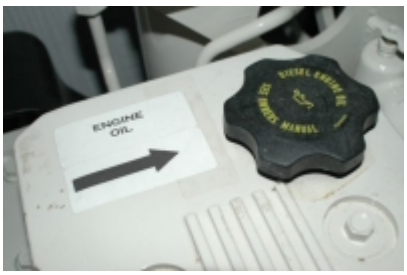
# Oil Change Fundamentals

A Steve D'Antonio Marine Consulting client recently sent me an e mail inquiring about the proper procedures for an oil change.  She didn't have the time to carry out the oil change herself, entrusting it instead to a professional.  However, she wanted to be certain the professional was doing it the right way and thus asked for a "guideline".  She also apologized for asking the question because she said, "I realize it's probably hard to mess up an oil change, right?" The following blog entry is an edited version of an article I once wrote on this subject and formed part of my response, you be the judge.

Whether you carry out oil changes yourself or if you hand it over to your favorite mechanic, all of the following principles apply.




Years ago a well know manufacturer of oil filters used a catchy slogan that went something like this, "pay a little now or a lot later".  The inference being, pay a few bucks for one of their oil filters, or big bucks for a major engine repair.

Changing the oil in your engine, be it your boat, car, lawn mower or any equipment that uses an oil sump, on a regular basis is probably one of the easiest and least expensive ways to extend the life, and improve the reliability, of that piece of equipment.  This is the goal, after all, to improve reliability and, in the process, make it last as long as possible.  As cruisers, power or sail, we like the idea of having an engine or generator that will work properly when

ever called upon to provide propulsion, charge current for our batteries or to power a variety of ACand DC electrical appliances.  In my former role as the manager of a busy boat building and repair yard, I quite frequently saw, from a mechanical failure standpoint,  marine diesel engines that died of old age and poor maintenance rather than wear and tear.

Preventing the once-inevitable mechanical failures is relatively straightforward; it’s a case of knowing your enemy.  Armed with this knowledge, as well as the relevant owner’s, service and parts manuals for your engine (service manuals can be obtained new from the engine dealer or on line at one of several used book websites such as www.abebooks.com) and a basic or, if you choose, advanced, tool kit, you should be able to undertake most, if not all routine maintenance tasks.

Among the simplest and most important of these maintenance tasks is changing engine lubricating oil.  There are a number of reasons why you should change the oil in your vessel’s propulsion and generator engines.  As you operate your engine the lubricating oil does wear out.  Initially, it becomes dirty or contaminated with combustion byproducts.  With each compression, power and exhaust stroke of each cylinder, gasses and liquids, albeit in small quantities, slip by the piston rings and into the crankcase where the lubricating oil reservoir is located.  These byproducts include unburned fuel, soot and water (water is one of the byproducts of burning fossil fuels), they are cumulative and they ultimately contaminate the oil.

**Combustion byproduct gasses bypass the piston rings (this is known as blow by), seen here, and make there way into the crankcase, where they contaminate the lubricating oil. Some blowby is normal, excessive blow by, on the other hand is undesirable and indicative of other problems.**

The deep black color that characterizes most diesel engine lube oil after it's used for just a few hours is soot from the combustion process. The soot, it's abrasive and thus harmful in and of itself, thickens the oil, making it sludgy, which prevents it from traveling into the close tolerances between the moving parts it lubricates. Additionally, the water mixes with the sulfur in the fuel, which creates sulfuric acid, a compound that will attack polished metal surfaces within the engine such as bearings and journals. Oil wears out and ages in several other ways, but you shouldn't need any more reasons to replace it other than those presented above.

**Crankcase oil lubricates the most important parts of your engine, the parts you typically, and hopefully, never see.**

Begin your oil change regimen by obtaining the proper filter and oil. The weight of oil you use, 10w30, 15w40 or a straight 30 or 40 weight for instance, will be determined by the ambient (the temperature of the engine compartment or room in his case) operating temperature. Consult your operator's manual for guidance on this subject. Nearly all diesel engines call for a "C" prefix grade oil such as CH or CG (the C stands for "commercial", but I prefer to think of it as representing "compression", the type of ignition a diesel engine utilizes). The second or suffix letter denotes the sophistication of the additive package. Again, check your

owner's manual to determine what's called for. Typically, it's safe to use a higher suffix letter, but not a lower one than what's been recommended.

