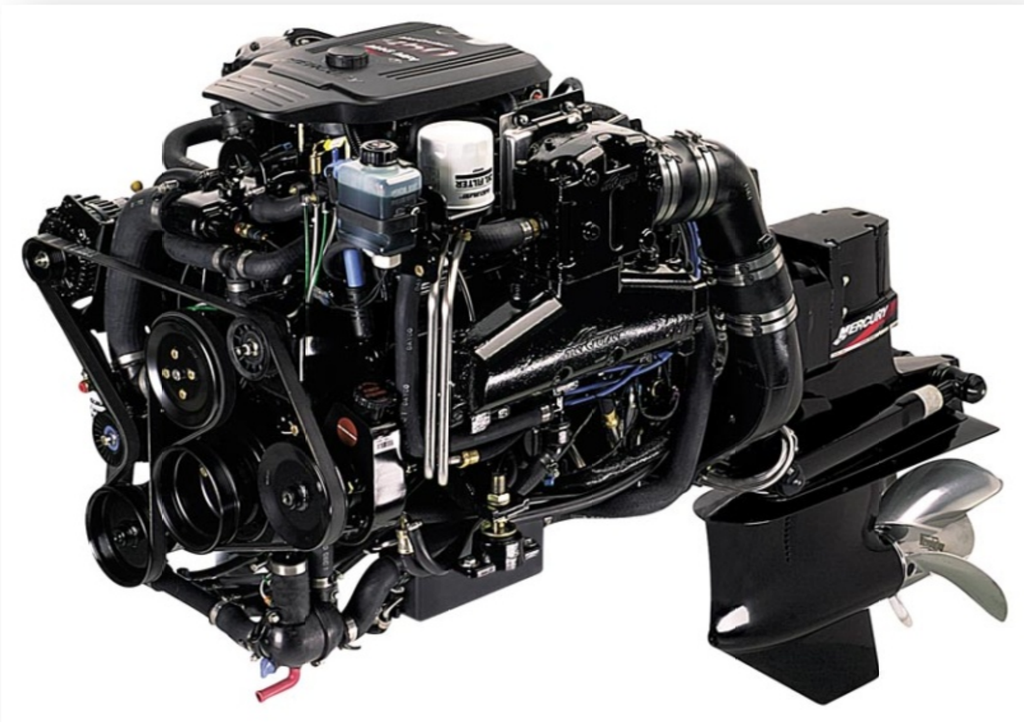
GAS vs DIESEL

One of the most frequently asked questions we get concerns the power choice of gas versus diesel. Lately we've received more e-mail on this subject than any other. OUr difficulty in answering that question has a lot to do with common misunderstandings about the nature of these engines. Most people make choices based on popular beliefs, without any real understanding of the nature of this rather complex subject. In this essay, we will attempt to dispel some of the myths, and give a brief discussion of the basis by which one should consider the pros and cons of each choice.



Myth #1: Diesel is safer than gas. For some reason or other, the fear of gasoline explosions, which are very rare, but had caused some rather spectacular accidents thirty years ago, just won't die. The facts are that gas engines are very safe and you probably stand a better chance of dying or being injured in an airline crash that you do in a gasoline fire or explosion. Yes, gas engines do pose a carbon monoxide hazard, but most of this hazard comes from gas generators.

Diesels are safer from the standpoint of explosions as diesel oil vapours are not explosive. Prior to the advent of water cooled turbochargers, statistics show that fires caused by diesel engines ran nearly 5 times the rate over gas engines. With the introduction of water cooled turbo, the rate of fires has come way down.

Of far more concern is the issue of carbon monoxide poisoning. Diesel exhaust produces far less CO than gas exhaust, though diesel exhaust produces sulphur dioxide that can quickly cause nausea, but is not life threatening. Gas generators are responsible for most instances of CO poisoning, with leaking exhaust systems and station wagon effect a very distant second place. If you plan to do much over-nighting at anchor with a generator running, diesel is definitely the way to go.

Myth #2: Diesel engines run for thousands of hours before requiring major maintenance. Diesel engines gained the reputation for longevity based on their use in continuous operation such as trucking, generators and commercial vessels. Diesel in trucks and commercial vessels can run for thousands of hours because they often are run continuously without ever being shut down, or shut down only infrequently. Without going into a technical explanation, this is what accounts for long life in commercial applications. That does not mean, however, that they last longer in terms of the calendar: commercial engines run for vastly more hours, but have to be rebuilt just as frequently by the rising and setting of the sun.

In pleasure craft use, diesels not only don't run continuously, but they are often rarely run. And in this case, it is the disuse that leads to their early demise. The reason for this is due to corrosion. An engine that is not running, especially for extended period of time like weeks, yet alone months, develops internal corrosion in all parts of the systems so that wear is greatly accelerated. An engine that is running all the time precludes most of this corrosion from occurring. Diesel engines in pleasure craft almost never wear out; they break down due to corrosion damage and other maintenance deficiencies.

