INTERNATIONAL FEDERATION OF MODEL AUTOMOBILE RACING

IFMAR®

a.i.s.b.l.

IFMAR ELECTRIC RACING BATTERIES and MOTORS

1/12TH & 1/10TH ISTC, FWD , F1 and 1/10th OFF ROAD.

Version: March 2023 (replaces December 2021)

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IFMAR BATTERIES

1 APPROVAL PROCEDURE BATTERIES

IFMAR only approves Lithium based Batteries.

1.1 Lithium based (LiPo/LiFe) cells and batteries must be submitted for IFMAR Approval.

- The original manufacturer or their agents may request approval.
- Manufacturers must submit batteries direct to the section chairman, the name and address of which will be supplied, on request, by IFMAR.
- Manufacturers will be responsible to pre-pay all fees and taxes for the approval
- Items for approval must be send "All shipping costs paid"; *incoterms* ***DDP*** *(Delivered Duty Paid), including V.A.T. Declaration and import taxes.*
- The deadline date/window for submitting new batteries (cells) to be approved for the next World Championship is around eight (8) months prior to the date of the Opening Ceremony of the IFMAR event. *(Note: the period may be moved when required)*
- Previously approved batteries remain on the approved products list for their lifespan, or until IFMAR deem they are no longer applicable.

The applications for approval must be submitted to IFMAR together with:

- The appropriate approval form (available on request around 8 months before a WC)
- Three (3) samples of the product that will be used as a future comparing reference for the product to be approved.
- Proof of pre-payment of the approval and handling fees into the IFMAR accounts
- Written technical specifications including exact dimensions (mm) and weights (gr.) with reasonable industrial tolerances *(4%)* from the original cell or battery manufacturer for comparative verification. The specification must also include:
  - Maximum charging parameters (Amps, Voltage, C rating).
  - Case material, case thickness and case sealing process.

  Lithium based batteries must be covered by their accordant safety test certification in compliance with UN Manual of Test and Criteria ST/SG/AC.10/11/Rev.7, Part 3, Sub- Section 38.3, Tests T1 to T8 (or later versions). A suitable copy must be supplied with approval documentation.
- A list of telephone numbers, email-addresses and postal addresses of retail suppliers, shops in each continent from whom the cells can be purchased must be provided. One sample at random can be tested and 2 samples will be kept by the Section Chairman at the disposal for the appropriate IFMAR Electric Section representatives for at least until one month after the first event they were approved for. If the product meets the technical specifications it will be added to the updated approved product list which will be published two (2) months before the first concerned event, provided it passes eventual availability checks by the block representatives.

  -These random checks may be done until seventy (70) days before the start of the first concerned event. To this effect a provisional list of submitted products together with the provided addresses will be sent to the four blocs five (5) months before the event.

2. BATTERIES TECHNICAL SPECIFICATION

Lithium Based (LiPo/LiFe) Batteries:

2.1 Lithium Based (LiPo/LiFe) battery packs must have a hard, protective case that completely envelopes the cell(s).
The case should be made from ABS or a similar material.
The two halves of the case must be factory sealed in a way that any attempt to open the case will destroy the case.
The only opening in the case that is allowed is for the exit of wires or pin type connectors. The outline shape of the battery hard case must be 'cuboid' (six flat surfaces with all angles 90 deg.), edges and corners can be radiused and a 'step' or 'recesses' are allowed in the area of tube connectors in the interest of safety to prevent any short circuit.

2.2 2S Battery: - Maximum external case sizes, including any manufacturer incorporated plugs or connections are:

- Length: 139.0 mm.
- Width: 47.0 mm. (The max. width includes any side exit. wires).
- Height: 25.1 mm. (Chassis location features additional to this dimension are allowed)

- Saddle-Pack cells are allowed, but must comply with the above width and height. Furthermore they must not exceed a combined length of 139.0mm max. when placed end to end.

2.3 1S Battery: - Maximum external case sizes, including any manufacturer Incorporated plugs or connections are:

- Length: 93.0 mm.
- Width: 47.0 mm. (Side exit wires are allowed outside this dimension).
- Height: 18.5 mm. (Chassis location features additional to this dimension are allowed)

- 1S Saddle-pack cells are not allowed.

2.4 Individual cells used in the construction of the battery pack shall be rated at:
- LiPo a nominal voltage of no more than 3.8 Volts,
LiFe a nominal voltage of no more than 3.3 volts.
Individual cells may be wired in parallel.

