Yamaha's
Prop Shop
"Propeller news that you can use"
VOL. 5 | EDITION 2 | APRIL 2015

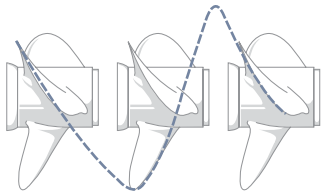
Three parts to proper performance

Don't forget about the propeller when it comes to overall boat performance (remember... without it, you go nowhere). It's one of the three major performance components of a boat package.

The propeller is perhaps the hardest working single piece of equipment on your boat, but it's many times taken for granted, and often overlooked when diagnosing a performance issue. For your boat to perform effectively, the prop you use must be the right one for the job and it must be kept in good condition **(see Prop Shop, Volume 2, Edition 1).**

What's news?

Propeller pitch explained



When it comes to propeller pitch there are three types of pitch that you might encounter – straight, progressive, and variable pitch. Each of these accomplish the same thing but in different ways. The pitch of a propeller blade will dictate how far the propeller can travel in one revolution. In fact the definition of propeller pitch is "the theoretical distance a propeller would travel in one revolution as if it were traveling through a soft solid" (think Jell-O) and this is represented by the indicated pitch number on the propeller. A propeller with an indicated pitch number of 25 would theoretically travel 25 inches in one complete revolution.

Most propellers will actually travel slightly less than their indicated pitch number. This result is known as propeller slip and is easily calculated with some simple math or one of the many slip calculators available online and in phone and tablet apps. For example, if that same 25 pitch propeller were to travel only 22.5" in one revolution, it would have 10% slip. Some level of slip is to be expected from all propellers, but the amount can vary greatly depending on the design of the propeller. Now that we have given you a brief overview of pitch, let's look at the various types of pitch.

Straight pitch

Straight pitch propellers are likely the earliest designs for accomplishing propeller pitch. A propeller that is designed with a straight pitch would maintain the same blade angle from trailing edge to leading edge. You would not notice any twist to the blade as you do with many modern propellers. This type of propeller would generally only have good holeshot or good top speed depending on the pitch. Lower pitch would provide good holeshot but have poor top speed, and a higher pitch would have good top speed but poor holeshot. It was for this reason that a better means of accomplishing pitch was desired.

(continued on next page)

YAMAHA

Yamaha's Prop Shop

Propeller pitch explained | continued

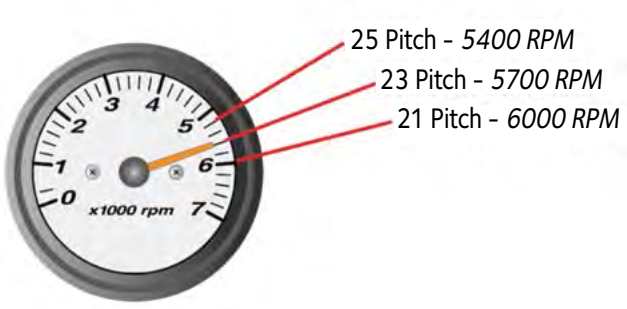
Variable pitch

A variable pitch propeller means that the blades actually mechanically rotate to change pitch as you increase from low to high speed. Many of these propellers are outfitted with a set of springs and cams that are adjustable by the user. Once installed and properly set up, the propeller starts out at a very low pitch (for excellent hole shot) and as the engine's RPM increases, the blades rotate to a higher pitch, for improved top speed.

Progressive pitch

The vast majority of modern propellers today utilize a progressive pitch, which gives the propeller blades that noticeable twist in their shape. A progressive pitch propeller actually uses different pitches as you move across the blade face. Because a progressive pitch propeller does not measure a constant pitch across the blade face, the indicated pitch number is determined by averaging the pitch measurements across the blade face. This average is done for each of the propeller blades and then the total measurement for each blade is averaged to give you the average pitch of the propeller. This allows the design of the propeller to give you the best overall balance of performance from holeshot to top speed. To make an analogy, straight pitch would be like a butter knife, while progressive pitch would be like a spoon. When it comes to moving water, the spoon is much more effective than the knife.

Pitch is one of the most important factors to understand when it comes to selecting the right prop for your boat. Too much pitch and the engine struggles to perform and doesn't make the most of its potential power, and too little pitch will let the engine spin too easily and not be able to achieve its full top speed potential. In fact every inch of pitch is changed is equal to approximately 150 ± 50 engine RPMs. If you increase your propeller pitch the engine RPMs will go down, and if you decrease propeller pitch the engine RPMs will go up. The easiest way to determine the correct propeller pitch is to check the owner's manual for the manufacturer's recommended wide open throttle RPM, and then test against your boat's maximum RPM while the prop is trimmed out for best efficiency. Most four-stroke Yamaha outboards have a wide open throttle rpm range of 5000 to 6000 RPM, but it is best if the engine is propped to achieve the closest RPM possible to the high end of the range. This will ensure that under normal conditions your boat and outboard are running at peak efficiency.



It is easy to see why pitch is so important when it comes to proper performance, and now you should know just a little bit more about pitch.

Yamaha's Prop Shop

Springtime boat prep

Spring has sprung, which means it is time to get your boat ship shape for the boating season. Most people only think about the motor itself…changing oil, spark plugs, fuel filters, etc. But what about the propeller? For most of us the propeller is sort of "out of sight, out of mind" and we don't think about it until we have to. A little time and a few simple checks now may save you precious boating time later this boating season.

Start by removing the propeller so you can get a better look at it on the bench. Go ahead and throw out that old cotter pin since you are going to replace it with a new one. (see Don't forget the pin? **Prop Shop Vol 3, ed. 2, September 2013**.)

