NMPRA Electric Formula One

Introduction

NMPRA Electric Formula One (EF1) is a racing event for radio control airplanes powered by electric motors. The event is intended to be easy to get into, available everywhere, reasonably priced and using off-the-shelf components to create the maximum amount of fun. While there is a great diversity in equipment available for electric models, these rules are designed to eliminate a technological advantage available to a limited few, and allow all participants to compete on an even level. The NMPRA intends to retain and maintain strict control of the rules and their interpretation, and will make necessary adjustments to these rules to eliminate any development, technological or otherwise, which upsets the level playing field the intent of these rules creates. Therefore, while the rules that follow provide a guideline for the event, all questions as to the interpretation and application of the rules will be determined at the sole discretion of the NMPRA. If, however, local clubs wish to modify these rules to suit local circumstances and interests, they are free to do so for their events, provided that advance notifications of the event outline the changes in their entirety.

AMA General Regulations

All competitors shall be members of the Academy of Model Aeronautics (AMA), Model Aeronautics Association of Canada (MAAC), or whatever appropriate governing body which applies to that competitor to ensure that they have and follow general safety guidelines of radio control airplane flying and competition, and are covered by those associations' insurance coverage. Although the event is not an official AMA event, the General Regulations as contained in the General Information section and the

sections of the R/C Racing rules entitled “1. General", "2. Defined Terms” and "3. Measurement Methods and Standards" of the AMA Competition Guidelines shall apply.

I Safety

A. General.

Consideration of safety for spectators, participants, and contest personnel is of the utmost importance. Hazardous flying over the racecourse or any flying over controlled spectator areas or pits during competition is a disqualification or black flag offense. Alcoholic beverages shall not be allowed in the pits or on the racecourse. Intentional hazardous flying, unsportsmanlike conduct, or consumption of alcohol or consciousness altering drugs during competition shall be cause for immediate disqualification from the contest.

B. Crowd control; protection of on-course personnel.

1) Every person going onto the racecourse or between the designated sideline and the racecourse (see racecourse diagram), and all officials, whether on or off the course, shall properly wear a helmet approved by OSHA, DOT, ANSI, SNELL, NOCSAE or other recognized organization that certifies safety equipment.

2) Pit and spectator areas shall be separated from the racecourse by a safe distance. Event organizers shall set up the racecourse to ensure that they prevent anybody from being in an unsafe area. Recommended safety distances are specified in the AMA Competition Rules, however, it is recommended that pit and spectator areas be at least 250 feet (75 meters) away from the race course.

3) A ready area should be established for pilots who are preparing to go onto the racecourse for their next heat. The ready area shall not be closer to the racecourse than the designated sideline. Only pilots, callers (one per pilot), starter, and assistant starter are to be permitted on the racecourse, in the locations indicated on the racecourse diagram, during the operation of any race.

4) Except for the starter and assistant starter, all judges, timers, lap counters, and other racecourse officials shall be located at least 225 feet (70 meters) from the nearest pylon or from the nearest line running between two pylons, as shown on the racecourse diagram, or as outlined in AMA Publication 540-b (http://www.modelaircraft.org/files/540-b.pdf) . In addition, all participants and racecourse workers shall be briefed on the safety aspects of their involvement in the event and instructed in the proper performance of their duties and the use of all safety equipment, communications systems, and timing devices.

C. Absolute authority of CD.

During a racing event, an unforeseen situation may arise that requires immediate controls. Therefore, the CD is authorized to initiate any special procedure he or she deems necessary to eliminate a situation that may be considered unsafe.

D. Authority of the Starter.

The starter acts for the CD in all matters arising on the racecourse. Unless overruled by the CD, the starter’s actions and decisions concerning the start, finish, and operation of each heat are final.

E. Airworthiness

1) Materials and workmanship shall be of satisfactory standards. The CD or the CD’s designee may refuse permission to fly or may disqualify any aircraft which, in his or her opinion, is not safe and airworthy in terms of materials, workmanship, radio installation, radio function, design details, or evidence of damage.

