



UL 758

STANDARD FOR SAFETY Appliance Wiring Material

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UL Standard for Safety for Appliance Wiring Material, UL 758

Third Edition, Dated May 2, 2014

Summary of Topics

This revision to ANSI/UL 758 has been made to change the effective date notes for 5.1.1, 5.3.1, 5.3.3, and Table 5.2. No technical changes have been made to the standard.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

The following table lists the future effective dates with the corresponding reference.

Future Effective Date	Reference
September 3, 2014	Paragraphs 1.7, 3.5, 4.3, 5.1.1, 5.3.1, 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.6.1, 5.7.2, 5.7.3, 5.9, 5.9.1, 5.9.2, 7.3.1, 7.3.2, 11.3, 11.4, 12.2, 13.3.2, 13.3.3, 49.2, 50.3, 51.2 (d), (f), (l); Tables 5.2 and 5.9
Effective date to be determined	Paragraphs 5.1.1, 5.3.1, 5.3.3; Table 5.2

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Standard for Appliance Wiring Material

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This ANSI/UL Standard for Safety consists of the Third Edition, including revisions through including revisions through September 2, 2014.

The most recent designation of ANSI/UL 758 as an American National Standard (ANSI) occurred on May 2, 2014. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover Appliance Wiring Material (AWM) in the form of single insulated conductors, multi-conductor cables, optical fibers, individual insulated conductors, and fiber optic members for use as components in multi-conductor cables.

1.2 The appliance wiring material covered by the requirements of this Standard are solely for use as factory-installed wiring either within the overall enclosure of appliances and other equipment (internal wiring) or as external interconnecting cable for appliances (external wiring), or for further processing as components in multi-conductor cables.

1.3 These requirements do not cover any wire, cable, or cord types that are presently covered in the National Electrical Code (NEC), NFPA 70, and are not intended for installation in buildings or structures in accordance with the NEC except within the scope of the installation instructions of the end-product for which their use is intended.

1.4 These requirements cover appliance wiring material with operating temperatures from a minimum 60°C (140°F) dry temperature rating and voltage ratings from a minimum 30-volt rating. Conductor size ranges from 50 AWG to 2000 kcmil. Appliance wiring material (AWM) composed entirely of optical fiber members or electrical conductors in combination with optical fiber members are also covered by these requirements.

1.5 These requirements do not cover the optical performance of any optical-fiber member or group of such members.

1.6 These requirements do not cover constructions which utilize flat, insulated conductors that are not laid parallel. The requirements for these products are found in the Standard for Flexible Materials Interconnect Constructions, UL 796F.

1.7 The evaluation of the performance of the semi-conductive polymeric layer described in 5.9 is not covered by this Standard.

1.7 effective September 3, 2014

1.8 In addition to these constructions, this Standard establishes guidelines for the evaluation of special constructions that, due to their specific end product use, are not required to meet all of the requirements for general construction AWM.

1.9 The final acceptance of AWM is dependent upon its use in complete equipment that conforms with the standards applicable to such equipment.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this Standard shall comply with the requirements for that component.

2.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.1.5 Polymeric materials evaluated for its intended use, are not prohibited from being used in the insulation and jacket applications indicated in Table 2.1.

Table 2.1
Polymeric materials for use in wire and cable and associated AWM ratings

AWM rating	Component	Minimum average thickness of insulation,		Compound's use or rating
		inch	(mm)	
Sunlight resistant	Insulation	0.030	0.76	Outer PVC or TPE insulation rated for 720 hours sunlight resistance
Sunlight resistant	Jacket	0.030	0.76	Outer PVC or TPE jacket rated for 720 hours sunlight resistance
60°C Wet	Insulation	0.030	0.76	PVC insulation rated for use in Type TW thermoplastic-insulated wire
60°C or 75°C Wet	Insulation	0.030	0.76	PVC insulation rated for use in Types THW or THHW thermoplastic-insulated wire
60°C or 75°C Wet	Insulation	0.015	0.38	PVC insulation rated for use in Type THWN thermoplastic-insulated wire
60°C, 75°C, or 90°C Wet	Insulation	0.015	0.38	PVC insulation rated for use in Type THWN-2 thermoplastic-insulated wire

2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2.2 Unless otherwise indicated, all voltage values mentioned in this Standard are root-mean-square (rms).

2.2.3 Equipment calibrated in metric units is to be used when a requirement is applied in metric terms.

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

2.3.2 Wherever the designation "UL 1581" is used in this Standard, reference is to be made to the designated part(s) of the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581.

CONSTRUCTION

3 General

3.1 The acceptability of an AWM for use in a specific end-product is based on the construction and flame rating of each individual construction.

3.2 Tables 3.1 – 3.9 serve as indices to requirements for construction details and basic test methods for typical AWM constructions.

3.3 Coiled cables shall comply with the requirements specified in this Standard. All tests and measurements shall be conducted on specimens obtained from the straight ends at each end of the coiled portion of the cable. The straight ends shall have been subjected to the same heat conditioning as the coiled portion during the coiling process. In addition, the minimum average thickness and minimum thickness at any point of insulation and jacket shall be made on the coiled portion and shall meet the requirements specified for an uncoiled construction.

3.4 Wires or cables which have a restricted use are those installed where not subject to movement or mechanical abuse, or where totally enclosed.

3.5 A wire or cable for Class 2 use shall have a voltage rating less than or equal to 150 V AC or DC.

3.5 effective September 3, 2014

3.6 The high voltage DC wire described in Table 3.6 shall have a minimum voltage rating of 3 kV DC. Wires with DC voltage rating less than 3 kV DC shall be evaluated in accordance with Table 3.1.

