



UL 1309

STANDARD FOR SAFETY

Marine Shipboard Cable

UL Standard for Safety for Marine Shipboard Cable, UL 1309

Third Edition, Dated April 21, 2017

Summary of Topics

This revision of ANSI/UL 1309 is being issued to update the title page to reflect the reaffirmation of this Third Edition as an American National Standard. No changes in requirements are involved.

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.

The requirements are substantially in accordance with Proposal(s) on this subject dated March 4, 2022.

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UL 1309

Standard for Marine Shipboard Cable

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Third Edition

April 21, 2017

This ANSI/UL Standard for Safety consists of the Third edition including revisions through May 3, 2022.

The most recent designation of ANSI/UL 1309 as a Reaffirmed American National Standard (ANS) occurred on April 20, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 <https://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 This Standard specifies the requirements for distribution (power) cables, and control and signal cables for installation aboard marine vessels, fixed and floating offshore petroleum facilities, and mobile offshore drilling units (MODUs), in accordance with industry installation standards and the regulations of the authorities having jurisdiction. The cables are single or multi-conductor, with or without metal armor and/or jacket, and are rated 300 V – 35 kV.

1.2 These cables are not intended for use in accordance with the National Electrical Code (NEC), ANSI/NFPA 70. Cables that also meet the requirements for use with the NEC may be additionally marked with the appropriate "Type" designation from the NEC.

2 Units of Measurement

2.1 In addition to being stated in the inch/pound units that are customary in the USA, each of the requirements in this standard is also stated in units that make the requirement conveniently usable in countries employing the metric system (practical SI). Equivalent – although not necessarily exactly identical – results are to be expected from applying a requirement in USA or metric terms. Equipment calibrated in metric units is to be used when a requirement is applied in metric terms.

3 References

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.

CONSTRUCTION

4 Copper Conductors

4.1 General

4.1.1 All conductors shall be of soft annealed stranded copper wire. The conductors may be tinned or alloy coated where necessary to ensure compatibility with primary insulation. Conductor sizes and resistances shall comply, within allowable tolerances, with the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581.

4.2 Composition

4.2.1 Stranded conductors shall comply with the requirements of the Standard Specification for Soft or Annealed Copper Wire, ASTM B3; the Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, ASTM B8; the Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes, ASTM B33; the Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors, ASTM B172; the Standard Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors, ASTM B173; the Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors, ASTM B174; the Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes, ASTM B189; the Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors, ASTM B496; or the Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation, ASTM B787; as applicable. Metric sizes complying with Conductors of Insulated Cables, IEC 60228 are acceptable.

4.3 Stranding

4.3.1 Except as specified in 4.3.2 – 4.3.5, the conductors shall be stranded Class B concentric conductors, as specified in the Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, ASTM B8. See Table 4.1.

Table 4.1
Construction and resistance of standard Class B concentric conductors

Conductor size		Class B stranding			Maximum dc resistance (Ω /km at 20°C)	
Area in circular mils	AWG or kcmil	Number of wires	Diameter of strand wire mm (mils)	Conductor diameter mm (in)	Uncoated	Alloy coated or tinned
640	22	7	0.240 (9.6)	0.7 (0.0288)	55.4	59.4
1 020	20	7	0.310 (12.1)	0.9 (0.0363)	34.6	36.7
1 620	18	7	0.386 (15.2)	1.2 (0.0456)	21.8	23.2
2 580	16	7	0.488 (19.2)	1.5 (0.0576)	13.7	14.6
4 110	14	7	0.615 (24.2)	1.8 (0.0726)	8.62	8.96
6 530	12	7	0.755 (30.5)	2.3 (0.0915)	5.43	5.64
10 380	10	7	0.987 (38.5)	2.9 (0.116)	3.41	3.55
16 510	8	7	1.234 (48.6)	3.7 (0.146)	2.14	2.23
20 820	7	7	1.384 (54.5)	4.2 (0.164)	1.70	1.77
26 240	6	7	1.554 (61.2)	4.8 (0.184)	1.35	1.40
33 090	5	7	1.748 (68.8)	5.2 (0.206)	1.07	1.11
41 740	4	7	1.961 (77.2)	5.9 (0.232)	0.848	0.882
52 620	3	7	2.202 (86.7)	6.6 (0.260)	0.673	0.700
66 360	2	7	2.474 (97.4)	7.4 (0.292)	0.534	0.555
83 690	1	19	1.687 (66.4)	8.4 (0.332)	0.423	0.440
105 600	1/0	19	1.892 (74.5)	9.5 (0.373)	0.335	0.349
133 100	2/0	19	2.126 (83.7)	10.6 (0.419)	0.266	0.277
167 800	3/0	19	2.386 (94.0)	11.9 (0.470)	0.211	0.219
211 600	4/0	19	2.680 (105.5)	13.4 (0.528)	0.167	0.172
250 000	250	37	2.088 (82.2)	14.6 (0.575)	0.142	0.147
300 000	300	37	2.286 (90.0)	16.0 (0.630)	0.118	0.123
350 000	350	37	2.471 (97.3)	17.3 (0.681)	0.101	0.105
400 000	400	37	2.642 (104.0)	18.5 (0.728)	0.0885	0.0911
500 000	500	37	2.951 (116.2)	20.7 (0.813)	0.0708	0.0729
600 000	600	61	2.520 (99.2)	22.7 (0.893)	0.0590	0.0614
750 000	750	61	2.817 (110.9)	25.3 (0.998)	0.0472	0.0486
1 000 000	1000	61	3.251 (128.0)	29.2 (1.152)	0.0354	0.0364
1 250 000	1250	91	2.977 (117.2)	32.7 (1.289)	0.0283	0.0292
1 500 000	1500	91	3.261 (128.4)	37.0 (1.459)	0.0236	0.0243
2 000 000	2000	127	3.187 (125.5)	41.5 (1.632)	0.0177	0.0182

