भारतीय मानक **IS 18316 : 2023**

Indian Standard

अर्ध/पूर्ण रूप से प्रक्रमित गैर-दिशात्मक विद्युतीय इस्पात एवं पूर्ण रूप से प्रक्रमित दिशात्मक विद्युतीय इस्पात के लिए तप्त-बेल्लित और अतप्त-बेल्लित इस्पात की चद्दर — विशिष्टि

Hot-Rolled and Cold-Rolled Steel Strips Intended for Processing of Semi/Fully Processed Non-Grain Oriented Electrical Steel or Fully Processed Grain Oriented Electrical Steel — Specification

ICS 77.140.50

भारतीय मानक ब्यूरो
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Wrought Steel Products Sectional Committee, MTD 04

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Electrical steels, which utilizes the ferromagnetic properties of iron, are used in the cores of electromagnetic devices such as motors, generators, and transformers because of the ability of ferromagnetic materials to magnify the magnetic effects of current-carrying coils. Electrical steel is often referred to as silicon steel, as Si is the main alloying element. A need is felt to formulate a standard for units, which utilizes steels, for enhancing their electrical and magnetic properties.

This standard prescribes requirements for steels used for manufacture of electrical steels covered under various Indian Standards such as IS 648, IS 3024, IS 15391.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of 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.

Indian Standard

HOT-ROLLED AND COLD-ROLLED STEEL STRIPS INTENDED FOR PROCESSING OF SEMI/FULLY PROCESSED NON-GRAIN ORIENTED ELECTRICAL STEEL OR 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 non-grain oriented electrical steel in semi/fully processed condition and 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:

IS No.	*Title*
IS 228 (all parts)	Methods for chemical analysis of steels
IS 1730 : 1989	Steel plates, sheets, strips and flats for structural and general engineering purposes — Dimensions (*second revision*)
IS 1956 (Part 4) : 2013	Glossary of terms related to iron and steel: Part 4 Steel sheet and strip (*second revision*)
IS 8910 : 2022/ ISO 404 : 2013	General technical delivery requirements for steel and steel products (*second revision*)
IS/ISO 16160 : 2012	Hot-rolled steel sheet products — Dimensional and shape tolerances (*first revision*)

3 TERMINOLOGY

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

3.2 Electrical Steels — Unalloyed steels with particular 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 subject to mutual agreement between the supplier and the purchaser:

a) hot-rolled with or without pickling; and
b) cold-rolled condition — Full hard/partially annealed.

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

5 DESIGNATION

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

Table 1 Designation and Grades of Steel

(*Clause* 5)

Sl No.	**Grade and Designation**	
	Grade	Designation
(1)	(2)	(3)
i)	LS	Low silicon
ii)	MS	Medium silicon
iii)	HS	High silicon
iv)	VHS	Very high silicon

6 MANUFACTURE

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 supplier and the purchaser.

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.

Table 2 Chemical Composition
(*Clauses* 4.4, 7.1 *and* 7.3)

Sl No.	Grade	Designation	Constituent, Percent					
			C *Max*	Si	S *Max*	P *Max*	Mn *Max*	Al *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	LS	Low silicon	0.06	≥0.10 to < 0.60	0.020	0.30	1.00	0.50
ii)	MS	Medium silicon	0.05	≥0.60 to <2.00	0.020	0.20	1.00	1.00
iii)	HS	High silicon	0.05	≥2.00 to <3.00	0.020	0.20	1.00	2.00
iv)	VHS	Very high silicon	0.05	≥3.00 to <6.00	0.020	0.20	1.00	2.00

NOTES

1 In case of material intended for semi processed CRNGO non alloy type, other limits for silicon content may be mutually agreed to between the manufacturer and the purchaser.
2 The nitrogen content of the steel shall not be more than 0.012 percent.
3 Restricted chemistry may be mutually agreed between the purchaser and the supplier.

Table 3 Permissible Variation for Product Analysis
(*Clause* 7.3)

Sl No.	Constituent	Percentage Limit of Constituent	Variation Over the Specified Maximum or Under the Minimum Limits, Percent, *Max*
(1)	(2)	(3)	(4)
i)	Carbon	≤0.050	0.010
ii)	Manganese	≤1.00	0.040
iii)	Sulphur	≤ 0.020	0.005
iv)	Phosphorus	≤0.30	0.010
v)	Silicon	≥0.10 to <0.60	0.030
		≥0.60 to<2.00	0.100
		≥2.00 to≤ 6.00	0.150
vi)	Aluminium	≤0.50	0.05
		>0.50 to ≤ 6.00	0.10

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.

