Designation: B 888 – 04

Standard Specification for Copper Alloy Strip for Use in Manufacture of Electrical Connectors or Spring Contacts[1]

This standard is issued under the fixed designation B 888; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification establishes the requirements for copper alloy strip for use in the manufacture of electrical connectors or spring contacts produced from one of the following Copper Alloy UNS Nos.[2]: C14530, C15100, C15500, C19010, C19025, C19210, C19400, C19500, C19700, C23000, C26000, C40810, C40850, C40860, C42200, C42500, C42520, C42600, C50580, C50780, C51000, C51080, C51100, C51180, C51980, C52100, C52180, C52480, C63800, C65400, C68800, C70250, C70260, C70265, C75200, and C76200.

1.2 The requirements for the other copper alloys such as beryllium copper UNS C17000, C17200, C17400, C17410, C17500, and C17510 shall be as prescribed in the current edition of Specifications B 194, B 768, and B 534, and copper-nickel-tin spinodal, UNS C72650, C72700, and C72900 shall be as prescribed in the current edition of Specification B 740.

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in noncompliance with this specification.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

B 193 Test Method for Resistivity of Electrical Conductor Material

B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

B 248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar [Metric]

B 534 Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

B 740 Specification for Copper-Nickel-Tin Spinodal Alloy Strip

B 768 Specification for Copper-Cobalt-Beryllium Alloy Strip and Sheet

B 820 Test Method for Bend Test for Formability of Copper Alloy Spring Material

B 846 Terminology for Copper and Copper Alloys

E 8 Test Methods for Tension Testing of Metallic Materials

E 8M Test Methods for Tension Testing of Metallic Materials [Metric]

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes[4]

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)

E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys

E 478 Test Methods for Chemical Analysis of Copper Alloys

E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 *ISO Standards:*

ISO 4744 Copper and Copper Alloys—Determination of Chromium Content - Flame Atomic Absorption Spectrometric Method[5]

[1] This specification is under the jurisdiction of Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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[2] The UNS system for copper and copper alloys (see Practice E 527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix "c" and a suffix "00." The suffix can be used to accommodate composition variations of the base alloy.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Withdrawn.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

***A Summary of Changes section appears at the end of this standard.**

ISO 7602 Copper and Copper Alloys—Determination of Tellurium Content[5]

3. Terminology

3.1 *Definitions*—For definition of terms used in this specification, refer to Terminology B 846.

4. General Requirements

4.1 For product furnished under this specification in English units, the following sections of Specification B 248 must constitute a part of this specification. For product furnished under this specification in the SI units, the following sections of Specification B 248M must constitute a part of this specification.

4.1.1 Terminology,
4.1.2 Materials and Manufacture,
4.1.3 Dimensions, Weights, and Permissible Variations,
4.1.4 Workmanship, Finish, and Appearance,
4.1.5 Sampling,
4.1.6 Number of Tests and Retests,
4.1.7 Specimen Preparation,
4.1.8 Test Methods,
4.1.9 Significance of Numerical Limits,
4.1.10 Certification,
4.1.11 Test Reports, and
4.1.12 Packaging and Package Marking.

4.2 In the event of a conflict between this specification and Specification B 248 or B 248M, the requirements of this specification shall take precedence.

5. Classification

5.1 Product produced to this specification is classified as strip material to be used for spring contact or electrical and electronic connector applications only.

6. Ordering Information

6.1 Contract or purchase orders for product under this specification should include the following information:

6.1.1 ASTM designation and year of issue,
6.1.2 UNS alloy designation,
6.1.3 Dimensions, for example, thickness, width,
6.1.4 Quantity, and
6.1.5 Temper (Section 8).

6.2 The following options are available under this specification and shall be specified in the contract or purchase order when required:

6.2.1 Type of edge: slit, sheared, sawed, square corners, rounded corners, rounded edges, or full-rounded edges (Section 11),

6.2.2 Width and straightness tolerances, slit-metal tolerances, square-sheared metal tolerances, sawed metal tolerances, straightened or edge-rolled metal tolerances (Section 11),

6.2.3 Identification marking (Section 22),
6.2.4 Certification (Section 20),
6.2.5 Mill test report (Section 21), and
6.2.6 How packaged: coil wound in traverse or pancake style (Section 22).
6.2.6.1 Number of strip lengths per coil,
6.2.6.2 Size and weight of each coil, and
6.2.7 The electrical resistivity or any other physical and electrical properties (See Table X1.1).

