

“Can I use ‘regular wire’ for my boat?” The answer to this common question is a qualified “yes,” if the wire is SAE (Society of Automotive Engineering) J378, J1127 or J1128. These wires are designed for “surface vehicles,” not for the special requirements of the marine industry, but meet the minimum standards for boats in limited circumstances. Even if tinned copper, they should not be run in bilge spaces or other areas subject to moisture from spray or dripping. They should not be run in engines spaces, unless marked “oil resistant” and “75°C”. They should not be used in applications where subjected to vibration or frequent flexing and must never be used for 110 volt applications. For safety, use only wire which is marked with size and type.

Most importantly, SAE wire is up to 12% smaller than

AWG Boat Cable which means that, in many applications, larger gauge wire must be used to stay within the voltage drop limits recommended by experts (see Tables C & D). The wire charts found in “Chapman’s Piloting” and other publications are all for “AWG” wire like **ANCOR**, not “SAE” type wire.

Using the wrong type of wire can cost you more in the long run. Insist on Marine Grade™ Boat Cable by **ANCOR**. It is UL approved for the corrosive marine environment and charter boat service. Marine Grade™ Boat Cable is specially designed to exceed all test standards for cold bend, moisture and oil resistance, heat shock and flammability. This ensures the safest, easiest to install, longest lasting and ultimately the least expensive electrical system you can buy. Only ANCOR offers a complete line of Marine Grade™ Boat Cable for every need.

TABLE A: MARINE COLOR CODE

Color	Item	Use
Red	DC Positive Conductor	Positive Mains
Black or Yellow	DC Negative Conductor	Return, Negative Mains
Green	DC Grounding Conductor	Bonding System
or Green w/ Yellow Stripe		Bonding Wires (if insulated)
Light Blue	Oil Pressure	Oil Pressure Sender to Gauge
Dark Blue	Cabin & Instrument Lights	Fuse or Switch to Lights
Brown	Generator Armature	Generator Armature to Regulator
	Alternator Charge Light	Generator
		Terminal/Alternator
		Auxiliary Terminal to Light to Regulator
	Pumps	Fuse or Switch to Pumps
Grey	Navigation Lights	Fuse or Switch to Lights
	Tachometer	Tachometer Sender to Gauge
Orange	Accessory Feed	Ammeter to Alternator or Generator Output and Accessory Fuses or Switches
	Common Feed	Distribution Panel to Accessory Switch
Pink	Fuel Gauge	Fuel Gauge Sender to Gauge
Purple	Ignition	Ignition Switch to Coil & Electrical Instruments
	Instrument Feed	Distribution Panel to Electric Instruments
Brown w/ Yellow Stripe	Bilge Blowers	Fuse or Switch to Blower
Yellow w/ Red Stripe	Starting Circuit	Starting Switch to Solenoid
Tan	Water Temperature	Water Temperature Sender to Gauge
Green/Stripe (G/x)	Tilt Down and/or Trim In	Tilt and/or Trim Circuits
(except G/Y)		
Blue/Stripe (Bl/x)	Tilt Up and/or Trim Out	Tilt and/or Trim Circuits

TECHNICAL DATA

Table B:
Conductors
Sized (AWG) for
3% Voltage Drop

Use 3% voltage drop for any "critical application" affecting the safety of the vessel or its passengers: bilge pumps, navigation lights, electronics, etc....

IMPORTANT!

Length (feet): Determined by measuring the length of the conductor from the positive (+) power source connection to the electrical device and back to the negative (-) power source connection. Note that the power source connection may be either the battery, panelboard or switchboard.

Current (amps): Determined by adding the total amps on a circuit. Conductor sizes not covered in Table B or Table C may be calculated by using the following formula:

$$CM = \frac{K \times I \times L}{E}$$

After calculating the Circular Mil Area (CM), use Table E to determine the proper conductor size (National Fire Protection Agency and Coast Guard require that the next larger conductor be used when the calculated CM area falls between the two conductor sizes).

CM = Circular Mil Area of Conductors
K = 10.75 (Constant representing the mil-foot resistance of copper)
I = Current - amps / **L** = Length - feet
E = Voltage drop at load (in voltage drop in a decimal expression)

For Example...

Q: A bilge pump draws 10 amps. The positive run is 11 feet from the power panel, including the float switch. The negative run is only 10 feet. What size is the wire?

A: Use the formula to reach the correct answer:

Table D shows that 12 AWG wire has a CM area of 6,500 and is the correct choice. However, SAE wire has a CM area of only 5,833. Under NFPA and USCG regulations, 10 SAE wire must be used.

