GreenpowerUSA

F24 Rules and Technical Regulations

2019 - 2020

Overview

All vehicles entered for any Formula 24, or Formula 24+ event in the 2019-2020 school year, organized by GreenpowerUSA, will comply with the following Technical and Sporting Regulations.

Remember that the project is for the benefit of the young people involved. It is important to ensure that they are as involved in as much of the design and build of the vehicle as possible and that the technology used is relevant and accessible to the age group of the category in which you are participating.

Race Categories

F24 Stock

A car will compete in the F24 Stock division when it has been built using ONLY the materials given by GreenpowerUSA when the kit was delivered to your location. No modifications (such as, but not limited to, gearing, electrical components, etc.) are allowed. If you need replacement tires, you must order tires that match the specifications on the original tires exactly (20 x 1.75 wire bead 40 PSI maximum).

F24 Modified

A car will compete in the F24 Modified division if it has made any modifications to the GreenpowerUSA kit. This includes, but is not limited to, tire improvements, gear/sprocket changes, controllers, etc. If a team has “stitch-drilled” holes in the chassis to reduce weight, Greenpower race officials reserve the right to deem the car unsafe from taking part in an event.

F24 Custom

A car will compete in the F24 Custom division if it has made modifications to the geometry of the GreenpowerUSA kit or has done a scratch-build car. If you are unsure that your team is in this division, reach out to GreenpowerUSA for further information.
T1 - Motor

T1.1 The vehicle will only be powered by one 24-volt DC electric motor supplied by Greenpower. No hybrid systems are allowed.

T1.2 The motor is sealed and must not be opened or modified.

T1.3 Motor cooling is only permissible using passive or forced air, without any prior energy input or power from batteries other than the main vehicle batteries. Heat sinks are approved forms of motor cooling.

T1.4 The motor must be easily accessible for inspection. Greenpower reserves the right to remove motors either for inspection by the manufacturer or by race officials (pre/post race).

T2 - Batteries

T2.1 Two 12-volt GreenpowerUSA approved unmodified batteries (Interstate Battery Model # DCM0035 and YUASA REC36), referred to as the ‘main batteries’, will be used on each vehicle during each GreenpowerUSA race.

Only one set of two main batteries will be used in a race. If a battery change is needed, you must inform the Race Director immediately and your car will be put in “exhibition” mode - which would make all race session data null and void. Your team would be removed from contention of receiving an award. Fastest lap must be applied to the heat with the most laps.

T2.2 Auxiliary batteries for powering devices on the car must not exceed one PP3 or six AA cells per car. Coin or button cells are permitted as a power source for brake lights but also to allow control systems to retain settings whilst main batteries are changed. Proprietary unmodified electronics with self-contained batteries, e.g. speedometers, watches, radios are permitted so long as they’re not connected to any of the car
control systems. All other devices including motor controllers must be powered off the main batteries. If in doubt consult Greenpower.

T2.3 Out of the car, the main batteries must be kept separate and lifted independently of one another.

**Safety Note** - Due to their weight, appropriate safe manual handling practices should be observed when handling batteries. Batteries that are dropped may cause injury or suffer internal damage.

T2.4 Outside of the race vehicle, charging of the batteries is only allowed up to a designated time at the event. There will be a designated cutoff time at which all batteries must be removed from their chargers. This information will be provided via Supplemental Regulations provided by the Race Organizer.

A battery quarantine/charging area will be identified at all race sites to ensure safety.

T2.5 The main batteries must be firmly secured to the chassis of the vehicle using rigid fixings – i.e. no webbing or elastic straps, and must not be able to move in any direction in those fixings. Plastic threads on fixings are not permitted. Over center clips must be security pinned.

T2.6 The main batteries may be mounted upright or on any side but must not be inverted, i.e. terminals must not point towards the ground.

T2.7 The main batteries must be separated from the driver by a bulkhead, sufficient to restrain the batteries from the driving compartment. This bulkhead must not be able to short circuit the battery terminals. Batteries must be located inside the vehicle’s bodywork.

T2.8 Batteries must have quick release connections to enable rapid disconnection in the event of an emergency. They must not be liable to disconnect or short against metal parts. Quick release connectors must be accessible and operable without the need for tools.

