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

ICS 29.030

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

This translation has been made based on the original Japanese Industrial Standard 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 : 2000** is replaced with this Standard.

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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 the third edition of IEC 60404-8-7 published in 2008 with some modifications of the technical contents to correspond to the mainstream technique in Japan.

The portions given continuous sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JB.

1 Scope

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

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

The grades are grouped into three classes:

- 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: 2008 *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)

The 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 sheet and strip by means of an Epstein frame* (MOD)

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* (MOD)

JIS C 2550-4 *Test methods for electrical steel strip and sheet—Part 4: Methods of test for the determination of surface insulation resistance of electrical strip and sheet*

NOTE : Corresponding International Standard: IEC 60404-11 *Magnetic materials—Part 11: Method of test for the determination of surface insulation resistance of magnetic sheet and strip* (MOD)

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* (MOD)

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

3 Terms and definitions

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

3.1 edge camber

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

NOTE : See **JIS C 2550-2**.

3.2 flatness

the property of a sheet or of a length of strip which is expressed by the wave factor in

percent, i.e. by the relation of the height of the wave to its length

NOTE : See JIS C 2550-2.

3.3 number of bends

number of alternate bends at 90° in opposite direction possible before the appearance of the first crack in the base metal detectable by the naked eye or hearing the cracking noise

NOTE : It constitutes an indication of the ductility of the material.

3.4 deviation from the shearing line due to internal stresses

greatest distance of cut edges in the longitudinal direction when putting on the cut edges of steel strip again

NOTE : See JIS C 2550-2.

4 Classification

The grades covered by this Standard are classified according to the nominal thickness of the material (0.23 mm, 0.27 mm, 0.30 mm and 0.35 mm), the value of maximum specific total loss $W_{17/50}$ in watts per kilogram at frequency of 50 Hz and the maximum magnetic flux density of 1.7 T and the value of minimum magnetic flux density B_8 in tesla (T) at magnetic field strength of 800 A/m and the application of magnetic domain refinement process.

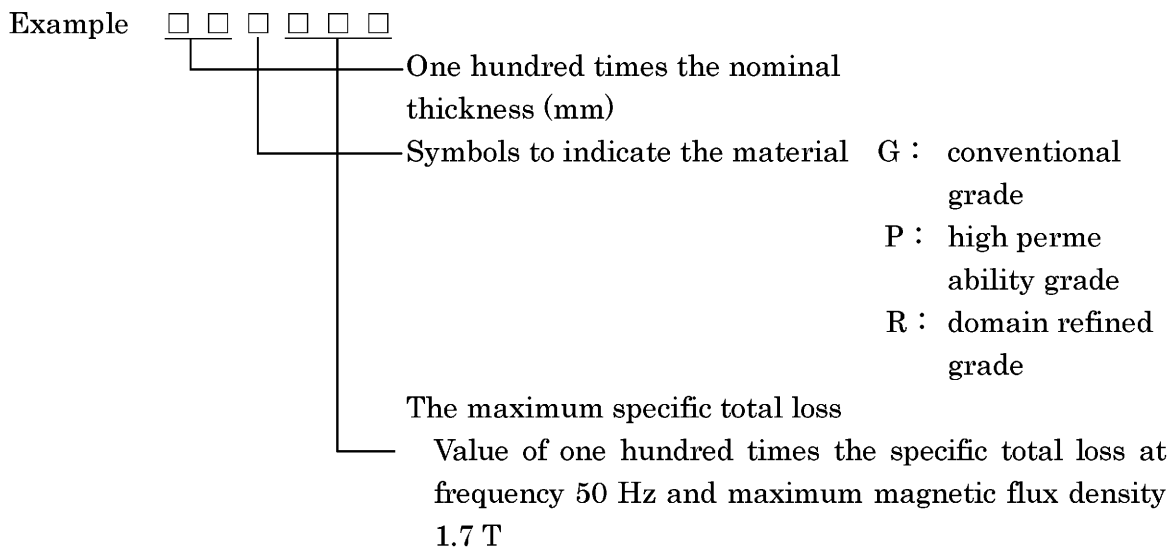
5 Designation of steel strips

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

The designation method shall be as follows.

- a) One hundred times the nominal thickness of the product in millimetres
- b) Symbol to indicate the material
 - 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

The example of designation shall be as follows.



23P090 denotes grain-oriented electrical steel strip of high permeability grade with a maximum specific total loss of 0.90 W/kg or under at frequency 50 Hz and maximum magnetic flux density 1.7 T, and nominal thickness of 0.23 mm.

NOTE : Steel symbols specified in the corresponding International Standard are given in Annex A.

