



Marine Diesel Operation

Pittwater to Dunk 2019 Seminar

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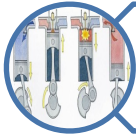


Objectives

- 1) Diesel engine overview
- 2) How to operate
- 3) How to recognise a problem
- 4) When to call for service support

Agenda

What we will be covering



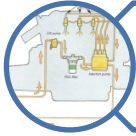
Basic operation



Operation



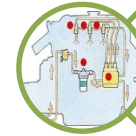
Maintenance



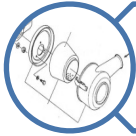
Fuel system



Diagnostics



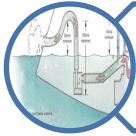
How do I?



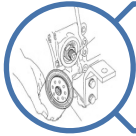
Air system



Spare parts



Engine cooling



Lubrication
system



Questions

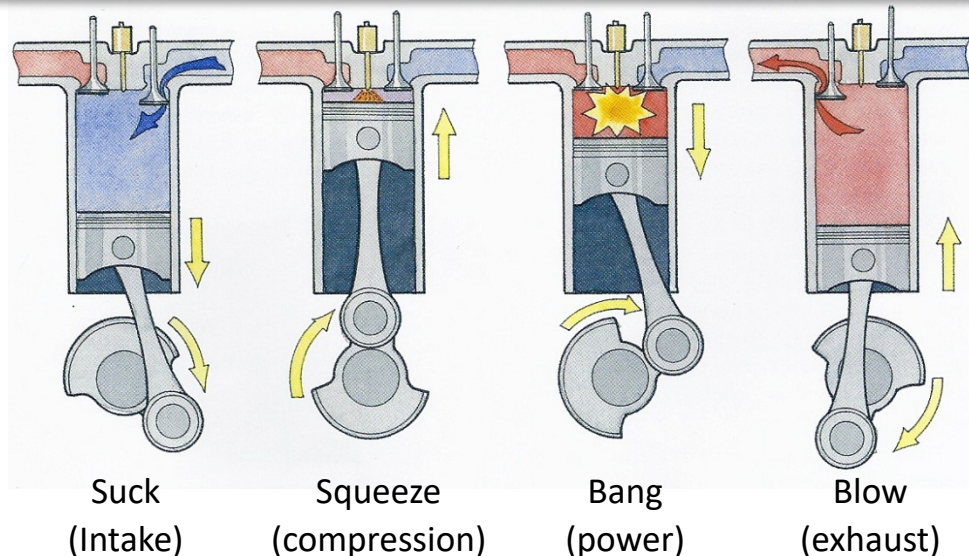
Basic operation

The Diesel engine requires air and fuel as input, producing, power, heat and noise

It operates on a pressure ignition principal, and once started requires no external energy source such as electricity

To operate, it compresses air thus heating the air, injects fuel at the top of the compression cycle which combusts and expands

The 4 stroke cycle is expressed as;