2) Any aircraft that has been damaged after a safety inspection or has a known history of problems shall not be permitted to fly until it has been satisfactorily repaired and re-inspected. Materials used for repair may come from any source. However, if a pilot chooses to completely replace a

damaged wing or fuselage, the replacement wing or fuselage may come only from that pilot's alternate aircraft. In other words, a pilot may not use more than two complete wings or two fuselages, or both, during one contest.

C. Preflight Inspection of Aircraft

During registration, all aircraft shall undergo a safety inspection to ensure that, at a minimum, the following requirements have been complied with:

1) Push/pull rods or cables, control horns, and servo leads shall be installed in such a way that they will not become disconnected in flight. Clevises shall be physically held closed by short pieces of fuel tubing or similar material. Metal clevises shall be protected from deterioration of the threads due to vibration by means of a jam nut, thread treatment such as Loctite® or Vibra-Tite®, or a similar method. Ball links shall be tight.

2) All screws holding the motor to the mount and the mount to the firewall shall be in place and secure.

3) Servos controlling the pitch and roll functions shall be of adequate strength for the weight and speed of the aircraft. It is recommended that servos have a minimum torque rating of 30 in/oz. (27 m/kg)

4) Control surfaces shall be firm on the hinge line without excessive play. Safety inspectors shall be alert to the danger of excessive play whenever electronic servo throw reduction is used in combination with a mechanically inefficient linkage.

5) All screws holding the servos to the servo rails or trays and holding any trays to the airframe shall be in place and secure. Rubber grommets shall be used on all servos designed to accept them. If the heads of the servo mounting screws are small enough to pull through the grommets, washers shall be used to prevent this. Alternatively, servos may be permanently installed with glue.

6) Servo trays, if used, shall be restrained by at least one safety screw (not turned down tight) that will prevent the tray from becoming completely dislodged if the primary mounting screws loosen in flight.

7) Pushrods shall have only one threaded end that is free to turn. The other end shall consist of a "Z" bend, an "L" bend with keeper or collar, a metal clevis that is soldered on, or a threaded ball-link that is glued or otherwise secured so that it cannot turn.

8) Wings, if removable, shall be securely attached to the fuselage with bolts or screws.

9) Wheels shall be securely attached and shall turn freely.

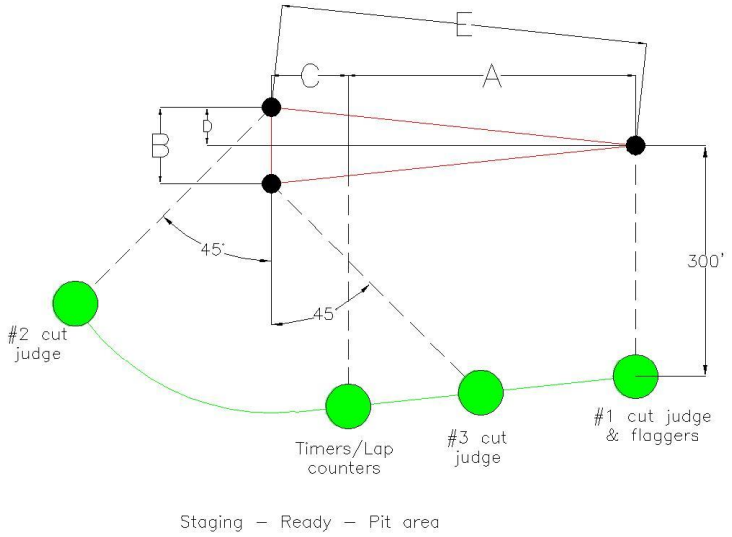
10) The aircraft shall be free of stress cracks and any other indications of structural damage.

11) There shall be a means of positive retention of the battery pack within the airplane to prevent it from shifting during flight.

12) Wires and connectors shall be of a sufficient capacity to accommodate the power system rating. All wires or connectors shall be fully insulated and protected. No open or unshielded wiring or connecters are permitted. Connectors shall be polarized and of sufficient size rating. Wiring for transmission of current to the motor shall be a minimum14AWG rating. ESC wire to the receiver's throttle channel shall be a minimum 22AWG rating.