Table 3.1
Single or multiple conductor with extruded insulation

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulation:	
Material	See Insulation, Section 7
Thickness	See Insulation, Section 7
Covering:	
Material	See Coverings, Section 8
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel or Carton, Section 51
Basic tests:	Physical Properties Unaged and Air Oven Aged, Section 14. Conductor Corrosion Test, Section 18 Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, Section. 21. Heat Shock Test (Thermoplastic Materials Only), Section 22. Cold Bend Test, Section 23. Durability of Ink-Print Test, Section 27 Crush Resistance Test, Section 28. Dielectric Test, Method I, Section 29. Dielectric Test, Method II, Section 30. Dielectric Test, Method III, Section 31. Horizontal Flame Test for Internal Wiring, Section 40.
Elective tests/ratings:	See Table 3.9

Table 3.2
Single conductor with other-than-extruded insulation

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulation:	
Material	See Insulation, Section 7
Thickness	See Insulation, Section 7
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel or Carton, Section 51
Basic tests:	Conductor Corrosion Test, Section 18. Flexibility Test, Section 21. Cold Bend Test, Section 23. Durability of Ink-Print Test, Section 27 Dielectric Test, Method I, Section 29. Dielectric Test, Method II, Section 30. Horizontal Flame Test for Internal Wiring, Section 40.
Elective tests/ratings:	See Table 3.9.
†Laminated, flat ribbon cable is covered in Table 3.5.	

Table 3.3
Single and parallel, multi-conductor cable with extruded integral insulation and jacket

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Integral insulation and jacket:	
Material	See Insulation, Section 7; Overall Jacket, Section 13
Thickness	See Insulation, Section 7; Overall Jacket, Section 13
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel or Carton, Section 51
Basic tests:	Physical Properties, Unaged and Air Oven Aged, Section 14. Conductor Corrosion Test, Section 18. Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, Section 21. Heat Shock Test (Thermoplastic Materials Only), Section 22. Cold Bend Test, Section 23. Durability of Ink-Print Test, Section 27 Dielectric Test, Method I, Section 29. Dielectric Test, Method II, Section 30. Dielectric Test, Method III, Section 31. Horizontal Flame Test for Internal Wiring, Section 40. Cable Flame Test, Section 41.
Elective tests/ratings:	See Table 3.9.

Table 3.4
Single and multiple-conductor cable using non-integral jacket

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulated conductors:	See Insulation, Section 7 The voltage and temperature rating of the cable shall not exceed the lowest rating of either the insulated conductors or the fiber optic members. Cables rated 60°C, 75°C, and 90°C wet shall use insulated conductors that comply with the applicable wet rating.
Covering:	
Material	See Coverings, Section 8
Shield:	See Shield(s), Section 11
Jacket:	
Material	See Overall Jacket, Section 13
Thickness	See Overall Jacket, Section 13
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel, or Carton, Section 51
Basic tests:	Insulated conductors tested in accordance with Tables 3.1, 3.2, 3.3, or 3.5. Physical Properties, Unaged and Air Oven Aged, Section 14 – Test jacket only. Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, Section 21. Heat Shock Test (Thermoplastic Materials Only), Section 22. Cold Bend Test, Section 23.

Table 3.4 Continued

Durability of Ink-Print Test, Section 27. Horizontal Flame Test for Internal Wiring, Section 40. Cable Flame Test, Section 41.	
Elective tests/ratings:	See Table 3.9.

Table 3.5
Bonded or laminated flat ribbon cable

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulation:	
Material	See Insulation, Section 7
Thickness	See Insulation, Section 7
Covering:	
Material	See Coverings, Section 8
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel, or Carton, Section 51
Basic tests: Physical Properties, Unaged and Air Oven Aged, Section 14 – Test bonded only. Conductor Corrosion Test, Section 18. Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, and Jacket, Section 21. Heat Shock Test (Thermoplastic Materials Only), Section 22. Cold Bend Test, Section 23. Durability of Ink-Print Test, Section 27. Delamination Test (Laminated Constructions Only), Section 24. Dielectric Test, Method I, Section 29. Dielectric Test, Method II, Section 30. Dielectric Test, Method III, Section 31. Horizontal Flame Test for Internal Wiring, Section 40.	
Elective tests/ratings:	See Table 3.9.

Table 3.6
High voltage* DC wire with extruded insulation

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulation:	
Material	See Insulation, Section 7 (solid insulation only)
Thickness	See Insulation, Section 7
Covering:	
Material	See Coverings, Section 8
Jacket:	
Material	See Overall Jacket, Section 13
Thickness	See Overall Jacket, Section 13
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel, or Carton, Section 51
Basic tests:	Physical Properties, Unaged and Air Oven Aged, Section 14. Conductor Corrosion Test, Section 18. Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, Section 21. Heat Shock Test (Thermoplastic Materials Only), Section 22. Shrinkback Test – Special Rating TV Wires Only, Section 25. Ozone Resistance Test – Special Rating TV Use Wires Only, Section 26. Durability of Ink-Print Test, Section 27. High-Voltage DC Wire Dielectric Voltage-Withstand Test, Method I, Section 32. High-Voltage DC Wire Dielectric Voltage-Withstand Test, Method II, Section 33. High-Voltage Cut-Through Test, Special Rated TV Wire Only, Section 34. Horizontal Flame Test for Internal Wiring, Section 40. VW-1 Flame Test (required for TV wire), Section 41.
Elective tests/ratings:	See Table 3.9.
*High voltage indicates wires rated 3kV DC or higher.	

Table 3.7
Fiber optic cables*

Optical fiber:	See Cable composed entirely of optical-fiber members, 6.3
Buffer:	
Material	See Cable composed entirely of optical-fiber members, 6.3
Thickness	See Cable composed entirely of optical-fiber members, 6.3
Covering:	
Material	See Coverings, Section 8
Jacket:	
Material	See Overall Jacket, Section 13
Thickness	See Overall Jacket, Section 13
Markings	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel, or Carton, Section 51
Basic tests:	Physical Properties, Unaged and Air Oven Aged, Section 14. Deformation Test (Thermoplastics and Class XL Only), Section 19. Flexibility Test, Section 21.

