Designation: ~~B258 – 14~~ B258 – 18

Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors[1]

This standard is issued under the fixed designation B258; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification prescribes standard nominal diameters and cross-sectional areas of American Wire Gage (AWG) sizes of solid round wires, used as electrical conductors, and gives equations and rules for the calculation of standard nominal mass and lengths, resistances, and breaking strengths of such wires (Explanatory Note 1).

1.2 The values stated in inch-pound or SI units are to be regarded separately as standard. Each system shall be used independently of the other. Combining values of the two systems may result in nonconformance with the specification. For conductor sizes designated by AWG or kcmil sizes, the requirements in SI units have been numerically converted from the corresponding values stated or derived, in inch-pound units. For conductor sizes designated by SI units only, the requirements are stated or derived in SI units.

1.2.1 For density, resistivity and temperature, the values stated in SI units are to be regarded as standard.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:[2]

A111 Specification for Zinc-Coated (Galvanized) "Iron" Telephone and Telegraph Line Wire
A326 Specification for Zinc-Coated (Galvanized) High Tensile Steel Telephone and Telegraph Line Wire (Withdrawn 1990)[3]
B1 Specification for Hard-Drawn Copper Wire
B2 Specification for Medium-Hard-Drawn Copper Wire
B3 Specification for Soft or Annealed Copper Wire
B9 Specification for Bronze Trolley Wire
B33 Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
B47 Specification for Copper Trolley Wire
B105 Specification for Hard-Drawn Copper Alloy Wires for Electric Conductors
B189 Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
B193 Test Method for Resistivity of Electrical Conductor Materials
B227 Specification for Hard-Drawn Copper-Clad Steel Wire
B230/B230M Specification for Aluminum 1350–H19 Wire for Electrical Purposes
B314 Specification for Aluminum 1350 Wire for Communication Cable (Withdrawn 1994)[3]
B396 Specification for Aluminum-Alloy 5005-H19 Wire for Electrical Purposes (Withdrawn 2003)[3]
B398/B398M Specification for Aluminum-Alloy 6201-T81 and 6201-T83 Wire for Electrical Purposes
B415 Specification for Hard-Drawn Aluminum-Clad Steel Wire

[1] This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.02 on Methods of Test and Sampling Procedure.

Current edition approved ~~April 1, 2014~~Oct. 1, 2018. Published ~~April 2014~~October 2018. Originally approved in 1951. Last previous edition approved in ~~2008~~2014 as ~~B258 – 02 (2008).~~B258 – 14. DOI: ~~10.1520/B0258-14.~~10.1520/B0258-18.

[2] 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~~standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

B498/B498M Specification for Zinc-Coated (Galvanized) Steel Core Wire for Use in Overhead Electrical Conductors
B502 Specification for Aluminum-Clad Steel Core Wire for Use in Overhead Electrical Aluminum Conductors
B606 Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced
B609/B609M Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes
B800 Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes—Annealed and Intermediate Tempers
B802 Specification for Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[Metric](Discontinued 1998-Replaced by B 802/B802M) B0802_B0802M
B803 Specification for High-Strength Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors
B957 Specification for Extra-High-Strength and Ultra-High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Overhead Electrical Conductors
B958 Specification for Extra-High-Strength and Ultra-High-Strength Class A Zinc–5% Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
F205 Test Method for Measuring Diameter of Fine Wire by Weighing

3. Standard Reference Temperature

3.1 For the purpose of this specification, all wire dimensions and properties shall be considered as occurring at the internationally standardized reference temperature of 20°C (68°F).

4. Standard Rules for Rounding

4.1 All calculations for the standard nominal dimensions and properties of solid round wires shall be rounded in the *final* value only, in accordance with rounding method of Practice E29.

5. Standard Nominal Diameters

5.1 Standard nominal diameters of AWG sizes of solid round wires shall be calculated in accordance with the conventional mathematical law of the American Wire Gage (see Explanatory Note 1) and in accordance with Section 4.

5.2 For wire sizes 4/0 to ~~44 AWG, inclusive,~~ 10 AWG, inclusive, expressed in mil units, and for wire sizes 4/0 to 18 AWG, inclusive, expressed in millimetre units, nominal diameters shall be expressed in no more than four significant ~~figures but in no case closer than the nearest 0.1 mil (0.0001 in.).~~figures.

