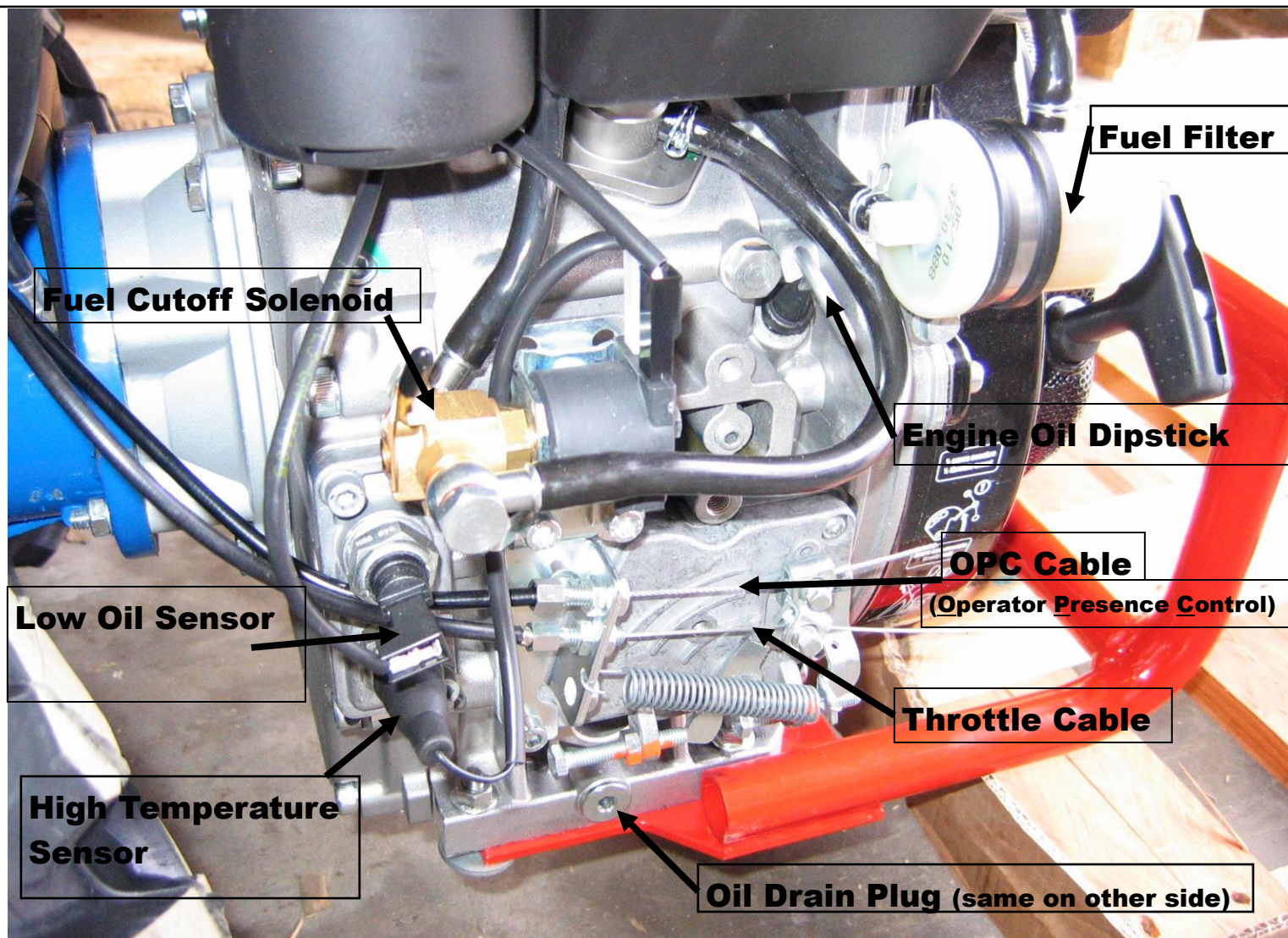


EARTH TOOLS TWO WHEEL TRACTOR DIESEL ENGINE PARTS IDENTIFICATION AND GENERAL INSTRUCTIONS



15LD400, KD400 and KD420 diesel engines MAY be equipped with the Fuel Cut-off Solenoid pictured above. The solenoid is ACTIVE when the rubber tipped lever is down (or away from the engine). When active, fuel will be cut off (and the engine will quit) if the oil pressure drops or if the engine temperature reaches unsafe levels. It ALSO means that the key WILL turn the engine off, as it is wired into this solenoid. **HOWEVER:** If a sensor malfunctions or a wire connection is poor, the engine will either not start or may start but run erratically when the solenoid is “active”. Therefore, you can flip the lever the other way (up, or toward the engine) to “Over-ride” the solenoid, which locks the fuel valve open. When this valve is locked open, the key will NOT turn the engine “OFF,” and also the low-oil or High-temp sensors will not shut the engine off. The engine can still be shut off with the red safety lever on the handlebars. (Make sure to still turn the key off, to prevent killing the battery)