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Table 3.7 Continued on Next Page



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Table 3.7 Continued

Heat Shock Test (Thermoplastic materials only), Section 22.
Cold Bend Test, Section 23.
Durability of Ink- Print Test, Section 27.
Horizontal Flame Test for Internal Wiring, Section 40.
VW-1 Flame Test (required for external use), Section 42.
*Cables covered by this table contain no current-carrying parts.

Table 3.8

Single- and multiple-conductor cable employing a non-extruded covering as the outermost layer[§]

Conductors:	
Material	See Conductor, Section 5
Size	See Conductor, Section 5
Insulated conductors:	
Material	See Insulation, Section 7
Thickness	See Insulation, Section 7
Shield:	See Shield(s), Section 11
Covering:	
Material	See Coverings, Section 8
Markings:	See Surface Marking of AWM, Section 50, and Markings on Tag, Reel, or Carton, Section 51
Basic tests:	
Insulated conductors tested in accordance with Tables 3.1, 3.2, 3.3, or 3.5.	
Flexibility Test, Section 21.	
Cold Bend Test, Section 23.	
Durability of Ink-Print Test, Section 27.	
Horizontal Flame Test for Internal Wiring, Section 40.	
Elective tests/ratings:	See Table 3.9.
[§] Laminated flat ribbon cable is covered in Table 3.5.	

Table 3.9
Elective tests and ratings

Flame tests:	VW-1 Flame Test, Section 42. FT-1 Flame Test, Section 43. FT-2 Flame Test, Section 44. IEC 60332-1 Flame Test, Section 45. IEC 60332-2 Flame Test, Section 46.
Mechanical test:	Crush Resistance Test, Section 28.
Sunlight resistance test:	Physical Properties, Sunlight Resistance, Section 17.
Oil and gasoline resistance tests:	Physical Properties, Oil Immersion Aging, Section 15. Physical Properties, Gasoline Conditioning, Section 16.
Wet ratings tests:	Temperature Correction Factor (Wet Rated AWM), Section 37.

Table 3.9 Continued

	Capacitance and Relative Permittivity Tests (Wet Rated AWM), Section 38. Short Term Insulation-Resistance Test in Water at Room Temperature (Wet Rated AWM), Section 35, required for all wet rated wires. Long Term Insulation-Resistance Test in Water at Elevated Temperature (Wet Rated AWM), Section 36, at 50°C required for wires rated 60°C wet. Long Term Insulation-Resistance Test in Water at Elevated Temperature (Wet Rated AWM), Section 36, at 75°C required for wires rated 75°C wet. Long Term Insulation-Resistance Test in Water at Elevated Temperature (Wet Rated AWM), Section 36, at 90°C required for wires rated 90°C wet. Long Term Insulation-Resistance Test in Water at Elevated Temperature (Wet Rated AWM), Section 36, at 100°C required for wires rated 100°C wet.
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4 Materials

4.1 Each material used in AWM shall be compatible with all of the other materials used in the wire or cable.

4.2 Due to possible incompatibility, TPE materials of the styrenic type may not be suitable for use in cords whereby direct contact with PVC may occur. A separator is one acceptable means of avoiding direct contact. Other combinations of materials which could be incompatible, if any, are as yet undetected.

4.3 Due to possible incompatibility, uncoated copper, copper alloy, copper-clad aluminum, copper-clad steel, or other components with uncoated copper on the outer surface shall not be used in wire or cable whereby direct contact with aluminum may occur. A separator is one acceptable means of avoiding direct contact, or the copper components shall be metal-coated.

4.3 effective September 3, 2014

5 Conductor

5.1 General

5.1.1 A conductor consisting of a single wire is designated as a solid conductor, while one consisting of a number of individual wires is designated as a stranded conductor. The American Wire Gauge (AWG) numbers, the kcmil (thousands of circular mils) sizes, and the square-millimeter sizes each signify a definite nominal total cross-sectional area (see Table 5.1 or Table 5.2) independent of the conductor material. The individual wires used in making up a stranded conductor are not required to correspond to any particular AWG or other standard gauge size. A tinsel conductor consists of a number of strands, twisted together, a portion of, or all strands being composed of one or more flattened wires of copper or copper alloy, helically wound on a fibrous polymeric thread. A conductor with a tubular cross-section and uniform wall thickness shall be of copper, and may be metal coated. A bus bar conductor consists of a single bar, or two or more bars stacked to form two or more layers, with each bar of solid rectangular cross-section with two plane, parallel surfaces and round or other simple regularly shaped edges. Fibrous yarns impregnated or coated with metal or other conductive materials may be used as a conductor, or may be assembled with other types of conductor strands to form a conductor. A carbon fiber filament conductor consists of a number of carbon fibers twisted together to form the conductor and the carbon fibers may be metal coated. A resistance wire is a conductor material used in products primarily as the source of heat

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based on a designed resistance per unit length. A magnet wire conductor shall consist of an enameled single conductor or an assembly of individually enameled wires which may be assembled or twisted together with an overall covering of film fiber, tape, or extruded compound to form a Litz wire. The magnet wire conductor shall have a minimum temperature rating of the AWM and be evaluated in accordance with the requirements in the Standard for Systems of Insulation Materials – General, UL 1446. The size of a conductor composed of or containing conductive fibrous yarns and resistance wires including carbon fiber filament conductors, a conductor of a tubular shape, or a bus bar conductor, and a magnet wire conductor shall be determined by conductor resistance described in 5.6.1. The circular mil area (CMA) of a rectangular conductor shall be determined from the formula:

$$\text{average width (mils)} \times \text{average thickness (mils)} \times 1.273$$

The AWG size can then be determined using Table 5.1.

