Designation: F 1883 – 9803

An American National Standard

Standard Practice for Selection of Wire and Cable Size in AWG or Metric Units[1]

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1. Scope

1.1 This practice is intended as a guide to shipbuilders, shipowners, and design agents for use in the selection of conductor size for single conductor or multiple conductor cable sizes either in American Wire Gauge (AWG) or metric designations for commercial ship design and construction.

1.2 The comparison chart of electrical conductor sizes shown in Table 1 presents a combined listing of international standard sizes of ~~annealed~~ Class 2 stranded copper conductors in accordance with AWG (Specification B 8) English units or IEC (IEC 60228) metric units.

1.3 As a precautionary caveat, some conductor sizes listed in Table 1 may exceed minimal size requirements of the U.S. Coast Guard, the American Bureau of Shipping, and IEEE STD 45 for specific applications.

1.4 The values stated for ampacity and dc resistance are presented as ~~typical~~ maximum values and are provided for information only.

~~TABLE 1 Conversion Table—AWG/Metric Preferred Sizes of Conductors~~

~~Size Metric, mm²~~	~~Size AWG/MCM~~	~~Area in Circ Mils (Nominal)~~	~~Ampacity[A]~~	~~dc Resistances at 20°C[B]~~	
				~~Ohms per 1000 ft~~	~~Ohms per km~~
	~~2000*[C]~~	~~2 000 000~~	~~1155~~	~~0.0053~~	~~0.0174~~
~~1000*~~		~~1 970 000~~	~~1145~~	~~0.0054~~	~~0.0176~~
	~~1750*~~	~~1 750 000~~	~~1070~~	~~0.0063~~	~~0.0199~~
~~800*~~		~~1 580 000~~	~~1009~~	~~0.0067~~	~~0.0218~~
	~~1500*~~	~~1 500 000~~	~~980~~	~~0.0071~~	~~0.0232~~
	~~1250*~~	~~1 250 000~~	~~890~~	~~0.0085~~	~~0.0278~~
~~630*~~		~~1 240 000~~	~~886~~	~~0.0096~~	~~0.0280~~
	~~1000*~~	~~1 000 000~~	~~780~~	~~0.0106~~	~~0.0347~~
~~500*~~		~~987 000~~	~~772~~	~~0.0105~~	~~0.0347~~
~~400*~~		~~789 000~~	~~675~~	~~0.0133~~	~~0.0438~~
	~~750*~~	~~750 000~~	~~655~~	~~0.0141~~	~~0.0463~~
	~~600*~~	~~600 000~~	~~575~~	~~0.0176~~	~~0.0578~~
~~300*~~		~~592 000~~	~~570~~	~~0.0211~~	~~0.0580~~
	~~500*~~	~~500 000~~	~~515~~	~~0.0211~~	~~0.0694~~
~~240*~~		~~474 000~~	~~499~~	~~0.0219~~	~~0.0720~~
	~~400*~~	~~400 000~~	~~455~~	~~0.0264~~	~~0.0867~~
~~185*~~		~~365 000~~	~~431~~	~~0.0286~~	~~0.0938~~
	~~350*~~	~~350 000~~	~~420~~	~~0.0302~~	~~0.0990~~
	~~300*~~	~~300 000~~	~~375~~	~~0.0353~~	~~0.1157~~
~~150*~~		~~296 000~~	~~372~~	~~0.0353~~	~~0.1157~~
	~~250*~~	~~250 000~~	~~340~~	~~0.0423~~	~~0.1388~~
~~120*~~		~~237 000~~	~~327~~	~~0.0436~~	~~0.1492~~
	~~4/0*~~	~~211 600~~	~~300~~	~~0.0500~~	~~0.1639~~
~~95*~~		~~187 000~~	~~265~~	~~0.0551~~	~~0.1808~~
	~~3/0*~~	~~167 000~~	~~260~~	~~0.0631~~	~~0.2065~~
~~70*~~		~~138 000~~	~~230~~	~~0.0752~~	~~0.2467~~
	~~2/0*~~	~~133 100~~	~~225~~	~~0.0794~~	~~0.2605~~
	~~1/0*~~	~~105 600~~	~~195~~	~~0.1002~~	~~0.3288~~
~~50*~~		~~98 000~~	~~185~~	~~0.1044~~	~~0.3424~~
	~~1~~	~~83 690~~	~~165~~	~~0.1261~~	~~0.4139~~
~~35*~~		~~69 100~~	~~144~~	~~0.1495~~	~~0.4904~~
	~~2*~~	~~66 360~~	~~140~~	~~0.1588~~	~~0.5211~~

[1] This specification is under the jurisdiction of ASTM Committee F~~-~~25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.10 on Electrical.

