

CIRCUIT PROTECTION

Part 1: Choosing the correct wire size for a DC circuit

This is the first in a 3-part series about choosing wire and circuit protection for DC electrical projects.

Choosing the right wire size for your DC electrical project is important, since a wire that is too small can overheat and possibly start a fire. The American Boat and Yacht Council (ABYC) publishes charts with valuable detail to help experienced boatbuilders and installers determine what wire size they need. Although these charts are an excellent resource, they are a bit intimidating. This technical brief distills the information on these charts to a more manageable size for installers and boatowners alike.

Quality marine wire, as specified by ABYC standards, will always be stranded rather than solid, and always tin-plated copper. In addition, the DC Wire Selection Chart shown on page 2 assumes a wire insulation rating of 105°C. A lower rating will decrease the current-carrying capacity of the wire.

To use the chart included with this technical brief, follow the instructions below.

Choosing the correct wire:

- A Locate the CURRENT IN AMPS** of your appliance across the top of the chart. Most electrical products include a rating label, or you can find the amperage rating in the documentation that came with the product.
- B Find circuit LENGTH IN FEET** along the left side of the chart. Note that the total length of the circuit is the roundtrip distance from power source (usually the battery) to the product and back.
- C Select the CIRCUIT TYPE.** Allowable voltage drop is based on whether a circuit is critical or non-critical.

Critical circuits, with 3% allowable voltage drop, include

- Panel main feeders
- Bilge blowers
- Electronics
- Navigation lights

Non-critical circuits, with 10% allowable voltage drop, include

- General lighting
- Windlasses
- Bait pumps
- General appliances

Follow down the column until you find your circuit's **LENGTH IN FEET**.

- D Intersect CURRENT IN AMPS** with **LENGTH IN FEET** to identify the wire size.

Example: A windlass rated 80A is 25' from the battery. Circuit length is 50', circuit type is 'non-critical', and correct wire size is 4 AWG.

The Circuit Wizard, at circuitwizard.blueseasystems.com, is a resource for a more detailed treatment of wire size selection for DC circuits. It allows you to input detailed information including wire insulation temperature rating and other derating factors. The Circuit Wizard is easy to use, and is accessible from any computer with an Internet connection.

DC WIRE SELECTION CHART

U.S. Coast Guard regulation requires all ungrounded current carrying conductors (except the starting circuit) to be protected with a circuit breaker or a fuse.

| CIRCUIT TYPE | | | CURRENT FLOW IN AMPS | | | | | | | | | | | | | | | | | | | |
|------------------|--------------|-----------------|----------------------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 10% VOLTAGE DROP | Non Critical | 3% VOLTAGE DROP | Critical | 5A | 10A | 15A | 20A | 25A | 30A | 40A | 50A | 60A | 70A | 80A | 90A | 100A | 120A | 150A | 200A | | | |
| CIRCUIT LENGTH | 0 to 20 ft | 0 to 6 ft | | 16 AWG | 16 AWG | 14 AWG | 14 AWG | 12 AWG | 10 AWG | 8 AWG | 6 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 1 AWG | | | | |
| | 30 ft | 10 ft | | 16 AWG | 14 AWG | 12 AWG | 12 AWG | 10 AWG | 10 AWG | 8 AWG | 6 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 1 AWG | | 2 0 AWG | | |
| | 50 ft | 15 ft | | 16 AWG | 12 AWG | 10 AWG | 10 AWG | 8 AWG | 8 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 2 AWG | 1 AWG | 0 AWG | | 2 0 AWG | |
| | 65 ft | 20 ft | | 14 AWG | 10 AWG | 10 AWG | 8 AWG | 6 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 3 0 AWG | |
| | 80 ft | 25 ft | | 12 AWG | 10 AWG | 8 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG |
| | 100 ft | 30 ft | | 12 AWG | 8 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG | 4 0 AWG |
| | 130 ft | 40 ft | | 10 AWG | 8 AWG | 6 AWG | 4 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG |
| | 165 ft | 50 ft | | 10 AWG | 6 AWG | 6 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG | 3 0 AWG | 3 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG |
| | 200 ft | 60 ft | | 8 AWG | 6 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 70 ft | | 8 AWG | 4 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 80 ft | | 8 AWG | 4 AWG | 2 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 90 ft | | 6 AWG | 4 AWG | 2 AWG | 1 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 100 ft | | 6 AWG | 4 AWG | 2 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 110 ft | | 6 AWG | 4 AWG | 2 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | | 120 ft | | 6 AWG | 4 AWG | 2 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG |
| | 130 ft | | 6 AWG | 2 AWG | 2 AWG | 1 AWG | 0 AWG | 0 AWG | 2 0 AWG | 3 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | 4 0 AWG | |

Although this process uses information from ABYC E-11 to recommend wire size and circuit protection, it may not cover all of the unique characteristics that may exist on a boat. If you have specific questions about your installation please consult an ABYC certified installer.

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