



M4.55

Operation manual

Operation manual

Vetus[®] **M4.55**

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.

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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.

For the Guarantee Conditions, see the Vetus Diesel 'Service and Warranty Manual' (320199.05).

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 guide-

lines 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.



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.



WARNING

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



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-inflammable, 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

- 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.

Prevention of injury

- 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

Prevention of injury

- 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.

2 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.

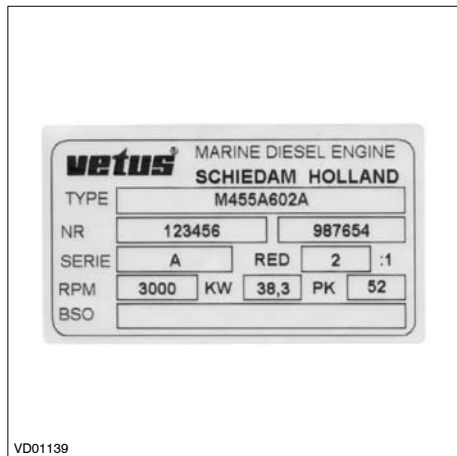
We have endeavoured to highlight any differences so that you will be able to locate the operating and maintenance instructions relevant to your engine quickly and easily.

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 n.v.

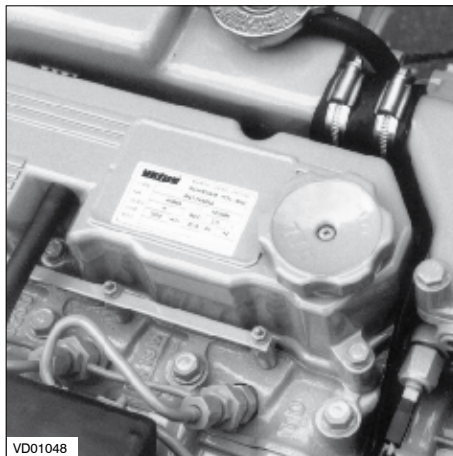
2 Introduction



1 Engine data tag

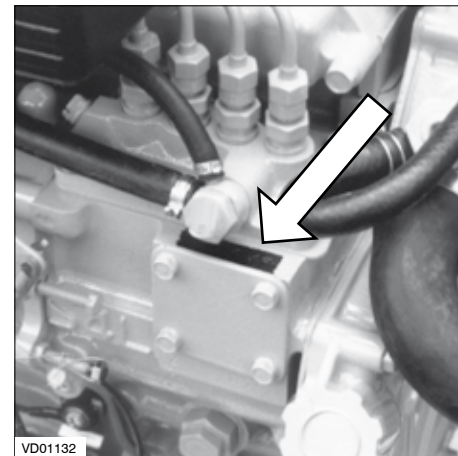
The **VETUS** engine serial number and performance data are printed on the engine data tag.

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



2 Engine data tag location

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

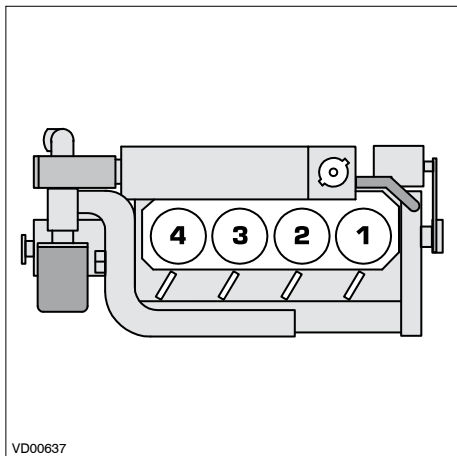


3 Engine serial number

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

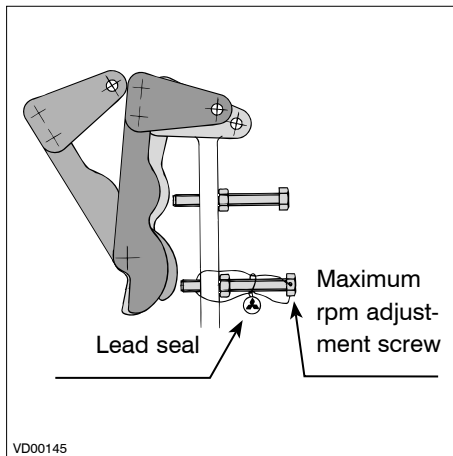
2 Introduction

Cylinder numbering, fuel pump seal



4 Cylinder numbering

Cylinders are numbered consecutively, beginning at the front end.



5 Fuel pump seal



Breaking the seals on the regulator to alter the settings of maximum rpm and maximum injector volume may only be carried out by authorised Vetus Service personnel.

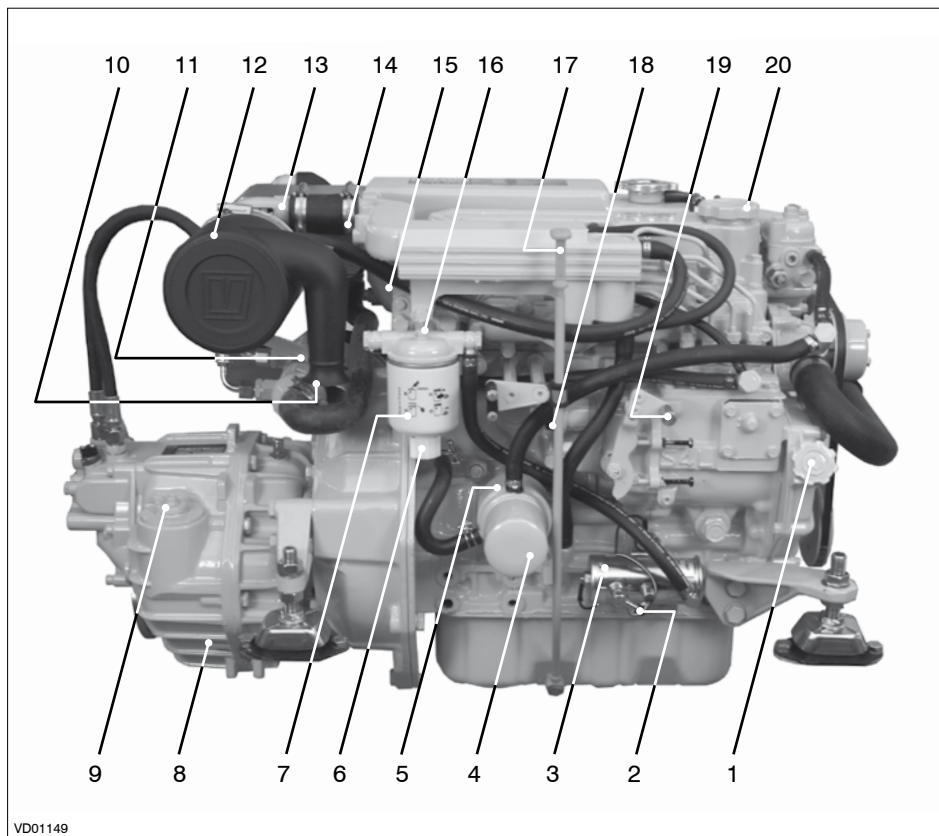
Breaking the seals and altering the settings can lead to:

- Accelerated wear of engine components.
- Increased fuel and oil consumption.
- Incorrectly adjusted injector volume and poor engine performance.
- Breaking emission regulations.

2 Introduction

Identification of engine parts Service side

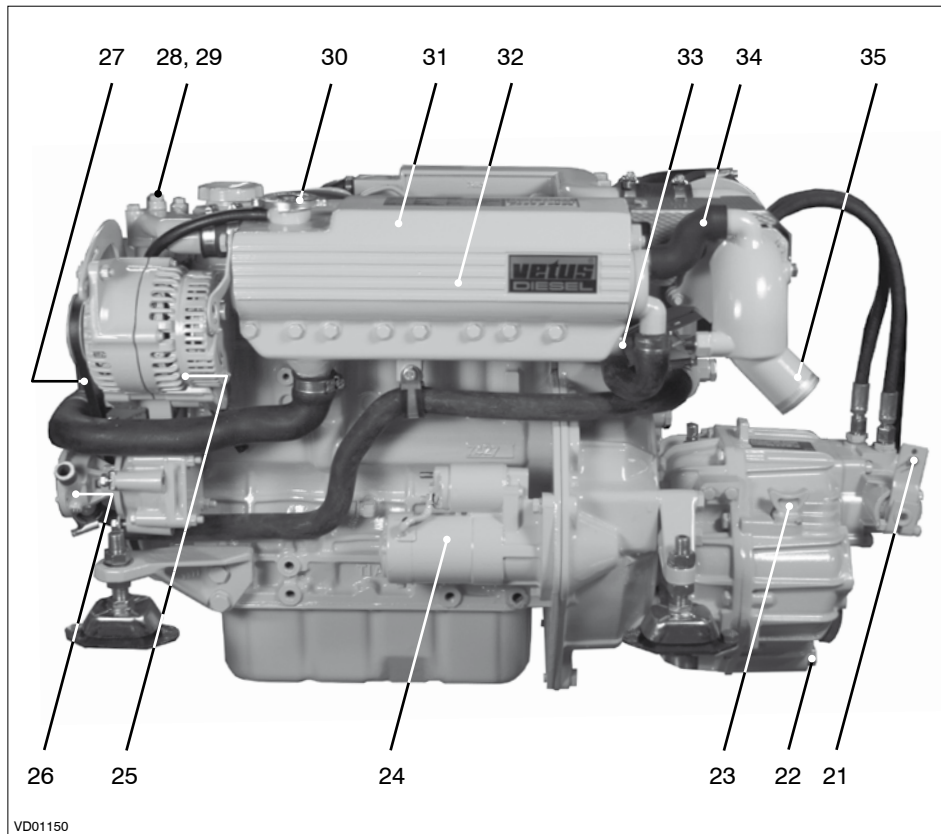
- 1 Oil filler cap
- 2 8 mm fuel hose connection
- 3 Fuel pump
- 4 Oil filter
- 5 Engine oil cooler
- 6 Water separator/fuel filter drain plug
- 7 Water separator/fuel filter
- 8 Gearbox
- 9 Gearbox filter
- 10 Air inlet
- 11 Gearbox oil cooler
- 12 Air filter
- 13 Turbo
- 14 Electrical system connector box and fuses
- 15 8 mm fuel return hose connection
- 16 Water separator/fuel filter bleed nipple
- 17 Oil dipstick
- 18 Manually operated electrical stop
- 19 Push-pull throttle cable connection
- 20 Oil filler cap



VD01149

2 Introduction

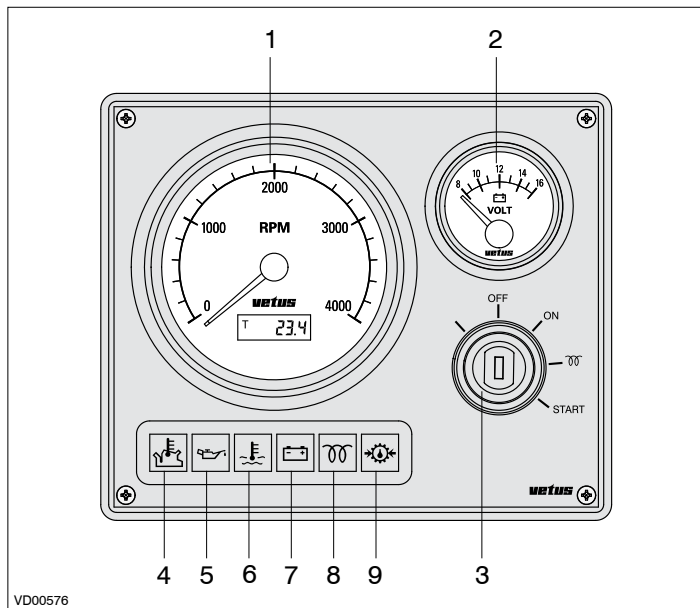
Identification of engine parts Starter side



- 21 Push-pull gearbox cable connection
- 22 Gearbox drain plug
- 23 Gearbox oil dipstick/filler cap
- 24 Starter motor
- 25 Alternator
- 26 Sea water pump, inlet ø 20 mm
- 27 V-belt
- 28 Extra expansion tank connection (only for keel cooling option)
- 29 Cooling system air bleeding nipple
- 30 Cooling system filler cap (pressure cap)
- 31 Expansion tank
- 32 Heat exchanger
- 33 Cooling system drain plug
- 34 Vent connection
- 35 Exhaust injector elbow ø 50 mm

VD01150

2 Introduction

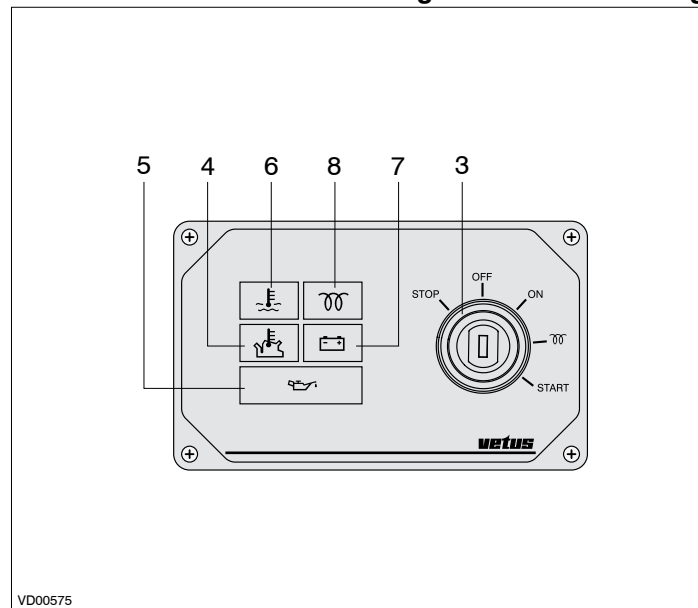


Basic panel (model 22)

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
- 6 Warning light high coolant temperature

Control panels, engines with intercooling

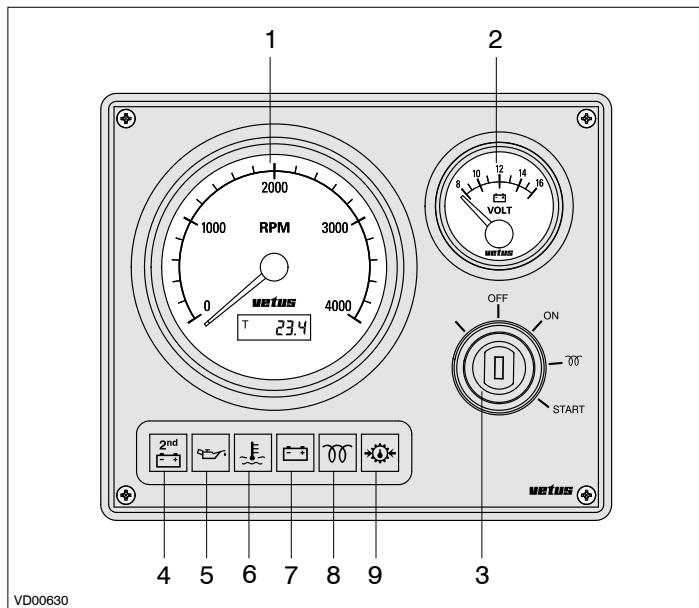


Sailingboat panel (model 10)

- 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.

2 Introduction

Control panels, engines with keelcooling



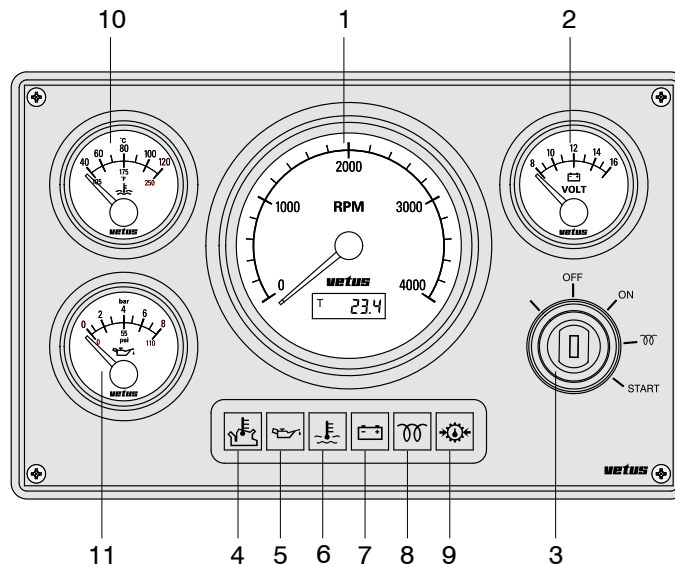
Basic panel (model 22)

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

- | | | | |
|---|--|---|--|
| 1 | Tachometer/Operating hours counter | 6 | Warning light high coolant temperature |
| 2 | Voltmeter | 7 | Warning light battery charging |
| 3 | Starter pre-heat switch/lock | 8 | Indicator light pre-heating |
| 4 | Warning light battery charging second alternator | 9 | Warning light gearbox low oil pressure * |
| 5 | Warning light low oil pressure | | |
- *) This is an option, not fitted as standard.

2 Introduction

Control panels, optional



VD00631

Extended panel (model 34)

- | | | | |
|---|--|----|--|
| 1 | Tachometer/Operating hours counter | 7 | Warning light battery charging |
| 2 | Voltmeter | 8 | Indicator light pre-heating |
| 3 | Starter pre-heat switch/lock | 9 | Warning light gearbox low oil pressure * |
| 4 | Warning light high raw water temperature | 10 | Temperature gauge, coolant |
| 5 | Warning light low oil pressure | 11 | Oil pressure gauge |
| 6 | Warning light high coolant temperature | | |

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

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 87.
- Never run the engine without a thermostat.
- Use a good quality lubricating oil. For specifications see page 84.
- 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 temperature¹ or battery charging lights up.
- Always follow the safety advice, see page 4.

¹ Only engines with intercooling.

