भारतीय मानक

Indian Standard

IS 5484 : 2023

सतत् ढलाई और रोलिंग द्वारा उत्पादित ई सी ग्रेड एल्यूमीनियम छड़ — विशिष्टि

(तीसरा पुनरीक्षण)

EC Grade Aluminium Rod Produced by Continuous Casting and Rolling — Specification

(Third Revision)

ICS 77.150.10

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May 2023 **Price Group 5**

Ores and Feedstock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee, MTD 07

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Ores and Feedstock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1969 and subsequently revised in 1978 and 1997. While reviewing this standard in the light of experience gained during these years, the Sectional Committee decided to revise the standard.

In this standard, requirements are laid down for EC Grade redraw rods produced by continuous casting and rolling for further fabrication by drawing into wire for electrical purposes.

In this revision, the following significant modifications have been made:

a) Added additional diameter range in the scope;

b) Included clause for ordering information;

c) Additional grades of EC grade aluminium are referred from IS 4026;

d) New clause of ‘supply of material’;

e) ‘Ultimate tensile strength’ and ‘Resistivity’ requirements modified and temper designation included; and

f) Clauses from 11 to 15 have been modified.

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

For the purpose of deciding whether 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

EC GRADE ALUMINIUM ROD PRODUCED BY CONTINUOUS CASTING AND ROLLING — SPECIFICATION

(Third Revision)

1 SCOPE

This standard covers the requirements for electrical conductor (EC) Grade aluminium redraw rods, between 6.5 mm to 15 mm in nominal diameter, produced by continuous casting and rolling for electrical conductors, cables and winding wires.

2 REFERENCES

The standards listed in Annex A 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.

3 TERMINOLOGY

For the purpose of this standard, the following definition and the definitions given in IS 5047 (Part 1) shall apply.

3.1 Ultimate Tensile Strength (UTS) — Stress corresponding to the maximum force.

4 ORDERING INFORMATION

For the benefit of the purchaser, particulars to be specified while ordering for the material to this specification shall be as following:

a) Name of material;

b) Grade and temper designation;

c) Size and dimension;

d) Quantity of material; and

e) Other requirement, if any.

5 MANUFACTURE

5.1 Primary aluminium of grades as mentioned in IS 4026 shall be used as the input for manufacture of EC grade wire rods.

5.2 The hot metal shall be subjected to filtration process before rolling into EC grade aluminium rods.

6 CHEMICAL COMPOSITION

6.1 The grades and chemical composition of EC grade aluminium rod produced by continuous casting and rolling process shall be as mentioned in IS 4026.

6.2 The chemical analysis of the material shall be carried out either in accordance with the methods specified in IS 504 (Part 1 to 12) and IS 504 (Part 13 to 16) or by any other established instrumental/chemical method. In case of any dispute the method specified in relevant parts of IS 504 shall be used as referee method. However, when the method is not given in IS 504, the referee method shall be as agreed to between the purchaser and the manufacturer.

7 SUPPLY OF MATERIALS

7.1 The general condition for delivery and inspection relating to the supply of material shall conform to IS 10259.

7.2 The rod shall be supplied in coil form with a single length in each coil.

8 SELECTION OF TEST SAMPLES

8.1 A tensile test sample and a resistivity test sample shall be taken to represent each 3 tonnes or less of rod in the lot.

8.2 For chemical composition, at least three samples randomly shall be selected throughout the casting process for each furnace batch

9 ULTIMATE TENSILE STRENGTH AND ELONGATION

The ultimate tensile strength of the rolled rod and corresponding temper designation as given in IS 5052 shall be as under (*see* Table 1).

Table 1 Ultimate Tensile Strength Limit of Rolled Rod
(*Clause* 9)

Sl No.	Range	Temper Designation	Ultimate Tensile Strength (MPa)
(1)	(2)	(3)	(4)
i)	I	O	59 to 97
ii)	II	H12 to H22	83 to 117
iii)	III	H14 to H24	103 to 138
iv)	IV	H16 to H26	117 to 152

NOTE — The tensile strength of the rod will vary depending upon the chemical composition and the work hardening that takes place during the rolling process.

9.1 The tensile test shall be conducted in accordance with IS 1608 (Part 1).

9.2 The desired elongation, otherwise mutually agreed between the supplier and the purchaser, shall be measured on 250 mm gauge length and shall be minimum 8 percent.

10 RESISTIVITY

10.1 Resistivity shall be determined on representative sample by resistance measurement as per IS 3635. Alternately, electrical conductivity shall be measured by eddy current method as per IS 5082.

10.1.1 At a temperature of 20 °C the resistivity/conductivity of the samples of rods produced shall be as follows:

Table 2 Resistivity and Conductivity Limit
(*Clause* 10.1.1)

Sl No.	Temper Designation	Resistivity at 20 °C Ohm. mm^2/m *Max*	Conductivity Percent, IACS *Min*
(1)	(2)	(3)	(4)
i)	O	0.027 899	61.8
ii)	H12 to H22	0.028 035	61.5
iii)	H14 to H24	0.028 080	61.4
iv)	H16 to H26	0.028 126	61.3

NOTE

1 In case purchaser has not specified the requirement of conductivity, the same shall be 61 percent IACS minimum at 20 °C.
2 Resistivity is used in place of conductivity. The value of 0.017 241 ohm.mm^2/m at 20 °C is the international resistivity of annealed copper equal to 100 percent conductivity. This term means that a copper wire 1 mm in cross section and one meter in length would have a resistance of 0.017 241 ohm.

