M4.15 M4.17

Operation manual

Operation manual

M4.15
M4.17

Serial numbers

Engine serial number Vetus: _____

Mitsubishi: _____

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 6).

We reserve the right to make any changes without previous notice.

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.

For the Guarantee Conditions, see the Vetus Diesel Service and Warrantee Manual.

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 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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Introduction

Dear customer,

Vetus diesel engines are designed both for pleasure 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 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 n.v.

Safety measures

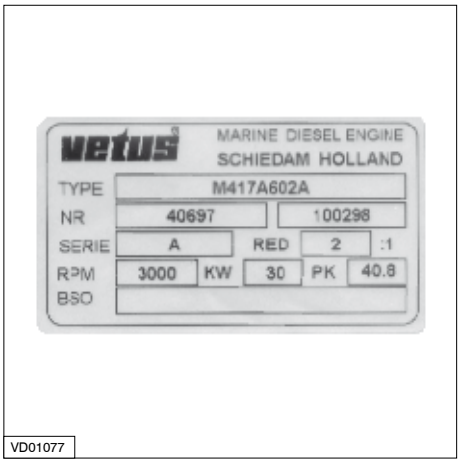
All safety instructions in this manual are designated by the accompanying symbol. Please follow them carefully.

Pass the safety instructions to other persons operating the engine as well.

General regulations and laws for safety and accident prevention must also be observed.

- Never attempt to touch moving parts when the engine is running.
- Never touch hot parts of the engine, and keep flammable materials well away from the engine.
- Always stop the engine before checking or adjusting components.
- Always stop the engine before checking or topping up the coolant or oil.
- **Never** open cap on top of header tank when the engine is at operating temperature.
- Always carry out maintenance safely by only using tools well matched in size.

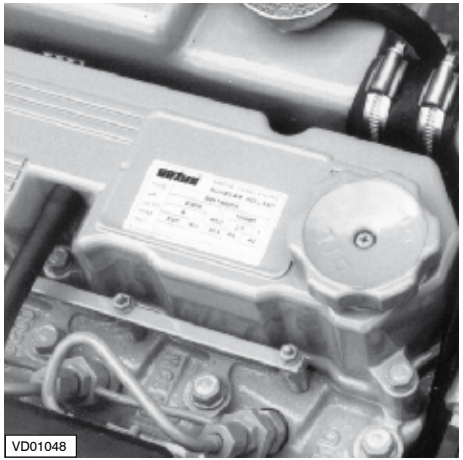
Engine description



Engine data tag

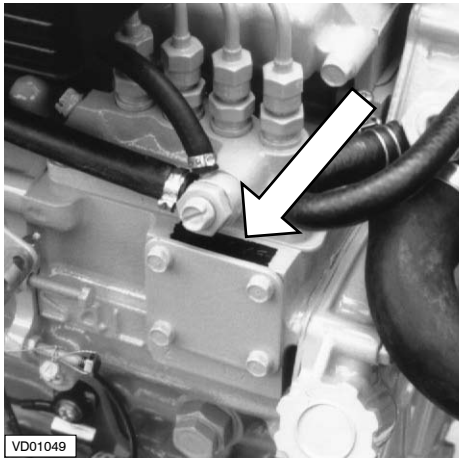
The **VETUS** engine serial number and performance data are printed on the engine data tag.

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



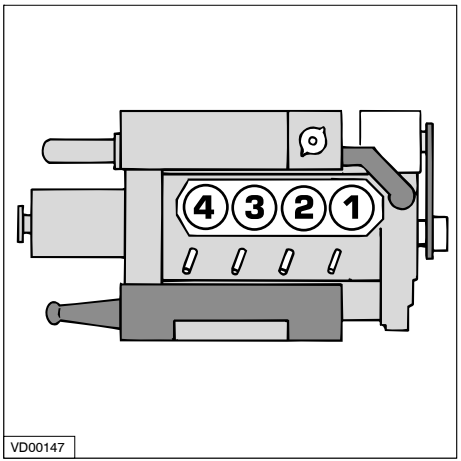
Engine data tag location

The **VETUS** engine data tag is attached to the valve cover.



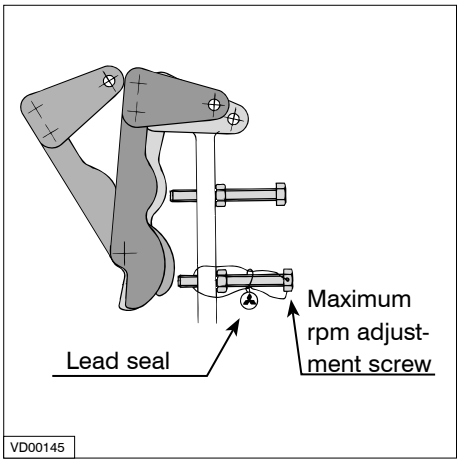
Engine serial number

The **MITSUBISHI** engine serial number is stamped on the fuel injection pump.



Cylinder numbering

Cylinders are numbered consecutively, beginning at the front end.



Fuel pump seal

The manufacturer shall not be held liable for damages resulting from adjustments made to the fuel injection pump.
The maximum engine speed adjustment screw has been sealed to prevent this.

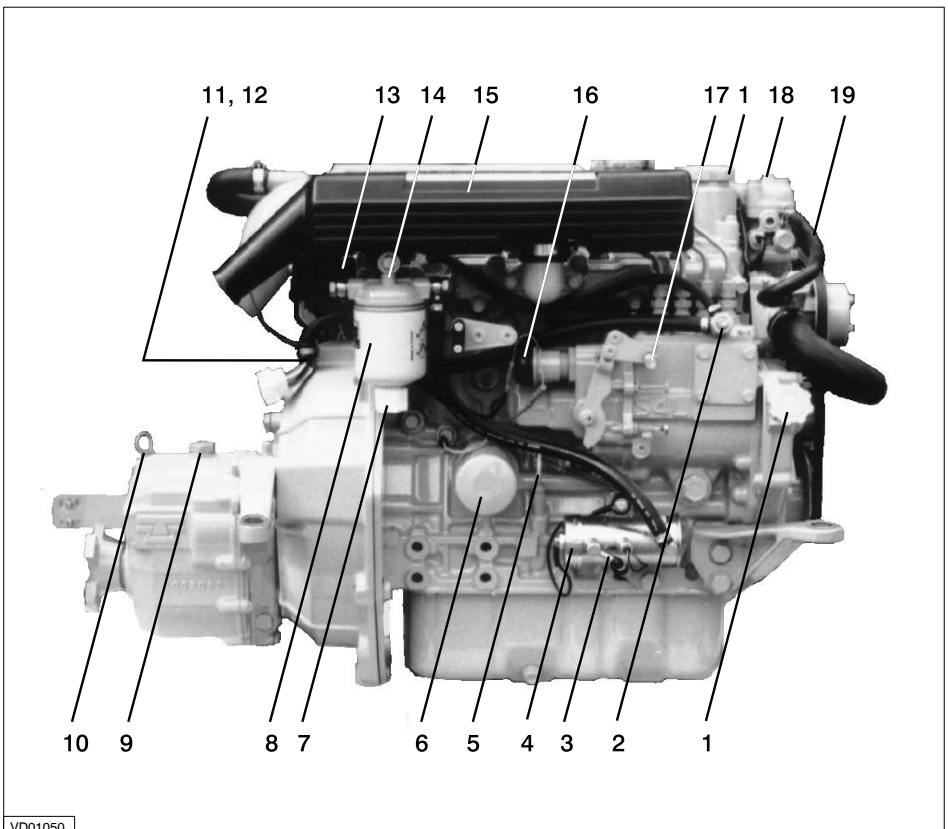
Adjustments to the fuel pump are to be carried out by authorized Vetus-Mitsubishi Service specialists only.

Engine description

Identification of engine parts

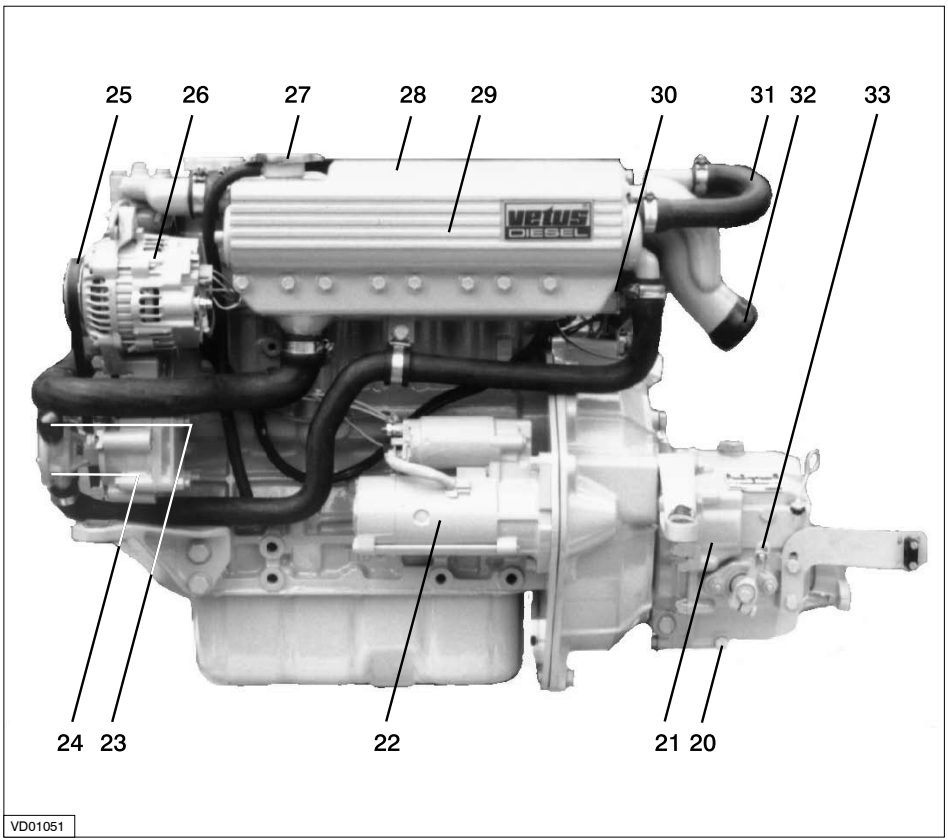
Service side

1 Oil filler cap
2 Fuel pump air bleed nipple
3 Fuel supply pipe connection ø 8 mm
4 Fuel lift pump
5 Oil dipstick
6 Oil filter
7 Water separator/fuel filter drain plug
8 Water separator/Fuel filter
9 Gearbox filler cap
10 Gearbox oil dipstick
11 Electrical system connectoion box
12 Fuse
13 Fuel return pipe connection ø 8 mm
14 Water separator/fuel filter air bleed nipple
15 Air inlet silencer
16 Manual operation of electric stop
17 Connection for throttle push-pull cable
18 Cooling system air bleed nipple / Connection for extra expansion tank (Keel cooling model only)
19 Calorifier connection
20 Gearbox drain plug
21 Gearbox

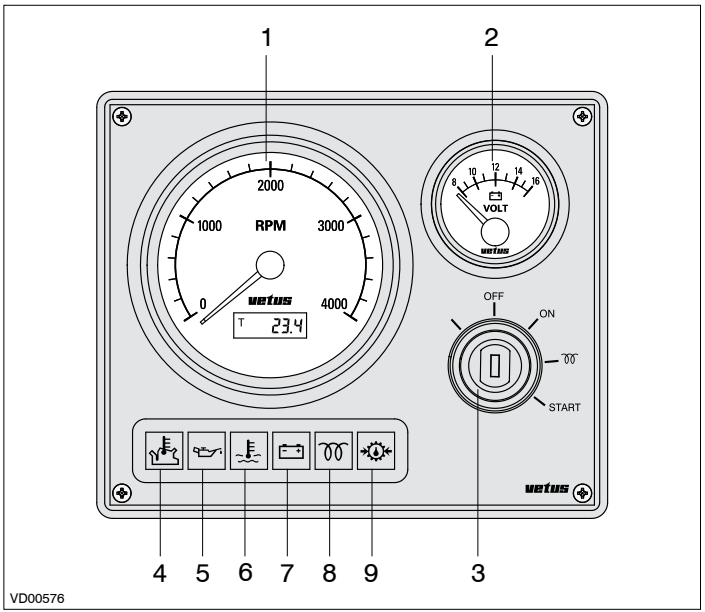


Identification of engine parts

Starter side



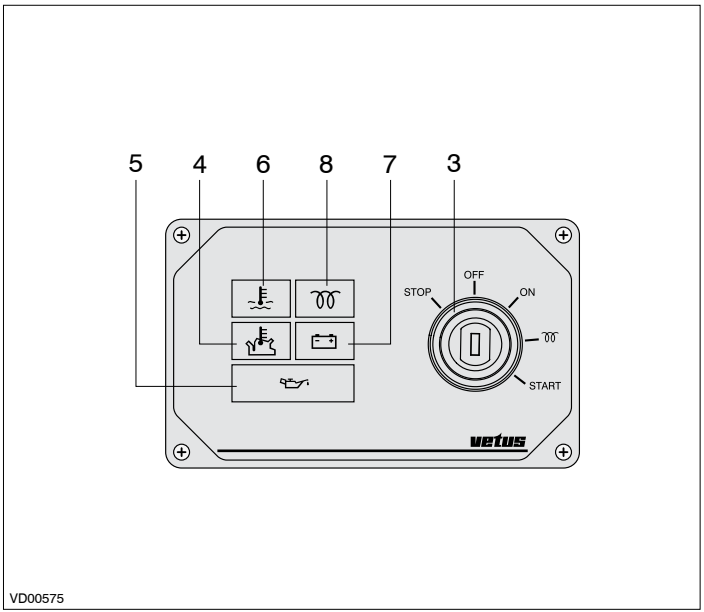
22 Starter motor
23 Raw water inlet ø 20 mm
24 Raw water pump
25 V-belt
26 Alternator
27 Filler cap for cooling system
28 Expansion tank
29 Heat exchanger
30 Cooling system drain plug
31 Airvent connection
32 Exhaust injection bend ø 50 mm
33 Connection for gearbox push-pull cable



Basic panel (model 22)

Fly-bridge panel (excl. voltmeter, model 21)

1 Tachometer/Operating hours counter
2 Voltmeter
3 Starter pre-heat switch/lock
4 Warning light high raw water temperature
5 Warning light low oil pressure



Sailingboat panel (model 10)

6 Warning light high coolant temperature
7 Warning light battery charging
8 Indicator light pre-heating
9 Warning light gearbox low oil pressure *

*) This is an option, not fitted as standard.

