steel strip.

3.4

deviation from the shearing line due to internal stresses

greatest distance between the cut edges of a length of steel strips sheared in parallel to the rolling direction, when putting the cut edges together again

NOTE See JIS C 2550-2.

4 Classification

The grades covered by this Standard are classified as follows :

- nominal thickness (0.23 mm, 0.27 mm, 0.30 mm and 0.35 mm);
- maximum value of specific total loss $W_{17/50}$ in watts per kilogram (W/kg) at frequency of 50 Hz and maximum magnetic polarization 1.7 T;
- minimum value of magnetic polarization in tesla (T) at magnetic field strength of 800 A/m;
- application of magnetic domain-refinement process.

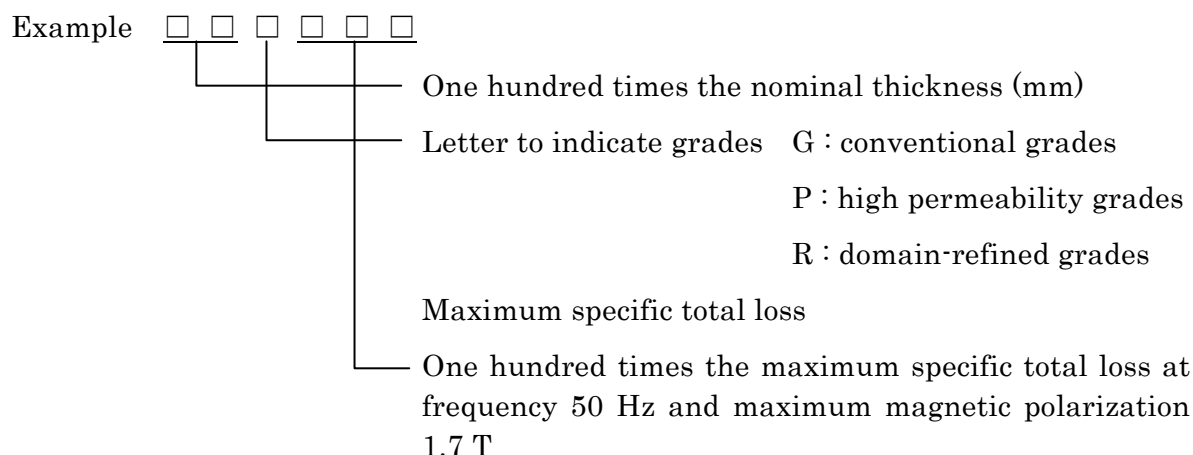
5 Designation of steel strips

The designation of steel strips shall be as given in Table 1, Table 2 and Table 2A.

The expression of designation shall be as follows :

- a) One hundred times the nominal thickness of steel strip in millimetres;
- b) Letter to indicate the grades;
 - G for conventional grades;
 - P for high permeability grades;
 - R for domain-refined grades;
- c) One hundred times the maximum specific total loss at 1.7 T and 50 Hz, expressed in W/kg.

An example of the expression of designation is shown below.



“23P090” denotes steel strips of high permeability grades with a maximum specific total loss of 0.90 W/kg or under at frequency 50 Hz and maximum magnetic polarization 1.7 T, and of nominal thickness of 0.23 mm.

NOTE : The designation specified in the corresponding International Standard is given in Annex JA.

6 General requirements

6.1 Production process

This Standard does not cover the production process and the chemical composition of steel strips.

6.2 Form of supply

The steel strips shall be supplied in coils in the case of strip, and in bundles in the case of sheets.

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

Usually one coil is made up of one steel strip. In the case where two or more strips are rolled up into one coil, the length of each strip shall be generally 200 m or longer.

The steel strips welded together may be regarded as one strip, if it is acceptable to the degree of no impediment in use.

The internal diameter of coils shall be between 500 mm and 520 mm, and approximately 508 mm is preferable.

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

Coils shall be of constant width and wound in such a manner 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.

Coils may exhibit welds or interleaves resulting from the removal of defective zones, if agreed between the purchaser and the manufacturer at the time of ordering. The marking on welds or interleaves shall be as agreed between the purchaser and the manufacturer.

For coils containing welds or interleaves, each part of the steel 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 steel strip.

Coils or bundles of sheets shall be packed so as not to be deformed or deteriorated during transportation and handling.

6.3 Delivery condition

The steel strips are usually supplied with an insulation coating on both sides. This coating generally consists of an EC-5-G coating on an EC-2 coating in accordance with JIS C 2557.

NOTE 1 This coating generally consists of a first coating of glass material composed of silicates of magnesium covered with a second coating of inorganic constituent such as phosphates, normally deposited at a flattening annealing operation. The insulation coating should bear the stress relief annealing recommended and specified by the manufacturer, have resistance to insulating varnish, transformer oil or machine oil, etc., and adhere tightly to the steel strip.

NOTE 2 Other coating may be used on special occasions.

6.4 Surface condition

The surfaces of steel strips shall be smooth and clean, free from grease and rust. Dispersed defects such as scratches, blisters, cracks and detachment of coating are permitted if they are within the tolerances on thickness specified in 7.2.1 and if they are not detrimental to the correct use. The tolerance limits for slightly abnormal parts such as welds shall be as agreed between the purchaser and the manufacturer.

The insulation coating present on the surface of steel strips shall be sufficiently adherent so that it does not become detached during cutting operations or heat treatment under conditions specified by the manufacturer.

Rust shall not be confused with some coloration of the insulation coating by the naked eye, which is inherent to the manufacturing process in the inspection.

If the steel strips are to be immersed in a fluid, an agreement between the purchaser and the manufacturer should be reached to ensure compatibility between the fluid and the coating.

6.5 Suitability for cutting

The steel strips shall be suitable for cutting accurately into the usual shapes at any point when appropriate cutting tools are used.

7 Technical properties and tolerances

7.1 Magnetic properties

7.1.1 General

The properties defined in 7.1.2 and 7.1.3 shall apply to the steel strips in the delivery conditions defined in 6.3 and those subjected to the ageing defined in 8.3.1.

The Epstein strips shall receive a stress relief heat treatment after cutting under conditions specified by the manufacturer.

The test specimens used in the single sheet test shall not be heat treated.

7.1.2 Magnetic polarization

The minimum value of peak magnetic polarization J_8 of 800 A/m at 50 Hz or 60 Hz shall be as given in Table 1, Table 2 and Table 2A.

7.1.3 Specific total loss

The maximum specific total loss at 50 Hz or 60 Hz shall be as given in Table 1, Table 2 and Table 2A.