Rocket Engine Test Bracket

ME-6617

Introduction

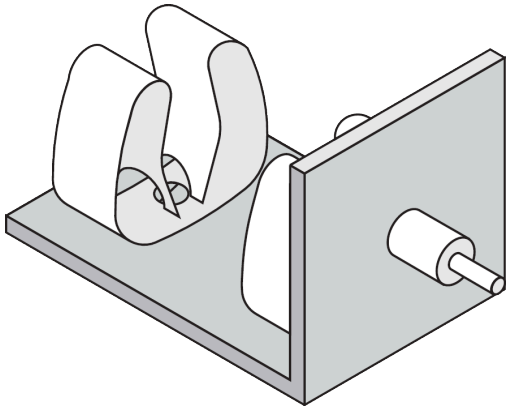
The Rocket Engine Test Bracket is designed to be used with a PASCO force sensor and data collection software to measure the magnitude of impulse of Estes™ (series A through D) and equivalent model rocket engines. Doing so can significantly augment rocketry studies, giving students a better understanding of the mechanics of rocket launches.

> **IMPORTANT:** The Rocket Engine Test Bracket should be used *only* in a supervised class setting by personnel who are familiar with the National Association of Rocketry (NAR) Safety Code and after complying with any state regulations for igniting rocket engines.

Equipment

Included equipment:

- Rocket Engine Test Bracket



Required equipment:

- Estes™ model rocket engine (series A, B, C, or D) or equivalent engine
- Appropriate launch controller for rocket
- Large Rod Base (ME-8735)
- Stainless Steel Rod, 90 cm (ME-8738)
- Any of the following PASCO force sensor setups:
  - Wireless Force Acceleration Sensor (PS-3202)
  - PASPORT Force Sensor (PS-2104) with PASPORT interface
  - PASPORT High Resolution Force Sensor (PS-2189) with PASPORT interface
- PASCO Capstone or SPARKvue data collection software

Safety

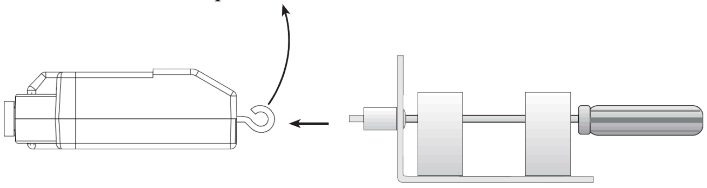
> **CAUTION:** To protect yourself, your students, and your surroundings during experiments, ALWAYS follow these safety guidelines when performing experiments with rocket engines!

- Read all of the warnings and follow the instructions provided with the model rocket engine and igniter.
- Review the National Association of Rocketry (NAR) Safety Code prior to igniting a rocket engine.
- Choose an asphalt or concrete launch area free of any people, animals, or combustible material.
- Ignite the model rocket engine with a remote electrical launching system that includes a safety key feature. Remote electrical launching is the **only** safe and approved way to ignite model rocket engines.
- Install igniters only while outdoors and almost ready to launch.
- Wear safety glasses when installing the igniter and connecting the cables to the launch controller.
- *Never* put the safety key in the launch controller unless the exhaust area of the rocket engine is clear. Inserting the key at other times may cause accidental ignition and injury.
- Before igniting the rocket engine, check again to make sure that there are no people, animals, or objects near the exhaust of the model rocket engine.
- Remove the safety key as soon as the rocket engine is ignited.
- **Do not** allow the igniter leads or alligator clips on the cables to come in contact with each other.
- Wait at least 10 minutes after ignition of the rocket engine before touching the Rocket Engine Test Bracket. ***The bracket will be hot.***
- Always comply with all state or county regulations for igniting rocket engines.
- Use only series A-D Estes model rocket engines or equivalent.
- In the event of a misfire, immediately remove the safety key from the controller and wait 60 seconds before disconnecting the micro-clips, then replace the igniter.
- Never store or transport rocket engines with the igniters installed.

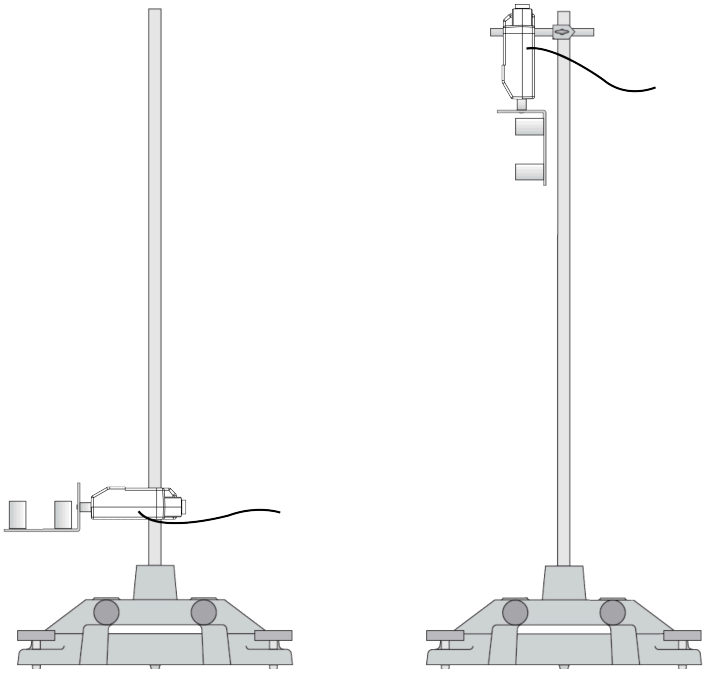
Setup

Set up the equipment

1. Remove the hook from the end of the Force Sensor, then use a small screwdriver to connect the Rocket Engine Test Bracket to the force sensor in place of the hook.