For 2S packs: the maximum “In Series” is two, to give a pack voltage of maximum 7.6V nominal for Lipo packs, or maximum 6.6V nominal for LiFe packs.

For 1S packs: the maximum “In Series” is one to give a pack voltage of maximum 3.8V nominal for Lipo packs, or maximum 3.3V nominal for LiFe packs.

2.5 The maximum charging cut-off voltage remains at 4.20V. per cell**.**

2.6 The battery pack shall have leads extending from the case for the positive and negative electrical connections using wire of adequate size to handle discharge rates acceptable to racing applications. Alternatively, ‘Female connection tubes’ to connect the power wires are allowed but the metal tubes must be well enough below the surface of the moulded case so to avoid short circuit if the pack is placed on a conductive surface. Any type of connection adaptors that are conductive and protrude above the level of the plastic case must be removed before the battery is removed from the car. The connection points shall be clearly marked positive and negative.

2.7 The case must have the original suppliers label intact, clearly stating: the name of the manufacturer/importer, the part number of the pack, the rated nominal voltage, the chemistry (LiPo/LiFe),the pack capacity in Wh. and the C- rating of the pack.
Saddle pack batteries that are ‘hard wired’ together can state the nominal voltage of the combined pair of batteries, BUT individual saddle pack batteries (not hard wired together) MUST state the correct nominal voltage of the individual battery on the labels.
The Brand name/logo label shall be easily readable. Batteries might be tested to verify the integrity claimed on the label.

2.8 Weight of any battery is limited to +/- 4% on manufacturers’ specified weight.
Batteries to comply with the weights specified on the IFMAR approval list.

3. BATTERIES RACE PROCEDURE

3.1 IFMAR shall produce an Approved Product List which lists all the batteries/cells eligible for that year’s IFMAR W.C. events. his Approved Product List shall be distributed to all competitors in the race acknowledgement package prior to the WC event.

3.2 All batteries/cells must comply with the published data contained in the current IFMAR Approved Battery List.

3.3 Modification to the original battery case by removal of material or any modification that could be deemed to affect safety is not allowed.

3.4 All batteries must be submitted to Technical Inspection for checking and marking prior to being used during Controlled Practice, Qualifying and Finals. Batteries not compliant with dimensional rules or weights will not be accepted. This may be completed at any time during the event. Cells which do not bear the Organizers mark may not be used for Controlled Practice, Qualifying or Finals.

3.5 The Organizer and IFMAR Officials may check the legality of a competitor's batteries/cells at any time during the IFMAR event.

3.6 A weight scale will be available at all times during the event for competitors to carry out weight checks on batteries/cells.

3.7 Cells may not be charged or changed during the race.

3.8 1/10th. Off-Road cars will be driven by only 2S LiPo/LiFe batteries with a maximum nominal voltage of 7.6V (LiFe 6,6V)

- 1/10th. Touring Cars and F1 will be driven by only 2S LiPo/LiFe batteries with a maximum nominal voltage of 7.6V (LiFe 6,6V)
- 1/12th. Cars will be driven only by 1S LiPo/LiFe batteries with a maximum nominal voltage of 3.8V (LiFe 3.3V), with maximum battery size of:- 93.0mm x 47.0mm x 18.5mm.

3.9 All LiPo/LiFe packs must be charged with a LiPo/LiFe-capable charger using the industry standard CC/CV. (Constant Current/Constant Voltage) charge profile.

3.10 Any competitor found to be charging Lithium based cells using a charger that is not specifically designed for LiPo/LiFe cells or using a charge profile other than the industry standard CC/CV, will be disqualified from the event. No converted PC power supplies to feed chargers.

3.11 LiPo/LiFe drive batteries MUST be charged in a closed 'LiPo sack' at all times.
LiPo sack is defined as a receptacle designed for the purpose of charging LiPo/LiFe batteries and of a suitable construction as to contain a LiPo/LiFe fire.
---- Any competitor found to be contravening this ruling will be disqualified from the event.

3.12 **2S** LiPo/LiFe batteries may be charged to a maximum of 8.40v (LiPo) resp. 7.40v (LiFe).

1S LiPo/LiFe batteries may be charged to a maximum of 4.20v (LiPo) resp. 3.70v (LiFe)

3.13 Overcharging is a safety hazard and will not be tolerated. Any competitor found to have charged LiPo/LiFe batteries to above the voltages detailed may be disqualified from the event. *(Will be checked recurrently)*

3.14 The use of any additional heating of any type to heat a LiPo/LiFe Battery is not allowed.
The use of any cooling devices or "freeze" sprays of any type to cool a LiPo/LiFe battery is not allowed.

