



VF4

Operation manual

VF4.145
VF4.180
VF4.200

Operation manual *Vetus*[®] **VF4.145** **VF4.180** **VF4.200**

Serial numbers

Engine serial number:

Gearbox serial number:

Please enter the serial numbers here.

These numbers should be quoted when inquiring about Customer Service, Repairs or Spare Parts (see page 11).

We reserve the right to make any changes without previous notice.
Images shown in this manual may be different.

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Please read and observe the information given in this operation manual. This will enable you to avoid accidents, preserve the manufacturer's warranty and maintain the engine in peak operating condition.

Make sure that the manual will remain intact and damage is prevented. Keep the manual away from humidity and heat.

Do not alter the content of the manual.

The manual is an integral part of the engine. Hand over the manual to the new owner if boat or engine is being sold.

For the Guarantee Conditions, see the Vetus Diesel 'Service and Warranty Manual' (320199.06).

This engine has been built exclusively for the application specified in the scope of supply and is to be used only for the intended purpose. Any use exceeding that scope is considered to be contrary to the intended purpose. The manufacturer will not assume responsibility for any damage resulting therefrom. The risks involved are to be borne by the user.

Use in accordance with the intended purpose also implies compliance with the conditions laid down by the manufacturer for operation, maintenance and servicing. The engine should only be operated, maintained and serviced by persons which are familiar with the former and the hazards involved.

The relevant accident prevention guidelines and other generally accepted safety and industrial hygiene regulations must be observed.

Unauthorized engine modifications will invalidate any liability claims against the manufacturer for resultant damage.

Manipulations of the injection and regulating system may also influence the performance of the engine, and its emissions. Adherence to legislation on pollution cannot be guaranteed under such conditions.

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1 Safety measures

Warning indications

Warning indications

The following warning indications are used in this manual in the context of safety:



DANGER

Indicates that great potential danger exists that can lead to serious injury or death.



WARNING

Indicates that a potential danger that can lead to injury exists.



CAUTION

Indicates that the usage procedures, actions etc. concerned can result in serious damage to or destruction of the engine. Some CAUTION indications also advise that a potential danger exists that can lead to serious injury or death.



NOTE

Emphasises important procedures, circumstances etc.

Symbols



Indicates that the relevant procedure must be carried out.



Indicates that a particular action is forbidden.

Pass the safety precautions on to other people who will use the engine.

General rules and laws concerning safety and accident prevention must always be observed.

1 Safety measures



FIRE RISK!

- Do not smoke if refuelling.
- Avoid spilling fuel on hot surfaces. Spilled fuel must be cleaned up immediately.
- Do not use petrol or diesel to clean components but make use of good quality, non-flammable, non-poisonous solvents that are available from dealers.
- Always be alert to possible fuel or oil leakage!
If you discover a leak, take counter-measures immediately. If fuel or oil is spilled on a hot engine, fire can break out. This can cause physical injury or damage to the equipment.
- Do not fill the fuel tank while the engine is running!
Only refuel with the engine stopped.
- Never put flammable materials in the vicinity of the engine!
- Keep the engine and engine compartment clean!
Remove all inflammable materials such as fuel, oil and other litter before it builds up in the vicinity of the engine.
- Connecting (emergency) extra starting battery
Proceed as follows when an extra starting battery is used to jump start the engine:
 - First connect the positive lead
 - Lastly connect the earth cable (negative pole) to the engine block

If this cable is connected in error to the negative pole of the engine battery, a spark can occur. The result of this could be that explosive gas produced by the battery explodes.

 - Once the engine is started, first remove the earth cable.

Preventing fire and explosion

1 Safety measures

Prevention of injury

- The moving parts of the engine are dangerous. Never touch moving parts of the engine while it is running, to prevent cuts and other injuries.
- Stop the engine before carrying out maintenance!
- Always stop the engine before topping up or replacing fuel, oil or coolant.
- Before carrying out inspection or maintenance, the ignition key must be removed and the main battery switch turned off.
- Satisfy yourself that everything is in order before the engine is started again! Make sure that no-one is working on or close to the engine before you start it. Remove all foreign objects from around the engine, such as litter, oil, tools and other components that are not part of the engine.
- Install all protective covers! To prevent injury, make sure that all protective covers and cover plates are replaced over moving parts.
- Remove any tool used to turn the engine over. If you leave this in position, serious injury or damage to the equipment can result.
- NEVER open the cap of the expansion tank when the engine is at working temperature.
- Only check the coolant level after the engine has been stopped and the filler cap on the heat exchanger is cool enough to be removed with bare hands.
- Never attempt to adjust the fan belt on a running engine.

1 Safety measures

- Be careful with battery acid!
If battery acid comes in contact with the eyes or skin, rinse the affected part immediately with copious amounts of water. If battery acid comes in contact with the eyes, rinse them out immediately with plenty of water and consult a doctor.
- Be careful with antifreeze!
If you accidentally swallow antifreeze, make yourself vomit and consult a doctor immediately. If antifreeze comes in contact with your eyes, wash them out immediately with plenty of water and consult a doctor.
- Make sure that you are wearing suitable clothing before starting work!
For your own safety you will most likely need special equipment – safety helmet, eye protection, safety boots, safety goggles, heavy gloves, ear protectors etc. Use them when necessary.
- Carry out maintenance procedures safely by only using suitable tools.
- Exhaust gases
Do not start the engine if the exhaust system is not connected.

1 Safety measures

When problems occur

When the engine stops suddenly:

If the engine stops suddenly, do not start it again immediately. Track down the cause and carry out the necessary repairs before you start the engine again. If you do not do this, serious engine problems can develop.

If the oil pressure is too low:

Stop the engine immediately and check the lubrication system. Running an engine with low oil pressure can cause bearing and other parts to seize.

If the engine overheats:

If the engine should overheat, do not switch it off immediately. If an overheated engine is stopped suddenly, this can cause the coolant temperature to rise rapidly and moving parts to seize. First let the engine run in neutral to allow the hot parts of the engine to cool down, stop the engine and allow it to cool, and then gradually top up the coolant. Remember: adding coolant to an overheated engine can cause damage to the cylinder head.

If the fan belt is broken:

Immediately stop the engine. If an engine is used with a broken fan belt, this can lead to the engine overheating, which in turn can cause coolant to spray out of the expansion tank.

If the engine behaves strangely:

Stop the engine or reduce the speed as far as possible. Do not use the engine again until the cause of the defect has been solved.

2 Introduction

Dear customer,

Vetus diesel engines are designed both for pleasure craft and commercial craft. Consequently, a wide range of variants are offered to meet the requirements of specific cases.

Your engine is appropriately equipped for your vessel, which means that not necessarily all components described in this manual are mounted to your engine.

We have endeavoured to highlight any differences so that you will be able to locate the operating and maintenance instructions relevant to your engine quickly and easily.

Please read this manual before starting your engine and always observe the operating and maintenance instructions.

We are available to help with any additional inquiries.

Sincerely,
Vetus b.v.

2 Introduction

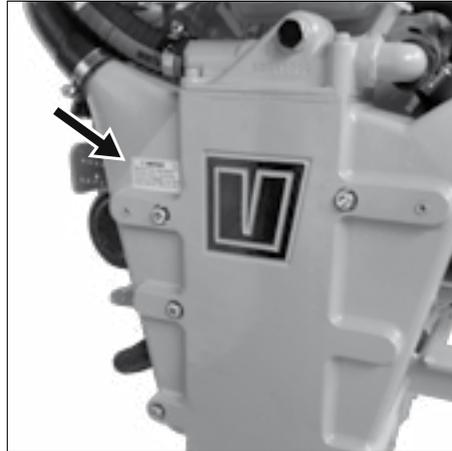
Data tag



1 Engine data tag

The Vetus engine serial number and performance data are printed on the engine data tag.

Model and engine serial number must be given when ordering spare parts.



2 Engine data tag location

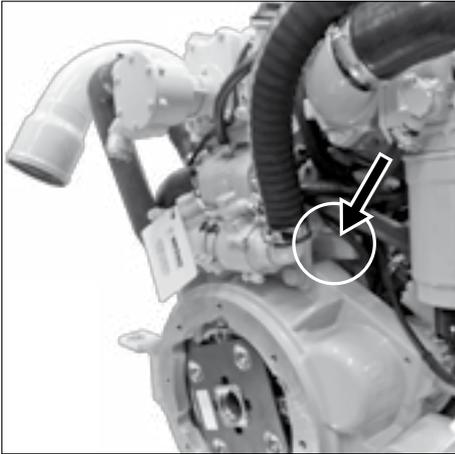
The type plate is positioned as shown.



There is a second type plate on the ECU box.

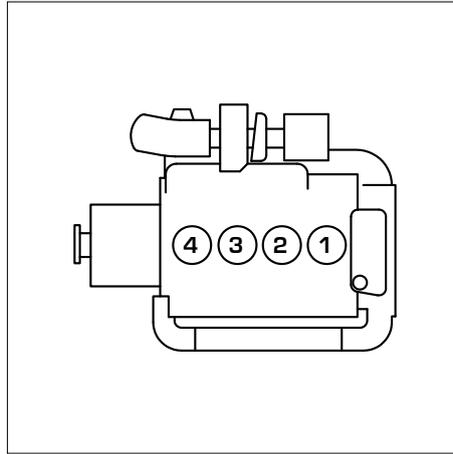
2 Introduction

Serial number Cylinder numbering



3 Position of serial number

The serial number is stamped in the engine block in the position shown.



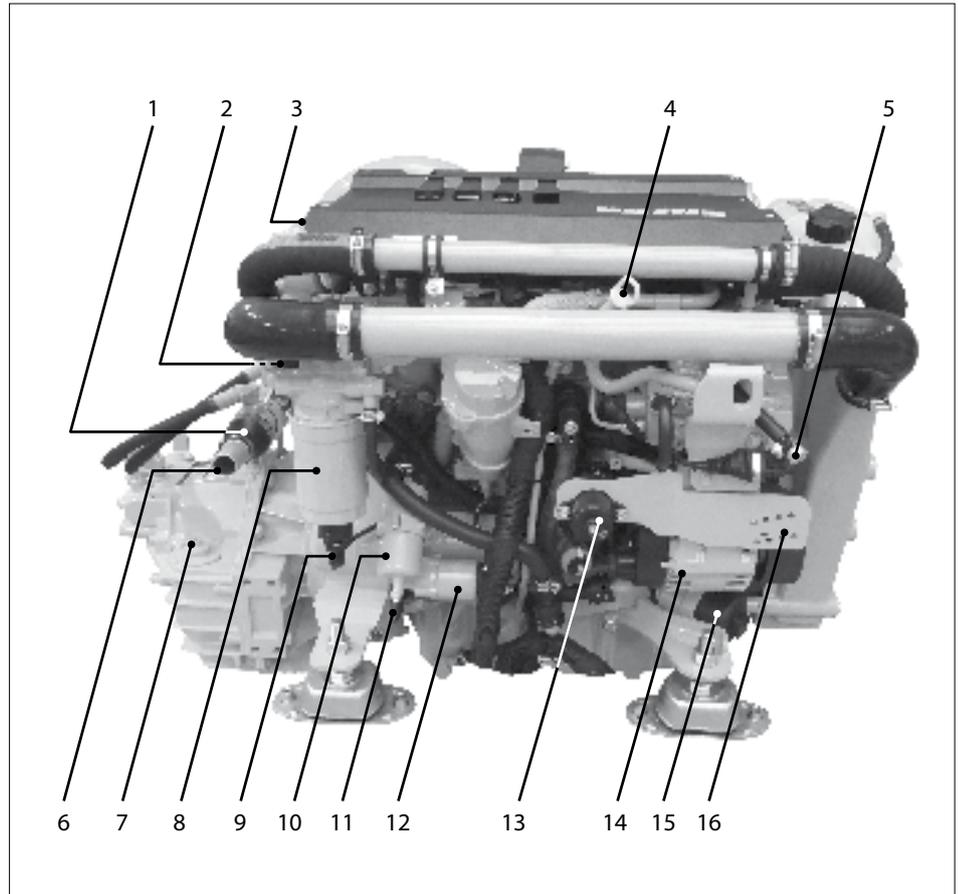
4 Cylinder numbering

Cylinders are numbered consecutively, beginning at the front end.

2 Introduction

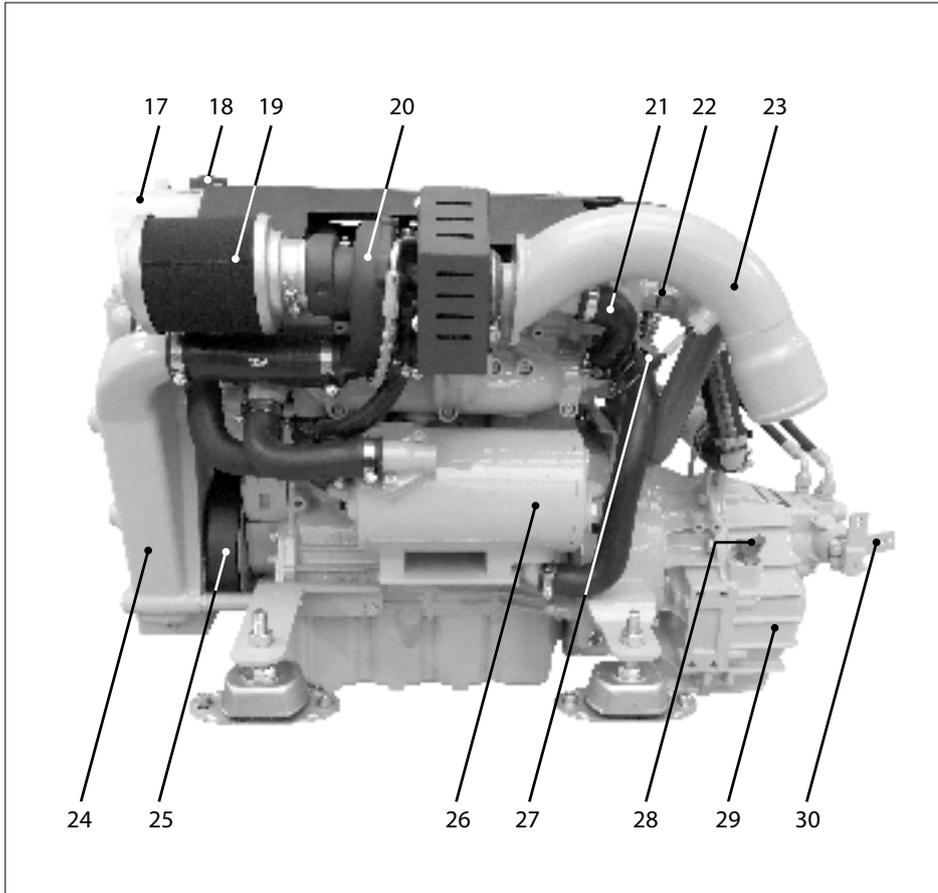
Identification of engine parts

1. Oil cooler, gearbox
2. Fuel return pipe connection \varnothing 8 mm
3. Oil filler cap
4. Oil dipstick
5. Oil drainage connection
6. Raw water intake, \varnothing 32 mm
7. Gearbox filter
8. Water separator/fuel filter
9. Water separator/fuel filter drain plug
10. Fuel lift pump
11. Fuel supply pipe connection \varnothing 8 mm
12. Starter motor
13. Potentiometer
14. Alternator
15. Oil filter
16. Connection of push-pull cable



2 Introduction

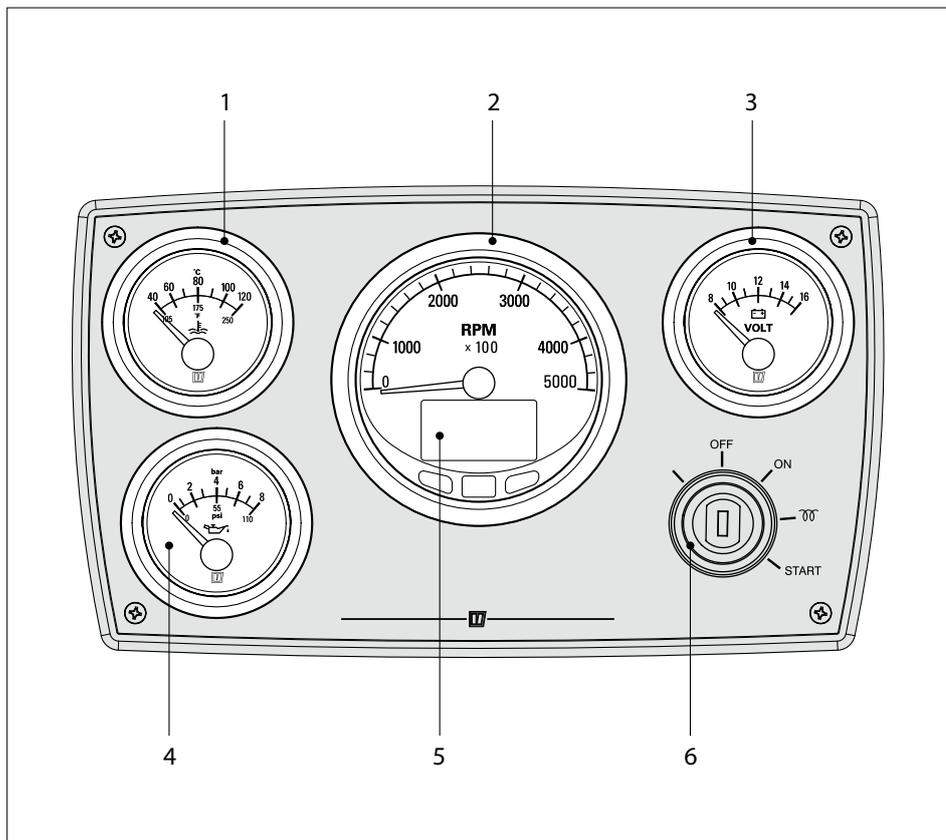
Identification of engine parts



17. Expansion tank
18. Filler cap (pressure cap) for cooling system
19. Air filter
20. Turbocharger
21. Airvent connection
22. Raw water pump
23. Exhaust injection bend
24. After cooler
25. Drive belt
26. Heat exchanger
27. Fuel cooler
28. Oil dipstick/Gearbox filler cap
29. Gearbox
30. Operating gearbox

2 Introduction

Control panel

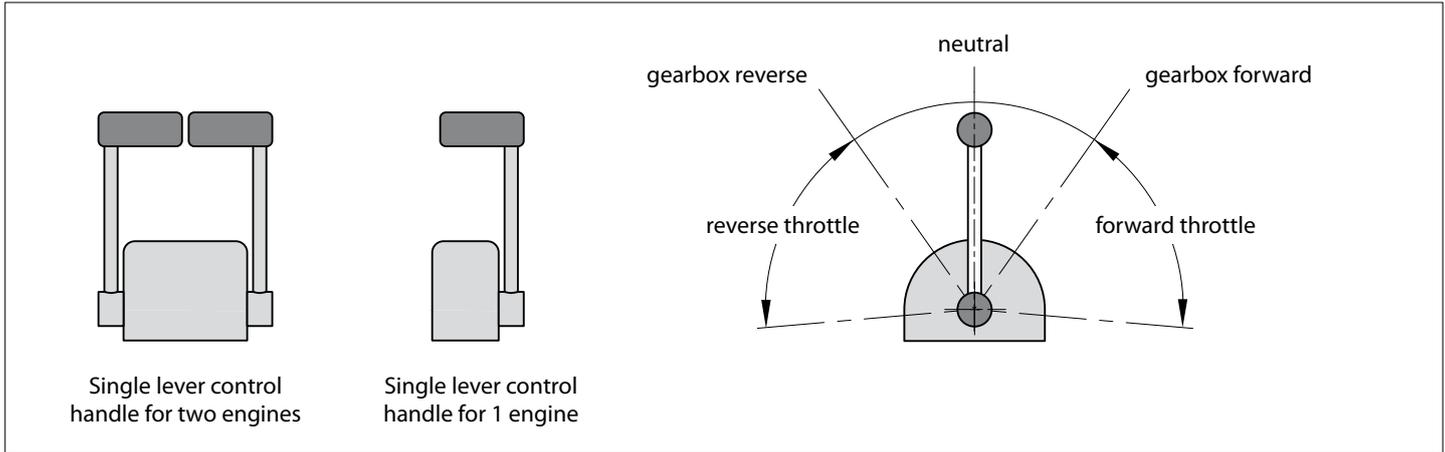


- 1 Temperature gauge, coolant
- 2 Tachometer/Operating hours counter
- 3 Voltmeter
- 4 Oil pressure gauge
- 5 Display
- 6 Starter pre-heat switch/lock

Panel, model MPA34 CAN BS2

2 Introduction

Control lever



5 Operating lever

Operating lever for 1 or 2 engines.

The engine or engines are typically controlled with a single-lever.

Depending on the brand and type (mechanical or electronic), there may be minor differences in the mode of operation. Please refer to the engine manual for details.

However, the principle is always as indicated above.

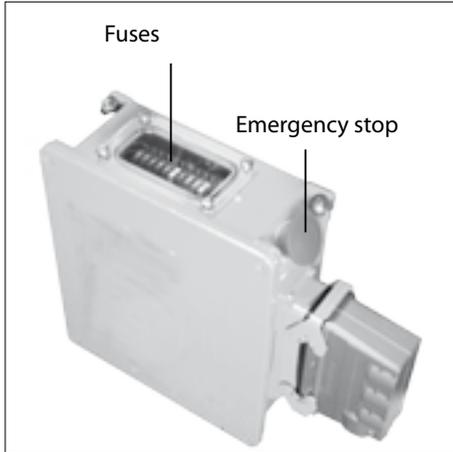
The control lever works as shown in the diagram.

Starting from neutral put the engine in ahead or astern by moving the lever 35° forwards or backwards.

The throttle lever operates at an angle of 60° forwards and 60° reverse.

2 Introduction

The ECU box



6 The ECU box

The ECU box contains the electronic control unit for the engine, the stop knob, the fuses, the engine wiring connections and the control panel wiring connections.

The stop knob switches the ECU off if faults may possibly have been caused by incorrect connections made during the installation.

Press the red key in an emergency to stop the engine.