2. Mount the sensor on the support rod either horizontally (see left below) or vertically (see right below). If the sensor is mounted vertically, the attachment point on the rod should be at least 80 cm above the base.



3. Insert the model rocket engine into the test stand with the engine's exhaust port pointing *away* from the force sensor.

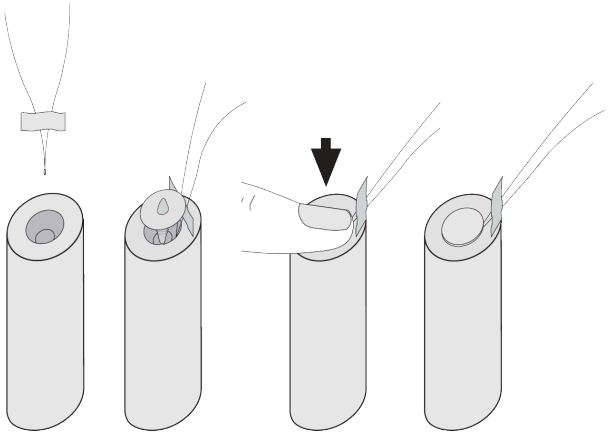
Set up the software

1. Connect the force sensor to PASCO Capstone or SPARKvue. For more information on this, see the manual for your chosen sensor and the PASCO Capstone or SPARKvue online help.
2. Adjust the sampling rate for the sensor to 500 Hz.
3. Create a graph display plotting force versus time.

Prepare for ignition

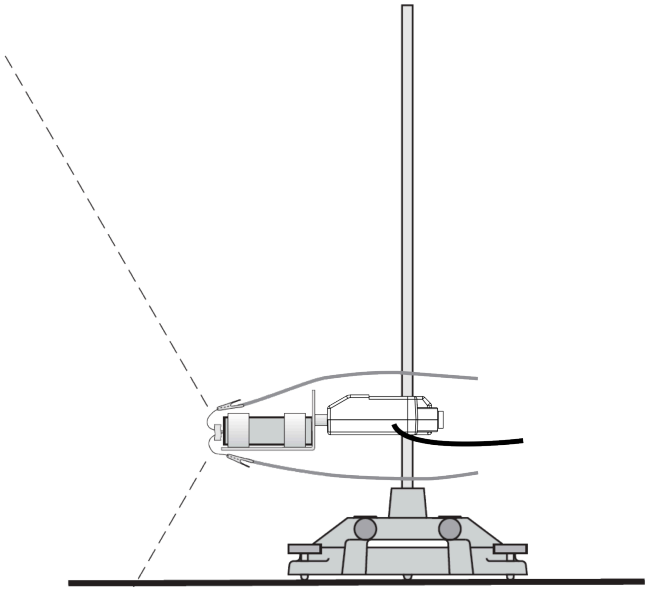
1. Move the equipment to the launch site.
2. Insert the igniter into the rocket engine. Spread the wires apart, leaving the paper separator in place, then insert the igniter plug and press down to hold the igniter in place. (See below.)

> **NOTE:** Carefully follow all instructions included with the rocket engine and igniter.



3. Clip the alligator clips of the cables from the launch controller to the igniter wires.

> ⚠ **WARNING:** Do NOT allow the igniter wires or alligator clips to touch each other! Make sure that the safety key is not in the launch controller during setup, that the cables are well away from the exhaust area, and that the computer interface is as far from the exhaust area as possible.



4. Zero the force sensor. For information on how to do this, see the manual for the sensor or the software online help.
5. Check the exhaust area to ensure it is clear of any people, animals, or combustible material.

Data collection and analysis

1. Insert the safety key into the launch controller.
2. Begin recording data, then move at least 15 feet (5 meters) away from the Rocket Engine Test Bracket.
3. Ignite the rocket.
4. Once the rocket stops burning, stop recording data.
5. Edit the graph display to display the area under the curve. The total area is equal to the impulse of the rocket engine.
6. Using the graph analysis tools, determine the time to the ejection charge.
7. Compare your recorded values with the expected values for the type of rocket you are using.

Software help

The SPARKvue, PASCO Capstone, and Chemvue Help provide information on how to use this product with the software. You can access the help from within the software or online.

SPARKvue

Software: Main Menu > Help

Online: help.pasco.com/sparkvue

PASCO Capstone

Software: Help > PASCO Capstone Help

Online: help.pasco.com/capstone

Technical support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to answer your questions or walk you through any issues.

Chat pasco.com

Phone 1-800-772-8700 x1004 (USA)
+1 916 462 8384 (outside USA)

Email support@pasco.com

Limited warranty

For a description of the product warranty, see the Warranty and Returns page at www.pasco.com/legal.

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