Modern battery testing

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Autoinform's Frank Massey talks about current battery technology and testing. Not only has the battery's importance been elevated, its construction has also changed and therefore, testing and servicing batteries has become more technically challenging.

There is an element of complacency with testing and evaluating batteries. My college days remind me that it's a chemical cocktail storage device, converting chemical energy into electrical energy. Today, it's a fully integrated component within a network. Over the years, several testing options were available. They included:

- **Specific Gravity (SG)/Refractometer** - simple & accurate, but no longer possible with sealed battery cells
- **High Rate Discharg**e – simple, but not specific to a cross section of battery capacities
- **Timed Load Discharge** - not simple, but accurate and time consuming
- **Battery Capacitanc**e - accurate, quick, linear results compared with timed discharge

Let's begin with a simple overview of the different battery types.

Traction Battery - designed to supply a high current over a short time, its cell construction is thinner and enables rapid discharge rates. However, it must be maintained above 12.6v if capacity is to be maintained. A fully charged cell will have 2.1v and a SG 1280.

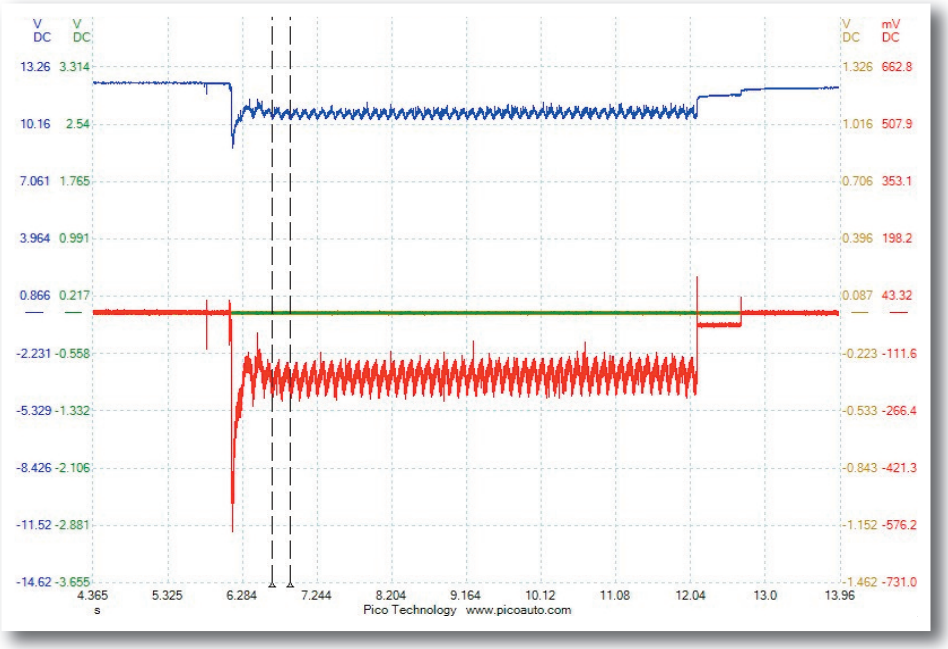
Leisure Battery - designed for environments where a steady current over extended time is required, i.e. caravans, boats. The cells are thicker, allowing a steady discharge down to 10% without cell capacity reduction. Often constructed with open cell design, allowing SG testing.

It has been necessary, due to increased demands on batteries, to move from a simple flooded cell design, to enhanced flooded battery (EFB). EFB batteries were introduced as part of Stop Start technology, where high demand, constant use and quick recovery is required. Additional internal polyester scrim was used between higher density plates. Leak resistance to 55deg.

Absorbent Glass Matt (AGM) - Cells are subject to 1 bar pressure, allowing for a higher level of storage capacity, as well as being able to resist distortion during high charge/discharge demands. They are able to cope with emission saving strategies. They have extremely low internal resistance with very high yield during Stop/Start, passive boost and recuperative braking. They are totally sealed, so they are leak free.

Lithium Ion (Li-ion) - starting to be fitted to top end vehicles (BMW M series), with 3v per cell. They are much lighter, offering a large advance in energy storage.

We introduced a policy of testing all vehicles coming through our workshop following a research project with Yuasa, where we found over 50% of batteries were either defective or were incorrect fitment. Remember that many faults found in networks relate to insufficient voltage or current.



Scope trace of a battery crank test showing battery voltage (blue) versus starter draw (red)

So, what about our test technique? PICO offer several options in their diagnostic platform. Nothing wrong there, they are accurate and easy to use. Midtronics also provide us with superb conductance testing technology. Once the correct data has been entered, the conductance test supplies a current of approx. 125 amps through the battery cells. It then applies an algorithm to ascertain the health, state of charge and end of life status.

My favourite method is a manual test using the PICO platform. First connect to the battery terminals, connect the current clamp to a total load circuit cable, while ensuring the polarity shows a negative current flow during cranking. Set a sweep time of 50 seconds, free run, nice high sample rate. You're ready to go! Disable engine starting for extended testing.

As you conduct the cranking test you will see a current draw of 800-1000amps for a very short time, during which time the available battery voltage will drop to 7.5-8.5v. The important observation should focus on recovery time to a stable & sustainable current & voltage.

Bring the vertical cursors in line with two compression peaks (4 strokes) = 1 cycle, then you can read the engine cranking speed. The picture above shows an example of a cranking test of a battery.

Another useful test is voltage drop across a component or circuit. Use two channels at extreme points of the component/circuit. Overlay the two channels and observe the voltage differential under load.