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By Stephen Sommer

How Slow is Too Slow For Your Diesel?

Steve,
I have heard that it is detrimental to run diesel engines at a low percentage of their rated output power. Is it detrimental to the life of my 30 horsepower engine to run it for two hours per day at 1200 RPM for battery charging?

Your question touches upon one of the worst areas of misconception and bad information in the cruising technical world. While it's true that it is possible to run a diesel at very low speeds and power output levels, harming the engine, this concern is grossly over-done in most cases. I have even seen companies doing a brisk business of selling huge load-banks for increasing the load on gensets, when the loads are low. This is rarely, if ever, required. If it's not required, it's a gross waste of diesel fuel and wear and tear.

Rules of Thumb are useful for understanding the issue. Propellers and transmissions are **matched** so that 100% of engine's output is required to turn the propeller, when the full speed output of the engine is reached. The pitch of the propeller is adjusted so that the full output of the engine is required to reach full RPM. The **propeller curve** defines the amount of power required to drive a propeller at slower RPM. Generally, the power required to drive a propeller increases with the "**cube**" of the RPM. For instance, if you are running at one half of full RPM, the horsepower required is 1/8th of full power. (½ x ½ x ½ = 1/8) If you find it hard to believe that you are using such a small fraction of the available power of you engine, consider this **fuel consumption** rule of thumb: modern quality diesels consume about one gallon per hour for every 20 horsepower of output. If you usually use ½ gallon per hour of motoring, you are producing ten horsepower at most! One final rule of thumb: One horsepower is required for each 25amps of alternator output, after allowing for various losses.

In your case, if you have a 100amp alternator, you are drawing about four horsepower from the engine. Let's compare this to the propulsion load that the engine would be driving at that RPM. If your engine is properly matched to the propeller at 3600 RPM, you are charging at 1/3 of the full load speed, which means that you would be driving 1/27th (1/3 x 1/3 x 1/3) of 30 horsepower in to the propeller if it were in gear, or about one horsepower. You are actually loading the engine much more heavily when charging than when motoring slowly, at 1200 RPM. If you charged at 1800 RPM, one half of full speed, you would be closely emulating motoring at 1800 RPM, which would require 1/8th (½ x ½ x ½) of 30 horsepower. The question, surprisingly, is whether you are over loading the engine when charging at 1200 RPM.

There's no simple rule of thumb for the issue of **available horsepower** from your engine. Try to get a power curve from you engine manufacturer that shows this. They almost always include a "propeller curve" also on these graphs, which will show you what power is available at medium speeds. It's sometimes hard to find out whether the curve they provide defines to maximum possible output at various speeds, or whether it shows the power recommended for continuous operation. To be safe, avoid trying to use anywhere near all the available power. Generally, the power available is greatest at medium speeds, so when in doubt, avoid the lowest and the highest speeds when drawing a lot of accessory power from the engine.

Now for the touchy issue of **minimum speed**: You will get every answer that you can imagine from sources that you expect to be well informed. (Remember the guys that sell genset load banks.) One very well respected diesel manufacturer provides some specifics. They define the oil change interval to be 250 hours **or** a specific number of gallons of fuel burned. If you do the math, you only get the 250 hours oil change interval if you run the engine at less than ¼ of the maximum power level. That tells me that you certainly don't have to run diesels at more than ¼ power to keep them running OK. This same manufacturer claims that any power level is OK as long as the propeller is matched and as long as you do a full power run for a couple of minutes for every 5 to 10 hours of very low power operation. This same manufacturer provides a remote control extra low idle setting to make slow maneuvering easier. This tells me that they do not want you to use the extra low idle for long periods of time. Never let your engine run at bare idle speed for long periods. My personal rule of thumb is **never** leaving an engine running at less than 1000 RPM. I wish I had this type of detailed information from a lot of manufacturers, but it doesn't seem available.

As always, check with your engine manufacturer's recommendations, but it looks like you are OK. As with all lightly loaded diesels, it would be a good idea to run the engine under load at near full power for a couple of minutes every few days.

If you have a 200-amp alternator, I certainly wouldn't worry about under-loading the engine. I would even suggest that you run at a higher RPM to get to a higher point on the available power curve.

Anytime you have accessories that can draw more than 20% of the engine's power, I recommend that you install a switch in the cockpit that disables you alternator. It's not often, but sometimes you need all the power for the propeller.

Stephen Sommer is a degreed electrical engineer with extensive experience in electrical, mechanical, refrigeration and air conditioning systems and holds a USCG Masters license. He consults in all areas of yacht systems, which include all the equipment on board yachts beyond a basic hull and motor or sails.

Have a systems problem or question? Ask Stephen Sommer. Email: steve@boatek.com