



Figure 8.27: Battery Discharge Curves

This sample battery discharge curve for a Lithium ion battery plots battery voltage as a function of the amp-hours delivered by the battery for several different rates of constant current (CC) discharge.

Note that under relatively light load (1C rate), the battery starts at about 4.3 volts. The voltage decreases steadily, and the battery finally dies a rapid death as it approaches the point where it has delivered almost 8 Ah. At higher rates (18C or about $18 \times 8 = 144$ A), the battery can muster only 3.7 volts to start and is effectively dead after delivering only about 6.5 Ah.



TECH NOTE: WHAT'S A MARINE BATTERY?

The term “marine battery” is a somewhat loosely defined category that may apply to wet batteries, AGM, gel cells, and others, depending on who’s doing the defining. Generally speaking, marine batteries are like car batteries in that they are nominally 12-volt, lead-acid batteries, but then various manufacturers have “optimized” them for use in boats by having one or more of the following features:

- The lead plates inside may be more rugged, to withstand the pounding and vibration of a boat.
- Often they are sealed (utilizing gel or absorbent glass mat) to reduce the chance of spilling acid in a rocking boat.
- They may include greater deep-cycle capacity (using lower current for longer periods of time and discharging further before recharging is necessary), in contrast with the typical car battery (which is optimized for brief bursts of very high current to run the starter motor and which seldom discharges very far).
- Marine batteries are often designed so that wires can be connected securely with bolts through holes in the battery terminals rather than the posts of automobile batteries.
- They incorporate features to protect the battery from saltwater, diesel fuel, and other common marine contaminants. Some include built-in handles for easier, safer movement on unstable marine platforms.

Note that using marine batteries to deliver surface-supplied power still requires significant safety precautions.



Figure 8.28: Marine Batteries

Image courtesy of Scott Côté, Côté Consulting