INTERNATIONAL STANDARD 431

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Electrolytic tough pitch copper — Refinery shapes

First edition — 1972-11-01

UDC 669.3-4

Ref. No. ISO 431-1972 (E)

Descriptors : copper, metal products, wire bars, billets, ingots, mass, dimensions, materials specifications, conductivity

Price based on 4 pages

FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 431 (originally Draft International Standard ISO/DIS 2310) was drawn up by Technical Committee ISO/TC 26, *Copper and copper alloys*.

It was approved in July 1971 by the Member Bodies of the following countries :

Austria	India	South Africa, Rep. of
Belgium	Italy	Spain
Chile	Netherlands	Sweden
Egypt, Arab Rep. of	Norway	Switzerland
Finland	Poland	U.S.A.
France	Portugal	
Germany	Romania	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Brazil
Canada

This International Standard cancels and replaces ISO Recommendation R 431-1965.

Printed in Switzerland

Electrolytic tough pitch copper — Refinery shapes

1 SCOPE AND FIELD APLICATION

This International Standard specifies the electrolytic tough pitch copper refinery shapes, i.e. wire bars, cakes, slabs and billets, mainly used for electrical purposes, as well as ingots and ingot bars used for alloying in wrought and cast copper alloys.

NOTE — Copper, for the purpose of this International Standard, is designated as Cu-ETP and corresponds to electrolytic tough pitch copper as defined in ISO/R 197.

2 REFERENCES

ISO 197, *Coppers, alloyed coppers and copper alloys — Terms and definitions — Part 1 : Material.* (At present at the stage of draft, revision of ISO/R 197.)

ISO/R 1553, *Chemical analysis of copper and copper alloys — Electrolytic determination of copper in unalloyed copper containing not less than 99,90 % of copper.*

ISO/R 1811, *Chemical analysis of copper and copper alloys — Sampling of copper refinery shapes.*

IEC Publication 28-1925, *International Standard of resistance for copper.*

IEC Publication . . . , *Resistivity test for copper.* (In preparation.)

3 CHEMICAL COMPOSITION

The copper in all shapes should conform to the following requirement as to chemical composition :

Copper plus silver, minimum 99,90 %.

NOTE — If the purchaser's requirements necessitate limits for any element not specified, these should be agreed upon between supplier and purchaser.

4 CHEMICAL ANALYSIS

The analysis for determining minimum purity of the copper should be made in accordance with ISO/R 1553.

5 ELECTRICAL PROPERTIES

The annealed copper should have the electrical properties specified in Table 1, at a temperature of 20 °C (68 °F).

TABLE 1 — Electrical properties

Quantities	Units	Values	
		Wire bars Slabs, cakes and billets for electrical uses	Slabs, cakes and billets other than for electrical uses Ingots and ingot bars
Mass resistivity (maximum)	ohm $\frac{g}{m^2}$	0,153 28	0,155 96 . . . .
Volume resistivity (maximum)	ohm $\frac{mm^2}{m}$	0,017 241 . . .	0,017 544 . . .
	microhm·cm	1,724 1	1,754 4 . . . . .
Conductivity (minimum)	$\frac{m}{ohm \cdot mm^2}$	58,00	57,00
	% IACS	100,0	98,28

NOTE — For further details see IEC Publication 28-1925.

6 RESISTIVITY TEST

Samples for the resistivity test should be hot-rolled or forged and then cold-drawn into wire approximately 2 mm (0.08 in) in diameter, which should be annealed at a temperature of approximately 500 °C (932 °F) for a minimum time of 30 min.

The resistivity test should be made in accordance with IEC Publication . . . .

7 PHYSICAL DEFECTS

Wire bars, cakes, slabs and billets should be reasonably free from shrink holes, cracks, cold sets, pits, sloppy edges, concave tops and other similar defects in set or casting; wire bars should be reasonably straight at the time of shipping from the refinery. These requirements do not apply to ingots or ingot bars, in which physical defects are of minor consequence.

8 SIZES AND SHAPES OF WIRE BARS

One size of mould should be used for casting 91 to 105 kg (200 to 230 lb) wire bars. The bottom width of these bars should be 89 mm (3 $^{1}/_{2}$ in), the nominal masses being 91 and 102 kg (200 and 225 lb) (see the Figure and Table 2).

One size of mould should be used for casting 109 to 136 kg (240 to 300 lb) wire bars. The bottom width of these bars should be 102 mm (4 in), the nominal masses being 113, 120, 125 and 136 kg (250, 265, 275 and 300 lb) (see the Figure and Table 2).

The bars should have the dimensions given in Table 2.