Do not overfill the engine with oil! Oil capacity for the 15LD400, KD400 / 420 / 440 is 1.5 quarts. Oil capacity for the KD350 / 15LD315 / 350 is 1.2 quarts. Overfilling can cause the engine to start running on its own lubricating oil, making it run faster than normal and impossible to stop without completely choking the air intake. Use high quality 15W-40 motor oil (synthetic is okay after the engine is fully broken in) and fill crankcase so the level is **between the marks on the dipstick, with the engine LEVEL!** Always check the oil before starting.

To change or clean the **oil filter**, remove the low oil/high temp sensor assembly (held on by two Allen head bolts). The wires and sensors do not have to be removed, just push the cover out of the way to access the oil filter. The oil filter is a cylindrical super fine steel mesh filter. Grab the rubber disk attached to the filter, pull it out, wash it out in some gasoline or diesel fuel, let it dry, (or blow dry with compressed air) and reinstall. The filter can be cleaned until the rubber seal finally tears, at which point the filter will need to be changed. (see picture on next page)

The part number for replacement **fuel filters** for Kohler diesel engines is 3730.096. Keep an eye on the fuel filter for WATER: It is translucent so it is easy to see if water is present; it will collect at the bottom. Change the filter if more than a tablespoon of water is present. Water will ruin an injector system, resulting in an expensive (~\$400) repair.

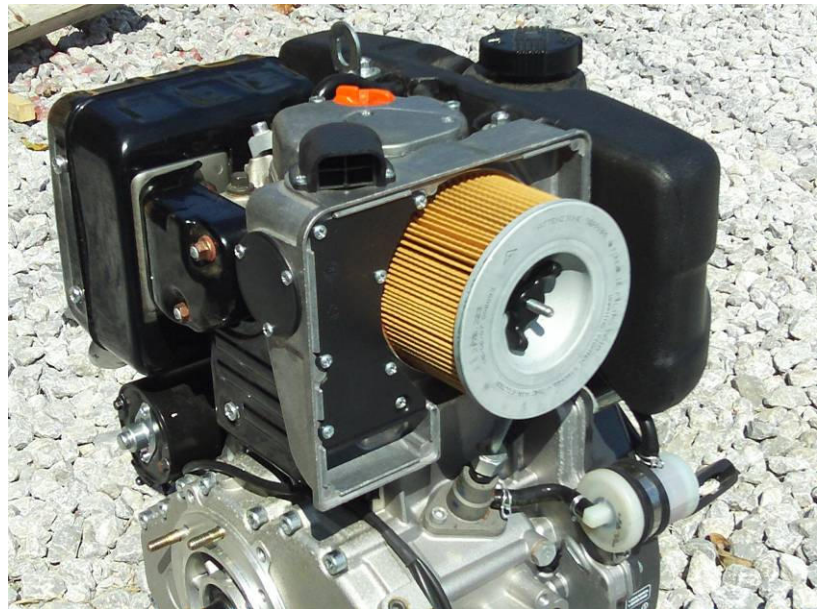
The part number for replacement **air filters** for the KD400, KD440, and the 15LD400 is 2175.306. Air filter for the 15LD315 / KD350 is 2175.254. We normally stock all filters at Earth Tools: 502-484-3988 (continued on next page)