5.1.1 effective date to be determined

Table 5.1
Conductor dimensions

Size of conductor, AWG	Diameter of solid conductor				Cross-sectional area of stranded conductor			
	Nominal,		Minimum,		Nominal,		Minimum,	
	Mils	(mm)	Mils	(mm)	Cmils	(mm ²)	Cmils	(mm ²)
50	0.99	0.0251	0.98	0.025	0.980	0.000497	0.960	0.000486
49	1.11	0.0282	1.10	0.028	1.23	0.000624	1.21	0.000613
48	1.24	0.0315	1.23	0.031	1.54	0.000768	1.51	0.000765
47	1.40	0.0356	1.39	0.035	1.96	0.000993	1.92	0.000973
46	1.57	0.0399	1.55	0.039	2.46	0.00125	2.41	0.00122
45	1.76	0.0447	1.74	0.044	3.10	0.00157	3.04	0.00154
44	2.0	0.051	1.98	0.050	4.00	0.00203	3.92	0.00198
43	2.2	0.056	2.18	0.055	4.84	0.00245	4.74	0.00240
42	2.5	0.064	2.48	0.063	6.25	0.00317	6.13	0.003115
41	2.8	0.071	2.77	0.070	7.84	0.00397	7.68	0.00389
40	3.1	0.079	3.07	0.078	9.61	0.00487	9.42	0.00477
39	3.5	0.089	3.47	0.088	12.2	0.00621	11.9	0.00603
38	4.0	0.102	3.96	0.101	16.0	0.00811	15.7	0.00796
37	4.5	0.114	4.46	0.113	20.2	0.0103	19.8	0.0100
36	5.0	0.127	4.95	0.126	25.0	0.0127	24.5	0.0124
35	5.6	0.142	5.54	0.141	31.4	0.0159	30.8	0.0156
34	6.3	0.160	6.24	0.158	39.7	0.020	38.9	0.0197
33	7.1	0.180	7.03	0.179	50.4	0.0255	49.4	0.0250
32	8.0	0.203	7.92	0.201	64.0	0.0324	62.7	0.0318
31	8.9	0.226	8.81	0.224	79.2	0.0401	77.6	0.0393
30	10.0	0.254	9.9	0.251	100	0.0507	98	0.0497
29	11.3	0.287	11.2	0.284	128	0.0647	125	0.0633
28	12.6	0.320	12.5	0.318	159	0.0804	156	0.0790
27	14.2	0.361	14.1	0.358	202	0.102	198	0.100
26	15.9	0.404	15.7	0.399	253	0.128	248	0.126
25	17.9	0.455	17.7	0.450	320	0.162	314	0.159
24	20.1	0.511	19.9	0.506	404	0.205	396	0.201
23	22.6	0.574	22.4	0.569	511	0.259	501	0.254
22	25.3	0.643	25.0	0.635	640	0.324	627	0.318
21	28.5	0.724	28.2	0.716	812	0.412	796	0.404
20	32.0	0.813	31.7	0.805	1020	0.519	1000	0.509

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Table 5.1 Continued

Size of conductor, AWG	Diameter of solid conductor				Cross-sectional area of stranded conductor			
	Nominal,		Minimum,		Nominal,		Minimum,	
	Mils	(mm)	Mils	(mm)	Cmils	(mm ²)	Cmils	(mm ²)
19	35.9	0.912	35.6	0.904	1290	0.653	1264	0.641
18	40.3	1.02	40.0	1.016	1620	0.823	1588	0.807
17	45.3	1.15	44.9	1.140	2050	1.04	2009	1.02
16	50.8	1.29	50.3	1.278	2580	1.31	2528	1.28
15	57.1	1.45	56.5	1.435	3260	1.65	3195	1.62
14	64.1	1.63	63.5	1.613	4110	2.08	4028	2.04
13	72.0	1.83	71	1.80	5180	2.63	5076	2.58
12	80.8	2.05	80	2.03	6530	3.31	6399	3.24
11	90.7	2.30	90	2.29	8230	4.17	8065	4.09
10	101.9	2.588	101	2.57	10380	5.261	10172	5.16
9	114.4	2.906	113	2.87	13090	6.631	12828	6.50
8	128.5	3.264	127	3.23	16510	8.367	16180	8.20
7	144.3	3.665	143	3.63	20820	10.55	20404	10.34
6	162.0	4.115	160	4.06	26240	13.30	25715	13.03
5	181.9	4.620	180	4.57	33090	16.77	32428	16.43
4	204.3	5.189	202	5.13	41740	21.15	40905	20.73
3	229.4	5.827	227	5.77	52620	26.67	51568	26.14
2	257.6	6.543	255	6.48	66360	33.62	65033	32.95
1	289.3	7.348	286	7.26	83690	42.41	82016	41.56
1/0	324.9	8.252	322	8.18	105600	53.49	103488	52.42
2/0	364.8	9.226	361	9.17	133100	67.43	130438	66.08
3/0	409.6	10.40	406	10.31	167800	85.01	164444	83.31
4/0	460.0	11.68	455	11.56	211600	107.2	207368	105.1
kcmil	—	—	—	—	kcmil	—	kcmil	—
250	—	—	—	—	250	127	245	124.1
300	—	—	—	—	300	152	294	149.0
350	—	—	—	—	350	177	343	173.8
400	—	—	—	—	400	203	392	198.6
450	—	—	—	—	450	228	441	223.5
500	—	—	—	—	500	253	490	248.3
550	—	—	—	—	550	279	539	273.1
600	—	—	—	—	600	304	588	297.9
650	—	—	—	—	650	329	637	322.8
700	—	—	—	—	700	355	686	347.6
750	—	—	—	—	750	380	735	372.4
800	—	—	—	—	800	405	784	397.2
900	—	—	—	—	900	456	882	446.9
1000	—	—	—	—	1000	507	980	496.6
1100	—	—	—	—	1100	557	1078	546.2
1200	—	—	—	—	1200	608	1176	595.9
1250	—	—	—	—	1250	633	1225	620.7
1300	—	—	—	—	1300	659	1274	645.5
1400	—	—	—	—	1400	709	1372	695.2
1500	—	—	—	—	1500	760	1470	744.9
1600	—	—	—	—	1600	811	1568	794.5
1700	—	—	—	—	1700	861	1666	844.2
1750	—	—	—	—	1750	887	1715	869.0