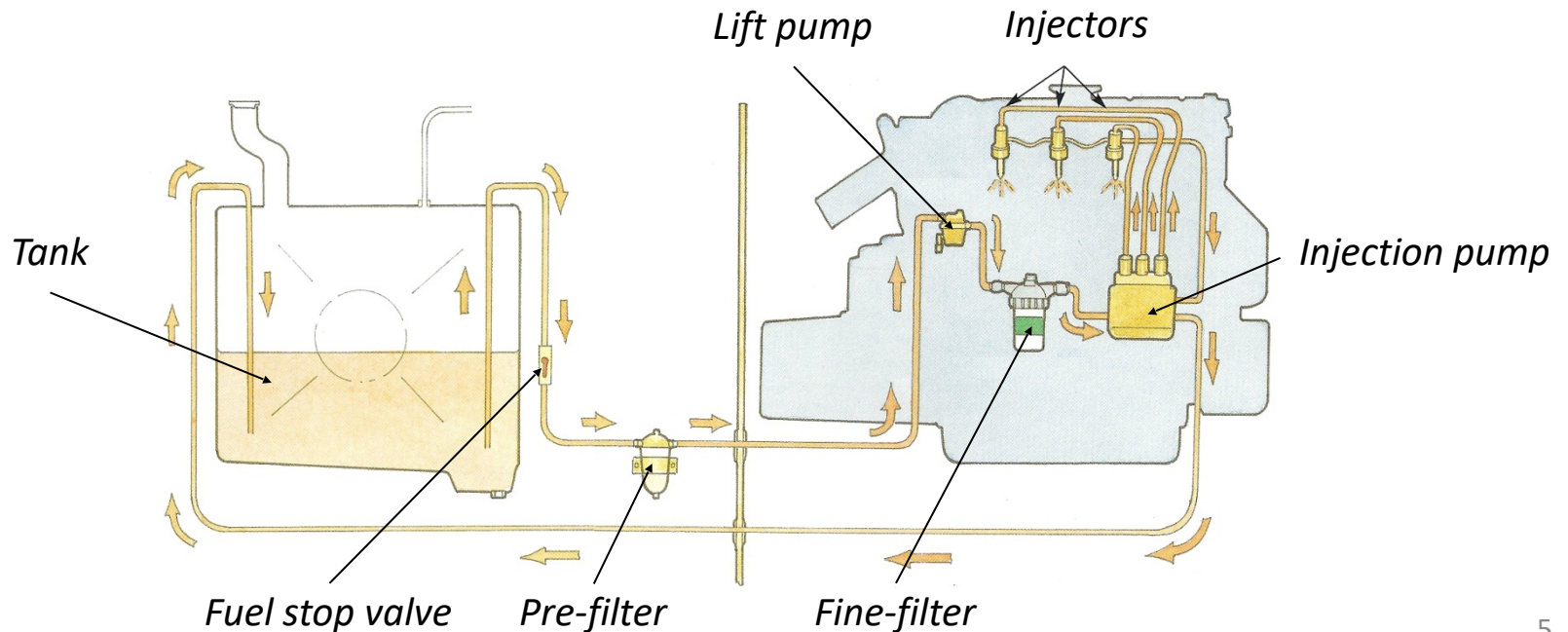


Fuel system

The diesel fuel system forms a continuous circuit from tank through filters, lift pump, injector pump and injectors, with unused fuel being returned to the tank

The lift pump, fine filter, injection pump and injectors are components of the engine

Tank, stop valve and pre filter are external components



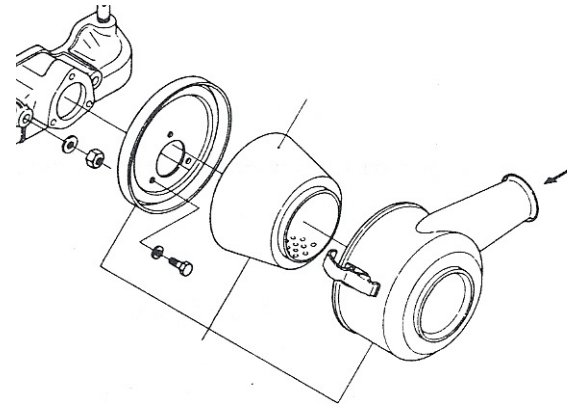
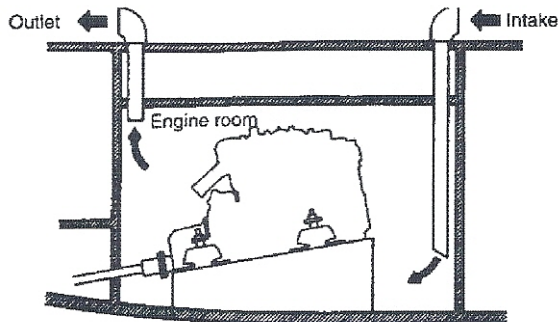
Air system

Air is one of two essential ingredients in the diesel engine combustion process

Starving the engine of air is like starving it of fuel

It is the compressed air, rising to 400°C that ignites the injected fuel and creates the combustion