13) ESC shall have a "safety start" feature that will not allow the motor to run until armed.

II Race Course



EVENT	A	B	C	D	E	10 LAP DISTANCE
Q500 Sport	375.5'	100'	100'	50'	–	2.0 mi
EF1	275.5'	100'	100'	50'	–	1.625 mi
F3D	–	40m	30m	20m	180m	4 km

A. General

1) Races may be held on a three-pylon long course "Q500 Sport", a three pylon short course (EF1) or a two-pylon course at the discretion of the event organizer. Race organizers should ensure that they identify which course will be used in advertisements and race promotion.

2) Pylon height shall be a maximum of 20 feet (6 meters) and a minimum of 10 feet (3 meters). Both pylons of a two-pylon course and pylons #2 and #3 of a three-pylon course shall be equal in height. There shall be no pilots " helpers" at any of the pylons or near any judges.

3) There shall be judges provided for each pylon to identify and report whether any competitor's airplane fails to go around or appropriately pass the pylon. Event organizers may wish to consult the AMA rules for guidelines as to number and placement of judges.

B. Three-Pylon Long Race Course

1) The three-pylon long course is identical to the AMA "Q500 Sport" pylon course used for 424 class racing and shall consist of an isosceles triangle with a base leg of 100' (30.5 meters) and two congruent legs meeting at a point 475.5' (145 meters) measured on a line perpendicular to the center of the base leg.

2) Pylon #1 is the pylon at the peak of the triangle; pylon #2 is at the left side of the base of the triangle and pylon #3 is at the right of the base of the triangle.

3) The starting line shall be a line parallel to the base leg between pylon #2 and pylon #3, and displaced 100' (30.5 meters) from the base leg.

4) Pilots and callers shall stand within the course triangle behind the starting line during the race and shall stay within the course triangle until all airplanes have landed.

C. Three-Pylon Short Race Course

1) The three-pylon short course shall consist of an isosceles triangle with a base leg of 100' (24.4 meters) and two congruent legs meeting at a point 375' (114.3 meters) measured on a line perpendicular to the center of the base leg.

2) Pylon #1 is the pylon at the peak of the triangle; pylon #2 is at the left side of the base of the triangle and pylon #3 is at the right of the base of the triangle.

3) The starting line shall be a line parallel to the base leg between pylon #2 and pylon #3, and displaced 100' (30.5 meters) from the base leg.

4) Pilots and callers shall stand within the triangle behind the starting line during the race and shall stay within the triangle until all airplanes have landed.

D. Two-Pylon Course

1) The two-pylon course shall consist of two pylons placed 400' (123 meters) apart.

2) Pylon #1 shall be at the right of the course and pylon #2 shall be at the left of the course.

3) Pilots and callers shall stand at the center of the two-poles displaced 225' (70 meters) on a perpendicular line from the line between the pylons.

4) The finish line shall be at the center of the two pylons along the perpendicular line from the line between the pylons.

5) The launch line shall be a diagonal line oriented at 45° to the racecourse centerline located at the finish line. The launch line shall be oriented to best address the wind direction at the time of the heat.

III Race Operation

A. A race shall consist of a minimum of four (4) rounds of race heats. Race heats shall be determined either by random assignment or preferably by using the NMPRA race matrix software available at www.NMPRA.org. Race heats may contain a maximum of 4 contestants.

B. Each heat race begins with the aircraft stationary at or behind the start/finish line for the three pylon courses, and at the launch line for the two pylon course, and ends when the aircraft cross the start/finish line after completing 10 laps (or 11 laps for an aircraft that has cut once). On a two pole course where the launch line is oriented to the right, the planes will be launched and will proceed directly to pylon #1 to begin the race. If the launch line is oriented to the left, the planes will be launched and proceed out and around pylon #2, which will result in a race that is actually 9 ½ laps (or 10 ½ laps for an aircraft that has cut once) long. Timers" clocks shall be started with the first drop of the starter's flag. No more than four aircraft per heat are allowed. All takeoffs shall be ROG. No mechanical device shall be used to assist in launching the aircraft. Laps shall be flown in a counterclockwise direction, with all turns to the left.