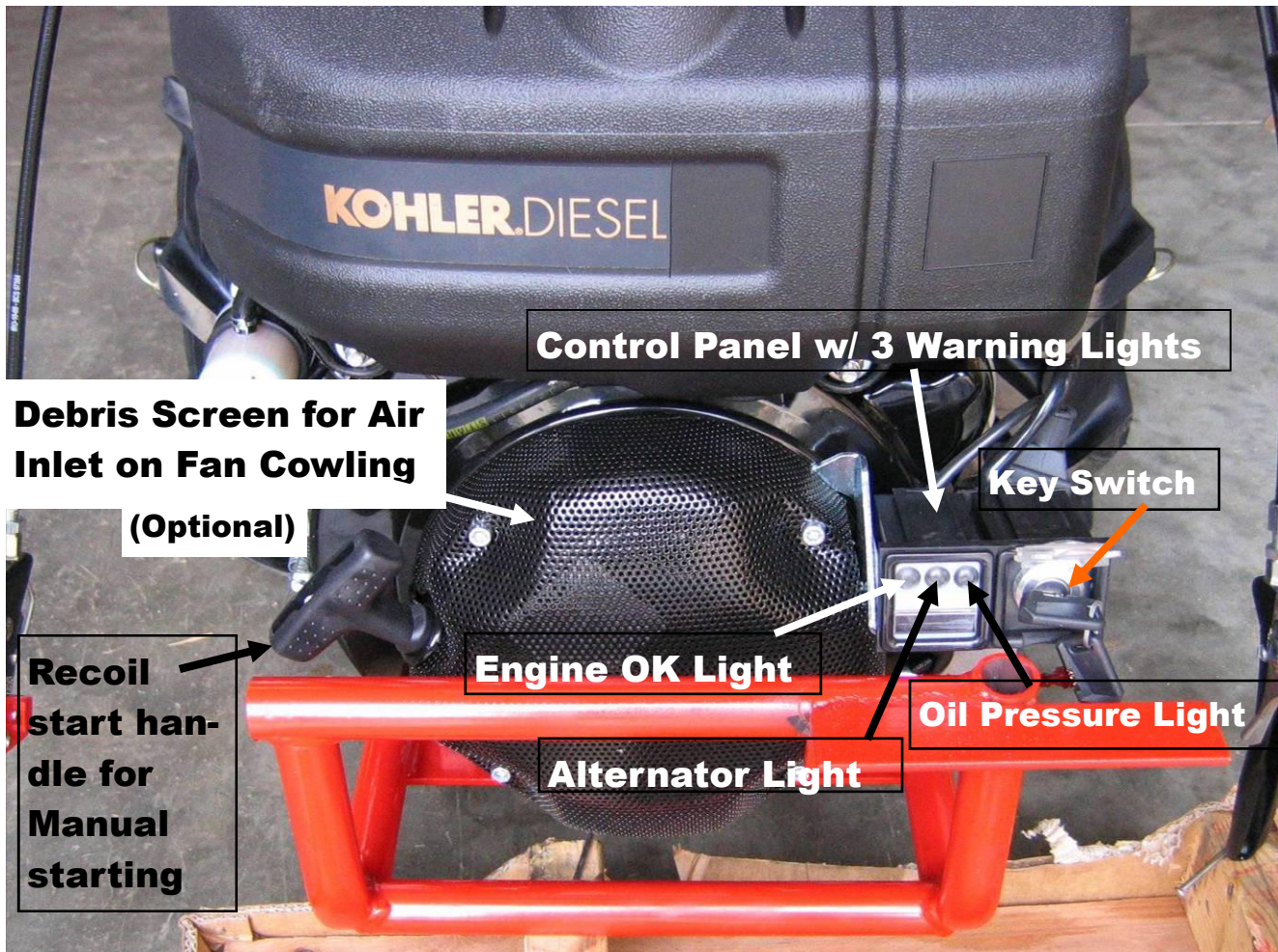
Diesel engine oil filter. Part number: 2175.155. Remember, it is cleanable and reusable. (See instructions on previous page)

Air filter side of engine with air filter cover removed. Once the filter cover is removed, the filter is still held in place by the large black wing-nut in the center; remove this to change or clean the filter. (see filter cleaning instructions on page 6 of this document)

Note that the engine pictured here does NOT have the electronic fuel cut-off solenoid described on the previous page. Some engines had this feature, and some did not.



Engine on tractor with battery. Air intake is black "snout".



This picture depicts a general configuration for 15LD315, 350, 400, and KD400 or 420 diesel engines on various walk-behind tractors. Also pertinent for 15LD440 and KD440 engines mounted to Grillo G131. The KD440 engines mounted on BCS 853 tractors after 05/2013 have the key switch mounted by the battery, and they only have the Alternator light (described below).

