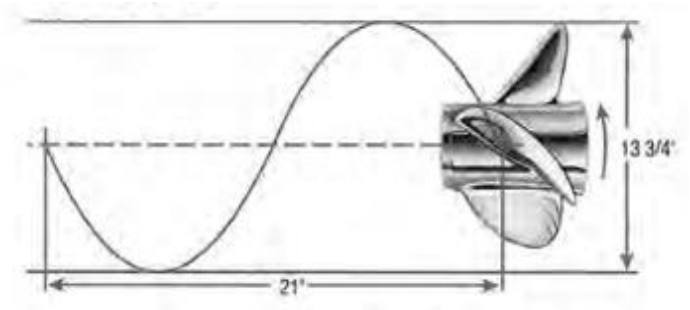
Propeller Selection

Some of the most frequent questions here are – "what prop do I use" or "I want more speed."
So I have put this simple guide form various sources to allow you to figure out what you need.

Some background information ….

If you think of a prop as a screw … for each full revolution it will move (in theory) a distance equal to pitch of the blades.

So for a 21" pitch prop :



The diameter (shown as 13.75") is set by the drive, so just use what the manufacturer has designed

Q. So if I want to go faster I simply put on larger pitch prop

Ahhh that would be a no.

For acceleration (holeshot) to get you from standstill to up on plane quickly you need grip on the water and good engine torque transferred to the water, to achieve this you need a low pitched prop, think of a car …. Driving in 1st gear it accelerates quickly but limited top end. If you started in 4th it will bog down and take a long time to get to speed … at the end its faster, but slow to get there.

Q. So can I get a low pitched prop to start and a high pitched for speed

Yes, using variable pitched blades, large cruise liners use these … just too inefficient for a small high speed boat.

There is a new concept – a Sharrow blade … like having 2 props in one … but as these are almost 20x the price of a standard prop.

The basic process

Every engine has a working power band, referred to as Wide Open Throttle (WOT) band …. This is a range within which the engine should operate when at full throttle.
For example my own boat has a range 5400 – 5800 rpm
Now you know what it should be, you need to find out what yours is in reality.

Take your boat for a spin, with your normal load of people, fuel & kit, run it to full throttle, trim out the drive correctly for speed and record the rpm, get an average over a couple of runs.

If your RPM falls in the WOT range then your pitch is correct.

If you cannot get to the lower number then your prop is pitched too high, and engine can't spin it fast enough, no real risk other than inefficient. (known as over-propped)

Now if you are above the higher number your prop is too low a pitch – this is a HIGH risk, as you can over-rev the engine and cause permanent damage, or at least early failure. (known as under-propped)

In both cases you change up or down a pitch to get into to the WOT band, ideally the centre of that band,

As a guide a 1" change of pitch will affect the engine by around 200rpm.

So to clarify if your WOT is 5400-5800, and your test run shows you to be only getting 5200 rpm, then you can drop the pitch by 2", and that should bring you right into the centre of the WOT band.

Q. So is that all …….

No, you need to make some other choices.
The ideal prop would be 1 blade … as minimum losses, most efficient ….. but vibration would be awful.
Now you need to consider your intended use.

Do you want a high end cruising speed …. If so then a 3 blade prop will be your best choice, more efficient, lees drag (than 4 or 5 blade), reasonable acceleration, good top end.

Examples are ***Mirage Plus, Laser II, Vengence***

If you want a bit more low end pull for popping occasional skier then this is where a 4 blade scores better, the 4 blade gives more holeshot, without sacrificing too much in top end (3-5 mph), usually slightly improved mpg.

Examples are ***Trophy, Revolution 4***

For those that want the best acceleration, exceptional hold in the turns, both of which suit towed water sports, then the choice move to a 5 blade.

These really 'grab' the water and pop the boat out onto plane, engine runs smoother, the trade-off being loss of top end, this has been countered by cupping the blades well, to perform better when at high speed, so minimises the top end loss (around 5mph)

The best known example is the ***HIGHFIVE***

Q. So where do I start …..

If your boat is new, then your manufacturer should have propped it correctly.

