BRITISH STANDARD

BS 7884 : 1997

Specification for

Copper and copper-cadmium stranded conductors for overhead electric traction and power transmission systems

ICS 29.060.01; 29.240.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee NFE/34, Copper and copper alloys, upon which the following bodies were represented:

British Bathroom Council
British Cable Makers Confederation
British Non-Ferrous Metals Federation
British Refrigeration Association
British Valve and Actuator Manufacturers' Association
Copper Development Association
Inco Europe Limited
London Metal Exchange
Non-Ferrous Metal Stockists
Transmission and Distribution Association (BEAMA Limited)

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Railways Board
Institution of Incorporated Executive Engineers
Society of Motor Manufacturers and Traders

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Contents

Foreword

This British Standard has been prepared by Technical Committee NFE/34/2. This revision supersedes BS 125 : 1970 and BS 2755 : 1970, which are withdrawn.

Copper and copper alloy conductors for overhead electric traction are also dealt with in BS 23.

In this revision due regard has been given to the work of the International Organization for Standardization (ISO) when reviewing the testing requirements, properties and physical dimensions of conductors. Where applicable, if possible, the requirements of this British Standard have been aligned with those of corresponding International Standards. However, it has been necessary to go outside ISO dimensions to specify conductors that are suitable for use with fittings currently in use.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

Specification

1 Scope

This British Standard specifies requirements for solid and stranded circular conductors for overhead power transmission systems and overhead electric traction systems. It specifies the requirements for material composition, dimensions, mechanical properties, electrical resistance, stranding, and other characteristics for hard-drawn high conductivity copper and copper alloy conductors.

NOTE. Guidance on information that should be supplied by the purchaser is given in annex A.

2 References

2.1 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies: any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purpose of this British Standard the following definitions apply.

3.1 solid conductor

Conductor consisting of one wire of circular cross-section.

3.2 stranded conductor

Conductor consisting of a number of circular wires of the same nominal diameter, having a central core wire surrounded by one or more layers of helically laid wires. When the conductor consists of more than one layer, alternate layers are stranded in opposite directions.

3.3 wire diameter

Mean of two micrometer measurements taken at right angles to each other at any one cross-section of the wire.

3.4 circularity

Degree by which the cross-section of a wire conforms to a circle.

NOTE. Circularity is ascertained by comparing the maximum and the minimum diameters measured at the same cross-section of the wire.

3.5 direction of lay

For stranded conductors, the direction in which the helically laid outer strands are wound round the central core wire.

NOTE. Wires conform to the direction of the central part of the letter ‘Z’ when the conductor is held vertically and viewed from the side. For left-hand lay, the wires conform to the central part of the letter ‘S’ when the conductor is held vertically and viewed from the side.

3.6 lay length

Axial length of one complete turn of the helix formed by an individual wire in a stranded conductor.

3.7 lay ratio

Ratio of the lay length to the external diameter of the corresponding layer of wires in the stranded conductor.

4 Requirements

4.1 Composition

Copper conductors shall be manufactured from high conductivity copper wires conforming to the composition requirements for BS 6926 : 1988, grade C100, C101 or C102, the choice of grade being at the discretion of the manufacturer. Copper alloy conductors shall be manufactured from wires conforming to the composition requirements for BS 2873 : 1969, alloy C108 or other composition requirements agreed between the purchaser and the supplier.

4.2 Dimensions, tolerances and masses

4.2.1 *Solid conductors*

The dimensions and masses of solid conductors shall conform to tables 1 and 2.

The conductor shall not depart from circularity (see **3.4**) by more than 2 % of the nominal diameter.

4.2.2 *Component wires of stranded conductors*

The dimensions of component wires for stranded conductors before stranding shall conform to tables 1 and 2, as appropriate.

The cross-section of any wire before stranding shall not depart from circularity (see **3.4**) by more than 2 % of the nominal wire diameter.

The mass per unit length of the wire before stranding shall be no more than 2 % greater than the nominal value given in tables 1 and 2, as appropriate.

4.2.3 ***Stranded conductors***

The construction of the stranded conductors (i.e. the number of strands and the wire diameter) shall conform to tables 3 and 4, as appropriate.

The mass per unit length of the stranded conductor shall be no more than 2 % greater than the nominal value given in tables 3 and 4, as appropriate.