3 First commissioning

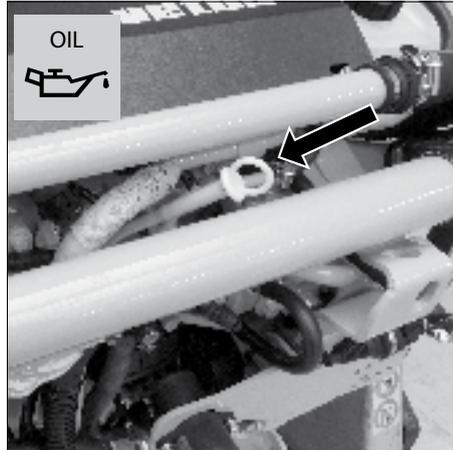
1 Commissioning the engine

Before starting the engine for the first time, the following procedures must be carried out:

2 Checking oil level

The engine is already filled with oil.

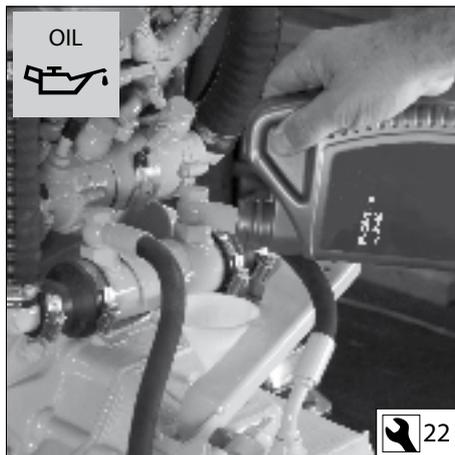
Check the oil level, see page 38.



3 First commissioning

Vetus engines are normally equipped with Technodrive or ZF-Hurth gearboxes.

In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owners manual.



3 Filling gearbox with oil

Fill the gearbox with oil.

Check the oil level with the dipstick, see page 49.

Technodrive:

- type TM345 : 1,6 litres Engine oil SAE 20W40-CD
- type TM345A : 1,6 litres, Engine oil SAE 20W40-CD
- type TM485A : 2,6 litres, Engine oil SAE 20W40-CD

ZF Hurth:

- type ZF25 : 2,5 litres, without oil cooler
- type ZF25A : 1,8 litres, without oil cooler
- type ZF45 : 3,0 litres, without oil cooler
- type ZF45A : 2,0 litres, without oil cooler
- type ZF63IV : 3,8 litres, without oil cooler

ATF: Automatic Transmission Fluid;
Transmissie olie type A, Suffix A.

3 First commissioning



4 Check the coolant level

The engine cooling system is already filled with coolant.

Check the coolant level in the expansion tank, see page 39.

Top up if necessary.



CAUTION

Never fill the cooling system with sea water or brackish water.



NOTE

Water Heater

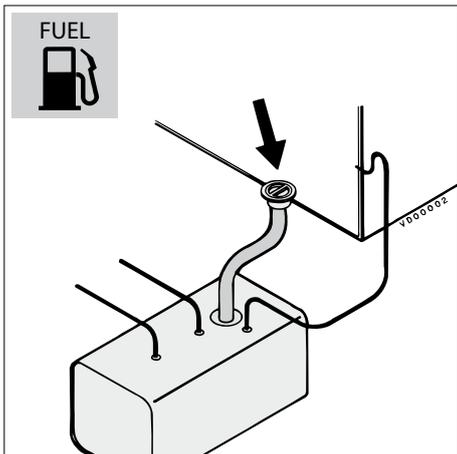
If the engine is connected to a water heater the cooling system must be topped up, see page 63.



NOTE

If the water heater is positioned higher than the top of the engine then it will not be bled automatically!
Follow the instructions for filling on page 63.

3 First commissioning



5 Fuel

- Ensure that the fuel tank is filled with diesel fuel.

Use only clean, water-free, commercial approved diesel fuel.

For fuel grade see page 107.

- Bleed the fuel system, see page 42.

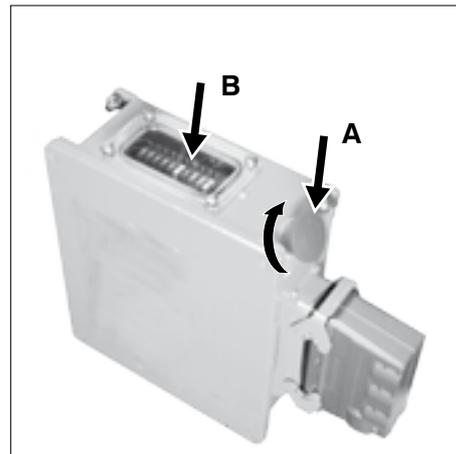


WARNING

Never fill the fuel tank while the engine is running. Do not spill fuel. Prevent unnecessary pollution.

6 Other preparations

- Check that the battery is charged and check the battery cable connections.
- Set the main switch to position 'on'.
- Open the sea cock.



- Check that the gearbox control lever is set to 'neutral'.
- Check that switch (A) on the ECU box is 'on'. Turn the knob in the direction of the arrow.
- Check that the fuse control LEDs (B) all light up.

3 First commissioning



CAUTION

Stop the engine immediately if it makes any strange noises, vibrates excessively or if black smoke comes out of the exhaust!

7 Starting

- How to start the engine and what to check before, during and immediately after starting is described on page 25 and further.

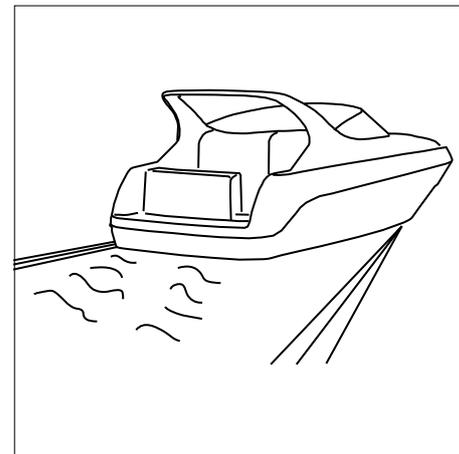
Allow the engine to test run for about 10 minutes at idling speed .

Check that the engine and all connections (fuel, coolant and exhaust) for leaks.

8 Bleeding

The cooling system must be bled as soon as the engine has reached normal working temperature.

- Open the cap on the expansion tank.
- Vary the revolutions between idling and 2000 rev/min.
- Add coolant if necessary.
- Close the cap on the expansion tank.
- Check the coolant temperature.



9 Sea trial

Make sure that the control lever(s) is (are) activated.

Engage the gearbox or stern drive and carry out a sea trial.

4 Running-in

In order to ensure a long life for your engine, please observe the following for the first 50 operating hours:

- Allow the engine to reach operating temperature before applying a load.
- Avoid fast acceleration.
- Do not allow the engine to run faster than 3/4 of maximum RPM.

After the first 50 operation hours carry out the following maintenance:

- Drain water from fuel filter, see page 41.
- Engine oil change, see page 43.
- Replace oil filter, see page 44 .
- Change gearbox oil, see page 51, 52.
- Replace fuel filter, see page 54.
- Check flexible engine mounts, see page 57.
- Check engine for leaks, see page 57.
- Check tightness of all fasteners, bolts and nuts, see page 57.

General guidelines for use

Implementing the following recommendations will result in longer life and better performance and more economical operation of your engine.

- Carry out the maintenance described regularly, including the 'Daily procedures before starting'.
- Use anti-freeze in the engine coolant all year long, this helps prevent corrosion as well as protecting against frost damage. For specifications see page 111.
- Never run the engine without a thermostat.
- Use a good quality lubricating oil. For specifications see page 108.
- Use a good quality diesel fuel that is free of water and other pollutants.
- Always stop the engine immediately if one of the warning lamps for oil pressure, high coolant temperature, high raw water temperature or battery charging indicated in the display.
- Always follow the safety advice, see page 4.



NOTE

First commissioning

Follow the instructions given for 'First commissioning' on page 17 and further if the engine is being commissioned for the first time.

After repair work:

Check that all guards have been replaced and that all tools have been removed from the engine.

When starting with pre-heating, do not use any other substance (e.g. injection with 'Easy Start'). Doing so could result in an accident.

5 Use

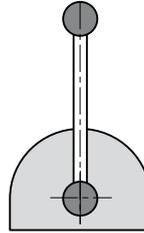
Starting

Before starting, always check the following points:

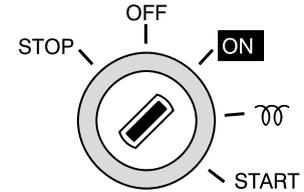
- Engine oil level.
- Coolant level.
- Sea cock open.
- Main switch 'ON'.
- Gearbox in '**NEUTRAL**' position.

Neutral

(No throttle, gearbox **not** engaged)



1 Control lever



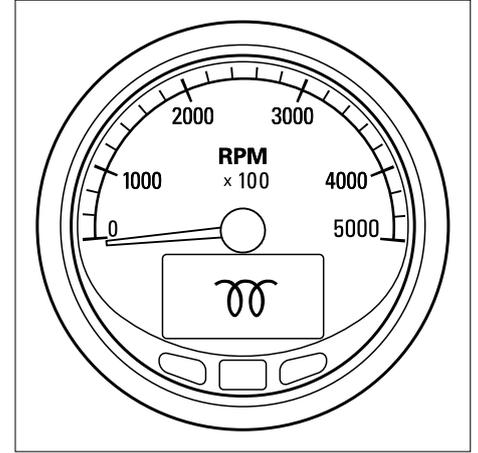
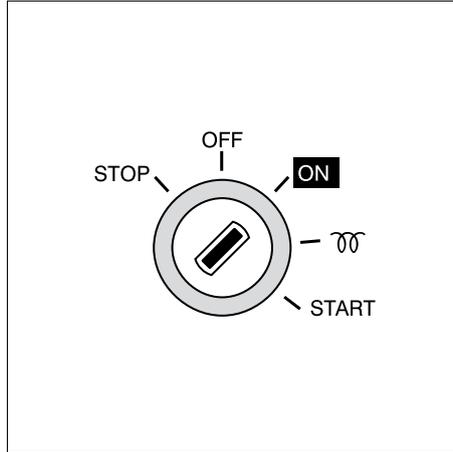
2 Switching on

Before starting the engine, always check that the control lever(s) is (are) in the **neutral position**.

- Turn the start key on the instrument panel clock-wise; the warning lights for oil pressure and alternator will now light up and the alarm buzzer will sound.

5 Use

Starting



3 Pre-heating

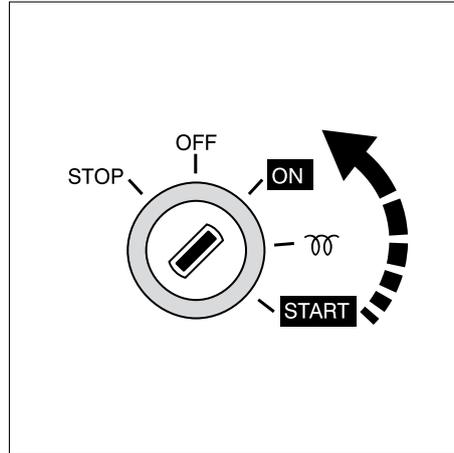
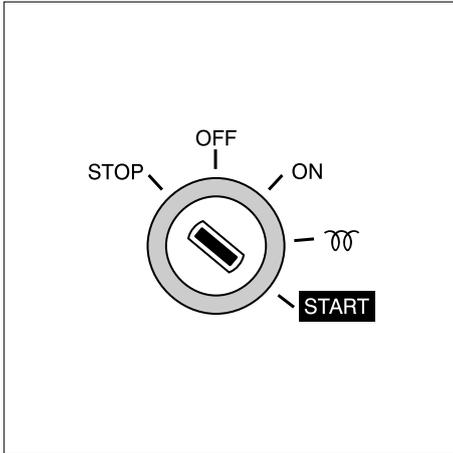
All LEDs for the fuses should come on when the starter key is in position 'ON'.

Automatic pre-heating will take place depending on the engine temperature.

The pre-heat time depends on the engine temperature.

During pre-heating, the pre-heating symbol will be shown in the display.

If the symbol for pre-heating disappears, the engine can be started.



4 Starting

Now turn the key further to the '**START**' position

Automatic pre-heating will also take place during starting when the ambient temperature is low.

Release the key as soon as the engine fires (the key will return to the '**ON**' position) and throttle back.

Leave the key in this position while the engine is running



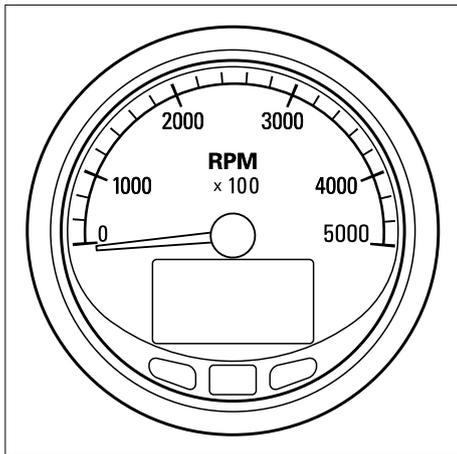
CAUTION

Release the key if the engine does not fire within 10 seconds.

Let the starter motor cool for 30 seconds before turning the key to the '**START**' position again.

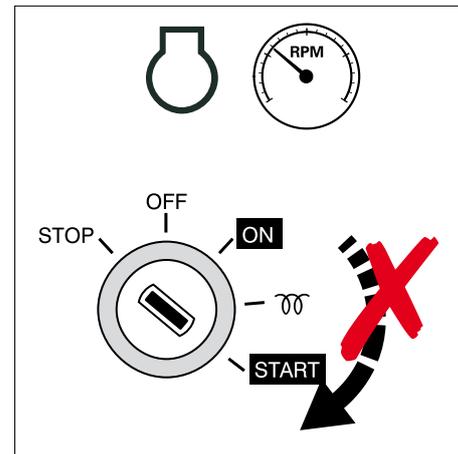
5 Use

Starting



NOTE

Idling speed will be about 100 rev/min higher than normal when the engine is cold, the coolant temperature is lower than 40°C (104°F), or the battery voltage is less than 11 Volt.



Check that there are no oil pressure and alternator warnings indicated in the display.

The cooling water should now flow out of the outlet; if this doesn't happen, stop the engine immediately.

Let the engine run for 5 to 10 minutes in neutral. A good warm up is essential to ensure maximum lifetime and good performance.



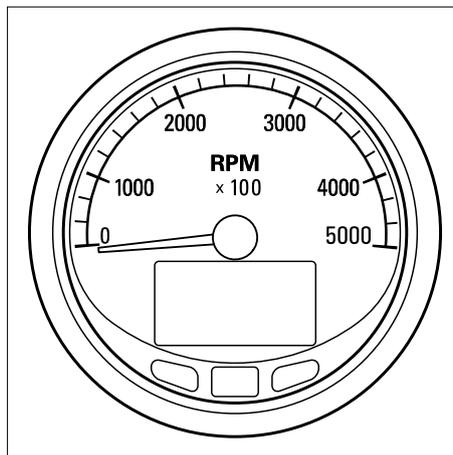
CAUTION

Never turn the main switch off while the engine is running.



CAUTION

Never turn the key to the 'START' position while the engine is running. Doing so will damage the starter motor..



5 Tachometer

The instrument panel is provided with the following instruments

Indicating the number of revolutions per minute of the engine.

Also the number of running hours is indicated.

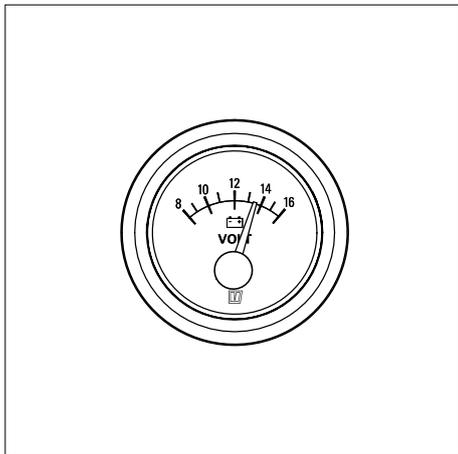
Idling speed: 800 rpm



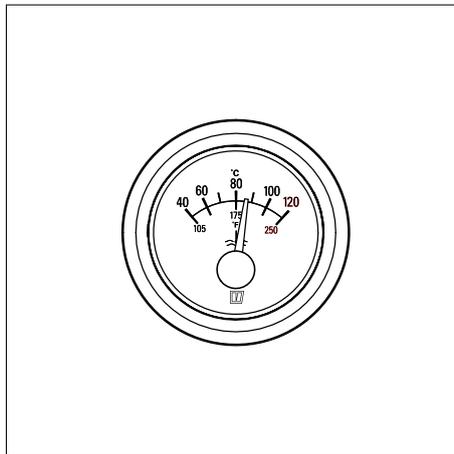
WARNING

Avoid idling for more than 10 minutes.

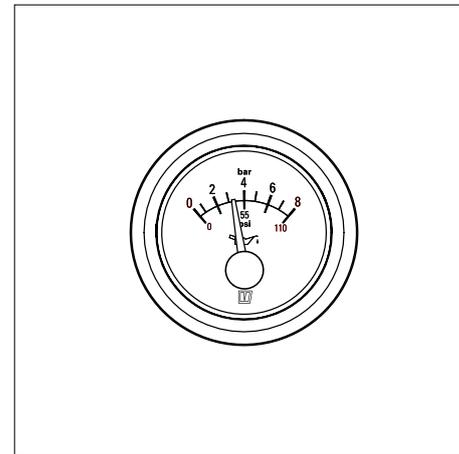
This can lead to carbon deposits in the combustion chambers and incomplete combustion of fuel.

**6 Voltmeter**

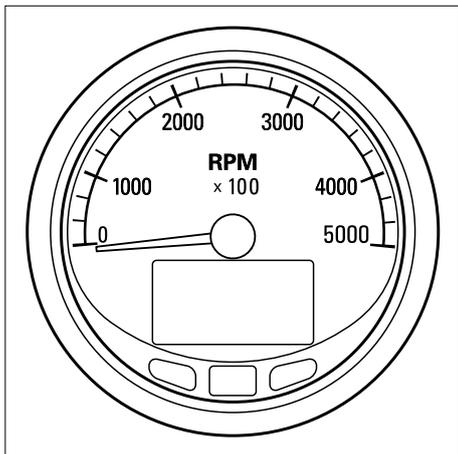
Indicating the battery voltage.
When the engine is running, the battery voltage should be between 12 and 14 Volts.
With the engine stopped and the start key in the first position, the voltmeter should indicate 12 Volts.

**7 Temperature gauge**

Indicating the temperature of the internal cooling system.
The operating temperature is 75°C - 90°C (167°F - 194°F).
In case the engine is overheated: turn off the engine and establish the cause, see fault finding table, page 93 .. 101.

**8 Oil pressure gauge**

With the engine at operating temperature, the oil pressure is:
When idling: at least 1 bar (7 psi).
In case the oil pressure is too low: turn off the engine and establish the cause, see fault finding table, page 93 .. 101.



9 Warnings

When the engine is running, no warnings should be displayed.

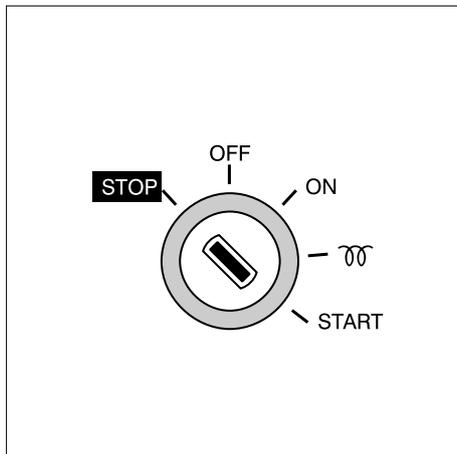
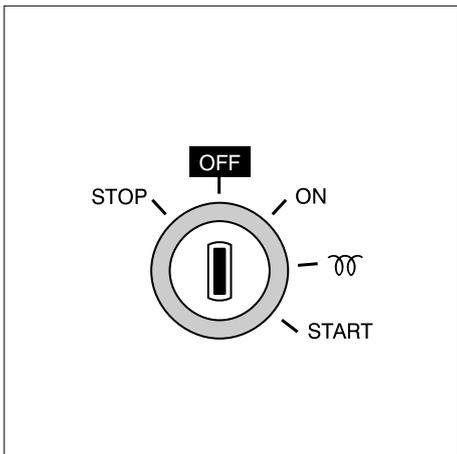


10 Alarm buzzer

The alarm buzzer sounds if the oil pressure is too low or the alternator does not charge or the engine temperature is too high. If this alarm buzzer sounds while running, **Stop the engine immediately!**

5 Use

Stopping



11 Electrical shutdown

- Reduce engine speed to idle and shift the gearbox to '**Neutral**'.
- Turn the key anticlockwise to the "Off" position.

NOTE

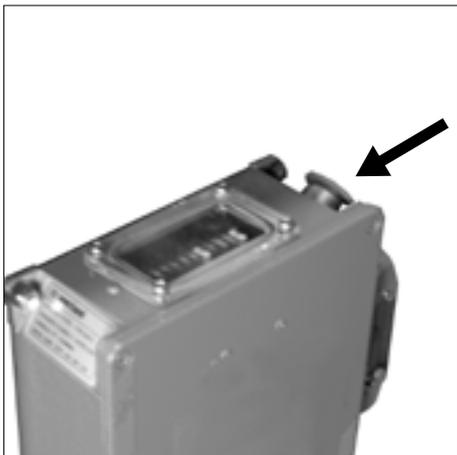
Never stop the engine immediately after it has been in operation for a long time. Allow the engine to idle for a few minutes before stopping.

N.B. The '**STOP**' position, left of the '**OFF**' position on the control panel, has normally no function for this engine.

When 2 control panels are connected to one engine, the engine can always be stopped by turning the key to the '**STOP**' position, no matter what the position is of the key on the other panel.

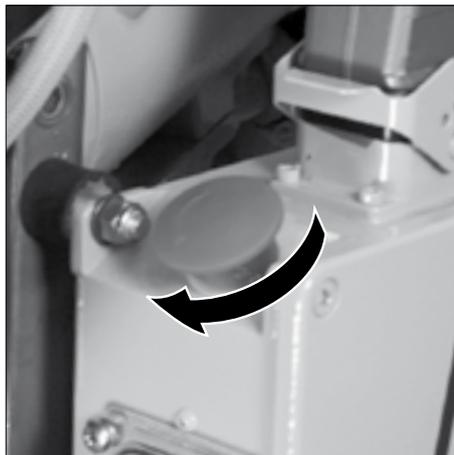
NOTE

If the engine is not to be used for some time, it is recommended that the sea cock is closed and the battery main switch turned off.



12 Mechanical stopping

If there is a fault, the engine can be stopped by pressing the red button on the ECU box.