3 Use

Engine Oil

5.5 litres 15 W40
(1 gal - 1.7 pt, UK)
(1 gal - 3.6 pt, US)

API: CF, CF-4, CI-4

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

1 Commissioning the engine

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



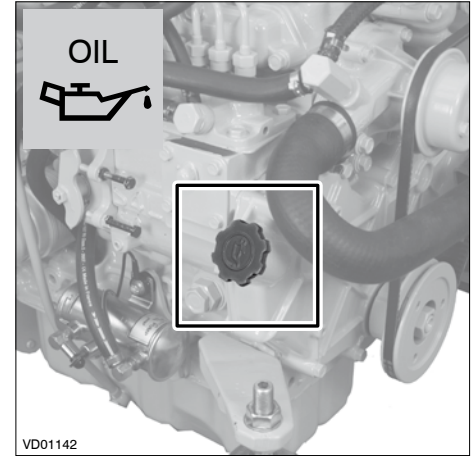
2 Filling with engine oil

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 65.

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

First commissioning



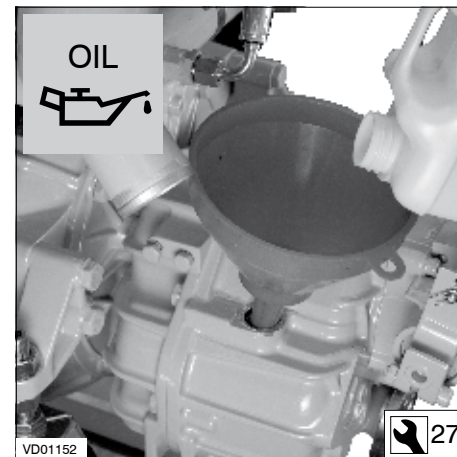
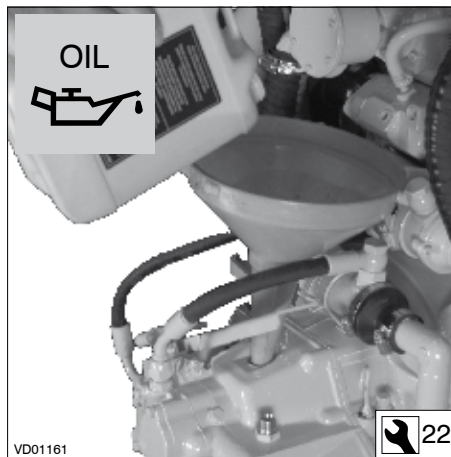
A second oil filling cap is located at the distribution cover.

3 Use

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.

First commissioning



3 Filling gearbox with oil

Fill the gearbox with oil.

Check the oil level with the dipstick, see page 42.

Technodrive:

- type TM345 : 1,6 litres, Engine oil
SAE 20W40-CD
- type TM345A : 1,6 litres, Engine oil
SAE 20W40-CD
(2.8 UK pt, 3.4 US pt)
- type TMC60 : 0,8 litre, Engine oil
SAE 20/30
(1.4 UK pt, 1.7 US pt)
- type TMC60E : 0.8 litres ATF*)
- type TMC60M : 0.8 litres ATF*)

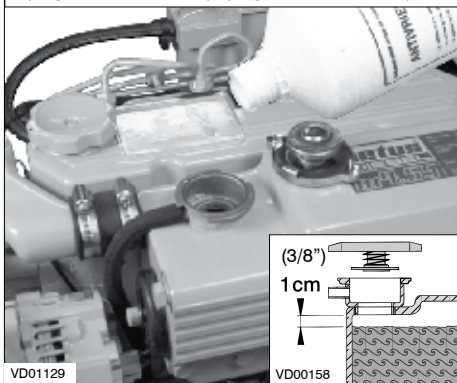
ZF Hurth:

- type ZF25 : 2,5 litres ATF*)
(4.4 UK pt, 5.3 US pt)
- type ZF25A : 1,8 litres ATF *)
(3.2 UK pt, 3.8 US pt)

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

3 Use

COOLANT QUANTITY : 6.5 litres
(1 gal - 3.4 pt UK) (1 gal - 5.7 pt US)



4 Filling the cooling system

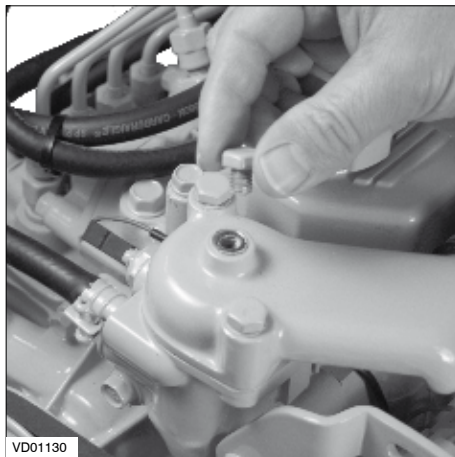
Remove the cap of the filler neck on the top of the heat exchanger housing.

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 87.



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.

First commissioning



WATER HEATER

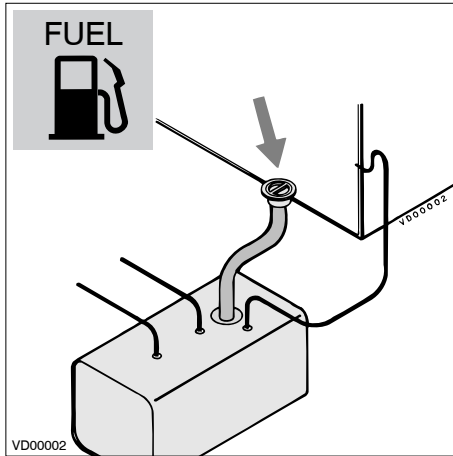
If a water heater is connected to the engine and this heater is positioned above the upper side of the engine then bleeding of the heater will not take place automatically!

Follow filling instructions on p. 57.



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

3 Use



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

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 83.

Bleed the fuel system, see page 36.

6 Other preparations

- Check battery and cable connections.
- Start the engine, see page 22, and let it run for about 10 minutes without load. Check the engine and all connections (fuel, cooling water and exhaust) for leaks.

First commissioning Running-in

7 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.

3 Use

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

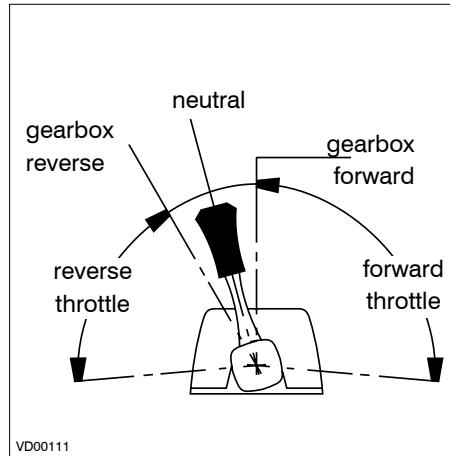
- Engine oil level.
- Coolant level.
- Sea cock open.
- Main switch 'ON'.
- Gearbox in 'NEUTRAL' position.

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.

Starting



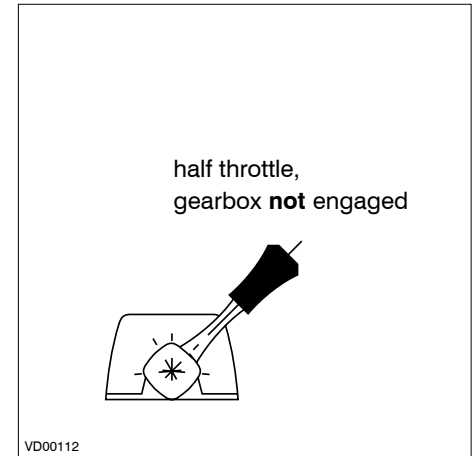
8 Preparation starting

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



WARNING

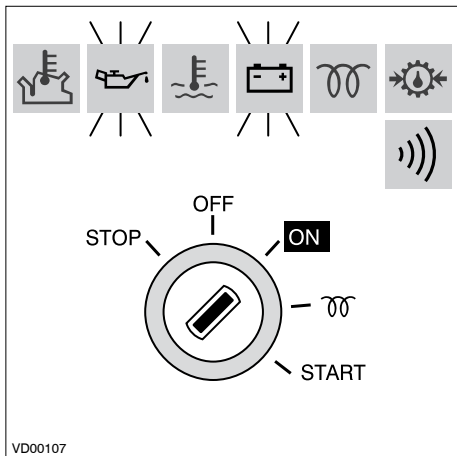
**Never start the engine with the fuel injection pump removed.
Disconnect battery.**



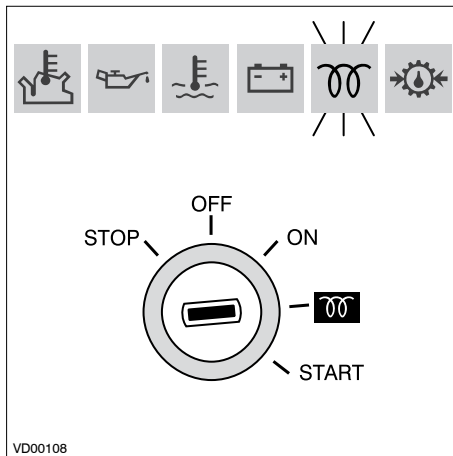
9 Control lever

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

3 Use



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.



10 Pre-heating

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

Hold the key in this position for about 6 seconds.

Starting

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

11 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.

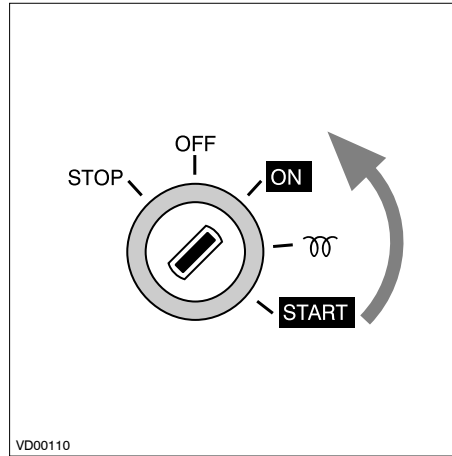
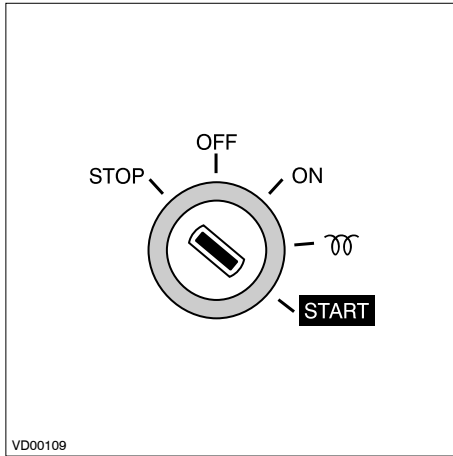


CAUTION

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

3 Use

Starting



12 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.

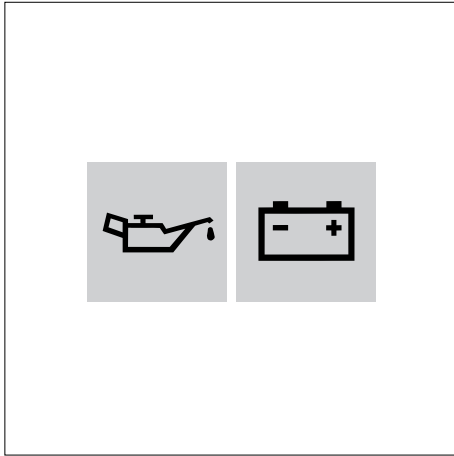


CAUTION

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.

3 Use



Check that the indicator lights for oil pressure and alternator are off.

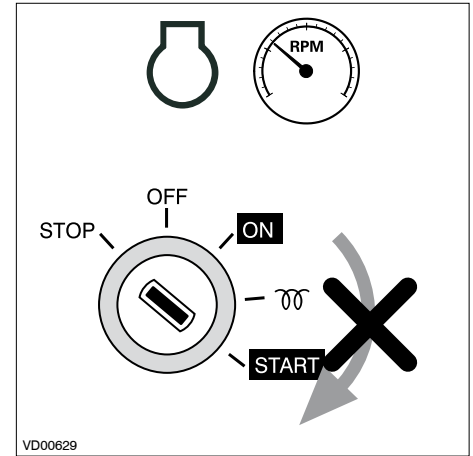
Cooling water should now flow out of the exhaust; if this is not the case, stop the engine immediately¹.

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

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

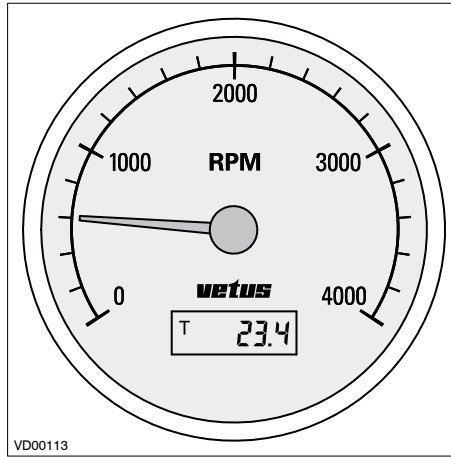
¹ Only engines with intercooling.

Starting



CAUTION

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



13 Tachometer

The instrument panel is provided with the following instruments (Depending of the type of panel, see page 14).

Indicating the number of revolutions per minute of the engine.

Also the number of running hours is indicated.

Idling speed : 900 rpm



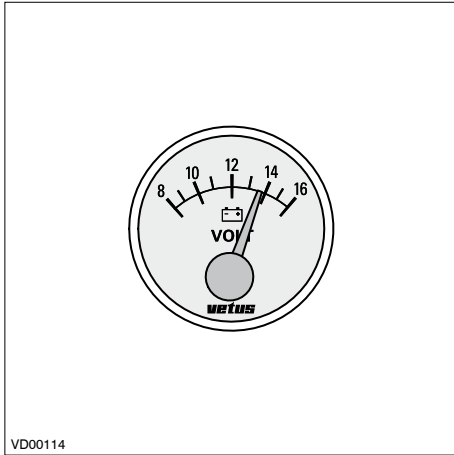
WARNING

Avoid idling for more than 10 minutes.

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

3 Use

Cruising



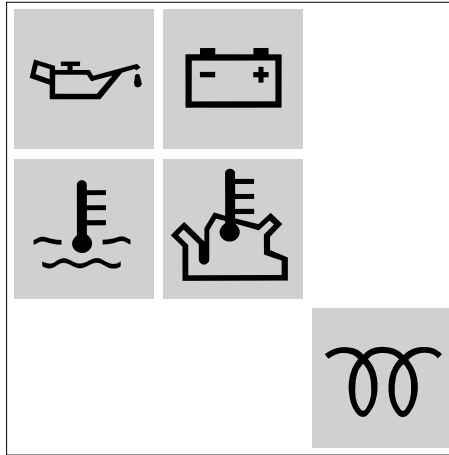
VD00114

14 Voltmeter

Indicating the battery voltage.

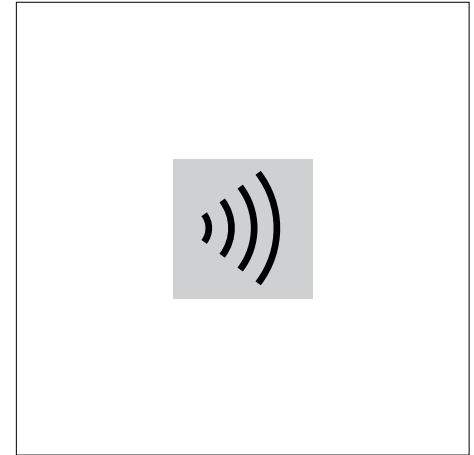
When the engine is running, the battery voltage should be between 12 and 14 Volts.

With the engine stopped and the start key in the first position, the voltmeter should indicate 12 Volts.



15 Warning lights

None of the five warning lights should light up while the engine is running.

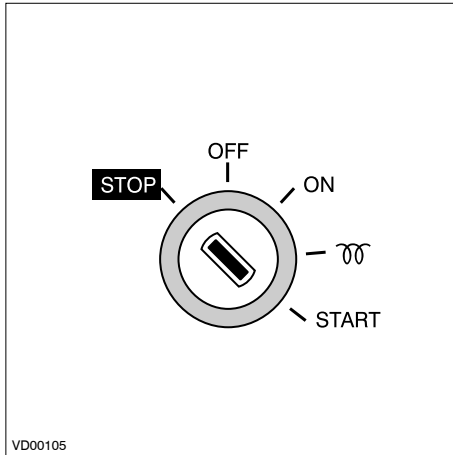


16 Alarm buzzer

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!**

3 Use

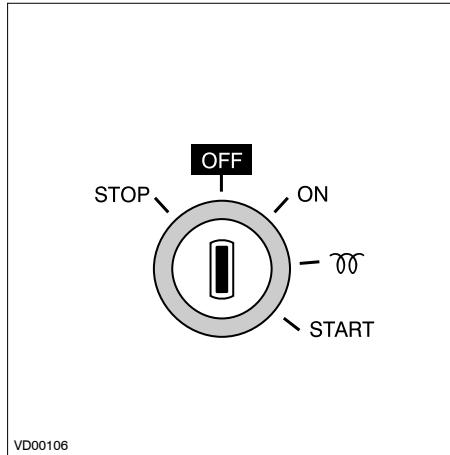
Stopping



17 Electrical shutdown

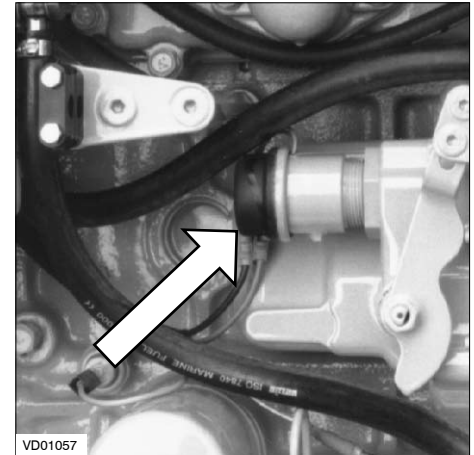
Reduce engine speed to idle and shift the gearbox to 'NEUTRAL'. Turn the key entirely to the left, **through** the 'OFF' position.

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.



18 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.

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 Guarantee Book':

- Total engine hours (reading engine hour counter).
- Amounts of oil, fuel 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.