Use

General guidelines for use

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

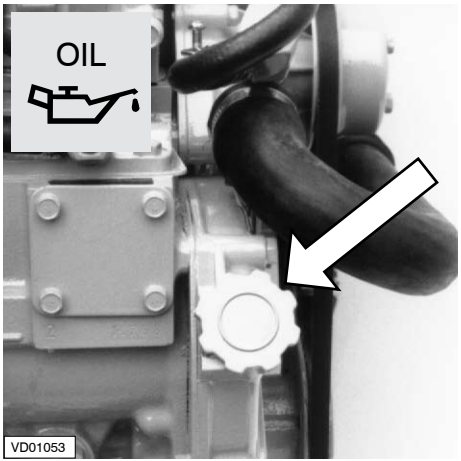
- Carry out the maintenance described regularly, including the ‘Daily procedures before starting’.
- Use anti-freeze in the engine coolant all year long, this helps prevent corrosion as well as protecting against frost damage. For specifications see page 65.
- Never run the engine without a thermostat.
- Use a good quality lubricating oil. For specifications see page 63.
- 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 lights up.

Engine Oil

5 litres (1 UKgal) 15W40

API: CD, CE or CF4
ACEA: A3/B3, A3/B4

For example:
- Vetus Marine Diesel Engine Oil 15W-40
- Shell Nautilus Premium Inboard Oil 15W-40



Commissioning the engine

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

Filling with engine oil

As a rule engines are delivered empty of oil.
Fill the engine with oil through the filler neck on top of the valve cover, for quantity and specification see page 63.

Check the oil level with the dipstick, see page 23.

A second oil filling cap is located at the front of the engine on starboard side.

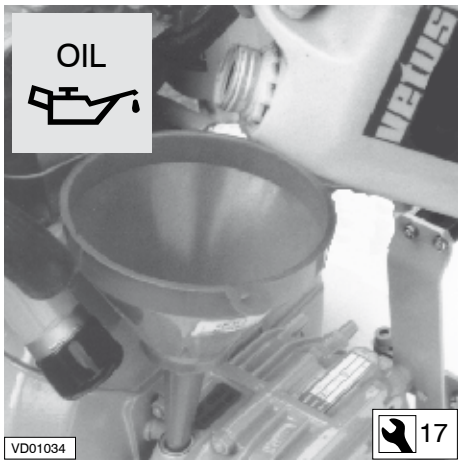
Vetus engines are normally equipped with Technodrive or ZF-Hurth gearboxes.

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

Filling gearbox with oil

Fill the gearbox with oil.

Check the oil level with the dipstick, see page 32.



Technodrive:

type TMC40 : 0.20 litres Engine oil SAE 20/30
type TMC40 M/P : 0.20 litres, ATF*) (0.35 UK pt, 0.4 US pt)
type TMC60 : 0,80 liter, Engine oil SAE 20/30
type TMC60 E/P : 0,80 liter, ATF*) (1.4 UK pt, 1.7 US pt)
type TM345 A / H: 1.6 litres, Engine oil SAE 20W40-CD (2.8 UK pt, 3.4 US pt)

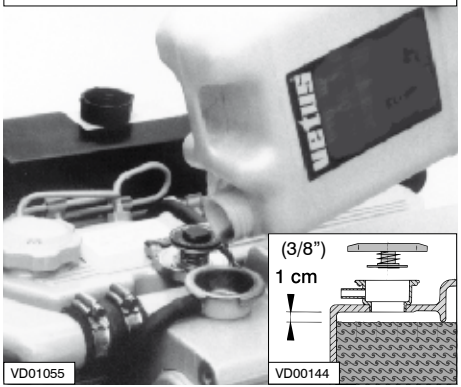
*) ATF: Automatic Transmission Fluid type A, Suffix A.

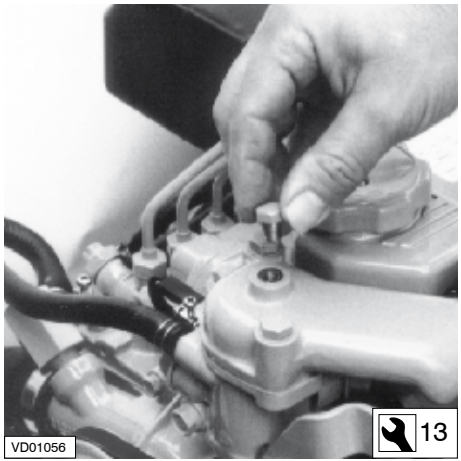
ZF Hurth:

type ZF10M : 0.35 litres ATF*) (0.6 UK pt, 0.74 US pt)
type ZF12 : 1.1 litres ATF*) (1.9 UK pt, 2.3 US pt)
type ZF15MA : 0.56 litres ATF*) (1 UK pt, 1.2 US pt)
type ZF15V : 1.0 litres ATF*) (1.8 UK pt, 2.1 US pt)

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

COOLANT QUANTITY : 6.5 litres (1.4 UKgal)





WATER HEATER

If a water heater is connected to the engine and this heater is positioned above the upper side of the engine then bleeding of the heater will not take place automatically! Fill the heater separately to bleed the cooling system completely.

Filling the cooling system

Remove the cap of the filler neck on the top of the heat exchanger housing.
Remove the bolt from the upper side of the thermostat cover, so that air can escape from the cooling system.
Fill the cooling system.
Use a mixture of 40% antifreeze (ethylene-glycol based) and 60% tap water or use a special coolant.

For specifications see page 65.

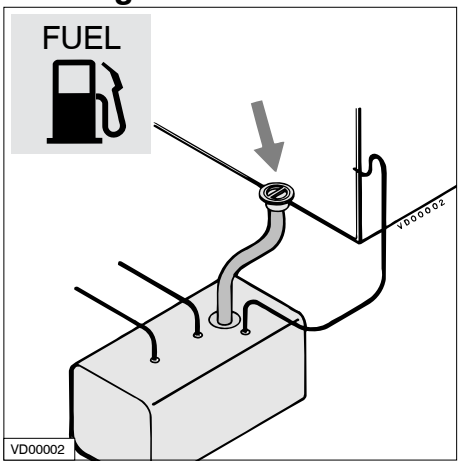
The level of the coolant must be approx. 1 cm (3/8”) below the lower edge of the filler neck.
Bleeding will take place automatically during filling!
Replace the filler cap.
After the engine has run for the first time and has reached operating temperature and has cooled down again to ambient temperature, check the coolant level in the heat exchanger housing.

If necessary, add coolant.

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

First commissioning

Running-in



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

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 64.
Bleed the fuel system, see page 26.

Other preparations

- Check battery and cable connections.
- Start the engine, see page 16, and let it run for about 10 minutes without load. Check the engine and all connections (fuel, cooling water and exhaust) for leaks.

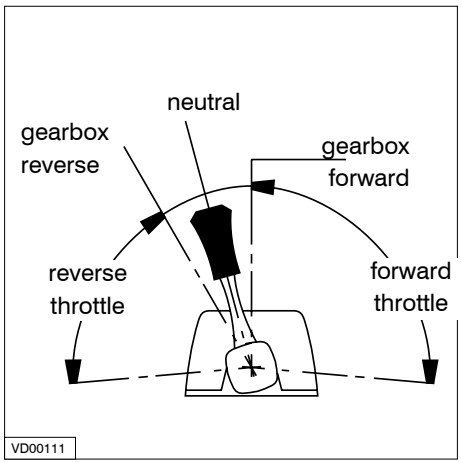
Running-in

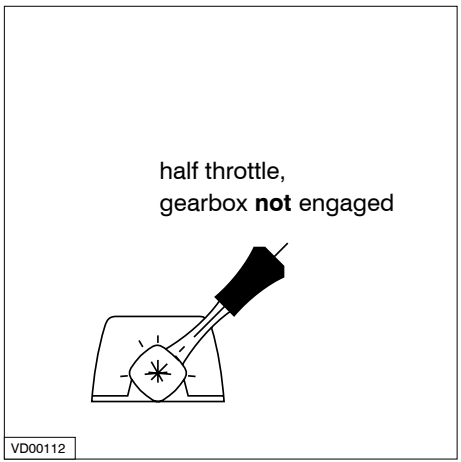
In order to ensure a long life for your engine, please observe the following for the first 50 operating hours:

- 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.

Before starting, **ALWAYS** check the following points:

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





After repair work:

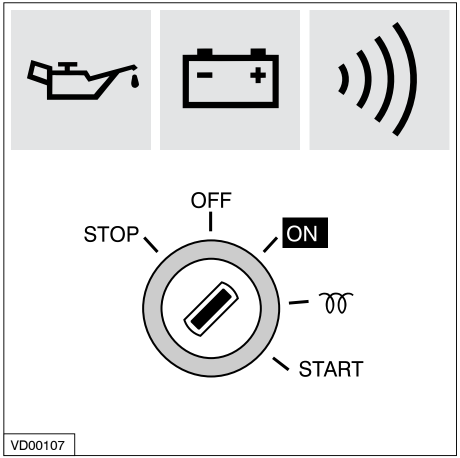
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with pre-heating, do not use any other substance (e.g. injection with 'Easy Start'). Doing so could result in an accident.

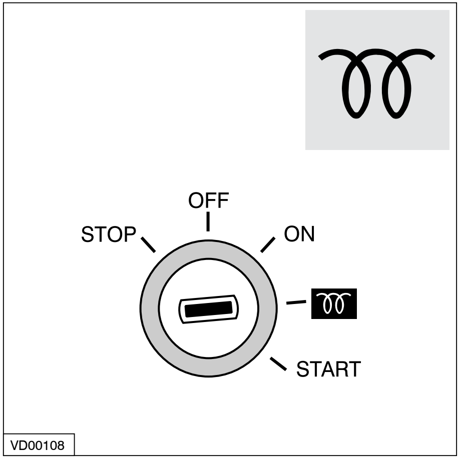
Preparation starting

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

Never start the engine with the fuel injection pump removed.
Disconnect battery.

Set the control lever to 'half throttle' **without** engaging the gearbox.





Ambient Temperature	Pre-heating time
Above + 5°C (41°F)	about 6 seconds
+5°C to -5°C (+41°F to +23°F)	about 12 seconds
Below -5°C (23°F)	about 18 seconds
Maximum pre-heating time	1 minute

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.

Pre-heating

Turn the key further clockwise to the ‘ ’ position; only the pre-heating indicator light will be lit now.

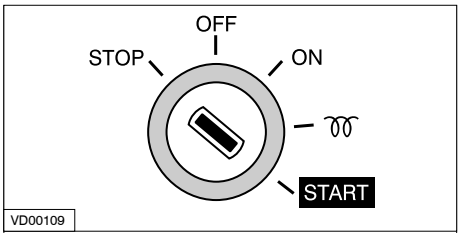
Hold the key in this position for about 6 seconds.

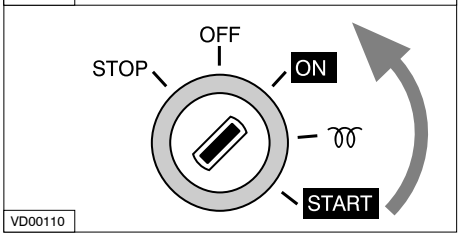
Pre-heating time

The ideal pre-heating time depends on ambient temperature; the lower the ambient temperature, the longer the pre-heating time required. See table.

WARNING

To prevent the glow plugs from burning out, **never** exceed the stated maximum pre-heating time.





WARNING

Release the key if the engine does not fire within 10 seconds. Wait until the starter motor has stopped running completely before turning the key to the '**START**' position again. Never allow the starter motor to run for more than 30 seconds consecutively.

WARNING

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

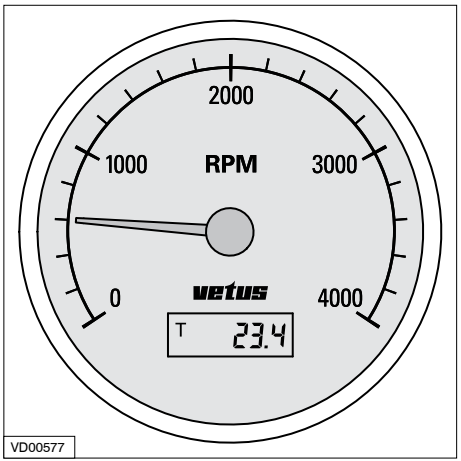
Starting

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

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.

Check that the indicator lights for oil pressure and alternator are off. Cooling water should now flow out of the exhaust; if this is not the case, stop the engine immediately. Before submitting the engine to full load it should be brought up to operating temperature as quickly as possible by running at 3/4 of maximum revs. **NEVER** turn the main switch off while the engine is running.

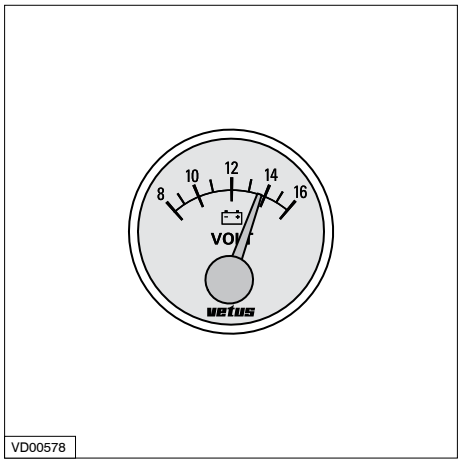
The instrument panel is provided with the following instruments (Depending of the type of panel, see page 10).



Tachometer

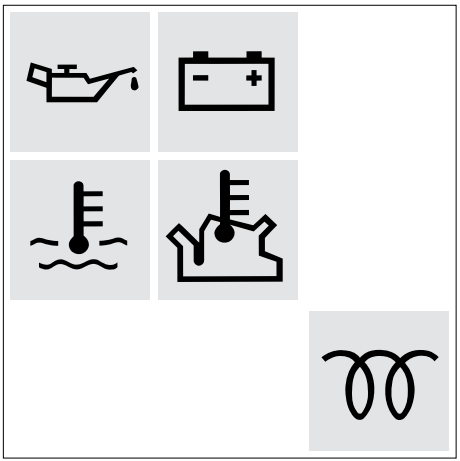
Indicating the number of revolutions per minute of the engine.
Avoid idling for more than 10 minutes.
Also the number of running hours is indicated.

Idling speed,
M4.15: 840 rpm
M4.17: 840 rpm



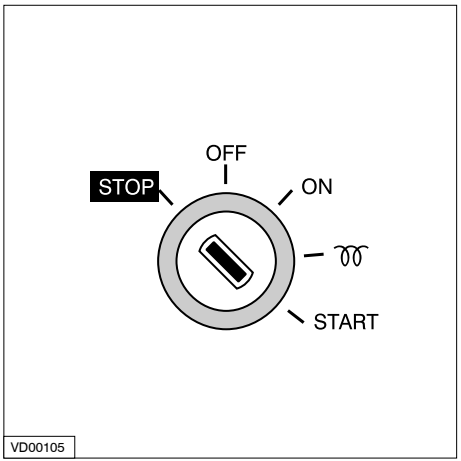
Voltmeter

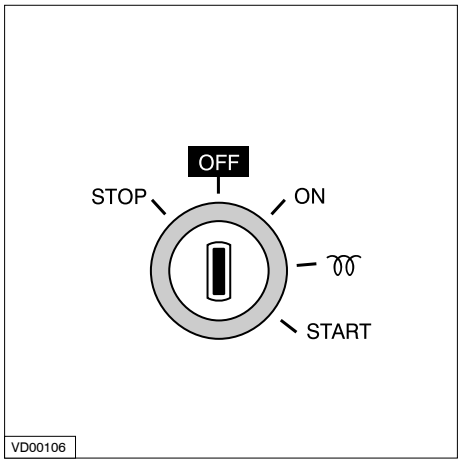
Indicating the battery voltage.
When the engine is running, the battery voltage should be between 12 and 14 Volts.
With the engine stopped and the start key in the first position, the voltmeter should indicate 12 Volts.

