CoolTech: Energizer Ultimate Lithium Batteries

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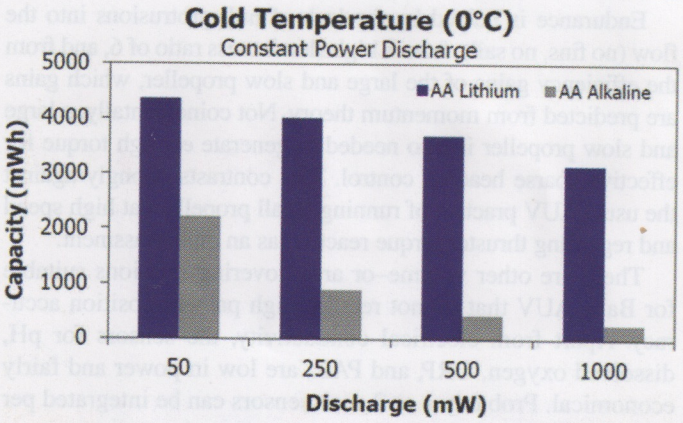
About Lithium/Iron Disulfide cells

Standard alkaline cells are hard to beat in ocean applications for a lot of reasons, but new chemistries provide interesting alternatives for instruments and releases in the cold waters of the deep sea.

One of the more interesting chemistries is Lithium/Iron Disulfide (Li/FeS_2) that operates well in the broad temperature range of −40 °C to 60 °C (−40 °F to 140 °F).

The cells are built as a spiral construction featuring two long, thin electrodes rolled together to form a jellyroll shape. This shape provides almost 20 times more reactive surface area than a standard alkaline, resulting in high-energy potential. Lithium is the lightest metal, making the cells a full 33% lighter than alkaline. When lithium metal (anode) is paired with iron disulfide (cathode), a voltage of 1.5 volts is generated. A lithium salt in an organic solvent blend is the electrolyte. This non-aqueous electrolyte provides the excellent low temperature performance.

A direct replacement for 1.5 v "AA" and "AAA" alkaline primary cells, and 9v batteries, the Energizer Ultimate Lithium cell (L91) retains its higher capacity at low temperatures, while providing higher capacity in high-drain situations.



Other advantages of the lithium/iron disulfide (Li/FeS_2) system over the alkaline chemistry include:

- Direct drop-in compatibility in applications using primary 1.5 volt "AA" and "AAA" battery sizes;
- Greater power density;
- A flatter discharge curve allows for consistent performance throughout the life of the battery;
- Longer service life in moderate to heavy drain applications;
- Higher operating voltage and flatter discharge curve;
- Superior leakage resistance;
- Outstanding shelf life; and
- No added mercury, cadmium, or lead.

Energizer has no current plans to make the larger "C" or "D" cells.

Engineers must consider the following conditions that can affect internal heating of $LiFeS_2$ batteries during discharge.

- Surrounding air temperature
- Thermal insulating properties of the battery container
- Heat generated by equipment components
- Cumulative heating effects of multiple batteries
- Discharge rate(s) and duration(s)
- Frequency and length of rest periods

Safety

"Intrinsic safety" is the globally recognized protection technique designed to ensure safe operation of electronic devices in potentially explosive environments by eliminating the potential for ignition. "There is no risk of hydrogen generation with lithium iron disulfide batteries and they can be used safely in water tight applications," states the application note. Additional safety references may be found at the Energizer battery website: <http://data.energizer.com/PDFs/design_and_safety_overview2.pdf>.

Pack assembly

Use of pressure contact for battery pack assemblies is recommended. If spot welded connections are needed, they can be made to the nickel-plated positive cap and the nickel-plated bottom using a capacitor discharge spot welder. Solder connections should be avoided because of the intense heat that needs to be applied to the battery. The use of a battery tube will allow rapid assembly of a battery pack from loose cells. For example, see the Open ROV Store: <http://store.openrov.com/products/battery-tube-replacement-kit-for-2-8>. It is important to not mix battery types, or old and new batteries.

Shipping

Shipping and transportation, including US DOT traveling with lithium battery guidelines, can be reviewed at <http://data.energizer.com/PDFs/lishipmentpolicy.PDF>

Disposal

Primary batteries may be disposed of in landfills, provided no contrary local statutes exist.

For further information, please go on-line to retrieve a copy of the "Cylindrical Primary Lithium Handbook and Application Manual" at the Energizer website: <http://data.energizer.com/PDFs/lithiuml91l92_appman.pdf>.

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