

1. **DESCRIPTION:** Teams will design and build a Boomilever meeting requirements specified in these rules **to support a minimum load** and achieve the highest structural efficiency.

**A TEAM OF UP TO: 2 IMPOUND: NO EYE PROTECTION: B EVENT TIME: 6 minutes**

2. **EVENT PARAMETERS:**

- a. Each team is allowed to enter only one Boomilever, built prior to the competition.
- b. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without proper eye protection will not be allowed to compete and be placed in Tier 4.
- c. **Participants may NOT bring any equipment such as levels or squares.**
- d. The Event Supervisor will provide the Test Apparatus (see Section 5) **and tools/materials for measurement.**

3. **CONSTRUCTION PARAMETERS:**

- a. The Boomilever must be a single structure, with no separate or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
  - i. Wood is defined as the hard-fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include: bark, particleboard, wood composites, bamboo or grasses, paper, commercially **laminated wood (i.e. plywood)**, or members formed of sawdust and adhesive. Wood may never be painted, color enhanced, or have **tape/preprinted/paper** labels affixed. Ink barcodes or markings from the construction process may be left on the wood.
  - ii. There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
  - iii. Adhesive is a substance used to join two or more materials together **and may be used only for this purpose.** Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane and super glues). Adhesive tapes are not allowed.
- b. **The Boomilever must be designed to attach to the testing wall using the Mounting Hook (5.a.ii.).**
- c. **The Boomilever must support the Loading Assembly (5.b.) at the loading point which must be between 40 cm and 45 cm from the testing wall (4.Part II.e.ii.).**
- d. **The loading point on the Boomilever must be constructed to permit placement of and completely support the Loading Assembly (5.b.).**
- e. **Before and throughout loading, no portion of the Boomilever may touch the testing wall below the Contact Depth Line which is more than 20 cm (Div. B) or 15 cm (Div. C) below the center of the hole for the Mounting Hook (5.a.iii.).**
- f. Participants 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).

4. **THE COMPETITION:**

**Part I: Check-In**

- a. **The team will present their Boomilever for inspection & measurement using materials provided.**
- b. The team will place their Boomilever on the scale so the event supervisor can determine the mass, in grams to the nearest 0.01 g.
- c. The team must submit their Estimated Load Score (6.b.) to be used as a tie breaker (6.d.).
- d. No alterations, substitutions, or repairs may be made to the Boomilever after the check-in process is started.
- e. The event supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g but no more than 15,200 g prior to testing.

**Part II: Testing**

- a. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
- b. Participants will have 6 minutes to setup and test their Boomilever to maximum load or failure.
- c. The participants must place the Boomilever on the Testing Wall and assemble the Loading Assembly as required to load the Boomilever. If necessary, participants may disassemble the Loading Assembly. The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Boomilever to deflect.