Proper ventilation of the engine room is critical



Air filter components

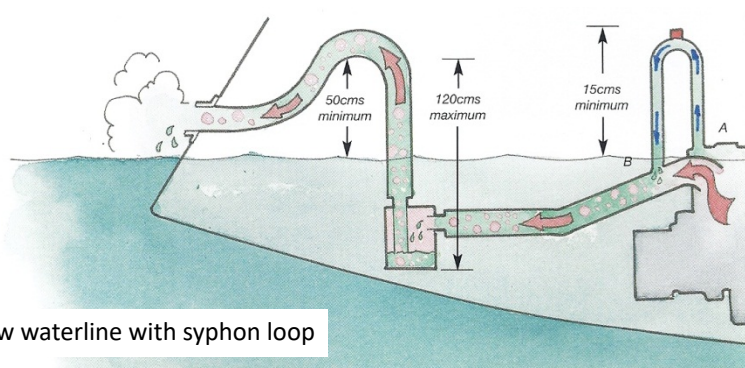
Exhaust system

Exhaust systems remove the spent gasses following combustion, sometimes as hot as 450°C

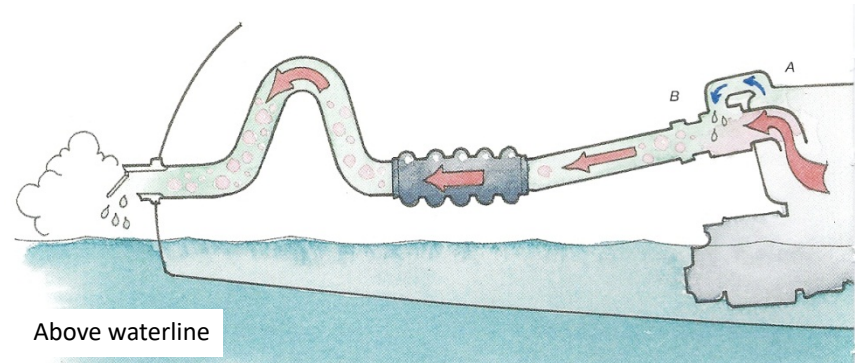
There are two exhaust arrangements, one with the manifold above the water line the other with the manifold below the water line

Seawater is injected below the manifold elbow, cooling the exhaust gases, reducing volume and partially silencing the exhaust