NOTE 1. The mass of a stranded conductor is affected by the lay ratio. With the exception of the central core wire, all wires are longer than the conductor length and the increase in mass per unit length depends on the lay ratio employed (see annex B).

NOTE 2. Information on the calculation of the increase in length of component wires due to stranding and on the calculation of the masses per unit length and resistance in tables 3 and 4 is given in annex B.

4.3 Mechanical properties

4.3.1 ***Tensile properties***

When tested in accordance with BS EN 10002-1, the tensile breaking load of the component wires before stranding shall conform to tables 1 and 2, as appropriate. The tensile breaking load of the stranded conductors shall conform to tables 3 and 4 as appropriate. The tensile breaking load shall be determined either directly [see a)] or by approximation [see b)] and shall conform to tables 3 and 4, as appropriate.

a) Test on the complete strand in accordance with BS EN 10002-1;

b) Test according to BS EN 10002-1, on each of the component wires before stranding. The breaking load of the complete strand shall be determined by multiplying the sum of the breaking loads of the individual wires by a factor of 0.92 for three and seven strand conductors or 0.90 for nineteen and thirty-seven strand conductors.

NOTE. The tensile breaking load specified corresponds to the maximum force (F_{max}), as defined in BS EN 10002-1.

If it is required to test component wires of a stranded conductor after stranding, the values for a conductor shall satisfy the following conditions:

– The tensile breaking load of an individual strand shall be not less than 92.5 % of the appropriate value given in tables 1 and 2.

– The average breaking load of all the wires in the conductor shall be not less than 94 % of the appropriate value given in tables 1 and 2.

4.3.2 ***Wrap properties***

Solid conductors and component wires taken from stranded conductors, either of copper of less than 5.6 mm nominal diameter, or of copper alloy less than 3.5 mm nominal diameter, shall not break when subjected to the wrap test given in annex C.

4.4 Electrical resistance

When tested in accordance with annex D, the electrical resistance of the conductors at 20 °C shall not exceed the maxima given in tables 1 to 4.

NOTE. These maxima have been calculated on the basis of a resistivity at 20 °C of 0.017 77 μΩ·m for hard drawn high conductivity copper or a resistivity at 20 °C of 0.021 55 μΩ·m for hard drawn copper alloy. These figures correspond to conductivities of 97 % and 80 % IACS respectively.

4.5 Manufacture

4.5.1 Stranding

The construction and lay ratio of the different layers of a stranded conductor shall conform to table 5.

In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed, unless otherwise specified by the purchaser (see **A.1**e). The wires in each layer shall be evenly and closely stranded around the underlying wire or wires.

4.5.2 ***Joins***

4.5.2.1 *Before stranding*

The wires used in the construction of the conductor shall be drawn in continuous lengths without joins, except those made in the drawing stock prior to drawing.

4.5.2.2 *During stranding*

4.5.2.2.1 *Cold compression welding*

Joins in individual wires made by cold compression welding are permissible, but no two joins shall be less than 15 m apart in the completed stranded conductor.

4.5.2.2.2 *Brazing or resistance welding*

For all conductors containing seven wires or less, see **4.5.2.2.1.**

For conductors containing more than seven wires, joins made by brazing or resistance welding are permissible as well as joins made by cold compression welding. However, no two joins of any type shall be less than 15 m apart in the completed stranded conductor.

4.5.3 ***Identification of material***

When requested by the purchaser, one wire in the outer layer of wires shall be tinned for identification purposes.

4.5.4 ***Surface condition***

The surface of a solid conductor, or of the component wires before stranding, shall be clean, smooth and free from harmful defects.

5 Rounding of results

The results obtained from tests for chemical composition and tensile strength shall be rounded to the last place of figures specified as limits, by applying the rounding rule given in BS 1957.