7. Materials and Manufacture

7.1 *Material*—The material of manufacture shall be a cast bar, slab, cake, billet, or other form of the composition given in Table 1 for the specified alloy, suitable for processing into the product prescribed in this specification.

7.2 *Manufacture*—The product shall be produced by either hot- or cold-working operation. It shall be finished, unless otherwise specified, by such hot working, cold working, annealing, or heat treatment as may be necessary to meet the properties specified in Table 2.

7.3 *Edges*—The edges shall be slit or rolled edges as specified by the buyer. Slit edges shall be furnished unless otherwise specified or agreed upon between the purchaser and supplier or manufacturer.

8. Chemical Composition

8.1 The materials shall conform to the chemical compositional requirements in Table 1 for the corresponding Copper Alloy UNS Number designation specified in the ordering information.

8.2 These composition limits do not preclude the presence of other elements. Limits for unnamed elements may be established and analysis required by agreement between manufacturer or supplier and purchaser when required.

8.3 Copper, when given as the remainder, is determined as the difference between the sum of results for all elements determined and 100 %.

8.4 Zinc, when given as the remainder, is determined as the difference between the sum of results for all elements determined and 100 %.

8.4.1 For those copper alloys in which zinc is given as the remainder, copper may be determined by difference; however, when so determined, the result shall conform to the limits prescribed in Table 1.

8.5 When all elements listed in Table 1 for the Copper Alloy UNS Number specified in the ordering information are determined, the sum of results shall be 99.8 % minimum, except for UNS No. C26000, C42200, and C42500, which shall be

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Elements Composition, % Copper	Aluminum	Cobalt	Iron	Lead	Magnesium	Manganese	Nickel	Phosphorus	Tin	Zinc	Chromium	Zirconium	Silicon	Silver	Tellurium
C14530	99.90 min								0.001-0.010	0.003-0.023						0.003-0.023^{A}
C15100	99.82 min	0.005 max^{B}		0.005 max^{B}			0.005 max^{B}						0.05-0.15			
C15500	99.75^{C} min					0.08-0.13			0.04-0.08						0.027-010	
C19010	remainder^{D}							0.8-1.8	0.01-0.05					0.15-0.35		
C19025	remainder^{E}			0.10 max				0.8-1.2	0.03-0.07	0.7-1.1	0.20 max					
C19210	remainder			0.05-0.15					0.025-0.04							
C19400	97.0 min			2.1-2.6	0.03 max				0.015-0.15		0.05-0.20					
C19500	96.0 min	0.02 max	0.30-1.3	1.0-2.0	0.02 max				0.01-0.35	0.10-1.0	0.20 max					
C19700	remainder		0.05 max	0.3-1.2	0.05 max	0.01-0.20	0.05 max	0.05 max	0.10-0.40	0.20 max	0.20 max					
C23000	84.0-86.0			0.05 max	0.05 max						remainder					
C26000	68.5-71.5			0.05 max	0.07 max						remainder					
C40810	94.5-96.5^{E}			0.08-0.12	0.05 max			0.11-0.20	0.028-0.04	1.8-2.2	remainder					
C40850	94.5-96.5^{E}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.04	2.6-4	remainder					
C40860	94-96^{E}			0.01-0.05	0.05 max			0.05-0.20	0.02-0.04	1.7-2.3	remainder					
C42200	86.0-89.0			0.05 max	0.05 max				0.35 max	0.8-1.4	remainder					
C42500	87.0-90.0			0.05 max	0.05 max				0.35 max	1.5-3.0	remainder					
C42520	88-91^{E}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.04	1.5-3	remainder					
C42600	87.0-90.0			0.05-0.20	0.05 max			0.05-0.20	0.02-0.05	2.5-4.0	remainder					
C50580	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	1.0-1.7	0.3 max					
C50780	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	1.7-2.3	0.3 max					
C51000	remainder			0.10 max	0.05 max				0.03-0.35	4.2-5.8	0.30 max					
C51080	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	4.8-5.8	0.3 max					
C51100	remainder			0.10 max	0.05 max				0.03-0.35	3.5-4.9	0.30 max					
C51180	remainder^{F}			0.05-0.20	0.05 max			0.11-0.20	0.02-0.10	3.5-4.9	0.3 max					
C51980	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	5.5-7.0	0.3 max					
C52100	remainder			0.10 max	0.05 max				0.03-0.35	7.0-9.0	0.20 max					
C52180	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	7.0-9.0	0.3 max					
C52480	remainder^{F}			0.05-0.20	0.05 max			0.05-0.20	0.02-0.10	9.0-11.0	0.3 max					
C63800	remainder	2.5-3.1	0.25-0.55	0.20 max	0.05 max		0.10 max	0.20 max			0.8 max			1.5-2.1		
C65400	remainder^{G}				0.05 max					1.2-1.9	0.50 max	0.01-0.12		2.7-3.4		
C68800	remainder^{G}	3.0-3.8^{C}	0.25-0.55	0.20 max	0.05 max						21.3-24.1^{C}					
C70250	remainder			0.20 max	0.05 max	0.05-0.30	0.10 max	2.2-4.2^{H}			1.0 max			0.25-1.2		
C70260	remainder^{D}							1.0-3.0^{D}	0.005 max^{D}					0.20-0.70^{D}		
C70265	remainder^{D}				0.05 max			1.0-3.0^{H}	0.01 max	0.05-0.8	0.30 max			0.20-.07		
C75200	63.5-66.5			0.25 max	0.05 max		0.50 max	16.5-19.5^{H}			remainder					
C76200	57.0-61.0			0.25 max	0.10 max		0.50 max	11.0-13.5^{H}			remainder					