- Turn the knob in the direction of the arrow when the engine has stopped.
- Trace the source of the fault and repair this.
- The engine can then be started again.

Introduction

The following guidelines should be observed for daily and periodic maintenance. Perform each function at the indicated time interval.

The intervals stated are for normal operational conditions. Service the unit more frequently under severe conditions.

Failure to carry out maintenance can result in faults and permanent damage to the engine.

No claim can be made on the Guarantee if maintenance has been neglected.

Keep record of the following information in the logbook and/or the 'Service and Warranty Manual':

- Total engine hours (reading engine hour counter).
- Amounts of oil and coolant needed for topping up.
- The dates and intervals at which the oil and coolant are changed.
- Oil pressure and coolant temperature.
- Parts on which maintenance is conducted and type of maintenance (adjustment, repair or replacement), and the results of each procedure.
- Changes in operating conditions, such as 'Exhaust gas became black', etc.

6 Maintenance

Maintenance schedule

Every 10 hours or daily, before starting	page
Check engine oil level	38
Check coolant level	39
Check water strainer	40
Check oil level Stern-drive	*)

After the first 50 hours	page
Draining of water from the water separator/fuel filter	41
Replace oil filter	43
Replace fuel filter	44
Change gearbox oil (Technodrive)	51
Change gearbox oil and replace filter (ZF-Hurth)	52
Replace fuel filter	54
Check flexible engine mounts	57
Check engine for leaks	57
Check tightness of all fasteners, bolts and nuts	57

Every 100 hours, at least once every year	page
Draining of water from the water separator/fuel filter	41
Engine oil change	43
Replace oil filter	44
Battery, cables and cable connections	46
Check gearbox oil level	49
Check oil level power steering Sterndrive	*)

Every 200 hours, at least once every year	page
Clean air filter	50



DANGER

Stop the engine before carrying out any maintenance work.

*) Consult the owner's manual supplied with the stern drive.

6 Maintenance

Maintenance schedule

Every 400 hours, at least once every year	page
Change gearbox oil (Technodrive)	51
Change gearbox oil and replace filter (ZF-Hurth)	52
Replace fuel filter	54
Check flexible engine mounts	57
Check engine for leaks	57
Check tightness of all fasteners, bolts and nuts	57

Every 400 hours	page
Check and adjust injector pressure	**)
Check glow plugs	**)

Every 800 hours, at least once every 2 years	page
Raw water pump inspection	58
Replace coolant	63

Every 800 hours	page
Replace drive belt	64
Check alternator	67
Check turbocharger	**)
Replace distributor belt	**)

When required	page
Bleeding fuel system	42
Cleaning heat exchanger	68
Cleaning the after cooler	72

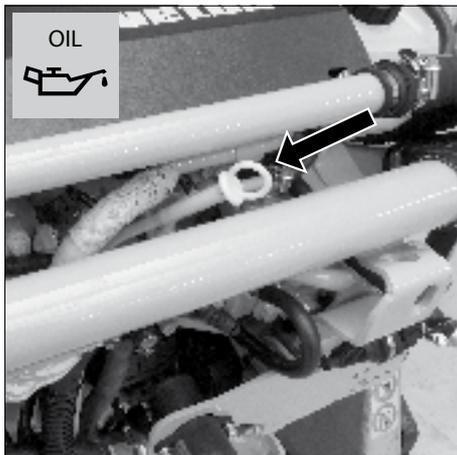


DANGER

Stop the engine before carrying out any maintenance work.

**) Consult the service manual, work to be carried out by a Vetus dealer.

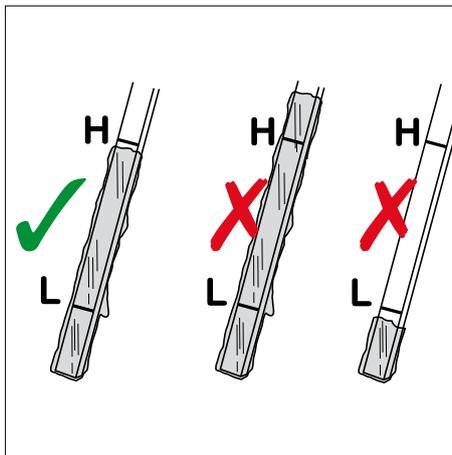
6 Maintenance



1 Check oil level

- Turn the engine off.

The dipstick is located on the starboard side of the engine.



2 Oil level

The oil level must be at or near the upper mark on the dipstick*.

- If necessary top up with the same brand and type of oil.

*) The difference between the two oil level marks is: 0,8 litres

Checking engine oil level

Daily, before starting.



3 Topping up oil

The oil filling cap is on top of the the valve cover.

6 Maintenance



4 Checking coolant level

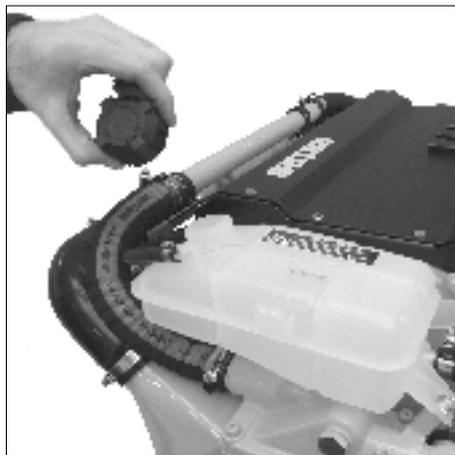
- Check the coolant level in the expansion tank. This has to be checked when the engine is **cold**.

The coolant level must be between the markings MIN and MAX.



WARNING

Never open the cap of the expansion tank when the engine is at operating temperature.



- Top up if necessary.
- Remove the cap from the expansion tank.

Checking coolant level

Daily, before starting.



5 Topping up coolant

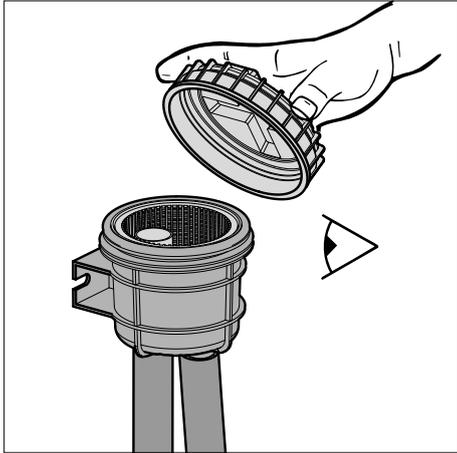
The internal cooling system can be filled with a mixture of anti-freeze (40 %) and tap water (60 %) or with a special coolant. For specification, see page [111](#).



CAUTION

Never fill the cooling system with sea water or brackish water.

6 Maintenance

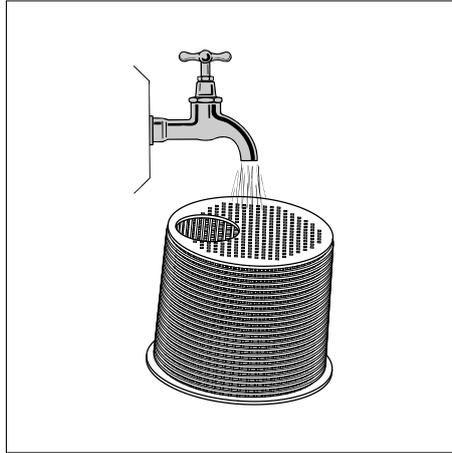


6 Checking the raw water strainer

- Check daily whether there is any dirt in the raw water strainer.

Checking and cleaning the raw water strainer

Daily, before starting.



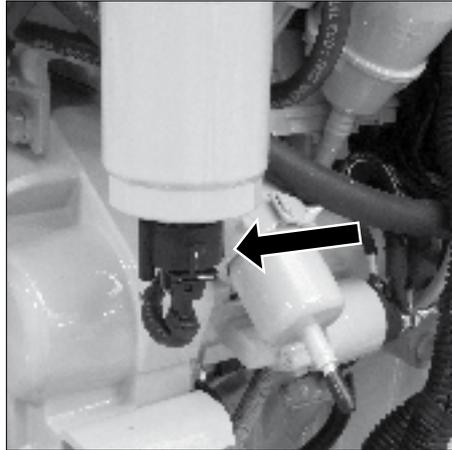
7 Cleaning the strainer

- Close the seacock before removing the lid of the water strainer.
- Clean the raw water strainer as often as is necessary, depending on the pollution of the waterways, but at least once every 6 months. A clogged raw water strainer will result in excessive temperatures or overheating of the engine coolant.
- Check the sealing between the lid and housing after cleaning and re-assembling the strainer. An improperly sealed lid will result in air sucked in by the sea water pump which again will result in overheating of the engine.

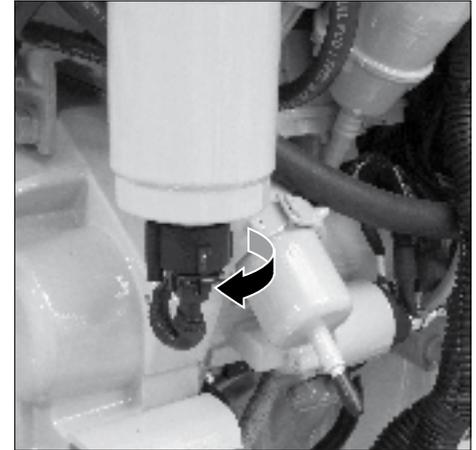
6 Maintenance

Draining of water from the water separator/fuel filter

Every 100 operating hours.



8 Drain fuel filter



DANGER

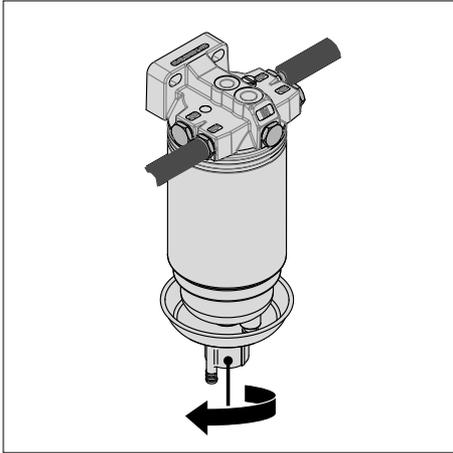
Do not smoke when draining off water and sediment. Keep flame and sources of ignition out of the area. Remove spilled fuel and litter before you start the engine.

The drain plug is on the bottom of the filter.

- First disconnect the connection on the drain plug.
The locking spring must be pushed in to release the connection.

- Unscrew the drain plug.
- Allow the water to drain out and then close the drain plug.
- Put the connection back on the drainplug.
The locking spring must be pushed in to allow the connection to be put back on the drain plug.

6 Maintenance



9 Empty water separator

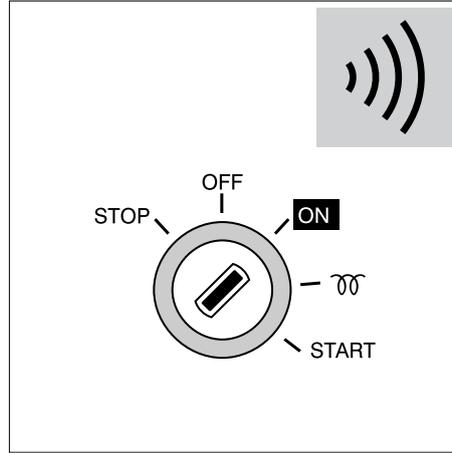
Empty the separately installed water separator/ fuel filter:

- Open the drain plug at the lower side of the filter.
- Drain the water and close the drain plug.

Note: The water separator is not within the scope of supply but installation is required!

Draining of water from the water separator/fuel filter

Every 100 operating hours.

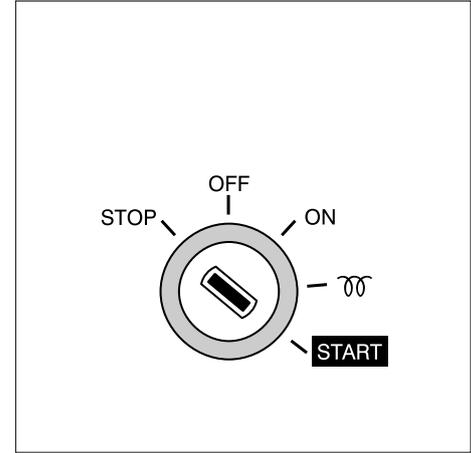


10 Bleeding

After the water separator/fuel filter has been drained, the air has to be bled from the fuel system

The fuel system is self-bleeding.

Turn the key in the ignition lock to 'ON' and leave the key in this position for 30 seconds. The fuel pump will now bleed the system.



11 Start the engine

- Operate the starter switch until the engine fires; release the starter switch if the engine does not fire within 20 seconds.
- Wait until the starter motor has stopped before making a new attempt to start the engine.
- Repeat the above if the engine cuts out after a short time.

6 Maintenance

Engine oil change

Every 100 operating hours.

12 Engine oil change

Change the engine oil every 100 hours of operation (together with engine oil filter replacement).

If the engine runs less than 100 hours during the year the oil should be changed at least once a year.

Run the engine for a few minutes before changing the oil; warm oil can be pumped out more easily.

Change the oil with a switched off engine at operation temperature. (Lube oil temperature approx. 80°C (176°F).)



DANGER

Be aware of the risk of skin burning during draining the hot oil! Used oil must be collected in a container for proper disposal according to laws and regulations.

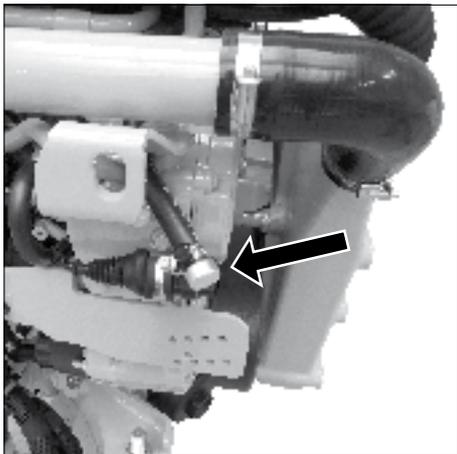


WARNING

Never use additives.

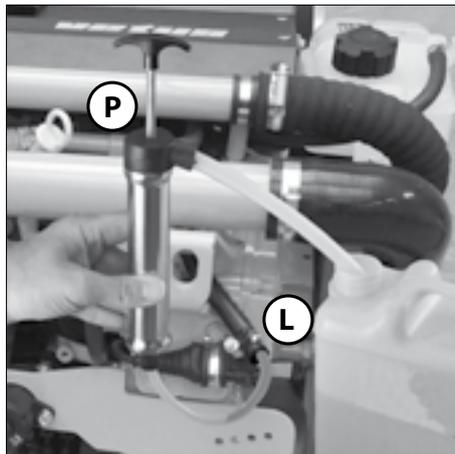
This could cause damage to the engine which is not covered by the guarantee.

6 Maintenance



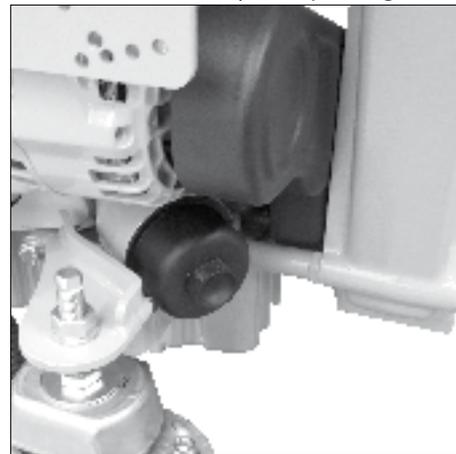
13 Draining the oil

- Remove the oil filler cap.
- Remove the plug from the oil drain pipe (L) and connect the oil drain pump (P) to this.
- Place the drain hose from the pump in a suitable receiver and pump the sump empty.



WARNING

The engine oil must be disposed in accordance with the applicable environmental regulations.



14 Removing the oil filter

Unscrew the oil filter, with a commercially available tool, when all the oil has been pumped out. Catch any dripping oil.

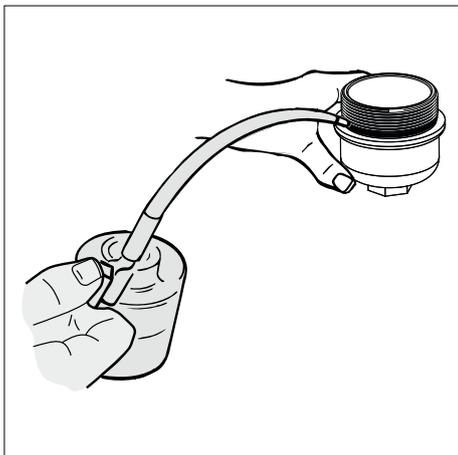


DANGER

Beware of burns from hot oil.

Engine oil change
Every 100 operating hours.

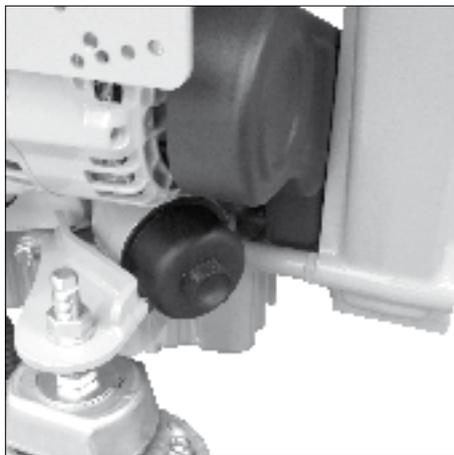
6 Maintenance



15 Oiling the oil seal

- Clean the contact surface of the gasket.
- Lubricate the oil seal of the new filter element with clean engine oil.

For **oil filter art. code** see page **120**.



16 Oil filter installation

- Install the filter in accordance with the instructions printed on the filter element housing.

Tightening torque 25 Nm (8-10 ft.lbf).

Engine oil change

Every 100 operating hours.

AMOUNT OF OIL (OIL FILTER INCL.):

litres	Imp. pt	US pt
4.5	7.9	9.5



17 Refilling with oil

- Refill the engine with new oil (for specification see page **108**) through the filler opening in the valve cover.

Operate the engine at idling speed for a short period of time. Check for oil leaks whilst the engine is running. Stop the engine. Allow 5 minutes for the oil to return to the sump. Check the oil level with the dipstick.

6 Maintenance

Warning notes and safety regulations for working with batteries



Wear eye protection.



Keep children away from acid and batteries.



Explosion hazard:

A highly-explosive oxyhydrogen gas mixture occurs when charging batteries, therefore:



Fires, sparks, naked flames and smoking are prohibited:

- Avoid causing sparks when dealing with cables and electrical equipment, and beware of electrostatic discharges.
- Avoid short-circuits.



Corrosive hazard:

Battery acid is highly corrosive, therefore:

- Wear protective gloves and eye protection.
- Do not tilt battery, acid can escape from the degassing openings or vents.



First aid:

- Rinse off acid splashed in the eyes immediately for several minutes with fresh water. Then consult a doctor immediately.
- Neutralize acid splash on skin or clothes immediately with acid neutralizer (soda) or soap suds and rinse with plenty of water.
- If acid is consumed, consult a doctor immediately.

Battery, cables and connections

Every 100 operating hours.



Warning note:

- Do not place batteries in direct daylight without protection.
- Discharged batteries can freeze up, therefore store in an area free from frost.



Disposal:

Hand in old batteries at a collection point.

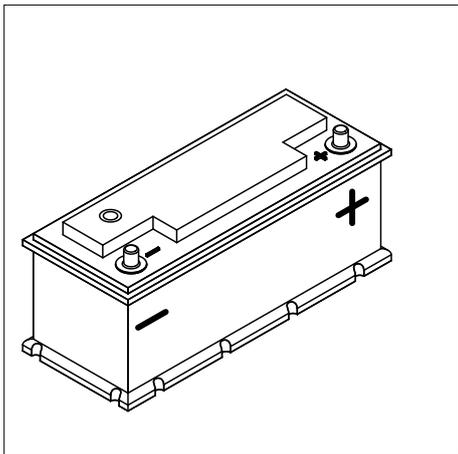
Keep the batteries upright and do not tip during transport and storage to prevent acid leaking out.

Never dispose of old batteries as domestic waste.



Careful! Metal parts of the battery will be always live so never lay objects or tools on the battery.

6 Maintenance



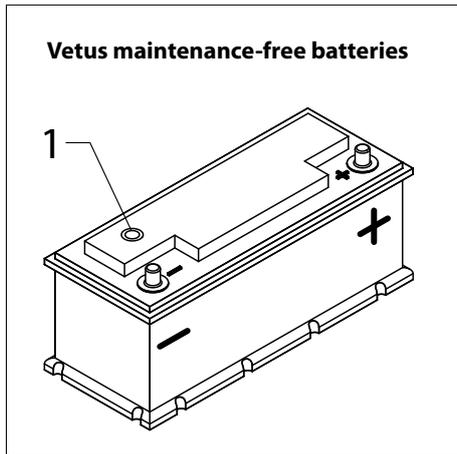
18 Battery, battery connections

Keep battery clean and dry.

- Remove battery cables (negative first).
- Clean battery posts (+ and -) and clamps and grease with acid-free and acid-resistant grease.

Ensure that clamps make good contact after reassembling.

- Hand tighten the bolts only.



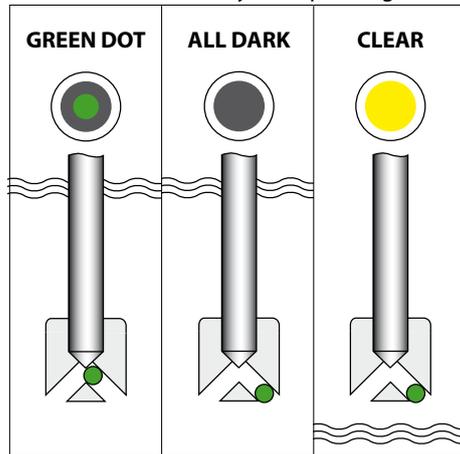
19 Checking specific gravity

Every Vetus Maintenance-free battery has a hydrometer (1) built into the cover.

Visual inspection of the hydrometer will show one of three conditions:

Battery, cables and connections

Every 100 operating hours.

