

Horsepower ratings and re-powering your outboard boat:

Repowering an outboard boat is a subject that gets frequent and often hot discussion on many boating forums. Of course, if the owner simply wants to replace their current outboard with a new one of the same rating, that is not an issue. Where it becomes an issue is when they want to put on a higher horsepower motor. The issues here are: safety, boat performance, fuel consumption, and legality.

Safety:

What are the safety issues? They are primarily stability at rest and stability when moving, and an issue of flotation. Most small boats are required by Federal Law to have positive flotation. That is, if the boat fills up with water, it will not sink and will float upright. The law applies to monohull outboard boats under 20 feet, but manufacturers put flotation in almost all types of boats up to about 26 feet. One of the crucial factors in getting a boat to float upright when swamped is the weight of the outboard. There is a separate calculation for the right amount of flotation to support the engine in an upright position. If you put a bigger heavier engine on, the boat may no longer float upright when swamped.

Another problem is stability at rest, generally called static stability. The manufacturer does calculations using the weights of all the materials on board. They try to balance the weights so that the boat floats without a list and is balanced both side to side and fore and aft. They also try to make the boat less sensitive to movement of weight, that is if you move yourself or some weight to one side, the boat doesn't dramatically heel or suddenly roll over. Part of the calculation is the weight of the engine. With an outboard mounted on the centerline of the transom, the vertical center of gravity of the engine becomes very important. It should be only a few inches above the top of the transom. If you put a much larger engine there, the vertical center of gravity moves up, making the boat easier to heel (lean over). For a better explanation of this see Stability Of Small Boats <http://newboatbuilders.com/docs/stability.pdf>

The weight of the engine also affects the longitudinal center of gravity, that is, the position of the center of gravity lengthwise. The heavier engine moves the CG toward the back of the boat, causing the stern to go down and the bow to go up. This affects the stability of the boat making it more sensitive to leaning or rolling over. It lowers the transom in the water making it easier for waves to wash over the transom and into the boat.

Stability of the moving boat is called dynamic stability. It is affected by the static stability, and the hull form. As a boat rises on to a plane, less of the hull is supported by the buoyancy of the hull, and more is supported by dynamic forces, but the dynamic forces work over a much smaller area of the hull than the buoyancy forces do when standing still. In addition, the vertical CG moves up as the boat rises, reducing the forces acting to keep the boat upright. So any shift in weight or motion of the boat to one side is resisted by less force than when the boat is standing still. Putting a heavier and more powerful engine on the boat changes the balance and may cause the boat to have erratic behavior such as chine walking (oscillating side to side) and porpoising (the bow oscillates up and down). If the change is extreme it may result in the boat nose diving, or suddenly flopping to one side. Also it could cause the boat to kite (fly up in the air) or swap ends (spin out). These behaviors can cause serious injuries and can be fatal.

Performance:

Most of the people who put on a bigger engine do it to simply make the boat go faster. They are usually very disappointed to find that they don't gain much, maybe 1 or 2 miles per hour. This is because the speed of a boat is a combination of the hull form, length of the boat, the width, the weight of the boat, the horsepower, and the propeller. For most outboard boats to gain 5 – 10 mph you would have to almost double the horsepower. They could have achieved the same increase in speed by cleaning up the bottom of the boat, making sure the planing surface is straight (not curved) and trying different propellers. They would have gained 1 or 2 mph and made the boat more efficient, saving gas.

Fuel Consumption:

A bigger engine will consume far more fuel than the smaller one. To gain more horsepower, and thus more speed, you have to expend more energy. That simply means more gas. To gain 5 – 10 mph you would have to almost double the horsepower, significantly increasing fuel consumption.

Legality:

The Federal Regulation for horsepower ratings for monohull outboard boats under 20 feet in length (33 CFR 183 subpart D), requires a boat manufacturer to place a label on the boat specifying the maximum safe horsepower for that boat. The horsepower rating is determined using a

formula specified in the law. See my page on horsepower <http://newboatbuilders.com/pages/hp.html>. This regulation does not apply to boats 20 feet and longer, and does not apply to multihulls, pontoon boats or inflatables. But the crucial point is, this regulation applies to manufacturers, not boat owners. So, is the boat owner violating the law if they put an outboard on their boat that exceeds the value on the label?

Not from a Federal stand point. The Coast Guard is not going to cite you for over powering. If the boat is erratic and obviously a danger they may cite you for negligent operation, but that is another issue.

What about state laws? Yes! Many states have passed laws requiring that you cannot exceed the values on the capacity label, which includes the horsepower rating. So by simply putting a larger horsepower motor on your boat you may have violated state laws and could be fined.

What about boats over 20 feet? Again, if the boat has a label with a horsepower rating, the state may cite you, even though the label is not required by Federal regulation. State law enforcement officers look for the label. They make no distinction between a Federally required label and a label voluntarily placed on the boat by the manufacturer. So, should you remove the label? No, because, you may be caught in a spider web of liability issues with your insurance company and if you have an accident, with someone suing you. The same applies to other boats such as pontoon boats and inflatable boats that have a label but are not required by law to have one. Both the American Boat and Yacht Council (ABYC), the industry standards organization, and the National Marine Manufacturers Association (NMMA) require their members to put capacity labels on the boats produced by their members. That includes the manufacturers of about 80% of the boats sold in the USA.

Most boat manufacturers use the ABYC or NMMA standards as their guide. The NMMA standards are taken directly from the ABYC standards. Most attorneys and courts use the ABYC standards as the defacto standard. So if the manufacturer puts a label on the boat in accordance with ABYC that is what you will be held to. Marine surveyors and marine accident investigators also use ABYC standards as a guide. If during a survey or investigation they find that your boat exceeds the horsepower rating for that boat, they will note that in their report. This will not help you if you are charged or sued.

The conclusion: Don't do it. If you want to go faster, get a bigger boat.