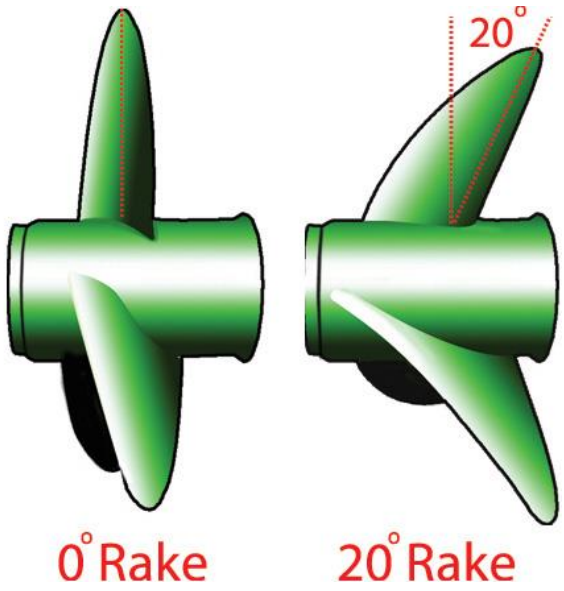
If not new, then a simple start is to ask others who run same boat, engine & drive and find what pitch they use. (but they may not be optimised)

There is a good interactive Prop guide on:
https://www.mercurymarine.com/en/us/propellers/selector/#!/step-one

There are other considerations, which allow manufacturers to offer several props in the same pitch

Rake

Which is the angle (front to back) of the blade is also a variable, more rake will increase bow lift.

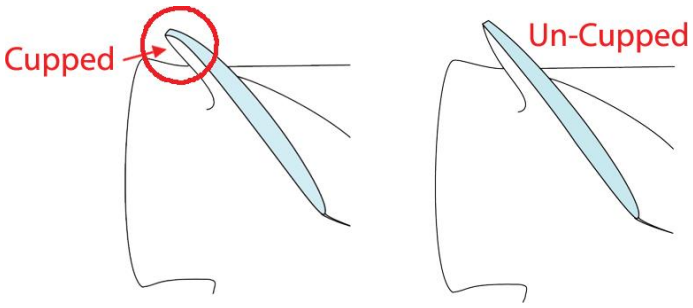


Cavitation

Cavitation is when your blade lose grips on the water, this is caused by the drop in pressure of the water in contact with the blade, causes it to boil ….. this can damage a blade surface, and lose a lot of power.

A well-matched blade of correct pitch & diameter will minimise cavitation …… there is an added design technique to overcome this …. cupping

Cupping



A cupped blade 'can' improve considerably the efficiency at higher speeds.

Venting

Some Mercury Propellers are fitted with holes behind each blade, the theory being you can vent off air bubbles, aerating the water, this makes it 'lighter' and allows prop to get up to higher RPM quicker.

This is referred to as the PVS system, you fit differing size plugs with thru holes in them, to tune performance to what you want. In practise you can fit a blanking plug and drill holes in them to tune. It can assist heavy boats to get on plane quicker – useful for lower torque engines.

They only affect the start and pay no part in running at speed.

The Manufacturer

Q. Do I need to stay with manufacturers props

No, there are many prop specialists such as **SOLAS or Michigan Wheel** who produce their own props, at often much better prices.

Specialist 'Prop Shops' or resources such as 'Propeller Warehouse' or 'Prop Gods' (who come to you) can help you from their experience select the optimum prop if you don't feel up to making your own choice.

Material

I am going to discount nylon, wood & brass as in the main we are owners of sports boats, so the choice is Aluminium or Stainless Steel.

Aluminium props are cheaper, and if you boat in an area where strikes are likely it may be a valid consideration to get this material, cheaper to repair or replace.

Stainless Steel has always been my preferred choice, the benefit being much more resilient to minor impact damage … but if you hit rocks hard they will bend. The design advantage is that the material allows for thinner blades, means less drag & more efficiency … they also hold their shape without flexing.

Plus a shiny SS prop looks much better than a dull Ally prop with half the paint missing,. 😊

Repair

Q. Can I get a prop repaired

If You boat long enough and you will probably whack your prop at some point …. If you are lucky its just a bent blade, if a hard strike then hopefully the hub saved you form gearbox damage and broke as designed (eg plastic Flo-Torque hub on Mercury) Simple to fit new hub.

Both aluminium & SS props can be repaired, and many specialist prop repair shops exist.

They can take what can look like a total write off and return as good as new, all props should be re-balanced as part of repair …… and most shops will offer to re-pitch if you wish, this allows you to take the prop pitch up or down … around a 1" change is easily obtained if required.

Resources:

SOLAS https://www.solas.com/exec/product.php?mod=&cid=92&lg=E

Mercury https://www.mercurymarine.com/en-gb/europe/propellers/

Michigan Wheel https://www.miwheel.com/

Turning Point http://www.turningpointpropellers.com/

Prop Gods https://propgods.com/

Propeller Warehouse https://www.boatpropellerwarehouse.com/

Hope this helps

Rick Hughes