DT4.70  DTA4.85
Operation manual
Serial numbers

Engine serial number Vetus: 

Mitsubishi: 

Gearbox serial number: 

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

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

Copyright © 2010 Vetus N.V. Schiedam Holland
Please read and observe the information given in this operation manual. This will enable you to avoid accidents, preserve the manufacturer’s warranty and maintain the engine in peak operating condition.

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

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

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

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

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

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

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

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

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
- OK: Indicates that the relevant procedure must be carried out.
- ❌: Indicates that a particular action is forbidden.

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

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

![Fire Risk!]

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

If this cable is connected in error to the negative pole of the engine battery, a spark can occur. The result of this could be that explosive gas produced by the battery explodes.
  - Once the engine is started, first remove the earth cable.
1 Safety measures

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

- Stop the engine before carrying out maintenance!

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

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

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

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

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

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

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

• Be careful with battery acid!
If battery acid comes in contact with the eyes or skin, rinse the affected part immediately with copious amounts of water. If battery acid comes in contact with the eyes, rinse them out immediately with plenty of water and consult a doctor.

• Be careful with antifreeze!
If you accidentally swallow antifreeze, make yourself vomit and consult a doctor immediately. If antifreeze comes in contact with your eyes, wash them out immediately with plenty of water and consult a doctor.

• Make sure that you are wearing suitable clothing before starting work!
For your own safety you will most likely need special equipment - safety helmet, eye protection, safety boots, safety goggles, heavy gloves, ear protectors etc. Use them when necessary.

• Carry out maintenance procedures safely by only using suitable tools.

• Exhaust gases
Do not start the engine if the exhaust system is not connected.
1 Safety measures

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

- **If the oil pressure is too low:**
  Stop the engine immediately and check the lubrication system. Running an engine with low oil pressure can cause bearing and other parts to seize.

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

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

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

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

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

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

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

We are available to help with any additional inquiries.

Sincerely, Vetus n.v.
2 Introduction

1 Type plate

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

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

2 Position of the type plate

The type plate is positioned as shown.

3 Serial number

The serial number is stamped in the engine block in the position shown.
4 Cylinder numbering direction of rotation

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

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

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

Identification of engine parts DT4.70

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

1. Coolant pump
2. Filler cap (pressure cap) cooling system
3. Cooling system air bleeding nipple
4. Connection water heater ‘IN’
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17. Heat exchanger
18. Cooling system drain plug, heat exchanger
19. Connection for prop shaft lubrication G 3/8
20. Connection of push-pull cable gearbox
21. Exhaust injection bend ø 75 mm
22. Turbocharger
23. Air filter
2 Introduction

Identification of engine parts DTA4.85

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

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

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

Control panels
Engines with intercooling

Panel, model 22
Panel, without voltmeter, model 21

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

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

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

Control panels
Engines with keel-cooling

Panel, model 22
Panel, without voltmeter, model 21

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

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

5 Operating lever

Operating lever for 1 or 2 engines.

The control lever works as shown in the diagram.

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

Engine Oil

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

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

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

1 Commissioning the engine

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

2 Filling with engine oil

As a rule engines are delivered empty of oil.
Fill the engine with oil through the filler neck on top of the valve cover, for quantity and specification see page 124.

Check the oil level with the dipstick, see page 46.
3 First commissioning

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

3 Filling gearbox with oil

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

Technodrive:

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

- Engine oil SAE 20W40-CD

ZF Hurth:

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

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

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

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

4 Filling the cooling system, INTER-COOLING

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

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

• Fill the cooling system.

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

For specifications see page 127.

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

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

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

Note

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

Caution

Never fill the cooling system with sea water or brackish water.
3 First commissioning

5 Filling the cooling system, KEELCOOLING

• Remove the cap (1) of the extra expansion tank.

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

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

• Fill the cooling system.

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

  For specifications see page 127.

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

• Reinstall the plug (2) after the system has been bled and the coolant is flowing out of the bleeder hole.

• Top up the expansion tank to the minimum level.

• Replace the filler cap (1).
3 First commissioning

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

For specifications see page 127.

**CAUTION**

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

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

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

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

- Remove the ‘**DO NOT OPEN**’ cap (1) and fill the cooling system via the filler neck.
- Unscrew plug (2), on top of the lid of the thermostat housing, a few turns to bleed the system properly.
- Tighten plug (2) after the cooling system has been filled and bled and replace the filler cap (1).

- Add coolant into the expansion tank (3) until minimal level has been reached.
3 First commissioning

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

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

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

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

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

For specifications see page 127.

![CAUTION]

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

**NOTE**

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

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

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

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

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

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

For specifications see page 127.

CAUTION

Never fill the cooling system with sea water or brackish water.
3 First commissioning

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

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

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

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

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

For specifications see page 127.

CAUTION

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

NOTE

VD00879

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

10 Fuel

- Fill the fuel tank with diesel fuel.

