MPBA-FES HEALTH AND SAFETY DOCUMENT AND POLICY

With regards to fast electric model boat racing and spectators.

Preface

The sport or hobby of fast electric model boat racing, whilst looking spectacular, has proven to be one of the safest of the modelling hobby pursuits in the UK and there have not been any recorded accidents or incidents since the formation of the MPBA Fast Electric Section. The MPBA Fast Electric Section, which was formed to promote and organise fast electric racing in the UK, is affiliated to the NAV1GA.

Members from MPBA Fast Electric Section have been competing in Europe and at the World Championships for a number of years.

THE MPBA BELIEVES THAT BY PRODUCING A SAFETY DOCUMENT IT WILL GIVE GUIDANCE TO OFFICIALS, RACERS, AND SPECTATORS.

Risk Assessment

Hazards

FALLING, TRIPPING, SLIPPING, DROWNING, AND BEING STRUCK BY AN OUT OF CONTROL BOAT, INJURY TO HANDS FROM PROPELLERS, FALLING FROM RESCUE BOAT, EYE INJURY FROM TRANSMITTER AERIAL'S, DANGERS FROM RE-CHARGEABLE BATTERIES.

Evaluations

1. Slipping, tripping, falling, the people most at risk are the officials and drivers at the waterside during the racing, spectators are also at risk.
2. Drowning, everyone at the waterside is at risk, especially non-swimmers and young
3. Being struck by an out of control boat, at risk will be spectators, drivers, officials within five meters of the water's edge, and wildlife such as waterfowl.
4. Risk of injury to hands from moving propellers, at risk will be assistants who start the
5. Boats in the water, drivers and assistants working on the boats in the pits, spectators after a boat has left the water.
6. Falling from the rescue boat, at risk are the officials who operate the boat.
7. Eye injuries from transmitter aerials, at risk are the officials, drivers and assistants in the start or rostrum area.
8. Risk of injury from re-chargeable batteries disintegrating or catching fire within a model boat or while the battery is being charged. At risk are the officials, drivers and assistants in the start or rostrum area also drivers and assistants in the pits.

Evaluating the Risk

The Officer Of The Day

The officer of the Day must look at the slipping, tripping, falling risk, and decide if he/she needs to erect a tape exclusion zone or safe spectators area where this risk manifests itself due to uneven surfaces, steep or wet banks, debris and rocks, where a fall would lead to the person going into the water, especially spectators. Evaluate the risk as HIGH, MEDIUM, LOW, and put the appropriate precautions in place, including highlighting the risk at the drivers meeting at the start, using the officials on the day to steward and advise spectators of this risk.

Drowning

The officer of the day must satisfy himself that he has assessed the conditions at the lakeside, i.e. depth of water at jetty or side, beach entrance, can you stand up if you fell in at edge of water. Is it suddenly shelving, is there a lifebelt and rope at hand, is it good condition, is everyone at the event aware of the dangers. Evaluate the risks as HIGH, MEDIUM, and LOW and put in place measures to inform and to protect, where possible perhaps a lifeguard may be needed.

Being Struck By an Out of Control Boat

The officer must evaluate the risk and put in place a catch netted area if spectators are nearby.

Evaluate the risk as HIGH, MEDIUM, and LOW and if needed put in place the necessary precautions and inform those at risk.

The Risk of Injury by Rotating Propeller

The Officer of the Day must check that all boats have a safety isolation loop fitted to avoid the risk of injury from rotating propellers. Drivers and officials must be made aware of the need to remove safety isolation loops whenever the boat is removed from the water. Evaluate the risk as HIGH, MEDIUM, and LOW this can be assessed by previous cases, as low risk, but the risk should be brought to everyone's attention.

Falling Out of the Rescue Boat

The officer of the day should ensure that the correct procedures are in place, for the use of the rescue, boat buoyancy jackets must be worn at all times in the boat. Evaluate the risk as HIGH, MEDIUM, LOW, this should include whether the officials in the boat are competent and trained.

Injuries to Eyes by Transmitter Aerials

The officer of the day should ensure that all transmitters, fitted with telescopic aerials, have a device to reduce the risk of eye injury, i.e. a practice golf ball, or foam ball, or some such device. Drivers wearing glasses reduce this risk. Evaluate the risk as HIGH, MEDIUM, and LOW.