4.3.2 Class B stranded conductors, compressed to a reduction in diameter of 3 percent maximum of concentric stranded conductors, shall also be permitted.

4.3.3 Unilay stranded conductors complying with the Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation, ASTM B787 shall also be permitted.

4.3.4 Flexible rope lay stranded conductors may be substituted for concentric conductors. Bunch-stranded conductors in sizes 6 AWG and smaller may be substituted for concentric stranded conductor. See [Table 4.2](#).

Table 4.2
Construction and resistance of flexible stranded conductors

AWG or Kcmil	Conductor area in circular mils	Nominal mm ²	Nominal stranding			Max. cond diameter		Maximum DC resistance			
			Number of wires	Individual wire diameter				Ohms per 1000-ft at 25°C		Ohms per km at 25°C	
				inch	mm	inch	mm	Bare	Coated	Bare	Coated
22	754	0.38	19	0.0063	0.160	0.0315	0.80	17.19	18.46	56.4	60.6
20	1216	0.62	19	0.0080	0.203	0.0400	1.02	10.83	11.62	35.5	38.1
18	1900	0.96	19	0.0100	0.254	0.052	1.32	5.91	6.342	19.4	20.8
16	2601	1.32	19	0.0117	0.297	0.062	1.56	4.26	4.527	14.0	14.9
or 16	2426	1.23	19	0.0113	0.287	0.060	1.51	4.63	4.915	15.2	16.1
14	4106	2.08	19	0.0147	0.373	0.076	1.92	2.67	2.835	8.76	9.30
or 14	3831	1.94	19	0.0142	0.361	0.073	1.85	2.93	3.110	9.61	10.2
12	6503	3.29	19	0.0185	0.470	0.095	2.40	1.68	1.784	5.51	5.85
or 12	6088	3.08	19	0.0179	0.455	0.092	2.32	1.84	1.958	6.05	6.42
10	10908	5.53	27	0.0201	0.511	0.128	3.25	1.048	1.101	3.44	3.61
or 10	10319	5.23	37	0.0167	0.424	0.117	2.97	1.045	1.110	3.43	3.64
8	16564	8.4	41	0.0201	0.511	0.147	3.73	0.659	0.692	2.16	2.27
or 8	14948	7.6	37	0.0201	0.511	0.147	3.73	0.728	0.765	2.39	2.51
6	26261	13.3	65	0.0201	0.511	0.207	5.26	0.423	0.445	1.39	1.46
or 6	24645	12.5	61	0.0201	0.511	0.207	5.26	0.455	0.478	1.49	1.57
5	36765	18.6	91	0.0201	0.511	0.244	6.20	0.336	0.353	1.10	1.16
4	41668	21.1	133	0.0177	0.450	0.258	6.55	0.269	0.286	0.88	0.94
or 4	42421	21.5	105	0.0201	0.511	0.264	6.71	0.266	0.279	0.87	0.92
3	53733	27.2	133	0.0201	0.511	0.295	7.49	0.211	0.221	0.69	0.73
or 3	50501	25.6	125	0.0201	0.511	0.295	7.37	0.220	0.231	0.72	0.76
2	66140	33.5	133	0.0223	0.566	0.324	8.23	0.183	0.193	0.60	0.63
or 2	60602	30.7	150	0.0201	0.511	0.325	8.23	0.183	0.193	0.60	0.63
or 2	65046	33.0	161	0.0201	0.511	0.325	8.26	0.167	0.175	0.55	0.58
1	84438	42.8	209	0.0201	0.511	0.361	9.17	0.133	0.140	0.44	0.46
or 1	90902	46.1	225	0.0201	0.511	0.390	9.91	0.122	0.128	0.40	0.42
1/0	107467	54.5	266	0.0201	0.511	0.407	10.34	0.1058	0.111	0.35	0.37
or 1/0	111103	56.3	275	0.0201	0.511	0.440	11.18	0.1009	0.106	0.33	0.35
2/0	131303	66.5	325	0.0201	0.511	0.477	12.12	0.0854	0.090	0.28	0.29
or 2/0	138171	70.0	342	0.0201	0.511	0.461	11.71	0.0842	0.0885	0.28	0.29
3/0	168876	85.6	418	0.0201	0.511	0.510	12.95	0.0669	0.0703	0.22	0.23
or 3/0	181805	92.1	450	0.0201	0.511	0.565	14.35	0.0615	0.0646	0.20	0.23
4/0	214933	109	532	0.0201	0.511	0.575	14.61	0.0530	0.0557	0.17	0.183
or 4/0	222206	113	550	0.0201	0.511	0.620	15.75	0.0505	0.0530	0.17	0.174
262	262607	133	650	0.0201	0.511	0.660	16.76	0.0437	0.0459	0.14	0.151
313	313108	159	775	0.0201	0.511	0.725	18.42	0.0365	0.0383	0.12	0.126