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

  For fuel grade see page 123.

  Bleed the fuel system, see page 50.

11 Other preparations

- Check that the battery is charged and check the battery cable connections.

- Set the main switch to position 'ON'.

- Open the sea cock.

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

**WARNING**

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

12 Test run

• Start the engine.

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

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

• Stop the engine.

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

• Start the engine.

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

• Stop the engine.

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

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

13 Bleeding

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

• Open the cap on the filler neck.

• Vary the revolutions between idling and 2000 rev/min.

• Add coolant if necessary.

• Replace the cap on the filler neck.

• Check the coolant temperature.

14 Sea trial

• Check the operation of the remote control.

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

- Allow the engine to reach operating temperature before applying a load.

- Avoid fast acceleration.

- Do not allow the engine to run faster than 3/4 of maximum RPM.

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

- Draining of water from the water separator/fuel filter, see page 49.

- Engine oil change, see page 58.

- Oil filter replacement, see page 58.

- Changing the gearbox oil (Technodrive), see page 61.

- Changing the gearbox oil en filter replacement (ZF-Hurth), see page 62.

- Fuel filter replacement, see page 64.

- Check V-belt, see page 68.

- Check flexible engine mounts, see page 70.

- Check if all fasteners, bolts and nuts are secured, see page 71.

- Check engine for leakage, see page 71.
General guidelines for use

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

- Carry out the maintenance described regularly, including the ‘Daily procedures before starting’.

- Use anti-freeze in the engine coolant all year long, this helps prevent corrosion as well as protecting against frost damage. For specifications see page 127.

- Never run the engine without a thermostat.

- Use a good quality lubricating oil. For specifications see page 124.

- Use a good quality diesel fuel that is free of water and other pollutants.

- Always stop the engine immediately if one of the warning lamps for oil pressure, high coolant temperature, high raw water temperature 1) or battery charging lights up.

- Always follow the safety advice, see page 4.

1] Only for intercooled engines.
5 Use

Starting

NOTE

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

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

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

⚠️ **WARNING**

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

---

**Starting**

1 **Control lever**

Put the control lever in ‘neutral’ position.

2 **Switching on**

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

3 Pre-heating

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

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>Pre-heating time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 0°C (+32°F)</td>
<td>15 seconds</td>
</tr>
<tr>
<td>0°C to 10°C (+32°F to +50°F)</td>
<td>10 seconds</td>
</tr>
<tr>
<td>10°C to 30°C (+50°F to +86°F)</td>
<td>5 seconds</td>
</tr>
<tr>
<td>Above 30°C (86°F)</td>
<td>-</td>
</tr>
</tbody>
</table>

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

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

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

Release the key as soon as the engine fires (the key will return to the ‘on’ position) and throttle back. Leave the key in this position while the engine is running.

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.

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

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

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

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


Never turn the key to the ‘START’ position while the engine is running. Doing so will damage the starter motor.
The instrument panel is provided with the following instruments (Depending of the type of panel, see page 16).

Indicating the number of revolutions per minute of the engine.

Also the number of running hours is indicated.

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

Avoid idling for more than 10 minutes.

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

6 Voltmeter

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

7 Temperature gauge

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

8 Oil pressure gauge

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

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

10 Alarm buzzer

Oil pressure, battery charging and temperature indicator lights are all connected to an alarm buzzer. If this alarm buzzer sounds while running, Stop the engine immediately!
5 Use

11 Stopping

Reduce engine speed to idle and place the control lever in ‘NEUTRAL’ position.

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

Turn the key to the left to the ‘OFF’ position.

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

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

Introduction

Keep record of the following information in the logbook and/or the ‘Service and Guarantee Book’:

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

### Maintenance schedule

<table>
<thead>
<tr>
<th>Maintenance Schedule</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Every 10 hours or daily, before starting</strong></td>
<td></td>
</tr>
<tr>
<td>Check engine oil level</td>
<td>46</td>
</tr>
<tr>
<td>Check coolant level</td>
<td>47</td>
</tr>
<tr>
<td>Check water strainer</td>
<td>48</td>
</tr>
<tr>
<td><strong>After the first 50 hours</strong></td>
<td></td>
</tr>
<tr>
<td>Drain water from fuel filter</td>
<td>49</td>
</tr>
<tr>
<td>Check gearbox oil level</td>
<td>52</td>
</tr>
<tr>
<td>Engine oil change</td>
<td>58</td>
</tr>
<tr>
<td>Replace oil filter</td>
<td>58</td>
</tr>
<tr>
<td>Replace fuel filter</td>
<td>64</td>
</tr>
<tr>
<td>Check V-belt</td>
<td>68</td>
</tr>
<tr>
<td>Check flexible engine mounts</td>
<td>70</td>
</tr>
<tr>
<td>Check tightness of all fasteners, bolts and nuts</td>
<td>71</td>
</tr>
<tr>
<td>Check engine for leaks</td>
<td>71</td>
</tr>
<tr>
<td><strong>Every 100 hours, at least once every year</strong></td>
<td></td>
</tr>
<tr>
<td>Drain water from fuel filter</td>
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**DANGER**

Stop the engine before carrying out any maintenance work.
### 6 Maintenance

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Gevaar

Stop the engine before carrying out any maintenance work.