Circulation of this seawater is critical



Below waterline with syphon loop

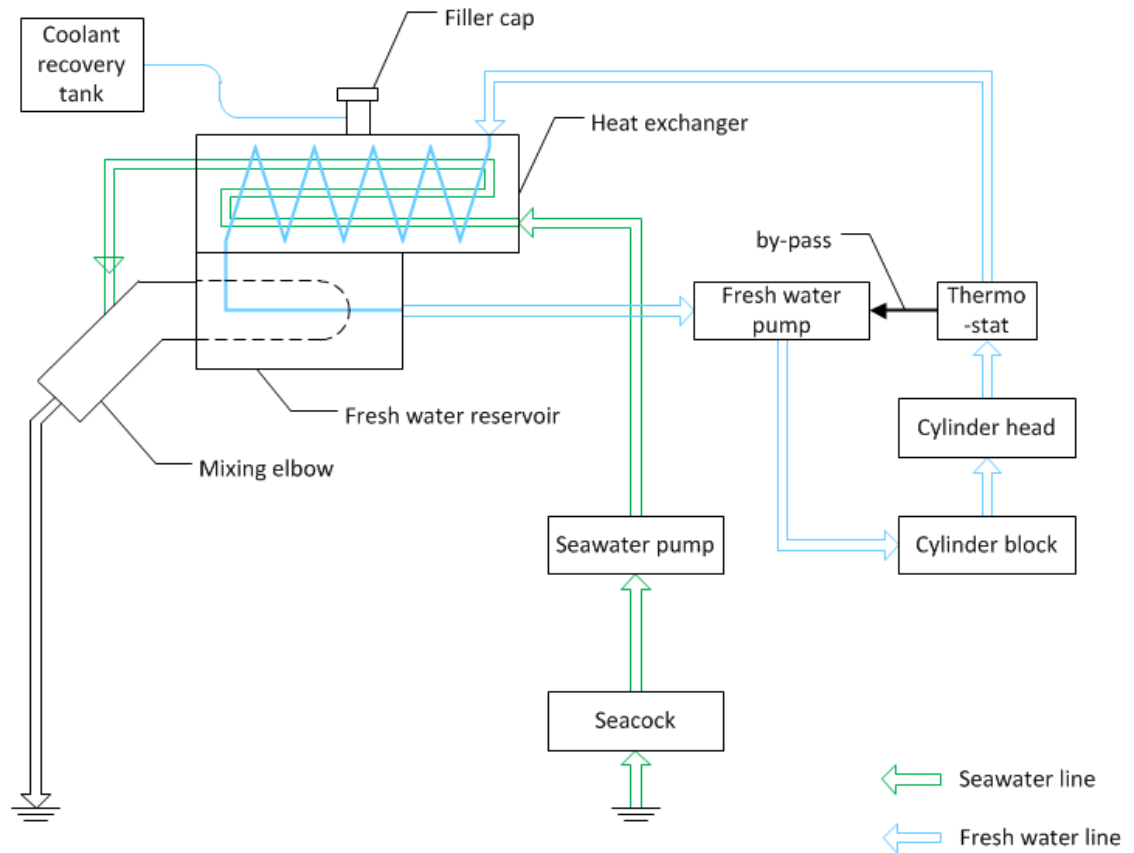


Above waterline

Engine cooling

Cool seawater is circulated by the seawater pump cooling the fresh water as it is directed through the heat exchanger.

Fresh water coolant from the heat exchanger is circulated around the cylinder block and cylinder head by the engine coolant pump.



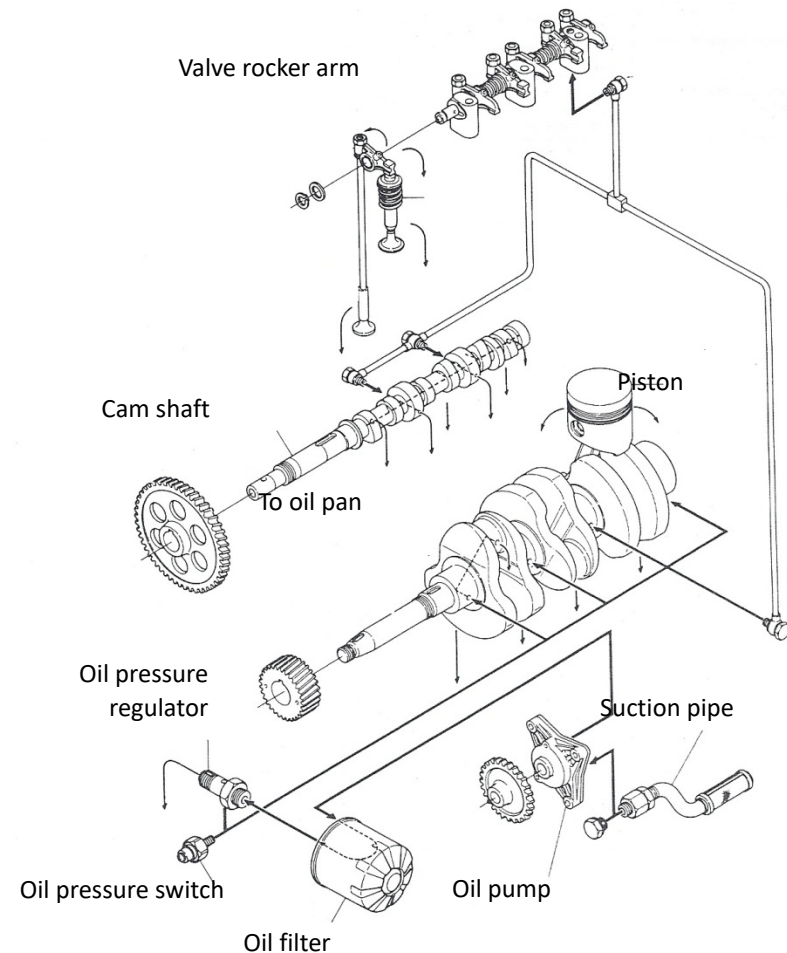
Lubrication system

Oil does so much

1. Lubricates the many moving parts
2. Maintains pressure in cylinders
3. Inhibits corrosion
4. Flushes foreign deposits caused by combustion

The greatest favour you can do a diesel engine is to be fastidious with its lubrication, keep the oil levels topped up and replace oil and oil filter regularly