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Table 5.1 Continued

Size of conductor, AWG	Diameter of solid conductor		Cross-sectional area of stranded conductor			
	Nominal, Mils	Minimum, (mm)	Nominal, Cmils	(mm ²)	Minimum, Cmils	(mm ²)
1800	—	—	1800	912	1764	893.8
1900	—	—	1900	963	1862	943.5
2000	—	—	2000	1010	1960	993.1

Table 5.2
Conductor dimensions in metric sizes

Table 5.2 effective date to be determined

Nominal cross-sectional area of conductor, mm ²	Minimum cross-sectional area of conductor, mm ²
0.01	0.0098
0.05	0.049
0.1	0.098
0.5	0.490
0.75	0.735
1.0	0.98
1.5	1.47
2.5	2.45
4	3.92
6	5.88
10	9.80
16	15.68
25	24.50
35	34.30
50	49.00
70	68.60
95	93.10
120	117.6
150	147.0
185	181.3
240	235.2
300	294.0
400	392.0
500	490.0
630	617.4
800	784.0
1000	980
1200	1176
1400	1372
1600	1568
1800	1764
2000	1960
2500	2450

5.1.2 A fibrous thread used within the conductor stranding and used as a reinforcing member to improve breaking strength is not prohibited from being used. The construction and arrangement of the threads is not specified.

5.1.3 A composite conductor composed of copper wires and hard-drawn copper alloy wires specified by Table 5.3 is not prohibited, and the placement of the hard-drawn copper alloy wires within a finished composite conductor are not specified, furthermore shall comply with the following:

- a) The cross-sectional area of the copper alloy wires shall not exceed 50 percent of the cross-sectional area of the complete conductor.
- b) The complete conductors have 80 percent minimum conductivity of 100 percent IACS standard copper.
- c) The composite conductor's maximum temperature limits shall use the lowest temperature of composite material in Table 5.3.

5.2 Metal

5.2.1 A solid or stranded conductor shall not be used where subjected to any temperature that exceeds that shown for the metal as indicated in the third column of Table 5.3. The metal shall comply with the applicable ASTM specification, when specified, as indicated in Table 5.3.

Table 5.3
Conductor – metal specifications

Conductor metal	ASTM reference for the metal	Temperature limit for the metal, °C (°F)	Other limits
Copper, uncoated, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 3	150 (302)	
Copper, uncoated, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 3	200 (392)	
Copper, tin-coated, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 33	150 (302)	
Copper, tin-coated, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 33	200 (392)	
Copper, hard-drawn, uncoated, each strand less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 1	150 (302)	
Copper, hard-drawn, uncoated, each strand at least 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 1	200 (392)	
Copper, medium-hard-drawn, uncoated, each strand less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 2	150 (302)	

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Table 5.3 Continued

Conductor metal	ASTM reference for the metal	Temperature limit for the metal, °C (°F)	Other limits
Copper, medium-hard-drawn, uncoated, each strand at least 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 2	200 (392)	
Copper, hard-drawn or medium-hard-drawn, tin coated, each strand less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 246	150 (302)	
Copper, hard-drawn or medium-hard-drawn, tin coated, each strand at least 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 246	200 (392)	
Copper, lead-base-alloy coated, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 189	150 (302)	
Copper, lead-base alloy coated, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 189	200 (392)	
Copper, uncoated or tin coated, each strand less than 0.015 inch (0.38 mm) in diameter, metallurgically bonded	ANSI/ASTM B 286, B 470	150 (302)	For use where flexibility is not a concern. Metallurgically bonded via heat or the addition of tin (topcoated, over coated)
Copper, uncoated or tin coated, each strand at least 0.015 inch (0.38 mm) in diameter, metallurgically bonded	ANSI/ASTM B 286, B 470	200 (392)	For use where flexibility is not a concern. Metallurgically bonded via heat or the addition of tin (topcoated, over coated)
Copper, silver-coated	ANSI/ASTM B 298	200 (392)	
Copper, nickel-coated	ANSI/ASTM B 355	250 (482)	
Copper, nickel-coated, Type A, 27 percent minimum nickel coated copper	ANSI/ASTM B 355	550 (1022)	
Copper, gold coated	Per the requirements in the 'other limits' column	200 (392)	Copper per ASTM B 3 Gold coating per ANSI/ASTM B 488
Copper, oxygen free, each strand less than 0.015 inch (0.38) in diameter	ANSI/ASTM B 170	150 (302)	
Copper, oxygen free, each strand at least 0.015 inch (0.38) in diameter	ANSI/ASTM B 170	200 (392)	
Copper-nickel-zinc (nickel-silver)	ANSI/ASTM B 206	150 (302)	
Copper, bus bars, uncoated	ANSI/ASTM B 187	105 (221)	
Copper, bus bars, tin coated	ANSI/ASTM B 187	105 (221)	