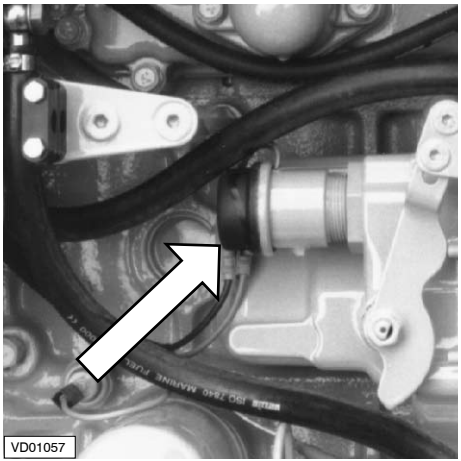


Warning lights

None of the five warning lights should light up while the engine is running. Oil pressure, battery charging and temperature indicator lights are all connected to an alarm buzzer. If this alarm buzzer sounds while running, **STOP THE ENGINE IMMEDIATELY!**







Electrical shutdown

Reduce engine speed to idle and shift the gearbox to '**Neutral**'. Turn the key entirely to the left, **through** the '**Off**' position.

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.

When the engine has stopped, turn the key to the '**Off**' position.

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.

Mechanical shutdown

On the engine itself stopping is possible by pressing the black button on the fuel injection pump.
If the fuel supply is not shut off by the electrically operated fuel solenoid stopping of the engine can be done this way.

Routine Maintenance

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.

Routine Maintenance

Every 10 hours or daily, before starting	
Check engine oil level	23
Check coolant level	24
Check water strainer	25

After the first 50 hours	
Drain water from fuel filter	26
Engine oil change	28
Replace oil filter	28
Gearbox oil change	33
Replace fuel filter	36
Check idle rpm	47

Every 100 hours, at least once every year	
Drain water from fuel filter	26
Engine oil change	28
Replace oil filter	28
Battery, cables and cable connections	30
Check gearbox oil level	32

Every 500 hours, at least once every year	
Gearbox oil change	33
Check valve clearance	34
Replace fuel filter	36
Cleaning fuel lift pump	37
Check V-belt	38
Check flexible engine mounts	39
Check engine for leaks	39
Check tightness of all fasteners, bolts and nuts	39

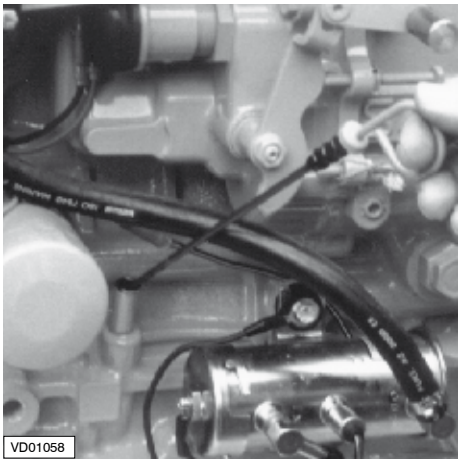
Every 1000 hours, at least once every 2 years	
Raw water pump inspection	40
Replace coolant	42

When required	
Bleeding fuel system	26
Cleaning heat exchanger	44
Check idle rpm	47

Stop the engine before carrying out any maintenance work.

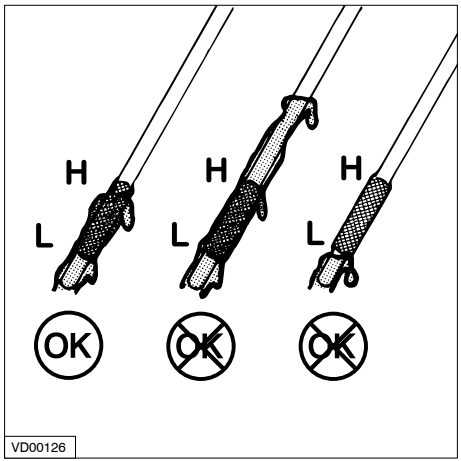
Checking engine oil level

Daily, before starting.



Check oil level

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



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: 1.9 litres (3 1/4 UKpt)

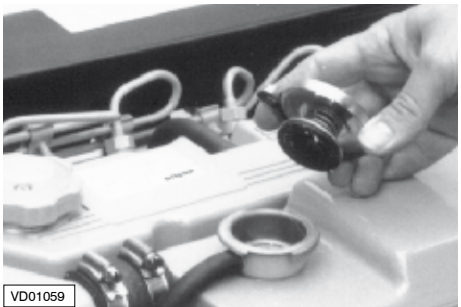
Topping up oil

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

A second oil filling cap is located at the front of the engine on starboard side, see page 12.

Checking coolant level

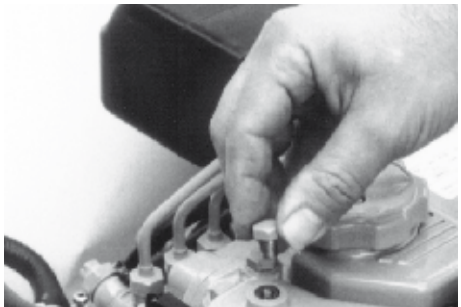
Daily, before starting.



Checking coolant level

Check the coolant level in the header tank. This has to be checked when the engine is **cold**.
Remove the cap of the filler neck on the heat exchanger.

The level of the coolant must be approx. 1 cm (3/8”) below the lower edge of the filler neck.



If necessary, top up.

When topping up coolant, remove the bolt from the upper side of the thermostat cover, so that air can escape from the cooling system.

WARNING

Never open the cap on the header tank when the engine is at operating temperature.

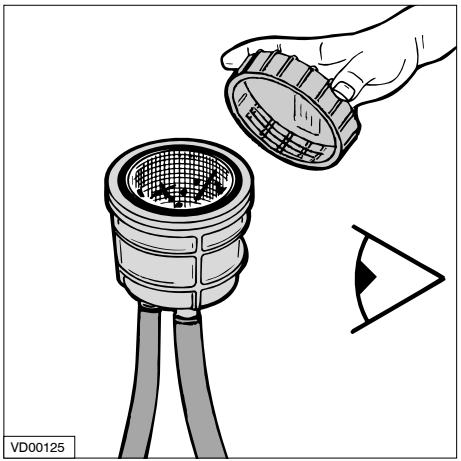
Topping up coolant

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 65.

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

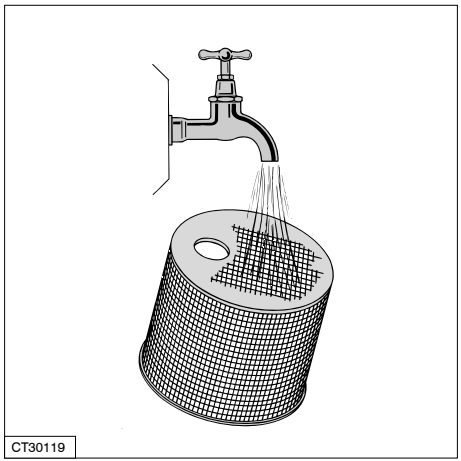
Checking and cleaning the raw water strainer

Daily, before starting.



Checking the raw water strainer

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



Cleaning the strainer

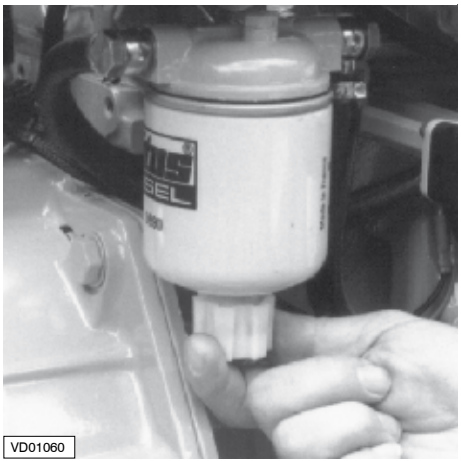
Close the seacock before removing the lid of the water strainer.

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.

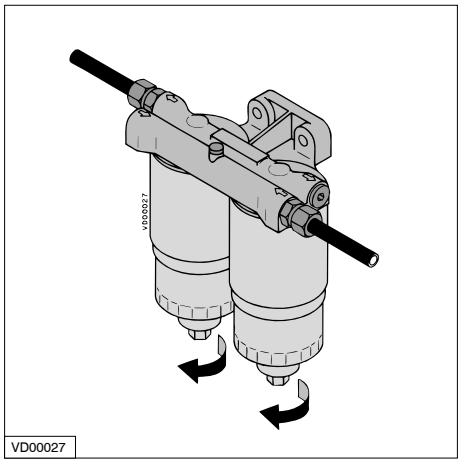
Draining of water from the water separator/fuel filter

Every 100 operating hours.



Empty fuel filter

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

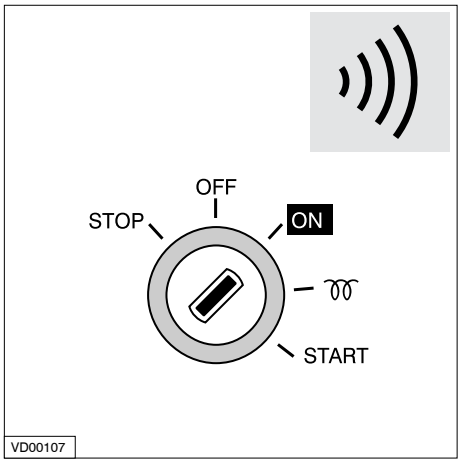


Empty water separator

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!



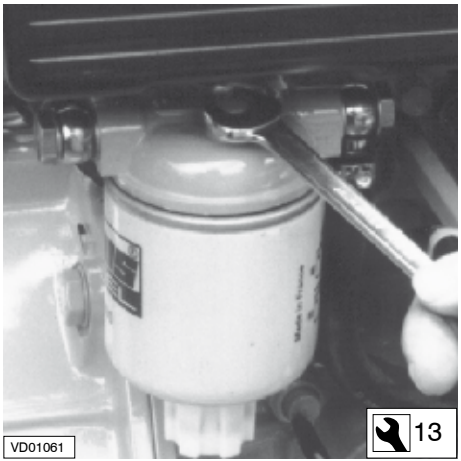
Bleeding

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 of the starter switch to position ‘ON’ and the fuel lift pump will feed the fuel system.

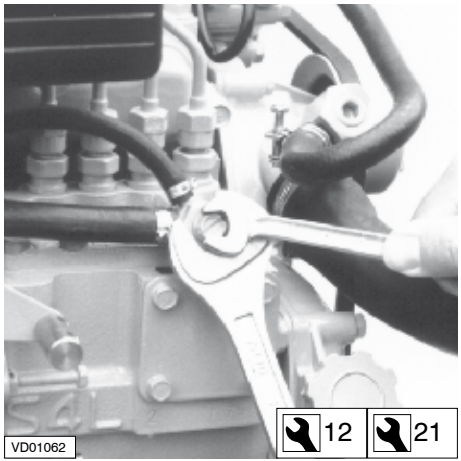
Draining of water from the water separator/fuel filter

Every 100 operating hours.



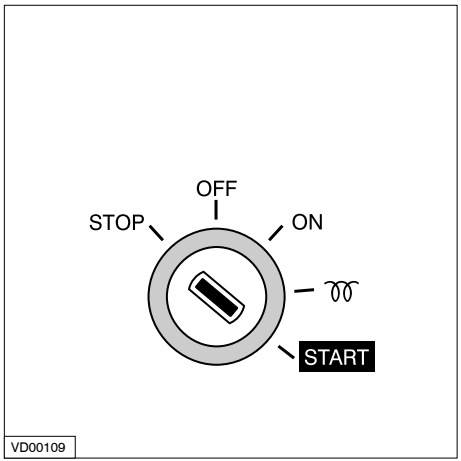
Open the two bleeding nipples to speed up the bleeding process.

One (1) bleeding nipple is located at the filter.



A second bleeding nipple is located at the fuel injection pump.

Close the bleeding nipples when all air has escaped.



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.

Maintenance

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.

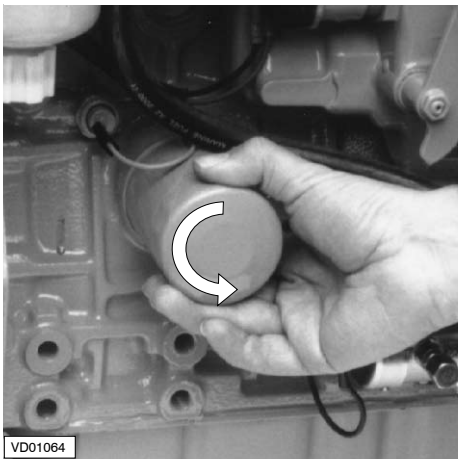
Run the engine for a few minutes before changing the oil; warm oil can be pumped out more easily.

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

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.

Draining the oil

Remove the dipstick; insert the suction hose of the supplied sump pump in the dipstick tube.
Push down the pump handle quickly and pull it up slowly.



Removing the oil filter

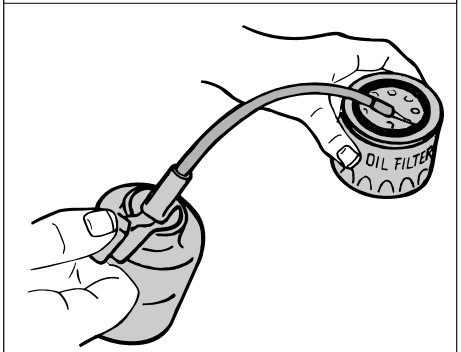
Unscrew the oil filter, with a commercially available tool, when all the oil has been pumped out.
Catch any dripping oil.

Beware of burns from hot oil.

Engine oil change

Every 100 operating hours.

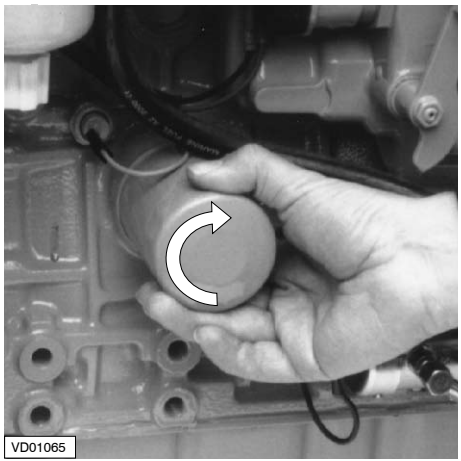
OIL FILTER, ART.CODE: STM0051



VD00124

Oiling the oil seal

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

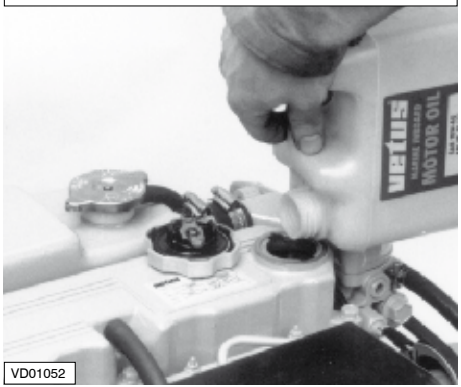


VD01065

Oil filter installation

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

AMOUNT OF OIL: (OIL FILTER INCL.) 5.6 litres (1.25 UKgal)



VD01052

Refilling with oil

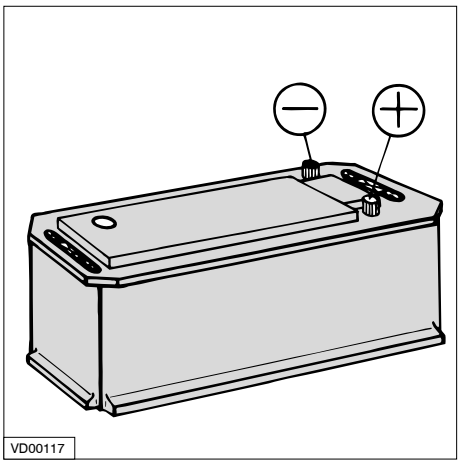
Refill the engine with new oil (for specification see page 63) through the filler opening in the valve cover.

