

2 cheap means to measure the thrust of a pop-pop engine

By Jean-Yves

First method

It uses a comparison of the pop-pop engine thrust with the one of a mass submitted to gravity. This a very cheap and accurate method, but it applies only when the engine is fitted on a floating hull.



Equipment:

Sewing thread,
Two masses, one of them being perfectly known (here it is a 2 gram mass),
Graduated ruler,
Hanging support made of what is available.

The plumb line on the left is used to adjust the zero (by bending the steel wire used to hang it).

Some complements are given on next page.

Second method

This is a cheap alternative as well; even less that the heart of the system (tea spoon) could go back to its original use when the measurements are over. This method allows to measuring the thrust of a pop-pop engine without need to fit it on a floating hull.



Equipment:

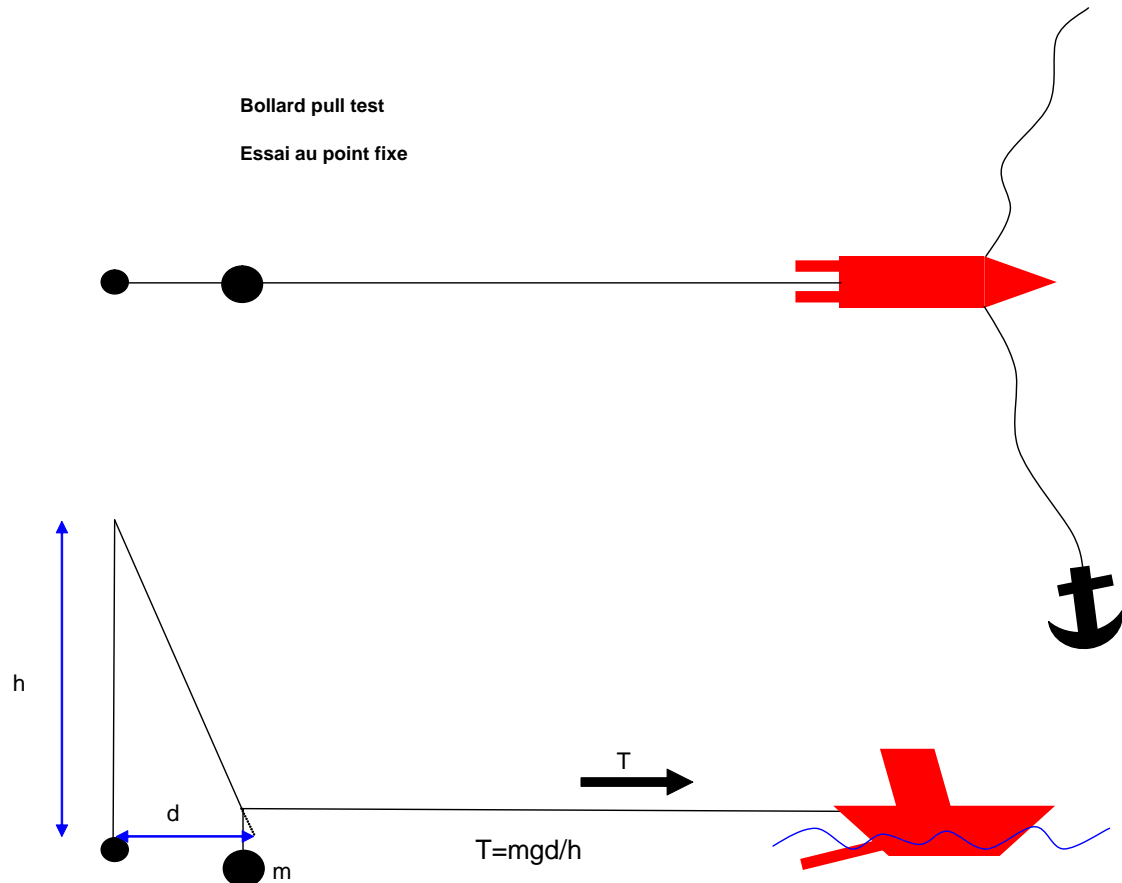
Tea spoon,
Rubber band,
Piece of steel string,
Kingpin (or pencil),
Graduated ruler.

Here, the instrument is located on a window flower box (cost : 1 Euro), but it could be fitted on any other tank. To do that, two parallel and horizontal small pieces of wood (ex: 2 rulers) would suffice to support the mobile part.

For the application, look at the excel file "*spoon*".

Some complements concerning the first method

Top view and side view.



Knowing “m” (ex: 2g) and “h » (ex: 400mm), we measure “d” and then we can calculate T according to the formulae

$$T = mx9,81x \frac{d}{h}$$

The two pieces of thread which keep roughly the boat along the axis are to be used when the tank is too wide to set the boat course. Don't tighten them, because it would influence the measurement.

Some complements concerning the first method

The method using the tea spoon is not so accurate as the first one, and it needs some precautions.

- The pipes end (nozzle) is to be at less than 40mm from the spoon.
- The mobile assembly must not deviate more than 30°. (If needed, use a thicker string).
- To be rigorous one should hammer the spoon in order to get it flat where it is used as a target.
- This target should be perpendicular to the jet of the pop-pop engine in measuring conditions.
- Theoretically, the test tank should be wide enough to avoid whirlpools influence.

In practice, due to the concavity of the spoon and to the size of the tank the measure is bigger than the actual value by 20 to 40%. On one hand this is generally acceptable to estimate the thrust of an engine. On the other hand, this measuring tool allows to compare engines or to estimate the improvements brought by such or such modification. A calibration is possible by using simultaneously both methods.