Table 1. Physical, mechanical and electrical properties of solid, circular, hard drawn copper wire

Nominal area of cross-section	Wire diameter			Nominal mass per unit length	Resistance at 20 °C		Minimum breaking load
	Nominal	Max.	Min.				
mm²	mm	mm	mm	kg/km	Ω/km	Ω/km	N
1.43	1.35	1.364	1.337	12.73	12.41	12.66	583
2.01	1.60	1.616	1.584	17.87	8.838	9.018	818
2.27	1.70	1.717	1.683	20.18	7.829	7.988	923
2.54	1.80	1.818	1.782	22.62	6.983	7.125	1035
3.46	2.10	2.121	2.079	30.79	5.130	5.235	1409
3.98	2.25	2.273	2.228	35.35	4.469	4.558	1618
4.75	2.46	2.484	2.435	42.25	3.739	3.816	1932
4.91	2.50	2.525	2.475	43.64	3.620	3.694	1997
5.51	2.65	2.677	2.624	49.03	3.222	3.286	2244
6.16	2.80	2.828	2.772	54.74	2.886	2.944	2505
6.61	2.90	2.929	2.871	58.72	2.690	2.745	2687
7.07	3.00	3.030	2.970	62.84	2.514	2.565	2875
8.04	3.20	3.232	3.168	71.50	2.210	2.254	3271
9.90	3.55	3.586	3.515	87.99	1.795	1.831	4027
11.04	3.75	3.788	3.713	98.19	1.609	1.641	4494
14.52	4.30	4.350	4.250	129.1	1.224	1.253	5675

NOTE 1. Resistance values are calculated from a resistivity of 0.017 77 μΩ·m at 20 °C. This is equivalent to a conductivity of 97 % IACS. Maximum values of resistance are calculated from minimum diameters.

NOTE 2. Minimum breaking loads for nominal diameters up to and including 4 mm are based on the minimum diameter of conductor and a tensile strength of 415 N/mm² and for nominal diameters greater than 4 mm they are based on the minimum diameter of conductor and a tensile strength of 400 N/mm².

NOTE 3. Nominal mass per unit length has been calculated using a density of 8890 kg/m³.

Table 2. Physical, mechanical and electrical properties of solid, circular, hard drawn copper alloy wire

Nominal area of cross-section	Wire diameter			Nominal mass per unit length	Resistance at 20 C		Minimum breaking load
	Nominal	Max.	Min.				
mm²	mm	mm	mm	kg/km	Ω/km	Ω/km	N
2.27	1.70	1.717	1.683	20.30	9.494	9.687	1379
2.54	1.80	1.818	1.782	22.76	8.469	8.641	1546
3.14	2.00	2.020	1.980	28.10	6.860	6.999	1909
3.46	2.10	2.121	2.079	30.98	6.222	6.348	2105
3.98	2.25	2.273	2.228	35.57	5.420	5.527	2417
4.15	2.30	2.323	2.277	37.16	5.187	5.292	2525
4.91	2.50	2.525	2.475	43.91	4.390	4.479	2983
5.31	2.60	2.626	2.574	47.49	4.059	4.141	3226
6.16	2.80	2.828	2.772	55.08	3.500	3.571	3561
6.61	2.90	2.929	2.871	59.08	3.263	3.329	3820
8.04	3.20	3.232	3.168	71.94	2.680	2.734	4651
9.62	3.50	3.535	3.465	86.06	2.240	2.285	5564
10.75	3.70	3.737	3.663	96.18	2.004	2.045	5901
12.57	4.00	4.040	3.960	112.4	1.715	1.750	6897
14.52	4.30	4.350	4.250	129.9	1.484	1.519	7944

NOTE 1. Resistance values are calculated from a resistivity of 0.021 55 μΩ·m at 20 °C. This is equivalent to a conductivity of 80 % IACS. Maximum values of resistance are calculated from minimum diameters.

NOTE 2. Minimum breaking loads are based on minimum wire diameters and tensile strength as follows:

Nominal diameter (mm)	Tensile strength (N/mm²)
up to and including 2.6	620
over 2.6, up to and including 3.5	590
over 3.5	560

NOTE 3. Nominal mass per unit length has been calculated using a density of 8945 kg/m³ and therefore the values apply only to copper-cadmium alloy C108.