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.

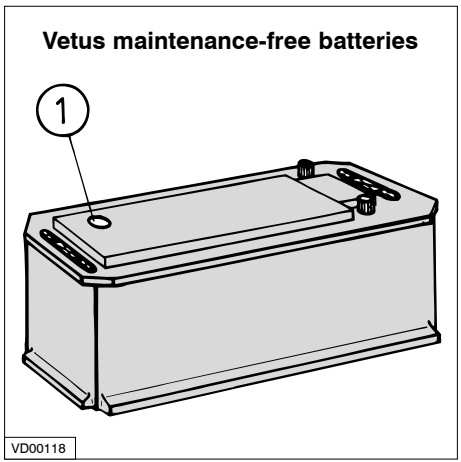
Battery, cables and connections

Every 100 operating hours.



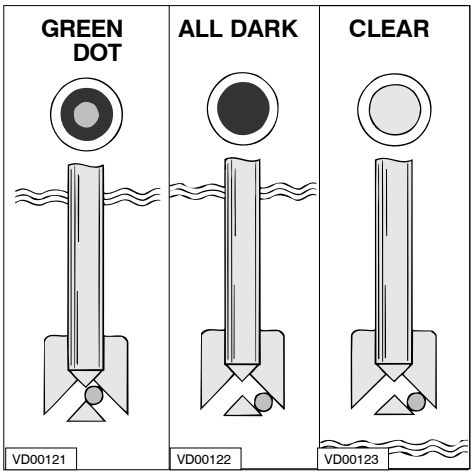
Battery, battery connections

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.



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:

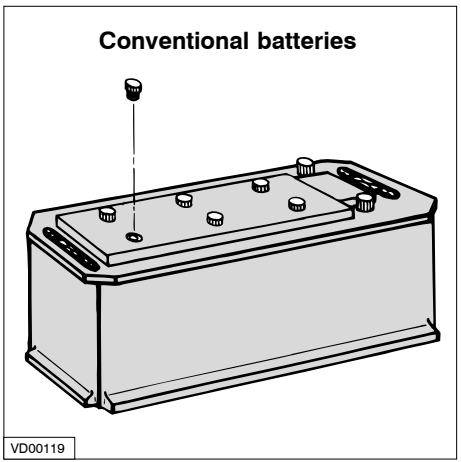


Hydrometer operation

- **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 over-charging the battery for a long period of time with a voltage too high, replace battery. Check alternator and/or voltage regulator.

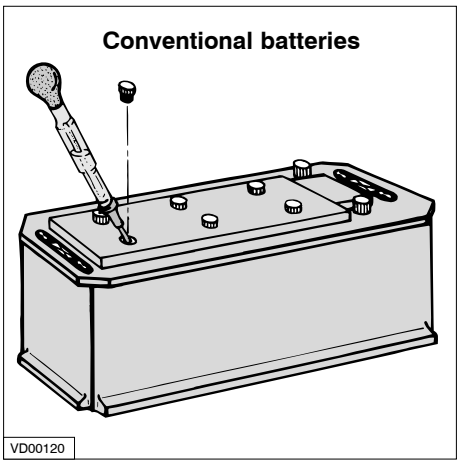
Battery, cables and connections

Every 100 operating hours.



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 (3/8” to 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.



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

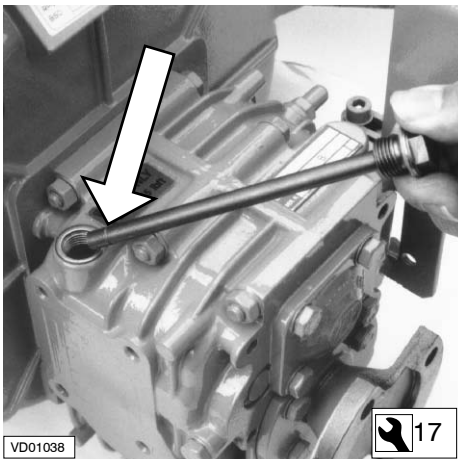
Specific gravity	State of charge	
1.280	100%	
1.200	50%	recharge
1.120	10%	recharge immediately

The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery!

Do not allow battery acid to come into contact with skin or clothing!
Wear protective goggles!
Do not rest tools on the battery!

Gearbox oil level check

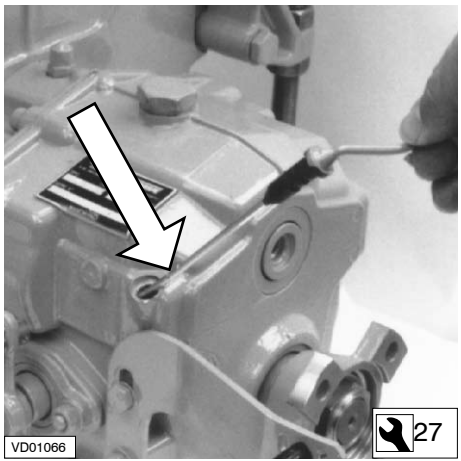
Every 100 operating hours.



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 should be between the end and the notch in the dipstick.
If necessary top up by pouring oil in the dipstick hole. For oil type and specification see page 63.



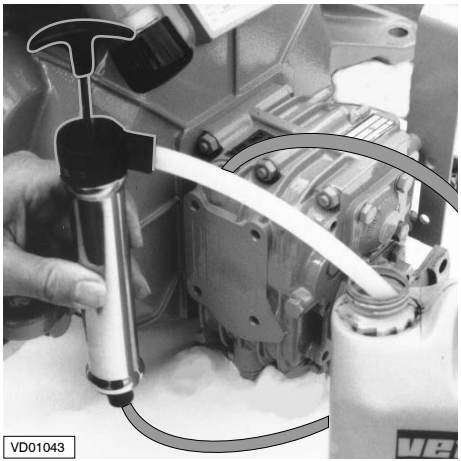
Oil level check (Technodrive)

The oil level must between the two marks on the dipstick
If necessary top up.
The fillercap is on top of the gearbox housing. For oil type and specification see page 63.

Vetus engines are normally equipped with ZF-Hurth or Technodrive gearboxes. Consult the supplied Owners Manual for more details about care and maintenance. 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.

Changing the gearbox oil

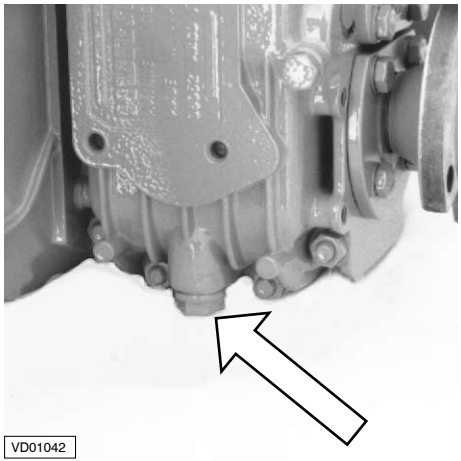
Every 500 operating hours.



Draining the oil

Drain the oil with the aid of a separate sump pump.
Remove the dipstick (ZF-Hurth, 17) or remove the dipstick (Technodrive, 27).

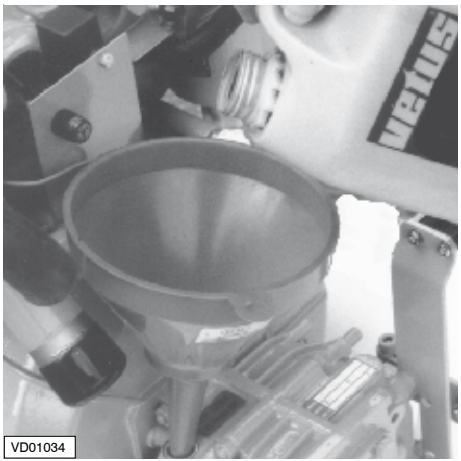
Insert the suction hose of the sump pump in the dipstick hole. Push down the pump handle quickly and pull it up slowly.
Remove the sump pump when all the old oil has been pumped out.



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

Drain plug: ZF-Hurth 17
Technodrive 14

Collect the oil in a dripping pan.



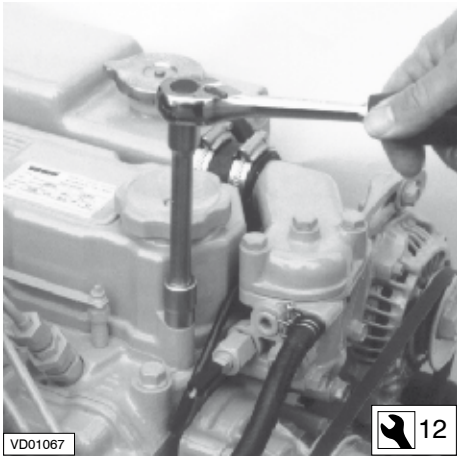
Filling with new oil

Refill the gearbox to the correct level via the dipstick opening (ZF-Hurth, 17) or via the filling hole (Technodrive, 27).
For oil specification see page 63.

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.

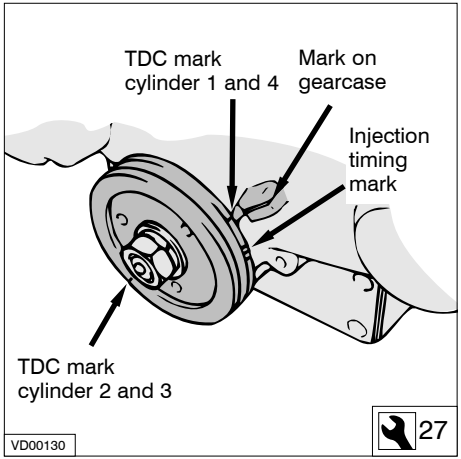
Checking / adjusting valve clearance

Checking the valve clearance must be done with a cold engine, that is an engine which did not run for at least 6 hours.



Remove rocker cover

Remove the 5 bolts of the rocker cover. Complete the following steps:



Locating TDC

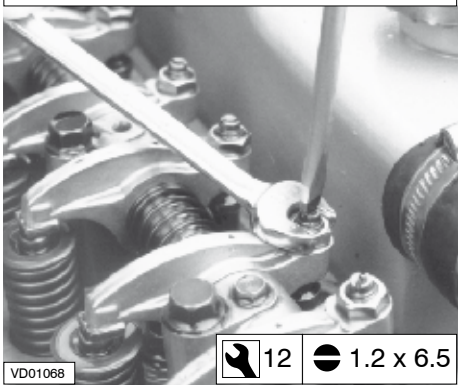
Locate the Top Dead Center (TDC), at the end of the compression stroke, for cylinder 1 by barring the engine slowly until the TDC marks of the engine block and the crank pulley match.

Note: There are two TDC's e.g. compression and suction. At the TDC at the end of the compression stroke the rocker arm does not move when the crank pulley is rotated a little.

Checking valve clearance

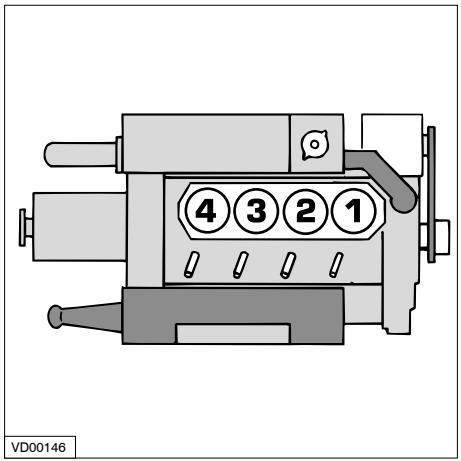
Every 500 operating hours.

VALVE CLEARANCE: INLET 0.25 mm (0.010")
EXHAUST 0.25 mm (0.010")



Adjusting valve clearance

- Check valve clearance at cylinder 1 and adjust if necessary.
- Rotate the crankshaft 180° clockwise and check valve clearance at cylinder 3.
- Again rotate the crankshaft 180° and check valve clearance at cylinder 4.
- Finally again rotate the crankshaft 180° and check valve clearance at cylinder 2.



Cylinder numbering

Cylinders are numbered consecutively, beginning at the front end.

Fuel filter replacement

Every 500 operating hours.

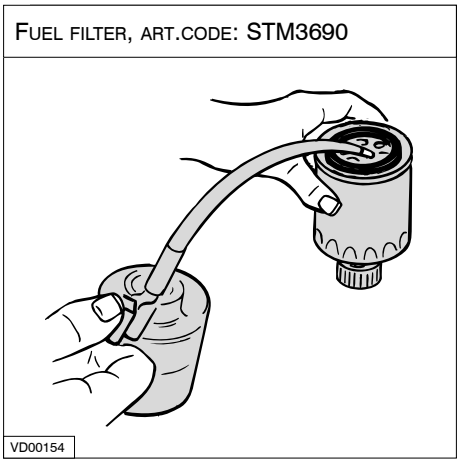
Fuel filter removal

The fuel filter is to be replaced as a unit.

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

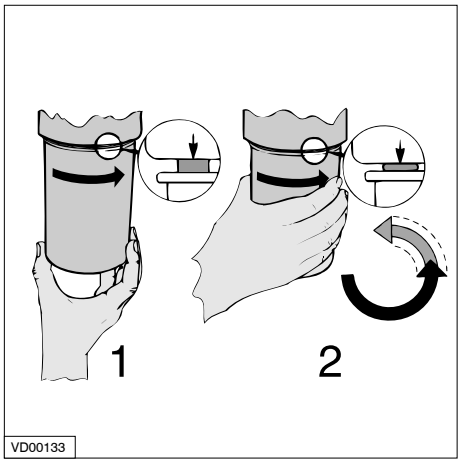
Keep naked flames away when working on the fuel system. Do not smoke!

FUEL FILTER, ART.CODE: STM3690



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.