Pull the forward thrust washer off (you might need to tap it with a flat metal punch and a hammer to get it free). Check for fishing line or other debris that may have wrapped itself around the washer or the prop shaft. If you find some, it may have damaged the seals in the gearcase. This would be a good time to contact your local Yamaha dealer and have the lower unit pressure tested to make sure there are no leaks.

With the propeller on the bench, start your inspection. If you have a propeller that uses a pressed-in rubber hub, look for signs of overheating or hub spinning. If the hub has spun in the past you will usually see chunks of rubber rolled up or melted around the edges of the hub. If your propeller uses a universal type hub such as the Guardian SQ-Lok™ Hub System, check for any cracks or splits in the hub or anything else that looks abnormal. Don't remove this type of hub from the prop to inspect it unless absolutely necessary. Regardless of the hub type your propeller has, you'll more than likely need to seek the services of your Yamaha Marine dealer or a local propeller shop for repair or replacement.

Check all the blades for nicks, dings or cracks. Make sure none of the blades are bent or distorted which could leave the propeller out of balance. Minor issues can be repaired by a reputable propeller repair shop. If you find any major issues, you should consider replacing the propeller and having this one refurbished to keep for an emergency spare.

If your propeller checks out with a clean bill of health, it's time to reinstall it. Before you put the propeller back on, take a minute to clean the old grease from the propeller splines, prop shaft, and thrust washer. Once clean, apply a light coating of fresh grease to the prop shaft and propeller splines, install the thrust washer, prop, and aft spacer. Tighten the propeller nut to factory spec and install that new cotter pin. Remember, if the cotter pin doesn't line up with the castle nut, always tighten further to align them and insert the cotter pin. Never back the nut off to line up the pin.

Doing an annual inspection of your propeller is easy and it can save you lost time and money if you catch problems early. Then you're free to tackle those oil changes, fuel filters, and spark plugs so that you're ready when that first warm spring day rolls in.

Yamaha's Prop Shop

Why should I have two props?

As mentioned before, there's no one prop that's right for all boating conditions. That's one big reason why there are so many different options, and why you should strongly consider keeping two propellers on hand. Here are a few others:

- The eventuality of needing a spare. Having a prop issue with a boatload of eager family members or with your fishing-fanatic buddies 70 miles out in the Gulf Stream is not the type of relaxed atmosphere you go boating for. You carry a spare tire in your car, don't you? Why not a spare prop in your boat?
- You need different performance from the same boat – like top speed for fishing in the morning and pulling power for skiing in the afternoon.
- Let's say you're all about top speed. Did you know that temperature swings on a single summer day can rob you of as much as 5mph? Even more between seasons, like spring and summer.

Being a prepared boater means many times having two propellers at your disposal, regardless of your reason. To find two that work best for your particular situation, talk with your local Yamaha Marine dealer **(yamaha-motor.com/outboard/dealers/dealerhome/home.aspx)** or check out our new website at **yamahaoutboards.com**

The Application Chart: Turbo® Offshore I

Coming from Yamaha's Turbo line of propellers, the Offshore I is an excellent performing four-blade propeller for a variety of applications. The Offshore I excels on many of today's bay boats due to its great stern lifting ability for improved shallow water holeshots and superior handling characteristics that many have come to expect from a four-blade propeller. Don't forget about those twin or triple engine offshore center consoles. With right and left hand pitches ranging from 15 to 25, the Offshore I will perfectly complement many of these vessels. Since this propeller comes from our Turbo line, it utilizes a universal hub system so it can be fit to any brand of outboard furthering its wide applicability. The Offshore I is available at over 2000 Yamaha Marine Dealers and 400 Turbo propeller dealers nationwide.

Diameter	Pitch	Blades	Rotation	Material	HUB	Part No.
OFFSHORE I						
14 1/2	**15**	**4**	**RH**	**SS**	**See Hub Chart**	**MAR-14415-0R-E0**
14 1/2	**15**	**4**	**LH**	**SS**	**See Hub Chart**	**MAR-14415-0L-E0**
14 1/2	**17**	**4**	**RH**	**SS**	**See Hub Chart**	**MAR-14417-0R-E0**
14 1/2	**17**	**4**	**LH**	**SS**	**See Hub Chart**	**MAR-14417-0L-E0**
14 1/2	**19**	**4**	**RH**	**SS**	**See Hub Chart**	**MAR-14419-0R-E0**
14 1/2	**19**	**4**	**LH**	**SS**	**See Hub Chart**	**MAR-14419-0L-E0**
14 1/2	**21**	**4**	**RH**	**SS**	**See Hub Chart**	**MAR-14421-0R-E0**
14 1/2	**21**	**4**	**LH**	**SS**	**See Hub Chart**	**MAR-14421-0L-E0**
14 1/2	23	4	RH	SS	See Hub Chart	MAR-14423-0R-E0
14 1/2	23	4	LH	SS	See Hub Chart	MAR-14423-0L-E0
14 1/2	25	4	RH	SS	See Hub Chart	MAR-14425-0R-E0
14 1/2	25	4	LH	SS	See Hub Chart	MAR-14425-0L-E0

indicates most popular propeller family per engine group/gearcase size **BOLD** type indicates most popular pitches

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

For short videos on Yamaha propellers, including proper installation, maintenance, and more, scan this symbol using your smart phone or tablet.

Message and data rates may apply. May not be available on all devices.

Also, please join us on Facebook at **facebook.com/yamahaoutboards.** We'll be happy to help you get pointed in the right direction.

Turbo® propellers are manufactured by Precision Propeller Industries, Inc. a wholly owned subsidiary of Yamaha Motor Corporation, U.S.A.

YAMAHA