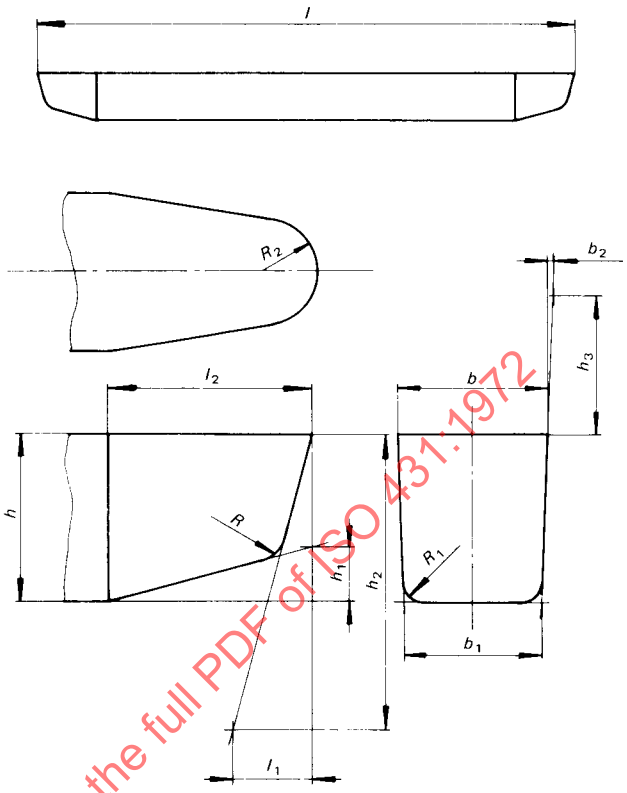

FIGURE — **Sizes and shapes of wire bars**

9 PERMISSIBLE VARIATIONS IN MASS AND DIMENSIONS

9.1 Billets

A variation of ± 5 % in mass, from the manufacturer's list or the supplier's specified size, is permissible. For diameters of billet up to 203 mm (8 in) a variation of ± 3 mm is permissible. Closer tolerances on diameter may be supplied by special request. For diameters of billet over 203 mm (8 in) tolerances on diameter should be agreed between supplier and purchaser. Billets should be straight within 6 mm per 1 220 mm ($^{1}/_{4}$ in per 4 ft) as measured at the centre of the billet.

TABLE 2 — **Masses and dimensions of wire bars**

Dimension	(91 kg) (200 lb)		(102 kg) (225 lb)		113 kg (250 lb)		120 kg (265 lb)		125 kg (275 lb)		136 kg (300 lb)	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
R	16	$^{5}/_{8}$	16	$^{5}/_{8}$	25	1	25	1	25	1	25	1
R_1	16	$^{5}/_{8}$	16	$^{5}/_{8}$	16	$^{5}/_{8}$	16	$^{5}/_{8}$	16	$^{5}/_{8}$	16	$^{5}/_{8}$
R_2	38	1 $^{1}/_{2}$	38	1 $^{1}/_{2}$	38	1 $^{1}/_{2}$	38	1 $^{1}/_{2}$	38	1 $^{1}/_{2}$	38	1 $^{1}/_{2}$
h	92	3 $^{5}/_{8}$	102	4	102	4	108	4 $^{1}/_{4}$	111	4 $^{3}/_{8}$	121	4 $^{3}/_{4}$
h_1	25	1	25	1	25	1	25	1	25	1	25	1
h_2	305	12	305	12	305	12	305	12	305	12	305	12
h_3	102	4	102	4	102	4	102	4	102	4	102	4
b	(98)	(3 $^{7}/_{8}$)	(98)	(3 $^{7}/_{8}$)	(111)	(4 $^{3}/_{8}$)	(111)	(4 $^{3}/_{8}$)	(111)	(4 $^{3}/_{8}$)	(111)	(4 $^{3}/_{8}$)
b_1	89	3 $^{1}/_{2}$	89	3 $^{1}/_{2}$	102	4	102	4	102	4	102	4
b_2	4,8	$^{3}/_{16}$	4,8	$^{3}/_{16}$	4,8	$^{3}/_{16}$	4,8	$^{3}/_{16}$	4,8	$^{3}/_{16}$	4,8	$^{3}/_{16}$
l	(1372)	(54)	1372	54	(1372)	(54)	(1372)	(54)	(1372)	(54)	1372	54
l_1	57	2 $^{1}/_{4}$	57	2 $^{1}/_{4}$	57	2 $^{1}/_{4}$	57	2 $^{1}/_{4}$	57	2 $^{1}/_{4}$	57	2 $^{1}/_{4}$
l_2	(152)	(6)	152	6	(152)	(6)	(152)	(6)	(152)	(6)	152	6

NOTE — All dimensions in parentheses are nominal.