

INTERNAL RESISTANCE IN LiPo BATTERY PACKS January 24, 2012

All LiPo battery cells will decay over time due to their internal chemical reaction. The electrolyte will slowly eat away the positive plate as the electrolyte decays. The result is increased internal resistance or IR. At some point the battery could show a full charge is present but the internal resistance will not allow the battery to supply the needed current on demand. At this point the battery must be replaced.

Internal resistance can be described as plaque in arteries or build up in water pipes. It's a restrictive condition that does not allow a battery pack to achieve its maximum potential and deliver full power. As IR increases in a battery pack the operating temperatures will be noticeably higher than before when the pack was newer. This is a good indication that it's time to test the pack and see what the IR of the individual cells is.

The best condition to test a battery pack for IR is at a 50% State of Charge, or SoC, and a temperature of about 70F, an average day. Temperature and voltage will affect the test results so when testing a battery pack it is best to establish a consistent condition in which to perform the test like a laboratory would do.

When a battery pack is new take an initial reading of the battery pack to establish its base line IR. From this point on in the future the condition of the battery pack can be monitored and any trend can be watched closer to determine if there is a problem or predict a reasonable level of performance from the battery pack.

Allow to the battery pack to be at rest at ambient temperature before testing. Do not test immediately after discharging or charging.

The voltage range of a LiPo cell is 2.8-4.2V. At 2.8V and below a cell is considered damaged and at 4.2V a cell is considered fully charged. It is generally accepted to maintain a low voltage cut off of 3.0V per cell to be

on the safe side and protect the battery pack from damage. Therefore a 50% SoC will be 3.6V per cell.

The Internal Resistance Table below represents a State of Charge (SoC) of about 50% in a LiPo cell.

Ohm	Battery Voltage	Ranking
0.075-0.150mOhm	3.6V	Excellent
0.150-0.250mOhm	3.6V	Good
0.250-0.350mOhm	3.6V	Marginal
0.350-0.500mOhm	3.6V	Poor
Above 500mOhm	3.6V	Fail

Age, number of cycles, storage condition, operating temperatures and other factors all contribute the overall condition and performance of the LiPo battery pack. The more you know about your battery pack the more performance and service life the battery pack will provide you. Test your LiPo packs often and keep good records to ensure the best results possible.