Table 3. Physical, mechanical and electrical properties of hard drawn copper stranded conductors

Nominal area of cross-section of stranded conductor	Construction (stranding and wire diameter)	Overall diameter of conductor (approx.)	Nominal mass per unit length	Resistance at 20 °C		Minimum breaking load
				Nominal	Max.	
mm^2	number/mm	mm	kg/km	Ω/km	Ω/km	N
10	7/1.35	4.05	89.82	1.788	1.829	3752
14	7/1.60	4.80	126.2	1.273	1.303	5267
16	3/2.65	5.70	148.3	1.082	1.106	6194
16	7/1.70	5.10	142.4	1.128	1.154	5946
25	7/2.10	6.30	217.3	0.7391	0.7563	9073
32	3/3.75	8.06	296.9	0.5405	0.5520	12400
32	7/2.46	7.38	298.2	0.5386	0.5497	12442
35	7/2.50	7.50	308.0	0.5215	0.5337	12860
50	7/3.00	9.00	443.5	0.3622	0.3706	18520
50	19/1.80	9.00	435.8	0.3727	0.3819	17700
70	7/3.55	10.65	621.1	0.2586	0.2646	25930
70	19/2.10	10.50	593.2	0.2738	0.2806	24090
95	19/2.50	12.50	840.7	0.1932	0.1980	34140
100	7/4.30	12.90	911.2	0.1763	0.1810	36540
120	19/2.80	14.00	1055	0.1540	0.1578	42830
125	19/2.90	14.50	1131	0.1436	0.1471	45940
150	19/3.20	16.00	1377	0.1180	0.1208	55940
150	37/2.25	15.75	1334	0.1233	0.1264	53880
185	19/3.55	17.75	1695	0.09582	0.09815	68860
185	37/2.50	17.50	1647	0.09981	0.1024	66490

NOTE 1. Resistance values are calculated from a resistivity of 0.017 77 μΩ·m at 20 °C. Nominal resistance is calculated from the nominal diameter and mean lay ratio. Maximum resistance is calculated from minimum diameter and minimum lay ratio.

NOTE 2. Minimum breaking load is based on the sum of the minimum breaking loads of the component wires shown in table 2, multiplied by a factor of 0.92 for three and seven wire standards and 0.90 for nineteen and thirty-seven wire strands.

NOTE 3. Nominal mass per unit length has been calculated using a density of 8890 kg/m^3.

Table 4. Physical, mechanical and electrical properties of hard drawn copper alloy stranded conductors

Nominal area of cross-section of stranded conductor	Construction (stranding and wire diameter)	Overall diameter of conductor (approx.)	Nominal mass per unit length	Resistance at 20 °C		Minimum breaking load
				Nominal	Max.	
mm^2	number/mm	mm	kg/km	Ω/km	Ω/km	N
12	3/2.30	4.95	112.4	1.743	1.780	6968
16	7/1.70	5.10	143.3	1.368	1.399	8883
22	7/2.00	6.00	198.3	0.9882	1.011	12290
25	7/2.10	6.30	218.7	0.8959	0.9171	13550
30	7/2.30	6.90	262.3	0.7469	0.7645	16260
35	7/2.50	7.50	309.9	0.6324	0.6471	19210
38	7/2.60	7.80	335.2	0.5847	0.5983	20780
45	7/2.90	8.70	417.0	0.4698	0.4809	24600
55	7/3.20	9.60	507.8	0.3859	0.3950	29950
70	19/2.10	10.50	596.8	0.3316	0.3403	35990
75	7/3.70	11.10	678.8	0.2887	0.2954	38010
95	19/2.50	12.50	845.9	0.2343	0.2400	51010
100	7/4.30	12.90	916.9	0.2138	0.2195	51160
120	19/2.80	14.00	1061	0.1862	0.1914	60890
125	19/2.90	14.50	1138	0.1739	0.1784	65310
150	19/3.20	16.00	1386	0.1428	0.1465	79530
150	37/2.25	15.75	1342	0.1493	0.1533	80490
180	19/3.50	17.50	1658	0.1196	0.1225	95140
180	37/2.50	17.50	1657	0.1209	0.1242	99330
200	19/3.70	18.50	1853	0.1068	0.1696	100900
240	19/4.00	20.00	2165	0.09153	0.09378	117900

NOTE 1. Resistance values are calculated from a resistivity of 0.02155 μΩ·m at 20 °C. Nominal resistance is calculated from the nominal diameter and mean lay ratio. Maximum resistance is calculated from minimum diameter and minimum lay ratio.