Risk of Disease in the Water

The officer of the day should evaluate the risk as HIGH, MEDIUM, LOW, They should regularly remind officials, drivers, assistants, and spectators of the dangers of still, or stagnant water and point out the need for latex gloves and personal hygiene at all times. Based on experience, the risk to all the above has only been assessed as LOW or less, but this does not mean that the assessment does not need to be made at every event.

Risk of Injury from Re-Chargeable Batteries

The officer of the day should evaluate the risk as HIGH, MEDIUM, LOW. A separate evaluation should be made for each cell technology. The following technologies are currently in use: Nickel Metal

Hydride (Ni-MH) Lithium Polymer (LIPO or LiPoly) and Lithium Iron Polymer ($LiFePO_4$). New technologies must be subject to a full risk assessment before their use is permitted. Separate assessments must be made for operational use within a boat and charging in the pit area. The risk of injury while the battery is within a running boat is usually LOW while the boat is in the lake but the risk when a boat comes ashore must be evaluated. The officer of the day should ensure that batteries are charged in a suitable manor with precautions appropriate to the cell technology. The risks associated with charging conditions at each event must be evaluated.

ALWAYS ASSESS THE RISKS, BASE THAT ASSESSMENT ON NOW AND HOW IT HAS BEEN IN THE PAST. IS THE RISK MORE OR LESS THAN USUAL, ARE MORE PRECAUTI ONS NEEDED OR CAN THEY BE REDUCED,

DO YOU NEED TO SEEK A SECOND OPINION?

Method Statement

Because of the nature of the environment and the location of most of the events, careful consideration and assessment is required.

1. The course should be set out to give the largest safety margin to spectators and competitors, with the distance between the water's edge and the spectators to provide a safety zone. This should be obtained by erecting a designated line by the use of poles and marking tape. If needed signs should be erected to state: PLEASE DO NOT PASS IN FRONT OF THIS TAPE AS MODEL POWERBOATS CAN BE DANGEROUS AND MAY LEAVE THE WATER AT ANY TIME, OR MAY START WITHOUT WARNING!

2. An exclusion zone may be needed around the pits and drivers area, also the officials and Signage should be provided to state: ONLY COMPETITORS AND RACE OFFICIALS PAST THIS POINT PLEASE!

3. The officials will keep strict control over the radio frequencies.

4. All race boats will have a safety isolation loop fitted to break the electrical circuit between motor and battery to make the boat safe, a radio kill switch is NOT acceptable.

5. All racing classes will start in the water as "dead boats" in the water.

6. At all MPBA Fast Electric Section events, a powered rescue boat will be used, the conditions for its use lies with the officer of the day and health and safety guidelines.

7. The MPBA provides third party insurance to the MPBA Fast Electric Section and all MPBA members. All International competitors and other individual competitors racing at a MPBA Fast Electric Section competition must have their own third party insurance and proof of it before they will be allowed to race.
   Internationals competitors must have insurance through their own National body.

8. A first aid kit will be made available at every meeting, but unless administered by a person qualified in first aid designated by MPBA Fast Electric Section, the responsibility falls to the

9. ANY DECISION MADE BY THE OFFICER OF THE DAY ON ANY MATTER IS FINAL, WHETHER IT IS A HEALTH AND SAFETY OR OTHER MATTER.

10. Ensure that the area used for any event has minimal environmental damage and is left free of litter.

11. The model boats used by MPBA members may be electrically powered. The radio control systems used with model boats will also be electrically powered. The electrical power may be derived from:

    1. Primary Cells

    2. Secondary Cells otherwise known as rechargeable cells or

Re-Chargeable Batteries

MPBA members are expected to operate these cells in *a* safe and responsible manner. To assist the members in this objective the MPBA Fast Electric section has issued members with guidance on cell handling.

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1) Primary Cells

2) Secondary Cells (otherwise known as rechargeable cells or batteries).

Batteries may be any of the following:

Nickel Metal Hydride (Ni-MH) Batteries must be of the Sub-C size or smaller.

Lithium Polymer (LiPo) or Lithium Ion Polymer (Lifepo4)

Will include the **Polymer** series (with a nominal voltage of 3.7 volts) And the **Ion** series (with a nominal voltage of 3.3 volts). Lithium packs will be defined as: number of cells wired in series with an optional number of series packs wired in parallel.

Example

A 5S2P would have a total of ten Lithium cells wired as two packs of 5 cells wired in series and then those two packs connected in parallel.

A 5S1P would have a total of five Lithium cells wired in series with no paralleled. When paralleling packs 2P is the maximum allowed.