Monitor condition of oil at each oil change



Operation



Pre-start check

- Check for sufficient fuel and enable fuel stop cock
- Check crankcase oil level and top up if necessary
- Check fresh water coolant reservoir and top up if necessary
- Check v-belt to alternator and cooling pumps
- Check primary fuel filter bowl for water, drain if necessary
- Check raw water inlet filter and open main stop cock

Starting

- Turn main battery switch to on
- Move transmission lever to neutral
- Push and hold the start button until the engine fires

Caution

- Do not crank the engine more than three times without starting, sea water is discharged through the exhaust system by the exhaust pressure
- Sea water can back fill into the manifold and cylinders
- Should engine not fire, turn the seawater cock to off until the engine does fire, once the engine fires, turn seawater cock on immediately

Operation (2)



Running checks

- Allow engine to come to operating temperature (60° C) while in neutral and low revolutions
- Verify oil pressure is at operational level
- Verify Alternator is at charge voltage
- Check stern exhaust outlet for good flow of seawater
- The audible alarm should stop

Caution

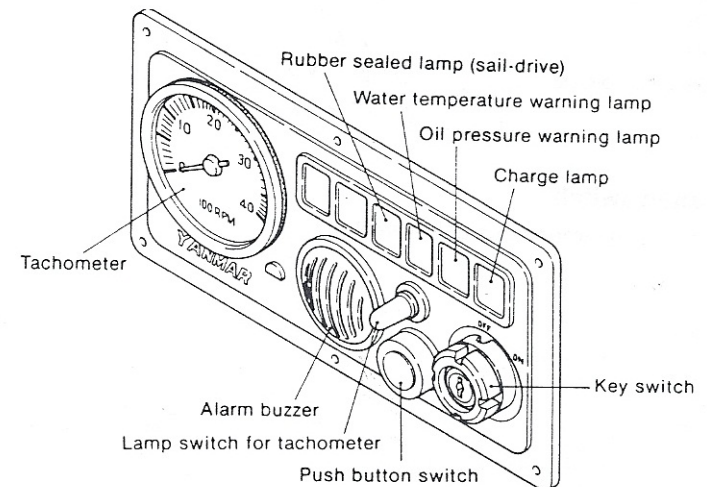
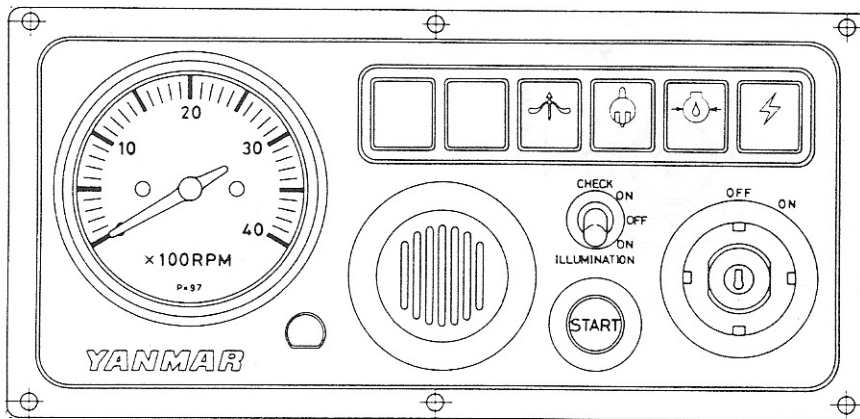
- If alarm does not stop and or oil pressure does not come to operating pressure, stop engine immediately and investigate

Stopping the engine

- Place transmission lever into neutral position
- Allow engine to run at idle speed for approximately 3-5 minutes
- Stop the engine

Engine Management

All engines have diagnostic gauges and alarms such as, temperature, oil pressure and charge voltage. Additional diagnostic aids include sight, sound, vibration and smell.





Diagnostics

Smoke signals

Black smoke is caused by unburned fuel and sometimes results in a soot residue forming on the water

Too much load on the engine, easier on the throttle

Fowled hull and or prop

Engine is not breathing, clean the filters

Engine space not ventilated

Turbo failure, again not enough air getting to the cylinders

Dirty fuel filters not supplying enough fuel for a clean burn

Blocked exhaust elbow



Diagnostics

Smoke signals

There are two forms of white smoke, one is steam the other is smoke.