C. After verification by the starter that the airplane radios are on and working, Pilots have a maximum of 20 seconds to reach their flying positions. The starter shall check that all pilots are in position and ready to control their aircraft before giving the signal to launch. Each pilot shall confirm his/her "ready" status by a nod of the head or other agreed signal. However, the pilots are only entitled to a

confirmation before the starting period has elapsed. At the end of the 20-second ready period, there will be a countdown of 5 seconds to the first launch. Any pilot not ready in the sole discretion of the starter at the end of the 20 second period will be disqualified and receive a zero for the heat, and shall be ineligible to participate in a re-fly of that heat should one be declared.

D. Lane assignments will be assigned according to the heat matrix posted at the beginning of the race, and shall be numbered lanes 1 through 4. At the expiration of the 5-second countdown, airplanes will be flagged off in groups of two according to lane number. Lanes 1 and 3 shall launch together, and lanes 2 and 4 shall launch together. The starter shall use two distinct motions of the starting flag to signal both groups approximately one-half (1/2) to one (1) second apart. An electronic timing and launching system may be utilized if it provides substantially similar functionality. In rounds 1,3,5,7,9 and any subsequent rounds with an odd number designator, lanes 1 and 3 shall be flagged together first and lanes 2 and 4 shall be flagged together after the ½ to 1 second interval. In rounds 2,4,6,8,10 and in subsequent rounds with an even number designator, lanes 2 and 4 will be flagged first and 1 and 3 shall be flagged second.

E. To receive credit for a lap, the contestant must fly such that any part of the airplane must be outside of each pylon when it passes the pylons, and if a pylon is cut, that lap shall not be counted. In addition, a cut penalty shall be assessed for any flying over the designated sideline, pit, or spectator area or in "no-fly" zones clearly identified at a pre-race pilots' meeting. If a pilot receives a single cut, then that lap shall not count and the pilot must fly another (eleventh) lap to complete the heat. A pilot who cuts twice in the same heat shall receive a score of zero points and, if both cuts occur before the last lap, the starter shall give that pilot the black flag. Pilots whose callers push off before their launch signal shall receive a cut for that heat. A blatant early push is a black flag offense.

F. The race organizers may wish to provide judges at pylon #1 in a three pylon event or at pylons #1 and #2 in a two pylon event to signal the pilot and his caller that the aircraft has reached that pylon. This notification to the pilot is merely a courtesy to the contestant and the action of the judge with respect to providing this signal to the contestant shall have no bearing on the decision of that judge to determine whether the pilot has passed outside of or cut that pylon, however, judges shall be instructed to not issue a cut penalty on any turn for which the "turn" signal was given.

G. In the event of takeoff contact between aircraft or a midair collision during the heat, the starter is empowered to black-flag any pilot whose aircraft may be damaged or whose flying becomes erratic or dangerous. Likewise, should an aircraft become damaged during the course of the heat either through structural failure or contact with any object, the starter may at his sole discretion, black flag that pilot. This decision is entirely at the discretion of the starter and is not subject to protest.

H. The starter may interrupt a heat in progress at any point if he or she believes that an unsafe condition exists. Unsafe conditions include, but are not limited to, persons or vehicles approaching the racecourse; full-scale aircraft in the area; sudden wind, rain, or lightning; or an out-of-control model. A heat that is stopped due to unsafe conditions shall be reflown at the earliest convenience of the officials and contestants, preferably before the beginning of the next round.

I. Aircraft shall not fly lower than the tops of the pylons at any time except for takeoff and landing. A pilot flying below the top of a pylon more than once in any heat (for example, below the top of #2 twice, or once below the top of #2 and once below the top of #3) shall be warned once, during or after the heat in which the low flying occurs. Another such violation in any later heat shall be cause for a black flag. Determination of low flying shall be made by the starter and is not subject to protest.