Classes will define allowable battery usage by cell count for NiMh and for the Lithium series of batteries. LiPo batteries will also be defined by battery weight. A ‘pack’ is defined as the cell(s) wired in series or parallel or any wiring combination that is used to provide electrical power to the speed control for the purpose of driving the electrical motor(s).

Contestants are cautioned to keep their wiring as simple as possible to make it easy for a contest director/technical inspector to confirm class conformance. Inspectors may require that batteries and or other components be removed from the model to make a ruling.

All batteries will be removable from the model by use of some type of connector arrangement. It is prohibited to “hard-wire” in the batteries. Hard wiring installations is where electrical connections are physically cut apart or de-soldered to allow removal of the battery. The battery/pack/cell is only recharged by the application of an electric current to the battery. Any method of recharging or partially recharging a battery/pack/cell by any other means is not allowed.

The pack must be made up of only one type of cell chemistry. In multiple speed control/motor installations the total pack voltage must be used as the supply input to each speed control.

Rules and Guidance for the Use of Lithium Based Cells/Batteries

Advancements in the design and manufacture of Lithium based cells has meant that the risk of cells catching fire has been almost eliminated. To reduce the risk of cells being damaged the following procedures should be followed:

1. Always use an intelligent charger which has settings for your type of cell.
2. Never combine cells/batteries from different manufacturers.
3. Always use a balancer when charging, either integrated into the charger or stand alone.
4. Do not charge at greater than the C rating recommended by the manufacturer.
5. Do not charge hot cells.
6. Do not charge batteries in the boat.
7. Do not discharge cells when the air temperature is too cold. Cells should be warmed first when the air temperature is around freezing.
8. Do not discharge at a level greater than the manufacturer's recommended C rating.
9. Do not discharge below a voltage of 3.0v per cell for Lipo cells.
10. Check cells/batteries regularly when they are being charged.
11. Always ensure that batteries are secured in the hull before running the boat.
12. Dispose of cells in the appropriate manner.
13. When carrying out maintenance on batteries ensure that the grey/silver sack is never damaged or altered, and ensure that the cell tags and connectors are fully insulated from one another.

The following changes are allowed across the board for all classes of competition whether it be for physical problems of getting cells into a boat or for class weight restrictions

1. Removal of the plastic covering to enable batteries to comply with the required weight limits or physical problems of getting cells into a boat is permitted.
2. Competitors are able to change the connectors if they wish.
3. The wires can be changed as long as they are capable of taking the expected current load.
4. Please make sure that all other terminals apart from the one you are working on are covered with an insulating material to avoid the possibility of a short circuit. On completion of alterations please ensure that all connectors are insulated and that all cell terminals are covered with polyimide tape or another suitable heatproof insulation material (fibre glass tape is also suitable) this will ensure that there will not be a short circuit from any wires including balance leads.
5. **NEVER ALTER THE GREY/SILVER PLASTIC CELL SACKS IN ANY WAY**

These measures should only be carried out by competent people. If in any doubt as to your own ability you should take advice from someone that has the required experience.

Sometimes balance leads break away from a cell tag due to fatigue. The cell connection therefore has to be repaired or the battery thrown away. The latter is not an economic solution so it will be necessary to take the above precautions to re-solder the wire.

The same safety measures also apply where individual cells are purchased and connected to make a battery, and also where a battery is purchased that has no leads attached.

General safety regulation valid for all Classes

All individual clubs are at liberty to devise their own classes

The following rules are valid for all Fast Electric classes:

1. All boats must be equipped with a so-called emergency circuit breaker. The emergency circuit breaker must be connected in such a way that in case of emergency, the competitor, start assistant, recovery boat or any another person can interrupt the power between motor and batteries.

2. All boats must be equipped with a kill switch for the Radio control equipment that is operated from the outside of the boat. If the receiver is supplied by a so-called BEC system, then the competitor has to prove this to the starting judge.

For Lipo batteries the voltage of a single cell cannot exceed 4,23v and for LiFePo not higher than 3,65vper cell.

Overcharging of batteries is not allowed. This is the case when at the voltage check a voltage is measured higher than the maximum voltage multiplied by the number of cells used. If this is the case, the competitor has over charged the cells, or used an inappropriate charge mode in order to obtain a higher voltage. The competitor is then disqualified. The competitor has to state the type and number of cells used to the people in charge of weighing and measuring batteries.

