WIND POWER B

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

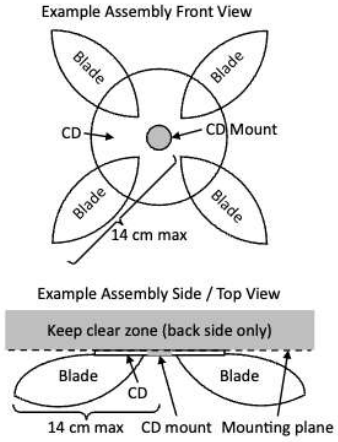
1. **DESCRIPTION:** Teams construct a blade assembly device prior to the tournament that is designed to capture wind power and complete a written test on the principles of alternative energy.

   A TEAM OF UP TO: 2 **EYE PROTECTION:** B **IMPOUND:** No

   CALCULATOR: Class III **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**
   a. Each team may bring one three-ring binder of any size containing information in any form and from any source, attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during any part of the event.
   b. Each team may also bring tools, supplies, writing utensils, and two calculators (Class III) for use during any part of the event.
   c. Each team may bring one pre-constructed blade assembly device.
   d. The Event Supervisor will provide the testing materials listed in the COMPETITION AREA section. **Teams should not bring these materials.**
   e. Competitors must wear eye protection during Part II. Teams without proper eye protection must be immediately informed and given an opportunity to obtain eye protection if time allows.
   f. Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy.

3. **CONSTRUCTION PARAMETERS:**
   a. The blade assembly device consists of any kind and number of propeller/pinwheel/rotor blade(s) **and any other pieces** attached to a central disc. **The central disc must be either a mini (8.0 cm in diameter) or a standard (12.0 cm in diameter) commercially-made CD, DVD or Blu-Ray disc intended for data or media storage.**
   b. The central disc must fit on the mount found in a standard CD player. Modification of the disc is not allowed (except to affix the blades via tape, glue, etc.).
   c. When mounted, no part of the blade assembly may have a radial distance from the center of the axis of rotation of more than **14.0 cm**. Note: adjacent diagrams are not to scale.
   d. The blade assembly must be made of only nonmetallic, **nonmagnetic** substance(s). **Only the wind from the fan may power the blade assembly.**
   e. When initially mounted, no part of the blade assembly **including fastening materials** may extend **onto the back of the disc or** behind the mounting plane of the disc. There is no limit on how far forward the blade assembly may extend.



   f. **The device must be designed and operated in such a way as to not damage or alter the support stand or disc mount (e.g., due to excessive weight/torque, residue on the mount).**

4. **DESIGN LOG: Competitors are not required to submit a design log for scoring, but are encouraged to test and calibrate their blade assembly.**

5. **THE COMPETITION:**

   Part I: Written Test
   a. Teams will be given a minimum of 20 minutes to complete a written test consisting of a variety of different question types (i.e., multiple choice, true-false, completion, or calculation).
   b. Unless otherwise requested, answers must be in metric units with appropriate significant figures.
   c. The test will consist of **roughly the same number of questions** from each of the following areas:
      i. Wind power rotor/fan blade design (e.g., types of designs, pros/cons of designs, ways to improve designs, sources of loss, **concepts related to blade design**)
      ii. Power generators (e.g., **types of generators, concepts related to generator design**)
      iii. Power storage (e.g., how is the power stored during charging and how is it used during discharge, concepts relating to methods of power storage)
      iv. Power transmission **and distribution** (e.g., ways electricity is transmitted, how power is lost in transmission, ways to reduce power loss)

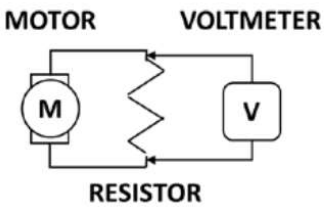
v. **Processes of siting and installing of commercial and individual wind applications, power transmission and distribution systems, and power storage systems**
vi. **Historical milestones of wind power development. Historical and current applications of wind power.** Environmental, ecological, and land use impacts of wind power