3.15 Additional battery packs :

1/12th. Cars are allowed to use an additional pack to power the receiver and/or servo.
1/10th. Off-Road Cars are allowed to use an additional pack to power the receiver and/or servo.
1/10th. Touring Cars are not allowed an additional pack to power the receiver and/or servo.

Other than any battery in the electronic timing device (transponder), the above are the only additional batteries that are allowed and under no circumstances are these allowed to supply any power to the drive motor.

End batteries

Motors: See next page

IFMAR MOTORS

4 APPROVAL PROCEDURE MOTORS

IFMAR only approve '05' size Brushless Motors. Only IFMAR approved motors may be used. Approved motors and optional rotors must meet the following specifications and be commercially available four (4) months prior to the IFMAR event. (Note: this period may be moved when required)
Availability requirements must be met at the time of submittal.
The deadline date/window for submitting new motors to be approved for the next World Championship is around four (4) months prior to the date of the Opening Ceremony of the World Championship.
Previously approved motors remain on the approved products list for their lifespan, or until IFMAR deem they are no longer applicable.

4.1 Manufacturers must also submit motors direct to a testing laboratory, the name and address of which will be supplied, on request, by the IFMAR Electric Section Chairman. This applies to Modified motors and any Spec. Class motors that will be allowed at any IFMAR event.

Manufacturers will be responsible to pre-pay all fees for examination. Upon receipt of laboratory confirmation to the IFMAR Electric Section Chairman that the product meets all specifications and the Chairman is satisfied that all IFMAR availability requirements have been met, the motor will be added on the approved products list for use at IFMAR. events. Be aware that shipping goods abroad may be subject to VAT.

4.2 An approved products list of Modified and Spec. motors and any optional parts or optional rotors approved for use at IFMAR events will be posted on the IFMAR website and Organizer's website (if available) 3 months prior to the event and the list shall be included in the race acknowledgement package made available the competitors no later than two (2) months prior to the event.

4.3 For Spec. Classes of motors:- Only **one** (1) Optional Rotor will be approved and allowed.

4.4 A minimum of two hundred (200) brushless motors must be available at the time of submittal. A minimum of three hundred (300) brushless motors must have been sold to at least three (3) distributors or hobby shops or OEM's on different continents at the time of approval.
The manufacturer has to provide addresses of hobby shops or the like, that any driver who wishes to obtain these motors at the time of the approval can do so.
IFMAR retains the right to check availability.

4.5 Despite the fact that and until further notice IFMAR does not approve SPEC motors. The motors must comply with the appropriate submitted specifications at all times and may not have failed by any active member. IFMAR will start listing as from 2023.

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5. BRUSHLESS MOTORS TECHNICAL SPECIFICATIONS.

Preamble: Modified and Spec brushless motors
Can/Casing design requirements to allow verification of stator sizes, design and construction rules have been updated many times to accommodate various manufacturer design changes:

- From 01.03.18 a minimum two pairs slots or holes (each exposing 3mm of stator ends minimum), in line with the center-line of the stator, that will allow measurement of the stator length. And slots or holes to allow visual appraisal of the laminates.
- From 01.03.21, any new motor submitted for homologation must have a minimum of one full length slot in the motor casing, parallel to the center-line of the stator, to allow all laminates to be viewed. The slot(s) must have length and width dimensions sufficient to allow stator length measurement using conventional measuring tools.
- Be aware that shipping motors from abroad to the European union is subject to V.A.T

Note: Older motors approved in past years retain their homologation status.

General definition of a brushless motor
1) For MODIFIED motors sensor or sensorless motors are allowed.

For “SPEC” class motors only sensored motors are allowed.

2) The motor has to be rebuildable, Ball bearings are allowed.

When the motor is sensored: It must use a six position JST ZH connector model number ZHR-6 or equivalent connector with 6 JST part number SZH-002T-P0.5 26-28 awg contacts or equivalent.

Wire sequence must be as follows:

Pin #1 - Black wire ground potential
Pin #2 - Orange wire phase C
Pin #3 - White wire phase B
Pin #4 - Green wire phase A
Pin #5 - Blue wire temp control, 10 k Thermistor referenced to ground potential
Pin #6 - Red wire + 5.0 volts d.c. +/- 10%.

Compatible speed control must use the 6 position JST header part number X-6B-ZR- SMX-TF (where the X denotes the style of the header), or equivalent. The power connector has to be clearly marked A, B, C.