5.3 For wire sizes ~~45 to 56 AWG, inclusive,~~ 11 AWG and smaller, expressed in mil units, and for wire sizes in 19 AWG and smaller expressed in millimetre units, nominal diameters shall be expressed ~~to the nearest 0.01 mil (0.00001 in.).~~in no more than three significant figures.

5.4 The standard nominal diameters expressed in mils and mm have been calculated in accordance with these rules and are given in Table 1 for convenient reference (Explanatory Note 2). The standard nominal diameters expressed in mm have been calculated based on the indicated mil diameter value × 0.0254.

6. Standard Nominal Cross-Sectional Areas

6.1 Standard nominal cross-sectional areas in circular mils and square millimetres shall be calculated in accordance with the following equations and shall be rounded in accordance with Section 4 to the same number of significant figures as used in expressing the standard ~~diameters, but in no case to less than three significant figures:~~diameters:

$$\text{Area, cmil} = d^2$$

$$\text{Area, mm}^2 = d^2 \times 5.067 \times 10^{-4}$$

where:

d = diameter of the wire in mils as given in Table 1.

~~Standard nominal cross-sectional areas in circular mils and square millimetres have been calculated in accordance with the foregoing rules and are given in Table 1 for convenient reference.~~

6.2 Standard nominal cross-sectional areas in circular mils and square millimetres have been calculated in accordance with the foregoing rules and are given in Table 1 for convenient reference.

7. Rules for Calculations Involving Mass and Length

7.1 Standard nominal mass and lengths shall be calculated from the standard wire diameters specified in Table 1, in accordance with the following equations. They shall be rounded in the *final* value only, in accordance with Section 4, to the same number of significant figures as used in expressing the standard diameters, but in no case to less than three significant figures:

