

BUREAU OF INDIAN STANDARDS

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Draft Indian Standard

**HOT-ROLLED AND COLD-ROLLED STEEL STRIPS INTENDED FOR PROCESSING
OF FULLY PROCESSED GRAIN ORIENTED ELECTRICAL STEEL —
SPECIFICATION**

ICS 77.140.50

Wrought Steel Products Sectional Committee,
MTD 04

Last date for receipt of comments:
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FOREWORD

(Formal clauses would be added later.)

Cold-rolled fully processed grain oriented steels have low total specific loss (core Loss) and high permeability in the direction of rolling which is achieved by appropriate downstream metallurgical processing. These steels are coated on both sides as part of its manufacturing process with an inorganic insulation which is necessary to attain the specified magnetic properties. These are used primarily in transformer cores operating at moderate to high induction at commercial power frequencies.

The pre-material for cold-rolled fully processed grain oriented steels are low carbon, silicon steel with a silicon contents of approximately 3.0 percent. The pre-material does not exhibit final electrical properties as defined in IS 3024. The pre-material can be as hot rolled coils or cold rolled material in semi-finished stage.

The Committee felt the need to formulate a standard on raw materials which are used to produce cold rolled fully processed grain oriented electrical steel. This standard specifies various steel grades of pre-material to produce cold rolled grain oriented electrical steel in fully processed condition.

The composition of the Committee responsible for the formulation of this standard is given in Annex A. *(to be added at later stage)*

For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO standard may also be followed as an alternate method.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Draft Indian Standard***HOT-ROLLED AND COLD-ROLLED STEEL STRIPS INTENDED
FOR PROCESSING OF FULLY PROCESSED GRAIN ORIENTED
ELECTRICAL STEEL — SPECIFICATION****1 SCOPE**

This standard covers the general technical conditions for steel strips intended for further processing to produce grain oriented electrical steel in fully processed condition.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards:

<i>IS No.</i>	<i>Title</i>
IS 228 (all parts)	Methods for chemical analysis of steels
IS 1956 (Part 4) : 2013	Glossary of terms related to iron and steel: Part 4 Steel sheet and strip (<i>second revision</i>)
IS 8910 : 2022/ ISO 404 : 2013	General technical delivery requirements for steel and steel products (<i>second revision</i>)
IS/ISO 16160 : 2012	Hot-rolled steel sheet products — Dimensional and shape tolerances (<i>first revision</i>)
IS 3024 :2015	Cold Rolled Grain Oriented Electrical Steel Strip and Sheet Delivered in Fully Processed State ⁷

3 TERMINOLOGY

3.1 For this standard, the definitions given in IS 1956 (Part 4) shall apply.

3.2 Electrical Steels — Unalloyed steels with requirements for magnetic or electrical properties (or) steels for sheets and strips containing only Si and/or Al as alloying element(s) and with requirements for magnetic losses and for the minimum values for magnetic induction only.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of hot-rolled/cold-rolled carbon steel sheet/strips shall conform to IS 8910.

4.2 Hot-rolled and cold-rolled steel strip shall be supplied in coil form either with mill edges or sheared (slit) edges as agreed to between the manufacturer and the purchaser.

4.3 The material may be supplied in any one of the following conditions as given in Table 1 subject to mutual agreement between the supplier and the purchaser.

4.4 The material shall be supplied as per the chemical composition given in Table 2.

5 DESIGNATION

There shall be five grades of steel as given in Table 1.

Table 1 Designation and Grades of Steel

(Clauses 4.3 and 5)

SI No.	Grade and Designation	
	Grade	Designation
(1)	(2)	(3)
i)	GO-HR	Hot Rolled Coil
ii)	GO-AP	Annealed Pickled Hot rolled coil
iii)	GO-FH	Full hard Coil
iv)	GO-MG	MgO Coated Coil
v)	GO-BA	Batch Annealed

6 MANUFACTURE

Unless otherwise agreed, strips shall be made from steel manufactured by any process of steel making at the discretion of the manufacturer or as mutually agreed between the purchaser and the supplier.

7 CHEMICAL COMPOSITION

7.1 Ladle analysis of the material, when carried out either by the method specified in the relevant parts of IS 228 or any other national/international standard for instrumental/chemical method shall be as given in Table 2.