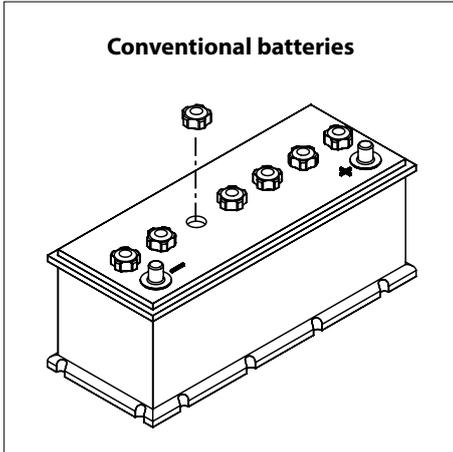


20 Hydrometer operation

- **Green dot visible:**
State of charge 65 % or more.
- **Dark:**
State of charge less than 65 %.
Recharge immediately.
- **Clear or light yellow:**
Electrolyte level low.

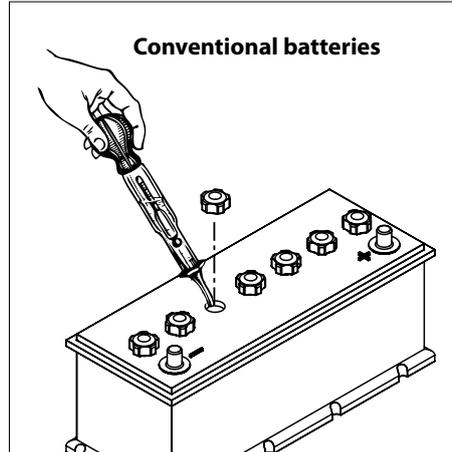
In case of low level, caused by overcharging the battery for a long period of time with a voltage too high, replace battery. Check alternator and/or voltage regulator.

6 Maintenance



21 Checking electrolyte level

For conventional batteries it is required to check the electrolyte level regularly. Remove vent caps (taking care no spark or open flame is nearby) and inspect the level. Fluid should be 10 to 15 mm ($\frac{3}{8}$ " to $\frac{5}{8}$ ") above top of all plates. If necessary top up with distilled water. Replace vent caps and charge the battery for 15 minutes at 15 - 25 Amps to mix electrolyte.



22 Checking specific gravity

Measure the electrolyte specific gravity of the individual cells with a commercial hydrometer. The hydrometer reading (see table) indicates the state of charge. Hydrometer reading of all cells should be at least 1.200 and show less than 0.050 between high and low. If not, recharge or replace battery.

Battery, cables and connections

Every 100 operating hours.

Specific gravity	Specific gravity	
1.28 kg/l	100%	
1.20 kg/l	50%	recharge
1.12 kg/l	10%	recharge immediately

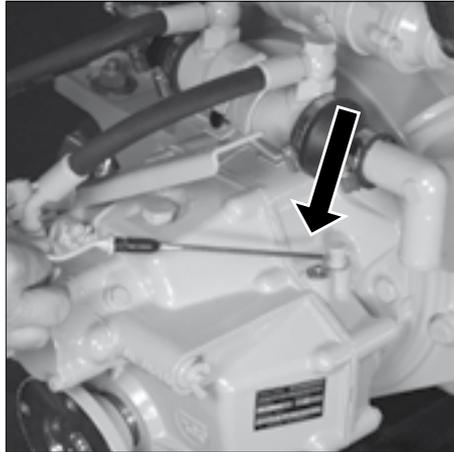
During checking the temperature of the electrolyte should preferably be 20°C (68°F).

Measuring the specific gravity shortly after water has been added results in an incorrect measurement. First charge the battery to mix the added water thoroughly.

6 Maintenance

Vetus engines are normally equipped with Technodrive or ZF-Hurth gearboxes.

Consult the supplied Owners Manual for more details about care and maintenance. In case your engine is gearbox follow the instructions given in the supplied owners manual for changing oil and other care and maintenance.



23 Oil level check (Technodrive)

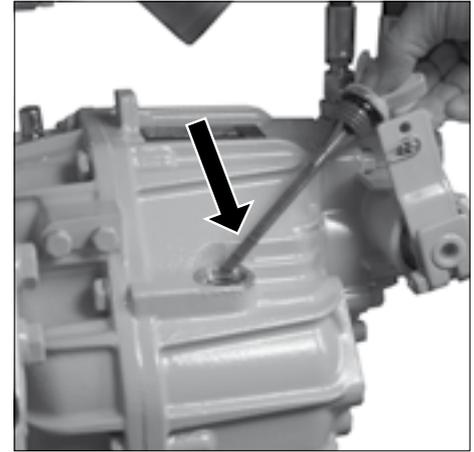
The oil level must be between the two marks on the dipstick.

If necessary, top up.

The filler cap is on top of the gearbox housing.

Gearbox oil level check

Every 100 operating hours.



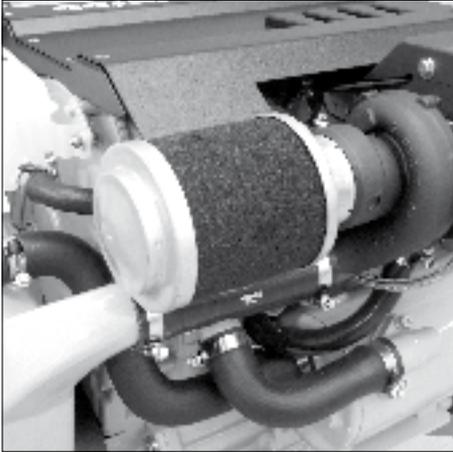
24 Oil level check (ZF-Hurth)

- Unscrew the dipstick out of the gearbox housing.
- Check the oil level by cleaning the dipstick and lowering it into the hole, without screwing it in. The oil level must be between the end and the mark on the dipstick.
- If necessary, top up by pouring oil in the dipstick hole.

For oil type and specification see page [108](#).

6 Maintenance

Cleaning the air filter
Every 200 operating hours.



25 Cleaning the air filter

- Stop the engine.
- Loosen the hose clamp.
- Remove the filter.
- Clean the filter material using a mixture of water and washing powder.
- Let the filter dry or blow dry using compressed air, maximum pressure 5 bar (70 psi) to prevent damage to the filter.
- Replace the filter and tighten the hose clamp.
A filter which is in bad condition needs to be replaced.

For **air filter art. code** see page **120**.



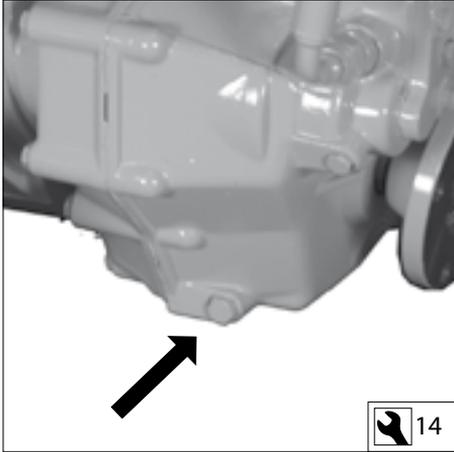
WARNING

Never clean the filter element with petrol or hot liquids.

Never apply any oil to the air filter.

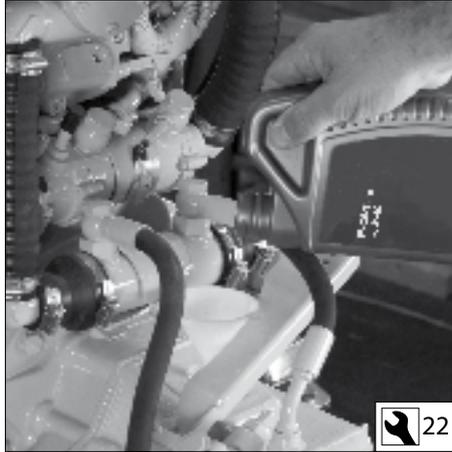
Never start the engine without the air filter in place.

6 Maintenance



26 Draining the oil

- Remove the drain plug to drain the oil.
- Remove the filler cap to vent the gearbox and check if all oil has been drained
- Collect the oil in a dripping pan.



27 Filling with new oil

- Refill the gearbox to the correct level via the dipstick opening.

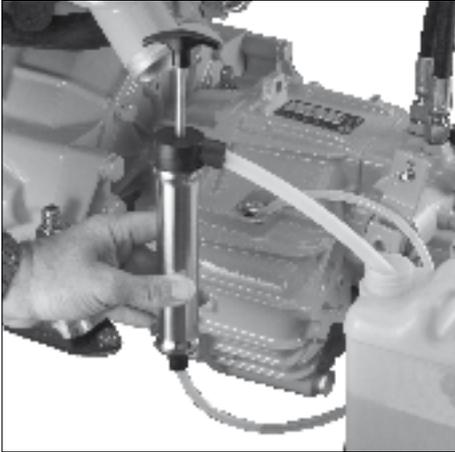
For oil specification see page [108](#).

Changing the gearbox oil (Technodrive)

Every 400 operating hours.

In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owners manual for changing oil and other care and maintenance.

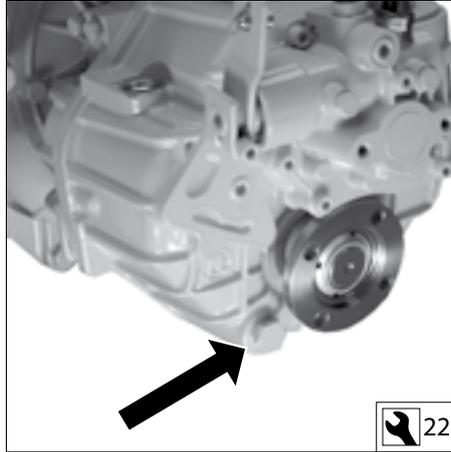
6 Maintenance



28 Draining the oil

Drain the oil with the aid of a separate sump pump.

- Remove the dipstick.
- Insert the suction hose of the sump pump in the dipstick hole. Push down the pump handle quickly and pull it up slowly.
- Remove the sump pump when all the old oil has been pumped out.

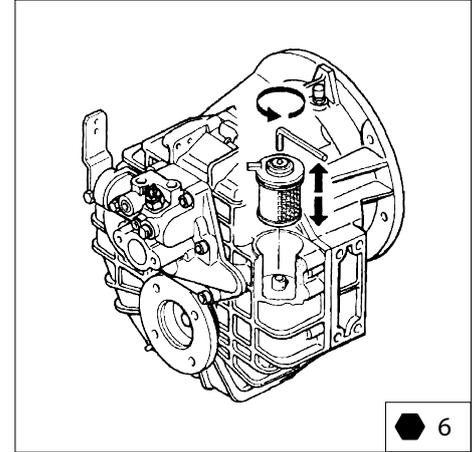


Or, if sufficient space below the gearbox is available, oil can be drained by removing the drain plug.

- Remove the fillcap to vent the gearbox and check if all oil has been drained
- Collect the oil in a dripping pan.

Changing the gearbox oil (ZF-Hurth)

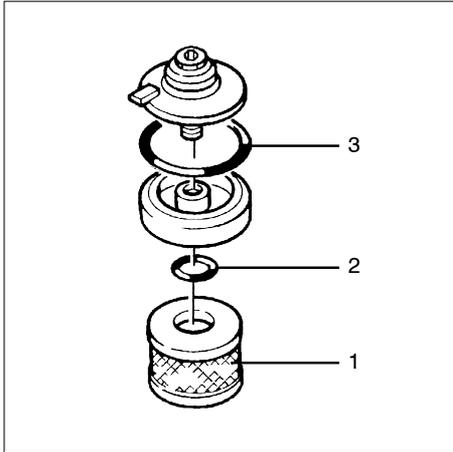
Every 400 operating hours.



29 Changing the oil filter

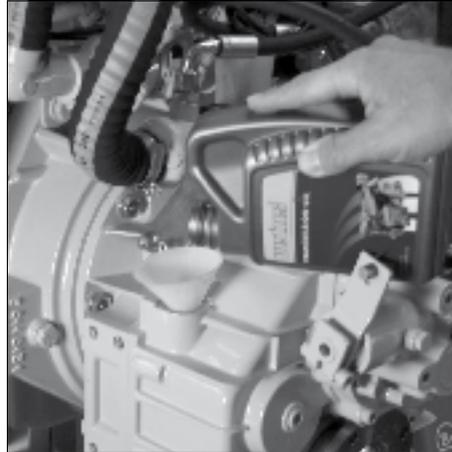
- The filter element must be replaced at the same time as the oil.
- Turn the screw that holds on the filter cover to the left and remove the filter from its housing. Use an Allen key for this.

6 Maintenance



- Withdraw the filter element (1).
- Check the O-rings (2 and 3) for damage and replace if necessary.
- Install the new filter and mount the unit on the gearbox.

For **filter element art. code** see page **120**.



30 Filling with new oil

- Refill the gearbox to the correct level via the dipstick opening.

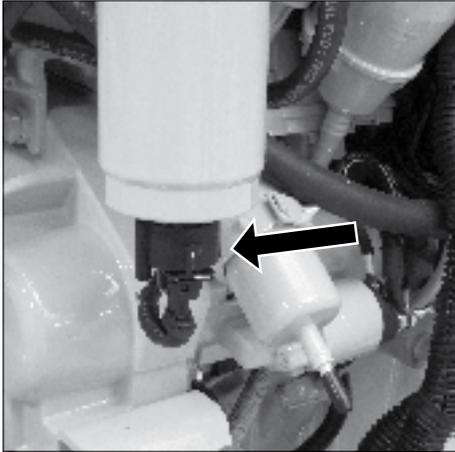
For oil specification see page **108**.

Changing the gearbox oil (ZF-Hurth)

Every 400 operating hours.

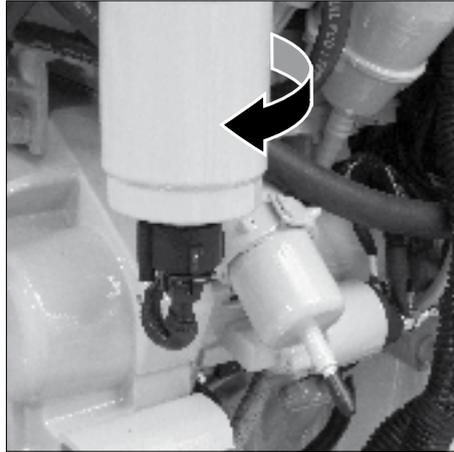
In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owners manual for changing oil and other care and maintenance.

6 Maintenance



31 Fuel filter removal

- The fuel filter is to be replaced as a unit.
- Close the fuel stopcock.
 - Loosen the connector on the drain plug at the lower side of the filter housing. Press the retainer spring to loosen the connector.



- Remove the fuel filter, use a filter wrench. Catch any fuel.

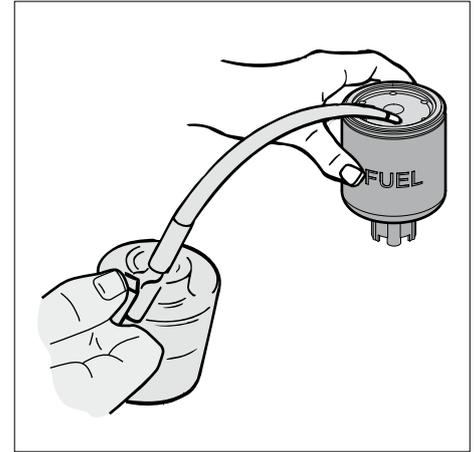


DANGER

Keep naked flames away when working on the fuel system. Do not smoke!

Fuel filter replacement

Every 400 operating hours.

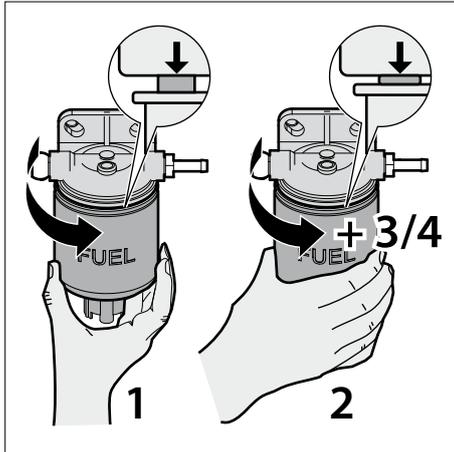


32 Fuel filter installation

- Clean any debris from the filter carrier rim.
- Lubricate the rubber gasket sparingly with clean engine oil.
- Fill the new filter with clean diesel fuel.

For **fuel filter art. code** see page **120**.

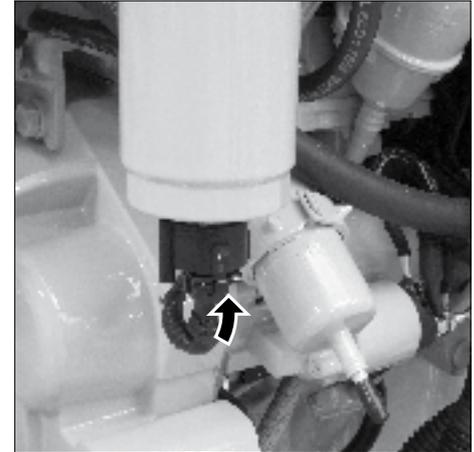
6 Maintenance



- Install the filter.
- When the rubber gasket touches the housing, apply another tightening of a half to three quarters of a turn by hand.
- Open fuel stopcock.
- Check for leaks.

Fuel filter replacement

Every 400 operating hours.

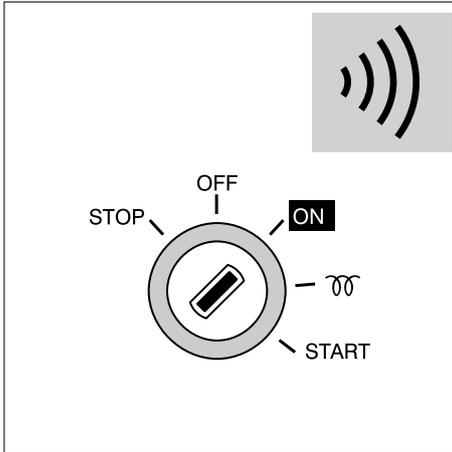


- Put the connection back on the bottom of the filter.

6 Maintenance

Fuel filter replacement

Every 400 operating hours.

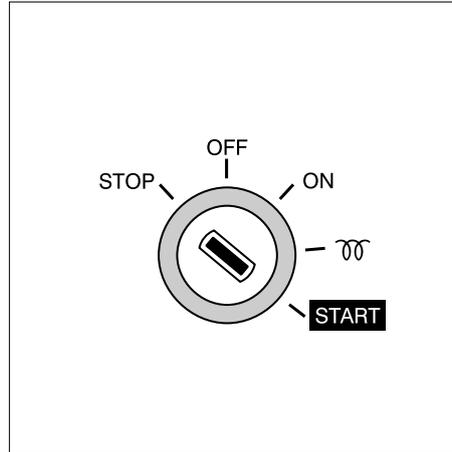


33 Bleeding

After replacing the fuel filter and cleaning the pilot filter inside the fuel lift pump the air has to be bled from the fuel system.

The fuel system is self-bleeding.

- Turn the key in the ignition lock to 'ON' and leave the key in this position for 30 seconds. The fuel pump will now bleed the system.



34 Start the engine

- Start the engine
- Operate the starter switch until the engine fires; release the starter switch if the engine does not fire within 20 seconds.
- Wait until the starter motor has stopped before making a new attempt to start the engine.

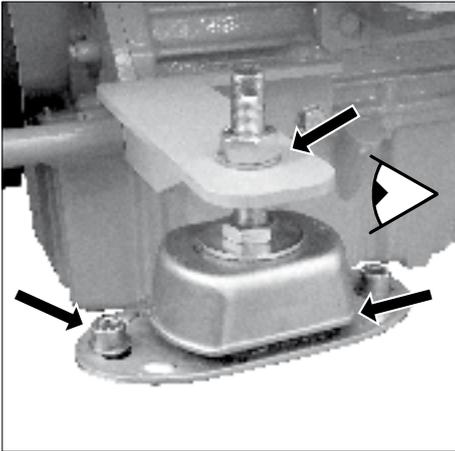
Repeat the above if the engine cuts out after a short time.

- Check for leaks once more.

6 Maintenance

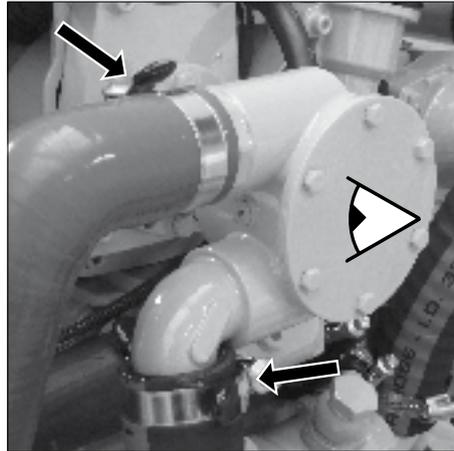
Flexible engine mounts, hose connections and fasteners

Every 400 operating hours.



35 Check flexible engine mounts

- Check the bolts which secure the damper element, the mounting bolts to engine bed and the nuts at the adjustment spindle for tightness.
- Inspect the rubber element of the engine support for cracks. Also check the deflection of the damper element, the deflection influences the alignment of engine and propshaft! Re-align engine in case of doubt.



36 Inspection hose connections

- Inspect all hose connections of the cooling-system. (Cracked hoses, loose hose clamps)

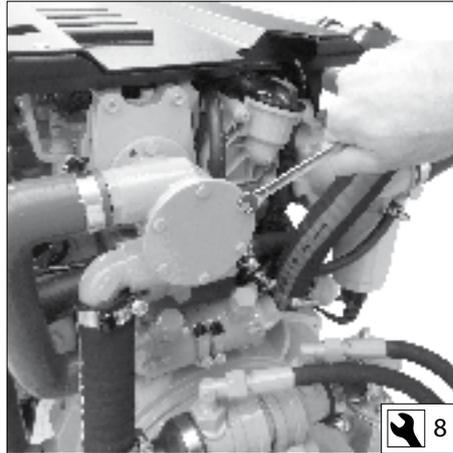
37 Check fasteners

- Check tightness of all fasteners, bolts and nuts.

6 Maintenance

Raw water pump inspection

Every 800 operating hours.



39 Pump cover removal

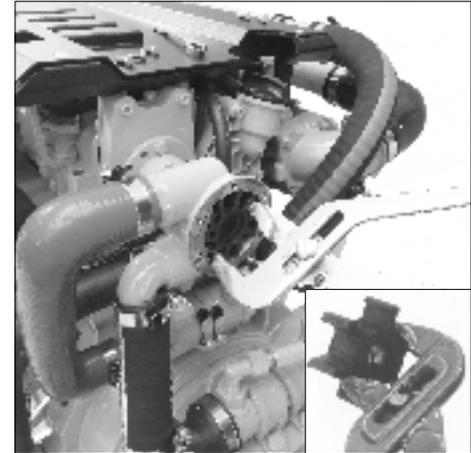
38 Raw water pump inspection

The rubber impeller of the outboard water pump is not proof against running dry.