**Not all oils are created equal. The oil that most diesel engines call for typically carries a "C" prefix, which technically represents the word "commercial", however, most folks have an easier time remembering that it's used in *compression ignition* (the diesel engine ignition process) engines.**

After collecting your materials, you'll then need to warm the engine up. This does two things, it thins the oil so it's easier to pump and it gets the soot, dirt and debris into suspension so it can be pumped out with the oil. Diesel engines tend to run cool unless loaded, so you may have to run your engine in gear for a while to warm the oil sufficiently (remember, the gauge, if you have one, indicates the temperature of the coolant rather than the oil).

Once the oil is warm, it's ready to pump. Some marine diesels are equipped with their own, hand or electrically operated, permanently installed crankcase oil pumps. If you have one of these, consider yourself lucky, they make the oil changer's life considerably easier and, I believe, promote more frequent oil changes. Even if you are entrusting the oil changing to a professional, the built-in oil change system will save this person time and you money, so I believe they are worth the expenses. If you have one of these, or planning an installation, be sure it's plumbed to the engines, generator and transmissions to ease oil changes on all of this gear. If you don't have one, you can obtain a portable engine oil pump

at most marine chandleries.  I prefer the ones that generate a vacuum by pumping, they resemble a bicycle pump, as opposed to the electric models.

**Removing oil from the engine or generator crankcase may be done manually, using an external pump (my preference for hand-operated units are those that develop a vacuum when pumped, they look something like a bicycle pump on steroids and are available at most marine retail outlets).  Built in, electric pumps like the one shown above make life easier on those doing the changing.  If you have or are contemplating installation of a permanent electric pump be sure that it's plumbed to the engine, generator and transmission oil sumps.**

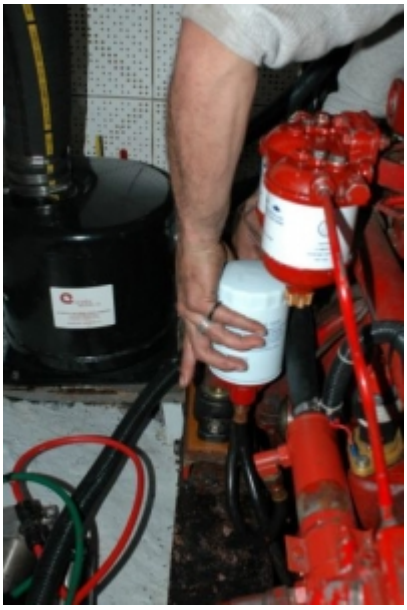
Shut the engine down and let it sit for five or ten minutes, to allow as much of the old oil to drain back into the pan.  Pump the old oil out either through the purpose-made hose that is attached to the oil drain plug on many engines (don't forget to replace the cap on this hose and tighten it well when you are finished) or through the dipstick tube and dispose of it properly.  Many marinas and boat yards have facilities for accepting used oil, as do local municipality recycling centers.

Remove the old oil filter (you may want to wear disposable rubber gloves for this part); this may require a filter or strap wrench, and place it in a zip-lock bag for proper disposal (these can often be disposed of at the same location as the oil, I like to let mine drain for a minimum of several hours before disposing of them).  Make sure the old filter's gasket is removed with the filter.  This is easy to overlook, especially on vertical filters whose engine gasket surface

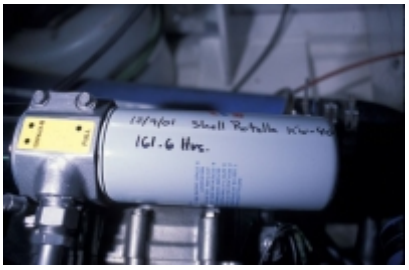
isn’t readily visible. I once saw the results of this error as a young mechanic, it was memorable.  Upon start up,  the engine pumped all of new oil out from between the *two* gaskets in about three seconds, it was quite a mess and had I not seen what had happened the engine may have been ruined.