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Table 5.3 Continued

Conductor metal	ASTM reference for the metal	Temperature limit for the metal, °C (°F)	Other limits
Copper alloy, hard-drawn, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 105	150 (302)	May be uncoated or provided with a tin, or lead-base-alloy coating
Copper alloy, hard-drawn, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 105	200 (392)	May be uncoated or provided with a tin, lead-base-alloy, silver, or nickel coating
High strength copper alloy, annealed, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 624	150 (302)	May be uncoated or provided with a tin, or lead based alloy coating
High strength copper alloy, annealed, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 624	200 (392)	May be uncoated or provided with a tin, or lead based alloy coating
Copper alloy, hard-drawn, or high strength silver-coated	ANSI/ASTM B 961	200 (392)	
Copper alloy, hard-drawn or high strength nickel-coated	—	250 (482)	
Copper-zirconium alloy, less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 747	150 (302)	
Copper-zirconium alloy, less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 747	200 (392)	Shall be silver coated
Copper-zirconium alloy, at least 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 747	200 (392)	
Phosphor-bronze alloy, less than 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 159	150 (302)	
Phosphor-bronze alloy, at least 0.015 inch (0.38 mm) in diameter	ANSI/ASTM B 159	200 (392)	
Copper-clad aluminum, annealed, 6530 circular mils or 3.31 mm ² (12 AWG) and larger	ASTM B 566	90 (194)	Class 10A
Copper-clad aluminum, hard-drawn, 6530 circular mils or 3.31 mm ² (12 AWG) and larger	ASTM B 566	90 (194)	Class 10H
Copper-clad steel, diameter of each strand or thickness of rectangular or tubular conductor less than 0.015 inch (0.38 mm)	ANSI/ASTM B 452	150 (302)	Minimum conductivity of 30 percent IACS ^a

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Table 5.3 Continued

Conductor metal	ASTM reference for the metal	Temperature limit for the metal, °C (°F)	Other limits
Copper-clad steel, diameter of each strand or thickness of rectangular or tubular conductor at least 0.015 inch (0.38 mm)	ANSI/ASTM B 452	200 (392)	Minimum conductivity of 30 percent IACS ^a
Copper-clad steel, silver-coated	ANSI/ASTM B 501	200 (392)	Minimum conductivity of 30 percent IACS ^a
Aluminum, 6,530 – 16,510 circular mils or 3.31 – 8.367 mm ² (12 – 4/0 AWG), solid or stranded	ANSI/ASTM B 800	90 (194)	Tensile-strength 15,000 – 22,000 psi or 103 – 152 MN/m ² or 10.3 – 15.2 kN/cm ² or 10.5 – 15.5 kgf/mm ² , elongation 10 percent or more with 10-inch or 250-mm gauge length – component aluminum wire stock (conductor material), formerly "aluminum conductor material (ACM)"
Aluminum, 3/4 hard, 6530 – 16510 circular mils or 3.31 – 8.367 mm ² (12 – 4/0 AWG), solid or stranded	ANSI/ASTM B 609	90 (194)	Tensile strength 17,000 – 22,000 psi or 117 – 152 MN/m ² or 11.7 – 15.2 kN/cm ² or 12 – 15.5 kgf/mm ²
Aluminum, 1/2 hard, 6530 – 16510 circular mils or 3.31 – 8.367 mm ² (12 – 4/0 AWG), solid or stranded	ANSI/ASTM B 609	90 (194)	Tensile strength 15,000 – 20,000 psi or 103 – 138 MN/m ² or 10.3 – 13.8 kN/cm ² or 10.5 – 14.9 kgf/mm ²
Aluminum, hard, 6530 – 16510 circular mils or 3.31 – 8.367 mm ² (12 – 4/0 AWG), solid or stranded	ANSI/ASTM B 609	90 (194)	
Aluminum 1100, H12 alloy 6530 – 16510 circular mils or 3.31 – 8.367 mm ² (12 – 4/0 AWG), solid or stranded	ANSI/ASTM B 211	105	
Stainless steel alloys	ANSI/ASTM A 580 or A 555	250 (482)	
Nickel-coated iron	–	250 (482)	
Nickel alloy	ANSI/ASTM B 160 or B 473, or per the requirements in the 'other limits' column	550 (1022)	Minimum tensile strength 45,000 psi or 31.6 kgf/mm ² elongation at least 10 percent, nominal volume resistivity 45 ohm circular mil/foot at 20°C (68°F)
Nickel-chromium-alloy	ANSI/ASTM B 344 or B 267, or B 166	550 (1022)	
Nickel-copper-iron alloy	ANSI/ASTM B 164	250 (482)	
NOTE 1 – "Copper, tin coated" mentioned in this table refers to copper strands of a conductor that are coated with tin before they are twisted. "Copper metallurgically bonded via the addition of tin," mentioned in this table refers to copper strands that are twisted and then coated with tin. NOTE 2 – The copper wires and hard-drawn copper alloy wires specified by Table 5.3 may be combined into a composite conductor in accordance with 5.1.3. ^a IACS – International Annealed Copper Standard			

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Table 5.4
Maximum direct-current resistance of stranded copper conductors, uncoated or with each strand coated with tin

Size of conductor, AWG	20°C				25°C			
	Tin coated copper		Uncoated copper		Tin coated copper		Uncoated copper	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
50	11837	38878	11020	36122	12041	39490	11224	36837
49	9431	30976	8780	28780	9593	31463	8943	29350
48	7532	24740	7013	22987	7662	25130	7143	23442
47	5918	19439	5510	18061	6020	19745	5612	18418
46	4715	15488	4390	14390	4797	15732	4472	14675
45	3742	12290	3484	11419	3806	12484	3548	11645
44	2900	9525	2700	8850	2950	9675	2750	9025
43	2397	7872	2231	7314	2438	7996	2273	7459
42	1856	6096	1728	5664	1888	6192	1760	5776
41	1480	4860	1378	4515	1505	4936	1403	4605
40	1207	3965	1124	3684	1228	4027	1145	3757
39	951	3123	885	2902	967	3172	902	2959
38	725	2381	675	2213	738	2419	688	2256
37	574	1886	535	1752	584	1916	545	1787
36	464	1524	432	1416	472	1548	440	1444
35	369	1213	344	1127	376	1232	350	1150
34	292	960	272	892	297	975	277	909
33	230	756	214	702	234	768	218	716
32	181	595	169	553	184	605	172	564
31	146	481	136	447	149	489	139	456