If the water supply has been blocked, it may be necessary to replace the impeller. Always carry a spare impeller on board.

Inspection where appropriate changing is as follows:

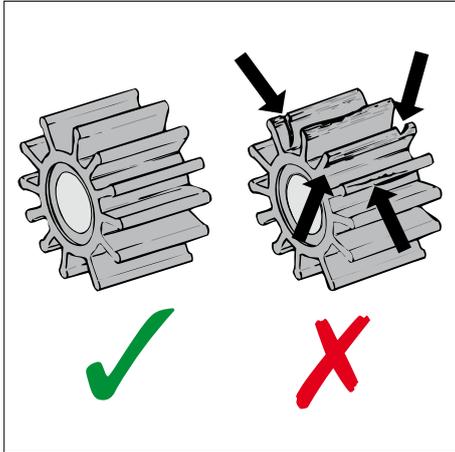
- Close the sea cock.
- Remove the cover of the pump by unscrewing the screws out of the housing.



40 Impeller removal

- Slide the impeller off of the shaft using a waterpump plier.
- Mark the impeller to ensure correct re-installation if it is to be re-used. The impeller must be installed in the same position as removed.

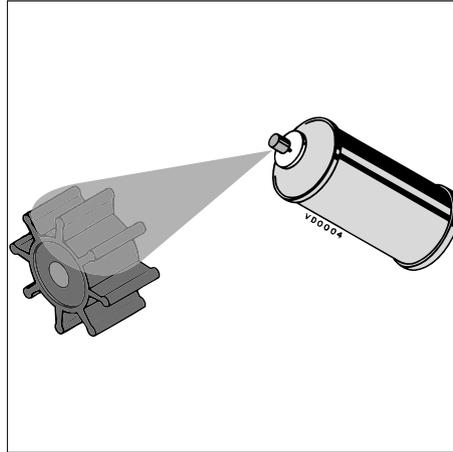
6 Maintenance



41 Impeller inspection

- Inspect the impeller for damage.
- Replace the impeller if necessary.

For **impeller art. code** see page [120](#).

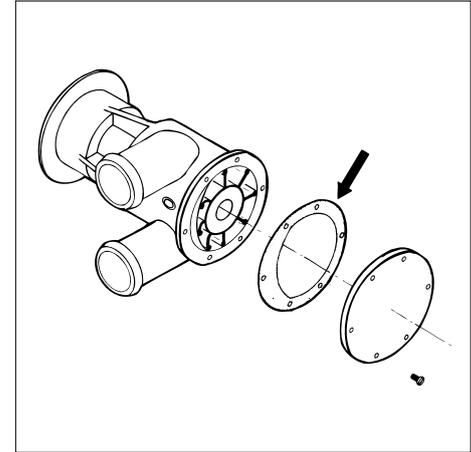


42 Re-install the impeller

- The impeller should be lubricated with glycerin or a non-petroleum based lubricant such as a silicone spray before fitting it into the impeller housing.
- Fit the impeller to the pump shaft. (if an existing impeller is re-used, install it in the same position as removed).

Raw water pump inspection

Every 800 operating hours.



43 Reinstall the pump cover

- Replace the cover with a **new** gasket.
- Check the water filter and open the sea cock.

For **gasket art. code** see page [120](#).

6 Maintenance

Coolant replacement
Every 800 operating hours.

44 Coolant replacement

The coolant has to be replaced every 800 operating hours or at least once every two years.

N.B. Replacing the coolant may also be necessary as part of the winter storage procedure; in case that the coolant present in the cooling system offers insufficient protection for the winter.



DANGER

Be aware of the risk of skin burning during draining the hot coolant! Used coolant must be collected in a container for proper disposal according to laws and regulations.

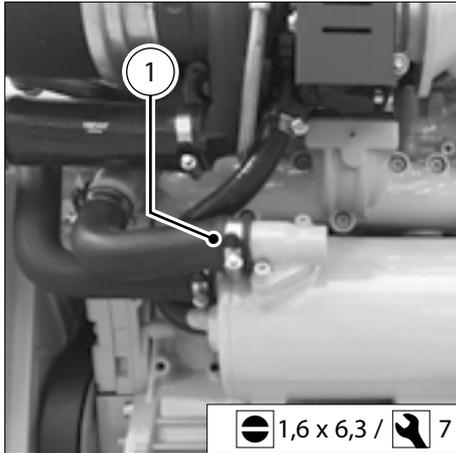


WARNING

Cooling system protective liquids must be disposed of in accordance with environmental regulations.

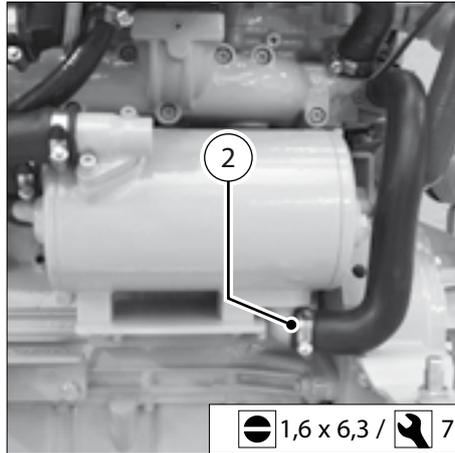


6 Maintenance



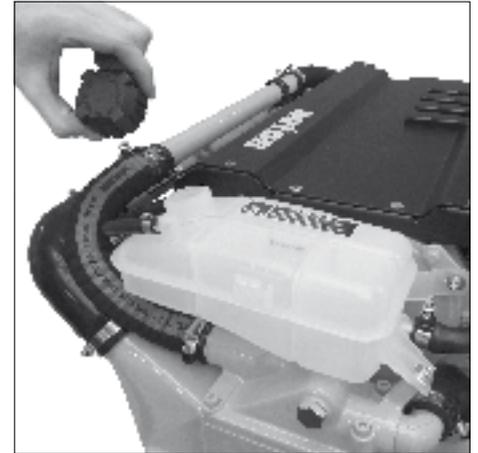
45 Drain coolant

- Remove the hose to the oil cooler (1) and the hose of the heat exchanger (2).



Coolant replacement

Every 800 operating hours.



- Remove the filler cap on the top of the expansion tank to allow air into the cooling system and check that all the liquid drains out.

6 Maintenance

Coolant replacement
Every 800 operating hours.

COOLANT QUANTITY:		
litres	Imp. pt	US pt
7.6	5.4	2



46 Fill cooling system

- Remove the cap on the expansion tank.
- Fill the cooling system.

Use a mixture of 40% antifreeze (on ethylene glycol basis) and 60% clean tap water or use a coolant.

See page 111 for specifications.

- Put the filler cap back.
- Check the coolant level after the engine has been run again for the first time has reached operating temperature and then has cooled back to ambient temperature.
- Top up if necessary.

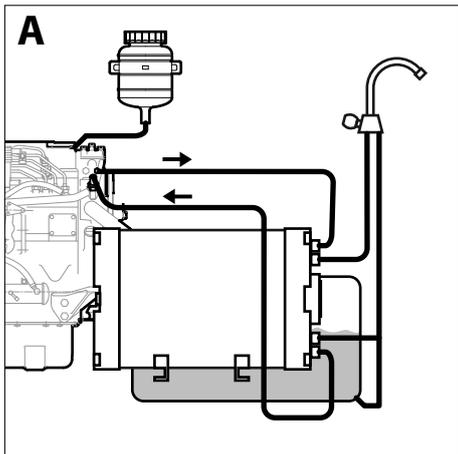


CAUTION

Never fill the cooling system with sea water or brackish water.

6 Maintenance

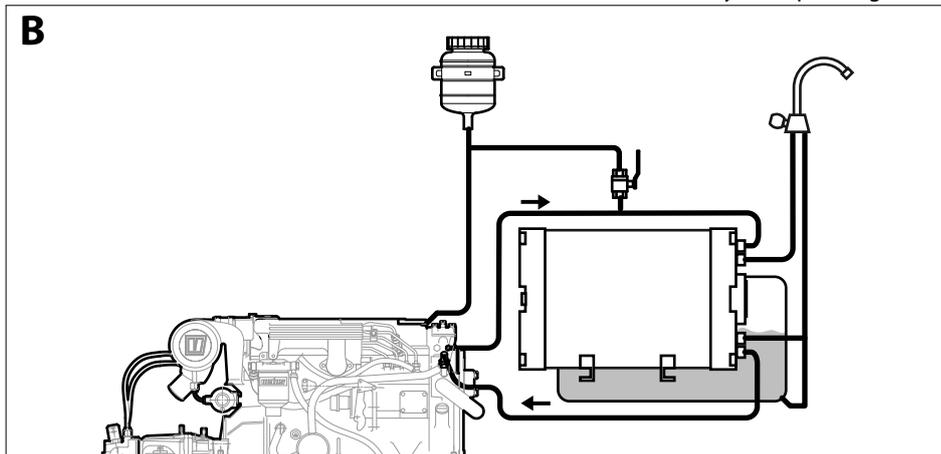
Coolant replacement
Every 800 operating hours.



47 Filling coolant system if a water heater is connected

A) The **HIGHEST** point of the water heater is situated at a **LOWER** level than the expansion tank for the ship's engine.

The water heater **will be filled and bled automatically** during filling of the cooling system.



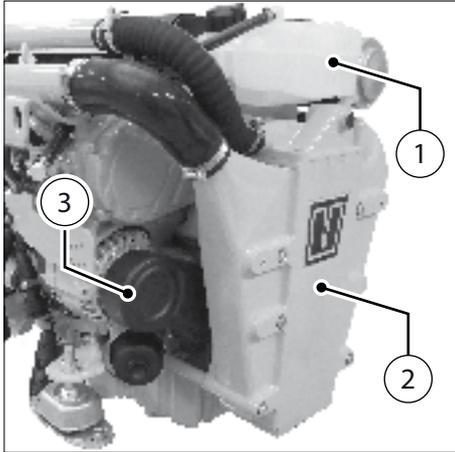
NOTE

B) The **HIGHEST** point of the water heater is situated at a **HIGHER** level than the expansion tank for the ship's engine.

The water heater will **not be filled and bled automatically** during filling of the cooling system.

- Fill the cooling system via the extra expansion tank.
- Open the valve during the filling and bleeding of the system.
- Close the valve again once the system is filled.

6 Maintenance

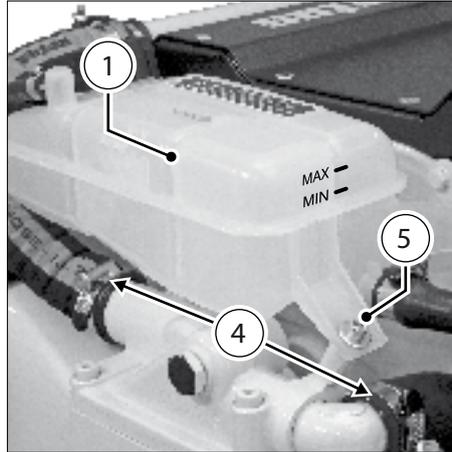


48 Replace drive belt

The after cooler (2) and the drive belt cover (3) have to be removed before the drive belt can be replaced.



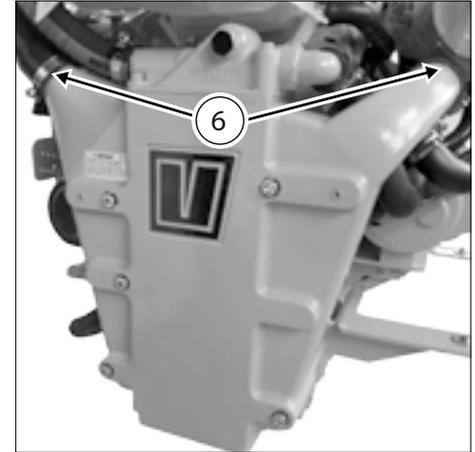
Only check, tension or replace the drive belt when the engine is stopped.



49 After cooler removal

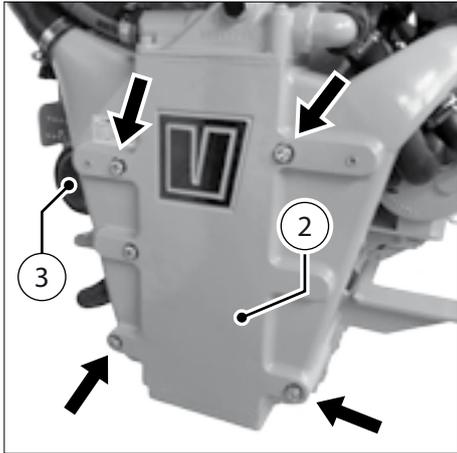
- Stop the engine, **close the sea cock** and drain the system.
- Loosen the hose clamps and take the hoses (4) off the hose connections.
- Loosen the bolt (5) so that the expansion tank (1) is released from the charge air cooler. The expansion tank does not need to be removed.

Replace drive belt
Every 800 operating hours.



- Remove the hose clamps from the charge air cooler and remove the hoses (6) off the hose connections.

6 Maintenance



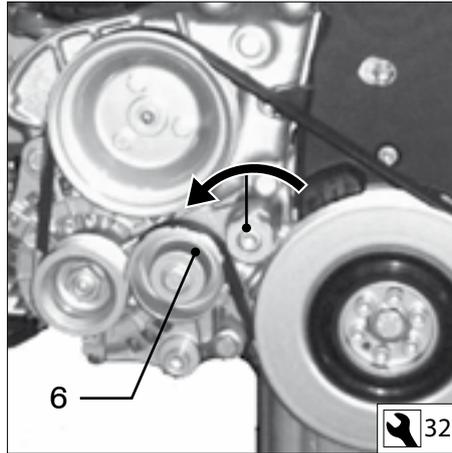
Replace drive belt
Every 800 operating hours.

- Remove the 4 bolts and remove the charge air cooler (2) together with the drive belt cover (3).

The charge air cooler and drive belt cover is 1 unit.

6 Maintenance

Replace drive belt
Every 800 operating hours.



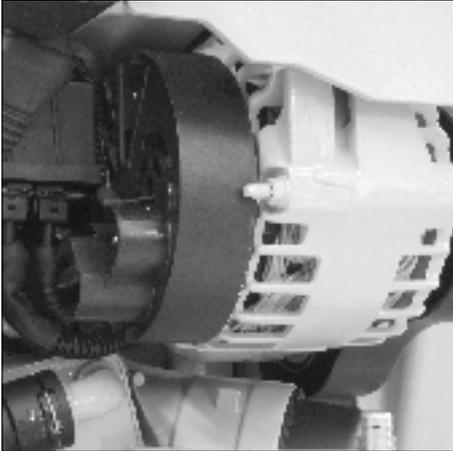
- Remove the spacer.
- Slacken the belt tensioner (6) in order to be able to remove the worn out belt.
- Fit a new belt. Make sure that the teeth on the belt fit well in the grooves of the belt pulleys.

For **drive belt art. code** see page **120**.

6 Maintenance

Checking the alternator

Every 800 operating hours.



50 Checking the alternator

- Check for visible defects.
- Remove the alternator belt. Turn the pulley by hand to check whether the alternator can be turned easily. If this is not the case, contact your Vetus dealer.



NOTE

Cleaning of the heat exchanger is not a routine maintenance job.

Only clean the heat exchanger if this is (badly) fouled.

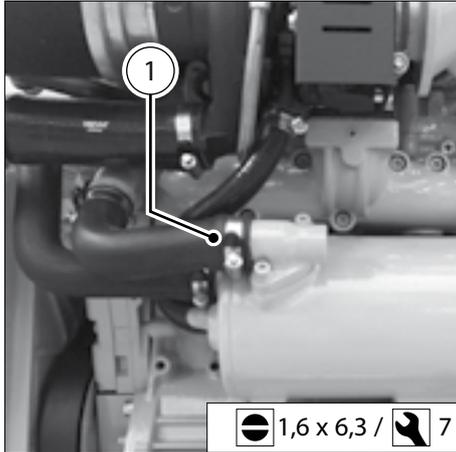
Under normal conditions of use cleaning the heat exchanger is not necessary!

The engine temperature will be higher than normal if the heat exchanger is fouled.

Possible causes of fouling are:

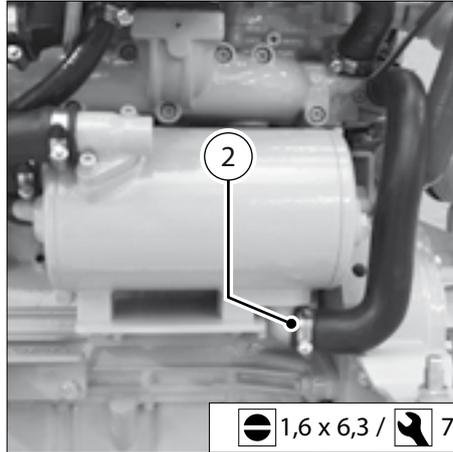
- Small rubber particles from a damaged sea water pump impeller.
- Growth of algae or seaweed.

6 Maintenance



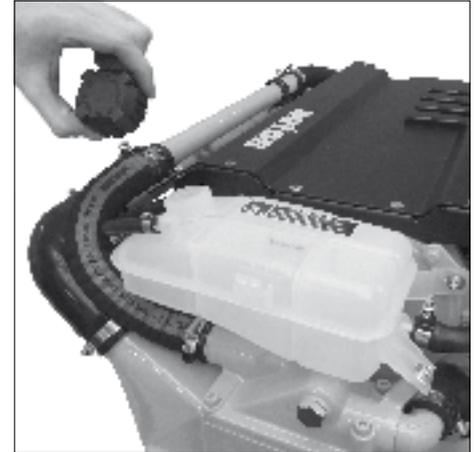
51 Removing heat exchanger

- Close the valve to the raw water supply and remove the water input hose to the oil cooler.



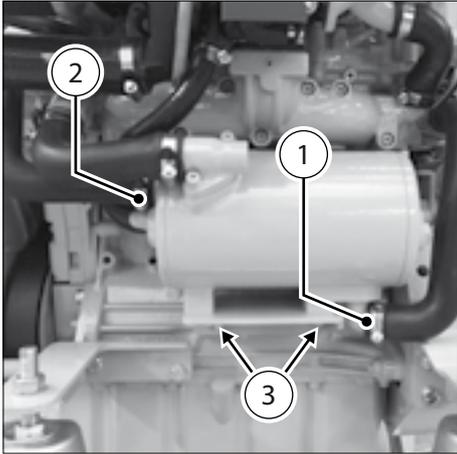
- Remove the hose to the oil cooler (1) and the hose of the heat exchanger (2).

Cleaning the heat exchanger



- Remove the filler cap on the top of the expansion tank to allow air into the cooling system and check that all the liquid drains out.

6 Maintenance



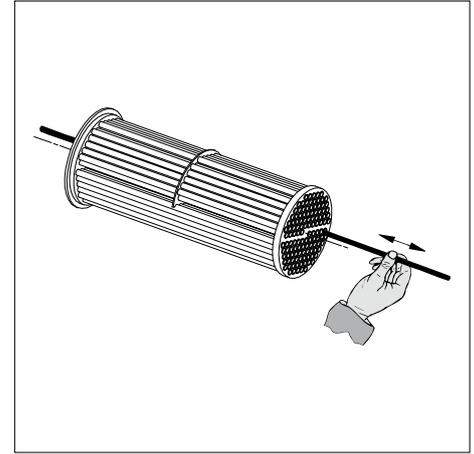
- Remove the second hose for the internal water (1).
- Remove both hoses for the raw water (2).
- Remove the nuts (3). The heat exchanger is now free from the engine.



52 Take out the heat exchanger

- Unscrew the 2 cap nuts and pull the rod out of the end covers.
- Remove the heat exchanger from the housing.

Cleaning the heat exchanger

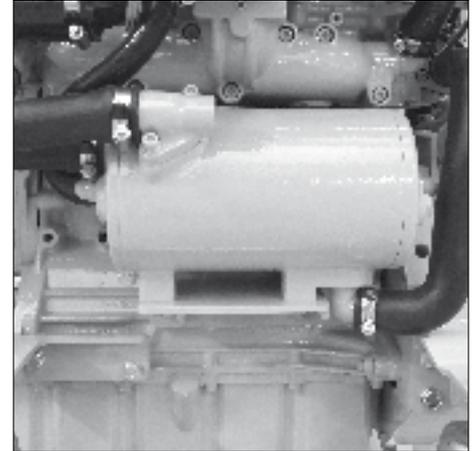


53 Cleaning the heat exchanger

- Clean the heat exchanger: Use a pipe cleaner to remove fouling in the pipes.
- Then rinse the heat exchanger pipes with clean water.
- Ensure that both heat exchanger end chambers are free from dirt.

6 Maintenance

Cleaning the heat exchanger



54 Replacing heat exchanger

- Replace the heat exchanger in the original position in the heat exchanger housing.

Use new O-rings which have been greased.

For **O-ring art. code** see page [120](#).

55 Replacing the end covers

- Fit the end covers in the housing.
- Put the threaded rod back and refit the nuts.

- Reconnect all hoses previously removed.
- Refill the cooling system, see page [62](#).

6 Maintenance



CAUTION

The heat exchanger element in the after cooler is very vulnerable!

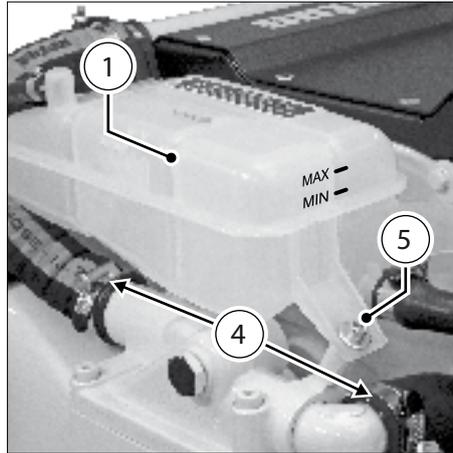


NOTE

Cleaning of the after cooler is not a routine maintenance job.

If the performance of the engine decreases this can be caused by a dirty heat exchanger in the after cooler.