Steam will generally be more noticeable in colder climates and will dissipate about 1 meter from the exhaust.

Caused by restricted salt water flow

Engine temperature above normal, faulty thermostat or blocked heat exchanger

White smoke will follow the boat and will not dissipate.

Caused by engine running below normal temperature

Faulty thermostat

Fuel injectors dribbling



Diagnostics

Overheating alarm

Reduce revs to idle and check that water is exiting exhaust outlet, then stop engine.

If there is little to no water exiting the exhaust;

Seacock partially or completely shut

Blocked raw water inlet

Damaged seawater pump impeller

Broken raw water hose

But if there is good flow of water from the exhaust outlet;

Thermostat failed in closed position

Low freshwater coolant

Loose or broken drive belt

Faulty temperature sender

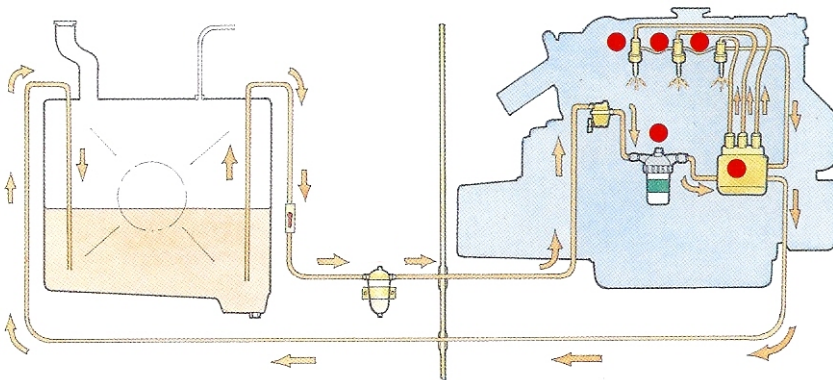
Maintenance schedule

System	Item	Before Starting	150 hrs	300 hrs
Fuel System	Check fuel level	o		
	Drain fuel filter		o	
	Replace fuel filter			o
Lubricating system	Check crankcase oil level	o		
	Check gearbox oil level	o		
	Replace crankcase oil		o	
	Replace gearbox oil		o	
	Check oil pressure	o		
	Replace oil filter			o
Cooling system	Seawater outlet	o		
	Cooling water level	o		
	Tension cooling water pump drive belt			o
	Replace seawater pump impeller			o
	Replace fresh water cooling			o
	Replace anticorrosion zinc			o
Air intake and exhaust system	Clean air intake element			o
	Clean exhaust/water mixing elbow			o
	Clean breather pipe			o
	Check exhaust gas condition	o		
Electrical system	Check charge lamp	o		
	Adjust alternator drive belt			o
	Check wiring connections			o

How do I

bleed the fuel system

1. Arm yourself with rags, and some spare
2. Check all fittings on tank side of lift pump are air tight, loosen bleed screw at fine filter
3. Check for full movement in the lift pump. If you do not have full movement it is because of the cam position. Turn the engine over briefly and try again
4. Pump the lift pump, full stroke, until you see clear fuel at the fine filter and then tighten bleed screw. Note this process may take some time
5. You now need to bleed the high pressure system
6. Loosen the bleed screw on the injector pump and continue with lift pump until you see clear fuel, tighten bleed screw



Step 2



Step 6

How do I

replace raw water impeller?

Shut the raw water sea cock

Place a container under the pump as you will catch water

Undo the screws and remove face plate

Grip the impeller with a pair of pliers and pull

If impeller has shred vanes it may be necessary to use two screw drivers, as shown

Inspect the impeller, if 100% complete proceed with replacing new impeller, if not complete locate the broken and missing parts

