# 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**

| Length | | Current (Amps) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 10' | 3 m | 18 | 14 | 12 | 10 | 10 | 8 | 6 | 6 | 6 | 6 | 6 | 4 | 4 |
| 15' | 5 m | 16 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 4 | 4 | 4 | 2 | 2 |
| 20' | 6 m | 14 | 10 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 |
| 25' | 8 m | 12 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 1 | 1 |
| 30' | 9 m | 12 | 10 | 8 | 6 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 1 | 1 |
| 40' | 12 m | 10 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 |
| 50' | 15 m | 10 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | 4/0 |
| 60' | 18 m | 10 | 6 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 |
| 70' | 21 m | 8 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 | |
| 80' | 24 m | 8 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | 4/0 | | |
| 90' | 27 m | 8 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | 4/0 | | | |
| 100' | 30 m | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | |
| 110' | 33 m | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | |
| 120' | 36 m | 6 | 4 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | | |
| 130' | 40 m | 6 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | | |
| 140' | 43 m | 6 | 2 | 2 | 1/0 | 2/0 | 3/0 | 4/0 | | | | | | |
| 150' | 46 m | 6 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | | | |
| 160' | 49 m | 6 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | | | | | | |
| 170' | 52 m | 6 | 2 | 1 | 2/0 | 3/0 | 3/0 | 4/0 | | | | | | |

**3% Voltage Drop at 24 Volts**

| Length | | Current (Amps) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 10' | 3 m | 18 | 18 | 16 | 14 | 12 | 12 | 10 | 10 | 10 | 8 | 8 | 8 | 6 |
| 15' | 5 m | 18 | 16 | 14 | 12 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 6 | 6 |
| 20' | 6 m | 18 | 14 | 12 | 10 | 10 | 10 | 8 | 6 | 6 | 6 | 6 | 4 | 4 |
| 25' | 8 m | 16 | 12 | 12 | 10 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 4 | 4 |
| 30' | 9 m | 16 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 4 | 4 | 4 | 2 | 2 |
| 40' | 12 m | 14 | 10 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 |
| 50' | 15 m | 12 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 1 | 1 |
| 60' | 18 m | 12 | 10 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 1/0 | 1/0 |
| 70' | 21 m | 12 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 1/0 | 1/0 | 2/0 |
| 80' | 24 m | 10 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 |
| 90' | 27 m | 10 | 8 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 | 3/0 |
| 100' | 30 m | 10 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 2/0 | 3/0 | 3/0 |
| 110' | 33 m | 10 | 6 | 6 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 |
| 120' | 36 m | 10 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 |
| 130' | 40 m | 8 | 6 | 4 | 2 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 |
| 140' | 43 m | 8 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 | |
| 150' | 46 m | 8 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 | |
| 160' | 49 m | 8 | 6 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | 4/0 | 4/0 | |
| 170' | 52 m | 8 | 6 | 2 | 2 | 1 | 1 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 | | |

**3% Voltage Drop at 32 Volts**

| Length | | Current (Amps) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 10' | 3 m | 18 | 18 | 16 | 16 | 14 | 14 | 12 | 12 | 10 | 10 | 10 | 8 | 8 |
| 15' | 5 m | 18 | 16 | 14 | 14 | 12 | 12 | 10 | 10 | 8 | 8 | 8 | 6 | 6 |
| 20' | 6 m | 18 | 16 | 12 | 12 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 6 | 6 |
| 25' | 8 m | 18 | 14 | 12 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 6 | 6 | 4 |
| 30' | 9 m | 16 | 14 | 10 | 10 | 10 | 8 | 8 | 6 | 6 | 6 | 4 | 4 | 4 |
| 40' | 12 m | 16 | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 4 | 4 | 4 | 2 | 2 |
| 50' | 15 m | 14 | 12 | 8 | 8 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 |
| 60' | 18 m | 14 | 10 | 8 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 | 1 |
| 70' | 21 m | 12 | 10 | 6 | 6 | 6 | 6 | 4 | 2 | 2 | 2 | 1 | 1 | 0 |
| 80' | 24 m | 12 | 10 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1 | 0 | 0 |
| 90' | 27 m | 12 | 8 | 6 | 6 | 6 | 4 | 2 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 |
| 100' | 30 m | 12 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 |
| 110' | 33 m | 10 | 8 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 |
| 120' | 36 m | 10 | 8 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 2/0 | 3/0 |
| 130' | 40 m | 10 | 6 | 6 | 4 | 4 | 2 | 2 | 1 | 1/0 | 2/0 | 2/0 | 3/0 | 3/0 |
| 140' | 43 m | 10 | 6 | 6 | 4 | 2 | 2 | 1 | 1/0 | 1/0 | 2/0 | 3/0 | 3/0 | 3/0 |
| 150' | 46 m | 10 | 6 | 6 | 4 | 2 | 1 | 1 | 1/0 | 2/0 | 2/0 | 3/0 | 3/0 | 4/0 |
| 160' | 49 m | 10 | 6 | 4 | 4 | 2 | 1 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 |
| 170' | 52 m | 8 | 6 | 4 | 2 | 2 | 1 | 1 | 1/0 | 2/0 | 3/0 | 3/0 | 4/0 | 4/0 |