4 Maintenance

Maintenance schedule

Every 10 hours or daily, before starting

Check engine oil level	32
Check coolant level	33
Check water strainer	34

After the first 50 hours

Drain water from fuel filter	35
Engine oil change	37
Replace oil filter	38
Change gearbox oil (Technodrive)	43
Change gearbox oil and replace filter (ZF Hurth)	44
Replace fuel filter	48
Check idle rpm	59

Every 100 hours, at least once every year

Drain water from fuel filter	35
Engine oil change	37
Replace oil filter	38
Battery, cables and cable connections	40
Check gearbox oil level	42

Every 500 hours, at least once every year

Change gearbox oil (Technodrive)	43
Change gearbox oil and replace filter (ZF Hurth)	44
Check valve clearance	46
Replace fuel filter	48
Cleaning fuel lift pump	49
Check V-belt	50
Check flexible engine mounts	51
Check engine for leaks	51
Check tightness of all fasteners, bolts and nuts	51



DANGER

Stop the engine before carrying out any maintenance work.

4 Maintenance

Every 500 hours

Check and adjust injector pressure	*)
Check glow plugs	*)

Every 1000 hours, at least once every 2 years

Raw water pump inspection **)	52
Replace coolant	54
Replace air filter	58

Every 1000 hours

Check starter motor	58
Check alternator	58
Check turbocharger	*)



DANGER

Stop the engine before carrying out any maintenance work.

Maintenance schedule

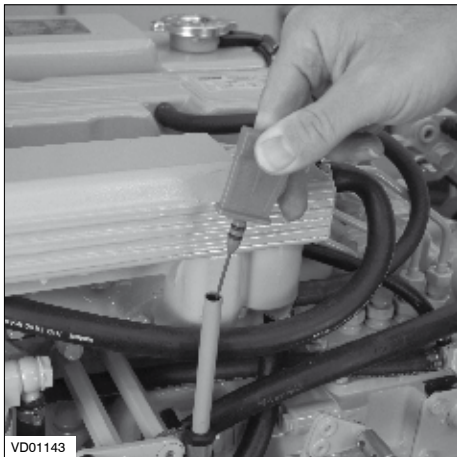
When required

Bleeding fuel system	36
Cleaning heat exchanger **)	60
Check idle rpm	59

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

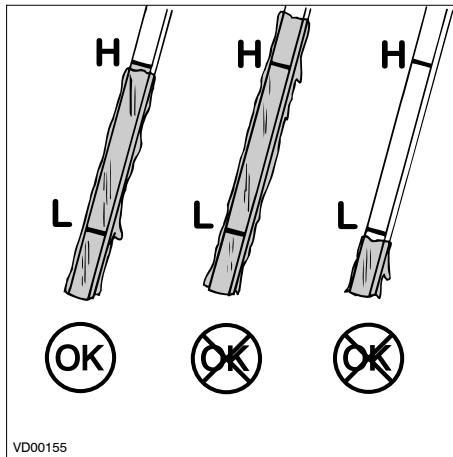
**) Only engines with intercooling!

4 Maintenance



1 Check oil level

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



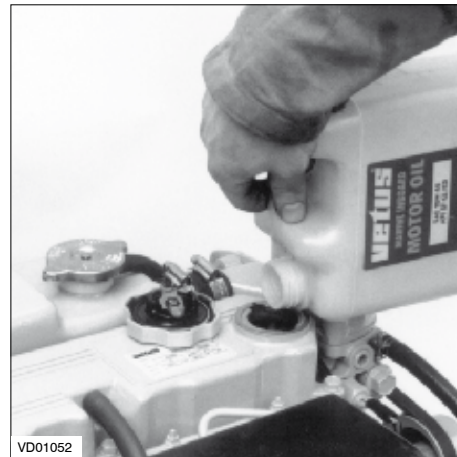
2 Oil level

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:
1.9 litres (3.3 UK pt, 4 US pt)

Checking engine oil level

Daily, before starting.

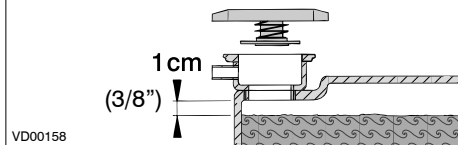


3 Topping up oil

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

A second oil filling cap is located at the distribution cover, see page 18.

4 Maintenance

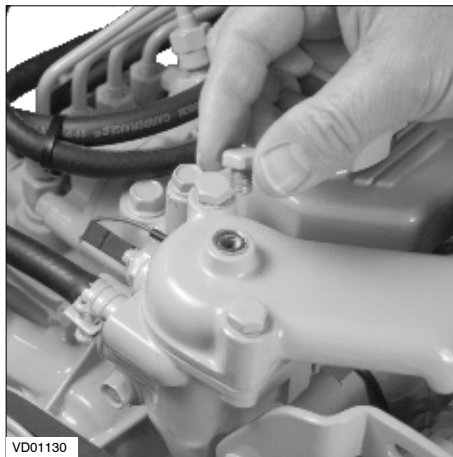


4 Checking coolant level

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.



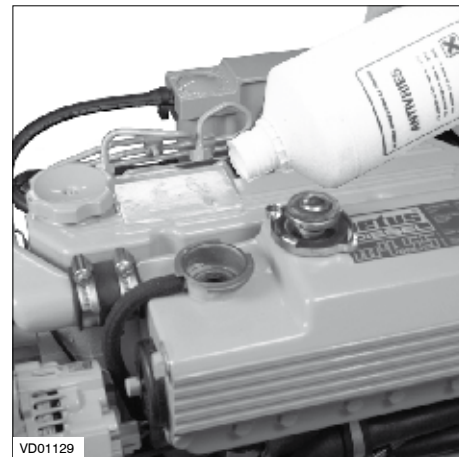
If necessary, top up. When topping up coolant, remove the bolt from the upper side of the thermostat cover, so that air can escape from the cooling system.



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

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 87.

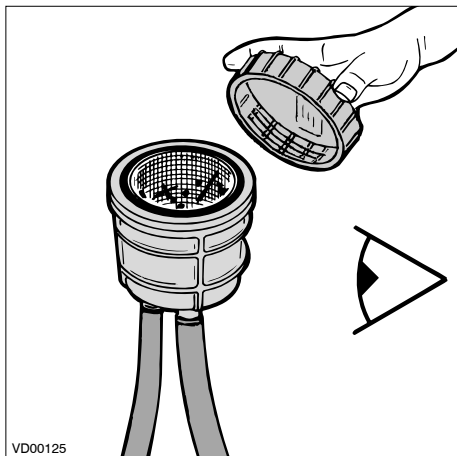


Never fill the cooling system with sea water or brackish water.

4 Maintenance

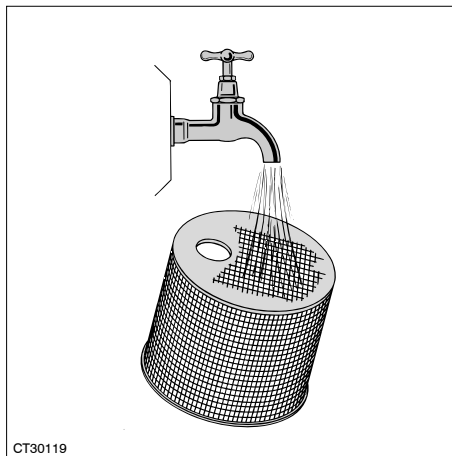
Checking and cleaning the raw water strainer

Daily, before starting.



6 Checking the raw water strainer

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



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.



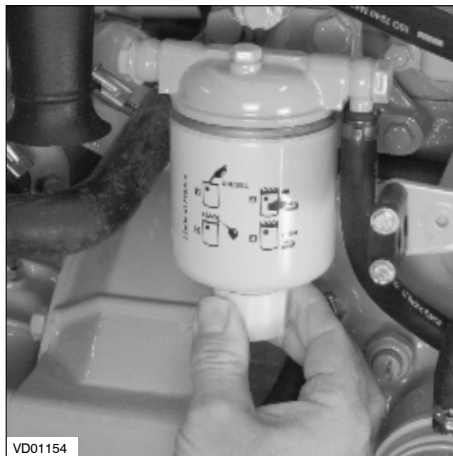
Only engines with intercooling!

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.

4 Maintenance

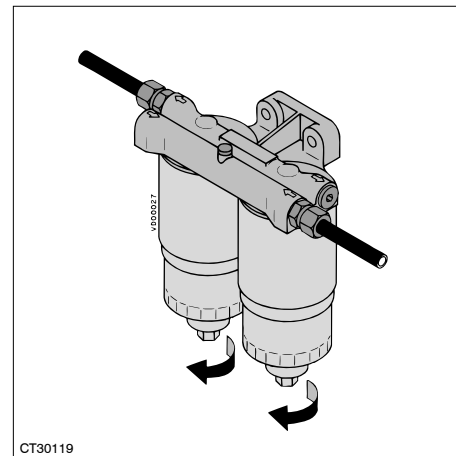
Draining of water from the water separator/fuel filter

Every 100 operating hours.



8 Empty fuel filter

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



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!



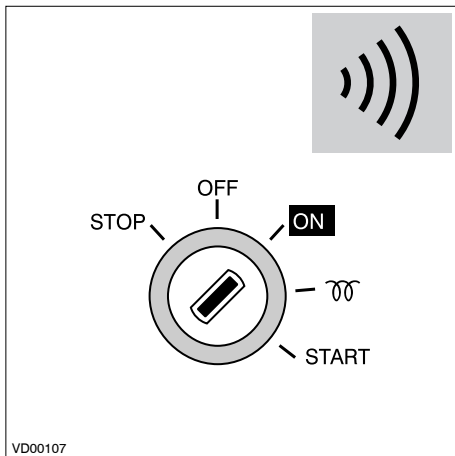
DANGER

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.

4 Maintenance

Draining of water from the water separator/fuel filter

Every 100 operating hours.

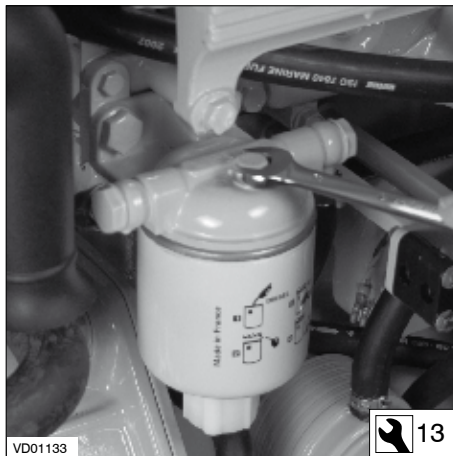


10 Bleeding

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

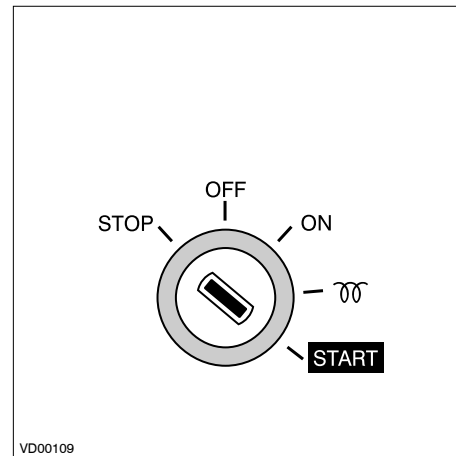
The fuel system is self-bleeding.

Turn the key of the starter switch to position 'ON' and the fuel lift pump will feed the fuel system.



Open the bleeding nipple to speed up the bleeding process.

Close the bleeding nipple when all air has escaped.



11 Start the engine

Operate the starter 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.

4 Maintenance

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 max. 80°C (176°F).)

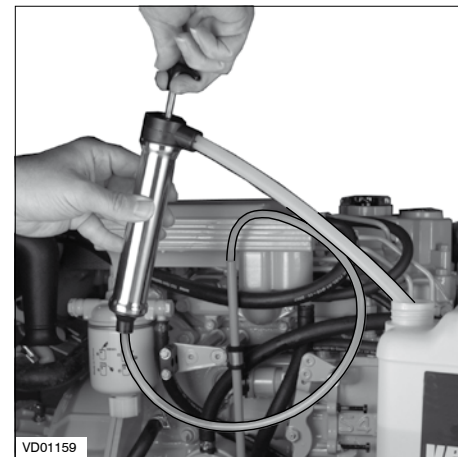


DANGER

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.

Engine oil change

Every 100 operating hours.



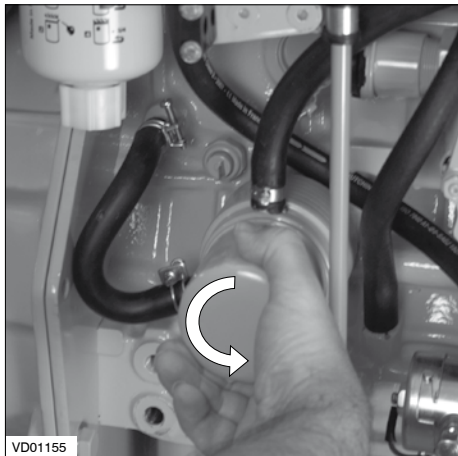
13 Draining the oil

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.

4 Maintenance

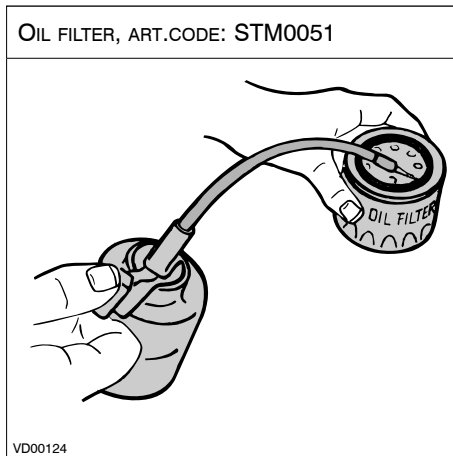
Engine oil change Every 100 operating hours.



VD01155

14 Removing the oil filter

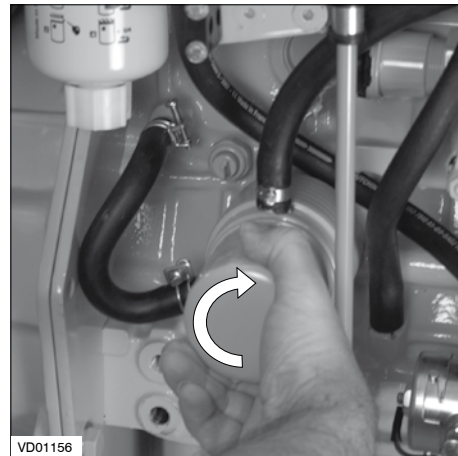
Unscrew the oil filter, with a commercially available tool, when all the oil has been pumped out. Catch any dripping oil.



VD00124

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.



VD01156

16 Oil filter installation

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



DANGER

Beware of burns from hot oil.

4 Maintenance

Engine oil change

Every 100 operating hours.

AMOUNT OF OIL: 6.0 litres (OIL FILTER INCL.)
(1 gal - 2.6 pt UK) (1 gal - 4.7pt US)



VD01052

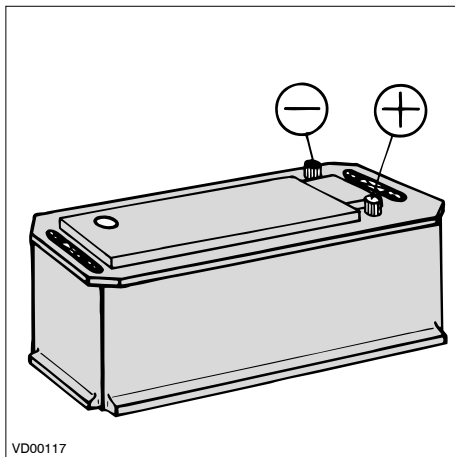
17 Refilling with oil

Refill the engine with new oil (for specification see page 84) 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.

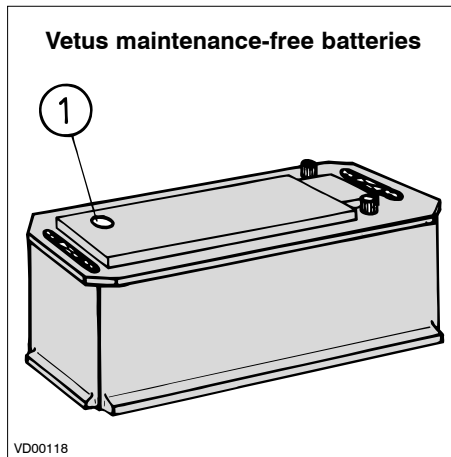
Stop the engine. Allow 5 minutes for the oil to return to the sump. Check the oil level with the dipstick.

4 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.

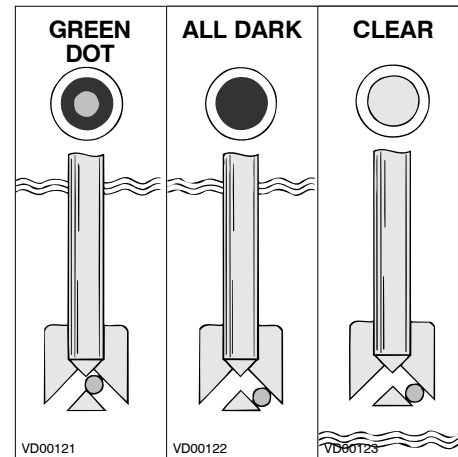


19 Checking specific gravity

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

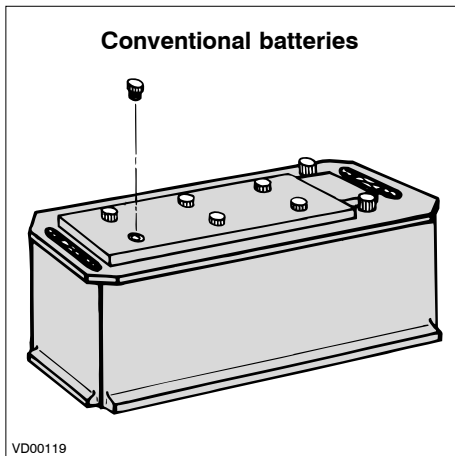
Every 100 operating hours.