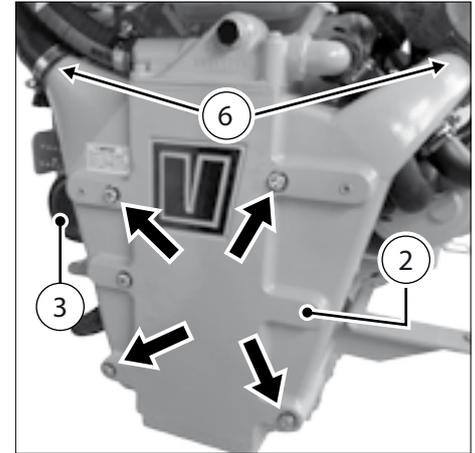
The heat exchanger must then be cleaned.



56 After cooler removal

- Stop the engine, **close the sea cock** and drain the system.
- Loosen the hose clamps and take the hoses (4) off the hose connection points.
- Loosen the bolt (5) so that the expansion tank (1) is released from the charge air cooler. The expansion tank does not need to be removed.

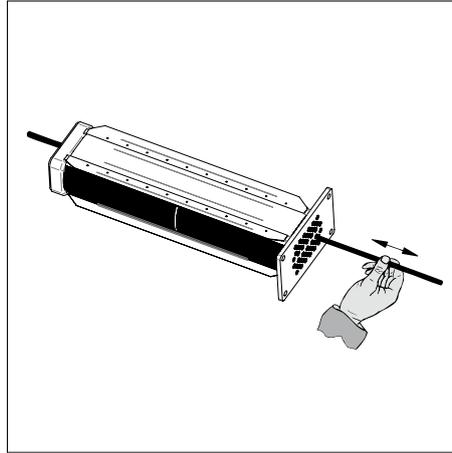
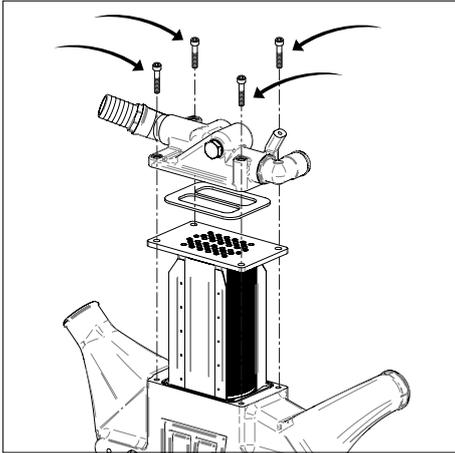
Cleaning the after cooler



- Remove the hose clamps from the charge air cooler and remove the hoses (6) off the hose connection points.
- Remove the 4 bolts and remove the charge air cooler (2) together with the drive belt cover (3).

6 Maintenance

Cleaning the after cooler



57 Cleaning the heat exchanger

- Remove the 4 bolts and remove the heat exchanger.
- Clean the pipes of the heat exchanger; use a pipe brush and fresh water to remove any growth in the pipes.
- Then rinse the heat exchanger pipes with clean water.
- Clean the fins using petrol and compressed air, maximum pressure 2 bar (28 psi) to prevent damage to the fins. Make sure there is no dirt on either of the covers to the after cooler housing.

! CAUTION

Handle with care, avoid shoves during assembly – disassembly that could damage the tube bundle and the cooling fins.

58 Replacing the heat exchanger

- Put the heat exchanger back in exactly the same position in the after cooler housing.
- Clean the seatings for the silicone gaskets and the O-rings.
- Put the covers back in place. Use compressed air (2 bar, 28 psi) to check the seals for tightness to prevent leaks.
- Reconnect the cooling water hoses and fit the expansion tank back in place.

7 Lay-up / Winter storage procedure

In case of lay-up for a long period the storage procedures as described in this chapter should be carried out.

A long period means a period longer than 3 months, for example, during the winter period.

Make sure that the engine compartment is well ventilated during the winter period.

Good ventilation prevents damp in the engine compartment, thus preventing corrosion of the engine from occurring.

The engine should be inspected at the start of the storage period and any necessary repairs should be carried out.

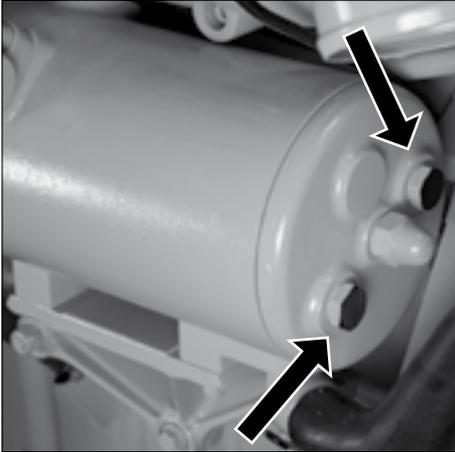
Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

7 Lay-up / Winter storage procedure

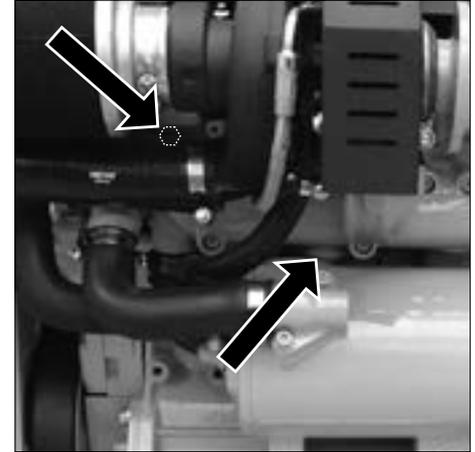
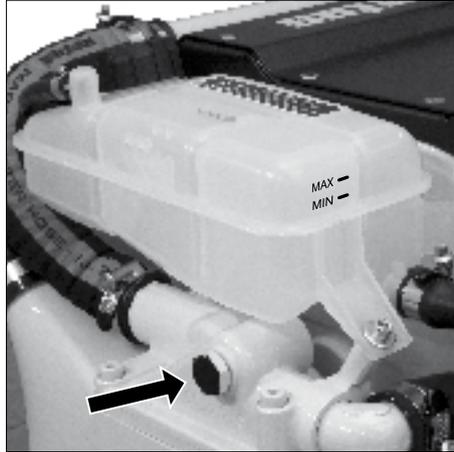
Inspections and maintenance work to be carried out:		page
1	Check the zinc anodes.	76
2	Clean the engine, remove any salt. Paint any rust spots and spray the whole engine with a protective medium, for example CRC protective 6-66.	78
3	Drain off the water from the fuel system and fill the fuel tank.	78
4	Make sure that the engine fuel system is filled with a fuel mixture with protective properties.	79
5	Flush out the raw water circuit with fresh water and if necessary fill with antifreeze. Clean the heat exchanger if necessary.	80
6	Make sure that the cooling system is filled with a suitable anti-freeze.	81
7	Change the oil filter and the engine oil.	82
8	Change the oil in the gearbox.	82
9	Grease moving parts of the engine, including the turbo.	83
10	Disconnect the battery cables, charge the batteries if necessary and grease the battery terminals.	85

7 Lay-up / Winter storage procedure



1 Zinc anode

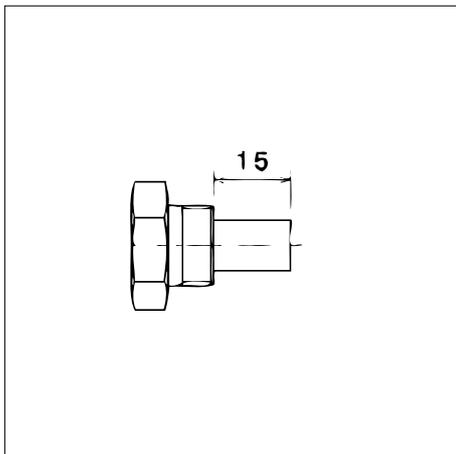
There are 5 zinc anodes in the raw water circuit to protect engine parts that come into contact with the external water from galvanic corrosion.



The speed at which the zinc anodes are sacrificed depends on many external factors.

The arrows indicate where the zinc anodes are located.
The zinc anodes are marked with black ink.

7 Lay-up / Winter storage procedure



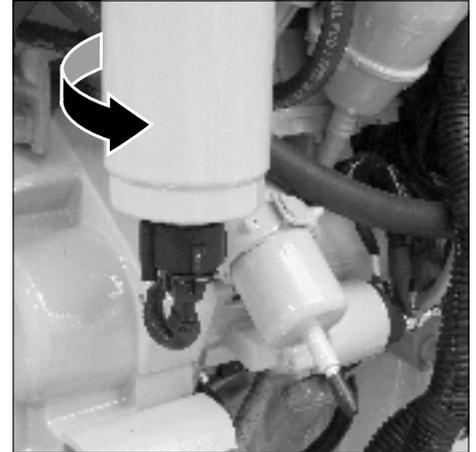
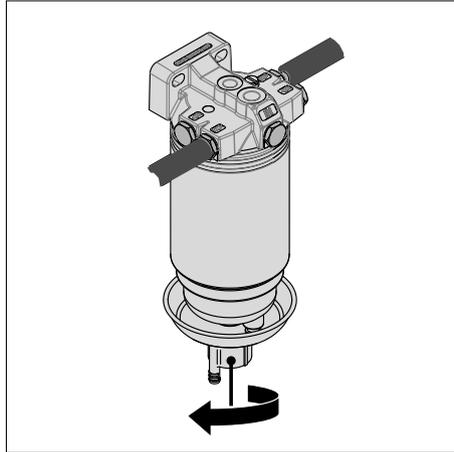
Check the zinc anodes; a new zinc anode is 15 mm in length; if a zinc anode is shorter than 7 mm it should be replaced.

Check and replace the zinc anodes as follows:

- Stop the engine.
- Close the sea cock.
- Remove the zinc anodes from the heat exchanger housing and the after cooler respectively.

- Replace the (new) zinc anodes and the copper rings.
Use a sealant, for example Loctite® Thread Sealant with PTFE or LOXEAL® 18-10 Pipe Sealant.
- Open the sea cock, start the engine and check for leaks.

7 Lay-up / Winter storage procedure



2 Corrosion protection

The various parts of the engine (except the engine block) have been treated with an anti-corrosion protective medium. In order to prevent corrosion, the engine should be rinsed off to remove any salt residues. If there is any corrosion, the paint should be touched up. Engine parts that become hot must be touched up with heat-resistant paint.

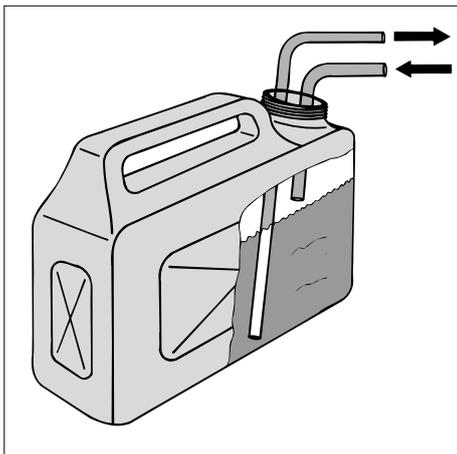
3 Fuel system

- Drain the water from the water separator/ fuel filter and the fuel tank.

Ensure that the tank is completely filled with fuel.

- Install a new fuel filter. (page 54)

7 Lay-up / Winter storage procedure



CAUTION

Never run the engine under load with this mixture of fuel and oil.



TIP!

Combine running the engine with the protective fuel mixture with flushing the raw water circuit with fresh water, see 'Winter storage procedure - Raw water cooling system'.

4 Protective fuel mixture

- Connect the fuel supply pipe to a can filled with protective diesel fuel, for example 'Calibration Fluid' (ISO 4113) or with a mixture of 1 part of engine oil ^[1] to 9 parts of clean fuel ^[2].
- Use this mixture to run the engine at **no load** for approx. 5 minutes.
- Stop the engine.

^[1] Engine oil with protective properties.

E.g.:

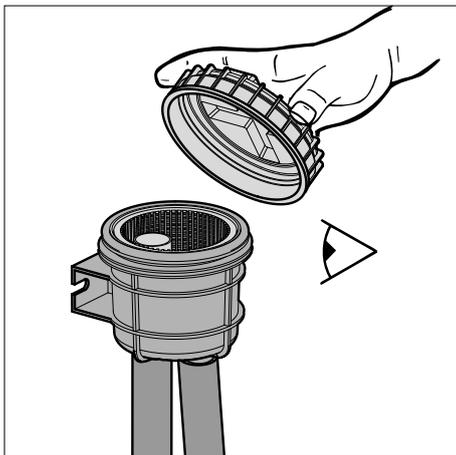
- Vetus Marine Diesel Engine Oil 15W40
- Shell Nautilus Premium Inboard 15W-40

^[2] Only use DIN EN 590 Diesel fuel.

Preferably water-free fuel.

Collect some fuel from the return pipe, while engine is running.

7 Lay-up / Winter storage procedure



5 Raw water cooling system

- Close the sea cock.
- Remove the lid of the water strainer.
- If necessary, clean the raw water strainer.

TIP!

Combine flushing the raw water circuit with fresh water with running the engine with the protective fuel mixture, see 'Winter storage procedure - Protective fuel mixture'

Heat exchanger

Only clean the heat exchanger if this is absolutely necessary, see page. 68.

Raw water pump

Check the impeller of the raw water pump at least once every two years, see page 58.

- Connect the raw water intake to a fresh water (tap water) supply or a tank containing fresh water. Open the tap and allow the engine to idle for at least 5 minutes to remove any salt and contamination from the raw water cooling system. Make sure that there is a sufficient supply of water to prevent the engine from overheating.
- Stop the engine and close the sea cock.
- The raw water system must be protected in areas where the temperature drops to below zero during the winter. Pour 1 litre (1/4 gallon) of anti-freeze (preferably a non-toxic biodegradable anti-freeze) into the water strainer and run the engine until the anti-freeze has disappeared into the cooling system.

7 Lay-up / Winter storage procedure

Tip!

Protect the sea cock as follows:
With the motor stopped.

- Place the sea cock in a position that it is just opening.
- Pour a small amount of non-toxic biodegradable anti-freeze into the raw water strainer.
- Close the sea cock as soon as it is filled with anti-freeze.



6 Fresh water cooling system

Anti-freeze can be toxic. Take care that no anti-freeze is spilled into the waterway

- Check the seal between the lid and housing after cleaning and re-assembling the strainer.

An improperly sealed lid will result in air sucked in by the raw water pump which again will result in overheating of the engine

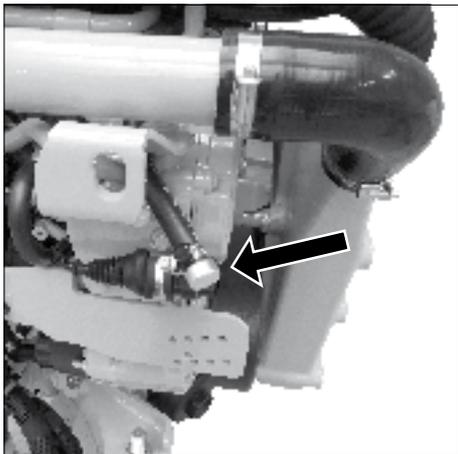
To avoid corrosion during winter storage the cooling system must be filled with an anti-freeze/water mixture (or a coolant).

For specifications see page [111](#).

N.B. Replacing the coolant is only necessary if the coolant present in the cooling system offers insufficient protection against temperatures below 0°C (32°F).

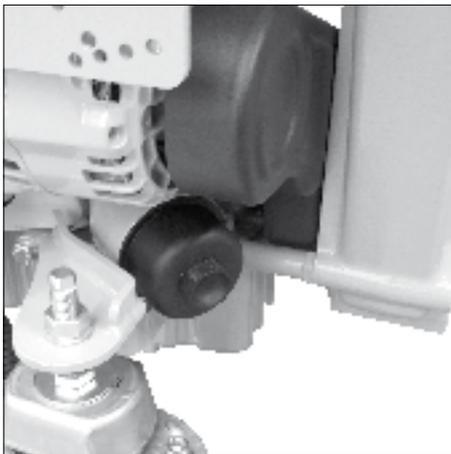
For coolant replacement see page [63](#).

7 Lay-up / Winter storage procedure



7 Lubrication system

With the engine still at operating temperature: (If not, run the engine until warm, then turn off.)



Replace the oil filter and change the engine oil; use oil with protective properties. See page 43.

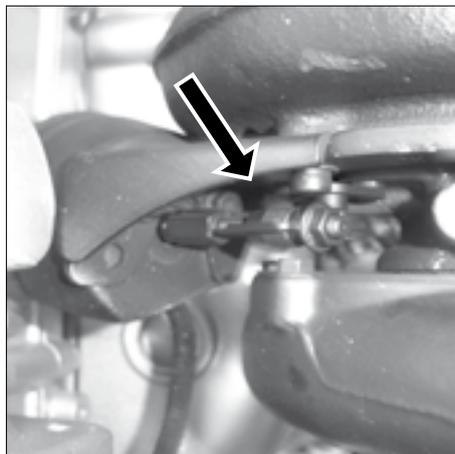
For quantity and oil specification see page 108.



8 Changing the gearbox oil

- Stop the engine and change the oil of the gearbox. (page 51 and 52)

7 Lay-up / Winter storage procedure



9 Greasing moving parts

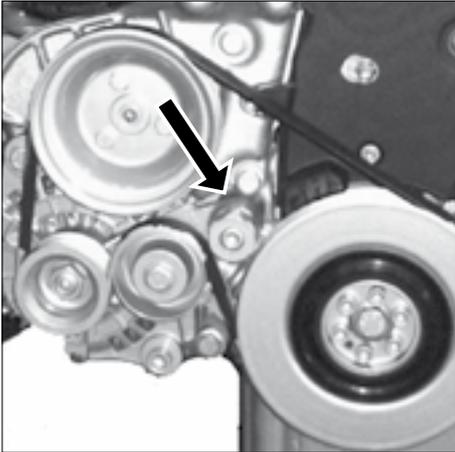
For a good working of the engine it is essential to grease a number of moving parts on the outside of the engine or to spray them with oil.

Turbocharger

The turbocharger is a variable geometry type (VGT). The operating mechanism for this is on the outside of the turbo. This operating mechanism must be free of corrosion and well greased if it is to work on the best possible way.

- Apply long-life water-resistant lithium-based grease, for example 'ZEP RED LITHIUM GREASE', to the operating mechanism.
- Then spray the cast-iron housing and the aluminium parts of the turbo with liquid lubricant containing Teflon®, for example 'ZEP 2000.'
- Disconnect the hose connecting the turbo to the after cooler from the turbo. Remove any oil residue from the surface of the turbo exhaust and then replace the hose.
- Remove the air filter. Remove any oil residue from the surface of the turbo intake and then replace the hose.
- Clean the air filter if necessary, see page 50

7 Lay-up / Winter storage procedure

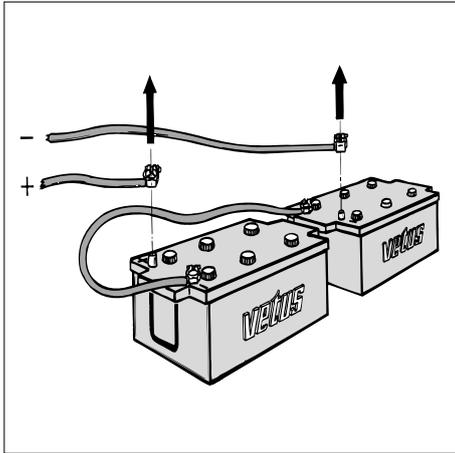


10 Belt tensioner

- Spray the spring and the rotation point of the belt tensioner with a liquid lithium-based lubricant.

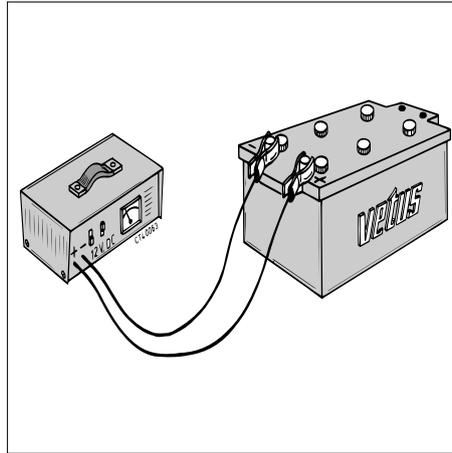
Be careful not to get any lubricant on the belt!

7 Lay-up / Winter storage procedure



11 Electrical system

- Disconnect the battery cables.
- Charge batteries during winter lay-up regularly if required!
- Follow the recommendations given on pages 46 to 48 or consult the recommendations given by the battery supplier for inspection and maintenance of the batteries.



8 Recommissioning after lay-up or winter storage

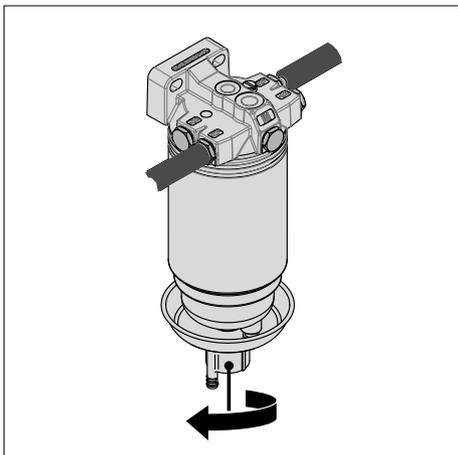
The engine must be inspected and any maintenance work carried out when re-commissioning for example at the beginning of the sailing season.

Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

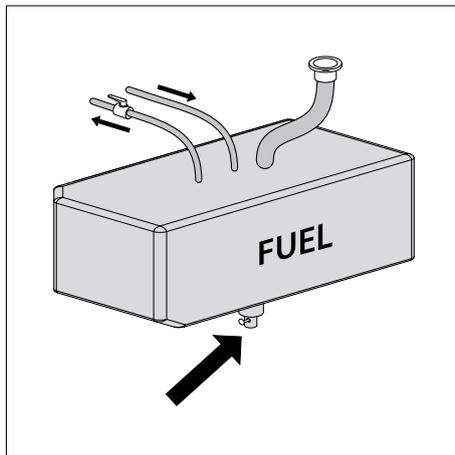
Inspections and maintenance work to be carried out are:		page
1	Drain the water from the fuel system.	87
2	Check the raw water system.	88
3	Check the coolant level in the internal cooling system.	89
4	Check the oil level.	89
5	Check the batteries and reconnect these.	90
6	Check the working of the ECU box.	90
7	Check all hose connections for leaks.	91
8	Check the operation of the instruments and the engine controls.	91

8 Recommissioning after lay-up or winter storage

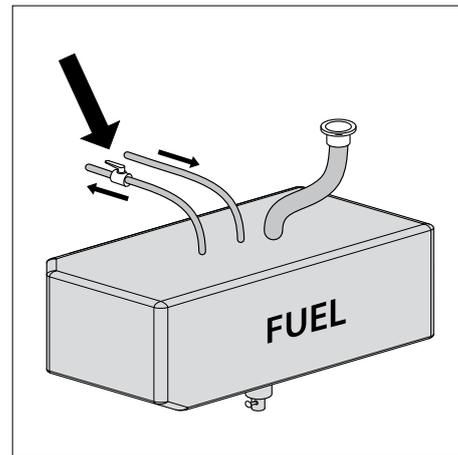


1 Fuel system

- Drain the water from the water separator/ fuel filter. (page 41)

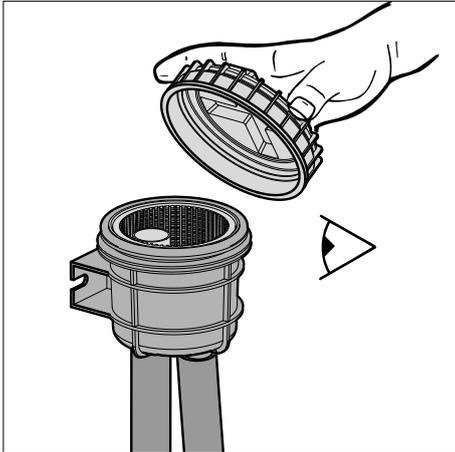


- Drain the water from the fuel tank.