TABLE 1 Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires at 20°C

Size	Diameter		Cross-Sectional Area		Size	Diameter		Cross-Sectional Area	
AWG	mils	mm	cmils	mm^2	AWG	mils	mm	cmils	mm^2
~~4/0~~	~~460.0~~	~~11.684~~	~~211 600~~	~~107.2~~	~~29~~	~~11.3~~	~~0.287~~	~~128~~	~~0.0647~~
4/0	460.0	11.68	211 600	107.2	29	11.3	0.287	128	0.0647
~~3/0~~	~~409.6~~	~~10.404~~	~~167 800~~	~~85.0~~	~~30~~	~~10.0~~	~~0.254~~	~~100~~	~~0.0507~~
3/0	409.6	10.40	167 800	85.01	30	10.0	0.254	100	0.0507
~~2/0~~	~~364.8~~	~~9.26~~	~~133 100~~	~~67.4~~	~~31~~	~~8.9~~	~~0.226~~	~~79.2~~	~~0.0401~~
2/0	364.8	9.266	133 100	67.43	31	8.90	0.226	79.2	0.0401
~~1/0~~	~~324.9~~	~~8.25~~	~~105 600~~	~~53.5~~	~~32~~	~~8.0~~	~~0.203~~	~~64.0~~	~~0.0324~~
1/0	324.9	8.252	105 600	53.49	32	8.00	0.203	64.0	0.0324
~~1~~	~~289.3~~	~~7.35~~	~~83 690~~	~~42.4~~	~~33~~	~~7.1~~	~~0.180~~	~~50.4~~	~~0.0255~~
1	289.3	7.348	83 690	42.41	33	7.10	0.180	50.4	0.0255
~~2~~	~~257.6~~	~~6.54~~	~~66 360~~	~~33.6~~	~~34~~	~~6.3~~	~~0.160~~	~~39.7~~	~~0.0201~~
2	257.6	6.543	66 360	33.62	34	6.30	0.160	39.7	0.0201
~~3~~	~~229.4~~	~~5.82~~	~~52 620~~	~~26.7~~	~~35~~	~~5.6~~	~~0.142~~	~~31.4~~	~~0.0159~~
3	229.4	5.827	52 620	26.66	35	5.60	0.142	31.4	0.0159
~~4~~	~~204.3~~	~~5.19~~	~~41 740~~	~~21.1~~	~~36~~	~~5.0~~	~~0.127~~	~~25.0~~	~~0.0127~~
4	204.3	5.189	41 740	21.15	36	5.00	0.127	25.0	0.0127
~~5~~	~~181.9~~	~~4.62~~	~~33 090~~	~~16.8~~	~~37~~	~~4.5~~	~~0.114~~	~~20.2~~	~~0.0103~~
5	181.9	4.620	33 090	16.77	37	4.50	0.114	20.2	0.0103
~~6~~	~~162.0~~	~~4.11~~	~~26 240~~	~~13.3~~	~~38~~	~~4.0~~	~~0.102~~	~~16.0~~	~~0.00811~~
6	162.0	4.115	26 240	13.30	38	4.00	0.102	16.0	0.00811
~~7~~	~~144.3~~	~~3.67~~	~~20 820~~	~~10.6~~	~~39~~	~~3.5~~	~~0.0890~~	~~12.2~~	~~0.00621~~
7	144.3	3.665	20 820	10.55	39	3.50	0.0889	12.2	0.00621
~~8~~	~~128.5~~	~~3.26~~	~~16 510~~	~~8.37~~	~~40~~	~~3.1~~	~~0.0787~~	~~9.61~~	~~0.00487~~
8	128.5	3.264	16 510	8.367	40	3.10	0.0787	9.61	0.00487
~~9~~	~~114.4~~	~~2.91~~	~~13 090~~	~~6.63~~	~~41~~	~~2.8~~	~~0.0711~~	~~7.84~~	~~0.00397~~
9	114.4	2.906	13 090	6.631	41	2.80	0.0711	7.84	0.00397