20 Hydrometer operation

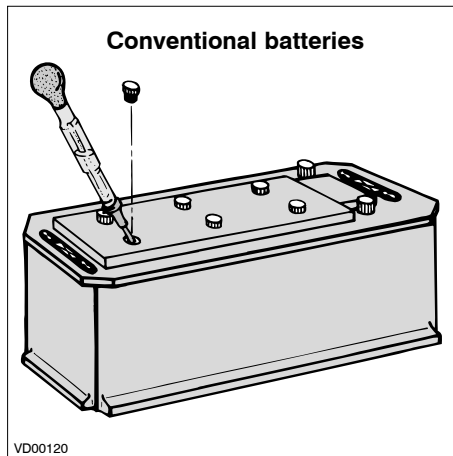
- **Green dot visible** - State of charge 65 % or more.
- **Dark** - State of charge less than 65 %. Recharge immediately.
- **Clear or light yellow** - Electrolyte level low.
In case of low level, caused by overcharging the battery for a long period of time with a voltage too high, replace battery. Check alternator and/or voltage regulator.

4 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 (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.



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

Battery, cables and connections

Every 100 operating hours.

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



! DANGER

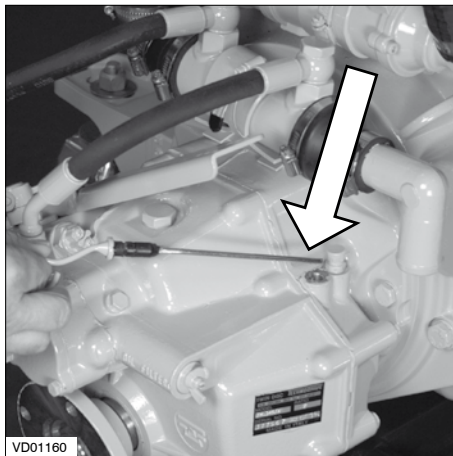
The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery!

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

4 Maintenance

Gearbox oil level check

Every 100 operating hours.



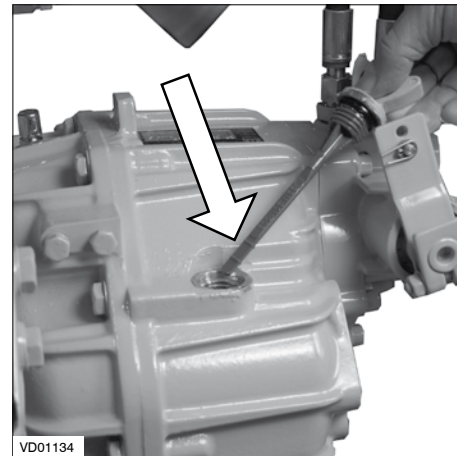
23 Oil level check (Technodrive)

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

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. For oil type and specification see page 86.



24 Oil level check (ZF-Hurth)

Unscrew the dipstick out of the gearbox housing.

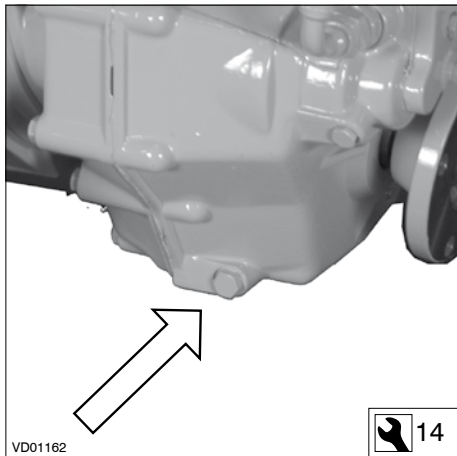
Check the oil level by cleaning the dipstick and lowering it into the hole, without screwing it in. The oil level must be between the two marks on the dipstick

If necessary top up by pouring oil in the dipstick hole. For oil type and specification see page 86.

4 Maintenance

Changing the gearbox oil (Technodrive)

Every 500 operating hours.

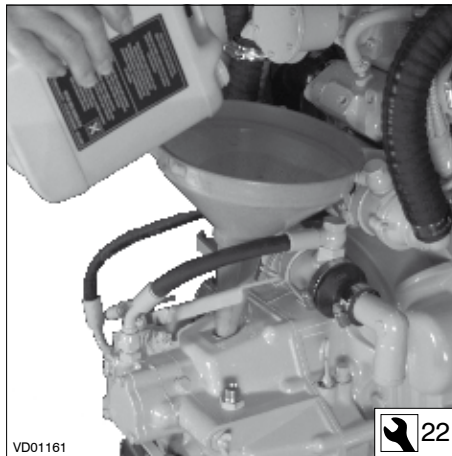


25 Draining the oil

Remove the drain plug to drain the oil.

Remove the fillercap to vent the gearbox and check if all oil has been drained

Collect the oil in a dripping pan.



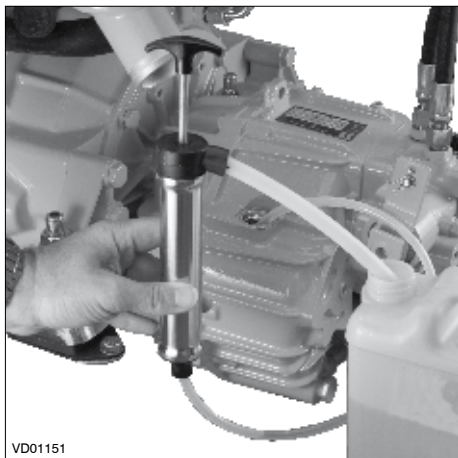
26 Filling with new oil

Refill the gearbox to the correct level via the filling hole.

For oil specification see page 86.

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.

4 Maintenance

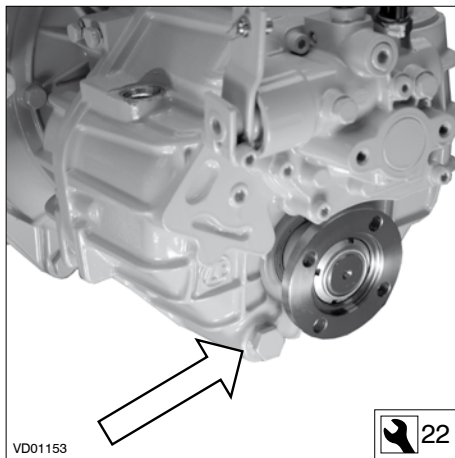


27 Draining the oil

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

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.

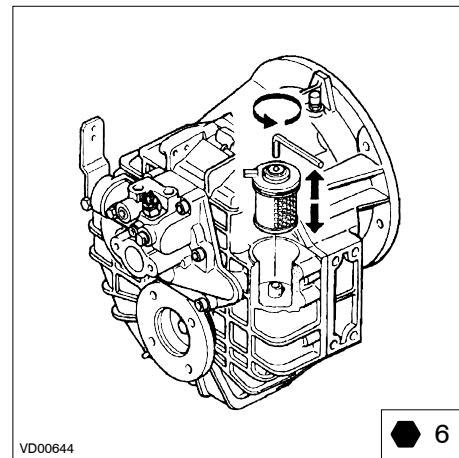


Or, if sufficient space below the gearbox is available, oil can be drained by removing the drain plug.

Collect the oil in a dripping pan.

Changing the gearbox oil (ZF-Hurth)

Every 500 operating hours.

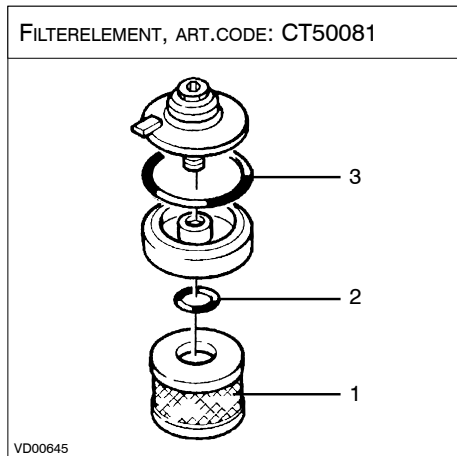


28 Changing the oil filter

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.

4 Maintenance



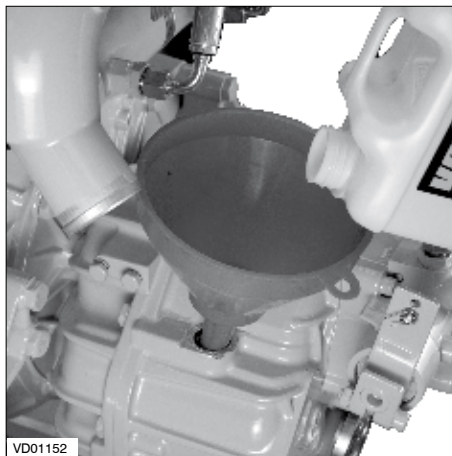
Withdraw the filter element (1).

Check the O-rings (2 and 3) for damage and replace if necessary.

Install the new filter and mount the unit on the gearbox.

Changing the gearbox oil (ZF-Hurth)

Every 500 operating hours.



28 Filling with new oil

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

For oil specification see page 65.

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.

4 Maintenance

Checking valve clearance

Every 500 operating hours.

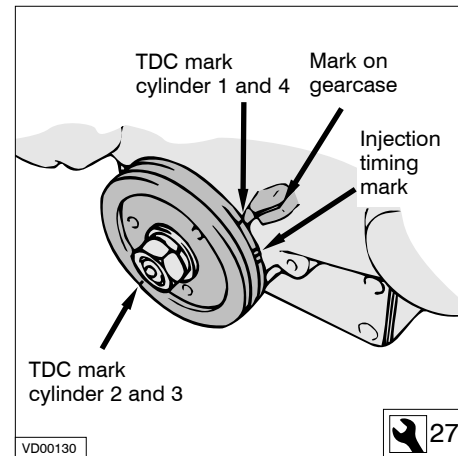


30 Checking / adjusting valve clearance

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

31 Remove rocker cover

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



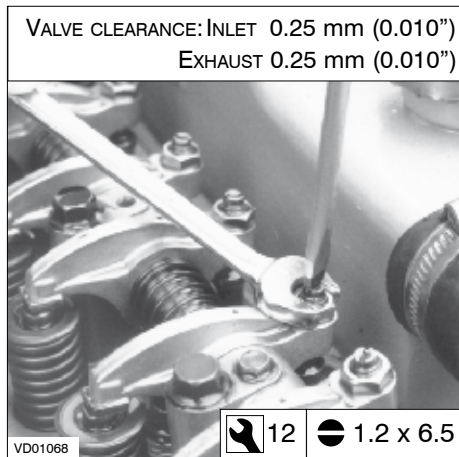
32 Locating TDC

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

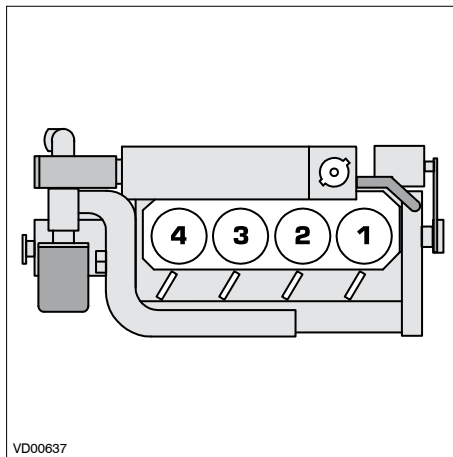
does not move when the crank pulley is rotated a little.

4 Maintenance



32 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.



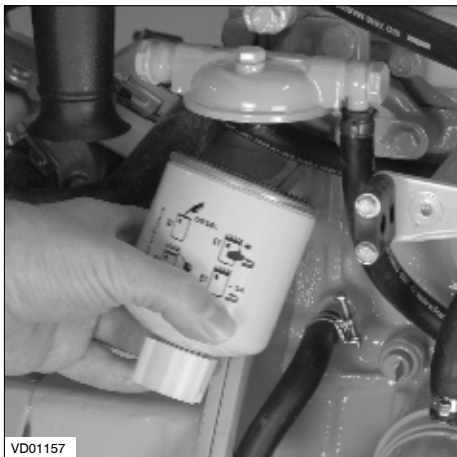
34 Cylinder numbering

Cylinders are numbered consecutively, beginning at the front end.

Checking valve clearance

Every 500 operating hours.

4 Maintenance



35 Fuel filter removal

The fuel filter is to be replaced as a unit.

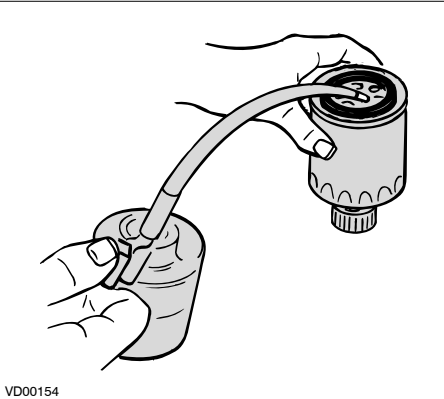
- Close the fuel stopcock.
- Remove the fuel filter, use a filter wrench. Catch any fuel.



DANGER

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

FUEL FILTER, ART.CODE: STM3690

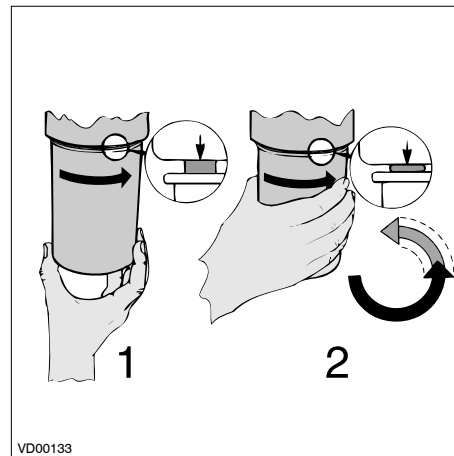


36 Fuel filter installation

- 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.

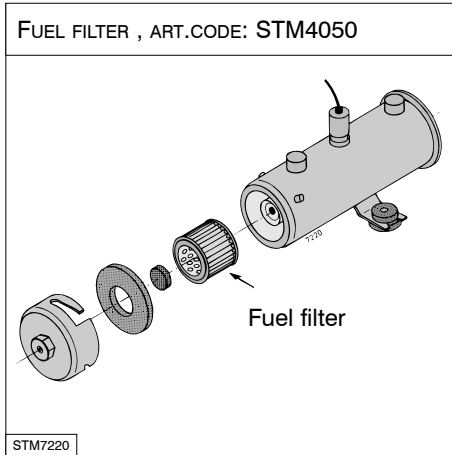
Fuel filter replacement

Every 500 operating hours.



- 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.

4 Maintenance



37 Fuel lift pump

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

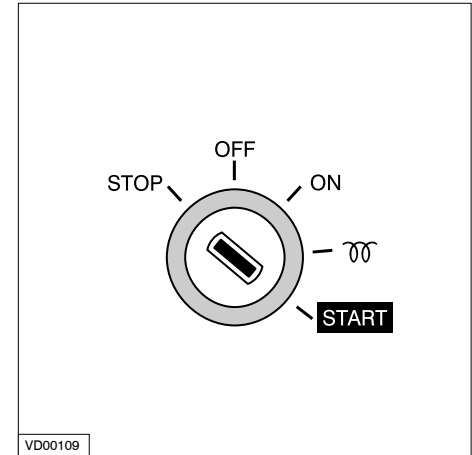
38 Bleeding

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 36.

Cleaning fuel lift pump

Every 500 operating hours.



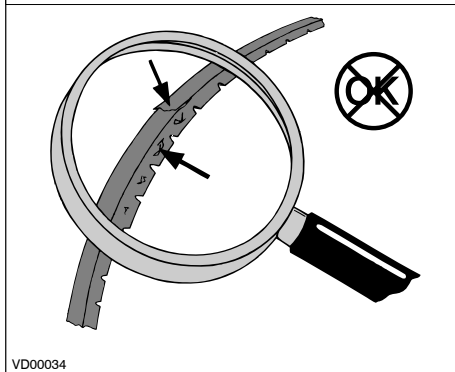
Start the engine

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.

4 Maintenance

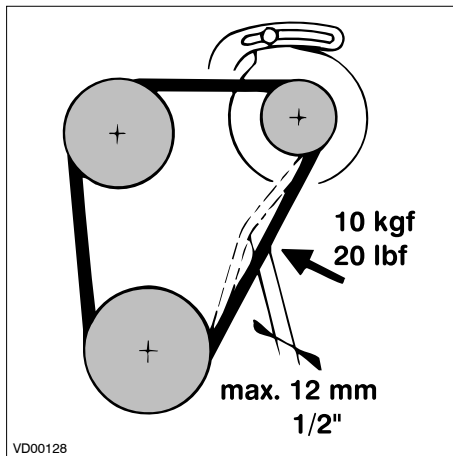
V-BELT, ART.CODE: STM7439, SEE 'TECHNICAL DATA'



39 Inspection V-belt

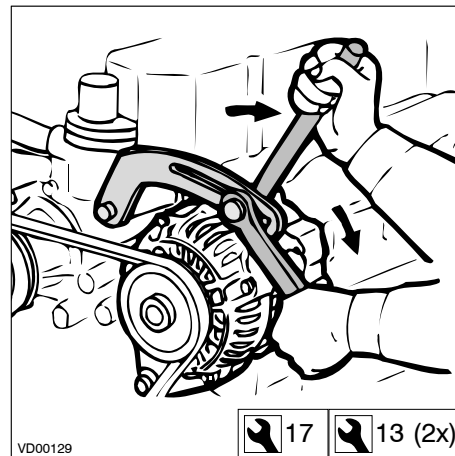
Inspect the belt for wear and tear (fraying and cracking). Belts which are in poor condition should be replaced.

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



40 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.



41 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.

