



# ELECTRIC VEHICLE

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.

1. **DESCRIPTION:** Teams must design, build, and test one vehicle that uses electrical energy as its sole means of propulsion to travel as quickly as possible and stop close to a Target Point.  
**A TEAM OF UP TO:** 2      **EYE PROTECTION:** None      **IMPOUND:** Yes      **TIME:** 8 minutes
2. **CONSTRUCTION PARAMETERS:**
  - a. The vehicle must be designed to travel between 9.00 - 12.00 meters and come to a complete stop. The exact distance in these intervals (0.50 m for Regionals; 0.10 m for States; 0.01 m for National) must be chosen by the Event Supervisor (ES) and will not be announced until the impound period is over.
  - b. Electrical energy used within the vehicle for any purpose must be stored in common, commercially available batteries labeled with their voltage by the manufacturer. Lead acid batteries are not allowed.
  - c. Batteries may be connected in parallel or series as long as the voltage across any two points  $\leq 9$  V as stated by the manufacturer labels. Batteries need not be installed until immediately prior to the run.
  - d. **All energy for propulsion must be electric and come from the batteries. Any non-propulsive functions (ex: braking system, steering) may be powered by either electric or non-electric storage devices.** All sources of energy must be in easily accessible locations for inspection by the ES.
  - e. Components may be purchased or made by the team members. Electronic components are allowed.
  - f. The wheels/treads in the ready-to-run configuration must fit in a 30.0 x 60.0 cm space of any height.
  - g. A single **approximately** 1/4" dowel must be attached to the front end of the vehicle. The dowel must be approximately perpendicular to the floor and be the leading part of the vehicle at all times except for a dowel attachment device of  $\leq 2.0$  cm extending beyond the front of the dowel. The dowel must extend  $\geq 20.0$  cm from the floor to trigger the photogate system whose lasers are placed  $17.0 \pm 2.0$  cm above the floor. The bottom of the dowel must be  $\leq 1.0$  cm from the track's surface so that its front bottom edge will be the vehicle's Measurement Point for distance measurements.
  - h. Competitors must start the vehicle by using any part of an unsharpened #2 pencil with an unused eraser (provided by the ES) to actuate a button or switch by pushing it perpendicular to the floor.
  - i. Sighting/aiming devices may use electricity and may be placed on the track but must be removed before each run. If mounted on the vehicle they may be removed at the team's discretion prior to each run. **Labeled** lasers are permitted - see Laser Policy on [www.soinc.org](http://www.soinc.org).
  - j. The only parts allowed to contact the floor during the run are wheels/treads and those parts in contact with the floor in ready-to-run position. Pieces falling from the vehicle are a construction violation.
  - k. The vehicle must not be remotely controlled or tethered and must stop automatically.
  - l. Competitors must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on [www.soinc.org](http://www.soinc.org)
3. **THE TRACK:**
  - a. At the ES's discretion, more than one track may be used. Teams must be given the option to choose which track they will use. Both runs by a team must be made on the same track. All tracks must be on a smooth, level, and hard surface. **Please refer to soinc.org for a diagram of the track.**
  - b. The ES must use approximately 2.5 cm wide tape. The **Start Point** and **Target Point** must be clearly marked on 5 cm long tape. **The Bonus Line is marked with tape halfway between the Start Point and Target Point extending perpendicular from an imaginary center line at least 1.0 m to the right when facing the Target Point. The Timing Lines are marked with tape at least 1.5 m long, 0.50 m and 8.50 m from the Start Point, centered on and perpendicular to the imaginary center line.** The edge of the tape closer to the starting point defines these lines. See [www.soinc.org](http://www.soinc.org)
  - c. **BONUS:** Two weighted cans with diameters 7.0 - 8.0 cm, height  $\geq 10.5$  cm are positioned standing upright with their centers on the Bonus Line. The outer can is placed by the ES so that its leftmost edge is 1.0 m from the imaginary center line. Prior to each run the competitors place the inner can at a distance of their choice between the imaginary center line and the outer can. The ES will then record the inner distance between the two cans along the Bonus Line. All parts of the vehicle must travel between the two cans to earn the Bonus. There is no penalty for the vehicle touching the cans. The cans must be removed from the track if the team does not want to attempt the bonus for a specific run.
  - d. A photogate timing system is highly recommended. If used, it must be set across the track at a minimum distance of 1.50 m between the laser and the gate, and at least a single backup timer must be used for those runs that do not trigger the system. See [www.soinc.org](http://www.soinc.org) for information. If no photogate system is available, it is recommended that two lasers and three timers be used with the middle time being official.
4. **PRACTICE LOG:** Teams must record at least 10 practice runs with at least 3 parameters. The parameters must include distance, time, and any additional parameter. Logs must be impounded.