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

1 Check oil level

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

2 Oil level

The oil level must be at or near the upper mark on the dipstick\(^1\). If necessary top up with the same brand and type of oil.\[1\] The difference between the two oil level marks is: 0.8 litres (1.4 UK pt, 1.7 US pt)

3 Topping up oil

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

---

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

4 Checking coolant level

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

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

5 Coolant level

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

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

6 Topping up coolant

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

**CAUTION**
Never fill the cooling system with sea water or brackish water.
6 Maintenance

7 Checking the raw water strainer

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

8 Cleaning the strainer

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

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

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

Draining of water from the water separator/fuel filter

Every 100 operating hours.

**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.

9 Drain fuel filter

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

10 Empty water separator

Empty the separately installed water separator/fuel filter:

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

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

11 Bleeding

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

- Turn the key of the starter switch to position ‘ON’ and leave the key in this position for 30 seconds. The fuel lift pump will now feed the fuel system.
- Open the bleeding nipple at the filter to speed up the bleeding process.
- Close the bleeding nipple when all air has escaped.
6 Maintenance

Draining of water from the water separator/fuel filter
Every 100 operating hours.

12 Start the engine

• Operate the starter switch until the engine fires; release the starter switch if the engine does not fire within 6 seconds.

• Wait until the starter motor has stopped before making a new attempt to start the engine.

• Repeat the above if the engine cuts out after a short time.
Vetus engines are normally equipped with Technodrive or ZF-Hurth gearboxes. Consult the supplied Owners Manual for more details about care and maintenance. In case your engine is equipped with another brand of gearbox follow the instructions given in the supplied owner’s manual for changing oil and other care and maintenance.

- Take the dipstick out of the gearbox housing by pulling or unscrewing.
- Check the oil level by lowering the dipstick (cleaned) into the hole.
- If necessary top up by pouring oil into the filler hole or the dipstick hole.

The oil level must between the two marks on the dipstick

For oil type and specification see page 126.
6 Maintenance

14 Draining after-cooler

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

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

**NOTE**
Only for engines equipped with an after-cooler!
6 Maintenance

Warning notes and safety regulations for working with batteries

- Wear eye protection.
- Keep children away from acid and batteries.
- Explosion hazard: A highly-explosive oxyhydrogen gas mixture occurs when charging batteries, therefore:
  - Fires, sparks, naked flames and smoking are prohibited:
    - Avoid causing sparks when dealing with cables and electrical equipment, and beware of electrostatic discharges.
    - Avoid short-circuits.

Warning note:
- Do not place batteries in direct daylight without protection.

Discharged batteries can freeze up, therefore store in an area free from frost.

Battery, cables and connections

Every 100 operating hours.

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.

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

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

15 Battery, battery connections

Keep battery clean and dry.

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

Ensure that clamps make good contact after reassembling.

- Hand tighten the bolts only.

Battery, cables and connections

Every 100 operating hours.
6 Maintenance

Vetus maintenance-free batteries

16 Checking specific gravity

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

17 Hydrometer operation

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

Battery, cables and connections
Every 100 operating hours.

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

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

Measure the electrolyte specific gravity of the individual cells with a commercial hydrometer. The hydrometer reading (see table) indicates the state of charge. Hydrometer reading of all cells should be at least 1.200 and show less than 0.050 between high and low. If not, recharge or replace battery. During checking the temperature of the electrolyte should preferably be 20°C (68°F).

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

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

### Table: Specific Gravity and State of Charge

<table>
<thead>
<tr>
<th>Specific Gravity</th>
<th>State of Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.280</td>
<td>100%</td>
</tr>
<tr>
<td>1.200</td>
<td>50% recharge</td>
</tr>
<tr>
<td>1.120</td>
<td>10% recharge immediately</td>
</tr>
</tbody>
</table>
20 Engine oil change

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

If the engine runs less than 500 hours during the year the oil should be changed at least once a year.

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

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

Danger

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

Warning

Never use additives.

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

21 Drain oil

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

22 Removing the oil filter

- After draining remove the suction hose of the sump pump out of the dipstick tube.
- Unscrew the oil filter, with a commercially available tool, when all the oil has been pumped out.
  Catch any dripping oil.

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

DANGER
- Beware of burns from hot oil.
6 Maintenance

**23 Oiling the oil seal**

- Clean the contact surface of the gasket.

- Lubricate the oil seal of the new filter element with clean engine oil.

**24 Oil filter installation**

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

**25 Refilling with oil**

- Fill the engine with fresh oil (see page 124 for the specification) through the filler opening in the valve cover.

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

---

**Engine oil change**

Every 500 operating hours.

**Oil filter installation**

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

**Oil capacity**

6.3 litres (incl. oil filter) (11 UK pt, 13.3 US pt)
6 Maintenance

26 Draining the oil

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

27 Filling with new oil

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

For amount of oil and specification see page 126.

Changing the gearbox oil (Technodrive)

Every 500 operating hours.

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

28 Draining the oil

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

- Remove the dipstick.

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

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

Collect the oil in a dripping pan.

29 Changing the oil filter

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

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

Changing the gearbox oil (ZF-Hurth)
Every 500 operating hours.

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

30 Filling with new oil

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

For amount of oil and specification see page 126.

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

Fuel filter replacement
Every 500 operating hours.

31 Fuel filter removal

The fuel filter is to be replaced as a unit.

- Close the fuel stopcock.

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

⚠️ DANGER
Keep naked flames away when working on the fuel system. Do not smoke!
6 Maintenance

Fuel filter replacement
Every 500 operating hours.

32 Fuel filter installation

- Clean any debris from the filter carrier rim.

- Lubricate the rubber gasket sparingly with clean engine oil.

- Fill the new filter with clean diesel fuel.

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

- Open fuel stopcock.

- Check for leaks.
6 Maintenance

Cleaning filter fuel lift pump
Every 500 operating hours.

33 Fuel lift pump

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

FUEL FILTER, ART.CODE: STM4050

STM7220

Fuel filter

STM4050
6 Maintenance

34 Bleeding

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

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

35 Start the engine

- Start the engine

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

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

- Check for leaks once more.
6 Maintenance

36 Remove the protection cover

- Loosen the 4 fixing bolts.
- Remove the protection cover.

DANGER

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

37 Inspection V-belt

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

Checking the V-belt

Every 500 operating hours.

38 Checking tension

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

39 Tensioning V-belt

- Loosen the bolt of the adjustment bracket and both the alternator mounting bolts. Now push the alternator outwards until the belt tension is correct.

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

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

40 Reinstall the protection cover

- Always reinstall the V-belt guard and re-install the 4 fixing bolts.
6 Maintenance

41 Check flexible engine mounts

- Check the bolts which secure the damper element, the mounting bolts to engine bed and the nuts at the adjustment spindle for tightness.

- Inspect the rubber element of the engine support for cracks. Also check the deflection of the damper element, the deflection influences the alignment of engine and prop shaft! Re-align engine in case of doubt.

Flexible engine mounts
Every 500 operating hours.
6 Maintenance

42 Inspection hose connections

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

43 Check fasteners

- Check tightness of all fasteners, bolts and nuts.

Hose connections and fasteners
Every 500 operating hours.
6 Maintenance

44 Raw water pump inspection

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

Inspection where appropriate changing is as follows:

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

• Use a special impeller puller or pipe wrench to slide the impeller off the shaft.
• Mark the impeller to ensure correct re-installation if it is to be re-used. The impeller must be installed in the same position as removed.

NOTE

Only engines with intercooling!
6 Maintenance

**47 Impeller inspection**

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

**48 Re-install the impeller**

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

**49 Replacing the pump cover**

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

The coolant has to be replaced every 1000 operating hours or at least once every two years.

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

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.

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

51 Drain coolant

- Remove the plug (1) and the filler cap (2) to allow air into the cooling system.
- Remove the hose to the oil cooler (3).
- Remove the drain plugs (4) and (5) (exhaust manifold and heat exchanger housing).
- Check that all the liquid drains out.
- After draining re-install the drain plugs and re-install the hose to the oil cooler.

NOTE

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

Refer to the keel cooler manufacturer’s instructions for this.
Check using a coolant hydrometer whether the coolant is providing sufficient protection against freezing if total draining off is not possible.
6 Maintenance

52 Fill cooling system

- Fill the cooling system.

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

See page 127 for specifications.

**CAUTION**

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

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

- After filling replace the filler cap and re-install the plug.

**NOTE**

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

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

Coolant replacement

Every 1000 operating hours.
6 Maintenance

Coolant replacement
Every 1000 operating hours.

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

! CAUTION
Never fill the cooling system with sea water or brackish water.
6 Maintenance

53 Changing the air filter

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

⚠️ WARNING
Never clean the filter element with petrol or hot liquids.
Never apply any oil to the air filter.
Never start the engine without the air filter in place.
6 Maintenance

Checking the starter motor and alternator

Every 1000 operating hours.

54 Checking the starter motor

- Check for visible defects.

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

55 Checking the alternator

- Check for visible defects.

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

Cleaning the heat exchanger

**NOTE**

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

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

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

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

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

**NOTE**

Only engines with intercooling!
6 Maintenance

Cleaning the heat exchanger

56 Drain the coolant

- To do this, remove the drain plug from the heat exchanger housing.

