DT4.70 DTA4.85

Operation manual

Operation manual

DT4.70
DTA4.85

Serial numbers

Engine serial number Vetus: .....

Mitsubishi: .....

Gearbox serial number: .....

Please enter the serial numbers here.
These numbers should be quoted when inquiring about Customer Service, Repairs or Spare Parts (see page 6).

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

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

Make sure that the manual will remain intact and damage is prevented. Keep the manual away from humidity and heat.
Do not alter the content of the manual.

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

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 not assume responsibility for any damage resulting there from. 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 who are familiar with the former and the hazards involved.

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

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

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

Inhoud

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

 **DANGER**

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

 **WARNING**

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

 CAUTION

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

 **NOTE**

Emphasises important procedures, circumstances etc.

Symbols

 Indicates that the relevant procedure must be carried out.

 Indicates that a particular action is forbidden.

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

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

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 countermeasures 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.

- The moving parts of the engine are dangerous. Never touch moving parts of the engine while it is running, to prevent cuts and other injuries.

- Stop the engine before carrying out maintenance!

- Always stop the engine before topping up or replacing fuel, oil or coolant.

- Before carrying out inspection or maintenance, the ignition key must be removed and the main battery switch turned off.

- Satisfy yourself that everything is in order before the engine is started again! Make sure that no-one is working on or close to the engine before you start it. Remove all foreign objects from around the engine, such as litter, oil, tools and other components that are not part of the engine.

- Install all protective covers! To prevent injury, make sure that all protective covers and cover plates are replaced over moving parts.

- Remove any tool used to bar the engine. If you leave this in position, serious injury or damage to the equipment can be the result.

- NEVER open the cap of the expansion tank when the engine is at working temperature.

- Only check the level of the coolant after the engine has been stopped and the cap of the expansion tank is cool enough to remove with bare hands.

- 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.

- **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 drive belt has broken:**
  Stop the engine immediately. If an engine is running with a broken drive belt this can result in the engine overheating and in turn to coolant squirting out of the expansion tank.

- **If the engine behaves strangely:**
  Stop the engine or reduce the speed as far as possible.
  Do not use the engine again until the cause of the defect has been solved.

2 Introduction

Dear customer,

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

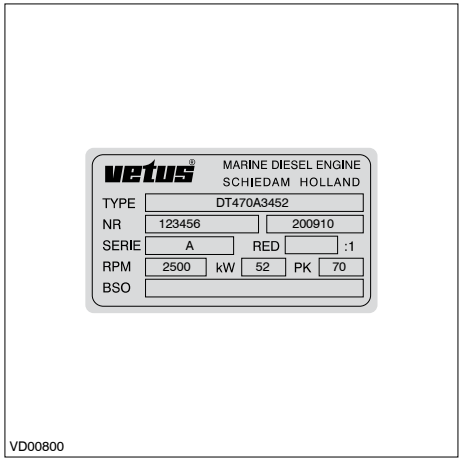
Your engine is appropriately equipped for your vessel, which means that not necessarily all components described in this manual are mounted to your engine.

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

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

We are available to help with any additional inquiries.

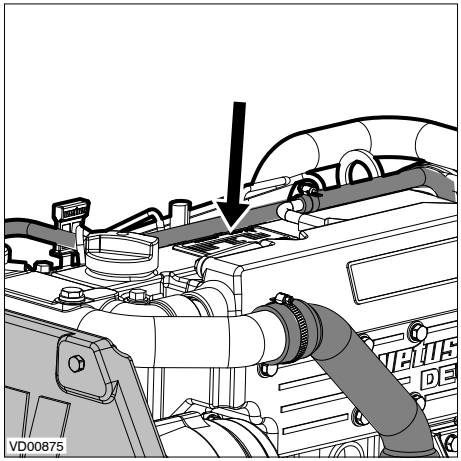
Sincerely, Vetus n.v.



1 Type plate

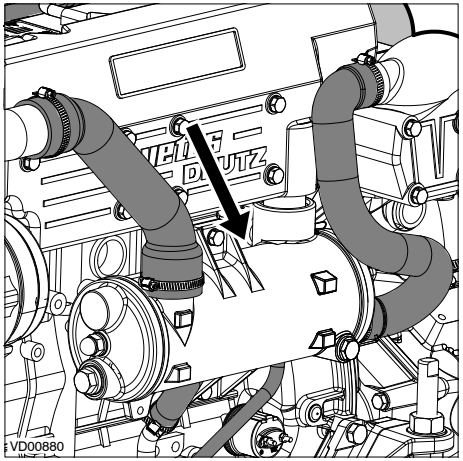
The engine type and the serial number are on the type plate.

The engine type and serial number must be quoted when ordering spare parts.



2 Position of the type plate

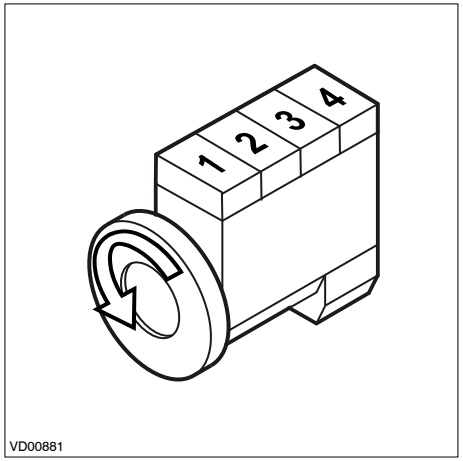
The type plate is positioned as shown.



3 Serial number

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

2 Introduction

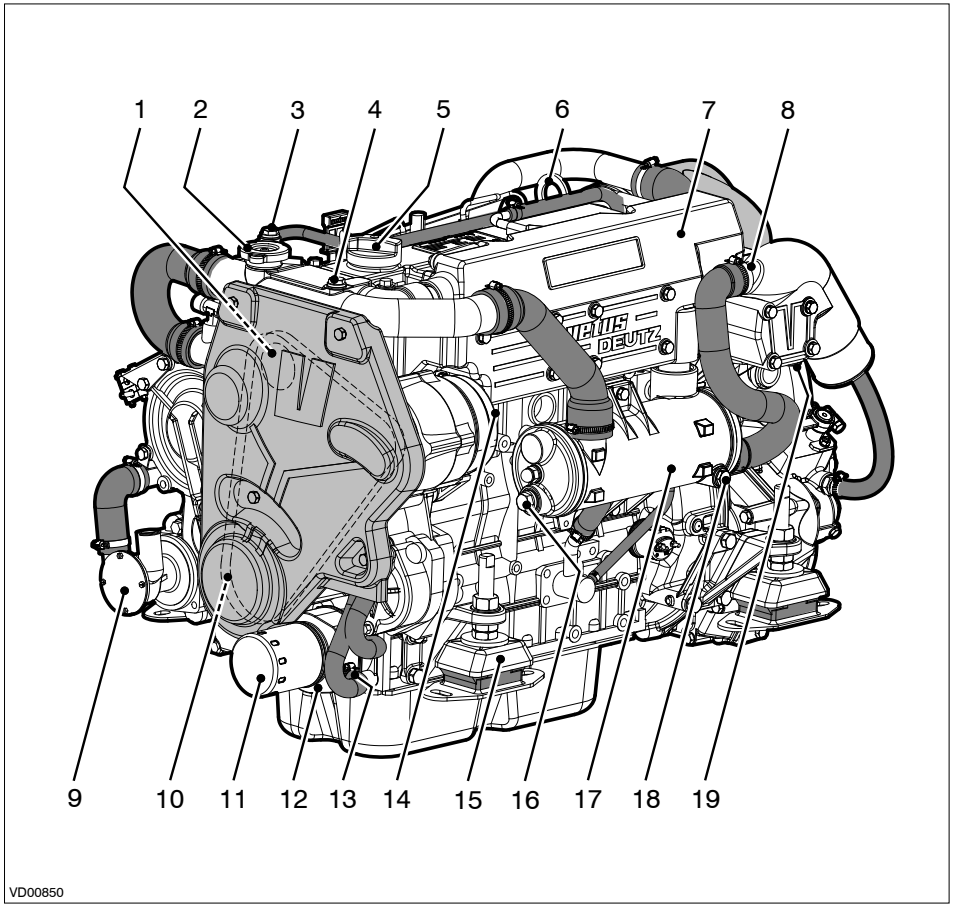


4 Cylinder numbering direction of rotation

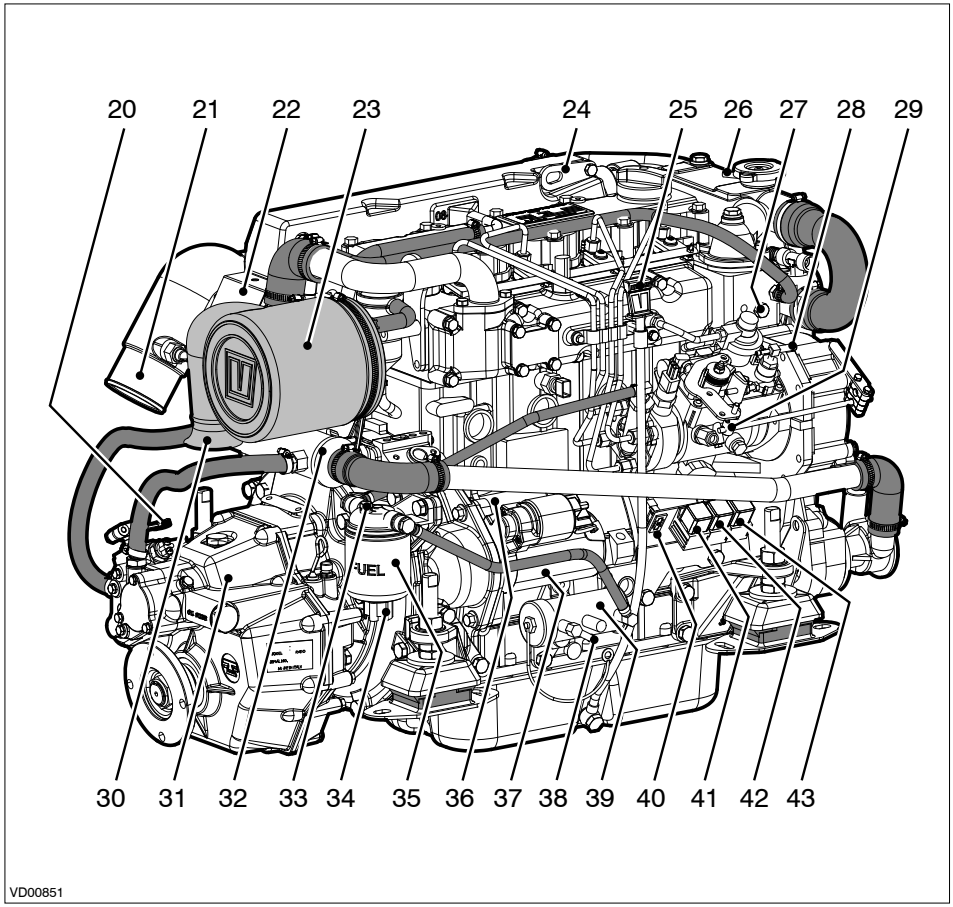
Cylinder numbering
Cylinders are numbered consecutively, beginning at the flywheel end.

Direction of rotation
The direction of rotation is viewed towards the flywheel counter clockwise.

1 Coolant pump
2 Filler cap (pressure cap) cooling system
3 Cooling system air bleeding nipple
4 Connection water heater 'IN'
5 Oil filler cap
6 Lift eye
7 Expansion tank
8 Connection airvent
9 Raw water pump, inlet ø 28 mm
10 V-belt
11 Oil filter
12 Engine oil cooler
13 Cooling system drain plug, engine block
14 Alternator
15 Flexible engine mount
16 Zinc anode
17 Heat exchanger
18 Cooling system drain plug, heat exchanger
19 Connection for prop shaft lubrication G 3/8
20 Connection of push-pull cable gear-box
21 Exhaust injection bend ø 75 mm



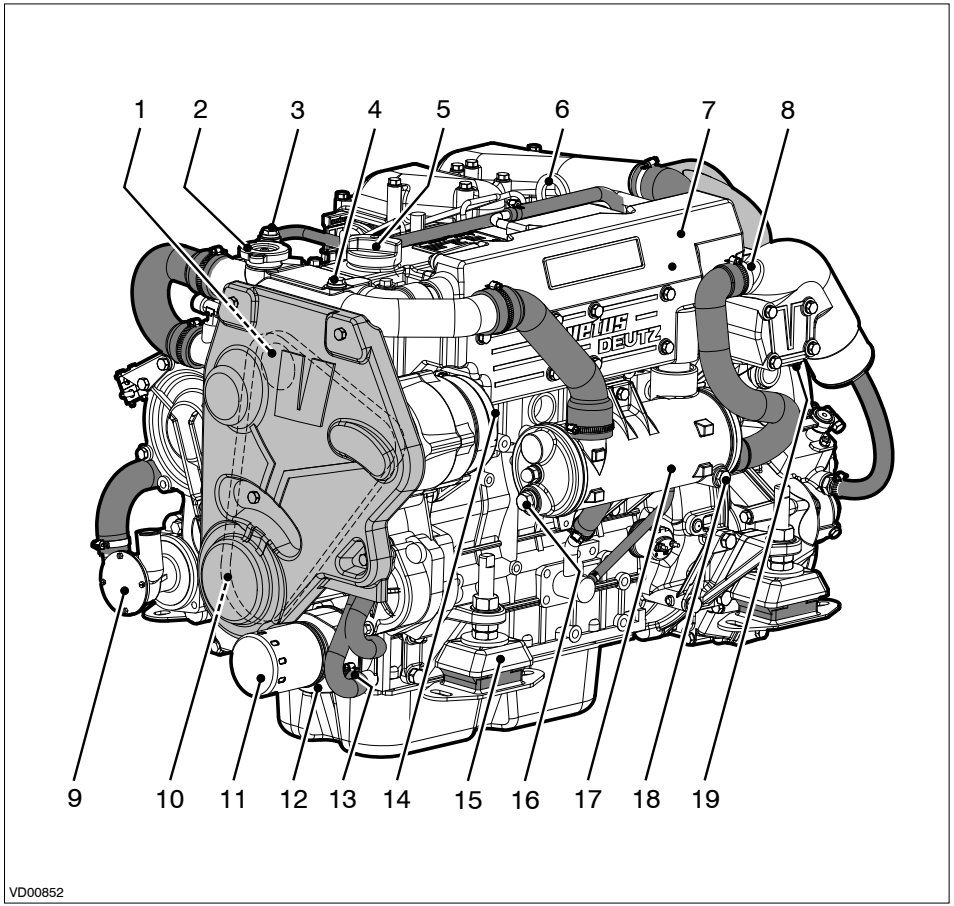
Identification of engine parts DT4.70



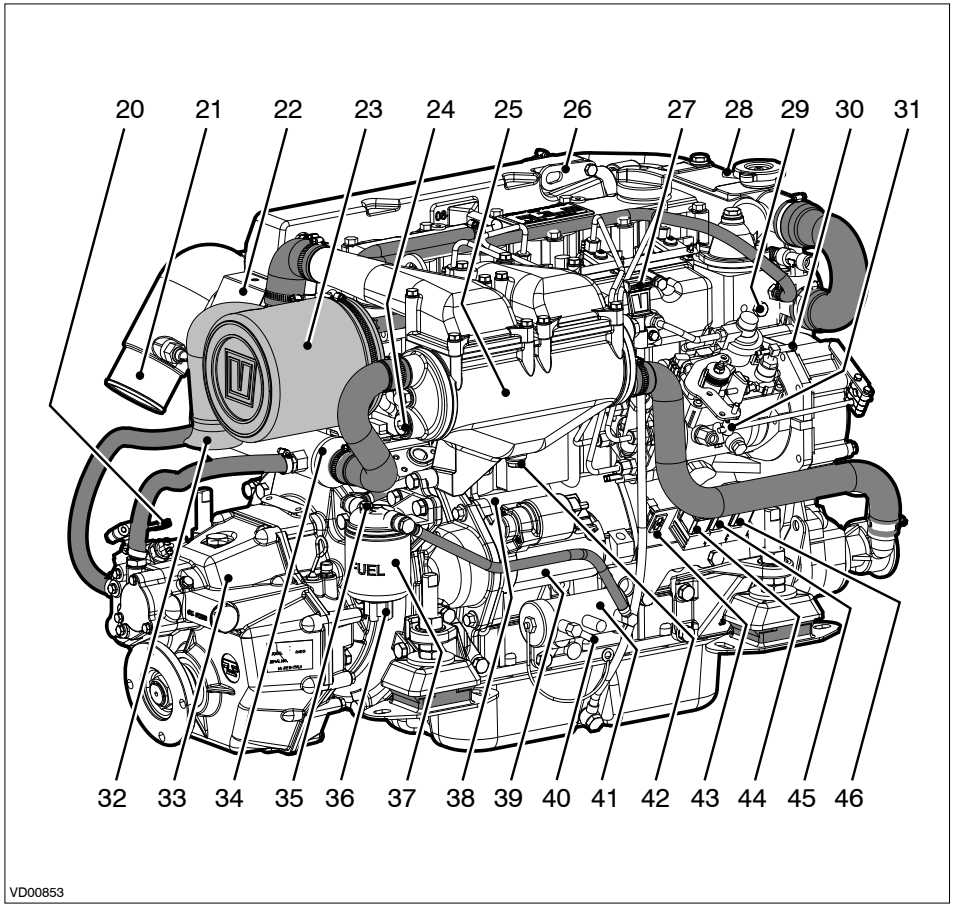
22 Turbocharger
23 Air filter
24 Lift eye
25 Oil dipstick
26 Extra expansion tank connection (only for keel cooling option)
27 Connection water heater 'OUT'
28 Return fuel pipe connection 8 mm
29 Push-pull throttle cable connection
30 Air inlet
31 Gearbox
32 Oil cooler, gearbox
33 Water separator/fuel filter bleed nipple
34 Drain plug for water separator/fuel filter
35 Water separator/fuel filter
36 Counter plug electrical system
37 Starter motor
38 Fuel supply pipe connection 8 mm
39 Fuel lift pump
40 Fuse
41 Stop relay
42 Auxiliary relay
43 Glow relay

Identification of engine parts DTA4.85

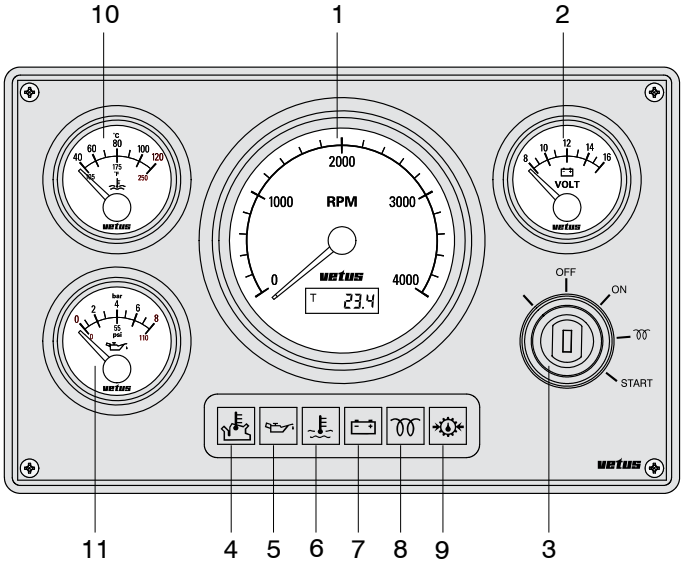
1 Coolant pump
2 Filler cap (pressure cap) cooling system
3 Cooling system air bleeding nipple
4 Connection water heater 'IN'
5 Oil filler cap
6 Lift eye
7 Expansion tank
8 Connection airvent
9 Raw water pump, inlet ø 28 mm
10 V-belt
11 Oil filter
12 Engine oil cooler
13 Cooling system drain plug, engine block
14 Alternator
15 Flexible engine mount
16 Zinc anode
17 Heat exchanger
18 Cooling system drain plug, heat exchanger
19 Connection for prop shaft lubrication G 3/8
20 Connection of push-pull cable gear-box
21 Exhaust injection bend ø 75 mm
22 Turbocharger
23 Air filter



Identification of engine parts DTA4.85



24 Zinc anode
25 After cooler
26 Lift eye
27 Oil dipstick
28 Extra expansion tank connection (only for keel cooling option)
29 Connection water heater 'OUT'
30 Return fuel pipe connection 8 mm
31 Push-pull throttle cable connection
32 Air inlet
33 Gearbox
34 Oil cooler, gearbox
35 Water separator/fuel filter bleed nipple
36 Drain plug for water separator/fuel filter
37 Water separator/fuel filter
38 Counter plug electrical system
39 Starter motor
40 Fuel supply pipe connection 8 mm
41 Fuel lift pump
42 Drain plug after cooler
43 Fuse
44 Stop relay
45 Auxiliary relay
46 Glow relay

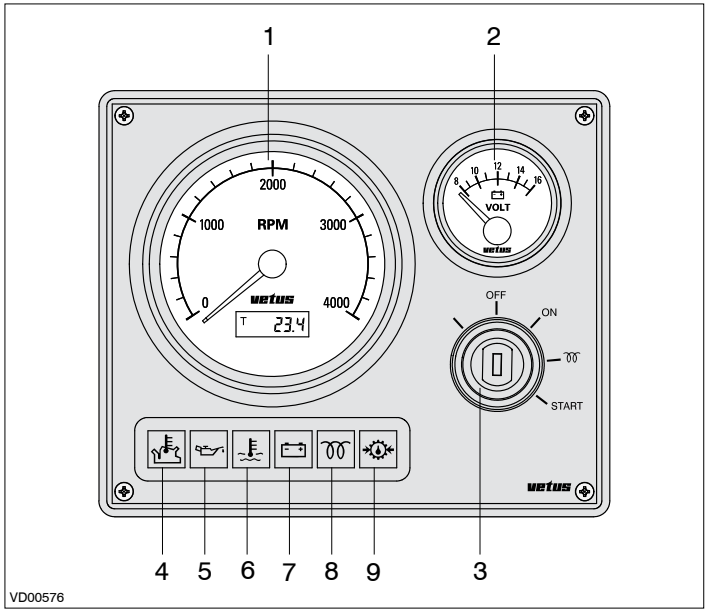


VD00631

Panel, model 34

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
7 Warning light battery charging
8 Indicator light pre-heating
9 Warning light gearbox low oil pressure [1]
10 Temperature gauge, coolant
11 Oil pressure gauge

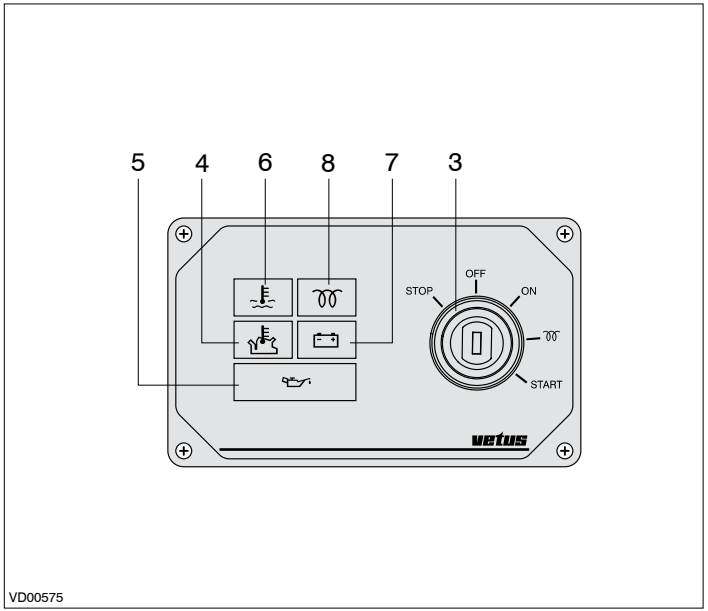
[1] This is an option, not fitted as standard.



Panel, model 22

Panel, without voltmeter, model 21

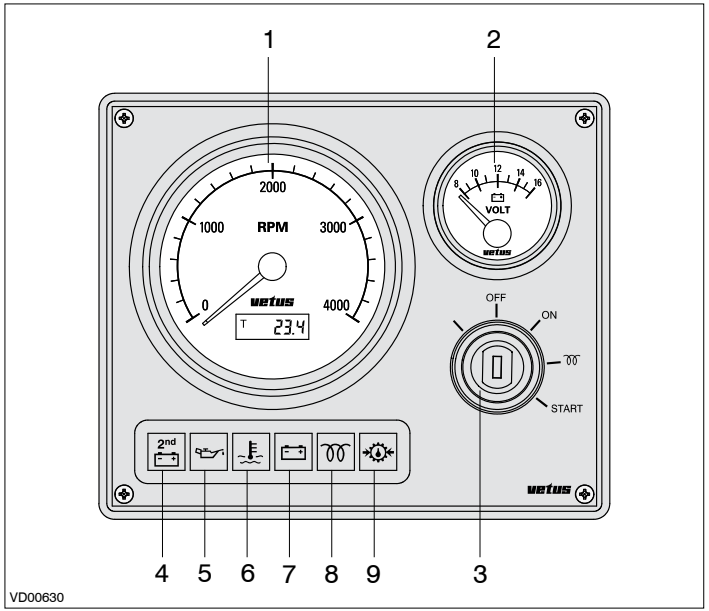
1 Tachometer/Operating hours counter
2 Voltmeter
3 Starter pre-heat switch/lock
4 Warning light high raw water temperature
5 Warning light low oil pressure
6 Warning light high coolant temperature
7 Warning light battery charging



Panel, model 10

8 Indicator light pre-heating
9 Warning light gearbox low oil pressure [1]

[1] This is an option, not fitted as standard.

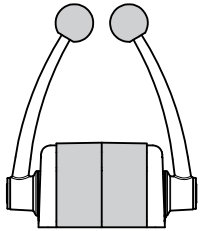


Panel, model 22

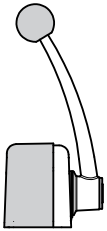
Panel, without voltmeter, model 21

1 Tachometer/Operating hours counter
2 Voltmeter
3 Starter pre-heat switch/lock
4 Warning light second alternator
5 Warning light low oil pressure
6 Warning light high coolant temperature
7 Warning light battery charging
8 Indicator light pre-heating
9 Warning light gearbox low oil pressure [1]

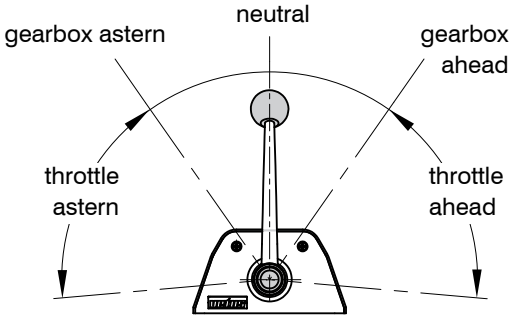
[1] This is an option, not fitted as standard.



Operating lever for 2 engines



Operating lever for 1 engine



VD00788

5 Operating lever

Operating lever for 1 or 2 engines.

The control lever works as shown in the diagram.

Starting from neutral put the engine in ahead or astern by moving the lever 35° forwards or backwards.
The throttle lever operates at an angle of 60° forwards and 60° reverse.

3 First commissioning

Engine Oil

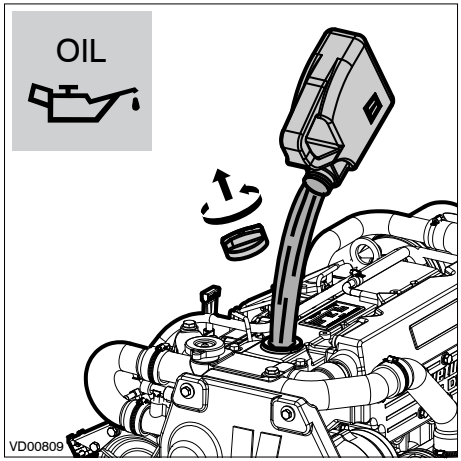
6 litres 15 W40 or 10W40
(10.6 UK pt, 12.7 US pt)

API: CH-4 / CG-4 / CI-4
ACEA: E3-96 / E4-07 / E5-02 / E7-04

For example:
- Vetus Marine Diesel Engine Oil 15W40
- Shell Rimula R4 L 15W40

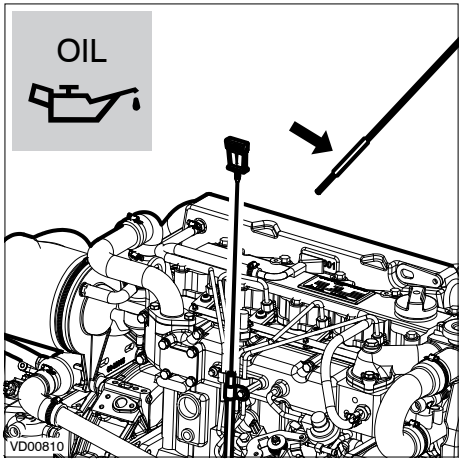
1 Commissioning the engine

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 124.



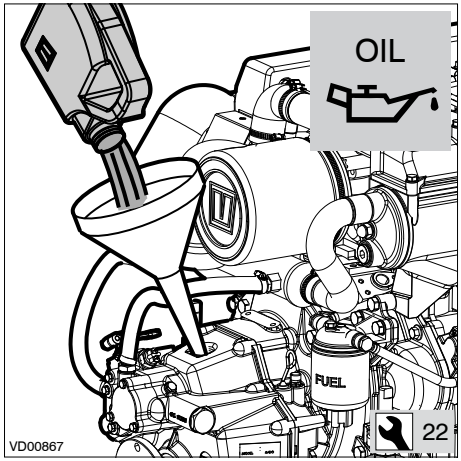
Check the oil level with the dipstick, see page 46.

3 First commissioning

Vetus engines are normally equipped with Technodrive or ZF-Hurth gearboxes.
In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owner's manual.

3 Filling gearbox with oil

Fill the gearbox with oil.
Check the oil level with the dipstick, see page 52.

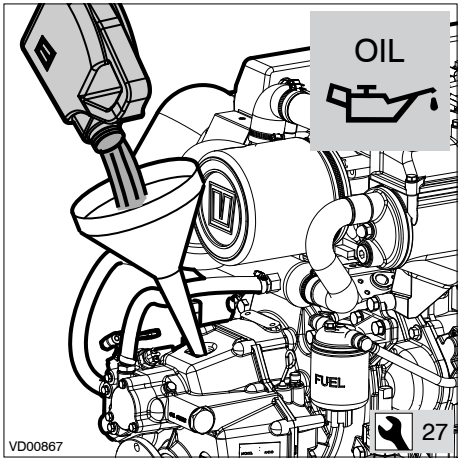


Technodrive:

type TM345 : 1.6 litres [1] Engine oil (2.8 UK pt, 3.4 US pt)
type TM345A : 1.6 litres [1] Engine oil (2.8 UK pt, 3.4 US pt)

Engine oil SAE 20W40-CD

[1] Without oil cooler, content oil cooler approx. ca. 0.3 litres (0.5 UK pt, 0.6 US pt)



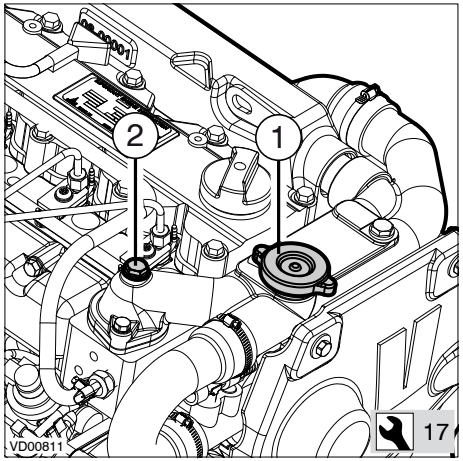
ZF Hurth:

type ZF25 : 2.5 litres [1] ATF (4.4 UK pt, 5.3 US pt)
type ZF25A : 1.8 litres [1] ATF (3.2 UK pt, 3.8 US pt)

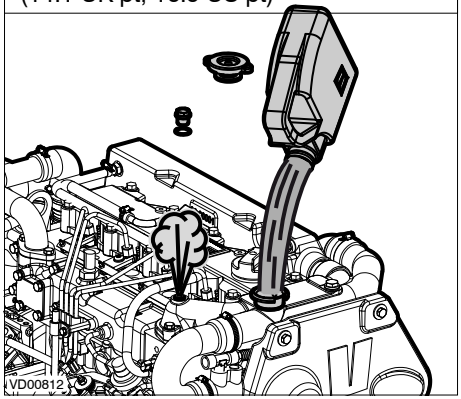
ATF :Automatic Transmission Fluid;
Transmissie olie type A, Suffix A.

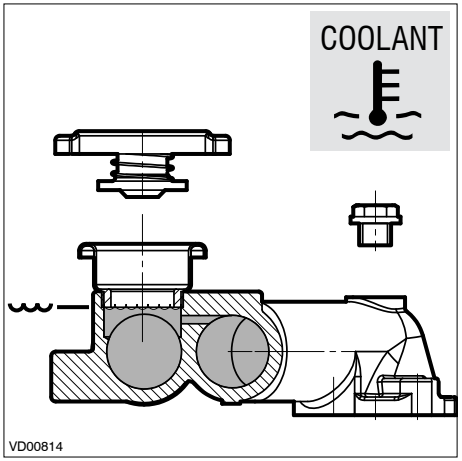
[1] Without oil cooler, content oil cooler approx. ca. 0.3 litres (0.5 UK pt, 0.6 US pt)

3 First commissioning



COOLANT QUANTITY: 8 litres
(14.1 UK pt, 16.9 US pt)





4 Filling the cooling system, INTERCOOLING

- Remove the filler / pressure cap (1) of the filler neck on the top of the heat exchanger housing.

- Remove the plug (2) from the upper side of the thermostat cover, so that air can escape from the cooling system.

NOTE

If a water heater is connected to the engine, see page 24 and 25.

- 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 127.

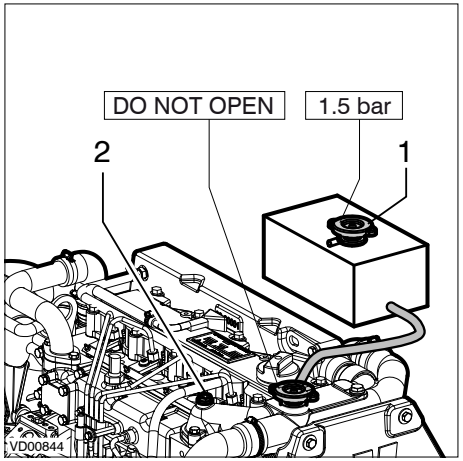
CAUTION

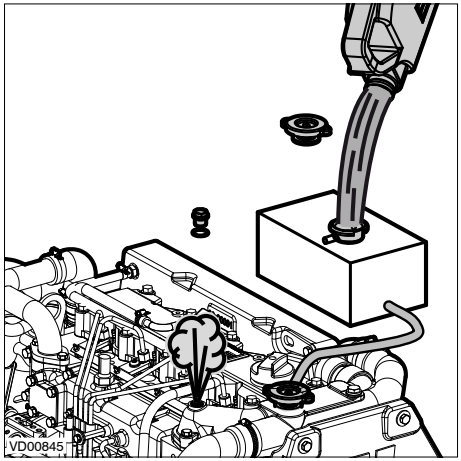
Never fill the cooling system with sea water or brackish water.

The level of the coolant must be at the lower edge of the filler neck.

- After filling replace the filler cap (1) and reinstall the plug (2).

3 First commissioning





5 Filling the cooling system, KEELCOOLING

- Remove the cap (1) of the extra expansion tank.
- Remove the plug (2) from the upper side of the thermostat cover, so that air can escape from the cooling system.

NOTE

If a water heater is connected to the engine, see page 26 and 27.

- Fill the cooling system.

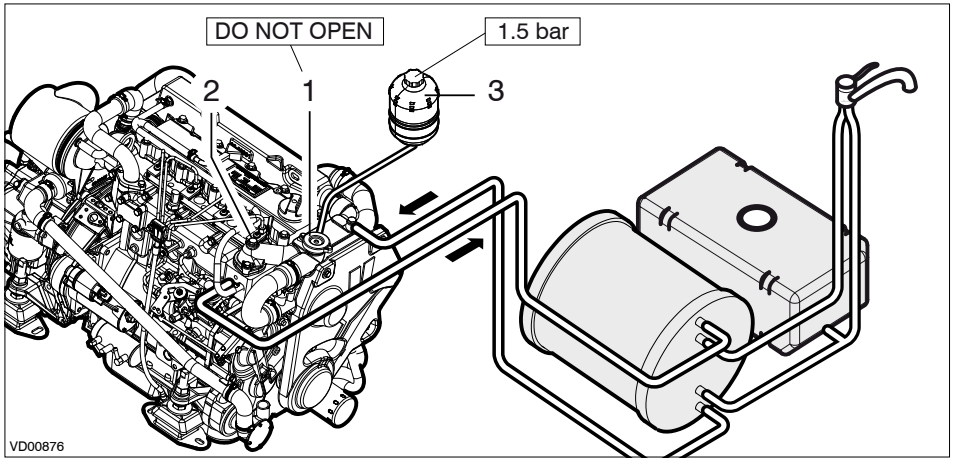
Use a mixture of 40% antifreeze (ethylene glycol based) and 60% tap water or use a special coolant.

For specifications see page 127.

CAUTION

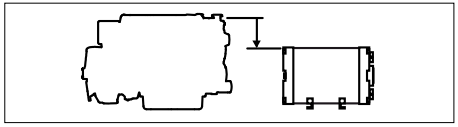
Never fill the cooling system with sea water or brackish water.

- Reinstall the plug (2) after the system has been bled and the coolant is flowing out of the bleeder hole.
- Top up the expansion tank to the minimum level.
- Replace the filler cap (1).



6 Filling coolant system, INTERCOOLING, if a water heater is connected (1)

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.

- Remove the 'DO NOT OPEN' cap (1) and fill the cooling system via the filler neck.
- Unscrew plug (2), on top of the lid of the thermostat housing, a few turns to bleed the system properly.
- Tighten plug (2) after the cooling system has been filled and bled and replace the filler cap (1).
- Add coolant into the expansion tank (3) until minimal level has been reached.

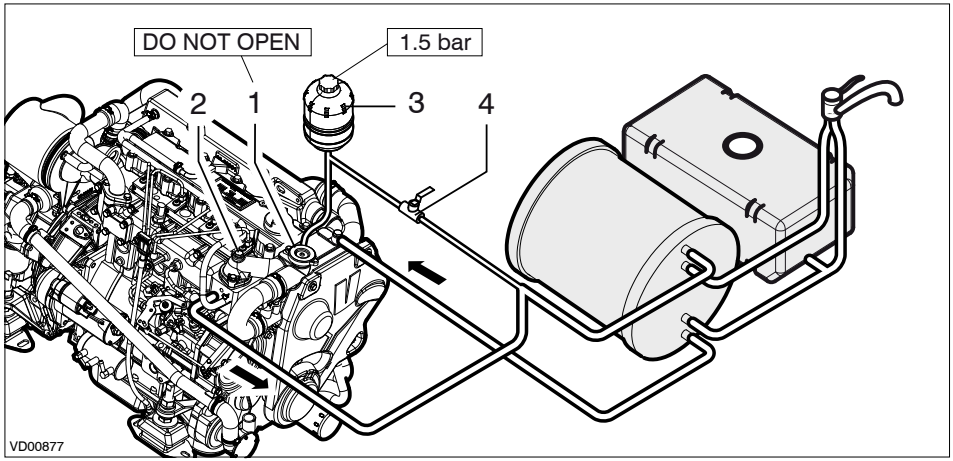
Use a mixture of 40% antifreeze (ethylene glycol based) and 60% tap water or use a special coolant.

For specifications see page 127.

! CAUTION

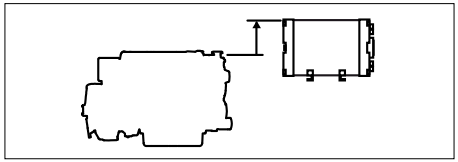
Never fill the cooling system with sea water or brackish water.

3 First commissioning



7 Filling coolant system, INTERCOOLING, if a water heater is connected (2)

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 expansion tank (3).
- Open valve (4) during filling and bleeding the system.
- Unscrew plug (2), on top of the lid of the thermostat housing, a few turns to bleed the system properly.
- Tighten plug (2) after the cooling system has been filled and bled and continue filling.

Use a mixture of 40% antifreeze (ethylene glycol based) and 60% tap water or use a special coolant.

For specifications see page 127.

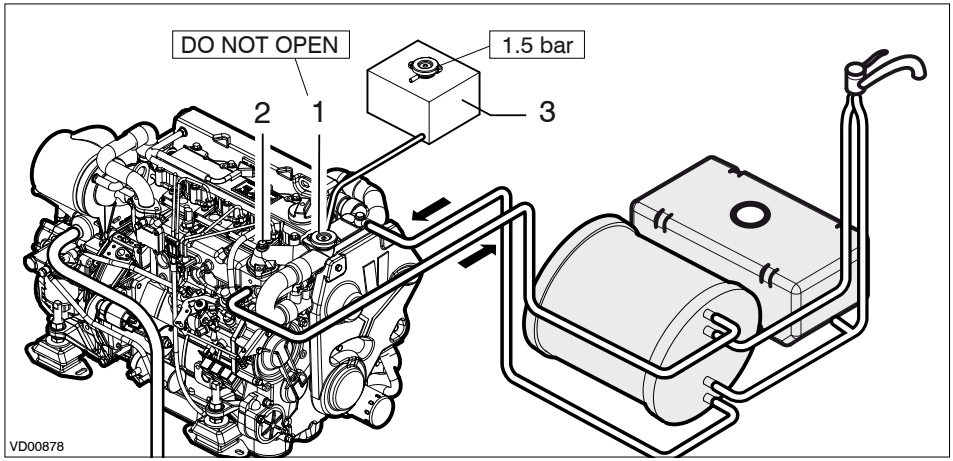
! CAUTION

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

NOTE

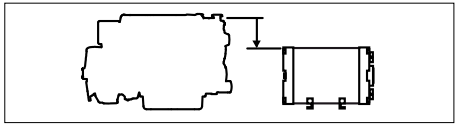
- Remember to close valve (4) after filling the system.

3 First commissioning



8 Filling coolant system, INTERCOOLING, if a water heater is connected (1)

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.

- Remove the 'DO NOT OPEN' cap (1) and fill the cooling system via the filler neck.
- Unscrew plug (2), on top of the lid of the thermostat housing, a few turns to bleed the system properly.
- Tighten plug (2) after the cooling system has been filled and bled and replace the filler cap (1).
- Add coolant into the expansion tank (3) until minimal level has been reached.

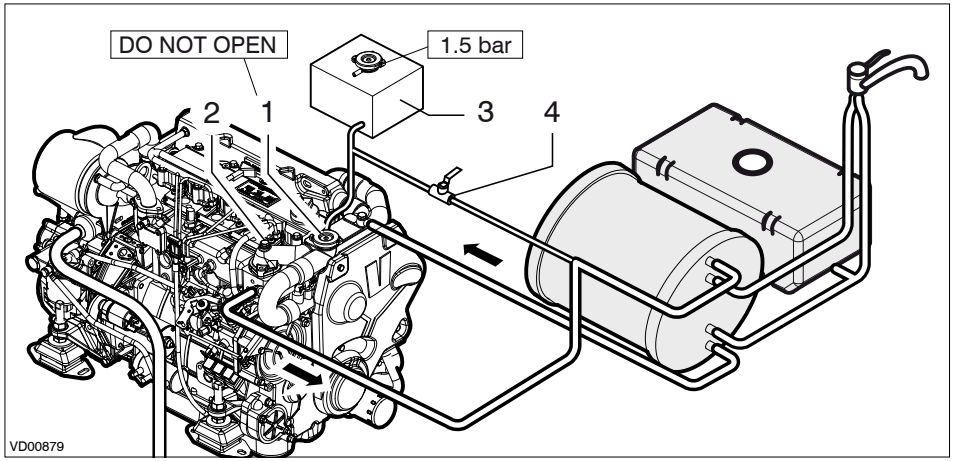
Use a mixture of 40% antifreeze (ethylene glycol based) and 60% tap water or use a special coolant.

For specifications see page 127.

! CAUTION

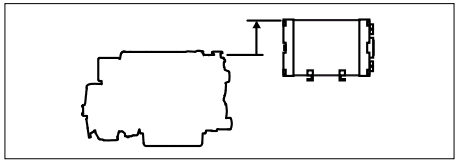
Never fill the cooling system with sea water or brackish water.

3 First commissioning



9 Filling coolant system, INTERCOOLING, if a water heater is connected (2)

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 expansion tank (3).
- Open valve (4) during filling and bleeding the system.
- Unscrew plug (2), on top of the lid of the thermostat housing, a few turns to bleed the system properly.

Use a mixture of 40% antifreeze (ethylene glycol based) and 60% tap water or use a special coolant.

For specifications see page 127.

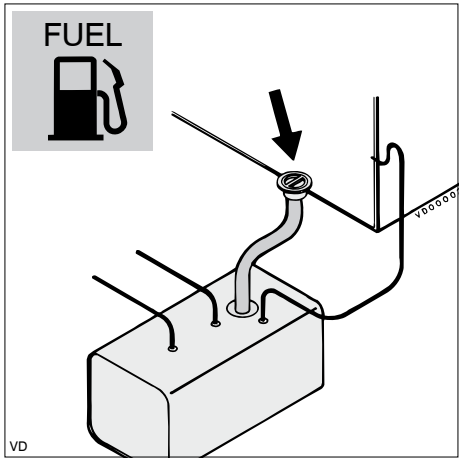
! CAUTION

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

- Tighten plug (2) after the cooling system has been filled and bled and and continue filling.

NOTE

3 First commissioning



10 Fuel

- Fill the fuel tank with diesel fuel.

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

  For fuel grade see page 123.

  Bleed the fuel system, see page 50.

WARNING

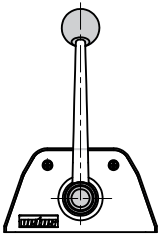
Never fill the fuel tank while the engine is running. Do not spill fuel. Prevent unnecessary pollution.

11 Other preparations

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

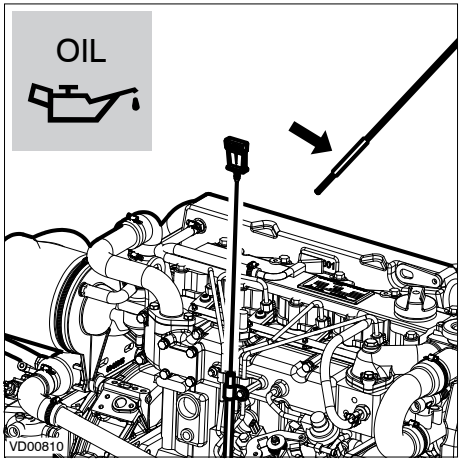
Neutral

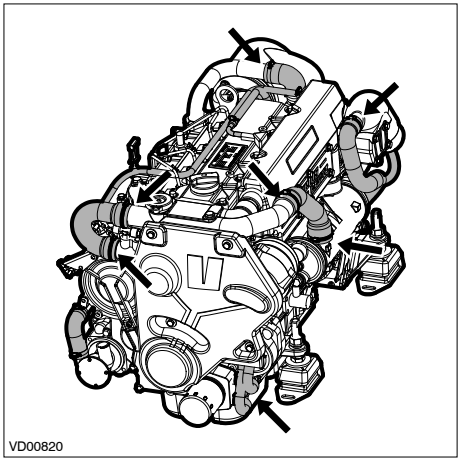
(No throttle,
gearbox not engaged)



- Check that the gearbox control lever is set to 'NEUTRAL'.

3 First commissioning





12 Test run

- Start the engine.

  How to start the engine and what to check before, during and immediately after starting is described on page 34 and further.

- Allow the engine to test run for about 2 minutes at idling speed .

- Stop the engine

- Check the oil level. If necessary top up to the indicated level.

- Start the engine.

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

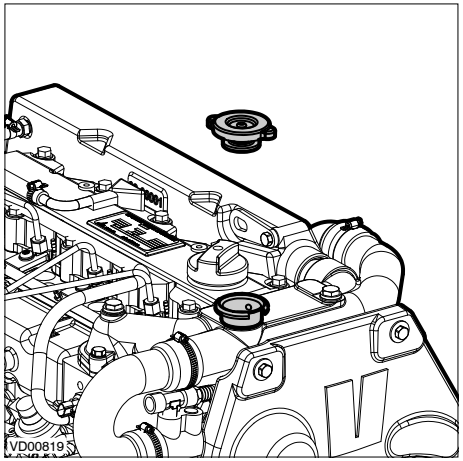
- Stop the engine.

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

! CAUTION

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

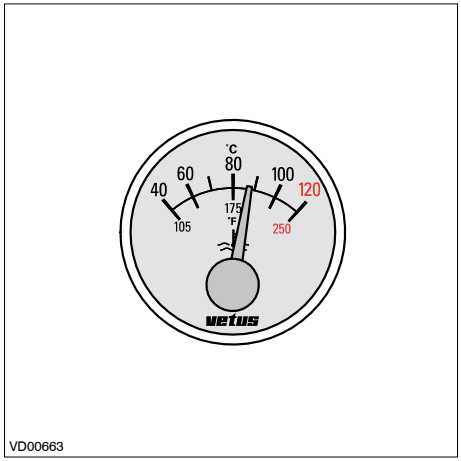
3 First commissioning



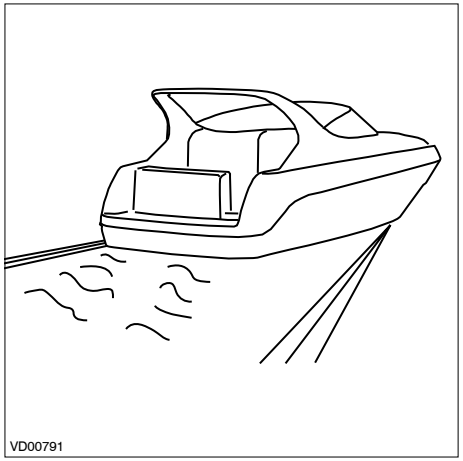
13 Bleeding

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

- Open the cap on the filler neck.
- Vary the revolutions between idling and 2000 rev/min.
- Add coolant if necessary.



- Replace the cap on the filler neck.
- Check the coolant temperature.



14 Sea trial

- Check the operation of the remote control.
- Carry out a sea trial

4 Running-in

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

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

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

- Draining of water from the water separator/fuel filter, see page 49.
- Engine oil change, see page 58.
- Oil filter replacement, see page 58.
- Changing the gearbox oil (Technodrive), see page 61.
- Changing the gearbox oil en filter replacement (ZF-Hurth), see page 62.
- Fuel filter replacement, see page 64.
- Check V-belt, see page 68.
- Check flexible engine mounts, see page 70.
- Check if all fasteners, bolts and nuts are secured, see page 71.
- Check engine for leakage, see page 71.

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 127.
- Never run the engine without a thermostat.
- Use a good quality lubricating oil. For specifications see page 124.
- Use a good quality diesel fuel that is free of water and other pollutants.
- Always stop the engine immediately if one of the warning lamps for oil pressure, high coolant temperature, high raw water temperature [1]or battery charging lights up.
- Always follow the safety advice, see page 4.

1] Only for intercooled engines.

☞ **NOTE**

First commissioning
Follow the instructions given for ‘First commissioning’ on page 20 and further if the engine is being commissioned for the first time.

After repair work:

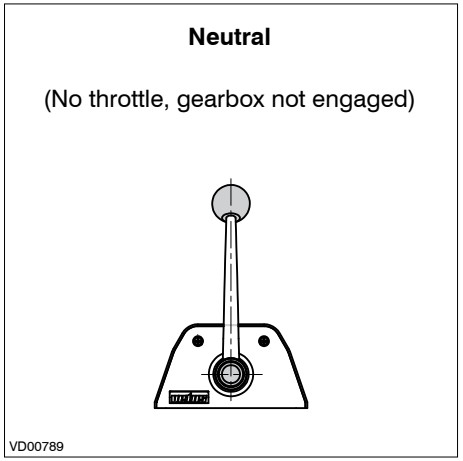
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with pre-heating, do not use any other substance (e.g. injection with ‘Easy Start’). Doing so could result in an accident.

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

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

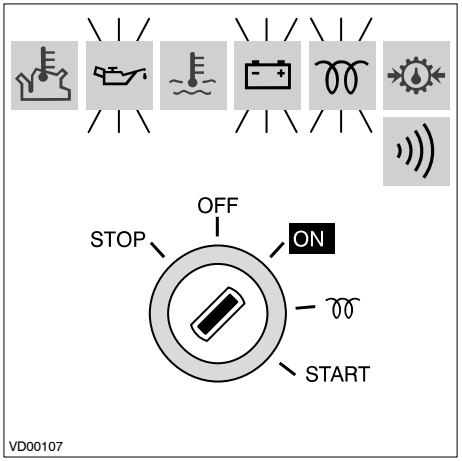
WARNING

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



1 Control lever

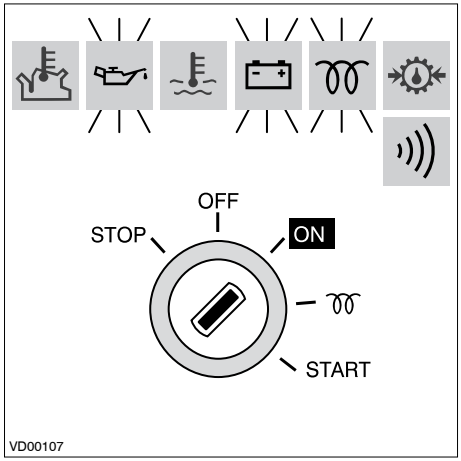
Put the control lever in 'neutral' position.



2 Switching on

Turn the starter key on the instrument panel to the right; the oil pressure and dynamo control lights will come on and the alarm buzzer will sound.

Ambient Temperature	Pre-heating time
Below 0°C(+32°F)	15 seconds
0°C to 10°C (+32°F to +50°F)	10 seconds
10°C to 30°C (+50°F to +86°F)	5 seconds
Above 30°C (86°F)	-



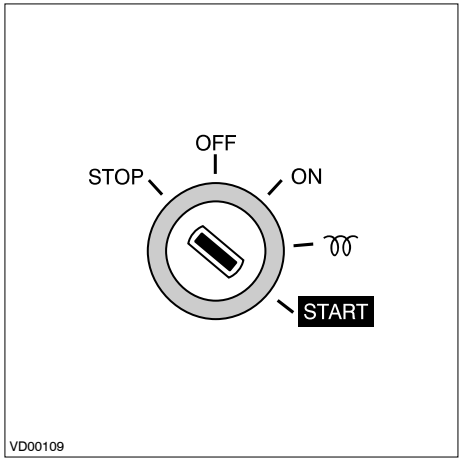
3 Pre-heating

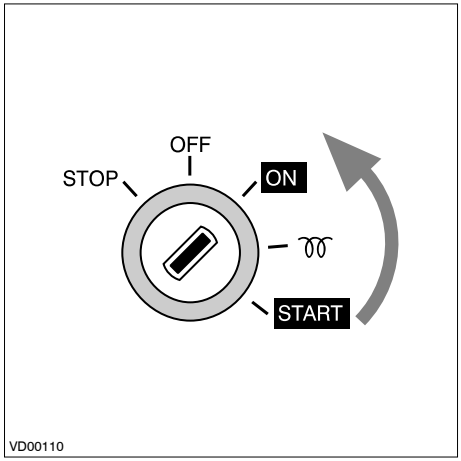
The ideal pre-heating time depends on ambient temperature; the lower the ambient temperature, the longer the pre-heating time required. See table.

CAUTION

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

Turn the key further clockwise to the ' ' position.
While pre-heating takes place the preheating indicator light will be on and the alarm buzzer off.
Hold the key in this position for about 5 seconds.





4 Starting

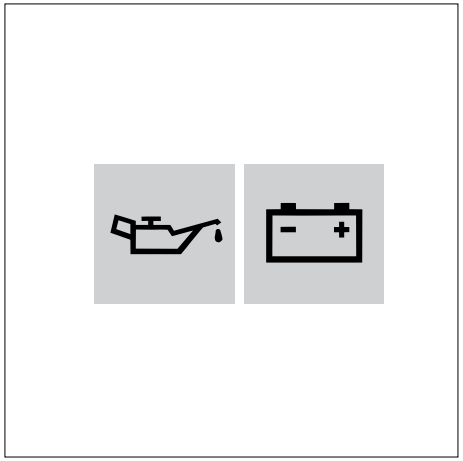
Now turn the key further to the ‘start’ position.

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.

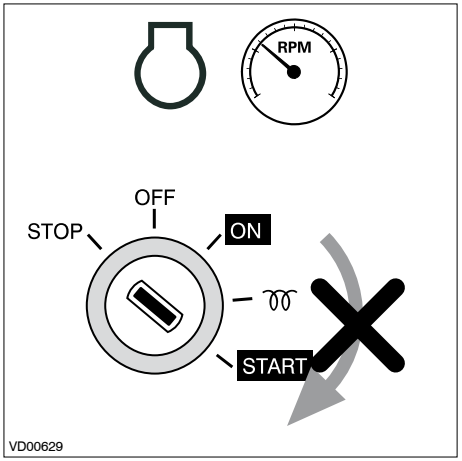


Check that the indicator lights for oil pressure and alternator are off.

Cooling water should now flow out of the exhaust [1]; if this is not the case, stop the engine immediately.

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

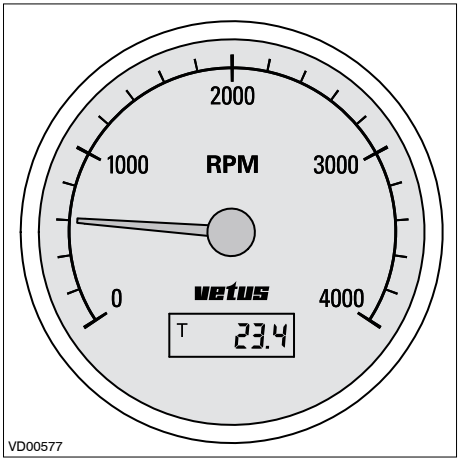
Never turn the main switch off while the engine is running.



CAUTION

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

[1] Only engines with intercooling.



5 Tachometer

The instrument panel is provided with the following instruments (Depending of the type of panel, see page 16).

Indicating the number of revolutions per minute of the engine.

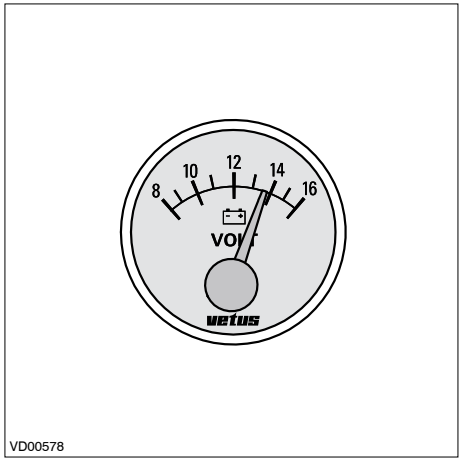
Also the number of running hours is indicated.

Idling speed :
- DT4.70: 900 rpm
- DTA4.85: 900 rpm

WARNING

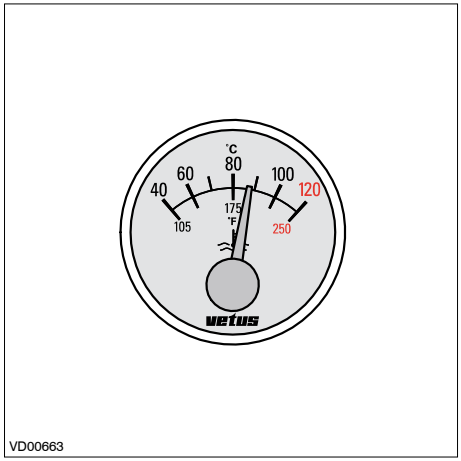
Avoid idling for more than 10 minutes.

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



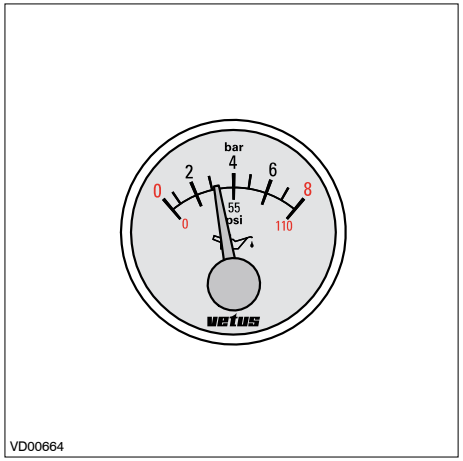
6 Voltmeter

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



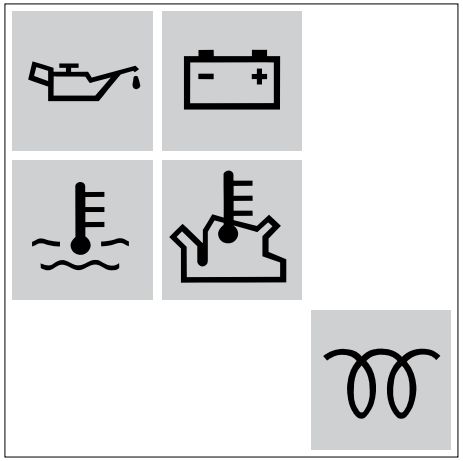
7 Temperature gauge

Indicating the temperature of the internal cooling system.
The operating temperature is 82˚C - 97˚C. (180°F - 207°F).
In case the engine is overheated: turn off the engine and establish the cause, see fault finding table, page 106 .. 115.



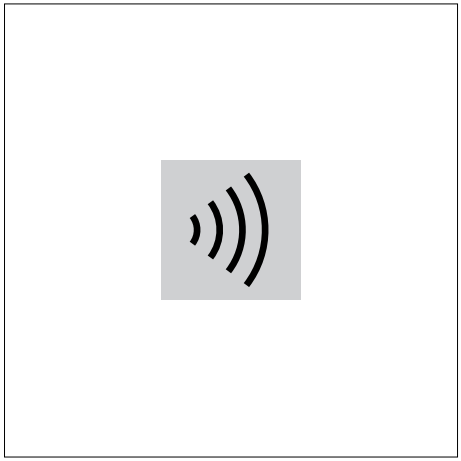
8 Oil pressure gauge

With the engine at operating temperature, the oil pressure is:
When idling: at least 1 bar (7 psi).
In case the oil pressure is too low: turn off the engine and establish the cause, see fault finding table, page 106 .. 115.



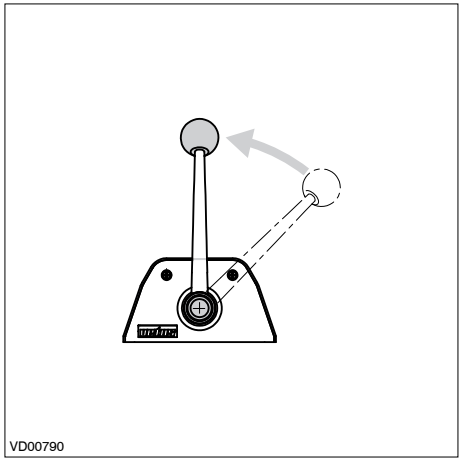
9 Warning lights

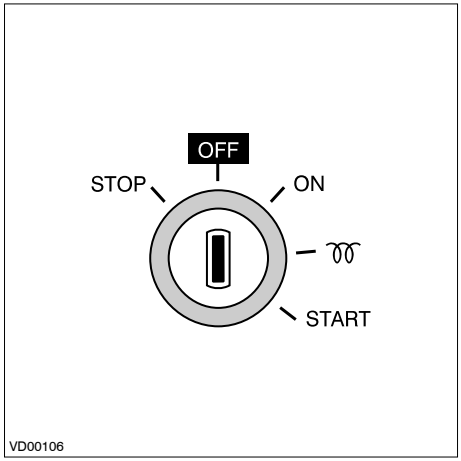
None of the five warning lights should light up while the engine is running.



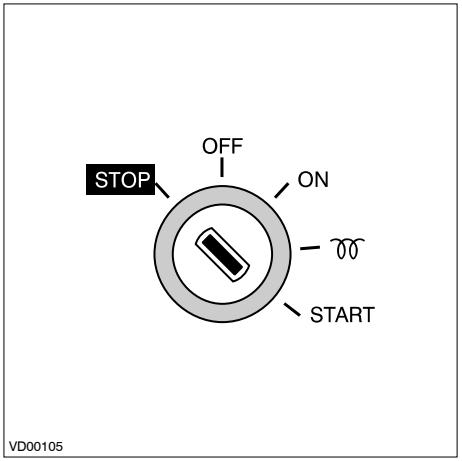
10 Alarm buzzer

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!


VD00790



VD00106



VD00105

11 Stopping

Reduce engine speed to idle and place the control lever in '**NEUTRAL**' position.

Never stop the engine immediately after it has been in operation for a long time.

Turn the key to the left 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.

Note The '**STOP**' position, left of the '**OFF**' position on the control panel, has normally no function for this engine.
When 2 control panels are connected to one engine, the engine can always be stopped by turning the key to the '**STOP**' position, no matter what the position is of the key on the other panel.

6 Maintenance

Introduction

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

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

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

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

6 Maintenance

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.

Every 10 hours or daily, before starting	page
Check engine oil level	46
Check coolant level	47
Check water strainer	48

After the first 50 hours	page
Drain water from fuel filter	49
Check gearbox oil level	52
Engine oil change	58
Replace oil filter	58
Replace fuel filter	64
Check V-belt	68
Check flexible engine mounts	70
Check tightness of all fasteners, bolts and nuts	71
Check engine for leaks	71

Every 100 hours, at least once every year	page
Drain water from fuel filter	49
Check gearbox oil level	52
Drain charge air cooler	53
Battery, cables and cable connections	54

Every 500 hours, at least once every year	page
Engine oil change	58
Replace oil filter	58
Change gearbox oil (Technodrive)	61
Change gearbox oil and replace filter (ZF Hurth)	62
Replace fuel filter	64
Cleaning filter fuel lift pump	66
Check V-belt	68
Check flexible engine mounts	70
Check tightness of all fasteners, bolts and nuts	71
Check engine for leaks	71

⚠ **DANGER**

Stop the engine before carrying out any maintenance work.

Every 500 hours	page
Check glow plugs	[1]

Every 800 hours, at least once every 2 years	page
Raw water pump inspection	72
Replace coolant	74
Replace air filter	78

Every 1000 hours	page
Check starter motor 79	79
Check alternator 79	79
Check turbocharger	[1]

Every 3000 hours	page
Check and adjust injector pressure	[1]

When required	page
Bleeding fuel system	50
Cleaning heat exchanger	80
Clean after cooler	86

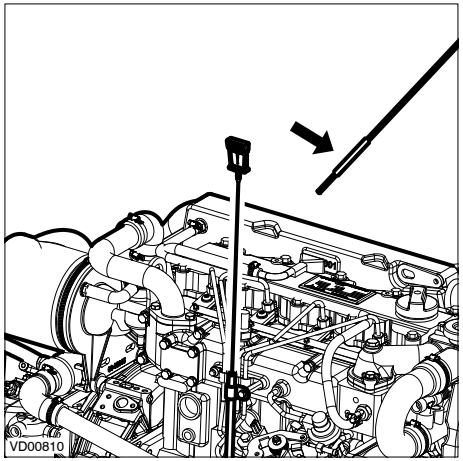
GEVAAR

Stop the engine before carrying out any maintenance work.

[1] Consult the service manual, work to be carried out by a Vetus dealer.

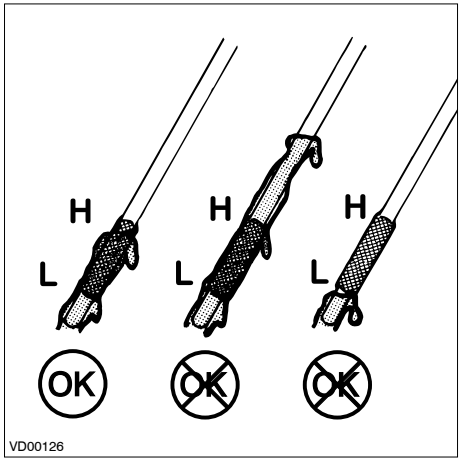
Checking engine oil level

Daily, before starting.



1 Check oil level

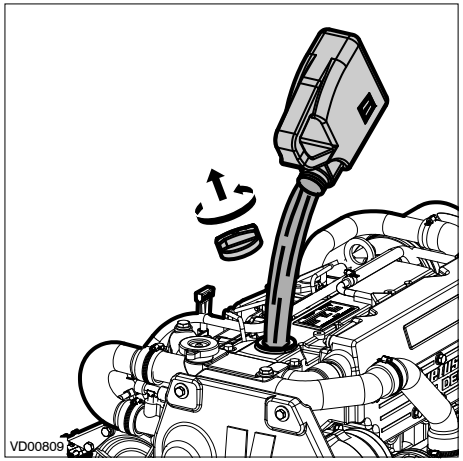
Turn the engine off.
The dipstick is located on the starboard side of the engine.



2 Oil level

The oil level must be at or near the upper mark on the dipstick[1]. If necessary top up with the same brand and type of oil.

[1] The difference between the two oil level marks is: 0.8 litres (1.4 UK pt, 1.7 US pt)



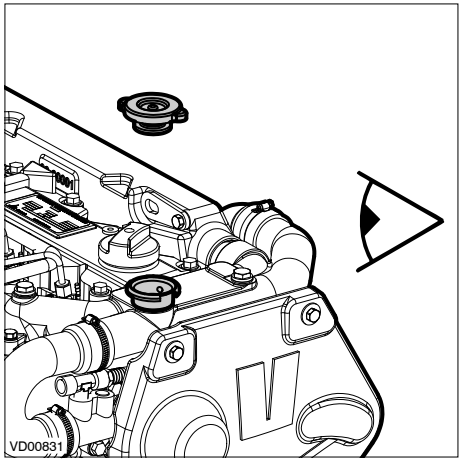
3 Topping up oil

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

[1] The difference between the two oil level marks is: 0.8 litres (1.4 UK pt, 1.7 US pt)

Checking coolant level

Daily, before starting.

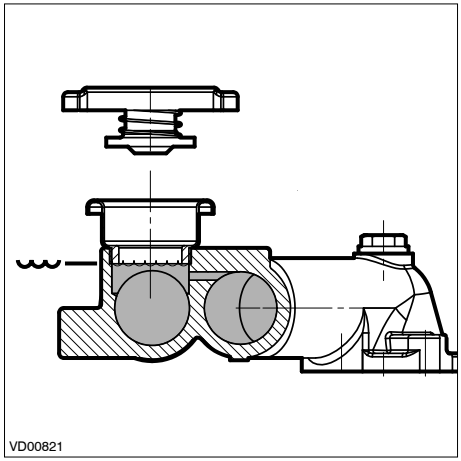


4 Checking coolant level

Check the coolant level in the filler neck. This has to be checked when the engine is cold.
Remove the cap of the filler neck.

WARNING

Never open the cap of the filler neck when the engine is at operating temperature.

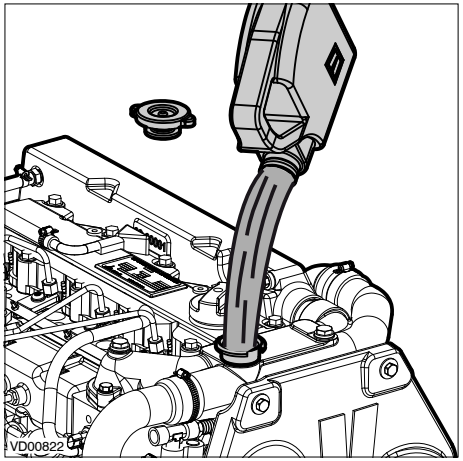


5 Coolant level

The level of the coolant must be at the lower edge of the filler neck.

NOTE

For a keel-cooled version, see page 23.
If a water heater is connected, see page 24 and 25
For a keel-cooled version with a water heater connected. see page 26 and 27.



6 Topping up coolant

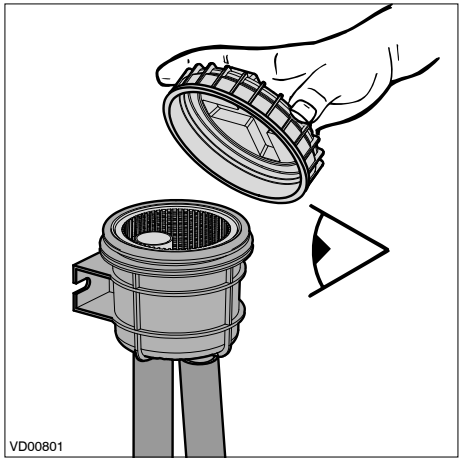
Top up if necessary.
The internal cooling system can be filled with a mixture of anti-freeze (40 %) and tap water (60 %) or with a special coolant. For specification, see page 127.

CAUTION

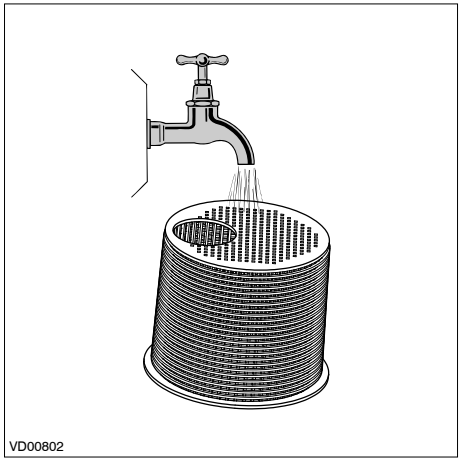
Never fill the cooling system with sea water or brackish water.

Checking and cleaning the raw water strainer

Daily, before starting.



7 Checking the raw water strainer



8 Cleaning the strainer

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

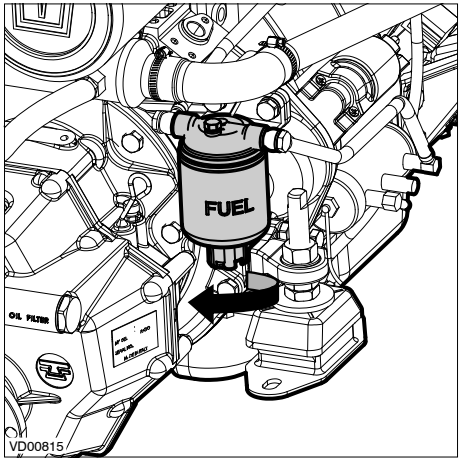
Close the sea cock before removing the lid of the water strainer.

Clean the raw water strainer as often as is necessary, depending on the pollution of the waterways, but at least once every 6 months. A clogged raw water strainer will result in excessive temperatures or overheating of the engine coolant.

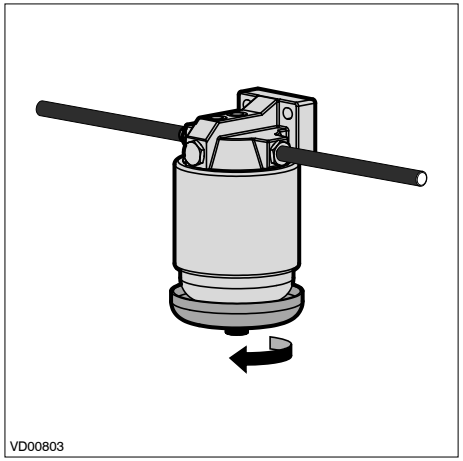
Check the sealing between the lid and housing after cleaning and re-assembling the strainer. An improperly sealed lid will result in air sucked in by the sea water pump which again will result in overheating of the engine.

Draining of water from the water separator/fuel filter

Every 100 operating hours.



9 Drain fuel filter



10 Empty water separator

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.

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

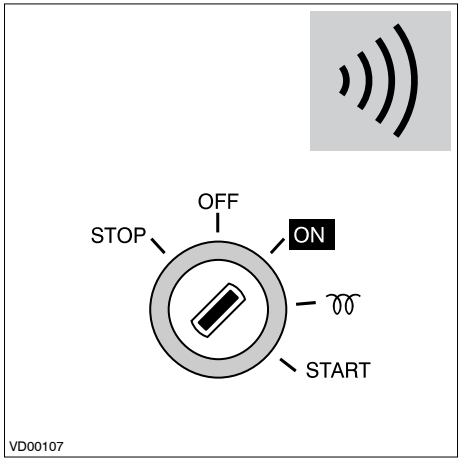
Empty the separately installed water separator/fuel filter:

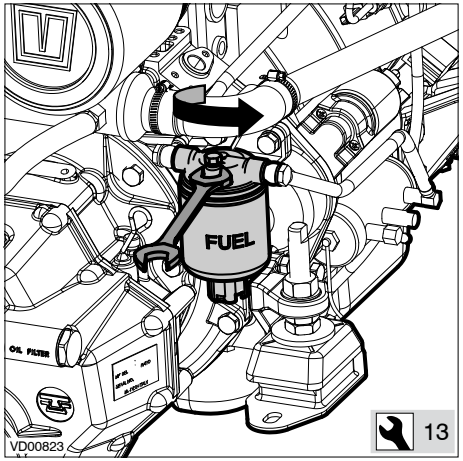
- Open the drain plug at the lower side of the filter.
- Drain the water and close the drain plug.

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

Draining of water from the water separator/fuel filter

Every 100 operating hours.

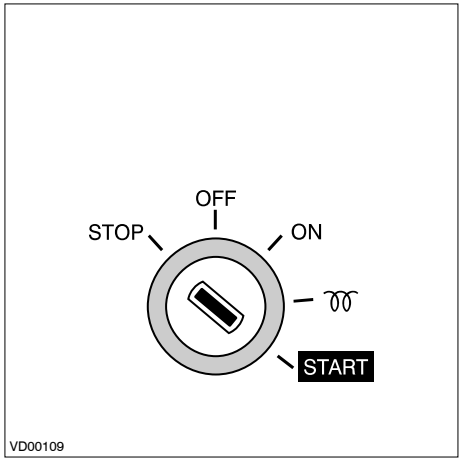




11 Bleeding

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 leave the key in this position for 30 seconds. The fuel lift pump will now feed the fuel system.
- Open the bleeding nipple at the filter to speed up the bleeding process.
- Close the bleeding nipple when all air has escaped.



12 Start the engine

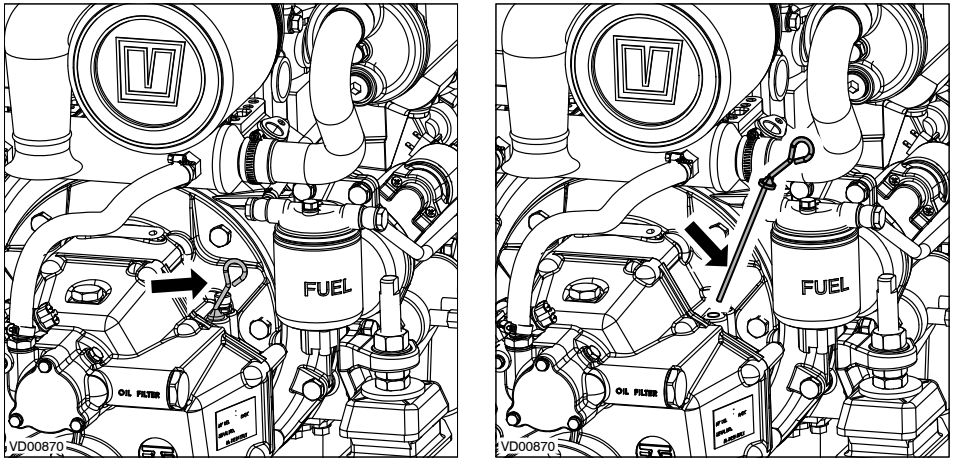
- Operate the starter switch until the engine fires; release the starter switch if the engine does not fire within 6 seconds.
- Wait until the starter motor has stopped before making a new attempt to start the engine.
- Repeat the above if the engine cuts out after a short time.

Draining of water from the water separator/fuel filter

Every 100 operating hours.

Gearbox oil level check

Every 100 operating hours.



13 Oil level check

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 owner's manual for changing oil and other care and maintenance.

- Take the dipstick out of the gearbox housing by pulling or unscrewing.
- Check the oil level by lowering the dipstick (cleaned) into the hole.

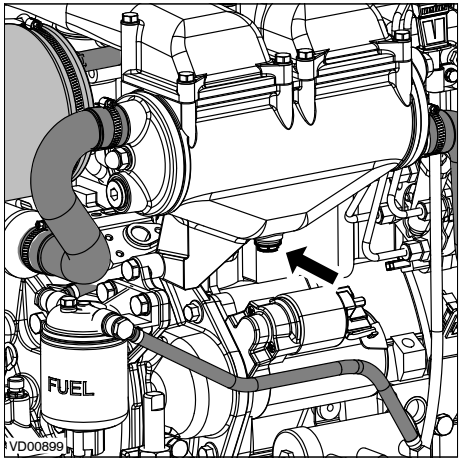
The oil level must between the two marks on the dipstick

- If necessary top up by pouring oil into the filler hole or the dipstick hole.

For oil type and specification see page 126.

Draining the after-cooler (charge air cooler)

Every 100 operating hours.



14 Draining after-cooler

Condensate accumulating in the after cooler must be drained every 100 hours of at least once a year.

- Remove the drain plug from the after cooler and check whether all the condensate is drained.
- After draining replace the drain plug.

☞ **NOTE**

Only for engines equipped with an after-cooler!

6 Maintenance

Warning notes and safety regulations for working with batteries

Wear eye protection.

Keep children away from acid and batteries.

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

Fires, sparks, naked flames and smoking are prohibited:

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

Corrosive hazard:

- Battery acid is highly corrosive, therefore:
- Wear protective gloves and eye protection.
- Do not tilt battery, acid can escape from the degassing openings or vents.

First aid:

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

Battery, cables and connections

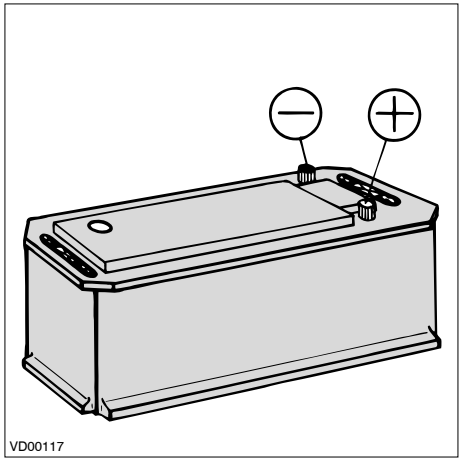
Every 100 operating hours.

Warning note:

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

Disposal:
Hand in old batteries at a collection point. The notes listed under 1 (Storage and transport) are to be followed for transport. Never dispose of old batteries as domestic waste.

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



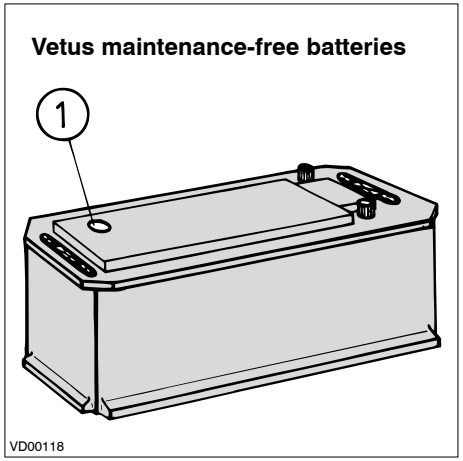
15 Battery, battery connections

Keep battery clean and dry.

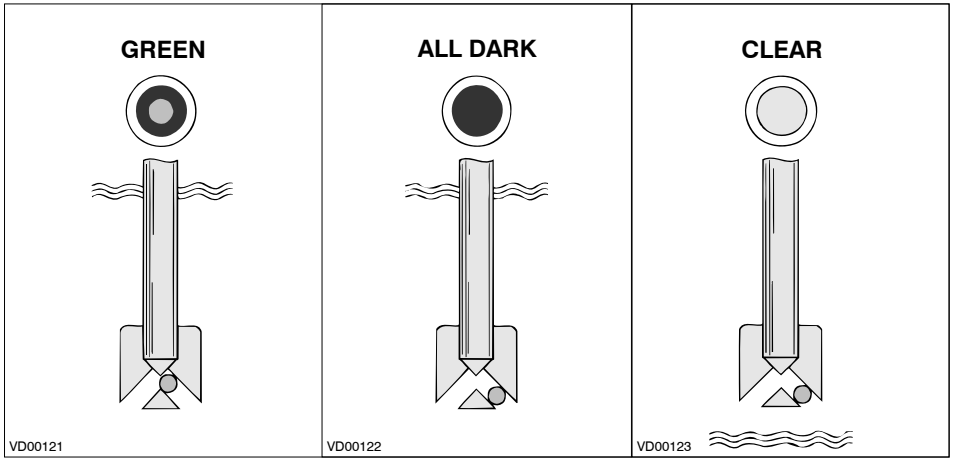
- Remove battery cables (negative first).
- Clean battery posts (+ and -) and clamps and grease with acid-free and acid-resistant grease.

Ensure that clamps make good contact after reassembling.

- Hand tighten the bolts only.



16 Checking specific gravity

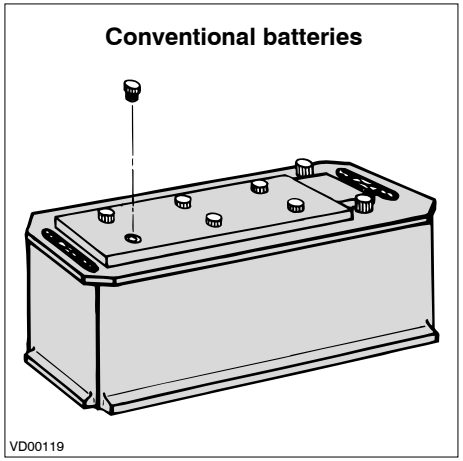


17 Hydrometer operation

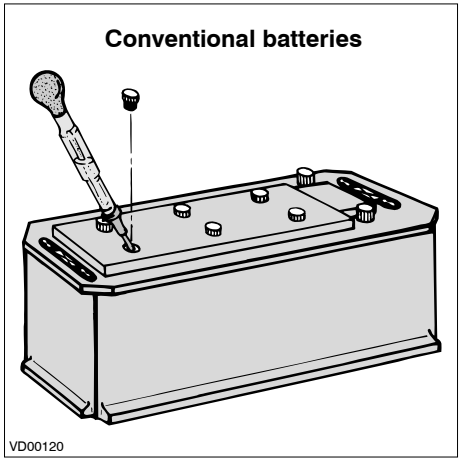
Every Vetus Maintenance-free battery has a hydrometer (1) built into the cover. Visual inspection of the hydrometer will show one of three conditions:

- **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.

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



18 Checking electrolyte level



19 Checking specific gravity

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

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.

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).

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

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

20 Engine oil change

Change the engine oil every 500 hours of operation (together with engine oil filter replacement).

If the engine runs less than 500 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.

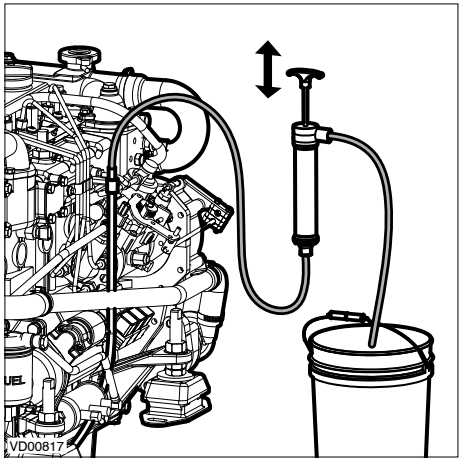
WARNING

Never use additives.

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

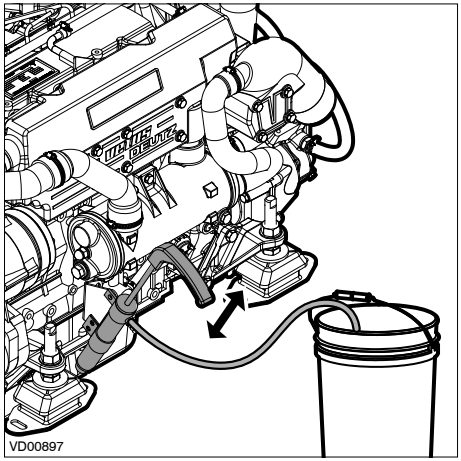
Engine oil change

Every 500 operating hours.



21 Drain oil

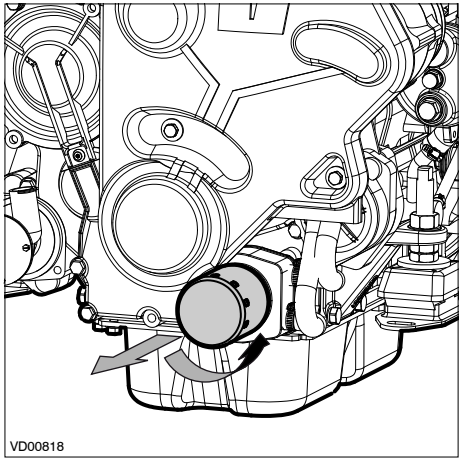
- Remove the dipstick; insert the suction hose of the supplied sump pump into the dipstick tube.
  OR
  Use the engine mounted sump pump (Option).
- Push down the pump handle quickly and pull it up slowly.
- Pump the sump empty.



- After draining remove the suction hose of the sump pump out of the dipstick tube.

WARNING

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



22 Removing the oil filter

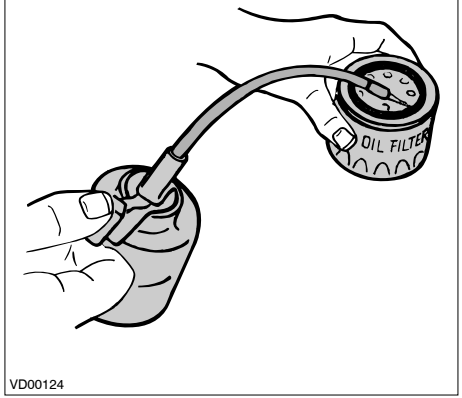
- Unscrew the oil filter, with a commercially available tool, when all the oil has been pumped out.
  Catch any dripping oil.

DANGER

Beware of burns from hot oil.

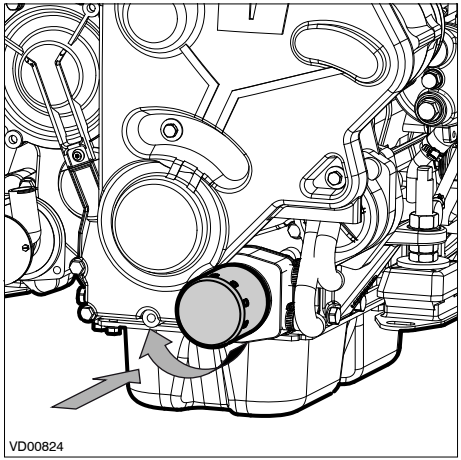
Engine oil change
Every 500 operating hours.

OIL FILTER, ART.CODE: 08-00085



23 Oiling the oil seal

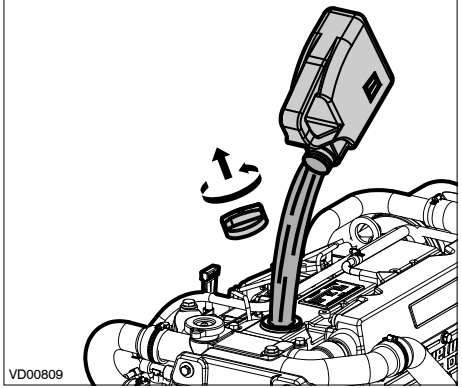
- Clean the contact surface of the gasket.
- Lubricate the oil seal of the new filter element with clean engine oil.



24 Oil filter installation

- Install the filter in accordance with the instructions printed on the filter element housing.
  Tightening torque 15 - 17 Nm
  (11 -12 ft.lbf)

OIL CAPACITY: 6.3 litres
(INCL. OIL FILTER) (11 UK pt, 13.3 US pt)

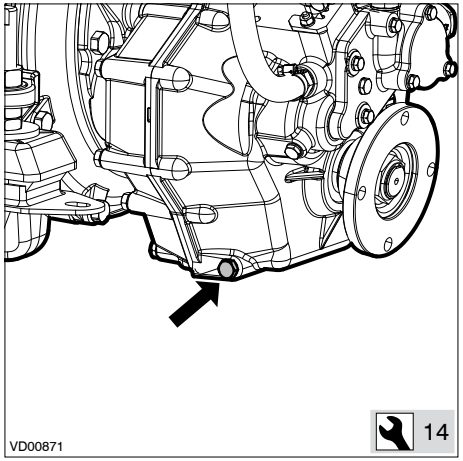


25 Refilling with oil

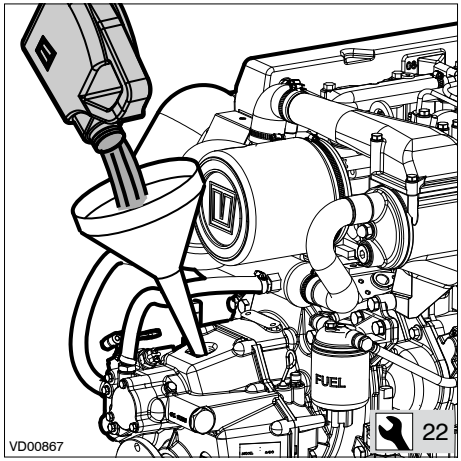
- Fill the engine with fresh oil (see page 124 for the specification) through the filler opening in the valve cover.
- Operate the engine at idling speed for a short period of time. Check for oil leaks whilst the engine is running. Stop the engine. Allow 5 minutes for the oil to return to the sump and check the oil level with the dipstick.

Changing the gearbox oil (Technodrive)

Every 500 operating hours.



26 Draining the oil

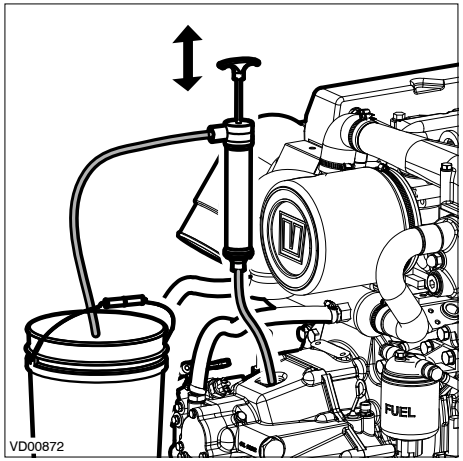


27 Filling with new oil

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

For amount of oil and specification see page 126.

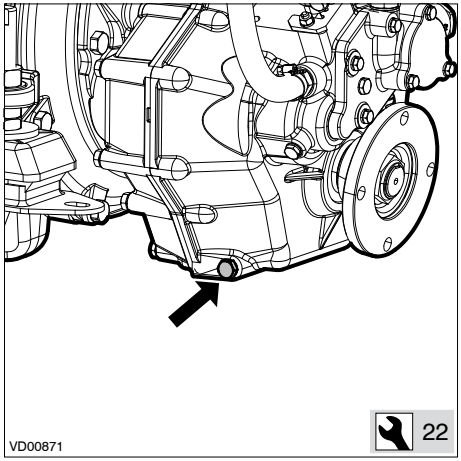
In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owner's manual for changing oil and other care and maintenance.



28 Draining the oil

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

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

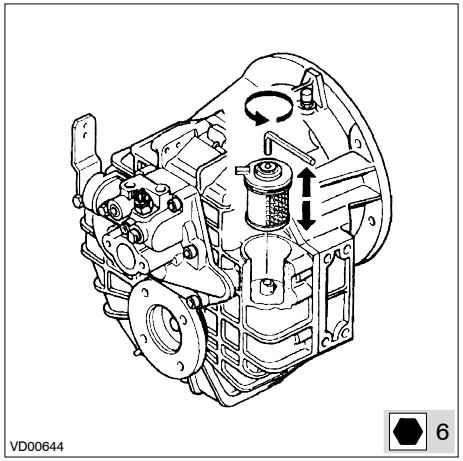


Or, if sufficient space below the gearbox is available, oil can be drained by removing the drain plug.

Collect the oil in a dripping pan.

Changing the gearbox oil (ZF-Hurth)

Every 500 operating hours.

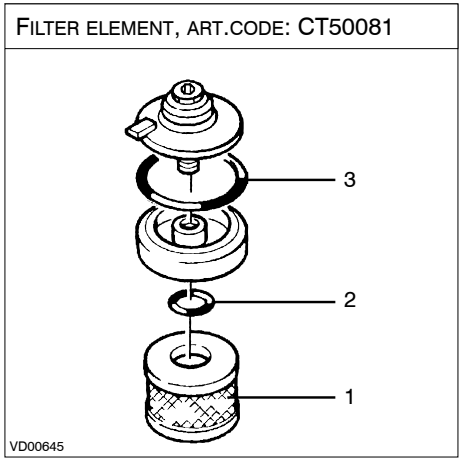


29 Changing the oil filter

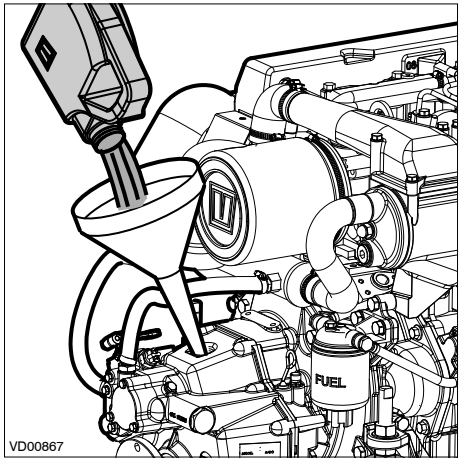
The filter element must be replaced at the same time as the oil.

- Turn the screw that holds on the filter cover to the left and remove the filter from its housing. Use an Allen key for this.

FILTER ELEMENT, ART.CODE: CT50081



- 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.



30 Filling with new oil

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

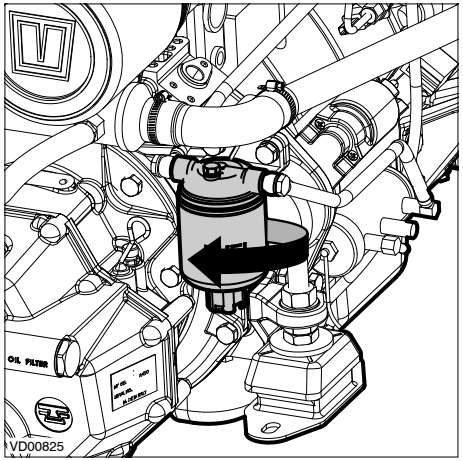
For amount of oil and specification see page 126.

Changing the gearbox oil (ZF-Hurth)

Every 500 operating hours.

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

Fuel filter replacement
Every 500 operating hours.



31 Fuel filter removal

The fuel filter is to be replaced as a unit.

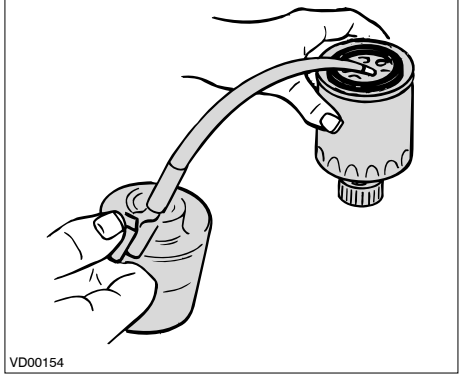
- Close the fuel stopcock.
- Remove the fuel filter, use a filter wrench. Catch any fuel.

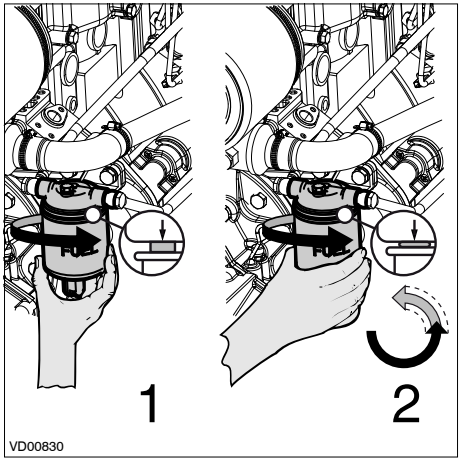
DANGER

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

Fuel filter replacement
Every 500 operating hours.

FUEL FILTER, ART.CODE: STM3690



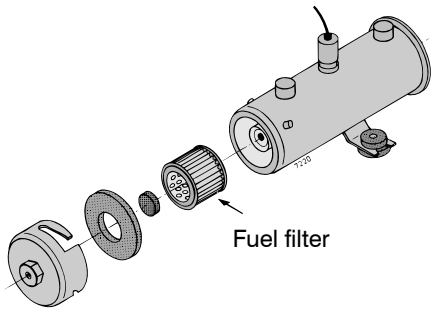


32 Fuel filter installation

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

Cleaning filter fuel lift pump
Every 500 operating hours.

FUEL FILTER , ART.CODE: STM4050

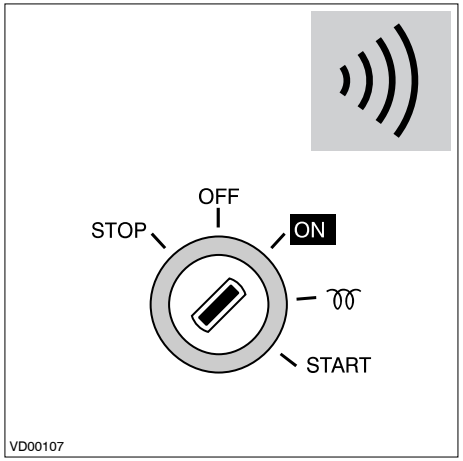


33 Fuel lift pump

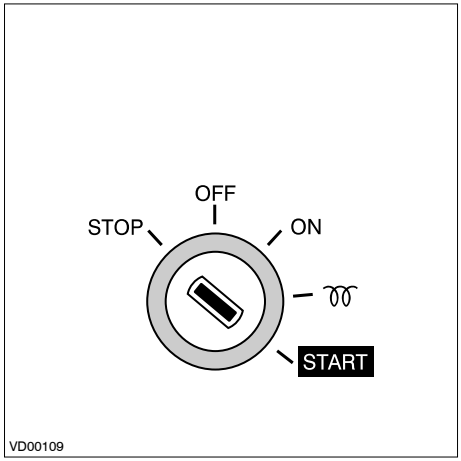
- Check, and if necessary clean, filter inside the fuel lift pump.
- Open the fuel stop cock.
- Check for leakage.

Bleeding, after fuel filter replacement

Every 500 operating hours.



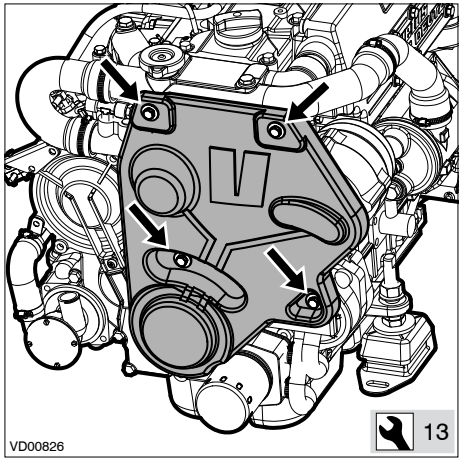
34 Bleeding



35 Start the engine

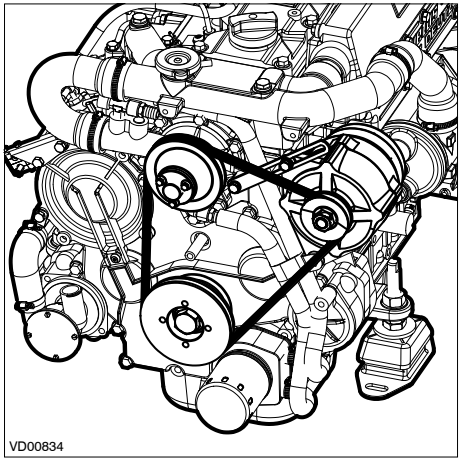
After replacing the fuel filter and cleaning the pilot filter inside the fuel lift pump the air has to be bled from the fuel system.
The fuel system is self-bleeding.

- Turn the key in the ignition lock to 'ON' and leave the key in this position for 30 seconds. The fuel pump will now bleed the system.
- Start the engine
- Operate the starter switch until the engine fires; release the starter switch if the engine does not fire within 20 seconds. Wait until the starter motor has stopped before making a new attempt to start the engine.
- Repeat the above if the engine cuts out after a short time.
- Check for leaks once more.



36 Remove the protection cover

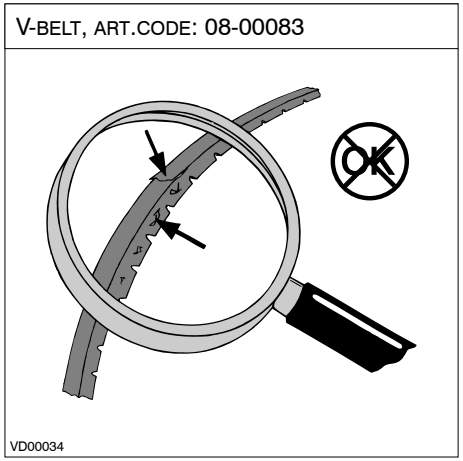
- Loosen the 4 fixing bolts.



- Remove the protection cover.

Checking the V-belt

Every 500 operating hours.



37 Inspection V-belt

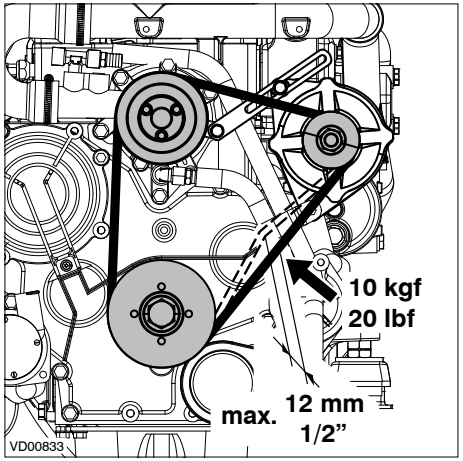
- Inspect the belt for wear and tear (fraying and cracking). Belts which are in poor condition should be replaced.

DANGER

Check, tension and change V-belts only with the engine off. Always reinstall the protection cover.

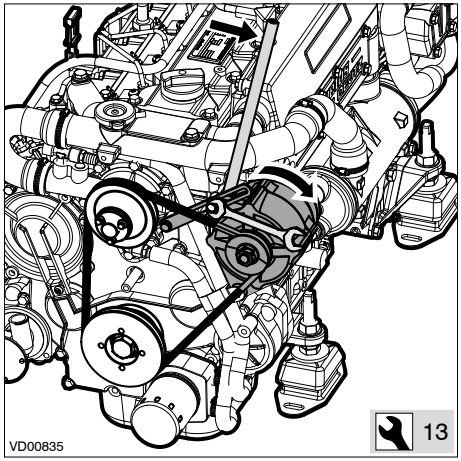
Checking the V-belt

Every 500 operating hours.



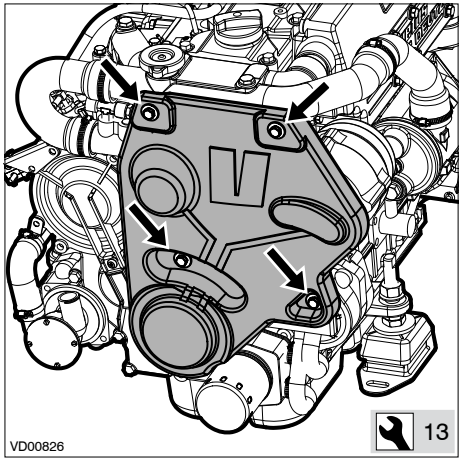
38 Checking tension

- 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.



39 Tensioning V-belt

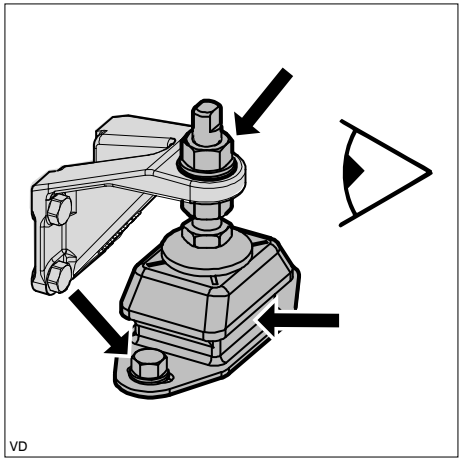
- Loosen the bolt of the adjustment bracket and both the alternator mounting bolts. Now push the alternator outwards until the belt tension is correct.
- Now first re-tighten the upper mounting bolt of the alternator.
- Then re-tighten the bolt of the adjustment bracket and the lower mounting bolt.



40 Reinstall the protection cover

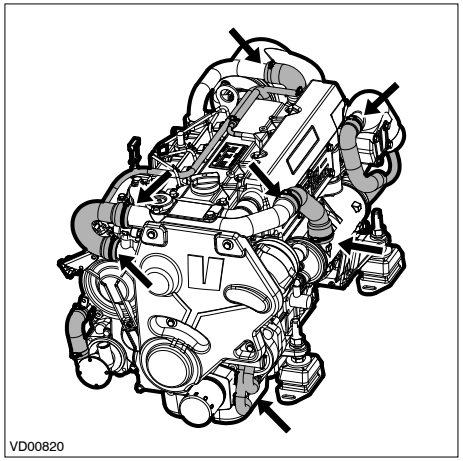
- Always reinstall the V-belt guard and reinstall the 4 fixing bolts.

Flexible engine mounts
Every 500 operating hours.



41 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 prop shaft! Re-align engine in case of doubt.



42 Inspection hose connections

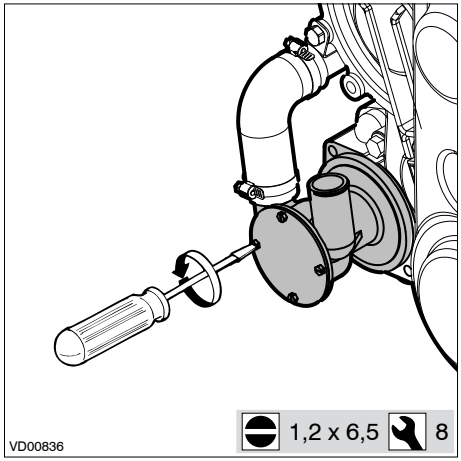
- Inspect all hose connections of the cooling system. (Cracked hoses, loose hose clamps).

43 Check fasteners

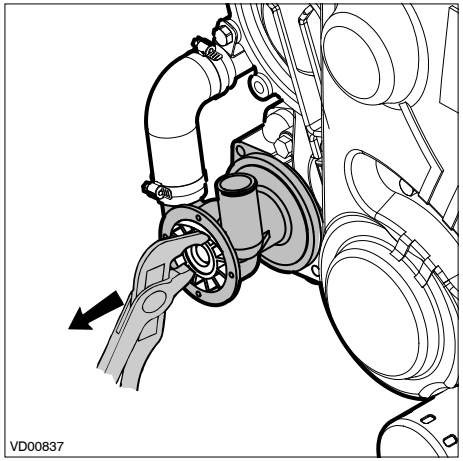
- Check tightness of all fasteners, bolts and nuts.

☞ **NOTE**

Only engines with intercooling!



45 Pump cover removal



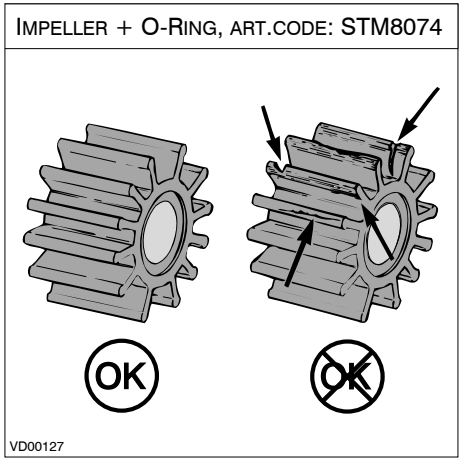
46 Impeller removal

44 Raw water pump inspection

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

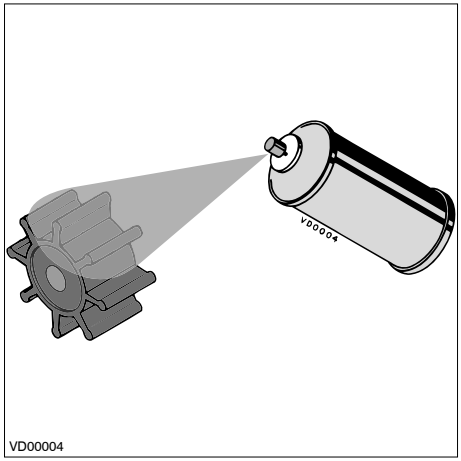
Inspection where appropriate changing is as follows:

- Close the sea cock.
- Remove the cover of the pump by unscrewing the screws out of the housing.
- Use a special impeller puller or pipe wrench to slide the impeller off the shaft.
- 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.



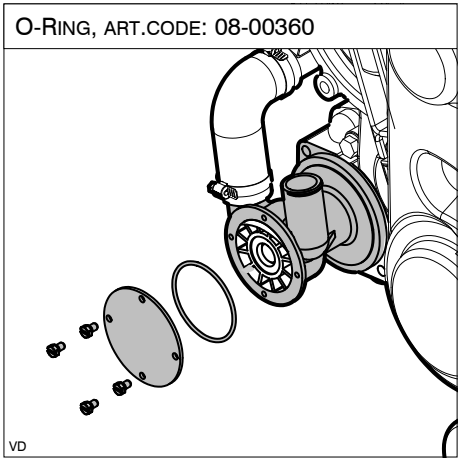
47 Impeller inspection

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



48 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).
- The direction of rotation of the impeller is anti-clockwise.



49 Replacing the pump cover

- Always use a **new** O-ring when replacing the cover.
- Check the water filter and open the sea cock.

50 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.

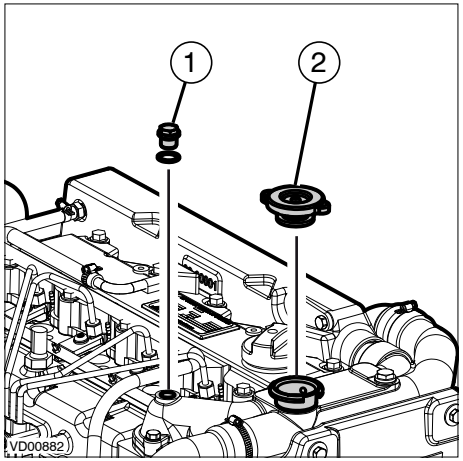
DANGER

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

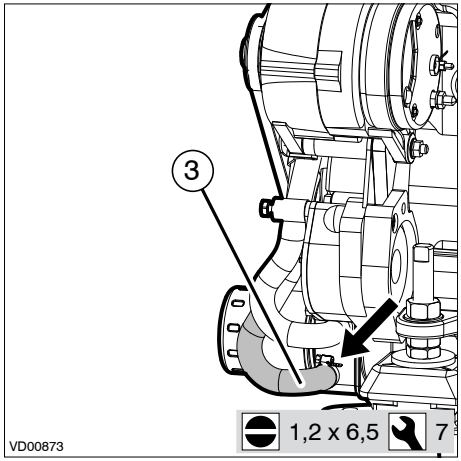
Cooling system protective liquids must be disposed of in accordance with environmental regulations.

Coolant replacement
Every 1000 operating hours.

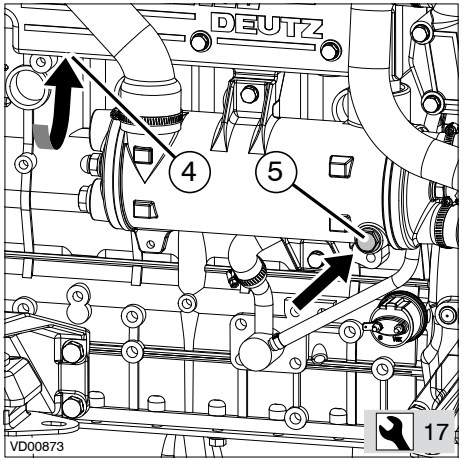


51 Drain coolant

- Remove the plug (1) and the filler cap (2) to allow air into the cooling system.



- Remove the hose to the oil cooler (3).

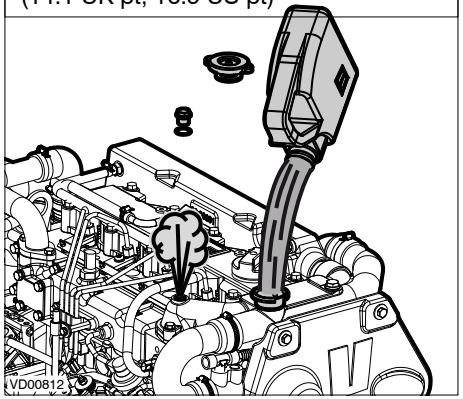


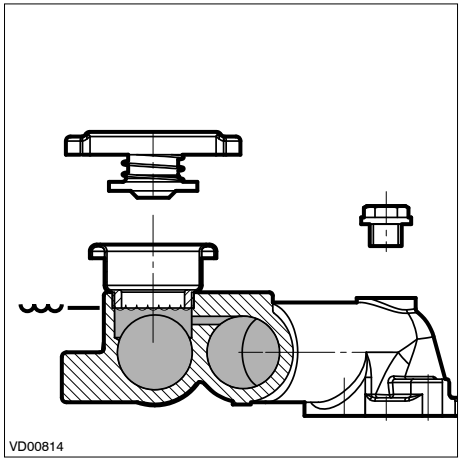
- Remove the drain plugs (4) and (5) (exhaust manifold and heat exchanger housing).
- Check that all the liquid drains out.
- After draining re-install the drain plugs and re-install the hose to the oil cooler.

☞ **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.

COOLANT QUANTITY: 8 litres
(14.1 UK pt, 16.9 US pt)





52 Fill cooling system

- Fill the cooling system.

Use a mixture of 40% antifreeze (on ethylene glycol basis) and 60% clean tap water or use a coolant.
See page 127 for specifications.

! CAUTION

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

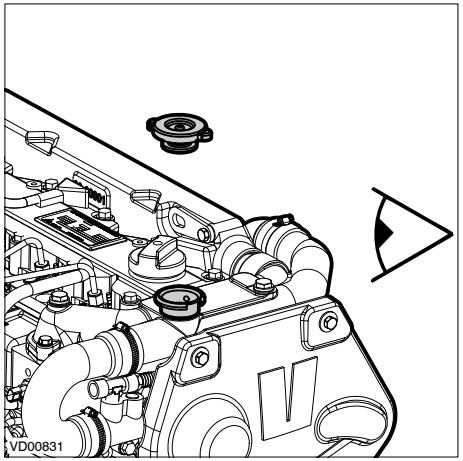
The level of the coolant must be at the lower edge of the filler neck.

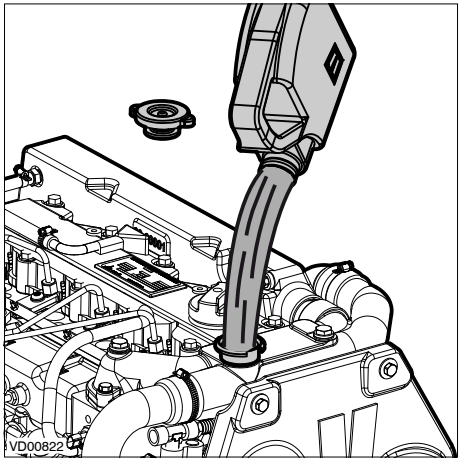
- After filling replace the filler cap and reinstall the plug.

☞ NOTE

When keel cooled, see page 23.
With a water heater connected, see page 24 and 25.
When keel cooled and a water heater connected, see page 26 and 27.

Coolant replacement
Every 1000 operating hours.

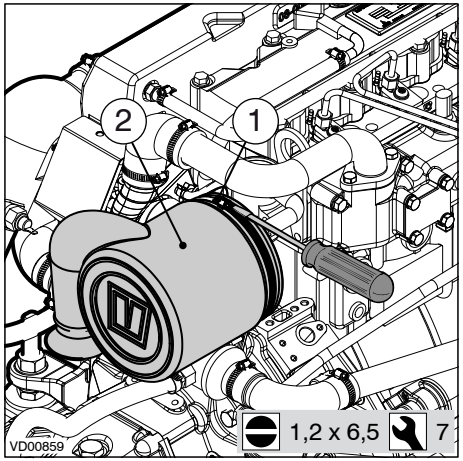


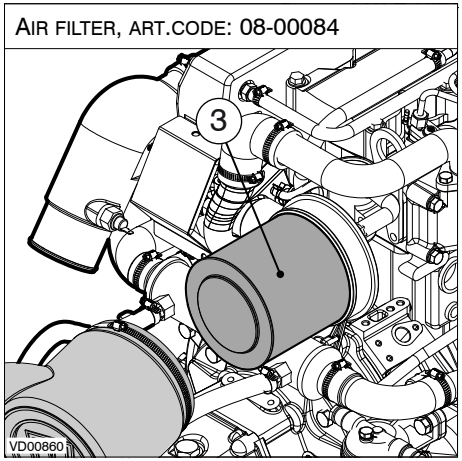


- Check the coolant level after the engine has been run again for the first time, has reached operating temperature and then has cooled back to ambient temperature.
- Remove the filler cap
- Top up if necessary.

CAUTION

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





53 Changing the air filter

Changing the air filter

Every 1000 operating hours.

- Stop the engine.
- 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

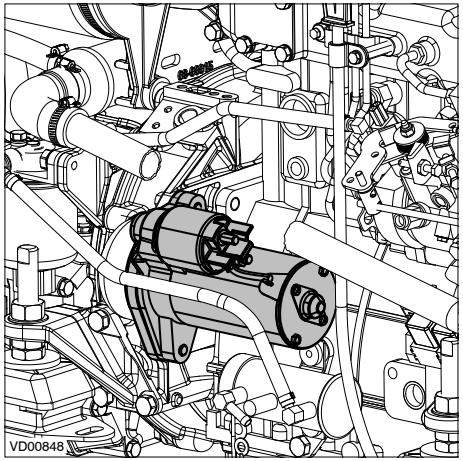
Never clean the filter element with petrol or hot liquids.

Never apply any oil to the air filter.

Never start the engine without the air filter in place.

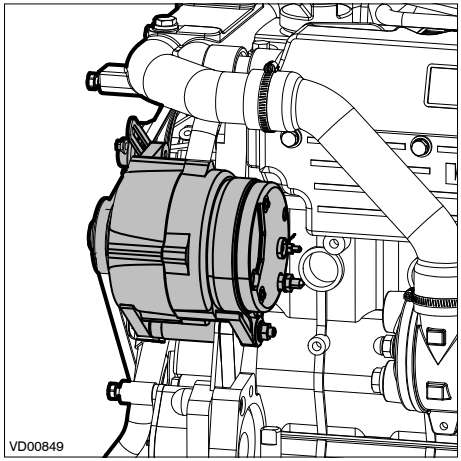
Checking the starter motor and alternator

Every 1000 operating hours.



54 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.



55 Checking the alternator

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

☞ **NOTE**

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

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

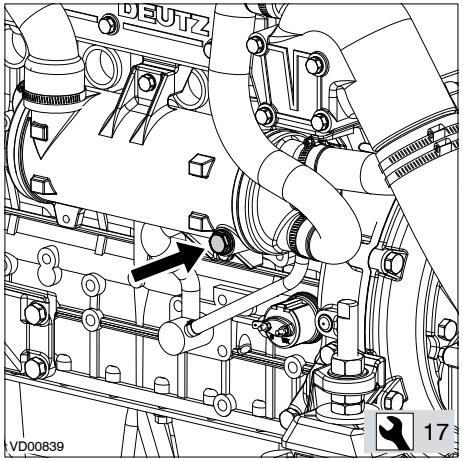
Under normal conditions of use cleaning the heat exchanger is not necessary!

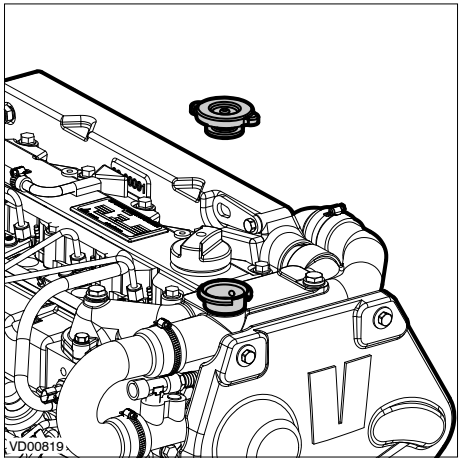
The engine temperature will be higher than normal if the heat exchanger is fouled.

Possible causes of fouling are:
- Small rubber particles from a damaged raw water pump impeller.
- Growth of algae or seaweed.

☞ **NOTE**

Only engines with intercooling!



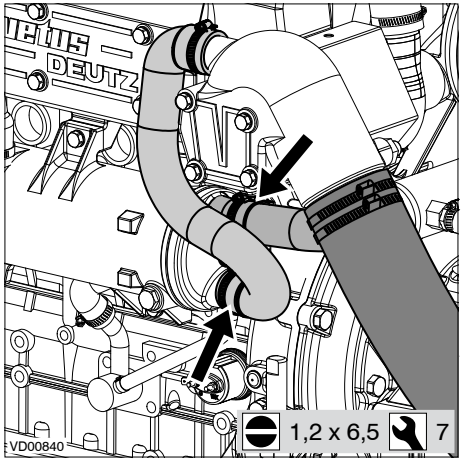


56 Drain the coolant

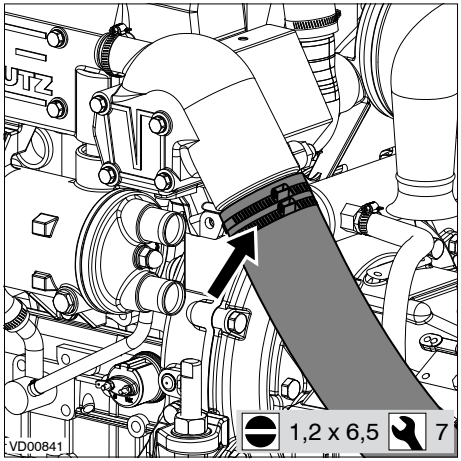
- To do this, remove the drain plug from the heat exchanger housing.
- Remove the filler cap on the top of the expansion tank to allow air into the cooling system and check that all the liquid drains out.
- Reinstall the drain plug.

☞ **NOTE**

Only engines with intercooling!



57 Removing the raw water hoses

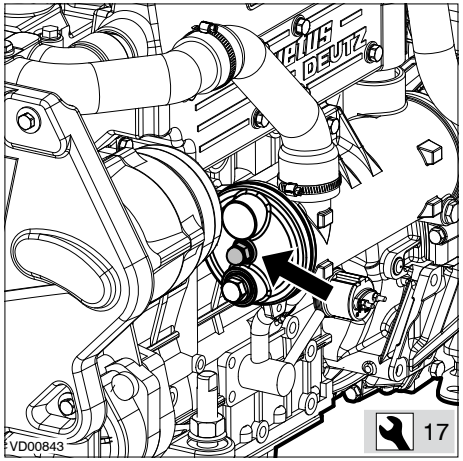


58 Removing the exhaust hose

- Close the sea cock.
- Remove both the raw water hoses.
- Remove the exhaust hose from the exhaust injection bend.

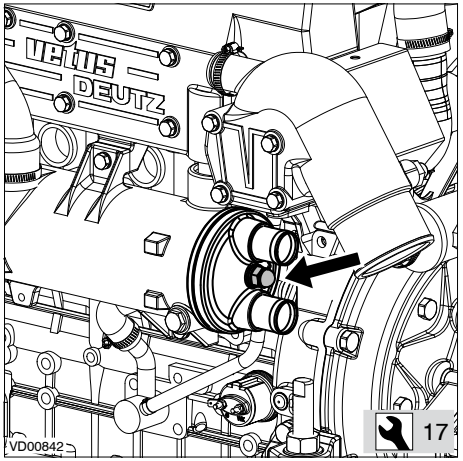
☞ **NOTE**

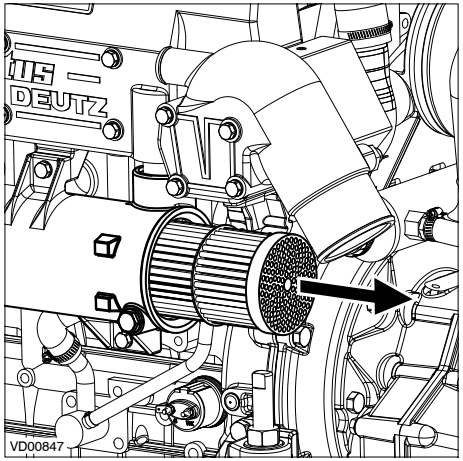
Only engines with intercooling!



59 Removing the end covers

- Unscrew the 2 cap nuts and pull the rod out of the end covers.
- Remove the end covers and the O-rings.



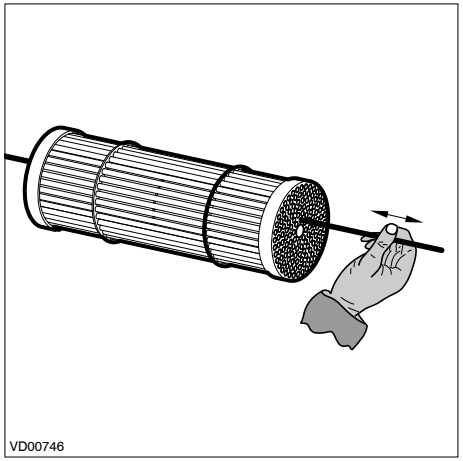


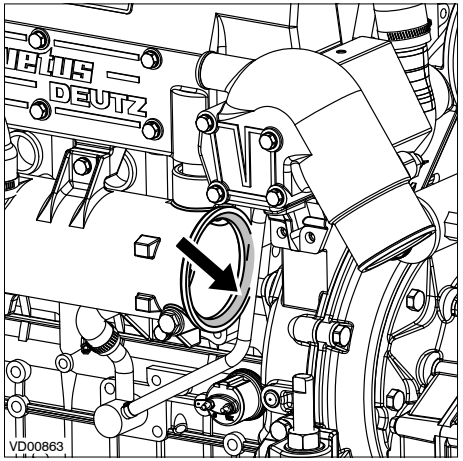
60 Take out the heat exchanger

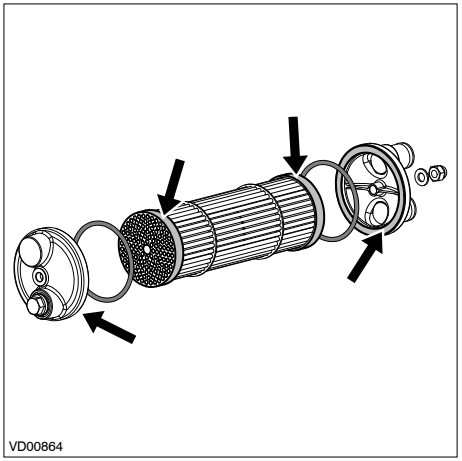
- Slide the heat exchanger out of the housing.

NOTE

Only engines with intercooling!





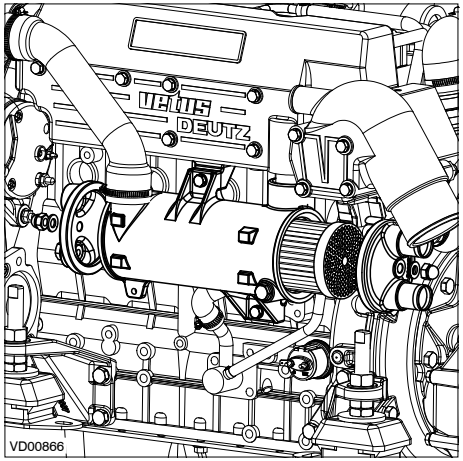


61 Cleaning the heat exchanger

- 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.
- Clean the contact surfaces of the O-rings.

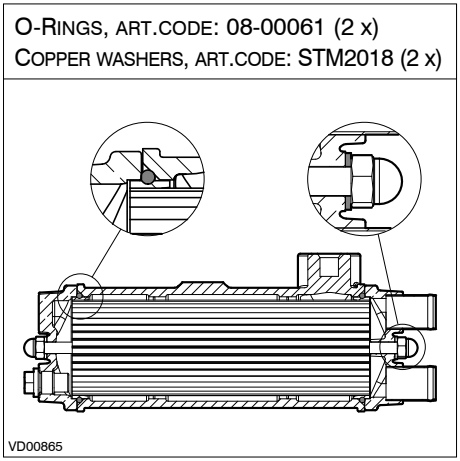
☞ **NOTE**

Only engines with intercooling!



62 Replacing heat exchanger

O-RINGS, ART.CODE: 08-00061 (2 x)
COPPER WASHERS, ART.CODE: STM2018 (2 x)



63 Fitting end covers

- Replace the heat exchanger in the original position in the heat exchanger housing.
- Centre the heat exchanger in the housing.
- Use new O-rings (87 x 5 mm) which have been greased and place them on the heat exchanger.
- Fit the end covers in the housing.
- Grease the ends of the threaded rod.
- Refit the threaded.
- Use new copper washers (M10) and refit the nuts with the washers.
  Tightening torque 30 Nm (22 ft.lbf)
- Refit all hoses disconnected.
- Top up the cooling system, see page 76.
- Open the sea cock.

NOTE

Only engines with intercooling!

☞ **NOTE**

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

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

Possible causes of fouling of the **tubes** of the after cooler are:
- Small rubber particles from a damaged raw water pump impeller.
- Growth of algae or seaweed.
-

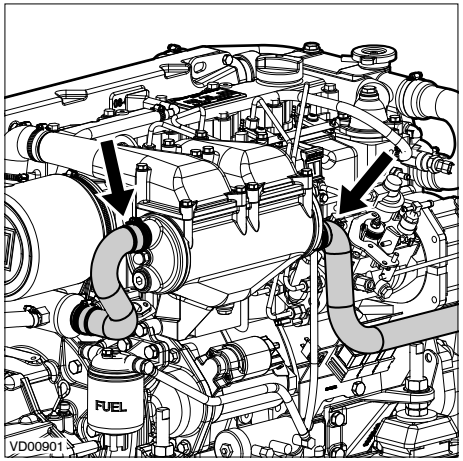
A possible cause of fouling of the **fins** of the after cooler is:
- Deposition dust and oil particles.

! **CAUTION**

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

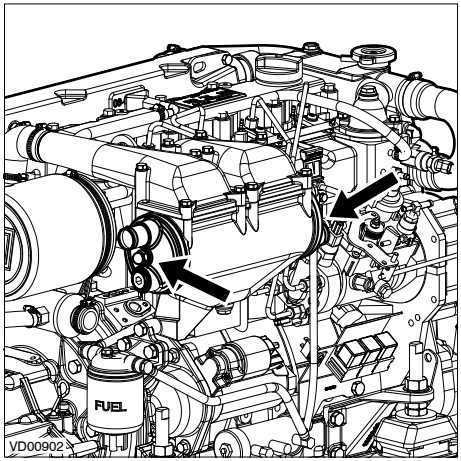
☞ **NOTE**

Only engines with a charge air cooler (after cooler).



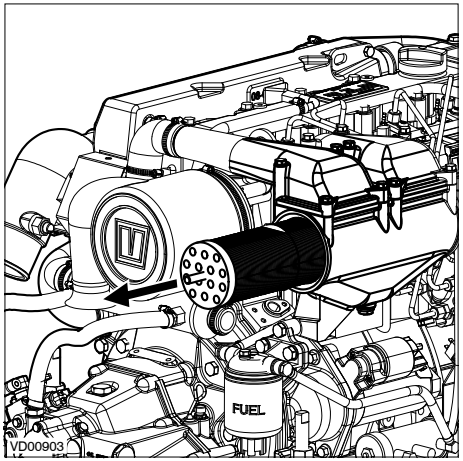
64 Removing the raw water hoses

- Close the sea cock.
- Remove both the raw water hoses.



65 Take out the heat exchanger

- Unscrew the 2 cap nuts.
- Remove the end covers and the O-rings.



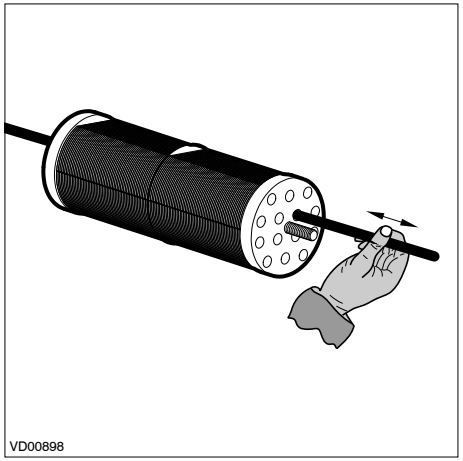
Slide the heat exchanger out of the housing.

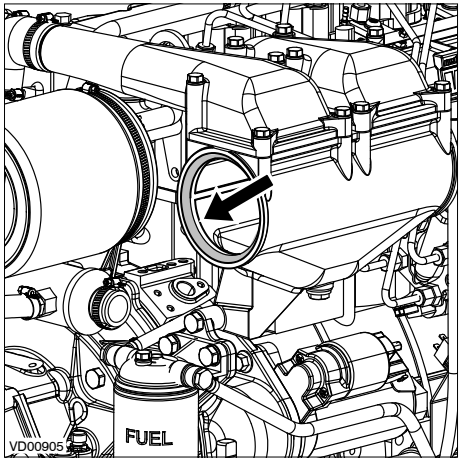
! CAUTION

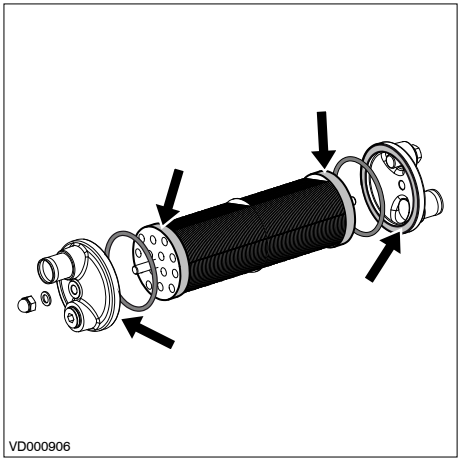
Avoid damage of the fins.

NOTE

Only engines with a charge air cooler (after cooler).







66 Cleaning the heat exchanger

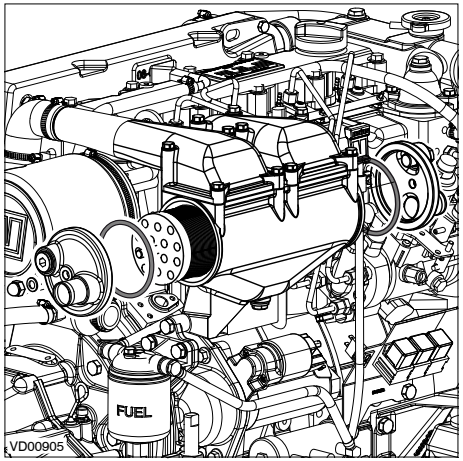
- Clean the tube of the heat exchanger; use a pipe brush and fresh water to remove any growth in the pipes.
- Then rinse the heat exchanger tubes with clean water.
- Clean the fins using petrol and compressed air, maximum pressure 2 bar (28 psi) to prevent damage to the fins.
- Ensure that both heat exchanger end chambers are free from dirt.
- Clean the contact surfaces of the O-rings.

! CAUTION

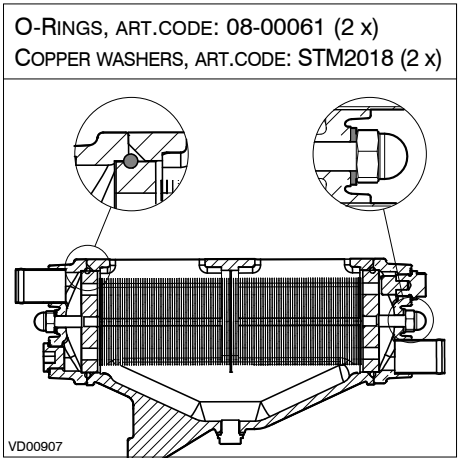
Handle with care to prevent damage to the tube stack and the cooling fins

NOTE

Only engines with a charge air cooler (after cooler).



67 Replacing the heat exchanger



68 Fitting end covers

- Put the heat exchanger back in exactly the same position in the after cooler housing.
- Centre the heat exchanger in the housing.
- Use new O-rings (87 x 5 mm) which have been greased and place them on the heat exchanger.
- Fit the end covers in the housing.
- Grease the threaded rods.
- Use new copper washers (M10) and refit the nuts with the washers.
  Tightening torque 30 Nm (22 ft.lbf)
- Refit all hoses disconnected.
- Open the sea cock.

NOTE

Only engines with a charge air cooler (after cooler).

7 Winter storage procedure

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

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

The engine should be inspected at the end of the sailing season and any necessary repairs carried out.

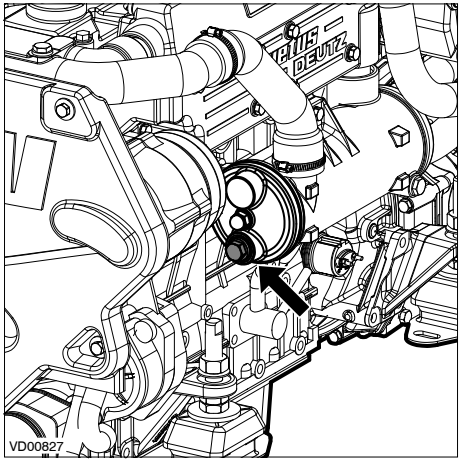
Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

7 Winter storage procedure

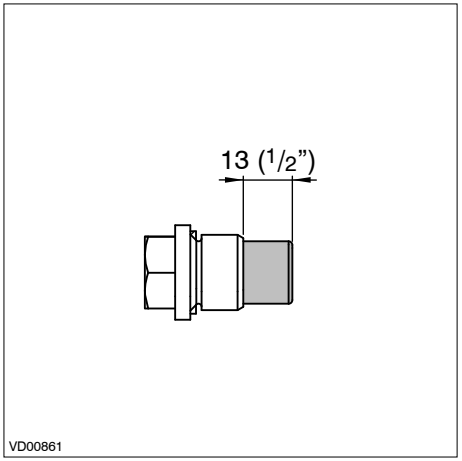
	Inspections and maintenance work to be carried out:	page
1	Clean the engine, remove any salt. Paint any rust spots and spray the whole engine with a protective medium, for example CRC protective 6-66.	92
2	Check the zinc anodes.	92
3	Drain off the water from the fuel system and fill the fuel tank.	94
4	Make sure that the engine fuel system is filled with a fuel mixture with protective properties.	95
5	Flush out the raw water circuit with fresh water and if necessary fill with antifreeze. Clean the heat exchanger if necessary.	96
6	Make sure that the cooling system is filled with a suitable anti-freeze.	97
7	Change the oil filter and the engine oil.	98
8	Change the oil in the gearbox.	98
9	Disconnect the battery cables, charge the batteries if necessary and grease the battery terminals.	99

7 Winter storage procedure



1 Corrosion protection

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



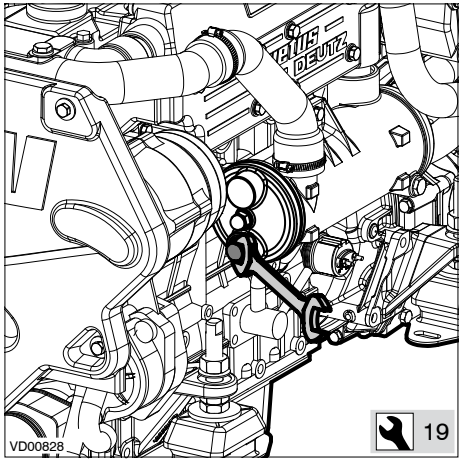
2 Zinc anode

There is a zinc anode in the heat exchanger to protect engine parts that come into contact with the external water from galvanic corrosion.

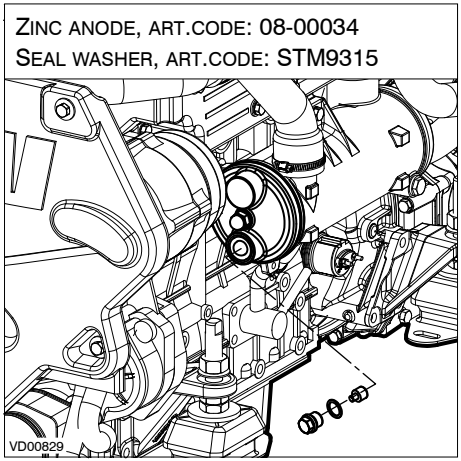
The speed at which the zinc anodes are sacrificed depends on many external factors.

- Check the zinc anodes; a new zinc anode is 13 mm (1/2") in length; if a zinc anode is shorter than 6 mm (1/4")it should be replaced.

7 Winter storage procedure



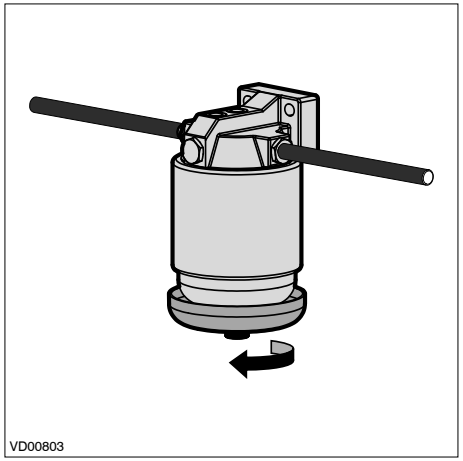
ZINC ANODE, ART.CODE: 08-00034
SEAL WASHER, ART.CODE: STM9315

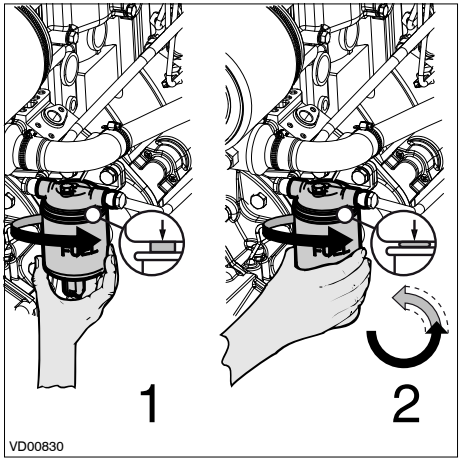


Check and replace the zinc anodes as follows:

- Stop the engine.
- Close the sea cock.
- Remove the zinc anode from the heat exchanger housing and respectively.
- Replace the (new) zinc anode and the copper ring. Use a sealant, for example Loctite® Thread Sealant with PTFE or LOXEAL® 18-10 Pipe Sealant.
- Open the sea cock, start the engine and check for leaks.

7 Winter storage procedure





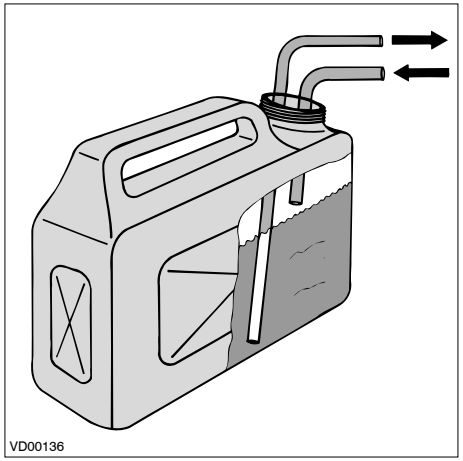
3 Fuel system

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

Make sure that the tank is completely filled with fuel. This to prevent the forming of condensation

- Fit a new fuel filter element. (page 64)

7 Winter storage procedure



4 Protective fuel mixture

! CAUTION

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

TIP!

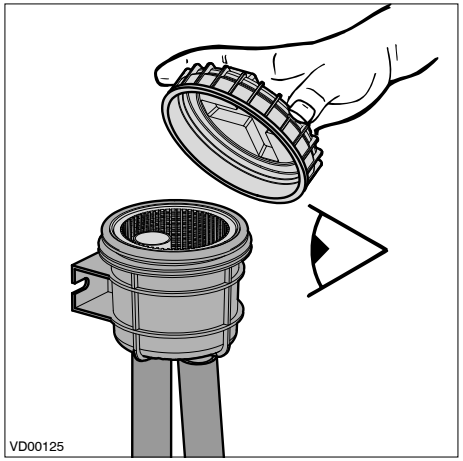
Combine running the engine with the protective fuel mixture with flushing the raw water circuit with fresh water, see Raw water cooling system.

- Connect the fuel supply pipe to a can filled with protective diesel fuel, for example 'Calibration Fluid' (ISO 4113) or with a mixture of 1 part of engine oil* to 9 parts of clean fuel**.
- Use this fuel to run the engine for 5 minutes at idling speed.
- Stop the engine.

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

** Only use DIN EN 590 Diesel fuel.
Preferably water-free fuel.
Collect some fuel from the return pipe, while engine is running.

7 Winter storage procedure



5 Raw water cooling system

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

TIP!

Combine flushing the raw water circuit with fresh water with running the engine with the protective fuel mixture, see Protective fuel mixture

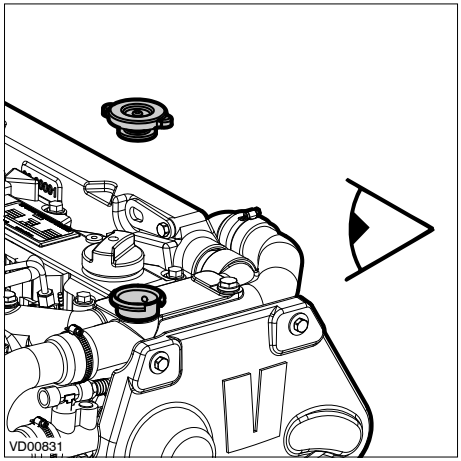
- Connect the raw water intake to a fresh water (tap water) supply or a tank containing fresh water. Open the tap and allow the engine to idle for at least 5 minutes to remove any salt and contamination from the raw water cooling system.
  Make sure that there is a sufficient supply of water to prevent the engine from overheating.

Heat exchanger
Only clean the heat exchanger if this is absolutely necessary, see page 80.

Raw water pump
Check the impeller of the raw water pump at least once every two years, see page 72.

- Stop the engine and close the sea cock.
- The external water system must be protected in areas where the temperature drops to below zero during the winter.
  Pour 1 litre (1/4 gallon) of anti-freeze into the water strainer and run the engine until the anti-freeze has disappeared into the cooling system.

7 Winter storage procedure



6 Fresh water 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.

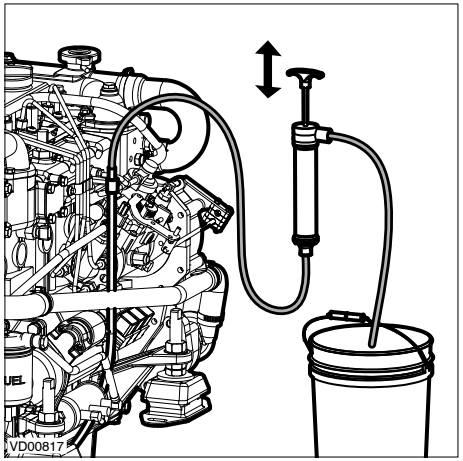
An improperly sealed lid will result in air sucked in by the raw water pump which again will result in overheating of the engine.

To avoid corrosion during winter storage the cooling system must be filled with an antifreeze/water mixture (or a coolant). For specifications see page 127.

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

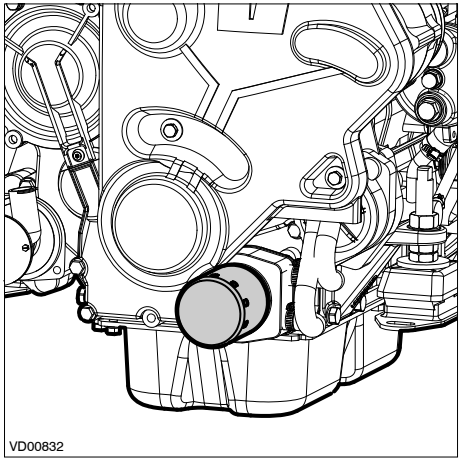
For coolant replacement see page 74.

7 Winter storage procedure

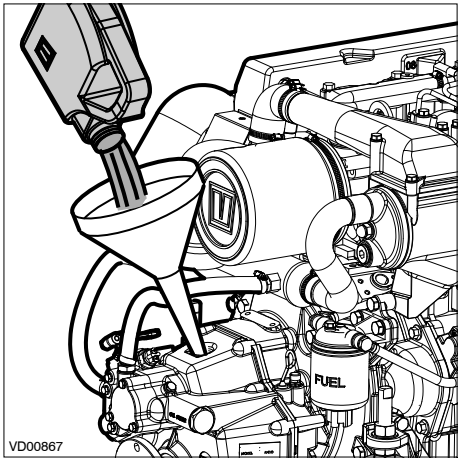


7 Lubrication system

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



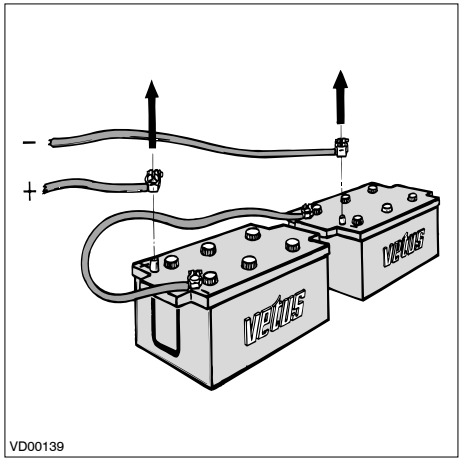
- Replace the oil filter and change the engine oil, see page 58; use oil with protective properties. For oil specification see page 124.



8 Gearbox oil change

- Stop the engine and change the oil of the gearbox. (page 61 and 62)

7 Winter storage procedure



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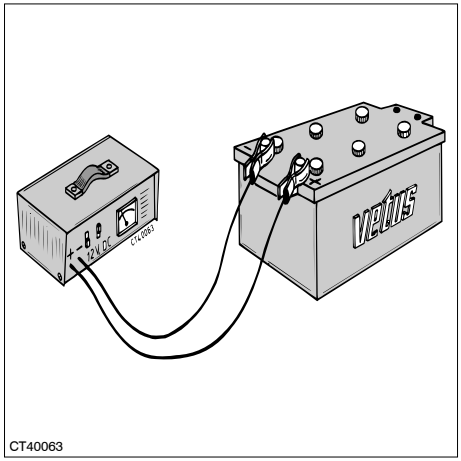


CT40063

9 Electrical system

- Disconnect the battery cables.
- Charge batteries during winter lay-up regularly if required!
- Follow the recommendations given on pages 54 to 57 or consult the recommendations given by the battery supplier for inspection and maintenance of the batteries.

8 Recommissioning after winter storage

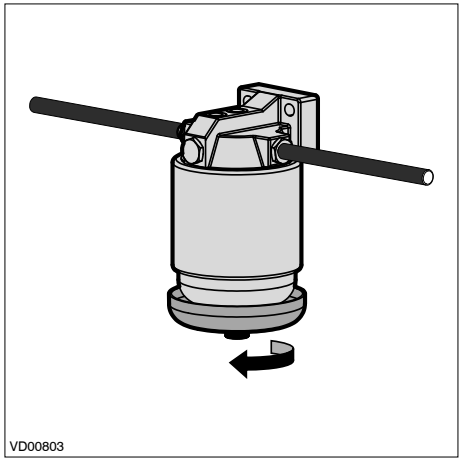
The engine must be inspected and any maintenance work carried out at the beginning of the sailing season.

Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

	Inspections and maintenance work to be carried out are:	page
1	Drain the water from the fuel system.	101
2	Check the raw water system.	102
3	Check the coolant level in the internal cooling system.	103
4	Check the oil level.	103
5	Check the batteries and reconnect these.	104
6	Check the working of the engine.	104
7	Check all hose connections for leaks.	105
8	Check the working of the instruments and the engine controls.	105

8 Recommissioning after winter storage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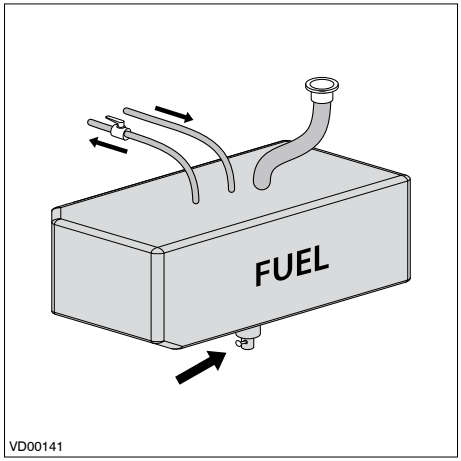

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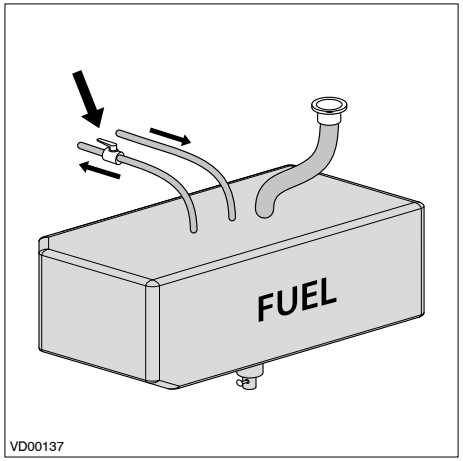
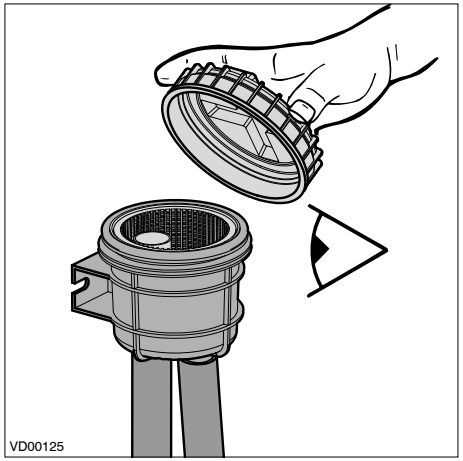


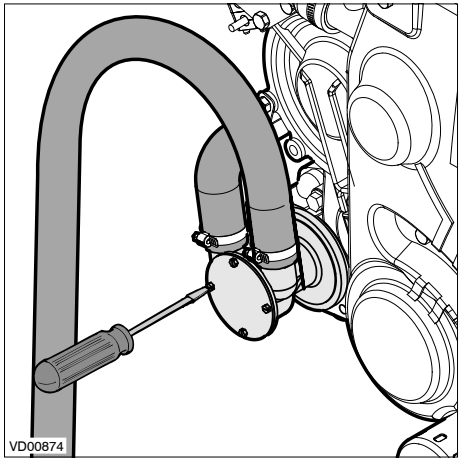
VD00137

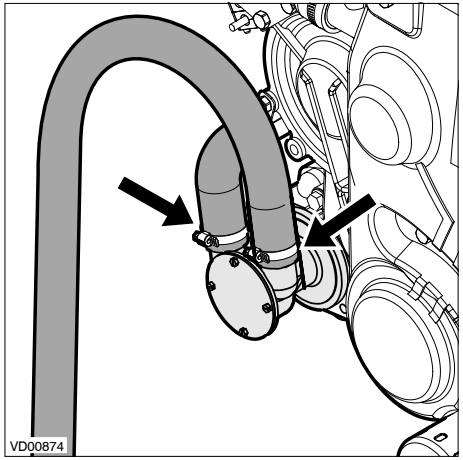
1 Fuel system

- Drain the water from the water separator/ fuel filter. (page 49)
- Drain the water from the fuel tank.
- Open the fuel valve.

8 Recommissioning after winter storage



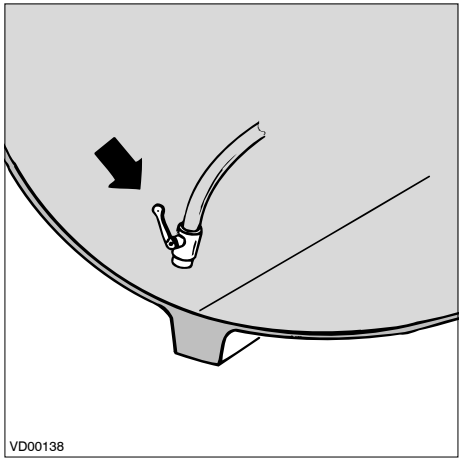




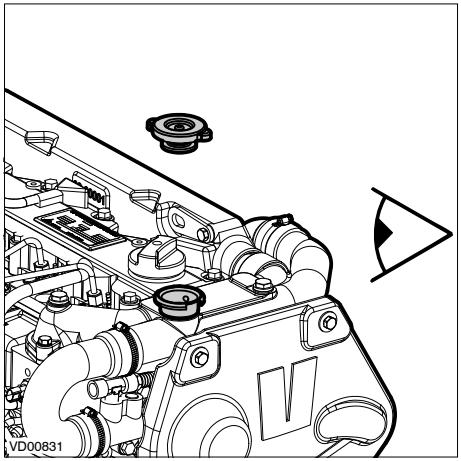
2 Raw water cooling system

- Check that the lid of the raw water strainer is reinstalled.
- Check that the lid of the raw water pump is in place (page 72, 73).
- Re-tighten possible loose hose clamps.

8 Recommissioning after winter storage

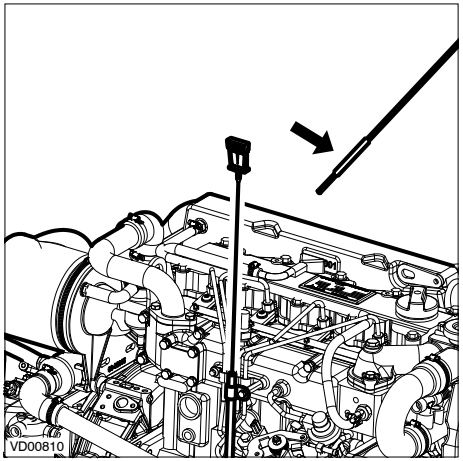


- Open the sea cock.



3 Fresh water cooling system

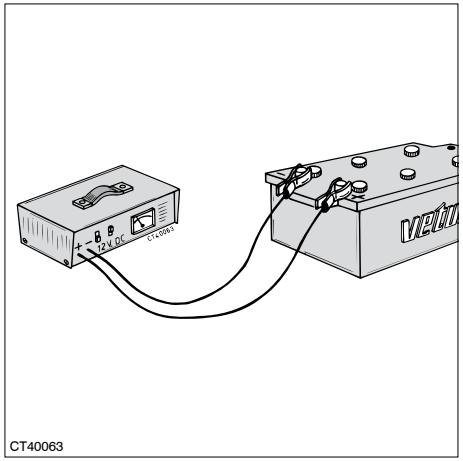
- Check the coolant level. (page 47)



4 Lubrication system

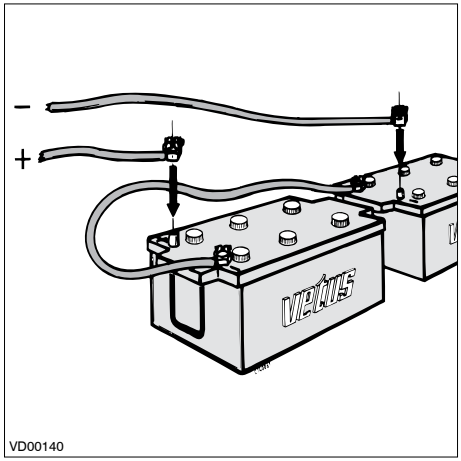
- Check the engine oil level. (page 46)

8 Recommissioning after winter storage

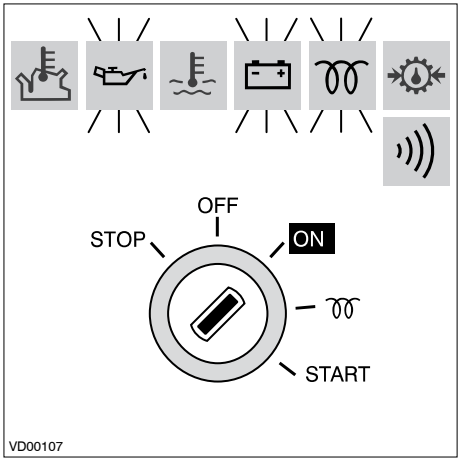


5 Electrical system

- Make sure that the batteries are fully charged. (page 54, 99).



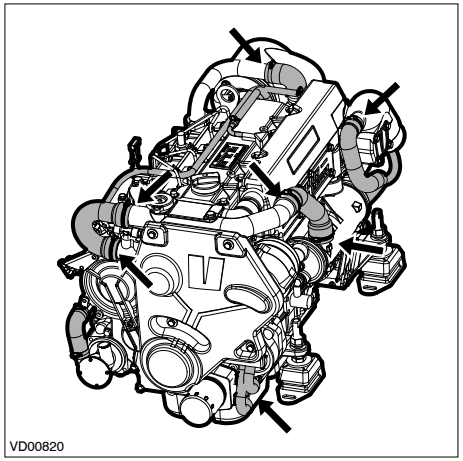
- Connect the batteries.



6 Switching on

- Turn the starter key on the instrument panel to ‘ON’; the indicator lights for oil pressure and the dynamo will now come on and the alarm buzzer will sound.

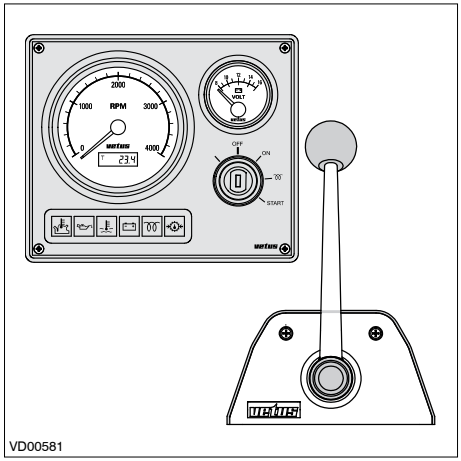
8 Recommissioning after winter storage



VD00820

7 Check engine for leaks

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



VD00581

8 Checking instruments and remote controls

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

9 Troubleshooting

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!

	Fault	page
1	Engine will not crank	108
2	Engine cranks but will not start, no smoke from exhaust	108
3	Engine cranks but will not start, smoke from exhaust	109
4	Engine starts but runs unevenly (rough idling) or stalls	109
5	Engine does not reach maximum RPM under load	110
6	Engine overheats	111
7	Engine not firing on all cylinders	112
8	Engine has little or no oil pressure	112
9	Engine oil consumption excessive	113
10	Fuel consumption excessive	113
11	Black exhaust smoke (idling)	114
12	Blue exhaust smoke (idling)	114
13	Black exhaust smoke (at load)	114
14	White exhaust smoke (at full load)	115
15	Burnt oil trace in exhaust line.	115

1 Engine will not crank

Possible fault	Remedy
Faulty or discharged battery (too low voltage).	Check / recharge battery and check engine alternator and/or battery charger.
Fuse blown.	Replace.
Loose or corroded connections in starting circuit.	Clean and tighten connections.
Wrong engine electric mass connection.	Repair.
Faulty starter-switch or faulty starter-relay.	Check / replace.
Faulty starter-motor or pinion does not engage.	Check / replace starter-motor.
Seized components.	Repair.
Water in the cylinder .	Check / Repair.

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

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

3 Engine cranks but will not start, smoke from exhaust

Possible fault	Remedy
Faulty injector/injection pump.	Check, replace if required.
Faulty injector/injection pump.	Check, replace if required.
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Incorrect injection timing.	Check / adjust.
Setting of stop valve incorrect.	Check / adjust.
Incorrect lube oil SAE class or quality for ambient temperature.	Replace.
Faulty glow plugs.	Check / replace.
Insufficient intake air.	Check.
Intake air filter clogged .	Clean/replace
Incorrect valve clearance.	Adjust.

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

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

5 Engine does not reach maximum rpm under load

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

5 Engine does not reach maximum rpm under load

Possible fault	Remedy
Turbocharger damaged .	Replace.
VGT turbocharger actuator blocked .	Check unblock or replace.
Engine overloaded.	Check size of propeller.
Boat load inadequate.	-
Hull/propeller dirty.	Clean.

6 Engine overheats

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

6 Engine overheats

Possible fault	Remedy
Motor becomes apparently overheated as a result of faulty temperature switch, sensor or meter.	Check / replace.

7 Engine not firing on all cylinders

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

8 Engine has little or no oil pressure

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

9 Engine oil consumption excessive

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

10 Fuel consumption excessive

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

11 Black exhaust smoke (idling)

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

12 Blue exhaust smoke (idling)

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

13 Black exhaust smoke (at load)

Possible fault	Remedy
Faulty injector / injection pump.	Check / replace if required.
Incorrect injection timing.	Check / adjust.
Oil level incorrect.	Check .
Insufficient intake air, air filter dirty.	Check/clean the filter .
Leak in inlet manifold.	Check / replace.
Intercooler dirty.	Check/clean.
Incorrect valve clearance.	Adjust.
Excessive wear of cylinder / piston.	Check compression; refurbish engine.
Faulty turbo compressor.	Check / replace.
VGT Turbocharger actuator blocked	Unblock /replace
Engine overloaded, max. rpm is not reached.	Check sizes of propeller.
Engine overloaded.	Check size of propeller.

14 White exhaust smoke (at full load)

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

15 Burnt oil trace in exhaust line .

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

Model	:	DT4.70	DTA4.85
General			
Make	:	Vetus Deutz	
Number of cylinders	:	4	
Based on	:	TD 2009 L04	
Type	:	4-stroke diesel, in-line	
Injection	:	Direct injection	
Aspiration	:	Turbo-charged	Turbo-charged, after-cooled
Bore	:	90 mm	
Stroke	:	90 mm	
Total displacement	:	2290 cm^3 (140 cu.inch)	
Compression ratio	:	16 : 1	
Idling speed	:	900 rpm	
Max. no. of revolutions at no load	:	3050 rpm	
Direction of rotation	:	counter clockwise, viewed from the flywheel side	
Number of valves	:	2 per cylinder	
Valve Clearances	:	Self adjusting hydraulic tappet	
Weight (with standard gearbox)	:	290 kg (639 lbs)	298 kg (657 lbs)
Engine installation			
Max. installation angle	:	15 degrees backwards	
Max. athwart ships angle	:	25 degrees continuously, 30 degrees intermittent	

Model	:	DT4.70	DTA4.85
Maximum Output			
at the flywheel (ISO 3046-1)	:	50 kW (69 hp)	63 kW (85 hp)
at the prop shaft (ISO 3046-1)	:	49 kW (68 hp)	62 kW (84 hp)
at no. of revolutions of	:	2800 rpm	3000 rpm
Torque,	:	200 Nm (20.4 kgm, 147 ft.lb)	265 Nm (27.0 kgm, 195 ft.lb)
at no. of revolutions	:	1800 rpm	2000 rpm
Fuel consumption	:	264 g/kW.h (194 g/hp.h, 6.8 oz/hp.h)	244 g/kW.h (179 g/hp.h, 6.3 oz/hp.h)
at no. of revolutions	:	2800 rpm	3000 rpm
Fuel System (Self-bleeding)	:		
Injection pump	:	Delphi DP210	
Injectors	:	Delphi	
Opening pressure	:	250 bar (3626 psi)	
Firing order	:	1 - 3 - 4 - 2	
Injection timing	:	1° CA ATDC	
Fuel filter element	:	Vetus STM3690	
Fuel lift pump	:	Suction height max. 1,5 m (5 ft)	
Fuel supply connection	:	for hose 8 mm (5/16") I.D.	
Fuel return connection	:	for hose 8 mm (5/16") I.D.	

Model	:	DT4.70	DTA4.85
Oil lubrication system			
Oil capacity, max.	:		
without oil filter	:	6.0 litres (10.6 UK pt, 12.7 US pt)	
with oil filter	:	6.3 litres (11.1 UK pt, 13.3 US pt)	
Oil Filter	:	08-00085	
Oil temperature in sump	:	max. 120°C (248°F)	
Cooling system			
Capacity	:	8.0 litres (14.1 UK pt, 16.9 US pt)	
Thermostat	:	opening at 82°C (180°F), fully opened at 97°C (207°F)	
Coolant pump,			
Flow at max. engine rpm	:	135 litres/min (29.7 UK gal/min, 35.7 US gal/min)	
Raw water pump,			
Flow at max. engine rpm	:	80 litres/min (17.6 UK gal/min, 21.1 US gal/min)	
Total head at max. flow	:	2 metre (6’ 7”) H2O	
Impeller	:	STM8074	
Inlet connection for hose	:	28 mm (1 1/8") I.D.	
Heater supply connection	:	16 mm (5/8") I.D.	
Heater return connection	:	16 mm (5/8") I.D.	

Model	:	DT4.70	DTA4.85
Combustion air			
Air filter	:	08-00084	
Intake vacuum pressure	:	max. 25 mbar (0.74 in Hg)	
Turbo pressure at max. load	:	max. 760 mbar (22.4 in Hg)	
Exhaust system			
Exhaust diameter	:	75 mm (3”)	
Exhaust back pressure	:	at specified output max. 100 mbar (3 in Hg)	
Electrical System			
Voltage	:	12 Volt	
Alternator	:	14 Volt, 90 A / 130 A optional	
Starter	:	14 Volt, 2.0 kW	
Capacity, starter battery	:	min. 65 Ah, max. 143 Ah	
Protection	:	Blade fuse ‘ATO’ 10 Amp	
V- belt	:	08-00083	

Model		:	**DT4.70**	**DTA4.85**
Gearbox			Gear ratio	Gear ratio
Technodrive:	type TM345	:	(1.54) 2.00 2.47	(1.54) 2.00 2.47
	type TM345A	:	(1.54) 2.00 2.47	(1.54) 2.00 2.47
ZF:	type ZF25	:	1.969 2.800	1.969 2.800
	type ZF25A	:	(1.548) 1.926 2.292 (2.480) 2.714	(1.548) 1.926 2.292 (2.480) 2.714

Screw connection	Size	Class	Torque	Remark
Engine bracket front	M10	8.8	41 Nm	
Engine bracket rear	M10	8.8	42 Nm	
Cylinder head bolts - Engine block	M12	10.9	35 Nm + 60° + 60°	Use new bolts. Observe tightening sequence.
Rocker - Cylinder head	M8	8.8	27 Nm	
Rocker cover	M8	10.9	27 Nm	
Lifting eye - Heat exchanger	M8	8.8	22 Nm	
Lifting eye - Cyl. head	M8	8.8	21 Nm	
Oil drain plug	M14		39 Nm	Use new copper washers.
Exhaust manifold - Cyl. Head	M8	8.8	27 Nm	
Exhaust manifold - Turbo charger	M8	8.8	41 Nm	Use screw thread mounting compound.
Turbo charger – exhaust bend	M8	8.8	27 Nm	Use screw thread mounting compound.
Air intake manifold (AIM)	M8	8.8	27 Nm	Observe tightening sequence.
Injector holder - Cylinder head	M8	10.9	35 Nm	Torx
Injector holder - Cylinder head	M22		68 Nm	
Injection line - Injector	M12		28 Nm	
Injection line mounting	M6	8.8	9 Nm	
Injection pump - Engine blok	M8	10.9	27 Nm	
Set screw - Injection pump			10 Nm	

Screw connection	Size	Class	Torque	Remark
Fuel line - Injection pump	1/2"		9 Nm	
Oil filter - Oil cooler	M14		Hand tight	Lubricate the oil seal.
Oil cooler - Adaptor	M22		41 Nm	
Oil pressure switch	M10x1		20 Nm	
Coolant pump - Timing cover	M8	8.8	27 Nm	Observe tightening sequence.
Temperature sender - Cylinder head			4 Nm	Use screw thread sealant.
Flywheel - Crank shaft	M12	10.9	96 Nm	Use new bolts.
Pulley - Crank shaft	M20	10.9	300 Nm	
Pulley - Coolant pump	M6	8.8	9 Nm	
Starter - Flywheel housing	M10	8.8	41 Nm	
Alternator - Timing cover	M8	8.8	21 Nm	
Alternator - Tensioner bracket	M8	8.8	21 Nm	
Tensioner bracket - Timing cover	M8	8.8	21 Nm	
Glow plug - Cylinder head	M10		15 Nm	
Connection strip - Glow plugs	M4		2.5 Nm	Lock nut.
Battery cable - Starter	M8		9 Nm	
Nuts end covers heat exchanger	M10		30 Nm	Use new copper washers.
Nuts end covers after cooler	M10		30 Nm	Use new copper washers.

Fuel Quality Grade

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

The following fuel specifications / standards are approved:
- CEN EN 590
- ASTM D 975-88: 1-D en 2-D
- NATO Code F-54
- JIS K2204 1 en 2
- DIN 51 628
- ASTM D 396: 1 en 2
- BS 2869 class A2

The cetane number must be at least 49.

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

Winter-grade fuel

Waxing may occur at low temperatures, clogging the fuel system and reducing engine efficiency.
If the ambient temperature is less than O°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).

Biodiesel

! CAUTION

Only use the prescribed diesel fuel.
Do not use biodiesel!

Engine oil

Lubricating oils are specified according to performance and quality class. It is usual for specifications to be given in accordance with the API (American Petroleum Institute) and the ACEA (European Automobile Manufacturers Association).

Permitted API oils: CH-4 / CG-4 / CI-4
Permitted ACEA oils: E3-96 / E4-07 / E5-02 / E7-04

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 life-span.

Recommended lubricating oil viscosity

There are two important considerations when it comes to ambient temperature in order to achieve satisfactory engine performance.
- the possibility to turn the engine over quickly enough to make an easy start possible and
- adequate lubrication of internal wear surfaces during starting and warming up.

By making the right choice of lubricating oil these requirements can be met.
Because the viscosity (runniness) of lubricating oil varies with temperature, the ambient temperature in which the engine is started determines the choice of viscosity class (SAE class).
To avoid having to change the oil for different seasons we recommend SAE 15W-40 all-season motor oil.

For example:
Vetus Marine Diesel Engine Oil 15W40
Shell Rimula R4 L 15W40

For oil capacity see page. 118.

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°	JIS: K 2283	=30% / -15% max. for new oil 3:3
Total base number (HCl)	mgKOH/g	JIS: K 2501	2.0 min.
Total acid number	mgKOH/g		+3.0 max. for new oil
Water content	% volume	JIS: K 2275	0,2 max.
Flash point	°C	JIS: K 2265	180 min.
Pentane insolubles	% weight	ASTM: D 893	0,5 max.
Coagulated pentane insolubles	% weight		3,0 max.

Gearbox Lubricating Oil

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

Technodrive:
type TM345 : 1.6 litres [1], Engine oil SAE 20W40-CD (2.8 UK pt, 3.4 US pt)
type TM345A : 1.6 litres [1] Engine oil SAE 20W40-CD (2.8 UK pt, 3.4 US pt)

ZF Hurth:
type ZF25 : 2.5 litres [1] (4.4 UK pt, 5.3 US pt) ATF [2]
type ZF25A : 1.8 litres [1] (3.2 UK pt, 3.8 US pt) ATF [2]

[1] Without oil cooler, content oil cooler approx. 0.3 litres (0.53 UK pt, 0.63 US pt)

[2] ATF : Automatic Transmission Fluid;
Transmission oil type A, Suffix A.
For example:
Vetus Transmission Oil
Shell Donax T6
Gulf Synth

Other brands of gearboxes:
See supplied owner's manual for oil type and quantities.

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%	-35°C (-31°F)	55%
40 vol%	-28°C (-18°F)	60%
min. 35 vol%	-22°C (-8°F)	65%

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

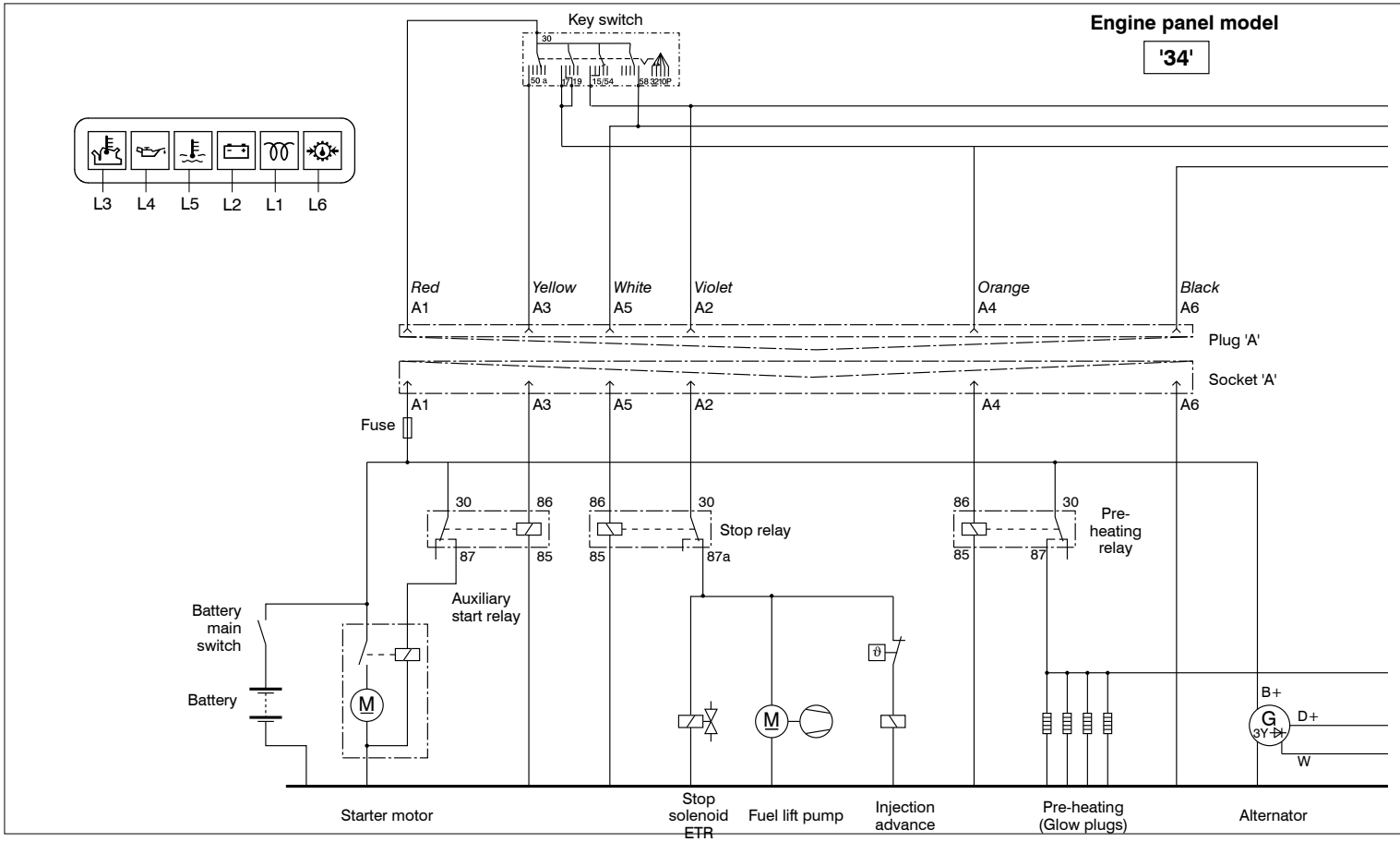
Water quality		min.	max.
pH-value at 20°C (68°F)		6.5	8.5
Chloride ion content	[mg/dm³]	-	100
Sulphate ion content	[mg/dm³]	-	100
Total hardness	[degrees]	3	12

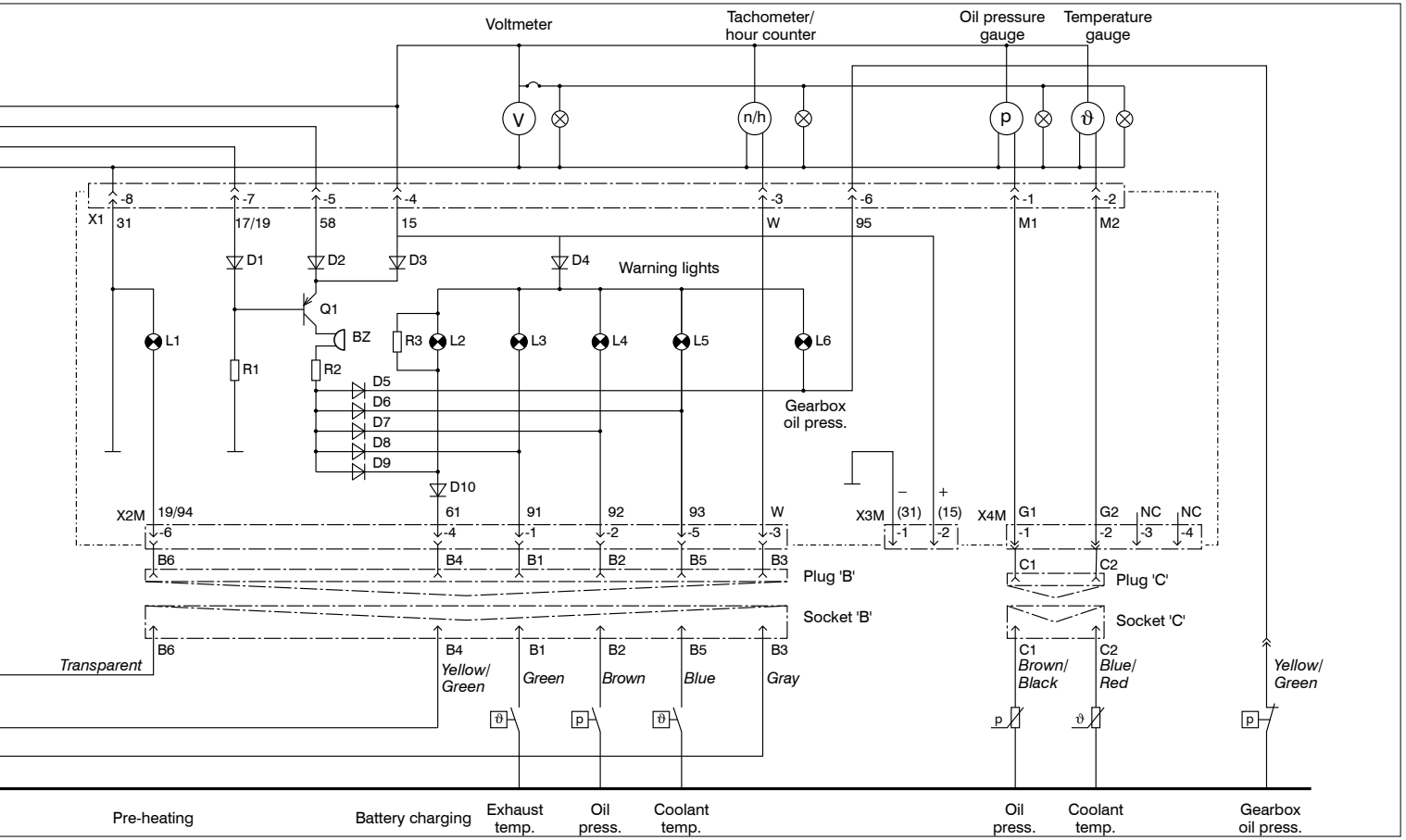
CAUTION

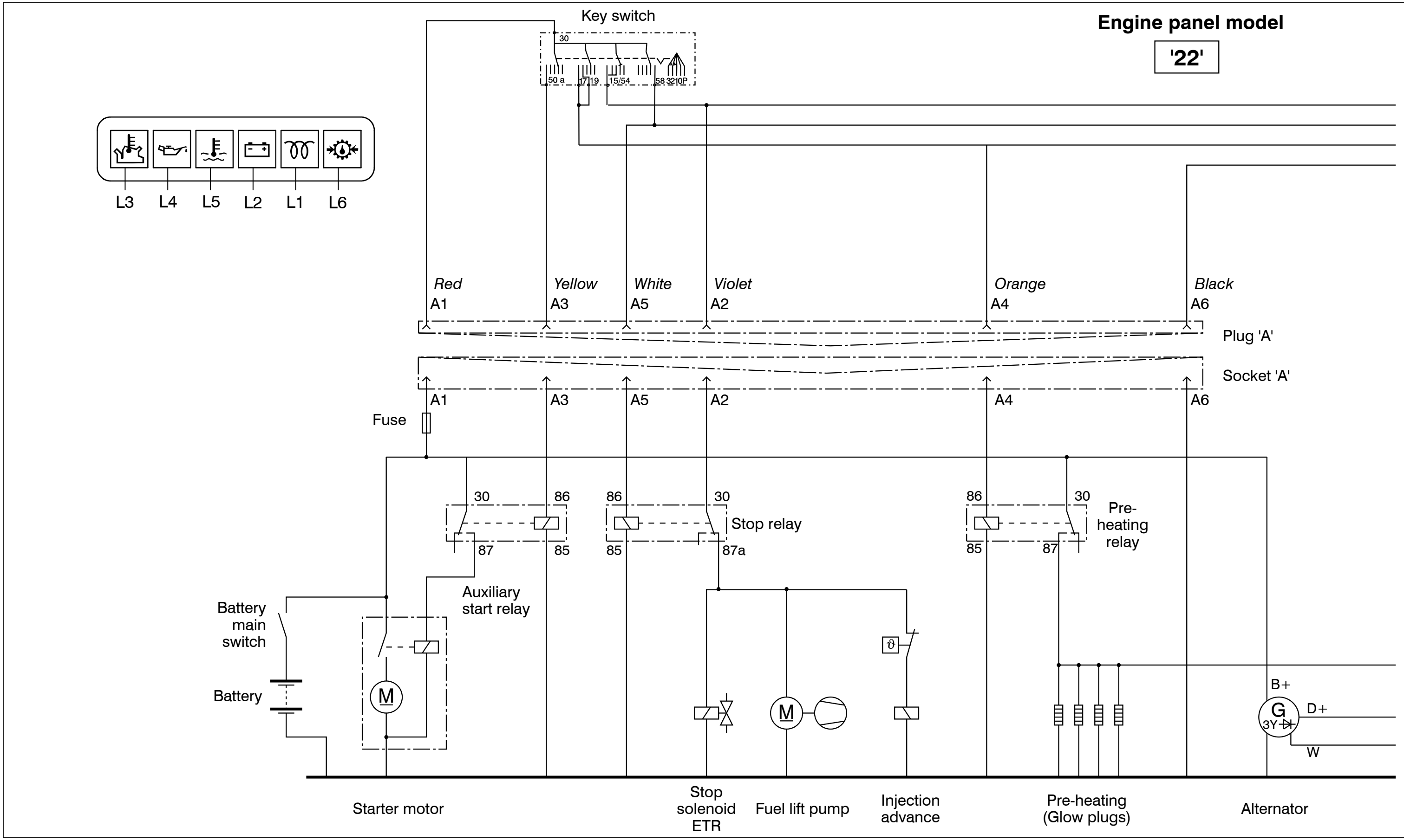
Never use sea-water or brackish water.

WARNING

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


Key switch
30
50 a
17/19
15/54
58 3210P
Engine panel model
'34'
L3
L4
L5
L2
L1
L6
Red
A1
Yellow
A3
White
A5
Violet
A2
Orange
A4
Black
A6
Plug 'A'
Socket 'A'
Fuse
30
86
87
85
Stop relay
87a
Pre-
heating
relay
Auxiliary
start relay
Battery
main
switch
Battery
M
B+
G
D+
W
Starter motor
Stop
solenoid
ETR
Fuel lift pump
Injection
advance
Pre-heating
(Glow plugs)
Alternator


Voltmeter
Tachometer/ hour counter
Oil pressure gauge
Temperature gauge
V
n/h
p
ϑ
X1
-8 31
-7 17/19
-5 58
-4 15
-3 W
-6 95
-1 M1
-2 M2
D1
D2
D3
D4
Warning lights
Q1
BZ
L1
R1
R2
R3
L2
L3
L4
L5
L6
D5
D6
D7
D8
D9
D10
Gearbox oil press.
X2M 19/94 -6
61 -4
91 -1
92 -2
93 -5
W -3
X3M (31) -1
(15) -2
X4M G1 -1
G2 -2
NC -3
NC -4
B6
B4
B1
B2
B5
B3
Plug 'B'
Socket 'B'
C1
C2
Plug 'C'
Socket 'C'
Transparent
Yellow/ Green
Green
Brown
Blue
Gray
Brown/ Black
Blue/ Red
Yellow/ Green
Pre-heating
Battery charging
Exhaust temp.
Oil press.
Coolant temp.
Oil press.
Coolant temp.
Gearbox oil press.


Key switch
30
50 a
17 19
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58 3210P
Engine panel model
'22'
L3
L4
L5
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L1
L6
Red
Yellow
White
Violet
Orange
Black
A1
A3
A5
A2
A4
A6
Plug 'A'
Socket 'A'
A1
A3
A5
A2
A4
A6
Fuse
30
86
86
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87a
85
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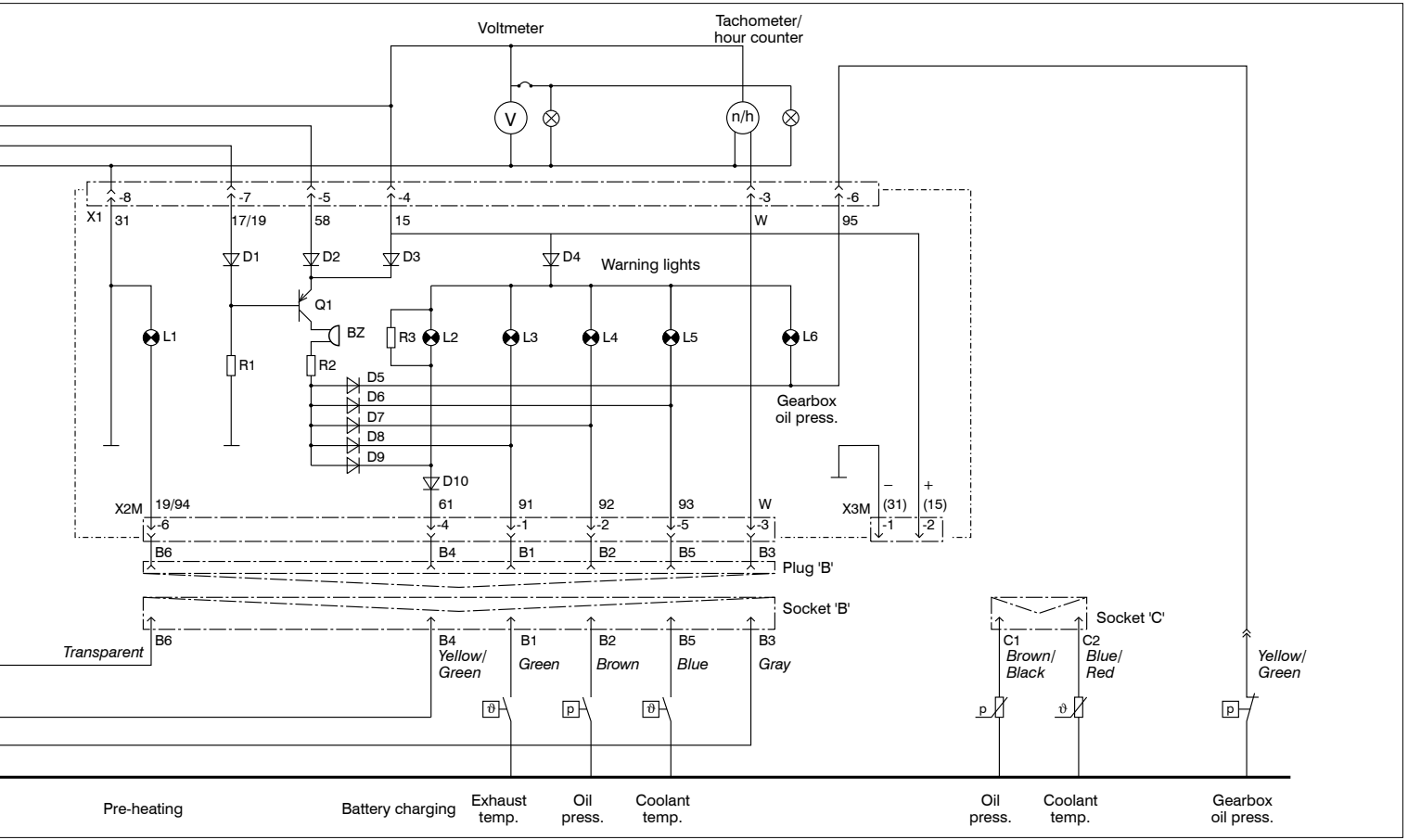
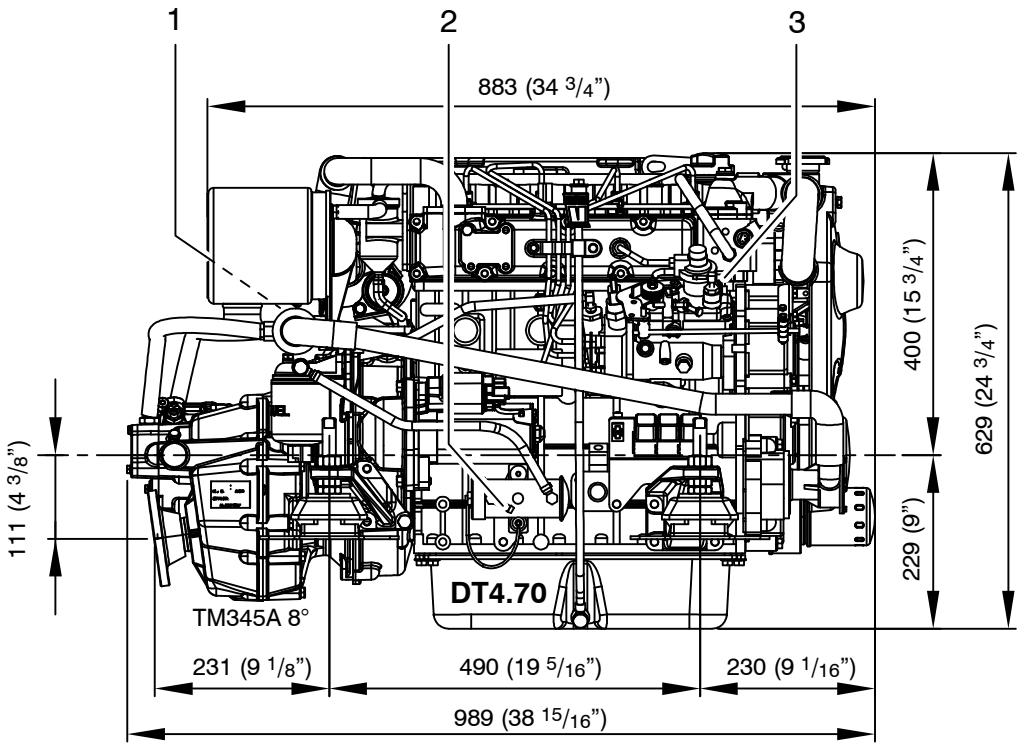
Stop relay
Pre-
heating
relay
Auxiliary
start relay
Battery
main
switch
Battery
M
M
B+
G
D+
3Y
W
Starter motor
Stop
solenoid
ETR
Fuel lift pump
Injection
advance
Pre-heating
(Glow plugs)
Alternator

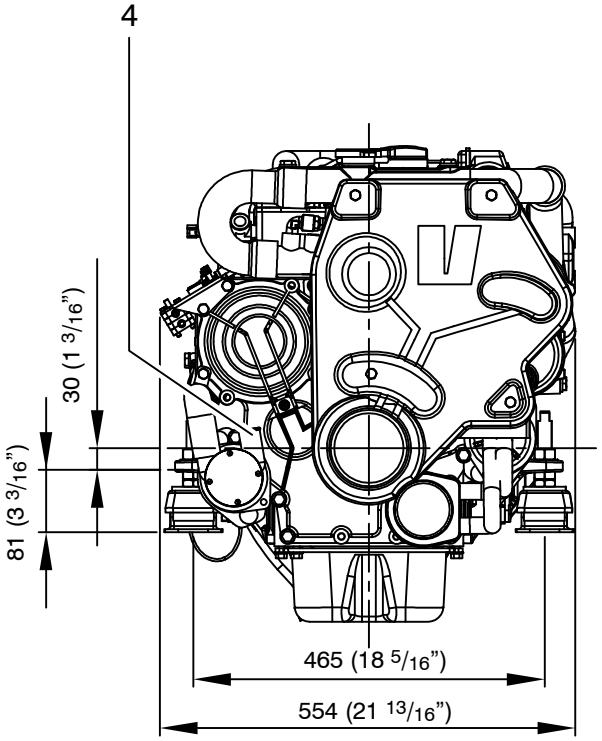

Voltmeter
Tachometer/
hour counter
V
n/h
-8
-7
-5
-4
-3
-6
X1
31
17/19
58
15
W
95
D1
D2
D3
D4
Warning lights
Q1
BZ
R3
L1
L2
L3
L4
L5
L6
R1
R2
D5
D6
D7
D8
D9
D10
Gearbox
oil press.
X2M
19/94
61
91
92
93
W
X3M
(31)
(15)
-6
-4
-1
-2
-5
-3
-1
-2
B6
B4
B1
B2
B5
B3
Plug 'B'
Socket 'B'
Socket 'C'
Transparent
B6
B4
Yellow/
Green
B1
Green
B2
Brown
B5
Blue
B3
Gray
C1
Brown/
Black
C2
Blue/
Red
Yellow/
Green
Pre-heating
Battery charging
Exhaust
temp.
Oil
press.
Coolant
temp.
Oil
press.
Coolant
temp.
Gearbox
oil press.

13 Overall dimensions



vetus® **DT4.70**

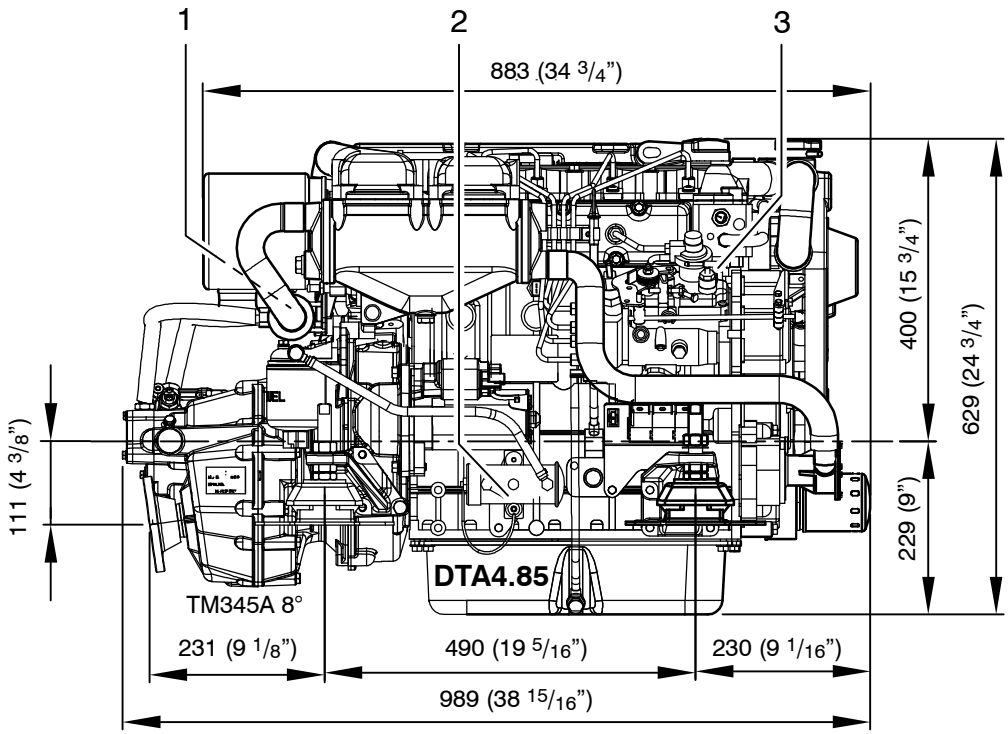
13 Overall dimensions



1 Exhaust ø 75 mm
2 Fuel supply ø 8 mm
3 Fuel return ø 8 mm
4 Raw water intake ø 28 mm

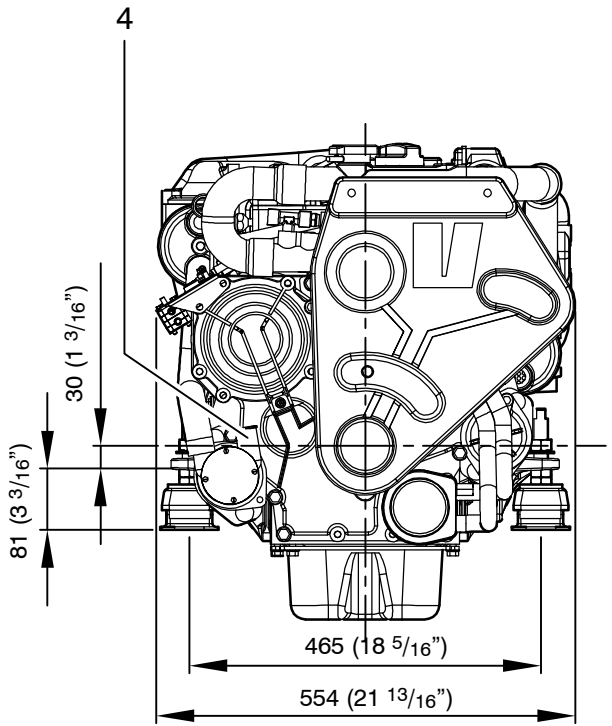
1 : 10

13 Overall dimensions



DTA4.85

13 Overall dimensions



1 Exhaust ø 75 mm
2 Fuel supply ø 8 mm
3 Fuel return ø 8 mm
4 Raw water intake ø 28 mm

1 : 10

14 Index

14 Index

Art. code	Description	
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360503.01	Bedienungsanleitung DT4.70, DTA4.85	(Deutsch)
360504.01	Manuel d'utilisation DT4.70, DTA4.85	(Français)
360505.01	Manual de operacion DT4.70, DTA4.85	(Español)
360506.01	Istruzioni per l'uso DT4.70, DTA4.85	(Italiano)
360507.01	Brugsanvisning DT4.70, DTA4.85	(Dansk)
360508.01	Användarmanual DT4.70, DTA4.85	(Svenska)
360509.01	Bruksanvisning DT4.70, DTA4.85	(Norsk)
360510.01	Käyttöopas DT4.70, DTA4.85	(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)
361531.01	Onderdelenboek / Parts manual DT4.70, DTA4.85	(Nederlands / English)
362433.01	Service manual DT4.70, DTA4.85	(English / Deutsch / Français / Español)

Vetus Diesel DT4.70 DTA4.85 English

vetus n.v.

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