T2.9 The main batteries in vehicles at the start of practice sessions or races will not exceed 77°F or ambient temperature plus 9 Fahrenheit when ambient is above 68°F as measured by Greenpower.
T3 - Wheels and Track

T3.1 Tires must not be less than 12 in. (300 mm) nor greater than 20 in. (520 mm) in diameter.

T3.2 There must be four wheels located as a matching front and matching rear pairs, symmetrically about the longitudinal centerline of the vehicle.

T3.3 The track of the vehicle must not be less than 19.685 inches (500 mm) front or rear. The track is deemed as the measured width between centers of tires where they contact the ground. The track may vary front to rear.

T3.4 Tires must be pneumatic.

T3.5 Plastic spoked wheels are not permitted.

T4 - Center of Gravity

T4.1 The base of the main batteries must be at or below 3.9 in. (99 mm) from ground level. A 0.25 in (6 mm) diameter hole should be drilled through any solid floors adjacent to the batteries to allow height measurement. See Figure 1

T4.2 The driver’s seat, including any padding, must be at or below 3.9 in (99 mm) from ground level. A 0.25 in (6 mm) hole should be drilled through the base of the seat to allow height measurement. See Figure 1
T5 - Dimensions

T5.1 The vehicle must not exceed 110 in. (2800 mm) in length, 47 in. (1200 mm) in width, and 47 in. (1200 mm) in height.

T5.2 Ground clearance must not be less than 1.18 in. (30 mm).

T5.3 No part of the vehicle may extend more than 31.5 in. (800 mm) behind the center point of the rear wheels.

T6 - Driver and Seating

T6.1 The vehicle will have one seat for the driver firmly fixed to the vehicle chassis.

T6.2 The driver must be seated in a feet-forward, reclined position. Drivers may not kneel, sit astride a seat, or lie down in any way such that their chests and head are forward of their waist.
The driver must be able to demonstrate a rapid and safe exit from the vehicle unaided.

There must be a solid floor under the whole of the driver, to prevent ingress of debris.

A padded headrest behind the driver's helmet must be attached to the vehicle for the absorption of force in the event of an impact to prevent whiplash.

Advance Notice - 2020-2021 Regulations - T6.5 will read “There must be a rigid, padded, headrest behind the driver’s helmet to prevent whiplash.”

All parts of the vehicle’s seat which are in contact with the driver must have some form of protective padding.

There will be a solid, rigidly mounted bulkhead forward of the driver's feet. Securely attached to the front of this bulkhead will be a foam structure at least 7.87 in. (200 mm) long and with a compressive strength of 300 – 700 kPa. A means of access to this foam must be available at scrutineering.

Advance Notice - 2020-2021 Regulations - T7.1 will be amended to read: There will be a solid bulkhead rigidly mounted forward of the driver’s feet forming the front-most part of the driver’s cell. This bulkhead must be vertical and parallel to the front axle center-line. Securely attached to the front of this bulkhead will be a foam structure at least 7.87 in. (200 mm) long and with a compressive strength of 300 – 700 kPa. A means of access to this foam must be available at scrutineering.

Note: A Scrutineer has the right to touch or push on the nose cone to assist in proving the ability to be deformed by impact. Construction of the nose cone must meet compliance of T8.1.

There will be a rigid driver's cell extending from the bulkhead in T7.1 to the driver's back. Between the harness lap strap mounting points and the driver's back, it will extend to a height of 10 in. (250 mm) above the seat base or above the driver's elbows, whichever is greater. The driver's cell height, forwards of the lap strap mounting points, may be less than 10 in. (250 mm) but must exceed the highest part of the driver in this area.
T7.3 The skin of the driver's cell in T7.2 must be constructed of rigid sheet material such as aluminum; rigid plastics; carbon fiber; glass reinforced plastic or other composites of at least 0.06 in. (1.5 mm) thickness. Plywood products must be at least 0.12 in. (3 mm) thick. The skin must form a continuous protective layer and be securely attached directly to the driver's cell so as to be unlikely to fail as a result of an impact.

Note: Corrugated plastic will also be observed as a suitable body material as long as it is bonded with a 1in. (25 mm) thick closed-cell foam backing.

T7.4 The driver's cell opening will accommodate a rectangle of at least 23.5 in x 14 in (600 x 350 mm) with no intrusions.

