

Which Prop Is Right For Your Boat?

by Gabe Capobianchi

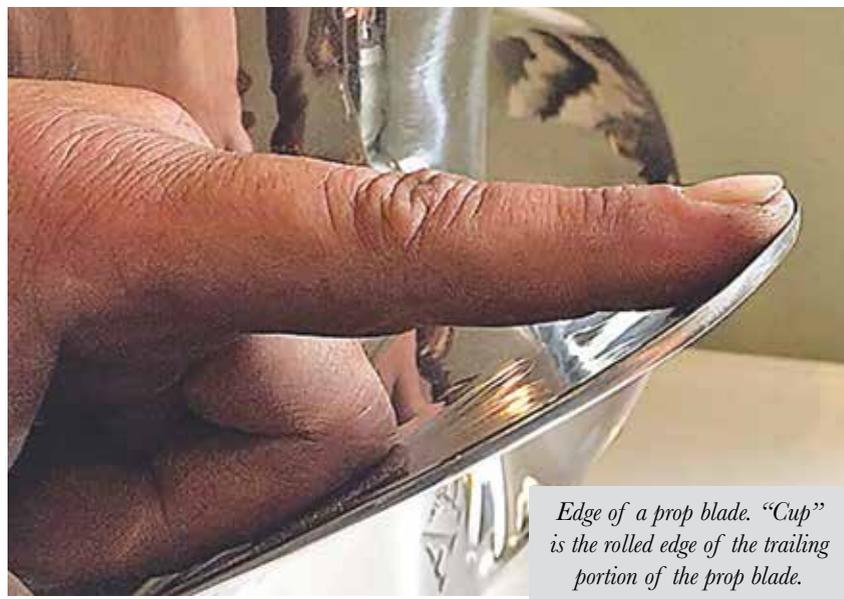
Gabe Capobianchi and his brother Mike own Precision Propeller in Newburgh, New York.



Diameter is one of the measurements used to identify a specific prop. The diameter of this propeller is 42 inches, as illustrated by my nephew.



Photo of a Mercury Enertia prop underwater.



Edge of a prop blade. "Cup" is the rolled edge of the trailing portion of the prop blade.

Watch the video on YouTube - www.youtube.com/watch?v=1dMNCrcx0gY



Mercury Black Max 20-25hp prop.

Diameter, Cup, Pitch, Rake - What do these all mean?

Pitch is defined as the distance a prop would move in one revolution if it were moving through a soft solid, like a screw through wood. So a 21-pitch propeller would move forward 21 inches in one revolution. **Cup**, another term you may have heard, refers to that rolled edge on the trailing edge of the propeller. (See photo above.) Its main purpose is to reduce slip, which is the difference between the actual and theoretical travel of a propeller. The difference is due to the need for an angle of attack in order to create forward motion. Most props are designed to a target of 10-percent to 15-percent slip. Adding cup can get the actual travel to become closer to the theoretical, thereby improving efficiency. Because stainless steel is stronger than aluminum, stainless-steel props can carry more cup than aluminum ones, improving efficiency as well. **Rake** is the angle between the face of the prop blade and the hub. Props with a high angle of rake increase bow lift and can maintain thrust better in the case of ventilation, which happens when air gets sucked into the prop from the surface; such props are therefore more commonly used for racing applications.

When customers come to my shop, they see many different propellers three-bladed ones, four-bladed models, aluminum props, stainless-steel beauties — displayed on my wall. Most gravitate to the shiny high-performance propeller, and they say to me, "Will that make my boat go faster?" My answer is almost always "What kind of boat do you have?"

There's no one right prop for every boat. In fact, even boats of similar length and weight may require completely different props. But with a little trial and error and some basic understanding of the terms we use to talk about props, you can find the one that works best for you. When you read about propellers, it's standard to identify a specific one by using two numbers, one referring to **diameter**, the second to **pitch**: 15 x 17, for instance, or 14 x 23. Diameter is the measurement of a circle circumscribing the tips of the prop blades. It's equal to twice the distance from the shaft centerline to the tip of one blade.

The Loaded Question

The interplay of all these factors comes together as load, the amount of force necessary to spin the prop at a given speed. Your engine has a wide-open-throttle range, expressed in rpm, that it should be able to rev to, if you give it the beans. For an outboard, it might be 5,000 to 5,500 rpm. Gas engines typically develop their highest horsepower at or near max rpm, so effectively you're testing whether or not you're overloading the engine by running a particular prop. If you're over-propped, meaning that the diameter is too big or the pitch is

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to great, the engine won't make it's rated max rpm, and you risk damaging it over the long haul by running it this way. Conversely, if you're under-propped, you risk over-revving the engine, pushing it beyond its redline, which can also cause damage.

The solution is to add or remove pitch or, in some cases, both pitch and a bit of diameter, because the two are related. Reducing pitch one inch will increase max rpm by 100 to 200 rpm; adding pitch will reduce your highest rpm by a similar amount. Experts recommend that you test this while lightly loaded (carrying less than half a tank of gas, with two people aboard) so that your boat will still operate within the proper range when you're running full of fuel and gusts.

Three-Bladed Versus Four-Bladed Props

Three blades versus four? Stainless versus aluminum? Just some of the questions to consider when choosing a new prop.

You may have noticed four-bladed props on boats at a marina or boat show and thought, "I wonder what that would do for my boat?" I often recommend a four-bladed prop to boat owners who enjoy tubing, waterskiing, and family outings. Four-bladed propellers have many benefits, including giving the boat more torque at the low end and in the mid range, which is ideal for waterskiing and tubing. They also get the boat to plane quicker. That extra blade is pushing more water, making the boat get up and go. You may trade off a bit of efficiency due to increased drag, but you'll also get better bite for low-speed maneuvering as well.

Stainless Steel Versus Aluminum

Customers always ask about the differences between stainless-steel and aluminum propellers. Aluminum is a softer metal, so aluminum props have less ability to endure the pressure and demands of higher-horsepower, higher-torque motors. They break more easily, but they're relatively inexpensive and cost-effectively repairable. A stainless-steel prop lends itself to having a more customizable shape. If you look at the number of different stainless-steel props that are available, you'll see that they come in many different shapes and sizes. So if your boat can't turn up to its rated rpm, or you're not happy with another aspect of its performance, look into a different prop. Now that you know about diameter, cup, pitch, and rake, the conversation at the chandlery or prop shop will go that much better.

Five Reasons You Might Need A New Prop

1. Is your boat slow to come onto a plane? If your prop has too much pitch, the engine will have a lousy "hole shot" — the ability to get onto a plane quickly — and will lug.
2. Does your engine over-rev and the boat seem slow? If your prop has too little pitch, the engine can rev past its redline, which is like driving your car on the interstate in second gear. Continuous running past an engine's wide-open-throttle rating will soon damage it.
3. Did you run over a log or hit a sandbar or a rock? A bent or nicked blade will severely affect performance and could even damage the engine and transmission. Note that a bad prop doesn't always look bad. If you feel a new wobble or vibration after bumping the bottom, get it checked.
4. Do you want your boat to be faster? As a rule, a stainless-steel prop of the same pitch and diameter will make your boat go faster — up to 2 to 3 knots, on some boats — than an aluminum prop. Stainless steel is stronger and can be made thinner, which allows more speed. Stainless steel also flexes less and keeps its shape at higher speeds.
5. Are you using too much fuel? It could be your prop. A dinged and bent prop can rob you of 10 percent of your fuel efficiency. Prop shops can determine how far out of specification your prop might be, and repair it like new if that's needed.

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