



LITHIUM BATTERY -- SAFETY CONSIDERATIONS – V3

Not all, but some basic information for those with less experience.

In recent weeks, following the publication of 2017 Lithium Battery Lists and EB 2017 Rules, there have been concerns raised regarding the charge rate used when charging lithium batteries.

There is no short explanation to cover all that needs to be considered when dealing with Lithium Batteries, but the following may help. For those not familiar with the terms used -- A “battery” is the item that is fitted to the car. Each Lithium battery has a number of foil covered “cells”, that are connected together to give the voltage required. Hard-case batteries have the foil cells inside a hard plastic ‘box’, soft-case batteries have no plastic case to protect the foil cells.

1. There are many different chemistries used in Lithium cells. They have developed over the ten years we have been using them. The chemistry used in the batteries we use is probably the least stable, so care in all areas is needed.
2. The area's that require attention being :- maximum charge voltage, physical abuse, storage conditions (temperatures), minimum discharge voltage, validation of full testing to conform with UN requirements, maximum charge rate (amps).

Maximum Charge Voltage: This is possibly the most critical and each chemistry may have a different maximum (eg: LiFe should be no more than 3.70v per. cell, most LiPo no more than 4.20v per cell). We know that charging to a voltage that is too high will result in the battery becoming unstable, which can result in a fire. Each time a cell is charged to more than the manufacturers stated max. voltage, some damage occurs to the cell internals which reduces the life of the cell and the cell stability.

If a cell is charged to voltage significantly above the stated maximum, then it will probably only survive a few charges before it flames.

It is very important to check all batteries for voltage before they are used in a car, to achieve good control that racers are treating their batteries correctly. Any overcharging should be treated seriously.

Physical Abuse: If the foil cover of a cell is punctured, it will very likely flame. Therefore the use of ‘hard-case’ batteries is obviously safer as the plastic case will help to stop any damage to the foil enclosed cell(s). If a soft-case (foil only) battery falls out of the car when racing, then a fire on the track may not be too serious. But if a hex. driver or scalpel blade slips when working on the car in the pits, that could be very serious. Using hard-case batteries is the safer choice.

Storage Conditions: Most manufacturers give storage temperatures of -20C to +35C for Lithium batteries. On a hot day do consider what temperature the contents of your car boot may reach if left out in the sun. (NOTE: BRCA Electric Board rules do not allow the use of any additional devices to pre-heat Lithium batteries prior to or during charging).

Minimum Discharge Voltage: Lithium batteries will not withstand being discharged below a certain voltage. For most, this is 3.0v per. cell. Some equipment has an automatic ‘cut-off’ to prevent this happening, but not all systems. If the battery goes below the minimum voltage, it usually results in permanent damage to the battery.

UN Testing Validation: The requirement for having test certification to UN 38.3 was deemed necessary, by all the major RC racing bodies, when we started using Lithium batteries.

All the major battery manufacturers are familiar with this process.

This certification must be in place for any batteries that are transported by air and often for other modes of transportation.

All batteries approved by BRCA Electric Board (also EFRA & IFMAR) for use in the Electric Sections that use the Approved Lists, have been certified as having passed UN 38.3 tests.

Batteries that have not been approved by the Electric Board may not have been subjected to UN testing, therefore we have no knowledge of the likely safety of these batteries. It is suspected that many of the low-cost soft case smaller batteries have not been submitted for UN 38.3 testing.

BRCA Electric Board Approval: When batteries are checked for approval, we ensure that they comply with our BRCA rules for :- dimensions, hard case construction & sealing, labelling details, UN certification etc.

The maximum energy capacity of a battery allowed for air travel is 100 Wh. (Wh. = Amp.hr x Voltage). As our sport is International, with many competitors using air travel, the BRCA EB (and EFRA and IFMAR) will not approve any battery that is more than 100 Wh. energy capacity, as detailed by the manufacturer. All batteries approved (2012 onwards) must detail the Wh. energy capacity. Any battery that does not include this detail on the label could be refused at airport security.

Maximum Charge Rate (amps): This is the area that has caused concern recently in some Sections.

NOTE: The BRCA Electric Board did NOT PROPOSE ANY NEW RULES for 2017 that restrict charge rates. WE HAVE SIMPLY GIVEN GOOD ADVICE, using data that manufacturers have supplied.

- a) **EB Rule 3.11** -- Simply states that we will detail maximum RECOMMENDED charge rates (on the Homologation Lists) as advised by the manufacturers.
It is sound advice, not a distinct rule.
- b) The Battery homologation lists have for many years stated :- **“It is advisable to restrict charge rates to 1C”**. All manufacturers that we have approved state this, to prolong the lifespan of the battery. This year we have asked the manufacturers to give their RECOMMENDED maximum fast charge rate, so we can advise members accordingly, the wording at the top of the lists has been expanded to clarify this. This data is given on the Homologation Lists under the column heading of “Manufacturer Supplied Data”. This is sound advice and there is NO wording that states or suggests that the maximum charge rate depicted is a BRCA ruling.

Understanding charge rate: The ‘C’ refers to battery capacity in Amp. Hr. So 1C = 1 x capacity in Amp. hr. Labels usually give values in mAh. (1000 x Amp hr.). SO:- A 6000 mAh. Battery charged at 1C = 6 Amps.

NOTE: The RECOMMENDED maximum charge rate shown on the homologation lists are those given by the actual manufacturer of the cells in the battery, which may not be the name shown on the battery label.

Quite simply; all we have done is given some sound advice obtained from the manufacturers, that will hopefully be recognised by the competitors. No new rule has been introduced that has to be monitored.

We also have to consider; that if we state a maximum charge rate as a rule, then the BRCA are effectively condoning this charge rate. If a battery then ‘flames’ when being charged at a rate we have stated can be used, then a smart lawyer might attribute blame directly to the BRCA or the club official at the event in question.

Controlling charge rates is totally different to controlling voltages (which are more important). E.g. voltages can be checked easily when the car is presented to technical inspection at a larger event.

BRCA Insurance:

The BRCA public liability insurance covers claims for injury or damage to a third party, resulting from an incident when a member is, in most cases, driving a model car. Public Liability Insurance generally does not cover any damage or injury resulting from faulty or misused products, as this would need a claim being made against the ‘Product Liability’ cover of the product supplier.

One aspect of the homologation procedure is to ensure this later chain of liability is in place, thereby protecting the user, as all bona fide suppliers accept this under the Sales of Goods Act.

However If the product has been misused, then be aware the liability could rest with the user.

If a club or event official sees a user misusing any potentially hazardous product they should eject them from the event and the premises immediately.

The Association offers free advice on this, and any other aspect of our sport, simply click on ‘Contact’ on brca.org and ask away.

Club Officials

Your responsibility to your members means that you need to ensure your racers know what they need to do, once you’re happy that:-

- Everybody is using a LiPo sack.
- You have suitable precautions in place – i.e. your fire bucket of dry sand.

Then a simple printout of this document handed out should suffice for the more experienced racers and we would recommend a ‘buddy’ system for new competitors to ensure they understand what’s required. In addition ‘Health & Safety’ should be on the agenda of any club meeting and always discussed at your AGM.