NOTE 2. Minimum breaking load is based on the sum of the minimum breaking loads of the component wires shown in table 3, multiplied by a factor of 0.92 for three and seven wire strands and 0.90 for nineteen and thirty-seven wire strands.

NOTE 3. Nominal mass per unit length has been calculated using a density of 8945 kg/m^3 and therefore the values apply only to copper-cadmium alloy C108.

Table 5. Lay ratios of stranded conductors

Number of wires in conductor	Lay ratio							
	3 wire layer		6 wire layer		12 wire layer		18 wire layer	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
3	11	16	—	—	—	—	—	—
7	—	—	13	17	—	—	—	—
19	—	—	13	17	12	15	—	—
37	—	—	13	17	12	15	10.5	13

6 Selection of test samples

6.1 Tests before stranding

Test samples shall be taken before stranding from not less than 10 % of the individual lengths of wire to be included in any one consignment of stranded conductors. One test sample, sufficient to provide one specimen for each test, shall be taken from each of the selected lengths of wire.

6.2 Tests after stranding

Test samples of conductor shall be selected from not less than 10 % of the drums included in any one consignment. Each test sample shall be sufficient to provide specimens for each test.

6.3 Retests

6.3.1 *Tests completed before stranding*

Any test samples from which the specimens fail to pass any of the tests specified in this standard shall be subjected to two retests. Should these retests result in failure of a test and the failures outnumber the passes, the package (reel/parcel) shall be rejected. If 10 % of the selected test samples from any consignment of material fail to be accepted then the whole consignment shall be deemed not to conform to this standard.

6.3.2 *Tests completed after stranding*

Any test samples from which specimens fail to pass any of the tests given in this standard shall be subjected to two retests. Should retests result in failure of a test and the failures outnumber the passes, the package (drum) shall be rejected. If 10 % of the selected test samples from any consignment of material fail to be accepted then the whole consignment shall be deemed not to conform to this standard.

7 Inspection documentation

When requested by the purchaser and agreed with the supplier, the supplier shall issue for the goods the appropriate declaration of conformity, in accordance with BS EN 1655, or a certificate of results of inspection.

8 Marking, labelling and packaging

Unless otherwise specified by the purchaser and agreed by the supplier, the marking, labelling and packaging shall be left to the discretion of the supplier.

Annexes

Annex A (informative)
Information to be supplied by the purchaser

A.1 The following information should be supplied by the purchaser at the time of enquiry and order:

a) the quantity of material required;

b) the number of this standard;

c) the material from which the conductor is to be manufactured;

d) the product construction, i.e. the number of wires and wire diameter;

e) if the direction of lay of the outermost layer of the stranded conductor is to be left-handed (see **4.5.1**);

f) if tests on the stranded conductor are to be carried out in the presence of a representative of the purchaser;

g) any delivery requirements, e.g. coil size, type of spool;

h) whether a declaration of conformity or a certificate of results of inspection is required;

i) any testing required (see **A.3**b).

A.2 The following information may be pertinent and should be supplied, if appropriate, at the time of enquiry and order:

a) whether special surface conditions are required, e.g. greased wires;

b) whether there are any special requirements for marking, labelling or packaging,

c) whether there is a special requirement for weight or length per coil or spool.

A.3 In normal commercial practice two levels of certification of the quality of the product should be available at the request of the purchaser, as follows:

a) Declaration of conformity. This is a statement from the supplier, claiming, under the supplier's sole responsibility, that a product conforms to this standard.

b) Certificate of results of inspection. This certificate is issued on the basis of tests, requested by the purchaser, having been carried out on the manufacturing batch from which the supplied consignment has been taken.

Annex B (informative)
Notes on the calculation of tables 3 and 4

B.1 General

The calculations involved in deriving the mass per unit length of stranded conductor and the resistance per kilometre of stranded conductor have been based on the factors given in **B.2** and **B.3**.

B.2 Increase in length due to stranding

When straightened out, each wire in a particular layer of stranded conductor, except the centre wire, is assumed to be longer than the stranded conductor by an amount depending on the mean lay ratio (see table 5) of that layer, as shown in table B.1.