~~10~~	~~101.9~~	~~2.59~~	~~10 380~~	~~5.26~~	~~42~~	~~2.5~~	~~0.0635~~	~~6.25~~	~~0.00317~~
10	101.9	2.588	10 380	5.261	42	2.50	0.0635	6.25	0.00317
~~11~~	~~90.7~~	~~2.30~~	~~8 230~~	~~4.17~~	~~43~~	~~2.2~~	~~0.0559~~	~~4.84~~	~~0.00245~~
11	90.7	2.304	8 230	4.168	43	2.20	0.0559	4.84	0.00245
~~12~~	~~80.8~~	~~2.05~~	~~6 530~~	~~3.31~~	~~44~~	~~2.0~~	~~0.0508~~	~~4.00~~	~~0.00203~~
12	80.8	2.052	6 530	3.308	44	2.00	0.0508	4.00	0.00203
~~13~~	~~72.0~~	~~1.83~~	~~5 180~~	~~2.63~~	~~45~~	~~1.76~~	~~0.0447~~	~~3.10~~	~~0.00157~~
13	72.0	1.829	5 180	2.627	45	1.76	0.0447	3.10	0.00157
~~14~~	~~64.1~~	~~1.63~~	~~4 110~~	~~2.08~~	~~46~~	~~1.57~~	~~0.0399~~	~~2.46~~	~~0.00125~~
14	64.1	1.628	4 110	2.082	46	1.57	0.0399	2.46	0.00125
~~15~~	~~57.1~~	~~1.45~~	~~3 260~~	~~1.65~~	~~47~~	~~1.40~~	~~0.0356~~	~~1.96~~	~~0.000993~~
15	57.1	1.450	3 260	1.652	47	1.40	0.0356	1.96	0.000993
~~16~~	~~50.8~~	~~1.29~~	~~2 580~~	~~1.31~~	~~48~~	~~1.24~~	~~0.0315~~	~~1.54~~	~~0.000779~~
16	50.8	1.290	2 580	1.308	48	1.24	0.0315	1.54	0.000779
~~17~~	~~45.3~~	~~1.15~~	~~2 050~~	~~1.04~~	~~49~~	~~1.11~~	~~0.0282~~	~~1.23~~	~~0.000624~~
17	45.3	1.151	2 050	1.040	49	1.11	0.0282	1.23	0.000624
~~18~~	~~40.3~~	~~1.02~~	~~1 620~~	~~0.823~~	~~50~~	~~0.99~~	~~0.0252~~	~~0.980~~	~~0.000497~~
18	40.3	1.024	1 620	0.823	50	0.99	0.0252	0.980	0.000497
~~19~~	~~35.9~~	~~0.904~~	~~1 290~~	~~0.653~~	~~51~~	~~0.88~~	~~0.0224~~	~~0.774~~	~~0.000392~~
19	35.9	0.912	1 290	0.653	51	0.88	0.0224	0.774	0.000392
20	32.0	0.813	1 020	0.519	52	0.78	0.0198	0.608	0.000308
21	28.5	0.724	812	0.412	53	0.70	0.0178	0.490	0.000248
~~22~~	~~25.3~~	~~0.643~~	~~640~~	~~0.324~~	~~54~~	~~0.62~~	~~0.0158~~	~~0.384~~	~~0.000195~~
22	25.3	0.643	640	0.324	54	0.62	0.0157	0.384	0.000195
23	22.6	0.574	511	0.259	55	0.55	0.0140	0.302	0.000153
~~24~~	~~20.1~~	~~0.511~~	~~404~~	~~0.205~~	~~56~~	~~0.49~~	~~0.0125~~	~~0.240~~	~~0.000122~~
24	20.1	0.511	404	0.205	56	0.49	0.0124	0.240	0.000122
25	17.9	0.455	320	0.162					
26	15.9	0.404	253	0.128					
27	14.2	0.361	202	0.102					
28	12.6	0.320	159	0.0804					