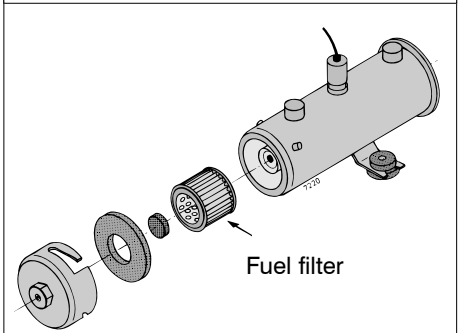


- Install the filter. When the rubber gasket touches the housing, apply another tightening of a half to three quarters of a turn by hand.

Cleaning fuel lift pump

Every 500 operating hours.

FUEL FILTER , ART.CODE: STM4050



STM7220

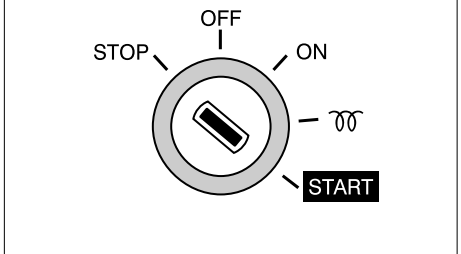
Fuel lift pump

- Check, and if necessary clean, filter inside the fuel lift pump.
- Open the fuel stop cock.
- Check for leakage.

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.

For bleeding see page 26.



VD00109

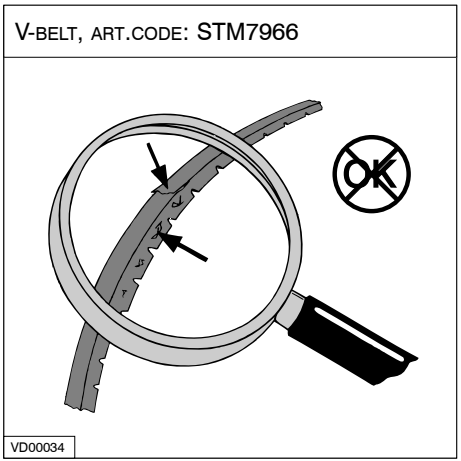
Start the engine

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.

Checking the V-belt

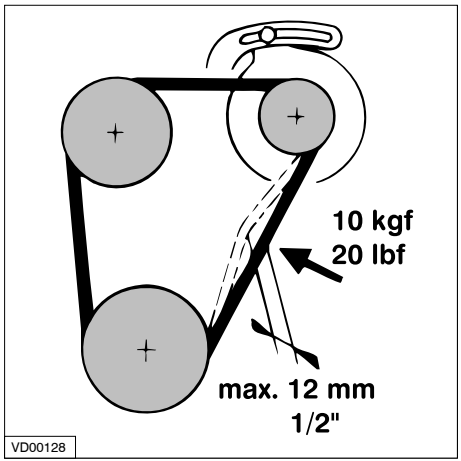
Every 500 operating hours.



Inspection V-belt

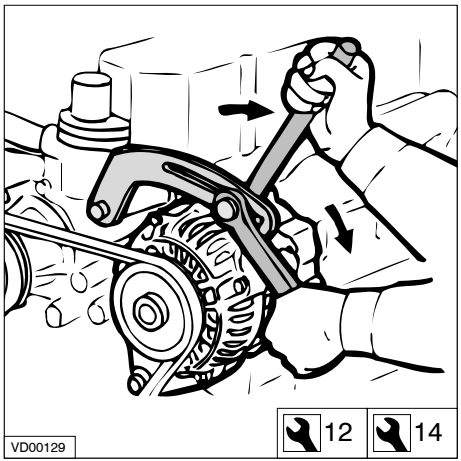
Inspect the belt for wear and tear (fraying and cracking). Belts which are in poor condition should be replaced.

Check, tension and change belts only with the engine off. Refit belt guard, if provided.



Checking tension

Check tension of the V-belt by applying moderate finger and thumb pressure. If the deflection of the belt is more than 12 mm (1/2”), using about 10 kg (20 lbs) thumb pressure, it should be tensioned.

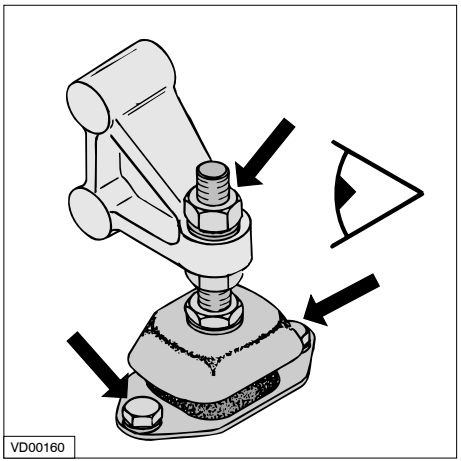


Tensioning V-belt

Loosen the bolt of the adjustment bracket and both the alternator mounting bolts. Now push the alternator outwards until the belt tension is correct.
Now first re-tighten the upper mounting bolt of the alternator.
Then re-tighten the bolt of the adjustment bracket and the lower mounting bolt.

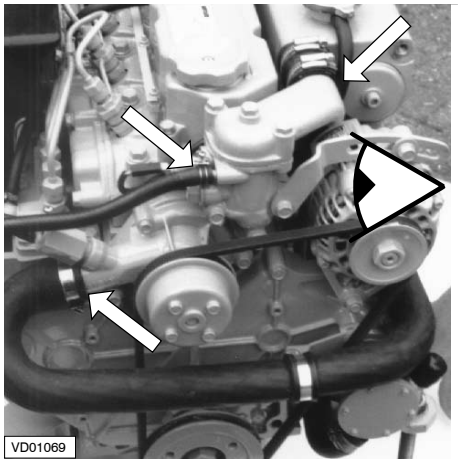
Flexible engine mounts, hose connections and fasteners

Every 500 operating hours.



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.



Inspection hose connections

Inspect all hose connections of the coolingsystem. (Cracked hoses, loose hose clamps)

Check fasteners

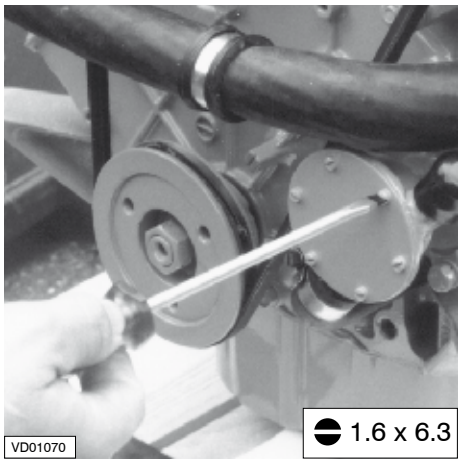
Check tightness of all fasteners, bolts and nuts.

Raw water pump inspection

Every 1000 operating hours.

Raw water pump inspection

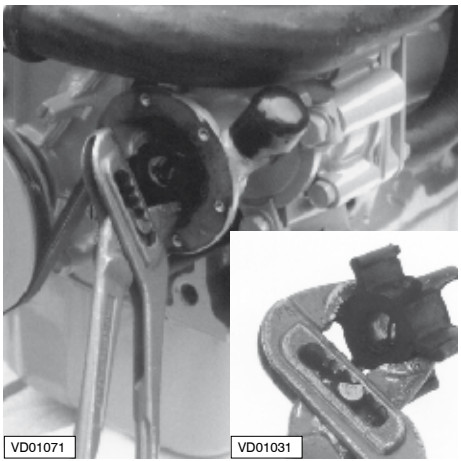
The rubber impeller of the outboard water pump is not proof against running dry. If the water supply has been blocked, it may be necessary to replace the impeller. Always carry a spare impeller on board.



Pump cover removal

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.



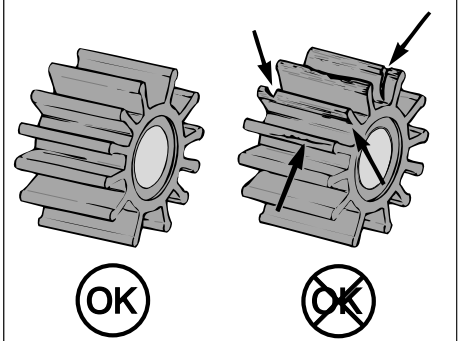
Impeller removal

- 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.

Raw water pump inspection

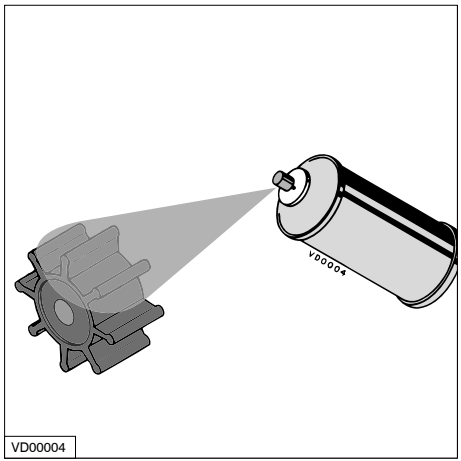
Every 1000 operating hours.

IMPELLER, ART.CODE: STM8061



Impeller inspection

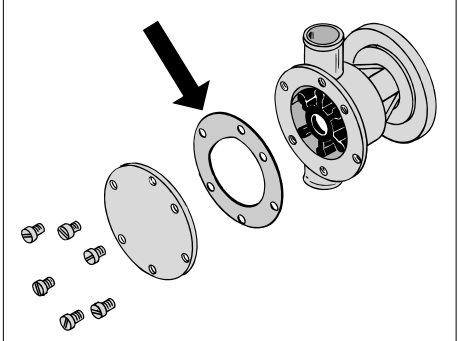
- Inspect the impeller for damage.
- Replace the impeller if necessary.



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).

GASKET, ART.CODE: STM8002



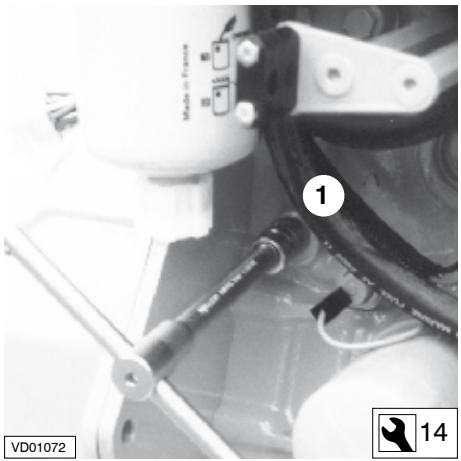
Replacing the pump cover

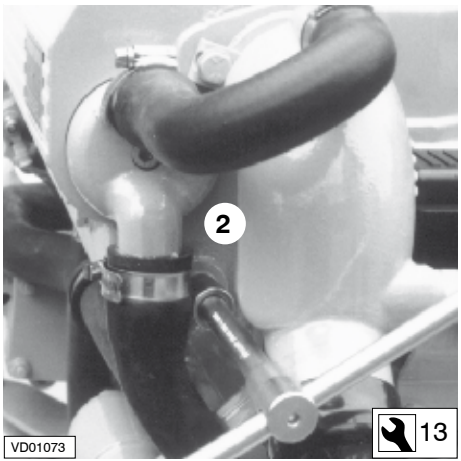
- Replace the cover with a **new** gasket.
- Check the water filter and open the sea cock.

Coolant replacement

The coolant has to be replaced every 1000 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.





Draining of coolant

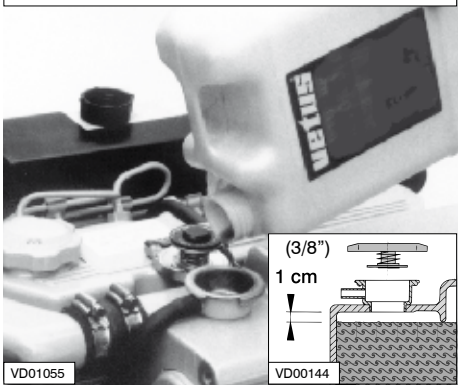
Be aware of the risk of skin burning during draining the hot coolant! Used coolant must be collected in a container for proper disposal according to laws and regulations.

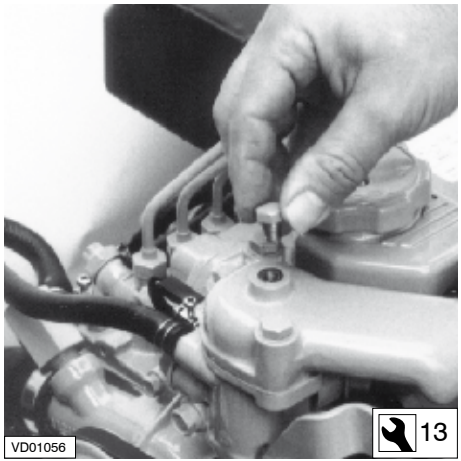
Remove the drain plugs from the engine block (1) and heat exchanger (2). Remove the filler cap to vent the cooling system and check that all the coolant has been drained. After draining replace the drain plugs.

Coolant replacement

Every 1000 operating hours.

COOLANT QUANTITY :	6.5 litres (1.4 UKgal)





WATER HEATER

If a water heater is connected to the engine and this heater is positioned above the upper side of the engine than bleeding of the heater will not take place automatically! Fill the heater separately to bleed the cooling system completely.

Filling the cooling system

Remove the cap of the filler neck on the top of the heat exchanger housing.
Remove the bolt from the upper side of the thermostat cover, so that air can escape from the cooling system.
Fill the cooling system.
Use a mixture of 40% antifreeze (ethylene-glycol based) and 60% tap water or use a special coolant.

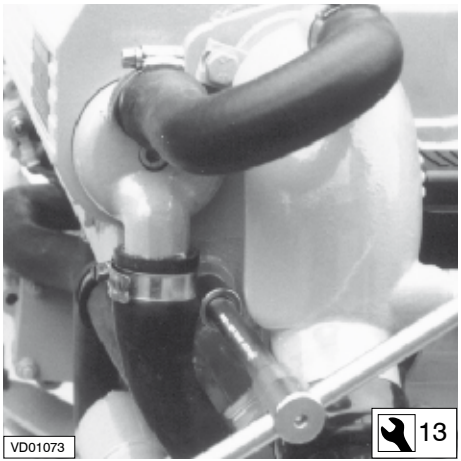
For specifications see page 65.

The level of the coolant must be approx. 1 cm (3/8") below the lower edge of the filler neck.
Bleeding will take place automatically during filling!
Replace the filler cap.

After the engine has run for the first time and has reached operating temperature and has cooled down again to ambient temperature, check the coolant level in the heat exchanger housing.

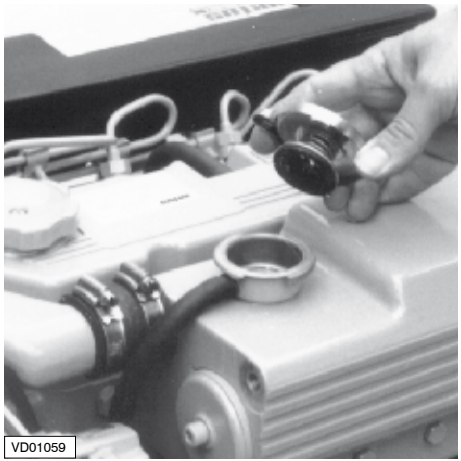
If necessary, add coolant.