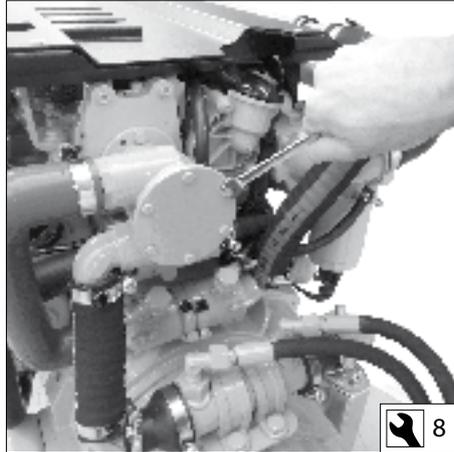
- Open the fuel valve.

8 Recommissioning after lay-up or winter storage

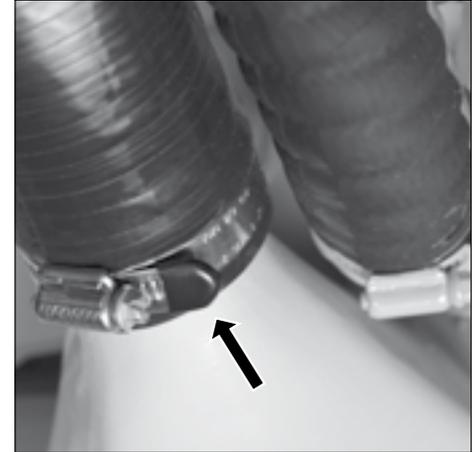


2 Raw water cooling system

- Check that the lid of the raw water strainer is reinstalled.

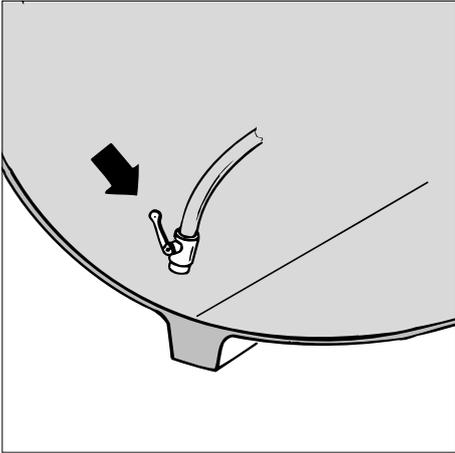


- Check whether the lid of the raw water pump and drain plugs are reinstalled. (pages 58, 59)

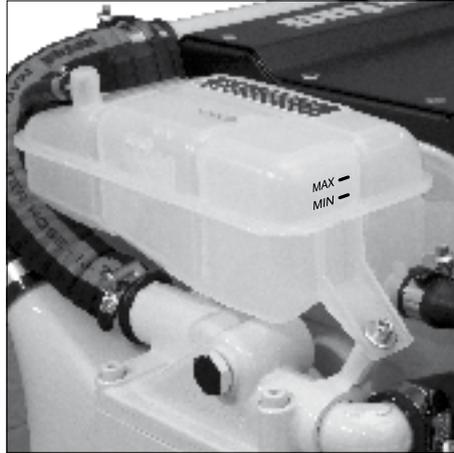


- Re-tighten possible loose hose clamps.

8 Recommissioning after lay-up or winter storage

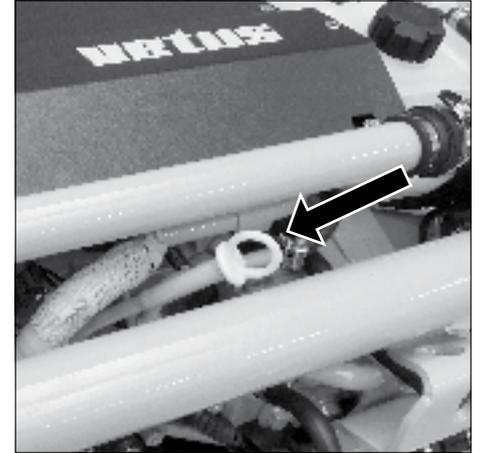


- Open the sea cock.



3 Fresh water cooling system

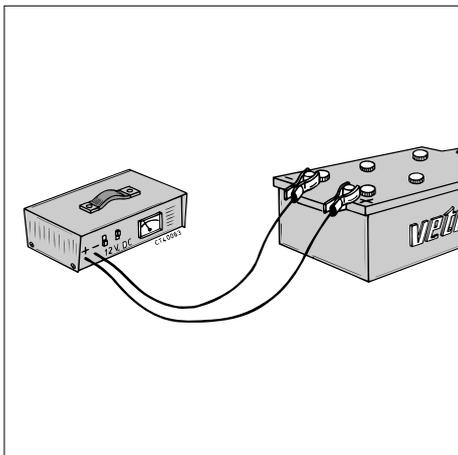
- Check the coolant level. (page 39)



4 Lubrication system

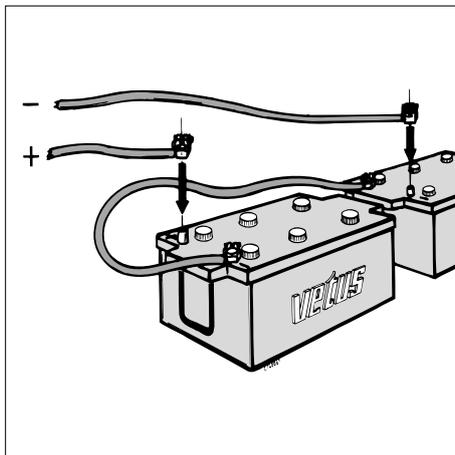
- Check the engine oil level. (page 38)

8 Recommissioning after lay-up or winter storage



5 Electrical system

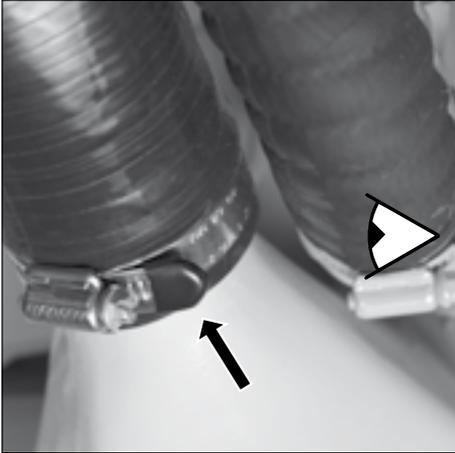
- Make sure that the batteries are fully charged. (page 46, 85)
- Connect the batteries.



6 Switching on

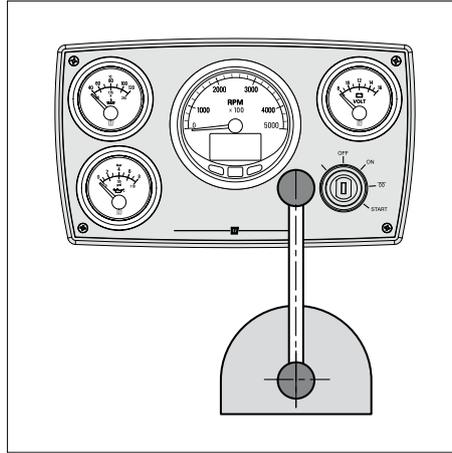
- Turn the start key on the instrument panel clock-wise; the warning lights for oil pressure and alternator will now light up and the alarm buzzer will sound.
- All indicator LEDs for the fuses must light up when the starter key is in position 'ON'.

8 Recommissioning after lay-up or winter storage



7 Check engine for leaks

- Start the engine.
- Check the fuel system, the cooling system and the exhaust for leakage.



8 Checking instruments and remote controls

- Check the operation of the instruments, the remote control and the gearbox.

Engine faults are in most cases caused by improper operation or insufficient maintenance.

Note Not all possible faults mentioned will be applicable to your engine.

In case of a fault, always check first that the operation and maintenance instructions have been followed.

In the following tables information is given about the possible causes of faults and suggested remedies. Please note that these ta-

bles can never be complete.

If you are unable to identify the cause of the fault or to rectify it yourself, then contact the nearest service representative.



DANGER

Before starting, make sure that nobody is in the immediate vicinity of the engine. When carrying out repair, **never** start the engine with the fuel injection pump removed.

Disconnect battery!

9 Troubleshooting

Fault finding table

	Fault	page
1	Engine will not crank	94
2	Engine cranks but will not start, no smoke from exhaust	94
3	Engine cranks but will not start, smoke from exhaust	95
4	Engine starts but runs unevenly (rough idling) or stalls	95
5	Engine does not reach maximum rpm under load	96
6	Engine overheats	97
7	Engine not firing on all cylinders	97
8	Engine has little or no oil pressure	98
9	Engine oil consumption excessive	98
10	Fuel consumption excessive	99
11	Black exhaust smoke (idling)	99
12	Blue exhaust smoke (idling)	99
13	Black exhaust smoke (at load)	100
14	White exhaust smoke (at full load)	100
15	Burnt oil trace in exhaust line	101
16	Idle speed >750-800 RPM	101

9 Troubleshooting

Fault finding table

1 Engine will not crank

Possible fault	Remedy
Faulty or discharged battery (too low voltage) .	Check / recharge battery and check engine alternator and/or battery charger.
Fuse blown.	Replace.
Loose or corroded connections in starting circuit.	Clean and tighten connections.
Wrong engine electric mass connection.	Repair.
Starter relay is not engaged due to a voltage too low; caused by a very long intermediate cable from engine to control panel.	Install an auxiliary starter relay
Faulty starter-switch or faulty starter-relay.	Check / replace.
Faulty starter-motor or pinion does not engage.	Check / replace starter-motor.
Seized components.	Repair.
Control lever not in neutral.	Put operating lever in neutral
The emergency stop knob is pushed in (ECU Box) .	Pull the emergency stop knob out.
Water in the cylinder .	Check / Repair .

2 Engine cranks but will not start, no smoke from exhaust

Possible fault	Remedy
(Nearly) Empty fuel tank.	Refill.
Fuel stop valve closed.	Open.
Fuel filter clogged with water and/ or contamination.	Check or replace.
Fuel pre-filter clogged .	Clean /replace
Vent line of fuel supply tank clogged.	Check / clean.
Faulty injector/injection pump..	Check, replace if required.
Fuel electric pressure regulator clogged	Check /clean or replace
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
Fuse burnt out in ECU box.	Check/replace.
ECU faulty.	Diagnosis -replace .
Electrical fuel low pressure pump is not working.	Check the electrical connection ,check the pump ,replace.
Exhaust restricted.	Check.

9 Troubleshooting

Fault finding table

3 Engine cranks but will not start, smoke from exhaust

Possible fault	Remedy
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Incorrect lube oil SAE class or quality for ambient temperature.	Replace.
Faulty glow plugs.	Check / replace.
Insufficient intake air.	Check.
Intake air filter clogged .	Clean/replace

4 Engine starts but runs unevenly (rough idling) or stalls

Possible fault	Remedy
(Nearly) Empty fuel tank.	Refill.
Fuel supply line restricted.	Check / clean.
Fuel filter clogged with water and/ or contamination.	Check or replace.
Vent line of fuel supply tank clogged.	Check / clean.
Faulty injector/injection pump.	Check, replace if required.
Fuel electric pressure regulator fault	Replace
Clogged filter of electric fuel lift pump.	Check / clean
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Low battery voltage	Recharge /replace
Exhaust restricted.	Check.

9 Troubleshooting

Fault finding table

5 Engine does not reach maximum rpm under load

Possible fault	Remedy
Fuel pre filter clogged .	Clean/replace.
Fuel filter clogged with water and/ or contamination.	Check or replace.
Clogged injectors.	Check, replace if required.
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Oil level too high.	Lower level.
Lubricating oil incorrect SAE spec or quality for ambient temperature.	Replace.
Insufficient intake air.	Check.
Leak in inlet manifold.	Check / replace.
Exhaust restricted.	Check / clean.
Transmission defect.	Check
Turbocharger damaged.	Replace
VGT turbocharger actuator blocked	Check unblock or replace

5 Engine does not reach maximum rpm under load

Possible fault	Remedy
Engine overloaded.	Check size of propeller. Clean the propeller.
Boat load inadequate .	-
Hull/propeller dirty .	Clean

9 Troubleshooting

Fault finding table

6 Engine overheats

Possible fault	Remedy
Faulty injector/injection pump.	Check, replace if required.
Sea cock closed.	Open.
Raw water strainer clogged.	Check / clean.
Faulty raw water pump impeller.	Check / replace.
Leak in raw water feed system.	Check / replace.
Coolant level too low.	Check / top up.
Faulty coolant pump.	Check / replace.
Faulty thermostat.	Check / replace.
Leak in coolant circuit .	Check.
Heat exchanger dirty or clogged as a result of rubber particles from a worn impeller.	Check / clean.
Oil level too low.	Increase level.
Oil level too high.	Lower level.
Faulty oil filter.	Replace.
Faulty oil heat exchanger.	Replace.
Insufficient intake air.	Check / replace air intake filter.
Faulty turbo compressor.	Check / replace.
Motor becomes apparently overheated as a result of faulty temperature switch, sensor or meter.	Check / replace.

7 Engine not firing on all cylinders

Possible fault	Remedy
Fuel supply line restricted.	Check / clean.
Fuel filter clogged with water and/ or contamination.	Check or replace.
Faulty electric fuel pump.	Check / replace.
Faulty injector/injection pump.	Check, replace if required.
Electric fuel pump filter blocked.	Check / clean.
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
Intake valve blocked .	Check /replace

9 Troubleshooting

Fault finding table

8 Engine has little or no oil pressure

Possible fault	Remedy
Oil level too low.	Increase level.
Incorrect lube oil SAE class or quality for ambient temperature.	Replace.
Blocked oil filter.	Replace.
Faulty oil pump.	Repair / replace.
Oil leaks .	Check.
Excessive inclination of engine.	Check / Adjust.
Oil pressure apparently too low due to faulty oil pressure switch, sensor or meter.	Check / replace.

9 Engine oil consumption excessive

Possible fault	Remedy
Oil level too high.	Lower level.
Incorrect lube oil SAE class or quality for ambient temperature.	Replace.
Leak in lubricating oil system.	Repair / replace.
Crank case vapour condenser clogged .	Replace
Insufficient intake air.	Check.
Excessive wear of cylinder/piston.	Check compression; overhaul engine.
Turbocharger oil leaks .	Replace or repair.
Engine overloaded.	Check size of propeller. Clean the propeller.
Excessive inclination of engine.	Check / Adjust.

9 Troubleshooting

Fault finding table

10 Fuel consumption excessive

Possible fault	Remedy
Faulty injector/injector pump.	Check, replace if necessary.
Incorrect fuel quality or dirty fuel.	Check fuel. Drain and rinse fuel tank. Replace with new fuel.
Fuel leaks .	Check and repair.
Insufficient air intake.	Check.
Excessive wear of cylinder / piston.	Check compression; refurbish engine.

11 Black exhaust smoke (idling)

Possible fault	Remedy
Injector fault	Check /replace.
Oil level too high.	Lower level.
Excessive inclination of engine.	Check / Adjust.

12 Blue exhaust smoke (idling)

Possible fault	Remedy
Oil level too high.	Lower level.
Leaking from turbo compressor oil seal.	Check / replace oil seal.

9 Troubleshooting

Fault finding table

13 Black exhaust smoke (at load)

Possible fault	Remedy
Faulty injector / injection pump.	Check / replace if required.
Oil level incorrect.	Check .
Insufficient intake air, air filter dirty.	Check/clean the filter .
Leak in inlet manifold.	Check / replace.
Intercooler dirty.	Check/clean.
Excessive wear of cylinder / piston.	Check compression; refurbish engine.
Faulty turbo compressor.	Check / replace.
VGT Turbocharger actuator blocked	Unblock /replace
Engine overloaded, max. rpm is not reached.	Check sizes of propeller.
Engine overloaded, dirty propeller -boat hull, excessive load on-board.	Check /clean.

14 White exhaust smoke (at full load)

Possible fault	Remedy
Faulty injector/injection pump.	Check, replace if required.
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Water in fuel system.	Check water separator.
Faulty glow plugs.	Check / replace.
Vapour in exhaust gases condenses as a result of very low ambient temperature.	-

9 Troubleshooting

Fault finding table

15 Burnt oil trace in exhaust line .

Possible fault	Remedy
Oil level too high .	Lower level.
Excessive wear of cylinder / piston, piston rings.	Check compression; refurbish engine.
Faulty turbocharger .	Check, Repair / Replace .

16 Idle speed >750-800 RPM

Possible fault	Remedy
Coolant temperature lower than 40 °C.	On normal functioning: Run the engine at a speed of 900 RPM until the coolant temp is over 40 °C .
Wrong indication of tachometer.	Adjust /replace .
Fault on electric -electronic equipment.	Check/repair.
Low battery voltage .	On normal functioning: If the battery voltage is lower than 13.5 V increase engine speed to 1050 RPM until the voltage is 13.5 Volt .

10 Technical data

Engine specifications

Model	:	VF4.145	VF4.180	VF4.200
General				
Make	:	Vetus C.M.D.		
Number of cylinders	:	4		
Based on	:	GM technology		
Type	:	4-stroke diesel, in-line, DOHC		
Injection	:	Direct injection, common rail		
Aspiration	:	Turbo-charged with variable geometrie		
Bore	:	83 mm		
Stroke	:	90.4 mm		
Total displacement	:	1956 cm ³ (119 cu.inch)		
Compression ratio	:	16.5:1		
Idling speed	:	800 rpm		
Max. no. of revolutions at no load	:	4700 rpm		
Direction of rotation	:	Counter clockwise, viewed towards the flywheel side		
Number of valves	:	16		
Valve Clearances	:	"mini-lash" hydraulic adjusters with roller fingers		
Weight (with standard gearbox)	:	320 kg (705 lbs)		

10 Technical data

Engine specifications

Model	:	VF4.145	VF4.180	VF4.200
Engine installation				
Max. installation angle	:	10° degrees backwards		
Max. athwartships angle	:	20° degrees continuously 30° degrees intermittent		
Maximum Output				
at the flywheel (ISO 3046-1)	:	108 kW (145 hp)	129 kW (173 hp)	140 kW (190 hp)
at the prop shaft (ISO 3046-1)	:	104.7 kW (142.4 hp)	125.1 kW (170.1 hp)	135.8 kW (184.3 hp)
at no. of revolutions of	:	4100 rpm	4100 rpm	4100 rpm
Torque,	:	280 Nm (28.6 kgm, 206 ft.lb)	340 Nm (34.7 kgm, 251 ft.lb)	355 Nm (36.2 kgm, 262 ft.lb)
at no. of revolutions	:	2300 rpm	2300 rpm	2300 rpm
Fuel consumption				
	:	235 g/kW.h (173 g/hp.h, 6.1 oz/hp.h)	222 g/kW.h (163 g/hp.h, 5.8 oz/hp.h)	237 g/kW.h (174 g/hp.h, 6.1 oz/hp.h)
at no. of revolutions	:	4100 rpm	4100 rpm	4100 rpm
Fuel System (Self-bleeding)				
Injection pump	:	Electronic		
Injectors	:	Bosch		
Opening pressure	:	200 bar (200 kgf/cm ² , 2900 psi)		
Firing order	:	1 - 3 - 4 - 2		
Injection timing	:	Electronic		

10 Technical data

Engine specifications

Model	:	VF4.145	VF4.180	VF4.200
Fuel lift pump	:		Suction height max. 1.5 m (5 ft)	
Fuel supply connection	:		for hose 8 mm (5/16") I.D.	
Fuel return connection	:		for hose 8 mm (5/16") I.D.	
Oil lubrication system				
Oil capacity, max.	:			
without oil filter	:		4 L (7 UK pt, 8.5 US pt)	
with oil filter	:		4.5 L (7.9 UK pt, 9.5 US pt)	
Oil temperature in sump	:		max. 130°C (266°F)	
Cooling system				
Capacity,				
Thermostat	:		opening at 65°C ±1.5°C (149°F ±3°F), fully opened at 76°C (169°F)	
Coolant pump,				
Flow at max. engine rpm	:		90 l/min (19.8 UK gal/min, 23.8 US gal/min)	
Raw water pump,				
Flow at max. engine rpm	:		100 l/min (22 UK gal/min, 26.4 US gal/min)	
Total head at max. flow	:		1,5 bar (21 psi)	

10 Technical data

Engine specifications

Model	:	VF4.145	VF4.180	VF4.200
Inlet connection for hose	:		32 mm (1 1/4") I.D.	
Heater supply connection	:		32 mm (1 1/4") I.D.	
Heater return connection	:		32 mm (1 1/4") I.D.	
Combustion air/Exhaust system				
Turbo pressure at max. load	:	max. 2450 mbar (35.5 psi)	max. 2700 mbar (39.1 psi)	max. 2850 mbar (41.3 psi)
Exhaust diameter	:		for gear box 90 mm (3 5/8") for stern drive 76 mm (3")	
Exhaust back pressure	:		at specified output max. 300 mbar (43.5 psi)	
Electrical System				
Voltage	:		12 Volt	
Alternator	:		14 Volt, 105 A	
Starter motor	:		14 Volt, 2.3 kW	
Battery capacity	:		min. 70 Ah, max. 200 Ah	
Protection	:		Fuse 'ATO' 10 Amp	

10 Technical data

Gearbox specifications

Model		VF4.145	VF4.180	VF4.200
Gearbox		Reduction ratio		
Technodrive:	model TM345 :		1.54 : 1	
	model TM345A :		1.54 : 1	
	model TM485A :		2.09 / 2.40 / 2.51 : 1	
ZF Hurth:	model ZF25 :	1.97 : 1	—	—
	model ZF25A :	2.03 : 1	—	—
	model ZF45 :		2.20 / 2.51 : 1	
	model ZF45A :		1.26 / 1.51 / 2.03 / 2.43 : 1	
	model ZF63 IV :		2.00 / 2.48 : 1	
Stern drive		Reduction ratio		
MerCruiser:	model Bravo 1 :		1.36 / 1.50 / 1.65 : 1	
	model Bravo 2 :		2.00 / 2.20 : 1	
	model Bravo 3 :		1.65 / 2.00 / 2.20 : 1	
Volvo:	model 290 :		A - B - C	
	model SX :		A - M	

11 Operating media

Fuel Quality Grade

Use commercially available diesel fuel with less than 0.5% sulphur content. Don't use fuel with more than 1% sulphur!