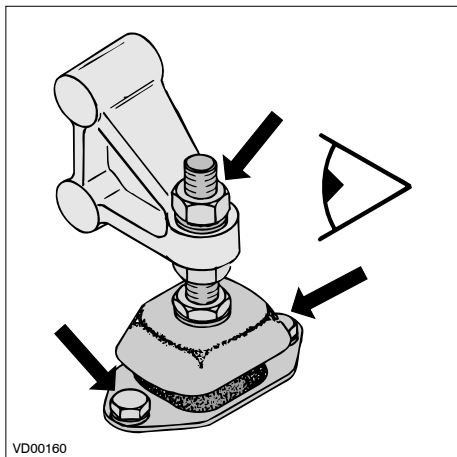
Now first re-tighten the upper mounting bolt of the alternator.

Then re-tighten the bolt of the adjustment bracket and the lower mounting bolt.

4 Maintenance

Flexible engine mounts, hose connections and fasteners

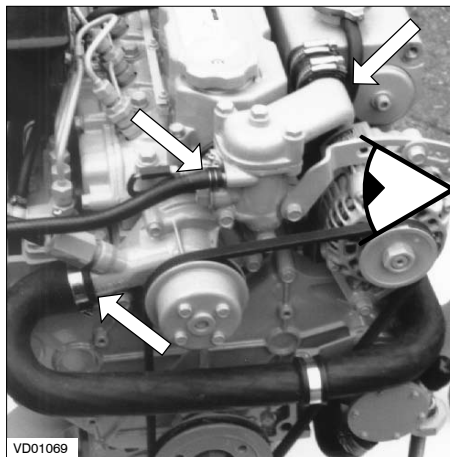
Every 500 operating hours.



42 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.



43 Inspection hose connections

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

44 Check fasteners

Check tightness of all fasteners, bolts and nuts.

4 Maintenance

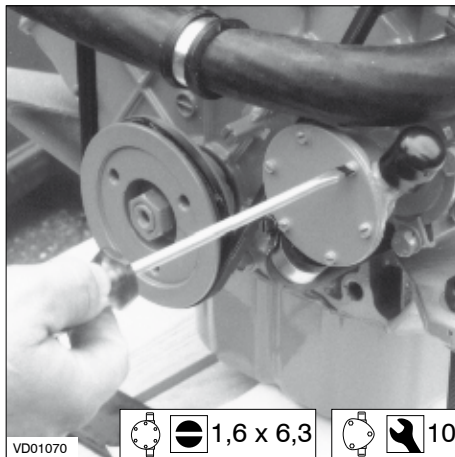


NOTE

Only engines with intercooling!

45 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.



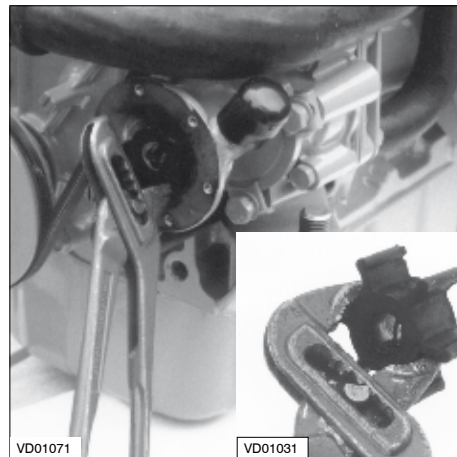
46 Pump cover removal

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.

Raw water pump inspection

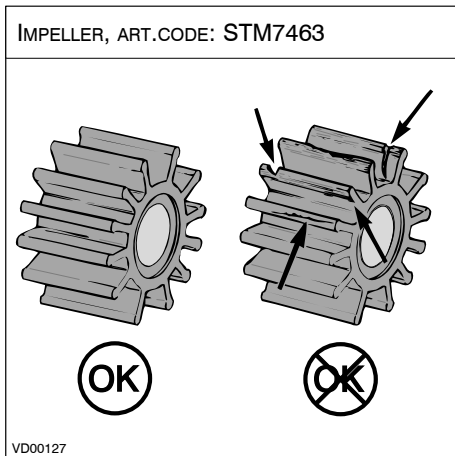
Every 1000 operating hours.



47 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.

4 Maintenance



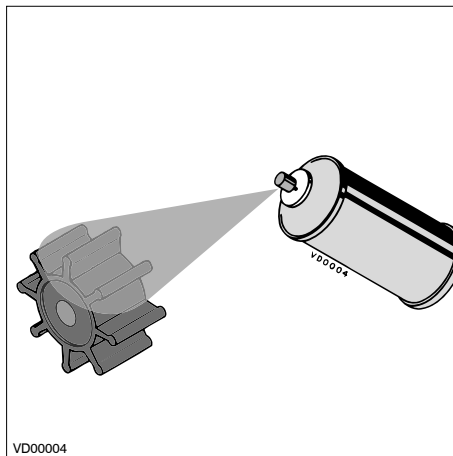
48 Impeller inspection

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



NOTE

Only engines with intercooling!

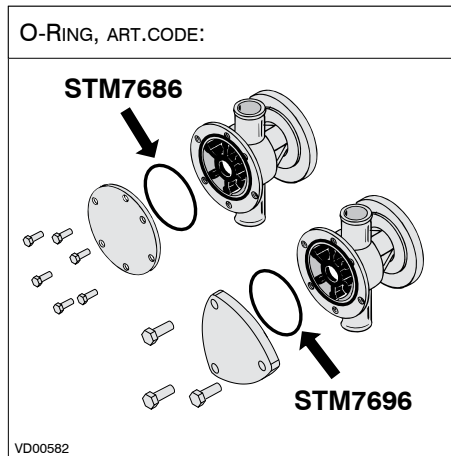


49 Re-install the impeller

- 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 1000 operating hours.



50 Replacing the pump cover

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

4 Maintenance

Coolant replacement

Every 1000 operating hours.

51 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.



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.

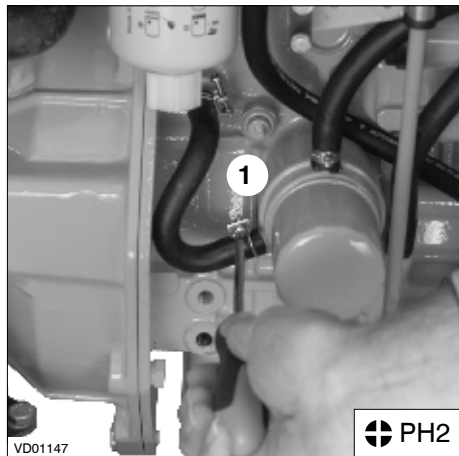


WARNING



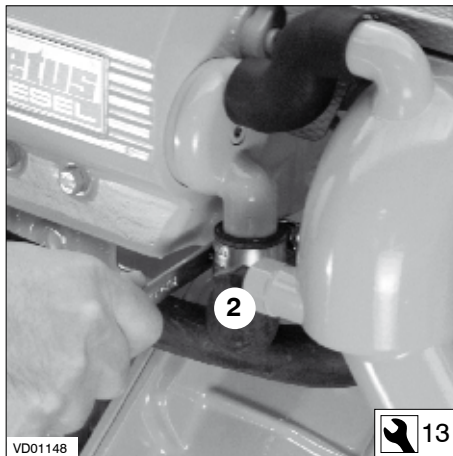
Cooling system protective liquids must be disposed of in accordance with environmental regulations.

4 Maintenance



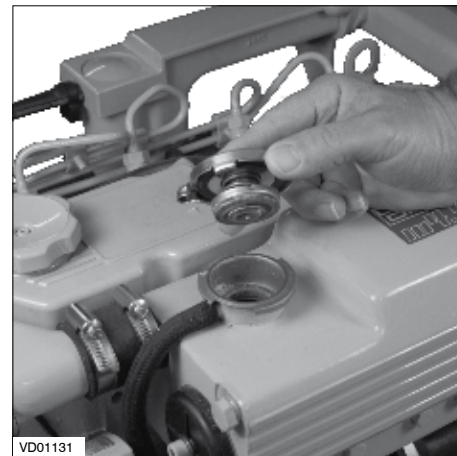
52 Draining of coolant

Detach the hose to the oil collar (1) and remove the drainplug from the heat exchanger (2).



Coolant replacement

Every 1000 operating hours.



Remove the filler cap to vent the cooling system and check that all the coolant has been drained.

After draining replace the drain plug.



NOTE

Keel cooler

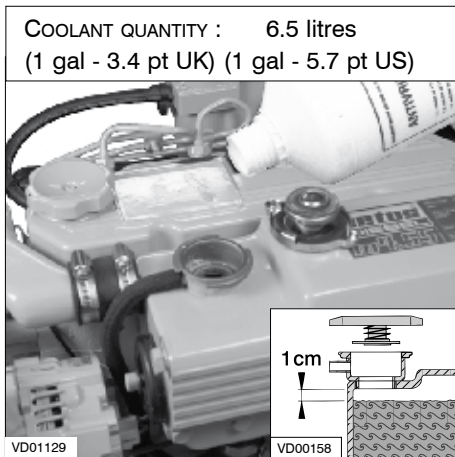
How the cooling system in engines with **keel cooling** should be drained depends on the installation of the keel cooler.

Refer to the keel cooler manufacturer's

instructions for this.

Check using a coolant hydrometer whether the coolant is providing sufficient protection against freezing if total draining off is not possible.

4 Maintenance



53 Filling the cooling system

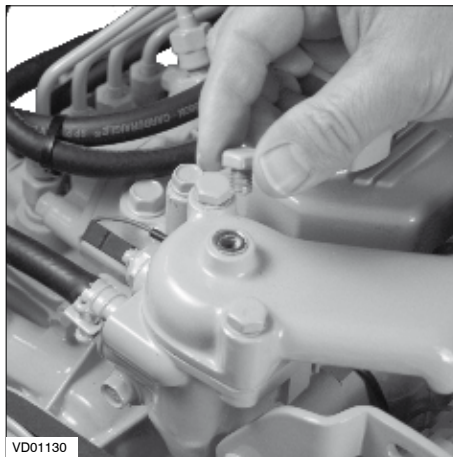
Remove the cap of the filler neck on the top of the heat exchanger housing.

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 87.



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.



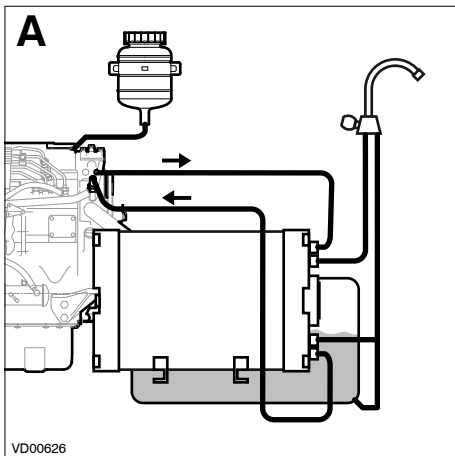
CAUTION

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

4 Maintenance

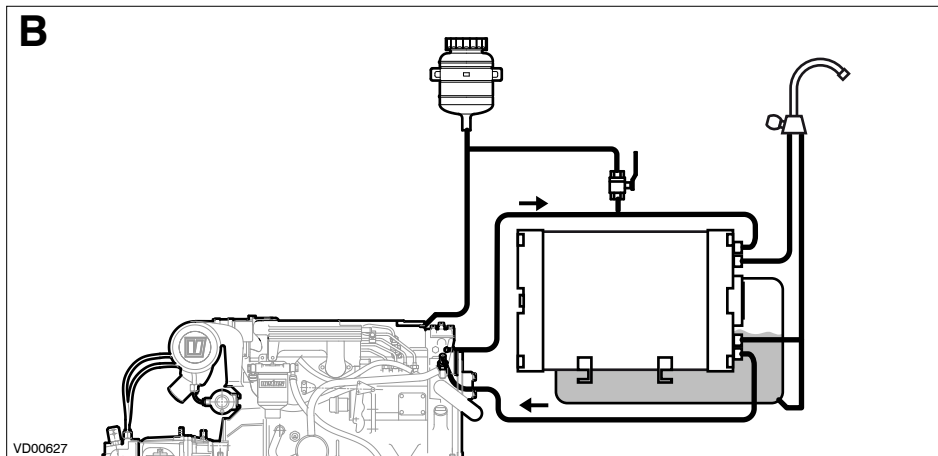
Coolant replacement

Every 1000 operating hours.



54 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

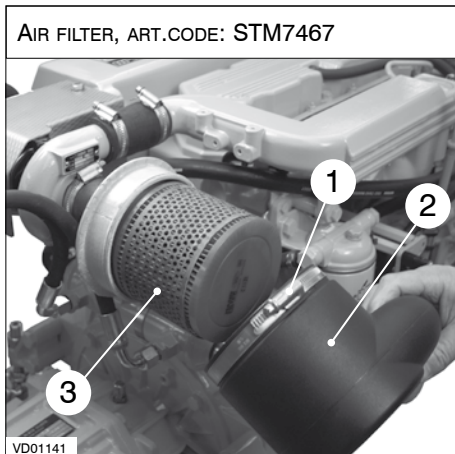
B) The **HIGHEST** point of the water heater is situated at a **HIGHER** level than the expansion tank for the ship's engine. The water heater will **NOT** be **filled and bled automatically** during filling of the cooling system.

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.

4 Maintenance

Changing the air filter, checking the starter motor and alternator

Every 1000 operating hours.



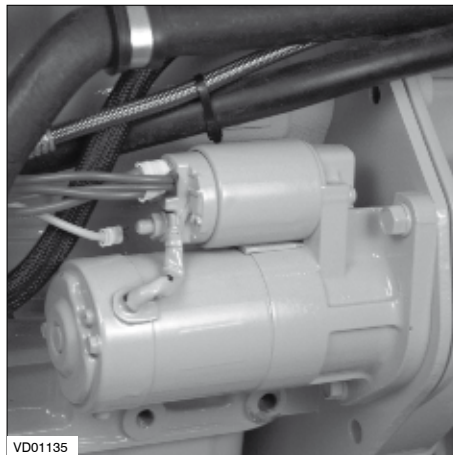
55 Changing the air filter

- Loosen the hose clamp (1).
- Remove the filter housing (2).
- Remove the old filter and fit a new filter (3).
- Replace the unit in reverse order and tighten the hose clamp again.



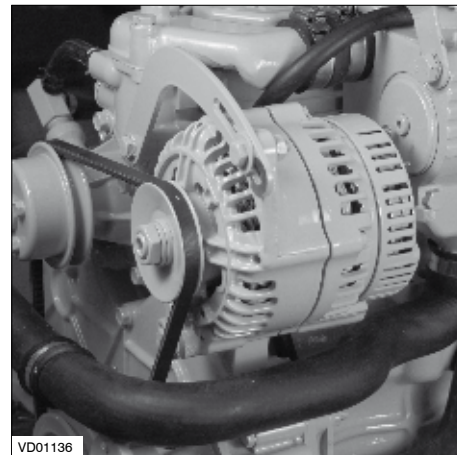
WARNING

Never clean the element with petrol or hot liquids



56 Checking the starter motor

Check for visible defects.
Check whether the Bendix engages with the starter ring when the starter motor is activated. If the Bendix does not engage properly, contact your Vetus dealer.



57 Checking the alternator

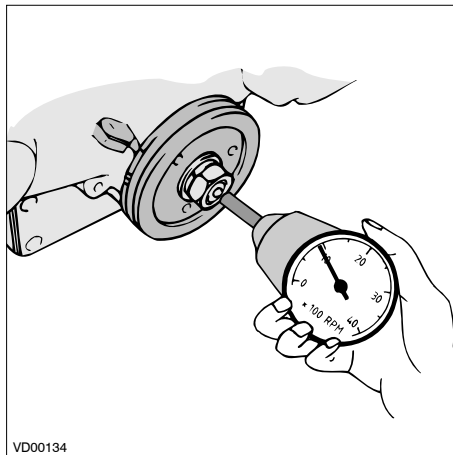
Check for visible defects.
Remove the alternator belt. Turn the pulley by hand to check whether the alternator can be turned easily. If this is not the case, contact your Vetus dealer.

4 Maintenance



CAUTION

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



58 Checking engine speed

At full load (with the boat cruising) the maximum engine speed should be about 3000 RPM (see technical data page 80). If the engine does not reach this speed, it is being overloaded!

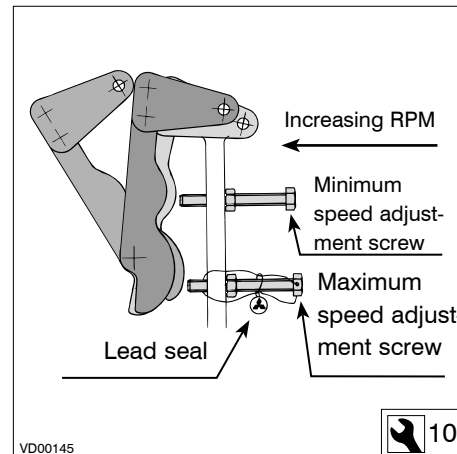
If this is the case, check the ship's propeller for defects or irregularities, and also to see that it is the correct pitch and diameter.

The engine idling speed should be 900 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.

Checking engine speed



59 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.

4 Maintenance



NOTE

Only engines with intercooling!

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

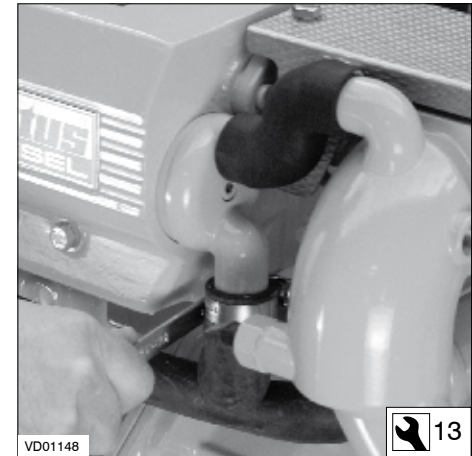
Under normal conditions of use cleaning the heat exchanger is not necessary!

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.