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

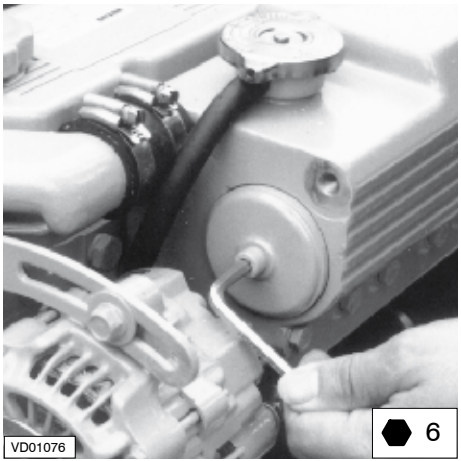


Remove the drain plug

- Close the seacock and detach the water inlet hose from the sea water pump.
- Drain the coolant: To do this, remove the drain plug from the heat exchanger housing.

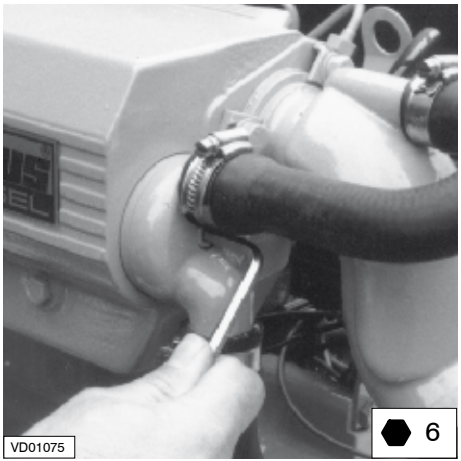


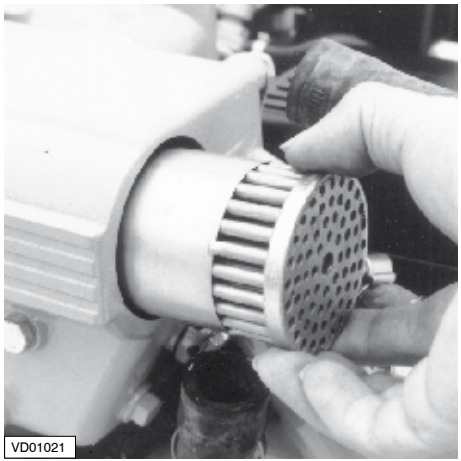
- Remove the filler cap from the top of the heat exchanger housing to allow air into the system and check that all coolant has drained off.



Removal of bolts out of the end covers

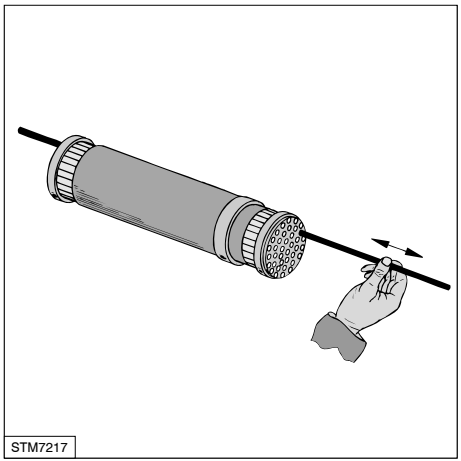
Take out both central bolts from the end covers and take the end covers with the O-rings out of the housing.





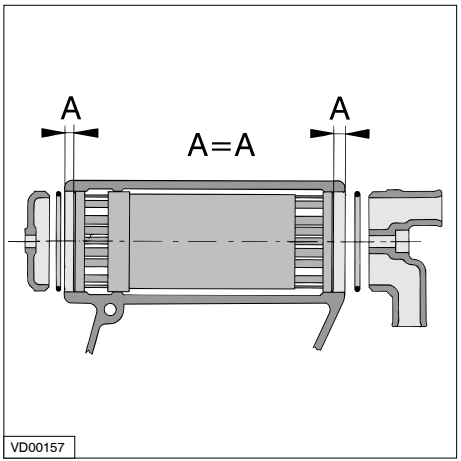
Remove heat exchanger

Slide the heat exchanger out of the housing.



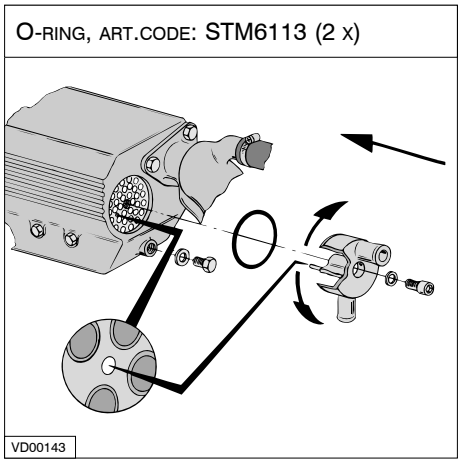
Cleaning the heat exchanger

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.



Replacing heat exchanger

Replace the heat exchanger in the original position in the heat exchanger housing.
Use new O-rings (61 x 2.5 mm) which have been greased.



Replacing the end covers

Fit the end covers in the housing; the connector cover is fitted with a locating pin so that it can be fitted in one way only in relation to the heat exchanger.
This ensures the correct position of the separator baffle in the connector cover in relation to the heat exchanger.

Tighten up the bolts when both covers are in the correct position.

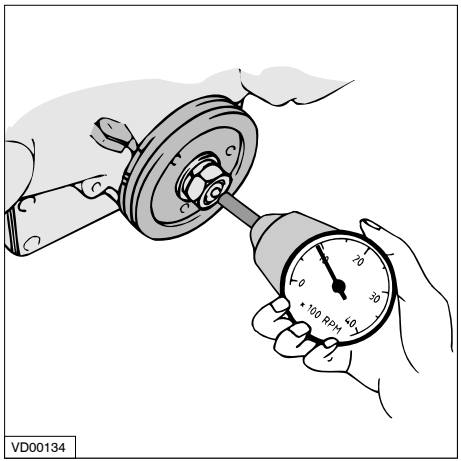
- Refit the drain plug.
- Reconnect all hoses previously removed.
- Refill the cooling system, see page 43.

Checking engine speed

WARNING

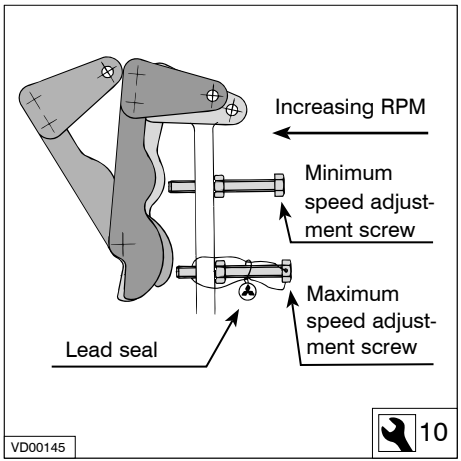
The maximum engine speed adjustment screw has been correctly set at the factory and sealed. DO NOT attempt to remove this seal.

At full load (with the boat cruising) the maximum engine speed should be about 3,200 RPM (see technical data page 60). If the engine does not reach this speed, it is being overloaded!
If this is the case, check the ship's propeller for defects or irregularities, and also to see that it is the correct pitch and diameter.



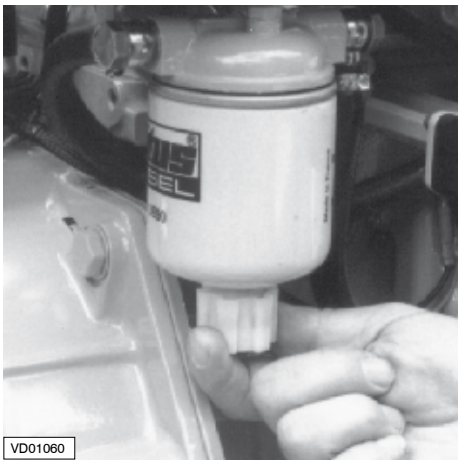
Checking engine speed

The engine idling speed should be 840 rpm.
Allow the engine to warm up normally (until the coolant temperature reaches at least 60°C (140°F).) before checking and/or adjusting the idling speed.
Check the engine RPM using a rev. counter, or use the rev. counter fitted to the control panel.



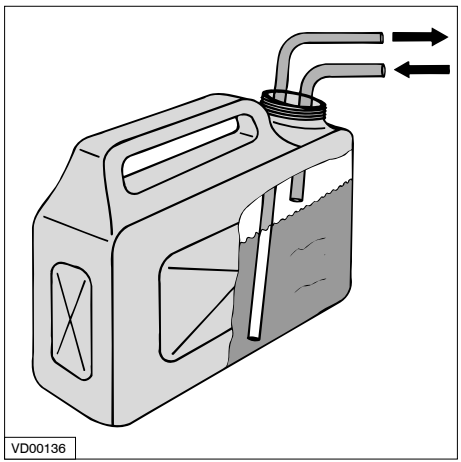
Adjusting engine idling speed

If the engine speed differs from that stated above, it must be adjusted.
The engine idling speed can be reset using the adjustment screw on the fuel pump.



Fuel system

Drain the water from the water separator/ fuel filter and the fuel tank. Ensure that the tank is completely filled with fuel.



Running with protective fuel mixture

Connect the fuel supply pipe to a can filled with a mixture of one (1) part of engine oil* to nine (9) parts of clean fuel**. Use this mixture to run the engine at **no load** for approx. 10 minutes.
Stop the engine.

* Engine oil with protective properties.
E.g. Shell Super Diesel T 10W40

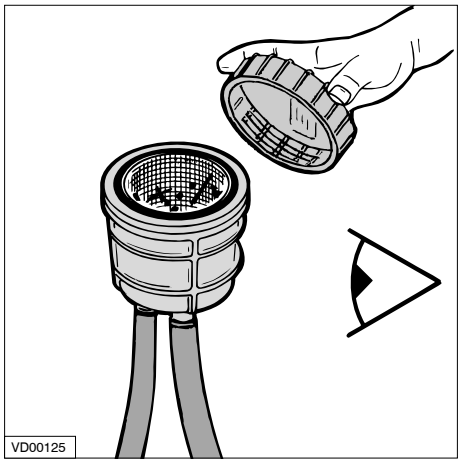
** Preferably water-free fuel.
Collect some fuel from the return pipe, while engine is running.

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

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 63.

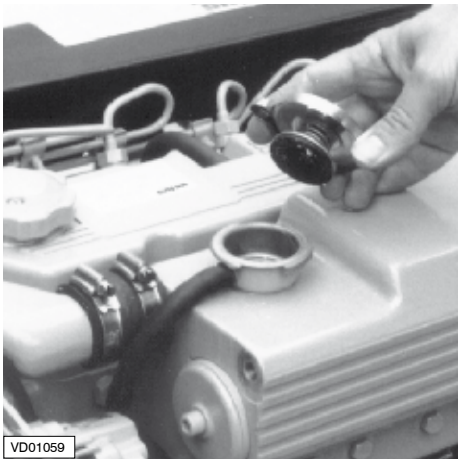


Raw water cooling system

Close the seacock before removing the lid of the water strainer. If necessary, clean the raw water strainer.
Pour 1 litre (2 UK pt) of anti-freeze into the water strainer and run the engine until the anti-freeze has disappeared into the cooling system.
Take care that no anti-freeze is spilled into the waterway (anti-freeze is poisonous).

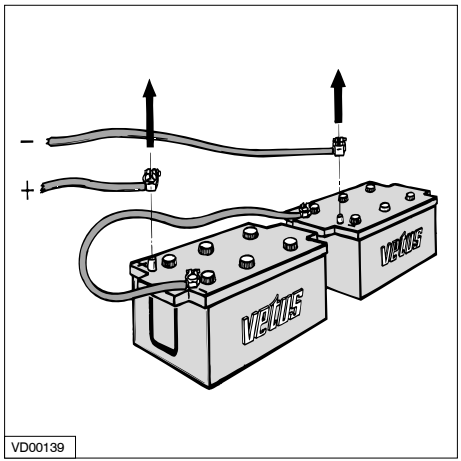
Check the seal between the lid and housing after cleaning and re-assembling the strainer.
An improperly sealed lid will result in air sucked in by the raw water pump which again will result in overheating of the engine.

Winter lay-up


VD01059

Fresh water cooling system

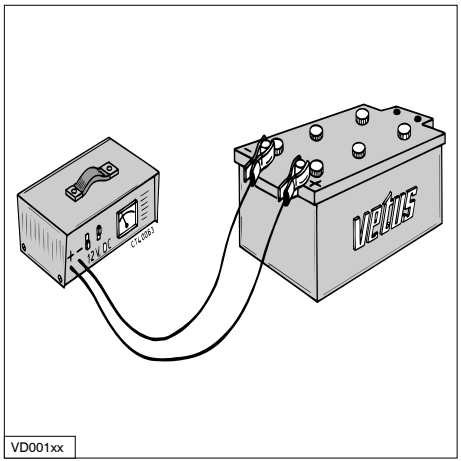
To avoid corrosion during winter storage the cooling system must be filled with an antifreeze/water mixture (or a coolant). For specifications see page 65.
N.B. Replacing the coolant is only necessary if the coolant present in the cooling system offers insufficient protection for the winter.
For coolant replacement see page 42.



VD00139

Electrical system

Disconnect the battery cables.

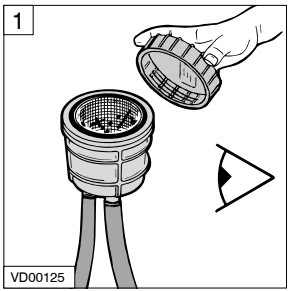


VD001xx

Charging the batteries

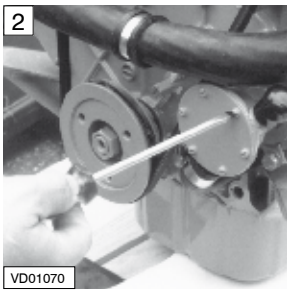
Charge batteries during winter lay-up regularly if required!

1



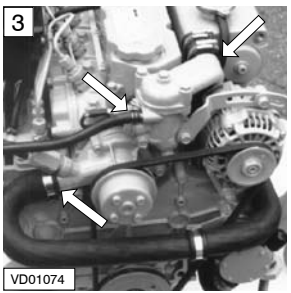
Check that the lid of the raw water strainer is reinstalled.

2



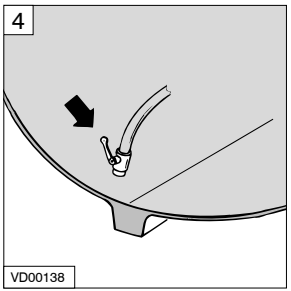
Check that the lid of the raw water pump and drain plugs are reinstalled. (pages 40, 42)

3



Re-tighten possible loose hose clamps.

4

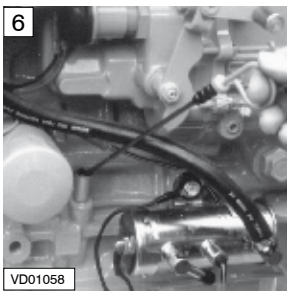


Open the sea cock.