Pressing Lipo cells that have “ballooned” in any device to press them back into their original shape and size, whether it is before use, after charging or after a race in or outside of a boat **is strictly forbidden** out of a safety aspect. Batteries that have “ballooned” should not be used anymore for safety reasons.

Heating of batteries is allowed up to 40 degrees Celsius. Heating of batteries is only allowed in solid state heating cases.

On every Race Platform a first aid kit, a fire extinguisher, fire blanket and bucket of **dry** sand has to be present. It is up to the Platform Judge to verify the presence of these items. There is to be no racing until these items are accounted for.

Lithium Metal Fires

Lithium Metal fires must be tackled with a specialist lithium extinguisher, commonly sold as a L2 extinguisher. A sodium chloride extinguisher is not suitable for use on a lithium metal fire. Cells/batteries not containing Lithium as a pure metal do not require a L2 extinguisher.

Proper Operation of A123Systems High Power Lithium-Ion Cells

CAUTION

Do not short circuit. These cells are capable of very high currents.

DO NOT rotate the negative tap (cap) relative to the can; this can cause internal damage to the cell. Note that the can is the positive terminal and the cap is the negative terminal.

Specification

Cell type	ANR26650-M1
Nominal voltage	3.3 V
Nominal capacity	2.3 Ah
Nominal dimensions	Diameter 26 mm Ht. 66.5 mm
Nominal weight	70 g

Charging parameters: CC-CV (constant current – constant voltage)

Recommended charge current (0 – 60 degrees Celsius ambient temp.)	3 A
Recommended charge voltage	3.6 V
Recommended cut-off current for CV hold	0.05 A
Recommended float-charge current (-20/+60 degrees Celsius)	3.45V
Maximum continuous charge current(-20/+60 degrees Celsius ambient temp.)	10 A
Maximum recommended charge voltage	3.8 V
Maximum allowable charge voltage	4.2 V
Fast charge time:	15 min

Discharging parameters (-30 /+60 Degrees Celsius ambient temperature)

Recommended discharge cut-off voltage	2.0 V
Maximum continuous discharge current	60 A

Temperature parameters (skin temperature)

Maximum recommended cell temperature	70 Deg' C
Maximum allowable cell temperature	85 Deg' C
Allowable storage temperature range	-50/+60 Deg' C

Storage

For prolonged storage of the cells they should be charged to 50 % state of charge. Check the voltage every 6 months and charge if required.

Disposal and Recycling

For disposal your countries regulations apply. Do not incinerate.

Understanding “C” Ratings

All rechargeable batteries have a “C” rating – this tells you how intensively the Battery can be used to power a motor.

Batteries are rated by voltage and capacity; capacity is stated in mAh (milli amp hours). This is a measure of how much the battery holds. In an electric boat, one key determinant for the power train is the amount of amps that a Battery can deliver. The battery pictured is rated at 11.1 volts, 2200 mAh.

The “25C cont” means 25C continuous; the “40C burst” refers to how fast the Battery can be rapidly discharged for a SHORT time period, something like 15-30 seconds; look at this as the “supercharger” rating – to be used rarely. The second set of numbers – 55A cont/88 burst – is what this battery can deliver to the system considering its capacity – 2200 mAh.

The two ratings – mAh and “C”, combine to tell you how intensively this battery can be used with the following formula:

Continuous amp draw = (mAh * 0.001) * (C continuous rating) Continuous amp draw = (2200 * 0.001) * 25 = 55 Amps Continuous

Burst amp draw = (mAh * 0.001) * (C Burst rating) Burst amp draw = (2200 * 0.001) * 40 = 88 Amps Burst

This particular battery can deliver 55 amps to the system continuously; if needed and the system can take it, it can deliver a short burst of 88 Amps for 15-30 seconds.

Why Are The “C” Ratings Important? Good question – because if you over-discharge the Battery, it will get VERY hot and possibly catch fire.

Your boats motor is the key determinant for how many Amps you need for your Boat. Amp ratings are readily available for motors, so there should be no mystery as to what’s needed. As a safety factor, if the motor needs 25 Amps, using a Battery that can deliver 50 Amps places a nice safety factor into the system – you can’t force feed a motor more Amps than its rating unless you intentionally over-prop it – then you’ll either burn it out or if you exceed the Battery’s rating.

As with any high performance battery, due consideration should be given to the safe handling and charging of batteries. As a responsible user of high performance batteries you will adhere to any of the manufacture recommendations on charging and discharging.

MPBA members are expected to operate these cells in a safe and responsible manner.