A for phase A
B for phase B
C for phase C

6 `05` Size <u>MODIFIED</u> Brushless Motor Specifications and Dimensions:

6.1 **Can Assembly** (not including rotor shaft):

a) Overall maximum/minimum diameter is 36.02mm./34.00mm., measured at whatever point yields the maximum/minimum dimension, excluding solder tabs or lead wires.

b) Overall maximum/minimum length is 53.00mm/50.00mm., measured from the mounting face of the motor to the furthest most point of the end bell/plate, not including solder tabs, lead wires or original manufacturer’s logo or name.

c) Motor mounting holes must be on 25.00/25.40mm centers.

6.2 **Stator**:

a) Slot-less stators are not allowed. The Stator must be continuous laminations having the same overall shape/design.
The laminations have to be one after the other without anything in between.
The laminations must be of one homogeneous material without cut-outs, holes or hollow sections other than the three slots for the copper wires and three grooves for any screws used to hold the entire assembly together.

NOTE: Whilst all laminates in the stator must have the ‘same overall shape/design’, removal of sharp edges is allowed in the winding area on the end laminates (only) to offset damage to wire coatings.

<u>This is clarified as follows:-</u>

The top and bottom laminate in the stator stack of Brushless Motors covered by these rules may be deburred or chamfered only on the wire winding web/leg, so long as the overall thickness of these end laminates is the same as other laminates in the stator and so long as the overall measured width of the wire winding web/leg of these end laminates is the same as other laminates in the stator. This requirement effectively restricts any deburring or chamfering to only the top and bottom laminates in the stator.

b) Stator length minimum is 19.30mm, maximum is 21.00mm. measured across the metal surfaces of the laminates and not including any coatings.
The faces of the end laminates of the stator must be free of any coatings or mouldings for 1mm from the outer circumference to allow direct measurement across the metal faces of the stator ends (motor range submitted after 2017).
The outer circumference edges of the end laminates must be complete with no material removed, to allow accurate measurement.

c) The thickness of the Stator laminations is 0.35+/-0.05mm.

d) All laminations must be of the same material.

e) Inside diameter of Stator must accept ‘plug’ gauges of 12.5 mm minimum, 16.0 mm max.

6.3 **Winding**:

Delta and Y wound stators are permitted. Only circular (round) pure copper wire is permitted. There is no turn limit. Individual Classes may restrict the number of turns to a specific minimum.
No solid glue or ‘filler’ can be added to the wires of the final winding assembly.

When the stator has been 'cut' to gain access to the wires, unwinding of the wires must be possible by normal 'hand' procedures.
A small amount of lacquer added to the winding is allowed, providing unwinding by hand is possible.

6.4 **Rotor:**

a) Output shaft diameter must be 3.175mm (where pinion gear locates).
b) Only one piece, two pole Neodymium or Ferrite magnetic rotors are permitted.
c) Magnet minimum length 23.00mm, maximum 27.00mm (not including non-magnetic balancing parts).
d) Magnet minimum diameter 12.00mm, maximum 15.50mm.
e) The rotor will be identified with the manufacturers name or logo and the unique part number of the rotor.

From 01.03.21, the unique part number must be etched/stamped on the external flat area of the rotor shaft (where the pinion is located). This must be the listed part number for the rotor as shown on the homologation list (multi-digit numbers can be adjusted to show the significant numbers). Rotor sizes/dimensions are not acceptable.

6.5 All motors must have the original manufacturer's logo or name moulded or etched into the end bell/plate.
6.6 No hybrid (mixing of parts from approved brushless motors) allowed.
6.7 No modifications, design changes or removal of materials are allowed to any approved motor.
6.8 Only 'optional' rotors detailed on the IFMAR approved list are allowed.
6.9 Any changes or modifications will require the motor to be re-submitted for approval.
6.10 Obvious deceitful intents to gain advantage proved can lead to exclusions.

7. 05` Size SPEC. Brushless Motor Specifications and Dimensions:

7.1 Can Assembly (not including rotor shaft):

a) Overall maximum/minimum diameter is 36.02mm./34.00mm., measured at whatever point yields the maximum/minimum dimension, excluding solder tabs or lead wires.
b) Overall maximum/minimum length is 53.00mm/50.00mm., measured from the mounting face of the motor to the furthest most point of the end bell/plate, not including solder tabs, lead wires or original manufacturer's logo or name.
c) motor mounting holes must be on 25.00/25.40mm centers.

