VD6.210

D-LINE Marine Diesel Engines

Operation manual

VD4.120
VD4.140
VD6.170
VD6.210

360602.01

Operation manual

VD4.120 VD6.170
VD4.140 VD6.210

Serial numbers

Engine serial number Vetus: .....

Engine serial number Deutz: .....

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 10).

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

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360602.01

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' (320199.06).

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

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

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

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

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

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

DANGER

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

CAUTION

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

WARNING

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

NOTE

Emphasises important procedures, circumstances etc.

Symbols

Indicates that the relevant procedure must be carried out.

Indicates that a particular action is forbidden.

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

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

Fire risk!

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

- First connect the positive lead
- Lastly connect the earth cable (negative pole) to the engine block

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

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

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

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

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

2 Introduction

Dear customer,

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

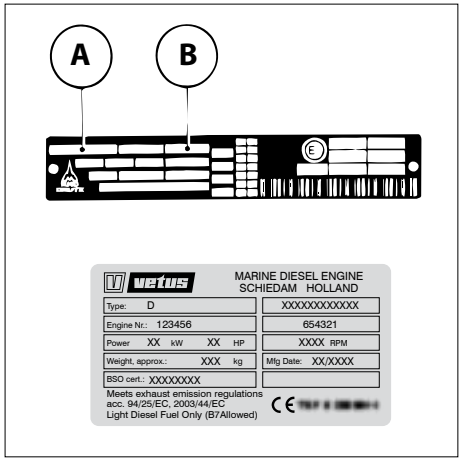
Your engine is appropriately equipped for your vessel, which means that not necessarily all components described in this manual are mounted to your engine.

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

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

We are available to help with any additional inquiries.

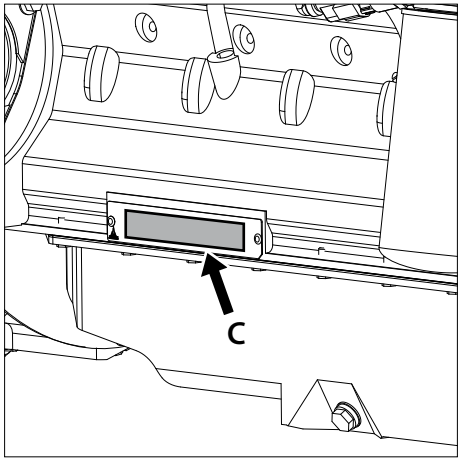
Sincerely,
Vetus b.v.



1 Engine data tag

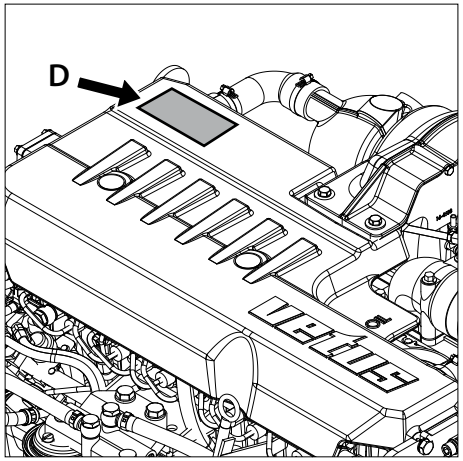
Model (A), Deutz engine serial number (B) and performance data are stamped on the engine data tag.

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

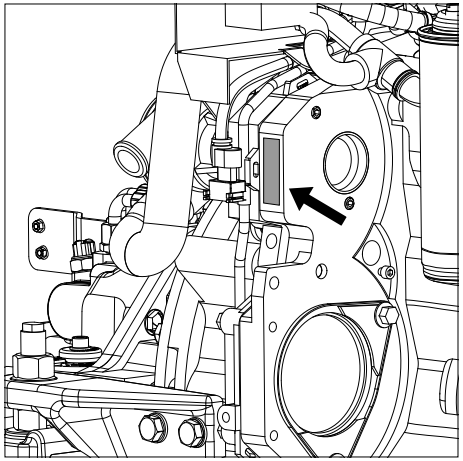


2 Engine data tag location

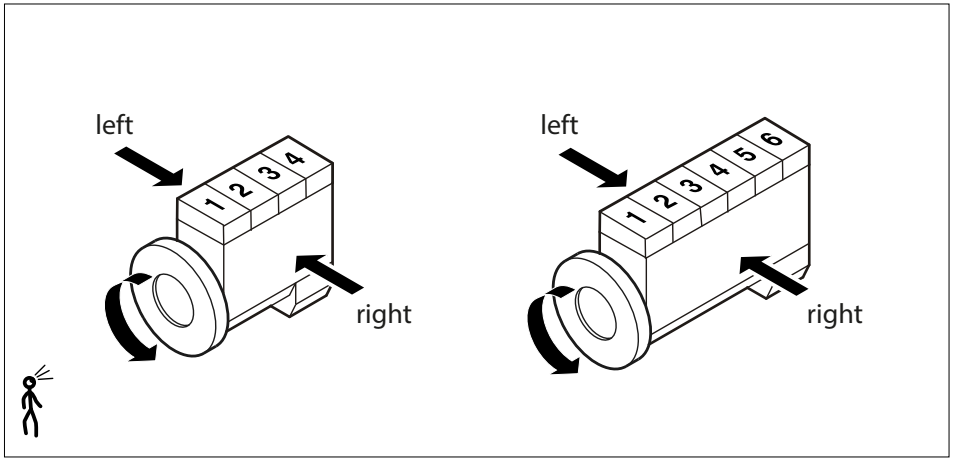
The Deutz engine data tag (C) is attached to the crank case.



The Vetus engine nameplate (D) is attached to the top cover.



3 Engine serial number



4 Cylinder numbering and direction of rotation

The Deutz engine serial number is stamped at the indicated spot.

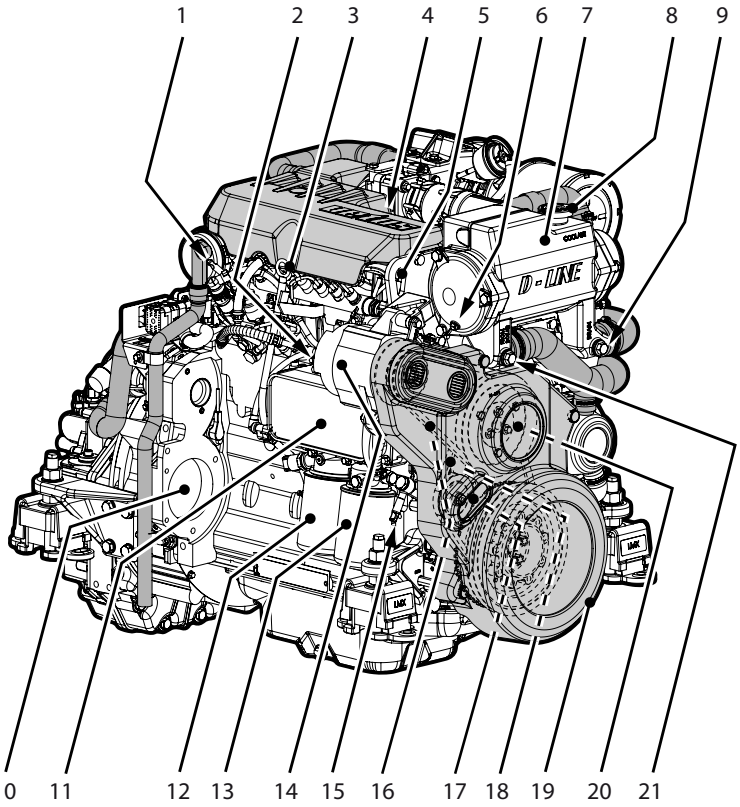
Cilinder numbering
Cylinders are numbered consecutively, beginning at the flywheel end.

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

Motor sides
Seen from the flywheel side.

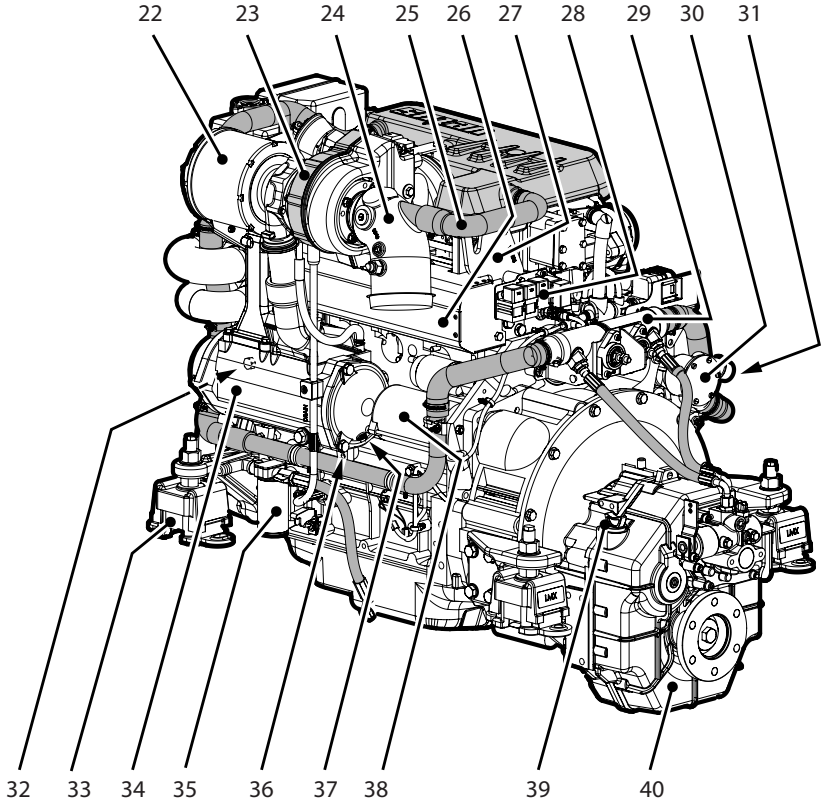
1 Fuel return pipe connection ø 10 mm
2 Calorifier connection, engine 'OUT'
3 Oil dipstick
4 Oil filler cap
5 Lifting eye
6 Cooling system drain plug, heat exchanger cover, raw water
7 Heat exchanger
8 Filler cap (pressure cap) for cooling system
9 Cooling system drain plug, heat exchanger
10 P.T.O. (Mounting facility for hydraulic pumps)
11 Oil cooler
12 Fuel filter
13 Oil filter
14 Alternator
15 Fuel supply pipe connection ø 12 mm
16 V-belt alternator
17 Fuel lift pump
18 V-belt alternator fuel pump / coolant pump
19 P.T.O. (Mounting facility for extra belt pulley)
20 Coolant pump
21 Calorifier connection, engine 'IN'

VD4.120, VD4.140



Identification of engine parts VD4

VD4.120, VD4.140



22 Air intake filter
23 Turbocharger
24 Exhaust injection bend
25 Connection airvent
26 Exhaust insulator
27 Lifting eye
28 Relays and fusses
29 Gearbox lube oil cooler
30 Raw water pump
31 Raw water inlet ø 32 mm
32 Cooling system drain plug, block
33 Flexible engine mounts
34 Aftercooler
35 Oil sump drain pump
36 Drain plug after cooler condens water
37 Drain plug after cooler raw water
38 Starter motor
39 Gearbox filler cap/ oil dipstick
40 Gearbox

1 Fuel return pipe connection ø 10 mm
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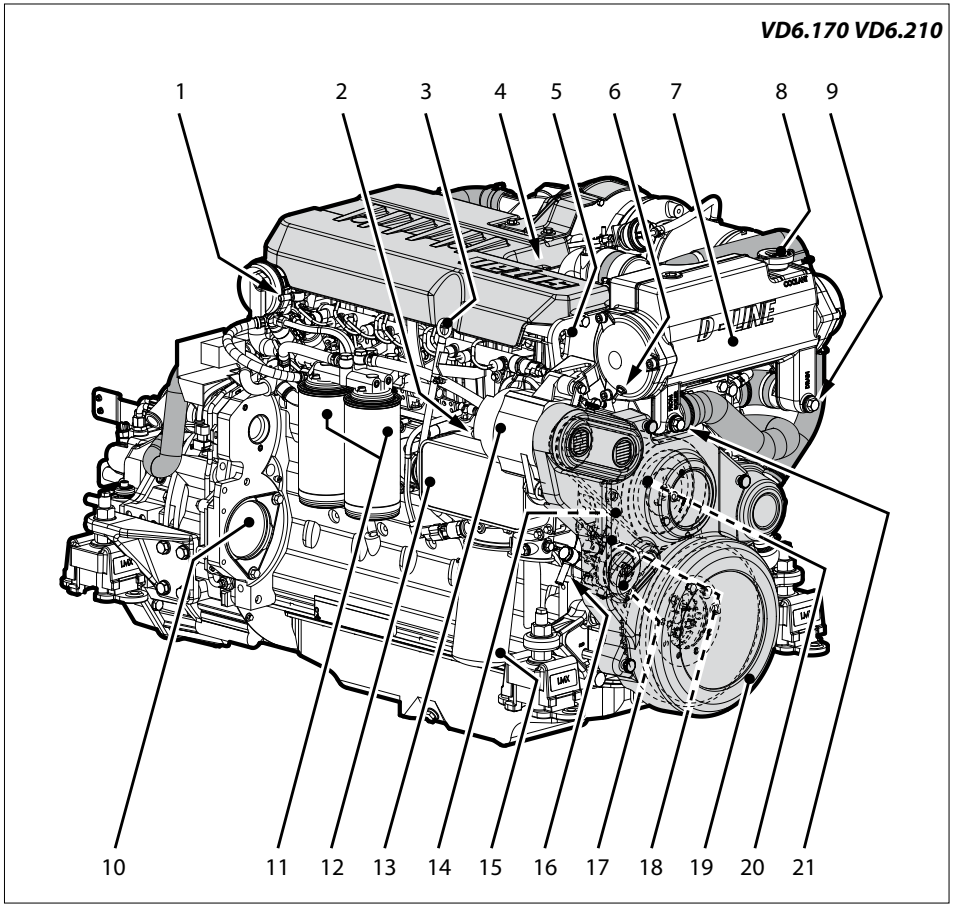

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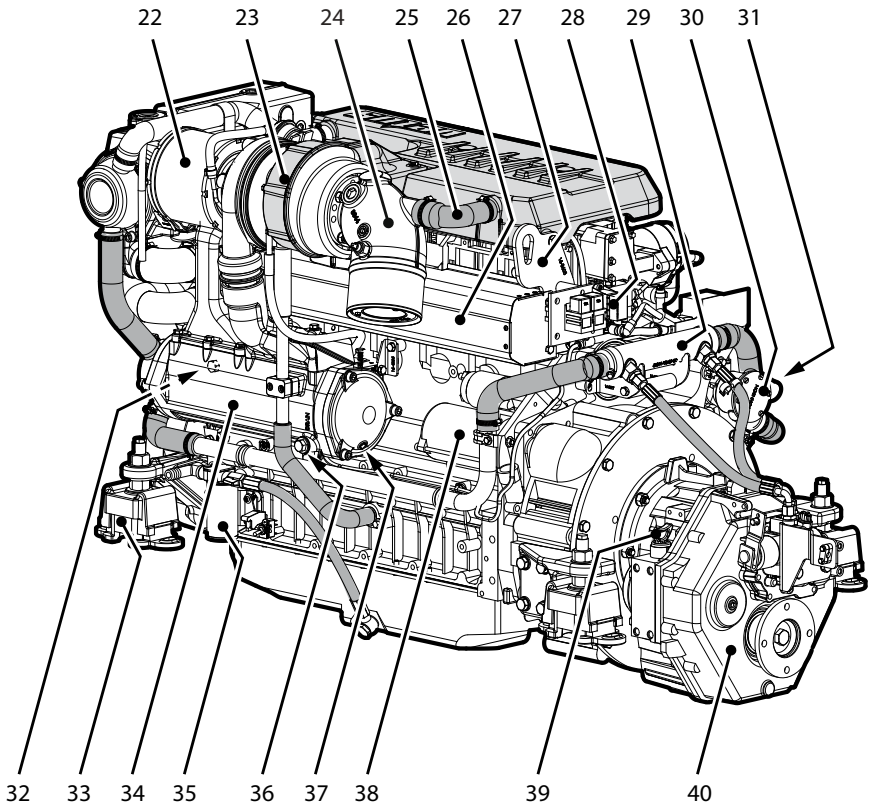

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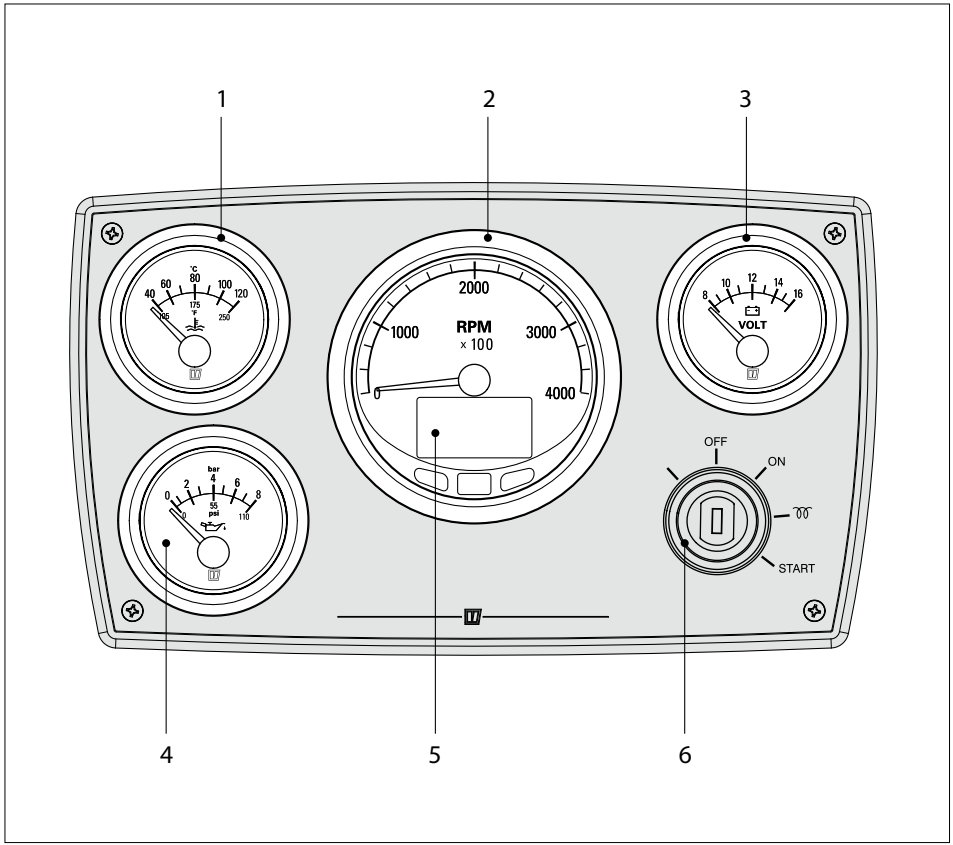
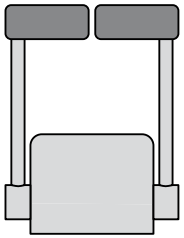
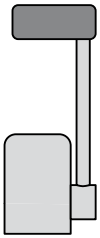


Panel, model MPA34

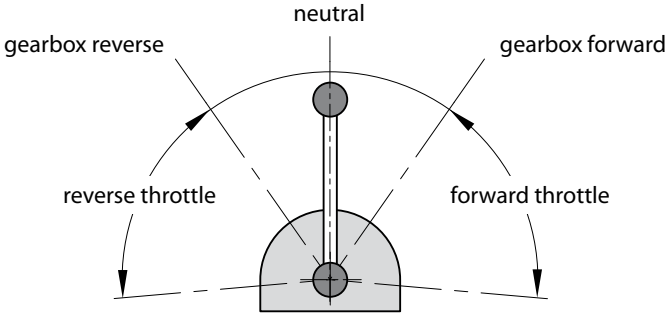
1 Temperature gauge, coolant
2 Tachometer/Operating hours counter
3 Voltmeter
4 Oil pressure gauge
5 Display
6 Starter pre-heat switch/lock



Single lever control handle for two engines



Single lever control handle for 1 engine



5 Operating lever

Operating lever for 1 or 2 engines.

The engine or engines are typically controlled with a single-lever.
Depending on the brand and type (mechanical or electronic), there may be minor differences in the mode of operation. Please refer to the engine manual for details.
However, the principle is always as indicated above.

The control lever works as shown in the diagram.

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

3 First commissioning

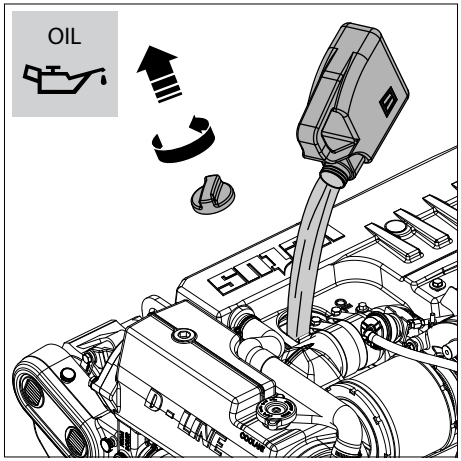
Engine Oil 10W40 of 15W40
API: CD, CE, CF of CF4
ACEA: D4, D5

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

		litres	Imp. pt	US pt
4 cyl.	:	8,5	15	18
6 cyl.	:	14	24.6	29.6

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.

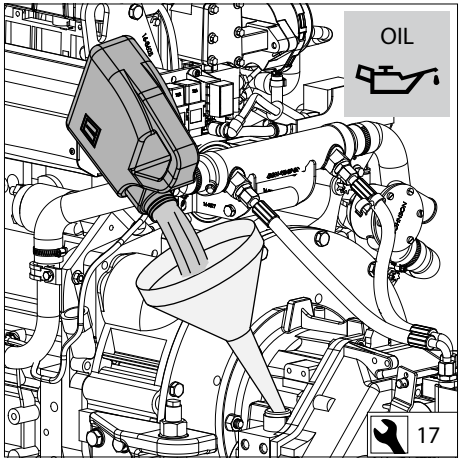
  For quantity and oil specification see page 108 and 116.

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

3 First commissioning

Vetus engines are normally equipped with ZF-Hurth gearboxes.

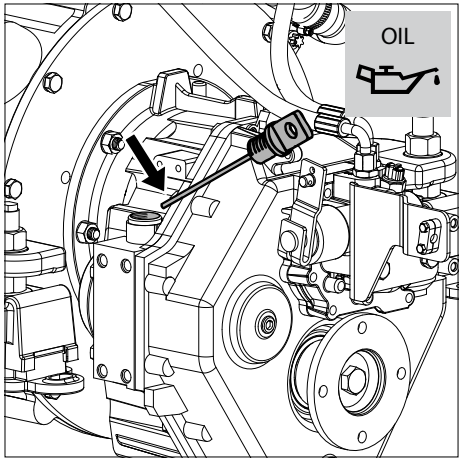
In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owners manual for changing oil and other care and maintenance.



3 Filling gearbox with oil

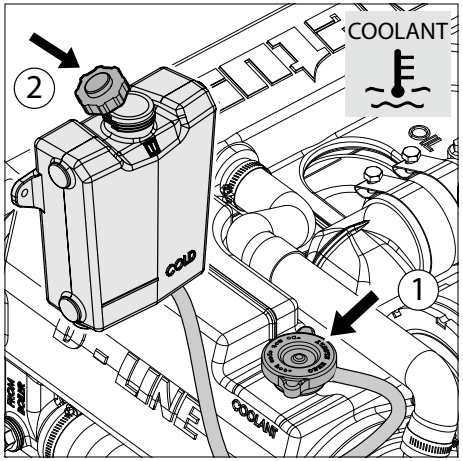
- Fill the gearbox with oil.

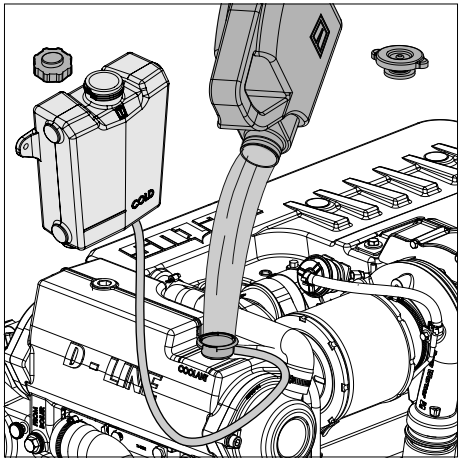
  For quantity and oil specification see page 118.



- Check the oil level with the dipstick, see page 50.

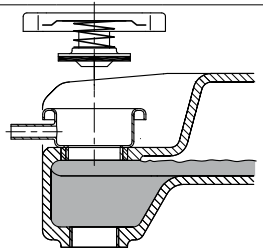
3 First commissioning





Coolant quantity:

		litres	Imp. pt	US pt
4 cyl.	:	8	14.1	16.9
6 cyl.	:	11	19.4	23.2



4 Filling the cooling system

- Remove the pressure/filler cap on the filler neck of the heat exchanger (1).
- Remove the expansion tank filler cap (2).
- Fill the cooling system via the filler neck on the engine's heat exchanger.

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

For specifications see page 119.

Fill until the coolant is level with the bottom of the filler neck.

Bleeding will take place automatically during filling!

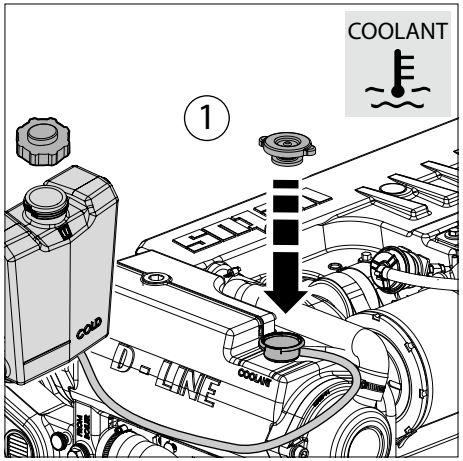
NOTE

If a water heater is connected to the engine, see page 22 and 23.

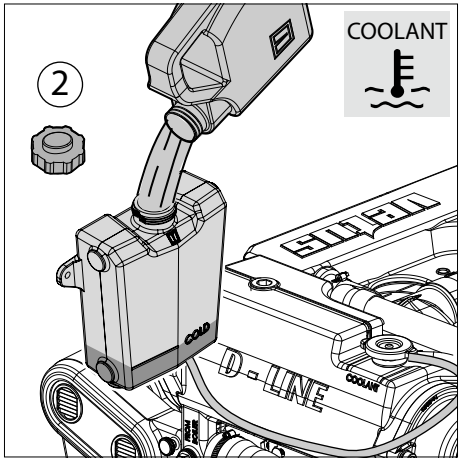
CAUTION

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

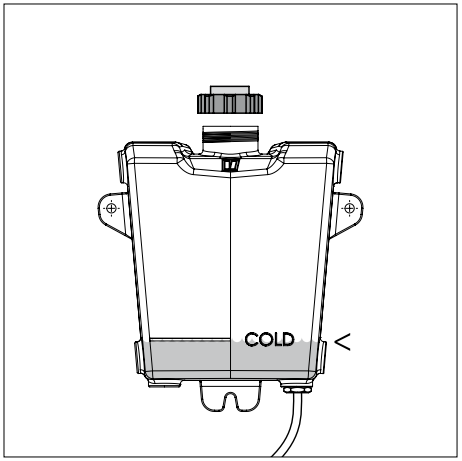
3 First commissioning



- Replace the pressure/filler cap (1).



- Fill the expansion tank until the coolant is at the minimum level.
- Replace the filler cap (2) on the expansion tank.

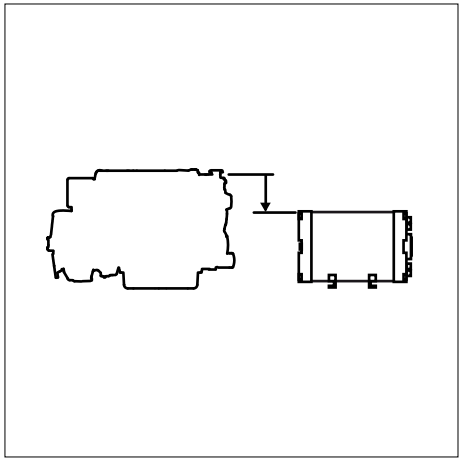


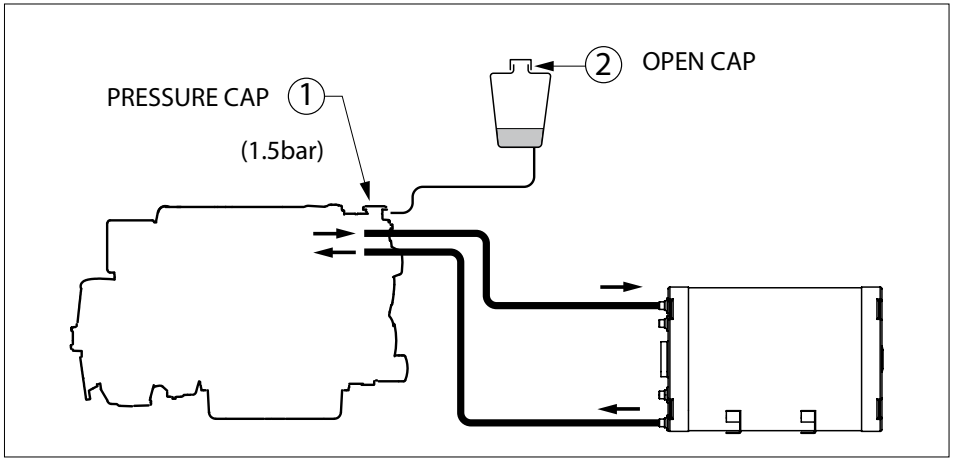
- After the first 3 times that the engine has been in operation, such that the operating temperature has been reached and the engine has cooled back to the ambient temperature, the coolant level in the expansion tank must be checked.
  If necessary, add coolant.

CAUTION

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

3 First commissioning





5 Filling coolant system, 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.

- Follow the filling instructions as shown on pages 20 and 21.

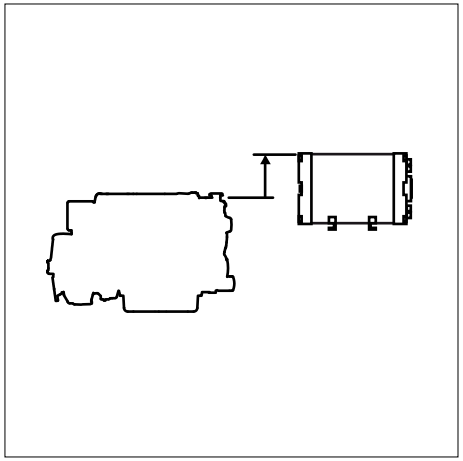
Use a mixture of 40% antifreeze (ethylene-glycol based) and 60% tap water or use a special coolant.

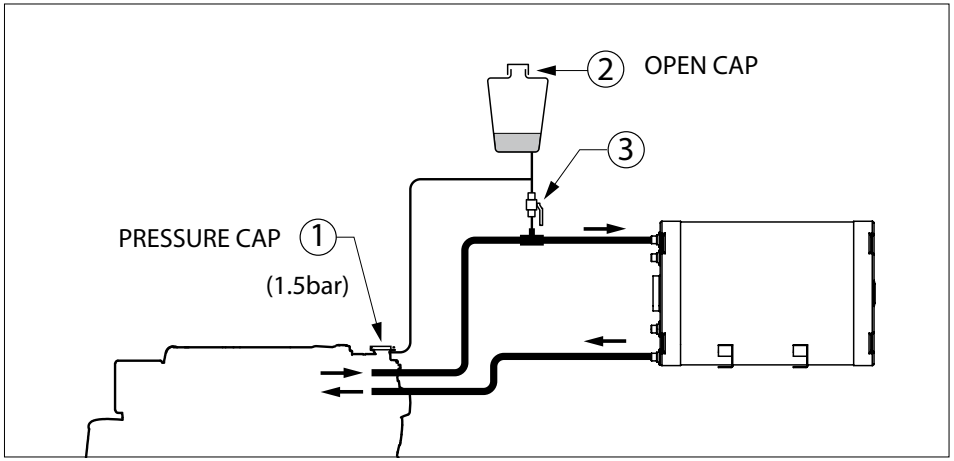
For specifications see page 119.

! CAUTION

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

3 First commissioning





6 Filling coolant system, 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.

- Open valve (3) during filling and bleeding the system.
- Follow the filling instructions as shown on pages 20 and 21.

NOTE

- Remember to close valve (3) after filling the system.

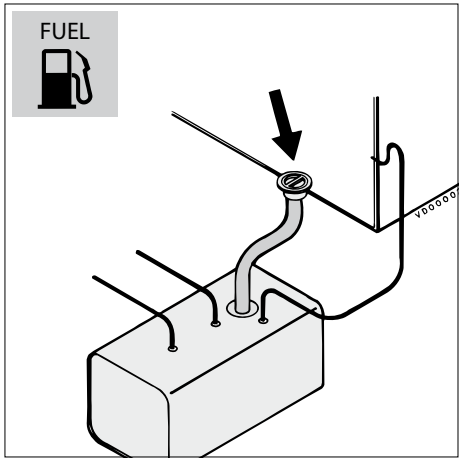
Use a mixture of 40% antifreeze (ethylene-glycol based) and 60% tap water or use a special coolant.

For specifications see page 119.

CAUTION

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

3 First commissioning



7 Fuel

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

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

For fuel grade see page 114.

The fuel system is self-bleeding.

WARNING

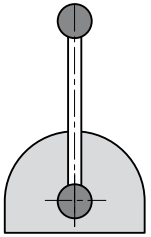
Never fill the fuel tank while the engine is running. Do not spill fuel. Prevent unnecessary pollution.

8 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.

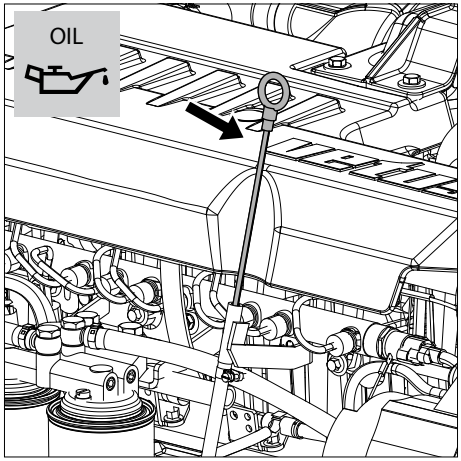
Neutral

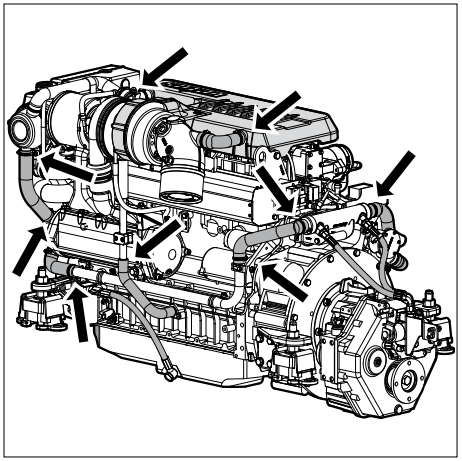
(No throttle, gearbox **not** engaged)



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

3 First commissioning





9 Test run

- Start the engine.

  How to start the engine and what to check before, during and immediately after starting is described on page 30 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.

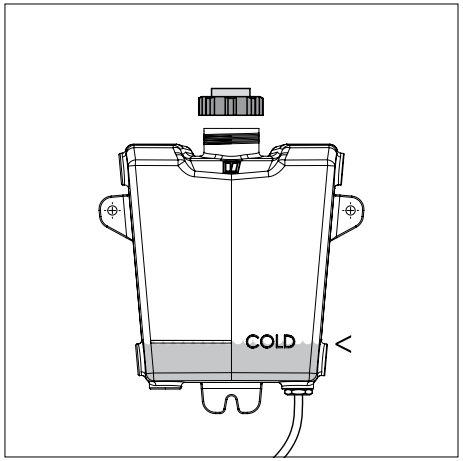
- Stop the engine.

- 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

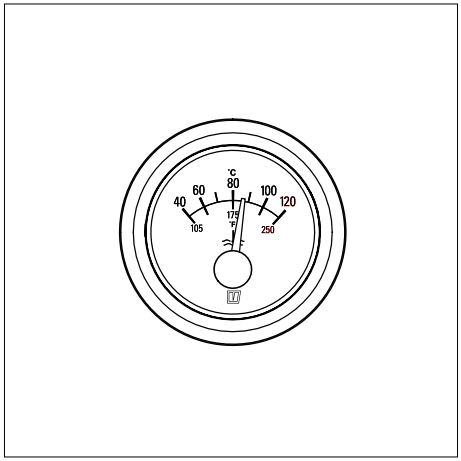


10 Checking the coolant level

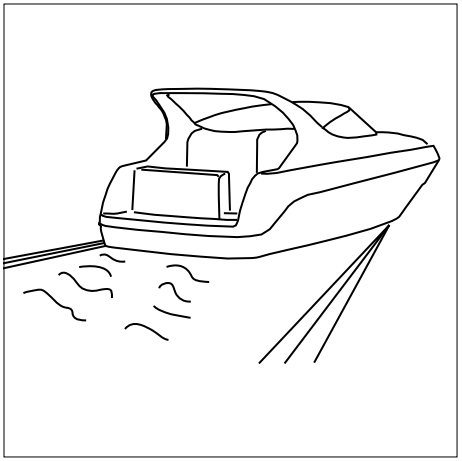
Once the engine has reached operating temperature, check the coolant level in the expansion tank.

- Vary the revolutions between idling and 2000 rev/min.
- Add coolant if necessary.

With a warm engine, the level will be slightly higher as indicated.



- Check the coolant temperature.



11 Sea trial

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

At full load (when the vessel is in motion), the maximum RPM must correspond to the value specified in the technical data. The engine can become overloaded if it doesn't reach this RPM! In this case, check the propeller for irregularities and the correct choice of speed and diameter.

4 Running-in

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

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

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

- Drain water from fuel filter, see page 45.
- Engine oil change, see page 52.
- Replace oil filter, see page 54.
- Change gearbox oil, see page 58.
- Replace fuel filter, see page 56.
- Check flexible engine mounts, see page 59.
- Check engine for leaks, see page 59.
- Check tightness of all fasteners, bolts and nuts, see page 59.
- Checking V-belts, see page 60.

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 119.
- Never run the engine without a thermostat.
- Use a good quality lubricating oil. For specifications see page 116.
- Use a good quality diesel fuel that is free of water and other pollutants.
- Always follow the safety advice, see page 4.

☞ **NOTE**

First commissioning
Follow the instructions given for 'First commissioning' on page 18 and further if the engine is being commissioned for the first time.

After repair work:

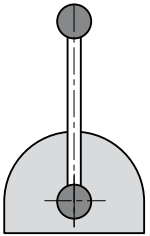
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with pre-heating, do not use any other substance (e.g. injection with 'Easy Start'). Doing so could result in an accident.

Before starting, always check the following points:

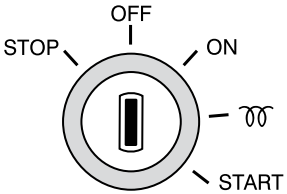
- Engine oil level.
- Coolant level.
- Sea cock open.
- Main switch '**ON**'.
- Gearbox in '**NEUTRAL**' position.

Neutral

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



1 Control lever

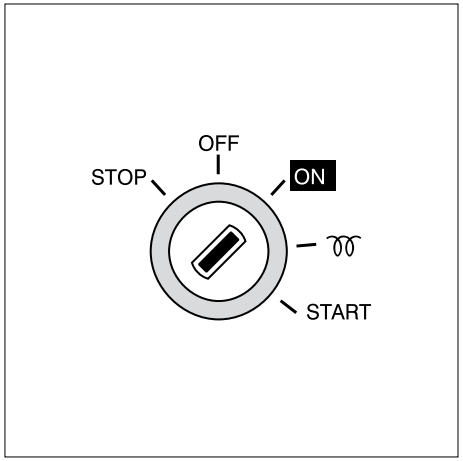


2 Control panel

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

Leave the control lever in position '**neutral**'.

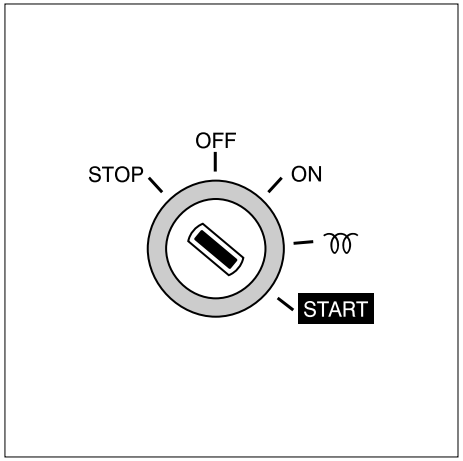
The control panel is equipped with a starter key.

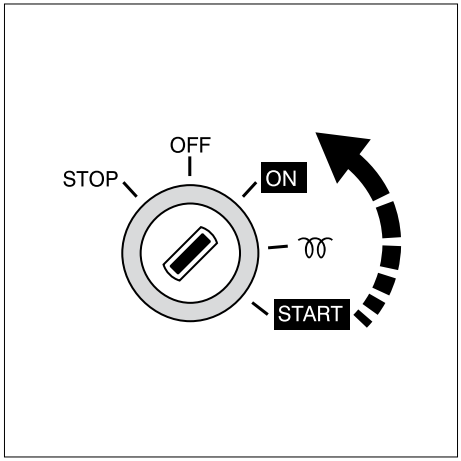


3 Switching on

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

By default, Vetus Deutz engines are not equipped with a pre-heat supply; the pre-heat switch/lock position on the operator panel can therefore be ignored.





4 Starting

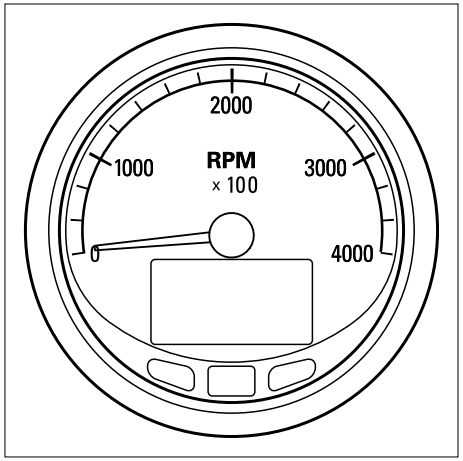
Now turn the key further to the '**START**' position.

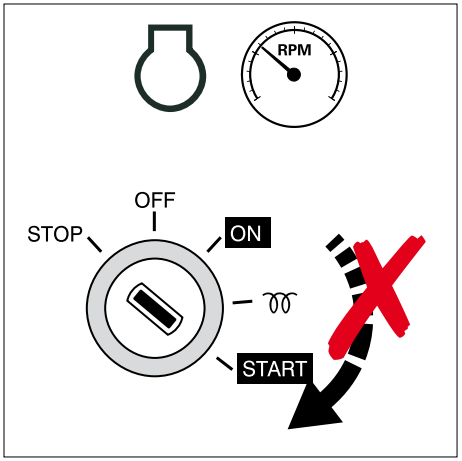
Release the key as soon as the engine fires (the key will return to the '**ON**' position) and throttle back.
Leave the key in this position while the engine is running.

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

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

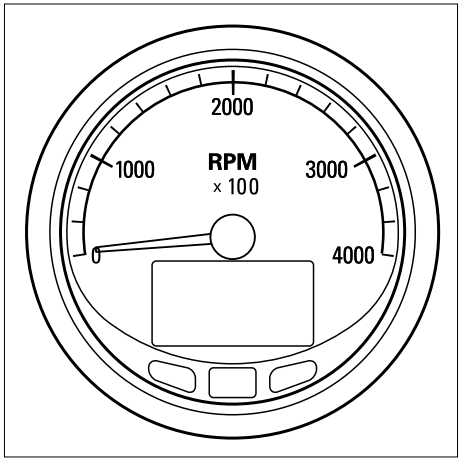
Before fully loading the engine, it should be brought up to temperature with about 3/4 of the maximum load as quickly as possible.
A good warming up is essential to ensure maximum life and performance.

! CAUTION

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

! CAUTION

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



5 Tachometer

The instrument panel is provided with the following instruments

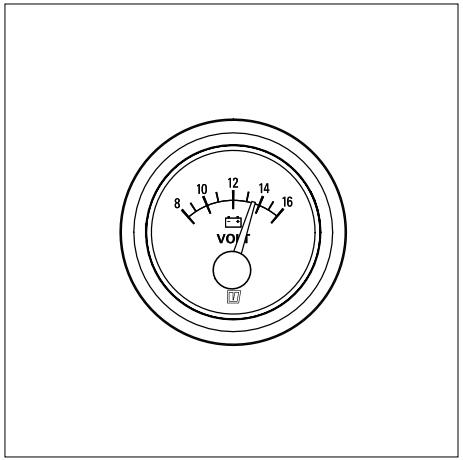
Indicating the number of revolutions per minute of the engine.

Also the number of running hours is indicated.

WARNING

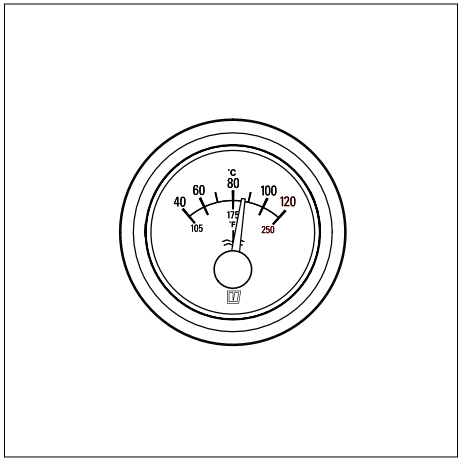
Avoid idling for more than 10 minutes.

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



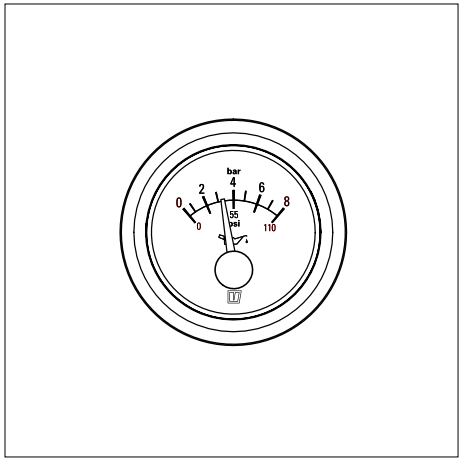
6 Voltmeter

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.



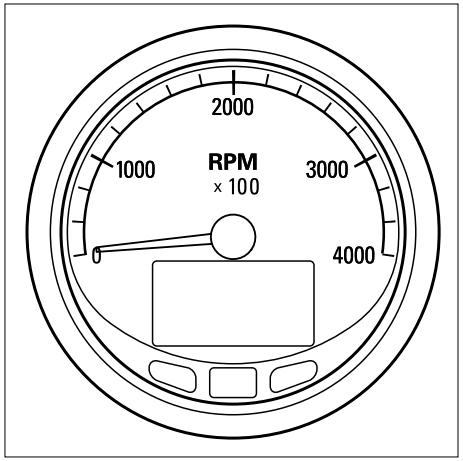
7 Temperature gauge

Indicating the temperature of the internal cooling system.
Fot the operating temperature, see technical data page 109.
In case the engine is overheated: turn off the engine and establish the cause, see fault finding table, page 96..105.



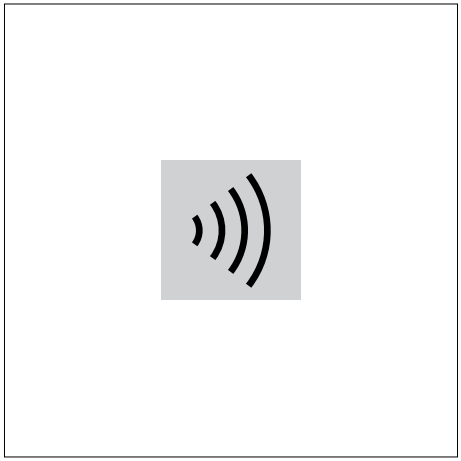
8 Oil pressure gauge

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 96..105.



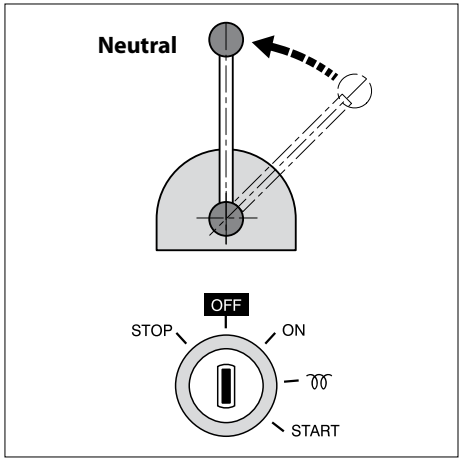
9 Warnings

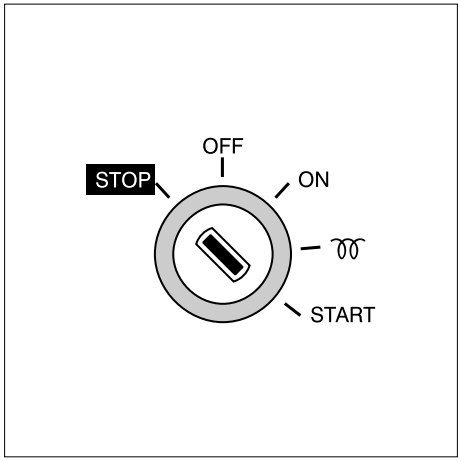
When the engine is running, no warnings should be displayed.



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!





11 Stoppen

- Reduce engine speed to idle and shift the gearbox to '**Neutral**'.

- Turn the key anticlockwise to the "Off" position.

NOTE

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

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

NOTE

Never switch off the battery main switch directly after the engine has stopped.
Wait at least 2 minutes.

The ECU remains active for about another 40 seconds to save the system data (lag) and then switches off automatically.

WARNING

The engine can not be restarted, if the system data is not been saved!

NOTE

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

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 Warranty Manual':

- 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	42
Check coolant level	43
Check water strainer	44

After the first 50 hours	page
Draining of water from the water separator/fuel filter	45
Check gearbox oil level	50
Engine oil change	52
Replace oil filter	54
Replace fuel filter	56
Check flexible engine mounts	59
Check engine for leaks	59
Check tightness of all fasteners, bolts and nuts	59
Check V-belt	60

Every 100 hours, at least once every year	page
Draining of water from the water separator/fuel filter	45
Battery, cables and cable connections	46
Check gearbox oil level	50
Draining the charge-air cooler	51
Replace oil filter	54

Every 500 hours, at least once every year	page
Engine oil change	52
Replace fuel filter	56
Change gearbox oil	58
Check flexible engine mounts	59
Check engine for leaks	59
Check tightness of all fasteners, bolts and nuts	59
Check V-belt	60

DANGER

Stop the engine before carrying out any maintenance work

Every 1000 hours, at least once every 2 years	page
Raw water pump inspection	62
Replace air filter	65

Every 1000 hours	page
Check starter motor	66
Check alternator	66

Every 1500 hours	page
Checking valve clearance	67

Every 2000 hours	page
Replace coolant	70

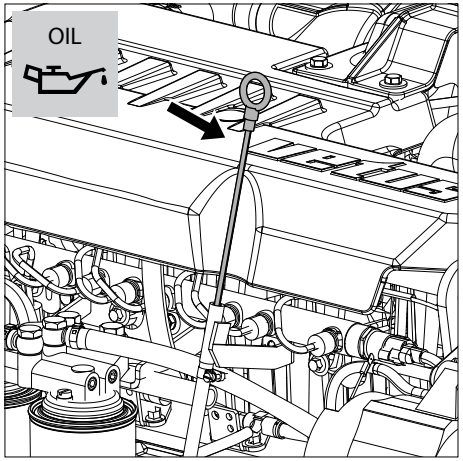
When required	page
Cleaning heat exchanger	73
Cleaning the after cooler	78

DANGER

Stop the engine before carrying out any maintenance work

Checking engine oil level

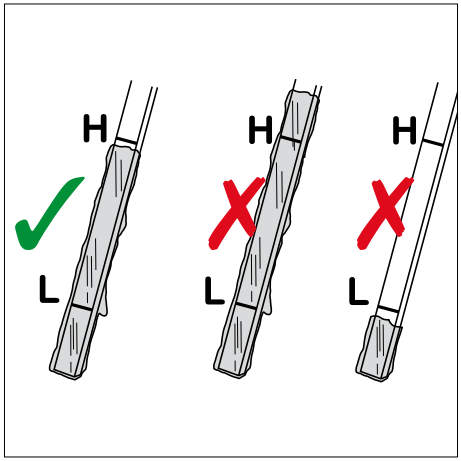
Daily, before starting.



1 Check oil level

- Turn the engine off.

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



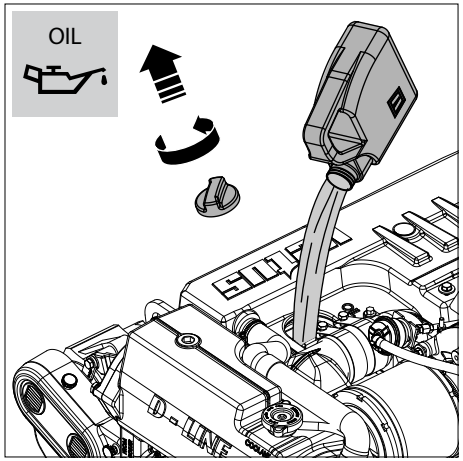
2 Oil level

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:

		litres	Imp. pt	US pt
4 cyl.	:	1.5	2.6	3.2
6 cyl.	:	2	3.5	4.2

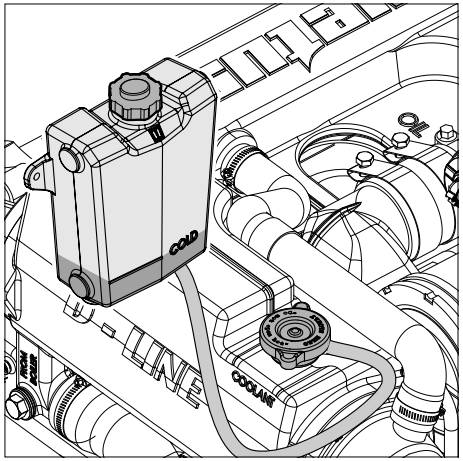


3 Topping up oil

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

Checking coolant level

Daily, before starting.

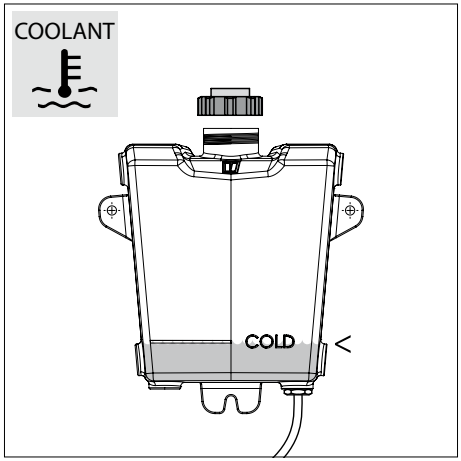


4 Checking coolant level

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

Warning

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

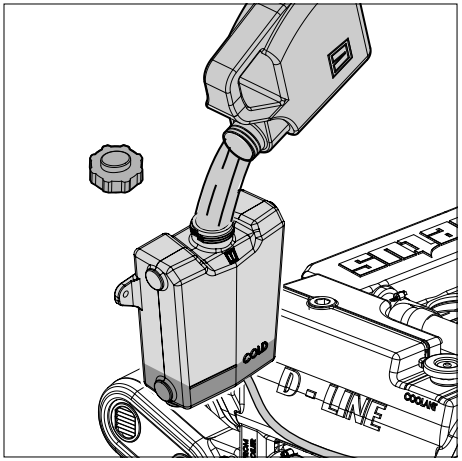


5 Coolant level

The coolant must be at the minimum level.

Note

If a water heater is connected, see page 22 and 23.



6 Topping up coolant

- If necessary, top up.

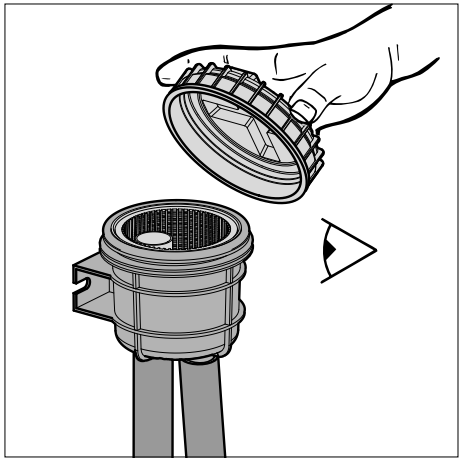
The internal cooling system can be filled with a mixture of anti-freeze (40 %) and tap water (60 %) or with a special coolant.
For specification, see page 119.

Caution

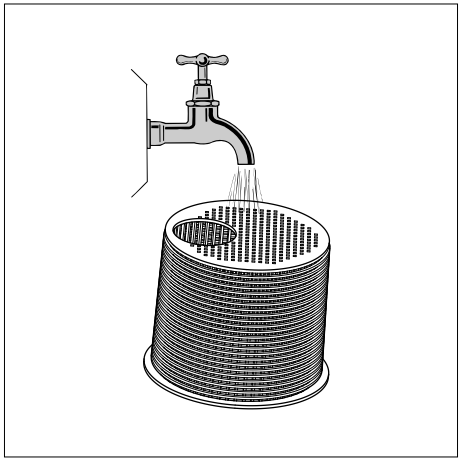
Never fill the cooling system with sea water or brackish water.

Checking and cleaning the raw water strainer

Daily, before starting.

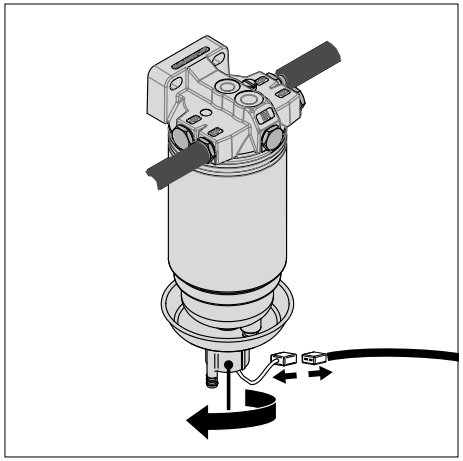


7 Checking the raw water strainer



8 Cleaning the strainer

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



9 Empty water separator

Empty the separately installed water separator:

- Disconnect the sensor connector (plug connection)
- Unscrew the drain plug/sensor on the underside of the filter.
- Allow the water to drain out and close the drain plug/sensor.
- Reconnect the sensor connector.

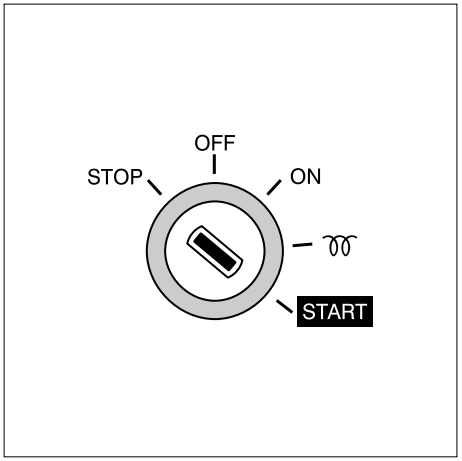
The water separator is not engined mounted, but installed is required and the sensor **must** be connected.

10 Bleeding

After the water separator/fuel filter has been drained, the air has to be bled from the fuel system
The fuel system is self-bleeding.

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.



11 Start the engine

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

6 Maintenance

Warning notes and safety regulations for working with batteries

Wear eye protection.

Keep children away from acid and batteries.

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

Fires, sparks, naked flames and smoking are prohibited:

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

Corrosive hazard:

Battery acid is highly corrosive, therefore:

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

First aid:

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

Battery, cables and connections

Every 100 operating hours.

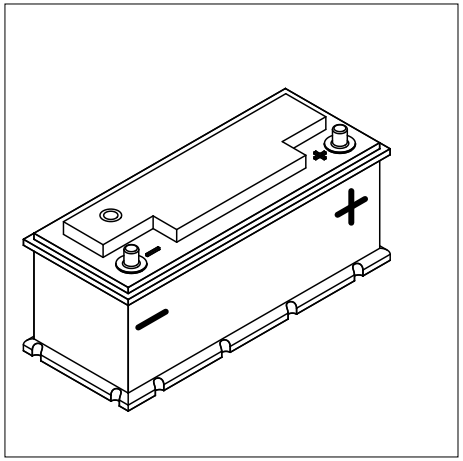
Warning note:

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

Disposal:
Hand in old batteries at a collection point.
Keep the batteries upright and do not tip during transport and storage to prevent acid leaking out.
Never dispose of old batteries as domestic waste.

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

Battery, cables and connections
Every 100 operating hours.



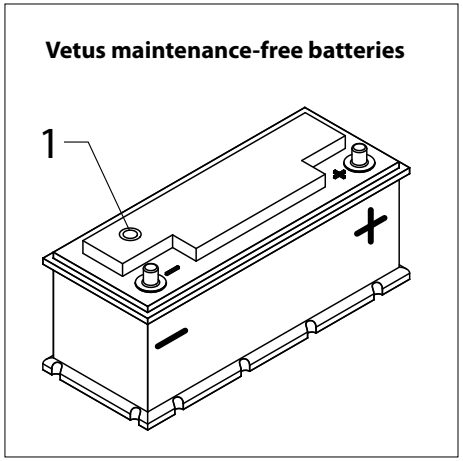
12 Battery, battery connections

Keep battery clean and dry.

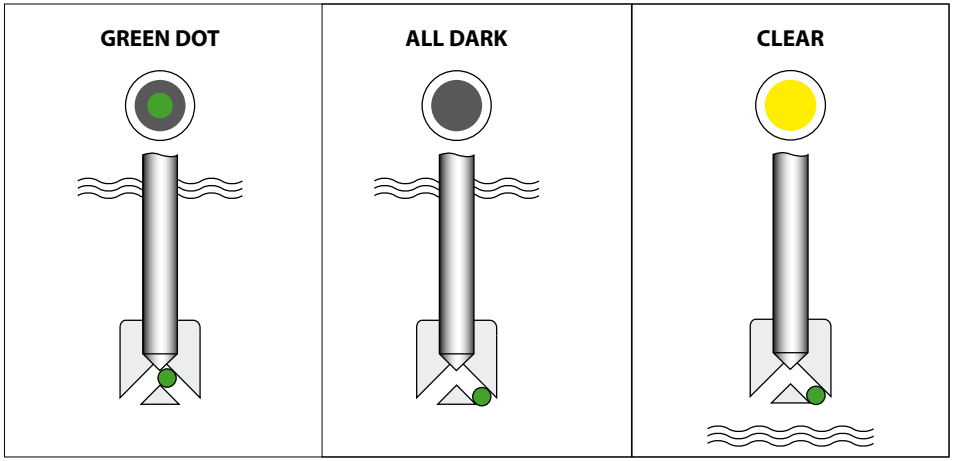
- Remove battery cables (negative first).
- Clean battery posts (+ and –) and clamps and grease with acid-free and acid-resistant grease.

Ensure that clamps make good contact after reassembling.

- Hand tighten the bolts only.



13 Checking specific gravity



14 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:

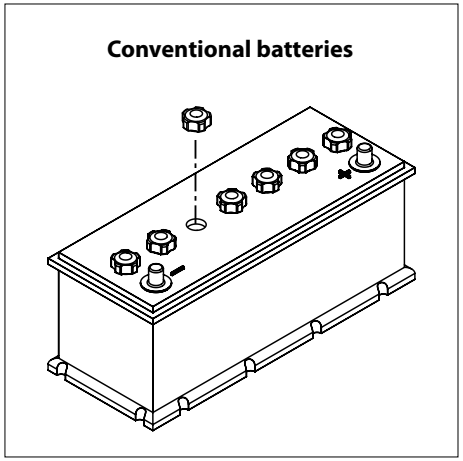
Green dot visible:
State of charge 65 % or more.

Dark:
State of charge less than 65 %. Recharge immediately.

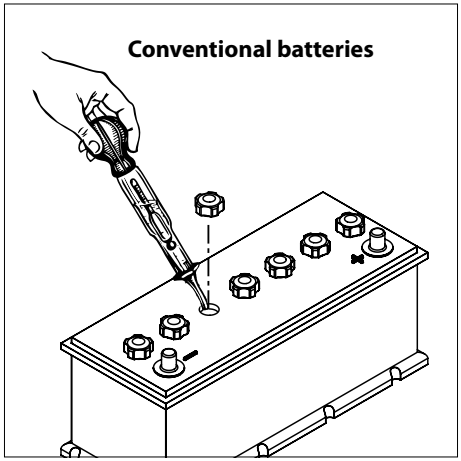
Clear or light yellow:
Electrolyte level low.

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

Battery, cables and connections
Every 100 operating hours.



15 Checking electrolyte level



16 Checking specific gravity

Specific gravity	State of charge	
1,.8 kg/l	100%	
1.20 kg/l	50%	recharge
1.12 kg/l	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.

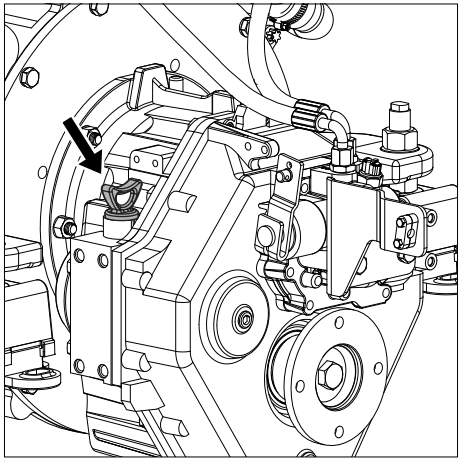
Measure the electrolyte specific gravity of the individual cells with a commercial hydrometer. The hydrometer reading (see table) indicates the state of charge. Hydrometer reading of all cells should be at least 1.200 and show less than 0.050 between high and low. If not, recharge or replace battery.

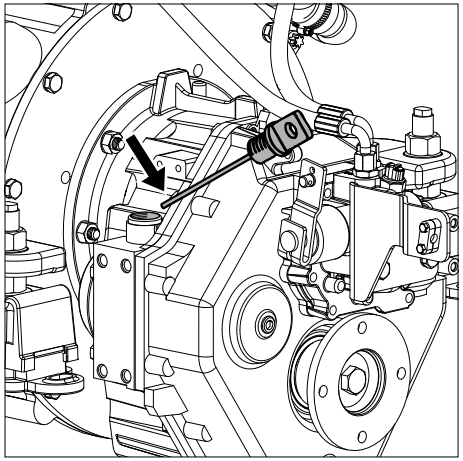
During checking the temperature of the electrolyte should preferably be 20°C (68°F).

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.

Vetus engines are normally equipped with ZF-Hurth gearboxes.

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





17 Oil level check

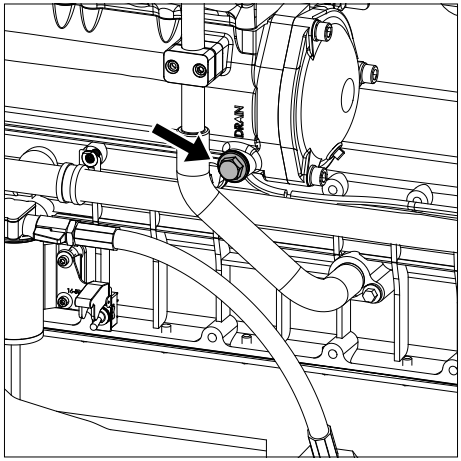
Gearbox oil level check

Every 100 operating hours.

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

For oil type and specification see page 118.

- Remember to replace the dipstick.



18 Draining the charge-air cooler

The condensate water collected in the charge-air cooler must be drained every 100 hours or at least 1 x per year.

- Remove the drain plug from the charge-air cooler housing and check that all condensate water is running out.
- After drainage, replace the drain plug.

19 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 approx. 80°C (176°F).)

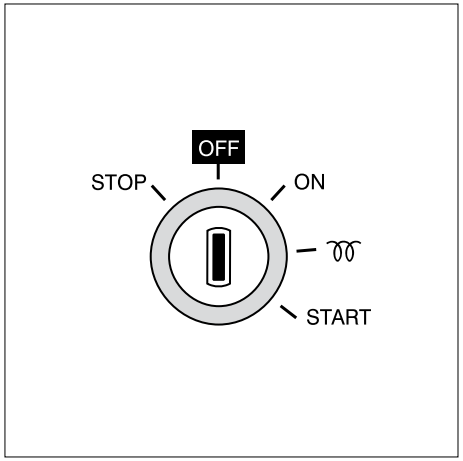
DANGER

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

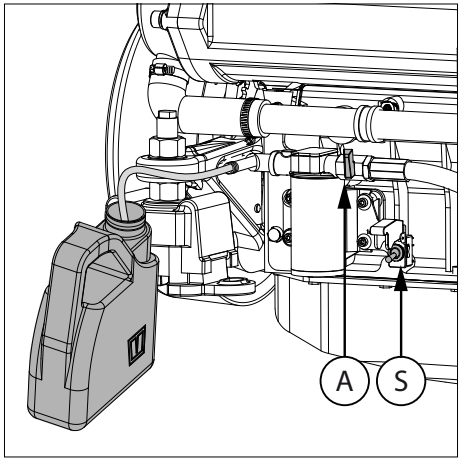
WARNING

Never use additives.

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



The battery master switch must be on and the engine must be stopped; the starter key on the control panel must be in the OFF position.



20 Draining the oil

Connect a Ø 10 mm hose to the crankcase oil-change pump as shown.

Open the shut-off valve 'A'.

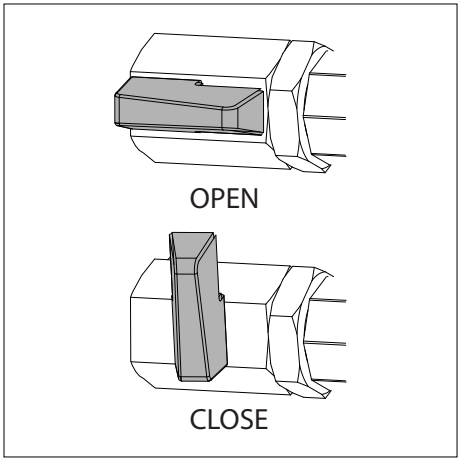
Turn on the oil-change pump with the switch 'S'. Turn off the pump when all the oil is pumped out of the crankcase.

DANGER

Beware of burns from hot oil.

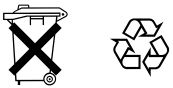
Engine oil change

Every 500 operating hours.



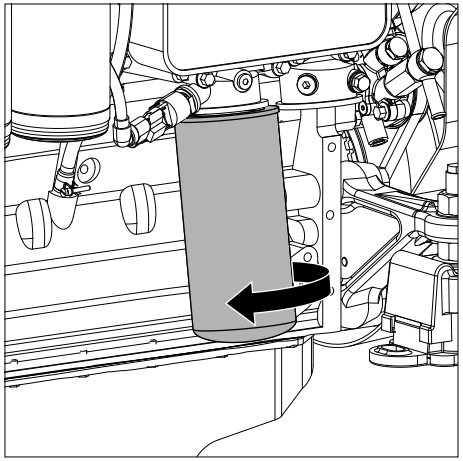
WARNING

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



Engine oil change

Every 500 operating hours.



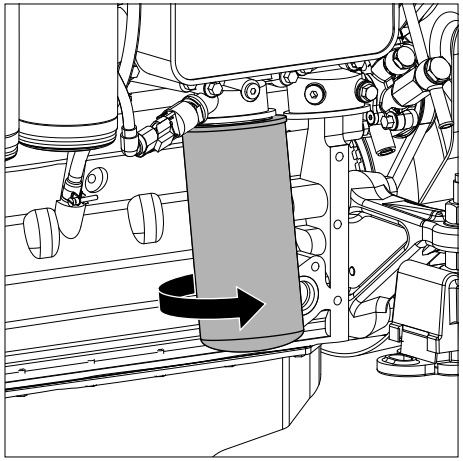
21 Removing the oil filter

- Unscrew the oil filter, with a commercially available tool.
  Catch any dripping oil.

22 Oiling the oil seal

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

For **oil filter art. code** see page 126.



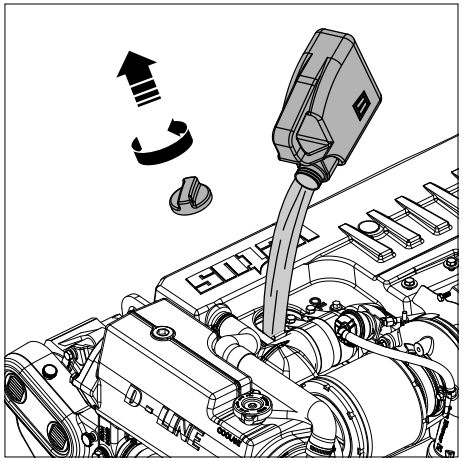
23 Oil filter installation

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

  Tightening torque 11 - 13 Nm (8-10 ft.lbf)

⚠ **DANGER**

Beware of burns from hot oil.



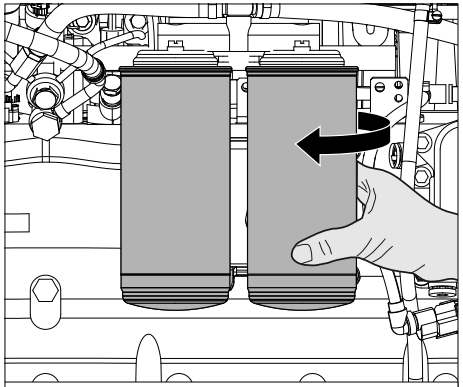
24 Refilling with oil

AMOUNT OF OIL (OIL FILTER INCL.):

		litres	Imp. pt	US pt
4 cil.	:	8,5	15	18
6 cil.	:	14	24.6	29.6

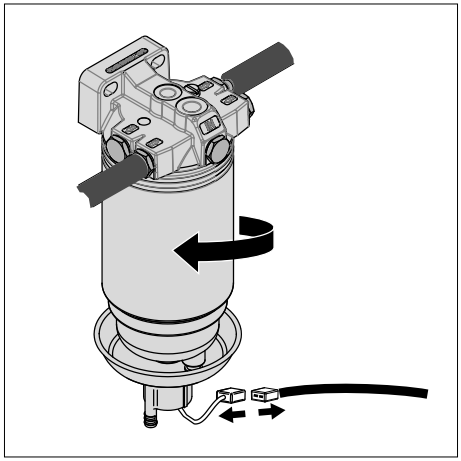
- Refill the engine with new oil (for specification see page 116) through the filler opening in the valve cover.
- Operate the engine at idling speed for a short period of time. Check for oil leaks whilst the engine is running. Stop the engine. Allow 5 minutes for the oil to return to the sump. Check the oil level with the dipstick.

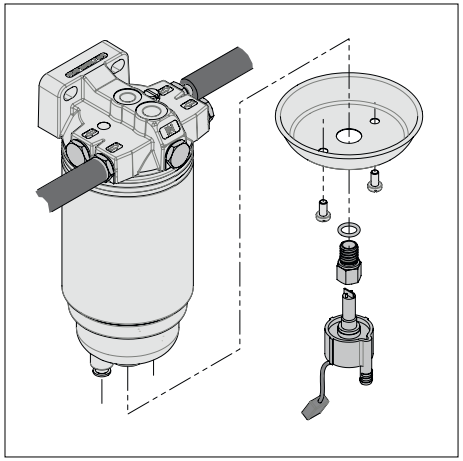
Fuel filter replacement
Every 500 operating hours.



N.B. 4 cylinder engine has 1 filter element instead of 2

25 Removing the fuel filter(s)





26 Water separator/fuel filter, sensor and metal protective basin

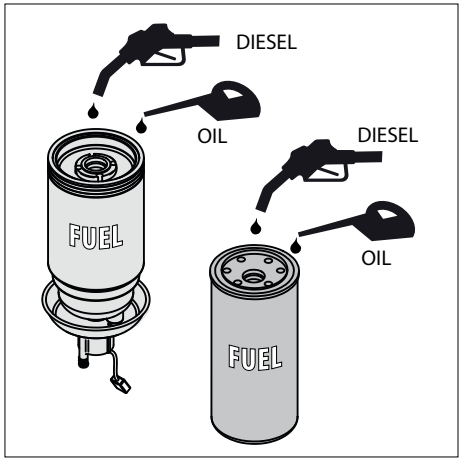
Replace the filter elements of the fuel filter on the engine and the separately installed water separator / fuel filter at the same time.

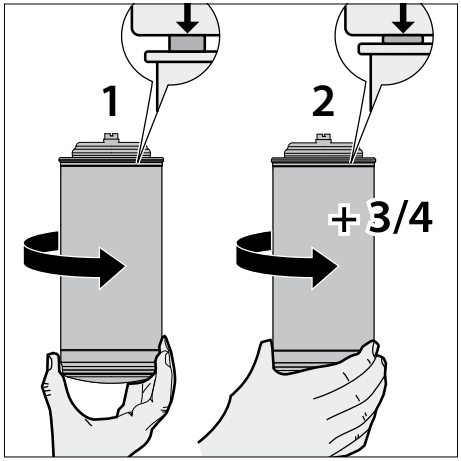
The filter elements are to be replaced as a unit.

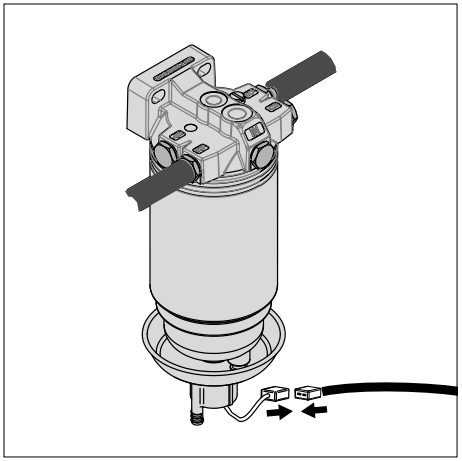
- Close the fuel shut-off valve.
- Disconnect the sensor connector of the water separator (plug connection)
- Remove the fuel filters with a filter wrench. Catch any liquid.
- Remove the sensor from the filter.
- Remove the metal protective basin from the filter element (2 screws) and place the metal protective basin on the new filter element.
- Install the sensor in the new filter element.

⚠ **Danger**

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







27 Installing the fuel filter(s)

Fuel filter replacement
Every 500 operating hours.

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

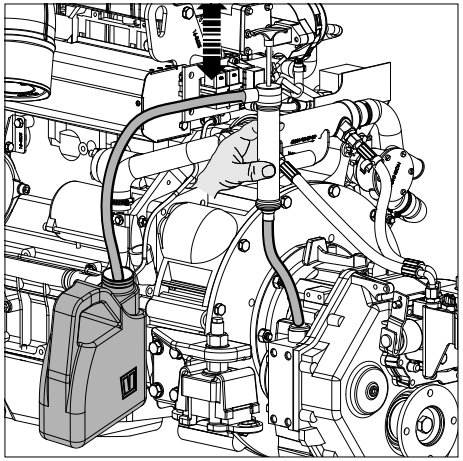
For **fuel filter art. code** see page 126.

- Install the filters. Turn the filter an additional one-half to three-quarters of a turn by hand after the rubber seal touches the housing.
- Open the fuel shut-off valve.
- Check for leakage.
- Reconnect the sensor connector.

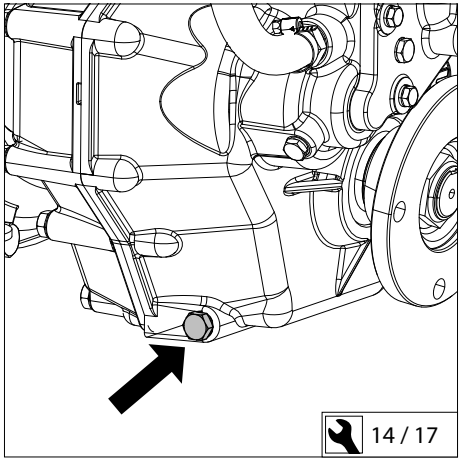
After the replacement of the fuel filters, it is not necessary to bleed the system.
The fuel system is self-bleeding.

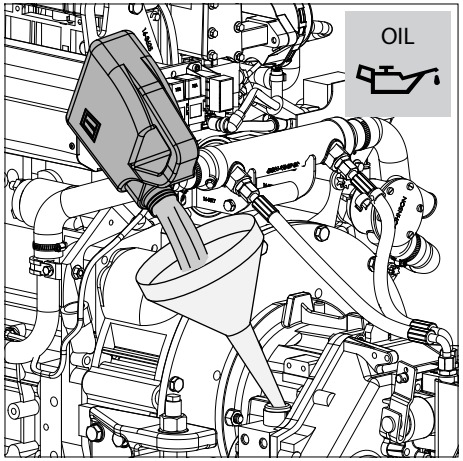
Changing the gearbox oil

Every 500 operating hours.



28 Draining the oil





29 Filling with new oil

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

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

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

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

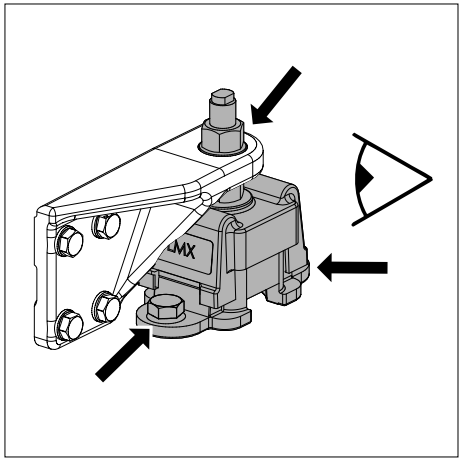
- Refill the gearbox to the correct level via the dipstick opening.

For oil specification see page 118.

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

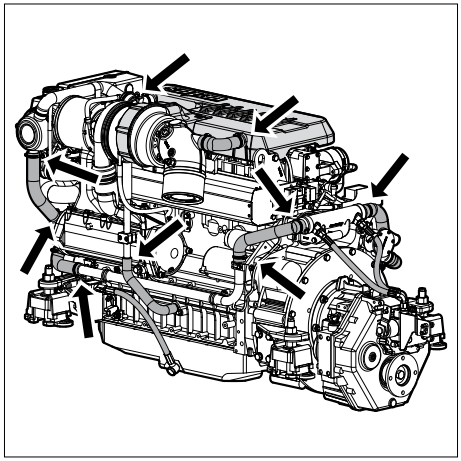
Flexible engine mounts, hose connections and fasteners

Every 500 operating hours.



30 Check flexible engine mounts

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



31 Inspection hose connections

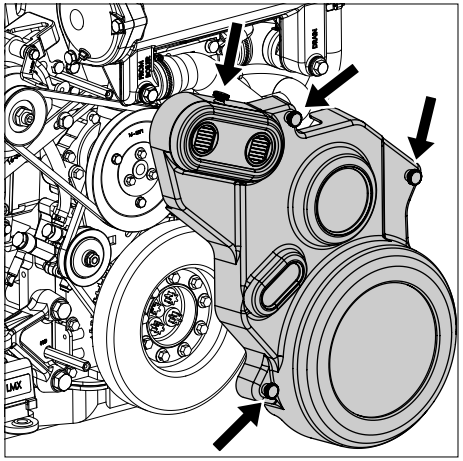
- Inspect all hose connections of the cooling-system. (Cracked hoses, loose hose clamps)

32 Check fasteners

- Check tightness of all fasteners, bolts and nuts.

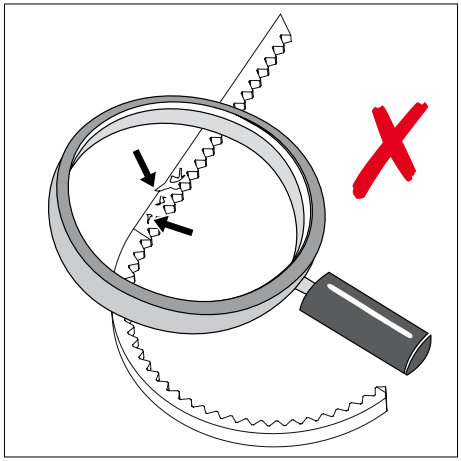
Checking the V-belts

Every 500 operating hours.



33 Remove the V-belt protection cover

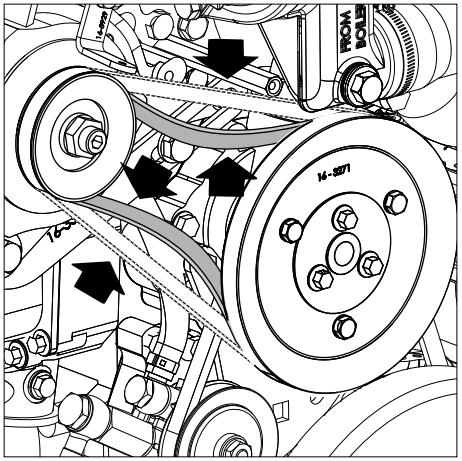
- Loosen the the screws -the screws can be loosened without tools- and remove the V-belt protection.



34 Inspection V-belts

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

For **V-belt art. code** see page 126.

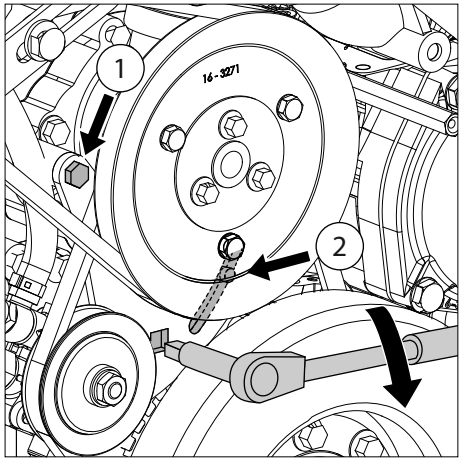


35 Checking tension

- Check tension of the V-belt by applying moderate finger and thumb pressure. If the deflection of the belt is more than 9 (3/8")-12 mm (1/2"), using about 10 kg (20 lbs) thumb pressure, it should be tensioned.

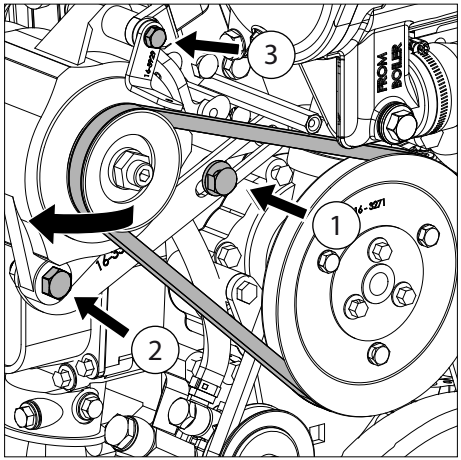
DANGER

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



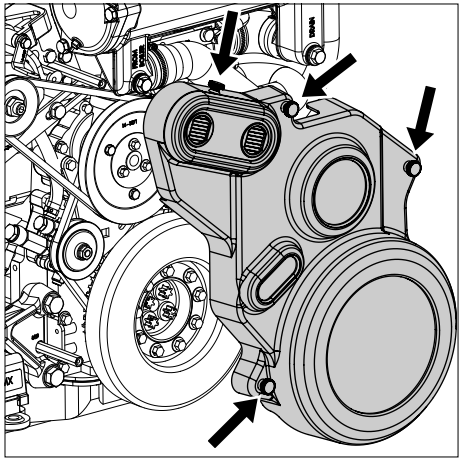
36 Tensioning the V-belt of the coolant and fuel pumps

- Unscrew the bolts (1) and (2).
- Turn the fuel pump tensioner in the direction of the arrow, using a square 1/2“ key (a), until the tension of the belt is correct.
- Tighten the bolts (1) and (2).



37 Tensioning V-belt

- Unscrew the mounting bracket bolts and both of the alternator mounting bolts. Now push the alternator outwards until the belt has the desired tension.
- Tighten the bolts in the order shown.

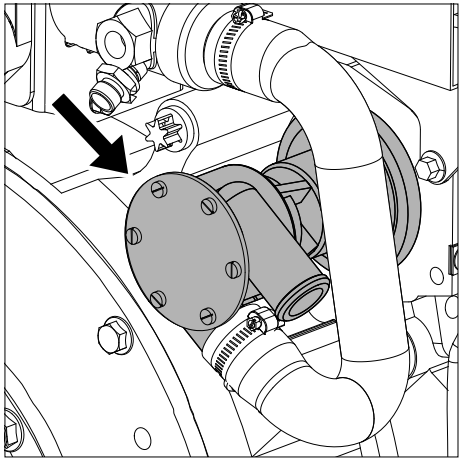


38 Reinstall the protection cover

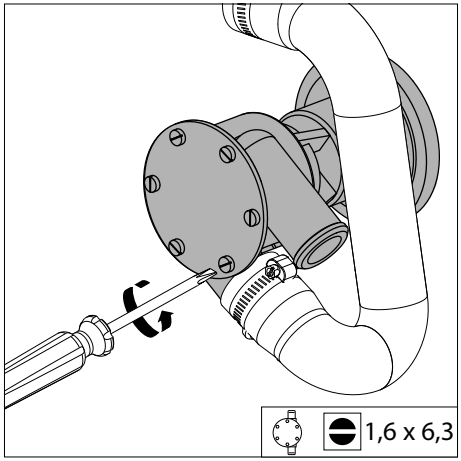
- Always reinstall the V-belt cover and tighten the screws.

Raw water pump inspection

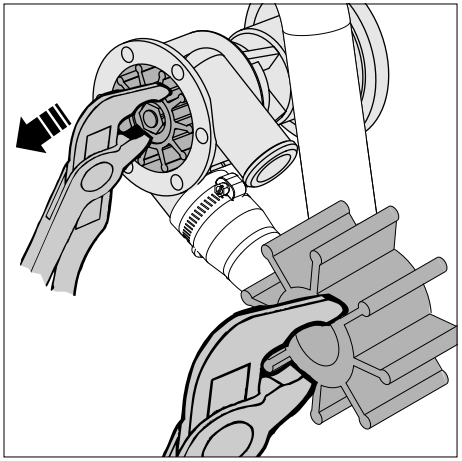
Every 1000 operating hours.



39 Raw water pump inspection



40 Pump cover removal



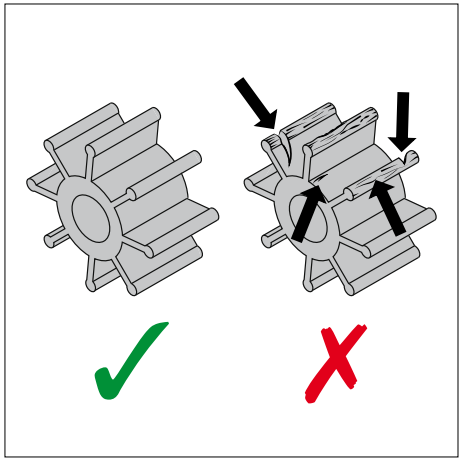
41 Impeller removal

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

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

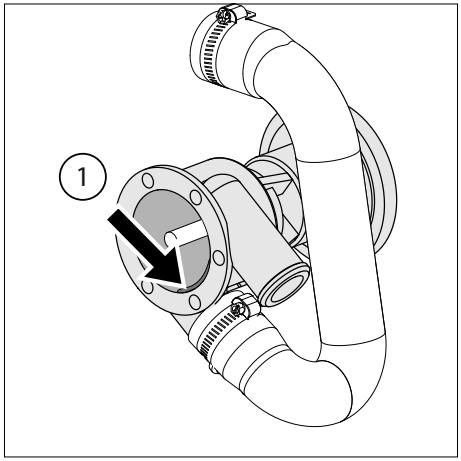
Inspection where appropriate changing is as follows:

- Close the sea cock.
- Remove the cover of the pump by unscrewing the screws out of the housing.
- Slide the impeller off of the shaft using a waterpump plier.
- Mark the impeller to ensure correct re-installation if it is to be re-used. The impeller must be installed in the same position as removed.



42 Impeller inspection

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

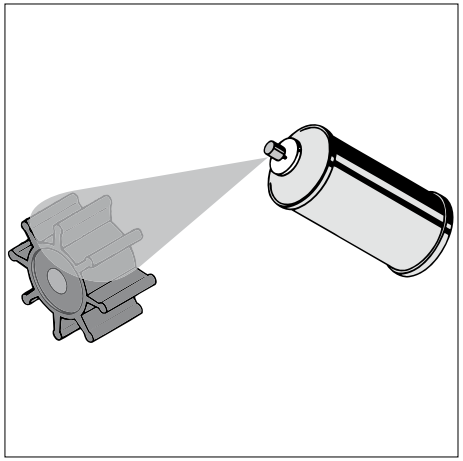


43 Pump housing inspection

- Check the inside of the pump housing for damage. Pay special attention to wear of the cam (1).
- Replace the cam and/or the pump housing in case of excessive wear.

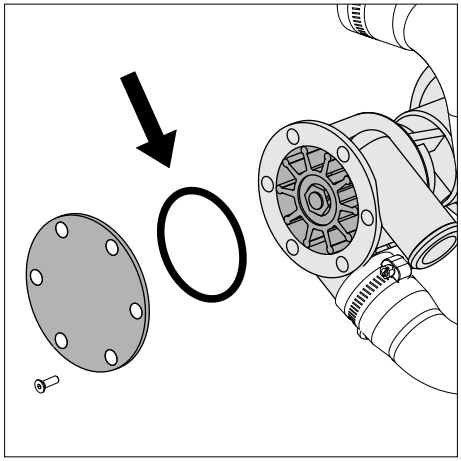
Raw water pump inspection

Every 1000 operating hours.



44 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).

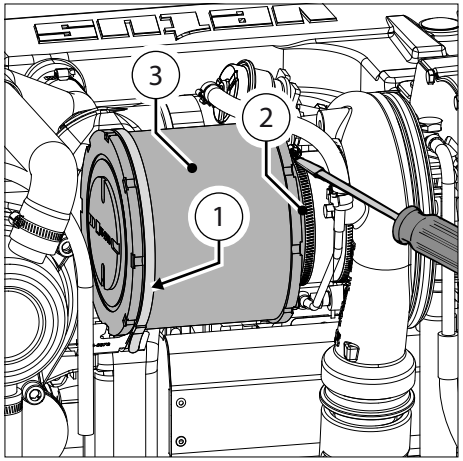


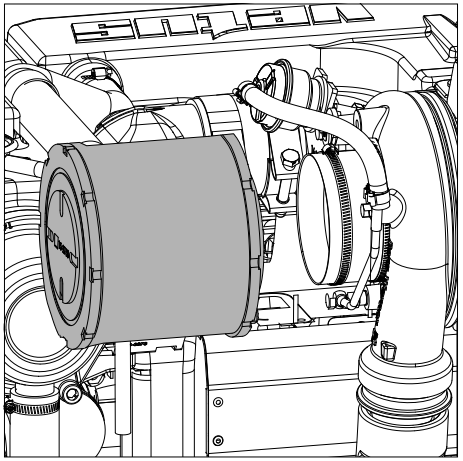
45 Reinstall the pump cover

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

For **O-ring art.code** see page 126.

Air filter replacement
Every 1000 operating hours.





46 Air filter replacement

- Cut the Ty-rap (1).
- Loosen the hose clamp (2).
- Remove the filter housing (3).
- Replace the filter.
- Install the unit in reverse order, tighten the hose clamp and fit a new Ty-rap.

For **air filter art. code** see page 126.

WARNING

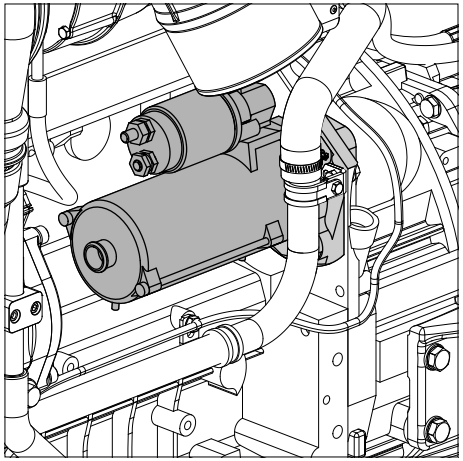
Never clean the element with petrol or hot liquids.

Never apply any oil to the air filter.

Never start the engine without the air filter in place.

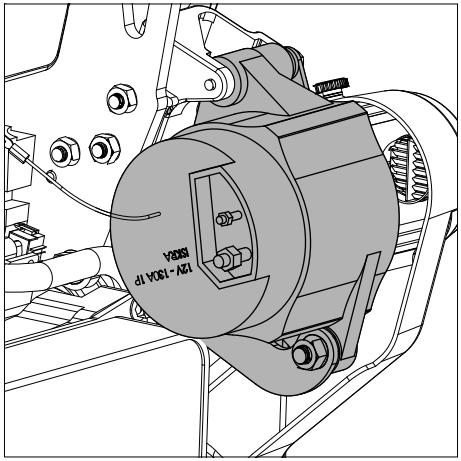
Checking the starter motor and alternator

Every 1000 operating hours.



47 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.



48 Checking the alternator

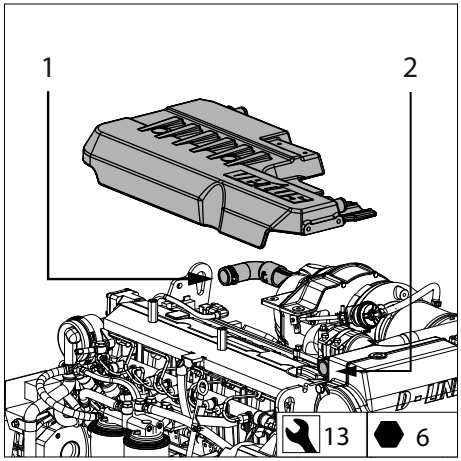
- Check for visible defects.
- Remove the alternator belt. Turn the pulley by hand to check whether the alternator can be turned easily. If this is not the case, contact your Vetus dealer.

Checking valve clearance

Every 1500 operating hours.

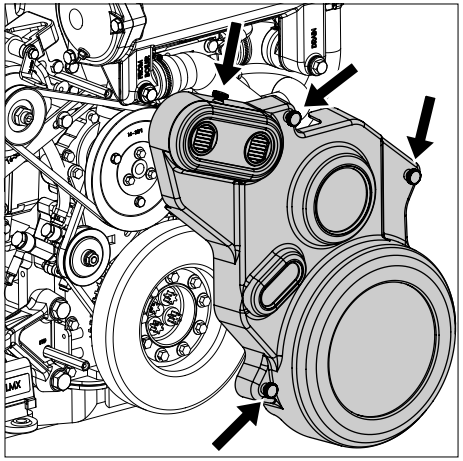
49 Checking / adjusting valve clearance

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



50 Remove upper cover

- Close the sea cock.
- Disconnect the hoses (1) and (2).
- Remove the 4 bolts and remove the upper cover.



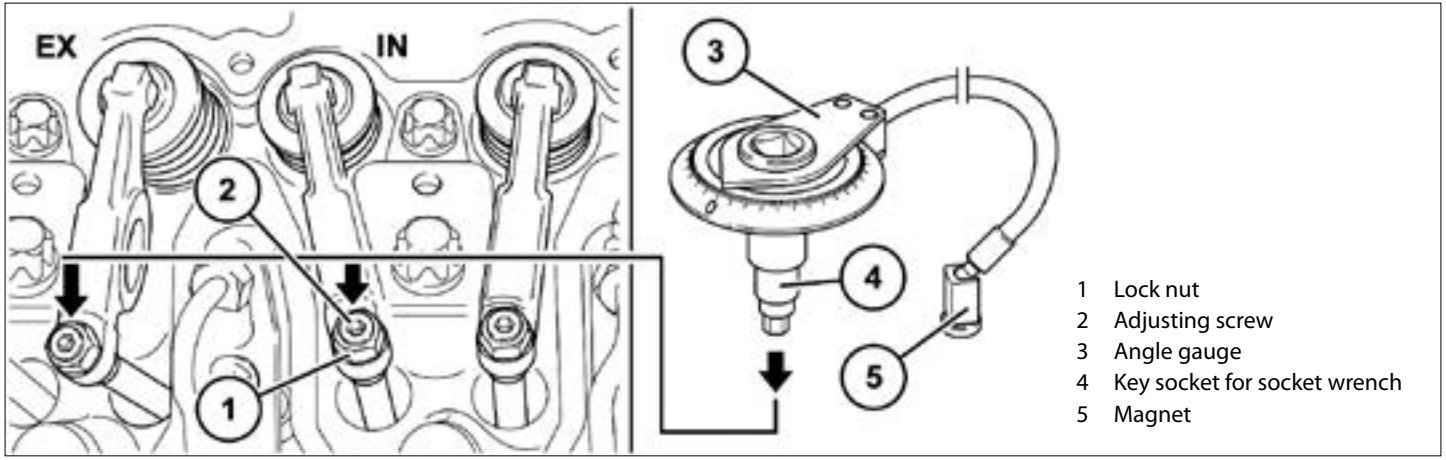
51 Remove the V-belt protection cover

- Loosen the the screws -the screws can be loosened without tools and they have anti-loss rings- and remove the V-belt protection.

NOTE

After checking / adjusting the valve clearance re-install the V-belt protection and the upper cover and re-connect the hoses.

Checking valve clearance
Every 1500 operating hours.



52 Adjusting the valve clearance

Check valve clearance and adjust if necessary

- Allow the engine to cool down for at least 30 minutes before you adjust the valve clearance: lube oil temperature less than 80°C.
- Loosen the screws.
- Remove the valve cover.
- Remove the gasket.
- The turning tool is placed on the mounting screws of the pulleys.
- Rotate the crankshaft until the valves overlap.

Exhaust valve is not yet closed, inlet valve starts opening.

Checking valve clearance
Every 1500 operating hours.

Determine which cylinders should be adjusted from the setup chart:

VD4

Valve overlap	Setting the cylinder
1	4
3	2
4	1
2	3

VD6

Valve overlap	Setting the cylinder
1	6
5	2
3	4
6	1
2	5
4	3

- Place the angle gauge with the key socket on the adjusting screw.
- Fix the magnet of the angle gauge.
- Turn the angle gauge in a clockwise direction until it is seated (rocker arm has no play) and turn the scale to zero.
- Rotate the angle gauge anticlockwise until you reach the specified rotational angle:

Valve clearance	**IN**	Inlet valve	75° +10°
	EX	Exhaust valve	120° +10°

53 Coolant replacement

The coolant has to be replaced every 2000 operating hours or at least once every two years.

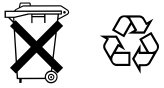
N.B. Replacing the coolant may also be necessary as part of the winter storage procedure; in case that the coolant present in the cooling system offers insufficient protection for the winter.

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.

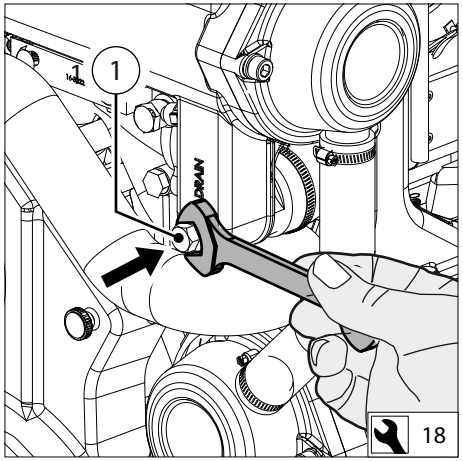
WARNING

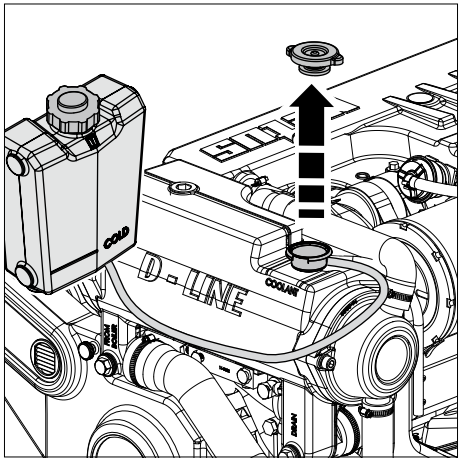
Cooling system protective liquids must be disposed of in accordance with environmental regulations.

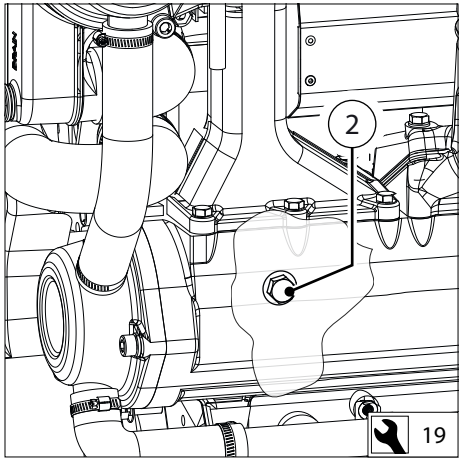


Coolant replacement

Every 2000 operating hours.





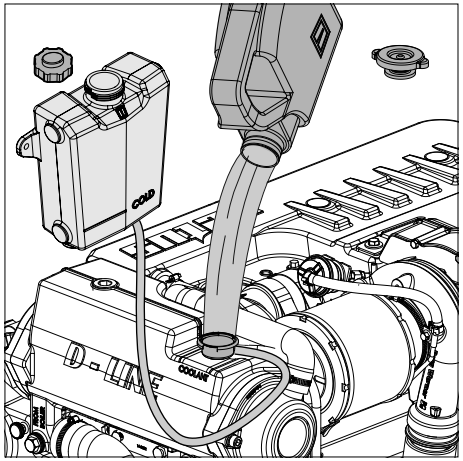


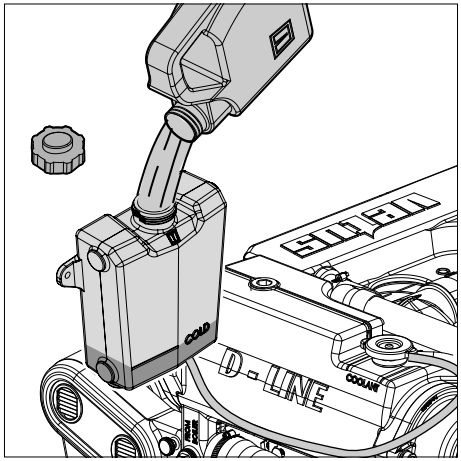
54 Draining of coolant

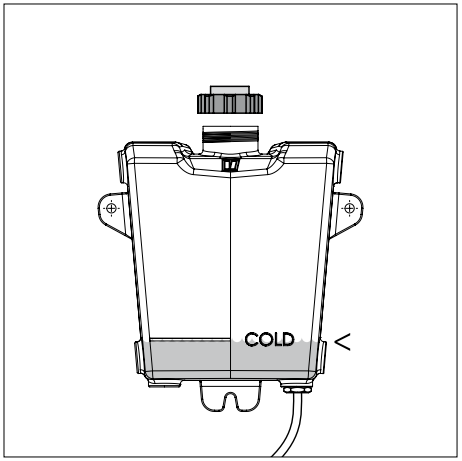
- Remove the drain plug from the heat exchanger housing (1).
- Remove the filler cap to bleed the cooling system and check that all the fluid is running out.
- Refit the drain plug after all the liquid has run out.

N.B. A small part of the coolant will remain in the engine block.

- If necessary, remove the drain plug (2) from the engine block to fully drain the engine.







55 Filling the cooling system

- Fill the cooling system as indicated on pages 20 to 23.

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

For specifications see page 119.

Coolant quantity:

		litres	Imp. pt	US pt
4 cyl.	:	8	14.1	16.9
6 cyl.	:	11	19.4	23.2

Coolant replacement
Every 2000 operating hours.

- Check the coolant level in the expansion tank after the engine has first been in operation, such that the operating temperature has been reached and the engine has cooled back to the ambient temperature. Top up, if necessary.

CAUTION

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

☞ **NOTE**

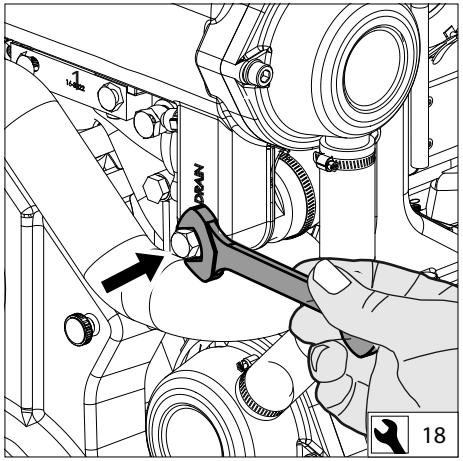
Cleaning of the heat exchanger is not a routine maintenance job.

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

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

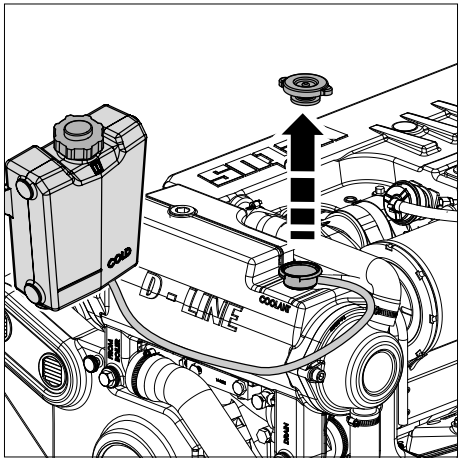
The engine temperature will be higher than normal if the heat exchanger is fouled.

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

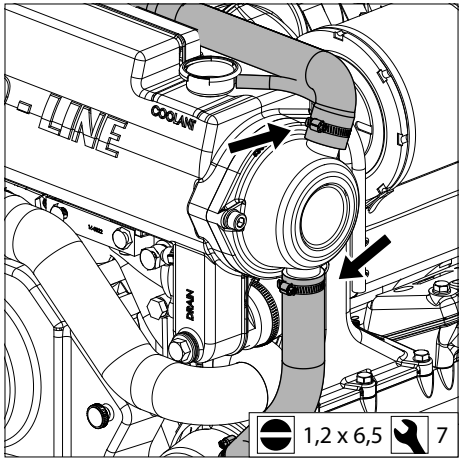


56 Draining the coolant

- Remove the drain plug in the heat exchanger housing to drain the coolant.

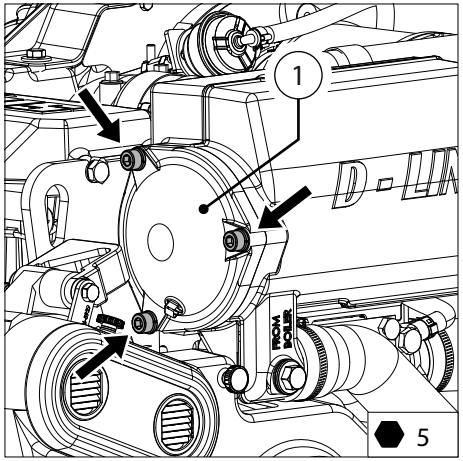


- Remove the filler cap to bleed the cooling system and check that all the fluid is running out.
- Refit the drain plug after all the liquid has run out.



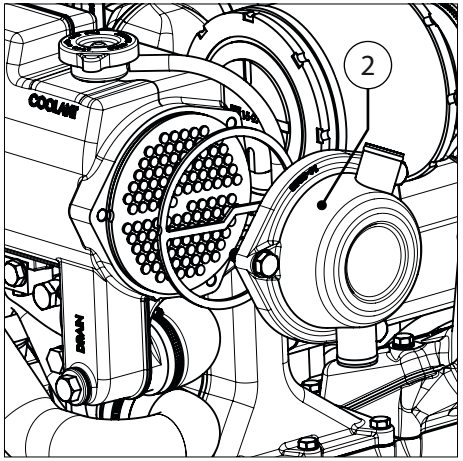
57 Disconnecting raw water hoses

- Close the tap of the raw water supply.
- Disconnect both raw water hoses.

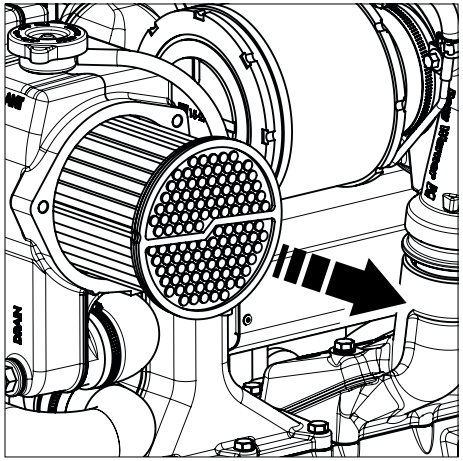


58 Remove the nuts from the end covers

- Remove the 3 nuts from both end covers.
- Take off the end cover (1) with the O-ring from the housing.

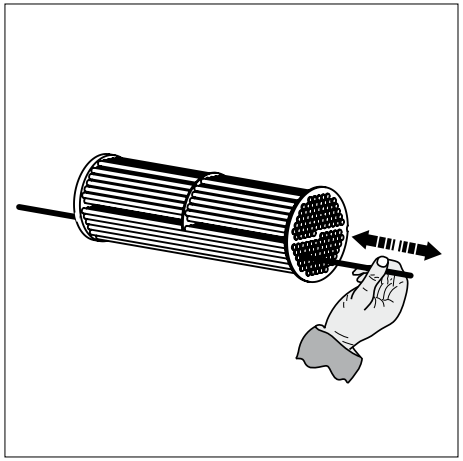


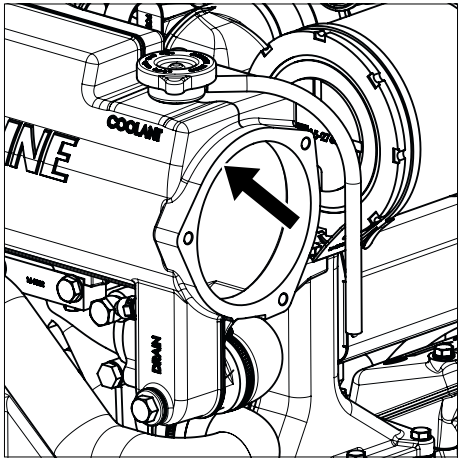
- Take off the connector cover (2) with the gasket from the housing.

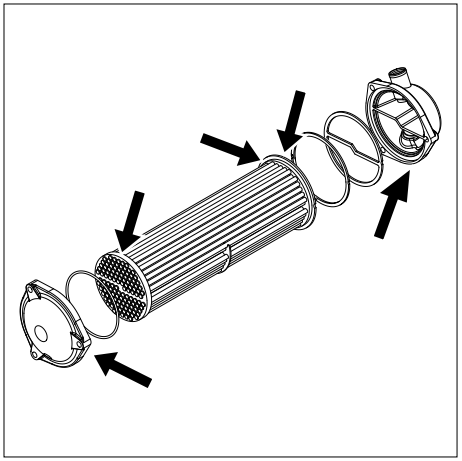


59 Remove heat exchanger

- Slide the heat exchanger out of the housing.
- Remove the gasket from the heat exchanger

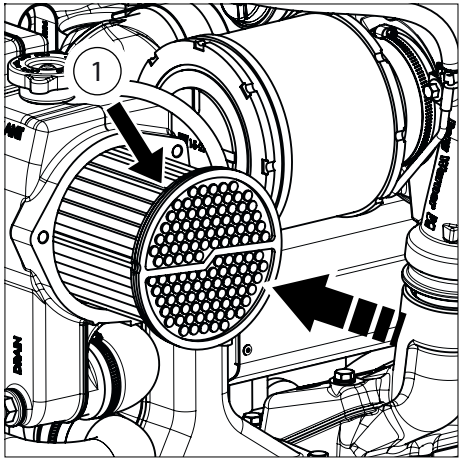






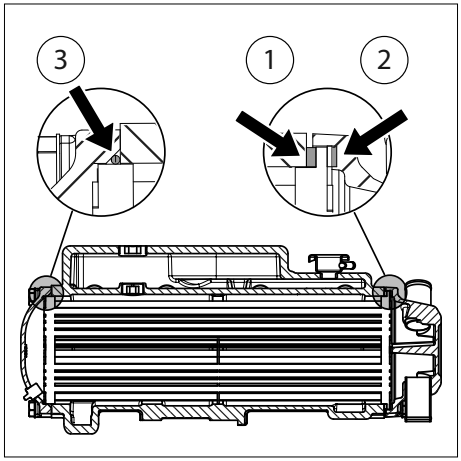
60 Cleaning the heat exchanger

- 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 contact surfaces of the heat exchanger are free from dirt.
- Clean the contact surfaces of the O-ring and gaskets.



61 Replacing heat exchanger

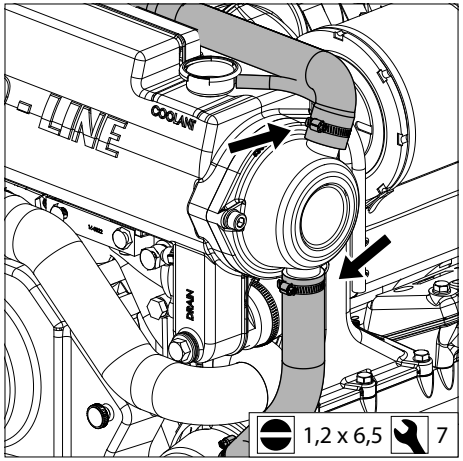
- Place the heat exchanger with a new gasket (1) in the heat exchanger housing.



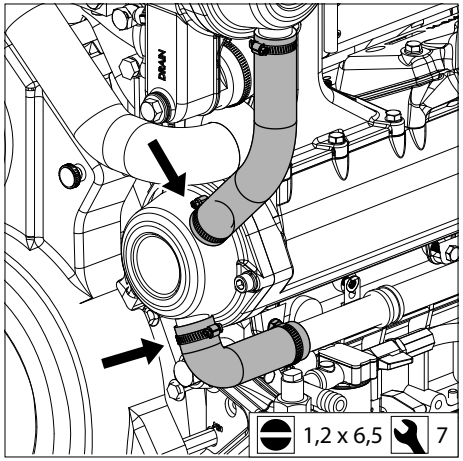
62 Replacing the end covers

- Refit the connector cover with a new gasket (2) to the housing.
- Refit the end cover with a new O-ring. (3)

  For **gasket set art.code** see pg 126.



- Refit all the disconnected hoses.
- Refill the cooling system, see pg. 72.
- Open the tap of the raw water supply.



63 Removing the raw water hoses

☞ **NOTE**

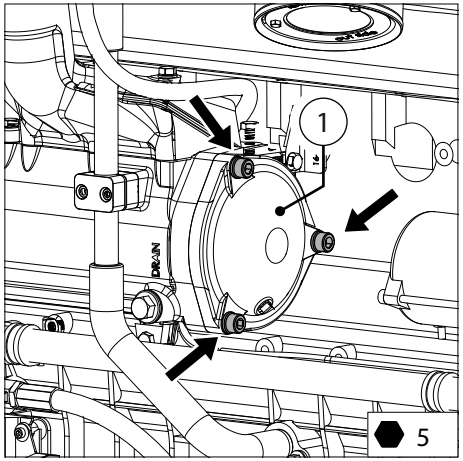
Cleaning of the after cooler is not a routine maintenance job.

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:

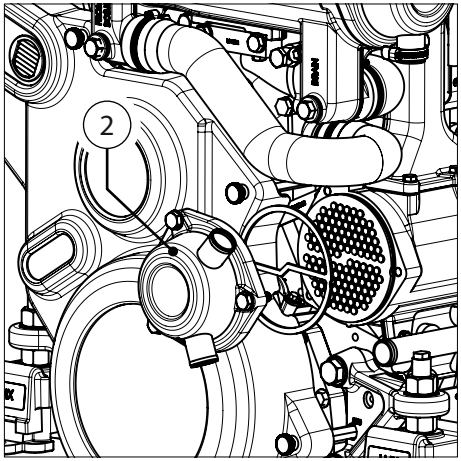
- Small rubber particles from a damaged raw water pump impeller.
- Growth of algae or seaweed.

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

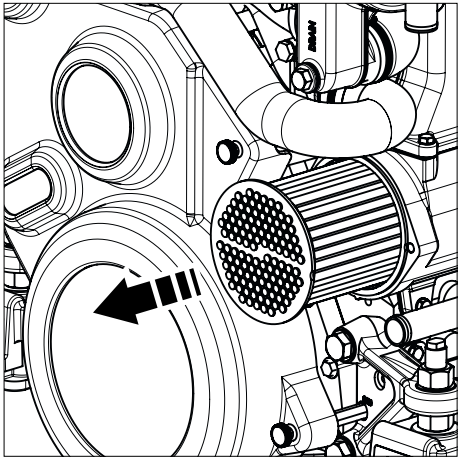


64 Remove the nuts from the end covers

- Remove the 3 nuts from both end covers.
- Take off the end cover (1) with the O-ring from the housing.

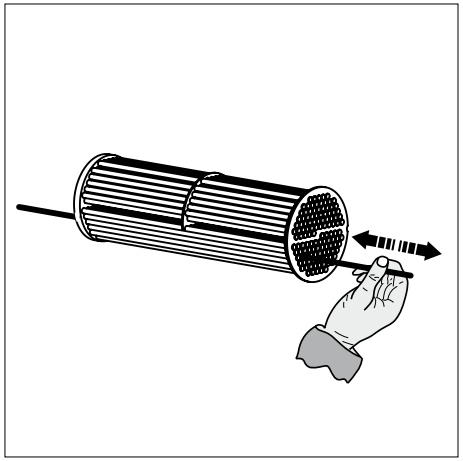


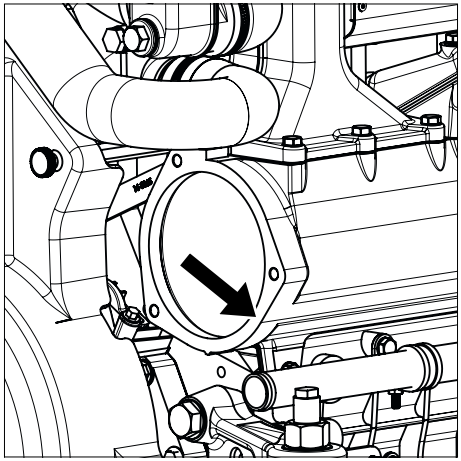
- Take off the connector cover (2) with the gasket from the housing.

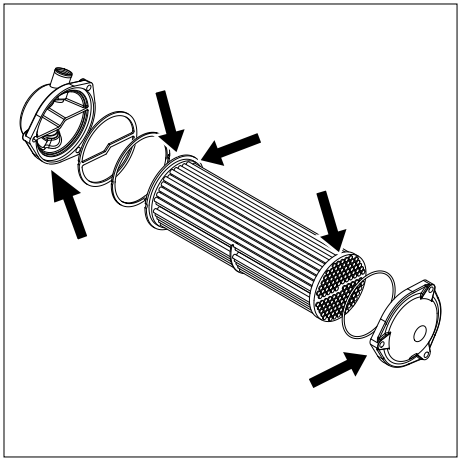


65 Removing the heat exchanger

- Slide the heat exchanger out of the housing.
- Remove the gasket from the heat exchanger

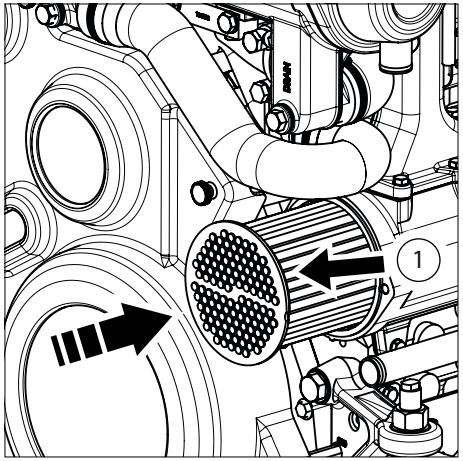






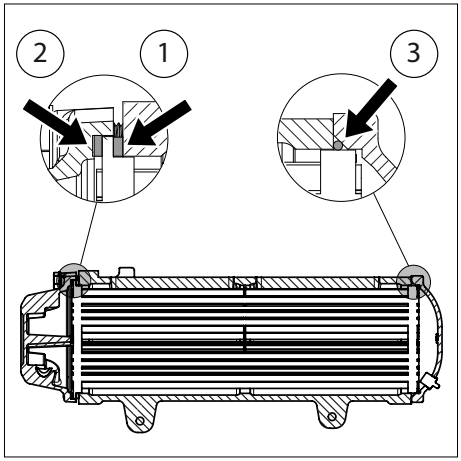
66 Cleaning the heat exchanger

- 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.
- Make sure that both surfaces of the after cooler housing are free from dirt residues.
- Clean the contact surfaces of the O-ring and gaskets.



67 Replacing the heat exchanger

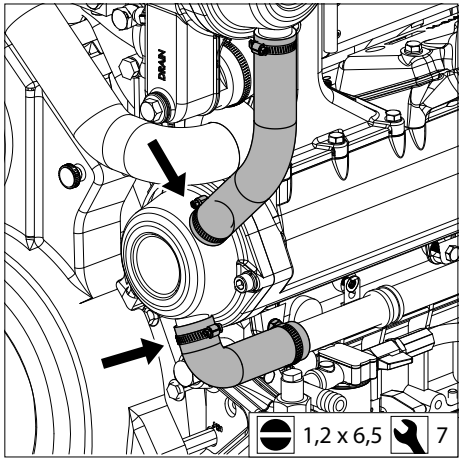
- Place the heat exchanger with a new gasket (1) in the charge-air cooler housing.



68 Fitting end covers

- Refit the connector cover with a new gasket (2) to the housing.
- Refit the end cover with a new O-ring. (3)

For **gasket set art.code** see pg. 126.



- Refit all the disconnected hoses.
- Open the tap of the raw water supply.

7 Lay-up / Winter storage procedure

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

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

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

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

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

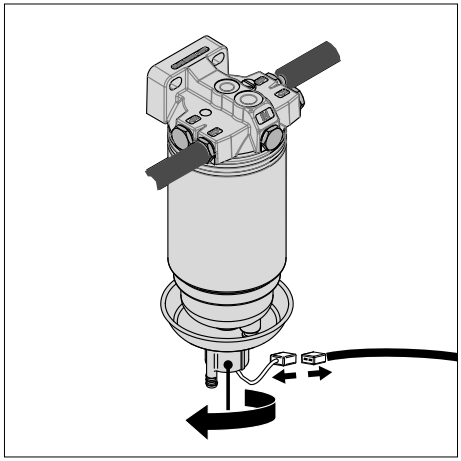
Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

7 Lay-up / Winter storage procedure

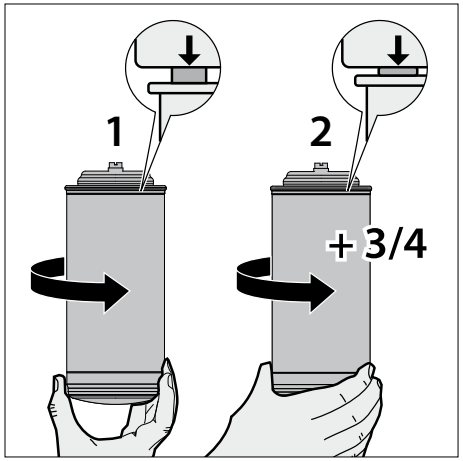
	Inspections and maintenance work to be carried out:	page
1	Clean the engine, remove any salt. Paint any rust spots and spray the whole engine with a protective medium, for example CRC protective 6-66.	84
2	Drain off the water from the fuel system and fill the fuel tank.	84
3	Make sure that the engine fuel system is filled with a fuel mixture with protective properties.	85
4	Flush out the raw water circuit with fresh water and if necessary fill with antifreeze. Clean the heat exchanger if necessary.	86
5	Make sure that the cooling system is filled with a suitable anti-freeze.	87
6	Change the oil filter and the engine oil.	88
7	Change the oil in the gearbox.	88
8	Disconnect the battery cables, charge the batteries if necessary and grease the battery terminals.	89

7 Lay-up / 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.



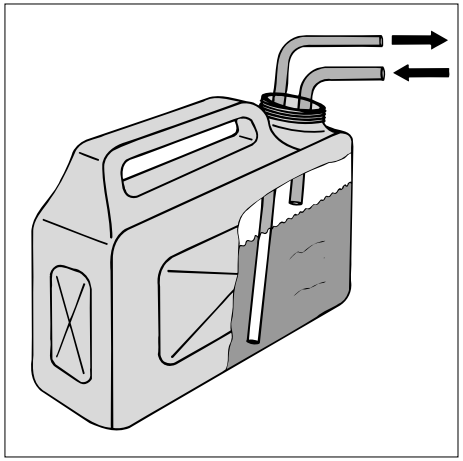
2 Fuel system

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

Ensure that the tank is completely filled with fuel.

- Install a new fuel filter. (page 56)

7 Lay-up / Winter storage procedure



3 Protective fuel mixture

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

CAUTION

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

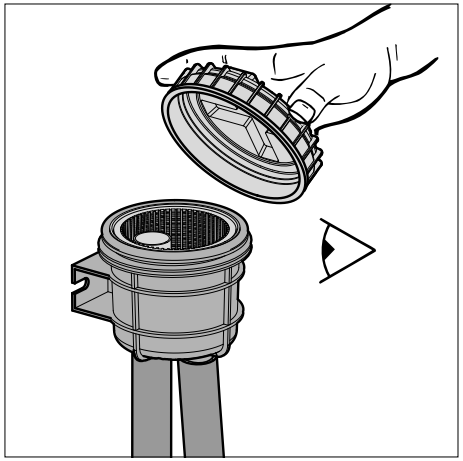
TIP!

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

[1] Engine oil with protective properties.
E.g.:
- Vetus Marine Diesel Engine Oil 15W40
- Shell Rimula R4 L 15W40

[2] Only use CEN EN 590 Diesel fuel.
Preferably water-free fuel.
Collect some fuel from the return pipe, while engine is running.

7 Lay-up / Winter storage procedure



4 Raw water cooling system

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

TIP!

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

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

Heat exchanger
Only clean the heat exchanger if this is absolutely necessary, see page 73.

Charge-air cooler
Only clean the heat exchanger if necessary, see page 78.

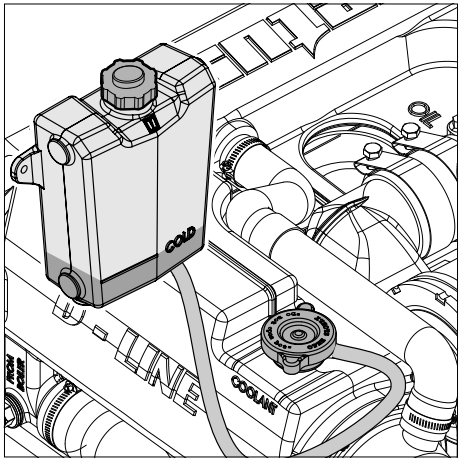
Raw water pump
Check the impeller of the raw water pump at least once every two years, see page 62.

7 Lay-up / Winter storage procedure

TIP!

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

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



5 Fresh water cooling system

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

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

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

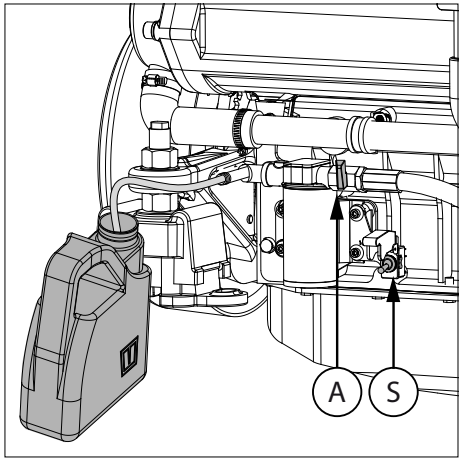
To avoid corrosion during winter storage the cooling system must be filled with an anti-freeze/water mixture (or a coolant).

For specifications see page 119.

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

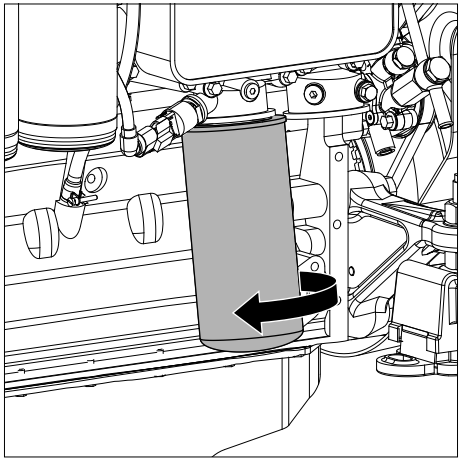
For coolant replacement see page 70.

7 Lay-up / Winter storage procedure



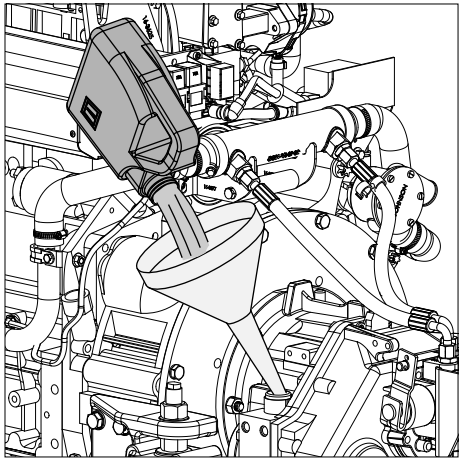
6 Lubrication system

- Drain the oil, see page 53.



- Replace the oil filter and change the engine oil; use oil with protective properties. See page 52-54.

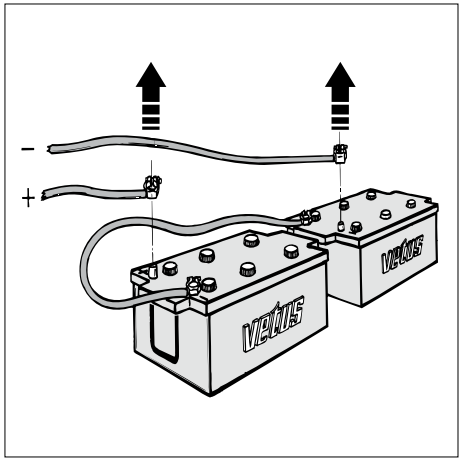
  For quantity and oil specification see page 108 and 116.

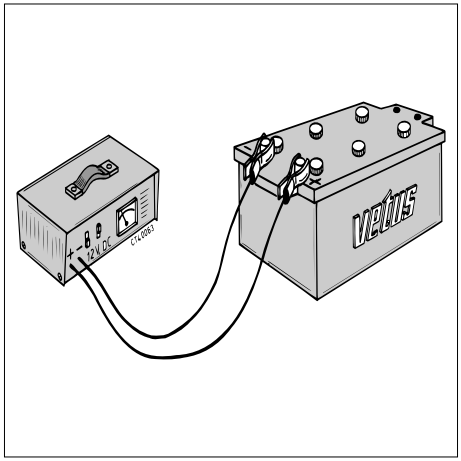


7 Changing the gearbox oil

- Stop the engine and change the oil of the gearbox. (page 58)

7 Lay-up / Winter storage procedure





8 Electrical system

- Disconnect the battery cables.
- Charge batteries during winter lay-up regularly if required!
- Follow the recommendations given on pages 46 to 55 or consult the recommendations given by the battery supplier for inspection and maintenance of the batteries.

NOTE

Never switch off the battery main switch directly after the engine has stopped.
Wait at least 2 minutes.
See page 37.

8 Recommissioning after lay-up or winter storage

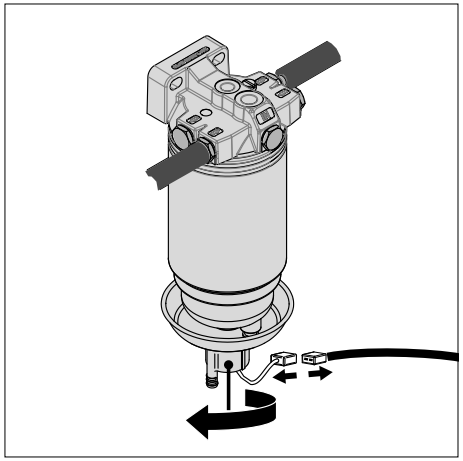
The engine must be inspected and any maintenance work carried out when re-commissioning for example at the beginning of the sailing season.

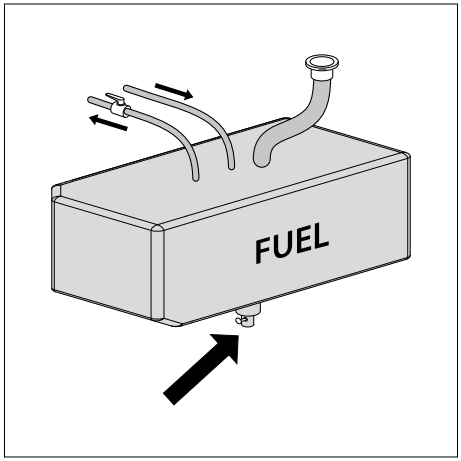
Consult a Vetus Dealer if help is required with this.

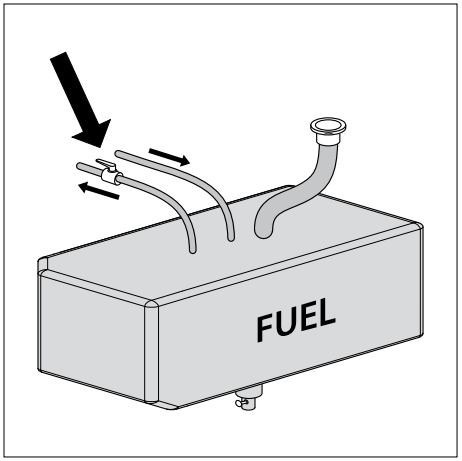
Inspections and maintenance work to be carried out are:

	Inspections and maintenance work to be carried out are:	page
1	Drain the water from the fuel system.	91
2	Check the raw water system.	92
3	Check the coolant level in the internal cooling system.	93
4	Check the oil level.	93
5	Check the batteries and reconnect these.	94
6	Check the operation of the engine.	94
7	Check all hose connections for leaks.	95
8	Check the operation of the instruments and the engine controls.	95

8 Recommissioning after lay-up or winter storage



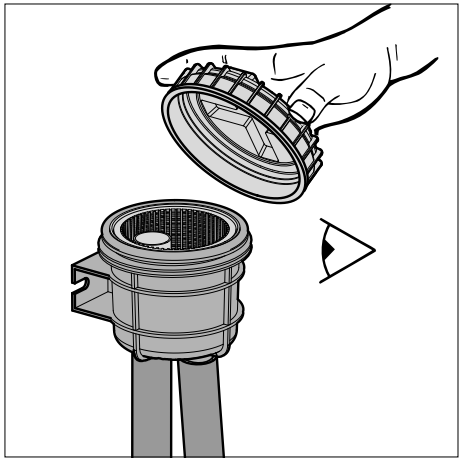


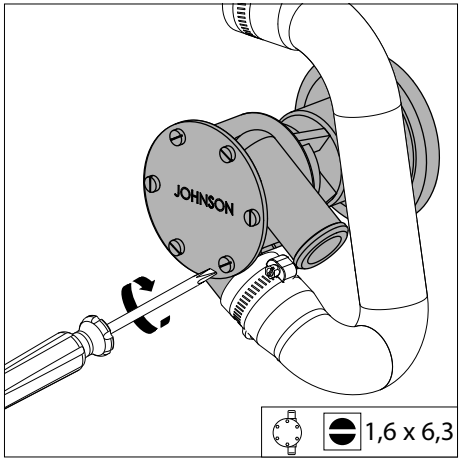


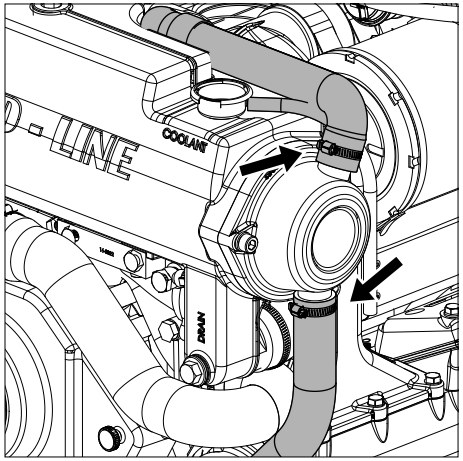
1 Fuel system

- Drain the water from the water separator/ fuel filter. (page 45)
- Drain the water from the fuel tank.
- Open the fuel valve.

8 Recommissioning after lay-up or winter storage



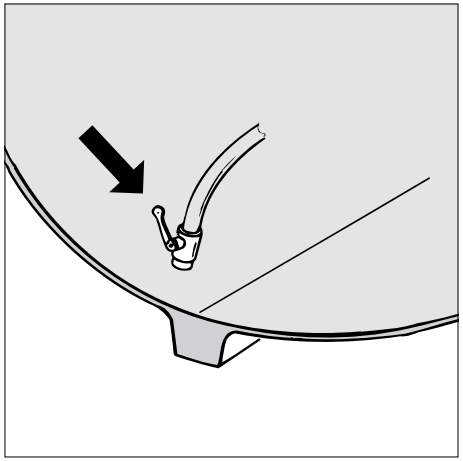




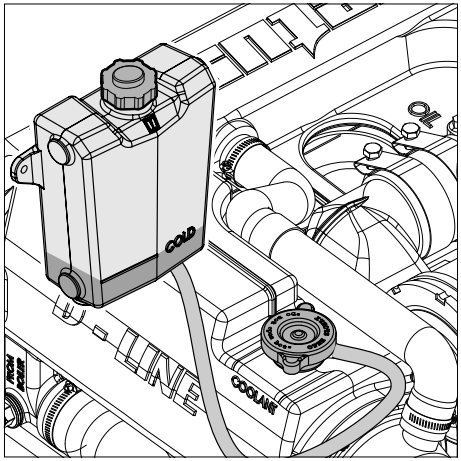
2 Raw water cooling system

- Check that the lid of the raw water strainer is reinstalled.
- Check whether the lid of the raw water pump and drain plugs are reinstalled. (pages 62, 64)
- Re-tighten possible loose hose clamps.

8 Recommissioning after lay-up or winter storage

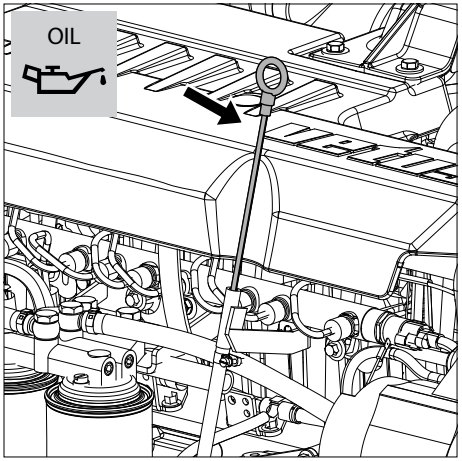


- Open the sea cock.



3 Fresh water cooling system

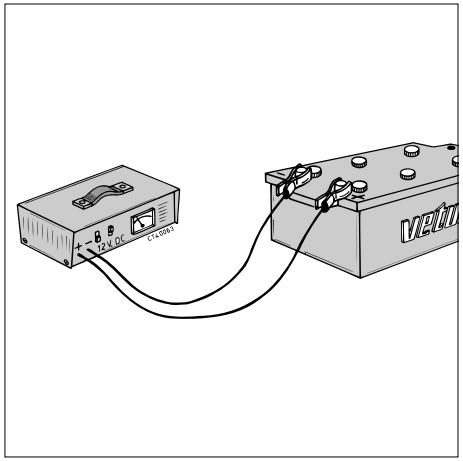
- Check the coolant level. (page 43)



4 Lubrication system

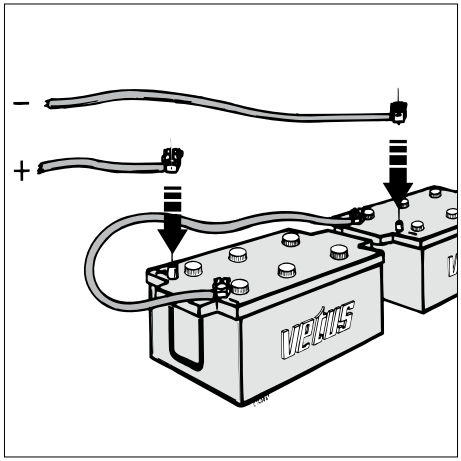
- Check the engine oil level. (page 42)

8 Recommissioning after lay-up or winter storage

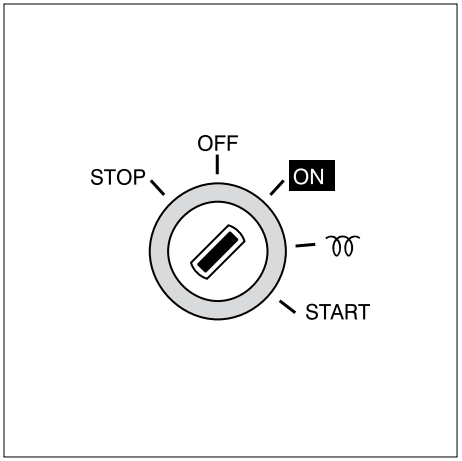


5 Electrical system

- Make sure that the batteries are fully charged. (page 46, 89)



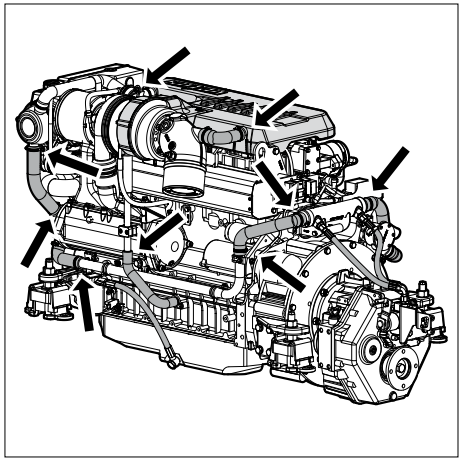
- Connect the batteries.



6 Switching on

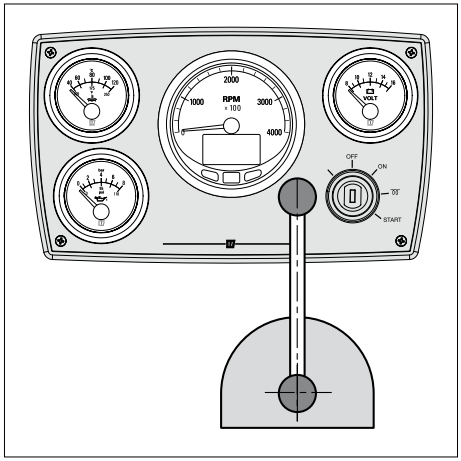
- Turn the start key on the instrument panel clock-wise;

8 Recommissioning after lay-up or winter storage



7 Check engine for leaks

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



8 Checking instruments and remote controls

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

9 Troubleshooting

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

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

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

In the following tables information is given about the possible causes of faults and suggested remedies. Please note that these 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 vincinity of the engine.
When carrying out repair, **never** start the engine with the fuel injection pump removed removed.
Disconnect battery!

	Fault	page
1	Engine will not crank	98
2	Engine cranks but will not start, no smoke from exhaust	98
3	Engine cranks but will not start, smoke from exhaust	99
4	Engine starts but runs unevenly (rough idling) or stalls	99
5	Engine does not reach maximum rpm under load	100
6	Engine overheats	101
7	Engine not firing on all cylinders	101
8	Engine has little or no oil pressure	102
9	Engine oil consumption excessive	102
10	Fuel consumption excessive	103
11	Black exhaust smoke (idling)	103
12	Blue exhaust smoke (idling)	103
13	Black exhaust smoke (at load)	104
14	White exhaust smoke (at full load)	104
15	Burnt oil trace in exhaust line	105
16	Idle speed >750-800 RPM	105

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.
Control lever not in neutral.	Put operating lever in neutral
ECU prevents starting.	Check error according to error code and eliminate fault.
Water in the cylinder .	Check / Repair .
Pump switch not in OFF position.	Check.

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.
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
Fuse burnt out in ECU box.	Check/replace.
ECU faulty.	Diagnosis -replace .
Exhaust restricted.	Check.
Faulty V-belt fuel pump.	Replace V-belt.
Compression too low.	Check.

3 Engine cranks but will not start, smoke from exhaust

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.
Incorrect lube oil SAE class or quality for ambient temperature.	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.
Compression too low.	Check.
ECU has detected s system error and activates an equivalent speed.	Check error according to error code and eliminate fault.

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.
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
Turbocharger damaged.	Replace

5 Engine does not reach maximum rpm under load

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

6 Engine overheats

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

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.
Leaking fuel supply line or fuel injection line.	Check / replace.
Air in fuel system.	Check and bleed.
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
Incorrect fuel quality or dirty fuel.	Check fuel. Drain and rinse fuel tank. Replace with new fuel.
Fuel leaks.	Check and repair.
Insufficient air intake.	Check.
Excessive wear of cylinder / piston.	Check compression; refurbish engine.

11 Black exhaust smoke (idling)

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

12 Blue exhaust smoke (idling)

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

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.
Engine overloaded, max. rpm is not reached.	Check sizes of propeller.
Engine overloaded, dirty propeller -boat hull, excessive load on-board.	Check /clean.

14 White exhaust smoke (at full load)

Possible fault	Remedy
Faulty injector/injection pump.	Check, replace if required.
Air in fuel system.	Check and bleed.
Wrong fuel quality or contaminated fuel.	Check fuel. Drain and flush fuel tank. Replace with new fuel.
Water in fuel system.	Check water separator.
Incorrect injection timing.	Check / adjust.
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 .

16 Idle speed >750-800 RPM

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

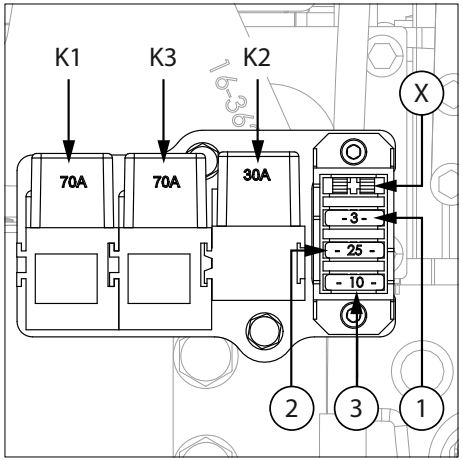
Model	:	VD4.120	VD4.140	VD6.170	VD6.210
General					
Make	:	Vetus Deutz			
Number of cylinders	:	4	4	6	6
Based on	:	TCD 2012 L04 2V Low	TCD 2012 L04 2V High	TCD 2012 L06 2V Low	TCD 2012 L06 2V High
Type	:	4-stroke diesel, in-line			
Injection	:	Direct, Common Rail			
Aspiration	:	Turbo-charged / After cooled			
Bore	:	101 mm	101 mm	101 mm	101 mm
Stroke	:	126 mm	126 mm	126 mm	126 mm
Total displacement	:	4038 cm^3	4038 cm^3	6057 cm^3	6057 cm^3
Compression ratio	:	18,0 : 1	18,0 : 1	18,0 : 1	18,0 : 1
Idling speed	:	800 rpm	800 rpm	800 rpm	800 rpm
Max. no. of revolutions at no load	:	2520 rpm	2520 rpm	2520 rpm	2520 rpm
Direction of rotation	:	Counter clockwise, viewed towards the flywheel			
Valve Clearances: Inlet/Exhaust	:	—			
Setting with rotary angle disc	:	75°+10° / 120°+10°			
Weight (with standard gearbox)	:	515 kg (1135 lbs)	515 kg (1135 lbs)	685 kg (1510 lbs)	685 kg (1510 lbs)

Model	:	VD4.120	VD4.140	VD6.170	VD6.210
Engine installation					
Max. installation angle	:	15 degrees backwards			
Max. athwartships angle	:	25 degrees continuously, 30 degrees intermittent			
Maximum output					
at the flywheel (ISO 8665)	:	90 kW (122 hp)	103 kW (140 hp)	125 kW (170 hp)	155 kW (210 hp)
at the prop shaft (ISO 8665)	:	86 kW (117 hp)	99 kW (134 hp)	120 kW (163 hp)	149 kW (203 hp)
at no. of revolutions of	:	2400 rpm	2400 rpm	2400 rpm	2400 rpm
Torque,	:	449 Nm (45,8 kgm) (331 ft.lb)	520 Nm (53 kgm) (383 ft.lb)	680 Nm (69,3 kgm) (502 ft.lb)	810 Nm (82,6 kgm) (597 ft.lb)
at no. of revolutions of	:	1600 rpm	1600 rpm	1600 rpm	1600 rpm
Fuel consumption	:	235 g/kW.h (173 g/hp.h) (6.1 oz/hp.h)	235 g/kW.h (173 g/hp.h) (6.1 oz/hp.h)	240 g/kW.h (177 g/hp.h) (6.2 oz/hp.h)	240 g/kW.h (177 g/hp.h) (6.2 oz/hp.h)
at no. of revolutions of	:	2400 rpm	2400 rpm	2400 rpm	2400 rpm

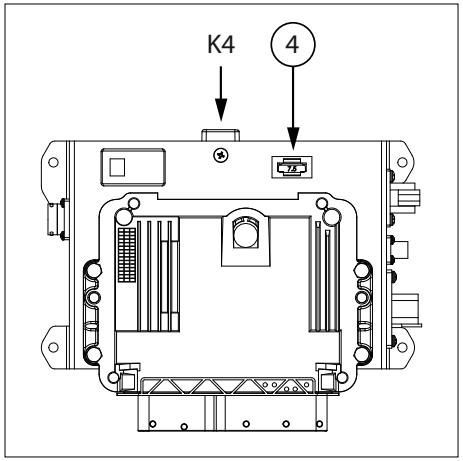
Model	:	VD4.120	VD4.140	VD6.170	VD6.210
Fuel System (Self-bleeding)					
Injection pump	:	Bosch			
Injectors	:	Bosch			
Opening pressure	:	250 bar (kgf/cm3) (3625 psi)			
Firing order	:	1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
Injection timing	:	4° BTDC	4° BTDC	4° BTDC	4° BTDC
Fuel lift pump	:	Suction height max. 1.5 m (5 ft)			
Fuel supply connection	:	for hose 12 mm I.D.			
Length fuel line	:	max. 6 m (20 ft)			
Fuel return connection	:	for hose 10 mm I.D.			
Return flow	:	max. 4 l/min (0.9 Imp. Gal/min) (1.1 US Gal/min)			
Oil lubrication system					
Oil capacity, max.					
without oil filter	:	7.5 litres (13.2 Imp. pt) (15.9 US pt)	7.5 litres (13.2 Imp. pt) (15.9 US pt)	12.5 litres (22 Imp. pt) (26.4 US pt)	12.5 litres (22 Imp. pt) (26.4 US pt)
with oil filter	:	8.5 litres (15 Imp. pt) (18 US pt)	8.5 litres (15 Imp. pt) (18 US pt)	14 litres (24.6 Imp. pt) (29.6 US pt)	14 litres (24.6 Imp. pt) (29.6 US pt)
Oil pressure with warm oil (120˚C, 248°F) and low idle	:	min. 0.8 bar (11.6 psi)			
Oil temperature in sump	:	max. 125°C (257°F)			

Model	:	VD4.120	VD4.140	VD6.170	VD6.210
Cooling system					
Capacity	:	8 liter (14 Imp. pt) (16.9 US pt)	8 liter (14 Imp. pt) (16.9 US pt)	11 liter (19.4 Imp. pt) (23.3 US pt)	11 liter (19.4 Imp. pt) (23.3 US pt)
Thermostat	:	opening at 83°C (181°F), fully opened at 95°C (203°F) (VD20833)			
Coolant pump,					
Flow	:	192 l/min (42.2 Imp. Gal/ min) (50.7 US Gal/min)	192 l/min (42.2 Imp. Gal/ min) (50.7 US Gal/min)	192 l/min (42.2 Imp. Gal/ min) (50.7 US Gal/min)	192 l/min (42.2 Imp. Gal/ min) (50.7 US Gal/min)
Total head	:	0.3 bar (4.3 psi)	0.3 bar (4.3 psi)	0.3 bar (4.3 psi)	0.3 bar (4.3 psi)
Raw water pump,					
Flow at max. engine rpm	:	94 l/min (20.7 Imp. Gal/ min) (24.8 US Gal/min)	94 l/min (20.7 Imp. Gal/ min) (24.8 US Gal/min)	117 l/min (25.7 Imp. Gal/ min) (30.9 US Gal/min)	117 l/min (25.7 Imp. Gal/ min) (30.9 US Gal/min)
Total head at max. flow	:	0.5 bar (7 psi)	0.5 bar (7 psi)	0.5 bar (7 psi)	0.5 bar (7 psi)
Inlet connection	:	for hose 32 mm I.D.			
Heater supply connection	:	G 1/2"			
Heater return connection	:	M26 x 1,5			
Combustion air system / Exhaust					
Intake vacuum pressure	:	max. 25 mbar (0.74 in Hg)			
Exhaust diameter	:	100 mm (4")	100 mm (4")	125 mm (5")	125 mm (5")
Exhaust back pressure	:	at specified output max. 100 mbar (2.9 in Hg) absolute maximum 120 mbar (3.5 in Hg)			

Model	:	VD4.120	VD4.140	VD6.170	VD6.210
Electrical system					
Voltage	:	12 Volt / 24 Volt, see alternator data tag			
Alternator	:	14 Volt, 160 A / 28 Volt, 60 A, see alternator data tag			
Starter motor	:	14 Volt, 3.1 kW / 28 Volt, 4 kW			
Battery capacity	:	min. 88 Ah, max. 176 Ah (at 12 Volt) / min. 2x 66 Ah, max. 2x 110 Ah (at 24 Volt)			
Fuses					
Oil-change pump/Immobiliser	:	Blade fuse 'ATO' 3 A, see page 111 ①			
EMR Power	:	Blade fuse 'ATO' 25 A, see page 111 ②			
Dashboard	:	Blade fuse 'ATO' 10 A, see page 111 ③			
CAN Diagnosis/EMR Control	:	Blade fuse 'ATO' 7.5 A, see page 111 ④			
V-belts, Tension					
Alternator	:	Pre-tension 650 N (145 lbf) / Re-tension 400±50 N (90±11 lbf)			
Fuel pump / Coolant pump	:	Pre-tension 650 N (145 lbf) / Re-tension 400±50 N (90±11 lbf)			



Electrical system			
Relay			
K1	70A	:	Starting
K2	30A	:	Elec. Oil sump drain pump
K3	70A	:	EMR
K4	30A	:	Diagnosis/ CAN relay
X		:	No fuse



Gearbox specifications

Model	:	VD4.120	VD4.140	VD6.170	VD6.210
Gearbox			Reduction ratio		
ZF-Hurth: model 45	:	2,2 / 2,5 / 3,0 : 1	2,2 / 2,5 / 3,0 : 1	—	—
model 45A	:	2,2 / 2,5 / 3,0 : 1	2,2 / 2,5 / 3,0 : 1	—	—
model 63	:	—	—	1,51 / 1,93 / 2,5 / 2,78 : 1	1,51 / 1,93 / 2,5 / 2,78 : 1
model 63A	:	—	—	1,22 / 1,56 / 2,04 / 2,52 : 1	1,22 / 1,56 / 2,04 / 2,52 : 1
model 63IV	:	1,29 / 1,56 / 1,99 / 2,47 : 1	1,29 / 1,56 / 1,99 / 2,47 : 1	1,29 / 1,56 / 1,99 / 2,47 : 1	1,29 / 1,56 / 1,99 / 2,47 : 1

Torque wrench settings
VD4.120 VD4.140 VD6.170 VD6.210

Screw connection	Size	Class	Torque				Angle
			Nm		(kgm)		
Oil pan	M8x16		30		(3,0)		
Oil drain plug	M18x1.5		50		(5,0)		
Cylinder head,							
- long bolts	M12x200	10.9	40/70		(40/70)		180°
- short bolts	M12x120	10.9	40/70		(40/70)		180°
Lifting eye / Cyl. head	M10x30	8.8	40	±10%	(4,0	±1%)	
Rocker cover	M6x75	10.9	8,5	±10%	(0,85	±1%)	
Rocker arm set-screw	M8x60	8.8	21		(2,1)		
Flange injection pump	M8x30	10.9	30		(3,0)		
Injector holder (Torx)	M8x50	10.9	16	+5	(1,6	+0,5)	
Fuel lift pump / clamping strap	M8x20	10.9 A4C	21	±2	(2,1	±0,2)	
Pulley fuel lift pump	M8x20	8.8	21	±2	(2,1	±0,2)	
Screw, banjo connector fuel line	M14x1.5		39	±10%	(3,9	±1%)	
Injection line mounting	M14x1.5		25	±3,5	(2,5	±0,35)	
Exhaust insulator	M8	8.8	21	±10%	(2,1	±1%)	
Air intake manifold (AIM)	M6x75	10.9	11	±10%	(1,1	±1%)	
Cover (AIM),							
- pre-tightening	M6x25		15	±10%	(1,5	±1%)	
- re-tightening	M6x25		15	±10%	(1,5	±1%)	
Plugs (AIM)	M10x1		13	±10%	(1,3	±1%)	
Plugs (AIM)	M16x1.5		38	±10%	(3,8	±1%)	
Plugs (AIM)	M18x1.5		50		(5,0)		

Torque wrench settings
VD4.120 VD4.140 VD6.170 VD6.210

Screw connection		Size	Class	Torque				Angle
				Nm		(kgm)		
Exhaust manifold / Cyl. head								
- Stud		M10		15		1,5		
- Locknut		M8		25	±10%	2,5	±1%	
Turbocharger / Exhaust manifold								
-Bolt	- 4 Cyl.	M8		21	±10%	2,1	±1%	
	- 6 Cyl.	M10		22	±10%	2,2	±1%	
Turbo-oplader / Uitlaatinjectiebocht								
- Stud	- 4 Cyl.	M8		22	±10%	2,2	±1%	
	- 6 Cyl.	M10		22	±10%	2,2	±1%	
- Nut	- 4 Cyl.	M8		21	±10%	2,1	±1%	
	- 6 Cyl.	M10		21	±10%	2,1	±1%	
Alternator mounting		M8x80	10.9	21	±10%	2,1	±1%	
Starter		M10x55	10.9	70		7,0		
Engine bracket front		M16x75	8.8	260	±10%	26,0	±1%	
Engine bracket rear		M12x40	8.8	95	±10%	9,5	±1%	
Flywheel housing		M12x150	10.9	99	±10%	9,9	±1%	
Flywheel housing		M16x140	10.9	243	±10%	24,3	±1%	
Damper plate		M10x25	8.8	55	±2%	5,5	±0,2%	
Gear-wheel raw water pump shaft		M12		80		8,0		

Fuel Quality Grade

Use only diesel fuel or diesel blends with up to 7% FAME (B7), with less than 0.5% sulphur content of which the quality is fully controlled and conform the standards below.

The following fuel specifications / standards are approved:
- CEN EN 590
- ASTM D 975 1-D
- ASTM D 975 2-D

Don't use fuel with more than 1% sulfur!

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

Biodiesel

CAUTION

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

Although the use of biodiesel is allowed in diesel blends with up to 7% FAME (Fatty Acid Methyl Esters) (B7) fast degradation of the biodiesel should be taken in account.
Problems caused by using FAME of poor quality or degraded fuel are not covered by warranty.

Engine oil

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

Acceptable API oils: CH-4, CG-4, CI-4, CJ-4, DHD-1
Acceptable 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 lifespan.

Recommended lubricating oil viscosity

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

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

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

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

For oil capacity see p. 108.

CAUTION

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

Limits concerning motor oil

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

NOTE

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

Limits concerning motor oil

Characteristic	Unit	Test method	Limit
Viscosity	cSt @ 100°C	JIS: K 2283	+30% / -15% max. for new oil
Total base numberl (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	% weigth	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.

ZF Hurth:

model ZF45 : 2,0 litres ATF [1]
model ZF45A : 3,0 litres ATF [1]
model ZF63 : 3,8 litres ATF [1]
model ZF63A : 4,0 litres ATF [1]
model ZF63IV : 4,0 litres ATF [1]

[1] ATF : AutomaticTransmission Fluid;
Transmission oil type A, Suffix A.

For example: Vetus Transmission Oil
Shell Donax T6
Gulf Synth

Other brands of gearboxes:
See supplied owners 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.

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

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

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

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

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

Water quality for coolant preparation

Use preferably tap water.

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

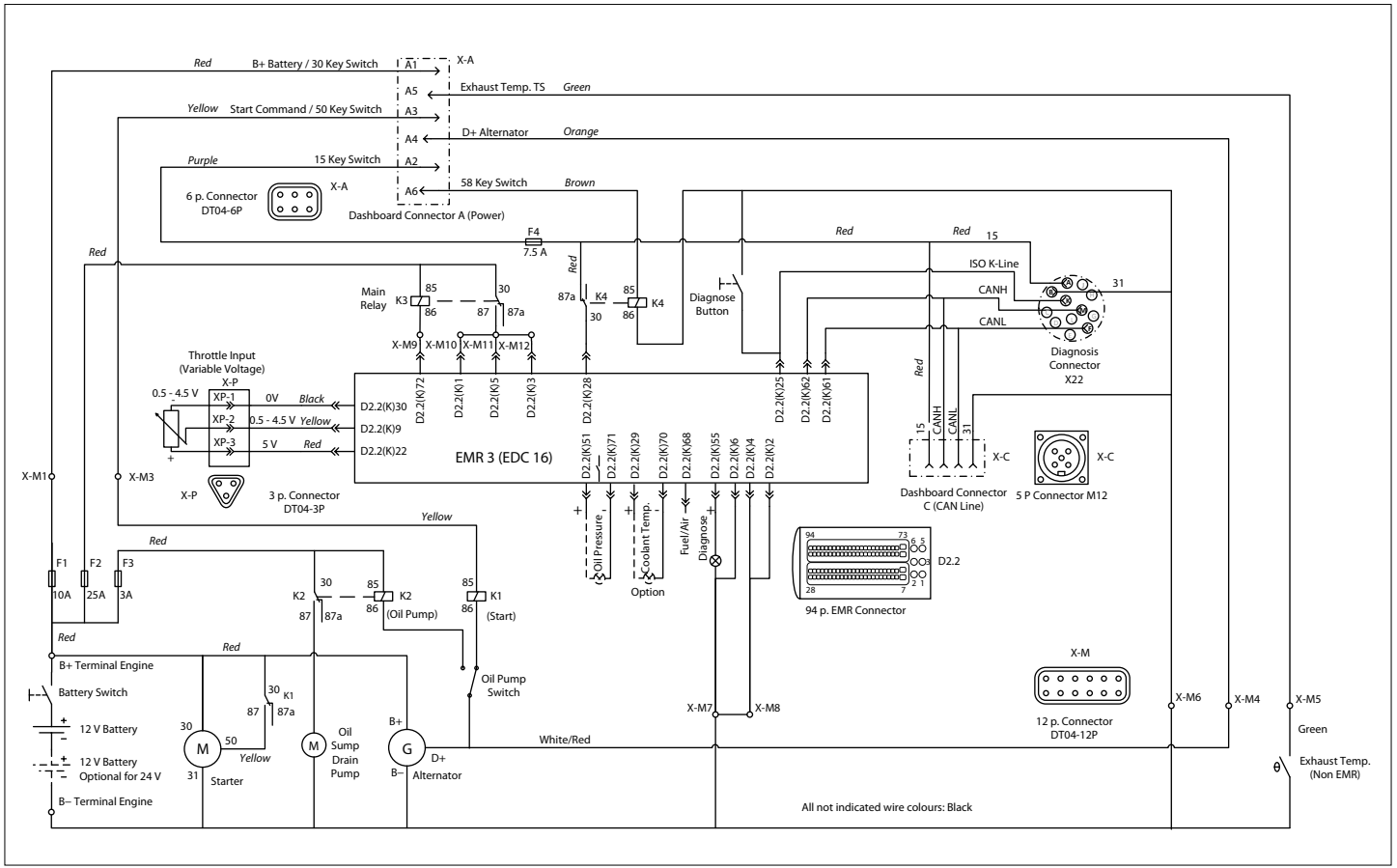
Water quality		min.	max.
pH-value at 20°C (68°F)		6.5	8.5
Chloride ion content	[mg/dm^3]	–	100
Sulfate ion content	[mg/dm^3]	–	100
Total hardness	[degrees]	3	12

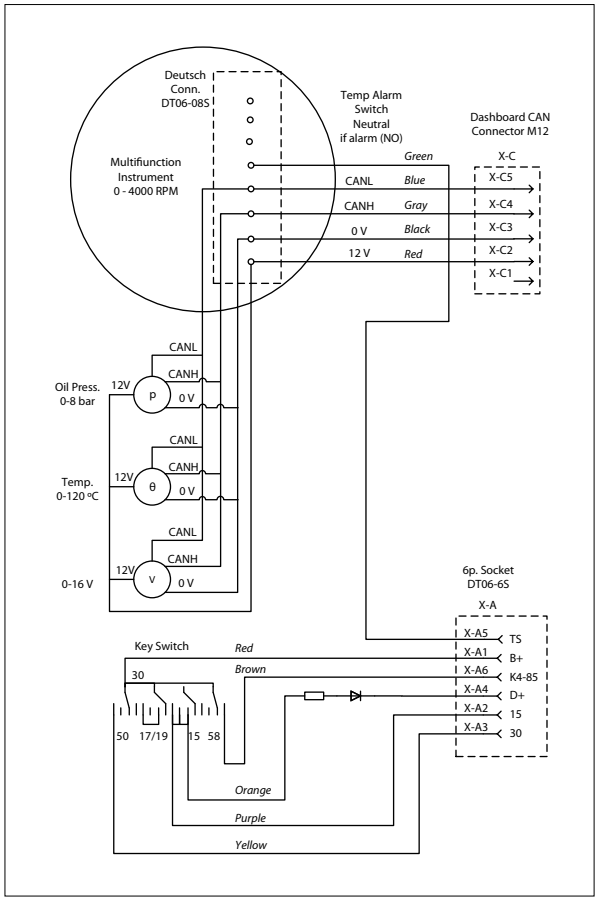
CAUTION

Never use sea-water or brackish water.

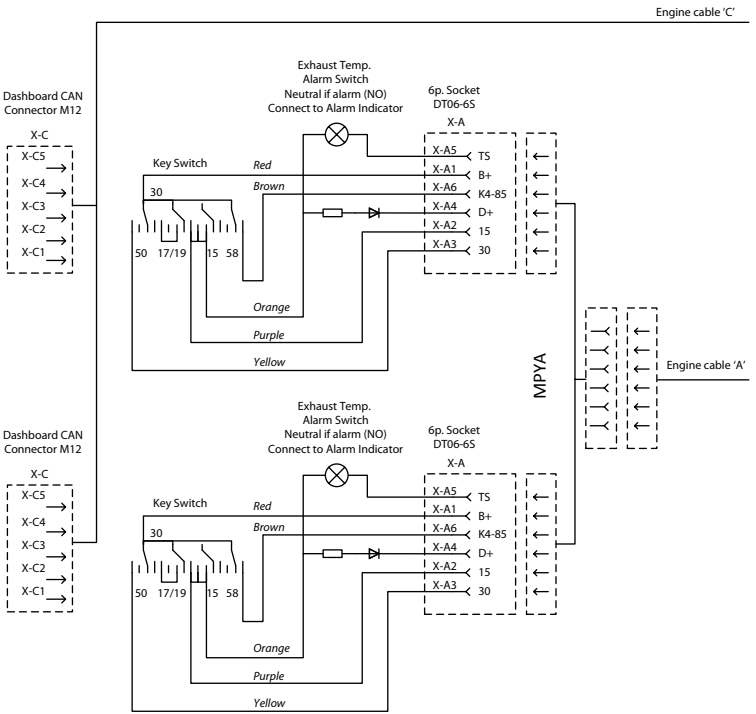
WARNING

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

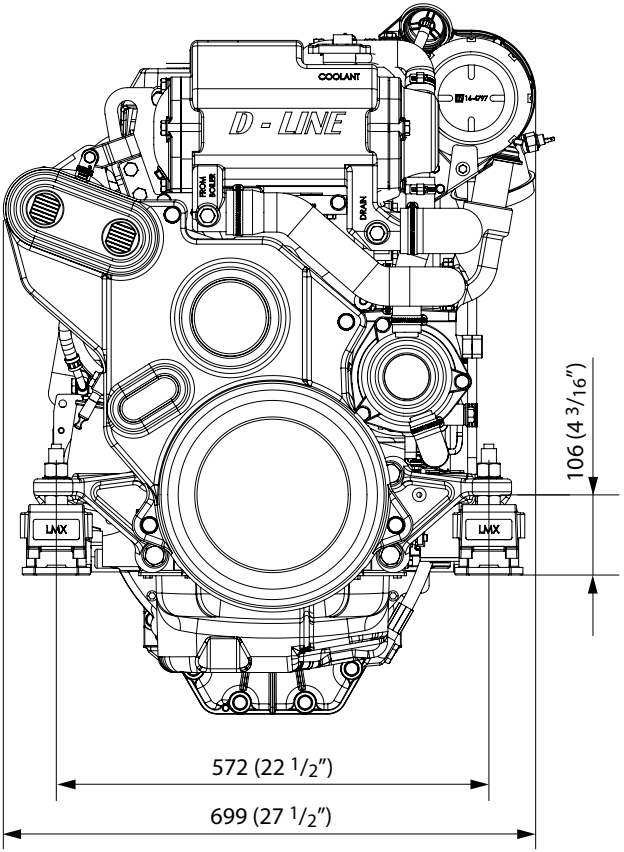

Red
B+ Battery / 30 Key Switch
A1
X-A
A5
Exhaust Temp. TS
Green
Yellow
Start Command / 50 Key Switch
A3
A4
D+ Alternator
Orange
Purple
15 Key Switch
A2
58 Key Switch
Brown
A6
6 p. Connector
DT04-6P
X-A
Dashboard Connector A (Power)
F4
7.5 A
Red
Red
15
ISO K-Line
CANH
CANL
31
Diagnosis
Connector
X22
Main
Relay
K3
85
86
87
30
87a
K4
Diagnose
Button
X-M9
X-M10
X-M11
X-M12
Throttle Input
(Variable Voltage)
X-P
0.5 - 4.5 V
XP-1
0V
Black
XP-2
0.5 - 4.5 V
Yellow
XP-3
5 V
Red
D2.2(K)30
D2.2(K)9
D2.2(K)22
D2.2(K)72
D2.2(K)1
D2.2(K)5
D2.2(K)3
D2.2(K)28
D2.2(K)25
D2.2(K)62
D2.2(K)61
EMR 3 (EDC 16)
D2.2(K)51
D2.2(K)71
D2.2(K)29
D2.2(K)70
D2.2(K)68
D2.2(K)55
D2.2(K)6
D2.2(K)4
D2.2(K)2
X-M1
X-M3
X-P
3 p. Connector
DT04-3P
Oil Pressure
Coolant Temp.
Option
Fuel/Air
Diagnose
X-C
Dashboard Connector
C (CAN Line)
5 P Connector M12
94 p. EMR Connector
D2.2
F1
F2
F3
10A
25A
3A
Yellow
K2
(Oil Pump)
K1
(Start)
B+ Terminal Engine
Battery Switch
12 V Battery
12 V Battery
Optional for 24 V
B– Terminal Engine
Oil Pump
Switch
K1
Starter
Oil
Sump
Drain
Pump
Alternator
B+
D+
B–
White/Red
X-M7
X-M8
X-M
12 p. Connector
DT04-12P
X-M6
X-M4
X-M5
Green
Exhaust Temp.
(Non EMR)
All not indicated wire colours: Black


Deutsch
Conn.
DT06-08S
Multifiunction
Instrument
0 - 4000 RPM
Temp Alarm
Switch
Neutral
if alarm (NO)
Dashboard CAN
Connector M12
Green
X-C
CANL
Blue
X-C5
CANH
Gray
X-C4
0 V
Black
X-C3
12 V
Red
X-C2
X-C1
CANL
CANH
Oil Press.
0-8 bar
12V
P
0 V
CANL
CANH
Temp.
0-120 °C
12V
θ
0 V
CANL
CANH
0-16 V
12V
V
0 V
6p. Socket
DT06-6S
X-A
Key Switch
Red
30
Brown
X-A5
TS
X-A1
B+
X-A6
K4-85
X-A4
D+
X-A2
15
X-A3
30
50
17/19
15
58
Orange
Purple
Yellow

2 Panels


Engine cable 'C'
Dashboard CAN
Connector M12
X-C
X-C5
X-C4
X-C3
X-C2
X-C1
Exhaust Temp.
Alarm Switch
Neutral if alarm (NO)
Connect to Alarm Indicator
6p. Socket
DT06-6S
X-A
Key Switch
Red
Brown
30
X-A5
TS
X-A1
B+
X-A6
K4-85
X-A4
D+
X-A2
15
X-A3
30
50
17/19
15
58
Orange
Purple
Yellow
MPYA
Engine cable 'A'
Dashboard CAN
Connector M12
X-C
X-C5
X-C4
X-C3
X-C2
X-C1
Exhaust Temp.
Alarm Switch
Neutral if alarm (NO)
Connect to Alarm Indicator
6p. Socket
DT06-6S
X-A
Key Switch
Red
Brown
30
X-A5
TS
X-A1
B+
X-A6
K4-85
X-A4
D+
X-A2
15
X-A3
30
50
17/19
15
58
Orange
Purple
Yellow

VD4.120 & VD4.140



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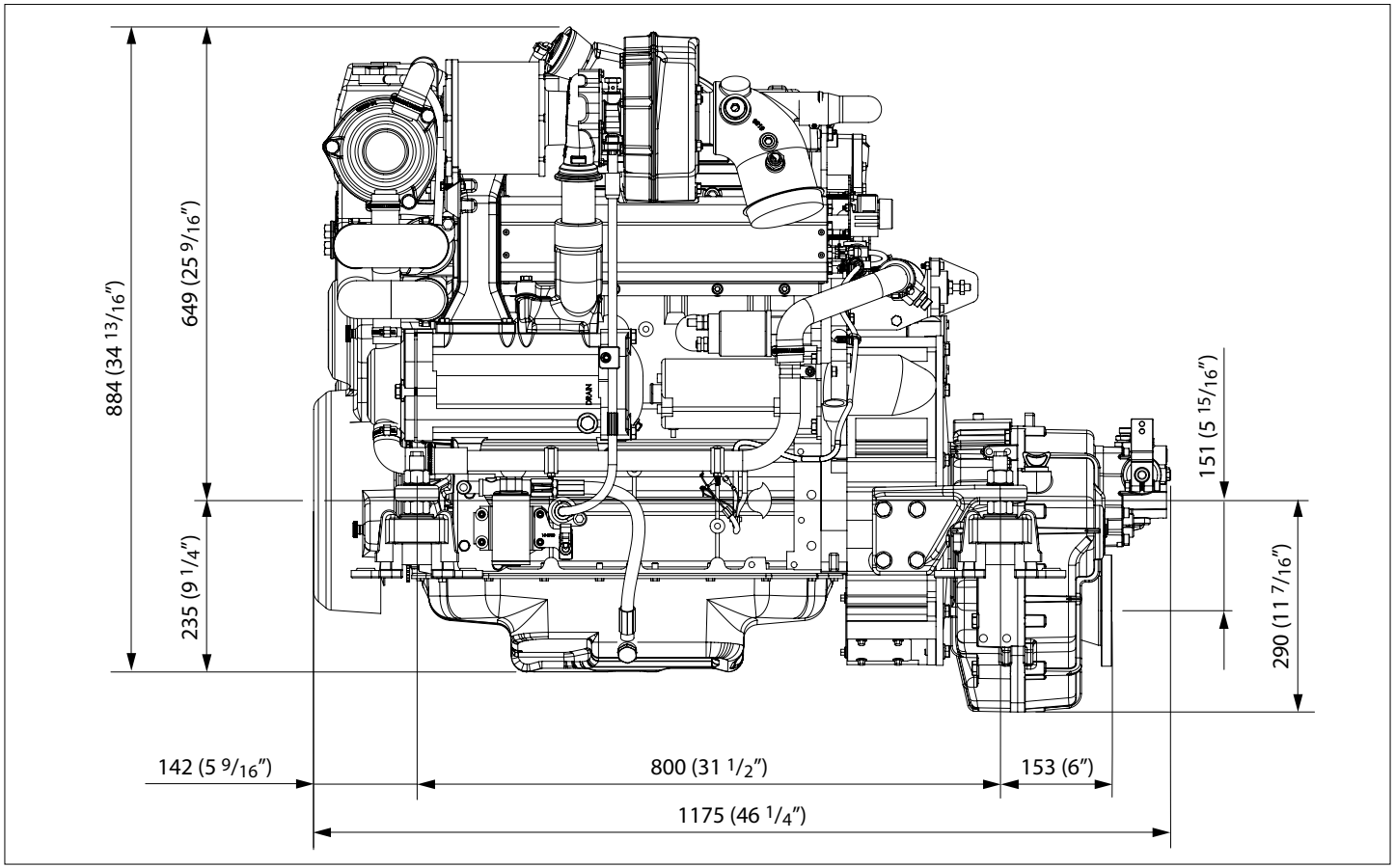
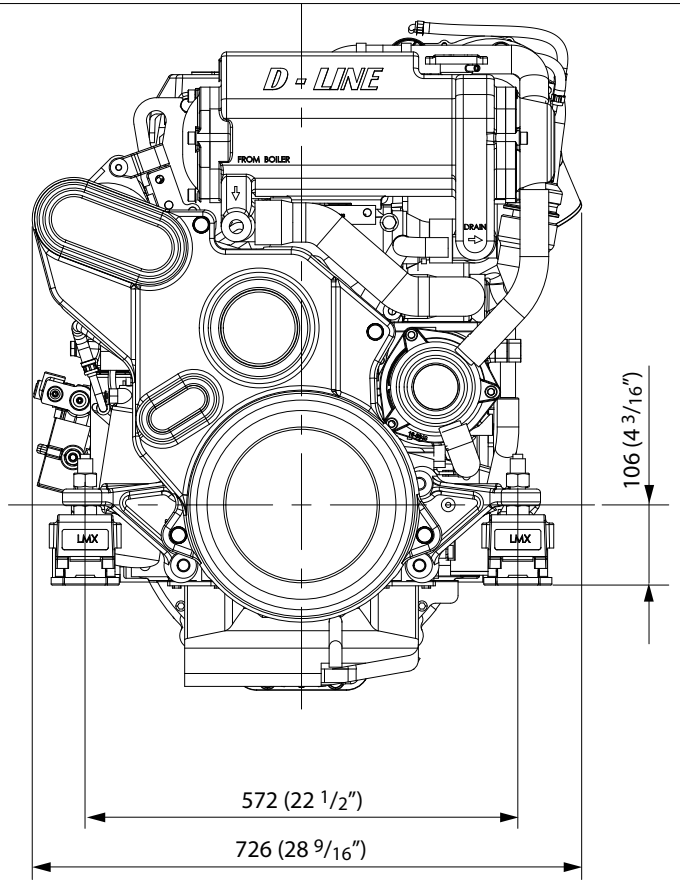
13 Overall dimensions



13 Overall dimensions

VD6.170 & VD6.210



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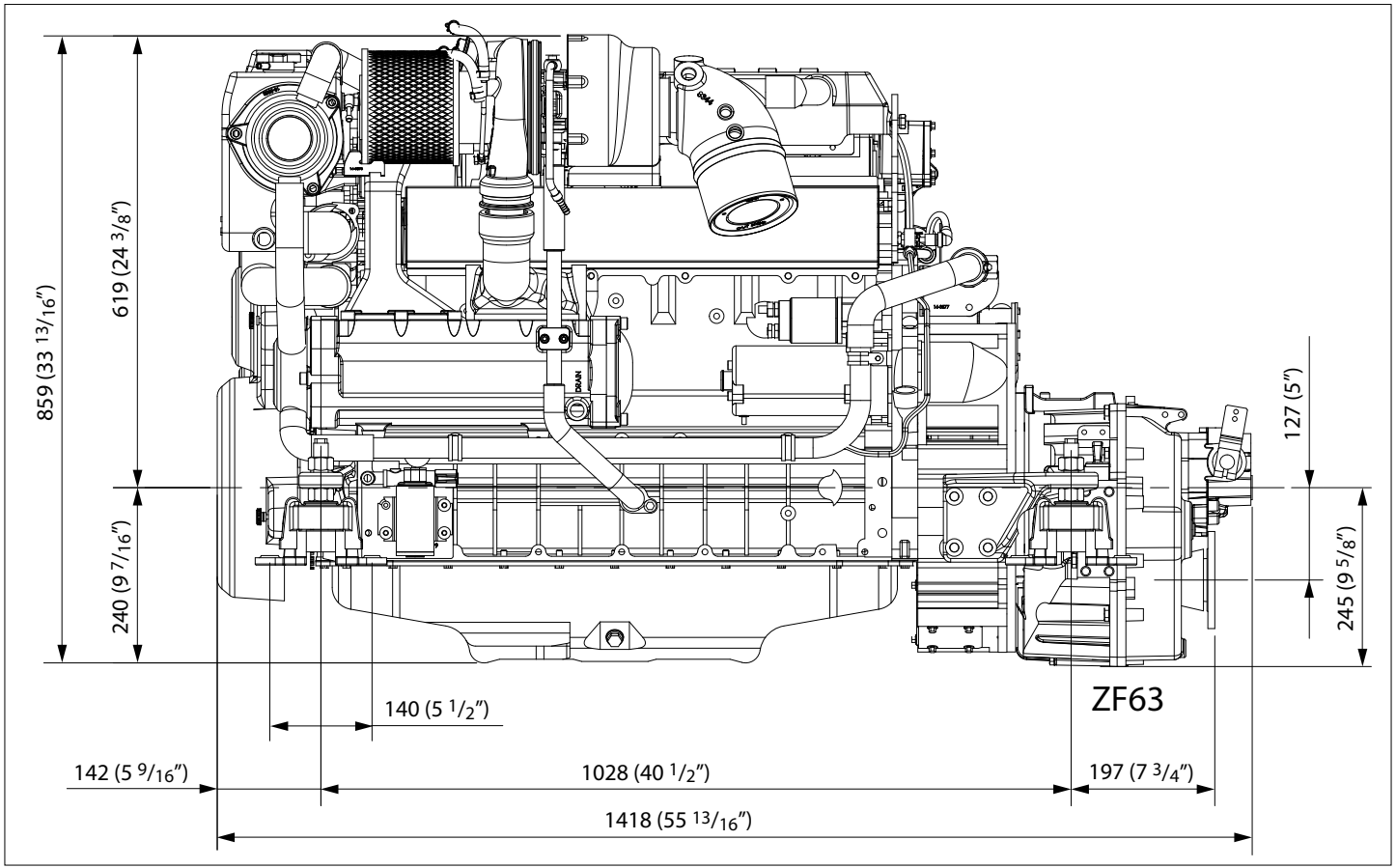
13 Overall dimensions



14 Parts for maintenance

Engine model	:	VD4.120	VD4.140	VD6.170	VD6.210		
						Check / replace every ... hour:	See page:
Oil Filter	:	17-8512	17-8512	17-8508	17-8508	100	54
Fuel filter element	:	17-8511	17-8511	17-8509	17-8509	500	56
Water separator/fuel filter element	:	VT34EB	VT34EB	VT34EB	VT34EB	500	56
V-belts	:						
Alternator		16-4258	16-4258	16-4258	16-4258	500	60
Fuel pump / Coolant pump	:	VD40069	VD40069	VD40069	VD40069	500	60
Raw water pump							
Impeller + O-ring	:	STM8250	STM8250	STM8250	STM8250	1000	62
Impeller	:	STM8246	STM8246	STM8246	STM8246	1000	62
O-ring		STM9974	STM9974	STM9974	STM9974	1000	62
Air intake filter	:	16-4797	16-4797	15-2768	15-2768	1000	65
Set of seals for heat exchanger	:	DM10001	DM10001	DM10001	DM10001	-	73
Set of seals for charge-air cooler	:	DM10001	DM10001	DM10001	DM10001	-	78

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Art. code	Description	
360601.01	Bedieningshandleiding D-LINE VD4, VD6	(Nederlands)
360602.01	Operation manual D-LINE VD4, VD6	(English)
360603.01	Bedienungsanleitung D-LINE VD4, VD6	(Deutsch)
360604.01	Manuel d'utilisation D-LINE VD4, VD6	(Français)
360605.01	Manual de operacion D-LINE VD4, VD6	(Español)
360606.01	Istruzioni per l'uso D-LINE VD4, VD6	(Italiano)
360607.01	Brugsanvisning D-LINE VD4, VD6	(Dansk)
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320331.01	(STM0032) Installatiehandleiding / Installation manual	(Nederlands / English)
320199.06	Service- en Garantieboek / Service and Warranty Manual / Service- und Garantieheft / Livret Garantie et Service / Manual de servicio y garantía / Libretto di assistenza e garanzia / Service- og garantibog / Service- och garantihäfte / Service- og garantibok / Huolto- ja takuukirja / Manual de Assistência e Garantia / Książeczka gwarancyjna i serwisowa	(Nederlands / English / Deutsch / Français / Español / Italiano / Dansk / Svenska / Norsk / Suomeksi / Português / Polski)
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