$$W = d^2 \times \delta \times 0.34049 \times 10^{-3}$$

$$L = (1/d^2) \times (1/\delta) \times 2.9369 \times 10^6$$

where:

W = mass, lb/1000 ft,
d = diameter of the wire in mils as given in Table 1,
δ = density of the wire material at 20°C in g/cm^3 as given in Table 2, and
L = length, ft/lb.

8. Rules for Calculations Involving Resistivity

8.1 Standard nominal resistances and other values derived from the resistivity units shall be calculated from the standard wire diameters specified in Table 1 in accordance with the following equations. All values so derived shall be rounded in the *final* value

TABLE 2 Density and Resistivity of Electrical Conductor Materials

Material	Density, δ, at 20°C, g/cm³	Resistivity[A], ρ, at 20°C, Ω· lb/mile²	Material	Density,δ, at 20°C, g/cm³	Resistivity, ρ, at 20°C Ω· lb/mile²
~~Material~~	~~Density, δ, at 20°C, g/cm³~~	~~Resistivity[A], ρ, at 20°C, Ω· lb/mile²~~	~~Material~~	~~Density,δ, at 20°C, g/cm³~~	~~Resistivity, ρ, at 20°C Ω· lb/mile²~~
~~Copper (Specifications B1, B2,~~			~~Aluminum-Clad Steel (Specification~~	~~6.59~~	~~3191~~
Copper (Specifications B3, B33, B47 and B189), Volume Conductivity, % IACS:			Aluminum-Clad Steel (Specifications B415 and B502)	6.59	3191
			Copper-Clad Steel (Specification B227):		
100	8.89	875.20	Grade 30 HS	8.15	2728
~~97.66~~	~~8.89~~	~~896.15~~	~~Grade 30 HS~~	~~8.15~~	~~2728~~
97.66	8.89	896.15	Grade 30 EHS	8.15	2728
~~97.16~~	~~8.89~~	~~900.77~~	~~Grade 30 EHS~~	~~8.15~~	~~2728~~
97.16	8.89	900.77	Grade 40	8.15	2045
96.66	8.89	905.44	Grade 40 EHS	8.15	2045
~~96.16~~	~~8.89~~	~~910.15~~	~~Grade 40 EHS~~	~~8.15~~	~~2045~~
~~94.16~~	~~8.89~~	~~929.52~~	~~Galvanized Steel (Telephone and~~		
96.16	8.89	910.15	Galvanized Steel (Telephone and		
94.16	8.89	929.52	Telegraph) (Specification A111):		
~~93.15~~	~~8.89~~	~~939.51~~	~~Telegraph) (Specification~~		
93.15	8.89	939.51	Class A Coating:		
~~Bronze (Specification B9):~~			~~A111):~~		
Bronze (Specification B9):			Grade EBB (Non-Copper	7.78	5000
~~Class A~~	~~8.89~~	~~2188~~	~~Class A Coating:~~		
~~Class B~~	~~8.89~~	~~1346~~	~~Grade EBB (Non-Copper~~	~~7.78~~	~~5000~~
~~Class C~~	~~8.89~~	~~1094~~	~~Bearing)~~		
Class A	8.89	2188	Bearing)		
~~Copper Alloys (Specification~~			~~Grade BB (Copper Bearing)~~	~~7.78~~	~~5800~~
Class B	8.89	1346	Grade BB (Copper Bearing)	7.78	5800
~~B105[B]):~~			~~Grade BB (Non-Copper~~	~~7.78~~	~~5600~~
Class C	8.89	1094	Grade BB (Non-Copper	7.78	5600
Copper Alloys (Specification B105[B]):			Bearing)		
~~Grade 8.5~~	~~8.78~~	~~10 169~~	~~Bearing)~~		
Grade 8.5	8.78	10 169	Class B Coating:		
~~Grade 13~~	~~8.78~~	~~6649~~	~~Class B Coating:~~		
~~Grade 15~~	~~8.54~~	~~5605~~	~~Grade EBB (Non-Copper~~	~~7.78~~	~~4900~~
Grade 13	8.78	6649	Grade EBB (Non-Copper	7.78	4900
~~Grade 20~~	~~8.89~~	~~4376~~	~~Bearing)~~		
Grade 15	8.54	5605	Bearing)		
~~Grade 30~~	~~8.89~~	~~2917~~	~~Grade BB (Copper Bearing)~~	~~7.78~~	~~5600~~
Grade 20	8.89	4376	Grade BB (Copper Bearing)	7.78	5600
~~Grade 40~~	~~8.89~~	~~2188~~	~~Grade BB (Non-Copper~~	~~7.78~~	~~5450~~
Grade 30	8.89	2917	Grade BB (Non-Copper	7.78	5450
~~Grade 55~~	~~8.89~~	~~1591~~	~~Bearing)~~		
Grade 40	8.89	2188	Bearing)		
~~Grade 65~~	~~8.89~~	~~1346~~	~~Class C Coating:~~		
Grade 55	8.89	1591	Class C Coating:		
~~Grade 74~~	~~8.89~~	~~1183~~	~~Grade EBB (Non-Copper~~	~~7.78~~	~~4800~~
Grade 65	8.89	1346	Grade EBB (Non-Copper	7.78	4800
~~Grade 80~~	~~8.89~~	~~1094~~	~~Bearing)~~		
Grade 74	8.89	1183	Bearing)		
~~Grade 85~~	~~8.89~~	~~1030~~	~~Grade BB (Copper Bearing)~~	~~7.78~~	~~5400~~
Grade 80	8.89	1094	Grade BB (Copper Bearing)	7.78	5400
~~Aluminum, 1350 (Specifications~~			~~Grade BB (Non-Copper~~	~~7.78~~	~~5300~~
Grade 85	8.89	1030	Grade BB (Non-Copper	7.78	5300
~~B230/B230M, B314, and B609/B609M),~~			~~Bearing)~~		
Aluminum, 1350 (Specifications B230/B230M, B314, and B609/B609M),			Bearing)		
~~Volume Conductivity, % IACS:~~			~~Galvanized Steel (Telephone and Telegraph) (Specification A326):~~		
Volume Conductivity, % IACS:			Galvanized Steel (Telephone and Telegraph) (Specification A326):		
61.8	2.705	430.91	Class A Coating:		
61.2	2.705	435.13	Grade 85	7.83	5800
~~61.0~~	~~2.705~~	~~436.56~~	~~Class A Coating:~~		
61.0	2.705	436.56	Class B Coating:		
~~Aluminum Alloys (Specifications B396 and B398/B398M)~~			~~Grade 85~~	~~7.83~~	~~5800~~
			~~Class B Coating:~~		
Aluminum Alloys (Specifications B396 and B398/B398M)			Grade 135	7.83	6500
~~Alloy 5005–H19~~	~~2.70~~	~~496.84~~	~~Grade 135~~	~~7.83~~	~~6500~~
Alloy 5005–H19	2.70	496.84	Grade 85	7.80	5600
~~Alloy 6201–T81~~	~~2.69~~	~~504.43~~	~~Grade 85~~	~~7.80~~	~~5600~~