Table 4.2 Continued on Next Page

Table 4.2 Continued

AWG or Kcmil	Conductor area in circular mils	Nominal mm ²	Nominal stranding			Max. cond diameter		Maximum DC resistance			
			Number of wires	Individual wire diameter				Ohms per 1000-ft at 25°C		Ohms per km at 25°C	
				inch	mm	inch	mm	Bare	Coated	Bare	Coated
373	373709	189	925	0.0201	0.511	0.795	20.19	0.0304	0.0319	0.10	0.105
444	444411	225	1100	0.0201	0.511	0.870	22.10	0.0256	0.0269	0.08	0.088
535	535313	271	1325	0.0201	0.511	0.970	24.64	0.0213	0.0223	0.07	0.073
597	597935	303	1480	0.0201	0.511	1.020	25.91	0.0207	0.0217	0.07	0.071
646	646416	328	1600	0.0201	0.511	1.060	26.92	0.0177	0.0186	0.06	0.061
777	777719	394	1925	0.0201	0.511	1.130	28.70	0.0147	0.0154	0.05	0.051
1111	1111028	563	2750	0.0201	0.511	1.340	34.04	0.0105	0.0110	0.03	0.036
Note 1 – The total number of wires should be as specified ±1 percent providing that the maximum conductor diameter and conductor resistance does not exceed the values indicated.											
Note 2 – The resistance values of 22 AWG and 20 AWG have been increased to account for stretching of the conductor during the insulating operations in accordance with the Standard Specification for Copper Conductors for Use in Hookup Wire for Electronic Equipment, ASTM B286.											
Tolerance for maximum resistance:^a											
Single Conductor:						R _{max} = value from Table 4.2					
Multi-Conductor											
One layer of conductor:						R _{max} = value from Table 4.2 X 1.02					
More than one layer of conductors:						R _{max} = value from Table 4.2 X 1.03					
Pairs or other precabled units:						R _{max} = value from Table 4.2 X 1.04					
More than one layer of pairs or other precabled units:						R _{max} = value from Table 4.2 X 1.05					
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4.3.5 Compact round concentric lay stranded copper conductors complying with the Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors, ASTM B496 shall also be permitted. See [Table 4.3](#).

Table 4.3
Construction and resistance of stranded compact concentric conductors

Conductor size		Compact stranding		Maximum dc resistance Ω/km at 20°C	
Area in circular mils	AWG or kcmil	Number of wires	Conductor diameter mm (in)	Uncoated	Alloy coated or tinned
16 510	8	7	3.4 (0.134)	2.14	2.23
26 240	6	7	4.3 (0.169)	1.35	1.40
41 740	4	7	5.4 (0.213)	0.848	0.881
66 360	2	7	6.8 (0.268)	0.533	0.554
83 690	1	19 ^a	7.6 (0.299)	0.423	0.440
105 600	1/0	19 ^a	8.5 (0.336)	0.335	0.348
133 100	2/0	19 ^a	9.6 (0.376)	0.266	0.276
167 800	3/0	19 ^a	10.7 (0.423)	0.211	0.219
211 600	4/0	19 ^a	12.1 (0.475)	0.167	0.172

