

**SPECIFICATION FOR
COPPER FOR
ELECTRICAL PURPOSES
ROD AND BAR**

BS 1433 : 1970

THIS BRITISH STANDARD, having been approved by the Non-ferrous Metals Industry Standards Committee, was published under the authority of the Executive Board on 25th June, 1970.

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A complete list of British Standards, numbering over 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 18. Methods for tensile testing of metals. Part 1, Non-ferrous metals.
- BS 1036. Electrolytic tough pitch high conductivity copper.
- BS 1037. Fire refined tough pitch high conductivity copper.
- BS 1432. Copper for electrical purposes. Strip with drawn or rolled edges.
- BS 1861. Oxygen-free high conductivity copper.
- BS 1954. Oxygen-free high conductivity copper for special applications.
- BS 2045. Preferred numbers.
- BS 3239. Determination of resistivity of metallic electrical conductor materials.
- BS 3643. ISO metric screw threads.
- BS 3839. Oxygen-free high conductivity copper for electronic valves and semi-conductor devices.
- BS 4229. Sizes of non-ferrous and ferrous bars.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or additions.

The following BSI references relate to the work on this standard:
Committee reference NFE/12. Draft for comment 69/11307

Amendment Slip No.1, published 8 June, 1973
to B.S. 1433 : 1970

Copper for electrical purposes
Rod and bar

Revised text

Clause 1. Scope

Table 1. In the last line of the 'Condition' column for bars over 10 mm and up to and including 50 mm insert 'or hard' so that it reads 'annealed, half hard or hard'.

Table 6. Mechanical properties of copper rod and bar. Delete the existing table and substitute the new Table 6 attached.

Appendix A. Conversion of stress values

In the table delete the heading 'hbar' of column 1 and substitute 'N/mm²'.

Multiply the values given in column 1 so that they read '230, 240, 250, 260, 280, 290, 310, 320, 330 and 350'.

In the list of conversion factors given under the table delete '1 hbar = 100 bar ='.

TABLE 6. MECHANICAL PROPERTIES OF COPPER ROD AND BAR

Diameter, width across flats or thickness		Condition	Tensile strength			Elongation on $5.65\sqrt{S_0}$ †		
Over	up to and including		Round	Square and hexagonal	Rectangular	Round	Square and hexagonal	Rectangular
mm	mm		*N/mm ²	*N/mm ²	*N/mm ²	%	%	%
4	6.3	O	260 max	—	—	32 min	—	—
6.3	10		250 max	—	—	32 min	—	—
10	12		240 max	240 max	240 max	40 min	40 min	40 min
12	50		230 max	230 max	230 max	45 min	45 min	45 min
50	80		230 max	230 max	—	45 min	45 min	—
4	6.3	$\frac{1}{2}$ H	290 min	—	—	4 min	—	—
6.3	10		280 min	—	—	8 min	—	—
10	12		260 min	260 min	250 min	12 min	12 min	12 min
12	25		250 min	250 min	230 min	18 min	18 min	18 min
25	50		230 min	230 min	230 min	22 min	22 min	18 min
50	80		230 min	230 min	—	22 min	22 min	—
4	6.3	H	350 min	—	—	—	—	—
6.3	10		330 min	—	—	—	—	—
10	12		320 min	310 min	270 min	6 min	6 min	8 min
12	25		290 min	280 min	260 min	8 min	8 min	8 min
25	50		260 min	250 min	250 min	12 min	12 min	10 min

*1 N/mm² = 1 MN/m²For conversion to kgf/mm², tonf/in², and lbf/in², see Appendix A.

†See BS 18, 'Methods for tensile testing of metals', Part 1, 'Non-ferrous metals'.

Amendment Slip No.2, published 29 July 1977
to BS 1433 : 1970

Copper for electrical purposes
Rod and bar

NOTE. This amendment slip includes revised dimensions and areas of bare, rectangular, half-hard and hard copper conductors suitable for busbar, switchgear and similar applications. These dimensional data are now included in Table 9.

In order to clarify the ranges of dimensions of bare, rectangular copper conductors specified in this standard and in BS 1432, it has been decided to include as in Table 10 (for information only) the dimensions and cross-sectional areas of bare, rectangular, annealed copper conductors suitable for insulation for winding purposes including conductors of controlled proof stress and half-hard temper.

In view of the long service life of certain telecommunication installations it is recognized that there will continue to be a need for material in alternative dimensions to be used for extension work, although new installations are being designed using dimensions specified in this standard.

Revised text

Contents. Under the heading 'Appendices', delete 'C. Table of recommended sizes (and related cross-sectional areas) for rectangular section copper' and substitute the following:

'C. Dimensions and areas of bare, rectangular copper conductors'.