		3% VOLTAGE DROP AT 12 VOLTS											
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	14	12	10	10	8	6	6	6	6	6	4	4
15'	16	12	10	10	8	8	6	6	4	4	4	2	2
20'	14	10	10	8	6	6	6	4	4	2	2	2	2
25'	12	10	8	6	4	4	4	2	2	2	2	1	1
30'	12	10	8	6	6	6	4	4	2	2	2	1	1
40'	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
50'	10	6	6	4	4	2	2	1	1/0	2/0	3/0	4/0	4/0
60'	10	6	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
70'	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
80'	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0		
90'	8	4	2	2	1	1/0	2/0	3/0	4/0	4/0			
100'	6	4	2	2	1	1/0	2/0	3/0	4/0				
110'	6	4	2	2	1	1/0	2/0	3/0	4/0				
120'	6	4	2	1	1/0	2/0	3/0	4/0					
130'	6	2	2	1	1/0	2/0	3/0	4/0					
140'	6	2	2	1/0	2/0	3/0	4/0						
150'	6	2	1	1/0	2/0	3/0	4/0						
160'	6	2	1	1/0	2/0	3/0	4/0						
170'	6	2	1	2/0	3/0	3/0	4/0						

		3% VOLTAGE DROP AT 24 VOLTS											
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	18	16	14	12	12	10	10	10	8	8	8	6
15'	18	16	14	12	12	10	10	8	8	6	6	6	6
20'	18	14	12	10	10	10	8	6	6	6	6	4	4
25'	16	12	12	10	10	8	6	6	6	4	4	4	4
30'	16	12	10	10	8	8	6	6	4	4	4	2	2
40'	14	10	10	8	6	6	6	4	4	2	2	2	2
50'	12	10	8	6	6	6	4	4	2	2	2	1	1
60'	12	10	8	6	6	4	4	2	2	1	1	1/0	1/0
70'	12	8	6	6	4	4	2	2	1	1	1/0	1/0	2/0
80'	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
90'	10	8	6	4	4	2	2	1	1/0	1/0	2/0	2/0	3/0
100'	10	6	6	4	4	2	2	1	1/0	2/0	2/0	3/0	3/0
110'	10	6	6	4	2	2	1	1/0	1/0	2/0	3/0	3/0	4/0
120'	10	6	4	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
130'	8	6	4	2	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
140'	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
150'	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
160'	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	
170'	8	6	2	2	1	1	2/0	3/0	3/0	4/0	4/0		

		3% VOLTAGE DROP AT 32 VOLTS											
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	18	16	16	14	14	12	12	10	10	8	8	8
15'	18	16	14	14	12	12	10	10	8	8	6	6	6
20'	18	16	12	12	12	10	10	8	8	6	6	6	6
25'	18	14	12	12	10	10	8	8	6	6	6	6	4
30'	16	14	10	10	10	8	8	6	6	6	4	4	4
40'	16	12	10	10	8	8	6	6	4	4	4	2	2
50'	14	12	8	8	8	6	6	4	4	2	2	2	2
60'	14	10	8	8	6	6	4	4	2	2	2	2	1
70'	12	10	6	6	6	6	4	2	2	2	1	1	0
80'	12	10	6	6	6	4	4	2	2	1	1	0	0
90'	12	8	6	6	6	4	2	2	2	1	1/0	1/0	2/0
100'	12	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
110'	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
120'	10	8	6	4	4	2	2	1	1/0	1/0	2/0	2/0	3/0
130'	10	8	6	4	4	2	2	1	1/0	2/0	2/0	3/0	3/0
140'	10	6	6	4	2	2	1	1/0	1/0	2/0	3/0	3/0	3/0
150'	10	6	6	4	2	1	1	1/0	2/0	2/0	3/0	3/0	4/0
160'	10	6	4	4	2	1	1	1/0	2/0	3/0	3/0	4/0	4/0
170'	8	6	4	2	2	1	1	1/0	2/0	3/0	3/0	4/0	4/0

Table C:
Conductors
Sized (AWG) for
10% Voltage Drop

Use 10% voltage drop for any
“non-critical” applications:
windlass, cabin lights, etc....