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TABLE 1 *Continued*

Size Metric, mm²	Size AWG/MCM	Area in Circ Mils (Nominal)	Ampacity[A]	dc Resistances at 20°C[B]	
				Ohms per 1000 ft	Ohms per km
	3	52 620	120	0.2005	0.6577
25*		49 300	115	0.2057	0.6748
	4*	41 740	105	0.2528	0.8295
16*		31 600	89	0.3259	1.069
	6*	26 240	80	0.4023	1.320
10*		19 700	63	0.5167	1.695
	8*	16 510	55	0.6380	2.093
6.0*		11 800	43	0.8543	2.803
	10*	10 380	40	1.017	3.335
4.0*		7 890	30	1.304	4.277
	12*	6 530	25	1.620	5.315
2.5*		4 930	22	2.067	6.782
	14*	4 110	20	2.573	8.442
1.5*		2 960	. . .	3.417	11.21
	16*	2 580	. . .	4.020	13.19
1.0*		1 970	. . .	5.213	17.11
0.90		1 773	. . .	6.45	21.10
	18*	1 620	. . .	6.82	20.95
0.80		1 576	. . .	6.52	21.40
0.75*		1 480	. . .	6.82	22.37
0.60*		1 182	. . .	9.5	31.16
	20*	1 020	. . .	10.5	34.45
0.50*		987	. . .	11.4	37.40
	22*	640	. . .	16.9	55.44
0.20*	24*	404	. . .	26.7	87.60
	26*	253	. . .	43.6	143.04

[A] Ampacity of single-conductor cable in air at ambient temperature of 30°C and maximum conductor temperature not exceeding 60°C.

[B] Temperature correction: the conductor resistance may be corrected for moderate temperature differences from the noted reference temperature by the following equation. The parameter, α_T, varies with conductivity and temperature. For a list of common temperature coefficients see Test Methods B 193.

$$R_T = R_t [1 + \alpha_T (t - T)] \quad (1)$$

where:

R_T = resistance at reference temperature T,
R_t = resistance as measured at temperature t,
α_T = known or given temperature coefficient of resistance of the conductor being measured at reference temperature T. At 20°C, the value is 0.003 93,
T = reference temperature, and
t = temperature at which measurement is made.

[C] An asterisk (*) indicates preferred sizes for wires of American Wire Gauge or per IEC 228 (metric) as appropriate.

2. Referenced Documents

2.1 *ASTM Standards:*

B 8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft[2]

B 193 Test Method for Resistivity of Electrical Conductor Materials[2]

2.2 *IEC Standards:*[3]

IEC 60092-350 Electrical Installations in Ships—Part 3: Cables (Construction, Testing, 350: Shipboard Power: Cables—General Construction and Installations) Test Requirements

IEC 60228 Conductors of Insulated Cables

2.3 *IEEE Standard:*[4]

IEEE STD 45 Recommended Practice for Electric Installations on Shipboard

3. Significance and Use

3.1 The selection criteria is to be applied for uses of (*1*) new cable and (*2*) replacement cable.

3.2 For the selection of new cable or the selection of replacement cable, this practice defines the choice criteria for conductor selection for cables in AWG (ASTM) or metric (IEC) sizes.

4. Selection Criteria

4.1 When selecting cable for any application, AWG or metric sizing should be selected according to preferred sizes. The sizes of conductors that have been marked with an asterisk in Table 1 designate preferred sizes per Specification B 8 and IEC 60228. Those sizes not marked are given for reference, and it is recommended that their use be discouraged.

[2] *Annual Book of ASTM Standards*, Vol 02.03.

[3] Available from International Electrochemical Commission, 1 rue de Varembe, Geneva, Switzerland.

[4] Available from Institute of Electrical and Electronics Engineers, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08554.