Table 5.5
Maximum direct-current resistance of metric-sized solid conductors of aluminum, copper-clad aluminum, and uncoated copper

Size of conductor, mm ²	20°C				25°C			
	Aluminum and copper-clad aluminum		Uncoated copper		Aluminum and copper-clad aluminum		Uncoated copper	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
0.01	—	—	538	1765	—	—	548	1797
0.05	—	—	107	351	—	—	110	361
0.1	—	—	53.4	175	—	—	54.5	179
0.5	—	—	10.7	35.1	—	—	10.9	35.8
0.75	—	—	7.15	23.5	—	—	7.29	23.9
1	—	—	5.36	17.6	—	—	5.46	17.9
1.5	—	—	3.56	11.7	—	—	3.63	11.9
2.5	—	—	2.15	7.05	—	—	2.19	7.18
4	2.20	7.22	1.34	4.40	2.24	7.35	1.38	4.53
6	1.46	4.79	0.893	2.93	1.49	4.90	0.911	2.99
10	0.879	2.88	0.536	1.76	0.896	2.94	0.547	1.79
16	0.549	1.80	0.335	1.10	0.562	1.84	0.342	1.12
25	0.352	1.15	0.214	0.703	0.359	1.18	0.219	0.717
35	0.251	0.824	0.153	0.502	0.256	0.840	0.156	0.512

Table 5.5 Continued

Size of conductor, mm ²	20°C				25°C			
	Aluminum and copper-clad aluminum		Uncoated copper		Aluminum and copper-clad aluminum		Uncoated copper	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
50	0.176	0.577	0.107	0.352	0.179	0.588	0.109	0.359
70	0.126	0.412	0.077	0.251	0.128	0.420	0.0781	0.256
95	0.0925	0.303	0.0564	0.185	0.0943	0.309	0.0575	0.189

Table 5.6
Maximum direct-current resistance of metric-sized solid conductors of tin coated copper

Size of conductor, mm ²	20°C		25°C	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
0.01	559	1834	570	1868
0.05	112	366	114	373
0.1	55.6	182	56.7	186
0.5	11.1	36.4	11.3	37.1
0.75	7.43	24.4	7.58	24.9
1	5.58	18.3	5.69	18.7
1.5	3.72	12.2	3.78	12.4
2.5	2.23	7.32	2.27	7.45
4	1.40	4.58	1.43	4.68
6	0.919	3.02	0.938	3.08
10	0.552	1.81	0.563	1.85
16	0.345	1.13	0.352	1.15
25	0.221	0.724	0.225	0.738
35	0.158	0.517	0.161	0.527
50	0.110	0.360	0.112	0.367
70	0.0784	0.257	0.0799	0.262
95	0.0578	0.189	0.0589	0.193

Table 5.7
Maximum direct-current resistance of metric-sized stranded conductors of aluminum and uncoated copper

Size of conductor, mm ²	20°C				25°C			
	Aluminum		Uncoated copper		Aluminum		Uncoated copper	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
0.01	—	—	548	1796	—	—	558	1829
0.05	—	—	110	359	—	—	112	366
0.1	—	—	54.5	179	—	—	55.6	182
0.5	—	—	11.0	36.1	—	—	11.2	36.8
0.75	—	—	7.31	24.0	—	—	7.45	24.4
1	—	—	5.48	18.0	—	—	5.58	18.3
1.5	—	—	3.64	11.9	—	—	3.71	12.2
2.5	—	—	2.19	7.18	—	—	2.23	7.32
4	2.24	7.35	1.38	4.51	2.28	7.49	1.40	4.58
6	1.49	4.89	0.911	2.99	1.52	5.00	0.929	3.05

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Size of conductor, mm ²	20°C				25°C			
	Aluminum		Uncoated copper		Aluminum		Uncoated copper	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
10	0.896	2.94	0.547	1.79	0.914	3.00	0.557	1.83
16	0.560	1.84	0.342	1.12	0.572	1.88	0.349	1.14
25	0.359	1.18	0.219	0.717	0.366	1.20	0.223	0.732
35	0.256	0.840	0.156	0.512	0.261	0.857	0.159	0.523
50	0.179	0.588	0.109	0.359	0.183	0.600	0.111	0.366
70	0.128	0.420	0.0781	0.256	0.131	0.428	0.0796	0.261
95	0.0943	0.309	0.0575	0.189	0.0962	0.316	0.0587	0.192

Table 5.8

Maximum direct-current resistance of metric-sized stranded copper conductors, with each strand coated with tin

Size of conductor, mm ²	20°C		25°C	
	Ohms per 1000 ft	Ohms per 1000 m	Ohms per 1000 ft	Ohms per 1000 m
0.01	560	1835	570	1870
0.05	118	386	120	392
0.1	58.4	192	59.7	196
0.5	11.6	38.1	11.8	38.8
0.75	7.75	25.4	7.89	25.9
1	5.81	19.1	5.93	19.4
1.5	3.78	12.4	3.86	12.7
2.5	2.27	7.45	2.31	7.59
4	1.43	4.68	1.45	4.75
6	0.948	3.11	0.966	3.17
10	0.569	1.86	0.580	1.90
16	0.356	1.17	0.362	1.19
25	0.227	0.746	0.232	0.761
35	0.162	0.533	0.166	0.543
50	0.114	0.373	0.116	0.380
70	0.0812	0.266	0.0828	0.272
95	0.0592	0.194	0.0604	0.198

5.3 Size and cross-sectional area

5.3.1 The size of a round, solid conductor shall not be less than indicated in Table 5.1 or Table 5.2 (as applicable) when measured in accordance with Conductor Diameter, Section 200, of UL 1581, or 5.1.1 for a rectangular conductor. The size of a solid conductor shall not be greater than the nominal value of the next larger conductor size indicated in Table 5.1.