# ELECTRIC VEHICLE (CONT.)

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## 5. THE COMPETITION:

- a. Teams filing an appeal must leave all impounded material with the ES.
- b. The vehicle, batteries, and spare parts must be impounded before the start of the competition. Tools **(including laptops)**, data and calculating devices need not be impounded.
- c. Only competitors and supervisors must be allowed in the impound and track areas. Once competitors enter the event area, they must not leave or receive outside assistance, materials, or communication. **Competitors may not use AC outlet power during their 8 minutes.**
- d. Teams are given 8 minutes to set up their vehicle and complete up to 2 runs. Vehicles in the ready-to-run configuration starting before the end of the 8 minute time period will be allowed to complete a run.
- e. In the ready-to-run configuration, **the vehicle's Measurement Point must be over the Start Point.** The vehicle must remain in the ready-to-run configuration without being touched.
- f. Teams may adjust their vehicle before each run (e.g., change its speed, distance, directional control, change batteries) within their 8 minutes providing the vehicle continues to meet specifications.
- g. Teams may use their own measuring devices to verify the track dimensions during their 8 minutes. **They must not roll the vehicle on the floor of the event track the day of the event without tournament permission. If permitted, only team members may be present.**
- h. **Substances applied to the vehicle must not damage the floor or leave residue on the track and/or event area and be approved by the ES prior to use.** During their 8 minute time, competitors may clean the track but it must remain dry at all times.
- i. If the vehicle does not move upon actuation, it does not count as a run and the team may request to set up for another run, but must not be given additional time.
- j. **The vehicle must not be propelled backwards at any time during the run.**
- k. Run time starts when the dowel of the vehicle reaches the 0.50 m Line and ends when it passes the 8.50 m Line. The Run Time must be recorded in seconds to the precision of the timing device used.
- l. Once the vehicle starts a run, the competitors must not follow it but must wait until called by the ES.
- m. The team's 8 minute time is paused when the vehicle stops to allow for the supervisor's measurements **and when the bonus distance is being measured.** Timing resumes once the competitors pick up their vehicle or begin making their own measurements.
- n. If the vehicle dowel passes the 0.50 m Line but stops before the 8.50 m Line, the Run Time, which ends when the vehicle comes to a complete stop, is recorded. The run is scored with a Competition Violation.
- o. If a photogate system is used and either the dowel passes the 8.50 m Line outside of the timing system or the vehicle hits part of the system but its dowel still passes the 8.50 m Line, the run is valid and does not have a Competition Violation. A backup timer stops time when the dowel passes the 8.50 m line.
- p. A Failed Run occurs if a second run does not occur in the 8 minutes, or if the time or distance cannot be measured for a vehicle (e.g., it starts before the ES is ready, if the competitors pick it up before it is measured, or it moves but does not go at least 0.50 m).
- q. **The ES must verify with the team the correct recording of data on the team scoresheet.**

## 6. SCORING:

- a. Low Final Score wins. The Final Score is the lower of the 2 Run Scores. The Final Score for any vehicle with one Failed Run must be the other Run Score.
- b. Run Score for each run = Run Time + Distance Score - **Bonus** + Penalties. Negative scores allowed.
- c. Distance Score = point-to-point distance from Measurement Point to Target Point to the nearest 0.1 cm
- d. **Bonus =  $0.2 \times (110 - \text{distance between the cans to the nearest 0.1 cm as detailed in 3.b.})$**
- e. **Teams with incomplete practice logs must incur a Penalty of 250 points. Teams without impounded practice logs must incur a Penalty of 500 points.**
- f. Each Competition Violation must incur a Penalty of 1000 points per occurrence for that run (max. of 4000 pts).
- g. Each Construction Violation must incur a Penalty of 5000 points for that run (max. of 15000 pts).
- h. A vehicle not impounded during the impound period must incur 10000 pts penalty for each run.
- i. Ties must be broken by this sequence: 1. Lower non-used Run Score; 2. Lower Run Time of the better run; 3. Lower Distance Score of the better run.
- j. Teams not completing any runs within the 8 mins. or have 2 Failed Runs receive participation points.

**Recommended Resources:** Reference and training resources including the **Electric Vehicle DVD (EVD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

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