Myth #3: Diesels are more economical. At one time diesel fuel could be obtained for 1/3 the cost of gasoline, but when you look at the price on the marina pumps today, at best its only 10-15% less. Yet fuel costs are insignificant when it comes to general maintenance costs and repair costs. I'll use two engines of comparable power to illustrate, a MerCruiser 300 HP gas and a Volvo 260 HP diesel engine. The MerCruiser engine was removed from the boat and rebuilt on the bench in a shop; the Volvo rebuilt in place in the boat. Costs: The MerCruiser bill was $5,440 and the Volvo $13,984, nearly triple the cost. Did the Volvo run substantially longer to justify the additional cost? No, it didn't. In fact, the Volvo engine was only one year older than its gas cousin, and both engines had 800+ hours on the hour meter. Diesel parts are much more expensive and mechanics charge on average about 30 - 50% higher labour rates over gas mechanics.

Myth #4: An engine with low engine hours as registered on an hour meter is better than one with high hours. Remember that hour meters turn on and off with the ignition key while the cosmic time clock never stops ticking. Why is this important? Because corrosion and internal degradation continues at a more accelerated rate when the engine is not running than when it is. A six year old boat with only a few hundred hours on the meter is telling you that it hasn't been used much. That means that it is much more likely to have wear and corrosion related internal damage than one that has had much more use.

Myth #5: A diesel engine can have an expected life expectancy of several thousand hours. Patently untrue. The average life expectancy of a marine diesel engine in a pleasure craft is somewhere around 1500 hours between major overhauls. The average boat reaches this in about 8-10 years, meaning that the average annual operating time averages around 150 hours. If that seems unrealistically low, consider that that translates into 2-1/2 weeks of eight hour days. Most boats have years when it’s even less than that. If this surprises you, it may surprise you even more when I tell you that gas engines average around 900 hours before overhauls.

The Problem With Light Weight Engines There is a direct relationship between service life and the weight of engine blocks and cylinder heads. The heavier or thicker the castings, the longer they will last. That's one of the reasons why older engines just seem to go and go, while we often refer to the engines of recent years as "throwaways."

The problem with light castings is a problem of both strength and heat distribution. Diesel engines, with their 350-550 lb. internal cylinder compression, develop tremendous heat within the cylinders and heads. When castings heat up they expand, and when casting thickness is unequal, this can lead to cracking. It follows then, that the thinner the casting, the weaker it is, and therefore more prone to heat distortion and cracking.

This has been one of the major problems of trying to adapt light weight automotive engines to marine use. Because the loads are much greater, more heat is generated, and therefore more distortion of the castings occurs. And when distortion occurs, the close tolerances of the moving internal parts such as crankshaft, bearings and journals, rods, pistons and cylinder walls goes out of whack. The end result is an early demise of the engine. Therefore the move to adapt high speed, light weight small truck engines to marine use results in an engine with a decidedly shorter service life. One of the most common problems that we see with light engines is the frequent cracking of cylinder heads, which is the first place that designers seek to reduce weight.

Over-fueling Another reason why high performance, light weight diesels don't last long is related to over-fueling. When you take an automotive engine that doesn't require as much power to push its load, and increase its power output, you do so by increasing the amount of fuel and air. This not only creates much more heat, but it has yet another side-effect: the increased fuel injected into the cylinder washes away the lubricating oil on the cylinder walls. This is true of both gas and diesel engines. The primary cause of all high performance engine failure is related to the pistons. This is closely followed by failures in the valve train, which is greatly stressed by increased heat and stress. To overcome these problems, these automotive engine systems must be completely redesigned. Unfortunately, they often are not.

Why not? You have to understand that the marine engine market is a rather limited market that doesn't generate the kind of revenues that the automotive market does. Over the years, this has been a universal problem for marine engines of all kinds, namely that the marine conversions simply don't go far enough to account for the differing service loads. And with the push to produce more efficient and clean-running diesels, the problem of marine conversions promises only to get worse, not better.

Small Boats and Diesel Engines: The question of whether gas or diesel is a better power choice dissolves for boats of a certain size or weight. I draw this line somewhat arbitrarily at around 16,000 lbs or 35 feet. I say "arbitrarily" because a lot of other factors come into play such as hull efficiency and windage in superstructures, but generally speaking you can use these numbers as a general guide line.

Diesel becomes the better choice in direct proportion to the amount of weight being propelled. In a word, the reason is "torque." Horse power and torque are two different measures of power. Torque is a measure of the kinetic energy that builds up in a rotating engine. The higher the torque, the more power it takes to slow the engine down or, in other words, it takes more power to make it work harder or, the engine will carry a heavier load with less strain. Diesel engines develop more torque for several reasons. One is because of their greater mass: heavier parts develop more kinetic energy. But they also have compression ratios three times that of a gas engine, which also develops more torque. Gas engines develop most of their horse power at the top end of their RPM curve; diesels develop more power lower on the speed curve because of their greater torque, which can be thought of as the reserve power behind the rotating shaft.