Exception: For a conductor composed of a round, solid metallic wire as described in Exception 6 to 51.2(d), the actual size of the conductor shall be within minus 1 percent, plus 10 percent of the diameter marked on the tag, reel, or carton.

5.3.1 effective date to be determined

5.3.2 The cross-sectional area of a rectangular, solid conductor shall not be less than indicated in Table 5.1 when measured in accordance with 5.1.1.

Exception: For a conductor composed of a rectangular, solid metallic wire as described in Exception 7 to 51.2(d), the actual width and thickness of the conductor shall be within minus 1 percent, plus 10 percent, respectively, of the width and thickness marked on the tag, reel, or carton.

5.3.3 The cross-sectional area of a stranded or braided conductor shall not be less than indicated in Table 5.1 or Table 5.2 (as applicable) when determined by either of the following:

- a) The sum of the areas of its component round or rectangular strands.
- b). The weight method outlined in UL 1581, for a round compact-stranded aluminum conductor or a round compressed-stranded copper or aluminum conductor.

The cross-sectional area of a stranded conductor shall not be greater than the nominal value of the next larger conductor size indicated in Table 5.1.

5.3.3 effective date to be determined

5.3.4 For a conductor composed of minimum 97 percent IACS unalloyed copper described in the Exception to 51.2(f) the determination of conductor resistance described in 5.6.1 – 5.6.3 may be used as an alternative method for determining conductor size and, in the case of a dispute, shall be used as the referee method of determining conductor size.

5.3.4 effective September 3, 2014

5.3.5 For a conductor composed of a material other than minimum 97 percent IACS unalloyed copper described in the Exception to 51.2(f), the determination of conductor resistance described in 5.6.1 – 5.6.3 shall be conducted.

5.3.5 effective September 3, 2014

5.3.6 For a tinsel conductor, the determination of the conductor resistance marked on the tag [see Exception 5 to 51.2(d)] shall be conducted in accordance with D-C Conductor Resistance, Section 220, in UL 1581.

5.3.6 effective September 3, 2014

5.4 Metal coating

5.4.1 When the insulation or other materials such as a fibrous thread or a separator adjacent to a copper, copper alloy, copper-clad aluminum, or copper-clad steel conductor is of a material that corrodes unprotected copper as determined in the test in Conductor Corrosion – General, Section 500, of UL 1581, and when a protective separator that prevents the corrosion of the copper conductor material is not provided, the solid conductor and each of the individual strands of a stranded conductor shall be separately covered with a metal or alloy coating complying with 4.1 as applicable to the finished wire.

5.4.2 In the case of a stranded conductor on which a coating is not required for corrosion protection and is solely to keep the insulation from adhering to copper, it is not prohibited to coat only the wires of the outer layer.

5.5 Joints

5.5.1 A joint (splice) in a solid conductor or in one of the individual wires of a stranded conductor shall not change the diameter of the solid conductor, the individual wire strand, or the overall stranded conductor. In other than flexing applications, a joint may be made in a stranded conductor as a whole or may be made by joining each individual wire. For flexing applications, joints shall be made by separately joining each individual strand. A joint shall be made only before any coverings are applied to an insulated conductor. The insulation applied to such joints shall be equivalent to that removed and shall comply with the requirements in this Standard. A joint in a compact or compressed-stranded conductor shall be made before compacting or compressing.

5.5.2 In a rope-lay-stranded conductor which consists of a central core surrounded by one or more layers of stranded members (primary groups), each member shall be spliced as a unit. These splices are not to be any closer together than two lay lengths.

5.6 Resistance

5.6.1 Conductor resistance shall be equal to or less than the maximum resistance values according to D-C Conductor Resistance, Tables 30.1 – 30.11 of UL 1581 for conductors in Sizes 14 AWG through 2000 kcmil; Tables 30.1 – 30.5 of UL 1581 for conductors between 15 – 30 AWG; Table 5.4 for stranded copper for conductors smaller than 30 AWG; and Tables 5.5, 5.6, 5.7, and 5.8 for metric-sized conductors. Compliance of the DC conductor resistance shall be determined in accordance with D-C Conductor Resistance, Section 220, of UL 1581. For braided conductors, the following formula shall be used to calculate the DC resistance (DCR):

$$\text{DCR} = \text{Resistance of one strand} / [\cos (\text{braid angle})] \times (\text{number of ends}) \times (\text{number of carriers})$$

Exception: The DC conductor resistance of tinsel conductor and magnet wire conductor shall not exceed the maximum value indicated on the tag, reel, or carton [see Exception 5 to 51.2(d)].

5.6.1 effective September 3, 2014

5.6.2 For conductors having a conductivity other than 100 percent as noted in Table 5.3, the maximum resistance is to be determined by multiplying the maximum resistance for uncoated copper by the ratio of 100 percent IACS (International Annealed Copper Standard) to the percent conductivity applicable to the conductor under consideration. For a composite conductor of copper and hard-drawn copper alloy strands, the maximum resistance is to be determined by multiplying the maximum resistance for uncoated copper by the ratio of 100 percent IACS (International Annealed Copper Standard) to the percent