

## Is Your Propeller Sized Correctly?

A few days ago I was on a friend's boat and due to the lack of wind we were motoring. I looked down at the knot meter and noticed we were traveling at 6 knots. This surprised me as we should have been traveling at 7 knots or faster. After some investigation I determined the propeller was likely too small or did not have enough pitch. If my friends were to replace their propeller with a properly sized one they could increase their speed, saving both time and fuel. How did I know this boat was capable of going faster and how did I determine the propeller was under sized? In this article I hope to share this knowledge so you can determine if your boat's propeller is properly sized.

**Hull Speed** – Mono-hull sailboats have displacement hulls. This means they slide through the water, as opposed to skimming over the top as a runabout might. Displacement hulls have two major characteristics: First, their speed is limited, at least under normal circumstances. This limit is known as 'Hull Speed' and it can be calculated by taking the square root of the length at the waterline times 1.34. The second characteristic is these hulls are very efficient – it takes very little energy to move them through the water at speeds below hull speed. Beyond hull speed the energy needed to move them through the water increases dramatically.

For example, my friend's boat is 40 feet over all and has a waterline length

of 35 feet. Therefore, hull speed for their boat should be the square root of 35 (5.92) times 1.34 or 7.9 knots. Now, whether or not they can get their boat up to this speed is going to be a function of a lot of things, the main items on the list are hull configuration, hull condition, engine horsepower and the propeller. Their boat is a modern cruiser with a clean bottom and a 40 hp engine. All of this would lead me to believe they should be able to travel at over 7 knots. For the sake of comparison, we used to own a Pearson 38 which had the same displacement as this 40 footer, a hull speed of 7.3 knots and a 30 hp engine; it cruised comfortably at 6.7 knots.

Again, there are many issues that can slow a boat down, growth on the bottom or on the propeller are high on this list. A line or kelp wrapped around the shaft will also slow a boat down. Also, it is important to be sure the knot meter is calibrated accurately. But my friend's boat has a clean bottom and is well maintained which leads me to suspect the propeller is too small.

**Sizing a Propeller** – There is a relatively easy way to determine if your propeller is sized correctly for your boat and engine. The first thing to do is look at the manual for your engine to determine the 'Rated RPM.' This is the speed at which the manufacturer says the engine will run for a sustained period of time. For example, the Yanmar on our boat is rated for 3700 RPM. If the propeller is sized correctly the

engine, at full throttle, should top out near this level. Again using our boat as an example, with full throttle we can get to 3800 RPM. To test your boat give your engine full throttle just long enough for the RPM's to reach their maximum or to run up over the rated level by 2-300 RPM. This does not need to be a long test, 20-30 seconds will do. Before doing this test be sure the bottom and propeller are clean. Also the boat should be 'fully loaded', meaning the fuel and water tanks should be full and normal gear should be onboard.

My friend's engine is rated for 3600 RPM but when I gave it full throttle the RPM's ran up to just under 4000. This told the propeller was not loading the engine as it should; in other words it is too small or does not have enough pitch.

This test will tell you if your propeller is too big or too small but not what you should do to correct the situation – this is when bringing in an expert is advisable. Talk to your boat or engine dealer or a propeller shop. They will likely test the tachometer to be sure it is accurate and look at other possible factors.

If you do decide to change propellers I would recommend considering a folding or feathering model. These are more expensive but they increase sailing speeds and have other advantages. Admittedly they are more expensive so you will need to weigh the cost verses the benefits.

*Mike Huston teaches sailing for San Juan Sailing in Bellingham, WA. He has been sailing for over 40 years, many of them spent racing. He and his wife own a Jeanneau 43DS, "Illuminé."*

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