

# Wing Tester

*User Guide*



# Wing Tester



Figure 1

## Wing Tester Overview

The Pitsco Wing Tester is designed to visually demonstrate the principle of lift and to evaluate the design and performance of model wing airfoil sections.

The Wing Tester accomplishes this by suspending the wing in a moving airstream, simulating actual flight. As the air moved by the tester's fans passes a properly constructed wing, lift is generated and the wing rises. Weights representing cargo can be added to the wing while it is in flight. The amount of weight supported by a wing before it sinks is a measure of its design efficiency. This visual demonstration is an excellent way to introduce students to the hard-to-grasp concepts of lift, drag, Bernoulli's principle, and Newtonian physics.

Students can design and build their airfoils using the Pitsco Wing Caddy (57246) or the Pitsco Foam Wing Cutter (17080) and test them on the Wing Tester to see whose design is the most efficient.

## Wing Tester Components

The Wing Tester comes with the components listed below and shown above. If anything is missing, call Customer Service at 800-358-4983.

- Wing Tester unit
- Balance arm
- Wing support bracket
- Brass washers
- Rubber bands
- Funnel

## Assembling the Wing Tester

1. Slide the balance arm into the mounting socket on the top of the Wing Tester unit. Align the holes in the balance arm with the mounting socket thumbscrew and tighten the thumbscrew.
2. Place the funnel on the balance arm as shown in Figure 1.
3. Raise the weight gauge on top of the tester to its upright position.

## Operating the Wing Tester

Place the Wing Tester on a flat, level surface and plug it into a standard 120-volt electrical outlet. Advise students to follow these safety precautions when using and storing the Wing Tester:

- Do not place hands, loose clothing, books, or other items within two feet of the fan intake or exhaust while the Wing Tester is in operation.
- Use the Wing Tester only after watching the instructor demonstrate its proper use.
- Unplug the Wing Tester when it is not in use.
- Store the Wing Tester in a safe, dry place.

## Testing a Wing

1. The wing support bracket is held on to the balance arm by a magnet – carefully, pull the bracket at an angle until it comes free of the balance arm (Figure 2).
2. Loop the rubber band onto the bracket (Figure 3). Place the test wing on the bracket so the two bracket ends are visible in front of the airfoil. Stretch the rubber band over the top of the wing and loop it over the bracket ends in front of the test wing (Figure 4).



Figure 2



Figure 3



Figure 4

3. Reattach the bracket to the balance arm so the bracket ends face the tester.
4. Balance the wing, which counters the effect of gravity on the wing. Hold the wing so the pointer is at zero on the weight gauge. Adjust the counterweight and release the mechanism. Make adjustments to the counterweight and then the micro counterweight until the pointer stays at zero. To ensure the wing is balanced, move it up or down and release it. When released, the wing should not move. A properly balanced wing can be moved to any position and will stay in that position when released.
5. Turn on the fan switch. If the wing has an efficient shape, it will rise.
6. While the wing is in the raised position, carefully drop washers in the funnel on the balance arm until the wing descends to the original level position (Figure 5).
7. Now, verify that the wing has lift. Turn off the Wing Tester. After the motor has stopped, turn on the Wing Tester to the previous setting. The wing should rise to the zero point.
8. On a piece of paper, record the number of washers the wing supported. This is the load that your airfoil supported. Efficient designs support the heaviest loads.



Figure 5

## Tip

To securely attach the airfoil to the tester's wing support bracket, tape two Launch Lugs (50071) to the underside of the airfoil so you can slide the bracket ends through the lugs to hold the airfoil on the support. Before taping, make sure the lugs are centered on the airfoil.

## Ideas for Additional Activities

- Vary the angle of attack by placing a piece of cardboard under the leading edge of the wing. Rebalance the wing to compensate for the additional weight of the cardboard. Does this improve or impair the lift performance of the wing?
- Demonstrate the concept of stall by gradually increasing the angle of attack until lift is no longer produced.
- Add a flap by taping a piece of card stock on the trailing edge of the wing. Bend the flap up and down to observe the aerodynamic effects.

## Disclaimer

Pitsco, Inc., is not responsible for bodily injury or property damage resulting from misuse of its products. Always follow standard safety procedures to ensure student safety.



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