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

- Reinstall the drain plug.

**NOTE**

Only engines with intercooling!
6 Maintenance

57 Removing the raw water hoses

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

58 Removing the exhaust hose

- Remove the exhaust hose from the exhaust injection bend.

Note

Only engines with intercooling!
59 Removing the end covers

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

60 Take out the heat exchanger

- Slide the heat exchanger out of the housing.

NOTE

Only engines with intercooling!
61 Cleaning the heat exchanger

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

⚠️ NOTE
Only engines with intercooling!
62 Replacing heat exchanger

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

- Centre the heat exchanger in the housing.

- Use new O-rings (87 x 5 mm) which have been greased and place them on the heat exchanger.

63 Fitting end covers

- Fit the end covers in the housing.

- Grease the ends of the threaded rod.

- Refit the threaded.

- Use new copper washers (M10) and refit the nuts with the washers. Tightening torque 30 Nm (22 ft.lbf)

- Refit all hoses disconnected.

- Top up the cooling system, see page 76.

- Open the sea cock.

**NOTE**

Only engines with intercooling!
6 Maintenance

Cleaning the after cooler

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

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

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

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

Caution

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

Note

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

64 Removing the raw water hoses

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

65 Take out the heat exchanger

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

Slide the heat exchanger out of the housing.

**CAUTION**
Avoid damage of the fins.

**NOTE**
Only engines with a charge air cooler (after cooler).
66 Cleaning the heat exchanger

- Clean the tube of the heat exchanger; use a pipe brush and fresh water to remove any growth in the pipes.

- Then rinse the heat exchanger tubes with clean water.

- Clean the fins using petrol and compressed air, maximum pressure 2 bar (28 psi) to prevent damage to the fins.

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

- Clean the contact surfaces of the O-rings.

⚠️ **CAUTION**

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

⚠️ **NOTE**

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

67 Replacing the heat exchanger

- Put the heat exchanger back in exactly the same position in the after cooler housing.
- Centre the heat exchanger in the housing.
- Use new O-rings (87 x 5 mm) which have been greased and place them on the heat exchanger.

68 Fitting end covers

- Fit the end covers in the housing.
- Grease the threaded rods.
- Use new copper washers (M10) and refit the nuts with the washers.  
  Tightening torque 30 Nm (22 ft.lbf)
- Refit all hoses disconnected.
- Open the sea cock.

**Note**

Only engines with a charge air cooler (after cooler).
7 Winter storage procedure

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

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

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

Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:
### Inspections and maintenance work to be carried out:

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<thead>
<tr>
<th></th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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.</td>
<td>92</td>
</tr>
<tr>
<td>2</td>
<td>Check the zinc anodes.</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>Drain off the water from the fuel system and fill the fuel tank.</td>
<td>94</td>
</tr>
<tr>
<td>4</td>
<td>Make sure that the engine fuel system is filled with a fuel mixture with protective properties.</td>
<td>95</td>
</tr>
<tr>
<td>5</td>
<td>Flush out the raw water circuit with fresh water and if necessary fill with antifreeze. Clean the heat exchanger if necessary.</td>
<td>96</td>
</tr>
<tr>
<td>6</td>
<td>Make sure that the cooling system is filled with a suitable anti-freeze.</td>
<td>97</td>
</tr>
<tr>
<td>7</td>
<td>Change the oil filter and the engine oil.</td>
<td>98</td>
</tr>
<tr>
<td>8</td>
<td>Change the oil in the gearbox.</td>
<td>98</td>
</tr>
<tr>
<td>9</td>
<td>Disconnect the battery cables, charge the batteries if necessary and grease the battery terminals.</td>
<td>99</td>
</tr>
</tbody>
</table>
7 Winter storage procedure

1 Corrosion protection

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

2 Zinc anode

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

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

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

Check and replace the zinc anodes as follows:

• Stop the engine.

• Close the sea cock.

• Remove the zinc anode from the heat exchanger housing and respectively.

• Replace the (new) zinc anode and the copper ring. Use a sealant, for example Loctite® Thread Sealant with PTFE or LOXEAL® 18-10 Pipe Sealant.

• Open the sea cock, start the engine and check for leaks.
7 Winter storage procedure

3 Fuel system

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

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

- Fit a new fuel filter element. (page 64)
7 Winter storage procedure

4 Protective fuel mixture

- Connect the fuel supply pipe to a can filled with protective diesel fuel, for example 'Calibration Fluid' (ISO 4113) or with a mixture of 1 part of engine oil* to 9 parts of clean fuel**.

- Use this fuel to run the engine for 5 minutes at idling speed.

- Stop the engine.

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

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

CAUTION

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

Tip!

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

5 Raw water cooling system

- Close the sea cock.
- Remove the lid of the water strainer.
- If necessary, clean the raw water strainer.
- 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 external water system must be protected in areas where the temperature drops to below zero during the winter. Pour 1 litre (1/4 gallon) of anti-freeze into the water strainer and run the engine until the anti-freeze has disappeared into the cooling system.

Tip!

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

Heat exchanger

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

Raw water pump

Check the impeller of the raw water pump at least once every two years, see page 72.
7 Winter storage procedure

Take care that no anti-freeze is spilled into the waterway (anti-freeze is poisonous).

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

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

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

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

For coolant replacement see page 74.
7 Winter storage procedure

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

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

8 Gearbox oil change

- Stop the engine and change the oil of the gearbox. (page 61 and 62)
7 Winter storage procedure

9 Electrical system

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

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

Consult a Vetus Dealer if help is required with this.

Inspections and maintenance work to be carried out are:

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

1 Fuel system

- Drain the water from the water separator/fuel filter. (page 49)
- Drain the water from the fuel tank.
- Open the fuel valve.
8 Recommissioning after winter storage

2 Raw water cooling system

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

- Open the sea cock.

3 Fresh water cooling system
- Check the coolant level. (page 47)

4 Lubrication system
- Check the engine oil level. (page 46)
8 Recommissioning after winter storage

5 Electrical system

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

6 Switching on

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

7  Check engine for leaks

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

8  Checking instruments and remote controls

- Check the operation of the instruments, the remote control and the gearbox.
Engine faults are in most cases caused by improper operation or insufficient maintenance.

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

In the following tables information is given about the possible causes of faults and suggested remedies. Please note that these tables can never be complete.

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

⚠️ **DANGER**

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

#### Fault finding table

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

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

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

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

### 3 Engine cranks but will not start, smoke from exhaust

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

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

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

#### Fault finding table

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

<table>
<thead>
<tr>
<th>Possible fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbocharger damaged</td>
<td>Replace.</td>
</tr>
<tr>
<td>VGT turbocharger actuator blocked</td>
<td>Check unblock or replace.</td>
</tr>
<tr>
<td>Engine overloaded.</td>
<td>Check size of propeller.</td>
</tr>
<tr>
<td>Boat load inadequate</td>
<td>-</td>
</tr>
<tr>
<td>Hull/propeller dirty</td>
<td>Clean.</td>
</tr>
</tbody>
</table>
## 9 Troubleshooting

### 6 Engine overheats

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

### 6 Engine overheats

<table>
<thead>
<tr>
<th>Possible fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor becomes apparently overheated as a result of faulty temperature switch, sensor or meter.</td>
<td>Check / replace.</td>
</tr>
</tbody>
</table>
## 7 Engine not firing on all cylinders

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

## 8 Engine has little or no oil pressure

<table>
<thead>
<tr>
<th>Possible fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil level too low.</td>
<td>Increase level.</td>
</tr>
<tr>
<td>Incorrect lube oil SAE class or quality for ambient temperature.</td>
<td>Replace.</td>
</tr>
<tr>
<td>Blocked oil filter.</td>
<td>Replace.</td>
</tr>
<tr>
<td>Faulty oil pump.</td>
<td>Repair / replace.</td>
</tr>
<tr>
<td>Oil leaks</td>
<td>Check.</td>
</tr>
<tr>
<td>Excessive inclination of engine.</td>
<td>Check / Adjust.</td>
</tr>
<tr>
<td>Oil pressure apparently too low due to faulty oil pressure switch, sensor or meter.</td>
<td>Check / replace.</td>
</tr>
</tbody>
</table>
## 9 Engine oil consumption excessive

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

## 10 Fuel consumption excessive

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

Fault finding table
## 9 Troubleshooting

### 11 Black exhaust smoke (idling)

<table>
<thead>
<tr>
<th>Possible fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injector fault</td>
<td>Check / replace.</td>
</tr>
<tr>
<td>Oil level too high.</td>
<td>Lower level.</td>
</tr>
<tr>
<td>Excessive inclination of engine.</td>
<td>Check / Adjust.</td>
</tr>
</tbody>
</table>

### 12 Blue exhaust smoke (idling)

<table>
<thead>
<tr>
<th>Possible fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil level too high.</td>
<td>Lower level.</td>
</tr>
<tr>
<td>Leaking from turbo compressor oil seal.</td>
<td>Check / replace oil seal.</td>
</tr>
</tbody>
</table>

### 13 Black exhaust smoke (at load)

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

#### Fault finding table

<table>
<thead>
<tr>
<th>14 White exhaust smoke (at full load)</th>
<th>15 Burnt oil trace in exhaust line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible fault</strong></td>
<td><strong>Possible fault</strong></td>
</tr>
<tr>
<td>Faulty injector/injection pump.</td>
<td>Oil level too high .</td>
</tr>
<tr>
<td>Air in fuel system.</td>
<td>Excessive wear of cylinder / piston, piston rings.</td>
</tr>
<tr>
<td>Wrong fuel quality or contaminated fuel.</td>
<td>Faulty turbocharger .</td>
</tr>
<tr>
<td>Water in fuel system.</td>
<td>Check, replace if required.</td>
</tr>
<tr>
<td>Incorrect injection timing.</td>
<td>Lower level.</td>
</tr>
<tr>
<td>Faulty glow plugs.</td>
<td>Check compression; refurbish engine.</td>
</tr>
<tr>
<td>Incorrect valve clearance.</td>
<td>Faulty turbocharger .</td>
</tr>
<tr>
<td>Vapour in exhaust gases condenses as a result of very low ambient temperature.</td>
<td>Check, Repair / Replace .</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 10 Technical data

<table>
<thead>
<tr>
<th>General</th>
<th>DT4.70</th>
<th>DTA4.85</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>DT4.70</td>
<td>DTA4.85</td>
</tr>
<tr>
<td><strong>Make</strong></td>
<td>Vetus Deutz</td>
<td></td>
</tr>
<tr>
<td><strong>Number of cylinders</strong></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Based on</strong></td>
<td>TD 2009 L04</td>
<td></td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>4-stroke diesel, in-line</td>
<td>Direct injection</td>
</tr>
<tr>
<td><strong>Injection</strong></td>
<td>Direct injection</td>
<td>Turbo-charged, after-cooled</td>
</tr>
<tr>
<td><strong>Aspiration</strong></td>
<td>Turbo-charged</td>
<td>Turbo-charged, after-cooled</td>
</tr>
<tr>
<td><strong>Bore</strong></td>
<td>90 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Stroke</strong></td>
<td>90 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Total displacement</strong></td>
<td>2290 cm³ (140 cu.inch)</td>
<td></td>
</tr>
<tr>
<td><strong>Compression ratio</strong></td>
<td>16 : 1</td>
<td></td>
</tr>
<tr>
<td><strong>Idling speed</strong></td>
<td>900 rpm</td>
<td></td>
</tr>
<tr>
<td><strong>Max. no. of revolutions at no load</strong></td>
<td>3050 rpm</td>
<td></td>
</tr>
<tr>
<td><strong>Direction of rotation</strong></td>
<td>counter clockwise, viewed from the flywheel side</td>
<td></td>
</tr>
<tr>
<td><strong>Number of valves</strong></td>
<td>2 per cylinder</td>
<td></td>
</tr>
<tr>
<td><strong>Valve Clearances</strong></td>
<td>Self adjusting hydraulic tappet</td>
<td></td>
</tr>
<tr>
<td><strong>Weight (with standard gearbox)</strong></td>
<td>290 kg (639 lbs)</td>
<td>298 kg (657 lbs)</td>
</tr>
</tbody>
</table>

### Engine installation

<table>
<thead>
<tr>
<th>Engine installation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. installation angle</strong></td>
<td>15 degrees backwards</td>
</tr>
<tr>
<td><strong>Max. athwart ships angle</strong></td>
<td>25 degrees continuously, 30 degrees intermittent</td>
</tr>
</tbody>
</table>
10 Technical data

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

#### Engine specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>DT4.70</th>
<th>DTA4.85</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil lubrication system</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil capacity, max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>without oil filter</td>
<td>6.0 litres (10.6 UK pt, 12.7 US pt)</td>
<td></td>
</tr>
<tr>
<td>with oil filter</td>
<td>6.3 litres (11.1 UK pt, 13.3 US pt)</td>
<td></td>
</tr>
<tr>
<td>Oil Filter</td>
<td>08-00085</td>
<td></td>
</tr>
<tr>
<td>Oil temperature in sump</td>
<td></td>
<td>max. 120°C (248°F)</td>
</tr>
</tbody>
</table>

#### Cooling system

<table>
<thead>
<tr>
<th>Capacity</th>
<th>8.0 litres (14.1 UK pt, 16.9 US pt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermostat</td>
<td>opening at 82°C (180°F), fully opened at 97°C (207°F)</td>
</tr>
<tr>
<td>Coolant pump,</td>
<td></td>
</tr>
<tr>
<td>Flow at max. engine rpm</td>
<td>135 litres/min (29.7 UK gal/min, 35.7 US gal/min)</td>
</tr>
<tr>
<td>Raw water pump,</td>
<td></td>
</tr>
<tr>
<td>Flow at max. engine rpm</td>
<td>80 litres/min (17.6 UK gal/min, 21.1 US gal/min)</td>
</tr>
<tr>
<td>Total head at max. flow</td>
<td>2 metre (6’ 7&quot;) H2O</td>
</tr>
<tr>
<td>Impeller</td>
<td>STM8074</td>
</tr>
<tr>
<td>Inlet connection for hose</td>
<td>28 mm (1 1/8&quot;) I.D.</td>
</tr>
<tr>
<td>Heater supply connection</td>
<td>16 mm (5/8&quot;) I.D.</td>
</tr>
<tr>
<td>Heater return connection</td>
<td>16 mm (5/8&quot;) I.D.</td>
</tr>
</tbody>
</table>
## 10 Technical data

### Engine specifications

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

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Model</th>
<th>DT4.70</th>
<th>DTA4.85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technodrive:</td>
<td>type TM345</td>
<td>(1.54) 2.00 2.47</td>
<td>(1.54) 2.00 2.47</td>
</tr>
<tr>
<td></td>
<td>type TM345A</td>
<td>(1.54) 2.00 2.47</td>
<td>(1.54) 2.00 2.47</td>
</tr>
<tr>
<td>ZF:</td>
<td>type ZF25</td>
<td>1.969 2.800</td>
<td>1.969 2.800</td>
</tr>
<tr>
<td></td>
<td>type ZF25A</td>
<td>(1.548) 1.926 2.292 (2.480) 2.714</td>
<td>(1.548) 1.926 2.292 (2.480) 2.714</td>
</tr>
</tbody>
</table>
## 10 Technical data

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

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

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

The following fuel specifications / standards are approved:
• CEN EN 590
• ASTM D 975-88: 1-D en 2-D
• NATO Code F-54
• JIS K 2204 1 en 2
• DIN 51 628
• ASTM D 396: 1 en 2
• BS 2869 class A2

The cetane number must be at least 49.

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

Winter-grade fuel

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

Only use the prescribed diesel fuel.

**Do not use biodiesel!**
11 Operating media

Engine oil

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

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

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

Recommended lubricating oil viscosity

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

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

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

To avoid having to change the oil for different seasons we recommend SAE 15W-40 all-season motor oil.

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

For oil capacity see page. 118.
11 Operating media

**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.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unit</th>
<th>Test method</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>cSt @ 100°</td>
<td>JIS: K 2283</td>
<td>=30% / -15% max. for new oil 3:3</td>
</tr>
<tr>
<td>Total base number (HCl)</td>
<td>mgKOH/g</td>
<td>JIS: K 2501</td>
<td>2.0 min.</td>
</tr>
<tr>
<td>Total acid number</td>
<td>mgKOH/g</td>
<td></td>
<td>+3.0 max. for new oil</td>
</tr>
<tr>
<td>Water content</td>
<td>% volume</td>
<td>JIS: K 2275</td>
<td>0,2 max.</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
<td>JIS: K 2265</td>
<td>180 min.</td>
</tr>
<tr>
<td>Pentane insolubles</td>
<td>% weight</td>
<td>ASTM: D 893</td>
<td>0,5 max.</td>
</tr>
<tr>
<td>Coagulated pentane insolubles</td>
<td>% weight</td>
<td></td>
<td>3,0 max.</td>
</tr>
</tbody>
</table>

**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.
11 Operating media

Gearbox Lubricating Oil

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

Technodrive:

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

ZF Hurth:


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

Transmission oil type A, Suffix A.
For example:
Vetus Transmission Oil
Shell Donax T6
Gulf Synth

Other brands of gearboxes:
See supplied owner’s manual for oil type and quantities.
11 Operating media

Coolant fluid

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

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

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

<table>
<thead>
<tr>
<th>Cooling system protective liquid (Anti-freeze)</th>
<th>Water</th>
<th>Protection against freezing to</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. 45 vol%</td>
<td>-35°C (-31°F)</td>
<td>55%</td>
</tr>
<tr>
<td>40 vol%</td>
<td>-28°C (-18°F)</td>
<td>60%</td>
</tr>
<tr>
<td>min. 35 vol%</td>
<td>-22°C (-8°F)</td>
<td>65%</td>
</tr>
</tbody>
</table>

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

Water quality for coolant preparation

Use preferably tap water.

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

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

** ! CAUTION**

Never use sea-water or brackish water.

** ! WARNING**

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

Engine with panel model ‘34’
13 Overall dimensions

[Diagram of Vetus DT4.70 engine with dimensions labeled.]

- Overall dimensions:
  - 883 (34 3/4"
  - 400 (15 3/4"
  - 989 (38 15/16"
  - 629 (24 3/4"
  - 229 (9"
  - 231 (9 1/8"
  - 490 (19 5/16"
  - 554 (21 13/16"
  - 111 (4 3/8"
  - TM345A 8°
  - DT4.70

Vetus®
13 Overall dimensions

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

[Image of a diagram showing the dimensions of a Vetus DTA4.85 engine, with measurements like 883 (34 3/4"), 490 (19 5/16"), 230 (9 1/16"), and 989 (38 15/16") labeled.]

Vetus DTA4.85
13 Overall dimensions

1 Exhaust ø 75 mm
2 Fuel supply ø 8 mm
3 Fuel return ø 8 mm
4 Raw water intake ø 28 mm
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<td>Operation manual DT4.70, DTA4.85</td>
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<td>Bedienungsanleitung DT4.70, DTA4.85</td>
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