The following fuel specifications / standards are approved:

- CEN EN 590 or DIN EN 590
- DIN 51 601 (Feb. 1986)
- BS 2869 (1988): A1 and A2
- ASTM D975-88: D1 and D2
- NATO Code F-54 and F75

The cetane number must be at least 49.

The exhaust emission levels determined during certification by the supervising authority are always based on the reference fuel described by law. These fuels match the diesel fuels which are in accordance with CEN EN 590 and ASTM D 975. Emission levels cannot be guaranteed with other fuels.

Biodiesel



CAUTION

Use only the prescribed diesel fuel. **Do not use 100% biodiesel (B100)!**

Winter-grade fuel

Waxing may occur at low temperatures, clogging the fuel system and reducing engine efficiency.

If the ambient temperature is less than 0°C (+32°F), winter-grade fuel -suitable down to -15°C (+5°F) - should be used. This fuel is usually available from filling stations well in advance of the cold months. Diesel fuel containing additives (Super Diesel) is often on sale as well, for use down to -20°C (-4°F).

Engine oil

Lubricating oils are specified by performance and quality classes. It is usual for the specifications to be indicated according to the API (American Petroleum Institute) and ACEA (European Automobile Manufacturers Association).

Acceptable API oils: SL, CF

Acceptable ACEA oils: A3/B4, E4, E7

Only use oil of a recognised brand to lubricate the engine. The choice of a correct oil guarantees that the engine starts easily, because an oil film remains on the cylinder walls and bearing surfaces. The friction is low and so the starting rpm necessary for a dependable start can be achieved with a lower starting torque. An incorrect choice of oil can lead to a thickened oil layer on the cylinder walls and bearing surfaces. This can in turn lead to higher frictional resistance and more effort, which forms a hindrance to reaching the starting rpm required for a dependable start, and this results in a reduced lifespan.

Recommended lubricating oil viscosity

There are two important considerations when it comes to ambient temperature in order to achieve satisfactory engine performance.

- the possibility to turn the engine over quickly enough to make an easy start possible and
- adequate lubrication of internal wear surfaces during starting and warming up.

By making the right choice of lubricating oil these requirements can be met.

Because the viscosity (runniness) of lubricating oil varies with temperature, the ambient temperature in which the engine is started determines the choice of viscosity class (SAE class).

To avoid having to change the oil for different seasons we recommend SAE 10W-40.

For example:

Vetus Marine Diesel Synthetic Engine Oil 10W-40

Shell Helix Plus 10W-40

For oil capacity see p. 104.

11 Operating media

Lubricating oil



CAUTION

Do not mix oil of different brands together. Oils of different brands are mostly not compatible with each other. If they are mixed, the mixtures can cause components such as piston rings, cylinders etc. to seize up and cause wear to moving parts. The best thing is to keep to one brand and one type of lubricating oil for each subsequent service.

Limits concerning motor oil

If an analysis of the used lubricating oil is conducted to determine its condition, consult the overview below. Change the oil if one or more of the conditions is not met.



NOTE

- How often the oil has to be changed depends on the characteristics of the fuel. Only use the recommended fuels.
- The limit for the total base number is half of that of new oil in the case of an analysis method based on perchloric acid.

Limits concerning motor oil

Characteristic	Unit	Test method	Limit
Viscosity	cSt @ 100°C	JIS: K 2283	+30% / -15% max. for new oil
Total base numberI (HCl)	mgKOH/g	JIS: K 2501	2.0 min.
Total acid number	mgKOH/g		+3.0 max. for new oil
Water content	% volume	JIS: K 2275	0.2 max.
Flash point	°C	JIS: K 2265	180 min.
Pentane insolubles	% weight	ASTM: D 893	0.5 max.
Coagulated pentane insolubles	% weight		3.0 max.

11 Operating media

Lubricating oil

Gearbox Lubricating Oil

Only use a recognised brand of oil for lubricating the gearbox.

Technodrive:

- model TM345 : 1,6 litres, Engine oil SAE 20W40-CD
- model TM345A : 1,6 litres, Engine oil SAE 20W40-CD
- model TM485A : 2,6 litres, Engine oil SAE 20W40-CD

ZF Hurth:

- model ZF25 : 2,5 litres ATF*), without oil cooler
- model ZF25A : 1,8 litres ATF*), without oil cooler
- model ZF45 : 3,0 litres ATF*), without oil cooler
- model ZF45A : 2,0 litres ATF*), without oil cooler
- model ZF63IV : 3,8 litres ATF*), without oil cooler

*) ATF : Automatic Transmission Fluid;
Transmissie olie type A, Suffix A.

For example : Vetus Transmission Oil
Shell Donax T6
Gulf Dextron

Other brands of gearboxes:

See supplied owners manual for oil type and quantities.

Sterndrive

Power steering and trim

: Hydraulic oil (ATF) 1,0 litres

Tail piece

- Bravo One : High Performance Gear Lube 2,7 litres
- Bravo Two : High Performance Gear Lube 3,2 litres
- Bravo Three : High Performance Gear Lube 3,0 litres

11 Operating media

Coolant

Coolant fluid

The preparation and monitoring of coolant in inter-cooled engines is especially important because corrosion, cavitation and freezing can lead to engine damage. Use as coolant a mixture of a cooling system protective liquid (anti-freeze, ethylene glycol based) and tap water.

Or use a, ethylene glycol based premix coolant i.e., 'ready-to-use' coolant. For example Vetus VOC Organic coolant.

In tropical climates, where anti-freeze availability may be limited, use a corrosion inhibitor to protect the engine cooling system.

The concentration of the cooling system protective liquid in the coolant should not fall below/exceed the following limits:

Cooling system protective liquid (Anti-freeze)	Water	Protection against freezing to
max. 45 vol%	55%	-35°C (-31°F)
40 vol%	60%	-28°C (-18°F)
min. 35 vol%	65%	-22°C (-8°F)

The protective liquid concentration must be maintained under all circumstances. Therefore if coolant must be added always use the same mixture of anti-freeze and tap water.

Water quality for coolant preparation

Use preferably tap water.

If an other available fresh water is used; the values given below must not be exceeded.

Water quality	min.	max.
pH-value at 20°C (68°F)	6.5	8.5
Chloride ion content [mg/dm ³]	–	100
Sulfate ion content [mg/dm ³]	–	100
Total hardness [degrees]	3	12



CAUTION

Never use sea-water or brackish water.



WARNING

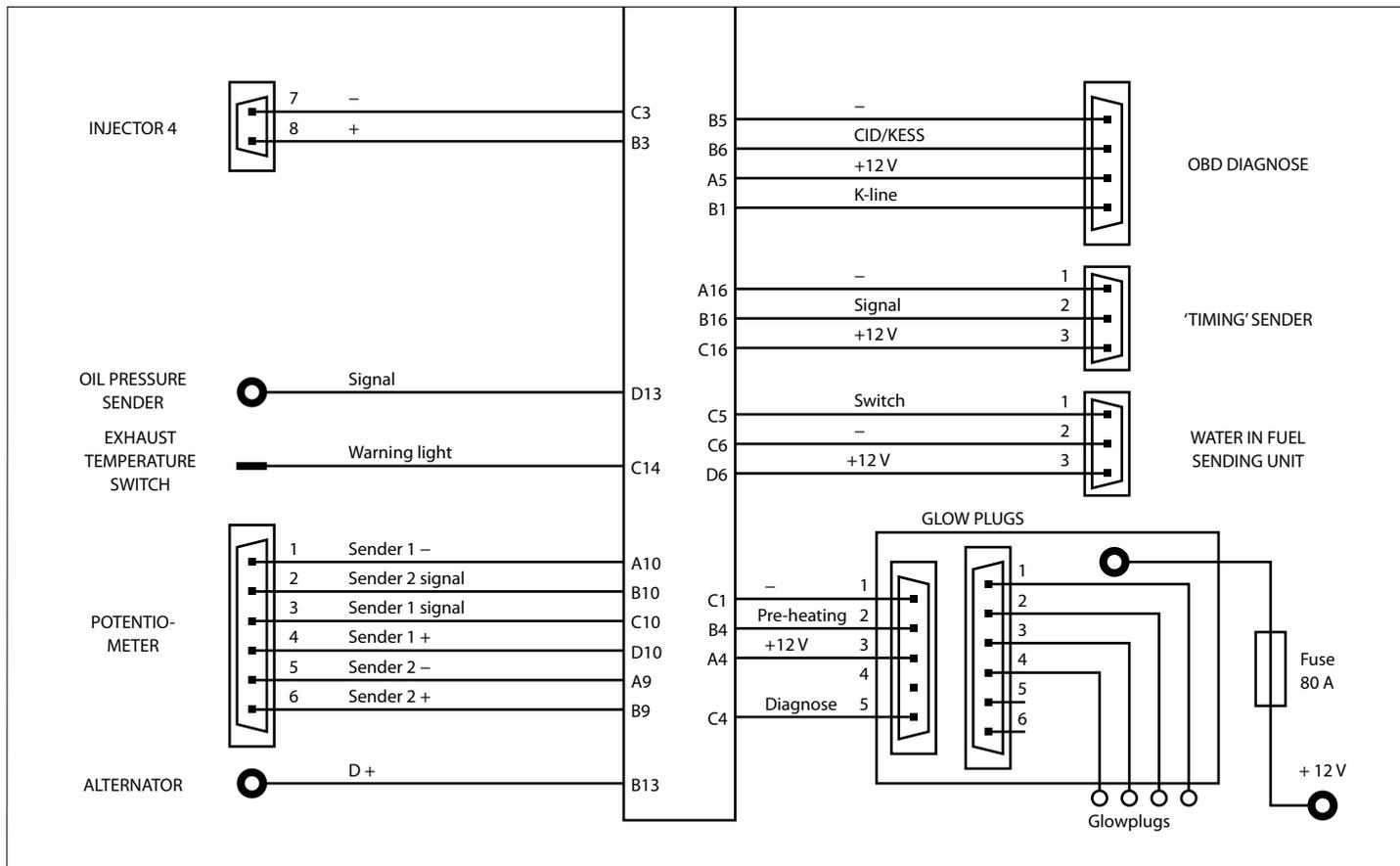
Cooling system protective liquids must be disposed of in accordance with environmental regulations.



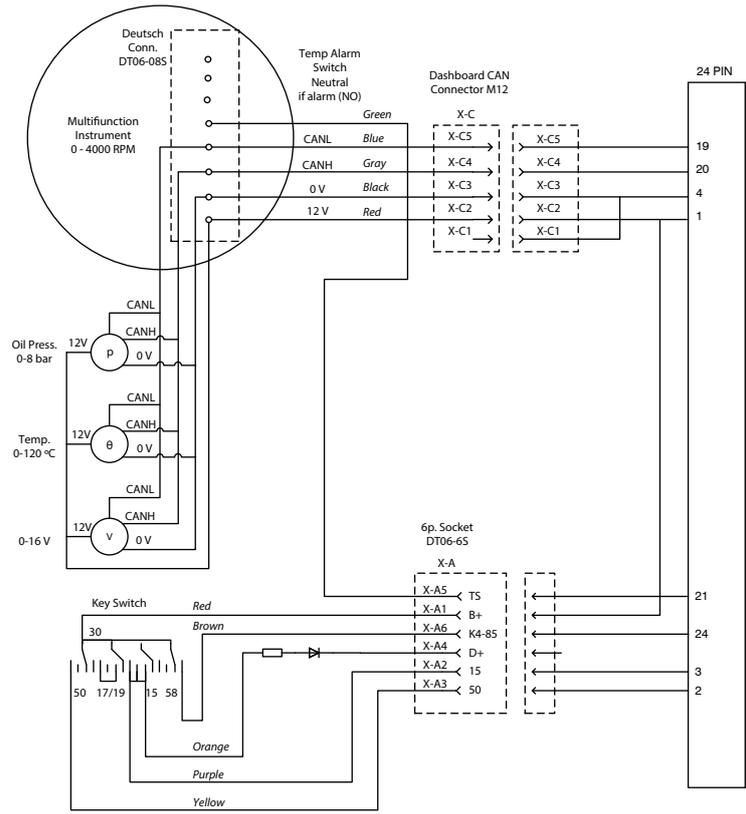
12 Wiring diagrams

Engine

VF4.145 / VF4.180 / VF4.200

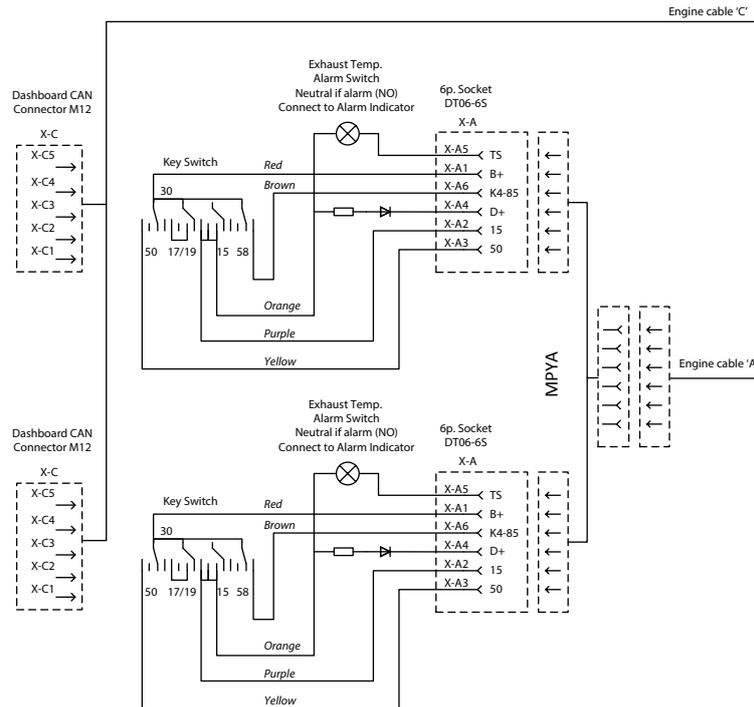


12 Wiring diagrams



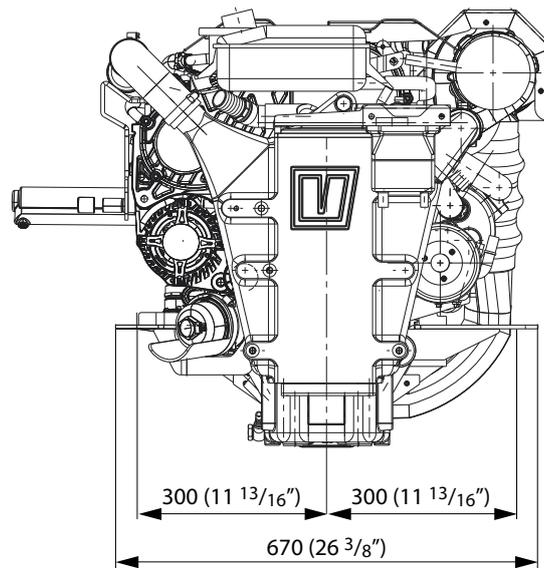
12 Wiring diagrams

2 panels



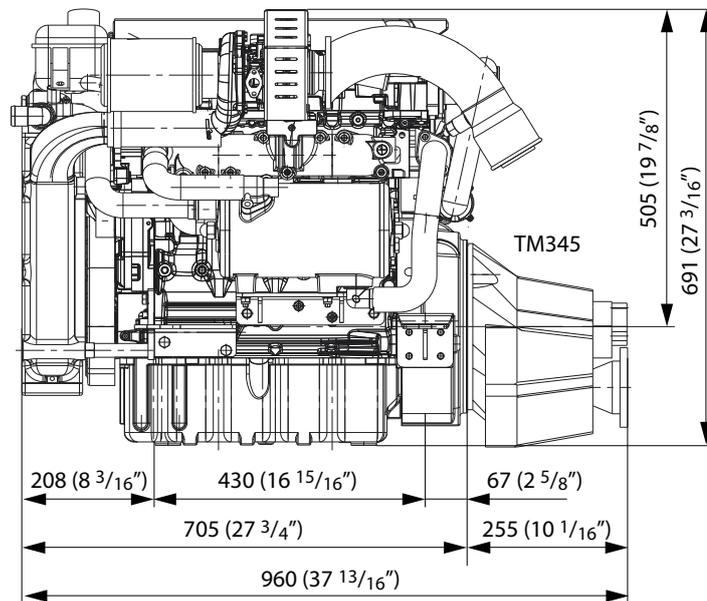
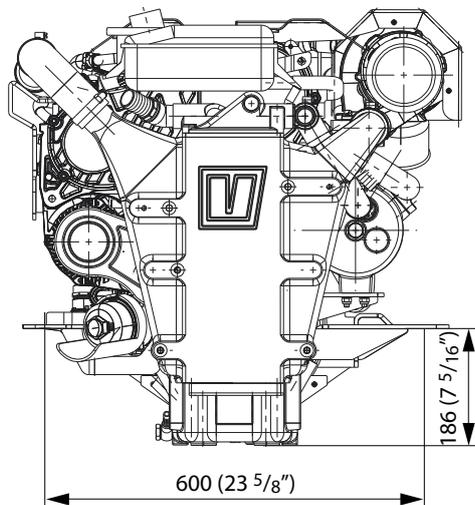
13 Overall dimensions

Vetus[®] **VF4.180, VF4.200**



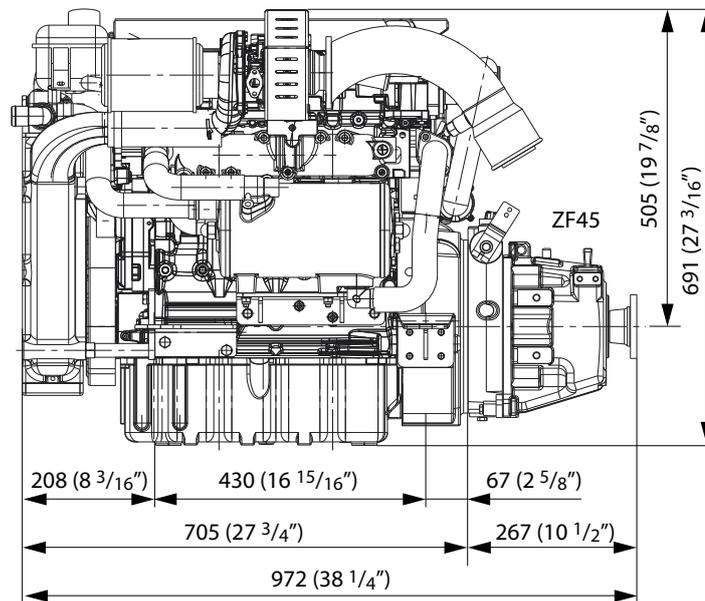
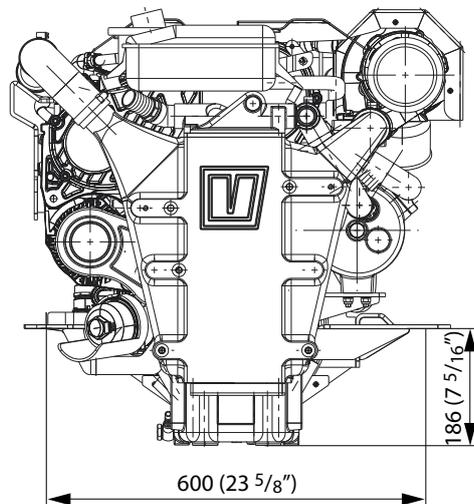
13 Overall dimensions

vetus® **VF4.145**



13 Overall dimensions

vetus® **VF4.180, VF4.200**



14 Parts for maintenance

Model VF4.145, VF4.180 and VF4.200

			Check / replace every ... hour:	See page:
Oil Filter	:	VFP51800	100	45
Air filter	:	VFP51801	200	50
Filter element, gearbox	:	CT50081	400	53
Fuel filter	:	STM9451	400	54
Impeller	:	VFP51802	800	59
Gasket	:	VFP51803	800	59
Drive belt	:	VFP51804	800	66
O-ring	:	STM9457	-	71

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Manuals

Art. code	Description	
400301.01	Bedieningshandleiding VF4	(Nederlands)
400302.01	Operation manual VF4	(English)
400303.01	Bedienungsanleitung VF4	(Deutsch)
400304.01	Manuel d'utilisation VF4	(Français)
400305.01	Manual de operacion VF4	(Español)
400306.01	Istruzioni per l'uso VF4	(Italiano)
400307.01	Brugsanvisning VF4	(Dansk)
400308.01	Användarmanual VF4	(Svenska)
400309.01	Bruksanvisning VF4	(Norsk)
400310.01	Käyttöopas VF4	(Suomeksi)
400319.01	Instrukcja obsługi VF4	(Polski)
400402.01	Installation manual VF4	(English)
320199.06	(STM0016) Service- en Garantieboek / Service and Warranty Manual / Service- und Garantieheft / Livret Garantie et Service / Manual de servicio y garantía / Libretto di assistenza e garanzia Service- og garantibog / Service- och garantihäfte Service- og garantibok / Huolto- ja takuukirja Manual de Assistència e Garantia / Książeczka gwarancyjna i serwisowa	(Nederlands / English / Deutsch / Français / Español / Italiano / Dansk / Svenska / Norsk / Suomeksi / Português / Polski)
401231.02	Onderdelenboek / Parts manual VF4, VF5	(Nederlands / English)
402102.01	Service manual VF4/VF5	(English)

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