T7.5 The driver's helmet must be positioned at the rearmost point of the opening in T7.4 to create a clear space in front of the helmet.

T7.6 Inner faces of the driver's cell sides will be lined with a minimum of 1 in. (25 mm) thick closed cell foam from the floor to the driver's cell opening to protect a substantial part of the driver's body.

T7.7 Any sharp edges or protrusions in the driver's cell must be padded.

T7.8 There will be a bulkhead separating the driver from any accidental contact with the wheels.

T8 - Bodywork

T8.1 Anything forward of the bulkhead in T7.1 must be easily deformable.

T8.2 Bodywork to the front or sides of the driver's helmet will be lower than the bottom of the driver's helmet visor aperture.

T8.3 No bodywork will be higher than 6 in. (150 mm) below the top of the rear roll hoop.

T9 - Brakes

T9.1 Brakes will be subject to a force test of 300 N applied horizontally forwards from the top of the roll bar with the car situated on a flat tarmac/concrete surface. There must
be no movement of the car. All drivers must be capable of producing this braking force. This will be subject to spot checks outside of scrutineering.

T9.2 A minimum of two independent brake systems must be fitted, such that there is still some braking if one system were to fail. These systems may be operated by a single dual system lever.

T9.3 Both wheels on either front or rear axles must have the same type of brake such that the car brakes in a straight line. This is in addition to any electrical braking system that might be incorporated.

T9.4 The driver must be able to operate the brakes without removing either hand from the steering mechanism.

T9.5 Braking systems must be operated by hand only. Foot operated brakes are prohibited.

T10 - Roll Bars

T10.1 The vehicle must have front and rear roll bars offering protection in accordance with the diagrams shown here – the helmeted head of all drivers must be at least 2 in. (50 mm) below the line A-B as shown. See Figure 2.

T10.2 Roll bars must be firmly secured to the chassis of the vehicle using mechanical fixings or welding. Roll bar to chassis mountings and points on the chassis to which roll bars connect must be suitably strong and where necessary reinforced to prevent failure in the event of a roll over incident. Gluing/bonding of roll bars to chassis with no mechanical fixings or welding is not permitted.

T10.3 One central triangulated brace or two side triangulated braces must connect the rear roll bar to the chassis. These braces must attach to the chassis of the vehicle at one end, to not more than 8 in. (200 mm) from the top of the roll bar at the other, must be capable of taking loading in all directions and must be rigidly mounted.

Advance Notice - 2020-2021 Regulations - T10.3 will be extended to include: The angle between roll bar and brace(s) must be at least 25 degrees.
T10.4 All rear roll bars & braces must be produced from circular section steel/aluminum, which meets a minimum outside circumference of, main hoop - 3.1 in. (78.74 mm), braces - 2.35 in. (59.69 mm) and minimum wall thickness of 0.06 in. (1.5 mm).

Advance Notice - 2020-2021 Regulations - All rear roll bars & braces must be produced from circular section steel, with minimum outside circumference of, main hoop - 3.1 in. (78.74 mm), braces - 2.35 in. (59.69 mm) and minimum wall thickness of 0.06 in. (1.5 mm).

Safety Note - Greenpower reserves the right to drill a 4 mm diameter hole in any roll bar for the purpose of inspection. Teams should avoid drilling roll bars as it weakens the structure.

T10.5 Non-structural bodywork along with front and rear wheels must not be regarded as part of the roll protection. The top 6 in. (150 mm) of the roll bar must not have any fairing or other aerodynamic aid. See Figure 2.

T10.6 The rear roll bar and bracing structure must extend down into the car to at least the level of the driver’s shoulder strap mounting points.
T11 - Safety Equipment

T11.1 Two rear view mirrors, each with a minimum area of 3.5 sq in. (2250 sq. mm) will be fitted and able to be adjusted by the driver while the driver is buckled in. Camera systems to replace rear view mirrors are not permitted.

Advance Note 2020-2021: Minimum area will be increased to 6 sq in.

T11.2 The vehicle must have a clearly audible single-tone horn.
A 24 volt, minimum 100 amp, rated isolation switch must be fitted. It must be clearly visible and be easily accessible to the driver, and from outside the vehicle. Two switches may be fitted if needed. Two switches may be fitted if needed. On/Off positions must be clearly marked. Indirect operation of the isolator is not permitted.

