

Overview

Rule 3.d (“The Energy rule”) states:

The launch force must be entirely supplied by the gravitational potential energy from the supervisor provided falling counterweights. The device, without the counterweight and projectile, must not contribute energy to the launch. This includes any part of the device whose potential energy decreases, with the exception of items of nominal mass, such as strings and thin rods. Devices will be inspected to ensure that there are no other energy sources. At the supervisor’s discretion, teams must disassemble devices after competing in order to verify this. Example violations, allowable types, and mechanisms for testing for added energy are available on soinc.org.

This document serves the purpose of showing the examples mentioned. It is intended to help participants, coaches and event supervisors understand and enforce this rule. In all situations, prior to testing any device, participants should first explain how the device works to the event supervisor. Then they should set it up in the ready to launch position without the counterweight and projectile. Only the participant should actually touch or manipulate the device per the directions of the event supervisor.

Example: Fixed Fulcrum Trebuchet or Catapult

Test 1: When the trigger is released the arm should not move in the direction of launch.

Test 2: If the arm is raised several inches and released, the arm should either stay in place or return to launch position. The device should be checked the same way in several positions up to the 90 degree position.

During both of these types of tests, the energy rule is not violated if the arm moves opposite to the launch direction, or in the launch direction and stops on its own before the arm reaches 90 degrees in relation to the floor (provided there is nothing else in place to stop the arm from moving to the 90 degree position.)



Ready to launch position



90 degree position

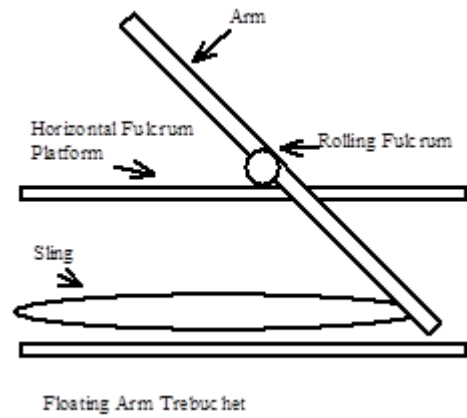


Balanced (not adding energy)

Example: Floating Arm Trebuchet

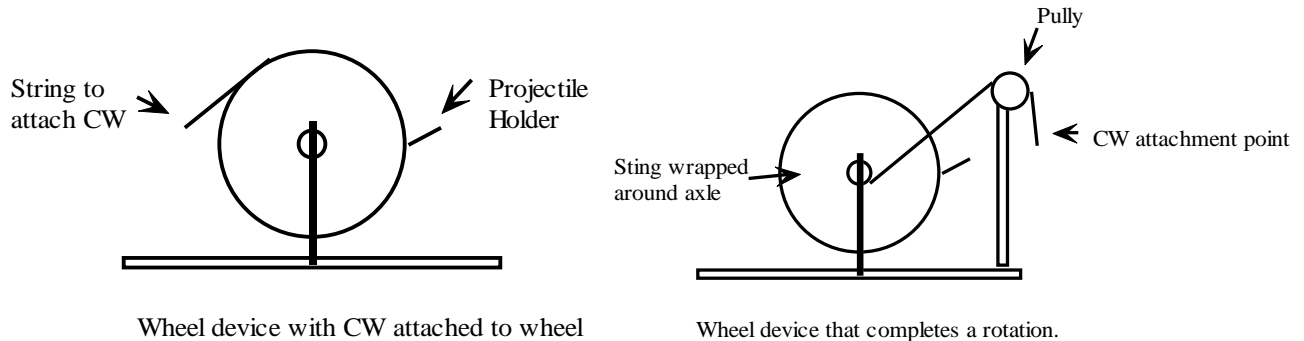
The floating arm trebuchet is similar to a fixed fulcrum, with the exception that the fulcrum of the arm can move horizontally, and hence should be tested the same way, with one additional test to check to ensure the arm does not roll downhill.

Test 3: When the trigger is released and with the arm slightly raised, the fulcrum point should not move forward.



Example: Wheels

Wheels typically have a string connecting the counterweight either to the outer surface or the axle of the wheel. When the weight drops it rotates the wheel forward and the projectile will ride in a holder and be released via some mechanism.



Test 1: The trigger should be released and the wheel should not move in launch direction.

Test 2: The wheel should then be rotated slowly in launch direction, then stopped, and released to ensure it does not continue to move in the launch direction. This should be checked in several locations, either until the projectile release point has been reached or one complete rotation has been made.

During both of these types of tests, the energy rule is not violated if the wheel moves opposite to the launch direction, or in the launch direction and stops on its own before reaching the release point (provided there is nothing else in place to stop the wheel from moving further.)

Example: Flexible Arms

These devices can be tested similar to the fixed fulcrum trebuchet. Note if an arm is bent before the counterweight is installed it is storing its own elastic energy and in violation of the rule. It is ok for the arm to bend when the counterweight is installed.