

# DRAFT TANZANIA STANDARD

First Edition

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**Electric conductors—EC grade aluminium rods produced by continuous casting and rolling—Specifications**





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## Contents

	Page
0 National foreword .....	iv
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	1
4 Manufacture .....	2
5 Material .....	2
6 Selection of test samples .....	2
7 Tensile strength .....	3
8 Resistivity .....	3
9 Dimensions and permissible variations .....	4
10 Joints .....	4
11 Finish and freedom from defects .....	4
12 Retest .....	4
13 Packing .....	4
14 Marking .....	5

## 0 National foreword

This draft Tanzania Standard has been prepared by the Electrical Equipment Technical Committee under the supervision of the Electrotechnical Divisional Standard Committee.

In development of this draft Tanzania Standard, assistance has been derived from *IS 5484:1997-EC grade aluminium rods produced by continuous casting and rolling-Specifications*, developed by the Bureau of Indian Standards (BIS)

### Terminology and conventions

In reporting the results of a test or analysis made in accordance with provision of this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4:1999, *Rules for rounding-off numerical values*

Draft for Stakeholders' Comments Only

# Electric conductors — EC grade aluminium rods produced by continuous casting and rolling — Specifications

## 1 Scope

This standard covers the requirements for EC grade aluminum redraw rods, in 9.5mm and 7.6mm in nominal diameter, produced by continuous casting and rolling for electrical conductors.

## 2 Normative references

The following referenced documents listed below are necessary adjuncts to this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

TZS 642:2001 *Metallic materials-tensile strength test*

## 3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply:

### 3.1 unwrought metal

a metal in any cast form meant for further processing.

### 3.2 ingot

a cast solid product of specific size, shape and chemical composition of metal or alloy intended for re-melting

### 3.3 billet

a cylindrical or rectangular casting used for subsequent working.

### 3.4 hollow billet

a billet cast with a central longitudinal hole.

### 3.5 bored billet

billet with a central longitudinal hole produced by machining.

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**ICS 77.150.10.**

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### 3.6 wire bar

a cast square or circular or any other regular section used for the production of hot rolled rod and ultimately wire.

### 3.7 grade

ingots/billets/wire bars (Al 99.7 percent) used for making rods by processes other than continuous casting and rolling.

### 3.8 grade 2

ingots/billets/wire bars (Al 99.6 percent) used for making rods produced by continuous casting and rolling.

### 3.9 grade 3

ingots/billets/wire bars (Al 99.5 percent) used for making rods by processes other than continuous casting and rolling.

## 4 Manufacture

The ingot used for manufacturing rods by continuous casting and rolling process shall conform to the requirements of Grade 2 (Al 99.6) of Table 1 below

Table 1 Chemical composition of EC grade aluminium ingots, billets and wire bars.

Serial No	Elements	Grade 1 (Al 99.7%)	Grade 2 (Al 99.6 %)	Grade 3 (Al 99.5 %)
i	Aluminium	99.7	99.6	99.5
ii	Silicon	0.10	0.12	0.15
iii	Iron	0.20	0.30	0.35
iv	Copper	0.04	0.04	0.04
v	Titanium +Vanadium	0.02	0.02	0.02
vi	Manganese, Zirconium and Chromium	0.01 each	0.01 each	0.01 each

NOTE-Composition limits are in percentage maximum unless shown otherwise.

## 5 Material

The rod shall be supplied in coil form not exceeding two lengths in each coil.

## 6 Selection of test samples

6.1 A tensile test sample and a resistivity test sample shall be taken to represent each 2.5 tonnes or less of rod in the lot.

**6.2** For chemical composition, one test sample shall be taken to represent one furnace load.

## 7 Tensile strength

**7.1** The tensile strength of the rolled rod shall be as given in Table 2 below.

Table 2 Tensile strength limits of rolled rod

Range	Rods produced from grade 2 and aluminium, tensile strength (MPa)
I	65 to 100
II	85 to 125
III	100 to 135
IV	110 to 155

NOTE 1-  $1 \text{ MPa} = 1 \text{ MN/m}^2 = 1 \text{ N/mm}^2 = 0.102 \text{ kgf/mm}^2$ .

NOTE 2-The tensile strength of the rod will vary depending upon the chemical composition and the work hardening that takes place during the rolling process. Since the purchaser has to order material to suit his equipment, technique and the end product, only a general indication of the range of tensile strength is given in this standard.

**7.2** The desired tensile strength range shall be as agreed to between the supplier and the purchaser. Elongation determination shall not be required for Grade 2 material unless specifically agreed upon by the supplier and the purchaser. However, elongation shall not be determined in specimens containing joints.

**7.3** The tensile test shall be conducted in accordance with TZS 642:2001 Metallic materials-Tensile strength test (1<sup>st</sup> Ed).

## 8 Resistivity

**8.1** Resistivity shall be determined on representative samples by resistance measurements.

**8.1.1** At a temperature of 20°C the resistivity/ conductivity of the samples of rods produced from aluminium with Grade 2 properties shall be as follows:

Type	Resistivity at 20°C ( $\Omega \cdot m$ ) <i>Max</i>	Conductivity (% IACS) <i>Min</i>
Type 1	0.028035	61.5
Type 2	0.028264	61.0

NOTE 1-In case a purchaser has not specified the requirement of conductivity, the same shall be 61 percent IACS minimum at 20°C

NOTE 2-IACS stands for International Annealed Copper Standard

**8.1.2** At a temperature of 20° C the resistivity of the samples shall not exceed 0.030 247 ohm.mm<sup>2</sup>/m (57 percent IACS conductivity).

NOTE 1-Resistivity is used in place of conductivity. The value of 0.017241ohm.mm<sup>2</sup>/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 241ohm.

NOTE 2-100% IACS is equivalent to a conductivity of 58.108 Mega siemen per meter (MS/m) at 20<sup>0</sup> C or a resistivity of 1/58.108 Ω m for a wire one square millimeter in cross section.

**8.2** The resistivity measurements shall be made on samples of rods in the temper as furnished

## **9 Dimensions and permissible variations**

**9.1** The rod shall be rolled to a nominal diameter of 9.50mm within the permissible variation of ± 0.50mm or to a nominal diameter of 7.6 ± 0.40 mm.

## **10 Joints**

Joints in the rod, if agreed upon between the supplier and the purchaser, shall be made by electric butt-welding or by cold-pressure welding.

## **11 Finish and freedom from defects**

**11.1** The rod shall be commercially clean

**11.2** 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.

## **12 Retest**

If a sample selected for testing fails to meet the requirements of the specification, two further samples shall be taken from the same lot represented by the sample. If either of these samples fails to meet the requirements of the specification, the lot represented by the sample shall be rejected.

## **13 Packing**

**13.1** The material shall be packed in coils.

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

**13.3** Coils need to be wrapped only when specified in the order. The quality and application of the wrapping material should be adequate to protect wire-rods from damage, incidental to normal handling and shipment.



## **14 Marking**

**14.1** 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.

**14.2** The coil shall carry a distinguishing tag, wrapping or like, to indicate if the coil is in two lengths and if the material contains any joints.

**14.3** The material may also be marked with Standard Mark.

NOTE –The use of the Standard Mark is governed by the provisions of the Standards Act, 2009 and the rules and regulations made thereunder. Details of conditions under which a licence for the use of the TBS Certification Mark may be granted to manufacturers or processors may be obtained from the Tanzania Bureau of Standards.