The vehicle must be fitted with a minimum four fixing points, 2 in. (50 mm) width safety harness, with secure fixing points on the roll bar or chassis. Harness shoulder strap fixing points should be close to shoulder height and neck width (approx. 6 in (150 mm)). Lap straps must be able to be fully tightened before shoulder straps and must fully tighten around the driver’s lap without additional padding in front of the driver.

Where the seat back has an angle of 45 degrees or more a minimum 4 point harness is required. See Figure 3.1

Where the seat back has an angle of 30 degrees or more combined with a front lip of 15 degrees or more a minimum 4 point harness is required. See Figure 3.2

Where the seat back has an angle of less than 45 degrees with a front lip of less than 15 degrees a minimum 5 point harness is required. See Figure 3.3.

If in doubt, use a 5 point harness.

A non-flashing, red brake light will be fitted so it is clearly visible from the rear of the vehicle.

The drive train must be guarded to prevent fingers, hair, and clothing from becoming trapped at any time.

The use of locking nuts on safety critical components is mandatory, including but not limited to: safety harnesses, roll bars, wheels, steering and braking systems.

Safety Note - If in doubt, use locking nuts.
12 - Steering

T12.1 Steering systems must have minimal play.

T12.2 Steering must be able to operate smoothly from lock to lock, without wheels making contact with bodywork.

T12.3 Steering must be by mechanical linkages only.

T12.4 Steering must be by front wheels only.

T12.5 Steering must be operable by hand only.

13 - Electrical / Electrics

T13.1 The accelerator must be spring loaded to the OFF position.
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T13.2  Electronic motor controllers must not be capable of boosting battery voltage, i.e. at any time, the voltage across the motor terminals may not exceed the voltage across the battery terminals.

T13.3  A fused link/cut-out must be in place in the main power circuit, rated at 70 amps or less.

T13.4  All wires and terminals on the vehicle must be neatly run, secured and unable to chafe, away from moving parts.

T13.5  All wiring and electrical components must be correctly rated for their use.

T13.6  Low current ancillary circuits must have their own fuse (normally 5A or less).

14 - Other

T14.1  Transmission of any form of electronic data to the car by whatever means is prohibited. Communication with the car/driver is only allowed via verbal (e.g. radio) or visual (pit board) means.

T14.2  Telemetry and all communication systems must operate at national legal frequencies and power levels.

T14.3  Driver to pit audio communication systems must be hands free. Any item, other than primary vehicle controls, in the driver’s cell must be adequately and securely restrained. No items shall be attached to the safety harness.

T14.4  Three racing numbers must be clearly visible on the left, right, and front of the vehicle. The side displayed numbers must be spaced equally between the wheels. Teams will register/request their car number prior to the start of every race season. These numbers should contain no more than three numerals.

*GreenpowerUSA will provide the race numbers at your first sanctioned Greenpower event of the race season. The race number will be a circular 10 in (250 mm) sticker with black numbering over a white background. Replacement stickers will come at a cost.*

T14.5  Provision must be made for the positioning of a timekeeping transponder, which will be provided at events complete with a mounting bracket. This must be mounted vertically...
on either side of the vehicle, on the outside of the bodywork. It must be located between the front axle and the race number, at axle height, and have clear line of sight to the ground. No fairings are permitted. See Figure 4.

T14.6 Cameras must not be attached to the crash helmet. Cameras must be attached to the car with secure mechanical fixing. Suction mounted cameras are not permitted.

T14.7 Greenpower will supply national partner stickers which must be applied to the vehicle in a prominent position.

T14.8 Cars may only be propelled by the drive system located on board, and drivers may not use any part of their body to propel the car. Drivers cannot put their arms/hands outside of the driver compartment to assist the car in a forward movement.

Figure 4

CAR NUMBER ON BOTH SIDES & FRONT (T14.4)

TRANSPOUNDER MOUNTED AT FRONT AXLE HEIGHT BETWEEN FRONT AXLE AND SIDE NUMBER (T14.5)
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Sporting Regulations

S1 - Team Clothing

S1.1 Drivers must wear helmets with visor or goggles at all times during practice and competition. It is the responsibility of the driver and team manager to ensure helmets fit properly and are in serviceable condition. In use helmets must be securely fastened. Helmets must have the DOT Approved/Certified sticker visible upon inspection.