J. In the event of a dead heat, where the finish order of a heat is disputed or scoring equipment failure occurs and a clear-cut decision cannot be made as to the outcome of the heat, the heat shall be declared void and rescheduled for another attempt ("re-fly"). The re-fly shall be held at the earliest convenience of the pilots and officials, preferably before, or at, the end of the round during which the void heat was originally scheduled. A pilot will be eligible to fly in the re-fly, if during the original heat, his airplane became airborne under its own power, unless the heat was declared void prior to any pilot in the heat

becoming airborne, in which case all pilots originally scheduled for the heat will automatically be eligible for the re-fly.

K. After each heat, points shall be awarded based on the order of finish. If the matrix is set up for four-plane heats, the result is four (4) points for first place, three (3) points for second place, two (2) points for third place, and one (1) point for last place. If the matrix is set up for three-plane heats, the winner receives three (3) points, second place two (2), and last place one (1) point. If the matrix is set up for two-plane heats, the winner receives two (2) points and the loser receives one (1). Zero points are awarded for a no-start (DNS), failure to complete the heat (DNF), double cut (XX), or black flag (DQ).

L. The winner of the event is the pilot who has accumulated the most points after the conclusion of all heats. If time permits, and there is no frequency conflict, ties shall be broken by a fly-off race. Otherwise, the best single race time shall be considered in determining final placing. If a prize is to be awarded for the best single race time of the event ("fast time trophy"), race times achieved during fly-off races shall be eligible for the fast time trophy.

M. Each pilot may enter up to two aircraft. If two are entered, both shall be inspected.

N. Any contestant may have another contestant's aircraft (including all electrical and power system components) inspected for compliance with the rules by posting a challenge fee of $25 cash with the CD. As soon thereafter as is practicable, the CD and at least one other person appointed by the CD shall inspect the challenged aircraft. If the aircraft is found to be legal, the challenge shall be dismissed and the owner of the challenged aircraft shall be given the $25. If the aircraft is found to be illegal, the owner shall be disqualified from the contest and the $25 shall be returned to the protester. At any time, the CD or the CD's designee may inspect an aircraft entered in the contest without requiring the posting of a challenge fee.

IV Aircraft Specifications

A. Replica rule.

Models entered in this event shall be of conventional layout and be recognizable replicas of full-scale, human-carrying, propeller-driven aircraft that either raced in or were built for the 190/200 cubic inch class of Formula I closed-course racing competition. Models of full-scale aircraft that do not meet the objective requirements of these rules (for example, a model of Wild Turkey whose wing thickness does not progress in a "straight line or convex taper" as required by paragraph C. 2) d., or a model of the mono-wheel version of Fast Lane Exit that does not meet the main wheel track requirement are prohibited.

1) Wing and tail outlines shall maintain the integrity of the outlines of the full-scale prototype aircraft, as shown by photographs or 3-views

2) The fuselage side view shall maintain the integrity of the outlines of the full-scale prototype aircraft, as shown by photographs or 3-views.

B. Prior approval of designs.

All designs, past and future inclusive, shall not be entered in competition until three (3) accurate views or photos of the model and the full-scale prototype aircraft have been submitted to the NMPRA EF1 Approval Committee and approved. The committee shall base their decisions regarding approval both on these rules and the guiding theme of the event, and may at their sole discretion deny approval for a submission which may meet all the criteria yet violates the spirit of the event. Such approval may be given orally, but shall be recorded for future reference. In the case of unusual or little known designs, the designer shall produce documentation to clarify that such a design did exist.

C. Airframe

Models must be primarily constructed of wood and covered with plastic film covering. Fuselages, wings and tails manufactured in molds designed to produce hollow core structures are prohibited. Painted molded fiberglass or vacuum-formed plastic parts may be used as nonstructural add-ons or "slip-overs" such as cowls, turtle decks, fillets, and canopies to create more complex shapes. Wings

and tails must be of built-up, all wood construction or wood sheeting over a solid foam core. Traditional fiberglass reinforcement, carbon fiber, inset wood or composite tubular spars continue to be acceptable. However, fiberglass or carbon reinforcement or covering (not including internal spars) may not extend beyond six (6) inches from the wing center section. The last two inches of each wingtip may be made of any material.