^{A} Includes Te + Se.
^{B} Aluminum + iron + manganese not to exceed 0.01 %.
^{C} Aluminum + zinc = 25.1 – 27.1.
^{D} Copper + nickel + phosphorus + silicon 99.5 min.
^{E} Copper + other elements 99.7 % min.
^{F} Copper + other elements 99.5 % min.
^{G} Including silver.
^{H} Including cobalt.

TABLE 2 Mechanical Requirements

Temper Designation		Tensile Strength, ksi		Tensile Strength, MPa		Yield Strength (0.2 % Offset), ksi	Yield Strength (0.2 % Offset), MPa	Elongation, %
Standard	Former	min	max	min	max	min	min	min
				Copper Alloy UNS NO. C14530				
H01	¼ hard	35	45	240	310	26	180	7
H02	½ hard	40	50	275	345	33	230	5
H03	¾ hard	44	54	305	370	39	270	3
H04	hard	47	57	325	395	43	295	2
H06	extra hard	50	60	345	415	47	325	1
H08	spring	54	64	370	440	51	350	1
H10	extra spring	58	. . .	400	. . .	56	385	. . .
				Copper Alloy UNS NO. C15100				
O61	annealed	37	42	255	290	9	60	35
H01	¼ hard	40	45	275	310	26	180	11
H02	½ hard	43	51	295	350	35	240	3
H03	¾ hard	47	56	325	385	45	310	1
H04	hard	53	62	365	425	51	350	1
H06	extra hard	59	65	405	450	57	395	1
H08	spring	64	71	440	490	62	425	1
				Copper Alloy UNS NO. C15500				
O61	annealed	34	43	235	295	15	105	30
H02	½ hard	45	55	310	380	38	260	13
H04	hard	56	64	385	440	50	345	6
H06	extra hard	63	72	435	495	56	385	5
H08	spring	65	73	450	505	60	415	4
H10	extra spring	68	75	470	515	63	435	3
				Copper Alloy UNS NO. C19010				
TM03	¾ HM	67	77	460	520	50	340	12
TM04	HM	71	81	490	560	60	410	10
TM06	XHM	75	86	520	590	64	440	8
TM08	SHM	84	. . .	580	. . .	74	510	6
H01	¼ hard	52	64	360	430	40	275	8
H02	½ hard	60	70	410	470	54	370	7
H03	¾ hard	67	77	460	520	62	410	5
H04	hard	71	81	490	560	66	435	4
H06	extra hard	75	86	520	590	72	460	3
H08	spring	84	95	580	655	78	520	2
H10	extra spring	95	. . .	655	. . .	85	585	1
				Copper Alloy UNS NO. C19025				
HR01	¼ hard	49	68	340	470	42	290	15
HR02	½ hard	63	76	435	525	58	400	9
HR04	hard	72	83	495	570	68	470	5
HR06	extra hard	78	89	540	615	74	510	4
HR08	spring	84	95	580	655	81	560	. . .
HR10	extra spring	91	106	625	730	88	605	. . .
				Copper Alloy UNS NO. 19210				
O61	annealed	27	42	190	290	16	110	30
H01	¼ hard	43	53	300	365	20	135	20
H02	½ hard	47	60	325	410	44	310	5
H03	¾ hard	52	62	355	425	50	345	4
H04	full hard	56	66	385	455	54	355	3
H06	extra hard	60	70	410	480	58	400	2
H08	spring hard	64	74	440	510	62	425	1
H10	extra spring	66	. . .	455	. . .	64	440	1
				Copper Alloy UNS NO. C19400				
O61	annealed	40	63	275	435	16	110	10
H02	½ hard	53	63	365	435	36	250	6
H04	full hard	60	70	415	485	53	365	3
H06	extra hard	67	73	460	505	64	440	2
H08	spring hard	70	76	485	525	67	460	2
H10	extra spring	73	80	505	550	70	485	1
				Copper Alloy UNS NO. C19500				
O61	annealed	50	60	345	415	21	145	22
H01	¼ hard	60	72	415	495	45	310	5
H02	½ hard	68	78	470	540	66	455	3
H03	¾ hard	75	85	515	585	72	495	2