10.2 At a temperature of 20 °C the resistivity of the samples shall not exceed 0.028 126 ohm.mm^2/m (minimum 61.3 percent IACS conductivity).

10.3 The resistivity measurements shall be made on samples of rods in the temper as furnished.

11 DIMENSIONS

The rod shall be rolled to the desired nominal diameter within the permissible diameter tolerance as mentioned in the table below.

Table 3 Nominal Diameter and Permissible Tolerance
(*Clause* 11)

Sl No.	Nominal Diameter	Permissible Tolerance
	mm	mm
(1)	(2)	(3)
i)	> 12.7	± 0.64
ii)	9.5 to 12.7	± 0.51
iii)	< 9.5	± 0.40

12 JOINTS

There shall not be any joints in the coil.

13 FINISH AND FREEDOM FROM DEFECTS

13.1 The rod shall be commercially clean, that is, free from any excessive oil and grease.

13.2 The rod shall be sound, smooth and free from pipes, laps, cracks, kinks, twists, seams, and other injurious defects within the limits of good commercial practice.

14 REJECTION AND RETEST

For the purpose of this standard, the clauses as given in IS 10259 shall apply.

15 PACKAGING

For the purpose of this standard, the following packaging methods and those given in IS 10259 shall apply.

15.1 Coil size and weight shall be agreed upon by supplier and the purchaser at the time of placing the order.

15.2 Coil shall be wrapped as specified in the order. The quality and application of the wrapping material should be adequate to protect the wire-rod from damage, incidental to normal handling and shipment.

16 MARKING

For the purpose of this standard, the following marking and labelling methods given in **16.1** and **16.2** shall apply.

16.1 Each coil shall bear a tag showing the manufacturer's name or trade-mark, weight and tensile range of material. If additional information is required on the tags, it shall be arranged with the manufacturer at the time of placing the order.

16.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

The products(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 may be marked with the Standard Mark.

ANNEX A
(*Clause* 9)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 504 (Part 1 to 12) : 2002	Chemical analysis of aluminium and its alloys: Parts (1 to 12) (*second revision*)
(Part 13 to 16) : 2003	Chemical analysis of aluminium and its alloys: Parts (13 to 16) (*second revision*)
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fifth revision*)
IS 3635 : 1966	Methods of test for resistance of metallic electrical resistance material
IS 4026 : 2007	Aluminium ingots, billets and wire bars (EC grade) (*fourth revision*)
IS 5047 (Part 1) : 1986	Glossary of terms relating to aluminium and aluminium alloys: Part 1 Unwrought and wrought metals (*second revision*)
IS 5052 : 1993	Aluminium and its alloys — Temper designations (*first revision*)
IS 5082 : 1998	Wrought aluminium and aluminium alloy bars, rods, tubes, sections, plates and sheets for electrical applications (*second revision*)
IS 10259 : 1982	General condition of delivery and inspection of aluminium and aluminium alloy product

ANNEX B
(*Foreword*)

COMMITTEE COMPOSITION

Ores and Feedstock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee, MTD 07

Organization	*Representative(s)*
CSIR - Institute of Minerals and Materials Technology, Bhubaneswar	DR KALI SANJAY **(*Chairperson*)**
Aeronautical Development Establishment, Bengaluru	SHRI G. S. RAVINDRA SHRI T. MOHAN REDDY (*Alternate*)
Aluminium Association of India, Bengaluru	SHRI ANIL MATHEW SHRI T. VIMAL RAJ (*Alternate*)
Aluminium Secondary Manufacturers Association, New Delhi	SHRI NAVEEN PANT SHRI PRAVEEN DIXIT (*Alternate*)
Bharat Aluminium Company Limited, New Delhi	MS ANJALI PAWAR SHRI JITENDRA KUMAR VERMA (*Alternate*)
Century Extrusions Limited, Kolkata	SHRI V. JHUNJHUNWALA SHRI SANJAY SINGH SEHRAWAT (*Alternate*)
Century Metal Recycling Limited, Faridabad	SHRI MOHAN AGARWAL
CSIR-Advanced Materials and Processes Research Institute, Bhopal	DR D. P. MONDAL
CSIR-National Metallurgical Laboratory, Jamshedpur	DR KANAI SAHOO DR V. C. SRIVASTAVA (*Alternate*)
Defence Metallurgical Research Laboratory, Ministry of Defence, Hyderabad	DR G. JAGAN REDDY DR S. N. SAHU (*Alternate*)
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Indian Space Research Organization, Bengaluru	DR S. K. GHOSH
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Jindal Aluminium Limited, Bengaluru	SHRI O. K. SHARMA SHRI P. DEVARAJ (*Alternate*)
Material Recycling Association of India (MRAI), Mumbai	SHRI DHAWAL SHAH SHRI JAYANT JAIN (*Alternate*)
National Aluminium Company Limited, Bhubaneswar	SHRI S. NANDA
National Test House, Kolkata	DR NISHI SRIVASTAVA SHRI BUDDH PRAKASH (*Alternate*)

Organization	*Representative(s)*
Shriram Institute for Industrial Research, Delhi	SHRI P. K. KAICHER SHRI B. GOVINDAN NAIR (*Alternate*)
Vedanta Limited, Mumbai	HRI VIVEK SAXENA SHRI RAM SANDIPAM (*Alternate*)
BIS Directorate General	SHRI SANJIV MAINI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (METALLURGICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI V. K. RAWAT
SCIENTIST 'D'/JOINT DIRECTOR
(METALLURGICAL ENGINEERING), BIS

Bureau of Indian Standards

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Review of Indian Standards

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