

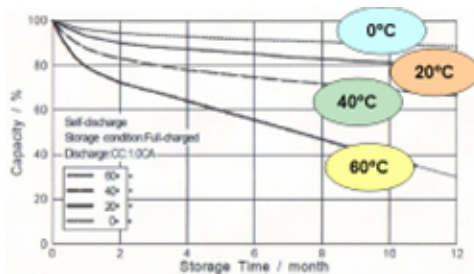
## Common Mistakes in Battery Pack Development (And how to avoid them)

By Katherine Mack, Rose Electronics

A few oversights can turn your battery project a nightmare. Here is a list of commonly made mistakes to keep in mind to ensure your project goes as smoothly as possible:

### Neglecting Shelf Life

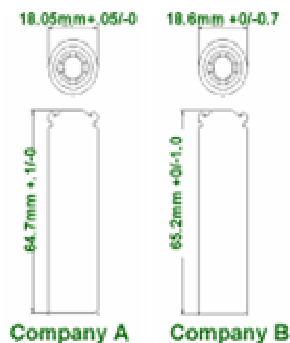
Some batteries, particularly sealed lead acid and lithium ion, have a limited shelf life if stored incorrectly or if not recharged periodically. Additionally, many devices draw a small amount of energy even when turned off, particularly if they have communication ICs, which drains the batteries further. This chart represents self discharge at various temperatures. As you can see, the higher the temperature, the faster the self discharge rate.



**How to avoid this mistake:** Be sure you know how the battery will be used and stored in the application and alert customers of possible battery management protocol necessary over time. In addition, be certain any communication from the battery draws the lowest possible current.

### Not Leaving Enough Space

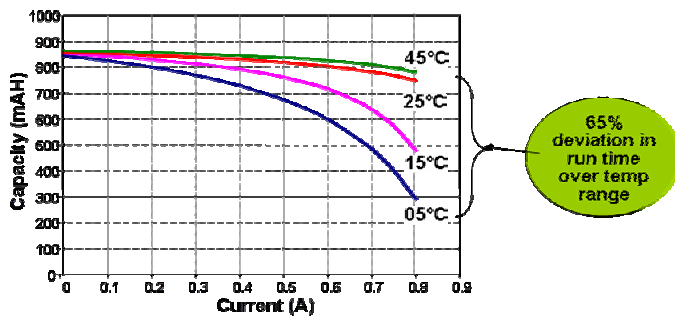
Not all “standard size” batteries are the same size. The figure below represents two different manufacturer’s take on what a 4/3A size really is. In addition, some cells will swell over time. This is particularly prevalent in lithium ion prismatic cells and lithium polymer cells. The cell size will increase approximately 10% over the life of the battery.



**How to avoid this mistake:** It is a good idea to leave enough room for the largest of cell sizes in that product category available to allow for second sourcing. In addition, in prismatic applications, allow 10% in the thickness space allowed to accommodate any swelling.

### Disregarding Temperature Effect on Predicting Run Time

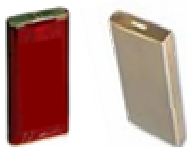
All batteries have a limited temperature range; exceeding this range can reduce battery performance and life. Specifications as to battery performance are generally made at room temperature (approximately 20°C).



**How to avoid this mistake:** Either derate your battery's performance for applications that will be cooler or warmer than room temperature, or increase battery capacity to accommodate the temperature changes if a minimum run time is needed.

### Single Sourcing Cells

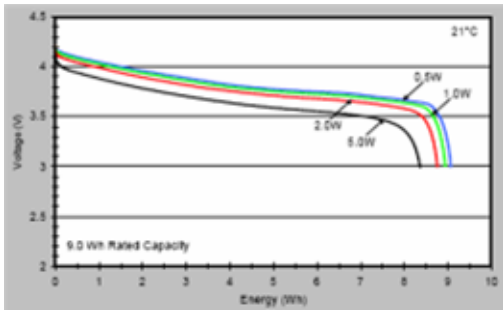
Most batteries come in standard sizes made by several cell manufacturers. However, some sizes have only one source. Cell manufacturers will often design a cell size with a particular large volume customer in mind (such as for a particular cell phone). If that OEM moves on to another product size, the cell manufacturer may discontinue that cell, leaving the smaller volume users with no source. In addition, if that cell vendor raises its price for that cell, no recourse is possible.



**How to avoid this mistake:** Choose a cell size that is commonly used among the industry among a wide variety of vendors. In the case of prismatic cells, choose a common footprint (such as 34mm x 50mm) so that if your cell is discontinued, there will at least be various thickness options.

### Mistake #5: Overlooking Power

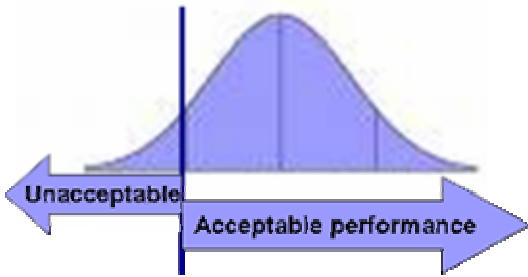
It is important to look at more than just the nominal voltage and capacity of a battery when designing a product. The amount of power and the actual operating voltage a battery will need must be considered for a truer estimation of battery run time.



**How to avoid this mistake:** Know your minimum operating voltage as well as your maximum peak current. Ensure that your battery can handle the load.