—Engine OK lights **Green** when engine is running and everything is functioning properly.

—Alternator indicator light lights **Red** when charging system is NOT charging the battery (if you see this light on only when the engine is on a very low idle, this is okay).

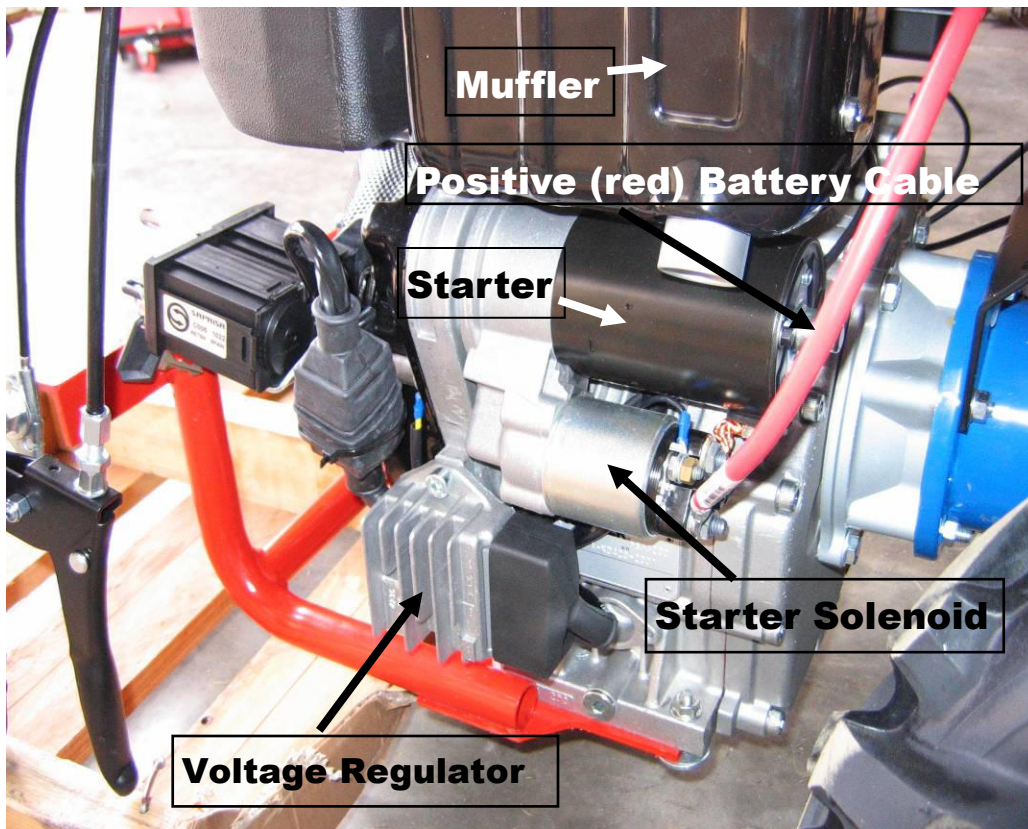
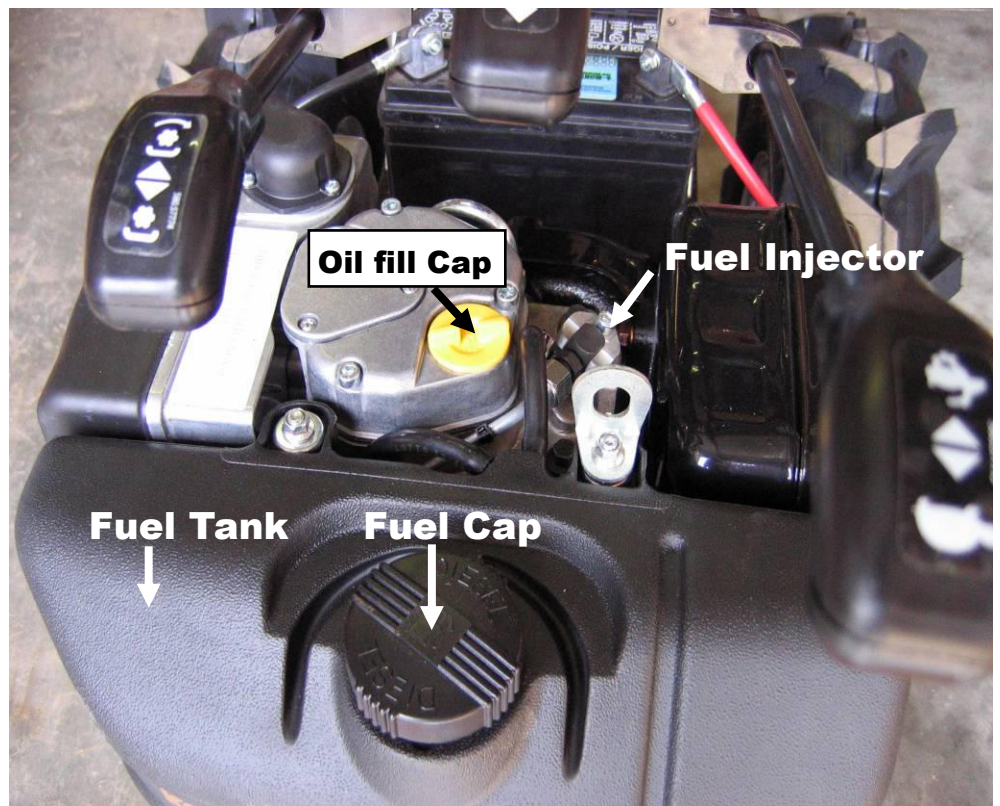
—Oil Pressure indicator light lights **Red** when there is no oil pressure.