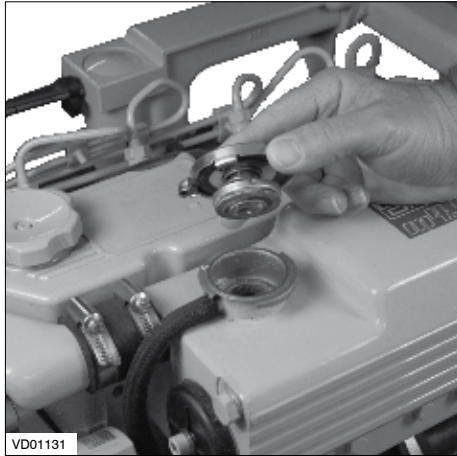
Cleaning the heat exchanger



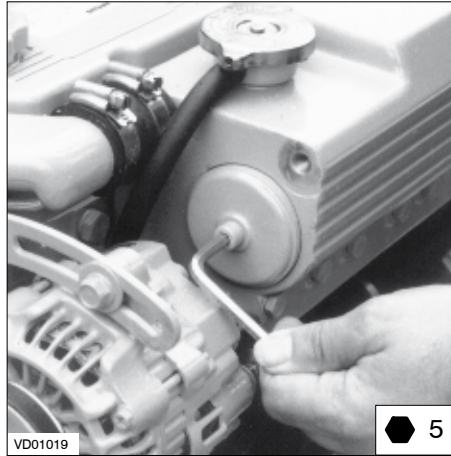
60 Remove the drain plug

- 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.

4 Maintenance



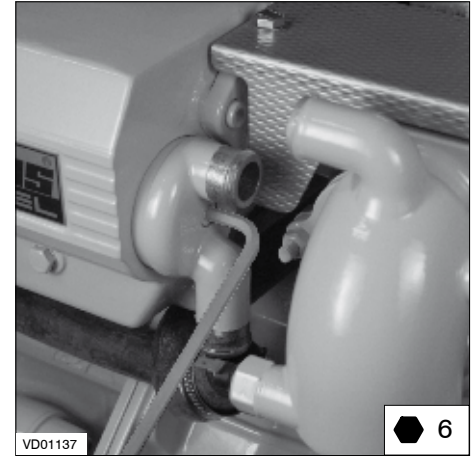
- Remove the filler cap from the top of the heat exchanger housing to allow air into the system and check that all coolant has drained off.



61 Removal of bolts out of the end covers

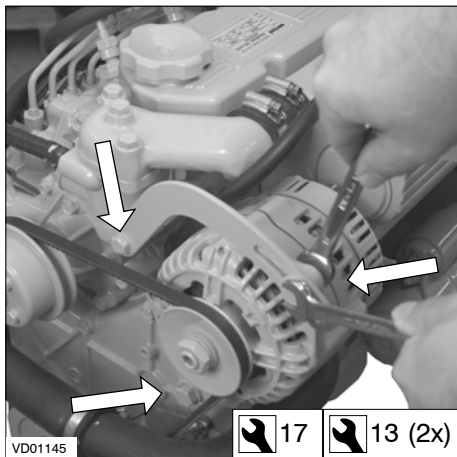
Take out both central bolts from the end covers and take the end covers with the O-rings out of the housing.

Cleaning the heat exchanger



Only engines with intercooling!

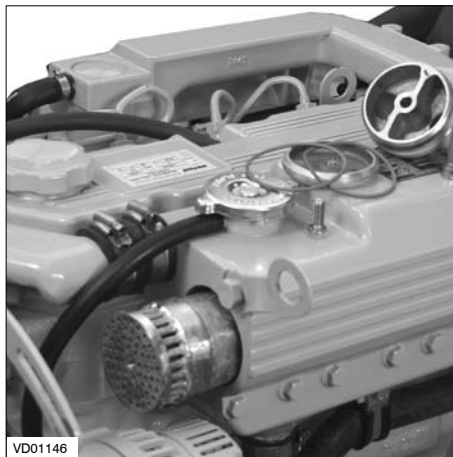
4 Maintenance



62 Revolving the alternator outwards

Loosen the bolts of the adjustment bracket and both the alternator mounting bolts. Remove the belt.

Push the alternator outwards to have enough room to slide the heat exchanger out of the housing.



63 Remove heat exchanger

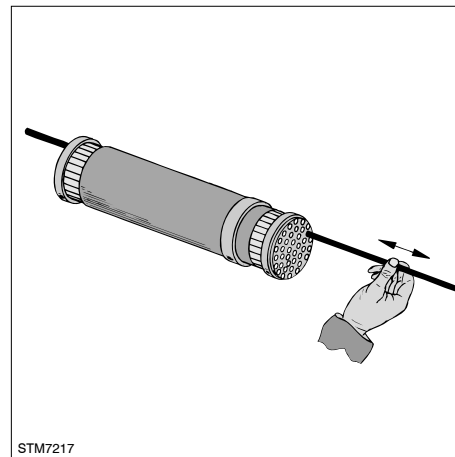
Slide the heat exchanger out of the housing.



NOTE

Only engines with intercooling!

Cleaning the heat exchanger



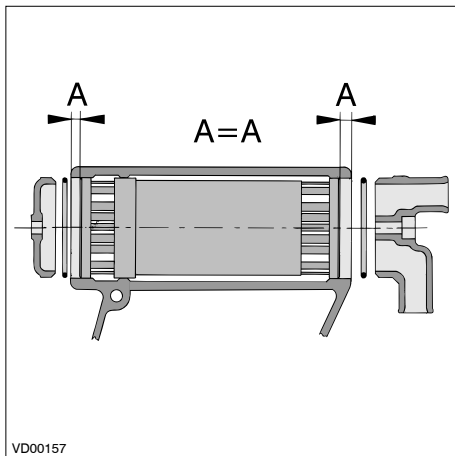
64 Cleaning the heat exchanger

Clean the heat exchanger: Use a pipe cleaner to remove fouling in the pipes.

Then rinse the heat exchanger pipes with clean water.

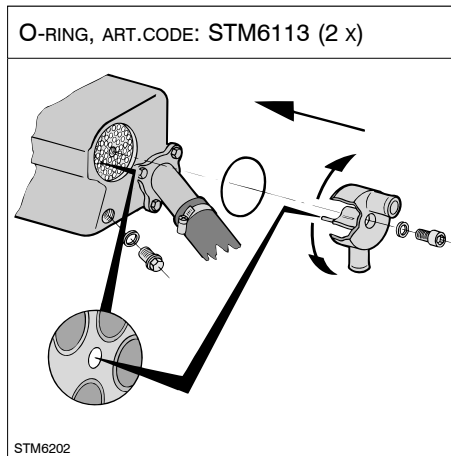
Ensure that both heat exchanger end chambers are free from dirt.

4 Maintenance



65 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.



66 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.

Cleaning the heat exchanger

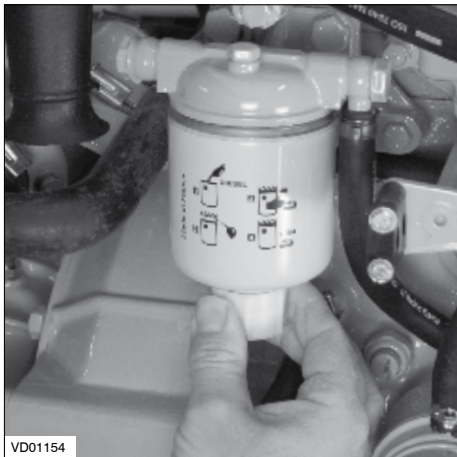


Only engines with intercooling!

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

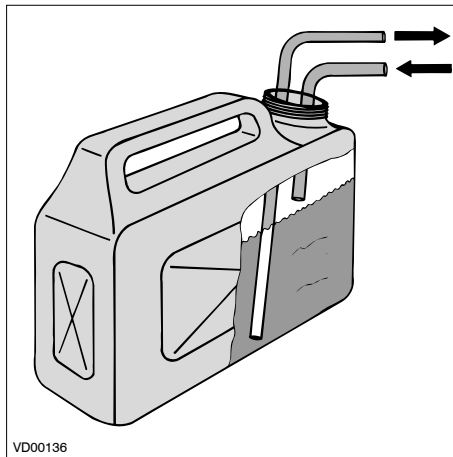
- Refit the drain plug.
- Reconnect all hoses previously removed.
- Refill the cooling system, see page 56.

5 Winter storage procedure



1 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.



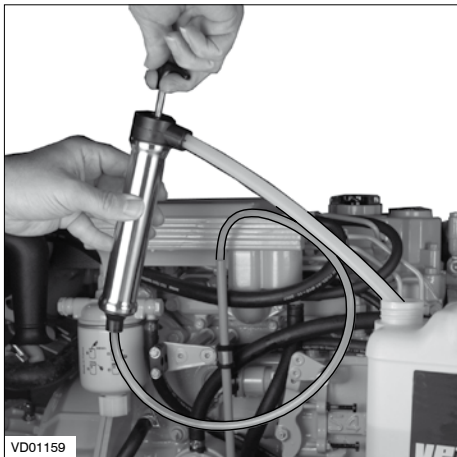
CAUTION

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

* Engine oil with protective properties.
E.g.:
Vetus Marine Diesel Engine Oil 15 W-40
Shell Nautilus Premium Inboard 15W-40

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

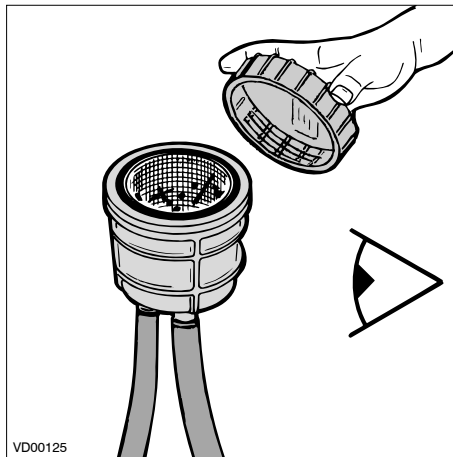
5 Winter storage procedure



2 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 65.



3 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 (1/4 Imp.gal.) 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.

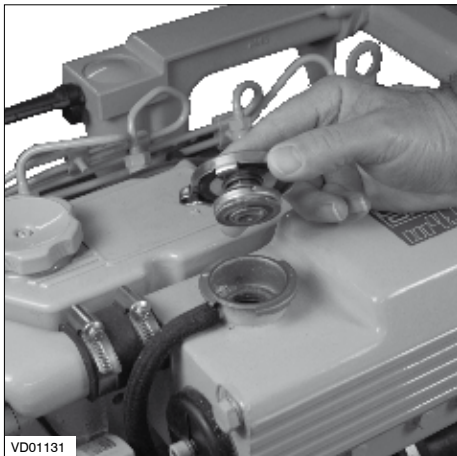
An improperly sealed lid will result in air sucked in by the raw water pump which again will result in overheating of the engine.



NOTE

Only engines with intercooling!

5 Winter storage procedure

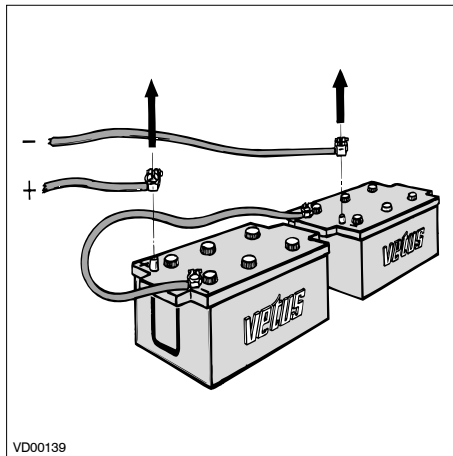


4 Fresh water cooling system

To avoid corrosion during winter storage the cooling system must be filled with an antifreeze/water mixture (or a coolant). For specifications see page 87.

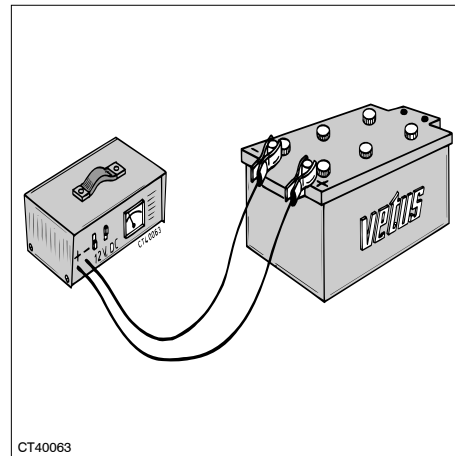
N.B. Replacing the coolant is only necessary if the coolant present in the cooling system offers insufficient protection for the winter.

For coolant replacement see page 54.



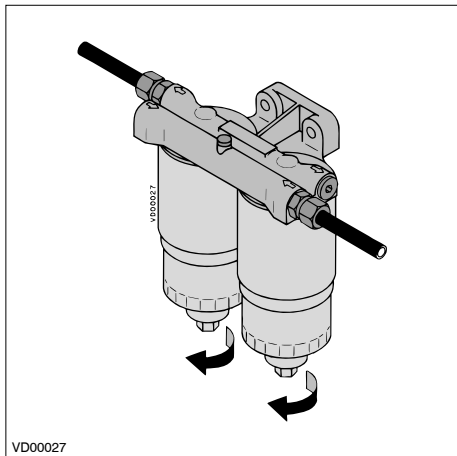
5 Electrical system

Disconnect the battery cables.



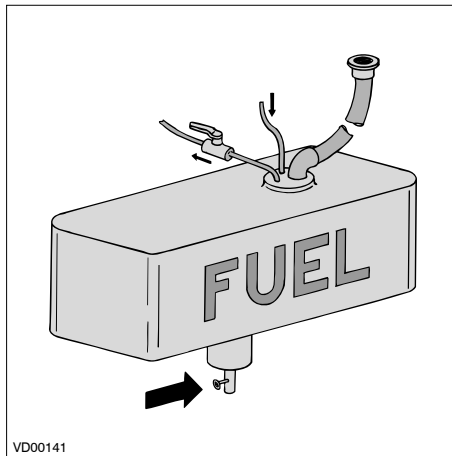
Charge batteries during winter lay-up regularly if required!

6 Recommissioning after winter storage

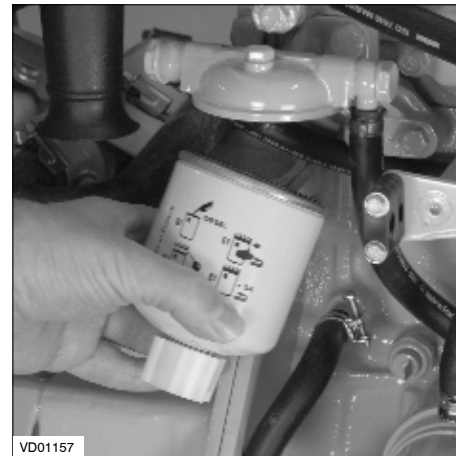


1 Fuel system

Drain the water from the water separator/
fuel filter. (page 35)



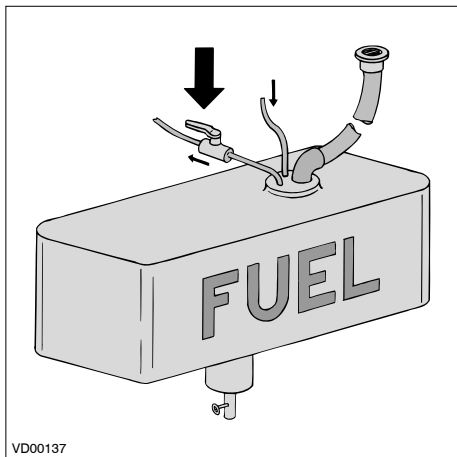
Drain the water from the fuel tank.



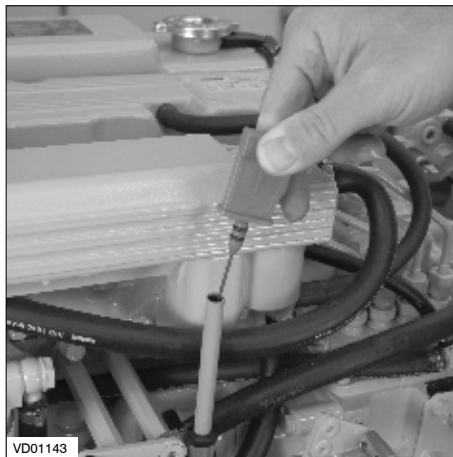
Install a new fuel filter. (page 48).



6 Recommissioning after winter storage

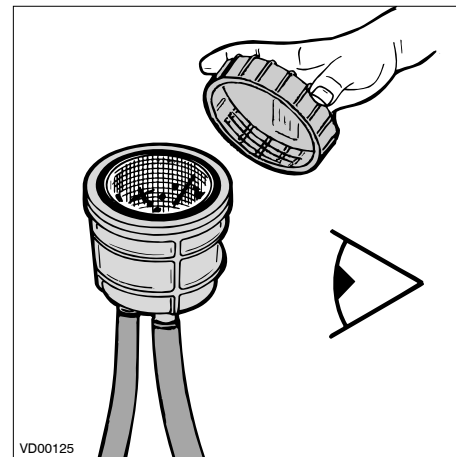


➞ Open the fuel valve.



2 Lubrication system

Check the engine oil level. (page 32)



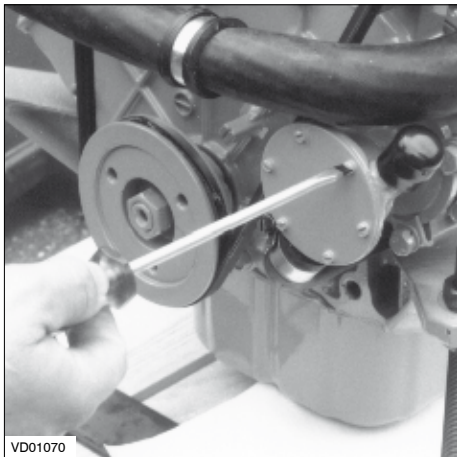
3 Raw water cooling system

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

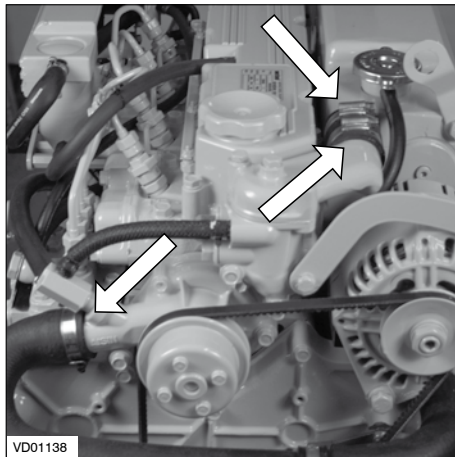


Only engines with intercooling!