7.2 **Stator**:

Slot-less stators are not allowed. The Stator must be continuous laminations having the same overall shape/design.
The laminations have to be one after the other without anything in between.
The laminations must be of one homogeneous material without cut-outs, holes or hollow sections other than the three slots for the copper wires and three grooves for any screws used to hold the entire assembly together.

NOTE: Whilst all laminates in the stator must have the 'same overall shape/design', Removal of sharp edges is allowed in the winding area on the end laminates (only) to offset damage to wire coatings.

This is clarified as follows:-

The top and bottom laminate in the stator stack of Brushless Motors covered by these rules may be deburred or chamfered only on the wire winding web/leg, so long as the overall thickness of these end laminates is the same as other laminates in the stator and so long as the overall measured width of the wire winding web/leg of these end laminates is the same as other laminates in the stator. This requirement effectively restricts any deburring or chamfering to only the top and bottom laminates in the stator.

a) Stator length minimum is 19.30mm, maximum is 21.00mm. measured across the metal
b) surfaces of the laminates and not including any coatings. The faces of the end laminates of the stator must be free of any coatings or mouldings for 1mm from the outer circumference to allow direct measurement across the metal faces of the stator ends (motor range submitted from 01.01.18 onwards). The outer circumference edges of the end laminates must be complete with no material removed, to allow accurate measurement
c) The thickness of the Stator laminations is 0.35+/-0.05mm.
d) All laminations must be of the same material.
e) Inside diameter of Stack/Stator must accept a 'plug gauge' of 14.50 mm +0/-.005 diameter, clearing the stator, plus its windings and any electrical collection ring at any end of the stator.

7.3 **Winding**:

a) Only three slot (phase) “Y” (star) wound stators are permitted. No delta wound stators allowed.
b) Only circular (round) pure copper wire is permitted. The three poles of the stator must be wound with:-

13.5T Class:- 13.5 turns of -- 2 wires at: 0.724 mm. maximum wire dia.
and -- 2 wires at: 0.574 mm. maximum wire dia.
17.5T Class:- 17.5 turns of – 2 wires at: 0.813 mm. maximum wire dia.
21.5T Class:- 21.5 turns of -- 2 wires at: 0.724 mm. maximum wire dia.
25.5T Class:- 25.5 turns of -- 2 wires at: 0.643 mm maximum wire dia

Above dimensions are before lacquer coating.

The electrical circuit through the windings can only be from the ends of the wires forming the designated number of turns.
No solid glue or ‘filler’ can be added to the wires of the final winding assembly.
When the stator has been ‘cut’ to gain access to the wires, unwinding of the wires must be possible by normal ‘hand’ procedures.
A small amount of lacquer added to the winding is allowed, providing unwinding by hand is possible.

7.4 **Rotor**:

a) Output shaft diameter must be 3.175mm (where pinion gear locates).
b) Only one piece, two pole Neodymium or Ferrite magnetic rotors are permitted.
c) Magnet minimum length 24.00mm, maximum 26.00mm (not including non-magnetic balancing parts).
d) Magnet minimum diameter 12.20mm, maximum 12.51mm. The rotor shaft outside diameter where the magnet is mounted will be: 7.25mm +/- 0.15mm, with this diameter extending beyond the magnet to facilitate measurement.
e) The rotor will be identified with the manufacturers name or logo and the unique part number of the rotor.

From 01.03.21, the unique part number must be etched/stamped on the external flat area of the rotor shaft (where the pinion is located). This must be the listed part number for the rotor as shown on the homologation list (multi-digit numbers can be adjusted to show the significant numbers). Rotor sizes/dimensions are not acceptable

7.5 All motors must have the original manufacturer’s logo or name moulded or etched into the end bell/plate.
’Spec’ motors must have the ‘wind’ number etched/engraved onto the outer surface of the motor on a part of the motor that cannot easily be separated from the stator windings.
7.6 No hybrid (mixing of parts from approved brushless motors) allowed.
7.7 No modifications, design changes or removal of materials are allowed to any approved motor. Only ‘optional’ rotors detailed on the IFMAR approved list are allowed.
7.8 Any changes or modifications will require the motor to be re-submitted for approval.
7.9 Obvious deceitful intentions to gain advantage proved can lead to exclusion.

FINISH

Version: March 2023.
Deletes and voids all previous versions
Ex: General Online IFMAR meeting 2021.
Corrected, General Electronic Meeting of Dec 2022: By: ROAR, FAMAR, EFRA & FEMCA.

IFMAR Platinum members2023: