

Prop Shop

Propeller Testing



In order to assure maximum performance from Yamaha and Turbo propellers, they're tested here at our state-of-the-art Test Facility in northern Alabama. After the initial design phase of a propeller is completed and prototypes built, they're put through a rigorous regimen that includes on-water testing on multiple platforms in multiple configurations. The results of each test is exhaustively documented and compared to desired performance, so that any necessary improvements can be made. This testing process repeats until Yamaha is satisfied the propeller design meets not only their expectations, but yours.

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➤ Endless Propeller Solutions: Making the Grade

"Endless Propeller Solutions by Yamaha" represents the fact that Yamaha has a multitude of propeller solutions available...to fit most any boat. But do you really know what it takes to manufacture stainless steel propellers? It's a very involved, labor-intensive process that requires a great deal of time. We thought we'd give you a glimpse.



Wax mold



Ceramic shell

Once a design is finalized and satisfactory testing of prototypes is completed, wax molds are built. Around each of these is built a multi-layered ceramic shell, which is then dried and the wax melted out, leaving them hollow.

Many of our stainless steel props are manufactured domestically by Yamaha's wholly-owned subsidiary, Precision Propeller Industries, Inc.



Preheating the ceramic shell



Pouring molten steel

Stainless steel ingots of exact metallurgy are melted and poured (by hand!) into these preheated shells, which, when cooled, form the raw propellers.

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➤ Endless Propeller Solutions: Making the Grade | continued

After a trip through several stages of highly specialized grinding, the multi-stage finishing process produces the highly polished end products, which are then boxed and prepared for shipment.

Since nearly all of the above processes are done by hand, it takes a lot of highly skilled labor to produce propellers, especially to the exacting standards of Yamaha and Turbo®. Also, a very important element of "Endless Propeller Solutions by Yamaha" is product quality and consistency, so each propeller undergoes



Grinding

a rigorous inspection process at the conclusion of each of these steps.



Finishing

It takes not only a great deal of skilled labor to make a stainless steel propeller, it takes time, and lots of it. If all goes just right throughout the entire process, it takes about 21 days. This means it takes longer to make the propeller than it does many boats!

For more information, visit the "How They're Made" section at turbo-props.com.

➤ Spotlight on Technology:



Shift Dampener System (SDS™)

Yamaha's patent-pending Shift Dampener System uses a unique, splined rubber hub and special splined aft spacer to distribute and absorb the forces, and the resulting sounds and vibrations that are normally associated with shifting an outboard into gear. The result: far quieter and smoother, 'clunk free' shifting. "Amazing" is the word most-often used to describe the result.

SDS technology is currently available on all models of Yamaha Saltwater Series XL® 3-bladed propellers for its 5.3L V8 F350; and all Saltwater Series II 3-bladed props and Saltwater Series HS4™ 4-bladed propellers for Yamaha V6s. All of these propellers are renowned for their durability and superior mid-range fuel efficiency on larger offshore boats, along with excellent anti-ventilation characteristics for better handling in rough seas. Now, they're known for being super-quiet, too.



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➤ You've got propeller questions? We've got answers.

Our continuing series, aimed at demystifying the world of propellers. Portions are reprinted with permission from Yamaha's *The Boater's Log*, Vol. 3, No. 14.

Q. During a sharp turn, my outboard revs up but the boat loses speed. It seems like my three-blade propeller isn't gripping like it should. What's going on and how do I fix it?

A. It sounds like your propeller is ventilating – ingesting air from the water's surface when the boat leans over in a turn. The propeller doesn't work well in this aerated water, and as you suspected, the prop loses its grip – simply spinning rather than pushing the boat. This can also happen when trolling in heavy following seas. First, make sure your propeller's blades are in good condition. They should be clean and free of knicks and cuts. Next, try trimming the engine down when you turn or are trolling in these conditions. This keeps the prop deeper in the water for better 'bite'. If the three-blade still ventilates, you could try a different style of three-blade prop with a larger diameter, more cup on the blade tips, or perhaps a four-blade wheel. Each of these modifications can help your prop stay hooked up in the described conditions.



➤ Ventilation

Ventilation is when air is drawn in around the propeller blades. Normally, this causes a gain in RPM, but a loss of speed, since the propeller blades are not biting "clean" water. This most usually occurs during hard cornering or in certain water conditions, such as following seas.



Controlled ventilation can be beneficial, though, in helping the engine gain rpm during hard acceleration. This is engineered into certain propellers, and is most-usually used on two stroke outboards. An example of this is the small holes in the side of the propeller barrel which allow exhaust to intentionally be drawn in around the blades at hole shot. This helps two stroke engines generate the higher rpm they need for proper hole shot performance. Four stroke engines typically don't need them.



For more information, consult the "The Boater's Log" at yamahaoutboards.com



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Keeping It Clean

Over time, depending on how you care for your propeller and the environment in which you use it, what most folks call "rust and corrosion" can appear on the surface of a prop. So why is this, and what can be done to prevent it?



First, it's important to remember the propellers are stainless not stain-proof. We test and re-test our props to help ensure maximum resistance to corrosion while still maintaining the necessary hardness in metallurgy. But because there is a measure of iron contained in any stainless steel propeller, surface discoloration can appear over time. This surface discoloration is somewhat normal in certain instances. It doesn't affect performance, just appearance.

The best prevention is to thoroughly rinse the props with fresh water (and perhaps mild liquid soap) after each use. For more stubborn stains, you might also try a soft rag and spray-on household bathroom cleaner, hydrogen peroxide, or a mild rubbing compound. It's very important,



however, that you rinse the prop immediately and thoroughly with fresh, clean water after using these.

Remember, since surface discoloration is not a defect in materials or workmanship, and the environment in which a prop is used and how it's maintained is beyond our control, this condition is not covered under either the Yamaha or PPI Limited Warranty.

> Unusual Application of the Month

What about propping at high altitudes?

Air at higher elevations is less dense and therefore contains less oxygen, which causes most engines to produce less power, including outboards. To help counteract this effect, you'll need to use a propeller with less pitch than you would at, say, sea level, in order to produce proper wide open throttle rpm. But how much less?



Using a properly-performing propeller at sea level as a baseline guide, a very general rule of thumb is: From sea level to about 2500' above sea level, no change in pitch is necessary. After that, drop about 1" of pitch size for every 1000' of additional elevation to help keep the WOT rpm in the correct range.

Here's a very general run-down*:

- > Up to 2500' – same as sea level
- > 2501' to 3500' – deduct 1" of pitch
- > 3501' to 4500' – deduct 2" of pitch
- > 4501' to 5500' – deduct 3" of pitch
- > 5501' & up – deduct 4" of pitch

Also, avoid four-blades and real aggressive props with high rake angles. These make the engine struggle to create rpm. Less blade area and lower rake helps the engine develop rpm faster.

You can find 'baseline' propeller values for various set ups in our Performance Bulletins <http://www.yamaha-motor.com/outboard/products/perfbull.aspx>

*Pitch reduction amounts are estimates only, and are intended as a guideline only. Your results may vary. Large displacement engines, particularly late model fuel-injected four stroke V6s, typically require less pitch reduction for proper performance than smaller displacement engines. On-water testing is always best to determine proper performance.



If you'd like more information about which Yamaha propeller is right for your needs, contact your local authorized Yamaha Marine Dealer at <http://www.yamaha-motor.com/outboard/dealers/dealerhome/home.aspx>

Also, feel free to check us out on Facebook at <http://www.facebook.com/yamahaoutboards>

We'll be happy to help you get pointed in the right direction.

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