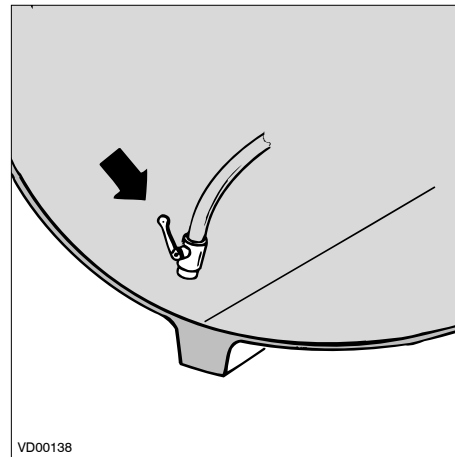
6 Recommissioning after winter storage



The lid of the raw water pump and drain plugs are reinstalled. (pages 52, 53)



Re-tighten possible loose hose clamps.



Open the sea cock.



NOTE

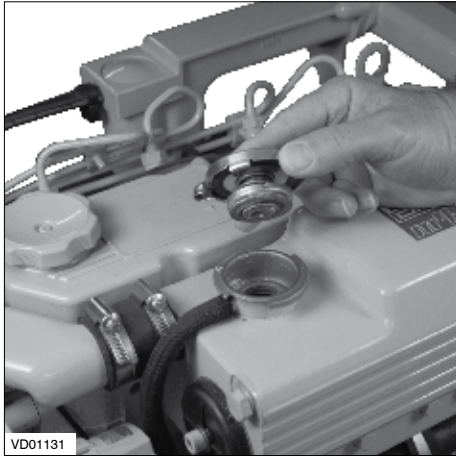
Only engines with intercooling!



NOTE

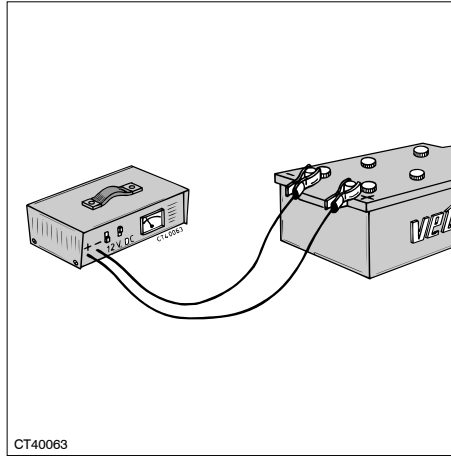
Only engines with intercooling!

6 Recommissioning after winter storage



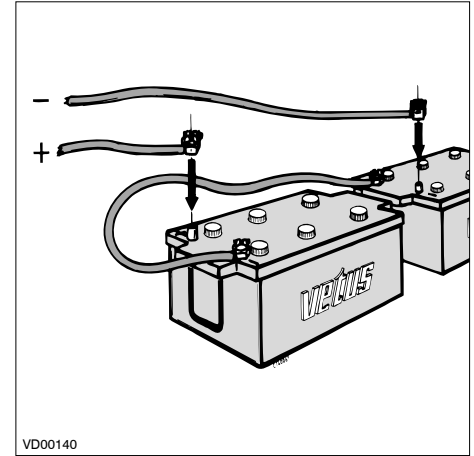
4 Fresh water cooling system

Check the coolant level. (page 38)



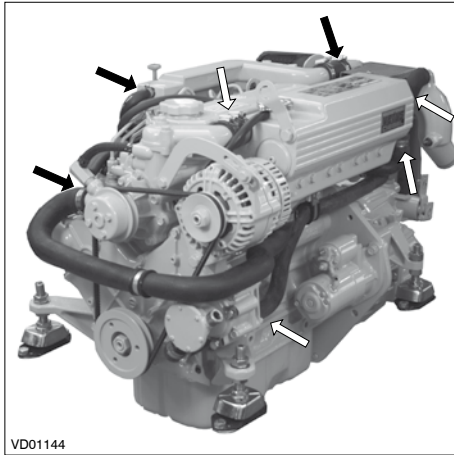
5 Electrical system

Make sure that the batteries are fully charged. (page 40, 66)



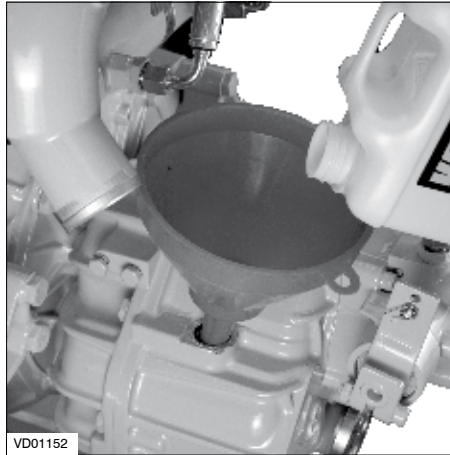
Connect the batteries.

6 Recommissioning after winter storage



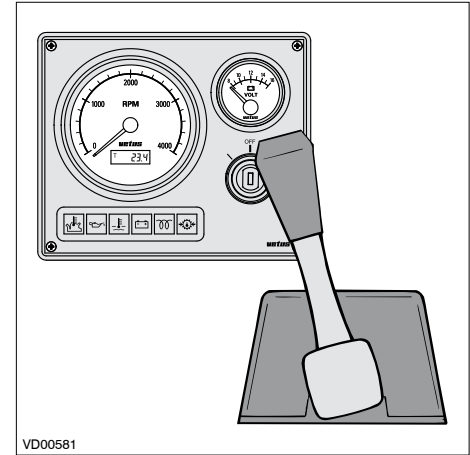
6 Check engine for leaks

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



7 Changing the gearbox oil

Stop the engine and change the oil of the gearbox. (page 43 and 44)



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.

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.



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!

7 Troubleshooting

Fault finding table

1 Engine will not crank

Possible fault	Remedy
Faulty or discharged battery.	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.
Faulty starter-switch or faulty starter-relay.	Check / replace.
Faulty starter-motor or pinion does not engage.	Check / replace starter-motor.
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
Seized components.	Repair.

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

Possible fault	Remedy
Fuel stop valve closed.	Open.
(Nearly) Empty fuel tank.	Refill.
Air in fuel system.	Check and bleed.
Fuel filter clogged with water and/or contamination.	Check or replace.
Leaking fuel supply line or fuel injection line.	Check / replace.
Faulty injector/injection pump..	Check, replace if required.
Vent line of fuel supply tank clogged.	Check / clean.
Exhaust restricted.	Check.
Electric fuel pump not working.	Check / clean.
Dirt in the inlet or outlet valves of the electric fuel pump.	Install a strainer in the fuel line between tank and engine.
Electric fuel pump filter blocked.	Check / clean.

7 Troubleshooting

Fault finding table

3 Engine cranks but will not start, smoke from exhaust

Possible fault	Remedy
Air in fuel system.	Check and bleed.
Faulty injector/injection pump.	Check, replace if required.
Setting of stop valve incorrect.	Check / adjust.
Faulty glow plugs.	Check / replace.
Incorrect valve clearance.	Adjust.
Incorrect injection timing after overhauling of engine.	Check / adjust.
Insufficient intake air.	Check.
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.

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

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

7 Troubleshooting

Fault finding table

5 Engine does not reach maximum rpm under load

Possible fault	Remedy
Air in fuel system.	Check and bleed.
Fuel filter clogged with water and/or contamination.	Check or replace.
Leaking fuel supply line or fuel injection line.	Check / replace.
Faulty injector/injection pump.	Check, replace if required.
Setting of stop valve incorrect.	Check / adjust.
Oil level too high.	Lower level.
Lubricating oil incorrect SAE spec or quality for ambient temperature.	Replace.
Incorrect valve clearance.	Adjust.
Exhaust restricted.	Check / clean.
Insufficient intake air.	Check.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Incorrect injector timing.	Check / adjust..
Leak in inlet manifold.	Check / replace.
Engine overloaded.	Check size of propeller.

6 Engine overheats

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

7 Troubleshooting

Fault finding table

7 Engine not firing on all cylinders

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

8 Engine has little or no oil pressure

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

7 Troubleshooting

Fault finding table

9 Engine oil consumption excessive

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

10 Fuel consumption excessive

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

7 Troubleshooting

Fault finding table

11 Blue exhaust smoke (idling)

Possible fault	Remedy
Oil level too high.	Lower level.
Excessive inclination of engine.	Check / Adjust.
Leaking turbo compressor oil seal.	Check / replace oil seal.

12 Black exhaust smoke (at load)

Possible fault	Remedy
Faulty turbo compressor.	Check / replace.
Insufficient intake air.	Check.
Leak in inlet manifold.	Check / replace.
Faulty injector / injection pump.	Check / replace if required.
Incorrect injector timing.	Check / adjust.
Incorrect valve clearance.	Adjust.
Excessive wear of cylinder / piston.	Check compression; refurbish engine.
Engine overloaded, max. rpm is not reached.	Check sizes of propeller.

7 Troubleshooting

Fault finding table

13 White exhaust smoke (at full load)

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

8 Technical data

Model	M4.55
General	
Make	: Vetus Mitsubishi
Number of cylinders	: 4
Based on	: S4L2-T
Type	: 4-stroke diesel, in-line
Injection	: Indirect
Aspiration	: Turbo-charged
Bore	: 78 mm
Stroke	: 92 mm
Total displacement	: 1758 cm ³ (107 cu.inch)
Compression ratio	: 22 : 1
Idling speed	: 900 rpm
Max. no. of revolutions at no load	: 3350 rpm
Valve Clearances (cold)	: Inlet 0.25 mm (0.010") Exhaust 0.25 mm (0.010")
Weight (with standard gearbox)	: 192 kg (423 lbs)
Engine installation	
Max. installation angle	: 15 degrees backwards
Max. athwartships angle	: 25 degrees continuously, 30 degrees intermittent

Engine specifications

Maximum Output	
at the flywheel (ISO 3046-1)	: 38.3 kW (52 hp)
at the prop shaft (ISO 3046-1)	: 37.1 kW (50.4 hp)
at no. of revolutions of	: 3000 rpm
Torque,	: 127 Nm (13 kgm, 93.7 ft.lb)
at no. of revolutions	: 3000 rpm
Fuel consumption	: 244 g/kW.h (179 g/hp.h) (8.6 oz/hp.h)
at no. of revolutions	: 1800 rpm
Fuel System (Self-bleeding)	
Injection pump	: Bosch model M (Nippon Denso)
Injectors	: Plug injector
Opening pressure	: 140 bar (kgf/cm ³) (2030 psi)
Firing order	: 1- 3 - 4 - 2
Injection timing	: 14° 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.

8 Technical data

Oil lubrication system

Oil capacity, max.	
without oil filter	: 5.5 litres (1 gal - 1.7 pt, UK) (1 gal - 3.6 pt, US)
with oil filter	: 6.0 litres (1 gal - 2.6 pt UK) (1 gal - 4.7pt US)
Oil Filter	: STM0051
Oil temperature in sump	: max. 130°C (266°F)

Cooling system

Capacity,	
Intercooler version	: 6.5 litres (1 gal - 3.4 pt UK) (1 gal - 5.7 pt US)
Keel cooler version, engine only	: 7.2 litres (1 gal - 4.7 pt UK) (1 gal - 7.2 pt US)
Thermostat	: opening at 71°C±1.5°C (160°F±3°F), : fully opened at 84°C (183°F)
Coolant pump,	
Flow at max. engine rpm	: 50 l/min (11 UK Gal/min, 13.2 US Gal/min)
Total head keelcooler at max. flow	: 2 m Water (6' 7")
Inlet connection for hose keelcooler	: 28 mm (1 1/8") I.D.
Raw water pump,	
Flow at max. engine rpm	: 45 l/min (9.8 UKGal/min, 11.9 US Gal/min)
Total head at max. flow	: 2 m Water (6' 7")
Impeller	: STM7463
Inlet connection for hose	: 20 mm (3/4") I.D.
Heater supply connection	: 15 mm (5/8")
Heater return connection	: 15 mm (5/8")

Engine specifications

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, 110 Amp
2 nd alternator:	
Intercooler version	: 14 Volt, 95 Amp
Keel cooler version	: 14 Volt, 110 Amp
Startmotor	: 14 Volt, 1.7 kW Fuse 'ATO'10 Amp
Capacity, starter battery	: min. 55 Ah, max. 108 Ah
Protection	: Fuse 'ATO'10 Amp

V-belt

Alternator and coolant pump	: STM7643
2 nd alternator:	
Intercooler version	: STM9857
Keel cooler version	: STM9858

Gearbox

		Gear ratio
Technodrive:	type TM345	: 1.54 / 2.0 / 2.47 : 1
	type TM345A	: 1.54 / 2.0 / 2.47 : 1
	type TMC60(E,M)	: 1.5 / 2.0 / 2.45 : 1
ZF Hurth:	type ZF25	: 1.97 / 2.8 : 1
	type ZF25A	: 1.55 / 1.93 / 2.29 / 2.71 : 1
Technodrive:	type TMC40	: 2.05 / 2.60 : 1

8 Technical data

Torque wrench settings

Screw connection	Wrench		Size	Torque		
	Diameter	Pitch		Nm	(kgm)	(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)

9 Operating media

Fuel

Fuel Quality Grade

Use commercially available diesel fuel with less than 0.5% sulfur 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.

Biodiesel



CAUTION

Only use the prescribed diesel fuel.

Do not use biodiesel!

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).

9 Operating media

Lubricating oil

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).

Acceptable API oils : CF, CF-4, CI-4

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. The recommended oil viscosity is shown in the overview below:

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 15W-40 all-season motor oil.

For example:

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

For oil capacity see p. 81.

Recommended lubricating oil viscosity

Starting temperature °C (deg F)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)
Lubricating oil viscosity				SAE30				
					SAE40			
			SAE15W-40					
		SAE10W30						
	SAE5W-20							

9 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 number _l (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	% weighth	ASTM: D 893	0.5 max.
Coagulated pentane insolubles	% weight		3.0 max.

9 Operating media

Lubricating oil

Gearbox Lubricating Oil

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

Technodrive:

- type TM345 : 1.6 litres, Motorolie SAE 20W40-CD
(2.8 UK pt, 3.4 US pt)
- type TM345A : 1.6 litres, Motorolie SAE 20W40-CD
(2.8 UK pt, 3.4 US pt)
- type TMC60 : 0.8 litres, Motorolie SAE 20/30
(1.4 UK pt, 1.7 US pt)
- type TMC60E : 0.8 litres ATF*)
- type TMC60M : 0.8 litres ATF*)

ZF Hurth:

- type ZF25 : 2.5 litres ATF*) (4.4 UK pt, 5.3 US pt)
- type ZF25A : 1.8 litres ATF*) (3.2 UK pt, 3.8 US pt)

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

For example : Vetus Marine Gearbox Oil
Shell Donax T6
Gulf Dextron

Other brands of gearboxes:

See supplied owners manual for oil type and quantities.

9 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.

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.