5

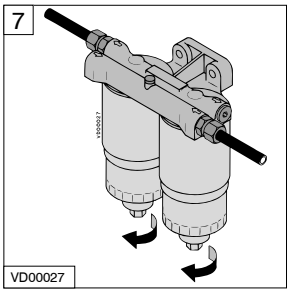
Check the coolant level. (page 24)

6



Check the engine oil level. (page 23)

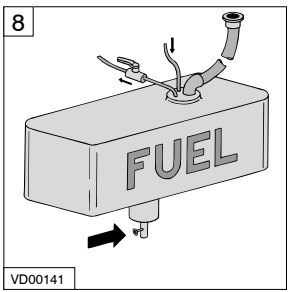
7



VD00027

Drain the water from the water separator/fuel filter. (page 26)

8



VD00141

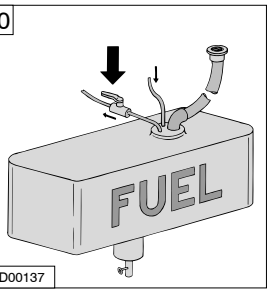
Drain the water from the fuel tank.

9

VD01017

Install a new fuel filter. (page 36)

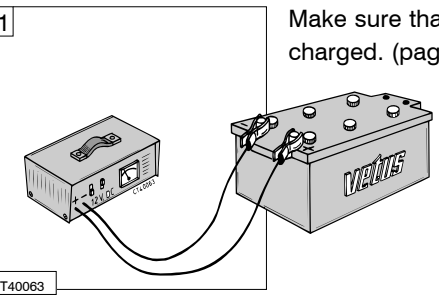
10



VD00137

Open the fuel valve.

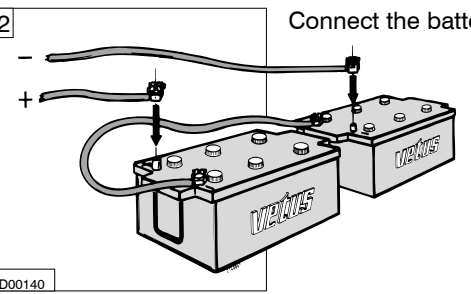
11



CT40063

Make sure that the batteries are fully charged. (pages 30, 50)

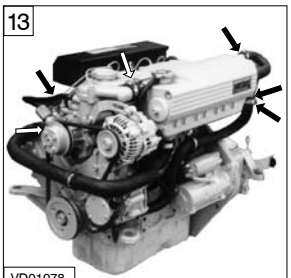
12



VD00140

Connect the batteries.

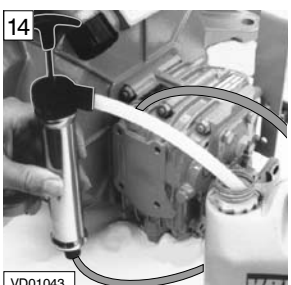
13



VD01078

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

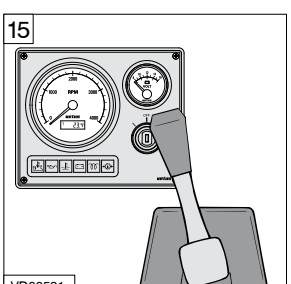
14



VD01043

Stop the engine and change the oil of the gearbox. (page 33)

15



VD00581

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

Troubleshooting

General

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

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 tables 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.

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

1 Engine will not crank

Possible fault	Remedy
A Faulty or discharged battery	A Check / recharge battery and check engine alternator and/or battery charger.
B Loose or corroded connections in starting circuit.	B Clean and tighten connections.
C Faulty starter-switch or faulty starter-relay.	C Check / replace.
D Faulty starter-motor or pinion does not engage.	D Check / replace starter-motor.
E Starter-relay is not engaged due to a voltage too low; caused by a very long intermediate cable from engine to control panel.	E Install an auxiliary starter relay.

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

Possible fault	Remedy
A Fuel stop valve closed.	A Open.
B (Nearly) Empty fuel tank.	B Refill.
C Air in fuel system.	C Check and bleed.
D Fuel filter clogged with water and/or contamination.	D Check or replace.
E Leaking fuel supply line or fuel injection line.	E Check / replace.
F Faulty injector/injection pump.	F Check, replace if required.
G Vent line of fuel supply tank clogged.	G Check / clean.
H Exhaust restricted.	H Check.
I Electric fuel lift pump doesn't operate.	I Check / replace.
J Delivery and suction valves of electric fuel lift pump obstructed by dirt.	J Check / clean. Install a fuel pilot filter in fuel line from tank to engine.
K Clogged filter of electric fuel lift pump.	K Check / clean.

3 Engine cranks but will not start, smoke from exhaust

Possible fault	Remedy
A Air in fuel system.	A Check and bleed.
B Faulty injector/injection pump.	B Check, replace if required.
C Setting of stop valve incorrect.	C Check / adjust.
D Faulty glow plugs.	D Check / replace.
E Incorrect valve clearance.	E Adjust.
F Incorrect injection timing after overhauling of engine.	F Check / adjust.
G Insufficient intake air.	G Check.
H Wrong fuel quality or contaminated fuel.	H Check fuel. Drain and flush fuel tank. Replace with new fuel.
I Incorrect lube oil SAE class or quality for ambient temperature.	I Replace.

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

Possible fault	Remedy
A (Nearly) Empty fuel tank.	A Refill.
B Air in fuel system.	B Check and bleed.
C Fuel filter clogged with water and/or contamination.	C Check or replace.
D Leaking fuel supply line or fuel injection line.	D Check / replace.
E Faulty injector/injection pump.	E Check, replace if required.
	F Check / clean.
F Vent line of fuel supply tank clogged.	G Check / clean.
G Fuel supply line restricted.	H Adjust.
H Incorrect valve clearance.	I Check/ adjust.
I Idle setting too low.	J Check.
J Exhaust restricted.	K Check fuel. Drain and flush fuel tank. Replace with new fuel.
K Wrong fuel quality or contaminated fuel.	L Check / clean.
L Clogged filter of electric fuel lift pump.	

5 Engine does not reach maximum rpm under load

Possible fault	Remedy
A Air in fuel system.	A Check and bleed.
B Fuel filter clogged with water and/or contamination.	B Check or replace.
C Leaking fuel supply line or fuel injection line.	C Check / replace.
D Faulty injector/injection pump.	D Check, replace if required.
E Setting of stop valve incorrect.	E Check / adjust.
F Oil level too high.	F Lower level.
G Incorrect valve clearance.	G Adjust.
H Exhaust restricted.	H Check / clean.
I Insufficient intake air.	I Check.
J Wrong fuel quality or contaminated fuel.	J Check fuel. Drain and flush fuel tank. Replace with new fuel.
K Engine overloaded.	K Check size of propeller.

6 Engine overheats

Possible fault	Remedy
A Faulty injector/injection pump.	A Check, replace if required.
B Oil level too high.	B Lower level.
C Oil level too low.	C Increase level.
D Faulty oil filter.	D Replace.
E Coolant pump defective.	E Check / clean.
F Heat exchanger dirty or clogged as a result of rubber particles from a worn impeller.	F Check / clean.
G Coolant level too low.	G Check / top up.
H Sea cock closed.	H Open.
I Raw water strainer clogged.	I Check / clean.
J Leaking raw water intake system.	J Check / replace.
K Faulty thermostat.	K Check / replace.
L Faulty impeller raw water pump.	L Check / replace.
M Insufficient intake air.	M Check / replace air intake filter.
N Motor becomes apparantly overheated as a result of faulty temperature switch, sensor or meter.	N Check / replace.

7 Engine not firing on all cylinders

Possible fault	Remedy
A Air in fuel system.	A Check and bleed.
B Fuel filter clogged with water and/or contamination.	B Check or replace.
C Leaking fuel supply line or fuel injection line.	C Check / replace.
D Faulty injector/injection pump.	D Check, replace if required.
E Fuel supply line restricted.	E Check / clean.
F Faulty glow plugs.	F Check / replace.
G Incorrect valve clearance.	G Adjust.
H Clogged filter of electric fuel lift pump.	H Check / clean.
I Faulty electric fuel lift pump.	I Check / replace.

8 Engine has little or no oil pressure

Possible fault	Remedy
A Oil level too low.	A Increase level.
B Excessive inclination of engine.	B Check / Adjust.
C Incorrect lube oil SAE class or quality for ambient temperature.	C Replace.

9 Engine oil consumption excessive

Possible fault	Remedy
A Oil level too high.	A Lower level.
B Excessive inclination of engine.	B Check / Adjust.
C Incorrect lube oil SAE class or quality for ambient temperature.	C Replace.
D Excessive wear of cylinder/ piston.	D Check compression; overhaul engine.
E Insufficient intake air.	E Check.
F Engine overloaded.	F Check size of propeller.

10A Blue exhaust smoke (idling)

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

10B Black exhaust smoke (at load)

Possible fault	Remedy
A Insufficient intake air.	A Check.
B Faulty injector / injection pump.	B Check/replace if required.
C Engine overloaded, max. rpm is not reached.	C Check sizes of propeller.

10C White exhaust smoke (at full load)

Possible fault	Remedy
A Air in fuel system.	A Check and bleed.
B Faulty injector/injection pump.	B Check, replace if required.
C Water in fuel system.	C Check water separator.
D Faulty glow plugs.	D Check / replace.
E Incorrect valve clearance.	E Adjust.
F Incorrect injection timing.	F Check / adjust.
G Wrong fuel quality or contaminated fuel.	G Check fuel. Drain and flush fuel tank. Replace with new fuel.
H Vapour in exhaust gases condenses as a result of very low ambient temperature.	H -

Technical data

Engine specifications

Model	M4.15	M4.17
General		
Make	Vetus Mitsubishi	
Number of cylinders	4	4
Based on	S4L-61DM	S4L2-61DM
Type	4-stroke diesel, in-line	
Injection	Indirect	
Aspiration	Natural	
Bore	78 mm	78 mm
Stroke	78.5 mm	92 mm
Total displacement	1500 cm^3	1758 cm^3
Compression ratio	22 : 1	22 : 1
Idle speed	840 rpm	840 rpm
Max. no. of revolutions at no load	3200 rpm	3200 rpm
Valve clearance (cold)	Inlet 0.25 mm Exhaust 0.25 mm	
Weight (with standard gearbox)	185 kg (408 lbs)	
Engine installation		
Max. installation angle	15 degrees backwards	
Max. athwartships angle	25 degrees continuously, 30 degrees intermittent	

Model	M4.15	M4.17
Maximum output		
at the flywheel (ISO 3046-1)	24.3 kW (33 hp)	30.9 kW (42 hp)
at the prop shaft (ISO 3046-1)	23.6 kW (32.1 hp)	30 kW (40.8 hp)
at no. of revolutions of	3000 rpm	3000 rpm
Torque,	77.4 Nm (7.9 kgm, 57.1 ft.lb)	98 Nm (10 kgm, 72.3 ft.lb)
at no. of revolutions	3000 rpm	3000 rpm
Fuel consumption		
at no. of revolutions of 1800 rpm	252 g/kW.h (185 g/hp.h)	252 g/kW.h (185 g/hp.h)
Fuel System (Self-bleeding)		
Injection pump	Bosch model M (Nippon Denso)	
Injectors	Plug injector	
Opening pressure	140 bar (kgf/cm^2) (2030 psi)	
Firing order	1 - 3 - 4 - 2	
Injection timing	21° BTDC	17° BTDC
Fuel filter element	STM3690	
Fuel lift pump Suction height max.	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.	

Engine specifications

Model	M4.15	M4.17
Oil lubrication system		
Oil capacity, max.		
without oil filter	5.4 litres (1.2 UKgal)	
with oil filter	5.6 litres (1.25 UKgal)	
Oil Filter	STM0051	
Oil temperature insump	max. 130°C (266°F)	
Cooling system		
Capacity,		
Intercooler version	6.5 litres (1.4 UKgal)	
Keel cooler version	7.2 litres (1.6 UKgal)	
Thermostat	opening at 82°C±1.5°C (180°F±3°F), fully opened at 95°C (203°F)	
Coolant pump,		
Flow at max. engine rpm	50 l/min (11 UKgal/min)	
Total head keelcooler at max. flow	2 m Water (6' 7")	
Raw water pump,		
Flow at max. engine rpm	30 l/min (6.6 UKgal/min)	
Total head at max. flow	2 m Water (6' 7")	
Impeller	STM8061	
Inlet connection	for hose 20 mm (3/4") I.D.	
Heater return connection	8 mm (5/16")	

Model	M4.15	M4.17
Exhaust system		
Exhaust diameter	50 mm	
Exhaust back pressure	at specified output max. 150 mbar (2.2 psi)	
Electrical system		
Voltage	12 Volt	
Alternator	14 Volt, 50 A	
Battery capacity	min. 55 Ah, max. 108 Ah	
Protection	Tubular glass fuse, 32 x 6.3 mm 10 A slow blow	
V-belt	STM7966	
Gearbox	Reduction ratio	
Technodrive:		
model TMC40	1.45 / 2.00 : 1	
model TMC40M	1.45 / 2.00 : 1	
model TMC60 (E,M)	1.5 / 2.00 / 2.50 : 1	
model TM345 (A,H)	1.54 / 2.0 / 2.47 : 1	
ZF Hurth: model ZF10M	2.05 / 2.72 : 1	
model ZF12	2.14 / 2.63 : 1	
model ZF15MA	1.88 / 2.63 : 1	
model ZF15V	2.13 / 2.99 : 1	

Technical data

Torque wrench settings

Screw connection	Wrench Diameter	Pitch	Size	Torque Nm	Torque (kgm)	Torque (ft.lbf)
Cylinder head bolt	M10	1.25	14	88 ±5	(9 ±0.5)	(65 ±3.5)
Connecting rod nut	M9	1.0	14	34.8 ±2.5	(3.55 ±0.25)	(26 ±2)
Fly-wheel bolt	M12	1.25	19	132 ±5	(13.5 ±0.5)	(98 ±3.5)
Crank shaft pulley nut	M18	1.5	27	172 ±25	(17.5 ±2.5)	(127 ±19)
Main bearing cap bolt	M10	1.25	17	51.5 ±2.5	(5.25 ±0.25)	(38 ±2)
Rocker stay bolt	M8	1.25	12	14.7 ±5	(1.5 ±0.5)	(10 ±3.5)
Valve cover bolt	M8	1.25	12	11.3 ±1.5	(1.15 ±0.15)	(8 ±1)
Nozzle holder	M20	1.5	21	54 ±5	(5.5 ±0.5)	(40 ±3.5)
Fuel leak oil pipe nut	M12	1.5	18	27 ±2.5	(2.75 ±0.25)	(20 ±2)
Nozzle retaining nut	M16	0.75	19	37 ±2.5	(3.75 ±0.25)	(27 ±2)
Fuel injection pipe nut	M12	1.5	—	29 ±5	(3 ±0.5)	(22 ±3.5)
Delivery valve holder	—		19	44 ±5	(4.5 ±0.5)	(32 ±3.5)
Solenoid lock nut	M30	1.5	36	44 ±5	(4.5 ±0.5)	(32 ±3.5)
Temperature switch	M16	1.5	17	22.6 ±4	(2.3 ±0.4)	(16 ±3)
Oil filter	M20	1.5	—	12 ±1	(1.2 ±0.1)	(9 ±0.8)
Oil pressure switch	PT1/8		26	10 ±2	(1 ±0.2)	(7 ±1.5)
Pressure relief valve	M22	1.5	22	49 ±5	(5 ±0.5)	(36 ±3.5)
Oil drain plug	M14	1.5	22	39 ±5	(4 ±0.5)	(29 ±3.5)
Glow plug	M10	1.25	12	17.2 ±2.5	(1.75 ±0.25)	(13 ±2)
Fly-wheel housing bolt	M12	1.25	17	64 ±10	(6.5 ±1)	(47 ±7)

Lubricating oil

Engine Lubricating Oil

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

Lube oils are differentiated according to their performance and quality class. In common use are specifications named after API (American Petroleum Institute) and CCMC (Committee of Common Market Automobile Constructors).