TABLE 2 *Continued*

Temper Designation		Tensile Strength, ksi		Tensile Strength, MPa		Yield Strength (0.2 % Offset), ksi	Yield Strength (0.2 % Offset), MPa	Elongation, %
Standard	Former	min	max	min	max	min	min	min
H04	full hard	82	90	565	620	79	545	2
H08	spring	88	97	605	670	85	585	1
				Copper Alloy UNS NO. C19700				
O61	annealed	43	53	295	365	16	110	20
H02	½ hard	53	63	365	435	36	250	6
H04	full hard	60	70	415	485	53	365	2
H06	extra hard	67	73	460	505	64	440	2
H08	spring hard	70	76	485	525	67	460	2
H10	extra spring	73	80	505	550	70	485	1
				Copper Alloy UNS NO. C23000				
O61	annealed	39	47	270	325	8	55	43
H01	¼ hard	44	54	305	370	23	160	15
H02	½ hard	51	61	350	420	43	295	8
H03	¾ hard	57	67	395	460	51	350	4
H04	hard	63	72	435	495	57	395	4
H06	extra hard	72	80	495	550	65	450	3
H08	spring	78	86	540	595	69	475	3
H10	extra spring	82	90	565	620	73	505	2
				Copper Alloy UNS NO. C26000				
O61	annealed	45	61	310	420	10	70	40
H01	¼ hard	49	59	340	405	21	145	34
H02	½ hard	57	67	395	460	42	290	19
H03	¾ hard	64	74	440	510	55	380	8
H04	hard	71	81	490	560	67	460	6
H06	extra hard	83	92	570	635	79	545	2
H08	spring	91	100	625	690	82	565	1
H10	extra spring	95	104	655	715	86	595	1
				Copper Alloy UNS NO. C40810				
H02	½ hard	57	73	395	505	41	285	20
H04	hard	75	87	515	600	68	470	8
H06	extra hard	88	97	605	670	84	580	6
H08	spring	92	100	635	690	88	605	4
				Copper Alloy UNS NO. C40850				
H02	½ hard	57	73	395	505	41	285	20
H04	hard	75	87	515	600	68	470	8
H06	extra hard	88	97	605	670	84	580	6
H08	spring	92	104	635	715	90	620	4
				Copper Alloy UNS NO. C40860				
H02	½ hard	56	72	385	495	40	275	20
H04	hard	73	86	505	595	66	455	8
H06	extra hard	86	96	595	660	84	580	6
H08	spring	90	103	620	710	88	605	4
				Copper Alloy UNS NO. C42200				
O61	annealed	41	49	285	340	12	85	43
H01	¼ hard	47	57	325	395	21	145	17
H02	½ hard	54	65	370	450	48	330	6
H03	¾ hard	60	72	415	495	58	400	4
H04	hard	67	79	460	545	67	460	3
H06	extra hard	75	85	515	585	72	495	2
H08	spring	82	92	565	635	77	530	2
H10	extra spring	88	. . .	605	. . .	82	565	1
				Copper Alloy UNS NO. C42500				
O61	annealed	41	47	285	325	13	90	47
H01	¼ hard	49	59	340	405	20	140	24
H02	½ hard	57	69	395	475	51	350	13
H03	¾ hard	62	74	425	510	58	400	10
H04	hard	70	82	485	565	66	455	6
H06	extra hard	76	88	525	605	73	505	5
H08	spring	84	94	580	650	81	560	3
H10	extra spring	92	. . .	635	. . .	87	600	. . .
				Copper Alloy UNS NO. C42520				

