DIESEL ENGINE ESSENTIALS

with

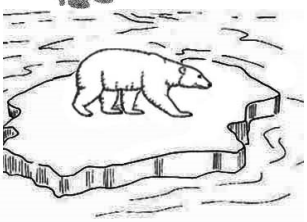
Amanda Swan

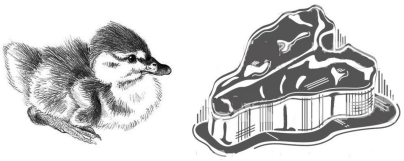
author of

Marine Diesel Engine Essentials

A learning and coloring book

Illustrated by Andrea England



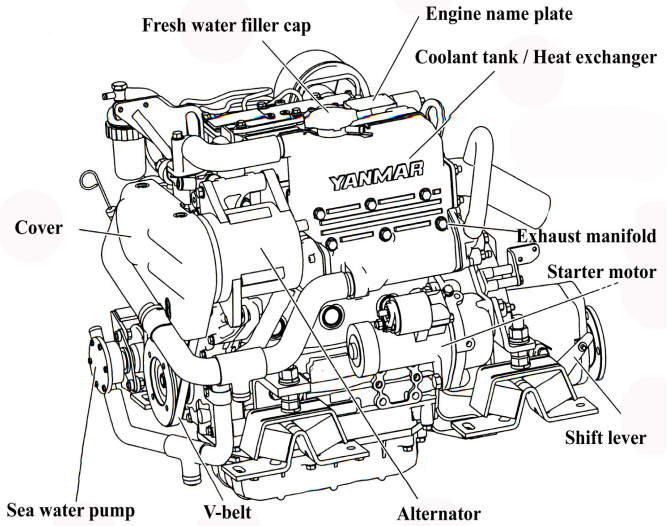


What does a diesel engine do?

- Converts diesel fuel to energy: torque and electricity.

6 Systems of a Diesel Engine - similarities to the body

1. **Fuel system** - food
2. **Electrical** - brain
3. **Cooling system** - hydration, sweating
4. **Lubricating system** - blood stream
5. **Air** - breathing
6. **Transmission** - movement



1. Fuel System

- Inspect and clean tanks.
- Install fuel tank sump pump.
- Pre-filter fuel if questionable (West Marine).
- Always add biocide/algaecide: Biobor JF or Star Brite.
- Lift pump brings the fuel from the tank to the fuel filter.
- Injection pump pressurizes the fuel and sends it to the injectors.
- Injectors spray the fuel into the cylinders at the right moment.
- BANG! The fuel/air mixture explodes due to compression.
- High pressure common rail engine vs traditional mechanical fuel injection engine.

2. Electrical

- The electrical system on your boat is very similar to the one in your car.
- An electric starter motor starts the engine and an alternator generates electricity.
- Belt tension is very important; if the belts slip, the alternator doesn't work or gets "fried".
- Check for "wiggle" in all wire connections.
- Replacing standard alternator with a high output Balmar and smart regulator speeds charging.

3. Cooling System

- Engine generates a lot of heat from the explosions; without efficient cooling, the engine overheats and stops.
- Engines have two separate cooling systems: sea water and fresh water.
- Marine diesel engines use seawater to cool the circulating freshwater by way of a heat exchanger.
- Sea water is sucked into the heat exchanger by a raw water pump.
- Potential causes of overheating: debris sucked into sea water intake (plastic bag, jellyfish, etc.), water pump impeller wearing out, belts slipping or broken.
- Check simplest solutions first: water flow, belt tension before checking impeller.
- Note if your engine has sacrificial zinc anodes and replace when 50% is eroded. Carry three sets of spare zincs.

4. Lubricating System - Oil

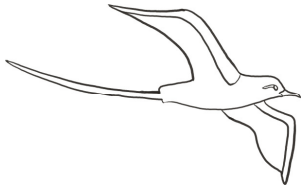
- Keeps the parts moving. Without oil, the engine stops.
- Carries away waste by-products (sulfur and carbon).
- Needs to be filtered. Oil filter is like your liver, filtering out impurities.
- Change oil and filter at number of engine hours specified by manufacturer or at least annually.
- Annual oil analysis shows unusual wear patterns.

Oil Change Quick Tips

- Use a Zip-loc when unscrewing and removing the filter.
- Drain oil from filter and Zip-loc into waste oil container.

5. Air

- Diesel engines need lots of clean air.
- Air filter needs to be cleaned or replaced at least once a season or when visually dirty.



6. Transmission

- The transmission on a boat is similar to one in a car; it takes energy from the engine to make the boat move forward.
- The transmission fluid level needs to be checked weekly and replaced at least annually.

Start Up and Operating Procedures

- Before start up
- After start up
- While motoring

Engine Maintenance

- Engine log and hour meter
- Zincs: prop, hull and engine
- Winterizing
- Siphon break
- Saildrive seals

Annual Mechanics Check

- Valves
- Alignment

Environmental Matters

- Do the right thing!
- Clean engine and bilge.
- Oil sorb pads.

Quick Tips

- When replacing both fuel filters, fill them to the top with clean fuel before screwing the lid down or screwing the cartridge to the engine, thus eliminating the need to bleed the fuel system (nasty job!).
- Engine should run up to within 100-200 rpms of maximum rated with wide open throttle (WOT).
- Smaller Yanmars (GM, YM & QM series) are famous for having their smaller-than-normal exhaust elbows carbon up, resulting in reduced power and in time, inability to start. These water-injection exhaust elbows are also subject to corroding through in as little as five years, resulting in seawater backfilling into the cylinders which can cause catastrophic failure. Solutions: run these engines up to within 200 rpms of max rated speed every 2-4 hours ("Italian Tune-Up") and pull the exhaust hose checking for carbon build-up and corrosion at least annually. Higher quality and much less expensive stainless after-market elbows are available from www.exhaustelbow.com.

20-Year-Old Engine and Heading Offshore

- Compression check.
- Service injectors.
- Replace fuel lift pump.
- Rebuild starter and alternator.
- Service heat exchanger, oil & transmission coolers.
- Replace engine mounts.
- Replace exhaust water injection elbow.
- Remove & inspect shaft, replace cutlass bearing.
- Check damper drive plate.

Resources

- Diesels Afloat - Pat Manley
- Marine Diesel Engines - Nigel Calder
- Engine Manuals: operators, shop & parts
- Marine Diesel Engine Maintenance DVD - by Bennet Marine
- Marine Diesel Engine Essentials – a Learning & Coloring Book - Amanda Swan & Andrea England

HOME WORK: name these 19 engine parts