Approved API Oils : CD, CE and CF4
Approved ACEA Oils : A3/B3, A3/B4

As the viscosity of lube oil is dependent on temperature, the oil vicosity (SAE grade) should be selected according to the ambient temperature when the the engine is started.
To avoid oil changes dictated by the seasons we advise one of the following multi-grade oils.

- SAE 10W40 for temperatures of -25°C up to +30°C (-13°F up to +86°F)
- SAE 15W40 for temperatures of -20°C up to +35°C (-4°F up to +95°F)

For example: Vetus Marine Diesel Engine Oil 15W-40
Shell Nautilus Premium Inboard Oil 15W-40

Gearbox Lubricating Oil

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

Technodrive:
model TMC40 : 0.20 litres, Engine oil SAE 20/30
model TMC40 M / P : 0.20 litres, ATF*) (0.35 UK pt, 0.4 US pt)
model TMC60 : 0.80 litres, Engine oil SAE 20/30
model TMC60 E / P : 0.80 litres, ATF*) (1.4 UK pt, 1.7 US pt)
model TM345 A / H : 1.6 litres, Engine oil SAE 20W-40-CD (2.8 UK pt, 3.4 US pt)

ZF Hurth:
model ZF10M : 0.35 litres, ATF*) (0.6 UK pt, 0.74 US pt)
model 12 : 1.1 litres, ATF*) (1.9 UK pt, 2.3 US pt)
model 15MA : 0.56 litres, ATF*) (1 UK pt, 1.2 US pt)
model 15V : 1.0 litres, ATF*) (1.8 UK pt, 2.1 US pt)

Other brands of gearboxes:
See supplied owners manual for oil type and quantities.

*) ATF : AutomaticTransmission Fluid;
Transmissie olie type A, Suffix A.
For example : Vetus Marine Gearbox Oil
Shell Donax T6
Gulf Dextron

Operating media

Fuel Quality Grade

Use commercially available diesel fuel with less than 0.5% sulfer content. If the sulfur content is higher than 0.5%, the intervals between oil changes should be halved e.g. change oil every 250 hours. Don't use fuel with more than 1% sulfur!

The following fuel specifications / standards are approved:
- CEN EN 590 or DIN/EN 590 (under development)
- DIN 51 601 (Feb. 1986)
- BS 2869 (1988): A1 and A2
- ASTM D975-88: D1 and D2
- NATO Code F-54 and F75

The exhaust emission levels determined during certification by the supervising authority are always based on the reference fuel described by law.

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).

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.

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. Therefor 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.

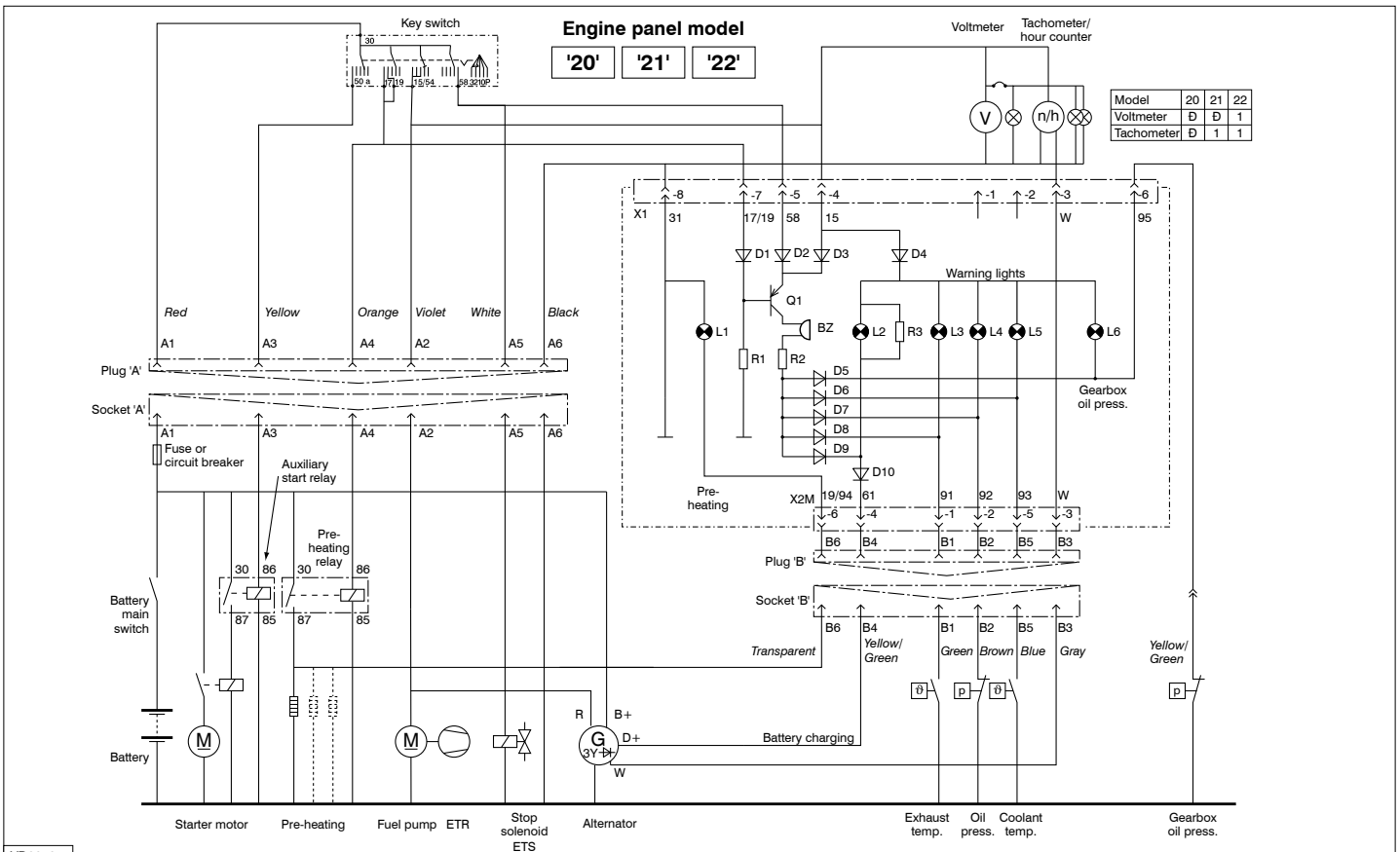
Water quality		min.	max.
pH-value at 20°C (68°F)		6.5	8.5
Chloride ion content	[mg/dm^3]	–	100
Sulfate ion content	[mg/dm^3]	–	100
Total hardness	[degrees]	3	12

Never use sea-water or brackish water.

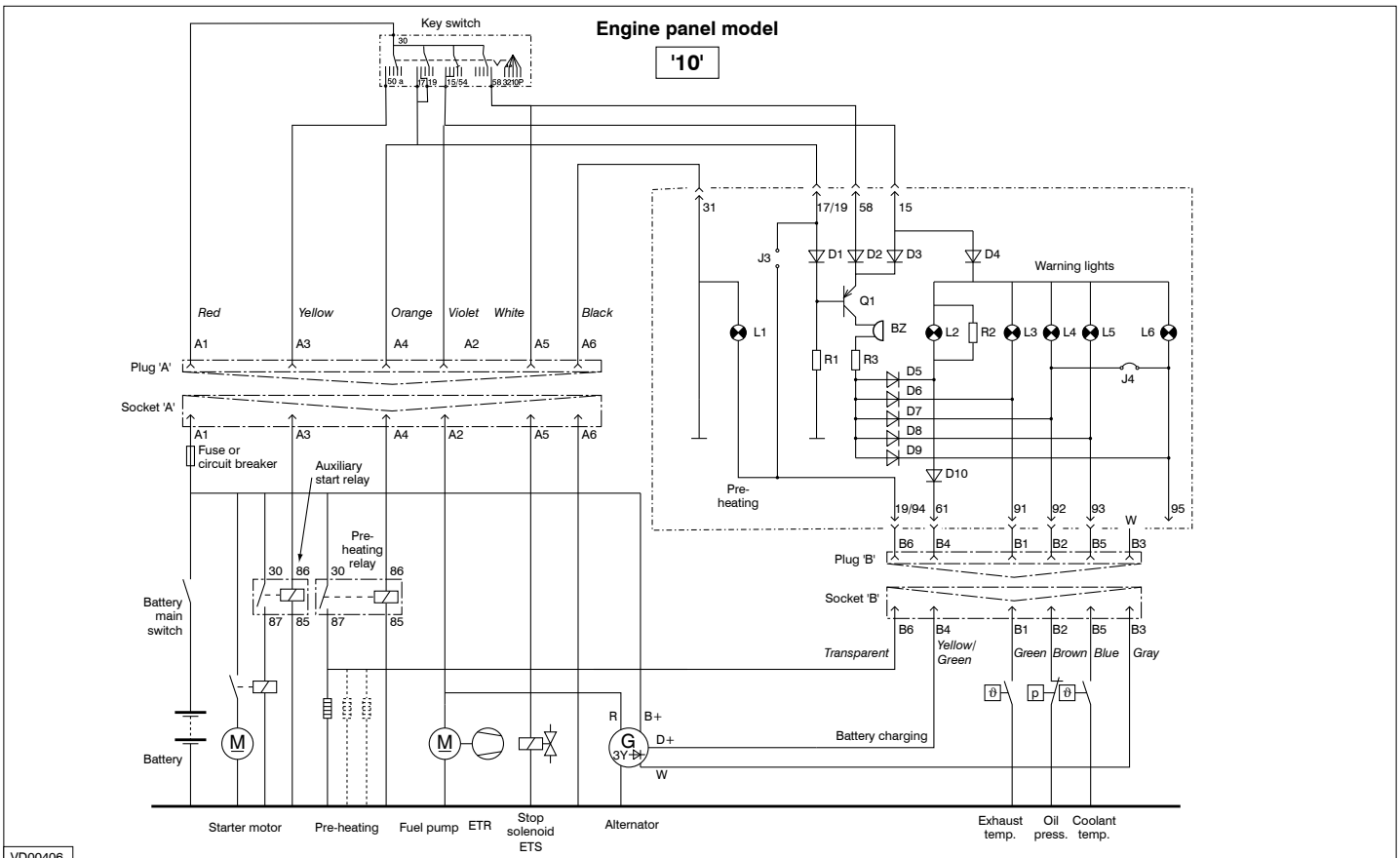
Cooling system protective liquids must be disposed of in accordance with environmental regulations.

Wiring diagram

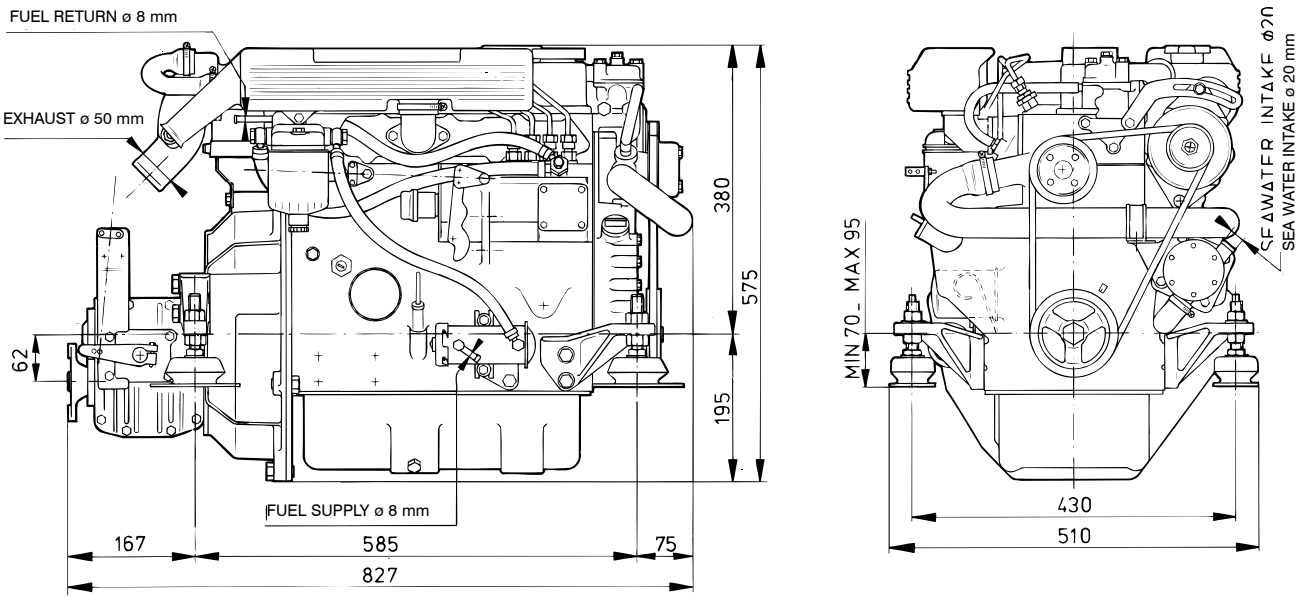
Engine with panel model ‘20’, ‘21’, ‘22’



Wiring diagram



Overall Dimensions



M4.15 / M4.17

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Manual

Art. code		Description		
340201.03	(STM0118)	Bedieningshandleiding	M4.15 / M4.17	(Nederlands)
340202.03	(STM0119)	Operation manual	M4.15 / M4.17	(English)
340203.02	(STM0124)	Bedienungsanleitung	M4.15 / M4.17	(Deutsch)
340204.03	(STM0125)	Manuel d'utilisation	M4.15 / M4.17	(Français)
340205.02	(STM0126)	Manual de operacion	M4.15 / M4.17	(Español)
340206.02	(STM0127)	Istruzioni per l'uso	M4.15 / M4.17	(Italiano)
340207.02	(STM0128)	Brugsanvisning	M4.15 / M4.17	(Dansk)
340208.02	(STM0129)	Användarmanual	M4.15 / M4.17	(Svenska)
340210.01		Käyttöopas	M4.15 / M4.17	(Suomeksi)
320331.01	(STM0032)	Installatiehandleiding / Installation manual		(Nederlands/English)
320199.05	(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		(Nederlands/English / (Deutsch/Français) (Español/Italiano)
341331.01	(STM0091)	Onderdelenboek / Parts manual M4.15 / M4.17		(Nederlands/English)
342402.02		Service manual M4.15 / M4.17		(English)

Vetus Diesel M4.15 M4.17 English

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