# BOOMILEVER (CONT.)

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

- d. The participants will be allowed to adjust the Boomilever until they start loading sand. Once loading of sand has begun, the Boomilever must not be further adjusted.
  - e. **The event supervisor will verify the Boomilever is placed properly for testing:**
    - i. **Only attached to the Testing Wall by the Mounting Hook (5.a.ii.)**
    - ii. **The loading point meets requirements as measured horizontally from the Testing Wall to the centerline of the chain on the Loading Assembly (5.b.)**
    - iii. **No portion of the Boomilever touches the Testing Wall below the Contact Depth line (3.e.)**
  - f. Participants will load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by participants is NOT allowed. The bucket may only be stabilized by the using the tips of the **provided** bucket stabilizing sticks (5.d.).
  - g. Loading stops immediately when the **Boomilever touches below the Contact Depth line (3.e.)**, failure occurs, or when time expires; any parts of the Boomilever in the bucket when loading stops will be removed.
  - h. Boomilevers that fail before supporting 15,000 g will be scored according to the actual **load** supported at time of failure **(6.b.)**, measured to the nearest gram or best precision available. Failure is defined as the inability of the Boomilever to carry any additional load or any part of the load being supported by anything other than the Boomilever. Incidental contact by the chain/eyebolt with the Boomilever is not failure.
  - i. More than one Test Apparatus may be used. Teams will be given a choice of which apparatus they will use.
  - j. Teams who wish to file an appeal must leave their Boomilever with the event supervisor.
  - k. The supervisor will review with the team the data recorded on their scoresheet.
5. **TEST APPARATUS:**
- a. The Testing Wall must be as follows:
    - i. **Vertical, solid, and rigid surface with dimensions minimum of 40.0 cm wide x 30.0 cm high. Constructed of  $\frac{3}{4}$ " grade plywood or other suitable material, with a smooth, hard, low friction surface that does not bend when loaded.**
    - ii. **The Mounting Hook must be 4" steel J-bolt made of  $\frac{1}{4}$ " nominal round stock, have a  $\frac{5}{8}$ " nominal inside hook diameter with a threaded  $\frac{1}{4}$ " mounting end [e.g., National Hardware barcode stock number N232-892 (UPC 038613228917),  $\frac{1}{4}$ " by 4" or exact equivalent shall be used].**
    - iii. **One Mounting Hook must be attached to the Testing Wall by the Supervisor with the "opening" up and installed to allow 2.5 cm +/- 0.1 cm clearance between the wall and the closest edge of the Hook. The Hook must be secured in place with a hex nut and flat washer on the front side and a wing nut and flat washer on the back side of the Testing Wall. The Hook must be horizontally aligned by centering between the sides of the Testing Wall approximately 5.0 cm below its top. The centerlines of the holes must be visible on the face of the Testing Wall.**
    - iv. **A horizontal Contact Depth line must be clearly visible on the Testing Wall. It must be drawn below the centerline of the hole for the Mounting Hook as defined in rule 3.e.**
  - b. The **Loading Assembly** will consist of:
    - i. A square Loading Block measuring 5 cm x 5 cm x approximately 2 cm high with a hole no larger than 8 mm drilled in the center of the 5 cm x 5 cm faces for a  $\frac{1}{4}$ " threaded eyebolt
    - ii.  $\frac{1}{4}$ " threaded eyebolt (1" nominal eye outside diameter), no longer than 3", and a  $\frac{1}{4}$ " wing nut
    - iii. A chain and S-hook that are suspended from the Loading Block
    - iv. **An approximately five-gallon plastic bucket with handle and hook to be suspended from the chain.**
  - c. Sand or other clean, dry free-flowing material (hereafter "sand").
  - d. Two (2) Bucket Stabilizing Sticks each made from of a piece of  $\frac{1}{2}$ " dowel approximately 18 inches long with a spring-type door stop screwed into one end. Refer to example on [www.soinc.org](http://www.soinc.org).

## 6. **SCORING:**

- a. **High score wins. Score = Load Score (g)/Mass of Boomilever (g).**
- b. The Load Score is the measured load supported, including the Loading Assembly (5.b.) and sand, but may not exceed 15,000 g. **The lowest Load Score is the mass of the Loading Assembly.**
- c. Boomilevers will be placed in four tiers as follows:
  - i. Tier 1: **Holding 3,000 g or more** and no violations
  - ii. Tier 2: **Holding less than 3,000 g** and no violations
  - iii. Tier 3: **Holding any load** with any violations
  - iv. Tier 4: Unable to be loaded for any reason (e.g., cannot accommodate Loading Block, Loading Assembly, or failure to wear eye protection) and will be ranked by Lowest mass
- d. Ties are broken as follows:
  - i. Estimated Load Score (4.Part I.c.) closest to, without exceeding, the actual Load Score (6.b.)
  - ii. Lowest Boomilever mass
- e. Example score calculations:
  - i. Boomilever 1: mass = 15.12 g, load supported = 12,134 g, Score = 802.5
  - ii. Boomilever 2: mass = 12.32 g, load supported = 13,213 g; Score = 1,072.5

**Recommended Resources:** The Science Olympiad Store ([store.soinc.org](http://store.soinc.org)) carries the Boomilever Video Download and Problem Solving/Technology CD; other resources are on the event page at [soinc.org](http://soinc.org).

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