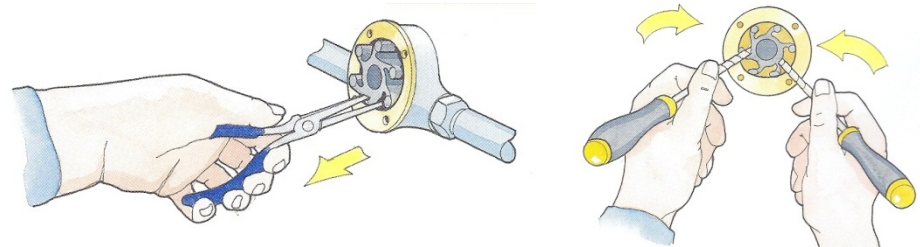
Clean the gasket surface on housing and face plate

Smear new impeller lightly with dish washing liquid or Vaseline

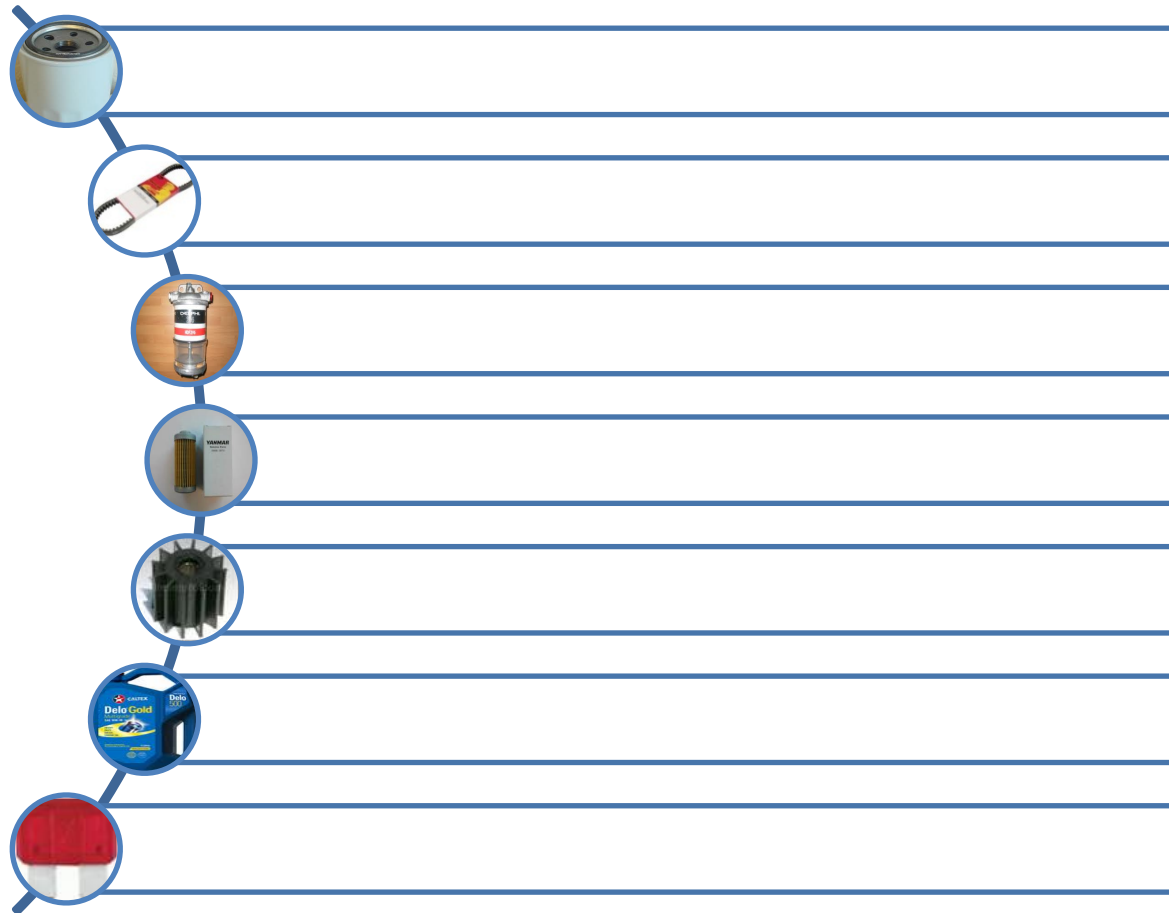
Slide impeller back onto shaft making sure vanes trail backwards from direction of rotation

Fit a new gasket and replace face plate

Open raw water seacock and check for leaks



Recommended spare parts





Q&A