Table B.1 Increase in length due to stranding

	Three wire conductor	Six wire layer	Twelve wire layer	Eighteen wire layer
Mean of maximum and minimum lay ratios as defined in **3.7** and table 5	13.5	15	13.5	11.75
Mean of maximum and minimum lay ratios based on mean helix diameter, used for calculating percentage increase in length of single wires	15	22.5	16.88	13.71
Percentage increase in length, calculated	0.79	0.97	1.72	2.59

B.3 Mass and resistance

The mass of each wire in any particular layer (except the centre) of a length of stranded conductor will be greater than that of an equal length of the straight wire by an amount depending on the mean lay ratio. In tables 3 and 4 the areas, masses and resistance of the stranded conductors have been calculated by multiplying the corresponding values for a single wire by the factors given in table B.2.

Table B.2 Stranding constants

Number of wires stranded	Multiplying factor for mean lay ratio		
	Area	Mass	Resistance
3	2.977	3.024	0.3360
7	6.942	7.058	0.1440
19	18.74	19.26	0.0534
37	36.27	37.73	0.0276

Annex C (normative)
Wrapping test

C.1 General

The wrapping test, for assessing the ductility of the conductor, shall be carried out on solid conductors (see **6.1**) and on individual component wires taken from the test sample of stranded conductors (see **6.2**).

C.2 Procedure

Wrap the specimen around a mandrel of the same diameter to form a close helix of eight turns. Unwrap six of the turns and re-wrap them closely in the same direction as the first wrapping. Examine the specimen, by eye (corrected for normal vision if necessary), for any signs of fracture.

Annex D (normative)
Electrical resistance test

The resistance per unit length shall be determined by direct measurement on a specimen using the routine method given in BS 5714. In cases of dispute, the reference method in BS 5714 shall be used, or any other method acceptable to the disputing parties.

Correct the value obtained to the reference temperature of 20 °C by means of the appropriate factor, given in tables D.1 and D.2 for hard drawn copper and copper-cadmium respectively. For copper alloys other than copper-cadmium the test shall be conducted at 20 °C ± 1 °C.

Table D.1 Factors for correcting resistance: hard drawn high conductivity copper of conductivity 97 % IACS

1	2	3	1	2	3
Temperature °C	**Correction factor**	**Reciprocal of factor**	**Temperature** °C	**Correction factor**	**Reciprocal of factor**
5	1.0606	0.9429	20.5	0.9981	1.0019
5.5	1.0585	0.9448	21	0.9962	1.0038
6	1.0563	0.9467	21.5	0.9943	1.0057
6.5	1.0542	0.9486	22	0.9924	1.0076
7	1.0521	0.9505	22.5	0.9906	1.0095
7.5	1.0500	0.9524	23	0.9887	1.0114
8	1.0479	0.9543	23.5	0.9868	1.0133
8.5	1.0458	0.9562	24	0.9850	1.0152
9	1.0437	0.9581	24.5	0.9831	1.0171
9.5	1.0417	0.9600	25	0.9813	1.0191
10	1.0396	0.9619	25.5	0.9795	1.0210
10.5	1.0376	0.9638	26	0.9777	1.0229
11	1.0355	0.9657	26.5	0.9758	1.0248
11.5	1.0335	0.9676	27	0.9740	1.0267
12	1.0314	0.9695	27.5	0.9722	1.0286
12.5	1.0294	0.9714	28	0.9704	1.0305
13	1.0274	0.9733	28.5	0.9686	1.0324
13.5	1.0254	0.9752	29	0.9668	1.0343
14	1.0234	0.9771	29.5	0.9651	1.0362
14.5	1.0214	0.9790	30	0.9633	1.0381
15	1.0194	0.9810	30.5	0.9615	1.0400
15.5	1.0174	0.9829	31.0	0.9598	1.0419
16	1.0155	0.9848	31.5	0.9580	1.0438
16.5	1.0135	0.9867	32.0	0.9563	1.0457
17	1.0116	0.9886	32.5	0.9545	1.0476
17.5	1.0096	0.9905	33.0	0.9528	1.0495
18	1.0077	0.9924	33.5	0.9511	1.0514
18.5	1.0057	0.9943	34.0	0.9494	1.0533
19	1.0038	0.9962	34.5	0.9476	1.0552
19.5	1.0019	0.9981	35.0	0.9459	1.0572
20	1.0000	1.0000			

NOTE 1. The primary purpose of this table is to enable a resistance measured at a temperature other than 20 °C to be converted to the resistance at 20 °C in order to determine whether the conductor under test conforms to this standard. Given the resistance at T °C, the resistance at 20 °C is found by multiplying the resistance at T °C by the constant for T °C given in column 2. Conversely, given the resistance at 20 °C, the corresponding resistance at T °C is found by multiplying the resistance at 20 °C by the reciprocal for T °C given in column 3. For this purpose the factors have been given at intervals of 0.5 °C from 5 °C to 35 °C, and the error in using the table between these limits does not exceed 0.06 % for copper within the range of conductivity 96 % to 98 % IACS.