Thus the diesel's great advantage is carrying more loads with less strain on the engine due to higher torque generated. (This is only true for heavy marine diesels; small, lightweight diesels, such as those made for small trucks, have a much lower advantage simply because the torque is lower). When dealing with lighter loads, that advantage disappears. There is also an issue of kinetic energy, which is energy that builds up in rotating parts such as flywheels, which helps sustain the load. Another advantage is that the diesel will develop that power with significantly less fuel. But that advantage is nullified by the much higher initial cost of the machine itself. The only real advantage is in the amount of fuel tank space savings since you can have smaller tanks with a diesel. Otherwise, few boaters run enough fuel through diesel engines for fuel savings to make up for the high initial cost.

By the time a boat reaches 16, 000 lbs. or around 36 feet, it is approaching the limit where a gas engine can power it efficiently. Not only is there the issue of weight, but the water resistance on a larger hull. Gas engines begin to build up too much internal heat and the strain begins to result in lower service life in larger boats. We're talking here about the big block, 454 CID V-8's that are the largest gas engines available. These engines at 300-425 hp usually do very well so long as they're not pushing a too heavy load.

Speed -vs- Weight Yet other factors come into play, engine speed and weight. There is no escape from the fact that fast turning diesels have substantially shorter life spans. Slow speed diesels can be longer lived precisely because they do turn much slower. But when you soup them up, that advantage is lost, for a variety of reasons. Diesel engines running at 3200 to 3600 RPM are lightweight automotive engines for which good service life should not be expected in marine applications. A vessel in water and a vehicle on wheels are two entirely different load situations. The light weight diesel was not designed to push heavy vessel loads any more than the gas engine was.

Whether its gas or diesel, its a universal axiom that the faster you want to go, the more it will cost you, not only in terms of fuel costs, but in terms of engine life. We've already discussed why high performance diesels have a very short service life, but I've not yet mentioned that high power gas engines suffer the same fate.

A pair of medium weight diesels can easily weigh 2,000 lbs. more than a pair of gas engines. In a 30' boat, an extra ton is going to result in a considerable speed loss because of that extra weight. In terms of speed, this gives a considerable edge to the gas engine. While everyone knows that gas power is faster, few people consider this point. The light weight diesel at least gains the advantage over the heavier counterpart in terms of speed potential, but looses out in the long run on longevity.

The One Big Diesel Advantage If one is willing to travel at slower speeds, the one great advantage that diesel holds over its gas counterpart is lower fuel consumption, lower fuel cost and greater range. If fuel range is a consideration, then diesel wins hands down. Of course this is entirely dependent on how fast you want to travel; if you want to run at the same speeds as gas power is capable of, then even that advantage fades.

Yet many people make the mistake of thinking that because fuel costs are less, the overall operating cost is less. This is simply not true when you figure how much lower cost diesel fuel you have to burn to make up for the added cost of the engines themselves. The "average" boater running his boat at 150 hrs/yr. will never see any advantage from lower fuel costs or consumption. Not when the option for diesels costs something like $30,000 or more.

By now you should begin to understand why small, light weight diesels are not necessarily a better choice for small boats. That is, of course, unless you just "want" diesels, which a lot of people do, but not necessarily for rational reasons. The argument for gas engines is that they're cheap, efficient, and far less costly to maintain. And they are certainly just as reliable as diesels, all things considered.

If you still want diesels in that 28 or 32 footer, just remember that you're paying a very substantial premium for them without much in the way of benefits.

And since we're talking about small boats (well, small by some people's standards), if maintenance costs are a concern to you, think twice about buying a boat with large engines crammed into small spaces. If it’s going to cause you pain to write a cheque for $1500 or $2000 for what should seem to be normal maintenance work, you had better consider whether a repairman has to dismantle part of the boat in order to change a water pump or whatnot.

Beware that there's always a trade off for the boat that seemingly has everything, because the extra space was obtained at the expense of engine room or compartment space. When the engines are put in with a shoe horn, rest assured that every aspect of maintenance is going to cost you more, and sometimes a lot more. This is particularly true when considering a used boat. If the front and outboard sides of the engines can't be seen, yet alone reached, problems develop that aren't observed, and therefore not maintained or repaired. There's not much chance of discovering a serious problem and correcting it before serious damage is done. When surveyed, boats with tight engine compartments almost invariably are found to have more engine problems than boats with engines that can be reached on all sides. Its a seemingly small thing that usually adds up to big dollars. Small boats with big diesels are usually the worst offenders.