Part II: Device Testing

a. The blade assembly must be tested once with the fan at a low wind speed and once at a high wind speed**. It is recommended to conduct the low speed test first to ensure no device components detach before attempting the high speed test.**
b. Event Supervisors must check the blade assembly specifications before a team's blade testing period begins. Teams must be notified as soon as possible if a blade assembly does not meet specifications. Event Supervisors may prohibit blade assemblies from being tested if they will damage the testing setup.
c. Teams may modify the blade assembly during their Part II testing period, if time is available. This may be to bring the blade assembly into compliance with event specifications. **Once the blade assembly is determined to meet construction parameters, the rotor blades of the assembly cannot be swapped out for other blades. Doing so constitutes a construction violation.**
d. **Teams have 2 minutes and 15 seconds of set-up time preceding each Measurement Period to attach their blade assembly to the motor/generator mount and position it.** At the request of the students, the Event Supervisor must turn on or off the fan during the set-up to allow the students to better position the blade assembly relative to the fan. No voltage measurements are allowed to be made by or seen by the competitors during the **set-up** period. Teams are allowed to start and stop the blade assembly rotation and reposition the support stand during the **set-up** period.
e. No later than **the end of the set-up** period, with the fan already on and the blade assembly already rotating, the students must tell the Event Supervisor to begin a 30 second Measurement Period. The team must not touch, **modify, influence,** or reposition the blade assembly or support stand during the Measurement Period.
f. **No pieces of the blade assembly may detach while the device is spinning during either set-up time or Measurement Periods.**
g. The Event Supervisor must record the Maximum Voltage that occurs during the Measurement Period and inform the team of the result.
h. The Event Supervisor will review with the team the Part II data recorded on their scoresheet.
i. Teams filing an appeal regarding Part II must leave their blade assembly device in the competition area.

6. **<u>THE COMPETITION AREA</u>:**

a. Example setups are provided on the event page on www.soinc.org
b. The Event Supervisor will provide the testing materials listed below which will be the same for all teams.
   i. 20" multi-speed box fan(s) to be used as the wind source(s)
   ii. Support stand(s) that allow for vertical and horizontal adjustments of the blade assembly
   iii. Motor/generator(s) mounted to the support stand(s), with axis of rotation approximately parallel to that of the fan.
   iv. Load resistor(s) between 5 and 25 ohms (1/4 Watt or greater) wired in parallel with the motor/generator that must have the same value for all teams



   v. Device(s) to measure voltage across the load resistor. Voltage measurement devices that have 'peak hold' or 'max hold' functions are recommended.
c. The fan(s) must be mounted in a fixed position with the bottom of the grill at least 15 cm above the table.
d. There may be one or two test stations. If there are two, one must be used for all low wind speed tests and the other for all high wind speed tests. The load resistors **and motor/generators** at each station are allowed to be different, but must be consistent for all teams.
e. The motor/generator must be equipped with an adapter to accommodate a CD or, if the motor/generator is from a disc player, it must be removed from the disc player and mounted on the support stand.

7. **<u>SCORING</u>:**

a. Final Score (FS) = ES + LSS + HSS. The maximum possible FS is 100 points. High score wins. A scoring spreadsheet is available at www.soinc.org.
b. Exam Score (ES) = (Part I score / highest Part I score for all teams) x **50 points**

c. Low Speed Score (LSS) = (low speed test Max Voltage / Highest low speed test Max Voltage of all teams) x **25 points**
d. High Speed Score (HSS) = (high speed test Max Voltage / Highest high speed test Max Voltage of all teams) x **25 points**
e. If the team violates any of THE COMPETITION rules, the Max Voltage at that wind speed must be multiplied by 0.9 when calculating the Speed Score.
f. **The Speed Score for a Speed Trial must be zero (0) if a team:**
   i. **Cannot test their device safely**
   ii. **Cannot bring their device into compliance with the CONSTRUCTION PARAMETERS by the start of the Measurement Period**
   iii. **Is not prepared for the Measurement Period by 2 minutes, 15 second of setup (per rule 5.Part II.d.)**
   iv. **Fails to bring a blade assembly device.**
g. Teams with Speed Scores of 0 will be allowed to compete in Part I
h. Tiebreakers
   i. 1st – Best HSS
   ii. 2nd – Best LSS
   iii. 3rd – Specific Test Questions

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase; other resources are on the Event Pages at soinc.org.

This event is supported by ADM Cares.

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