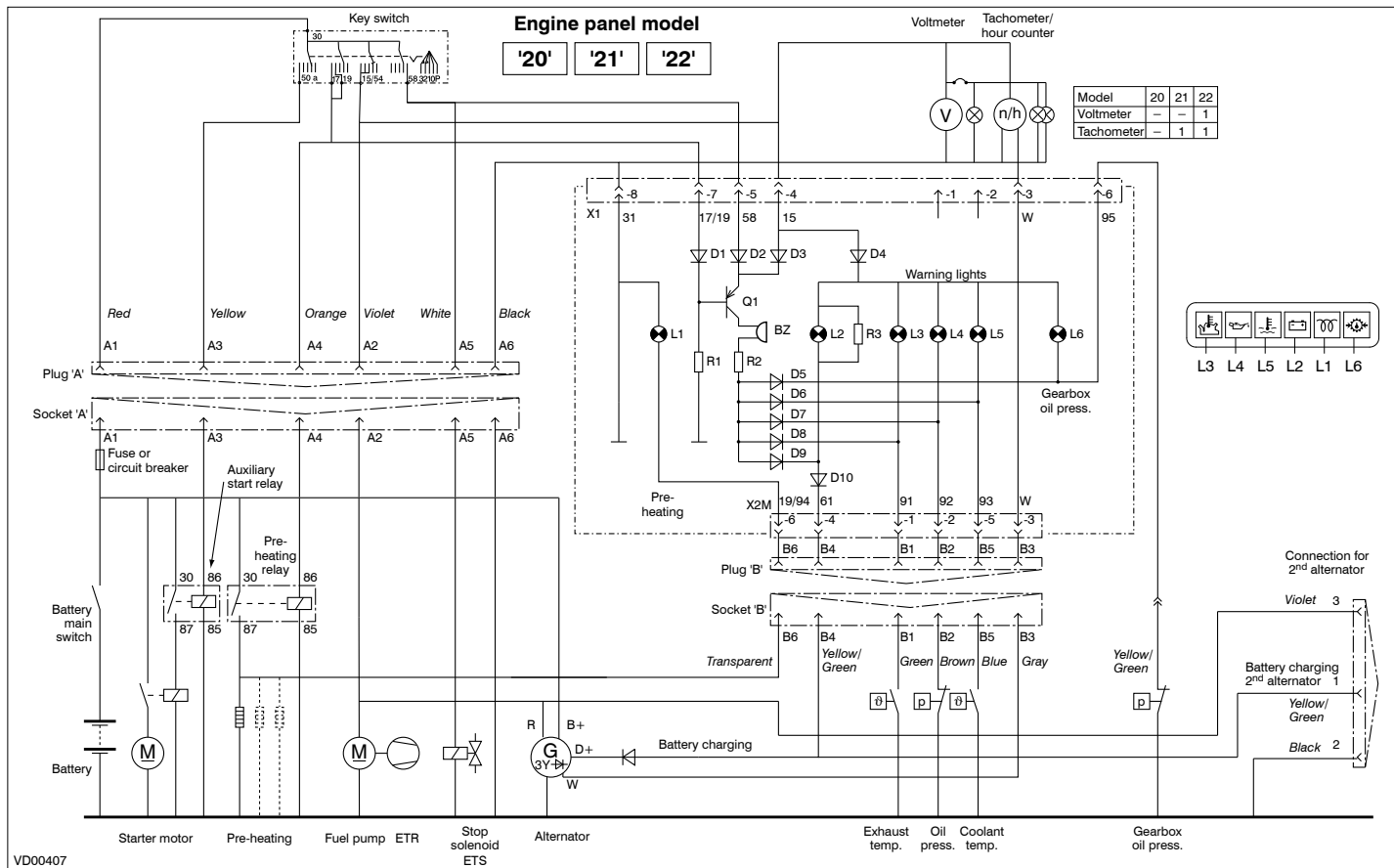
WARNING



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

10 Wiring diagram

Engine with panel model '20', '21', '22' engine with intercooling

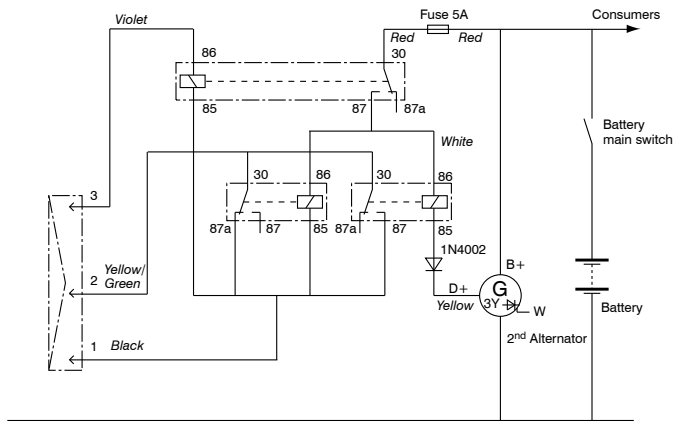


VD00407

10 Wiring diagram

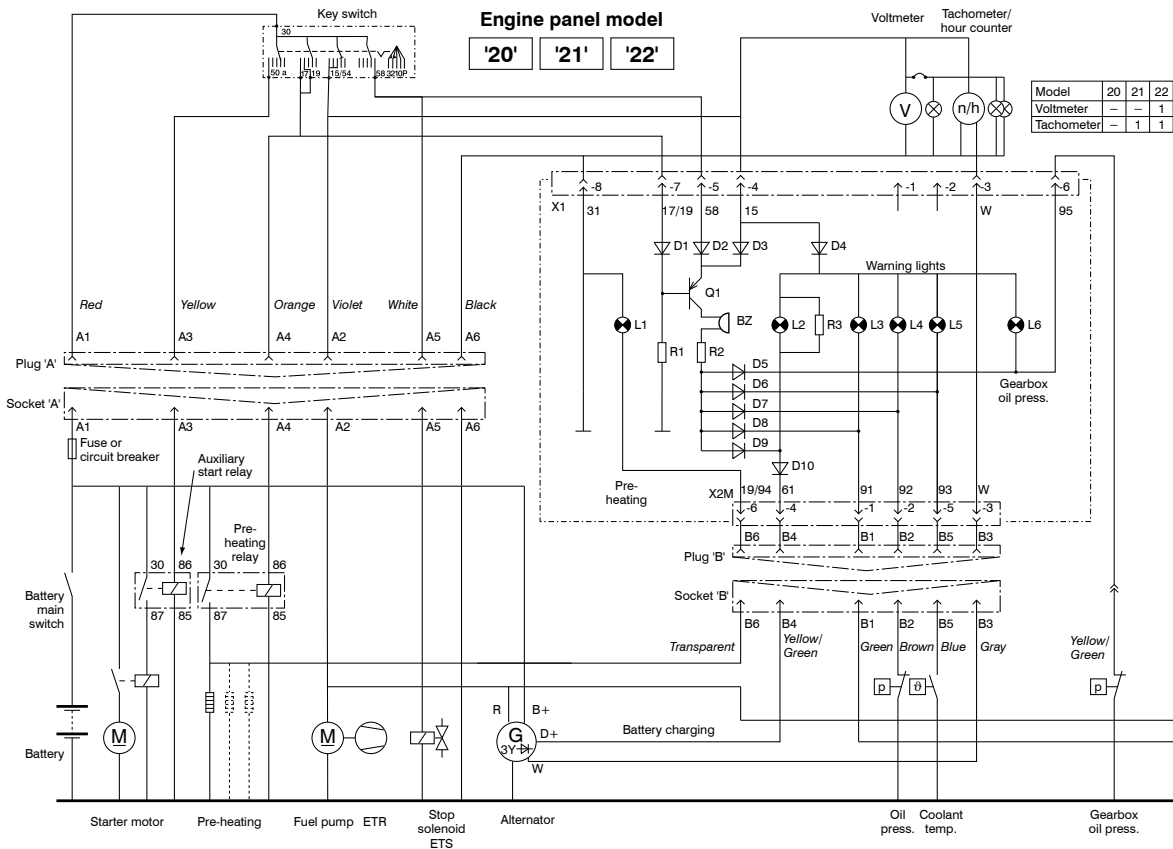
Options, 2nd alternator engine with intercooling

2nd Alternator



10 Wiring diagram

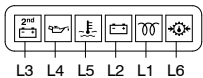
Engine with panel model '20', '21', '22' engine with keel cooling



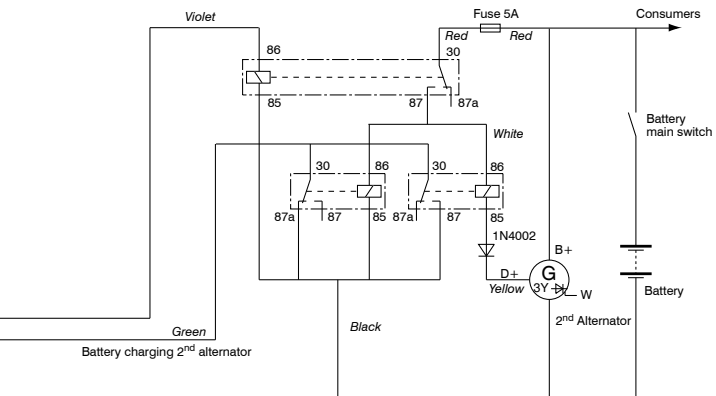
VD00651

10 Wiring diagram

Engine with panel model '20', '21', '22'
engine with keel cooling

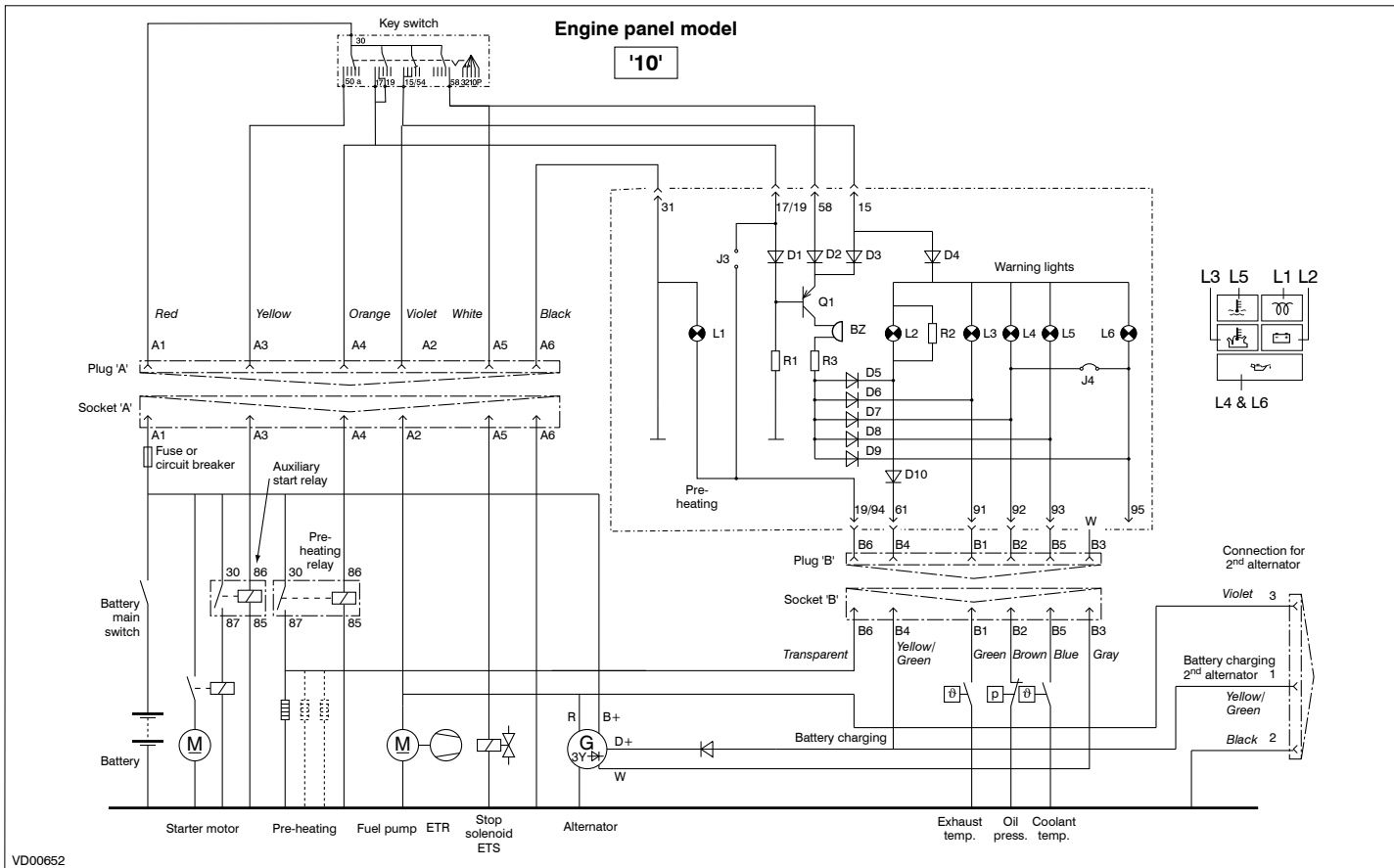


2nd Alternator



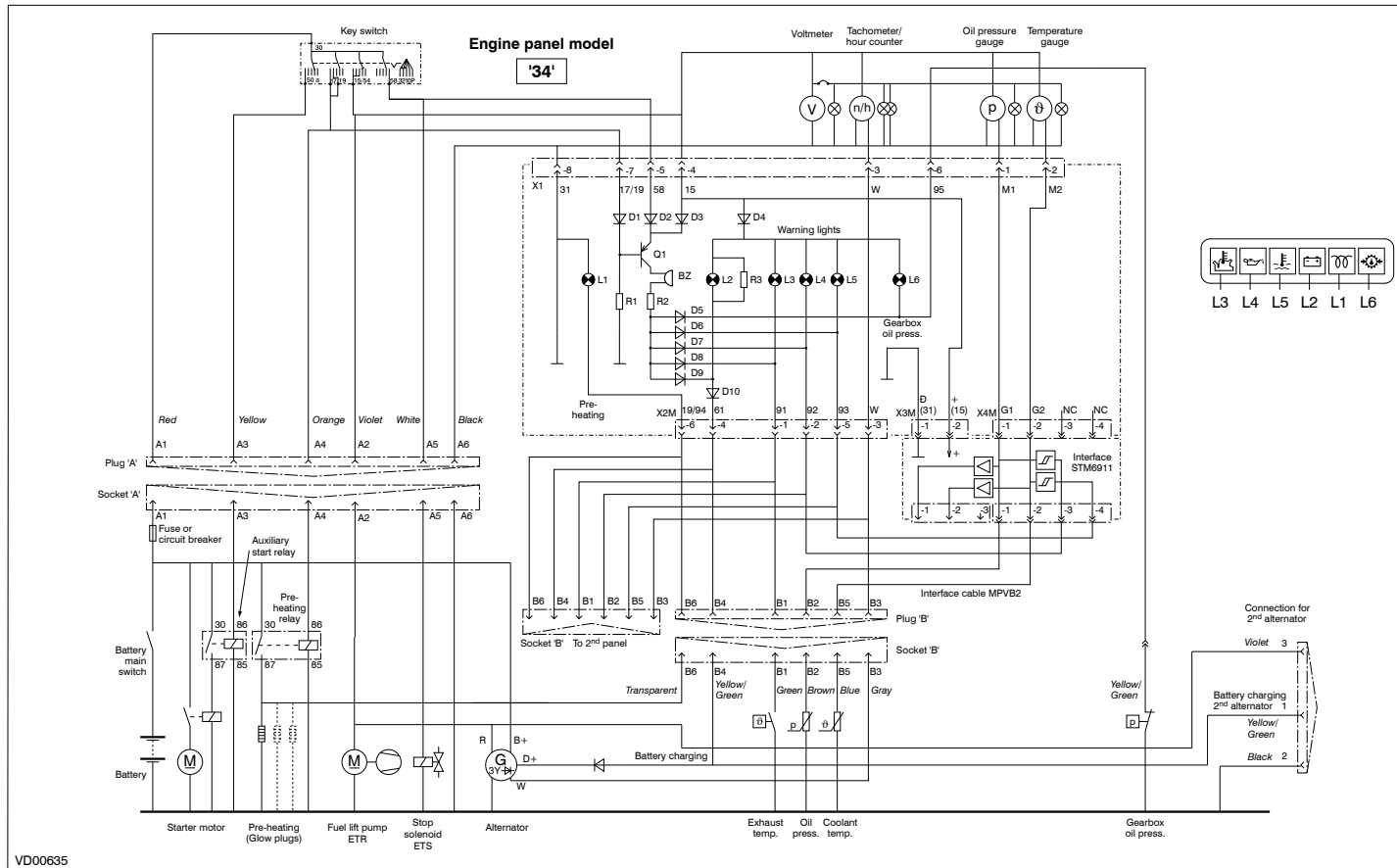
10 Wiring diagram

Options, panel model '10' engine with intercooling



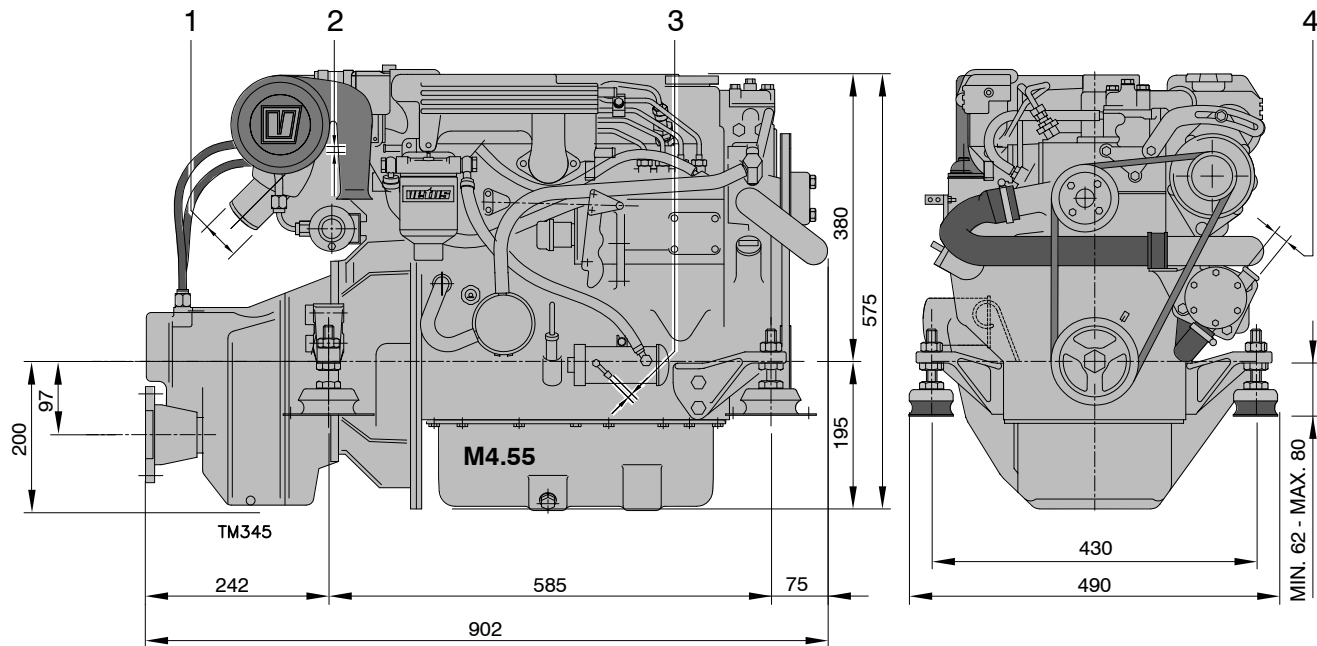
10 Wiring diagram

Options, panel model '34' engine with intercooling



VD00635

11 Overall dimensions



M4.55

VD00649

- 1 Exhaust \varnothing 40 mm
- 2 Fuel return \varnothing 8 mm
- 3 Fuel supply \varnothing 8 mm
- 4 Sea water intake \varnothing 20 mm

1:10

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Manuals

Art. code	Description	
340401.01	Bedieningshandleiding M4.55	(Nederlands)
340402.01	Operation manual M4.55	(English)
340403.01	Bedienungsanleitung M4.55	(Deutsch)
340404.01	Manuel d'utilisation M4.55	(Français)
340405.01	Manual de operacion M4.55	(Español)
340406.01	Istruzioni per l'uso M4.55	(Italiano)
340407.01	Brugsanvisning M4.55	(Dansk)
340408.01	Användarmanual M4.55	(Svenska)
340409.01	Bruksanvisning M4.55	(Norsk)
340410.01	Käyttöopas M4.55	(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 Service- og garantibog / Service- och garantihäfte Service- og garantibok / Huolto- ja takuukirja	(Nederlands / English / Deutsch / Français / Español / Italiano / Dansk / Svenska / Norsk / Suomeksi)
341831.01	Onderdelenboek / Parts manual M4.55	(Nederlands / English)
342402.01	Service manual M4.55	(English)
342404.01	Service manual M4.55	(French)



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