Designation: F1883 – 20

An American National Standard

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

This standard is issued under the fixed designation F1883; 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 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 stranded uncoated (plain) copper conductors in accordance with AWG Class B stranding (Specification B8) inch-pound units or international standard sizes of Class 2 IEC (Specification 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 maximum values and are provided for information only.

1.5 *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]

B8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B193 Test Method for Resistivity of Electrical Conductor Materials

2.2 *IEC Standards:*[3]

IEC 60092-350 Electrical Installations in Ships—Part 350: Shipboard Power: Cables—General Construction and Test Requirements

IEC 60228 Conductors of Insulated Cables

2.3 *IEEE Standard:*[4]

IEEE STD 45 Recommended Practice for Electric Installations on Shipboard

2.4 *NFPA Documents:*[5]

NFPA 70 National Electrical Code (NEC)

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 in accordance with Specification B8 and IEC 60228. Those sizes not marked are given for reference, and it is recommended that their use be discouraged.

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

[1] This practice is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.10 on Electrical.

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[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 Document Summary page on the ASTM website.

[3] Available from International Electrotechnical Commission (IEC), 3, rue de Varembé, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, https://www.iec.ch.

[4] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., Piscataway, NJ 08854-4141, http://www.ieee.org.

[5] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.

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

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	0.00529	0.0174
1000*		1 970 000	1145	0.00537	0.0176
	1750*	1 750 000	1070	0.00604	0.0198
800*		1 580 000	1009	0.00674	0.0221
	1500*	1 500 000	980	0.00705	0.0231
	1250*	1 250 000	890	0.00846	0.0278
630*		1 240 000	886	0.00863	0.0283
	1000*	1 000 000	780	0.0106	0.0348
500*		987 000	772	0.0112	0.0366
400*		789 000	675	0.0143	0.0470
	750*	750 000	655	0.0141	0.0462
	600*	600 000	575	0.0176	0.0578
300*		592 000	570	0.0183	0.0601
	500*	500 000	515	0.0212	0.0695
240*		474 000	499	0.0223	0.0754
	400*	400 000	455	0.0264	0.0866
185*		365 000	431	0.0302	0.0991
	350*	350 000	420	0.0302	0.0991
	300*	300 000	375	0.0353	0.116
150*		296 000	372	0.0378	0.124
	250*	250 000	340	0.0423	0.139
120*		237 000	327	0.0466	0.153
	4/0*	211 600	300	0.0500	0.164
95*		187 000	265	0.0588	0.193
	3/0*	167 000	260	0.0630	0.207
70*		138 000	230	0.0817	0.268
	2/0*	133 100	225	0.0795	0.261
	1/0*	105 600	195	0.100	0.328
50*		98 700	185	0.118	0.387
	1	83 690	165	0.126	0.413
35*		69 100	144	0.160	0.524
	2*	66 360	140	0.159	0.522
	3	52 620	120	0.201	0.659
25*		49 300	115	0.222	0.727
	4*	41 740	105	0.253	0.823
16*		31 600	89	0.321	1.15
	6*	26 240	80	0.403	1.32
10*		19 700	63	0.558	1.83
	8*	16 510	60	0.640	2.10
6.0*		11 800	43	0.939	3.08
	10*	10 380	40	1.02	3.35
4.0*		7 890	30	1.41	4.61
	12*	6 530	25	1.63	5.35
2.5*		4 930	22	2.26	7.41
	14*	4 110	20	2.58	8.46
1.5*		2 960	. . .	3.69	12.18
	16*	2 580	. . .	4.10	13.45
1.0*		1 970	. . .	5.52	18.10
0.90		1 773	. . .	6.45	21.10
	18*	1 620	. . .	6.54	21.46
0.80		1 576	. . .	6.52	21.40
0.75*		1 480	. . .	7.47	24.50
0.60*		1 182	. . .	9.5	31.16
	20*	1 020	. . .	10.3	33.80
0.50*		987	. . .	11.0	36.00
	22*	640	. . .	16.4	53.80
	24*	404	. . .	26.1	85.60
	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. Also shown in NFPA 70, NEC Table 310.15 (B) (17).

[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 Method B193.

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

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 0.00393,
T = reference temperature, and
t = temperature at which measurement is made.

[C] An asterisk (*) indicates preferred sizes for wires of AWG or in accordance with IEC 60228 (metric) as appropriate.