Be prepared with an absorbent pad in the bilge, particularly if your filter is horizontally mounted, it’s tough to avoid spilling some oil.  Oil filters are like screws, they are turned counter clockwise for removal and clockwise for installation.  Lubricate the gasket on the new filter with clean oil and then screw it into place.

**Lubricate the gasket of the new filter with clean oil.  If the filter installs vertically, opening side up that is, then pre-charge the filter with clean oil.  When lubricating the gasket or pre-charging the filter, observe absolute cleanliness, any debris that makes its way into the filter will enter the engine without filtration.**



**Vertical, opening facing down, and horizontal oil filters present a challenge when changing. Be prepared with plenty of rags and oil absorbant pads.**

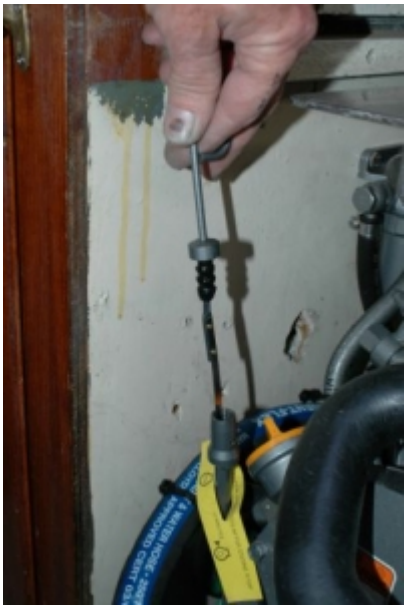


The filter should be installed hand tight, and snug, however, there's no need to use a wrench (in fact, you*shouldn't* use a wrench, many filters offer guidance as to how many turns are required after the gasket makes contact with the engine's mounting base). If the filter is installed vertically, with the opening facing up (some sadistic engine designers equip engines with vertical, opening facing *down*, or horizontal filters, which virtually guarantees a mess during the change sequence), you can and should "pre-charge" the filter with clean oil (this is especially important for, and may be required by, some turbo-charged engines). This reduces the time required for the engine to develop oil pressure upon the first start up after the oil change; every second counts where lubrication is concerned. Be certain, however, that the oil that is poured into the filter, as well as the filter opening and gasket area, is scrupulously clean because any debris that

enters this part of the filter will also enter the engine, the filter will not capture it.

**Once again, when adding oil, observe absolute cleanliness. Be certain no debris, dust or dirt are on top of the oil container, around the fill cap or in the funnel.**

Finally, add oil to the crankcase until it reaches the "FULL" mark on the dipstick (check your owner's manual to determine the correct capacity). Then, start the engine, make sure oil pressure is generated by either watching the gauge or ensuring the alarm stops sounding (you do have a functioning low oil pressure alarm, right?) after no more than 3-5 seconds. Provided you have oil pressure, allow the engine to run for two or three minutes. Shut it down and check for leaks around the filter. After waiting a few minutes, check the dipstick a couple of times, you'll probably have to add a little bit of oil because, unless you pre-charged it, you will have filled the oil filter by running the engine (remember all that oil that spilled out of the filter when you removed it? Well, it has to be replaced).



**Fill the crankcase with oil until it registers FULL on the dipstick.  Do not overfill, if you do the crankshaft may collide with the oil in the pan.  When it does so it's as if it's hitting a solid mass (ever do a bellyflop from a diving board?  If you have you know what the crankshaft feels like when it hits the oil at hundreds and thousands of times a minute.  This may lead to crankshaft/bearing damage or oil aeration, which in turn may cause erratic running characteristics, lubrication starvation or accelerated oil oxidation.**

If you treat your diesel to an oil change every 100-200 hours (engines that are operated under chronic light loads, less

than 50%, for much of the time shoudl tend toward the lower side of this range, particularly traditional, mechanically injected engines and those that are not equipped with jacket water oil coolers and/or oil thermostats), or once a season, which ever comes first, you'll be rewarded with reliable performance from the parts you can't see, the ones on the inside of the engine.

For more information on the services offered by Steve D'Antonio Marine Consulting, from pre-purchase and pre-acceptance inspections to vessel selection and new build assistance, please browse this website or e mail info@stevedmarineconsulting.com for more information.