For engines with the control panel as in the picture above: If **no** lights are on when key is on and / or engine is running, there is a bad ground or the fuse is blown inside the Control Panel. To replace the fuse, remove 4 Phillips head screws affixing panel to bracket (on bottom). Pop the plastic cover off the rear of the panel and look for a 20A blade-fuse next to the key switch body. If there is a bad ground, it is commonly that the small ground wire coming out of the rear of the panel has come loose from the key switch bracket mounting lug on the bottom.

The Alternator light (and Oil Pressure light, if equipped) will remain lit when the key is on and the engine is off. If you do not turn the key off, the battery will be drained. If you stop the engine by releasing the OPC (red safety) lever, make sure you turn the key off to conserve the battery. **The key must remain in the “Run” position when the engine is running in order for the alternator to charge the battery.**

If the battery or electric starter system fails to operate (due to a dead battery, loose wiring, faulty / dirty components, etc.), the engine can be started manually, using the recoil starting handle. **WARNING: This operation takes quite a bit of strength!** The proper procedure for manual starting is: **#1.** Turn the key to the “run” position (one click). **#2.** If the engine is equipped with a fuel cut-off solenoid (see page 1), flip the lever to the “Over-ride” position, so the solenoid is NOT active. **#3.** Pull the recoil start handle SLOWLY, rotating the engine through one complete cycle (the rope is about 3 feet long; you will pull to the end of the rope. Pulling at the proper “slow” speed, It should take about 2—3 seconds to pull the rope all the way out) This “slow pull” activates the automatic compression release in the engine. **#4.** Let the rope back in, and then pull the rope fast, with all your strength. The internal compression release will release the compression on the first compression stroke encountered on this pull, which allows you to continue to accelerate and build up momentum in the engine...you will then encounter full compression on the “second” compression stroke, which is a little more than halfway through the pull. Therefore, FOLLOWING THROUGH on the pull towards the end is especially important. If you do NOT have sufficient speed or power on this pull to overcome the compression stroke, the engine can “kick back”, which can be, frankly, painful. I have been manual-starting diesel engines since I was 13 years old (at about 120 lbs), so I know it can be done...but you have to really pull like you mean it! (getting MAD helps!!)

NOTE: Later-model BCS 853 tractors (May 2012 and later) equipped with Kohler diesel engines **ALSO** have an oil fill port (with yellow cap) on the side of the engine, very close to the oil dipstick pictured earlier. If your engine is so equipped, use this “lower” fill port, as the oil gets into the crankcase faster, and you get a quicker accurate reading on the oil level.



In high dust conditions, it is possible that the starter motor may eventually not engage properly. This is due to a dirt/dust buildup in the starter solenoid. We have a separate service document to deal with this issue, please see “Lomb. Starter-solenoid repair” in our Engines / Service procedures section, or click this link: http://www.earthtoolsbcs.com/Lomb_Starter-Solenoid_repair.pdf

Performing this service at the first signs of starter trouble (failure to properly engage) is recommended, as continued use when full of dirt can ruin the solenoid by overheating.