Table 4.3 Continued on Next Page

Table 4.3 Continued

Conductor size		Compact stranding		Maximum dc resistance Ω/km at 20°C	
Area in circular mils	AWG or kcmil	Number of wires	Conductor diameter mm (in)	Uncoated	Alloy coated or tinned
250 000	250	37 ^b	13.2 (0.520)	0.142	0.147
300 000	300	37 ^b	14.5 (0.570)	0.118	0.123
350 000	350	37 ^b	15.7 (0.616)	0.101	0.105
400 000	400	37 ^b	16.7 (0.659)	0.0884	0.0910
500 000	500	37 ^b	18.7 (0.736)	0.0708	0.0728
600 000	600	61 ^c	20.7 (0.813)	0.0590	0.0613
750 000	750	61 ^c	23.1 (0.908)	0.0472	0.0486
1 000 000	1000	61 ^c	26.9 (1.060)	0.0354	0.0364
^a 18 wires minimum. ^b 35 wires minimum. ^c 58 wires minimum. To convert from kg/km to lb/1000 ft multiply number $\times 0.672$. To convert from Ω/km to $\Omega/1000 \text{ ft}$ multiply number $\times 0.3048$.					

4.4 Joints

4.4.1 Joints in the individual wires of a stranded conductor shall neither increase the diameter nor substantially decrease the strength of the conductor or the individual wire. Joints in stranded conductors larger than 16 AWG shall only be permitted in the individual wires of the strand. The distance between brazes or welds in individual strand wires shall be not less than 0.3 m (1 ft) of conductor.

4.4.2 For rope-lay stranded conductors, a stranded member (primary group) may be jointed as a unit; these joints shall not be closer than two lay lengths.

4.4.3 Joints in stranded conductors 16 AWG and smaller may be made in the whole conductor, provided that the solid section of the braze or weld does not exceed 13 mm (0.5 in) in length and the distance between brazes or welds is greater than 1000 m (3280 ft).

4.5 Conductor stress control layer (for cables rated above 2 kV)

4.5.1 The conductor stress control layer shall be an extruded semiconducting material of a thickness as shown in the Standard for Medium-Voltage Power Cables, UL 1072. This layer shall be applied over the surface of the conductor and bonded to the inner surface of the insulation. The conductor stress control layer material shall be compatible with all materials into which it comes in contact.

4.5.2 The contact surface between the conductor stress control layer and the insulation shall be cylindrical and free from protrusions and irregularities that extend more than 0.13 mm (0.005 in) into the insulation or more than 0.25 mm (0.01 in) into the conductor stress control layer.

4.5.3 The conductor stress control layer shall have a maximum volume resistivity of 1000 $\Omega \cdot \text{m}$ at 90 ± 1 °C (194 ± 1.8 °F), and other physical properties in accordance with the Standard for Medium-Voltage Power Cables, UL 1072.

4.5.4 The extruded conductor stress control layer may be supplemented by a semiconducting tape applied directly over the conductor. The maximum dc resistance of the semiconducting tape at room

temperature shall be 10 000 Ω per unit square, when determined in accordance with the Standard Test Method for D-C Rated Resistance or Conductance of Moderately Conductive Materials, ASTM D4496.

4.5.5 The extruded conductor stress control layer material shall have a brittleness temperature not warmer than -25°C (-13°F) when tested in accordance with the Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact, ASTM D746.

4.5.6 The conductor stress control layer shall be easily removable from the conductor when terminating or splicing.

5 Insulation

5.1 General

5.1.1 The insulation shall be one of the following types:

Marking code symbol	Material	Maximum conductor operating temperature $^{\circ}\text{C}$
T75	Polyvinyl chloride	75
TPE90	Thermoplastic elastomer	90
T/N90	Polyvinyl chloride/nylon	90
E90	Ethylene propylene rubber	90
X90	Cross-linked/polyolefin	90
X100	Cross-linked/polyolefin	100
X110	Cross-linked/polyolefin	110
X100P	Cross-linked/polyolefin for special applications	100
X110P	Cross-linked/polyolefin for special applications	110
S100	Silicone rubber	100

Note – The maximum short circuit temperature of all thermoplastic materials is 150°C , and of the thermoset materials is 250°C .

5.2 Separator

5.2.1 Where required to ensure free stripping, a suitable opaque separator tape may be applied to the conductor of a cable rated 2 kV or less.

5.3 Thickness of extruded insulation

5.3.1 The average thickness of the insulation shall not be less than the values given in [Table 5.1](#).

5.3.2 The minimum thickness of the insulation at any point shall not be less than 90 percent of the average value shown in [Table 5.1](#).

5.3.3 For silicone insulated conductor sizes larger than 8 AWG, refer to the General Specification for Cable and Cord, Electrical, Low Smoke, for Shipboard Use, MIL-C-24643 for construction details using silicone impregnated tape insulation.