TABLE 1 Conversion Table—AWG/Metric Preferred Sizes of Conductors

Size Metric, mm^2	Size AWG/MCM	Area in Circ Mils (Nominal)	Ampacity[A]	dc Resistances at 20°C[B]	
				Ohms per 1000 ft	Ohms per km
	2000*[C]	2 000 000	1155	0.0053	0.0177
1000*		1 970 000	1145	0.0054	0.0176
	1750*	1 750 000	1070	0.0063	0.0199
800*		1 580 000	1009	0.0067	0.0224
	1500*	1 500 000	980	0.0071	0.0232
	1250*	1 250 000	890	0.0085	0.0278
630*		1 240 000	886	0.0096	0.0286
	1000*	1 000 000	780	0.0106	0.0347
500*		987 000	772	0.0105	0.0369
400*		789 000	675	0.0133	0.0475
	750*	750 000	655	0.0141	0.0463
	600*	600 000	575	0.0176	0.0578
300*		592 000	570	0.0211	0.0607
	500*	500 000	515	0.0211	0.0694
240*		474 000	499	0.0219	0.0762
	400*	400 000	455	0.0264	0.0867
185*		365 000	431	0.0286	0.1000
	350*	350 000	420	0.0302	0.0990
	300*	300 000	375	0.0353	0.1157
150*		296 000	372	0.0353	0.1260
	250*	250 000	340	0.0423	0.1388
120*		237 000	327	0.0436	0.1540
	4/0*	211 600	300	0.0500	0.1639
95*		187 000	265	0.0551	0.1950
	3/0*	167 000	260	0.0631	0.2065
70*		138 000	230	0.0752	0.2700
	2/0*	133 100	225	0.0794	0.2605
	1/0*	105 600	195	0.1002	0.3288
50*		98 700	185	0.1044	0.3910
	1	83 690	165	0.1261	0.4139
35*		69 100	144	0.1495	0.5290
	2*	66 360	140	0.1588	0.5211
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25*		49 300	115	0.2057	0.7340
	4*	41 740	105	0.2528	0.8295
16*		31 600	89	0.3259	1.160
	6*	26 240	80	0.4023	1.320
10*		19 700	63	0.5167	1.840
	8*	16 510	55	0.6380	2.093
6.0*		11 800	43	0.8543	3.110
	10*	10 380	40	1.017	3.335
4.0*		7 890	30	1.304	4.700
	12*	6 530	25	1.620	5.315
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[A] Ampacity of single-conductor cable in air at ambient temperature of 30°C and maximum conductor temperature not exceeding 60°C.

[B] Temperature correction: the conductor resistance may be corrected for moderate temperature differences from the noted reference temperature by the following equation. The parameter, αT, varies with conductivity and temperature. For a list of common temperature coefficients see Test Methods B 193.

$$R_T = R_t\,[\,1 + \alpha_T(t - T)\,] \quad (1)$$

where:

R_T = resistance at reference temperature T,
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α_T = known or given temperature coefficient of resistance of the conductor being measured at reference temperature *T*. At 20°C, the value is 0.003 93,
T = reference temperature, and
t = temperature at which measurement is made.

[C] An asterisk (*) indicates preferred sizes for wires of American Wire Gauge or per IEC 60228 (metric) as appropriate.

4.2 When selecting cable for any application, AWG or metric sizing should be selected with full consideration of the relationship of type of insulation and ampacity. Direct selection between AWG and metric sizes can be made only after a determination of the equivalence of insulation is made.

4.3 When selecting cable, the conductor size will be determined from analysis of required ampacity, voltage drop considerations, type of cable insulation, and planned installation. Recommended practices for selection and installation of cable systems are detailed in IEEE STD 45 and IEC 60092-350.

4.4 For the selection of cable sizes for new applications, conductor size that satisfies ampacity requirements, voltage drop factors, and the adequacy for application in the available cable space must also be considered.

4.5 For the selection of cable sizes for replacement applications, cable size should be selected in excess of or equal to the replaced cable size. Existing cable space limitations should then be determined to ensure that space for installation of the replacement cable is adequate.

5. Keywords

5.1 AWG conductor sizes; cable selection; conductor comparison; metric conductor sizes