1) **Weight:** Minimum three and one quarter (3.25) pounds (1.48 kg).
2) **Wing:**
    a. **Area:** Minimum 375 square inches (24.2 sq dm). Wing area is the total projected wing area and includes that portion of the wing covered by, or within the fuselage and fairings.
    b. **Span:** Maximum 52 inches (projected) (132 cm). Removable wings are measured in their final configuration ready for flight.
    c. **Chord:** No limit, however, the wing taper, in addition to other distinctive design features, is subject to the design approval requirements stated above.
    d. **Airfoil thickness:** Minimum one-inch (25.4 mm) at the wing center section, and shall be measurable by the use of a "no-go" minimum thickness gauge at the closest point to the center of the wing as possible. In the case of non-removable or two-piece wings, the measurement shall be taken at the point closest to the fuselage that the measurement gauge can be utilized. Thickness shall progress uniformly in a straight line or convex taper from the point of maximum airfoil thickness measurement to within 2" (51 mm) of the wingtip and shall have a minimum airfoil thickness of .5" (12.7mm) within 2" (51 mm) of the tip. The outboard 2 inches (51 mm) of the wing may utilize an alternate, but uniform, thickness taper or contour.
    e. **Wing Trailing edge thickness:** The trailing edge of each wing panel must maintain a minimum of 1/16" thickness from the root to within 2" of the wing tip. This measurement will be taken at the point where the wing terminates at the trailing edge along its length.

3) **Fuselage:**
    a. **Depth:** Minimum six (6) inches (152 mm) at its deepest point. Depth does not include radiators or belly scoops (if any), but shall include the windshield, canopy, pilot's head, or headrest, but does not include tail surfaces, dorsal or sub fins, tailskids, or non-scale protuberances.
    b. **Width:** Minimum three (3) inches (76 mm) at its widest point. Width and depth points need not coincide. Width does not include fillets, cheek cowl fairings, or non-scale protuberances.
    c. **Cross-sectional shape and features:**
        (i) Profile representations of any significant feature of the full-scale prototype are prohibited. Cross-sectional contours at the height and width measurements and at stations determining the likeness to the full-scale prototype shall maintain the integrity of the contours in the full-scale prototype. The only exceptions permitted shall be in the motor and battery compartments for maintenance purposes and for cooling as specified in item (iii) below. Non- scale protuberances cannot be used to meet dimensions
        (ii) Cheek cowls, canopy if any, shall have at least a 5/8" (16 mm) radius at their widest point so that a hypothetical 1-1/4" (32 mm) diameter ball would fit inside, tangent to the outer surface. A cowl, canopy, or scoop with an oval or rectangular cross-section and corners of less than 5/8" radius (16 mm) satisfies this requirement if the hypothetical 1-1/4" (32mm) diameter ball would be fully enclosed. Cheek cowls shall represent the shape of the full size airplane at the front, middle, and rear, and shall be the same on both sides of the airplane unless the full-scale airplane had unequal cheek cowls. The plan view across both cowls shall be no less than 4.25" (108 mm). Any chin scoops will be represented as on the original. Canopies must have a minimum outside radius of 5/8" (16 mm) at the pilot's head area and a minimum of 1.75" (46 mm) at the un-filleted base of canopy. Canopy must represent shape of original version both front and back.

(iii) Cooling holes: Cooling holes and vents for the purposes of allowing cooling airflow to the motor, ESC and battery shall be allowed as long as they do not change the outlines of the aircraft.