TABLE 2 *Continued*

Temper Designation		Tensile Strength, ksi		Tensile Strength, MPa		Yield Strength (0.2 % Offset), ksi	Yield Strength (0.2 % Offset), MPa	Elongation, %
Standard	Former	min	max	min	max	min	min	min
H02	½ hard	67	82	460	565	60	415	20
H04	hard	80	95	550	655	75	515	8
H06	extra hard	90	105	620	725	85	585	6
H08	spring	95	110	655	760	90	620	4
H10	extra spring	100	115	690	795	95	655	3
Copper Alloy UNS NO. C42600								
H02	½ hard	72	87	495	600	65	450	12
H04	hard	85	100	585	690	80	550	8
H06	extra hard	97	112	670	770	92	635	6
H08	spring	108	123	745	850	103	710	3
H10	extra spring	114	128	785	885	110	760	1
Copper Alloy UNS NO. C50580								
H02	½ hard	56	71	385	490	51	350	15
H04	hard	69	84	475	580	66	455	8
H06	extra hard	74	89	510	615	71	490	6
H08	spring	79	94	545	650	77	530	5
Copper Alloy UNS NO. C50780								
H02	½ hard	58	74	400	510	43	295	15
H04	hard	75	88	515	605	65	450	8
H06	extra hard	83	97	570	670	76	525	5
H08	spring	86	100	595	690	81	560	3
Copper Alloy UNS NO. C51000								
O61	annealed	46	56	315	385	19	130	48
H01	¼ hard	49	61	340	420	22	150	32
H02	½ hard	58	73	400	505	47	325	10
H03	¾ hard	68	79	470	545	61	420	10
H04	hard	76	91	525	625	74	510	9
H06	extra hard	88	103	605	710	85	585	2
H08	spring	95	110	655	760	92	635	1
H10	extra spring	100	114	690	785	98	675	1
Copper Alloy UNS NO. C51080								
H02	½ hard	87	102	600	705	83	670	8
H04	hard	100	115	690	795	96	660	6
H06	extra hard	105	120	725	825	101	695	4
H08	spring	110	125	760	860	107	740	1
Copper Alloy UNS NO. C51100								
O61	annealed	46	54	315	370	16	110	45
H01	¼ hard	46	58	315	400	20	140	25
H02	½ hard	55	70	380	485	42	290	12
H03	¾ hard	67	82	460	565	64	440	6
H04	hard	72	87	495	600	70	485	2
H06	extra hard	84	99	580	685	81	560	1
H08	spring	91	105	625	725	88	605	1
H10	extra spring	96	109	660	750	92	635	1
Copper Alloy UNS NO. C51180								
H02	½ hard	83	98	570	675	78	540	15
H04	hard	97	112	670	770	93	640	8
H06	extra hard	102	117	705	805	98	675	5
H08	spring	105	120	725	825	103	710	2
Copper Alloy UNS NO. C51980								
H02	½ hard	90	105	620	725	86	595	18
H04	hard	103	118	710	815	99	685	10
H06	extra hard	109	124	750	855	105	725	6
H08	spring	115	130	795	895	112	770	2
Copper Alloy UNS NO. C52100								
O61	annealed	56	65	385	450	23	160	60
H01	¼ hard	63	75	435	515	35	240	40
H02	½ hard	69	84	475	580	51	350	25
H03	¾ hard	80	92	550	635	70	485	18
H04	hard	85	100	585	690	78	540	12
H06	extra hard	97	112	670	770	92	635	10