	10% VOLTAGE DROP AT 12 VOLTS												
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	18	18	16	16	14	14	12	12	10	10	10	10
15'	18	18	16	14	14	12	12	10	10	8	8	8	8
20'	18	16	14	14	12	12	10	10	8	8	8	6	6
25'	18	16	14	12	12	10	10	8	8	6	6	6	6
30'	18	14	12	12	10	10	8	8	6	6	6	6	4
40'	16	14	12	10	10	8	8	6	6	6	4	4	4
50'	16	12	10	10	8	8	6	6	4	4	4	2	2
60'	14	12	10	8	8	6	6	4	4	2	2	2	2
70'	14	10	8	8	6	6	6	4	2	2	2	2	1
80'	14	10	8	8	6	6	4	4	2	2	2	1	1
90'	12	10	8	6	6	6	4	2	2	2	1	1	1/0
100'	12	10	8	6	6	4	4	2	2	1	1	1/0	1/0
110'	12	8	8	6	6	4	2	2	2	1	1/0	1/0	1/0
120'	12	8	6	6	4	4	2	2	1	1	1/0	1/0	2/0
130'	12	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
140'	10	8	6	6	4	2	2	1	1	1/0	2/0	2/0	2/0
150'	10	8	6	4	4	2	2	1	1/0	1/0	2/0	2/0	3/0
160'	10	8	6	4	4	2	2	1	1/0	2/0	2/0	3/0	3/0
170'	10	6	6	4	2	2	2	1	1/0	2/0	2/0	3/0	3/0

	10% VOLTAGE DROP AT 24 VOLTS												
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	18	18	18	18	18	16	16	14	14	14	12	12
15'	18	18	18	18	16	16	14	14	12	12	12	10	10
20'	18	18	18	16	16	14	14	12	12	10	10	10	10
25'	18	18	16	16	14	14	12	12	10	10	10	8	8
30'	18	18	16	14	14	12	12	10	10	8	8	8	8
40'	18	16	14	14	12	12	10	10	8	8	8	6	6
50'	18	16	14	12	12	10	10	8	8	6	6	6	6
60'	18	14	12	12	10	10	8	8	6	6	6	6	4
70'	16	14	12	10	10	8	8	6	6	6	6	4	4
80'	16	14	12	10	10	8	8	6	6	6	4	4	4
90'	16	12	10	10	8	8	6	6	6	4	4	4	2
100'	16	12	10	10	8	8	6	6	4	4	4	2	2
110'	14	12	10	8	8	8	6	6	4	4	2	2	2
120'	14	12	10	8	8	6	6	4	4	2	2	2	2
130'	14	12	10	8	8	6	6	4	4	2	2	2	2
140'	14	10	8	8	6	6	6	4	2	2	2	2	1
150'	14	10	8	8	6	6	4	4	2	2	2	2	1
160'	14	10	8	8	6	6	4	4	2	2	2	1	1
170'	12	10	8	6	6	6	4	2	2	2	2	1	1

	10% VOLTAGE DROP AT 32 VOLTS												
	Current (amps)												
Length	5	10	15	20	25	30	40	50	60	70	80	90	100
10'	18	18	18	18	18	18	18	16	16	14	14	14	14
15'	18	18	18	18	18	18	16	14	14	14	12	12	12
20'	18	18	18	18	16	16	14	14	12	12	12	10	10
25'	18	18	18	16	16	14	14	12	12	10	10	10	10
30'	18	18	18	16	14	14	12	14	10	10	10	10	8
40'	18	18	16	14	14	12	12	10	10	8	8	8	8
50'	18	16	14	14	12	12	10	10	8	8	8	6	6
60'	18	16	14	12	12	10	10	8	8	8	6	6	6
70'	18	14	14	12	10	10	8	8	8	6	6	6	6
80'	18	14	12	12	10	10	8	8	6	6	6	6	4
90'	18	14	12	10	10	10	8	6	6	6	6	4	4
100'	16	14	12	10	10	8	8	6	6	6	4	4	4
110'	16	14	12	10	10	8	8	6	6	6	4	4	4
120'	16	12	10	10	8	8	6	6	6	4	4	4	2
130'	16	12	10	10	8	8	6	6	6	4	4	2	2
140'	14	12	10	8	8	8	6	6	4	4	2	2	2
150'	14	12	10	8	8	6	6	6	4	4	2	2	2
160'	14	12	10	8	8	6	6	4	4	2	2	2	2
170'	14	12	10	8	8	6	6	4	4	2	2	2	2

ABYC Recommends...

“Conductors used for panelboard or switchboard main feeders, bilge blowers, electronic equipment, navigation lights, and other circuits where voltage drop must be kept to a minimum, shall be sized for a voltage drop not to exceed three percent. Conductors used for lighting, other than navigation lights, and other circuits where voltage drop is not critical, shall be sized for a voltage drop not to exceed 10 percent.” 11.16.1.2.7.