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 centre 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:

Sl No.	*Nominal Thickness* mm		*Tolerance on Thickness Over Two Edges* mm
	From	*Up to and Including*	
(1)	(2)	(3)	(4)
i)	—	3	0.06
ii)	3	4	0.08

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 as indicated below:

Sl No.	*Nominal Width* mm		*Measured Length* mm	*Camber* mm	
	From	*Up to and Including*		*Mill Edge*	*Slit Edge*
(1)	(2)	(3)	(4)	(5)	(6)
i)	—	600	2 500	—	10
ii)	600	1 500	2 500	25	15

10 DIMENSIONS AND TOLERANCES (FOR COLD-ROLLED STEEL)

10.1 Thickness Tolerances

10.1.1 The allowable tolerance on the nominal thickness within the same acceptable unit shall be ± 8 percent of the nominal value for thickness less than or equal to 0.5 mm and ± 6 percent of the nominal value for thickness greater than 0.50 mm. The additional thickness due to welds, with respect to the measured thickness of the steel strip shall not exceed 0.050 mm.

10.1.2 The difference in the thickness in a direction perpendicular to the direction of rolling shall not exceed 0.02 mm for thickness less than or equal to 0.5 mm and 0.03 mm for thickness 0.65 mm and 1.00 mm. The measurement shall be made using a micrometer with an accuracy of 0.001 mm. These tolerances apply only to the materials with a width greater than 150 mm.

10.1.3 The height of the weld if any and edge burr

For width up to and including 1 200 mm :	100 µm, *Max*
For width above 1 200 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 The difference in thickness across width at the two edges of slit strip shall not exceed the limits given below:

shall not exceed 50 microns.

10.2 Width Tolerances

10.2.1 For material supplied with trimmed edges, the tolerances of mentioned below shall apply:

Sl No.	*Nominal Width* mm	*Tolerance* mm
(1)	(2)	(3)
i)	600 to ≤1000	+2.0/-0.0
ii)	>1000 to ≤1500	+3.0/-0.0

10.2.2 For materials supplied with as rolled edges, the tolerances on nominal width should be +20/-0 mm.

10.3 Material required to tolerances other than those specified in **10.1** and **10.2** shall be subject to agreement between the purchaser and the manufacturer.

11 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 contracting parties.

12 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.

13 MARKING

13.1 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 trade mark or shall be legibly marked at top.

13.2 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.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 04

Organization	*Representative(s)*
SAIL, Research & Development Center for Iron & Steel, Ranchi	SHRI NIRVIK BANERJEE **(*Chairperson*)**
All India Induction Furnace Association, New Delhi	SHRI A. K. SHARMA SHRI PRABHAKAR MISHRA (*Alternate*)
AM/NS Steel Hazira, Surat	SHRI DEEPAK GUPTA SHRI KALPESH DAVE (*Alternate*)
Bharat Heavy Electrical Ltd, Bhopal	SHRI S. K. MAHAJAN SHRI ARUN KHARE (*Alternate*)
Central Boilers Board, New Delhi	SHRI S. K. JAIN
Cold Rolled Steel Manufacturers Association of India, New Delhi	SHRI RAJIV CHATURVEDI SHRI N. K. SOOD (*Alternate*)
DMRL, Ministry of Defence, Hyderabad	SHRI R. V. S. NAGESH
Indian Machine Tools Manufacturers Association, Bengaluru	SHRI Y. BALARAMAIAH
Institute of Steel Development and Growth, Kolkata	SHRI P. L. RAO SHRI SAJAL KUMAR GHORAI (*Alternate*)
Jindal Steel & Power Ltd (JSPL), Raigarh	SHRI MORESHWAR BORKAR SHRI JOY DUTTA (*Alternate*)
JSW Ltd, Bellary	SHRI DEVASISH MISHRA SHRI G. V. RAMANA (*Alternate*)
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Ministry of Steel (Government of India), New Delhi	 SHRI BHAGIRATHI PRADHAN (*Alternate*)
Power Grid Corporation, Gurgaon	SHRI MANOJ KUMAR GUPTA SHRI DEEPAK KUMAR SAHOO (*Alternate*)

Organization	*Representative(s)*
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Research Designs and Standards Organization (RDSO), Lucknow	SHRI MANOJ KUMAR GUPTA SHRI SALISH ORAON (*Alternate*)
SAIL, Bhilai Steel Plant, Bhilai	SHRI SHRIRANG KHANKHOJE SHRI K.V. SHANKAR (*Alternate*)
SAIL, Bokaro Steel Plant, Bokaro	SHRIMATI BISWASI SUNITA MINZ SHRIMATI ROSELIN DODRAE (*Alternate*)
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Tata Motors Ltd, Pune	SHRI PRADEEP KULKARNI SHRI LOKESH PALIWAL (*Alternate*)
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