7.2 In case of dispute the procedure given in the relevant part of IS 228 shall be the referee method.

7.3 Product Analysis

Permissible variation in case of product analysis from the limits specified in Table 2 shall be as given in Table 3.

8 FREEDOM FROM DEFECTS

The steel shall be free from segregation, laminations, surface flaws and other defects, which are detrimental to subsequent processing and ultimate use.

Table 2 Chemical Composition

(Clauses 4.4, 7.1 and 7.3)

SI No.	Grade	Designation	Constituent, Percent, <i>Max</i>					
			C	Si	S	P	Mn	Al
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	GO-HR	Hot Rolled Coil	0.09	≥2.5 to < 4.0	0.020	0.10	0.80	0.06
ii)	GO-AP	Annealed Pickled Hot rolled coil						
iii)	GO-FH	Full hard Coil						
iv)	GO-MG	MgO Coated Coil	0.01	≥2.5 to < 4.0	0.020	0.10	0.80	0.06
V	GO-BA	Batch Annealed						

NOTES

1 Composition is given in percent of weight.**2** Restricted chemistry may be mutually agreed between the purchaser and the manufacturer/supplier.**Table 3 Permissible Variation for Product Analysis**

(Clause 7.3)

SI No.	Constituent	Percentage Limit of Constituent	Variation Over the Specified Maximum or Under the Minimum Limits, Percent, <i>Max</i>
(1)	(2)	(3)	(4)
i)	Carbon	≤0.090	0.005
ii)	Manganese	≤0.80	0.040
iii)	Sulphur	≤ 0.020	0.005
iv)	Phosphorus	≤0.10	0.010
v)	Silicon	≥2.00 to ≤ 6.00	0.150
vi)	Aluminum	≤0.06	0.010

9 DIMENSIONS AND TOLERANCES (FOR HOT-ROLLED STEEL)

9.1 Unless otherwise agreed to between the supplier and the purchaser, standard dimensions of hot-rolled steel strip shall be as specified in IS 1730.

9.2 Unless otherwise agreed the thickness, tolerances shall be as per IS/ISO 16160.

9.3 Crown

Crown is the difference in strip thickness from centre to edge.

$$\text{Crown} = t_c - (t_1 + t_2)/2$$

where

t_c — thickness at center of the strip width; and

t_1 and t_2 — thicknesses measured at 40 mm inside of the two edges.

The crown of the hot-rolled mill edge steel strip meant for cold rolling shall be as follows:

For width up to and including 1100 mm: 100 μm , *Max*

For width above 1100 mm: 150 μm , *Max*

9.3.1 Any special tolerances to suit specific requirements shall be mutually agreed to between the manufacturer and the customer.

9.3.2 Typical thickness tolerance is given in the table below, however other agreements are possible between manufacturer and end user for GO-HR and GO-AP.

9.3.3 For Thickness tolerance, perpendicular to rolling direction, is valid for coil width > 200 mm and 40 mm from either edge.

Sl No.	Grade	Nominal Thickness mm		Tolerance on Thickness In mm	
		From	Up to and Including	Parallel to Rolling	Perpendicular to Rolling
(1)	(2)	(3)	(4)	(5)	(6)
i)	GO-HR	—	3	± 0.25	0.10
ii)	GO-AP	3	4	± 0.25	0.12
iii)	GO-FH GO-MG GO-BA	0.18	0.20	± 0.020	0.020
iv)		0.20	0.23	± 0.023	
v)		0.23	0.27	± 0.027	
vi)		0.27	0.35	± 0.030	

9.4 Permissible Width Variations

The permissible tolerance on the nominal width of hot-rolled strip shall conform to the requirements specified in IS/ISO 16160.

9.5 Edge Camber

The edge camber tolerance shall be agreed to between the supplier and the purchaser.

10 DELIVERY

The material in the form of strips shall be supplied in coils. The mass of the coil shall be as agreed to between the purchaser and the manufacturer/supplier.

11 PACKING

Material with suitable packing shall be provided by the manufacturer/supplier to prevent damages and deterioration in quality during storage, handling, and transport. The exact method of packing and weight of each packet shall be mutually agreed to between the purchaser and the supplier.

12 MARKING

12.1 Each strip/coil shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and the manufacturer's name or trademark or shall be legibly marked at top.

12.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.