TECHNICAL DATA

Table D: Conductor Sizes

AWG	Sq. mm	AWG CM area	SAE CM area	Ampacity Engine Space	
				Outside	Inside
18	0.8	1,600	1,537	20	17
16	1	2,600	2,336	25	21
14	2	4,100	3,702	35	30
12	3	6,500	5,833	45	38
10	5	10,500	9,343	60	51
8	8	16,800	14,810	80	68
6	13	26,600	24,538	120	102
4	21	42,000	37,360	160	136
2	34	66,500	62,450	210	178
1	42	83,690	77,790	245	208
1/0	53	105,600	98,980	285	242
2/0	68	133,100	125,100	330	280
3/0	85	167,800	158,600	385	327
4/0	107	211,600	205,500	445	378

Table E: Temperature Rating of Conductor Insulation

The Law

The Code of Federal Regulations (CFR) 183.425 Conductors

- (b) Except for intermittent surges each conductor must not carry a current greater than that specified in Table E for the conductor's gauge and temperature rating.
- (c) For conductors in engine spaces, amperages must be corrected by the appropriate correction factor in note 1 of Table E.

Due to engine heat, the ambient temperature in engine spaces is usually higher than in other spaces of the boat. Wiring in and passing through engine spaces must be able to operate at these higher ambient temperatures. The ampacity values in Table E are based on an ambient temperature of 30° C (86° F) which is considered reasonable for use on boats except in engine spaces. The correction factors in Note 1 in Table E convert the ampacities to Table E to acceptable values in an ambient temperature of 50° C (122° F). This higher temperature has been selected as satisfactory for engine spaces. Note 1 is supplied to eliminate the need for calculating the corrections to Table E. The values are already corrected.

Conductor Size (AWG)	Ampacity Outside of Engine Space	Ampacity Inside of Engine Space (Note 1)
18	20	17
16	25	21
14	35	30
12	45	38
10	60	51
8	80	68
6	120	102
4	160	136
3	180	153
2	210	178
1	245	208
1/0	285	242
2/0	330	280
3/0	385	327
4/0	445	378

*De-rating for engine space is 0.85 for 105° C (221° F) rated wire.

Table F: Allowable Amperage of Conductors of 50 Volts or More

The current values shown in Table F and also on Table D do not consider voltage drop for conductors under 50 volts. The values shown on the ampacity table are the maximum safe amperages which the conductor can carry on a continuous basis. They do not apply to intermittent starting loads such as motor start currents. Since all **ANCOR** Boat Cable is 105° C insulated, only that temperature rating is shown.

Due to the higher ambient temperatures in engine spaces and the heat retention of large wire bundles, a "correction factor" must be used to derate the wire by increasing conductor size. Table F takes into consideration these factors and should be used to select conductor sizes for circuits over 50 volts. Note that for electrical systems under 50 volts, voltage drop is the controlling factor and the tables on pages 14 and 15 should be used.

Conductor Size (AWG)	2 Conductors 105° C (221° F)		3 Conductors 105° C (221° F)		4 to 6 Conductors 105° C (221° F)		7 to 24 Conductors 105° C (221° F)	
	Outside Engine Space	Inside Engine Space	Outside Engine Space	Inside Engine Space	Outside Engine Space	Inside Engine Space	Outside Engine Space	Inside Engine Space
18	20	17.0	14.0	11.9	12.0	10.2	10.0	8.5
16	25	21.3	17.5	14.9	15.0	12.8	12.5	10.6
14	35	29.8	24.5	20.8	21.0	17.9	17.5	14.9
12	45	38.3	31.5	26.8	27.0	23.0	22.5	19.1
10	60	51.0	42.0	35.7	36.0	30.6	30.0	25.5
8	80	68.0	56.0	47.6	48.0	40.8	40.0	34.0
6	120	102.0	84.0	71.4	72.0	61.2	60.0	51.0
4	160	136.0	112.0	95.2	96.0	81.6	80.0	68.0
3	180	153.0	126.0	107.1	108.0	91.8	90.0	76.5
2	210	178.5	147.0	125.0	126.0	107.1	105.0	89.3
1	245	208.3	171.5	145.8	147.0	125.0	122.5	104.1
1/0	285	242.3	199.5	169.6	171.0	145.4	142.5	121.1
2/0	330	280.5	231.0	196.4	198.0	168.3	165.0	140.3
3/0	385	327.3	269.5	229.1	231.0	196.4	192.5	163.6
4/0	445	378.3	311.5	264.8	267.0	227.0	222.5	189.1

Table F is supplied to eliminate the need for calculating the corrections for multi-conductor cable bundles to Table E. The values are already corrected.

Number of current carrying conductors:	Correction Factor
3	0.70
4 to 6	0.60
7 to 24	0.50
25 and above	0.40

- Note: These tables only apply for 105° C (221° F) wire and other premium wire and should not be used for lesser grades of wire and cable.
- Reprinted at the courtesy of the United States Coast Guard Electrical System Compliance Guideline.
- * There is NO LIMIT on conductors in a bundle under 50 Volts.