GENERAL INSTRUCTIONS FOR DIESELS

Congratulations on your purchase of a walk-behind tractor with a diesel engine! The diesel engine will give 2 to 3 times the engine life of a gasoline engine when maintained properly and will use 1/3 to 1/2 the fuel of a comparable torque gas engine. Your engine choice also gives you the option of using alternative fuels (biofuels).

OPERATION, SHUTDOWN AND MAINTENANCE

1. Always check fuel and oil levels before starting. Even though the Lombardini / Kohler diesels are equipped with an automatic air bleed to aid with starting in case you run it out of fuel, it is still not a good idea to run a diesel out of fuel.
2. To start, first depress the red safety lever on the top of the left handlebar grip. Then, squeeze and latch the clutch lever (on the bottom of the same grip). When the clutch lever is latched, it holds the safety switch down.
3. Move the throttle lever (on right handlebar) to the 1/3 or 1/2 position.
4. Turn the key (key switch located on engine or on battery box) to the 'start' position and crank until engine starts. Key will return to the 'run' position when you release it.
5. Reduce throttle speed to just above idle and let engine warm up a minute before putting tractor to work.
NOTE: Until engine is fully warmed up (10-15 minutes), it may sputter a bit at three quarters to full throttle.
6. SHUTDOWN: After work is done and your are ready to shut engine off, idle engine down and allow to cool down at idle for at least 20 seconds before shutting off.
7. With tractor wheels and PTO in neutral, release the red safety lever on top of left handlebar. Engine will shut down.
8. After engine has fully stopped, depress the red safety lever again and squeeze clutch lever to lock it, just like step 2. Not only does this save you from doing this the next time you start it, more importantly, storing the tractor with the clutch in the squeezed position guarantees the clutch will never 'stick' during storage.
9. ALSO IMPORTANT: Turn the key back to the 'off' position. If you forget this step and leave the key in the 'run' position, you may run down the battery. TURNING THE KEY 'OFF' WHILE THE ENGINE IS RUNNING WILL **NOT** SHUT OFF THE ENGINE, BUT **WILL** DISABLE THE AUTOMATIC BATTERY CHARGING SYSTEM BUILT INTO THE ENGINE!! Always leave the key in the 'run' position while the engine is running to the battery can re-charge.

MAINTENANCE

*** Break-in

During the first few hours of operation, do not run the engine more than 3/4 throttle.

After the first 4 hours of running, change the engine oil. A 10W40 or 15W40 diesel-rated oil (minimum API specification CC/CD) is recommended.

VERY IMPORTANT: CHECK ENGINE OIL LEVEL WITH ENGINE LEVEL; ON LOMBARDINI / KOHLER ENGINES, KEEP OIL LEVEL BETWEEN TOP & BOTTOM NOTCHES ON DIPSTICK. ON YANMAR ENGINES, FILL TO TOP OF FILLER HOLE. Make sure oil dipstick is pushed ALL THE WAY IN while checking!
DO NOT OVERFILL ENGINE OIL! SERIOUS DAMAGE CAN RESULT!

*** After Break-in

Oil changes should be every 50 hours of run time or once a year, whichever comes first.

NOTE: If you want to use synthetic or synthetic blend oils, the engine should have 40-50 running hours on it before you switch.

The Oil filter on the Lombardini / Kohler engines is a cleanable stainless steel mesh and is located under small cover held on by 2 allen-head bolts on air filter side of the engine. Clean with gasoline and let air-dry before re-installing. Clean every 50 hours.

Air filter should be changed at least once a year.

You have invested a lot of money in this diesel engine and substandard air filtration will only shorten engine life. To clean filter, remove from engine and tap against a hard surface to knock dust out. You can use an air compressor to blow the dust away, but **NEVER PUT AN AIR COMPRESSOR NOZZLE CLOSER THAN 3 INCHES** to a paper filter. Putting a compressor nozzle too close to the filter will force too much air through too small an area of the filter, which will enlarge the pores in the paper. This will allow larger dust particles through the filter and wear the engine out prematurely. We stock these filters here at EARTH TOOLS.

Fuel filter should be changed every 1 to 2 years. We keep these in stock as well.

This list is for quick reference -- for a more complete schedule of engine maintenance, see the engine owners manual.

Thanks for your purchase and we look forward to serving you in the future.

Joel Dufour

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