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# ELECTRICAL MOTOR CONTEST

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## FOREWORD

This contest is limited to five (5) entries per school.

Each school MUST pre-register online. Visit [oef.org/2025-fair-registration](http://oef.org/2025-fair-registration). Prizes will be awarded to winning entries from registered schools only. Entries from unregistered schools will NOT be eligible for prizes.

## OBJECTIVE

Prior to competition, design and build an electric motor-powered by a dry cell battery that rotates at the highest possible speed.

## DESIGN STATEMENT

Each entrant will design, build and test a Horizontal shaft electrical motor. The motor shall be powered by one readily available non-rechargeable dry cell battery. The motor is judged on its highest rotation speed with no load. The motor may be started by hand. The motor is to be constructed from materials and simple hardware readily available at retail stores or mail order suppliers.

**A hard copy of a design drawing and parts list indicating the source, cost and fabrication operations for each part must accompany the motor at the competition.**

## MATERIALS & RESTRICTIONS (\$50 MAXIMUM EXPENSES)

·The motor must be built by this year's contestant and not by a previous year's contestant.

The power must be derived from one non-rechargeable dry cell battery. The maximum nominal voltage shall be one and one-half (1.5) Volts. A single flashlight battery up to D size may be used. Batteries may not be paralleled. The battery is supplied by the entrant and may not be replaced during a timed contest. The battery may be replaced between the first and second trial. Readily available permanent magnets may be used.



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### MATERIALS and RESTRICTIONS, CONTINUED

Electrical and electronic components such as switches, resistors (variable and fixed), capacitors, inductors, relays, transistors, integrated circuits and interconnection hardware readily available through local retail or mail order sources may be used. Pre-manufactured subassemblies such as armatures, field structures, computer, or controller modules will not be permitted.

Materials such as wire, cable, string; wood, plastic, permanent magnets, metal sheet; bar and rod stock; common fasteners such as nails, screws, adhesives, staples and rivets; wheels, pulleys, bearings; and other common items readily available in local retail stores may be used.

Toy or hobbyist type articles such as erector set structural components may be used. Major components such as armatures, commutators, or field structures from motors or motor kits may not be used.

### RULES

All power for operating the motor must come from the battery. Only non-rechargeable dry cell batteries are permitted. The total nominal battery voltage shall not exceed one and one-half (1.5) Volts. A single flashlight battery up to and including D size may be used. Batteries may not be replaced during a timed contest. Batteries are to be supplied by the entrant.

The motor may be operated by the entrant(s) through manual electrical controls such as switches, variable resistors or other electrical interface devices, or the system may operate automatically after starting.

The stable no-load rotation speed of the motor will be determined using an electro-optic tachometer. An electro-optic tachometer observes and measures the rate alternate light and dark reflective areas pass by a light sensitive detector.

**NOTE: There must be a 1 " or larger diameter disc attached to one end of the motor shaft and painted black (on the outside) so that a reflective tape marker may be readily viewed by the tachometer** (see illustration below). This mark will be viewed by an electro-optic tachometer to determine rotation speed.



1" black circular disk  
mounted perpendicular  
to the motor shaft.

**IMPORTANT NOTE: Re-READ the Construction Specification regarding the required black disk above.** The reflective tape and tachometer will be supplied by the judges.

**NOTE:** The more uniform and straight the motor shaft is constructed the less friction, vibration and reduction in rotating speed it will experience.

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### RULES, CONTINUED

**THEREFORE:** It is better to have the 1" disk already attached to the shaft (for all motors) with a 3/16" square piece of reflective tape attached at the outer edge of the disc ahead of time.

· This allows the contestants to tweek the motor to it's optimum performance and not damage it while attempting to attach the disc &/or reflective tape to it at the contest site.  
The objective is to achieve the maximum possible rotation speed for the motor when operating with no load.

**Each entry will have two (2) one (1) minute timed runs.** The higher observed speed score will be used.

The entrant will have a one (1) minute setup and test period prior to the first run. No more than one (1) minute may elapse between the end of the first timed run and the beginning of the second timed run.

No intervention with the motor's operation is permitted during the timed run except through the electrical control panel or for starting.

The motor may be started by hand or other auxiliary means. The motor must accelerate to a final stable speed if started by auxiliary means - it cannot "coast down" from a starting impulse.

Repairs and adjustments are permitted between timed runs and during the setup period.

**NOTE: A hard copy** of the design drawing and parts list **must be submitted at the time of check-in** and inspection. The motor will be placed on the competition table and operated by the entrant.

The judges will observe the rotation speed with the electro-optic tachometer during each of the one (1) minute timed runs and determine the maximum observed speed.

The competition area will be off limits to everyone except the competitors and officials.

### JUDGES & SCORING

1. Students will receive a Electric Motor Entry Form (EM-EF) at the registration desk. Students must submit this form at the contest registration before 11:30 A.M.. Judges will then inspect the electric motor and assign an entry number indicating student's turn in sequence of competing.
2. Only a Horizontal design motor will be accepted and judged.
3. All entries must be registered at the contest location between 9:00 A.M. and 11:30 A.M. on Fair day. Competition will run until all registered entries have competed.
4. The motor will be inspected and registered at the contest area just prior to competition. A motor shall be registered and operated by one and only one team. No re-registration is permitted. A team may register only one motor. After inspection by the judges, the motor will be placed in the contest queue.
5. The score will be the maximum observed stable no-load rotation speed of the motor in revolutions per minute (rpm) reduced by any penalties.

**NOTE:** A penalty of 50% of the observed speed will be applied for any entry not providing a complete and accurate design drawing and parts list.

## 2025 ELECTRICAL MOTOR CONTEST - CONTINUED



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### **JUDGES & SCORING**

6. Any motor using manufactured components from motors or motor kits will be disqualified.
7. Each entrant is responsible for providing batteries, supplies and tools as required. The judges will provide the tachometer and reflective tape.
8. Prior to the testing, each motor will be inspected and initialed by the judges to indicate compliance with contest construction specifications.
9. Each team is responsible for the security of its entry. No time will be spent looking for or waiting for teams not present when it is their turn. Teams not present will go to the end of the queue if time permits.
10. No one is allowed behind the test table except the judges.
11. Only two (2) participants will be allowed in the test area – other students must stand back away from the test table.
12. In the event of a tie, the motor determined to have the most creative design will be declared the winner.
13. Decision of judges, during all phases of the competition, is FINAL. In the event of a tie, prizes will be equally distributed between winning entries.

### **CASH PRIZES AND DISTRIBUTION**

Contest winners will be announced on the OEF website at <https://oef.org/2025winners> and on the BAND app on or before March 1, 2025.

First, Second and Third place winners will receive medals.

The winning classrooms of the First, Second and Third Place entries will receive a cash award, which will be mailed on or before April 1, 2025.

### **CONTACT**

For more information contact Dan Morehead, IEEE OKC, at [moreheaddb@cox.net](mailto:moreheaddb@cox.net).