4) **Tail Surfaces:** Tail surfaces shall be flat plate surfaces with a minimum thickness of 3/16th inch (5 mm), with rounded edges. Rounding of surface edges shall be limited to rounding to a radius equal to 1/2 the thickness of the surface and the rounding shall begin at a distance no further than the measure of the thickness of the surface from any edge of the surface. The horizontal stabilizer, including elevators, shall be a minimum of 70 square inches (4.5 sq dm).
5) **Landing gear:** The landing gear shall be fixed and shall resemble that of the full-scale aircraft as to location on the airframe and the number of wheels used. Main wheels shall be a minimum of 2.25" (67 mm) in diameter with a hub width and tire width of no less than .700" (18 mm) for at least 1.5" (38 mm) of the diameter, and shall be separated laterally by at least 7.5" (203 mm) as measured at the outside of the wheels. In-line wheels are prohibited. Wheel pants will be required if found on original and shall be no thinner than 1" (25 mm) at axle area. The Contest Director may waive the wheel pants requirement if local field conditions make the use of wheel pants inappropriate.
6) **Spinner:** Spinner diameter should represent that used on the full size airplane. Slightly smaller is acceptable, provided it is a minimum of 1.5" (38 mm).
7) **Control linkages:** Movable tail surfaces shall be connected to the servos using fully exposed, external control horns and pushrod connections. Ailerons may be driven through internal torque rods from a servo or servos located at the center section of the wing, but if aileron servos are mounted outboard of the center section, they shall be connected to the ailerons using fully exposed, external control horns and pushrod connections.

D. Power System

EF1 is intended to be enjoyed by the maximum number of potential participants. Therefore, all power system components, including motor, ESC, BEC, battery and connectors shall be off-the-shelf and readily available to the general public in reasonable quantities and at reasonable prices.

1) **Motor**
   - **a.** The motor shall be a direct-drive, 3-phase, brushless electric motor with magnets fastened to a rotating outer housing and a fixed armature, with wound copper wire, at the center, commonly known as an "outrunner" style motor. The motor shall be commercially available and in stock configuration as provided by the manufacturer and not modified in any way other than the addition or substitution of items identified in (d) below.
   - **b.** All motors shall be approved for use by the EF1 Committee prior to their being entered in competition. All motors eligible for approval shall be substantially similar in power and performance to the E-Flite Power 25 1250kV - 60A outrunner motor. Manufacturers wishing to have a motor approved for competition shall submit a minimum of three (3) production examples accompanied by a full set of technical specifications and drawings and a detailed distribution plan to the EF1 Approval Committee.
   - **c.** Currently Approved Motors:
     - **(i)** E-Flite Power 25 1250kV - 60A outrunner motor
     - **(ii)** Turnigy AerodriveXp 25 SK Series 35-42 1250Kv
   - **d.** The following items are not considered part of the motor and may be substituted as desired:
     - **(i)** Connectors for electronic speed control
     - **(ii)** Drive washer or collets
     - **(iii)** Mounting hardware
     - **(iv)** Propeller nut
     - **(v)** Propeller washer
     - **(vi)** Spinner (subject to **IV (c)(6)** above)
2) **Electronic Speed Controller (ESC**
   - **a.** A commercially available brushless Electronic Speed Controller with a minimum of 60 watt rating shall be utilized and controlled by a separate throttle channel.
   - **b.** Speed controller may incorporate a Battery Eliminator Circuit (BEC) which would eliminate the need for a separate battery to power the receiver and servos.

3) **Battery:** Battery shall be a commercially available Lithium Polymer (LiPo) battery.
    a. **Maximum Number of Battery Cells:** Motor battery shall have a maximum of 4 cells, and all cells shall be contained in shrink tubing.
    b. **Maximum Battery Weight:** Motor battery pack shall have a maximum weight of 325 grams including all connectors, wires and shrink tubing. It is recommended that batteries utilize a balancing tap to balance the individual cells as part of the charging process; however, batteries without a balancing connector are permitted and shall have a maximum weight of 315 grams.
    c. **Battery Retention:** There shall be a means of positive retention of the battery pack within the airplane to prevent it from shifting during flight.
4) **Wires and Connectors:** Wires and connectors shall be of a sufficient capacity to accommodate the power system rating. All wires or connectors shall be fully insulated and protected. No open or unshielded wiring or connecters are permitted. Connectors shall be polarized and of sufficient size rating. Wiring for transmission of current to the motor shall be a minimum 14AWG rating. ESC wire to the receiver's throttle channel shall be a minimum 22AWG rating.
5) **Propeller:** Propeller shall be the APC 8 x 8 Thin Electric Propeller, part number LP08080E. The propeller shall be used in stock configuration except that it may be balanced be by removing material from the face of the heavy blade. Any twisting, bending or tampering with the stock propeller is prohibited and will not be allowed during competition