Under the heading 'Tables' delete '3. Tolerances on diameter, width across flats or thickness of rod and bar' and substitute the following:

'3A. Tolerances on diameter, width across flats or thickness of rod

'3B. Tolerances on width and thickness of bar'

Insert the following under Table 8:

'9. Dimensions and areas of bare, rectangular, half-hard and hard copper conductors, suitable for busbar, switchgear and similar applications

10. Dimensions and areas of bare, rectangular, annealed copper conductors suitable for insulation for winding purposes and including conductors of controlled proof stress and half-hard temper.'

Table 1. Sizes and conditions. In column 4 headed 'Width' delete '160' and substitute '300'.

Clause 8.1.3 Bar. Delete the existing text and substitute the following:

'The width and thickness of bars shall be stated in millimetres and shall conform to the appropriate range of sizes given in Table 9. The ratio of width to thickness shall not exceed 27:1.'

Table 3. Tolerances on diameter, width across flats or thickness of rod and bar. Renumber this table as Table '3A'. In the title of the table delete 'and bar'.

In the table delete column 5 entirely.

Insert a new table below Table 3A as follows:

TABLE 3B. TOLERANCES ON WIDTH AND THICKNESS OF BAR

Specified thickness		Tolerance Plus and minus
Over	Up to and including	Rectangular bar (width or thickness)
mm	mm	mm
10	12	0.07
12	25	0.10
25	50	0.14
50	100	0.25
100	160	0.40
160	300	By agreement

Table 6. Mechanical properties of copper rod and bar (as amended by Amendment No.1). In column 3 headed 'Condition', delete 'H' in the third section at the bottom of the column and insert 'H‡'.

Below Table 6 insert the following footnote:

'‡Condition 'H' is not applicable to materials designated C103 and C110 for thicknesses in excess of 25 mm.'

Appendix A. Conversion of stress values. Delete the table and related footnotes and substitute the following:

N/mm ² (= MPa)	kgf/mm ²	tonf/in ²	lbf/in ²
230	23.5	15.0	33 500
240	24.5	15.5	35 000
250	25.5	16.0	36 000
260	26.5	17.0	38 000
270	27.5	17.5	39 000
280	28.5	18.0	40 500
290	29.5	19.0	42 000
310	31.5	20.0	45 000
320	32.5	21.0	46 500
330	33.5	21.5	48 000
350	35.5	22.5	51 000

Conversion factors. 1 N/mm² = 1 MN/m² = 0.064749 tonf/in²
= 145.038 lbf/in² = 0.101972 kgf/mm². For more detailed conversions see
BS 350, 'Conversion factors and tables'.

Appendix C. Delete this Appendix entirely and substitute the following:

APPENDIX C

DIMENSIONS AND AREAS OF BARE, RECTANGULAR, COPPER CONDUCTORS

TABLE 9. DIMENSIONS AND AREAS OF BARE RECTANGULAR HALF-HARD AND HARD COPPER CONDUCTORS SUITABLE FOR BUSBAR, SWITCHGEAR AND SIMILAR APPLICATIONS

Width (mm)	Thickness (mm)								Width (mm)	
R 10	1.60	2.00	2.50	3.15	4.00	5.00	6.30	R 10		
10.0	16.00	20.00	25.00	31.50	40.00	50.00	63.00	10.0		
12.5	20.00	25.00	31.25	39.38	50.00	62.50	78.75	12.5		
16.0	25.60	32.00	40.00	50.40	64.00	80.00	100.80	16.0		

Width (mm)	Thickness (mm)												Width (mm)	
R"10	1.6	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12	16	R"10		
20	32.0	40.0	50.0	60.0	80.0	100	120	160	200			20		
25	40.0	50.0	62.5	75.0	100	125	150	200	250	300	400	25		
30	48.0	60.0	75.0	90.0	120	150	180	240	300	360	480	30		
40		80.0	100	120	160	200	240	320	400	480	640	40		
50			125	150	200	250	300	400	500	600	800	50		
60			150	180	240	300	360	480	600	720	960	60		
80				240	320	400	480	640	800	960	1 280	80		
100					400	500	600	800	1 000	1 200	1 600	100		
120							720	960	1 200	1 440	1 920	120		
160							960	1 280	1 600	1 920	2 560	160		
200								1 600	2 000	2 400	3 200	200		
250									2 500	3 000	4 000	250		
300											4 800	300		

Corner radius (mm) (if specified)	0.50	0.65	0.8	0.8	1.0	1.0	1.0	1.0	1.0	2.5	2.5
Area to be deducted for radiused corners (mm ²)	0.21	0.36	0.55	0.55	0.86	0.86	0.86	0.86	0.86	5.37	5.37

NOTE. a) Areas shown below the stepped line in this table are for conductors which are normally manufactured to the requirements of IIS 4608.
b) Areas shown above the stepped line in this table are for conductors which are manufactured to the requirements of IIS 1432.
c) Rectangular conductors over 10 mm thickness are manufactured to the requirements of IIS 1433.