NOTE 2. The temperature coefficient of resistance of copper varies slightly from sample to sample according to its exact conductivity. The figures given are based on a value of the temperature coefficient of resistance of 0.003 81 per degree Celsius, which is an average value for copper of 97 % IACS conductivity.

Table D.2 Factors for correcting resistance: hard drawn copper-cadmium

1	2	3	1	2	3
Temperature °C	**Correction factor**	**Reciprocal of factor**	**Temperature** °C	**Correction factor**	**Reciprocal of factor**
5	1.049	0.954	20.5	0.998	1.002
5.5	1.047	0.955	21	0.997	1.003
6	1.045	0.957	21.5	0.995	1.005
6.5	1.044	0.958	22	0.994	1.006
7	1.042	0.960	22.5	0.992	1.008
7.5	1.040	0.961	23	0.991	1.009
8	1.039	0.963	23.5	0.989	1.011
8.5	1.037	0.964	24	0.988	1.012
9	1.035	0.966	24.5	0.986	1.014
9.5	1.033	0.968	25	0.985	1.016
10	1.032	0.969	25.5	0.983	1.017
10.5	1.030	0.971	26	0.982	1.019
11	1.029	0.972	26.5	0.980	1.020
11.5	1.027	0.974	27	0.979	1.022
12	1.025	0.975	27.5	0.977	1.023
12.5	1.024	0.977	28	0.976	1.025
13	1.022	0.978	28.5	0.974	1.026
13.5	1.021	0.980	29	0.973	1.028
14	1.019	0.981	29.5	0.971	1.030
14.5	1.017	0.983	30	0.970	1.031
15	1.016	0.984	30.5	0.9685	1.032
15.5	1.014	0.986	31	0.9670	1.034
16	1.013	0.988	31.5	0.9656	1.036
16.5	1.011	0.989	32	0.9641	1.037
17	1.009	0.991	32.5	0.9627	1.039
17.5	1.008	0.992	33	0.9613	1.040
18	1.006	0.994	33.5	0.9598	1.042
18.5	1.005	0.995	34	0.9584	1.043
19	1.003	0.997	34.5	0.9570	1.045
19.5	1.002	0.998	35	0.9556	1.047
20	1.000	1.000			

NOTE 1. The primary purpose of this table is to enable a resistance measured at a temperature other than 20 °C to be converted to the resistance at 20 °C in order to determine whether the conductor under test conforms to this standard. Given the resistance at T °C, the resistance at 20 °C is found by multiplying the resistance at T °C by the constant for T °C given in column 2. Conversely, given the resistance at 20 °C, the corresponding resistance at T °C is found by multiplying the resistance at 20 °C by the reciprocal for T °C given in column 3

NOTE 2. The temperature coefficient of resistance of copper varies slightly from sample to sample according to its exact conductivity. The figures given are based on a value of the temperature coefficient of resistance of 0.0031 per degree Celsius, which is an average value for copper of 80 % IACS conductivity.

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List of references (see clause 2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 1957 : 1953	*Presentation of numerical values (fineness of expression; rounding of numbers)*
BS 2873 : 1969	*Specification for copper and copper alloys. Wire*
BS 5714 : 1979	*Method of measurement of resistivity of metallic materials*
BS 6926 : 1988	*Specification for copper for electical purposes: high conductivity copper wire rod*
BS EN 10002-1 : 1990	*Tensile testiong of metallic materials — Part 1: Method of test at ambient temperature*
BS EN 1655	*Copper and copper alloys — Declarations of conformity*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 23 : 1970	*Specification for copper and copper-cadmium trolley and contact wire for electrical traction*

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