### Depending on actual performance versus specification

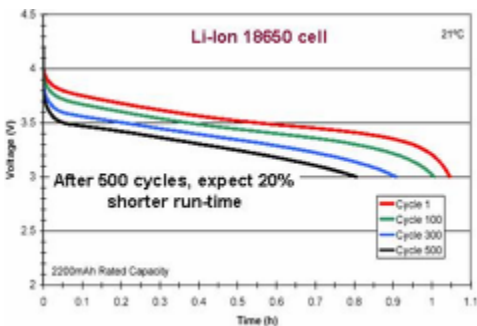
Cell manufacturers rate their cells based on a specifically defined discharge current and temperature. For higher quality cell manufacturers, cells may actually out-perform their actual specifications as the specifications are based on minimum lot performance levels. The drawback to this is that occasionally, a lot of cells may fall at the low end of the performance bell curve; the cells meet specification but are lower-performing than previous lots.



**How to avoid this mistake:** Always use the “Minimum” capacity on the cell specification, not the “Typical”, as your guide when estimating run time.

### Omitting Cycle Life

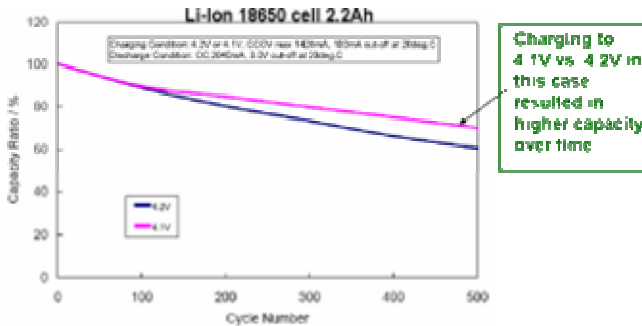
Different cell chemistries have different cycle lives. Tradeoffs between cell capacity and cycle life must be considered, especially when comparing performance levels. Whether the product is a cyclic or backup application should be considered when choosing battery chemistry.



**How to avoid this mistake:** Expect shorter run time as the battery ages. Over time, the run time of the battery will decrease. Know the guaranteed cycle life of the cell you are using, and consider derating capacity accordingly.

### Miscalculating Charging

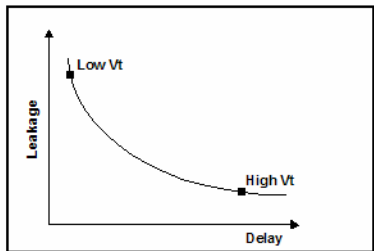
In secondary (rechargeable) batteries, proper charge methods can make the difference between a battery that lasts five years and a battery that lasts five weeks.



**How to avoid this mistake:** Ensure that your charge method is appropriate and recommended for the chemistry you are using. Follow cell manufacturers guidelines and don't be seduced by promises of quick charge via alternative methods not recommended for the cell chemistry.

### Discounting Parasitic Drain

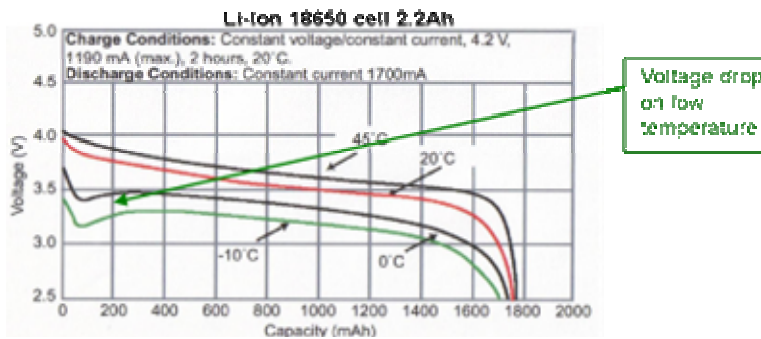
Some devices have volatile memory that continues to draw power after the device is turned off. Also, the addition of battery communication will draw a quiescent current, even in sleep mode. If this drain is large, the battery can be discharged by a few weeks of storage.



**How to avoid this mistake:** Calculate any drain on the battery that is not associated with running the application and take steps to minimize their effects.

### Discounting Battery Behavior

Battery voltage drops as current draw increases. Several applications have momentary high current drain on startup. If the device cut-off voltage is close to the nominal voltage of the battery, the system will shut down prematurely. The problem is exacerbated with low temperature.



**How to avoid this mistake:** Ensure that the nominal battery pack voltage contains enough headroom to accommodate for pulse currents and low temperature usage.

### Preventing the Most Common Mistakes in Designing Batteries:

How do skilled engineers avoid these common pitfalls? Follow these common sense tips:

#### Tip 1: Design in Early

Go beyond merely specifying the battery on paper. Early in your design process, select the battery cell, get a prototype and test to your application's parameters.

#### Tip 2: Consult with an Expert

Even the most experienced and talented engineers may not be familiar with all of the potential pitfalls designing in batteries. There is a myriad of information available and making sense of it all is difficult, especially when battery development is only a small part of your responsibilities. Consulting experts who are familiar with battery behavior and development is crucial to bring your product to market faster, and right the first time.

### About Rose Electronics

Rose Electronics is a leading supplier of batteries and power solutions for Original Equipment Manufacturers for the GPS mobile systems, medical device, industrial field service equipment and enterprise storage solution marketplaces. ISO 9001:2000 certified assembly, industry-first warranty and failure analysis service, award winning battery management and field replacement programs, and long-standing commitment to customer service. For more information on implementing batteries properly based on your application profile, contact [enr@rose-elec.com](mailto:enr@rose-elec.com).

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