Table 1 Steel name, specific total loss and magnetic flux density of conventional grades

Steel name	Nominal thickness	Density ^{a)}	Maximum specific total loss at 1.5 T ^{b)}		Maximum specific total loss at 1.7 T ^{b)}		Minimum magnetic flux density B_8 for $H=800$ A/m ^{c)}	Minimum stacking factor
			W/kg		W/kg			
	mm	kg/dm ³	$W_{15/50}$ 50 Hz	$W_{15/60}$ 60 Hz	$W_{17/50}$ 50 Hz	$W_{17/60}$ 60 Hz	T	
23G110	0.23	7.65	0.73	0.96	1.10	1.45	1.78	0.945
23G120			0.79	1.04	1.20	1.57	1.78	0.945
27G120	0.27		0.83	1.10	1.20	1.58	1.78	0.950
27G130			0.89	1.18	1.30	1.72	1.78	0.950
30G120	0.30		0.85	1.12	1.20	1.58	1.78	0.955
30G130			0.91	1.20	1.30	1.72	1.78	0.955
30G140			0.97	1.28	1.40	1.85	1.78	0.955
35G135	0.35		0.98	1.29	1.35	1.78	1.78	0.960
35G145			1.04	1.37	1.45	1.91	1.78	0.960
35G155			1.11	1.47	1.55	2.04	1.78	0.960

NOTE 1 The Epstein frame is used to determine the intrinsic magnetic flux density (magnetic polarization) for the material according to the following formula.

$$J = B - \mu_0 H$$

where, J : intrinsic magnetic flux density (magnetic polarization)
 B : magnetic flux density
 μ_0 : magnetic constant $4\pi \times 10^{-7}$ H/m
 H : magnetic field strength

NOTE 2 The difference between B and J at 800 A/m is equal to 0.001 T

Notes ^{a)} Density indicates the specified value used for the calculation of cross-section area of the test specimen.

^{b)} Numerators suffixed to W (15 or 17) indicate maximum magnetic flux density and denominators (50 or 60) indicate frequency.

^{c)} B_8 indicates the intrinsic magnetic flux density at magnetic field strength of 800 A/m.

Table 2 Steel name, specific total loss and magnetic flux density of high permeability grades

Steel name	Nominal thickness	Density ^{a)}	Maximum specific total loss at 1.7 T ^{b)}		Minimum magnetic flux density B_8 for $H=800$ A/m ^{c)}	Minimum stacking factor
			W/kg			
			$W_{17/50}$	$W_{17/60}$		
	mm	kg/dm ³	50 Hz	60 Hz	T	
<u>23P090</u>	0.23	7.65	0.90	1.19	1.85	0.945
<u>23P095</u>			0.95	1.25	1.85	0.945
<u>23P100</u>			1.00	1.32	1.85	0.945
<u>27P095</u>	0.27		0.95	1.25	1.88	0.950
<u>27P100</u>			1.00	1.32	1.88	0.950
<u>27P110</u>			1.10	1.45	1.85	0.950
<u>30P100</u>	0.30		1.00	1.33	1.88	0.955
<u>30P105</u>			1.05	1.39	1.88	0.955
<u>30P110</u>			1.10	1.46	1.88	0.955
<u>30P120</u>			1.20	1.58	1.85	0.955
<u>35P115</u>	0.35		1.15	1.52	1.88	0.960
<u>35P125</u>			1.25	1.65	1.88	0.960
<u>35P135</u>			1.35	1.78	1.88	0.960

Notes ^{a)} Density indicates the specified value used for the calculation of cross-section area of the test specimen.

^{b)} Numerators suffixed to W (17) indicate maximum magnetic flux density and denominators (50 or 60) indicate frequency.

^{c)} B_8 indicates the intrinsic magnetic flux density at magnetic field strength of 800 A/m.

Table 2A Steel name, specific total loss and magnetic flux density of domain-refined grades

Steel name	Nominal thickness	Density ^{a)}	Maximum specific total loss at 1.7 T ^{b)}		Minimum magnetic flux density B_8 for $H=800$ A/m ^{c)}	Minimum stacking factor
			W/kg			
	mm		kg/dm ³	$W_{17/50}$		
23R080	0.23	7.65	0.80	1.06	1.85	0.945
23R085			0.85	1.12	1.85	0.945
23R090			0.90	1.19	1.85	0.945
27R090	0.27		0.90	1.19	1.85	0.950
27R095			0.95	1.25	1.85	0.950

Notes ^{a)} Density indicates the specified value used for the calculation of cross-section area of the test specimen.

^{b)} Numerators suffixed to W (17) indicate maximum magnetic flux density and denominators (50 or 60) indicate frequency.

^{c)} B_8 indicates the intrinsic magnetic flux density at magnetic field strength of 800 A/m.