**Advance Notice - 2020-2021 Regulations** - A list of approved helmet types will be listed for reference.

S1.2 Drivers must be outfitted with suitable clothing covering them from head to toe. Full length sleeves and pants are required for all drivers.

S1.3 Full fingered gloves must be worn by the driver.

S1.4 All team members must wear stout closed toe footwear, ideally with toe protection.

S2 - Logbooks

GreenpowerUSA will maintain an electronic Logbook entry for all cars. This will include scrutineering comments that must be actioned before future events, otherwise the vehicle will not be allowed to participate.

S3 - Team Members Regulation

S3.1 At the start of the race season, drivers must be enrolled in:
    - Grades 6-8 to compete in F24 Intermediate Stock, F24 Intermediate Modified and F24 Intermediate Custom
    - Grades 9-12 to compete in F24 Advanced Stock, F24 Advanced Modified and F24 Advanced Custom

To compete in F24+, drivers must be between the ages of 18-25.
S3.2 (F24) - Drivers are not permitted to drive at the International Final without completing one regional event beforehand.

S3.3 (F24) - A minimum of two driver changes must take place in the 90-minute race. Drivers may only operate one car per classification in a race session for a minimum of 15 minutes in each race.

S3.4 (F24+) - There is no limit to the number of drivers that may be used during a 60 minute race.

S3.5 All team members must be fully conversant with the Supplementary Regulations for each event, must be knowledgeable about their vehicle, and must attend the Team Briefing at events.

S3.5 It is the responsibility of the team manager to ensure all drivers are able to drive safely with adequate all around visibility.

S3.6 (F24) - Adults must not participate in pit stops unless by specific arrangement beforehand with Greenpower.

S4 - Formula 24 and Formula 24+ Championship Regulations

S4.1 Teams must compete in a sanctioned GreenpowerUSA points race in order to receive national championship points. Competing in a sanctioned event means your car must physically be on site to race in that event.

S4.2 A GreenpowerUSA sanctioned event has a total of 220 possible points: 100 possible points (Presentation Score), 100 possible points (Race Placement), 10 possible points (Fastest Lap Bonus) and 10 possible points (Lap Completion Bonus).

S4.3 Cars must be able to start under their own power. Push starts for vehicles are not permitted at the start of the race.

Terms of Entry

By entering for any GreenpowerUSA Foundation organized event in any category, the team are agreeing to the following Terms of Entry.
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1. Published regulations may be subject to change. In the event of this happening, notification will be sent to all entered teams and posted on the Greenpower website.

2. All team members must sign on at Race Administration prior to entering the controlled race area.

3. All vehicles will be subject to pre-event and possible post-event scrutineering to ensure compliance.

4. The vehicle, tallest and shortest drivers must be presented at scrutineering in a race ready configuration.

5. Supplementary Regulations specific to each event will be published approximately two weeks beforehand and sent by email to all entrants for that event.

6. Greenpower’s scrutineers and officials accept no responsibility for damage caused to cars while performing safety checks, recovery or rescue during an event.

7. While these regulations, the scrutineers and other officials endeavour to ensure vehicles are safe to participate, ultimate responsibility lies with the entrant.

8. While compliance with the Technical and Sporting Regulations should result in a compliant vehicle, race officials reserve the right to prevent a vehicle racing. A vehicle deemed unfit may, following modification and further inspection be permitted to race.

9. It is understood that all persons participating in events under these rules are doing so at their own risk and the entrant will ensure that all competitors under the age of 18 will have disclaimers (as provided by the Race Organizer) signed by their parents or guardians prior to competing.

10. Greenpower ensures that Public Liability and Personal Accident Insurance for participants is always in place for events under their control and accept no liability for events organised by third parties or team practice sessions.

11. As part of the communications activity, GreenpowerUSA regularly uses photography for publicity purposes. Entrants must ensure all participants are aware of this and the necessary permission is obtained. If permission is not granted, GreenpowerUSA must be notified prior to every event in which the participant takes part.

Team leaders with less able students wishing to participate, who may have special requirements with regard to the regulations, should contact GreenpowerUSA who will be pleased to assist in any way possible.